Accredited Since 1993

QUALIFICATION TEST REPORT

EMISSIONS -FCC Part 15
FCC Part 24 Paragraph 24.238 only

Test Report Number: OTI 99020302 Date of Issue: 25 February 1999
Model No: Redhawk 2000C Date of Test Article Receipt: 4 February 1999
Type of product: FCC Part 24

Manufacturer: Omnipoint Technologies, Inc.

Address: 1365 Garden of the Gods Road

Colorado Springs, CO 80907

Test Results: [X] Complies [ ] Does Not Comply

R. Barry Wallen Lab Director
(NVLAP Signatory)

Michael E. Mussler Compliance Engineer

Accredited by NIST NVLAP for FCC Part 15

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The client is aware that Criterion Technology has performed testing in accordance with the applicable standard(s). Test data is accurate within ANSI uncertainty parameters for Emissions testing, unless a specific level of accuracy has been defined in writing prior to testing, by Criterion Technology and the client.

Criterion Technology reports apply only to the specific Equipment Under Test (EUT) sample(s) tested under the test conditions described in this report. If the manufacturer intends to use this report as a document demonstrating compliance of this model, additional models of this product must have electrical and mechanical characteristics identical to the device tested for this report. Criterion Technology shall have no liability for any deductions, inferences, or generalizations drawn by the client or others from Criterion Technology issued reports.

Total liability is limited to the amount invoiced for the testing of this EUT and the contents of this report are not warranted.

Compliance with the appropriate governmental standards is the responsibility of the manufacturer.
Any questions regarding this report should be directed to:

Laboratory Director
Criterion Technology
P.O. Box 387
1350 County Road 16
Rollinsville, Colorado 80474
Phone: 1-303-682-6600
Fax:1-303-682-6672
email: Laboratory_Director@criteriontech.com

NVLAP Notes:

The **NVLAP Logo** on the front cover of this report applies only to the **47 CFR part 15 and CISPR 22:1993** data contained herein.

This report contains data which are not covered by the NVLAP accreditation.

This report must not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government.

Criterion Technology has been accredited by the following groups: NVLAP, VCCI, BCIQ and NMi (EU Competent Body Accreditation)

All Criterion Technology instrumentation and accessories used to test products for compliance to the indicated standards are calibrated regularly in accordance with ISO 9001, ISO Guide 25, ANSI/NCSL Z540-I-1994 and are traceable to national standards.

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Section 1 Executive Summary

The test article was in compliance with all the test standards listed below.

FCC Part 15 Subpart A
FCC Part 15 Subpart B Conducted Emissions
FCC Part 15 Subpart B Radiated Emissions
FCC Part 24, Paragraph 24.238 only

All test methods were performed in accordance with the standards listed above.

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Section 2 Emissions Test Standards

The emissions tests were performed according to following standards:

FCC Part 15, Subpart B [ ] Class A [X] Class B

Other: FCC Part 24, Paragraph 24.238 only

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Part 2.1 FCC Part 15 Subpart B - Conducted Emissions

Measurement of *conducted emissions* was performed as indicated below:

Environmental conditions in the lab:

Date(s) of Test: mm/dd/yy 2/5/99

Temperature: 70°F
Rel. Humidity 16%

Test Voltage [X]120 V, 60Hz [ ] ____V, Hz

Test location:
[ ] Criterion OATS Test Area
[X] Criterion Shield Room
[ ] Not applicable

Test instruments:		**Calibration Due Date**
[X]	Hewlett Packard Spectrum Analyzer, Model 8566B	7/12/99
[ ]	Hewlett Packard Quasi Peak Adapter, Model 85650A	12/17/99
[X]	Rohde and Schwarz Receiver, Model, ESHS-30	8/26/99
[ ]	Rohde and Schwarz Model Receiver, ESVS-30	9/1/99
[X]	Rohde and Schwarz Model LISN, ESH2-Z5	7/24/99
[ ]	Not applicable	

Test results:

Conducted Emission: 450 kHz - 30 MHz

The requirements are [X] PASS [ ] FAIL [ ] N/A

Min. limit margin 11.5 dB at 2.17500 MHz

Max. limit exceeding __ dB at __ MHz

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Part 2.2 FCC Part 15 Subpart B –Radiated Emissions

Measurement or *radiated emissions (electric* field) in the frequency range of 30 MHz-1000 MHz were tested in a horizontal and vertical polarization as indicated below:

Environmental conditions in the lab:

Date(s) of Test:	mm/dd/yy	2/4/99
Temperature:	71°F	
Rel. Humidity	12%	
Test Voltage	[X]120 V, 60Hz [ ]	____V, Hz

Test location:
[X] Criterion Technology Open Area Test Site
[ ] Pre-Scan In Semi-Anechoic Chamber
[ ] Not applicable

Test distance (antenna - EUT):

[ ]1 meter	[ ]Preliminary Measurement	[ ]Final Measurement
[ ]3 meters	[ ]Preliminary Measurement	[ ]Final Measurement
[X]10 meters	[X]Preliminary Measurement	[X]Final Measurement
[ ]30 meters	[ ]Preliminary Measurement	[ ]Final Measurement
[ ]Not applicable		

Test instruments:		**Calibration Due Date**
[X]	Hewlett Packard Spectrum Analyzer, Model 8566B	7/12/99
[X]	Hewlett Packard Quasi Peak Adapter, Model 85650A	12/17/99
[ ]	Hewlett Packard Tracking Generator, Model 85645A	5/22/99
[ ]	Rohde and Schwarz Receiver, Model, ESHS-30	8/26/99
[X]	Rohde and Schwarz Model Receiver, ESVS-30	9/1/99
[ ]	EMCO, BiConnical Antenna, Model 3108	5/30/99
[ ]	EMCO, Log Periodic Antenna, Model 3146	5/30/99
[X]	Chase, BiLog Antenna, Model 1121	5/30/99
[X]	Mini Circuits Pre-Amp	N/A
[ ]	Not Applicable	

Test accessories:
[ ] Other
[X] Not applicable

Results

Radiated Emissions (Electric Field) 30 MHz - 1000 MHz

The requirements are [X] PASS [ ] FAIL [ ] N/A

Min. limit margin 7.50 dB at 250.1538 MHz

Max. limit exceeding __ dB at __ MHz

Remarks: Reference Section 4 for Data Sheets

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Part 2.3 Other Directive: FCC Part 24, Paragraph 24.238

Measurement or *radiated emissions (electric* field) in the frequency range of 30 MHz-1000 MHz were tested in a horizontal and vertical polarization as indicated below:

Environmental conditions in the lab:

Date(s) of Test:	mm/dd/yy	2/4/99
Temperature:	71°F	
Rel. Humidity	12%	
Test Voltage	[X]120 V, 60Hz [ ] ____V,	Hz

Test location:
[X] Criterion Technology Open Area Test Site
[ ] Pre-Scan In Semi-Anechoic Chamber
[ ] Not applicable

Test distance (antenna - EUT):

[ ]1 meter	[ ]Preliminary Measurement	[ ]Final Measurement
[X]3 meters	[X]Preliminary Measurement	[X]Final Measurement
[ ]10 meters	[ ]Preliminary Measurement	[ ]Final Measurement
[ ]30 meters	[ ]Preliminary Measurement	[ ]Final Measurement
[ ]Not applicable		

