

EMC EMISSION - TEST REPORT

Test Report No. **B835501** Issue Date 04 September 1998

Model / Serial No. RS200TX/RS250TX / 01

Product Type Wireless Remote Sensor

Client Compliance and More

Manufacturer Venstar

License holder Venstar

Address 14693 East Wesley Avenue
Aurora, CO 80014-2442

Test Criteria Applied FCC Part 15 15.231C

Test Start Date: 14 August 1998

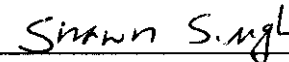
Test End Date: 14 August 1998

Test Result ☒ **PASS** ☐ **FAIL**

Test Report Project No. **B241835502**

Total Pages including
Appendices 48


Reviewed By : Felix J. Chavez


Reviewed By : Shawn Singh

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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: EUT is battery operated.

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

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

Passing Margin _____ 19 dB at _____ 433.00 MHz

Remarks: _____

Radiated emissions (electric field) 418.17 MHz - 4180.6 MHz (Intentional Radiator)

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

Passing Margin _____ 2.4 dB at _____ 4180.6 MHz

Remarks: _____

GENERAL REMARKS:

Modifications required to pass:

Added a 15 Ohm resistor pin 4-3 TX out to ground.

Test Specification Deviations: Additions to or Exclusions from: None

Test-setup photo(s):
Conducted Emissions

Test Not Applicable

Test Equipment Used

Colorado Test Equipment

27-Aug-98

Report: B8355 Date: 31 Aug 98 Signature: Shawn Singh

Temp: 21°C Rel. Humd.: 50% Atmo. Pressure: 81 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	g545HSY20483	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	08-Jul-97	08-Jul-98
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	X	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	R	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	85668	2410A00154	Spectrum Analyzer (dc-22 GHz)	01-Apr-98	30-Sep-98
PW	R, C	Hewlett Packard	85668	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	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

Colorado Test Equipment

22-Jul-98

Report: B8355

Date: 14 Aug 98

Signature: [Signature]

Temp: 22°C

Rel. Humd.: 40%

Atmo. Pressure: 80.0 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	g545HSY20483	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	08-Jul-97	08-Jul-98
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	X	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
PW	R, C, RE101, CISP	Hewlett Packard	8568B	2304A02508	Spectrum Analyzer (set 1) (dc-1.8 Ghz)	17-Jun-98	17-Jun-99

FCC ID:

1

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TÜV PRODUCT SERVICE INC

40 Meadow Road

Pinewood Springs, Lyons, CO 80540 Tel: 303 786 7999 Fax: 303 449 3004 Rev.No 1.0

Location	Tests	Manufacturer	Model Number	Serial Number	Description	Cal Date	Cal Due
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		Radio Shack	63-867	005	Temperature / Humidity Indicator		
PW	C, R	Rhode & Schwarz	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	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

B8355.XLS

15.231 PERIODIC OPERATION INTENTIONAL RADIATOR

Date: 14-Aug-98
 EUT: Wireless Remote Sensor
 Manufacturer: Venstar
 Representative: Doug Barnes

Measured @
 418.17 MHz

Miscellaneous Measurements:

FCC Specification Measurement

1) 20 dB Bandwidth 1 MHz 347 kHz

Tx Mode: Radiated Measurements

Calculated Averaging Factor: -7 dB (20*Log(duty cycle))
 Averaging Factor Applied: -7 dB

Peak
 Measurement
 dBuV/m @ MHz
 70.3 418.17

Specification

80.2 dBuV/m

Fundamental Field Strength:

Harmonics	Specification	Peak Measurement dBuV/m @ MHz	Average Measurement dBuV/m @ MHz	Delta dB
2nd harmonic (836.07 MHz)	60 dBuV/m	43.8	36.8	-23.2
3rd harmonic (1254.1 MHz)	60 dBuV/m	50.8	43.8	-16.2
4th harmonic (1672.2 MHz)	54 dBuV/m	51.7	44.7	-9.3
5th harmonic (2090.3 MHz)	60 dBuV/m	44.6	37.6	-22.4
6th harmonic (2508.4 MHz)	60 dBuV/m	52.3	45.3	-14.7
7th harmonic (2926.3 MHz)	60 dBuV/m	51.9	44.9	-15.1
8th harmonic (3344.5 MHz)	60 dBuV/m	47.7	40.7	-19.3
9th harmonic (3762.5 MHz)	54 dBuV/m	53.5	46.5	-7.5
10th harmonic (4180.6 MHz)	54 dBuV/m	58.6	51.6	-2.4

Minimum Passing Margin: -2.4 dB

Appendix B

Detailed Test Data Sheets

TUV PRODUCT SERVICE

RADIATED EMISSIONS

PW1 Test Site
 3 Meter Antenna Distance
 Equipment Under Test:
 Venstar, M/N: RS200TX/RS250TX
 Wireless Remote Sensor
 Notes: S/N 01, Fresh (2) AA Batteries, FCC ID MUHRSTX.

Report B8355 Run 7
 Date 08/15/98 Page 1
 Engineer ECJ
 Tech: dmK
 Requester

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

CHECKING FOR UNINTENTIONAL EMISSIONS , 30-1,000 MHz

Bicon Antenna, Vertical

Full turntable rotation, no emissions detected

Bicon Antenna , Horizontal

Full turntable rotation , No emissions detected.

Changing to the Log Periodic Antenna, Vertical.

538.64	4.4	17.5	1.4	23.3	--	V	--	-22.7
618.57	5.25	19.8	1.5	26.6	--	V	--	-19.4
432.43	7.45	16.1	1.2	24.8	--	V	--	-21.2

All the above readings are maximized.

Changing to Horizontal.

433.00	9.7	16.1	1.2	27	--	H	--	-19
--------	-----	------	-----	----	----	---	----	-----

The above reading is maximized.

END OF RUN.

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:
 Venstar, M/N: RS200TX/RS250TX
 Wireless Remote Sensor
 Notes: S/N 01, Fresh (2) AA Batteries, FCC ID MUHRSTX.

