

# EMC EMISSION - TEST REPORT



Test Report No.

**B849901**

Issue Date

23 November 1998

Model / Serial No.

**RFV-1 / 1**

Product Type

**Air Machine Remote Transmitter**

Client

**Technik Manufacturing, Inc.**

Manufacturer

**Technik Manufacturing, Inc.**

License holder

**Technik Manufacturing, Inc.**

Address

**1005 17 Street, P.O. Box 1617**

**Columbus, NE 68602**

Test Criteria Applied

**FCC Part 15 15.231C**

Periodic Operation in the band 40.66-40.70 MHz and above 70 MHz. Paragraphs (a) to (c).

Test Start Date:

**22 October 1998**

Test End Date:

**22 October 1998**

Test Result

**■ PASS       FAIL**

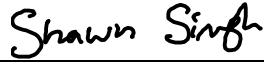
Test Report Project No.

**B241849901**

Total Pages including Appendices

**39**

  
Reviewed By : Felix J. Chavez

  
Reviewed By : Shawn Singh

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FCC ID: N9O-RFV1

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## EMISSIONS TEST REGULATIONS :

The tests were performed according to following regulations :

■ - Federal Communication Commission part 15	<input type="checkbox"/> - Class A	■ - Class B
■ - Federal Communication Commission part 15, Subpart C	■ - 15.209	■ - 15.231

---

All tests performed according to ANSI C63.4

### Emission Test Results:

#### Conducted emissions 150 kHz - 30 MHz

Test Result	<input type="checkbox"/> - PASS	<input type="checkbox"/> - FAIL	■ - Not Applicable
-------------	---------------------------------	---------------------------------	--------------------

Passing Margin \_\_\_\_\_ dB at \_\_\_\_\_ MHz

Remarks: \_\_\_\_\_  
\_\_\_\_\_

#### Radiated emissions (electric field) 30 MHz - 1000 MHz (Unintentional Radiator)

Test Result	■ - PASS	<input type="checkbox"/> - FAIL	<input type="checkbox"/> - Not Applicable
-------------	----------	---------------------------------	---

Passing Margin \_\_\_\_\_ 20.1 dB at \_\_\_\_\_ 30 MHz

Remarks: \_\_\_\_\_  
\_\_\_\_\_

#### Radiated emissions (electric field) 315 MHz - 3150 MHz (Intentional Radiator)

Test Result	■ - PASS	<input type="checkbox"/> - FAIL	<input type="checkbox"/> - Not Applicable
-------------	----------	---------------------------------	---

Passing Margin \_\_\_\_\_ 3.6 dB at \_\_\_\_\_ 315 MHz

Remarks: \_\_\_\_\_  
\_\_\_\_\_

### GENERAL REMARKS:

Modifications required to pass: None

Test Specification Deviations: Additions to or Exclusions from: None

### Test Equipment Used

# Colorado Test Equipment

07-Oct-98

Report: B8499 Date: 22 OCT 98 Signature: Shawn Sing  
 Temp: 22 C Rel. Humid.: 20% Atmo. Pressure: 80.8 kPa

Location	Tests	Manufacturer	Model Number	Serial Number	Description	Cal Date	Cal Due
PW	R	AH Systems	SAS-200/510	705	Log Periodic Antenna (300-1800 MHz)	06-Jul-98	06-Jul-99
PW	R	AH Systems	SAS-200/512	104	Log Periodic Antenna (200-1500 MHz)	13-Jul-98	13-Jul-99
PW	R	AH Systems	SAS-200/542	256	Biconical Antenna	03-Feb-98	03-Feb-99
PW	R	Avantek	AFT97-8434-10	1007	RF Pre-Amplifier (4-8 GHz)	18-Nov-97	18-Nov-98
PW	R	Avantek	AWT-18037	1002	RF Pre-Amplifier (8-18 GHz)	18-Nov-97	18-Nov-98
PW	bird		4022	1825	Sensor, 25 to 1000 MHz		
PW	bird		4024	1863	Sensor, 1.5 to 32 MHz		
PW	bird		4025	3702	Sensor, 100 to 2500kHz		
PW		Bird	4421-103	1254	Metering Unit		
PW	R C	California Instr.	850T-1	68458	Oscillator (45-5000 Hz)	08-Mar-98	08-Mar-99
PW	R C	California Instr.	9000TCA/3-1	50666+	Power Source 9kVA (45-5000 Hz, 0-280VAC)		
PW	R C	Compaq	470A	23605277B504	Monitor - PW Testbed		
PW	R C	Compaq	DeskPro 575	g545HSY20483	Computer for PW Testbed		
PW	R	Compliance Design	none	RD-1	Roberts Dipole Ant. Set (30-1000 MHz)	03-Mar-97	02-Mar-00
PW		EMC Test Systems	3109	3142	Biconical Antenna	27-Jan-98	27-Jan-99
PW		EMCO	1070-4	9206-1681	Antenna tower with manual polarization		
PW		EMCO	1080/1081	9206-1636	2 meter dia. wood turntable		
PW	R	EMCO	1090	1134	Multiple Device Controller		
PW	R	EMCO	3108	2149	Biconical Dipole Antenna (30-300 MHz)	19-Jun-98	19-Jun-99
PW	R	EMCO	3108	7059203-2457	Biconical Dipole Antenna (30-300 MHz)	06-Jul-98	06-Jul-99
PW	R	EMCO	3115	3886	Dbi Ridged Horn Antenna (1-18 GHz)	20-Feb-98	20-Feb-99
PW	-3, R	EMCO	3146	9203-3376	Log Periodic Antenna	18-Jun-98	18-Jun-99
PW	C	EMCO	3825/2	9202-1945	LISN	15-Jul-98	15-Jul-99
PW	C	EMCO	3825/2	9202-1946	LISN	23-Jul-98	23-Jul-99
PW	R	EMCO	4610	9205-1199	Royce field site source		
PW	C	EMCO	4620	9110-1015	Conducted noise source		
PW		EMCO	6502	2082	Magnetic Field Loop		
PW	R	EMCO	6502	9205-2738	Magnetic loop	30-Oct-97	29-Oct-00
PW		EMCO	7123	9205-1028	Field Strength Sensor		
PW		EMCO	7123	9205-1029	Field Strength Sensor	11-Dec-97	11-Dec-98
PW	R	EMCO	7405	9203-2175	Near field probe set		
PW	CISPR14	Fischer	F-201	141	Absorbing Clamp (30-300 MHz)	05-Mar-98	05-Mar-99
PW	C	Fischer	F-33-1	356	Current Probe (10 kHz - 250 MHz)	04-May-98	04-May-99
PW	3, C, R, 6	Fischer Custom Co	F-61	274	Current Probe	17-Jun-97	17-Jun-98
PW	3, C, R, 6	Fischer Custom Co	F-61	274	Current Probe	30-Jul-98	30-Jul-99
PW		Gishard	600-1040 mb	002	Altimeter		
PW	R	Hewlett Packard	11940A	2650A04527	Close field probe		
PW	R	Hewlett Packard	11940A	2650A04563	Close field probe		
PW	R	Hewlett Packard	11941A	2807A02957	Close field probe		
PW	C	Hewlett Packard	11947A	2820A00277	Transient Limiter	18-Nov-97	18-Nov-98
PW	C	Hewlett Packard	11947A	3107A01975	Transient Limiter	17-Jun-98	17-Jun-99
PW		Hewlett Packard	8444A	2325A07899	Tracking Generator (1-1200 MHz)	18-Nov-97	18-Nov-98
PW	R C	Hewlett Packard	8447D	2727A05399	Amplifier (30-1000 MHz)	18-Nov-97	18-Nov-98
PW	R, C	Hewlett Packard	8447F	3113A04923	Option H64 Dual Preamp	21-Nov-97	21-Nov-98
PW	R, C, RE101, CISP	Hewlett Packard	85650A	2043A00256	Quasi Peak Adapter (set 1)	17-Jun-98	17-Jun-99
PW	R, C, RE101, CISP	Hewlett Packard	85650A	2811A01300	Quasi Peak Adapter	18-Nov-97	18-Nov-98
PW	R, C	Hewlett Packard	85662A	2112A02220	Display Section	11-Mar-98	11-Mar-99
PW	R, C, RE101, CISP	Hewlett Packard	85662A	2318A04983	Display Section (set 1)	17-Jun-98	17-Jun-99
PW	C, R	Hewlett Packard	85662A	2403A06707	Display Section (Loaner)	20-Nov-97	20-Nov-98
PW	R, C	Hewlett Packard	85662A	2403A08749	Display Section	01-Apr-98	30-Sep-98
PW	R, C, RE101, CISP	Hewlett Packard	8566B	2410A00154	Spectrum Analyzer (dc-22 GHz)	01-Apr-98	30-Sep-98
PW	R, C	Hewlett Packard	8566B	2410A00254	Spectrum Analyzer (Loaner)	20-Nov-97	20-Nov-98