Test instruments:		**Calibration Due Date**
[X]	Hewlett Packard Spectrum Analyzer, Model 8566B	7/12/99
[X]	Hewlett Packard Quasi Peak Adapter, Model 85650A	12/17/99
[ ]	Hewlett Packard Tracking Generator, Model 85645A	5/22/99
[ ]	Rohde and Schwarz Receiver, Model, ESHS-30	8/26/99
[ ]	Rohde and Schwarz Model Receiver, ESVS-30	9/1/99
[ ]	EMCO, BiConnical Antenna, Model 3108	5/30/99
[ ]	EMCO, Log Periodic Antenna, Model 3146	5/30/99
[ ]	Chase, BiLog Antenna, Model 1121	5/30/99
[ ]	Mini Circuits Pre-Amp	N/A
[X]	Antenna Research, Model 1181A (sn: 1056)	4/15/99
[X]	Amp3 and High Freq. Cable Set	9/30/99
[ ]	Mini Circuits Pre-Amp, Amp 2	6/2/99
[ ]	EMCO Loop Antenna, Model 6502	10/7/99
[ ]	Not Applicable	

Test accessories:
[ ] Other
[X] Not applicable

Results

Radiated Emissions (Electric Field) 1 GHz - 20 GHz

The requirements are	[X] PASS	[ ] FAIL	[ ] N/A
Min. limit margin	67.9 dB	at 3819.6 MHz	
Max. limit exceeding	__ dB	at __ MHz	

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Remarks: Reference Section 4 for Data Sheets

Specification limit was calculated as follows:

The EUT can not be tested without a license while radiating the desired fundamental signal. The procedure for measuring unwanted emissions levels relative to the desired (radiated) signal is to calculate a field strength from the rated power output into an ideal half wave dipole and determine the allowable radiated field strength of the unwanted emission from this level.

The reference level of the fundamental radiated signal is calculated by:

$$E\ (v/m) = \frac{(30*Pt*G)^{0.5}}{R}$$

where
E = field strength in volts per meter
R = measurement distance in meters
Pt = rated transmitter power in watts
G = gain of ideal dipole (ratio), taken as 1.64

The Redhawk 2000 C has a rated transmitter output of 1 watt. The reference level for spurious radiated emissions is 2.34 volts/meter or 127.4 dBuV/m from the above expression.

Per paragraph 24.238, unwanted emissions shall be attenuated below the transmitter power P by:

$$43 + 10 \log (P)\ dB$$

Therefore the specification limit for unwanted emissions is:

Spec = 127.4 dBuV/m - 43 dB
Spec = 84.4 dBuV/m

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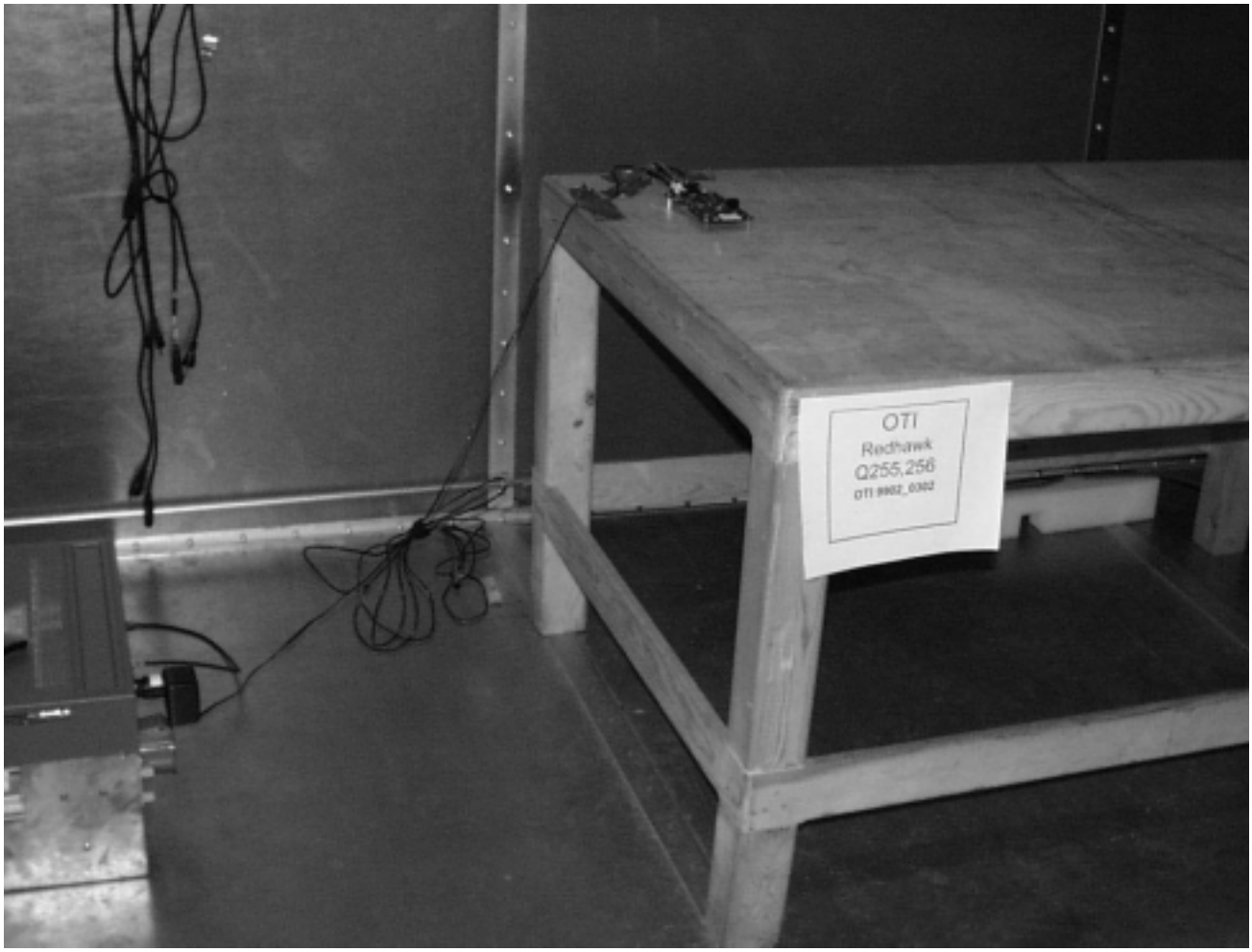
Section 3 Test Setup Photographs

