MEASUREMENT/TECHNICAL REPORT

Intermec
Technologies Corporation
EMC Test Laboratory
Cedar Rapids, IA

Intermec Technologies Corporation
EasyLAN® Wireless CF Radio
2.4 GHz Spread Spectrum Transmitter

REPORT NO: 040804-1

DATE: Aug. 8, 2004

This report concerns: Original Grant ___X___ Class II Change _____
Equipment Type: 2412 – 2462 MHz Direct Sequence Spread Spectrum Transceiver, FCC 15.247 Industry Canada RSS-210 Issue 5, RSS-102 Issue 1
Request issue of the grant immediately upon completion of review.
Measurement procedure used: ANSI C63.4-2001 and as described within this test report.

Report Prepared by:	Report Prepared For:
Dave Fry Intermec Technologies Corporation EMC Test Lab 550 Second Street SE Cedar Rapids, Iowa 52401 Phone: (319) 846-2415 FAX: (319) 846-2475	Stu Adams Intermec Technologies Corporation 550 Second Street SE Cedar Rapids, Iowa 52401 Phone: (319) 369-3100 FAX: (319) 369-3453

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SECTION NUMBER

1.0 COMPLIANCE CERTIFICATION

The electromagnetic compatibility test and data evaluations findings of this report have been prepared by the EMC Test Lab, Intermec Technologies Corporation, in accordance with applicable specifications instructions required per-

FCC SECTION	CANADA RSS-210	TEST NAME
15.33, 15.35	4.0	Range of Meas., Meas. Detectors
15.15, 15.31	5.3, 5.8, 9.0, 11.0	General Requirements, Meas. Methods
15.203, 15.204	5.5	Antenna Description(s)
2.925, 15.19	5.10	Labeling
15.21	5.11, 14.0	Information to the User
15.247 (a, b, c, d, e), 15.209	5.7-5.9.2	Transmitter Characteristics
15.207, 15.107	6.6, 7.4/3.2	AC Line Conducted Emissions, TX, RX
1.1307 (b)(1)	14.0 & RSS-102	RF Safety, Exposure Limits

The data, data evaluation and equipment configuration represented herein are a true and accurate representation of the measurements of the test sample's electromagnetic compatibility characteristics as of the dates and at the times of the test under the conditions herein specified. The data presented herein is traceable to the National Institute of Standards and Technology.

This report is not an endorsement of the tested product by NVLAP or any agency of the U.S. Government.

NVLAP®

NVLAP LAB CODE 100269-0

Accredited by the National Institute of Standards and Technology, National Voluntary Laboratory Accreditation Program.

The scope of accreditations addressed in this report is limited to NVLAP codes:
[12/FCC15b] ANSI C63.4 (2001) with FCC Method - 47 CFR Part 15, Subpart B: Unintentional Radiators
[12/FCC15c] ANSI C63.4 (2001) with FCC Method - 47 CFR Part 15, Subpart C: Intentional Radiators
[12/T51] AS/NZS CISPR 22 (2002) and AS/NZS 3548 (1997) Electromagnetic Interference - Limits and Methods of Measurement of Information Technology Equipment
*[12/RSS210]*RSS-210, Issue 5 (November 2001)Low Power Licence-Exempt Radiocommunication Devices
[12/RSS210a] RSS-210, Issue 5, Amendment 2 (April 26, 2003)

Intermec Technologies Corporation
EMC Test Laboratory
550 Second Street S.E.
Cedar Rapids, Iowa 52401

Dave Fry — Date 10/14/04
Dave Fry — mm/dd/yy
NCE, EMC Engineer III

Signature — Date 10/15/04
Signature — mm/dd/yy

EMC 017

Interference Technology International

CERTIFIED NARTE ENGINEER

National Association of Radio and Telecommunications Engineers

STUART ADAMS, MGR. PRODUCT RELIABILITY + COMPLIANCE
Print Name and Title

1.1 Measurement Uncertainties:

ESI 40 Receiver / Spectrum Analyzer

Radiated Emissions on 3 Meter Open Area Test Site

30-300 MHz	has an Expanded Measurement Uncertainty of + 3.04 -3.99 dB
200-1000 MHz	has an Expanded Measurement Uncertainty of + 4.59 -3.01 dB
1-5 GHz without pre-amp	has an Expanded Measurement Uncertainty of + 2.99 -2.93 dB
1-5 GHz	has an Expanded Measurement Uncertainty of + 3.16 –3.11 dB
5-12.5 GHz	has an Expanded Measurement Uncertainty of + 3.20 –3.15 dB
12.5-18 GHz	has an Expanded Measurement Uncertainty of + 3.00 –2.95 dB

Radiated Emissions On 1 Meter Open Area Test Site

1-5 GHz	has an Expanded Measurement Uncertainty of + 4.08 -2.15 dB
5-12.5 GHz	has an Expanded Measurement Uncertainty of + 4.28 -2.55 dB
12.5-26.5 GHz	has an Expanded Measurement Uncertainty of + 4.12 -2.44 dB

AC Line Conducted Emissions

0.15-30 MHz	has an Expanded Measurement Uncertainty of + 0.59 -0.44 dB

Generator Substitution Radiated Measurements Using the 3 Meter Open Area Test Site

30-50 MHz	has an Expanded Measurement Uncertainty of + 2.94 -2.98 dB
50-1000 MHz	has an Expanded Measurement Uncertainty of + 2.85 -2.86 dB
1-12.5 GHz	has an Expanded Measurement Uncertainty of + 2.76 -2.81 dB

Receiver and Transmitter Conducted, Generator Substitution Measurements with
HP83630A RF Generator and ESI 40 Receiver / Spectrum Analyzer

50-7000 MHz	has an Expanded Measurement Uncertainty of + 0.88 -0.88 dB
7- 20 GHz	has an Expanded Measurement Uncertainty of + 1.01 -1.02 dB
20-26.5 GHz	has an Expanded Measurement Uncertainty of + 1.23 -1.27 dB
26.5-40 GHz	has an Expanded Measurement Uncertainty of + 1.55 -1.63 dB

Receiver and Transmitter Direct Measurements of Conducted Emissions with
ESI 40 Receiver / Spectrum Analyzer

9 kHz-5 GHz	has an Expanded Measurement Uncertainty of + 0.56 -0.56 dB
5-7 GHz	has an Expanded Measurement Uncertainty of + 0.74 -0.75 dB
7-20 GHz	has an Expanded Measurement Uncertainty of + 1.16 -1.18 dB
20-26.5 GHz	has an Expanded Measurement Uncertainty of + 1.40 -1.46 dB
26.5-40 GHz	has an Expanded Measurement Uncertainty of + 1.73 -1.88 dB

Confidence Statement
The measurement uncertainty statements above use a Coverage Factor K = 2.
The Coverage Factor K = 2 equates to an approximate confidence level of 95%.

