



**ADDITIONAL PRESENTATION FOR
SPURIOUS EMISSIONS MEASUREMEMTS**

**ADDENDUM TO CERTIFICATION
TEST REPORT FC99-028**

FOR THE

**TRA ASSY, TRX 1000S, FE, 1.4, 31GHZ [S1],
MODEL PTM 1000-31**

**FCC PART 101
COMPLIANCE**

DATE OF ISSUE: JANUARY 13, 2000

PREPARED FOR:

Wavtrace, Inc.
1545 134th Ave NE
Bellevue, WA 98005

P.O. No: 8590
W.O. No: 71941

PREPARED BY:

Joyce Walker
CKC Laboratories, Inc.
5473A Clouds Rest
Mariposa, CA 95338

Date of test: August 9-13, 17-20,
& 23-25, 1999

Report No: FC99-028A

DOCUMENTATION CONTROL:

A handwritten signature in black ink, appearing to read 'Tracy Phillips'.

Tracy Phillips
Documentation Control Supervisor
CKC Laboratories, Inc.

This report contains a total of 8 pages and may be reproduced in full only. Partial reproduction may only be done with the written consent of CKC Laboratories, Inc.

APPROVED BY:

A handwritten signature in black ink, appearing to read 'Dennis Ward'.

Dennis Ward
Director of Laboratories
CKC Laboratories, Inc.

ADMINISTRATIVE INFORMATION

DATE OF TEST:

Date of test: August 9-13, 17-20 & 23-25, 1999

PURPOSE AND SUMMARY OF ADDENDUM:

To demonstrate the compliance of the TRA Assy, TRX 1000S, FE, 1.4, 31GHz [S1], Model PTM 1000-31, with the requirements for FCC Part 101 devices. This addendum contains a reformatted presentation of the spurious emissions data contained in the original report for the pages referenced. This presentation was prepared from the original data to satisfy the following FCC requests:

1. Reformat data to clearly express in dB attenuation as stated in Part 101.111(a)(2)(ii) and (iii).
2. Reformat data to show comparison to the emissions mask of Part 101.111(a)(2)(ii) and (iii) based on the special FCC interpretation of the emissions mask as percent removed (P) from the center of the Frequency Band, and not the "Carrier Frequency" as presently defined in Part 101.111(a)(2)(ii) and (iii).

The results of this revised presentation show the unit to be compliant, as original tested, with the spurious emissions requirements of 101.111(a)(2)(ii) and (iii), including demonstrated compliance with the FCC special interpretation of the emissions mask.

MANUFACTURER:

Wavtrace, Inc.
13434 NE 16th St., Suite 140
Bellevue, WA 98005

REPRESENTATIVE:

Dean Busch

TEST LOCATION:

CKC Laboratories, Inc.
22105 Wilson River Hwy
Tillamook, OR 97141

TEST PERSONNEL:

Mike Wilkinson, Adam Ross & Clark Vitek

Wavtrace
CKC Report #

FC99-028 (31 GHz TRA)

Radiated Spurious Emissions Measurements Recalculated
to show direct compliance with limits of 101.111(a) (2) (ii) and (iii)
(converted from original comparison to FCC Part 15.209 General Limits)

Parameters for Limit Calculations

P = Percent of Authorized Bandwidth (B)

Removed from Center of Frequency Band

Attenuation Requirements

Beyond P=250% paragraph 101.111 (a) (2) (iii)

NOTE : All Spurious Emissions Reported for This Device >250% Removed from Center of Frequency Band

Transmitter Rated Output 16 dBm

CKC Report #FC99-028, Page 24 Recalculation

Freq(MHz)	Reading (dBuV)	Reading (uV/M)	ERP (mW)	Polarity	Transmitter Rated Output (mW)	Measured Attenuation (dB)	Percent (P) Removed	Required Attenuation (dB)	Reference	Pass/Fail	Margin (dB)
486.8	38.5	84.14	0.000001295	Horiz	39.8	74.88	>250%	29	101.111(a)(2)(iii)	Pass	-45.88
486.44	37.2	72.44	0.000000960	Vert	39.8	76.18	>250%	29	101.111(a)(2)(iii)	Pass	-47.18
50.936	29.2	28.84	0.000000152	Vert	39.8	84.18	>250%	29	101.111(a)(2)(iii)	Pass	-55.18
1.168	55.5	595.66	0.000064905	Vert	39.8	57.88	>250%	29	101.111(a)(2)(iii)	Pass	-28.88
244.188	29.7	30.55	0.000000171	Horiz	39.8	83.68	>250%	29	101.111(a)(2)(iii)	Pass	-54.68
244.176	29.5	29.85	0.000000163	Vert	39.8	83.88	>250%	29	101.111(a)(2)(iii)	Pass	-54.88