Part 3.1 Conducted Emissions Setup - Front View



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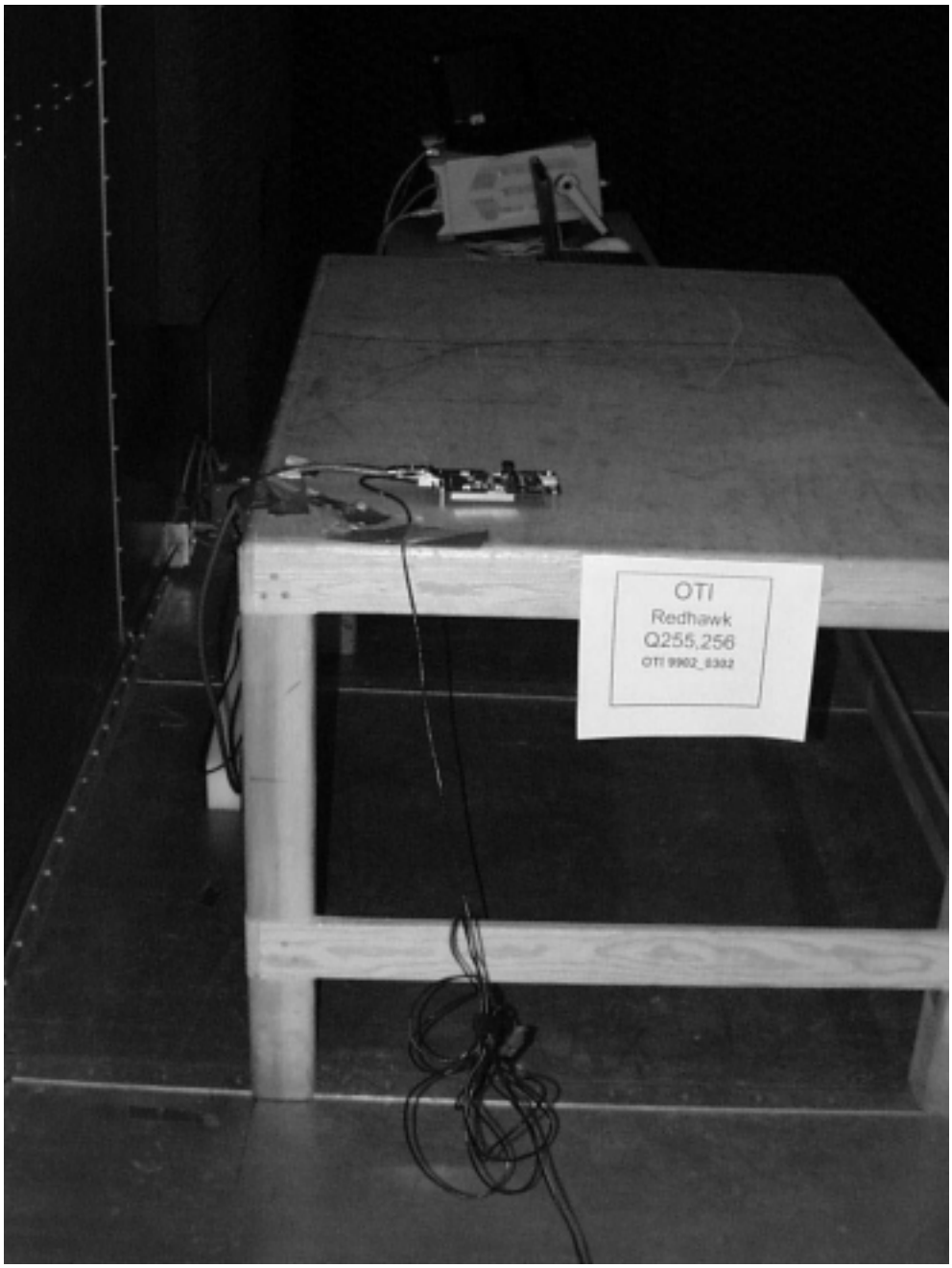
Part 3.2 Conducted Emissions Setup - Side View



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Part 3.3 Radiated Emissions Setup - Front View

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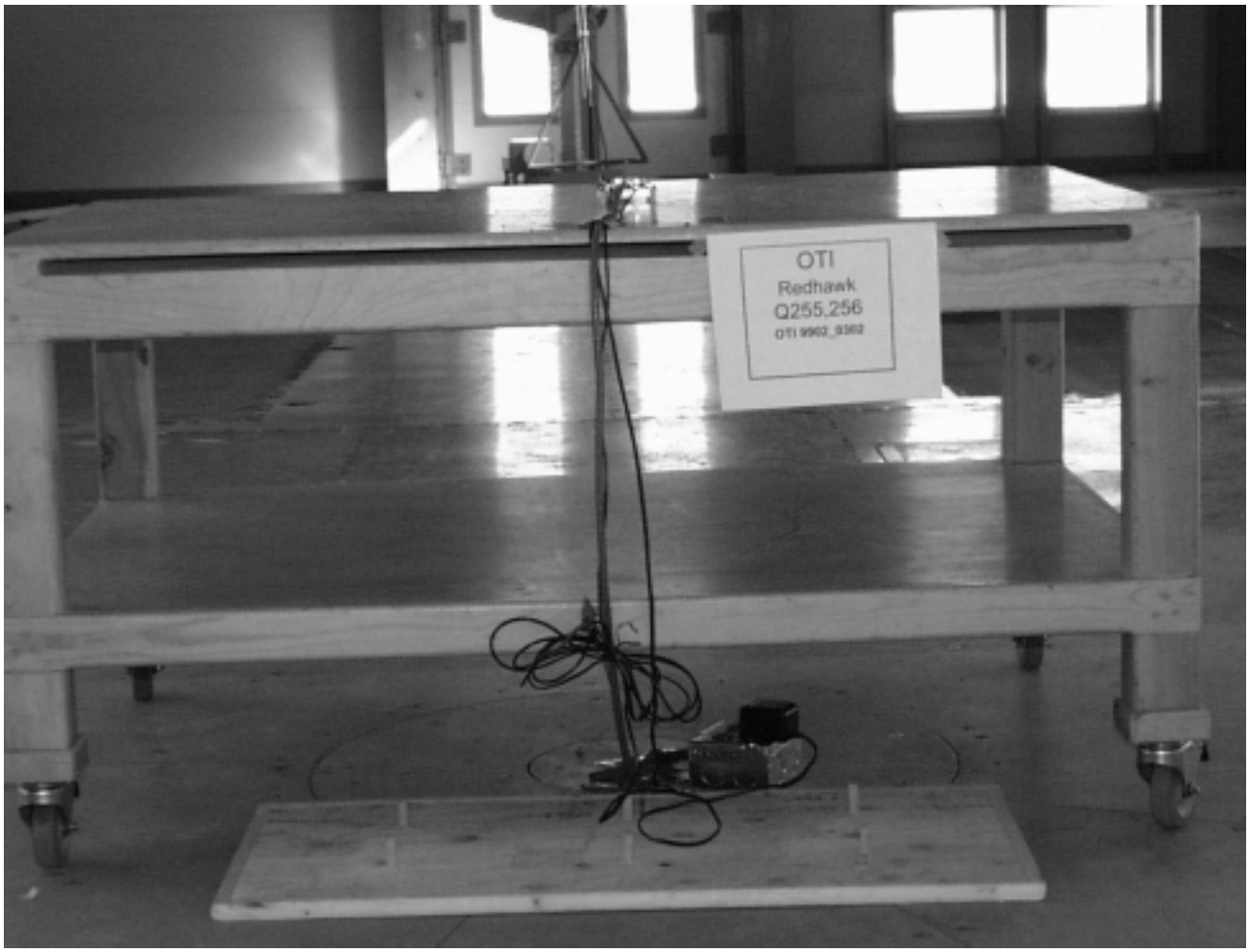
Part 3.4 Radiated Emissions Setup - Rear View



Note: Pegboard used to fix position of DC line during maximization.

