



ROGERS LABS, INC.

4405 West 259th Terrace
Louisburg, KS 66053
Phone / Fax (913) 837-3214

TEST REPORT ADENDUM

For

APPLICATION of CERTIFICATION

For

INTERMEC TECHNOLOGIES CORPORATION
6001 36th Avenue West
Everett, WA 98203-9280
Phone: (505) 856-8054

Jerry Johnson,
Project Manager

MODEL: 1555
Hand Held Reader
Frequency 902 - 928 MHz
FCC ID: HN21555-900

Test Date: November 9, 2000

Certification Date: November 9, 2000

Certifying Engineer: *Scot D. Rogers*

Scot D. Rogers
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FORWARD:

The following is submitted for consideration in obtaining a Grant of Certification for low power intentional radiators operated under CFR 47, paragraph 15.247.

Name of Applicant:

INTERMEC TECHNOLOGIES CORPORATION
6001 36th Avenue West
Everett, WA 98203-9280

Model: 1555 Hand Held Reader

FCC I.D.: HN21555-900

Frequency Range: 902 MHz to 928 MHz

Operating Power: 1 Watt

1) Applicable Standards & Test Procedures

a) In accordance with the Federal Communications Code of Federal Regulations, dated October 1, 1999, Part 2, Subpart J, Paragraphs 2.907, 2.911, 2.913, 2.925, 2.926, 2.1031 through 2.1057, Part 15C Paragraph 15.247 the following is submitted:

b) Test procedures used are the established Methods of Measurement of Radio-Noise Emissions as described in the ANSI 63.4-1992 Document.

2) Application for Certification per 2.1033(b)

- (1) Manufacturer:
INTERMEC TECHNOLOGIES CORPORATION
6001 36th Avenue West
Everett, WA 98203-9280
- (2) Identification: Model: 1555 Hand Held Reader
FCC I.D.: HN21555-900
- (3) Instruction Book:

Refer to Exhibit for Instruction Manual (files:
1555_gs.pdf and 1555_ops_guide.pdf).
- (4) Description of Circuit Functions

Refer to Exhibit for Circuit Description (file
operational description.doc).
- (5) Block Diagram with Frequencies:

Refer to Exhibit for Block Diagram (file: Hand
Held_bl_diag.pdf).
- (6) Report of Measurements:

Follows in this Report.
- (7) Photos: Construction, Component Placement, etc.:

Refer to original application of equipment.
- (8) Brief description of peripheral equipment used with EUT.

The EUT has provision to interface with a computer, which
uses the RS232 communications protocol. The support
equipment used for testing was a Sharp laptop computer
and a Hewlett Packard printer. The communications cable
was permanently attached to the EUT as manufactured and
utilized the RS232 serial communication port of the
computer.
- (9) Transition Provisions of 15.37 are not being requested.

(10) Frequency Hopping Spectrum:

Applications for the certification of frequency hopping transmitters under Part 15 shall be accompanied by an exhibit describing compliance of the associated receiver or receivers with Section 15.247(a)(1) of this chapter. Refer to exhibit for operational description. (file: opdesc1555.pdf)

(11) Not Applicable. The EUT is not a Scanning Receiver.

3) Equipment Tested

| <u>EQUIPMENT</u> | <u>MODEL/PART#</u> | <u>FCC I.D.</u> |
|------------------|--------------------|-----------------|
| EUT | 1555 | HN21555-900 |
| CPU | Sharp PC9000 | FKG PC9000 |
| Printer | H.P. C2168A | B94C2121X |

4) Equipment Function and Testing Procedures

The EUT is a hand held laser and radio frequency tag reader used for bar code label and RF tag identification. The unit is designed to interface to a computer utilizing the RS232 communications protocol. A laptop computer was used to communicate with the EUT over the RS232 cable. A printer was also connected to the laptop through a standard parallel printer cable.

5) Equipment and Cable Configurations

Radiated Emission Test Procedure

The EUT was placed on a rotatable 1 x 1.5-meter wooden platform, 0.8 meters above the ground plane at a distance of

3 meters from the FSM antenna. EMI energy was maximized by equipment placement, raising and lowering the FSM antenna, changing the antenna polarization, and by rotating the turntable. Each emission was maximized before data was taken using a spectrum analyzer.

