APPLICATION

For

GRANT OF CERTIFICATION

FOR

MODEL:

GSC10
Data Transmitter
P/N 011-01227-xx

FCC ID: IPH-01227
IC: 1792A-00447

FOR

GARMIN INTERNATIONAL, INC.

1200 East 151st Street
Olathe, KS 66062

ROGERS LABS, INC.

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

TEST REPORT

For

APPLICATION of CERTIFICATION

For

GARMIN INTERNATIONAL, INC.

1200 East 151st Street
Olathe, KS 66062
Phone: (913) 397-8200

Mr. Van Ruggles
Director of Quality Assurance

MODEL: GSC10 PN 011-01227-xx

Data Transmitter
FREQUENCY: 2,400-2,483.5 MHz

FCC ID: IPH-00447
IC: 1792A-00447

Test Date: October 26, 2005

Certifying Engineer: Scot D Rogers

Scot D. Rogers
ROGERS LABS, INC.
4405 West 259th Terrace
Louisburg, KS 66053
Phone: (913) 837-3214
FAX: (913) 837-3214

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Applicable Standards & Test Procedures

a) In accordance with the Federal Communications Code of Federal Regulations, dated October 1, 2004, Part 2, Subpart J, Paragraphs 2.907, 2.911, 2.913, 2.925, 2.926, 2.1031 through 2.1057, applicable parts of paragraph 15, Part 15C paragraph 15.249, and Industry Canada RSS-210, the following information is submitted.

b) Test procedures used are the established Methods of Measurement of Radio-Noise Emissions as described in the ANSI 63.4-2003 Document FCC and documents DA00-1407 and DA00-705.

Equipment Tested

Equipment	Serial Number	FCC I.D.#
GSC10	1	IPH-00447

List of Test Equipment

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

HP 8591EM SPECTRUM ANALYZER SETTINGS		
CONDUCTED EMISSIONS:		
RBW	AVG. BW	DETECTOR FUNCTION
9 kHz	30 kHz	Peak/Quasi Peak
RADIATED EMISSIONS (30 – 1000 MHz):		
RBW	AVG. BW	DETECTOR FUNCTION
120 kHz	300 kHz	Peak/Quasi Peak
HP 8562A SPECTRUM ANALYZER SETTINGS		
RADIATED EMISSIONS (1 – 40 GHz):		
RBW	AVG. BW	DETECTOR FUNCTION
1 MHz	1 MHz	Peak/Average
ANTENNA CONDUCTED EMISSIONS:		
RBW	AVG. BW	DETECTOR FUNCTION
120 kHz	300 kHz	Peak

EQUIPMENT	MFG.	MODEL	CAL. DATE	DUE.
LISN Comp.	Design	FCC-LISN-2-MOD.CD	10/05	10/06
LISN FCC		FCC-LISN-50-16-2-08	6/05	6/06
LISN Comp.	Design	1762	2/05	2/06
Antenna	ARA	BCD-235-B	10/05	10/06
Antenna	EMCO	3147	10/05	10/06
Antenna	EMCO	3143	5/05	5/06
Analyzer	HP	8591EM	5/05	5/06
Analyzer	HP	8562A	2/05	2/06

2.1033(b) Application for Certification

(1) Manufacturer: GARMIN INTERNATIONAL, INC.
1200 East 151st Street
Olathe, KS 66062
PHONE: (913) 397-8200

(2) FCC Identification: FCC I.D.: IPH-00447

(3) Copy of the installation and operating manual:
Refer to exhibit for Draft Instruction Manual.

(4) Description of Circuit Functions, Device Operation:
The GSC10 is a low power Data Transmitter.

(5) Block Diagram with Frequencies:
Refer to exhibit for the Block Diagram

(6) Report of measurements showing compliance with the pertinent FCC technical requires are provided in this report.

(7) Photographs of equipment are provided in this report and exhibits.

(8) Peripheral equipment or accessories for the equipment.
No interface ports are available on this device. No peripheral equipment or accessories are available.

(9) Transition Provisions of 15.37 are not being requested.

(10) The equipment is not a scanning receiver.

(11) The equipment is not a transmitter operating in the 59-64 GHz frequency range.

Equipment and Cable Configuration

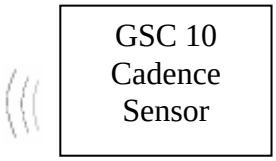
Test Setup

The GSC10 is a transmitter sending pedal cadence count data to a receiver, offering a bicycle enthusiast the opportunity to track, and log pedal movement past the sensor. The receiver would be mounted on the handlebars and offer display and control for the GPS receiver used for location and navigation. The unit was designed to be mounted on a bicycle frame near the rear tire and pedals. This location would offer the transmitter the ability to detect pedal movement and transmit the data to the receiver unit. The EUT was arranged in a typical user equipment configuration. The transmitter offers no interface connection and powered solely from internal battery source. As requested by the manufacturer and required by the CFR, the unit was tested for emissions compliance using the available configurations with the worst-case data presented. Test results in this report relate only to the products described in this report.

Equipment Function and Testing Procedures

The EUT is a single-channel transmitter operating in the 2400-2483 MHz frequency band. The unit allows data to be sent to the receiver showing a cadence count as the pedal moves past the transmitter.