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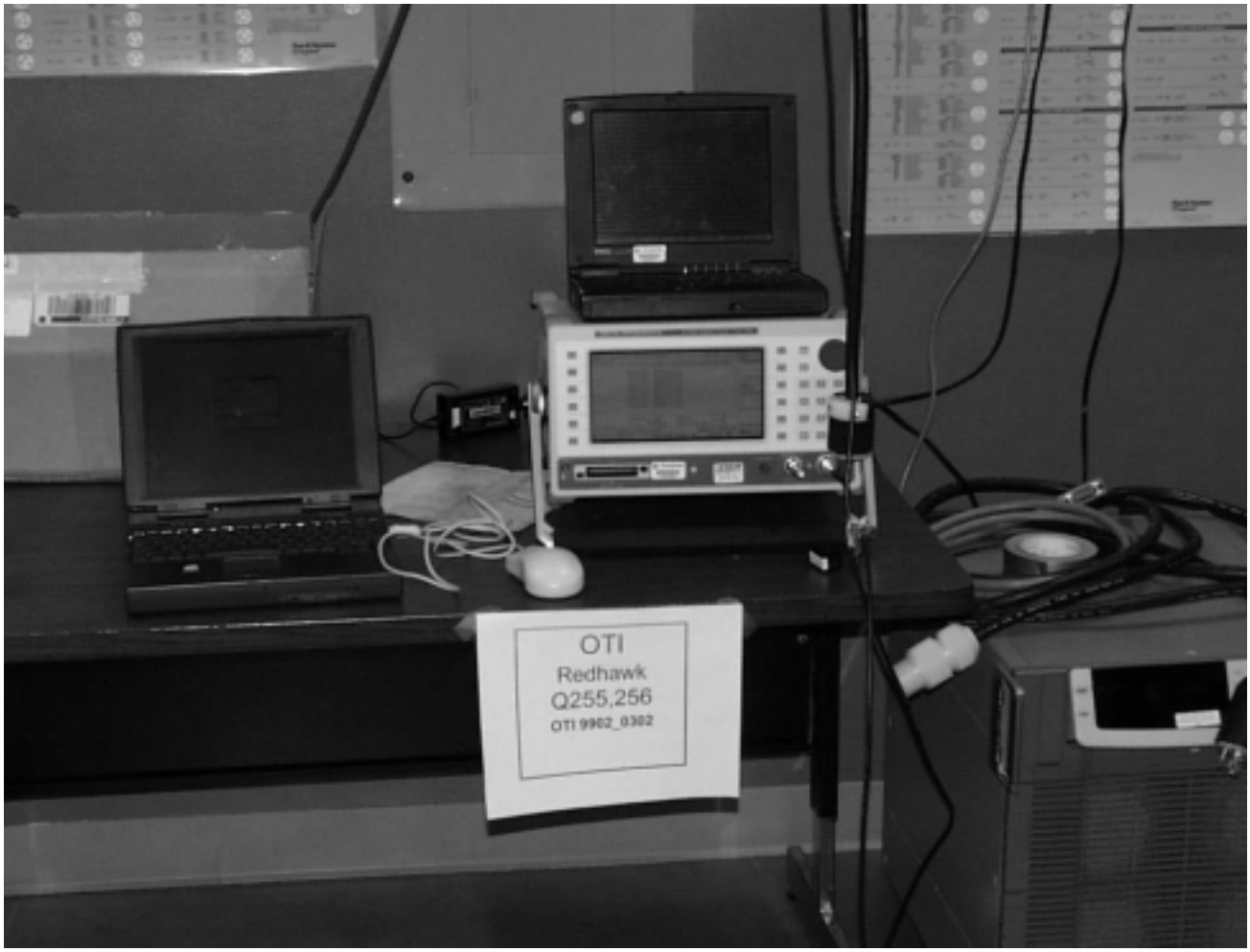
Part 3.5 Radiated Emissions Host Setup



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Section 4 Original Test Data / Plots

Conducted Emissions
Radiated Emissions

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Part 4.1 FCC Conducted Emissions Plot

Criterion TechnologyShield Room 05. Feb 99 07:51
Conducted Emissions through ESH2-Z5

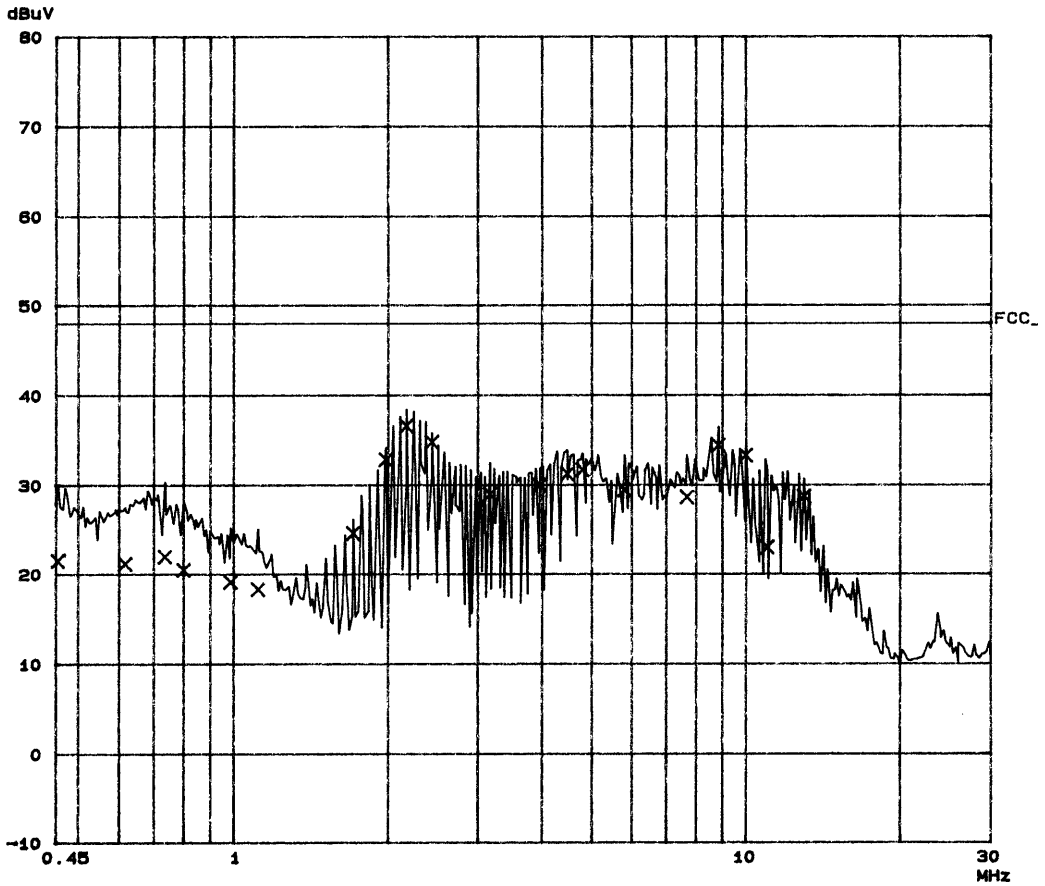
EUT: Redhawk 2000C Rev 1As/n Board 1
Manuf: Omnipoint Technologies, Inc.
Op Cond: No Handset on dia. port, DC power supply
Operator: MEN per OTI Q255
Test Spec: FCC Class B per ANSI C63.4
Comment: 120v 60 Hz, prescan L1, L1 & N scanned
Tabletop, Host in SR.

