ROGERS LABS, INC.

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Louisburg, KS 66053
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TEST REPORT

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: 1555-2450
Hand Held Reader
Frequency 2400 – 2483.5 MHz
FCC ID: HN21555-2450

Test Date: November 15, 2000

Certification Date: November 15, 2000

Certifying Engineer: Scot D Rogers

Scot D. Rogers
ROGERS LABS, INC.
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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: 1555-2450 Hand Held Reader

FCC I.D.: HN21555-2450

Frequency Range: 2400 MHz to 2483.5 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: 1555-2450 Hand Held Reader
FCC I.D.: HN21555-2450

(3) Instruction Book:

Refer to Exhibit for Instruction Manual (Getting Started guide file 1555_gs_guide.pdf and Operational Manual file 1555_ops_guide.pdf).

(4) Description of Circuit Functions

Refer to Exhibit for Circuit Description (file Operational Description 2450.pdf).

(5) Block Diagram with Frequencies:

Refer to Exhibit for Block Diagram (file 2450Reader1.pdf).

(6) Report of Measurements:

Follows in this Report.

(7) Photos: Construction, Component Placement, etc.:

Refer to Appendix of this report for Photographs 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 Spread 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. The Handheld reader uses a pseudo random hop sequence that consists of 79 channels between the frequencies of 2402 and 2480 MHz with an equal channel spacing of 1 MHz. The digital board ASIC controls the hopping sequence of the RF source, using look up tables and a simple mathematical algorithm. The code used to generate the hopping sequence is based on the hopping sequence as specified in the IEEE 802.11 standard. Therefore, channel 1 is 2402 MHz, channel 2 is 2403 MHz and so on, till channel 78 is 2479 MHz and channel 79 is 2480 MHz. The hop sequence is derived from two subsets of random numbers and is derived from two subsets of random patterns, which are combined together to form the channel index.

When power is initially applied to the handheld reader, a random number is generated in the digital board ASIC which determines the starting point of the hop sequence. As RF power is applied the handheld reader will follow the hop sequence. When a command is complete and RF is turned off, the hop sequence position is maintained. When a new command is initiated, and RF is turned back on, the Handheld reader starts the hop sequence where it left off the

last time RF was on. Therefore, the transmitter will use each frequency channel equally, on the average. Since the hop sequence starting channel is determined by a random number generated at initial power up, the transmitter cannot coordinate its hopping with any other transmitter.

The Hand Held reader communicates with the tag through a spread spectrum, frequency-hopping signal. The Hand Held reader modulates the carrier that is decoded by the tag. The tag then imposes modulation upon the carrier and reflects the carrier (modulated backscatter) to the Hand Held reader. The receiver operates in a homodyne mode. The received signals pass through a pre-selector filter designed to eliminate high frequency interference including the harmonics generated in the transmitter. The local oscillator used in the receiver is the same frequency hopping oscillator used to generate the carrier signal that is transmitted to the tag, modulated by the tag, and back-scattered to the receiver. Therefore, both signals are hopping at exactly the same frequency. Since the receiver operates simultaneously with the Hand Held reader transmission, the system receiver will shift frequency in synch with the transmitter signal. The received signals are directly converted to baseband in the homodyne. The down converted signals are band limited by a series of active filters that provide a 3 dB pass band of approximately 6 kHz to 120 kHz. The filters provide the receiver with a 20 dB IF bandwidth of approximately 750 kHz. Since each received signal is down converted and band limited at baseband, the IF bandwidth, and hence the front end bandwidth of the receiver, exactly matches the transmitted signal from the tag.

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

3) Equipment Tested

EQUIPMENT	MODEL/PART#	FCC I.D.
EUT	1555-2450	HN21555-2450
CPU	Sharp PC9000	FKG PC9000
Printer	H.P. C2168A	B94C2121X

Per paragraph 2.1 the device is a frequency hopping system and transmits information to the tag. The operation of the unit and information included in the modulated signal is described as follows. The 1555 Hand Held RFID reader, combined with an Intellitag-500 tag, is a read/write 2-way RF communication system. For every command from the reader to the tag, a response is generated. Data can be written to the tag, or read from it. The tag data can be locked and unlocked. For reader to tag communication (forward link) and writing data to the tag, a carrier is modulated with the desired data using an on-off key format. The RF field being on corresponds to a 1, while the RF field being off corresponds to a 0. The on-off ratio specification is 40dBc. The data signal and the power signal, which controls the modulation, are time division duplexed. These signals occur at the same frequency with the maximum pseudo-random hop interval being less than 120 msec. For tag to reader communication (return link), data is sent using backscatter techniques. The reader provides a CW signal to the tag during the return link. While the reader powers the tag, the tag alternately opens and shorts its antenna connection, changing the effective impedance of the tag front end and thus changing the backscatter return of the tag to the reader. The receiver tracks the transmitter as it is

looking for reflections from the rf id tag. The receiver hopping sequence is therefore defined by the same sequence of events as the transmitter.

4) Equipment Function and Testing Procedures

This product is an RFID tag reader and is intended for use in business and industrial environments for inventory control and similar purposes. The EUT incorporates a hand held laser and radio frequency (RF) 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. It does not have any residential applications. The device is NOT a class B computer peripheral and does not require additional FCC approval. However, the device has been tested for the requirements of class digital equipment and has been correctly labeled to reflect this. The information that is required in part 15.19(a)(3), 15.21, and 15.105, are included in the owner's manual.

5) Equipment and Cable Configurations

Conducted Emission Test Procedure

The test setup, including the EUT, was arranged in a typical equipment configuration and placed on a 1 x 1.5-meter wooden bench, 0.8 meters high located in a screen room. Line conducted emissions testing was performed on the EUT, which was powered through the manufacturer-supplied cable. The power lines of the system were isolated from the power source using a standard LISN with a 50-µHy choke. EMI was coupled to the spectrum analyzer through a 0.1 µF capacitor internal to the LISN. The LISN was positioned on the floor beneath the wooden bench supporting the EUT. The power lines and cables were draped over the back edge of the table.

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. Refer to photos in Appendix for EUT placement.

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

EQUIPMENT	MFG.	MODEL	CAL. DATES	DUE.
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

Conducted EMI: Data is in dBµV; dB referenced to one microvolt.

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

8) Test Site Locations

Conducted EMI: The AC powerline conducted emissions tests were performed in a shielded screen room located at Rogers Labs, Inc., 4405 W. 259th Terrace, Louisburg, KS.

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.

9) SUBPART B – Unintentional Radiators

Conducted EMI

The EUT was arranged in a typical equipment configuration and placed on a 1 x 1.5-meter wooden bench 80 cm above the conducting ground plane, floor of a screen room. The bench was positioned 40 cm away from the wall of the screen room.

The LISN was positioned on the floor of the screen room 80-cm

from the rear of the EUT. The power cord of the EUT was connected to the LISN. A second LISN was also positioned on the floor of the screen room and used to power the auxiliary equipment. EMI was coupled to the spectrum analyzer through a 0.1 µF capacitor, internal to the LISN. Power line conducted emissions testing was carried out individually for each current carrying conductor of the EUT. The excess length of lead between the system and the LISN receptacle was folded back and forth to form a bundle not exceeding 40 cm in length. The screen room, conducting ground plane, analyzer and LISN were bonded together to the protective earth ground. Preliminary testing was performed to identify the frequencies of the emissions, which had the highest amplitudes. The cables were repositioned to obtain maximum amplitude of measured EMI level. Once the worst case configuration was identified, plots were made of the EMI from 0.15 MHz to 30 MHz then the data was recorded with maximum conducted emissions levels. Refer to figures 1 and 2 for plots of conducted emissions for the EUT.