2.0 GENERAL INFORMATION

2.1 Product Description

This report addresses Certification for the EasyLAN® Wireless Compact Flash (CF) radio module FCC ID: HN2-802CF13E, IC: 1223A-802CF13E. The compact flash radio model 802CF13 is supplied by ActionTech. The radio is currently used with the Intermec 730 portable hand held computer under FCC ID: EHA-802CF13. Intermec Technologies has added a Compact Flash (CF) interface card to allow the use of this radio within label printers manufactured by Intermec Technologies.

The radio remains a 2412 - 2462 MHz direct sequence spread spectrum (DSSS) transmitter that Intermec Technologies Corporation now will use within label printers. These printers are used exclusively in business and commercial environments.

Intermec Technologies Corporation will use the EasyLAN® Wireless CF radio, interface card combination, only within label printers manufactured by Intermec Technologies. This application for certification maybe considered "Limited Modular Approval" with the following conditions defined within;

FCC DA 00-1407 Released: June 26, 2000;
PART 15 UNLICENSED MODULAR TRANSMITTER APPROVAL

(a) In order to be considered a transmitter module, the device must be a complete RF transmitter, i.e., it must have its own reference oscillator (e.g., VCO), antenna, etc. The only connectors to the module, if any, may be power supply and modulation/data inputs.

The EasyLAN® Wireless CF radio contains all the radio reference oscillator and antenna connector that meet Part 15.203 requirements. Only the antennas specified within this report or subsequent permissive change requests can be used with this radio module. The radio connections include buffered input for parallel, serial and Ethernet data. The remaining connection is for +5 volts supply connection via a 2 pin cable.

(b) Compliance with FCC RF Exposure requirements may, in some instances, limit the output power of a module and/or the final applications in which the approved module may be employed.

Intermec Technologies specifies within this report the transmitter power and antennas used. The RF exposure characteristics for each antenna approved is shown to meet the RF safety requirements. The listed antennas do not require transmitter power to be reduced to meet RF Exposure or maximum transmitter radiated power limits shown in the regulations.

(c) While the applicant for a device into which an authorized module is installed is not required to obtain a new authorization for the module, this does not preclude the possibility that some other form of authorization or testing may be required for the device (e.g., a WLAN into which an authorized module is installed must still be authorized as a PC peripheral, subject to the appropriate equipment authorization).

Intermec Technologies is fully aware of the obligation to complete unintentional emissions testing on the final products that integrate this radio module. The appropriate declaration of conformity, verification or certification approvals will be pursued prior to marketing.

(d) In the case of a modular transceiver, the modular approval policy only applies to the transmitter portion of such devices. Pursuant to Section 15.101(b), the receiver portion will either be subject to Verification, or it will not be subject to any authorization requirements (unless it is a Scanning Receiver, in which case it is also subject to Certification, pursuant to Section 15.101(a)).

As stated in paragraph (c) Intermec Technologies will follow all the unintentional emissions regulations prior to marketing products with the EasyLAN® Wireless CF Radio Module.

(e) The holder of the grant of equipment authorization (Grantee) of the module is responsible for the compliance of the module in its final configuration, provided that the OEM, integrator, and/or end user has complied with all of the instructions provided by the Grantee which indicate installation and/or operating conditions necessary for compliance.

Intermec Technologies will be the only user of the radio module. The integration testing and instructions for installations by OEM users are unnecessary.

In order to obtain a modular transmitter approval, a cover letter requesting modular approval must be submitted and the numbered requirements identified below must be addressed in the application for equipment authorization.

Attached to this application is a cover letter that repeats the 8 numbered sections below.

1. The modular transmitter must have its own RF shielding. This is intended to ensure that the module does not have to rely upon the shielding provided by the device into which it is installed in order for all modular transmitter emissions to comply with Part 15 limits. It is also intended to prevent coupling between the RF circuitry of the module and any wires or circuits in the device into which the module is installed. Such coupling may result in non-compliant operation.

   Intermec Technologies is provided the compact flash radio as a shielded assembly. The CF interface board with the radio is shown in this report reveals the transmitter emissions comply with the limits defined by the regulatory agencies.

2. The modular transmitter must have buffered modulation/data inputs (if such inputs are provided) to ensure that the module will comply with Part 15 requirements under conditions of excessive data rates or over-modulation.

   The CF radio and interface board all operate using digital technology. The ActionTech radio buffering eliminates the ability to over-modulate the radio under all conditions.

3. The modular transmitter must have its own power supply regulation. This is intended to ensure that the module will comply with Part 15 requirements regardless of the design of the power supplying circuitry in the device into which the module is installed.

   The EasyLAN® Wireless CF radio interface board uses an onboard 3.3 volt regulator. The ActionTech 802CF13 radio is specified to operate in the 3.3v +/- 10% range which is standard for 3.3v technology.

4. The modular transmitter must comply with the antenna requirements of Section 15.203 and 15.204(c). The antenna must either be permanently attached or employ a "unique" antenna coupler (at all connections between the module and the antenna, including the cable). Any antenna used with the module must be approved with the module, either at the time of initial authorization or through a Class II permissive change. The "professional installation" provision of Section 15.203 may not be applied to modules.

   The antennas shown within this report as well as any additional antennas that are approved via a Class II permissive change will meet this requirement. The current antennas and connectors use the unique coupler and professional installation is not used for any antennas.

5. The modular transmitter must be tested in a stand-alone configuration, i.e., the module must not be inside another device during testing. This is intended to demonstrate that the module is capable of complying with Part 15 emission limits regardless of the device into which it is eventually installed. Unless the transmitter module will be battery powered, it must comply with the AC line conducted requirements found in Section 15.207. AC or DC power lines and data input/output lines connected to the module must not contain ferrites, unless they will be marketed with the module (see Section 15.27(a)). The length of these lines shall be length typical of actual use or, if that length is unknown, at least 10 centimeters to insure that there is no coupling between the case of the module and supporting equipment. Any accessories, peripherals, or support equipment connected to the module during testing shall be unmodified or commercially available (see Section 15.31(i)).

   Testing herein shows the radio raised above and external of an Intermec Technologies printer. The setup photographs show no ferrites or decoupling devices to reduce emissions of the module. AC power line conducted emissions is shown within for the final product. Both printers represent the final installation of the radio when marketed by Intermec Technologies.