Location	Tests	Manufacturer	Model Number	Serial Number	Description	Cal Date	Cal Due
PW	R, C, RE101, CISP	Hewlett Packard	8568B	2304A02508	Spectrum Analyzer (set 1) (dc-1.8 Ghz)	17-Jun-98	17-Jun-99
PW		Hewlett Packard	8590	2722A02036	Spectrum Analyzer		
PW	RE101, -8, -9, -11	Hewlett Packard	8594E	3223A00145	Spectrum Analyzer	21-Nov-97	21-Nov-98
PW	C	HP	11947A	3107A01984	Transient Limiter	09-Jun-97	09-Jun-98
PW		JFW	50FH-003-100N	9825	Attenuator	18-Jun-98	18-Jun-99
PW		JFW	50FHB-003-5	00363	Attenuator	18-Nov-97	18-Nov-98
PW	(R)	Mini-Circuits	ZHL-1042J	D020698-14	RF Pre-Amplifier (10-4200 MHZ)	13-Feb-98	13-Feb-99
PW	R	Mini-Circuits	ZHL-1042J	N032698	RF Pre-Amplifier (30-4000 MHz)	11-May-98	11-May-99
PW	C	Polarad Electronics	ESH3-Z2	357.881J.32	Transient Limiter		
PW	X	Radio Shack	63-867	005	Temperature / Humidity Indicator		
PW	C, R	Rhode & Schwartz	ESHS 30	842806/001	EMI Test Receiver	07-Oct-97	07-Oct-98
PW	C	Rhode & Schwarz	ESH2-Z5	830364/002	LISN 50 ohm/50uH 3 line (1kHz - 30 MHz)	23-Feb-98	23-Feb-99
PW	C	Rhode & Schwarz	ESH3	872318/036	Low Frequency Receiver (9 kHz - 30 MHz)	06-Aug-97	06-Aug-98
PW	C	Rhode & Schwarz	ESH3	872318/036	Low Frequency Receiver (9 kHz - 30 MHz)	03-Sep-98	03-Sep-99
PW	R	Rhode & Schwarz	HFH2-Z2	880665/042	Loop Antenna (10 kHz - 30 MHz)	08-Feb-98	08-Feb-99
PW		Schwarzbeck	NNLK 8129	8129126	LISN	20-Oct-97	20-Oct-98
PW	C	Schwarzbeck	TK 9416	TUV-600	Conducted Line Probe (150 kHz - 30 MHz)	04-Apr-98	04-Apr-99
PW		Shaffner	NSG 431	1426	ESD Tester		
PW	C	Solar	8028-50-TS-24-	8305121	LISN	23-Feb-98	23-Feb-99
PW	C	Solar	8028-50-TS-24-	8305122	LISN (10 kHz - 30 MHz)	23-Feb-98	23-Feb-99
PW		Tensor	4105	2020	Ridged Guide Antenna	11-Jun-98	11-Jun-99
PW		Transonic	T-100	147	Ion Meter		
PW		TUV PS	LPS-1	1	P/S for Loop Antenna		
PW		WaveTek	DM5XL	60206553	Hand Held Multimeter		
PW		Weinschel	2-3dB	BC5530	Attenuator	18-Nov-97	18-Nov-98
PW		Weinschel	2-3dB	BC5539	Attenuator	18-Nov-97	18-Nov-98
PW		Weinschel	2-6B	BC6492	Attenuator	18-Nov-97	18-Nov-98
PW		Weinschel	2-6dB	BC6487	Attenuator	18-Nov-97	18-Nov-98

## **Appendix A**

Transmitter Data Sheets

15.231 PERIODIC OPERATION INTENTIONAL RADIATOR

Date:	22-Oct-98	Measured @	315 MHz
EUT:	Air Machine Remote Transmitter		
Manufacturer:	Technik Manufacturing, Inc.		

## Miscellaneous Measurements:

### 1) 20 dB Bandwidth

### Calculated Averaging Factor: Averaging Factor Applied:

## **Measurement FCC Specification**

360 kHz      87 kHz

IB (20\*Log(duty cycle))

Fundamental Field Strength:

Harmonics	Specification	Measurement			Delta dB
		dBuV/m @	MHz	dBuV/m @	
2nd harmonic (630 MHz)	55.6 dBuV/m	47.3	629.9	29.3	629.9
3rd harmonic (945 MHz)	55.6 dBuV/m	47.5	944.9	29.5	944.9
4th harmonic (1260 MHz)	55.6 dBuV/m	54.3	1259.8	36.3	1259.8
5th harmonic (1575 MHz)	54 dBuV/m	52.4	1574.8	34.4	1574.8
6th harmonic (1890 MHz)	55.6 dBuV/m	48.4	1889.8	30.4	1889.8
7th harmonic (2205 MHz)	54 dBuV/m	47.6	2204.7	29.6	2204.7
8th harmonic (2520 MHz)	55.6 dBuV/m	54.7	2519.7	36.7	2519.7
9th harmonic (2835 MHz)	54 dBuV/m	61.6	2834.7	43.6	2834.7
10th harmonic (3150 MHz)	55.6 dBuV/m	51.5	3149.7	33.5	3149.7