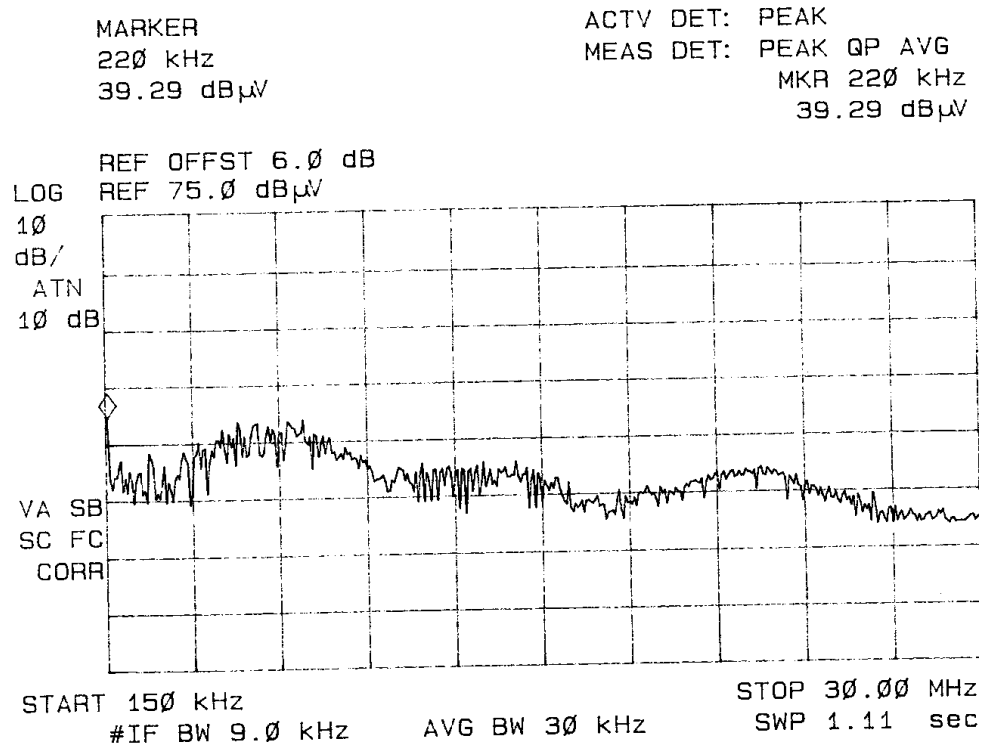


Figure 1 Line conducted emissions L1

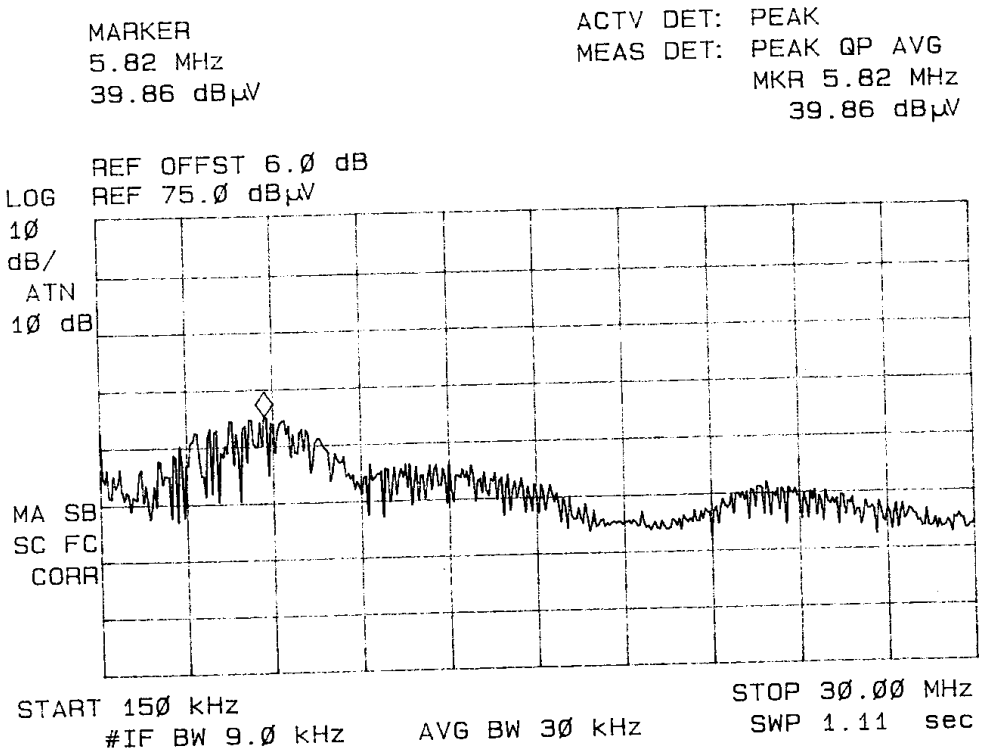


Figure 2 Line conducted emissions L2

Radiated EMI

The EUT was arranged in a typical equipment configuration and operated in a standard mode. 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. Plots were made of the frequency spectrum from 30 MHz to 1000 MHz for the preliminary testing. Refer to figures 3 and 4 for plots of the frequency spectrum produced by the EUT and support equipment. The EUT and cable locations were noted and reconfigured at the open area test site. The highest radiated emission was then re-maximized at this location before final radiated emissions measurements were performed. Final data was taken with the EUT located at the OATS at a distance of 3 meters between the EUT and the receiving antenna. The frequency spectrum from 30 MHz to 1200 MHz 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 position between horizontal and vertical polarization. Antennas used were Broadband Biconical from 30 to 200 MHz, Log Periodic from 200 MHz to 5 GHz, and or a Biconilog from 30 to 1000 MHz, and pyramidal horns and/or mixers from 4 GHz to 25 GHz.

Sample Calculations:

RFS = Radiated Field Strength

dBµV/m @ 3m = dBµV + A.F. - Amplifier Gain

dBµV/m @ 3m = 55.9 + 7.9 - 35

= 28.8

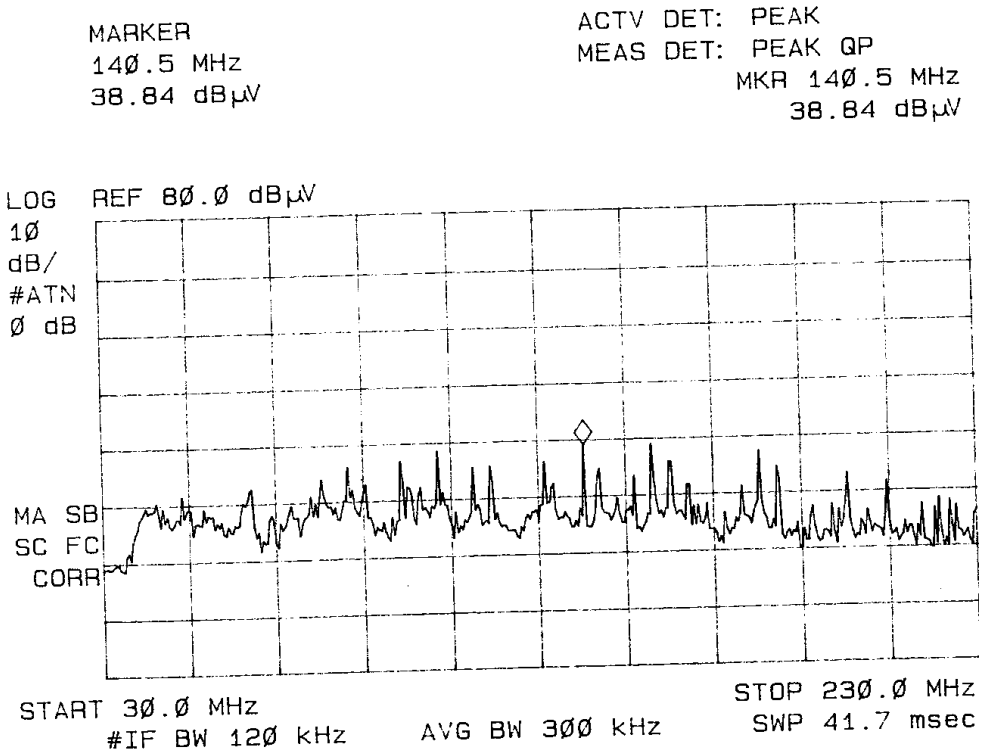


Figure 3 Radiated Emissions taken in screen room.

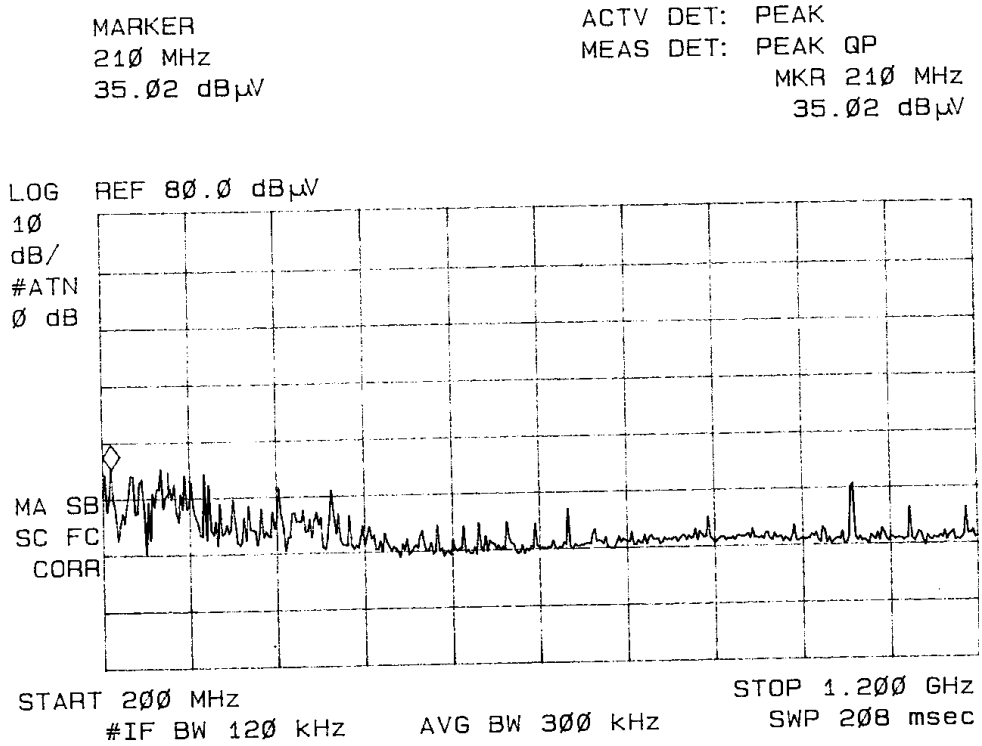


Figure 4 Radiated Emissions taken in screen room.

Data: Conducted (6 Highest Emissions):

FREQUENCY OF EMISSION IN (MHz)	LEVEL IN dBµV L1 PK/QP/AVE	LEVEL IN dBµV L2 PK/QP/AVE	FCC CLASS B LIMIT QP
0.15 – 0.5	39.2 29.7 15.5	42.6 33.3 21.0	48
0.5 – 5.0	39.2 38.1 34.1	38.6 37.3 33.7	48
5.0 – 10.0	39.0 37.2 32.7	39.8 38.6 33.7	48
10.0 – 15.0	30.6 27.7 21.2	29.2 23.7 14.8	48
15.0 – 20.0	28.7 25.8 20.6	28.0 24.6 18.5	48
20.0 – 25.0	25.5 23.1 20.5	26.2 23.4 21.0	48
25.0 – 30.0	25.9 18.8 13.9	25.6 21.8 18.2	48

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

Data: EUT and System Radiated Emissions (8 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	55.9	59.6	7.9	35	28.8	32.5	40.0
85.9	52.3	59.8	8.0	35	25.3	32.8	40.0
118.7	49.1	62.6	6.9	35	21.0	34.5	43.5
131.0	50.9	63.1	8.0	35	23.9	36.1	43.5
140.0	59.4	66.0	9.3	35	33.7	40.3	43.5
163.7	49.5	63.3	9.0	35	23.5	37.3	43.5
200.0	54.3	56.2	11.2	35	30.5	32.4	43.5
320.0	55.9	51.9	15.1	35	36.0	32.0	46.0

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

Summary of Results for Conducted Emissions:

The conducted emissions for the EUT meet the requirements for FCC Part 15B CLASS B Digital Devices. The EUT had a minimum margin of 9.4 dB below the class B limit. Other emissions were present with amplitudes at least 10.0 dB below the limit.

Summary of Results for Radiated Emissions:

The radiated emissions for the EUT meet the requirements for FCC Part 15B CLASS B Digital Devices. The laptop computer had a minimum margin of 3.2 dB and the EUT had a 7.4 dB minimum margin below the class B limit. Other emissions were present with amplitudes at least 10 dB below the limit.

Statement of Modifications:

No modifications to the EUT were required for the unit to meet the FCC Part 15B CLASS B emissions standards. There were no deviations to the specifications.

10) Subpart C - Intentional Radiators

As per CFR Part 15, Subpart C. The following information is submitted:

15.203 Antenna Requirements

The unit is produced with an integral antenna with unique coupling from the transmitter to the antenna. The antenna is not replaceable or user serviceable and is located inside the case. The requirements of 15.203 are met; there are no deviations or exceptions to the specification.