6. The modular transmitter must be labeled with its own FCC ID number, and, if the FCC ID is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: "Contains Transmitter Module FCC ID: XYZMODEL1" or "Contains FCC ID: XYZMODEL1." Any similar wording that expresses the same meaning may be used. The Grantee may either provide such a label, an example of which must be included in the application for equipment authorization, or, must provide adequate instructions along with the module

which explain this requirement. In the latter case, a copy of these instructions must be included in the application for equipment authorization.

Enclosed within this report are label diagrams with similar verbiage shown above. The module will show the FCC ID. If when integrated the radio module identifier is not visible, the exterior will show the "Contains TX FCC ID:" text.

7. The modular transmitter must comply with any specific rule or operating requirements applicable to the transmitter and the manufacturer must provide adequate instructions along with the module to explain any such requirements. A copy of these instructions must be included in the application for equipment authorization. For example, there are very strict operational and timing requirements that must be met before a transmitter is authorized for operation under Section 15.231. For instance, data transmission is prohibited, except for operation under Section 15.231(e), in which case there are separate field strength level and timing requirements. Compliance with these requirements must be assured.

   The radio operates as an IEEE 802.11b compliant device. The operation protocol and timing meet operation requirements defined within FCC 15.247 and Canada RSS-210.

8. The modular transmitter must comply with any applicable RF exposure requirements. For example, FCC Rules in Sections 2.1091, 2.1093 and specific Sections of Part 15, including 15.319(i), 15.407(f), 15.253(f) and 15.255(g), require that Unlicensed PCS, UNII and millimeter wave devices perform routine environmental evaluation for RF Exposure to demonstrate compliance. In addition, spread spectrum transmitters operating under Section 15.247 are required to address RF Exposure compliance in accordance with Section 15.247(b)(4). Modular transmitters approved under other Sections of Part 15, when necessary, may also need to address certain RF Exposure concerns, typically by providing specific installation and operating instructions for users, installers and other interested parties to ensure compliance.

   The RF exposures for all antennas show compliance to FCC and Canada regulations. The exposure calculations and installation details are defined for mobile devices only. Additional antennas approved via permissive changes will address the RF safety concerns as defined within the regulations.

The final product is for globally marketing, where the 2450 MHz transmitter is allowed, therefore must comply with the CISPR 22 (EN55022) digital emissions. The Intermec, Cedar Rapids, EMC Test Lab has perform testing for compliance for digital emissions to the CISPR 22 limits and issue separate reports addressing the integration in Intermec products. Based on these tests and reports the Declaration of Conformity or verification is used for United States marketing. Canada will accept a self-declaration for compliance to ICES-003.

2.2 Related Submittal(s)/Grants(s)
Intermec Technologies 730 Grant FCC ID: EHA-802CF13 Date: Dec. 18, 2003

2.3 Tested Systems Details Items tested:

Model Number (Serial Number)	FCC ID:	Description	Cable Description
EasyLAN® Wireless CF Radio Module PN: 074616-001 SN: Prototype	HN2-802CF13E	2412 – 2462 MHz DSSS radio module	N/A
3400e EasyCoder® Printer PN: 3400E01000201 SN: 12500400260	FCC Class A	Label printer	Extended EasyLAN® radio with short cable to high gain dipole or panel antenna. AC conducted, radio is internal.
4400 EasyCoder® Printer PN: 4420E01000201 SN: 11800400740	FCC Class A	Label printer	AC conducted, radio is internal.
Laptop (remote) PN: Not Available SN: Not Available	-	Serial port connection allows radio commands	10 meter shielded RS232
Antennas tested for this report that will be used with the EasyLAN CF radio:			
Integral Patch Antenna PN: 067262-001 SN: not available	-	Xertex 5.0 dBi Dual panel	1 meter RG8 with reverse N and reverse TNC connectors.
Dipole Antenna PN: 063363-002 SN: not available	-	Cushcraft 5.0 dBi omni directional	1 meter RG8 with reverse N and reverse TNC connectors.
Antennas not tested that will be used with the EasyLAN CF radio:			
Dipole Antenna PN: 072833-002 SN: not available	-	Centurion 1 dBi omni directional	Direct connect to reverse TNC connectors.

2.4 Test Methodology

This section addresses the following: FCC Sections 15.15 General Requirements, 15.31 Measurement Standards, 15.33 Range of Measurement, and 15.35 Measurement Detectors

Industry Canada RSS-210 sections; 4.1 Instrumentation, 4.2 Measurement Bandwidths, 5.3 Test Method, 5.17, Digital Circuits Emissions, 5.18 Modular Construction, 6.3 Restricted Bands and Unwanted Emissions Frequencies, 9.0 AC Wireline Conducted Measurement Method, 11.0 Radiation Measurement Method

Per FCC rules 15.31 (k) the measurements on an intentional radiator operating over a range greater than 10 MHz requires testing on channels at the bottom, middle and top of the range of operation.

The internal test software of the EasyLAN® Wireless CF Radio is capable of operating the radio continuously in either transmit or receive modes.

The radio operates at 4 data rates and on 11 channels within the 2400 – 2483.5 MHz band. Preliminary testing shows the spurious emissions from the radio are worst case when using the 11MB data rate.

Data to be presented on alternate antennas will be the following:

Mode	channel	antenna disc and unit placement
11MB	1, 6, 11	high gain dipole with radio external of Intermec printer
11MB	1, 6, 11	high gain panel with radio external of Intermec printer

All transmitter radiated emissions measurements were made with the transmitter operating at a 100% duty cycle. The 100% duty cycle data is presented on the spreadsheets that calculate the emissions to the limit. This data contained with the transmitter radiated emissions section of this report.

Per FCC regulations, the transmitter emissions are measured to the 10^{th} harmonic, or 24.84 GHz. Canadian RSS-210, 6.2.2(o) (e1) for this transmitter testing is required to the 5^{th} harmonic. Receiver emissions are not presented here because the receiver section operates out of the range of regulatory concern for certification. Receiver emissions are addressed in the unintentional radiator report for each product the radio is integrated.

Where possible, ANSI C63.4-2001 is referenced during radiated emissions testing. Details on measurement equipment, set-up, test details and calculations are presented within the specific test section.

Radiated emissions from 30 to 1000 MHz are tested at a three-meter distance using a Quasi-Peak detector with a 120 kHz measurement bandwidth (BW).