## Minimum Passing Margin:

3.6 dB

## **Appendix B**

**Detailed Test Data Sheets**

## T U V P R O D U C T S E R V I C E

## RADIATED EMISSIONS

PW1 Test Site  
 3 Meter Antenna Distance  
 Equipment Under Test:

Technik Mfg, Inc. M/N: RFV-1  
 Air Machine Remote (TX)

Notes: Remote control for adding credits to air vend machine, S/N: EMC-1

Report B8499 Run 3

Date 10/22/98 Page 1

Engineer Elaine

Tech: S S Shawn S. ngL

Requester \_\_\_\_\_

Frequency	Level	Factor	Cable	Final	Az	Polar\	Delta	Delta
MHz	dBuV	dB	dB	dBuV/m	deg	Height	FCC B	

Investigating incorporated digital circuitry 30 - 1000 MHz.

B/V  
 0 deg/initial ant. height 1 meter.

No emissions were found.

90 degrees azimuth

No emissions were found.

180 degrees azimuth

No emissions were found.

270 degrees azimuth

No emissions were found.

Below readings are above the receiver's noise floor.

30	5.7	13.8	.4	19.9	--	V	--	-20.1
35	3.2	13.2	.4	16.8	--	V	--	-23.2
45	5.1	12.1	.4	17.6	--	V	--	-22.4
55	5	10.9	.5	16.3	--	V	--	-23.7
65	6	9.5	.5	16	--	V	--	-24
69.97	5.45	8.9	.5	14.9	--	V	--	-25.1

Horizontal polarization.

0 deg/initial antenna height 2 meters.

No emissions were found.

90 degrees azimuth

No emissions were found.

## T U V P R O D U C T S E R V I C E

## RADIATED EMISSIONS

PW1 Test Site  
 3 Meter Antenna Distance  
 Equipment Under Test:

Technik Mfg, Inc. M/N: RFV-1  
 Air Machine Remote (TX)

Notes: Remote control for adding credits to air vend machine, S/N: EMC-1

Report B8499 Run 3

Date 10/22/98 Page 2

Engineer File 101.

Tech: S S Shawn Singh

Requester \_\_\_\_\_

Frequency	Level	Factor	Cable	Final	Az	Polar\	Delta	Delta
MHz	dBuV	dB	dB	dBuV/m	deg	Height	FCC	B

180 degrees azimuth

No emissions were found.

270 degrees azimuth

No emissions were found.

Log periodic antenna, horizontal polarization.

0 deg/initial antenna height 2 meters.

No emissions were found.

90 degrees azimuth

No emissions were found.

180 degrees azimuth

No emissions were found.

270 degrees azimuth

No emissions were found.

Vertical polarization.

0 deg/initial antenna height 1 meter.

No emissions were found.

90 degrees azimuth

No emissions were found.

180 degrees azimuth

No emissions were found.

T U V P R O D U C T S E R V I C E

RADIATED EMISSIONS

PW1 Test Site  
3 Meter Antenna Distance  
Equipment Under Test:  
Technik Mfg, Inc. M/N: RFV-1

Air Machine Remote (TX)

Notes: Remote control for adding credits to air vend machine, S/N: EMC-1

Report B8499 Run 3

Date 10/22/98 Page 3

Engineer FC Shawn

Tech: S S Shawn Singh

Requester

---

Frequency	Level	Factor	Cable	Final	Az	Polar\	Delta	Delta
MHz	dBuV	dB	dB	dBuV/m	deg	Height	FCC B	

---

270 degrees azimuth

No emissions were found.

## T U V P R O D U C T S E R V I C E

## RADIATED EMISSIONS

PW1 Test Site  
 3 Meter Antenna Distance  
 Equipment Under Test:  
 Technik Mfg, Inc. M/N: RFV-1  
 Air Machine Remote (TX)  
 Notes: Remote control for adding credits to air vend machine, S/N: EMC-1

Figure\_\_\_\_\_

Report B8499 Run 3

Date 10/22/98 Page 4

Engineer ELATech: S S Shawn Singl

Requester\_\_\_\_\_

## Measurement Summary

Frequency MHz	Final dBuV/m	Azimuth deg	Polar\ Height	Delta FCC B	Delta
30	19.9	9.8855	--	V --	-20.1
35	16.8	6.9183	--	V --	-23.2
45	17.6	7.5857	--	V --	-22.4
55	16.3	6.5313	--	V --	-23.7
65	16	6.3095	--	V --	-24
69.97	14.9	5.5590	--	V --	-25.1

Minimum Passing Margin for FCC B is 20.1 dB at 30 MHz

File B8499 Run 3

## T U V P R O D U C T S E R V I C E

## RADIATED EMISSIONS

PW1 Test Site  
 3 Meter Antenna Distance

## Equipment Under Test:

Technik Mfg, Inc. M/N: RFV-1  
 Air Machine Remote (TX)

Notes: Remote control for adding credits to air vend machine, S/N: EMC-1

Report B8499 Run 4

Date 10/22/98 Page 1

Engineer EV

Tech: S S Shawn Singl

Requester \_\_\_\_\_

Frequency	Level	Factor	Cable	Final	Az	Polar\	Delta	Delta
MHz	dBuV	dB	dB	dBuV/m	deg	Height		

Fresh 2 x 1.5 Volts batteries. All frequencies are fully maximized.

Peak readings. Average readings will be computed from duty cycle.

Log periodic antenna, horizontal polarization.

180 degrees azimuth, antenna height 1 meter.

314.92 75.2 13.8 1 90 -- H --

Vertical polarization.

57 degrees azimuth, antenna height 1 meter.

314.92 63.15 13.8 1 78 -- V --

629.93 13.9 20.7 1.5 36.1 -- V --

944.92 19.2 23.9 2 45.2 -- V --

Horizontal polarization.

166 degrees azimuth, antenna height 1 meter.

629.90 25.05 20.7 1.5 47.3 -- H --

18 degrees azimuth, antenna height 1 meter.

944.92 21.5 23.9 2 47.5 -- H --

Vertical polarization.

Horn antenna

0 degrees azimuth, antenna height 1 meter.

1259.8 26.05 25.9 2.3 54.3 -- V --

40 degrees azimuth, antenna height 1.1 meters.

1574.8 22.5 27.3 2.6 52.4 -- V --

267 degrees azimuth, antenna height 1 meter.

1889.8 16.95 28.6 2.9 48.4 -- V --

## T U V P R O D U C T S E R V I C E

## RADIATED EMISSIONS

PW1 Test Site  
 3 Meter Antenna Distance  
 Equipment Under Test:  
 Technik Mfg, Inc. M/N: RFV-1  
 Air Machine Remote (TX)

Report B8499 Run 4  
 Date 10/22/98 Page 2  
 Engineer EL 108  
 Tech: S S Suman Singh  
 Requester \_\_\_\_\_

Notes: Remote control for adding credits to air vend machine, S/N: EMC-1

Frequency	Level	Factor	Cable	Final	Az	Polar\	Delta	Delta
MHz	dBuV	dB	dB	dBuV/m	deg	Height		

0 degrees azimuth, antenna height 1.2 meters.