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
450k	30M	5k	10k	PK	20ms	AUTO	LN OFF	60dB

Final Measurement: x QP
Meas Time: 5 s
Subranges: 25
Acc Margin: 25dB

Transducer	No.	Start	Stop	Name
4	1	10k	30M	SR_W3dB
	5	10k	30M	LISN



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Part 4.2 FCC Conducted Emissions Table

Criterion TechnologyShield Room 05. Feb 99 07:51
Conducted Emissions through ESH2-Z5

EUT: Redhawk 2000C Rev 1As/n Board 1
Manuf: Omnipoint Technologies, Inc.
Op Cond: No Handset on dia. port, DC power supply
Operator: MEM per OTI Q255
Test Spec: FCC Class B per ANSI C63.4
Comment: 120v 60 Hz, prescan L1, L1 & N scanned
Tabletop, Host in SR.

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
450k	30M	5k	10k	PK	20ms	AUTO	LN OFF	60dB

Final Measurement Results:

Indicated Phase/PE shows Configuration of max. Emission

Frequency MHz	QP Level dB	QP Limit dB	Phase -	PE -
0.45500	21.5	48.0	N	gnd
0.61500	21.1	48.0	N	gnd
0.73500	21.9	48.0	N	gnd
0.80000	20.5	48.0	N	gnd
0.99000	19.1	48.0	N	gnd
1.12000	18.3	48.0	N	gnd
1.71500	24.6	48.0	L1	gnd
1.98000	32.8	48.0	L1	gnd
2.17500	36.5	48.0	L1	gnd
2.44000	34.7	48.0	L1	gnd
3.16500	29.0	48.0	L1	gnd
3.95500	30.0	48.0	L1	gnd
4.48500	31.1	48.0	L1	gnd
4.81500	31.5	48.0	L1	gnd
5.80000	29.4	48.0	L1	gnd
7.66500	28.6	48.0	L1	gnd
8.85000	34.4	48.0	L1	gnd
10.02500	33.2	48.0	L1	gnd
11.02000	23.0	48.0	L1	gnd
12.97500	28.7	48.0	L1	gnd

* limit exceeded

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Part 4.3 Radiated Emissions Data

Data for 30 MHz to 1000 MHz:

Criterion Technology Mon Mar 08 12:27:56 1999
EUT: Model: Redhawk 2000C Rev 1A, serial: Board 1, Radio Module WC 26
Manufacturer: Omnipoint Technologies, Inc.
Tester: MEM Special ID: OTI Q255
EUT Level: Rev 1A, no handset on diagnostic port
EUT Information: Tabletop, powered by typical (non supplied) DC power source
Test information: Typical Operation, 10m, 120V 60 Hz on DC supply, FCC-15 Class B

Table 1: Scan List, sorted by margin to limit FCCB10, -30.0dB filter

Freq, MHz	Value	Sts	FCCB10	TT	Hght	Az	Comment
250.1538	28.06	q	-7.50	178	400	H	amb?
49.8272	17.48	q	-12.06	244	163	V	nbn
663.0002	23.32	m	-12.24	217	104	H	nb
42.6054	17.03	q	-12.51	90	100	V	nb + bb
30.0138	16.62	m	-12.92	299	195	V	.
61.5438	16.51	q	-13.03	230	164	V	nb + bb
33.1368	16.24	q	-13.30	230	164	V	nb + bb data
199.8418	19.06	m	-14.00	230	164	V	bb
39.9998	15.45	q	-14.09	180	100	V	data
47.3355	13.63	q	-15.91	178	186	V	bb
56.8100	11.58	q	-17.96	270	400	H	nb
62.9604	11.51	q	-18.03	178	186	V	.
66.1040	11.38	q	-18.16	178	186	V	nb
89.9378	14.06	m	-19.00	244	163	V	nb
52.0770	10.42	q	-19.12	180	100	V	.
79.9958	9.61	q	-19.93	270	400	H	.
144.5438	12.91	q	-20.15	180	100	V	nb
160.6037	12.15	q	-20.91	180	100	V	data
60.3800	8.09	q	-21.45	270	400	H	bb

Table 2: Scan List for FCCB10, sorted by Frequency, -30.0dB filter

Freq, MHz	Value	Sts	FCCB10	TT	Hght	Az	Comment
30.0138	16.62	m	-12.92	299	195	V	.
33.1368	16.24	q	-13.30	230	164	V	nb + bb data

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Table 2: Scan List for FCCB10, sorted by Frequency, -30.0dB filter

Freq, MHz	Value	Sts	FCCB10	TT	Hght	Az	Comment
39.9998	15.45	q	-14.09	180	100	V	data
42.6054	17.03	q	-12.51	90	100	V	nb + bb
47.3355	13.63	q	-15.91	178	186	V	bb
49.8272	17.48	q	-12.06	244	163	V	nbn
52.0770	10.42	q	-19.12	180	100	V	.
56.8100	11.58	q	-17.96	270	400	H	nb
60.3800	8.09	q	-21.45	270	400	H	bb
61.5438	16.51	q	-13.03	230	164	V	nb + bb
62.9604	11.51	q	-18.03	178	186	V	.
66.1040	11.38	q	-18.16	178	186	V	nb
79.9958	9.61	q	-19.93	270	400	H	.
89.9378	14.06	m	-19.00	244	163	V	nb
144.5438	12.91	q	-20.15	180	100	V	nb
160.6037	12.15	q	-20.91	180	100	V	data
199.8418	19.06	m	-14.00	230	164	V	bb
250.1538	28.06	q	-7.50	178	400	H	amb?
663.0002	23.32	m	-12.24	217	104	H	nb

Table 3: Complete Scan List Sorted by Frequency

Freq, MHz	I-val	Final	Sts	TT	Hght	Az	Time	Comment
30.0138	21.16	16.62	m	299	195	V	Thu Feb 04 11:17:37 1999	.
33.1368	22.44	16.24	q	230	164	V	Thu Feb 04 11:39:50 1999	nb + bb data
39.9998	25.12	15.45	q	180	100	V	Thu Feb 04 10:40:51 1999	data
42.6054	28.07	17.03	q	90	100	V	Thu Feb 04 10:20:17 1999	nb + bb
47.3355	27.10	13.63	q	178	186	V	Thu Feb 04 09:40:48 1999	bb
49.8272	32.43	17.48	q	244	163	V	Thu Feb 04 11:32:09 1999	nbn
52.0770	26.34	10.42	q	180	100	V	Thu Feb 04 10:41:00 1999	.
56.8100	28.41	11.58	q	270	400	H	Thu Feb 04 10:49:11 1999	nb
60.3800	25.02	8.09	q	270	400	H	Thu Feb 04 10:49:13 1999	bb
61.5438	33.46	16.51	q	230	164	V	Thu Feb 04 11:40:07 1999	nb + bb
62.9604	28.41	11.51	q	178	186	V	Thu Feb 04 09:41:12 1999	.
66.1040	28.19	11.38	q	178	186	V	Thu Feb 04 09:41:14 1999	nb
79.9958	25.28	9.61	q	270	400	H	Thu Feb 04 10:49:20 1999	.
89.9378	28.40	14.06	m	244	163	V	Thu Feb 04 11:29:55 1999	nb
144.5438	24.08	12.91	q	180	100	V	Thu Feb 04 10:41:17 1999	nb
160.6037	24.27	12.15	q	180	100	V	Thu Feb 04 10:41:19 1999	data
199.8418	31.40	19.06	m	230	164	V	Thu Feb 04 11:39:29 1999	bb
250.1538	37.47	28.06	q	178	400	H	Thu Feb 04 09:54:04 1999	amb?
663.0002	23.56	23.32	m	217	104	H	Thu Feb 04 11:21:46 1999	nb

