MEASUREMENT AND TECHNICAL REPORT

HUNTER INDUSTRIES
1940 Diamond Street
San Marcos, CA 92069

DATE: 25 February 2002

This Report Concerns:	Original Grant: X	Class II Change:
Equipment Type:	Wireless Rain-Clik Transmitter, Model WRCTX	
Deferred grant requested per 47 CFR 0.457(d)(1)(ii)?	Yes: **Defer until:**	No: X
Company Name **agrees to notify the Commission by:** **of the intended date of announcement of the product so that the grant can be issued on that date.**	N/A	
Transition Rules Request per 15.37?	Yes:	*No: X

(*) FCC Part 15, Paragraphs 15.231(b), (c); 15.107(a); 15.209(a)

Report Prepared by:

TÜV PRODUCT SERVICE
10040 Mesa Rim Road
San Diego, CA 92121-2912
Phone: 858 546 3999
Fax: 858 546 0364

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TÜV PRODUCT SERVICE 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone 858 546 3999 FAX 858 546 0364

1 GENERAL INFORMATION

1.1 Product Description

General Equipment Description

EUT Description: Wireless Rain-Clik Transmitter

EUT Name: Wireless Rain-Clik Transmitter

Model No.: WRCTX Serial No.: 0100

Typical Installation and/or Operating Environment: Residential Installation

EUT Power Cable: Not applicable

EUT Operating Modes to be Tested

Special SW has been created for the test that will transmit a message every 1 second. In normal use, the only time a message is transmitted is when the state of the rain sensor changes (wet-dry or vice versa). Duty cycle and power level is identical no matter what message is sent due to the encoding scheme used.

Oscillator Frequencies

Frequency	*Derived Frequency*	*Component # / Location*	*Description of Use*
315MHZ	315MHZ	U2	Transmitter Hybrid – Utilizes SAW resonator
4MHZ	Internal RC Oscillator	U1	Microcontroller clock

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1 GENERAL INFORMATION (continued)

1.2 Related Submittal/Grant

None

1.3 Tested System Details

The FCC IDs for all equipment, plus descriptions of all cables used in the tested system are:

None

1.4 Test Methodology

Purpose of Test: To demonstrate compliance with the ANSI C63.4 setup.

TEST	FCC CFR 47 #	PASS/FAIL
Radiated	15.231(b)	Pass
Emission Bandwidth	15.231(c)	Pass
Duty Cycle Measurements	ANSI C63.4, Appendix 14, Para. 10	Pass
Conducted Emissions	15.107(a)	Pass
Radiated Emissions	15.109(a)	Pass
Deactivation[1]		N/A
Emission Band Edge[2]		N/A

([1]) Not performed - EUT intentionally programmed for continuous running for test purposes only.
([2]) Not performed - EUT is not a multiple frequency device and does not operate between 40.66 and 40.70 MHz.

Both Conducted and radiated testing were performed according to the procedures in FCC/ANSI C63.4 and CSA 108.8 - M1983. Radiated testing was performed at an antenna-to-EUT distance of 3 meters (1 - 25 GHz).

1.5 Test Facility

The open area test site and conducted measurement data were tested by:

TÜV PRODUCT SERVICE
10040 Mesa Rim Road
San Diego, CA 92121-2912
Phone: 858 546 3999
Fax: 858 546 0364

The Test Site Data and performance comply with ANSI 63.4 and are registered with the FCC, 7435 Oakland Mills Rd, Columbia Maryland 21046. All Measurement Data is acquired according to the content of FCC Measurement Procedure and ANSI C63.4, unless supplemented with additional requirements as noted in the test report.

2. SYSTEM TEST CONFIGURATION

2.1 Justification

The EUT was initially tested for FCC emission in the following configuration:

See Block Diagram.

2.2 EUT Exercise Software

None

2.3 Special Accessories

None

2.4 Modification

None

2.5 Configuration of Tested System

See Block Diagram.

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3 RADIATED EMISSION EQUIPMENT/DATA

The following data lists the significant emission frequencies, measured levels, correction factor (which includes cable and antenna corrections), the corrected reading, and the limit.

See following page(s).

See test setup photos for radiated emissions test setup.

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REPORT No: SC200600 TESTER: Alan Laudani SPEC: FCC Part 15 para 15.231(b)

CUSTOMER: Hunter Industries TEST DIST: 3 Meters

E U T: WRC Transmitter/Receiver TEST SITE: Roof

EUT MODE: Transmit BICONICAL: N/A

DATE: February 14, 2002 LOG: N/A

NOTES: Duty Cycle= 10% OTHER: 251

above 1GHz: RBW & VBW 1 MHz for Pk calculated for AVG

AVE = Peak + 20 x Log (Duty Cycle)

CF = Antenna Factor + Cable Loss - Preamplifier Gain + Preselector Loss

v.beta1a

FREQ (MHz)	VERTICAL (dBuv) pk	av	HORIZONTAL (dBuv) pk	av	CF (dB/m)	MAX LEVEL (dBuV/m) pk	av	SPEC LIMIT (dBuV/m) pk	av	MARGIN (dB) pk	av	EUT Rotation	Antenna Height
1260	46.1	26.1	48.7	28.7	-11.2	**37.5**	**17.5**	75.6	55.6	-38.07	-38.1	1.1	30
1575	46.6	26.6	48.6	28.6	-8.7	**39.9**	**19.9**	75.6	55.6	-35.75	-35.7	1.1	30
1890	43.5	23.5	44.1	24.1	-6.4	**37.7**	**17.7**	75.6	55.6	-37.91	-37.9		
2205	43.9	23.9	44	24	-4.6	**39.4**	**19.4**	75.6	55.6	-36.18	-36.2		
2520	43.8	23.8	43.5	23.5	-3.0	**40.8**	**20.8**	75.6	55.6	-34.89	-34.8		

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REPORT No: SC200600 SPEC: FCC Part 15.231(b)
FCC Part 15.35(b)

CUSTOMER: Hunter Industries TEST DIST: 3 Meters

E U T: WRC Transmitter/Receiver TEST SITE: 1

EUT MODE: Transmit BICONICAL: 738

DATE: 13-Feb-02 TESTED BY: A. Laudani LOG PERIODIC: 738

NOTES: Peak with 120 KHz measurement bandwidth. RCVR: 466
Average = 20 x Log (Duty Cycle) + Peak
Duty Cycle = 10 % Battery 3.6 Vdc
Temperature: 24 Relative Humidity: 22

EUT MARGIN -4.5 dB at 315 MHz ver 1.6a

FREQUENCY (MHz)	VERTICAL measured (dBuv)	HORIZONTAL measured (dBuV)	CORRECTION FACTOR (dB/m)	MAXIMUM CORRECTED (dBuV/m)	SPECIFIED LIMIT (dBuV/m)	EUT MARGIN (dB)	EUT ROTATION (degrees)	ANTENNA HEIGHT (meters)	NOTE
315.00	54.7	79.1	18.0	91.1	95.6	-4.5	30	1	Peak
315.00	34.7	53.1	18.0	71.1	75.6	-4.5	30	1	Average
630.00	13	33.5	26.2	39.7	75.6	-15.9	30	1	Peak
630.00	-7	13.5	26.2	39.7	55.6	-15.9	30	1	Average
945.00	16.1	12.1	30.8	46.9	75.6	-28.7	30	1	Peak
945.00	-3.9	-7.9	30.8	26.9	55.6	-28.7	30	1	Average

