

MEASUREMENT/TECHNICAL REPORT



**Intermec Technologies Corporation
700 With Novatel CDPD
Cellular Radio Module**

FCC ID: EHANOVCDPD

DATE: January 17, 2002

This report concerns: Original Grant <input checked="" type="checkbox"/> Class II change <input type="checkbox"/>	
Equipment Type: 824-849 MHz cellular radiotelephone modem within mobile computer	
Request issue of the grant immediately upon completion of review.	
Measurement procedure used: ANSI/TIA/EIA-603-1992 and reference to ANSI C63.4 1992 where appropriate.	
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This report contains data that is outside the NVLAP scope of accreditation.

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APPENDIXES (may be file attachments for electronic applications of approval)

- A. 020117A1.xxx Novatel Users Manual
- B. 020117B1.xxx Radiated Measurement Photos
- C. 020117C1.xxx TX radiated emissions data, all terminal configurations

xxx = file extension .doc or .pdf

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

TEST NAME

2.1053	TX Field Strength of Spurious Radiation
22.917	Emissions Limitations for Cellular Radiotelephone Service

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.



Accredited by the National Institute of Standards and Technology, National Voluntary Laboratory Accreditation Program for the specific scope of accreditation under Lab Code 100269-0.

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

The scope of accreditation at the EMC Test Laboratory is limited to NVLAP codes:

12/CIS22 IEC/CISPR 22:1993: Limits and methods of measurement of radio disturbance characteristics of information technology equipment. **12/CIS22a** IEC/CISPR 22:1993: Limits and methods of measurement of radio disturbance characteristics of information technology equipment, Amendment 1:1995, and Amendment 2:1996. **12/CIS22b** CNS 13438:1997: Limits and methods of measurement of radio disturbance characteristics of information technology equipment.
12/F01 FCC Method - 47 CFR Part 15 - Digital Devices. **12/F01a** Conducted Emissions, Power Lines, 450 kHz to 30 MHz. **12/F01b** Radiated Emissions.
12/T51 AS/NZS 3548: Electromagnetic Interference - Limits and Methods of Measurement of Information Technology Equipment.



Interference Technology
International

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Date 01/18/02

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SCOTT C. HOFSTETTER

Print/Type Name



National Association of Radio and
Telecommunications Engineers

1.1 Measurement Uncertainties :

ESI 40 Receiver / Spectrum Analyzer

Generator Substitution Measurements Using The 3 meter Open Area Test Site

30-50 MHz	has an Expanded Measurement Uncertainty of	+ 2.96	-2.99 dB
50-1000 MHz	has an Expanded Measurement Uncertainty of	+ 2.86	-2.88 dB
1-12.5 GHz	has an Expanded Measurement Uncertainty of	+ 2.77	-2.82 dB

Confidence Level

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 per FCC 2.1033 (c) as well as 22.917

2.1 Product Description

This report addresses the request for certification for a 700 hand held computer with integrated cellular modem radio operating in the 824-849 MHz radio band. The Novatel radio will be used as a wireless wide-area LAN to communicate to mainframe computers or other terminal devices. This report shows the radiated spurious emissions of the 700 unit with the Novatel radio operating.

The Novatel NRM-6832 (Expedite) radio is provided to Intermec Technologies Corp. by Novatel Wireless Technology Limited as an OEM radio. The radio remains unchanged from Novatel. The remaining regulatory requirements under FCC Part 22 are represented under the original request for Grant report submitted to the FCC by Novatel. FCC ID: NBZNRM-6832. Copies of the supporting documents from the original FCC grant are contained within this application.

This report shows the radio is to be used within the entire family of 700 hand held computers manufactured by Intermec. The 700 family of computers uses the same exterior shell, radio antenna coupling board and antenna. The options available change the processor, memory, display and peripheral interface options.

Intermec markets these computers to users in the route and delivery services industries for inventory control automation. As this radio is integrated within the 700 computer, the digital emissions will be verified to meet FCC Class B emissions. Digital emissions of the 700 with Novatel CDPD radio will be tested to demonstrate compliance to the Class B requirements under the FCC Declaration of Conformity. The digital emissions concerns related to the 700 Novatel radio integration will be addressed in separate reports.

The 700 and Novatel radio and antennas for this report are production versions.

