

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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DIRECTORY - EMISSIONS

	Page(s)
Documentation	
Test report	<u>1 - 3</u>
Directory	<u>2</u>
Test Regulations	<u>3</u>
General Remarks	<u>3</u>
Test Equipment Used	<u>4-6</u>
Appendix A	
Transmitter Data Sheets	<u>A1 - A2</u>
Appendix B	
Detailed Test Data Sheets	<u>B1 - B8</u>
Appendix C	
Plot of 20 dB bandwidth	<u>C1 - C2</u>
Appendix D	
Plots of Calculated Duty Cycle	<u>D1 - D4</u>
Appendix E	
Test Plan/Constructional Data Form	<u>E1 - E11</u>
Appendix F	
Measurement of Protocol	<u>F1 - F3</u>
Attachment G	
Test-setup Photographs	<u>G1 - G3</u>

EMISSIONS TEST REGULATIONS :

The tests were performed according to following regulations :

- | | | |
|---|--|---|
| ☒ - Federal Communication Commission part 15 | ☐ - 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 ☐ - PASS ☐ - FAIL ☒ - Not Applicable

Passing Margin _____ dB at _____ MHz

Remarks: _____

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

Test Result ☒ - PASS ☐ - FAIL ☐ - Not Applicable

Passing Margin _____ 20.1 dB at _____ 30 MHz

Remarks: _____

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

Test Result ☒ - PASS ☐ - FAIL ☐ - 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: Sharon Singl
 Temp: 22°C Rel. Humd.: 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		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	q545HSY20483	Computer for PW Testbed		
PW	R	Compliance Desig	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		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		Transjonic	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

B8499.XLS

15.231 PERIODIC OPERATION INTENTIONAL RADIATOR

Date: 22-Oct-98
EUT: Air Machine Remote Transmitter 315 MHz
Manufacturer: Technik Manufacturing, Inc.
Representative: Dennis L. Carstens

Miscellaneous Measurements:

1) 20 dB Bandwidth 787 kHz

Tx Mode: Radiated Measurements

Calculated Averaging Factor: -18 dB (20*Log(duty cycle))
Averaging Factor Applied: -18 dB

Fundamental Field Strength:

Specification	Peak Measurement dBuV/m @ MHz	Average Measurement dBuV/m @ MHz	Delta dB
75.6 dBuV/m	90	72	-3.6

Harmonics	Specification	Peak Measurement dBuV/m @ MHz	Average Measurement dBuV/m @ MHz	Delta dB
2nd harmonic (630 MHz)	55.6 dBuV/m	47.3	29.3	-26.3
3rd harmonic (945 MHz)	55.6 dBuV/m	47.5	29.5	-26.1
4th harmonic (1260 MHz)	55.6 dBuV/m	54.3	36.3	-19.3
5th harmonic (1575 MHz)	54 dBuV/m	52.4	34.4	-19.6
6th harmonic (1890 MHz)	55.6 dBuV/m	48.4	30.4	-25.2
7th harmonic (2205 MHz)	54 dBuV/m	47.6	29.6	-24.4
8th harmonic (2520 MHz)	55.6 dBuV/m	54.7	36.7	-18.9
9th harmonic (2835 MHz)	54 dBuV/m	61.6	43.6	-10.4
10th harmonic (3150 MHz)	55.6 dBuV/m	51.5	33.5	-22.1

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)

Report B8499 Run 3
 Date 10/22/98 Page 1

Engineer W. Age

Tech: S S Shawn S. MGL

Requester _____

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

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

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.