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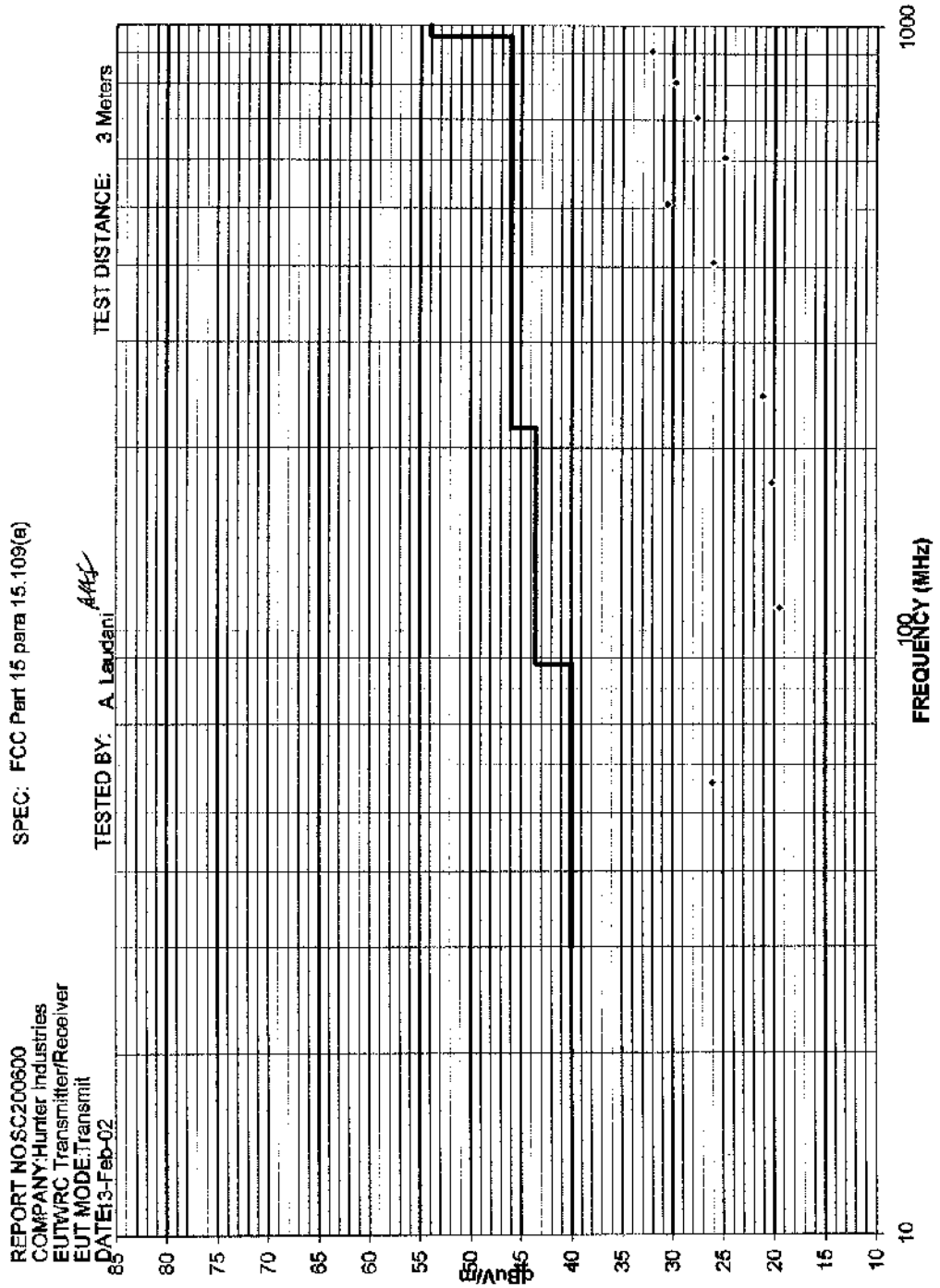
REPORT NO:SC200600
COMPANY:Hunter Industries
EUT:WRC Transmitter/Receiver
EUT MODE:Transmit
DATE:13-Feb-02
SPEC: FCC Part 15 para 15.109(a)
TESTED BY: A. Laudani
TEST DISTANCE: 3 Meters
dBuV/m
FREQUENCY (MHz)
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
10
100
1000

REPORT No: SC200600 SPEC: FCC 15.109(a)

CUSTOMER: Hunter Industries TEST DIST: 3 Meters

E U T: WRC Transmitter/Receiver TEST SITE: 1

EUT MODE: Transmit BICONICAL: 738

DATE: 13-Feb-02 TESTED BY: A. Laudani LOG PERIODIC: 738

NOTES: Quasi-Peak with 120 KHz measurement bandwidth. RCVR: 466
Battery 3.5 Vdc

Temperature: 24 C Relative Humidity: 22%

EUT MARGIN -13.8 dB at 908 MHz

ver 1.8a

FREQUENCY (MHz)	VERTICAL measured (dBuv)	HORIZONTAL measured (dBuV)	CORRECTION FACTOR (dB/m)	MAXIMUM CORRECTED (dBuV/m)	SPECIFIED LIMIT (dBuV/m)	EUT MARGIN (dB)	EUT ROTATION (degrees)	ANTENNA HEIGHT (meters)
56.00	10.8	4.6	15.3	**26.1**	40	-13.9		
109.00	4.8	6	13.5	**19.5**	43.5	-24.0		
175.86	8	3.1	12.3	**20.3**	43.5	-23.2		
244.22	3.6	4.6	16.5	**21.1**	46	-24.9		
406.90	5	5.1	20.9	**26.0**	46	-20.0		
508.34	6.3	4.4	24.3	**30.6**	46	-15.4		
608.00	-1	-1.1	26.0	**25.0**	46	-21.0		
708.00	-0.9	-0.1	27.8	**27.7**	46	-18.3		
808.00	0.1	0	29.7	**29.8**	46	-16.2		
908.00	1.3	1.7	30.5	**32.2**	46	-13.8		