Figure _____

Report B8355 Run 7
 Date 08/15/98 Page 2
 Engineer FX 116
 Tech: dmk
 Requester _____

Measurement Summary

Frequency MHz	----- Final dBuV/m	----- uV/m	Azimuth deg	Polar\ Height	Delta FCC B	Delta
432.43	24.8	17.378	--	V --	-21.2	
433.00	27	22.387	--	H --	-19	
538.64	23.3	14.621	--	V --	-22.7	
618.57	26.6	21.379	--	V --	-19.4	

Minimum Passing Margin for FCC B is 19 dB at 433.00 MHz

File B8355 Run 7

TUV PRODUCT SERVICE

RADIATED EMISSIONS

PW1 Test Site
 3 Meter Antenna Distance
 Equipment Under Test:
 Venstar, M/N: RS200TX/RS250TX
 Wireless Remote Sensor
 Notes: S/N 01, Fresh (2) AA Batteries, FCC ID MUHRSTX

Report B8355 Run 6
 Date 08/14/98 Page 1
 Engineer FLA
 Tech: dmK FLA
 Requester FLA

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

NOTE: With Shield over RF Chip area. Installed on a AC cover plate.

418.17 63.8 16.3 1.2 81.3 -- V --
 The above reading is peak, maximized at 2 degrees, 1.2 meters.

4180.9 22.45 34.1 4.5 61 -- V --

NOTE: Moved the antenna Horizontal on the faceplate.

4180.9 22.3 34.1 4.5 60.9 -- V --
 The above reading is max at 129 degrees, 1.4 meters, Vertical.

 NOTE: Added a 15 Ohm resistor , TX out to Gnd. Pin 4-3. (Also removed shield)

4180.6 16.6 34.1 4.5 55.2 -- V --
 The above reading is max at 327 degrees, 1.2 meters, Vertical.

Changing to Horizontal.

4180.6 20 34.1 4.5 58.6 -- V --
 The above reading is max at 253 degrees, 1.3 meters, Horizontal.

Going back to check the fundamental.

Log Antenna, Vertical.

418.14 52.85 16.3 1.2 70.3 -- V --
 The above reading is max at 204 degrees, 1.2 meters, Vertical.

418.14 51.45 16.3 1.2 68.9 -- H --
 The above reading is max at 132 degrees, 2 meters, Horiz.

TUV PRODUCT SERVICE

RADIATED EMISSIONS

PW1 Test Site
 3 Meter Antenna Distance
 Equipment Under Test:
 Venstar, M/N: RS200TX/RS250TX
 Wireless Remote Sensor
 Notes: S/N 01, Fresh (2) AA Batteries, FCC ID MUHRSTX

Report B8355 Run 6
 Date 08/14/98 Page 2,
 Engineer PS-306
 Tech: dmk
 Requester

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

 NOTE: When the resistor was added (previous page) the shields were removed .

Continuing to measure the rest of the harmonics.

HORN ANTENNA HORIZONTAL.

(Disregard the above note)

Log Periodic Antenna

836.07 19.75 22.2 1.9 43.8 -- H --
 The above reading is max at 98 degrees, 1 meter , Horiz.

Checking Vertical.

836.14 16.75 22.2 1.9 40.8 -- V --
 The above reading is max at 234 degrees, 1.2 meters, Vertical.

NOW CHANGING TO THE HORN ANTENNA , HORIZONTAL POLARIZATION

1254.2	19	25.9	2.3	47.2	--	H	--
1672.2	18.05	27.7	2.7	48.4	--	H	--
2090.3	10.4	29.3	3.1	42.8	--	H	--
2508.4	15.6	30.7	3.4	49.7	--	H	--
2926.4	11.4	31.4	3.7	46.5	--	H	--
3344.5	5.15	32.4	4	41.5	--	H	--
3762.5	11.45	33.6	4.2	49.2	--	H	--

4180.8 MHz was previously maximized.

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:
 Venstar, M/N: RS200TX/RS250TX
 Wireless Remote Sensor
 Notes: S/N 01, Fresh (2) AA Batteries, FCC ID MUHRSTX

Report B8355 Run 6
 Date 08/14/98 Page 31
 Engineer For J.M.
 Tech: dmK
 Requester [Signature]

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

Changing to Vertical, Horn Antenna.

1254.1	22.6	25.9	2.3	50.8	--	V	--	
1672.2	21.3	27.7	2.7	51.7	--	V	--	
2090.3	12.25	29.3	3.1	44.6	--	V	--	
2508.4	18.2	30.7	3.4	52.3	--	V	--	
2926.3	16.75	31.4	3.7	51.9	--	V	--	
3344.5	11.35	32.4	4	47.7	--	V	--	
3762.5	15.75	33.6	4.2	53.5	--	V	--	

END OF RUN.

TUV PRODUCT SERVICE

RADIATED EMISSIONS

PW1 Test Site
3 Meter Antenna Distance
Equipment Under Test:
Venstar, M/N: RS200TX/RS250TX
Wireless Remote Sensor

Figure_____

Report B8355 Run 6
Date 08/14/98 Page 4
Engineer PCAM
Tech: dmK
Requester

Notes: S/N 01, Fresh (2) AA Batteries, FCC ID MUHRSTX

Measurement Summary

Frequency MHz	----- Final dBuV/m	----- uV/m	Azimuth deg	Polar\ Height	Delta	Delta
418.17	81.3	11614.	--	V --		
836.07	43.8	154.88	--	H --		
1254.1	50.8	346.73	--	V --		
1672.2	51.7	384.59	--	V --		
2090.3	44.6	169.82	--	V --		
2508.4	52.3	412.09	--	V --		
2926.3	51.9	393.55	--	V --		
3344.5	47.7	242.66	--	V --		
3762.5	53.5	473.15	--	V --		
4180.6	58.6	851.13	--	V --		
4180.9	61	1122.0	--	V --		