6) List of Test Equipment

A Hewlett Packard 8591EM Spectrum Analyzer was used as the measuring device for the emissions testing of frequencies below 1 GHz. A Hewlett Packard 8562A Spectrum Analyzer was used as the measuring device for testing the emissions at frequencies above 1 GHz. The analyzer settings used are described in the following table. Refer to the Appendix for a complete list of Test Equipment.

| HP 8591 EM ANALYZER SETTINGS | | |
|-------------------------------------|----------|-------------------|
| CONDUCTED EMISSIONS: | | |
| RBW | AVG. BW | DETECTOR FUNCTION |
| 9 kHz | 30 kHz | Peak / Quasi Peak |
| RADIATED EMISSIONS: | | |
| RBW | AVG. BW | DETECTOR FUNCTION |
| 120 kHz | 300 kHz | Peak / Quasi Peak |
| HP 8562A ANALYZER SETTINGS | | |
| RBW | VIDEO BW | DETECTOR FUNCTION |
| 100 kHz | 100 kHz | PEAK |
| 1 MHz | 1 MHz | Peak / Average |

| <u>EQUIPMENT</u> | <u>MFG.</u> | <u>MODEL</u> | <u>CAL. DATES</u> | <u>DUE.</u> |
|------------------|--------------|--------------|-------------------|-------------|
| LISN | Comp. Design | 1762 | 10/00 | 10/01 |
| Antenna | ARA | BCD-235-B | 10/00 | 10/01 |
| Antenna | EMCO | 3147 | 10/00 | 10/01 |
| Antenna | EMCO | 3143 | 4/00 | 4/01 |
| Analyzer | HP | 8591EM | 7/00 | 7/01 |

7) Units of Measurements

Radiated EMI: Data is in dBµV/m; dB/m referenced to one microvolt per meter.

Radiated EMI: The radiated emissions tests were performed at Rogers Labs, Inc. 3 meters Open Area Test Site (OATS) located at Rogers Labs, Inc., 4405 W. 259th Terrace, Louisburg, KS.

Site Approval: Refer to Appendix for FCC Site Approval Letter, Reference 31040/SIT 1300F2, Dated February 6, 1998.

8) Subpart C - Intentional Radiators

15.205 Restricted Bands of Operation

Spurious emissions falling in the restricted frequency bands of operation were measured at the OATS. The EUT utilizes frequency, determining circuitry, which generates harmonics falling in the restricted bands. Emissions were checked at the OATS, using appropriate notch filters, antennas or pyramidal horns, amplification stages, and a spectrum analyzer. No other significant emission was observed which fell into the restricted bands of operation.

Sample Calculations:

$$\begin{aligned} \text{Computed Quasi-Peak (dB}\mu\text{V/m @ 3m)} &= \text{FSM(dB}\mu\text{V)} + \text{A.F.(dB)} - \text{Gain(dB)} \\ &= 47.4 + 8.4 - 35 \\ &= 20.8 \end{aligned}$$

Data 15.205:

Radiated Emissions in Restricted Bands:

| Frequency In MHz | FSM Hor. (dBμV) Quasi-Peak | FSM Vert. (dBμV) Quasi-Peak | Ant. Fact. (dB) | Amp. Gain (dB) | Comp. Hor. (dBμV/m) @ 3m | Comp. Vert. (dBμV/m) @ 3 m | FCC Limit (dBμV) |
|------------------|----------------------------|-----------------------------|-----------------|----------------|--------------------------|----------------------------|------------------|
| 131.8 | 47.4 | 45.2 | 8.4 | 35 | 20.8 | 18.6 | 43.5 |
| 165.1 | 45.3 | 43.0 | 9.0 | 35 | 19.3 | 17.0 | 43.5 |
| 168.8 | 45.2 | 44.4 | 9.1 | 35 | 19.3 | 18.5 | 43.5 |
| 240.0 | 60.5 | 53.9 | 11.4 | 35 | 36.9 | 30.3 | 46.0 |
| 249.6 | 53.7 | 49.0 | 11.4 | 35 | 30.1 | 25.4 | 46.0 |
| 264.0 | 47.0 | 50.8 | 12.8 | 35 | 24.8 | 28.6 | 46.0 |
| 265.6 | 48.9 | 49.0 | 12.8 | 35 | 26.7 | 26.8 | 46.0 |
| 273.2 | 40.2 | 36.1 | 12.7 | 35 | 17.9 | 13.8 | 46.0 |
| 280.0 | 49.9 | 52.0 | 12.9 | 35 | 27.8 | 29.9 | 46.0 |
| 297.0 | 47.2 | 40.4 | 13.8 | 35 | 26.0 | 19.2 | 46.0 |
| 400.0 | 54.3 | 47.5 | 16.4 | 35 | 35.7 | 28.9 | 46.0 |
| 2710.2 | 32.6 | 23.0 | 32.6 | 25 | 40.2 | 30.6 | 54.0 |
| 2767.7 | 35.6 | 24.6 | 32.6 | 25 | 43.2 | 32.2 | 54.0 |
| 2782.2 | 33.5 | 28.3 | 32.6 | 25 | 41.1 | 35.9 | 54.0 |
| 3613.6 | 24.8 | 23.6 | 37.1 | 25 | 36.9 | 35.7 | 54.0 |
| 3690.3 | 25.3 | 24.3 | 37.1 | 25 | 37.4 | 36.4 | 54.0 |
| 3709.6 | 27.3 | 25.0 | 37.1 | 25 | 39.4 | 37.1 | 54.0 |