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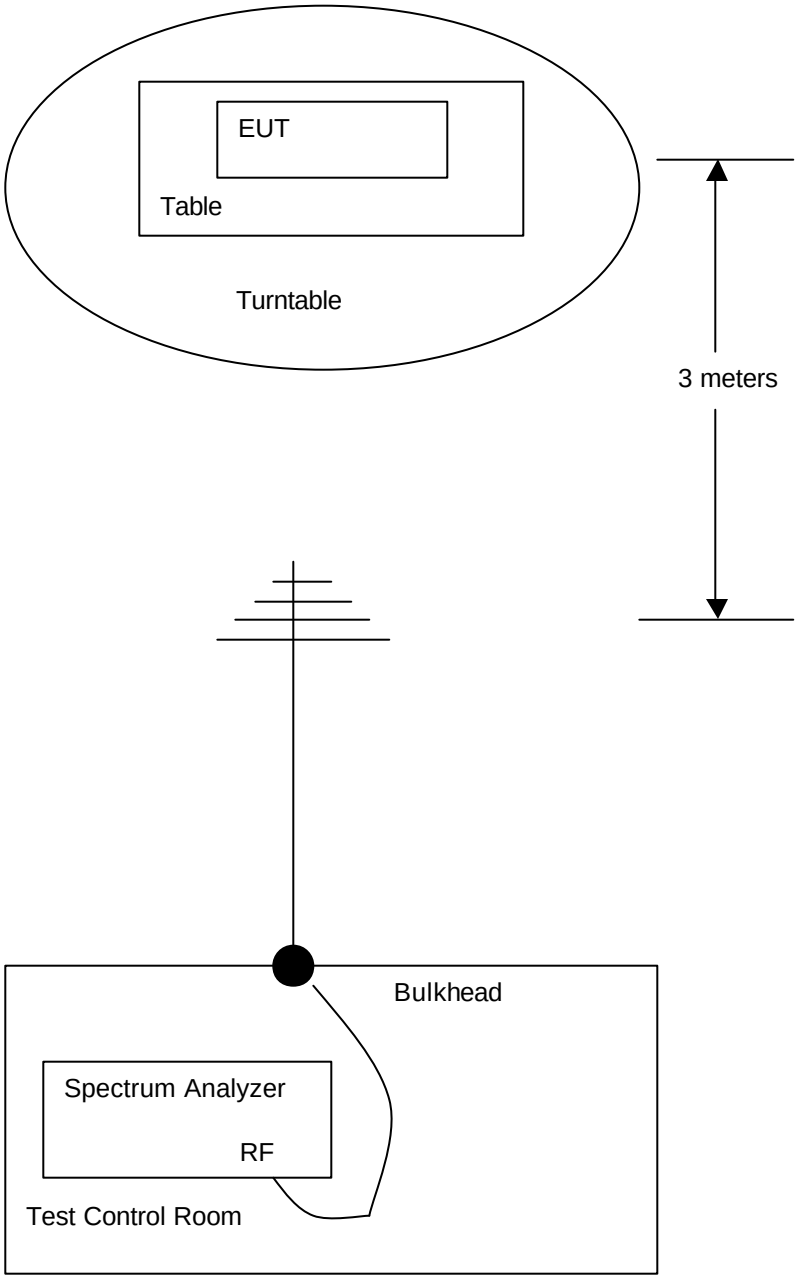
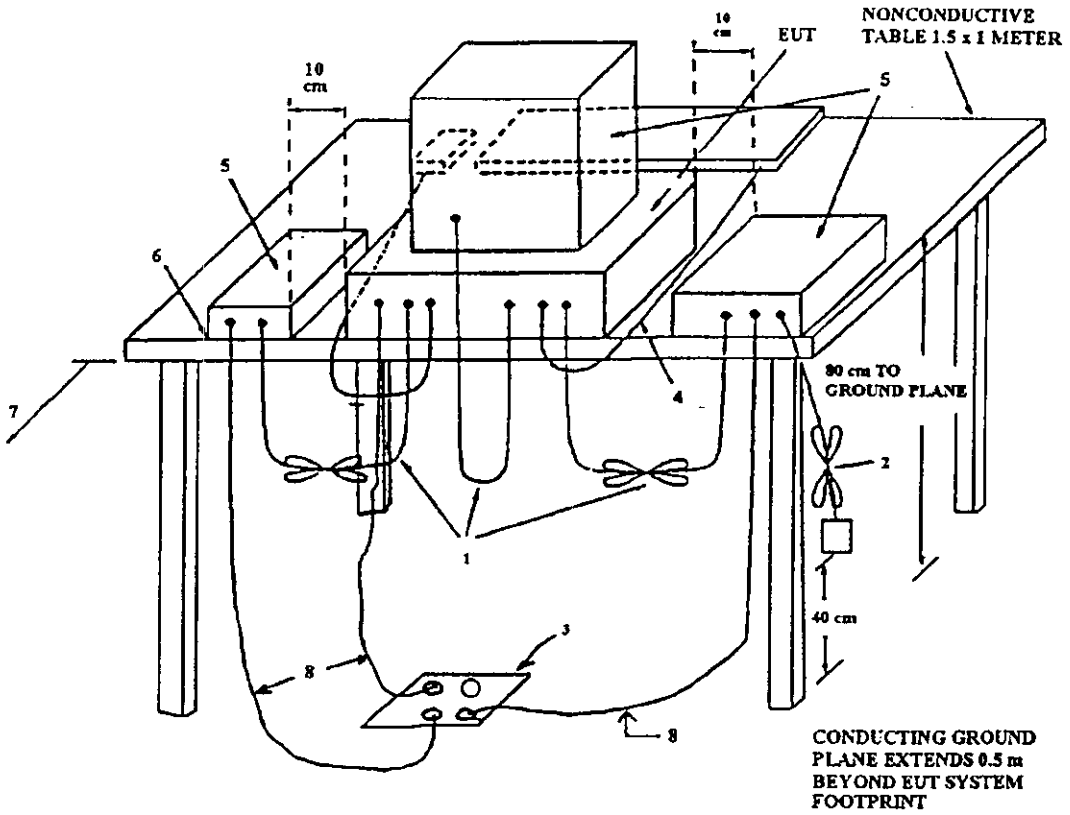
Radiated Emissions Test Setup1



Radiated Emissions Test Setup2

Radiated Emissions Test Setup, 30 to 1000 MHz



LEGEND:

1. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth forming a bundle 30 to 40 cm long, hanging approximately in the middle between ground plane and table.
2. I/O cables that are connected to a peripheral shall be bundled in center. The end of the cable may be terminated if required using correct terminating impedance. The total length shall not exceed 1 m.
3. If LISNs are kept in the test setup for radiated emissions, it is preferred that they be installed under the ground plane with the receptacle flush with the ground plane.
4. Cables of hand-operated devices, such as keyboards, mouses, etc., have to be placed as close as possible to the controller.
5. Non-EUT components of EUT system being tested.
6. The rear of all components of the system under test shall be located flush with the rear of the table.
7. No vertical conducting wall used.
8. Power cords drape to the floor and are routed over to receptacle.