2.1 Product Description, continued

FCC sections 2.1033 are addressed in the following;

2.1033 (a) See FCC EAS system 731 form

2.1033 (c) Technical Description:

- (1) Intermec Technologies Corporation is the applicant and manufacturer of the final assembly presented with this report.
The transmitter is provided to Intermec by Novatel. The Expedite CDPD module is integrated with the Intermec 700 at Intermec Technologies Corporation 6001 36th Ave W, Everett, WA, 98203
- (2) FCC ID: EHANOVCDPD
- (3) See Appendix A for the user information received from Novatel.
- (4) Type(s) of emissions: 28K8FXW
- (5) Operation is from 824 to 849 MHz
- (6) The Expedites are tested to 26.8 +/- 0.5 dBm, which means the maximum out of manufacturing should be 27.3 dBm or 0.537 mW. Typically they will be 26.8 dBm or 0.479 mW. The maximum Tx power 0.006 to 0.573 watts and is variable under control of the cellular phone system. The radiated power for the Intermec 700 terminal is 0.0006 to .066 watts ERP.
- (7) Under Part 22 the maximum ERP allowed is 6.0 watts
- (8) As stated in (3) the operation by batteries is from the range of 8.5 - 6.8 volts with a nominal voltage of 7.5 volts DC. Internal circuitry provides a highly regulated 5.0 volts to the final power amplifier stage of the radio.
- (9) The radio tune up procedure is provide by Novatel, the procedure is not released to OEM integrators such as Intermec.
- (10) The theory of operation, circuit diagrams and parts lists is included within the "Confidential" section of this application. Please notify Intermec to acquire this document to support this application.
- (11) See Appendix C in report 20010830-1 for label information.
- (12) See Appendix A and B in report 20010830-1 for photographs.
- (13) Digital modulation description is not applicable.
- (14) Test and measurement data for the transmitter characteristics are shown in Appendix G in report 20010830-1 and further supplemented with radiated spurious emissions testing of the integrated radio within the Intermec 700.
- (15) – (17) not applicable

2.2 Related Submittal(s)/Grants(s) None.

2.3 Tested Systems Details Items tested:

Model Number (Serial Number)	FCC ID:	Description	Cable Description
700 CDPD WAN PN: 25-221-001/004 SN: 4734166	EHANOVCDPD	Mobile computer with integrated Novatel Expedite CDPD radio	N/A
ITE Power Supply PN: 851-050-001 SN: N/A	N/A	700 charger 100-240 VAC, 47-63 Hz 12 VDC output	Unshielded DC cable.

2.4 Test Methodology

The transmitter radio test software is capable of operating the radio continuously in either CW or pseudo-random transmit modes. CW mode is used during ALL testing recorded in this report. The CW mode produces the maximum emissions during radiated spurious emissions testing..

All testing performed in accordance to measurement procedure ANSI/TIA/EIA-603-1992 [Land Mobile FM or PM Communications Equipment Measurements and Performance Standards]. Where appropriate reference is made to ANSI C63.4-1992 [Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz] and CFR 47 Parts 1, 2 and 22.

The measurement procedure used in this application is ANSI/TIA/EIA-603-1992. The exceptions to this standard is the 700 antenna remained connected during all emissions testing. The unit was raised to a height of 1.5 meters and the unit was tested in two orthogonal planes to allow a complete evaluation of all sides of the mobile terminal by the measurement antenna. The References are made to ANSI C63.4-1992 where appropriate.

Radiated emissions below 1000 MHz tested at a three meter distance on the open area test site (OATS), measurement bandwidth is 100 kHz utilizing a quasi-peak detector on a test receiver. Emissions from 1 - 10 GHz tested at a three meter measurement distance on the OATS. Radiated emissions above 1000 MHz was measured a spectrum analyzer. All radiated emissions are referenced to a generator and antenna substitution method.

Refer to the setup diagrams in section 6.0 for details. Also see Appendix B for Radiated Emissions set-up photographs.

2.5 Test Facility

The location of the open area test site and conducted measurement facility used to collect the radiated data is 90 West Cemetery Road, Fairfax, Iowa 52228. This site has been fully described in report number 577-500-971, dated November 6, 2000, and submitted to the Federal Communication Commission USA, and accepted in a letter dated December 8, 2000 for ANSI C63.4: 1992 testing. The test site was also submitted to Industry Canada for the performance of radiated measurements and is reference by the file number IC 1223. Test site complies too CISPR Publication 22: 1993, Clauses 10 and 11 for methods of measurements for radiated and conducted emissions testing.