Radiated emissions from 1 to 24.84 GHz are tested at a one-meter measurement distance with a preamplifier to improve the measurement sensitivity. Average measurements above 1 GHz are made with a spectrum analyzer on a 100 MHz span with Resolution BW 1 MHz and Video BW of 10 Hz. Peak measurements are made using the spectrum analyzer on a 100 MHz span with Resolution BW and Video BW of 1 MHz; these settings are detailed on the spreadsheet test results.

Refer to the diagrams and test setup figures in section 8.0 for details.

2.5 TEST FACILITY:

The location of the open area test site and conducted measurement facility used to collect the test data is 90 West Cemetery Road, Fairfax, Iowa 52228. The laboratory is accredited with a scope covering the required measurements and was deemed competent to test and submit test data for equipment subject to verification, Declaration of Conformity, and certification under FCC Section 2.948(d).
The test site was also submitted to Industry Canada for the performance of radiated measurements and is reference by the file number IC 3909. Test site complies too CISPR Publication 22 for methods of measurements for radiated and conducted emissions testing.

3.0 PHOTOGRAPHS

- 3.1 External pictures appendix A. 040804A1.xxx
- 3.2 Internal pictures appendix C. 040804C1.xxx
- 3.3 Test setup pictures appendix H. 040804H1.xxx

4.0 PRODUCT LABELING AND INFORMATION TO THE USER

- 4.1 Product labeling appendix B. 040804B1.xxx
- 4.2 Information to the user appendix I. 040804I1.xxx

5.0 BLOCK DIAGRAM

Proprietary Intermec Technologies document. Confidentiality requested for this document. See appendix K. 040804J1.xxx

6.0 OPERATION DESCRIPTION

Proprietary Intermec Technologies document. Confidentiality requested for this document. See appendix J. 040804K1.xxx

7.0 SCHEMATICS

Proprietary Intermec Technologies document. Confidentiality requested for this document. See appendix L. 040804L1.xxx

8.0 CONDUCTED AND RADIATED EMISSIONS TEST DATA

The following tests and results are recorded within this section.

RF Safety, Exposure Limits; supporting appendix D, 040804D1.XXX

AC Wireline Conducted Emissions; supporting appendix E, 040804E1.XXX

Out of Band Emissions, Transmitter Radiated; supporting appendix F and G, 040804F1.XXX, 040804G1.XXX

Transmitter Conducted Characteristics are included within
BABT report for FCC ID EHA-802CF13

TX Power
BW
PSD
Conducted Spurious
Out of Band

EQUIPMENT: EasyLAN Wireless, CF Radio

NAME OF TEST: RF Exposure Safety

FCC RULE NUMBER: **§ 1.1310 Radiofrequency radiation exposure limits.**

The criteria listed in table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in § 1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of § 2.1093 of this chapter. Further information on evaluating compliance with these limits can be found in the FCC's OST/OET Bulletin Number 65, ''Evaluating Compliance with FCC-Specified Guidelines for Human Exposure to Radiofrequency Radiation.''

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*(900/f^2)	6
30–300	61.4	0.163	1.0	6
300–1500			f/300	6
1500–100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f^2)	30
30–300	27.5	0.073	0.2	30
300–1500			f/1500	30
1500–100,000			1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density
NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/ controlled limits apply provided he or she is made aware of the potential for exposure.
NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be ex-posed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

§ 2.1091 Radiofrequency radiation exposure evaluation: mobile devices.

(a) Requirements of this section are a consequence of Commission responsibilities under the National Environmental Policy Act to evaluate the environmental significance of its actions. See subpart I of part 1 of this chapter, in particular § 1.1307(b).

(b) For purposes of this section, a mobile device is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20-centimeters is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons. In this context, the term ''fixed location'' means that the device is physically secured at one location and is not able to be easily moved to another location. Transmitting devices designed to be used by consumers or workers that

can be easily relocated, such as wireless devices associated with a personal computer, are considered to be mobile devices if they meet the 20-centimeter separation requirement.

CANADA RSS-210 Par.: 14.0 (see RSS-102)

CANADA RSS-102

4.2 Exemption power levels for portable radios are: - Operation at frequencies below 1.0 GHz with an output power equal to or less than 200 milliwatts (mW); - Operation at frequencies between 1.0 and 2.2 GHz with an output power equal to or less than 100 mW.

4.3 Mobile radios (not portables, see 2.2 for definition) are exempt from RF evaluation if the operating frequency is below 1.5 GHz with effective radiated power (ERP) of 1.5 watts or less (i.e. EIRP of 2.5 watts or less) or above 1.5 GHz with ERP of 3 watts or less (i.e. EIRP of 5 watts or less).

Exposures produced by such radios shall not exceed the exposure limits (see section 3 below) specified in Health Canada's Safety Code 6. Health Canada's address is 775 Brookfield Road, Ottawa, Ontario Canada K1A 1C1; Tel: (613) 954-6699/ Fax: (613) 941-1734; e-mail: alice_mackinnon@hc-sc.gc.ca.

HEALTH CANADA SAFETY CODE 6, 99-EHD-237

Table 5
Exposure Limits for Persons Not Classed As RF and Microwave Exposed Workers (Including the General Public)

1 Frequency (MHz)	2 Electric Field Strength; rms (V/m)	3 Magnetic Field Strength; rms (A/m)	4 Power Density (W/m^2)	5 Averaging Time (min)
0.003–1	280	2.19		6
1–10	$280/f$	$2.19/f$		6
10–30	28	$2.19/f$		6
30–300	28	0.073	2*	6
300–1 500	$1.585f^{0.5}$	$0.0042f^{0.5}$	$f/150$	6
1 500–15 000	61.4	0.163	10	6
15 000–150 000	61.4	0.163	10	$616\,000/f^{1.2}$
150 000–300 000	$0.158f^{0.5}$	$4.21 \times 10^{-4}f^{0.5}$	$6.67 \times 10^{-5}f$	$616\,000/f^{1.2}$

* Power density limit is applicable at frequencies greater than 100 MHz.
Notes: 1. Frequency, f, is in MHz.
2. A power density of 10 W/m^2 is equivalent to 1 mW/cm^2.
3. A magnetic field strength of 1 A/ m corresponds to 1. 257 microtesla (μT) or 12. 57 milligauss (mG).

MINIMUM STANDARD: Summarized within the rules sections above.

PERFORMED BY: Dave Fry Date: Aug. 18, 2004

CALCULATION DATA: Observe the appendix D (040804D1.xxx) that shows the transmitter RF exposure calculations.