Emissions Test Conditions: RADIATED EMISSIONS, FCC Part 15, Paragraphs 15.231(b); 15.109(a)

The *RADIATED EMISSIONS* measurements were performed at the following test location :

☐ **- Test not applicable**

■ - Roof 3-Meter Open Area Test Site), San Diego

Testing was performed at a test distance of:

☐ - 1 meters
■ - 3 meters
☐ - 10 meters

Test Equipment Used :

Model No.	Prop. No.	Description	Manufacturer	Serial No.	Cal Date
3115	251	Antenna, Double Ridge Guide	EMCO	2495	10/02
LPB2520/A	738	Antenna, LPB	Antenna Research	1169	06/02
ESVS30	466	Receiver	Rhode & Schwarz	833825/003	02/02

Remarks: _____

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Field Strength Calculation

If a preamplifier was used during the Radiated Emission Testing, it is required that the amplifier gain must be subtracted from the Spectrum Analyzer (Meter) Reading. In addition, a correction factor for the antenna , cable used and a distance factor, if any, must be applied to the Meter Reading before a true field strength reading can be obtained. In the automatic measurement, these considerations are automatically presented as a part of the print out. In the case of manual measurements and for greater efficiency and convenience, instead of using these correlation factors for each meter reading, the specification limit was modified to reflect these correlation factors at each frequency value so that the meter readings can be compared directly to the modified specification limit. This modified specification limit is referred to as the "Corrected Meter Reading Limit" or simply the CMRL, which is the actual field strength present at the antenna. The quantity can be derived in the following manner:

Corrected Meter Reading Limit (CMRL) = SAR + AF + CL - AG - DC

Where, SAR = Spectrum Analyzer Reading
AF = Antenna Factor
CL = Cable Loss
AG = Amplifier Gain (if any)
DC = Distance Correction (if any)

Assume the following situation: A meter reading of 29.4 dBuV was obtained from a Class A computing device measured at 83 MHz. Assume an antenna factor of 9.2 dB, a cable loss of 1.4 dB and amplifier gain of 20.0 dB at 83 MHz. The final field strength would be determined as follows:

CMRL = 29.4 dBuV + 9.2dB = 1.4 dB - 20 dB/M - 0.0 dB

CMRL = 20.0 dBuV/M

This result is well below the FCC and CSA Class A limit of 29.5 dbuV/m at 83 MHz.

For the manual mode of measurement, a table of corrected meter reading limit was used to permit immediate comparison of the meter reading to determine if the measure emission amplitude exceeded the specification limit at that specific frequency.

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4 20 dB BANDWIDTH EMISSIONS and DUTY CYCLE EQUIPMENT/DATA

See following page(s).