File B8355 Run 6

Appendix C

Plots of 20 dB Bandwidth

VENSTAR RS200TX/RS250TX 20dB BANDWIDTH
 REF 57.0 dBμV ATTN 20 dB
 MKR Δ 347 KHZ
 -0.10 dB

hp

5 dB/

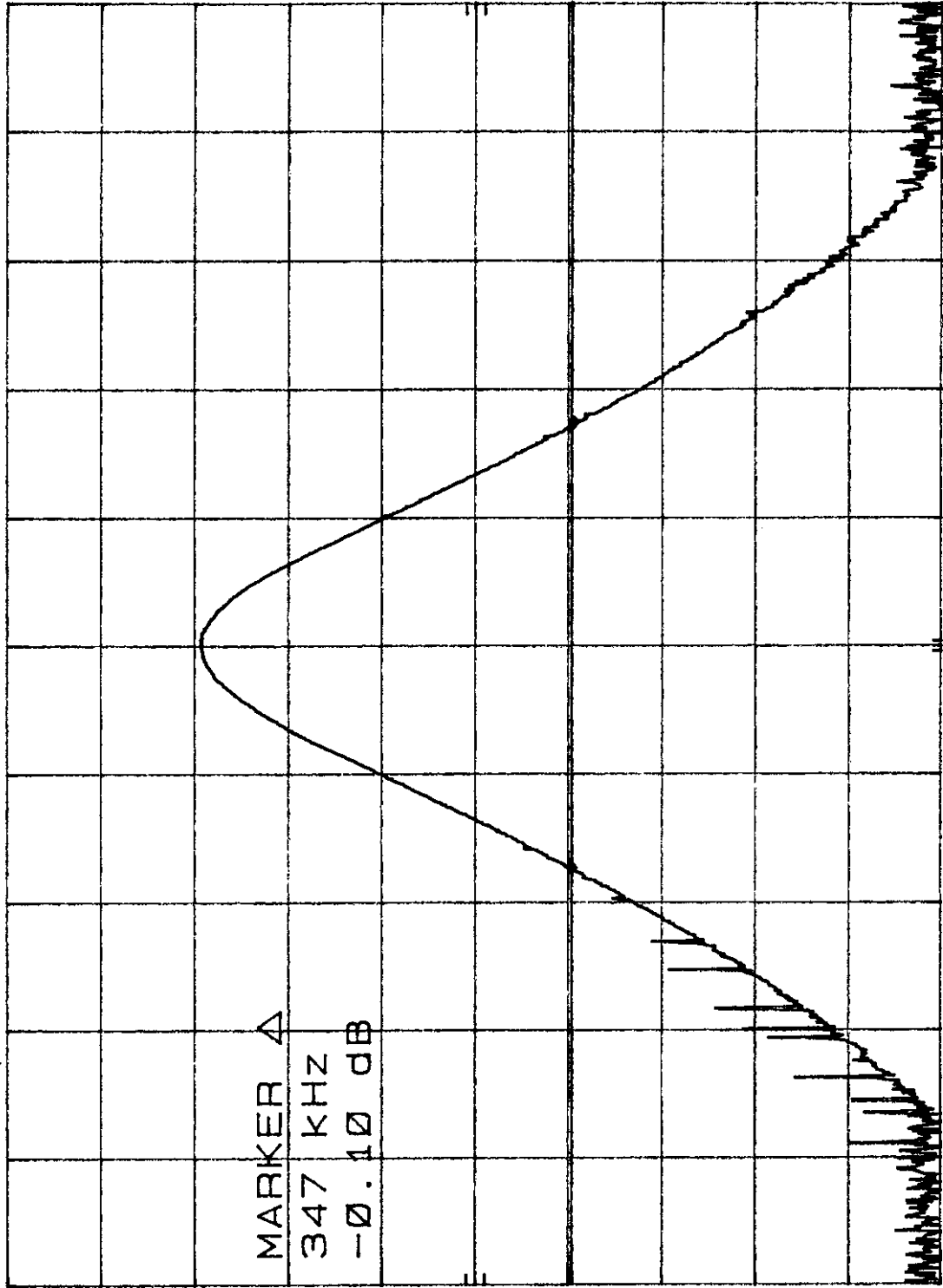
POS PK

OFFSET
 -30.0
 dB

DL
 26.8
 dBμV

MARKER Δ
 347 KHZ
 -0.10 dB

CORR'D



CENTER 418.03 MHz
 RES BW 100 KHZ
 OFS-31 KHZ
 VBW 100 KHZ
 SPAN 1.00 MHz
 SWP 20.0 msec

Appendix D

Plots of Calculated Duty Cycle

$3.12 \text{ ms} \times 6 = 18.72 \text{ ms}$
 $1.16 \text{ ms} \times 22 = 25.52 \text{ ms}$

Duty cycle $\approx 20 \log \left(\frac{44.2 \text{ ms}}{100 \text{ ms}} \right) \log = -7 \text{ dB}$
 $= 20 \log 0.44$