WARNING STATEMENTS TO THE USER:

Mobile computer usage with direct connect dipole and remote high gain antennas

The EasyLAN Wireless, CF Radio spread spectrum transmitter utilizes a low gain direct connection dipole antenna or two higher gain remote antennas These antennas are used on either the 3400E or 4400 EasyCoder® label printer. The antenna placement keeps the operator as well as nearby persons greater than the 20-cm spacing to comply with the RF exposure requirements.

Normal installation and operation directs the radio antenna away from the user and nearby persons. Making the operator aware of the potential for exposure the warning statement below will be included with the information to the user.

WARNING: EasyLAN® Wireless Users
Warning: per the FCC and Canadian RF (radio frequency) exposure requirements,

(1) Antennas must be supplied and installed as recommended by Intermec Technologies to ensure compliance to RF exposure requirements. Intermec antenna part numbers 072833-002 whip, 063363-002 omni and 067262-001 panel. Correct antenna mounting is fully described within the Intermec EasyCoder® Users Guide.
(2) When installing and using Intermec Technologies approved antennas associated the EasyCoder® printer, a 20-cm (8-inch) passing distance must be maintained from any body part of the user or near by persons and the antenna. The antenna must not be touched during transmitter operation.

EQUIPMENT: EasyLAN Wireless, CF Radio

NAME OF TEST: TX, RX AC Wireline Conducted Emissions

FCC RULE NUMBER: 15.209 (a)
CANADA RSS-210 Par: 6.6-7.4

MINIMUM STANDARD: FCC Rules § 15.207 Conducted limits.
(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of emission (MHz) Conducted limit (dBμV)

	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

*Decreases with the logarithm of the frequency.

Canada RSS-210 6.6, 7.4 This is a measurement of the extent of unwanted emissions conducted back into the AC electrical network by LPDs. Note that this test is only for unwanted emissions and not the wanted conducted emissions of AC Carrier Current devices described in section 8.3. This test applies when the device has any one or more of the following characteristics:
(i) The carrier frequency is within 0.45-30 MHz; (ii) The equipment power supply contains switching circuitry (any frequency); (iii) Internal clock or local oscillator frequency is within 0.45-30 MHz.

To claim test exemption, the engineering brief or test report shall contain a statement that the conditions of test exemption are met. More information on this is in section 9. The test on the transmitter may be combined with the test of section 7.4 on the receiver.

Minimum Standard

(a) On any frequency or frequencies within the band of 0.45-30 MHz, the measured RF voltage (CISPR meter) shall not exceed 250 microvolts (across 50 ohms).
(b) Transmitters marketed for use only in a commercial, industrial or business environment and not intended for use in homes are permitted a limit of 1000 microvolts (0.45 - 1.705 MHz) and 3000 microvolts (1.705 - 30 MHz).

TEST PROCEDURE:

As referenced in ANSI C63.4-2001, place the EUT on a wooden table inside a shield room. Connect the AC power supply to the LISN mounted on the floor behind the table. Measure from .15 to 30 MHz the conducted emissions while the radio is transmitting, then repeat with the radio in receive mode. Preliminary testing was made using a spectrum analyzer to determine the maximum emissions placement of the EUT. Final measurements were made and plots of the conducted emissions were produced. The spectrum analyzer was used in a pre-scan and swept the frequency range from .15 to 30 MHz using the peak detector as compared to the FCC Class B limit.

Quasi-peak measurements of the highest emissions were made with the test receiver. The tabulated data is contained with the measurement data section.

Refer to appendix A for photographs of the maximum emissions placement of the EUT during AC wireline conducted testing.

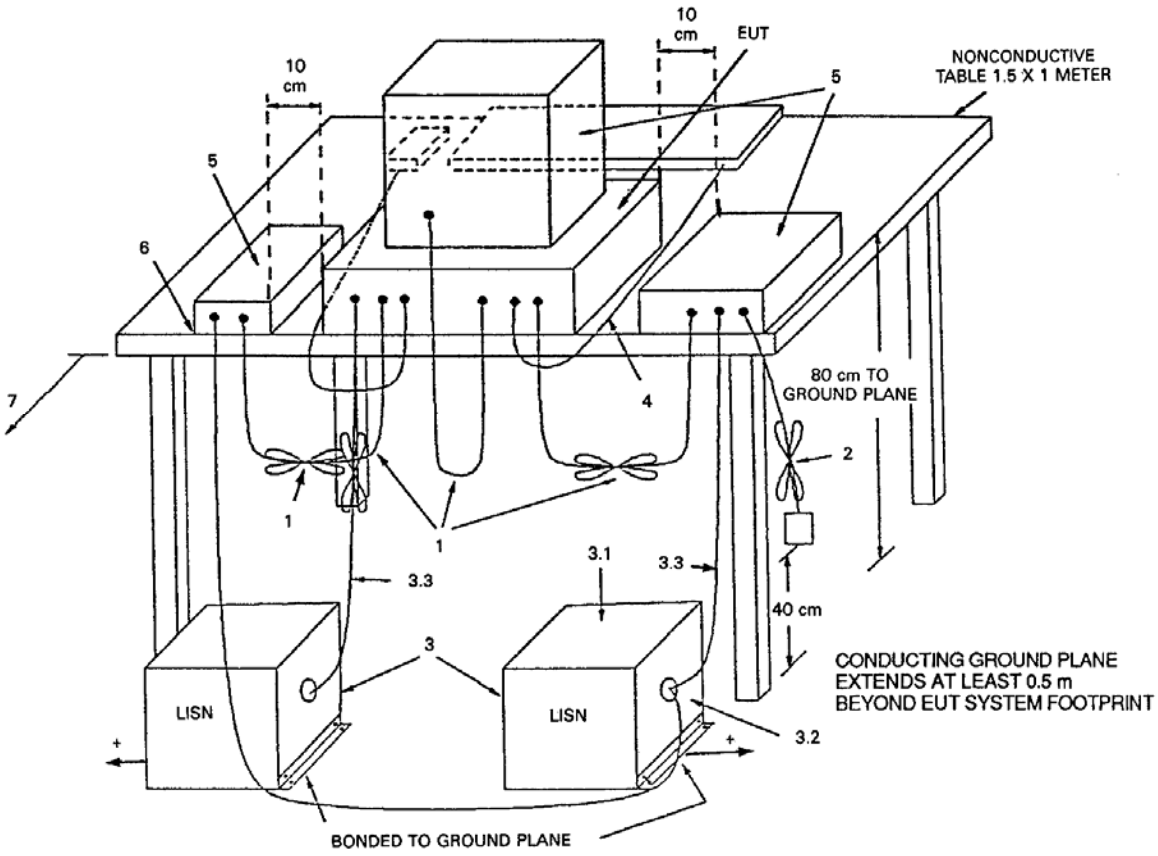
General and Environmental Conditions

For FCC and Industry Canada, testing was performed within a shield room, setup as described in ANSI C63.4-2001 section 5.2. The EUT was powered by single phase 120 Volts ~ 60 Hz AC power.