Configuration options for the EUT



AC Line Conducted Emission Test Procedure

The GSC10 equipment operates solely from DC power offered internally to the unit. A lithium Ion battery cell powers the unit. There are no provisions for connecting to the utility power system, and therefore the device was exempt from AC Line conducted emissions testing.

Radiated Emission Test Procedure

The EUT was placed on a rotating 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 photographs in exhibits for EUT placement.

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.

Test Site Locations

Conducted EMI: ROGERS LABS, INC. located at 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).

Site Approval: Refer to Appendix for FCC Site Approval Letter, Reference 90910, And Dated August 15, 2003, Industry Canada reference IC 3041 dated August 30, 2003.

Subpart C - Intentional Radiators

As per CFR Part 15, Subpart C the following information is submitted for consideration in obtaining a grant of certification for unlicensed intentional radiators.

15.203 Antenna Requirements

The unit is produced with a permanently attached antenna inside the sealed plastic case. No provisions for modification or alterations of the antenna configuration are available to the end user. The requirements of 15.203 are met there are no deviations or exceptions to the specification.

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 antennas or pyramidal horns, amplification stages, and a spectrum analyzer. Peak and average amplitudes of frequencies above 1000 MHz were compared to the required limits with worst-case data presented below. No other significant emission was observed which fell into the restricted bands of operation. Computed emission values take into account the measured radiated field strength, receive antenna correction factor, amplifier gain stage, and test system cable losses.

Sample Calculations:

Computed Peak (dBµV/m @ 3m) = FSM (dBµV) + A.F. (dB) - Gain (dB)
= 16.5 + 22.8 - 30
= 9.3

Data 15.205

Radiated (Highest Emissions):

Emission Frequency (MHz)	FSM Horz. (dBµV)	FSM Vert. (dBµV)	Ant. Factor (dB)	Amp. Gain (dB)	RFS Horz. @ 3m (dBµV/m)	RFS Vert. @ 3m (dBµV/m)	Limit @ 3m (dBµV/m)
1228.4	16.5	16.3	22.8	30	9.3	9.1	54.0
3685.4	16.3	16.6	36.8	30	23.1	23.4	54.0
4914.0	17.6	14..3	32.9	30	20.5	17.2	54.0
7371.0	18.0	15.6	36.7	30	24.7	22.3	54.0
12285.0	18.5	17.8	40.0	30	28.5	27.8	54.0

No other emissions found in the restricted bands.

Summary of Results for Radiated Emissions in Restricted Bands 15.205

The radiated emissions for the EUT meet the requirements for FCC CFR 47 Part 15.205 restricted bands of operation. The EUT had a 25.5 dB minimum margin below the limits. Other emissions were present with amplitudes at least 20 dB below the FCC Limits.

15.207 Conducted emissions limits; general requirements

AC Line Conducted EMI 15.207

The GSC10 equipment operates solely from DC power offered internally to the unit. A lithium Ion battery cell powers the unit. There are no provisions for connecting to the utility power system, and therefore the device was exempt from AC Line conducted emissions testing.

Summary of Results for AC Line Conducted General Emissions 15.207

The conducted emissions for the EUT meet the requirements for FCC Part 15C Intentional Radiators. The GSC10 equipment operates solely from DC power offered internally to the unit. A lithium Ion battery cell powers the unit. There are no provisions for connecting to the utility power system, and therefore the device was exempt from AC Line conducted emissions testing.

15.209 Radiated emissions limits; general requirements

General Radiated EMI 15.209

The EUT was arranged in a typical equipment configuration and operated through all of its various modes. Preliminary testing was performed in a screen room with the EUT positioned 1 meter from the FSM. Radiated emissions investigations were performed to identify the frequencies, which produced the highest emissions. Plots were made of the frequency spectrum from 30 MHz to 20,000 MHz for the preliminary testing. Refer to figures one through five showing the radiated emission spectrum displayed on the spectrum analyzer taken in a screen room. The highest radiated emission was then re-maximized at the OATS site 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 25,000 MHz was searched for radiated emissions. Peak and average amplitudes of frequencies above 1000 MHz were compared to the required limits with worst-case data presented below. 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, Pyramidal Horns, and amplification stages.