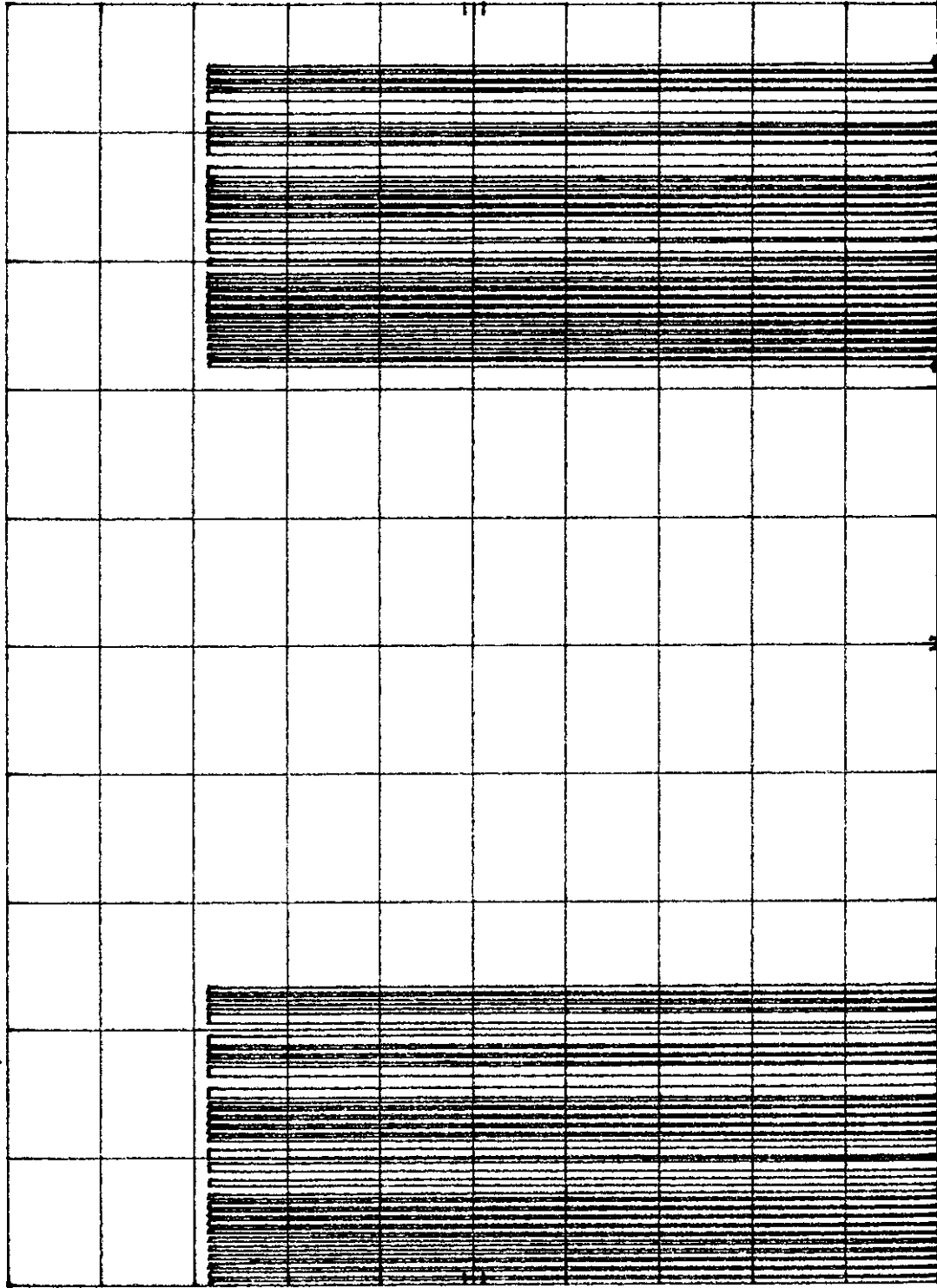
FCC ID MUHRSTX

REF 77.0 dBμV ATTN 0 dB

MKR Δ 71.10 msec
 0.00 dB

hp

5 dB/



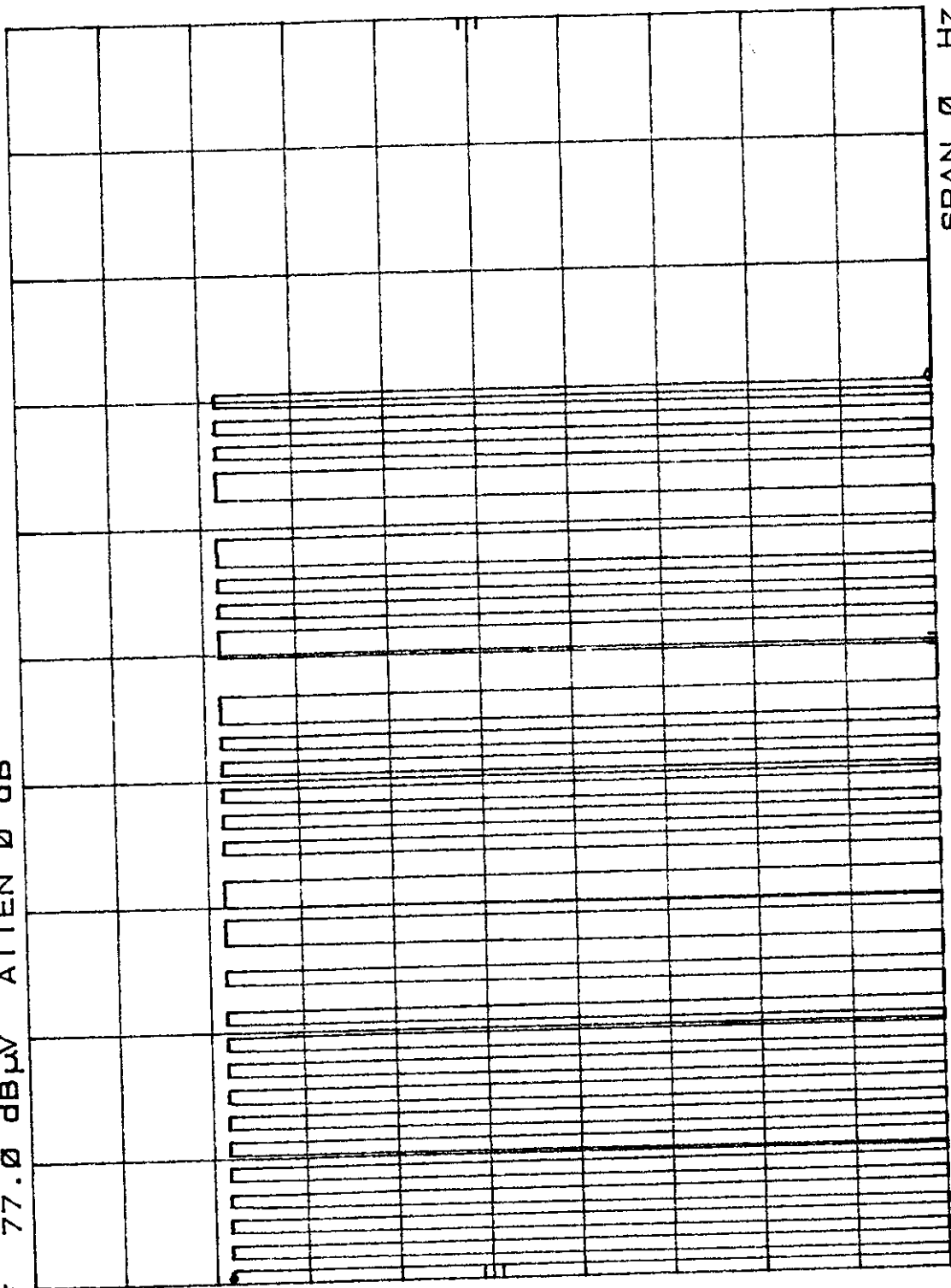
CENTER 417.994 289 MHz
 RES BW 100 KHZ
 VBW 100 KHZ
 SPAN 0 Hz
 SWP 300 msec
 0.00 dB