2204.8 14.5 29.7 3.2 47.4 -- V --  
 271 degrees azimuth, antenna height 1 meter.

2519.7 20.6 30.7 3.4 54.7 -- V --  
 264 degrees azimuth, antenna height 1 meter.

2834.7 25.1 31.2 3.7 60 -- V --  
 3149.7 15.7 31.9 3.9 51.5 -- V --

Horizontal polarization.

145 degrees azimuth, antenna height 1 meter.

1259.8 19.45 25.9 2.3 47.7 -- H --  
 1574.8 17.75 27.3 2.6 47.6 -- H --  
 0 degrees azimuth, antenna height 1 meter.

1889.8 16.4 28.6 2.9 47.8 -- H --

193 degrees azimuth, antenna height 1 meter.

2204.7 14.75 29.7 3.2 47.6 -- H --

0 degrees azimuth, antenna height 1 meter.

2519.8 16 30.7 3.4 50.1 -- H --

180 degrees azimuth, antenna height 1 meter.

2834.7 26.7 31.2 3.7 61.6 -- H --  
 3149.7 11.5 31.9 3.9 47.3 -- H --

## T U V P R O D U C T S E R V I C E

## RADIATED EMISSIONS

PW1 Test Site  
 3 Meter Antenna Distance  
 Equipment Under Test:  
 Technik Mfg, Inc. M/N: RFV-1  
 Air Machine Remote (TX)  
 Notes: Remote control for adding credits to air vend machine, S/N: EMC-1

Figure

Report B8499 Run 4

Date 10/22/98 Page 3

Engineer Ex-101Tech: S S Shawn Singl

Requester

## Measurement Summary

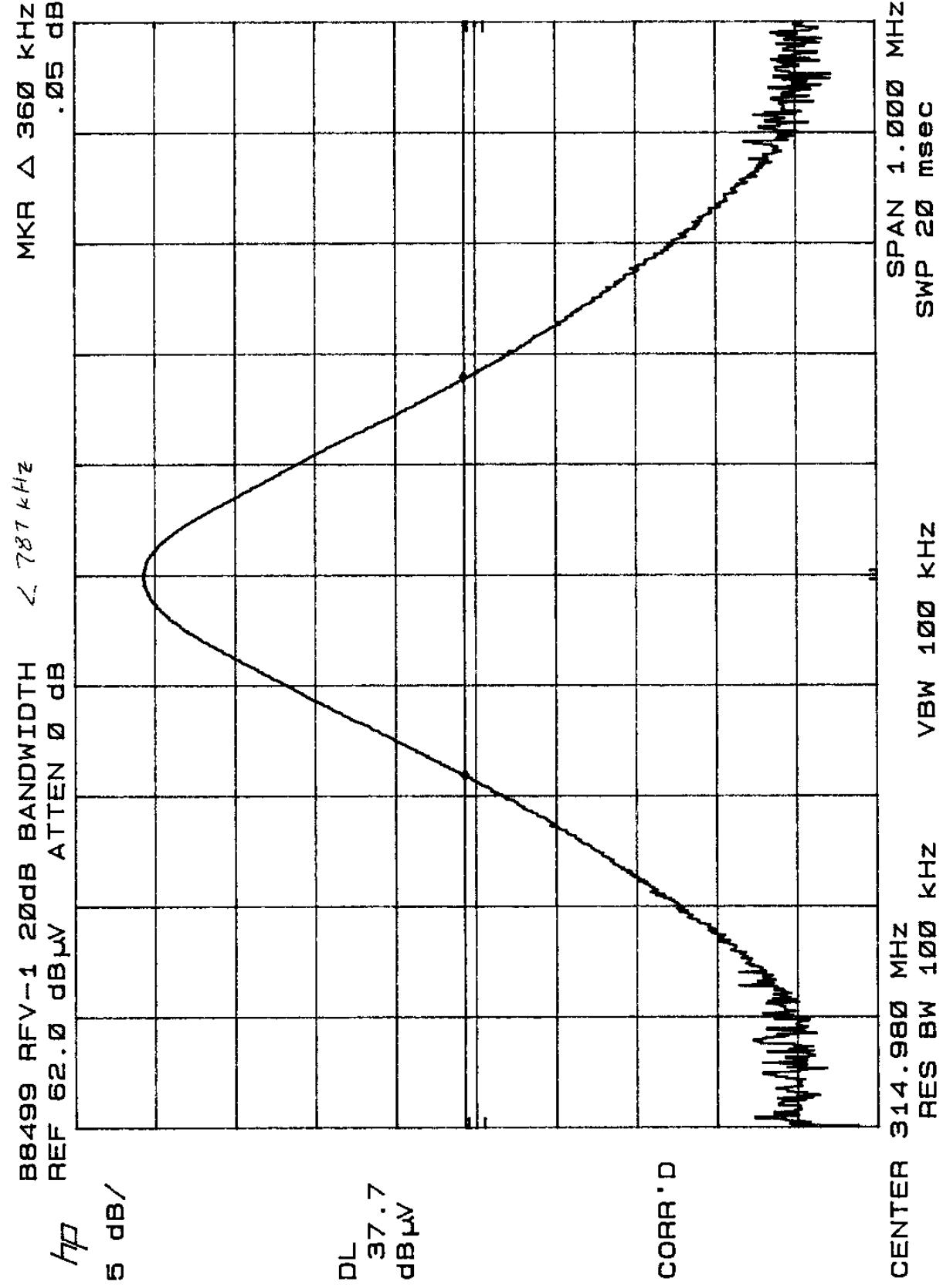
Frequency MHz	Final dBuV/m	uV/m	Azimuth deg	Polar\ Height	Delta	Delta
314.92	90	31622.	--	H	--	
629.90	47.3	231.73	--	H	--	
944.92	47.5	237.13	--	H	--	
1259.8	54.3	518.8	--	V	--	
1574.8	52.4	416.86	--	V	--	
1889.8	48.4	263.02	--	V	--	
2204.7	47.6	239.88	--	H	--	
2519.7	54.7	543.25	--	V	--	
2834.7	61.6	1202.2	--	H	--	
3149.7	51.5	375.83	--	V	--	