TUV PRODUCT SERVICE

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 3
 Date 10/22/98 Page 2
 Engineer FL 102
 Tech: S S Shawn Singh
 Requester _____

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

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

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)

Report B8499 Run 3
 Date 10/22/98 Page 3
 Engineer GL
 Tech: S S Shawn Singh
 Requester _____

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

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

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 Figure_____ Report B8499 Run 3
 3 Meter Antenna Distance Date 10/22/98 Page 4
 Equipment Under Test: Engineer EC 398
 Technik Mfg, Inc. M/N: RFV-1 Tech: S S Shawn Singh
 Air Machine Remote (TX) Requester _____
 Notes: Remote control for adding credits to air vend machine, S/N: EMC-1

Measurement Summary

Frequency MHz	----- Final dBuV/m	----- uV/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)

Report B8499 Run 4
Date 10/22/98 Page 1
Engineer RV Jgl
Tech: S S Shawn Singh
Requester _____

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

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

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 JOE
 Tech: S S Shawn Singh
 Requester _____

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

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

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 101
 Tech: S S Shawn S. S. S.
 Requester _____

Measurement Summary

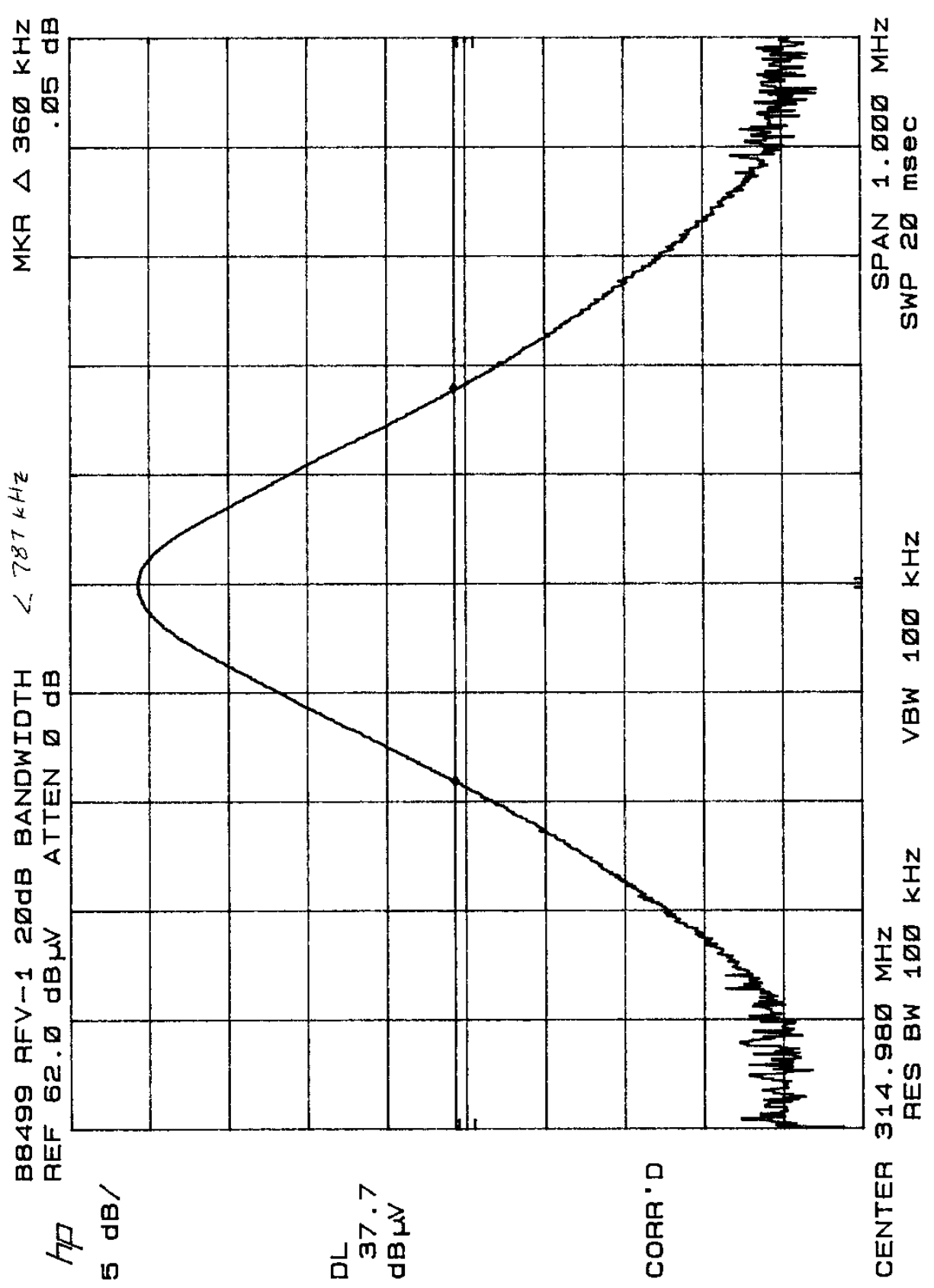
Frequency MHz	----- Final dBuV/m	----- uV/m	Azimuth deg	Polar\ Height	Delta	Delta
314.92	90	31622.	--	H --		
629.90	47.3	231.73	--	H --		
944.92	47.5	237.13	--	H --		
1259.8	54.3	518.8	--	V --		
1574.8	52.4	416.86	--	V --		
1889.8	48.4	263.02	--	V --		
2204.7	47.6	239.88	--	H --		
2519.7	54.7	543.25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