MKR Δ 70.80 msec
-39.15 dB

FCC ID MUHRSTX
REF 77.0 dB μ V
ATTEN 0 dB

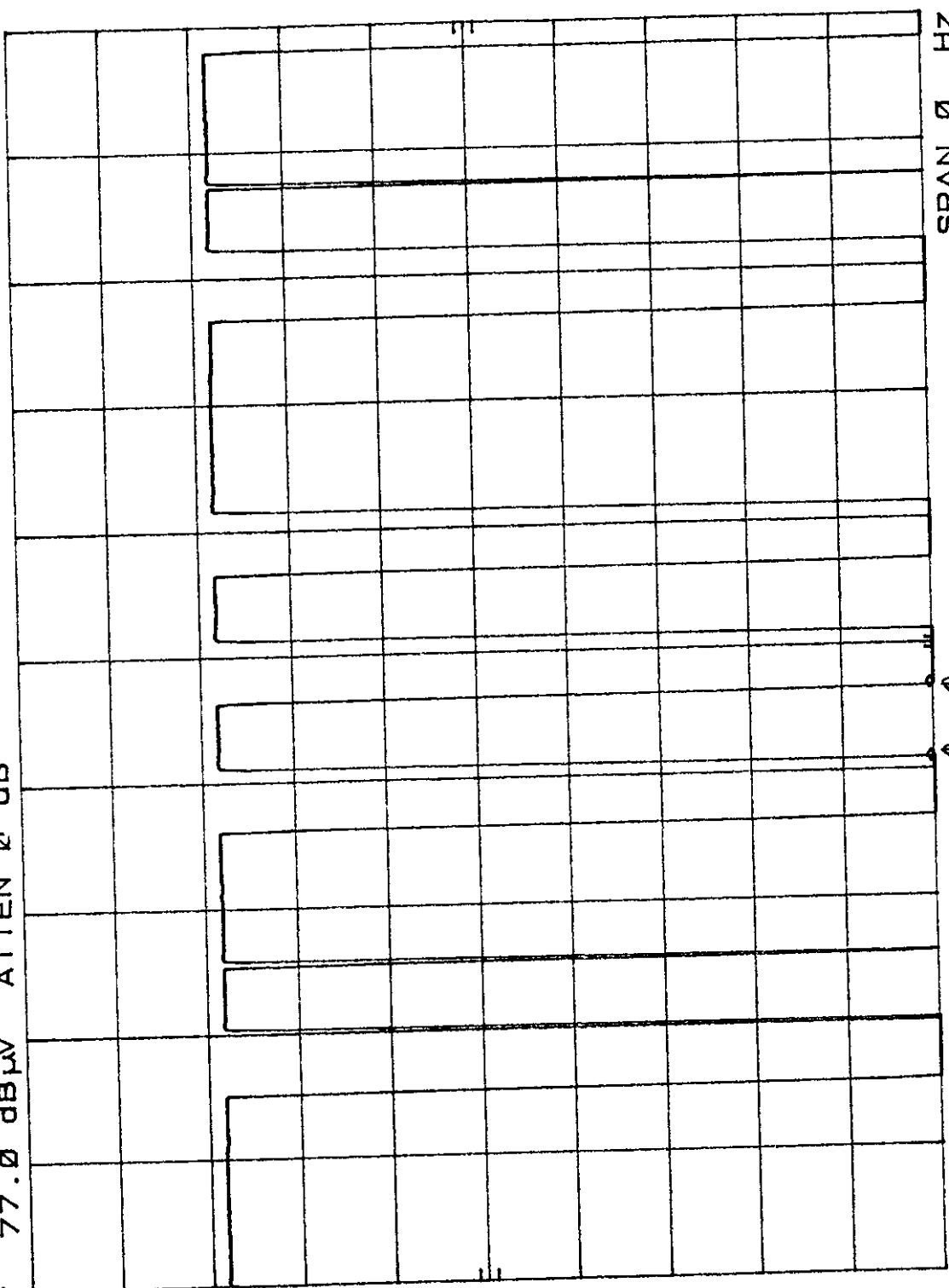
hp

5 dB/



MKR Δ 1.160 msec
0.00 dB

FCC ID MUHRSTX
REF 77.0 dB μ V
ATTEN 0 dB



SPAN 0 Hz
SWP 20.0 msec

VBW 30 kHz

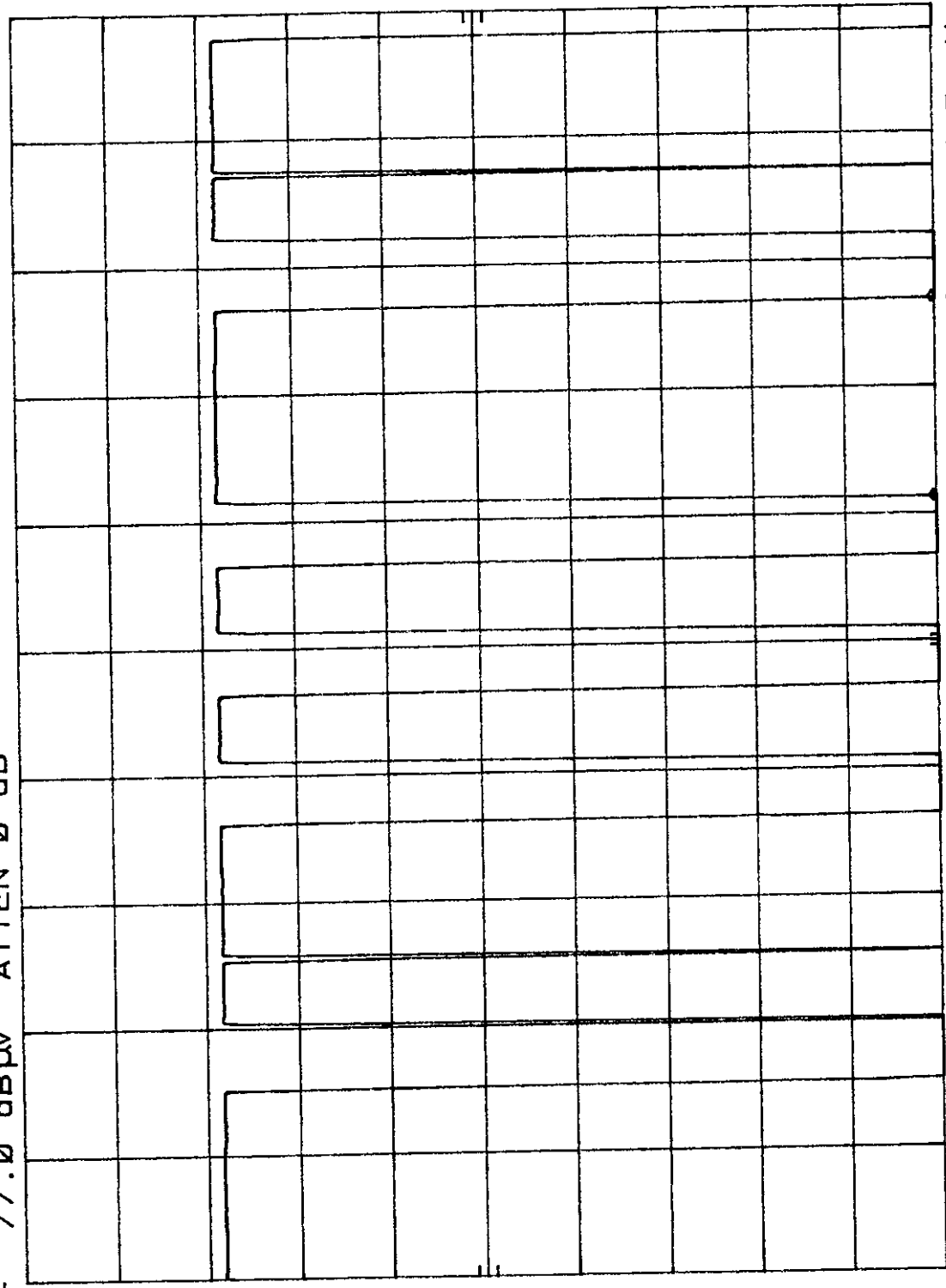
CENTER 417.994 289 MHz
RES BW 100 kHz

hp
5 dB/

MKR Δ 3.120 msec
0.00 dB

FCC ID MUHRSTX
REF 77.0 dB μ V
ATTEN 0 dB

hp
5 dB/



SPAN 0 Hz
SWP 20.0 msec

VBW 30 kHz

CENTER 417.994 289 MHz
RES BW 100 kHz

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: Compliance & More Quote Number: 303 751 4453
Contact: Doug Barnes Phone: (business hrs) 303 751 0370
E-mail Address: Doug_barnes@compuserve.com Phone: (after hrs) 303 751 0370

Product Description

Brand Name: Venstar RF Sensor
Model Number: RS 200 RX RS 200 TX Serial Number: Test1 01
RS 250 RX RS 250 TX

Test Objective

- ☐ EMC Directive 89/336/EEC (EMC Requirements)
- ☐ Machinery Directive 89/392/EEC (EMC Requirements)
- ☐ Medical Device Directive 93/42/EEC (EMC Requirements)
- ☒ FCC Part 15 (list) Declaration of conformity
- ☒ Other Part 15 (list) Certification

Attendance

Test will be, ☒ Attended by the customer ☐ Unattended by the customer

Failure

If a failure occurs, TÜV Product Service should,

- ☒ Call contract list above, if not available then stop testing.
- ☐ Continue testing to complete test series.
- ☐ Continue testing to define corrective action.
- ☐ Stop testing.

Test Plan for Electromagnetic Compatibility Testing



Transportation

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

Dimensions and Weight

Length 2 inches Width 1 inch
Height 1 inch Weight 1/2 lb

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 _____ VDC Expected 10 hrs hours
life _____
- ☐ Other _____

* Note: European power is typically 230 VAC 50 Hz or 400 VAC 50 Hz single and three phase respectively. FCC requires testing to be performed at typical US power ratings at 60 Hz.

N/A.