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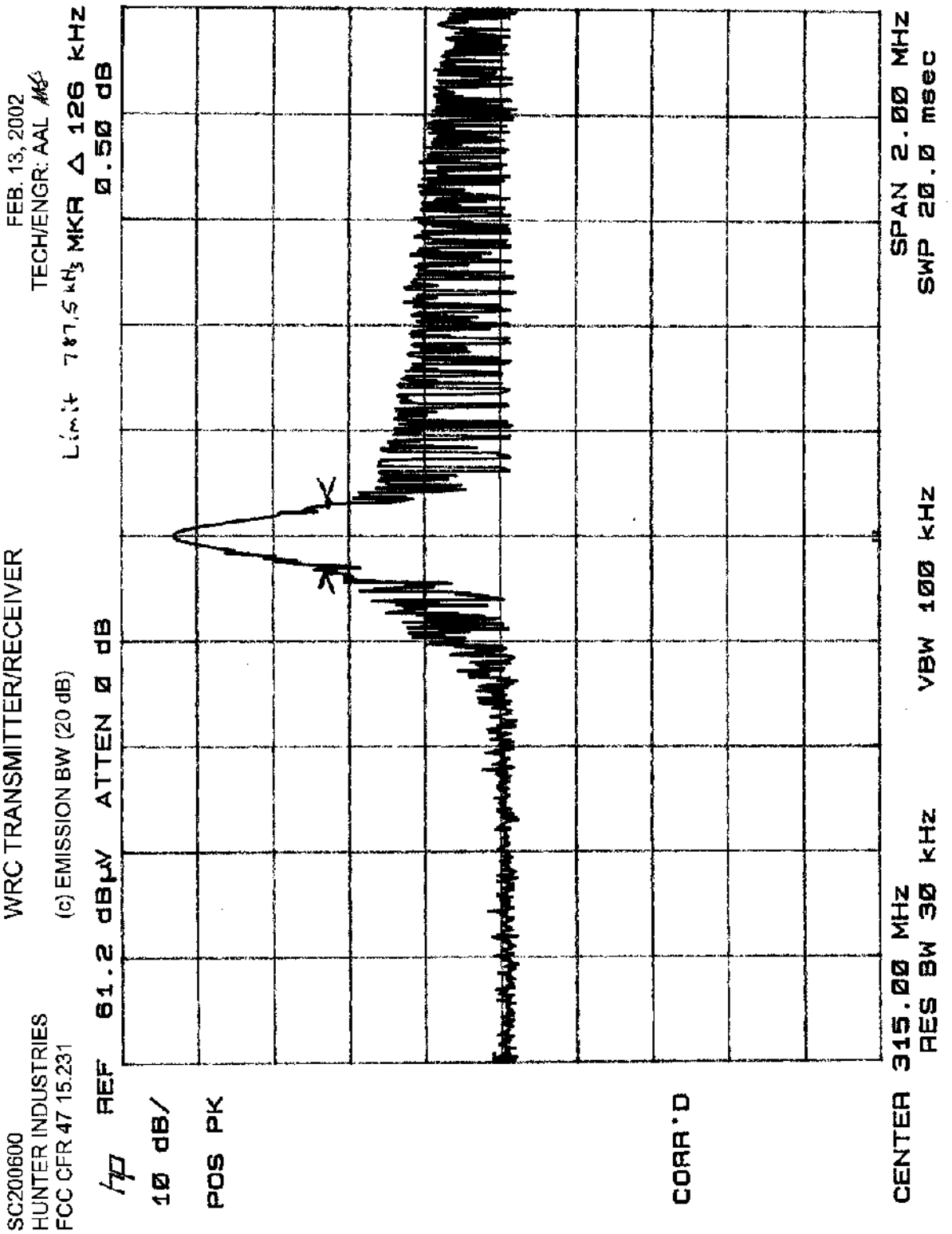
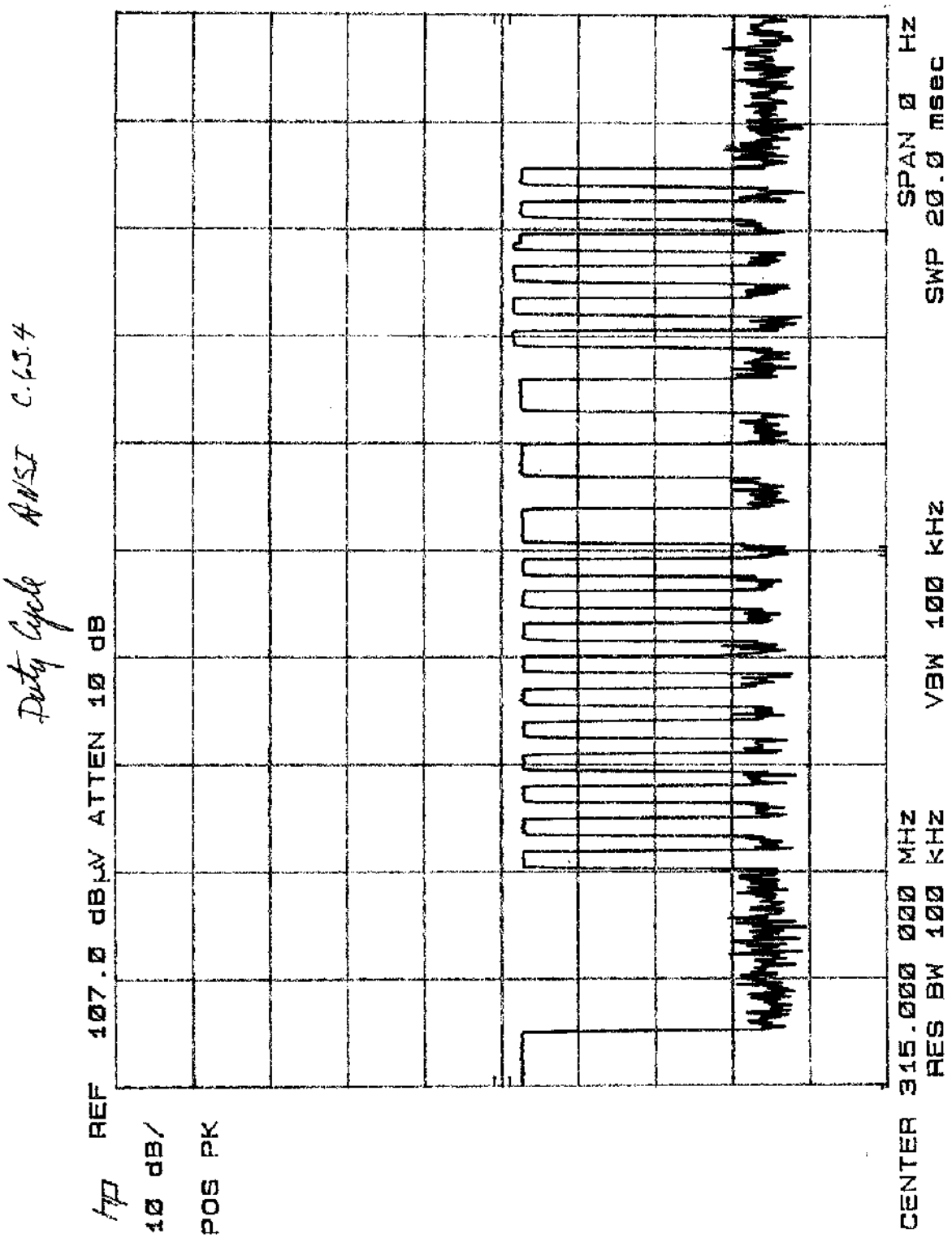
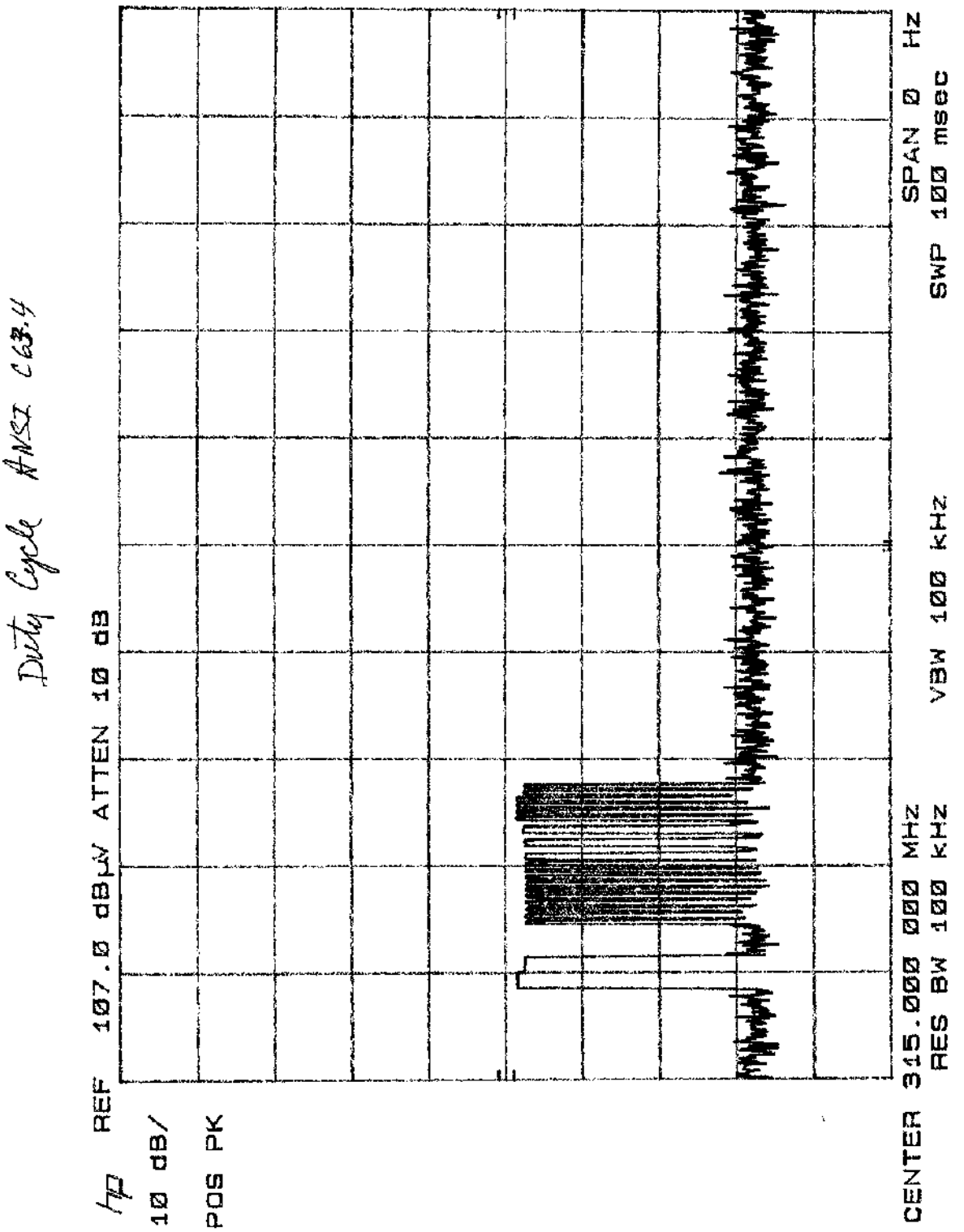
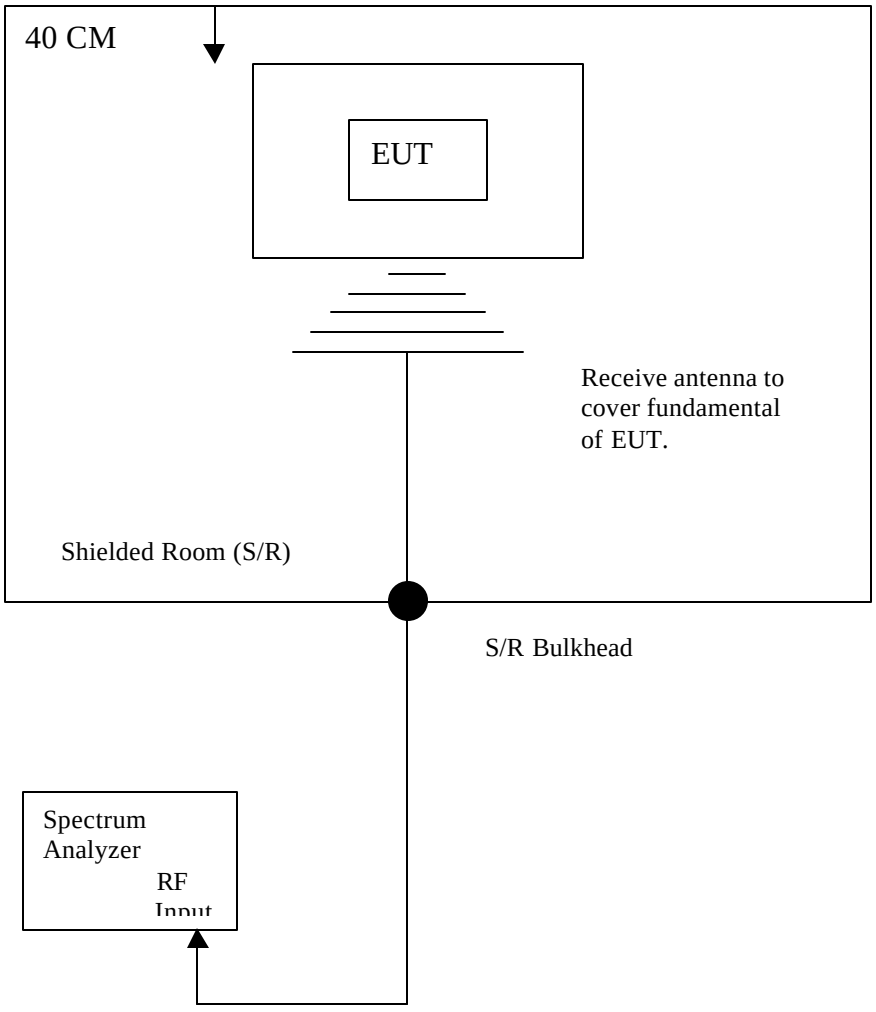