CKC Report #FC99-028, Page 25 Recalculation

Freq(MHz)	Reading (dBuV)	Reading (uV/M)	ERP (mW)	Polarity	Transmitter Rated Output (mW)	Measured Attenuation (dB)	Percent (P) Removed	Required Attenuation (dB)	Reference	Pass/Fail	Margin (dB)
487.08	40.1	101.16	0.000001872	Horiz	39.8	73.28	>250%	29	101.111(a)(2)(iii)	Pass	-44.28
486.56	39.2	91.20	0.000001522	Vert	39.8	74.18	>250%	29	101.111(a)(2)(iii)	Pass	-45.18
53.32	29.3	29.17	0.000000156	Vert	39.8	84.08	>250%	29	101.111(a)(2)(iii)	Pass	-55.08
244.177	30.5	33.50	0.000000205	Vert	39.8	82.88	>250%	29	101.111(a)(2)(iii)	Pass	-53.88
244.168	30.1	31.99	0.000000187	Horiz	39.8	83.28	>250%	29	101.111(a)(2)(iii)	Pass	-54.28
1.168	25.2	18.20	0.000000061	Vert	39.8	88.18	>250%	29	101.111(a)(2)(iii)	Pass	-59.18

CKC Report #FC99-028, Page 26 Recalculation

Freq(MHz)	Reading (dBuV)	Reading (uV/M)	ERP (mW)	Polarity	Transmitter Rated Output (mW)	Measured Attenuation (dB)	Percent (P) Removed	Required Attenuation (dB)	Reference	Pass/Fail	Margin (dB)
20028.67	47	223.87	0.000009168	Vert	39.8	66.38	>250%	29	101.111(a)(2)(iii)	Pass	-37.38
3445	45.4	186.21	0.000006343	Horiz	39.8	67.98	>250%	29	101.111(a)(2)(iii)	Pass	-38.98
1965.05	45.4	186.21	0.000006343	Horiz	39.8	67.98	>250%	29	101.111(a)(2)(iii)	Pass	-38.98
8860	44.7	171.79	0.000005399	Vert	39.8	68.68	>250%	29	101.111(a)(2)(iii)	Pass	-39.68
24134.73	44	158.49	0.000004595	Horiz	39.8	69.38	>250%	29	101.111(a)(2)(iii)	Pass	-40.38
1970	42.5	133.35	0.000003253	Vert	39.8	70.88	>250%	29	101.111(a)(2)(iii)	Pass	-41.88
22200.58	41.4	117.49	0.000002525	Horiz	39.8	71.98	>250%	29	101.111(a)(2)(iii)	Pass	-42.98
2696	39.4	93.33	0.000001593	Vert	39.8	73.98	>250%	29	101.111(a)(2)(iii)	Pass	-44.98
21020.13	38.9	88.10	0.000001420	Vert	39.8	74.48	>250%	29	101.111(a)(2)(iii)	Pass	-45.48
1086	37.3	73.28	0.000000982	Horiz	39.8	76.08	>250%	29	101.111(a)(2)(iii)	Pass	-47.08

CKC Report #FC99-028, Page 27 Recalculation

Freq(MHz)	Reading (dBuV)	Reading (uV/M)	ERP (mW)	Polarity	Transmitter Rated Output	Measured Attenuation	Percent (P) Removed	Required Attenuation	Reference	Pass/Fail	Margin (dB)
21357.33	49.6	302.00	0.000016683	Vert	39.8	63.78	>250%	29	101.111(a)(2)(iii)	Pass	-34.78
18085	48.2	257.04	0.000012086	Horiz	39.8	65.18	>250%	29	101.111(a)(2)(iii)	Pass	-36.18
20040	47.9	248.31	0.000011279	Horiz	39.8	65.48	>250%	29	101.111(a)(2)(iii)	Pass	-36.48
21017	47.6	239.88	0.000010526	Vert	39.8	65.78	>250%	29	101.111(a)(2)(iii)	Pass	-36.78
26259	47.2	229.09	0.000009600	Horiz	39.8	66.18	>250%	29	101.111(a)(2)(iii)	Pass	-37.18
20875.83	46.9	221.31	0.000008959	Vert	39.8	66.48	>250%	29	101.111(a)(2)(iii)	Pass	-37.48
25848.2	46.1	201.84	0.000007452	Horiz	39.8	67.28	>250%	29	101.111(a)(2)(iii)	Pass	-38.28
24729.37	41.8	123.03	0.000002769	Vert	39.8	71.58	>250%	29	101.111(a)(2)(iii)	Pass	-42.58

Description of Calculations for Radiated Field Spurious Emissions Measurements :

The radiated electric field measurement obtained on the Open Area Test Site, in dBuV/m, is converted for converted for comparison to the attenuation requirements of 101.111(a)(2)(ii) and (iii) as follows :