Environmental conditions at the time of testing were a temperature 25 C, pressure 30.1 inches and relative humidity of 43 %.

TEST EQUIPMENT:	LISN	Rohde & Schwarz, ESH3.Z5
	EMI Test Receiver	Rohde & Schwarz, ESI-40
PERFORMED BY:	Dave Fry	Date: Aug. 16, 2004

NAME OF TEST: AC Wireline Conducted Emissions, TX and RX



+LISNs may have to be moved to the side to meet 3.3 below.

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.
Cables of hand-operated devices, such as keyboards, mouses, etc., have to be placed as close as possible to the host.

4. Non-EUT components being tested.
5. Rear of EUT, including peripherals, shall be all aligned and flush with rear of tabletop.
6. Rear of tabletop shall be 40 cm removed from a vertical conducting plane that is bonded to the floor ground plane.

Test Configuration
Tabletop Equipment Conducted Emissions

NAME OF TEST: AC Wireline Conducted Emissions, TX and RX

CALCULATIONS AND CONVERSION FACTORS:

The conducted emissions are calculated using the following. The receiver reading is added to the correction factor "Transd (dB)" (includes LISN insertion loss, RF cable loss and filter loss (if used)) to create “Level (dBµV)”. The “LIMIT” is subtracted from “Level” to show "Margin". Margin will be displayed as a positive margin below the limit.

The conversion for calculating dB (µV) to microvolts (µV) follows.

dB(µV) to µV (dB (µV) / 20) anti log = µV

µV to dB (µV) 20 (log µV) = dB (µV)

TEST RESULTS: Complies with FCC and Industry Canada (IC) requirements while operated at 120 VAC. Listed below are the operation configuration and AC voltage.

MEASURED DATA: Judgment: For FCC testing; PASSED, see the following tabulated results. Detailed plots are shown in appendix E, 040804E1.XXX.

Unless otherwise noted, all final measurements are made using an average or quasi-peak detector and a 9 kHz measurement bandwidth with the data being compared to the CISPR quasi-peak and average limit.

3400E EasyCoder® Printer with EasyLAN® Wireless CF Radio

MEASUREMENT RESULT: "CE L1_fin AV"
8/16/04 1:27PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.156000	12.70	-0.10	55.70	43.00	L1	GND
0.234000	7.00	0.00	52.30	45.30	L1	GND
0.336000	3.00	0.00	49.30	46.30	L1	GND
2.082000	0.20	0.30	46.00	45.80	L1	GND
2.730000	4.50	0.20	46.00	41.50	L1	GND
4.290000	5.40	0.20	46.00	40.60	L1	GND
4.614000	4.50	0.30	46.00	41.50	L1	GND
17.766000	7.80	0.10	50.00	42.20	L1	GND
21.138000	9.00	0.00	50.00	41.00	L1	GND

MEASUREMENT RESULT: "CE L1_fin QP"
8/16/04 1:27PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.156000	42.50	-0.10	65.70	23.20	L1	GND
0.234000	34.30	0.00	62.30	28.00	L1	GND
0.336000	27.80	0.00	59.30	31.50	L1	GND
0.564000	22.10	0.00	56.00	33.90	L1	GND
0.684000	16.70	0.10	56.00	39.30	L1	GND
4.290000	9.30	0.20	56.00	46.70	L1	GND
17.766000	13.70	0.10	60.00	46.30	L1	GND
21.138000	16.40	0.00	60.00	43.60	L1	GND

MEASUREMENT RESULT: "CE N_fin AV"
8/16/04 1:38PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.156000	12.60	-0.10	55.70	43.10	N	GND
0.234000	7.00	0.00	52.30	45.40	N	GND
0.450000	1.90	0.00	46.90	45.00	N	GND
0.498000	1.90	0.00	46.00	44.20	N	GND
4.422000	4.60	0.20	46.00	41.40	N	GND
4.878000	3.80	0.30	46.00	42.20	N	GND
6.696000	5.30	0.20	50.00	44.70	N	GND
20.418000	8.60	0.20	50.00	41.40	N	GND
21.984000	10.10	0.10	50.00	39.90	N	GND

MEASUREMENT RESULT: "CE N_fin QP"
8/16/04 1:38PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.156000	42.50	-0.10	65.70	23.20	N	GND
0.234000	34.40	0.00	62.30	27.90	N	GND
0.450000	30.20	0.00	56.90	26.70	N	GND
0.498000	30.20	0.00	56.00	25.80	N	GND
0.684000	17.50	0.10	56.00	38.50	N	GND
4.356000	9.00	0.20	56.00	47.00	N	GND
4.746000	9.20	0.30	56.00	46.80	N	GND
20.418000	14.60	0.20	60.00	45.40	N	GND
20.994000	17.90	0.20	60.00	42.10	N	GND

4400 EasyCoder® Printer with EasyLAN® Wireless CF Radio

MEASUREMENT RESULT: "CE L1_fin AV"
8/16/04 2:33PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.156000	14.10	-0.10	55.70	41.60	L1	GND
0.222000	8.80	-0.10	52.80	43.90	L1	GND
0.336000	4.50	0.00	49.30	44.80	L1	GND
0.486000	-1.50	0.00	46.20	47.70	L1	GND
5.334000	2.40	0.30	50.00	47.60	L1	GND
7.998000	3.60	0.30	50.00	46.40	L1	GND
19.230000	13.70	0.00	50.00	36.30	L1	GND
20.664000	6.30	0.00	50.00	43.70	L1	GND

MEASUREMENT RESULT: "CE L1_fin QP"
8/16/04 2:33PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.156000	44.80	-0.10	65.70	20.90	L1	GND
0.222000	38.40	-0.10	62.80	24.30	L1	GND
0.336000	32.00	0.00	59.30	27.30	L1	GND
0.486000	22.60	0.00	56.20	33.60	L1	GND
0.684000	16.50	0.10	56.00	39.50	L1	GND
1.452000	17.80	0.10	56.00	38.20	L1	GND
1.488000	18.40	0.10	56.00	37.60	L1	GND
19.230000	20.00	0.00	60.00	40.00	L1	GND
20.586000	12.40	0.00	60.00	47.60	L1	GND