SC200600
HUNTER INDUSTRIES
FCC CFR 47 15.231
WRC TRANSMITTER/RECEIVER
(c) EMISSION BW (20 dB)
FEB. 13, 2002
TECH/ENGR: AAL
Limit 787.5 kHz MKR Δ 126 kHz
0.50 dB
REF 61.2 dBµV ATTEN 0 dB
10 dB/
POS PK
CORR'D
CENTER 315.00 MHz
RES BW 30 kHz
VBW 100 kHz
SPAN 2.00 MHz
SWP 20.0 msec


Duty Cycle ANSI C.63.4
hp REF 107.0 dBµV ATTEN 10 dB
10 dB/
POS PK
CENTER 315.000 000 MHz
RES BW 100 kHz
VBW 100 kHz
SPAN 0 Hz
SWP 20.0 msec


Duty Cycle ANSI C63.4
REF 107.0 dBµV ATTEN 10 dB
10 dB/
POS PK
CENTER 315.000 000 MHz
RES BW 100 kHz
VBW 100 kHz
SPAN 0 Hz
SWP 100 msec

20 dB Bandwidth Measurement Test Setup



Emissions Test Conditions: 20 dB Bandwidth EMISSIONS, FCC Part 15, Paragraph 15.231(c)

The *RADIATED EMISSIONS* measurements were performed at the following test location :

☐ - Test not applicable

■ - SR-3, Shielded Room, 12’ x 20’ x 8’, Metal Chamber

Test Equipment Used :

Model HP8586B, Property # 721, Spectrum Analyzer, Hewlett Packard, S/N 2542A12099, Cal Date 08/02
Model CBL6111, Property # 461, Antenna Bilog, Chase Electronic, S/N 1291, Cal Date NCR

Remarks: _____

5 CONDUCTED EMISSION EQUIPMENT/DATA

See following page(s).

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TÜV PRODUCT SERVICE

TUV Product Service
Conducted Emissions

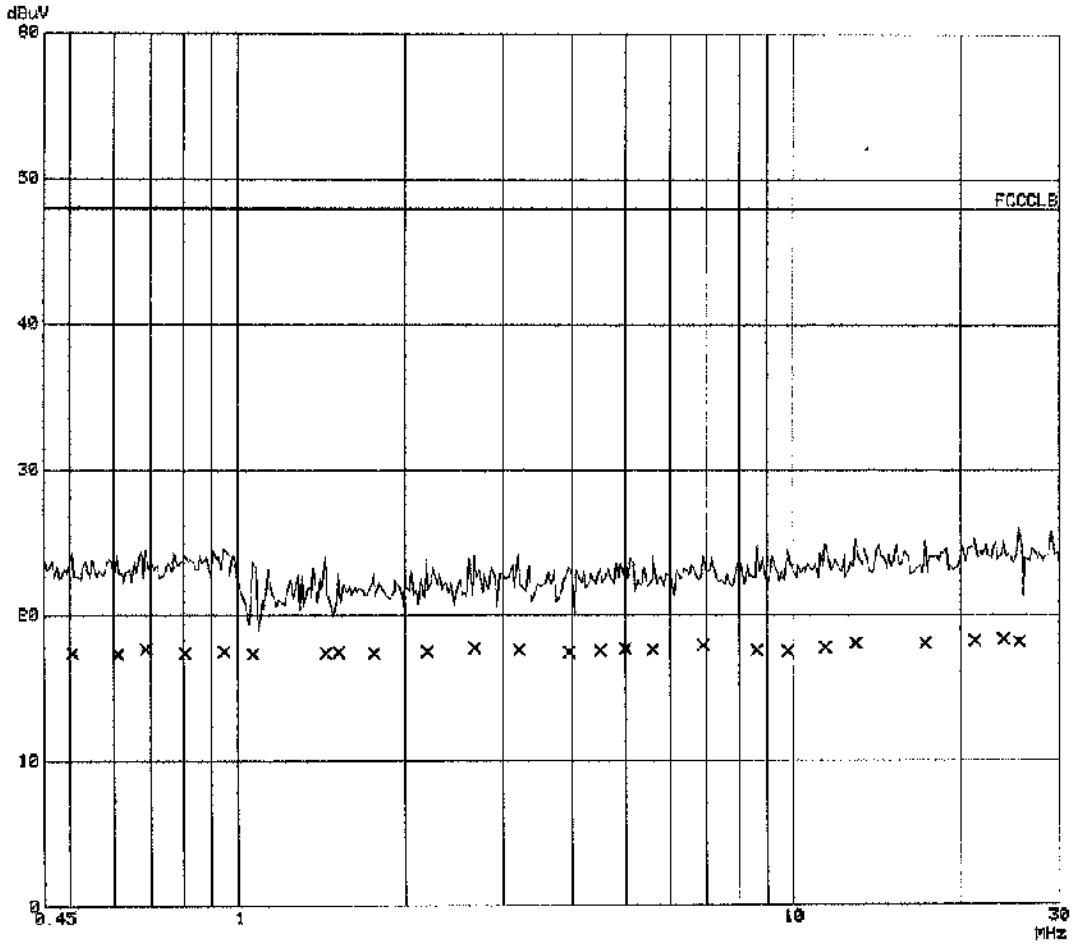
EUT: WRC-transmitter/reciever
Manuf: HUNTER INDUSTRIES
Op Cond: recieving normal mode
Operator: Alan Laudani
Test Spec: FCC PART 15 Class B
Comment: 110VAC 60Hz Line 2
SC200600
Date: 13. Feb 02 09:23