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Radiated Emissions Data, 1 GHz to 20 GHz

Criterion Technology Tue Mar 09 07:14:35 1999
EUT: Model: Redhawk 2000C Rev 1A, serial: Board 1, Radio Module WC 26
Manufacturer: Omnipoint Technologies, Inc.
Tester: MEM Special ID: OTI Q255
EUT Level: Rev 1A, no handset on diagnostic port
EUT Information: Tabletop, powered by typical (non supplied) DC power source
Test information: Typical Operation, 3m, 120V 60 Hz on DC supply, FCC-15 Class B

Table 4: Complete Scan List Sorted by Frequency

Freq, MHz	I-val	Final	Sts	TT	Hght	Az	Time	Comment
1850.2000	33.87	36.62	m	131	150	V	Fri Feb 05 11:59:18 1999	fo.
1880.0450	37.52	40.29	m	131	147	H	Fri Feb 05 10:17:34 1999	fo.
1909.8000	33.84	36.67	m	141	150	H	Fri Feb 05 12:57:49 1999	fo
3700.5320	26.95	30.68	m	226	107	V	Fri Feb 05 11:39:23 1999	2fo.
3760.0000	35.20	31.63	m	91	150	H	Thu Feb 04 15:30:00 1999	2fo
3819.6000	27.64	31.45	m	31	107	V	Fri Feb 05 12:58:56 1999	2fo
5550.6000	26.75	31.34	m	116	162	V	Fri Feb 05 11:47:45 1999	3fo, noise floor
5640.0000	26.81	31.54	m	251	162	V	Fri Feb 05 10:31:56 1999	3fo
5729.4000	26.89	31.62	m	268	162	V	Fri Feb 05 13:00:22 1999	3fo
7400.8000	33.10	38.84	a	366	161	H	Fri Feb 05 11:17:09 1999	4fo, noise floor
7520.0000	33.53	39.29	a	364	162	H	Fri Feb 05 10:35:30 1999	4fo, noise floor
7639.2000	33.27	39.13	a	366	150	H	Fri Feb 05 12:40:26 1999	4 fo, noise floor
9251.0000	33.08	39.59	a	365	161	V	Fri Feb 05 11:19:54 1999	5fo, noise floor
9400.0000	33.05	39.62	a	-5	150	H	Fri Feb 05 10:39:51 1999	5fo, noise floor
9549.0000	33.21	39.96	a	365	150	V	Fri Feb 05 12:43:49 1999	5fo, noise floor
11101.2000	33.26	40.51	a	365	161	H	Fri Feb 05 11:22:34 1999	6fo, noise floor
11280.0000	33.25	40.65	a	0	150	V	Fri Feb 05 10:43:30 1999	6fo, noise floor
11458.8000	33.19	40.60	a	366	150	H	Fri Feb 05 12:47:25 1999	6fo, noise floor
12951.4000	37.17	45.36	a	364	150	V	Fri Feb 05 11:25:07 1999	7fo, noise floor
13160.0000	37.05	45.34	a	-3	150	H	Fri Feb 05 10:46:05 1999	7fo, noise floor
13368.6000	37.21	45.44	a	363	150	V	Fri Feb 05 12:49:46 1999	7fo, noise floor
14801.6000	37.36	46.16	a	366	150	H	Fri Feb 05 11:27:50 1999	8fo, noise floor
15040.0000	37.45	46.42	a	76	150	V	Fri Feb 05 10:48:36 1999	8 fo, noise floor
15278.4000	37.31	46.17	a	364	150	H	Fri Feb 05 12:52:16 1999	8fo, noise floor
16651.8000	37.24	46.88	a	363	150	V	Fri Feb 05 11:31:18 1999	9fo, noise floor
16920.0000	37.32	47.08	a	-4	150	H	Fri Feb 05 10:51:27 1999	9 fo, noise floor
17188.2000	37.37	47.01	a	363	150	V	Fri Feb 05 12:54:49 1999	9fo, noise floor

Note: The Ival and Fval values in this list were obtained from the spectrum analyzer average detector. The average values reported against the specification limit were obtained from peak measurements corrected for the duty cycle of the pulsed transmitted signal and its harmonics. See Table 5. Besides the harmonics of the fundamental, no other emissions were measured.

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Table 5:

Average Field Strength Calculation
OTI 9902 0301
2/5/99

Freq. (MHz)	Peak Level (dBuV/m)	Duty Cycle (dB)	Calc. Avg. (dBuV/m)	Spec. Lim. (dBuV/m)	Spec. Margin (dB)
1850.2000	75.15	18.2	56.95	NA, fo	-
1880.0000	77.55	18.2	59.35	NA, fo	-
1909.8000	75.60	18.2	57.40	NA, fo	-
3700.4000	30.70	18.2	12.50	84.40	71.90
3760.0000	34.25	18.2	16.05	84.40	68.35
3819.6000	34.70	18.2	16.50	84.40	67.90
5550.6000	24.10	18.2	5.90	84.40	78.50
5640.0000	13.95	18.2	-4.25	84.40	88.65
5729.4000	14.60	18.2	-3.60	84.40	88.00

Duty Cycle Peak-to-Average Correction Calculation:

22 Pulses in 100 mSec.

Pulse Width = 560 uSec.