No other emissions found in the restricted bands.

15.209 Radiated Emissions Limits; General Requirements

Radiated EMI

The EUT was arranged in a typical equipment configuration and operated in a standard mode. Radiated emissions measurements were performed to identify the frequencies, which produced the highest emissions. The highest radiated emission was

maximized at the OATS location before final radiated emissions measurements were performed. Final data was taken with the EUT located at the open field test site at a distance of 3 meters between the EUT and the receiving antenna. The frequency spectrum from 30 MHz to 10 GHz was searched for radiated emissions. Measured emission levels were maximized by EUT placement on the table, changing cable location, rotating the turntable through 360 degrees, varying the antenna height between 1 and 4 meters above the ground plane and changing antenna polarization between horizontal and vertical. Antennas used were Broadband Biconical from 30 MHz to 200 MHz, Log Periodic from 200 MHz to 5 GHz and/or Biconilog from 30 MHz to 1000 MHz; and pyramidal horns and or mixers from 4 GHz to 10 GHz, notch filters and appropriate amplifiers.

Sample Calculations:

RFS = Radiated Field Strength

$\text{dB}\mu\text{V}/\text{m} @ 3\text{m} = \text{dB}\mu\text{V} + \text{A.F.} - \text{Amplifier Gain}$

$\text{dB}\mu\text{V}/\text{m} @ 3\text{m} = 57.2 + 7.9 - 35$

$= 30.1$

Data 15.209:

Data: EUT and System Radiated Emissions (7 Highest) :

| Frequency In MHz | FSM Hor. Quasi-Peak (dBµV) | FSM Vert. Quasi-Peak (dBµV) | Ant. Fact. (dB) | Amp. Gain (dB) | Comp. Hor. (dBµV/m) @ 3m | Comp. Vert. (dBµV/m) @ 3 m | FCC Limit (dBµV) |
|------------------|----------------------------|-----------------------------|-----------------|----------------|--------------------------|----------------------------|------------------|
| 80.0 | 57.2 | 62.3 | 7.9 | 35 | 30.1 | 35.8 | 40.0 |
| 90.0 | 49.0 | 47.1 | 7.9 | 35 | 21.9 | 20.0 | 43.5 |
| 95.9 | 49.8 | 47.5 | 7.7 | 35 | 22.5 | 20.2 | 43.5 |
| 160.0 | 51.3 | 51.2 | 8.9 | 35 | 25.2 | 25.1 | 43.5 |
| 208.7 | 41.5 | 44.8 | 11.5 | 35 | 18.0 | 21.3 | 43.5 |
| 280.0 | 49.9 | 52.0 | 12.9 | 35 | 27.8 | 29.9 | 46.0 |
| 297.0 | 47.2 | 40.4 | 13.8 | 35 | 26.0 | 19.2 | 46.0 |

Other emissions present had amplitudes at least 10 dB below the limit.

Summary of Results for Radiated Emissions:

The radiated emissions for the EUT meet the requirements for FCC Part 15C Intentional Radiators. The EUT had a minimum margin of 4.8 dB below the limits. Other emissions were present with amplitudes at least 10 dB below the FCC Limits.