Scan Settings (2 Ranges)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
450k	1M	5k	10k	PK	100ms	AUTO	LN OFF	60dB
1M	30M	5k	10k	PK	2ms	AUTO	LN OFF	60dB

Transducer No.	Start	Stop	Name
5	9k	30M	20dBLISN

Final Measurement: x QP
Meas Time: 1 s
Subranges: 25
Acc Margin: 40dB



TÜV PRODUCT SERVICE

TUV Product Service
Conducted Emissions

EUT: WRC-transmitter/reciever
Manuf: HUNTER INDUSTRIES
Op Cond: recieving normal mode
Operator: Alan Laudani
Test Spec: FCC PART 15 Class B
Comment: 110VAC 60Hz Line 2
SC200600
Date: 13. Feb 02 09:23

Final Measurement Results:

Frequency MHz	QP Level dBuV	QP Limit dBuV
0.50500	17.4	48.0
0.61000	17.4	48.0
0.68500	17.7	48.0
0.80500	17.4	48.0
0.94500	17.5	48.0
1.06500	17.4	48.0
1.44000	17.4	48.0
1.52000	17.5	48.0
1.76000	17.4	48.0
2.19000	17.5	48.0
2.66500	17.8	48.0
3.20500	17.7	48.0
3.95000	17.5	48.0
4.49500	17.6	48.0
4.99000	17.7	48.0
5.60000	17.7	48.0
6.90000	17.9	48.0
8.61500	17.6	48.0
9.78500	17.5	48.0
11.45000	17.8	48.0
12.97000	18.1	48.0
17.27000	18.1	48.0
21.24500	18.2	48.0
23.91500	18.3	48.0
25.52000	18.2	48.0

* limit exceeded

TÜV PRODUCT SERVICE 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone 858 546 3999 FAX 858 546 0364

TÜV PRODUCT SERVICE

TUV Product Service
Conducted Emissions

EUT: WRC-transmitter/reciever
Manuf: HUNTER INDUSTRIES
Op Cond: recieving normal mode
Operator: Alan Laudani
Test Spec: FCC PART 15 Class B
Comment: 110VAC 60Hz Line 1
SC200600
Date: 13. Feb 02 09:15

Final Measurement Results:

Frequency MHz	QP Level dBuV	QP Limit dBuV
0.50500	17.5	48.0
0.62000	17.2	48.0
0.69500	17.4	48.0
0.85500	17.4	48.0
0.97000	17.5	48.0
1.20000	17.5	48.0
1.43000	17.4	48.0
1.57000	17.4	48.0
2.03500	17.5	48.0
2.36500	17.5	48.0
2.47500	17.4	48.0
2.94000	17.3	48.0
3.54000	17.4	48.0
4.63500	17.7	48.0
5.46000	17.6	48.0
6.27000	17.6	48.0
6.99000	17.6	48.0
9.06000	17.7	48.0
10.25000	17.6	48.0
12.85500	18.2	48.0
14.67000	18.1	48.0
16.00500	17.8	48.0
21.32500	18.2	48.0
21.45500	18.0	48.0
26.23000	18.0	48.0

* limit exceeded

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TÜV PRODUCT SERVICE

TUV Product Service
Conducted Emissions

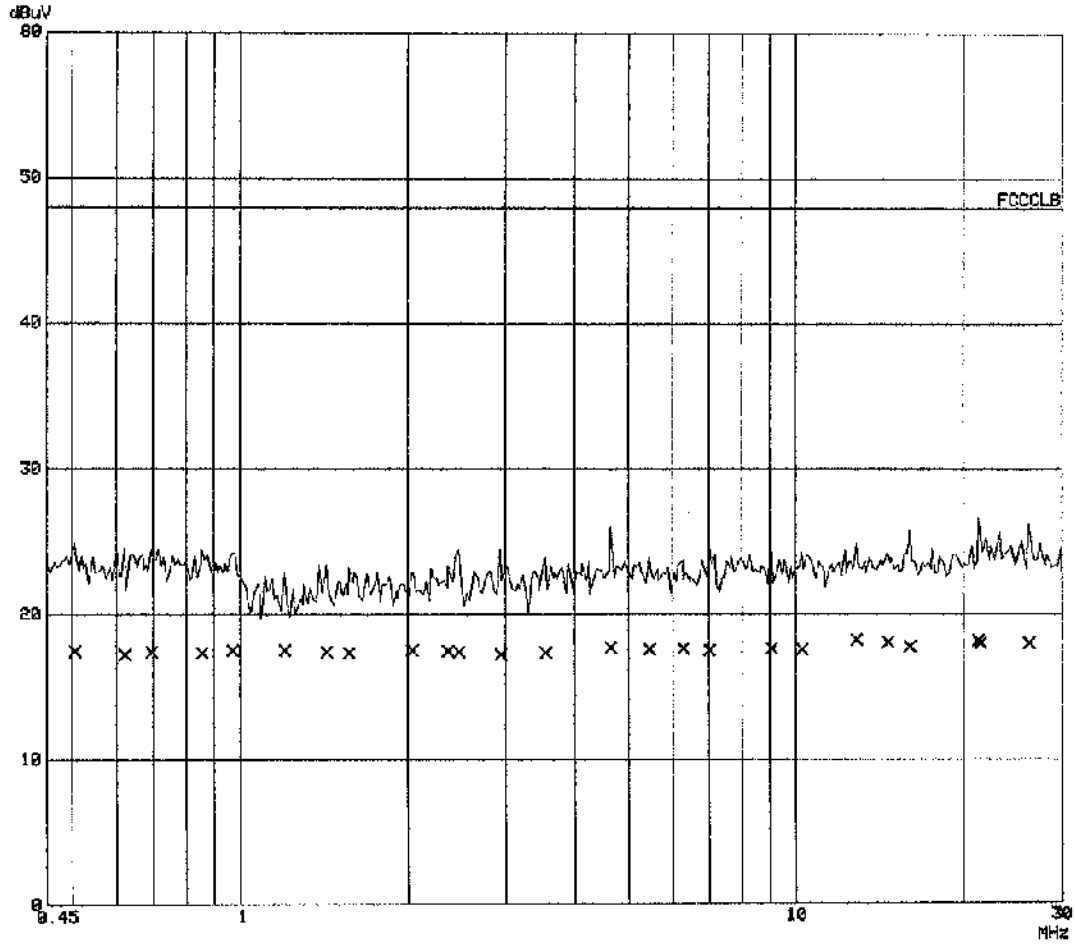
EUT: WRC-transmitter/reciever
Manuf: HUNTER INDUSTRIES
Op Cond: recieving normal mode
Operator: Alan Laudani
Test Spec: FCC PART 15 Class B
Comment: 110VAC 60Hz Line 1
SC200600
Date: 13. Feb 02 09:15