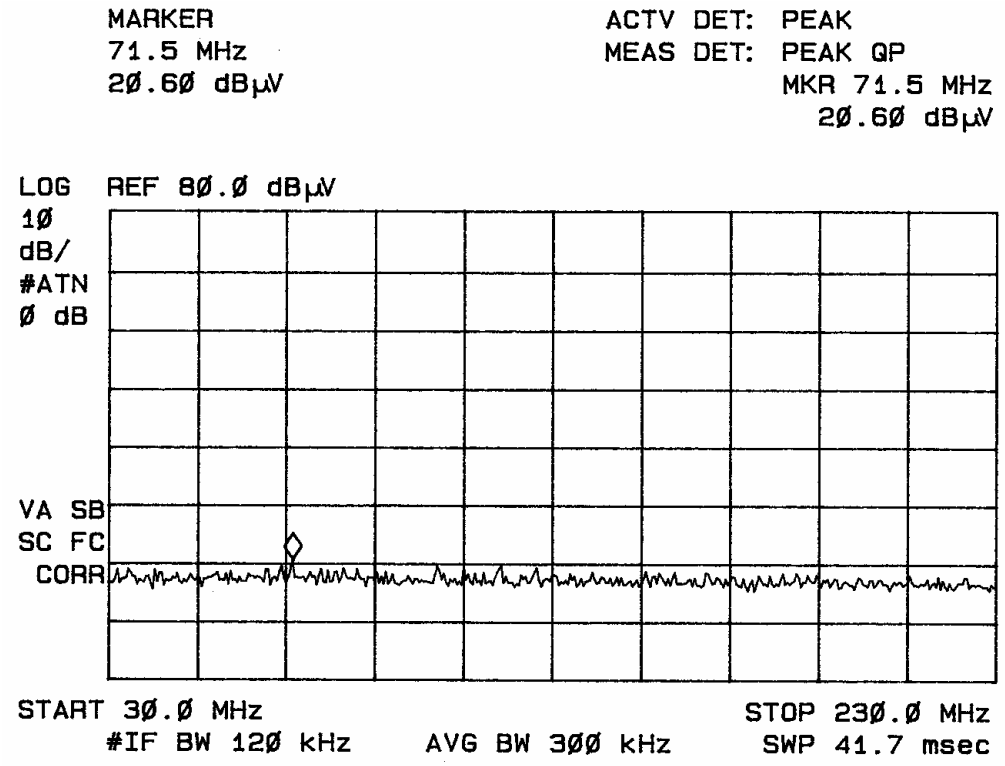


Figure one Radiated Emissions taken at 1 meter in screen room.

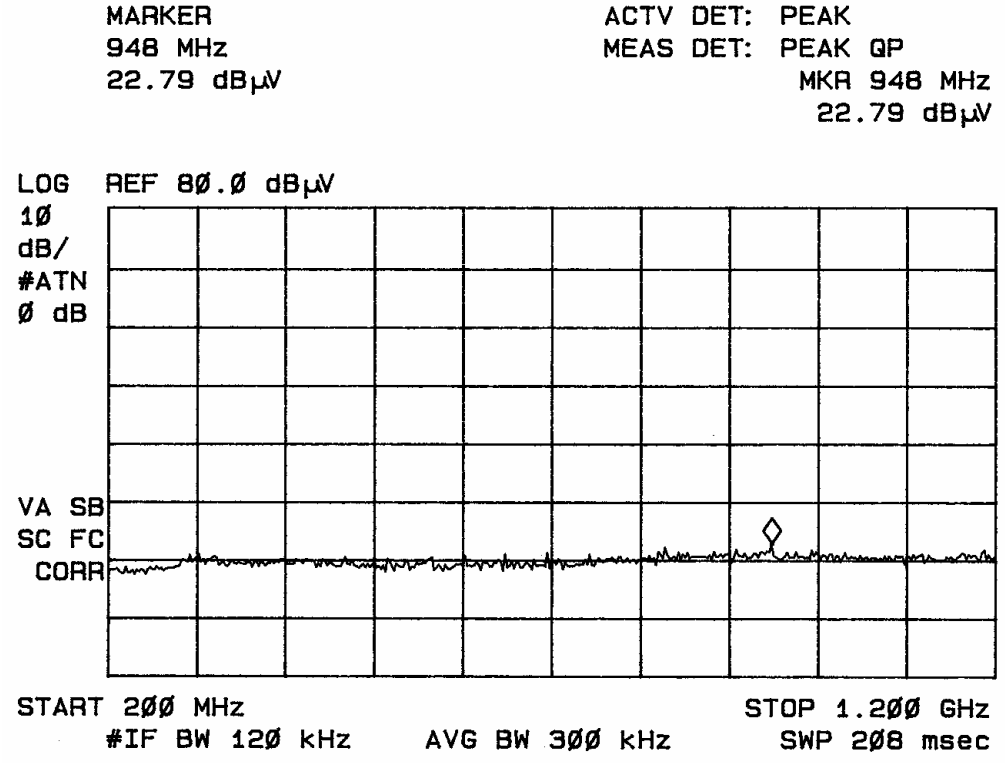


Figure two Radiated Emissions taken at 1 meter in screen room.