Duty Cycle = $\frac{22(0.560)}{100}$ = 0.123, 12.3%

Correction (dB) = 20 log (0.123) = -18.2 dB

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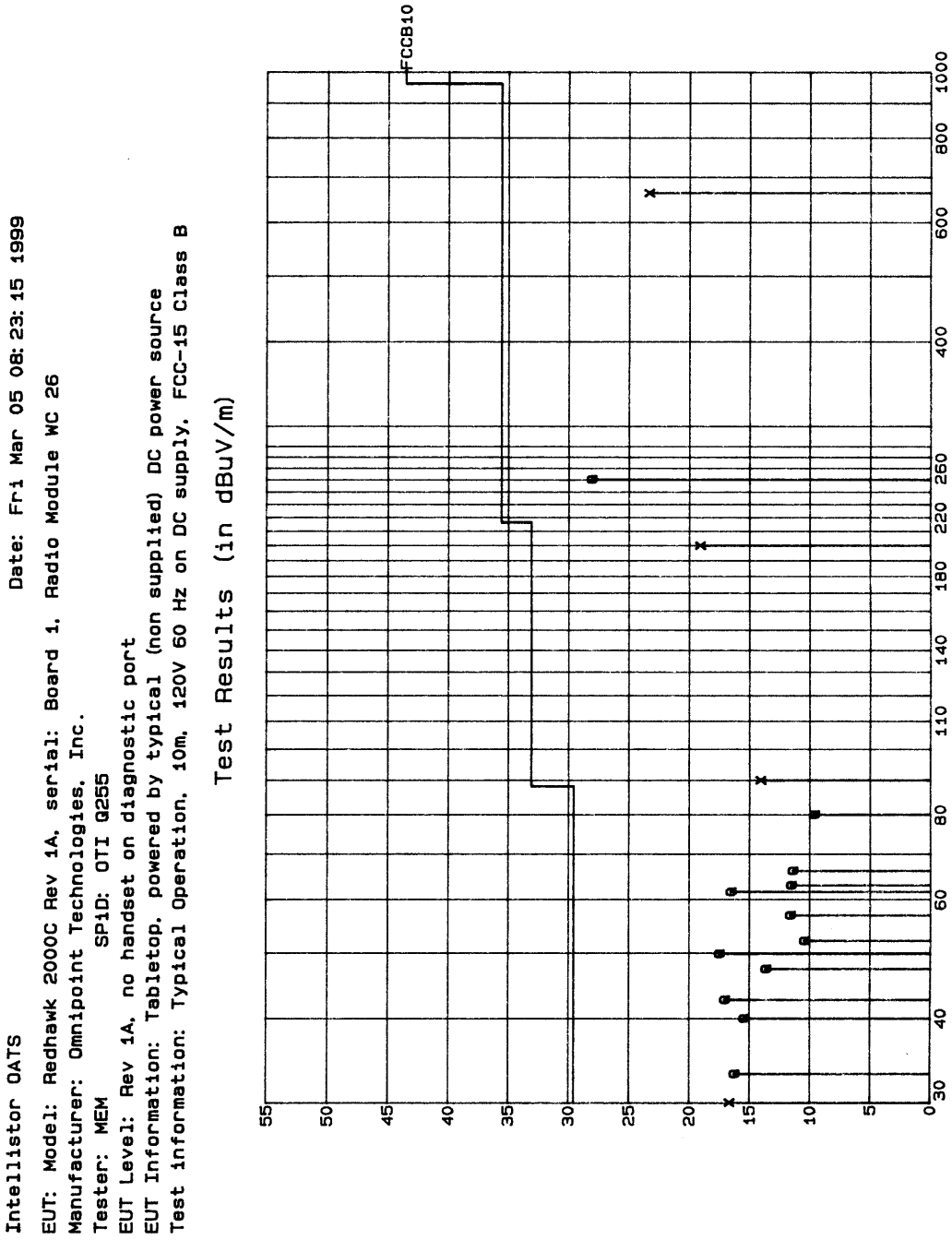
Part 4.4 Radiated Emissions Plot, 30 MHz to 1 GHz



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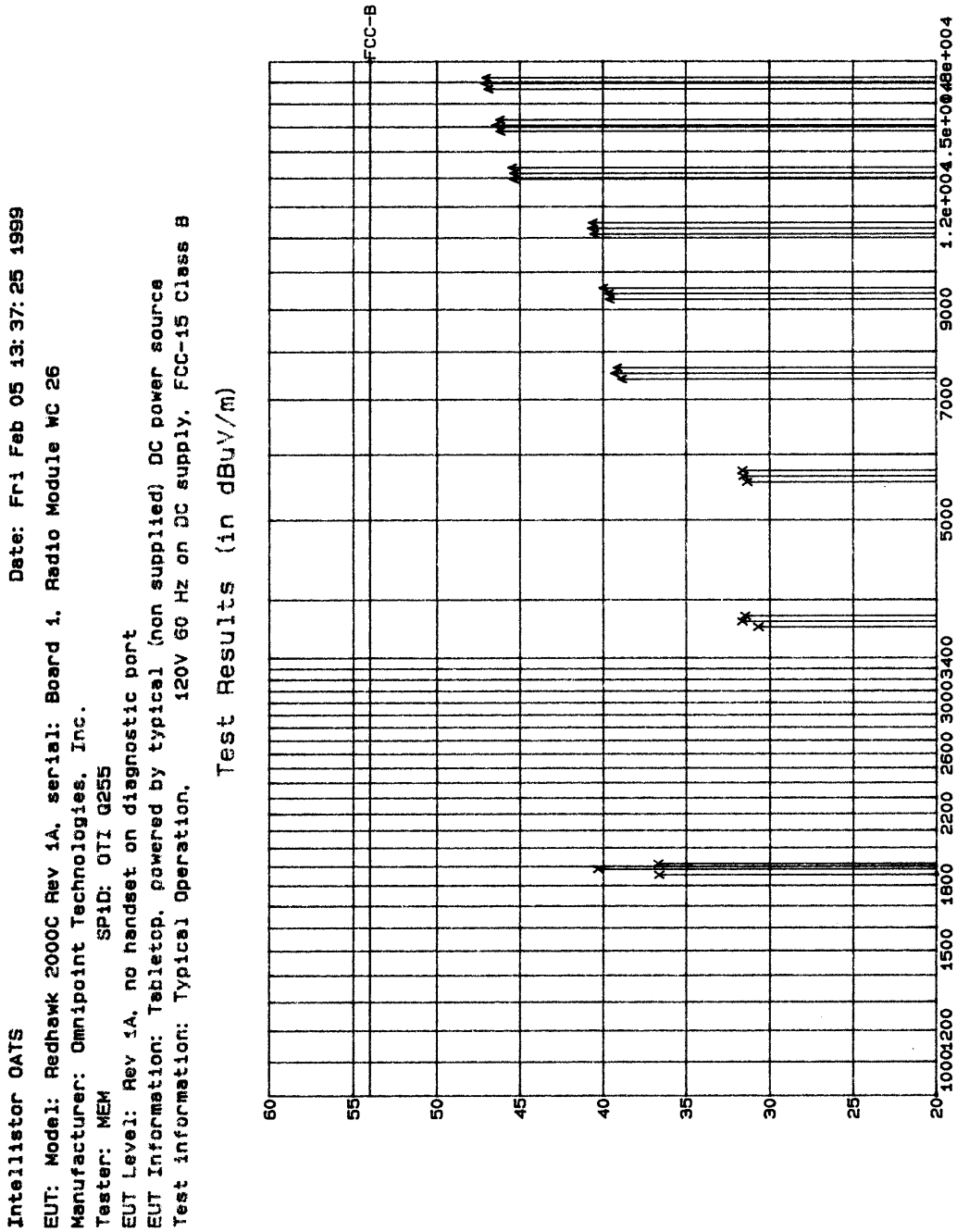
Part 4.5 Radiated Emissions Plot, 1 GHz to 20 GHz