3.0 PRODUCT LABELING

3.1 See Appendix C in report 20010830-1 for label information.

4.0 THEORIES OF OPERATION

See CONFIDENTIAL attachment, or to be provided upon request.

5.0 SCHEMATICS

See CONFIDENTIAL attachment, or to be provided upon request.

6.0 CONDUCTED AND RADIATED EMISSION TEST
DATA

NAME OF TEST: Field Strength of Spurious Radiation

FCC RULE NUMBER: §2.1053, § 22.917

MINIMUM STANDARD:

§ 2.1053 Measurements required: Fieldstrength of spurious radiation.

(a) Measurement shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emissions. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of 2.989, as appropriate. For equipment operating on frequency below 890 MHz, an open field test is normally required, with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from halfwave dipole antenna.

(b) The measurements specified in paragraph (a) of this section shall be made for the following equipment:

- (1) Those in which the spurious emissions are required to be 60 dB or more below the mean power of the transmitter.
- (2) All equipment operating on frequencies higher than 25 MHz.
- (3) All equipment where the antenna is a integral part of, and attached directly to the transmitter.
- (4) other types of equipment as required, when deemed necessary by the Commission.

§ 22.917 Emission limitations for cellular.

The rules in this section govern the spectral characteristics of emissions in the Cellular Radiotelephone Service.

(e) *Out of band emissions.* The mean power of emissions must be attenuated below the mean power of the unmodulated carrier (P) on any frequency twice or more than twice the fundamental frequency by: at least $43 + 10 \log P$ dB. (P = power in watts)

TEST RESULTS: Conforms. Meets the minimum standard of the following:

$$43 + 10 \log P^*(\text{watts}) = \text{dBc}$$
$$43 + 10 \log (0.5) = 40.0 \text{ dBc}$$

* (P) Power 0.5 watts or +27.0 dBm

dBc to dBm conversion

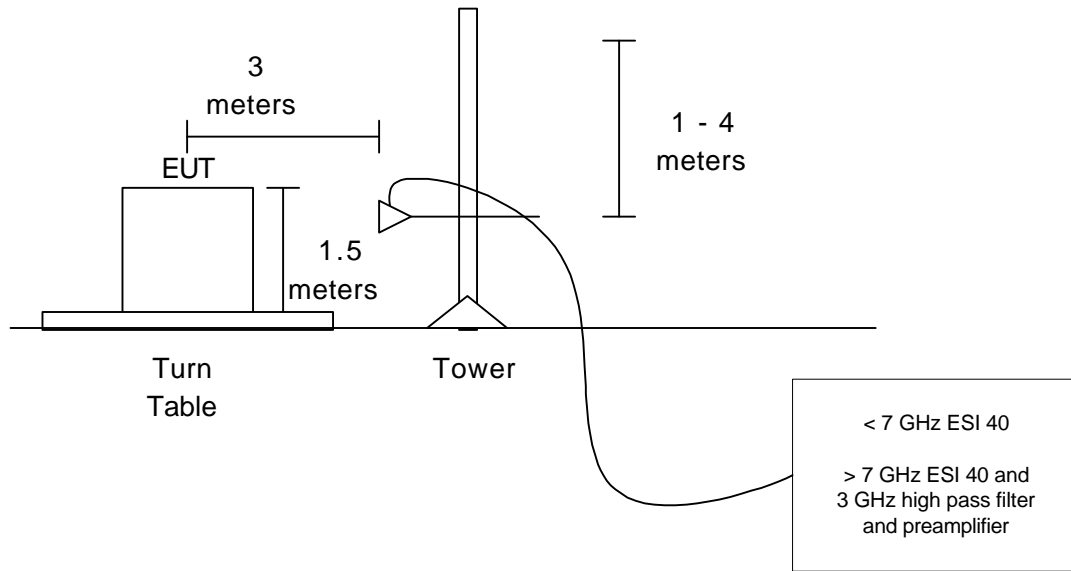
$$PO^*(\text{dBm}) - \text{dBc} = \text{limit in dBm}$$
$$+27.0 \text{ dBm} - 40.0 \text{ dBc} = -13.0 \text{ dBm}$$

All emission measured were >-15dB below the limit.
See appendix C for data sheets for test data.

TEST EQUIPMENT: See Section 7.0.