Restricted Bands of Operation Per 15.205

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 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:

Computed Quasi-Peak (dBµV/m @ 3m) = FSM(dBµV) + A.F.(dB) - Gain(dB)
= 49.2 + 8.0 - 35
= 22.2

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	49.2	52.7	8.0	35	22.2	25.7	43.5
165.1	44.4	51.3	9.0	35	18.4	25.3	43.5
168.8	43.4	50.0	9.0	35	17.4	24.0	43.5
240.0	58.1	62.5	12.8	35	34.9	39.3	46.0
249.6	47.1	48.6	12.3	35	24.4	25.9	46.0
264.0	43.5	47.3	12.8	35	21.3	25.1	46.0
265.6	48.6	55.0	12.8	35	26.4	32.8	46.0
273.2	39.2	42.6	12.7	35	16.9	20.3	46.0
280.0	52.9	57.3	12.9	35	30.8	35.2	46.0
297.0	40.6	47.0	13.8	35	19.4	25.8	46.0
400.0	44.4	40.6	16.4	35	25.8	22.0	46.0
4808.0	35.3	31.3	29.9	20	45.2	41.2	54.0
4904.0	28.1	28.4	29.9	20	38.0	38.3	54.0
4960.0	25.5	33.6	29.9	20	35.4	43.5	54.0
7212.0	29.5	28.6	29.9	20	39.4	38.5	54.0
7356.0	36.0	30.0	29.9	20	45.9	39.9	54.0
7440.0	34.7	29.0	29.9	20	44.6	38.9	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. 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. Plots were made of the frequency spectrum from 30 MHz to 1200 MHz for the preliminary testing. Antenna conducted emissions testing was also performed on the EUT at the manufacturer service antenna port. The highest radiated emission was then re-maximized at this 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 26 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, Biconilog from 30 MHz to 1000 MHz, and pyramidal horns and or mixers from 4 GHz to 26 GHz.

Sample Calculations:

RFS = Radiated Field Strength

dBµV/m @ 3m = dBµV + A.F. - Amplifier Gain

dBµV/m @ 3m = 55.9 + 7.9 - 35

= 28.8

Data 15.209:

Data: EUT and System Radiated Emissions (8 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	55.9	59.6	7.9	35	28.8	32.5	40.0
85.9	52.3	59.8	8.0	35	25.3	32.8	40.0
118.7	49.1	62.6	6.9	35	21.0	34.5	43.5
131.0	50.9	63.1	8.0	35	23.9	36.1	43.5
140.0	59.4	66.0	9.3	35	33.7	40.3	43.5
163.7	49.5	63.3	9.0	35	23.5	37.3	43.5
200.0	54.3	56.2	11.2	35	30.5	32.4	43.5
320.0	55.9	51.9	15.1	35	36.0	32.0	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 computer system had had a minimum margin of 3.2 dB and the EUT had a minimum margin of 7.4 dB below the limits. Other emissions were present with amplitudes at least 10 dB below the FCC Limits.

15.247 Operation in the Band 2400-2483.5 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 spread spectrum techniques 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. Plots were made of the frequency spectrum, produced at the antenna terminal, from 1,000 MHz to 26,500 MHz for the preliminary testing. Refer to figures 5 through 14 for plots of the frequency spectrum produced by the EUT taken at the manufacturer service antenna port. Insertion loss for the test setup was 2 dB at 2450 MHz. 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. 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 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 26.5 GHz. Emissions were measured in dBµV and converted to dBµV/m at 3 meters using the following equation.

dBµv/m@ 3m = FSM + A.F. – AMP. GAIN
= 94.9 +31.6 –(-3.5)
= 130.0

Data: Intentional Radiated Emissions:

Frequency of emission	FSM Horizontal dBµV	FSM vertical dBµV	Antenna Factor dB	Amp gain dB	LEVEL IN dBµV/m @ 3m Horizontal	LEVEL IN dBµV/m @ 3m Vertical	Limit
2404.0	94.9	95.1	31.6	-3.5	130.0	130.2	130.2
4808.0	35.3	31.3	29.9	20	45.2	41.2	54.0
7212.0	29.5	28.6	29.9	20	39.4	38.5	54.0
9616.0	26.5	26.5	33.5	20	40	40	54.0
2452.0	94.8	95.0	31.6	-3.5	129.9	130.1	130.2
4904.0	28.1	28.4	29.9	20	38.0	38.3	54.0
7356.0	36.0	30.0	29.9	20	45.9	39.9	54.0
9808.0	26.3	26.8	33.5	20	39.8	40.3	54.0
2480.0	94.7	94.8	31.6	-3.5	129.8	129.9	130.2
4960.0	25.5	33.6	29.9	20	35.4	43.5	54.0
7440.0	34.7	29.0	29.9	20	44.6	38.9	54.0
9920.0	26.8	26.0	33.5	20	40.3	39.5	54.0

The output power of the unit was measured at the manufacturer service port for three frequencies.

Conducted Emissions of Intentional Radiator

Frequency of Emission (MHz)	Measured Conducted Power (dBµv)
2404	136.83
2452	136.52
2480	137.00

The calculations for the EIRP are giving in the following table. The measured 130.2 dBµV was first converted to volts per meter at three meters using the equation $E(v/m)=10^{(dBuv-120/20)}$ and using this to calculate the EIRP from the equation $EIRP(w)=(Ed)^2/30$.

Calculated EIRP from data: Intentional Radiated Emissions

Frequency of Emission (MHz)	Field Strength (dBµV/m at 3m)	Calculated volts/meter	Calculated EIRP (W)
2404	130.2	3.24	3.1
2452	130.1	3.20	3.1
2480	129.9	3.13	2.9