1. Convert Reading to uV/m (linear units) : $R(\text{uV/m}) = 10^{\text{R(dBuV/m)}}/20$
2. Convert Reading to ERP (mW) :

$$\text{ERP (W)} = (\text{E}^* \text{d})^2 / (30^* \text{G}) \text{ where E is Electric field in V/m, d = distance in meters (3 meters for above), G=numeric Gain of a half wave dipole=1.64}$$

$$\text{ERP(mW)} = 1000^* \text{ERP(W)}$$
3. Calculate Measured Attenuation compared to Transmitter Rated Output Power P (mW) :

$$A (\text{dB}) = 10^*\log(P / \text{ERP})$$

Attenuation Requirement Calculations (Emissions Mask)

-For Frequencies between 50% and 250% removed from the CENTER of the frequency band (paragraph 101.111(a)(2)(ii) :

$A=11 + 0.4(P-50) + 10^*\log(B)$ where P=Percent removed from the center of the frequency band and B=maximum authorized bandwidth of 850 MHz.

A greater than 56 dB not required.

For Frequencies Greater than 250% removed from the CENTER of the frequency band (paragraph 101.111(a)(2)(iii) :

$A=43 + 10\log(P)$ where P transmitter output Power in Watts

**Antenna Port Conducted Spurious Emissions Measurements Recalculated
to limits of 101.111(a) (2) (ii) and (iii)**

Parameters for Limit Calculations

P = Percent of Authorized Bandwidth (B)

Removed from Center of Frequency Band

Attenuation Requirements

P Between 50% and 250%

paragraph 101.111 (a) (2) (ii)

Beyond P=250%

paragraph 101.111 (a) (2) (iii)

Channel 0 Data										
Carrier Frequency 31006 MHz Center of Authorized Band 31037.5 MHz Maximum Authorized BW=B 75 MHz										
Frequency (MHz)	Limit Calculation			Spurious Emissions Measurement						
	P= Percent	Required	Measurement	Mean	Measured	RESULT	MARGIN			
	Removed (%)	Limit Paragraph	Attenuation (dB)	Measurement (dBuV)	Measurement (dBm)	Operating Power (dBm)	Attenuation (dB)	(Pass/Fail)		
95766.66	86305.5467	101.111(a)(2)iii	27.70	53.5	-53.5	14.70	68.20	PASS	-40.50	
86783.34	74327.7867	101.111(a)(2)iii	27.70	53.5	-53.5	14.70	68.20	PASS	-40.50	
80483.34	65927.7867	101.111(a)(2)iii	27.70	53.2	-53.8	14.70	68.50	PASS	-40.80	
51100	26750.0000	101.111(a)(2)iii	27.70	49.8	-57.2	14.70	71.90	PASS	-44.20	
53916	30504.6667	101.111(a)(2)iii	27.70	44	-63	14.70	77.70	PASS	-50.00	
63875	43783.3333	101.111(a)(2)iii	27.70	42.7	-64.3	14.70	79.00	PASS	-51.30	

Channel 15 Data										
Carrier Frequency 31129 MHz Center of Authorized Band 31225 MHz Maximum Authorized BW=B 150 MHz										
Frequency (MHz)	Limit Calculation			Spurious Emissions Measurement						
	P= Percent	Required	Measurement	Mean	Measured	RESULT	MARGIN			
	Removed (%)	Limit Paragraph	Attenuation (dB)	Measurement (dBuV)	Measurement (dBm)	Operating Power (dBm)	Attenuation (dB)	(Pass/Fail)		
37429	4136.0000	101.111(a)(2)iii	28.00	79	-28	15.00	43.00	PASS	-15.00	
53866.67	15094.4467	101.111(a)(2)iii	28.00	53.3	-53.7	15.00	68.70	PASS	-40.70	
53066.66	14561.1067	101.111(a)(2)iii	28.00	52.3	-54.7	15.00	69.70	PASS	-41.70	
43033.33	7872.2200	101.111(a)(2)iii	28.00	51.7	-55.3	15.00	70.30	PASS	-42.30	
42400	7450.0000	101.111(a)(2)iii	28.00	50.5	-56.5	15.00	71.50	PASS	-43.50	
23028.33	-5464.4467	101.111(a)(2)iii	28.00	42.5	-64.5	15.00	79.50	PASS	-51.50	