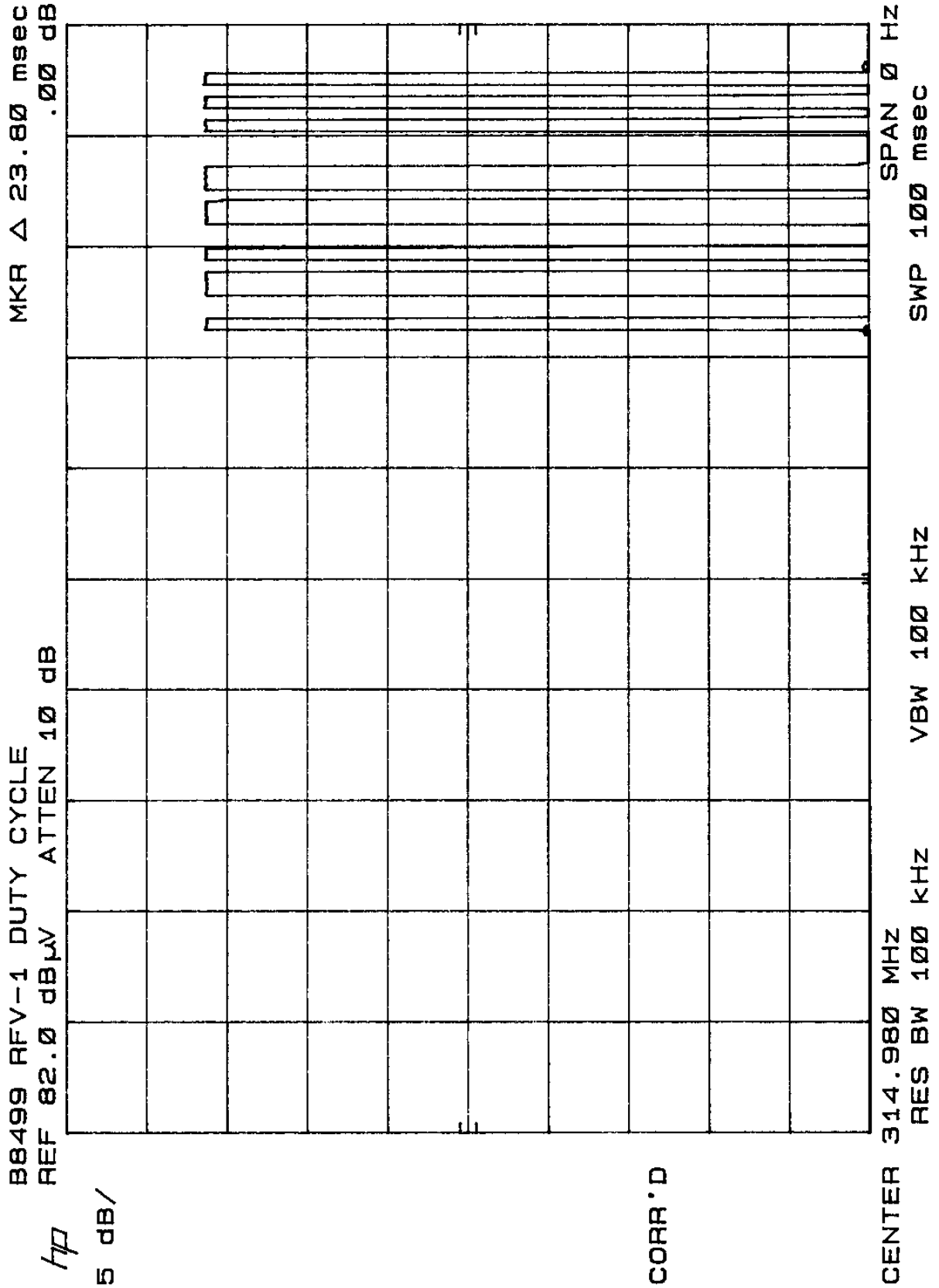
Limit < 0.25% 315 x .0025 = 787.5 kHz



Appendix D

Plots of Calculated Duty Cycle

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

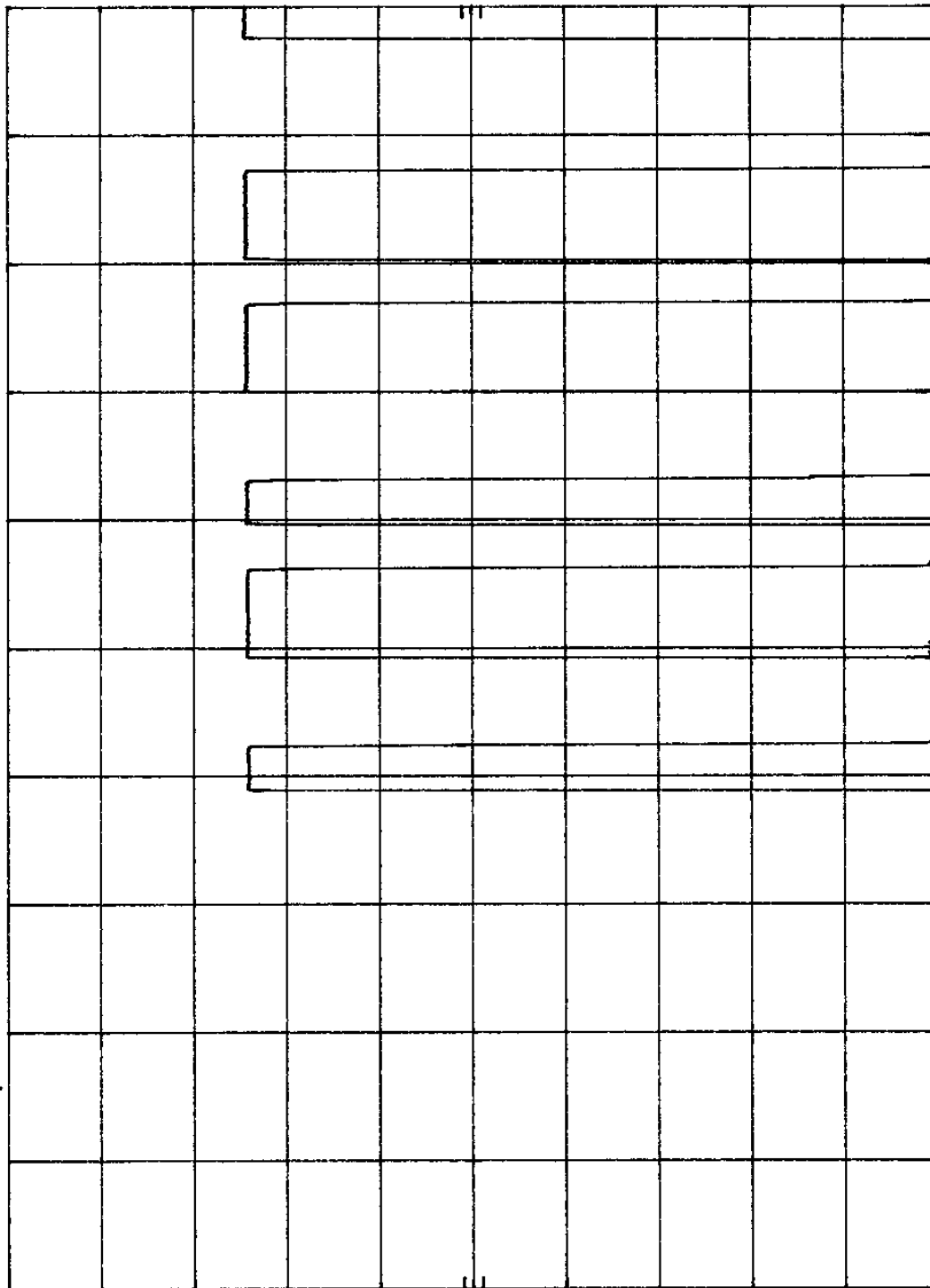


h_p MKR Δ 2.190 msec
REF 82.0 dBμV ATTEN 10 dB
5 dB/

B8499 RFV-1 DUTY CYCLE

h_p

5 dB/



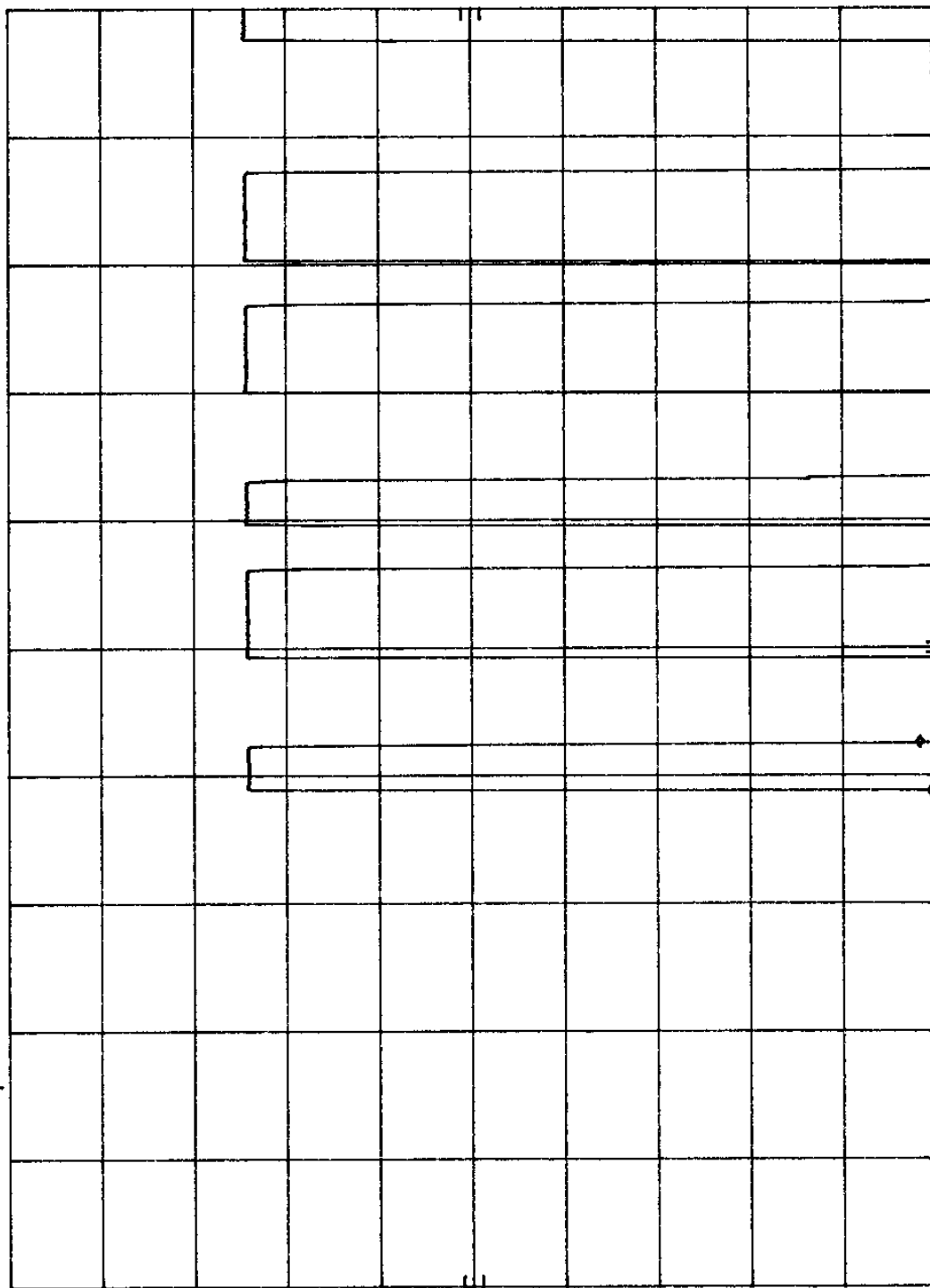
CORR'D

CENTER 314.980 MHz
RES BW 100 kHz
VBW 100 kHz
SWP 30 msec
SPAN 0 Hz

B8499 RFV-1 DUTY CYCLE
REF 82.0 dBμV ATTN 10 dB
MKR Δ 1.140 msec
.85 dB

hp

5 dB/



CORR'D

CENTER 314.980 MHz
RES BW 100 kHz
VBW 100 kHz
SWP 30 msec
SPAN 0 Hz

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) | ☐ Vehicle Directive 72/245/EEC (EMC) |
| ☐ Machinery Directive 89/392/EEC (EMC) | ☐ FDA Reviewers Guidance for Premarket Notification Submissions (EMC) |
| ☐ Medical Device Directive 93/42/EEC (EMC) | ☐ Other _____ (list) |
| ☒ FCC <u>15</u> Part <u>a-d</u> (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