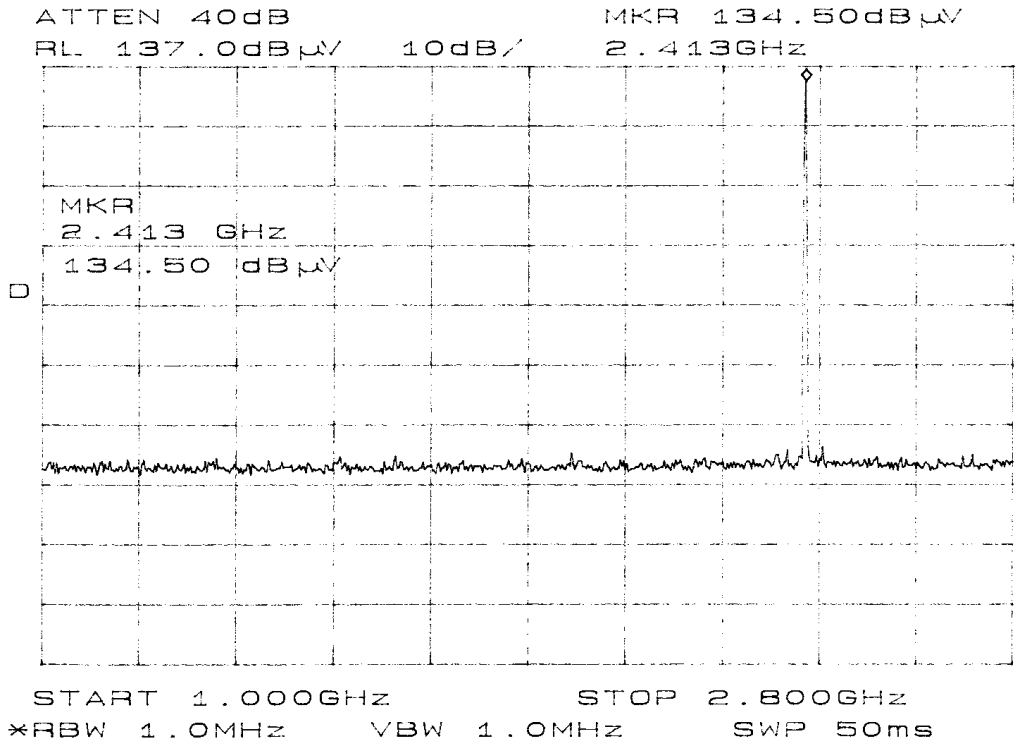


Figure 5 Emissions at Manufacturer Service Antenna Port

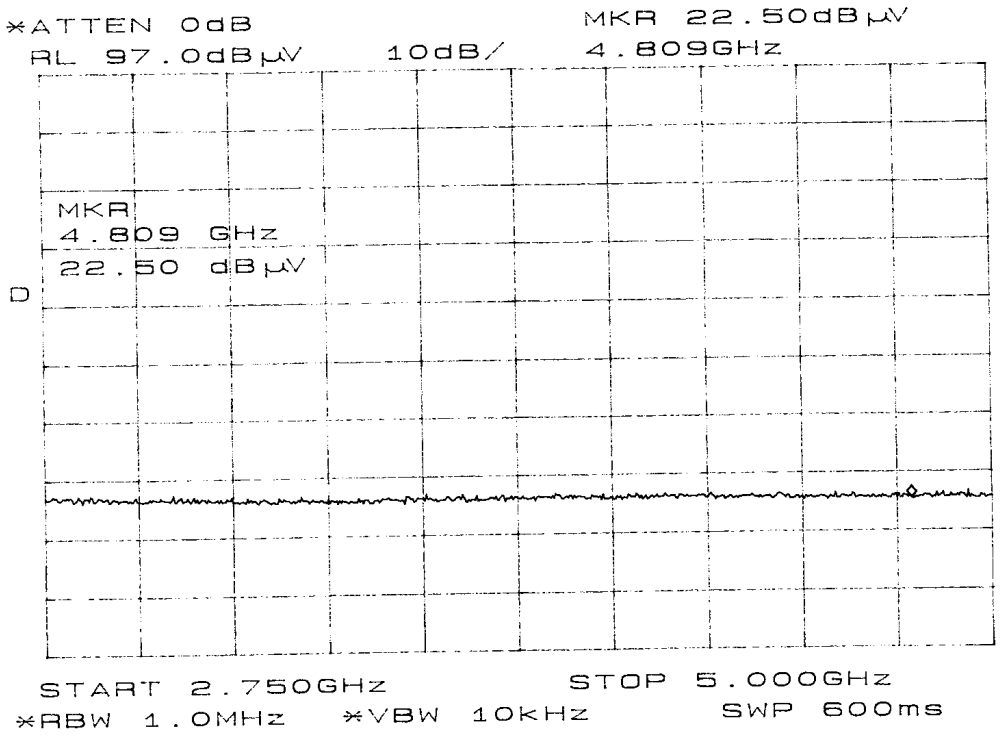


Figure 6 Emissions at Manufacturer Service Antenna Port

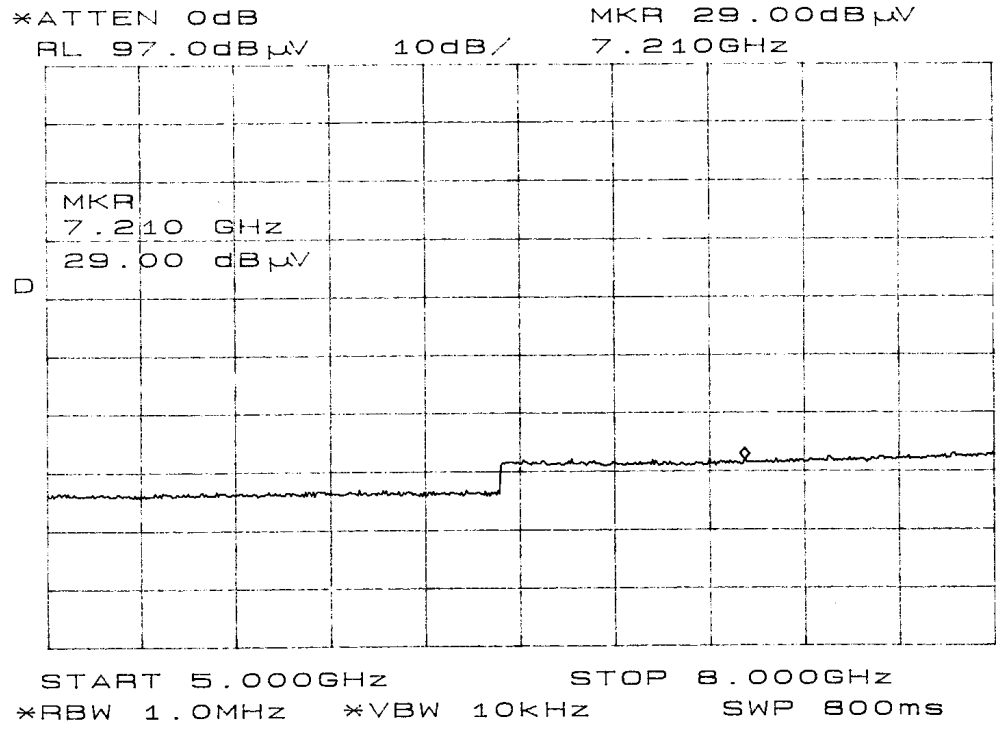


Figure 7 Emissions at Manufacturer Service Antenna Port

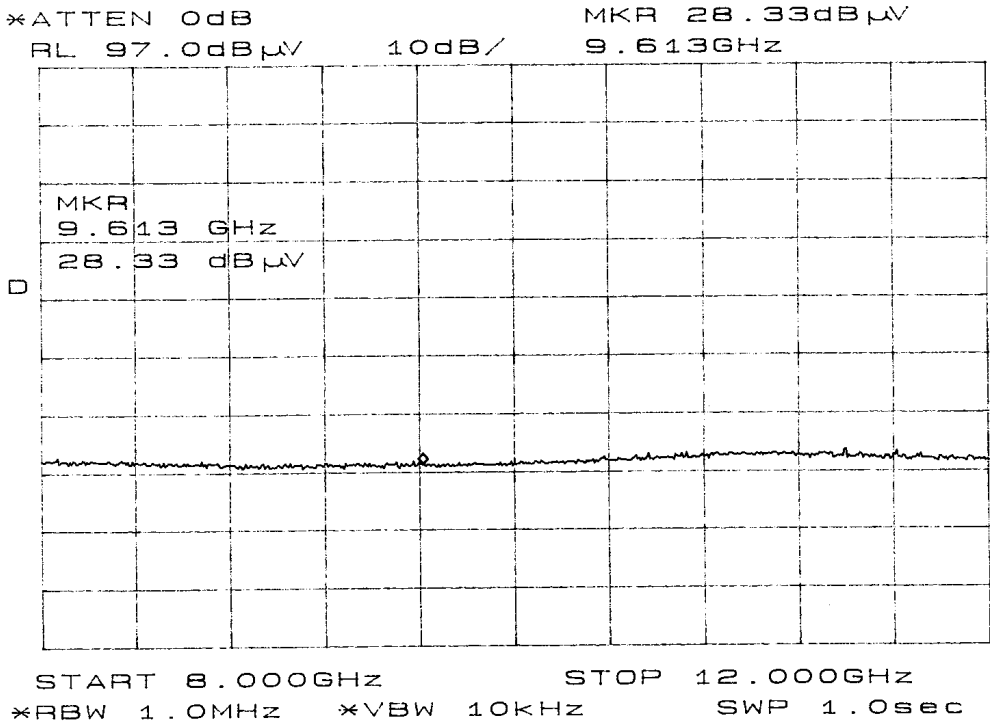


Figure 8 Emissions at Manufacturer Service Antenna Port

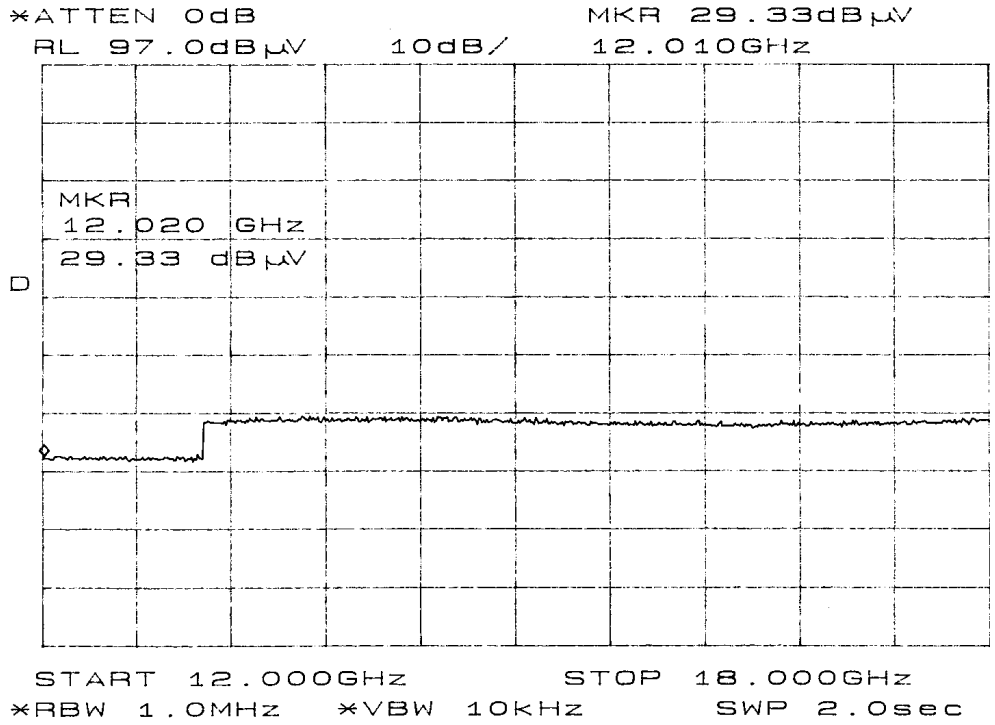