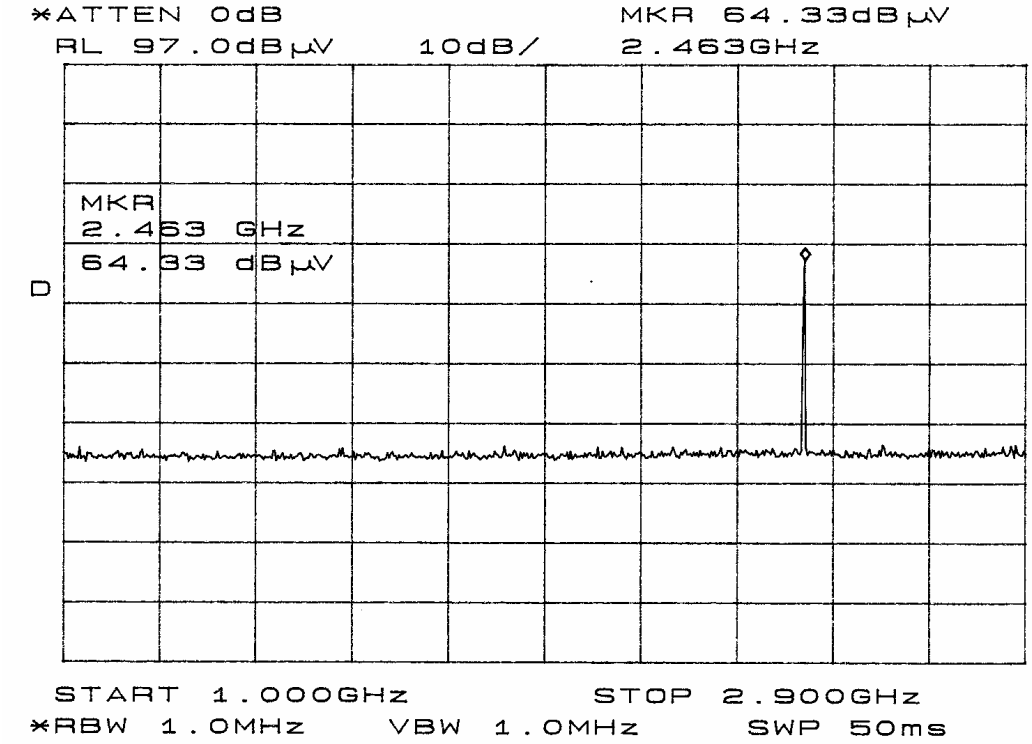


Figure three Radiated Emissions taken at 1 meter in screen room.

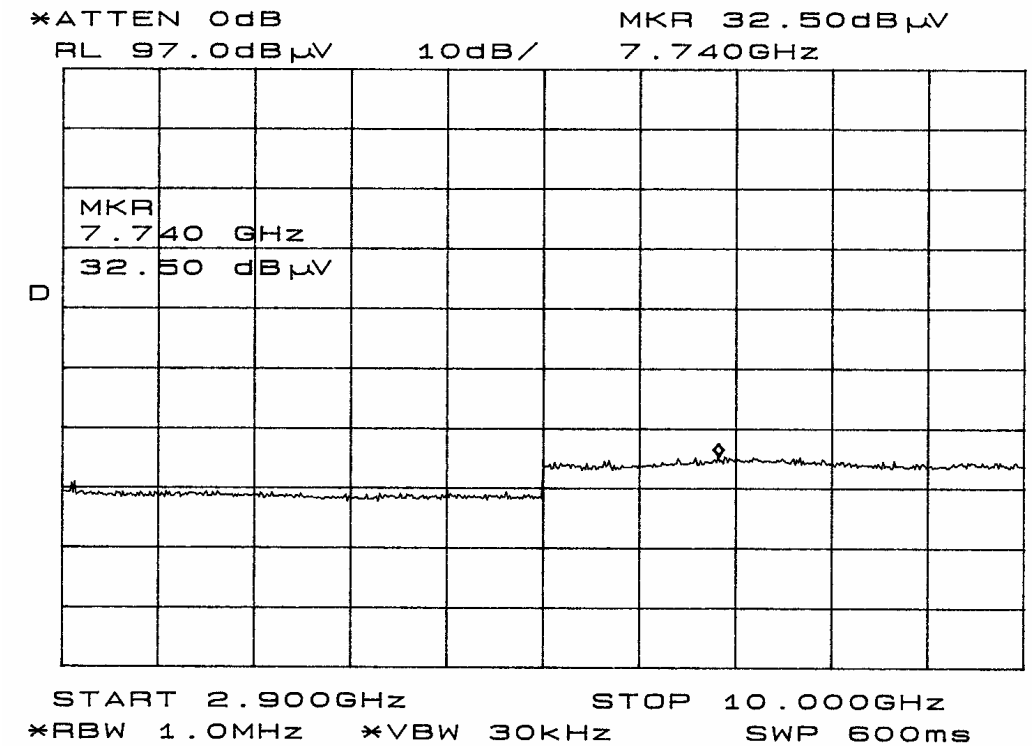


Figure four Radiated Emissions taken at 1 meter in screen room.