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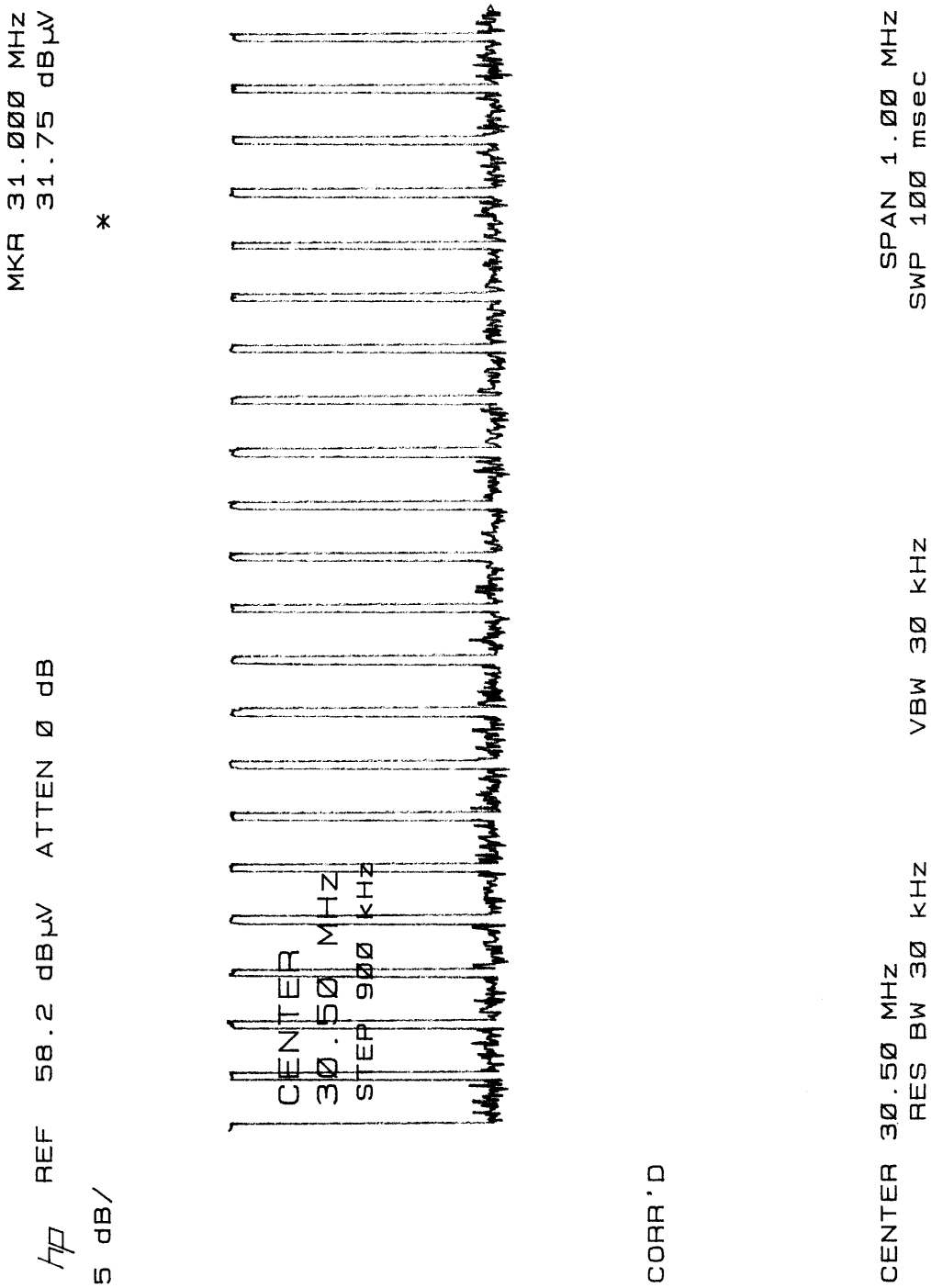
Part 4.6 Radiated Emissions Timing Plot, 100 mSec. Span



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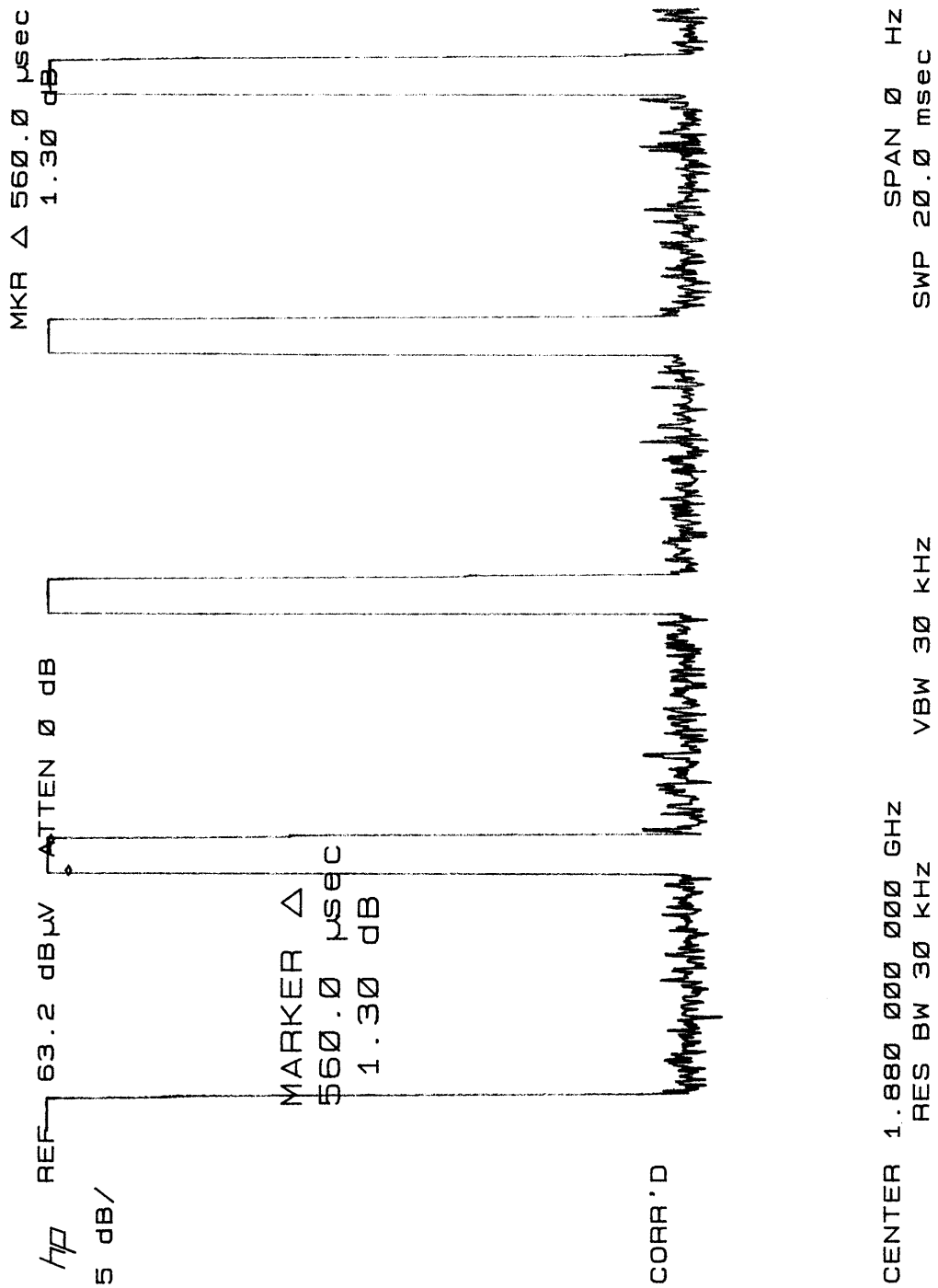
Part 4.7 Radiated Emissions Timing Plot, 20 mSec. Span



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Section 5 Product Information Forms

The client will provide all information on the product.

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