File B8499 Run 4

## Appendix C

Plots of 20 dB Bandwidth

Limit < 0.25% = 787.5 kHz



## Appendix D

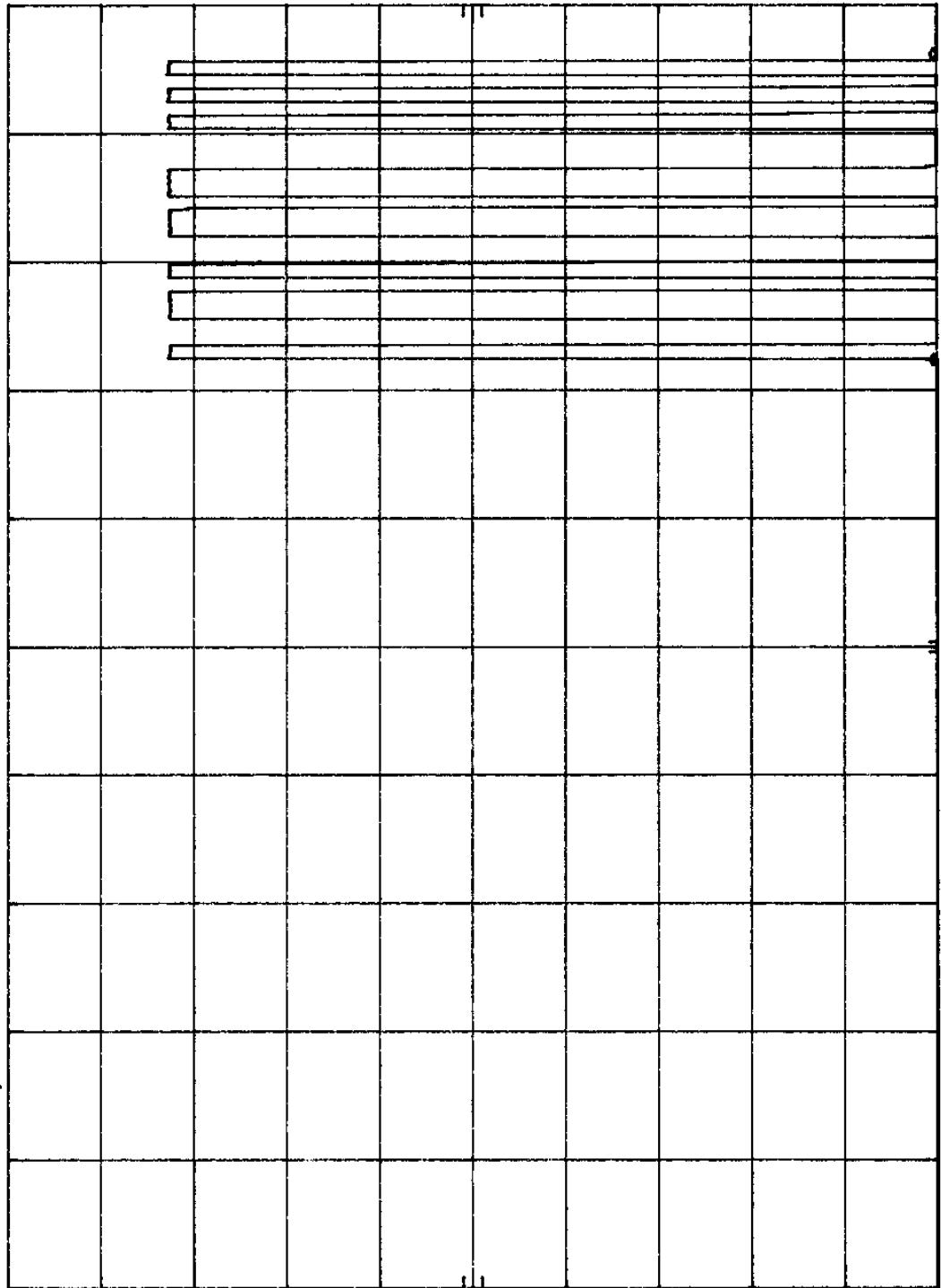
Plots of Calculated Duty Cycle

$$\text{Duty cycle} = \frac{1.14 \times 5 + 2.19(3)}{100} = \frac{5.7 + 6.57}{100} = -18.2 \text{ dB}$$

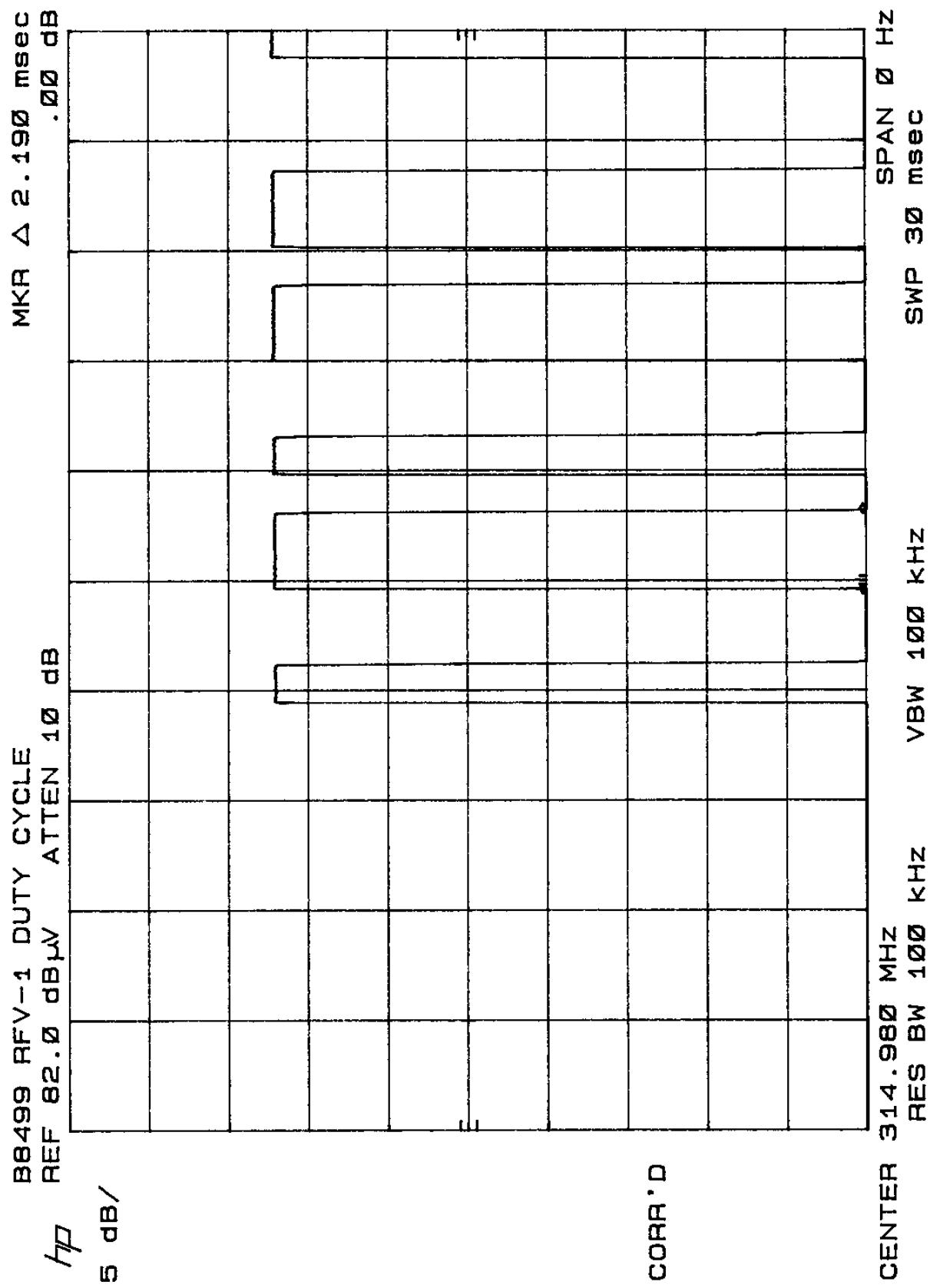
B8499 RFV-1 DUTY CYCLE  
REF 82.0 dBμV ATTEN 10 dB