Figure 9 Emissions at Manufacturer Service Antenna Port

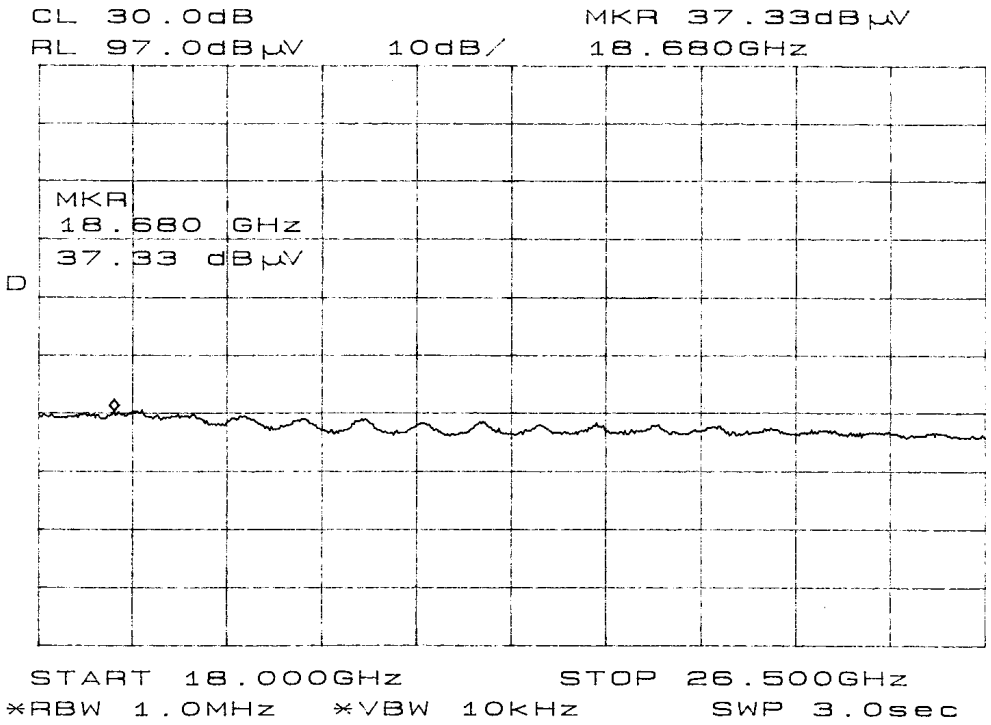


Figure 10 Emissions at Manufacturer Service Antenna Port

The maximum output power was also measured at the manufacturer service port by replacing the antenna with a spectrum analyzer and appropriate attenuation. The 20-dB bandwidth was also measured for frequencies of operation. Refer to figures 11 through 14 for plots of the frequency spectrum produced by the EUT.