MEASUREMENT RESULT: "CE N_fin AV"
8/16/04 2:39PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.156000	13.50	-0.10	55.70	42.10	N	GND
0.234000	8.10	0.00	52.30	44.30	N	GND
0.432000	2.90	0.00	47.20	44.40	N	GND
0.468000	2.30	0.00	46.50	44.30	N	GND
5.334000	2.30	0.30	50.00	47.70	N	GND
7.998000	3.40	0.30	50.00	46.60	N	GND
19.578000	19.80	0.20	50.00	30.20	N	GND
20.550000	12.70	0.20	50.00	37.30	N	GND

MEASUREMENT RESULT: "CE N_fin QP"
8/16/04 2:39PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.156000	44.20	-0.10	65.70	21.40	N	GND
0.234000	37.20	0.00	62.30	25.10	N	GND
0.444000	33.20	0.00	57.00	23.80	N	GND
0.468000	31.90	0.00	56.50	24.60	N	GND
0.684000	15.30	0.10	56.00	40.70	N	GND
1.410000	16.10	0.10	56.00	39.90	N	GND
1.476000	18.10	0.10	56.00	37.90	N	GND
19.710000	24.90	0.20	60.00	35.10	N	GND
20.550000	18.40	0.20	60.00	41.60	N	GND

EQUIPMENT: EasyLAN Wireless, CF Radio

NAME OF TEST: Out of Band Emissions

FCC RULE NUMBER: 15.247 (c)
MINIMUM STANDARD:
(c) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

CANADA RSS-210 Par.: 6.2.2, (o)(e1)
MINIMUM STANDARD:
(e1) **Out of Band Emissions:** In any 100 kHz bandwidth outside the operating frequency bands, between 30 MHz and 5 times the carrier frequency, the unwanted emission spectral density shall be either at least 20 dB below the in band spectral density, or shall not exceed the levels specified in Table 3, whichever is less stringent. **Note:** For frequency hopping systems, the in band density S_i shall be measured with the hopping sequence stopped at the lowest channel and the highest channel in turn, as well as with the hopping running normally. The 20 dB shall be with reference to the lowest of the three S_i values.

TEST PROCEDURE:
1. Record the radiated emissions using the testing methodology described in section 2.4 to measure the spurious emissions. Using the three-meter measurement distance and test receiver, scan and measure transmitter related spurious emissions from 30 to 1000 MHz. A measurement distance of one meter and an amplifier between the horn antenna and spectrum analyzer, measure emissions from 1 – 24.84 GHz. Refer to section 2.4, Test Methodology, for more details on testing above 1000 MHz.

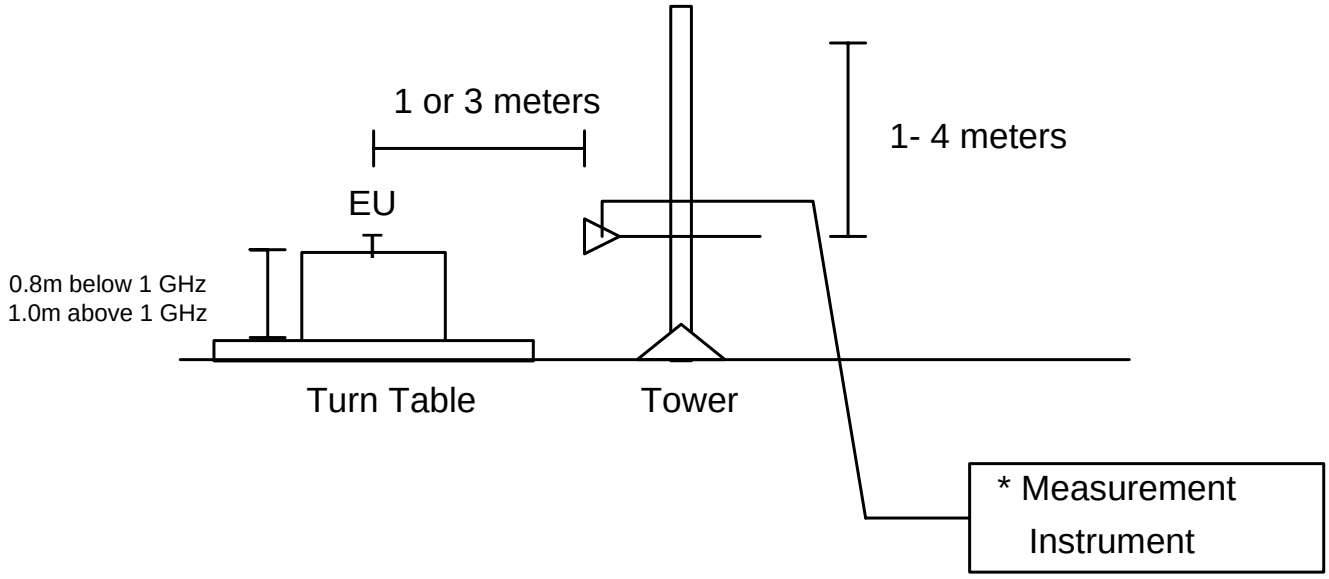
TEST EQUIPMENT:	Antenna, bi-conical	EMCO 3110
	Antenna, log periodic	EMCO 3146
	Antenna, DRG horn	EMCO 3115
	Antenna, Std G horn	EMCO 3160-08
	Antenna, Std G horn	EMCO 3160-09
	Attenuator	HP 8491-20 dB
	Receiver	Rohde & Schwarz ESI-40
	Microwave amplifier	HP 8449B
	High Pass Filter	Cir-Q-Tel R9H-1G5/10G-28A
	High Pass Filter	K&L 13SH01-3000/T24000

PERFORMED BY: Dave Fry Date: Aug. 11-13, 2004

SET UP: Transmitter Radiated Spurious Emissions

Open area test site at the Intermec EMC Test Facility
Three-meter test range 30 MHz - 10 GHz.
Above 1 GHz the product was raised to 1-meter height to better align the horn antenna to potential emissions from the radio module.

Review the following diagrams for setup details. Refer to the photographs in appendix C (040804C1.xxx) for radio placement.



* 30-1000 MHz, Rohde & Schwarz ESI-40 receiver or
1-10 GHz, R&S ESI-40 with preamplifier and high-pass filter

TEST RESULTS: Transmitter radiated emissions conform.