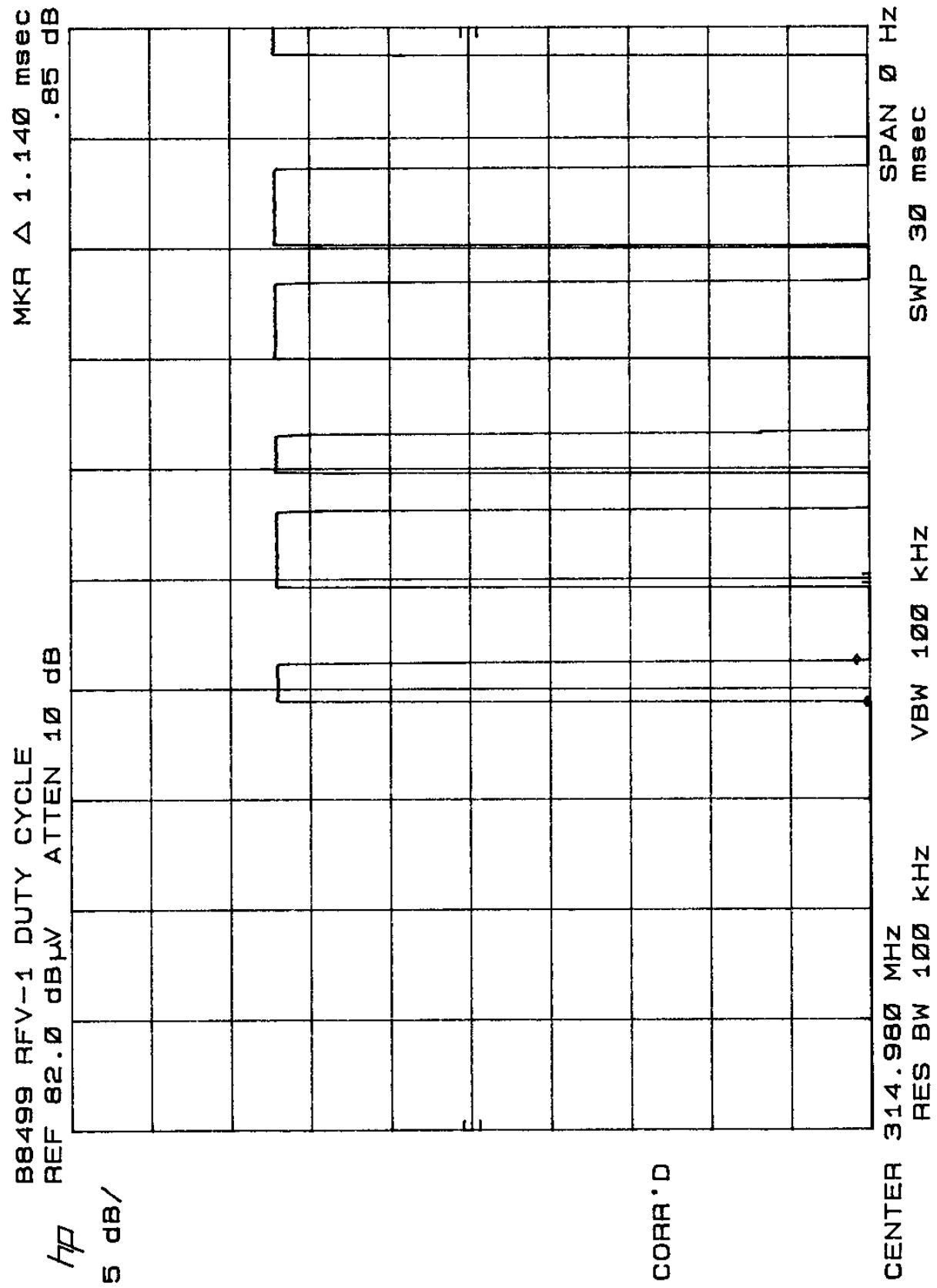
MKR Δ 23.80 msec  
.00 dB

5 dB/  
Hz



CORR'D





## **Appendix E**

Test Plan  
and  
Constructional Data Form

# Test Plan

## for Electromagnetic Compatibility Testing



### General Information (if you need assistance completing this form contact your TÜV Product Service representative.)

Company: Technik Mfg. Inc. Quote Number: \_\_\_\_\_  
Contact: Jim Lane Phone: (business hrs) 402-553-6372  
E-mail Address: Jim\_Lane@MSN.com Phone: (after hrs) 402-598-1147

### Product Description

Description: Remote control for air vending machine  
Model Number: RFV-1 Serial Number: 1

### Test Objective

EMC Directive 89/336/EEC (EMC)  
 Machinery Directive 89/392/EEC (EMC)  
 Medical Device Directive 93/42/EEC (EMC)  
 FCC 15 Part a-d (list)       Vehicle Directive 72/245/EEC (EMC)  
 FDA Reviewers Guidance for Premarket Notification Submissions (EMC)  
 Other \_\_\_\_\_ (list)

### Attendance

Test will be:  Attended by the customer  Unattended by the customer

### Failure

If a failure occurs, TÜV Product Service should:

Call contact listed above, if not available then stop testing.  
 Continue testing to complete test series.  
 Continue testing to define corrective action.  
 Stop testing.