10-16-98

Test Plan Prepared By (please print)

_____ Date

Shawn Singh

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

- Constructional Data Form (CDF) * The CDF is required for all test plans.
☒ Applicable (attached)
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 17th 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 ≥ 3.0 meters, then it is required to test with a cable of at least 3.0 meters.

I/O Ports and Cables

Description: - none -

Type of Port: _____ # of ports/cables of type _____

Exercised during testing? ☐ Yes ☐ No

Assembly $\leftrightarrow$ Assembly Interconnect ☐ Yes ☐ No

Cable shielded: ☐ Yes ☐ No

Shield Type (describe) _____

Termination: (describe) _____

Transmission Type: ☐ Analog ☐ Digital

Length of cable: Maximum: _____ Tested: _____

I/O Ports and Cables

Description: _____

Type of Port: _____ # of ports/cables of type _____

Exercised during testing? ☐ Yes ☐ No

Assembly $\leftrightarrow$ Assembly Interconnect ☐ Yes ☐ No

Cable shielded: ☐ Yes ☐ No

Shield Type (describe) _____

Termination: (describe) _____

Transmission Type: ☐ Analog ☐ Digital

Length of cable: Maximum: _____ Tested: _____

I/O Ports and Cables

Description: _____

Type of Port: _____ # of ports/cables of type _____

Exercised during testing? ☐ Yes ☐ No

Assembly $\leftrightarrow$ Assembly Interconnect ☐ Yes ☐ No

Cable shielded: ☐ Yes ☐ No

Shield Type (describe) _____

Termination: (describe) _____

Transmission Type: ☐ Analog ☐ 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.

Description	Model #	Serial #	FCC ID #

☐ 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.

Description	Model #	Serial #	FCC ID #

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



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, 0.01 μ F, 1 ea. at C12 - C20).

Oscillator Frequencies

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

Power Supply

<i>Frequency</i>	<i>Manufacturer</i>	<i>Model #</i>	<i>Serial #</i>	<i>Type (list frequency)</i>

Power Line Filters

<i>Manufacturer</i>	<i>Model #</i>	<i>Qty</i>	<i>Location on EUT</i>

Critical EMI Components (Capacitors, ferrites, etc.)

<i>Description</i>	<i>Manufacturer</i>	<i>Part # or Value</i>	<i>Qty</i>	<i>Location on EUT</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.

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 ± 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 μ 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 μ V and μ 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 μ V/m, is arrived at by taking the reading from the spectrum analyzer (Level dB μ 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 μ V)	+	Factor & Cable (dB)	=	Final (dB μ V/m)	-	FCC B Limit (dB μ V/m)	=	Delta FCC B (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 Ω /50 μ 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