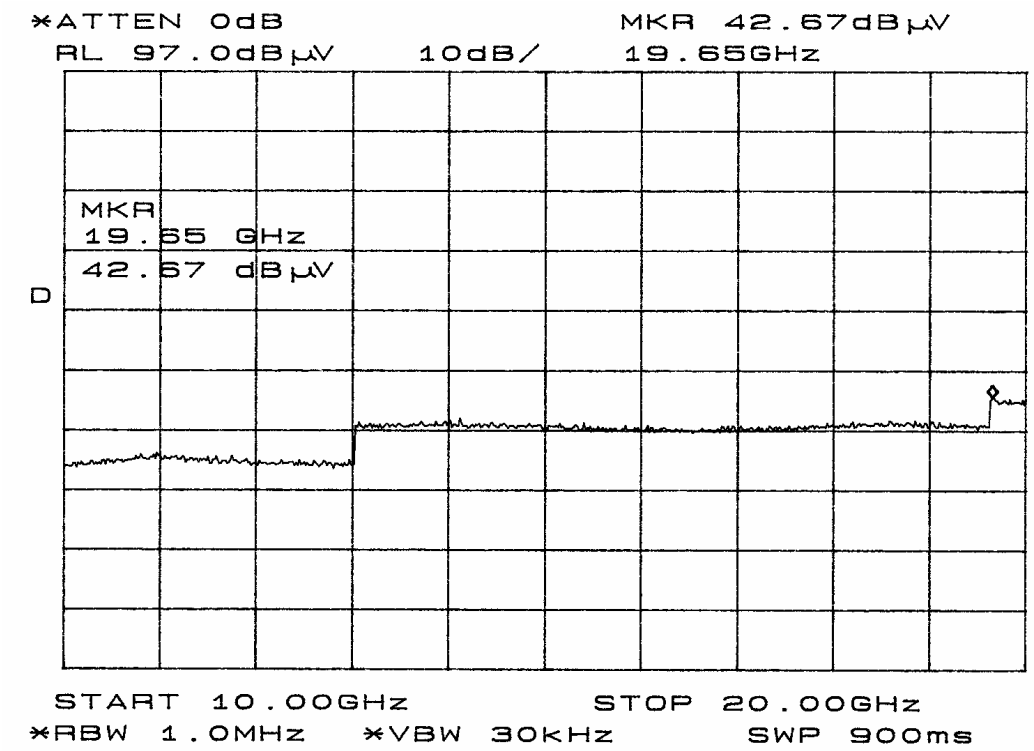


Figure five Radiated Emissions taken at 1 meter in screen room.

Sample Calculations:

RFS = Radiated Field Strength
dBµV/m @ 3m = dBµV + A.F. - Amplifier Gain
dBµV/m @ 3m = 26.8 + 18.6 - 30
= 15.4

General Radiated Emissions Data 15.209

Radiated (6 Highest Emissions) 15.209

Emission Freq. (MHz)	FSM Horz. (dBµV)	FSM Vert. (dBµV)	Ant. Factor (dB)	Amp. Gain (dB)	RFS Horz. @ 3m (dBµV/m)	RFS Vert. @ 3m (dBµV/m)	Limit @ 3m (dBµV/m)
614.3	26.8	27.3	18.6	30	15.4	15.9	46.0
1228.4	16.5	16.3	22.8	30	9.3	9.1	54.0
1842.8	14.3	14.1	28.9	30	13.2	13.0	54.0
3685.4	16.3	16.6	36.8	30	23.1	23.4	54.0
4914.0	17.6	14.3	32.9	30	20.5	17.2	54.0
12285.0	18.5	17.8	40.0	30	28.5	27.8	54.0

Other emissions were present with amplitudes at least 20 dB below limits.

Summary of Results for General Radiated Emissions 15.209

The radiated emissions for the EUT meet the requirements for FCC Part 15C Intentional Radiators. The EUT had a 25.5 dB minimum margin below the limits. Other emissions were present with amplitudes at least 20 dB below the FCC Limits.

15.249 Operation in the Band 2,400-2,483.5 MHz

The power output was measured on an open field test site @ 3 meters.

(a) 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.

(b) Emissions radiated outside of the specified bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in 15.209, whichever is the lesser attenuation. Refer to figures six through eight showing the radiated emission spectrum displayed on the spectrum analyzer taken in a screen room. 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 Pyramidal Horn Antennas from 4 GHz to 25 GHz. Emissions were measured in dBµV/m @ 3 meters.