### Authorization

Customer authorization to perform tests according to this test plan. \_\_\_\_\_ Date \_\_\_\_\_  
Jim Lane \_\_\_\_\_ Date 10-16-98  
Test Plan Prepared By (please print) \_\_\_\_\_  
Shawn Singh \_\_\_\_\_ Date 11-10-98  
Reviewed by TÜV Product Service Associate \_\_\_\_\_ Date \_\_\_\_\_

# Test Plan

## for Electromagnetic Compatibility Testing



### Equipment Under Test Transportation

- Transportation between sites by customer.
- Other (consult your TÜV Product Service representative)

### Dimensions and Weight

Length 5 inches Width 3 inches  
Height 1.5 inches Weight \_\_\_\_\_

### Facilities

#### Power Requirements

- 230 VAC 50 Hz Single Phase \_\_\_\_\_ Amps
- 400 VAC 50 Hz Three Phase \_\_\_\_\_ Amps per phase
- 120 VAC 60 Hz Single Phase \_\_\_\_\_ Amps
- 208 VAC 60 Hz Three Phase \_\_\_\_\_ Amps per phase
- \_\_\_\_\_ VDC \_\_\_\_\_ Amps
- Battery 2xAA VDC Expected life \_\_\_\_\_ hours
- Other \_\_\_\_\_

*Regulations require testing to be performed at typical power ratings in the countries of intended use. (i.e., European power is typically 230 VAC 50 Hz or 400 VAC 50 Hz, single and three phase, respectively)*

#### Other

- Air \_\_\_\_\_ cfm \_\_\_\_\_ psi  Water \_\_\_\_\_ gpm \_\_\_\_\_ psi
- Other \_\_\_\_\_ (describe)

### Test Plan Attachments

- Applicable (attached) \* The CDF is required for all test plans.

#### Immunity Test Plan Details

- Applicable (attached)  N/A

#### Emissions Test Plan Details

- Applicable (attached)  N/A

#### On Site Test Plan Details

- Applicable (attached)  N/A

# Constructional Data Form for Electromagnetic Compatibility Testing



A completed form helps ensure that product testing will go smoothly. Add attachments as necessary for additional documentation. For additional help, please contact your TÜV Product Service Representative.

Press TAB to go to the next field.

**Applicant** -- Enter company information pertaining to the location where the product is manufactured and for the manufacturer's contact soliciting the testing.

Company: Technik Mfg, Inc.

Address: 1005 17<sup>th</sup> Street

Columbus, NE 68601

Phone: 402-564-3191 Fax: 402-564-0406

Contact: Dennis L. Carstens Position: President

**General Equipment Description** -- Indicate which attachments you are providing with this document. It is recommended that you provide those listed.

Type of Equipment: Air Machine Remote Transmitter Model No.: RFV-1

Serial No.: 1 FCC ID No.: N9O-RFV1

General description: See attached.

Product Variant/Options:

Attachments: (only required for certification)

External Photographs     Product Literature     High Level Bill of Materials

Press TAB to go to the next field. Date and sign each page of the CDF. Original signatures must be present on each page.

Date: 10/13/98    Signature of Applicant:

# Constructional Data Form for Electromagnetic Compatibility Testing



**Installation and Environmental Conditions (describe)** -- Describe the intended installation. Include details such as power connection and system grounding approaches. Describe the intended operating environment, include details such as humidity, cooling, heating and hazardous environments. Attaching a copy of an Installation manual is recommended for proper documentation of your system. Please indicate.

**See user manual.**

Installation manual/instructions (attached, only required for certification)

**Power Requirements** -- Indicate your system power requirements for the equipment to be tested.

Rated Voltage \_\_\_\_\_ Rated Input Power \_\_\_\_\_

**Protection Class** -- Indicate your product's protection class. Contact your TÜV Product Service representative and is only required for certification.

Type: \_\_\_\_\_ Class: \_\_\_\_\_

**Press TAB to go to the next field.** Date and sign each page of the CDF. Original signatures must be present on each page.

**Date:** 10/13/98 **Signature of Applicant:**

# Constructional Data Form

## for Electromagnetic Compatibility Testing



### I/O Ports and Cables

Indicate all interface cables which can be attached to the equipment even if they are not sold as part of your system. Describe the port (e.g., Parallel, Serial, SCSI), list its type (e.g., AC, DC, Signal, Control) and number of ports/cables of type. Indicate if the I/O port is to be exercised during testing. List the type of transmission and if the cable is an EUT assembly-to-assembly interconnection cable (PC to printer, to modem). Indicate whether the cable is shielded or not, type of shield (e.g. Braid, Foil) and how terminated (e.g. 360 degree to conductive shell, pigtail) at both ends of the cable. If a cable can have a typical length of  $\geq 3.0$  meters, then it is required to test with a cable of at least 3.0 meters.

### I/O Ports and Cables

Description:	<b>- none -</b>			
Type of Port:	# of ports/cables of type			
Exercised during testing?	<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
Assembly ↔ Assembly Interconnect	<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
Cable shielded:	<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
Shield Type (describe)				
Termination: (describe)				
Transmission Type:	<input type="checkbox"/>	Analog	<input type="checkbox"/>	Digital
Length of cable:	Maximum:	Tested:		

### I/O Ports and Cables

Description:				
Type of Port:	# of ports/cables of type			
Exercised during testing?	<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
Assembly ↔ Assembly Interconnect	<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
Cable shielded:	<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
Shield Type (describe)				
Termination: (describe)				
Transmission Type:	<input type="checkbox"/>	Analog	<input type="checkbox"/>	Digital
Length of cable:	Maximum:	Tested:		

### I/O Ports and Cables

Description:				
Type of Port:	# of ports/cables of type			
Exercised during testing?	<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
Assembly ↔ Assembly Interconnect	<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
Cable shielded:	<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
Shield Type (describe)				
Termination: (describe)				
Transmission Type:	<input type="checkbox"/>	Analog	<input type="checkbox"/>	Digital
Length of cable:	Maximum:	Tested:		

Press TAB to go to the next field. Date and sign each page of the CDF. Original signatures must be present on each page.

Date: 10/13/98 Signature of Applicant:

# Constructional Data Form for Electromagnetic Compatibility Testing



**EUT configurations** -- Provide a technical description of all possible EUT configurations. Specify if more than one configuration is to be tested.

**As shipped.**

**EUT Software and Operation Modes to be Tested** -- list the operating modes to be used during test. It is recommended the equipment be tested while operating in a typical operation mode. Consult with your TÜV Product Service Representative when typical operating modes are not practical. FCC testing of personal computers and/or peripherals requires that a simple program generate a complete line of upper case H's. This pattern must be sent to the parallel port device, serial port device, and must be write/read/verified to each storage device. Monitors must display the H pattern, typically in white letters on a black background. Provide a general description of all software, firmware, and PLD algorithms used in the equipment. List all code modules as described above, with the revision level used during testing.

General Description: **See product description.**  
(describe)

Software Revision Level: **V3.0 10/26/98**  
(list and describe)

Operating modes to be tested: **See product description.**  
(list and describe)

Operation manual/instructions (attached)

**Press TAB to go to the next field.** Date and sign each page of the CDF. Original signatures must be present on each page.

**Date: 10/13/98      Signature of Applicant:**

# Constructional Data Form for Electromagnetic Compatibility Testing



**System, Subsystem, Major Subassemblies or Internal Peripherals** -- List and describe all system, subsystem, major subassemblies and all internal peripherals. This should include such things as an external monitor, parallel interface peripheral, serial interface peripheral, internal disk drives or internal circuit boards. It is recommended that circuit diagrams, assembly and subassembly drawings be attached. Please indicate.