15.247 Operation in the Band 902-928 MHz

Operation under the provisions of this section is limited to frequency hopping and direct sequence spread spectrum intentional radiators. The EUT utilizes frequency hopping and complies with the regulations as stated. Preliminary testing was performed in a screen room with the EUT positioned 1 meter from the FSM. Radiated emissions measurements were performed to identify the frequencies,

which produced the highest emissions. The frequencies of operation ensure the frequency band edges are protected. For final test data the output power was measured on an open field test site at 3 meters distance. Data was taken per Paragraph 2.1046(a) and 15.247. The EUT was placed on a wooden turntable 0.8 meters above the ground plane and at a distance of 3 meters from the FSM antenna. The amplitude of the carrier frequency was measured using a spectrum analyzer and appropriate antenna. The amplitude of the emission was then recorded from the analyzer display. The amplitudes of each spurious emission were measured at a distance of 3 meters from the FSM antenna at the OATS. The harmonic frequency amplitudes were measured using a spectrum analyzer, appropriate antenna, notch filter and amplification. The amplitude of each spurious emission was maximized by varying the FSM antenna height, polarization, and by rotating the turntable. A Biconilog Antenna was used for measuring emissions from 30 to 1000 MHz, a Log Periodic Antenna for 200 to 5000 MHz; and/or Pyramidal Horn Antenna and/or mixers from 4 to 10 GHz, notch filters and appropriate amplifiers.

Emissions were measured in dB μ V and converted to dB μ V/m at 3 meters using the following equation.

$$\begin{aligned}
 \text{dB}\mu\text{v/m@ 3m} &= \text{FSM} + \text{A.F.} - \text{AMP. GAIN} \\
 &= 104.3 + 23.7 - 0.0 \\
 &= 128.0
 \end{aligned}$$

Data: Intentional Radiated Emissions:

| FREQ. | FSM IN HOR. dBμV | FSM IN VERT. dBμV | ANT. FACT. DB | AMP. GAIN dB | LEVEL IN dBμV/m @ 3m Horizontal | LEVEL IN dBμV/m @ 3m Vertical |
|--------|------------------------|-------------------------|---------------------|--------------------|---------------------------------------|-------------------------------------|
| 903.38 | 104.3 | 94.5 | 23.7 | 0 | 128.0 | 118.2 |
| 922.60 | 100.0 | 91.8 | 23.7 | 0 | 123.7 | 115.5 |
| 927.40 | 99.2 | 87.5 | 23.7 | 0 | 122.9 | 111.2 |
| 1806.8 | 27.2 | 26.3 | 29.4 | 21 | 35.6 | 34.7 |
| 1845.3 | 30.0 | 30.1 | 29.4 | 21 | 38.4 | 38.5 |
| 1854.8 | 28.2 | 25.1 | 29.4 | 21 | 36.6 | 33.5 |
| 2710.2 | 32.6 | 23.0 | 32.6 | 20 | 45.2 | 35.6 |
| 2767.7 | 35.6 | 24.6 | 32.6 | 20 | 48.2 | 37.2 |
| 2782.2 | 33.5 | 28.3 | 32.6 | 20 | 46.1 | 40.9 |
| 3613.6 | 24.8 | 23.6 | 37.1 | 20 | 41.9 | 40.7 |
| 3690.3 | 25.3 | 24.3 | 37.1 | 20 | 42.4 | 41.4 |
| 3709.6 | 27.3 | 25.0 | 37.1 | 20 | 44.4 | 42.1 |

Summary of Results for Radiated Emissions of Intentional Radiator:

The radiated emissions for the EUT meet the requirements for FCC Part 15C Intentional Radiators. There are no measurable emissions in the restricted bands other than those recorded in this report. Other emissions were present with amplitudes at least 10 dB below the FCC Limits. The specification of 15.247 are met, there are no deviations or exceptions to the requirements.

Statement of Modifications:

No modifications to the EUT were required for the unit to meet the FCC Part 15B CLASS B emissions standards or the requirements of Part 15C paragraph 15.247. There were no deviations to the specifications.

1. Rogers Qualifications
2. Test Equipment List
3. FCC Site Approval Letter

TEST EQUIPMENT LIST FOR ROGERS LABS, INC.

The test equipment used is maintained in calibration and good operating condition. Use of this calibrated equipment ensures measurements are traceable to national standards.