Channel 35 Data Carrier Frequency 31296 MHz Center of Authorized Band 31300 MHz Maximum Authorized BW=B 75 MHz										
Frequency (MHz)	Limit Calculation			Spurious Emissions Measurement				Measured Attenuation (dB)	RESULT (Pass/Fail)	MARGIN (dB)
	P= Percent (%)	Removed Paragraph	Limit	Required Attenuation (dB)	Measurement (dBuV)	Measurement (dBm)	Operating Power (dBm)			
31547.08	329.4400	101.111(a)(2)iii		30.10	62.1	-44.9	17.1	62	PASS	-31.90
31047	-337.3333	101.111(a)(2)iii		30.10	61.5	-45.5	17.1	62.6	PASS	-32.50
31557.75	343.6667	101.111(a)(2)iii		30.10	48.3	-58.7	17.1	75.8	PASS	-45.70
56866.67	34088.8933	101.111(a)(2)iii		30.10	72.8	-34.2	17.1	51.3	PASS	-21.20
51600	27066.6667	101.111(a)(2)iii		30.10	71.3	-35.7	17.1	52.8	PASS	-22.70
61958.33	40877.7733	101.111(a)(2)iii		30.10	66.8	-40.2	17.1	57.3	PASS	-27.20
28853.67	-3261.7733	101.111(a)(2)iii		30.10	56.5	-50.5	17.1	67.6	PASS	-37.50

CKC Report #FC99-028 (31 GHz TRA)
Transducer Key and Sample Calculations

Pages 24-25, transducers appearing between column Raw "Reading" and Corrected Reading "Corr":

1. Amp-A = Emission Pre-Amplifier Insertion Loss (dB, -Gain)
2. Bilog = Antenna Factor for Bilog Antenna (dB/m)
3. Cb10a= Cable Insertion Loss (dB)
4. 3301B=Antenna Factor for Rod Antenna (dB/m) (use exclusive of Bilog)
5. Dist= Distance extrapolation (if applicable)

Transducers 1-3 were used for the frequency range of 27 MHz - 1 GHz
Transducer 4 for readings <27 MHz

The Corrected E-Field Reading "Corr" in dBuV/m measured by the antenna at a 3 meter distance is obtained from the raw reading on the spectrum analyzer (in dBuV) as follows:

27 MHz - 1 GHz:

Reading + AmpA + Bilog + cb10a

Example: Page 24, Reading #1 at 486.8 MHz= 42.8 dBuV

Corrected Reading = $42.8 + (-27.6) + 17.8 + 5.5 = 38.5$ dBuV/m

<27 MHz:

Reading + 3301B

Example, Page 24, Reading #4 at 1.168 MHz=51 dBuV

Corrected Reading = $51 + 4.5 = 55.5$ dBuV/m

These readings were compared on the original data sheets for the purpose of demonstrating compliance to the general radiated field requirements of 47 CFR FCC Part 15.209 (the "limit" column). All radiated spurious emissions measurements have been recalculated to specifically also show compliance with Part 101.111(a)(2)(ii) and (iii) attenuation requirements.

CKC Report #FC99-028 (31 GHz TRA)
Transducer Key and Sample Calculations

Pages 26-27, transducers appearing between column Raw "Reading" and Corrected Reading "Corr":

Used in the Frequency Range 1-18 GHz

1. "26.5" = Emissions Pre-Amplifier insertion Loss (dB, -Gain)
2. Cable = Cable Insertion Loss (dB)
3. Cbl-2 = Cable Insertion Loss (dB)
4. Horn = Horn Antenna Factor (dB/m)

Used in the Frequency Range of 18-40 GHz

5. High = Emissions Pre-Amplifier insertion Loss (dB, -Gain)
6. Horn = Horn Antenna Factor (dB/m)

The Corrected E-Field Reading "Corr" in dBuV/m measured by the antenna at a 3 meter distance is obtained from the raw reading on the spectrum analyzer (in dBuV) as follows:

1 - 18 GHz:

$$\text{Corr (dBuV/m)} = \text{Reading (dBuV)} + \text{"26.5"} + \text{Cable (dB)} + \text{Cbl-2 (dB)} + \text{Horn (dB/m)}$$

Example: Page 26, Raw Reading #2 at 3445 MHz = 46.2 dBuV

$$\begin{aligned}\text{Corrected Reading (dBuV/m)} &= 46.2 \text{ dBuV} + (-33.8) + 1.3 + 1.6 + 30.1 \\ &= 45.4 \text{ dBuV/m}\end{aligned}$$

18 - 40 GHz:

$$\text{Corr (dBuV/m)} = \text{Reading} + \text{Horn} + \text{High}$$

Example: Page 26, Raw Reading #1 at 20028.67 MHz = 51.8 dBuV

$$\begin{aligned}\text{Corrected Reading (dBuV/m)} &= 51.8 \text{ dBuV} + 40.5 + (-45.3) \\ &= 47 \text{ dBuV/m}\end{aligned}$$

These readings were compared on the original data sheets for the purpose of demonstrating compliance to the general radiated field requirements of 47 CFR FCC Part 15.209 (the "limit" column). All radiated spurious emissions measurements have been recalculated to specifically also show compliance with Part 101.111(a)(2)(ii) and (iii) attenuation requirements.