<i>Description</i>	<i>Model #</i>	<i>Serial #</i>	<i>FCC ID #</i>
<input type="checkbox"/> Technical Drawings attached			

**Interfacing Equipment and/or Simulators (which are not part of the EUT)** -- List and Describe all equipment or peripherals that will be connected to the EUT. For FCC testing a minimum configuration is required. If you have questions about this minimum configuration contact your TÜV Product Service representative.

<i>Description</i>	<i>Model #</i>	<i>Serial #</i>	<i>FCC ID #</i>

Press TAB to go to the next field. Date and sign each page of the CDF. Original signatures must be present on each page.

<b>Date:</b> 10/13/98	<b>Signature of Applicant:</b>
-----------------------	--------------------------------

# Constructional Data Form

## for Electromagnetic Compatibility Testing



**EMC System Details** -- List all frequencies and sub-harmonics which are 10kHz or above for such things as oscillators, horizontal line rate of monitors, and clock rates of incorporated OEM assemblies. List all power supplies. Indicate switching frequencies. List power line filters and indicate the manufacturer, model and location on EUT. Indicate all components used for high frequency noise reduction. (e.g., ceramic capacitor, 0.01µF, 1 ea. at C12 - C20).

### Oscillator Frequencies

Frequency	Sub-harmonics	EUT Location	Description of Use
5.0MHz		Transmitter Board	MCU crystal osc.

### Power Supply

Frequency	Manufacturer	Model #	Serial #	Type (list frequency)

### Power Line Filters

Manufacturer	Model #	Qty	Location on EUT

### Critical EMI Components (Capacitors, ferrites, etc.)

Description	Manufacturer	Part # or Value	Qty	Location on EUT

Press TAB to go to the next field.

Date and sign each page of the CDF. Original signatures must be present on each page.

Date: 10/13/98

Signature of Applicant:

# Constructional Data Form

## for Electromagnetic Compatibility Testing



**Other EMI Critical Construction Detail --** Indicate any other measures taken to reduce high frequency noise, (e.g., grounding the circuit board on the right rear corner with 0.25" braid, 3 inches long to the chassis).

**Description of Enclosure** -- Describe the principle materials of the enclosure (e.g., plastic, plastic with shielding material, metal, metal with specific shielding contact points, metal with paint on all surfaces).

**ABS plastic.**

**Press TAB to go to the next field.** Date and sign each page of the CDF. Original signatures must be present on each page.

**Date:** 10/13/98 **Signature of Applicant:**

# Constructional Data Form for Electromagnetic Compatibility Testing



**System Configuration Block Diagram --** Provide a line drawing identifying the EUT, simulators, support equipment, I/O cables, power cables, and any other pertinent components to be used during testing. Use a dashed line to separate the equipment in the testing field versus equipment outside testing field.

See test set-up photos

Date and sign each page of the CDF. Original signatures must be present on each page.

Date:

Signature of Applicant:

## **Appendix F**

### **Measurement of Protocol**

# MEASUREMENT PROTOCOL FOR FCC

## GENERAL INFORMATION

### Measurement Uncertainty

The test system for conducted emissions is defined as the LISN, tuned receiver or spectrum analyzer, and coaxial cable. The test system for radiated emissions is defined as the antenna, the pre-amplifier, the spectrum analyzer and the coaxial cable. These test systems have a measurement uncertainty of  $\pm 4.5$  dB. The equipment comprising the test systems are calibrated on an annual basis.

### Justification

The Equipment Under Test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions. A cable is connected to each available port and either terminated with a peripheral into its characteristic impedance or left unterminated. When appropriate, the cables are manually manipulated with respect to each other to obtain maximum emissions from the unit.

## CONDUCTED EMISSIONS

The final level, expressed in dB $\mu$ V, is arrived at by taking the reading directly from the EMI receiver. This level is compared directly to the FCC limit.

To convert between dB $\mu$ V and  $\mu$ V, the following conversions apply:

$$\text{dB}\mu\text{V} = 20(\log \mu\text{V})$$

$$\mu\text{V} = \text{Inverse log}(\text{dB}\mu\text{V}/20)$$

## RADIATED EMISSIONS

The final level, expressed in dB $\mu$ V/m, is arrived at by taking the reading from the spectrum analyzer (Level dB $\mu$ V) and adding the antenna correction factor and cable loss factor (Factor dB) to it. This result then has the FCC limit subtracted from it to provide the Delta which gives the tabular data as shown in the data sheets in Attachment B. The amplifier gain is automatically accounted for by using an analyzer offset.

Example:

Frequency (MHz)	Level (dB $\mu$ V)	+	Factor & Cable (dB)	=	Final (dB $\mu$ V/m)	-	FCC B (dB $\mu$ V/m)	=	Delta (dB)
32.21	13.9	+	16.3	=	30.2	-	40.0	=	-9.8

## DETAILS OF TEST PROCEDURES

### General Standard Information

The test methods used comply with **ANSI C63.4-1992 - "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz."**

### Conducted Emissions

Conducted emissions on the 60 Hz power interface of the EUT are measured in the frequency range of 450 kHz to 30 MHz. The measurements are performed using a receiver, which has CISPR characteristic bandwidth and quasi-peak detection, and a Line Impedance Stabilization Network (LISN), with  $50\ \Omega/50\ \mu\text{H}$  (CISPR 16) characteristics. Table top equipment is placed on a non-conducting table 80 centimeters above the floor **and is positioned 40 centimeters from the vertical ground plane (wall) of the screen room.** In some cases, a pre-scan using a spectrum analyzer is initially performed on the units comprising the system under test to locate the highest emissions. If the minimum passing margin appears to be less than 20 dB with a peak mode measurement, the emissions are re-measured using a tuned receiver or spectrum analyzer with quasi-peak and average detection and recorded on the data sheets.

### Radiated Emissions

Radiated emissions from the EUT are measured in the frequency range of 30 to 3150 MHz using a spectrum analyzer and appropriate broadband linearly polarized antennas. Measurements between 30 MHz and 1000 MHz are made with 120 kHz/6 dB bandwidth and quasi-peak detection and measurements above 1000 MHz are made with a 1 MHz/6 dB bandwidth and peak detection. Table top equipment is placed on a 1.0 X 1.5 meter non-conducting table 80 centimeters above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. Interface cables that are closer than 40 centimeters to the ground plane are bundled in the center in a serpentine fashion so they are at least 40 centimeters from the ground plane. Cables to simulators/testers (if used in this test) are routed through the center of the table and to a screen room located outside the test area. The antenna is positioned 3 meters horizontally from the EUT. To locate maximum emissions from the test sample the antenna is varied in height from 1 to 4 meters, measurement scans are made with both horizontal and vertical antenna polarizations and the EUT are rotated 360 degrees. Intentional radiators are rotated through three orthogonal axes to determine the attitude that maximizes the emissions.

## **Attachment G**

Test Set-up Photos

Test-setup photo(s):  
Conducted Emissions

**Test Not Applicable**

Test-setup photo(s)  
Radiated Emissions