| <u>List of Test Equipment:</u> | <u>Calibration Date:</u> |
|---|--------------------------|
| Scope: Tektronix 2230 | 2/00 |
| Wattmeter: Bird 43 with Load Bird 8085 | 2/00 |
| Power Supplies: Sorensen SRL 20-25, SRL 40-25, DCR 150, DCR 140 | 2/00 |
| H/V Power Supply: Fluke Model: 408B (SN: 573) | 2/00 |
| R.F. Generator: HP 606A | 2/00 |
| R.F. Generator: HP 8614A | 2/00 |
| R.F. Generator: HP 8640B | 2/00 |
| Spectrum Analyzer: HP 8562A, | 2/00 |
| Mixers: 11517A, 11970A, 11970K, 11970U, 11970V, 11970W | |
| HP Adapters: 11518, 11519, 11520 | |
| Spectrum Analyzer: HP 8591 EM | 7/00 |
| Frequency Counter: Leader LDC 825 | 2/00 |
| Antenna: EMCO Biconilog Model: 3143 | 4/00 |
| Antenna: EMCO Log Periodic Model: 3147 | 10/00 |
| Antenna: Antenna Research Biconical Model: BCD 235 | 10/00 |
| Antenna: EMCO Dipole Set 3121C | 2/00 |
| Antenna: C.D. B-100 | 2/00 |
| Antenna: Solar 9229-1 & 9230-1 | 2/00 |
| Antenna: EMCO 6509 | 2/00 |
| Audio Oscillator: H.P. 200CD | 2/00 |
| R.F. Power Amp 65W Model: 470-A-1000 | 2/00 |
| R.F. Power Amp 50W M185- 10-500 | 2/00 |
| R.F. PreAmp CPPA-102 | 2/00 |
| Shielded Room 5 M x 3 M x 3.0 M (100 dB Integrity) | |
| LISN 50 µHy/50 ohm/0.1 µf | 10/00 |
| LISN Compliance Eng. 240/20 | 2/00 |
| Peavey Power Amp Model: IPS 800 | 2/00 |
| Power Amp A.R. Model: 10W 1000M7 | 2/00 |
| Power Amp EIN Model: A300 | 2/00 |
| ELGAR Model: 1751 | 2/00 |
| ELGAR Model: TG 704A-3D | 2/00 |
| ESD Test Set 2000i | 10/95 |
| Fast Transient Burst Generator Model: EFT/B-100 | 10/95 |
| Current Probe: Singer CP-105 | 2/00 |
| Current Probe: Solar 9108-1N | 2/00 |
| Field Intensity Meter: EFM-018 | 10/95 |
| KETEK Ecat Surge Generator | 10/99 |

11/01/2000

QUALIFICATIONS

Of

SCOT D. ROGERS, ENGINEER**ROGERS LABS, INC.**

Mr. Rogers has approximately 13 years experience in the field of electronics. Six years working in the automated controls industry and 6 years working with the design, development and testing of radio communications and electronic equipment.

POSITIONS HELD:

| | |
|----------------------|---|
| Systems Engineer: | A/C Controls Mfg. Co., Inc. 6 Years |
| Electrical Engineer: | Rogers Consulting Labs, Inc. 5 Years |
| Electrical Engineer: | Rogers Labs, Inc. Current |

EDUCATIONAL BACKGROUND:

- 1) Bachelor of Science Degree in Electrical Engineering from Kansas State University.
- 2) Bachelor of Science Degree in Business Administration Kansas State University.
- 3) Several Specialized Training courses and seminars pertaining to Microprocessors and Software programming.

Scot D Rogers
Scot D. Rogers

November 9, 2000
Date

1/11/00

FEDERAL COMMUNICATIONS COMMISSION

7435 Oakland Mills Road
Columbia, MD 21046
Telephone: 301-725-1585 (ext-218)
Facsimile: 301-344-2050

February 6, 1998

IN REPLY REFER TO
31040/SIT
1300F2

Rogers Labs, Inc.
4405 West 259th Terrace
Louisburg, KS 66053

Attention: Scot D. Rogers

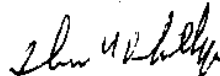
Re: Measurement facility located at above address
(3 and 10 meter site)

Gentlemen:

Your submission of the description of the subject measurement facility has been reviewed and found to be in compliance with the requirements of Section 2.948 of the FCC Rules. The description has, therefore, been placed on file and the name of your organization added to the Commission's list of facilities whose measurement data will be accepted in conjunction with applications for certification or notification under Parts 15 or 18 of the Commission's Rules. Our list will also indicate that the facility complies with the radiated and AC line conducted test site criteria in ANSI C63.4-1992. Please note that this filing must be updated for any changes made to the facility, and at least every three years the data on file must be certified as current.

Per your request, the above mentioned facility has been also added to our list of those who perform these measurement services for the public on a fee basis. This list is updated monthly and is available on the Laboratory's Public Access Link (PAL) at 301-725-1072, and also on the Internet at the FCC Website www.fcc.gov/oet/info/database/testsite/.

Sincerely,



Thomas W. Phillips
Electronics Engineer
Customer Service Branch