Scan Settings (2 Ranges)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
450k	1M	5k	10k	PK	100ms	AUTO	LN OFF	60dB
1M	30M	5k	10k	PK	2ms	AUTO	LN OFF	60dB

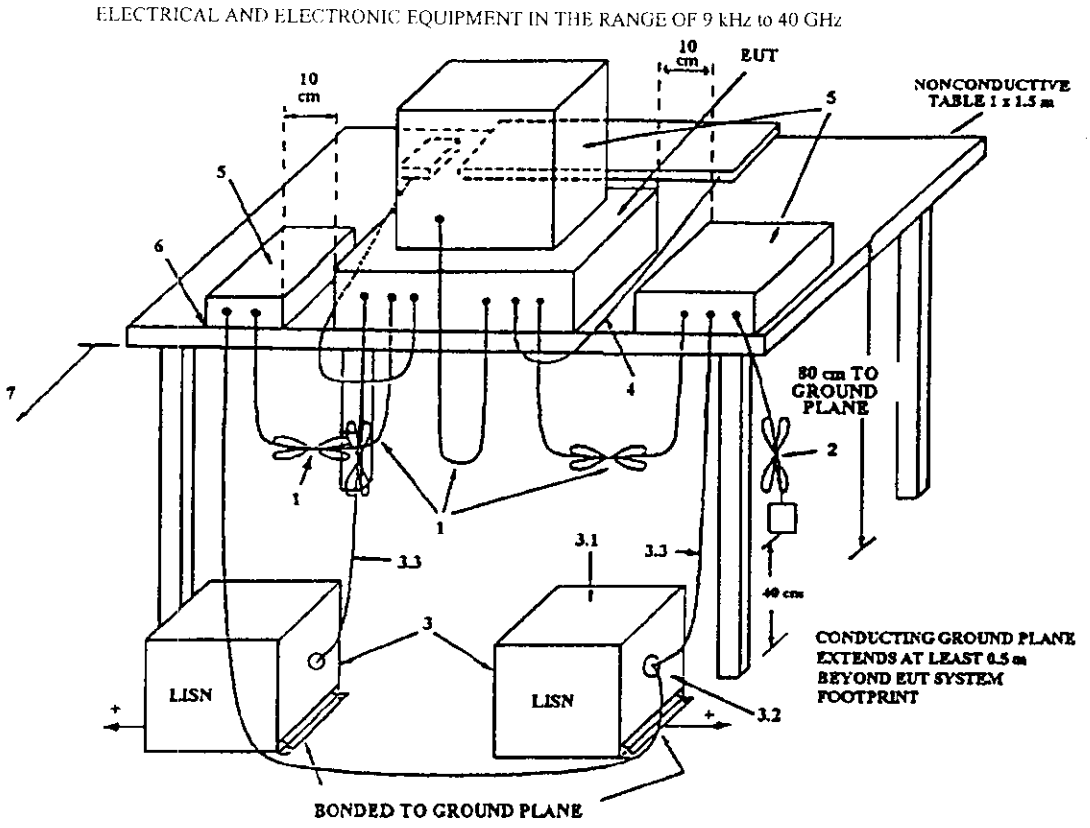
Transducer No.	Start	Stop	Name
5	9k	30M	20dBLISN

Final Measurement: x QP
Meas Time: 1 s
Subranges: 25
Acc Margin: 40dB



Conducted Emissions Test Setup

Conducted Emissions Test Setup, 0.15 to 30 MHz



LEGEND:

1. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth forming a bundle 30 to 40 cm long, hanging approximately in the middle between ground plane and table.
2. I/O cables that are connected to a peripheral shall be bundled in center. The end of the cable may be terminated if required using correct terminating impedance. The total length shall not exceed 1 m.
3. EUT connected to one LISN. Unused LISN connectors shall be terminated in 50 Ω. LISN can be placed on top of, or immediately beneath, ground plane.
   - 3.1 All other equipment powered from second LISN.
   - 3.2 Multiple outlet strip can be used for multiple power cords of non-EUT equipment.
   - 3.3 LISN at least 80 cm from nearest part of EUT chassis.
4. Cables of hand-operated devices, such as keyboards, mouses, etc., have to be placed as close as possible to the controller.
5. Non-EUT components being tested.
6. Rear of EUT, including peripherals, shall be all aligned and flush with rear of tabletop.
7. Rear of tabletop shall be 40 cm removed from a vertical conducting plane that is bonded to the floor ground plane.

Emissions Test Conditions: CONDUCTED EMISSIONS, FCC Part 15, Paragraph 15.107(a)

The *Conducted EMISSIONS* measurements were performed at the following test location :

☐ **- Test not applicable**

■ - SR-3, Shielded Room, 12’ x 20’ x 8’, Metal Chamber

Test Equipment Used :

Model ESHS 20, Property # 428, EMI Test Receiver, Rohde & Schwarz, S/N 837055/001, Cal Date 12/02
Model CAT-20, Proper # 616, 20 dB Attenuator, Mini-Circuits, Cal Date N/A
Model 9242-50-R-24-BNC, Property # 457, LISN, Solar Electronics, Co., S/N 941720, Cal Date 02/03

Remarks: _____

7 ATESTATION STATEMENT

GENERAL REMARKS:

SUMMARY:

All tests were performed per CFR 47, *Part 15, Paragraphs 15.231(b), (c); 15.107(a); 15.109(a)* were

■ - Performed

The Equipment Under Test

■ - **Fulfills** the requirements of CFR 47, *Part 15, Paragraphs 15.231(b) (c); 15.107(a); 15.109(a).*

- TÜV PRODUCT SERVICE, INC. -

Responsible Engineer:

Alan Laudani
(EMC Engineer)

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