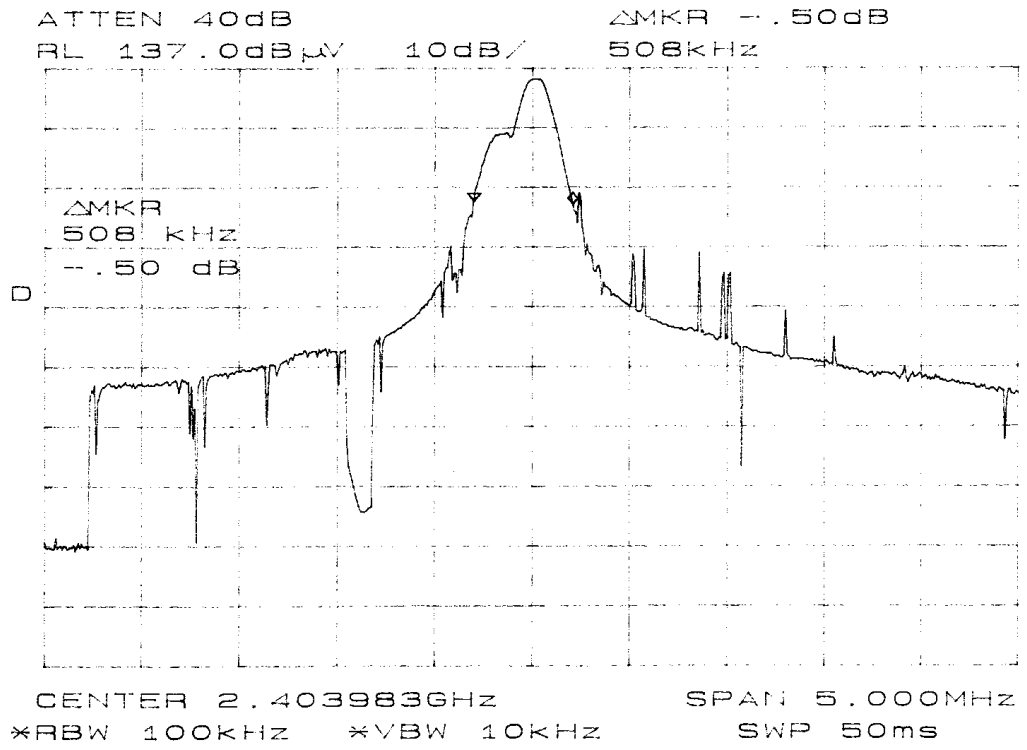


Figure 11 Antenna Conducted Emissions occupied bandwidth

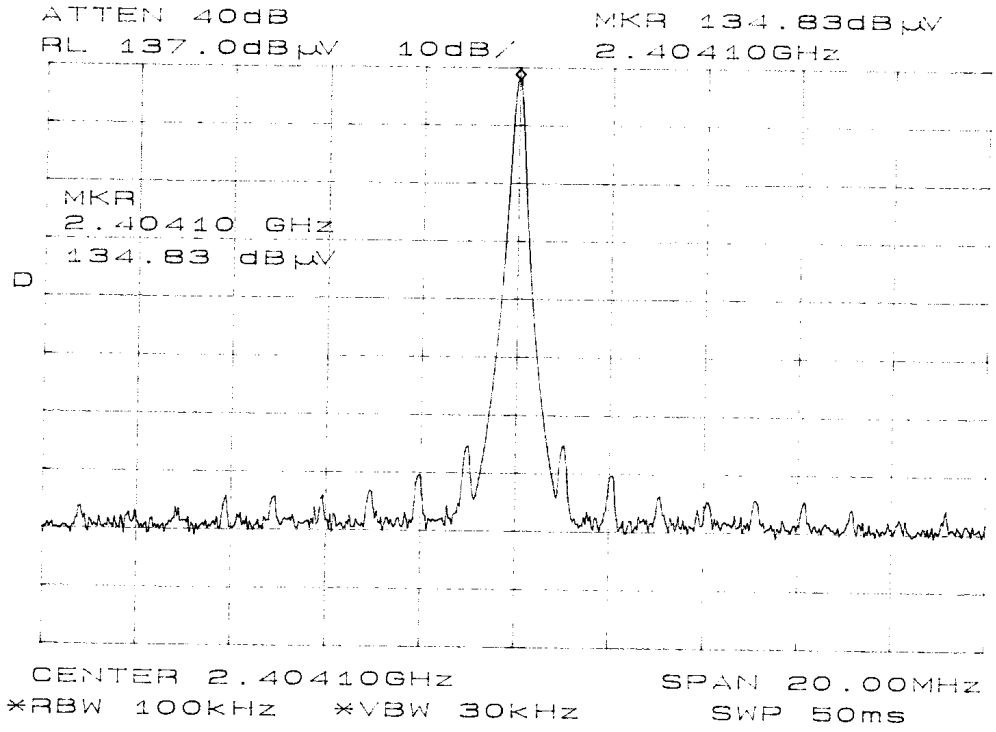


Figure 12 Antenna Conducted Emissions

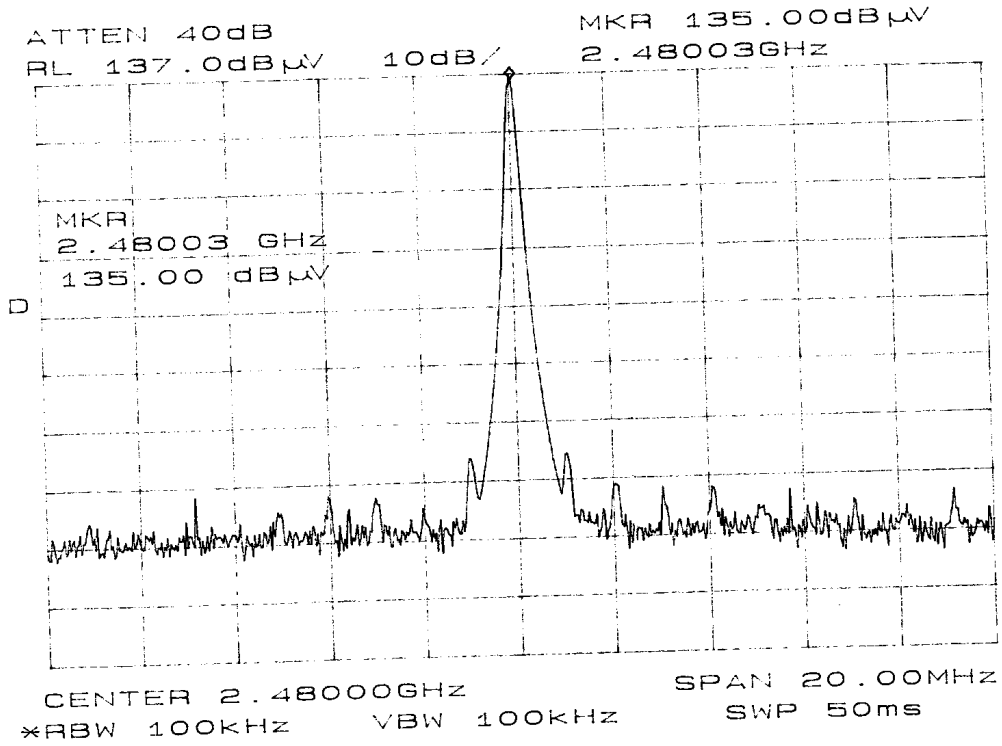


Figure 13 Antenna Conducted Emissions

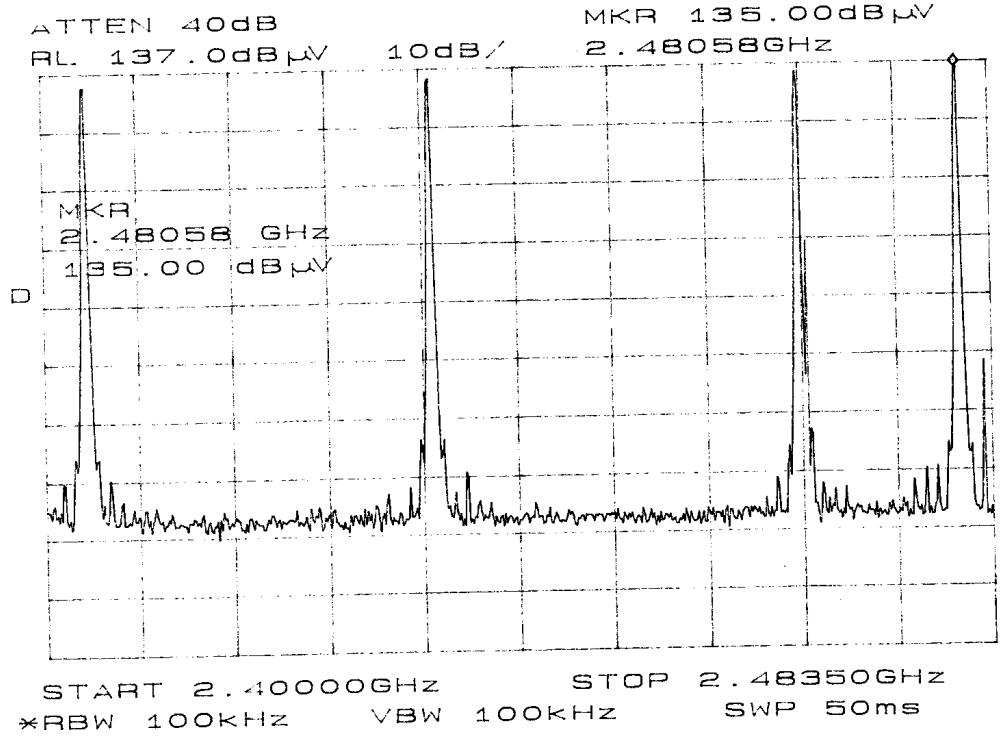


Figure 14 Antenna Conducted Emissions

CALCULATED SAR for UNCONTROLLED, GENERAL POPULATION

To demonstrate compliance with the SAR requirements, the unit will be tested and a SAR report will be uploaded to the FCC with the submittal. The required operator warnings are shown in the operations manual.