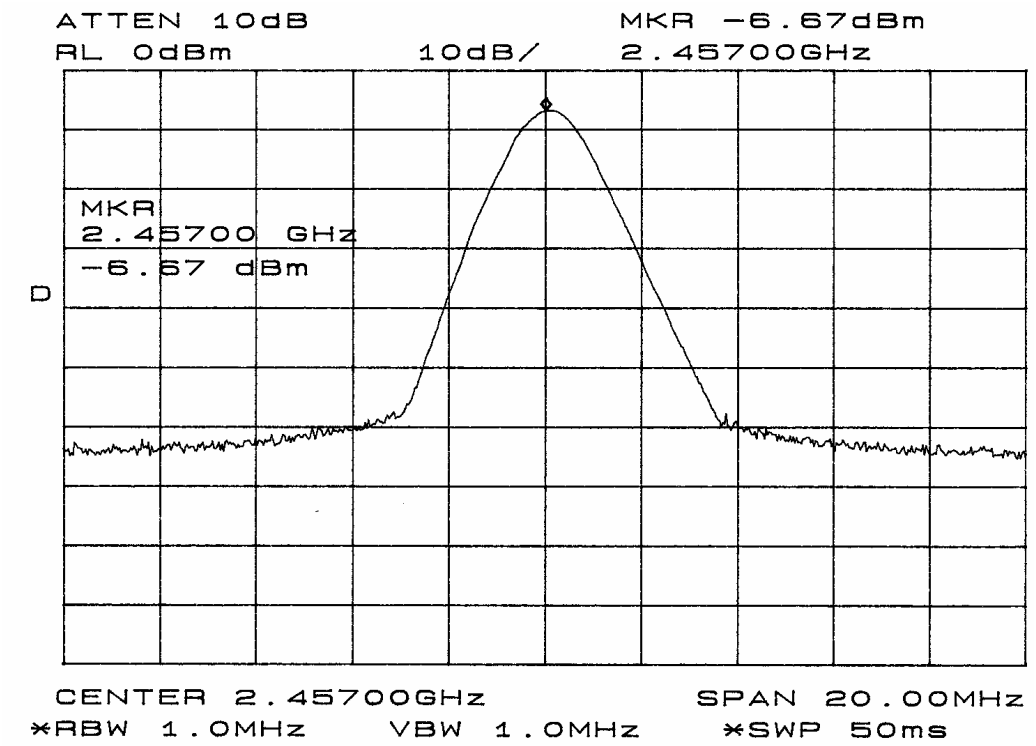


Figure six Power output measured at temporary antenna terminal.

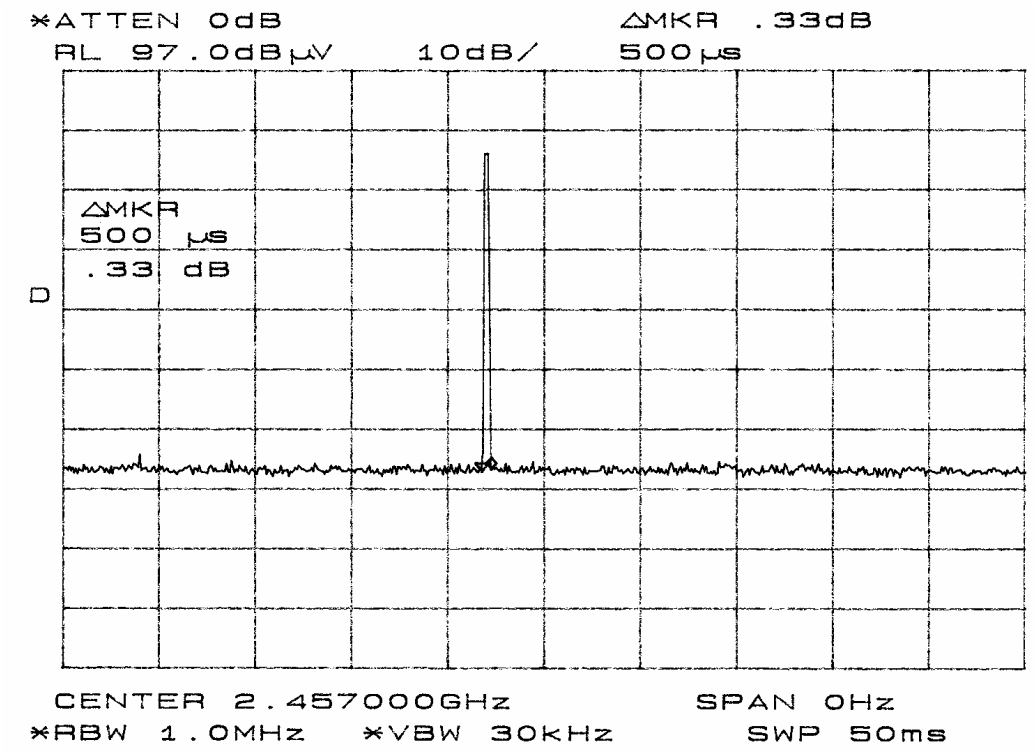


Figure seven Dwell Time of Occupancy.