Other

- ☐ Air _____ cfm _____ psi ☐ Water _____ gpm _____ psi
(describe)
☐ Other _____

Constructional Data Form (CDF)

- ☐ Attached

Test Plan Details

Immunity

- ☐ Applicable (attached)

☒ N/A

Emissions

- ☐ Applicable (attached)

☒ N/A

TÜV Product Service
5541 Central Ave.
Boulder CO 80301
Telephone (303) 786-7999

UEMC0901.DOC, Rev. Final Draft
Author: B. Dill
Revised: 20 March 1997

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Test Plan for Electromagnetic Compatibility Testing



On Site

☐ Applicable (attached)

☒ N/A

TÜV Product Service
5541 Central Ave.
Boulder CO 80301
Telephone: (303) 786-7999

UEMC0901.DOC, Rev. Final Draft
Author: B. Dill
Revised: 20 March 1997

4

FCC ID:

TÜV PRODUCT SERVICE INC

40 Meadow Road

File No. B241835502 , Page E5 of E19
Pinewood Springs, Lyons, CO 80540 Tel: 303 786 7999 Fax: 303 449 3004 Rev.No 1.0

FCC Emissions Test Plan Details (ATTACHMENT)



Standards to be Applied			
☐	CISPR 22		
☐	Class A		
☐	Class B		
☒	FCC	(list)	Class <u>B</u> (list)
	Part		
☐	Other	(list)	

Required Testing	
☒	Test to minimum requirements
☐	Other (describe)
☐	Test to margin dB (list)
	of

Description	Basic Document	Requirement
Radiated & Conducted Emissions	ANSI 63.4	Reference Basic Document or Applicable Standard

Engineering Justifications / Test Deviations
N/A.

Constructional Data Form for Electromagnetic Compatibility Testing



Date:

7-31-98

When entering information you may add attachments to this form as necessary for additional documentation space. A completed form will ensure that your product testing goes well. If you need additional help contact your TÜV Product Service representative.

1. Enter company information pertaining to the location where the product is manufactured and for the manufacture's contact soliciting the testing.

Applicant

Company

Compliance + More

Address:

18693 E. Wesley Ave

Aurora, CO 80014

Contact:

Douglas Barnes

Position:

owner

1. Enter brand name, model number, serial number and FCC ID number, if applicable.
2. Describe the equipment and all product variants or options of the equipment. Provide enough detail to ensure a good understanding of the product.
3. Indicate which attachments you are providing with this document. It is recommended that you provide all listed.

General Equipment Description

Brand
Name:

Venstar
RF Sensor

Model No.:

RS 200 RX RS 250 TX
RS 250 RX RS 200 RX

Serial No.:

01

FCC ID
No.:

MUH RS TX

General
description:

Wireless RF Transmitter + Receiver
418 MHz

Product
Variant/Options:

Case enclosures supplied by user

TÜV Product Service
5541 Central Ave.
Boulder CO 80301

UEMC0902 doc, Rev. Final Draft
Author: B. Dill
Revised: 20 March 1997

1

FCC ID:

TÜV PRODUCT SERVICE INC

40 Meadow Road

Pinewood Springs, Lyons, CO 80540 Tel: 303 786 7999 Fax: 303 449 3004 Rev.No 1.0

File No. B241835502, Page E7 of E19

Constructional Data Form for Electromagnetic Compatibility Testing



Attachments:

N/A

☐ External
Photographs

☐ Product
Literature

☐ High Level Bill of Materials

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

Date:

7-3-98

Signature of
Applicant:

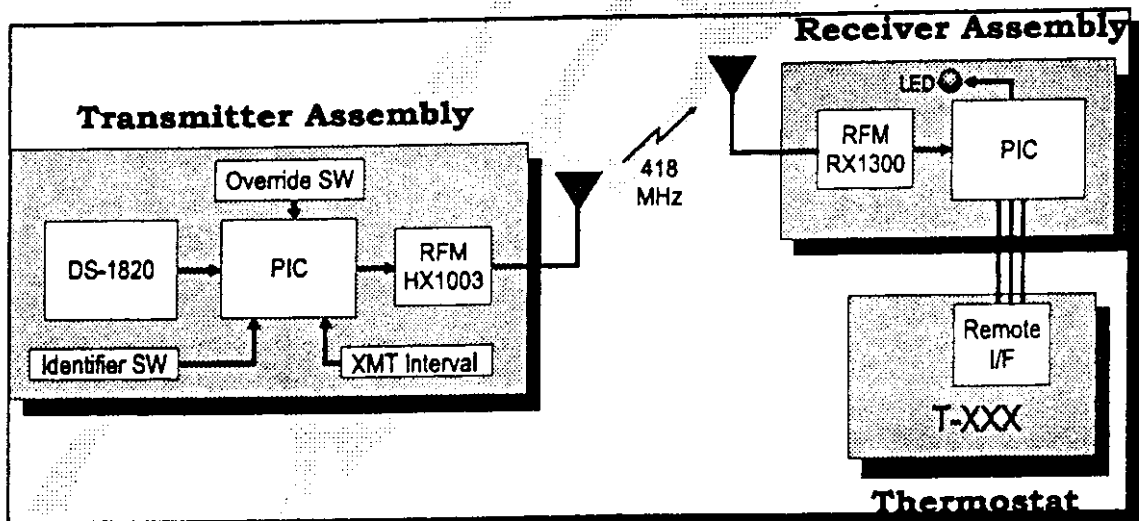
D. Barne

Constructional Data Form for Electromagnetic Compatibility Testing



1. Provide a line drawing showing and identifying the equipment under test, simulators, support equipment, I/O cables, power cables and any other pertinent components used during testing.
2. Use a dashed line to show equipment in the testing field versus equipment outside the testing field. Use an additional page if more space is required.

System Configuration Block Diagram



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

Date:

2-3-98

Signature of
Applicant:

[Signature]

Constructional Data Form for Electromagnetic Compatibility Testing



1. Describe the intended installation. Include details such as power connection and system grounding approaches.
2. Describe the intended operating environment, include details such as humidity, cooling, heating and hazardous environments.
3. Indicate if you have attached a copy of an installation manual. It is recommended for proper documentation of your system.

Installation and Environmental Conditions (describe)

To be used as an accessory to a Venstar Digital
Thermist T-71, T-250, T-260 as a remote temperature
sensor.