PERFORMED BY: Dave Fry Date: January 15-16, 2002

TEST SETUP:

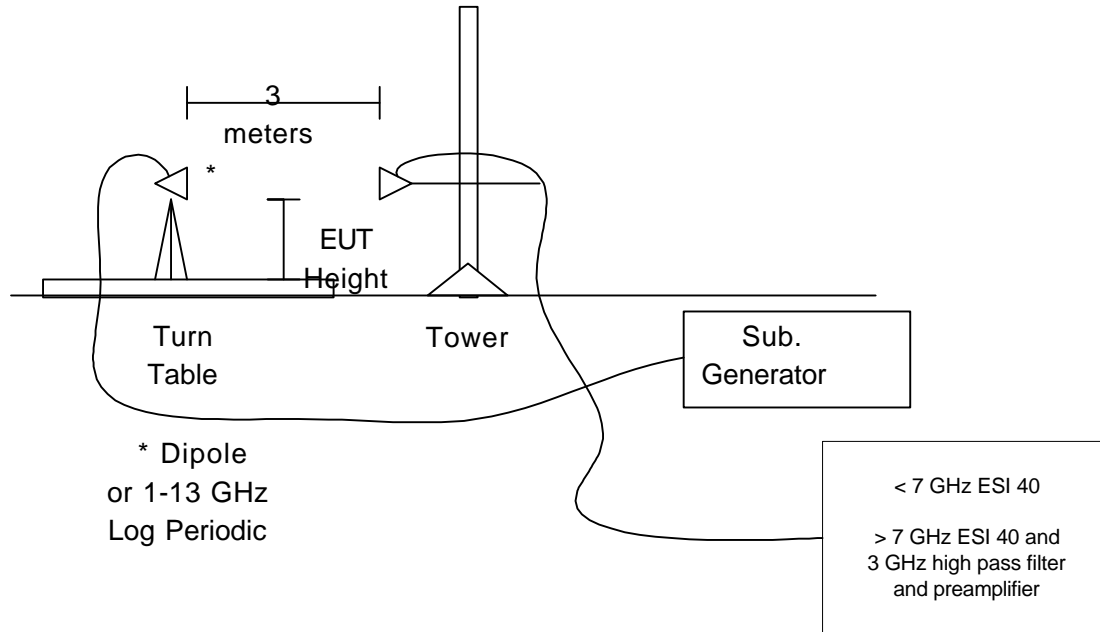


Radiated Emissions

Frequency Range	Antenna	Signal Conditioning	Cable
30 MHz to 200 MHz	Bi-conical	Internal Pre Amp and Preselector	RG 214
200 MHz to 1 GHz	Log Periodic	Internal Pre Amp and Preselector	RG 214
1 to 7 GHz	Horn	Internal Pre Amp and Preselector	Heliac
7 to 10 GHz	Horn	3 - 24 GHz Hi Pass Filter and HP 8449B Pre Amp	Heliac

TEST SETUP: continued

Generator Substitution



TEST PROCEDURE:

Enable the transmitter for full power TX on the a specific channel. Measure radiated spurious emissions with a biconical and log periodic antennas below 1 GHz. The substitution reference antenna below 1 GHz was tuned 1/2 wave dipoles. Above 1 GHz radiated spurious attenuation was measured with a broad-band double-ridge wave-guide horn antenna. A log antenna was used for a reference antenna. The generator substitution power output was set to 0 dBm reference level for the field calculation. Measurements were made for both horizontal and vertical antenna orientation.

MEASUREMENT DATA:

See the Appendix C for data sheets showing the radiated spurious emissions calculated to the FCC limit of -13 dBm.

7.0 EQUIPMENT LIST

EQUIPMENT	MFG/MODEL	SERIAL NO.	CAL. DATE	CYCLE
<u>Measurements</u>				
Antenna, bi-conical	EMCO 3110	1185	9/01	12 Mo.
Antenna, log periodic	EMCO 3146	1262	9/01	12 Mo.
Antenna, DRG horn	EMCO 3115	2246	7/01	12 Mo.
High Pass Filter	K&L 13SH01-3000/T24000	01	9/01	12 Mo.
Preamplifier	HP 8449B	3008A00439	4/01	24 Mo.
Receiver/SA	Rohde & Schwarz ESI 40	100047/040	6/01	24 Mo.
<u>Generator Substitution</u>				
Antenna, dipole set	EMCO 3121C	B1 9812-1414 B2-B4 9812-1421	1/01	12 Mo.
Antenna, log periodic	AEL, APN-101B	1162	10/01	12 Mo.
Signal Generator	HP 83630A	3250A00322	3/00	24 Mo.

On Req. = On Request