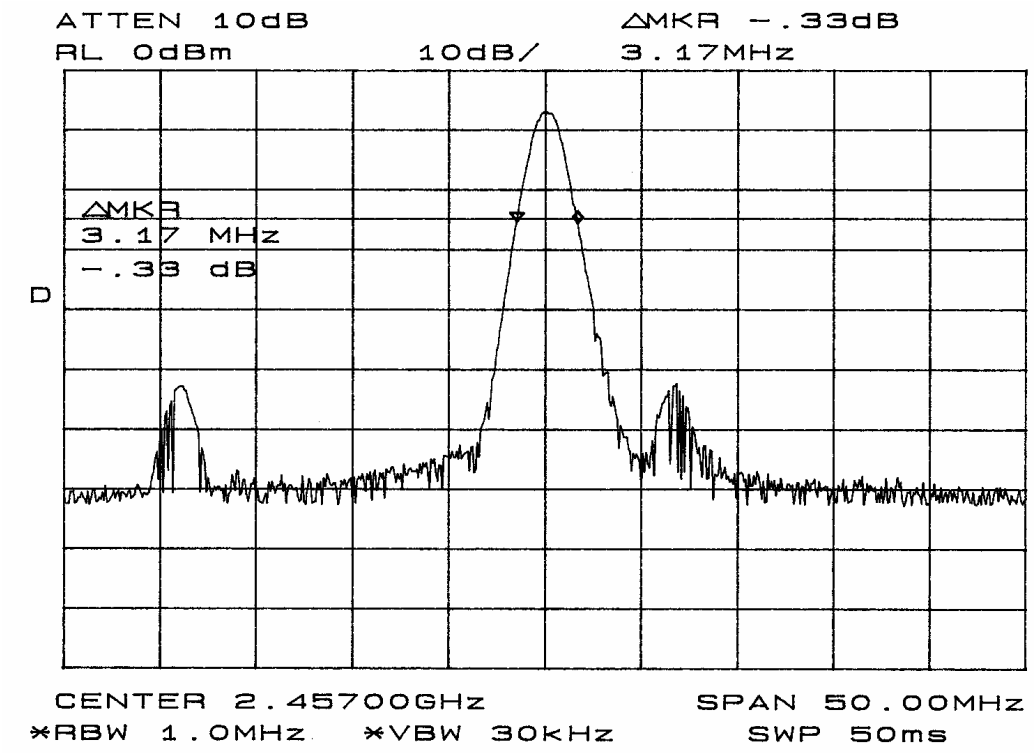


Figure eight Occupied bandwidth.

Sample calculation.

dBµv/m@ 3m = FSM + A.F.- cable loss - amplifier Gain
= 84.5 + 27.0 – 2.5 – 32.5
= 87.2

Data: Transmitter Radiated Emissions from EUT

Emission Frequency (MHz) (polarization)	FSM Peak (dBµV)	FSM Average (dBµV)	Ant. Factor (dB)	Amp. Gain (dB)	RFS Peak @ 3m (dBµV/m)	RFS Average @ 3m (dBµV/m)	Limit @ 3m (ave) (dBµV/m)
2457.0(H)	84.5	27.0	32.7	30	87.2	29.7	94.0
2457.0(V)	74.5	26.3	32.7	30	77.2	29.0	94.0
4914.0(H)	28.5	17.6	32.9	30	31.4	20.5	54.0
4914.0(V)	24.0	14.3	32.9	30	26.9	17.2	54.0
7371.0(H)	27.0	18.0	36.7	30	33.7	24.7	54.0
7371.0(V)	27.1	15.6	36.7	30	33.8	22.3	54.0
9828.0(H)	26.8	17.0	38.1	30	34.9	25.1	54.0
9828.0(V)	26.8	16.8	38.1	30	34.9	24.9	54.0
12285.0(H)	27.3	18.5	40.0	30	37.3	28.5	54.0
12285.0(V)	27.6	17.8	40.0	30	37.6	27.8	54.0

Note: Levels measured @ 3-meter OATS site.

Data: Antenna Substitution Method for 15.249

Frequency of Emission	**Measured Amplitude of EUT emission**		**Signal level to substitution antenna required to reproduce**	
	Horizontal	**Vertical**	**Horizontal**	**Vertical**
(MHz)	**dBm**	**dBm**	**dBm**	**dBm**
2457.0	-22.5	-29.8	-7.0	-15.6

TRANSMITTER EMISSIONS SUMMARY OF RESULTS

Summary of Results for Transmitter Radiated Emissions 15.249

The EUT had a peak amplitude emission of 6.8 dB margin below the average limit of 15.249. The EUT had an average amplitude emission of 64.3 dB margin below the average limit of 15.249. The radiated emissions for the EUT meet the requirements for FCC CFR 47 Part 15.249 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 20 dB below the FCC Limits.

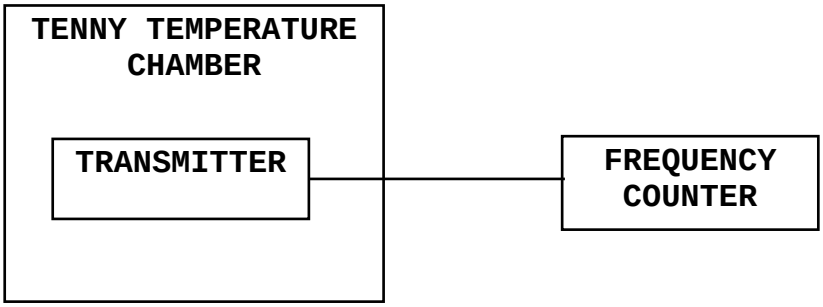
Frequency Stability

Measurements Required

Temperature stability was measured for the operating temperature range and voltage variations of the unit and recorded.

(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.
(2) For hand carried, batteries powered equipment, reduce primary supply voltage to the battery-operating end-point, which shall be specified by the manufacturer.
(3) The supply voltage shall be measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided.

Test Arrangement



The measurement procedure outlined below shall be followed:

Step 1: The transmitter shall be installed in an environmental test chamber whose temperature is controllable. Provision shall be made to measure the frequency of the transmitter.

Step 2: With the transmitter inoperative (power switched "OFF"), the temperature of the test chamber shall be adjusted to +25°C. After a temperature stabilization period of one hour at +25°C, the transmitter shall be switched "ON" with standard test voltage applied.

Step 3: The carrier shall be keyed "ON", and the transmitter shall be operated unmodulated at full radio frequency power output at the duty cycle for which it is rated, for duration of at least 5 minutes. The radio frequency carrier frequency shall be monitored and measurements shall be recorded.

Step 4: The test procedures outlined in Steps 2 and 3, shall be repeated after stabilizing the transmitter at the environmental temperatures specified.