Summary of Results for Radiated Emissions of Intentional Radiator:

The radiated emissions for the EUT meet the requirements for FCC Part 15C Intentional Radiators. The EUT had a 0-dB margin below the FCC required limits. No measurable emissions where observed 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.

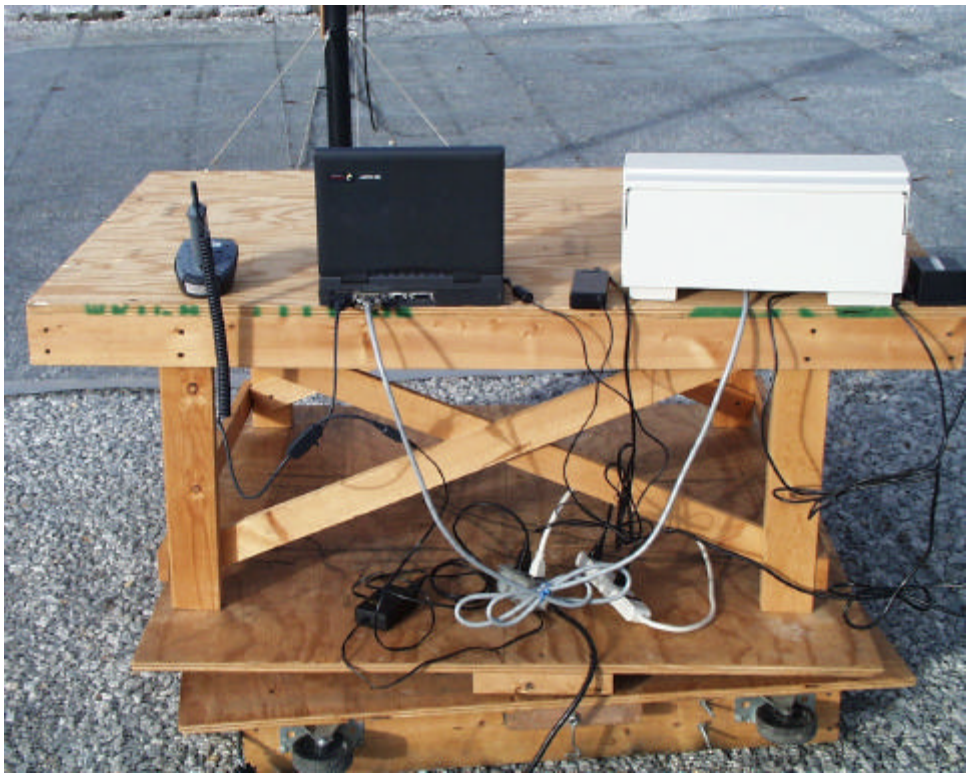
APPENDIX

Model: 1555-2450

1. Photos of Conducted Emissions Test Set Up
2. Photos of Radiated Emissions Test Set Up
3. Photos of Case Front and Back
4. Photos Inside of Case
5. Photos of Antenna
6. Photo of FCC ID Label Location
7. Rogers Qualifications
8. Test Equipment List
9. FCC Site Approval Letter

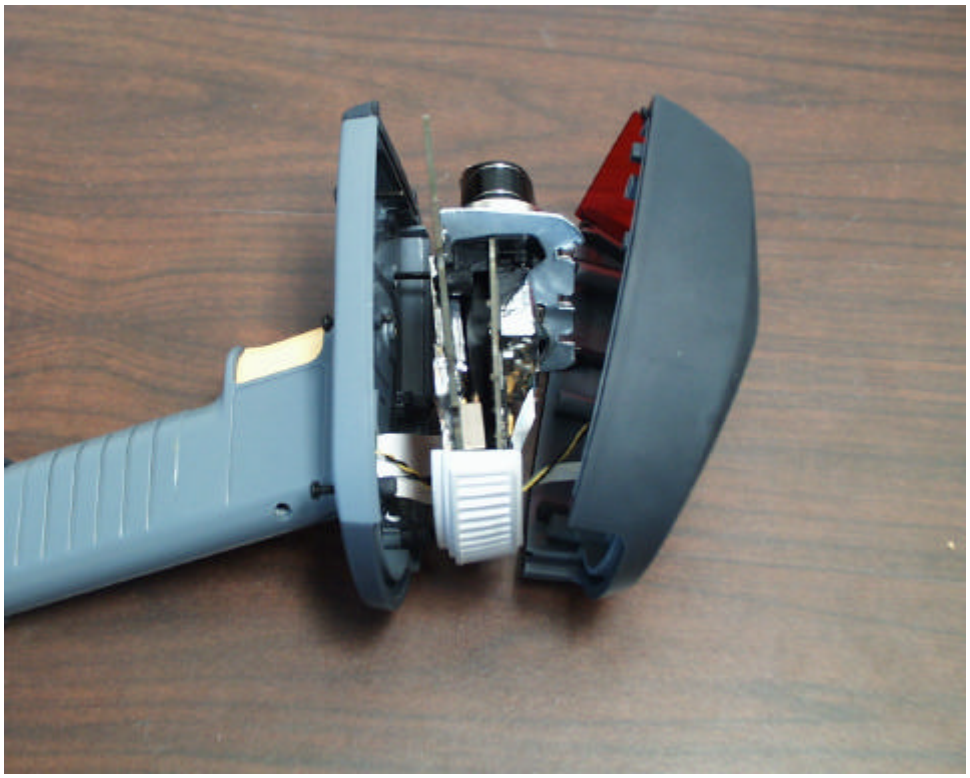
INTERMEC TECHNOLOGIES CORPORATION
MODEL: 1555-2450
PHOTOS OF CONDUCTED EMISSIONS TEST SET UP

INTERMEC TECHNOLOGIES CORPORATION
MODEL: 1555-2450
PHOTOS OF RADIATED EMISSIONS TEST SET UP



INTERMEC TECHNOLOGIES CORPORATION
MODEL: 1555-2450
PHOTOS OF CASE FRONT AND BACK

INTERMEC TECHNOLOGIES CORPORATION
MODEL: 1555-2450
PHOTO OF INSIDE CASE



INTERMEC TECHNOLOGIES CORPORATION
MODEL: 1555-2450
PHOTO FCC ID LABEL LOCATION

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.

List of Test Equipment:	Calibration Date:
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, Mixers: 11517A, 11970A, 11970K, 11970U, 11970V, 11970W HP Adapters: 11518, 11519, 11520	2/00
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 27, 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