The spreadsheet data appendix G shows the measured emissions for a 100% transmit duty cycle. The data shows all emissions compared to the limits outlined in 15.209 for restricted bands. The data summary below highlights the highest emissions.

Appendix F shows band-edge emissions delta measurements.

To show modular compliance the antenna data presented shows the radio extended from the case and placed vertically. (See setup photographs in appendix H.)

802CF13E radio vertically (x axis)

EasyLAN, CF Radio with 5 dBi dipole antenna (see appendix G, 040804G1.xxx, for the data spreadsheets)

The highest AVERAGE field strength of the out of band transmitter radiated emissions is 66.45 dB(µV)/m measured at a distance of one-meter for 9848 MHz. The emissions was observed during testing with the measurement antenna vertically polarized. That is –28.55 dB relative to the limit of 93 dB(µV)/m at one-meter. The 22158 MHz emission is a noise floor measurement which is the closest to the limit.

AVERAGE EMISSIONS

Highest emissions observed for this radio/terminal and antenna configuration.
Complete data is contained in the Spreadsheet Appendix or file attachments

	Ch. /MHz	Meas. Polarity	100% dB(uV)/M	limit dB(uV)/M @1M	margin dB	
	11 / 9848	V	66.45	93	-26.55	
	11 / 9848	H	62.94	93	-30.06	
	11 / 22158	V	54.27	64	-9.73	
	11 / 22158	H	54.14	64	-9.86	

The highest Quasi-Peak or PEAK field strength of the out of band transmitter radiated emissions relative to the limit is 68.06 dB(µV)/m measured at a distance of one-meter for 9848 MHz. The emissions were observed during testing with the measurement antenna vertically polarized. That is –15.94 dB relative to the limit of 84 dB(µV)/m at one-meter. The 21933 MHz emission is a noise floor measurement with the margin closest to the limit.

QUASI-PEAK AND PEAK EMISSIONS

Highest emissions observed for this radio/terminal and antenna configuration.
Complete data is contained in the Spreadsheet Appendix or file attachments

Ch. / MHz	Detector QP or Pk	Meas. Polarity	dB(uV)/M	limit dB(uV)/M@1M	margin dB
1 / 9648	Pk	V	66.36	84	-17.64
11 / 9848	Pk	V	68.06	84	-15.94
6 / 21933	Pk	V	67.73	84	-16.27
6 / 21933	Pk	H	67.45	84	-16.55

802CF13E radio vertically (x axis)

EasyLAN, CF Radio with 5 dBi dual panel antenna (see appendix G, 040804G1.xxx, for the data spreadsheets)

The highest AVERAGE field strength of the out of band transmitter radiated emissions is 66.91 dB(µV)/m measured at a distance of one-meter for 9848 MHz. The emissions was observed during testing with the measurement antenna vertically polarized. That is –27.09 dB relative to the limit of 64 dB(µV)/m at one-meter. The 22158 MHz emission is a noise floor measurement which is the closest to the limit.

AVERAGE EMISSIONS

Highest emissions observed for this radio/terminal and antenna configuration.
Complete data is contained in the Spreadsheet Appendix or file attachments

	Ch. /MHz	Meas. Polarity	100% dB(uV)/M	limit dB(uV)/M @1M	margin dB	
	11 / 9848	V	66.91	94	-27.09	
	11 / 9848	H	63.11	94	-30.89	
	11 / 22158	V	54.16	64	-9.84	
	11 / 22158	H	53.96	64	-10.04	

The highest Quasi-Peak or PEAK field strength of the out of band transmitter radiated emissions relative to the limit is 68.1 dB(µV)/m measured at a distance of one-meter for 9848 MHz. The emissions were observed during testing with the measurement antenna vertically polarized. That is –15.9 dB relative to the limit of 84 dB(µV)/m at one-meter. The 21933 MHz emission is a noise floor measurement with the margin closest to the limit.

QUASI-PEAK AND PEAK EMISSIONS

Highest emissions observed for this radio/terminal and antenna configuration.
Complete data is contained in the Spreadsheet Appendix or file attachments

Ch. / MHz	Detector QP or Pk	Meas. Polarity	dB(uV)/M	limit dB(uV)/M@1M	margin dB
6 / 9848	Pk	V	67.02	84	-16.98
11 / 9848	Pk	V	68.17	84	-15.83
6 / 21933	Pk	V	67.41	84	-16.59
6 / 21933	Pk	H	67.38	84	-16.62

MEASUREMENT DATA: The appendix G (040804G1.xxx) file attachment spreadsheets show the radiated emissions data tabulated and graphically in dB(µV)/m. The conversion for calculating dB(µV)/m to µV/m follows.

[(dB (µV)/m)/ 20] anti log = µV/m
[(54 dB (µV)/m @ 3 mtr) / 20] anti log = 501.2 µV/m @ 3 mtr

or µV/m to dB(µV)/m

20 (log µV/m) = dB (µV)/m
20 (log 500 µV/m) = 54 dB (µV)/m

Limit correction for distance

3 meter limit + 10 db = 1 meter limit

9.0 EQUIPMENT LIST

EQUIPMENT	MFG/MODEL	SERIAL NO.	CAL. DATE	CYCLE
Antenna, dipole	EMCO 3121C	9812-1414	03/03	24 Mo
Antenna, biconical	EMCO 3110B	1787	09/03	12 Mo
Antenna, log periodic	EMCO 3146	1262	09/03	12 Mo
Antenna, biconical	EMCO 3110B	1185	09/03	12 Mo
Antenna, log periodic	EMCO 3146	3277	09/03	12 Mo
Antenna, DRG Horn	EMCO 3115	4143	06/04	12 Mo
Attenuator	HP 8491-20 dB	36824	05/04	12 Mo.
EMI Test Receiver	Rohde & Schwarz, ESI-40	1088.7490.40	06/04	12 Mo
High Pass Filter	Cir-Q-Tel R9H-1G5/10G-28A	01	05/04	12 Mo.
High Pass Filter	K&L 13SH01-3000/T24000	01	05/04	12 Mo.
Power Supply	HP6200A	N/A	On Req.	
Power Meter	Giga-Tronics 8541	010618569	04/04	12 Mo.
Preamplifier	HP 8449B	3008A00439	05/03	24 Mo.
Signal Generator	HP 83630A	3250A00322	04/04	24 Mo.
Voltmeter	Fluke 77	007-2153	12/03	16 Mo.
Test Automation SW	Rohde & Schwarz, ES-K1 V1.6	2492	12/03	N/A

On Req. = On Request N/A = Not Available