The frequency stability was measured with variations in the power supply voltage from 85 to 115 percent of the nominal value. A Sorenson DC Power Source was used to vary the dc voltage for the

power input from 2.55 Vdc to 3.45 Vdc. The frequency was measured and the variation in parts per million was calculated.

Results

Nominal frequency 2,457.000 MHz	FREQUENCY STABILITY VS TEMPERATURE IN PARTS PER MILLION (PPM) and percent								
	Temperature in °C								
	-30	-20	-10	0	+10	+20	+30	+40	+50
Change (Hz)	23000	16600	11300	1300	-2000	-700	300	1000	5000
PPM	9.3	6.7	4.6	0.5	-0.8	-0.3	0.1	0.4	2.0
%	0.0009	0.0007	0.0005	0.00005	-0.00008	-0.00003	0.00001	0.00004	0.0002

FREQUENCY IN MHz	STABILITY VS VOLTAGE VARIATION ±15% IN PPM INPUT VOLTAGE		
	2.55 V_{dc}	3.0 V_{dc}	3.45 V_{dc}
2457.000	0	0	0

Specifications of Paragraphs 15.249 are met. There are no deviations to the specifications.

Summary of Results for Frequency Stability

The EUT fulfills the requirements for FCC Part 15C Intentional Radiators frequency stability. The EUT had a 0.0009% worst-case stability at -30 degrees centigrade.

Statement of Modifications and Deviations

No modifications to the EUT were required for the unit to meet the FCC CFR 47 Parts 15B & 15C, Class B Emissions Standards. There were no deviations to the specifications.

APPENDIX

Model: GSC10

1. Test Equipment List.
2. Rogers Qualifications.
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.

List of Test Equipment:	Calibration Date:
Scope: Tektronix 2230	2/05
Wattmeter: Bird 43 with Load Bird 8085	2/05
Power Supplies: Sorensen SRL 20-25, SRL 40-25, DCR 150, DCR 140	2/05
H/V Power Supply: Fluke Model: 408B (SN: 573)	2/05
R.F. Generator: HP 606A	2/05
R.F. Generator: HP 8614A	2/05
R.F. Generator: HP 8640B	2/05
Spectrum Analyzer: HP 8562A, Mixers: 11517A, 11970A, 11970K, 11970U, 11970V, 11970W HP Adapters: 11518, 11519, 11520	2/05
Spectrum Analyzer: HP 8591 EM	5/05
Frequency Counter: Leader LDC 825	2/05
Antenna: EMCO Biconilog Model: 3143	5/05
Antenna: EMCO Log Periodic Model: 3147	10/05
Antenna: Antenna Research Biconical Model: BCD 235	10/05
Antenna: EMCO Dipole Set 3121C	2/05
Antenna: C.D. B-101	2/05
Antenna: Solar 9229-1 & 9230-1	2/05
Antenna: EMCO 6509	2/05
Audio Oscillator: H.P. 201CD	2/05
R.F. Power Amp 65W Model: 470-A-1010	2/05
R.F. Power Amp 50W M185- 10-501	2/05
R.F. PreAmp CPPA-102	2/05
LISN 50 µHy/50 ohm/0.1 µf	10/05
LISN Compliance Eng. 240/20	2/05
LISN Fischer Custom Communications FCC-LISN-50-16-2-08	6/05
Peavey Power Amp Model: IPS 801	2/05
Power Amp A.R. Model: 10W 1010M7	2/05
Power Amp EIN Model: A301	2/05
ELGAR Model: 1751	2/05
ELGAR Model: TG 704A-3D	2/05
ESD Test Set 2010i	2/05
Fast Transient Burst Generator Model: EFT/B-101	2/05
Current Probe: Singer CP-105	2/05
Current Probe: Solar 9108-1N	2/05
Field Intensity Meter: EFM-018	2/05
KEYTEK Ecat Surge Generator	2/05
Shielded Room 5 M x 3 M x 3.0 M (101 dB Integrity)	

10/20/2005

QUALIFICATIONS

Of

SCOT D. ROGERS, ENGINEER

ROGERS LABS, INC.

Mr. Rogers has approximately 17 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

October 26, 2005
Date

1/11/03

FEDERAL COMMUNICATIONS COMMISSION

Laboratory Division
7435 Oakland Mills Road
Columbia, MD 21046

August 15, 2003

Registration Number: 90910

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

Attention: Scot Rogers

Re: Measurement facility located at Louisburg
3 & 10 meter site
Date of Renewal: August 15, 2003

Dear Sir or Madam:

Your request for renewal of the registration of the subject measurement facility has been received. The information submitted has been placed in your file and the registration has been renewed. The name of your organization will remain on the list of facilities whose measurement data will be accepted in conjunction with applications for Certification under Parts 15 or 18 of the Commission's Rules. Please note that the file must be updated for any changes made to the facility and the registration must be renewed at least every three years.

Measurement facilities that have indicated that they are available to the public to perform measurement services on a fee basis may be found on the FCC website www.fcc.gov under E-Filing, OET Equipment Authorization Electronic Filing, Test Firms.

Sincerely,

Ms. Phyllis Parrish
Information Technician