☒ Installation manual/instructions (attached)

1. Indicate your system power requirements for the equipment to be tested.

Power Requirements

Rated Voltage 120 VAC Rated Input Power 10 watt

1. Indicate your product's protection class. If you do not know, contact your TÜV Product Service representative.

Protection Class

Type: N/A Class: _____

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

Constructional Data Form for Electromagnetic Compatibility Testing



Date:

7-31-98

Signature of
Applicant:

D. Banner

Constructional Data Form for Electromagnetic Compatibility Testing



1. Indicate all interface cables which can be attached to the equipment. All cables should be listed even if they are not sold as part of your system.
2. Give a description of the type of port (e.g., Parallel, Serial, SCSI), purpose and indicate if the I/O port is to be exercised during testing. This means active occurrence of data or signals.
3. Indicate the type of transmission and if the cable is a EUT assembly-to-assembly interconnection cable (this could be PC to printer, modem or such).
4. Indicate whether the cable is shielded or not. If so then provide information about the type of shield (e.g., Braid, Foil) and how the shield is terminated (e.g., 360 degree to conductive shell, pigtail) at both ends of the cable.
5. 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: 3 wire cable
 Purpose: connect Receiver to thermostat
 Exercised during testing? ☒ Yes ☐ No
 Transmission ☒ Analog ☒ Digital
 Assembly $\leftrightarrow$ Assembly ☒ Yes ☐ No
 Interconnect
 Length of cable: Maximum : 12 inches Tested : _____
 Cable shielded: ☒ Yes ☐ No
 Shield Type (describe) : no
 Termination: (describe) : no

I/O Ports and Cables

Descriptions: _____
 Purpose: _____
 Exercised during testing? ☐ Yes ☐ No
 Transmission ☐ Analog ☐ Digital
 Assembly $\leftrightarrow$ Assembly ☐ Yes ☐ No
 Interconnect
 Length of cable: Maximum : _____ Tested : _____
 Cable shielded: ☐ Yes ☐ No
 Shield Type (describe) : _____
 Termination: (describe) : _____

TÜV Product Service
 5541 Central Ave.
 Boulder CO 80301

UEMCD002.doc, Rev. Final Draft
 Author: B. Dill
 Revised: 20 March 1997

6

FCC ID:

TÜV PRODUCT SERVICE INC

40 Meadow Road

Pinewood Springs, Lyons, CO 80540 Tel: 303.786.7999 Fax: 303.449.3004 Rev.No 1.0

File No. B241835502, Page E12 of E19

Constructional Data Form for Electromagnetic Compatibility Testing



I/O Ports and Cables

Description: _____

Purpose: _____

Exercised during testing? ☐ Yes ☐ No

Transmission ☐ Analog ☐ Digital

Assembly ↔ Assembly ☐ Yes ☐ No

Interconnect

Length of cable: Maximum _____ Tested _____

Cable shielded: ☐ Yes ☒ No

Shield Type (describe) _____

Termination: (describe) _____

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

Date: 7-31-98 Signature of Applicant: 

Constructional Data Form for Electromagnetic Compatibility Testing



1.0 Describe all possible EUT configurations. Provide enough detail to provide a technical understanding of all equipment configurations which may require testing. In some instances it is appropriate to require testing of more than one configuration.

EUT configurations: (list and describe)

1. Identify the operating modes to be used during testing of the equipment. It is recommended the equipment be tested while operating in a typical operation mode. In some instances, this may not be practicable to do such. In this case consult your TÜV Product Service representative to determine the proper operating mode(s) to be tested.
2. For FCC testing of personal computers and/or peripherals it is required that a simple program generate a complete line of upper case H's, and that this pattern must be alternately sent to the parallel port device, the serial port device, and must write/read/verify to each disk drive. Monitors must display the H pattern, typically in white letters on a black background.
3. Provide a general description of all software, firmware, and PLD algorithms used in the equipment.
4. List all code modules as described above, with the revision level used during testing.

EUT Software and Operation Modes to be Tested

General Description:
(describe)

None

Software Revision
Level: (list and describe)

N/A

Operating modes to
be tested: (list and
describe)

N/A

☐ Operation manual/instructions (attached)

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

Date:

7-31-98

Signature of
Applicant:



Constructional Data Form for Electromagnetic Compatibility Testing



1. Describe and list all system, subsystem, major subassemblies and all internal peripherals. This should include such things as an external monitor, parallel interface peripheral, serial interface peripheral and internal disk drives.
2. Indicate if technical drawings are attached. It is recommended that circuit diagrams, assembly and subassembly drawings be attached.

System, Subsystem, Major Subassemblies or Internal Peripherals			
Description	Model #	Serial #	FCC ID #
Slialine J-250	Slialine	Test	N/A.
Thermostat.			

☐ Technical Drawings attached

Describe and list 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 you TÜV Product Service representative.

Interfacing Equipment and/or Simulators (which is not a part of the EUT)			
Description	Model #	Serial #	FCC ID #
N/A.			

Constructional Data Form for Electromagnetic Compatibility Testing



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

Date: <u>7-31-98</u>	Signature of Applicant: <u></u>
--------------------------------	---

Constructional Data Form for Electromagnetic Compatibility Testing



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

EMC System Details				
Oscillator Frequencies				
Frequency	Sub-harmonics	EUT Location	Description of Use	
4.0 MHz			Crystal	
Power Supply				
Frequency	Manufacturer	Model #	Serial #	Type (list frequency)
Ac Wall Transformer	Stancor	STA-418	N/A	60 Hz
Batteries				
Power Line Filters				
Manufacturer	Model #	Qty	Location on EUT	
N/A.				
Critical EMI Components (Capacitors, ferrites, etc.)				
Description	Manufacturer	Part # or Value	Qty	Location on EUT
N/A.				

Constructional Data Form for Electromagnetic Compatibility Testing



--	--	--	--	--

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

Date: <u>7-31-98</u>	Signature of Applicant: <u></u>
--------------------------------	---

Constructional Data Form for Electromagnetic Compatibility Testing



1. Indicated any other measure 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).

Other EMI Critical Construction Details

N/A.

1. Describe the principal materials of the enclosure (e.g., plastic, plastic with shielding material, metal, metal with specific shielding contact points, metal with paint on all surfaces).

Description of Enclosure

Plastic Box for Transmitter supplied by
User
heat shrink tubing on Receiver

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

Date:

7-31-98

Signature of
Applicant:

DBarnes

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 it's 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 1000 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.