

REPORT OF MEASUREMENTS
PART 15C - INTENTIONAL RADIATOR

DEVICE: LOW POWER TRANSMITTER
MODEL: G5R
MANUFACTURER: ITRON, INC.
ADDRESS: 2818 NORTH SULLIVAN ROAD
PO BOX 15288
SPOKANE WA 99215

THE DATA CONTAINED IN THIS REPORT WAS
COLLECTED ON 24 JULY 2000 AND COMPILED BY:

PAUL G. SLAVENS
CHIEF EMC ENGINEER

WORK ORDER: 2265

1. GENERAL.....	3
1.1 PURPOSE.....	3
1.2 MANUFACTURER.....	3
1.3 TEST LOCATION	3
1.4 TEST PERSONNEL.....	3
2. TEST RESULTS SUMMARY.....	4
3. DESCRIPTION OF EQUIPMENT AND PERIPHERALS.....	5
3.1 EQUIPMENT UNDER TEST (EUT)	5
3.2 EUT PERIPHERALS FOR EMISSIONS	5
3.3 DESCRIPTION OF INTERFACE CABLES FOR EMISSIONS	5
3.4 MODE OF OPERATION DURING TESTING.....	5
3.5 MODIFICATIONS REQUIRED FOR COMPLIANCE.....	5
4. ANTENNA REQUIREMENT	6
4.1 REGULATION.....	6
4.2 RESULT	6
5. CONDUCTED EMISSIONS TESTS.....	7
5.1 PURPOSE.....	7
5.2 TEST PROCEDURES.....	7
5.3 TEST RESULTS.....	7
6. PERIODIC OPERATION.....	8
6.1 REGULATION.....	8
6.2 RESULT	8
7. INTENTIONAL RADIATORS NOT MEETING SECTION 15.231(A)	9
7.1 REGULATION.....	9
7.2 RESULT	9
8. RADIATED SPURIOUS EMISSIONS.....	10
8.1 REGULATION.....	10
8.2 TEST EQUIPMENT.....	11
8.3 TEST PROCEDURES.....	12
8.4 TEST RESULTS.....	13
9. 20 DB BANDWIDTH.....	14
9.1 REGULATION.....	14
9.2 TEST EQUIPMENT.....	14
9.3 CALCULATION OF 20 DB BANDWIDTH AND RESULT.....	14
10. MISCELLANEOUS COMMENTS AND NOTES.....	15
11. LIST OF ATTACHMENTS	15

1. General

1.1 Purpose

The purpose of this report is to show compliance to the FCC regulations for unlicensed devices operating under section 15.231 of the Code of Federal Regulations title 47.

1.2 Manufacturer

Company Name: Itron, Inc.
Contact: Dave Beliveau
Street Address: 2818 North Sullivan Road
Mailing Address: PO Box 15288
City/State/Zip: Spokane WA 99215-5288
Telephone: 509 924-9900

1.3 Test location

Company: Acme Testing Inc.
Street Address: 2002 Valley Highway
Mailing Address: PO Box 3
City/State/Zip: Acme WA 98220-0003
Laboratory: Test Site 2
Telephone: 888 226-3837
Fax: 360 595-2722
E-mail: acmetest@acmetesting.com
Web: www.acmetesting.com
Receipt of EUT: 24 July 2000

1.4 Test Personnel

Paul G. Slavens

2. Test Results Summary

Summary of Test Results
Low Power Transmitter, model G5R

Requirement	CFR Section	Test Result
Antenna Requirement	15.203	**
Conducted Emissions < 48.0 dBuV	15.207	*
Field Strength Limits	15.231(b & e)	Pass
20 dB Bandwidth	15.231(c)	Pass
Periodic Operation Characteristics	15.231(e)	**

* Not required, the EUT is battery powered.

** No judgment offered.

The signed original of this report, supplied to the client, represents the only “official” copy. Retention of any additional copies (electronic or non-electronic media) is at Acme Testing’s discretion to meet internal requirements only. The client has made the determination that EUT Condition, Characterization, and Mode of Operation are representative of production units, and meet the requirements of the specifications referenced herein.

Consistent with Industry practice, measurement and test equipment not directly involved in obtaining measurement results but having an impact on measurements (such as cable loss, antenna factors, etc.) are factored into the “Correction Factor” documented in certain test results. Instrumentation employed for testing meets tolerances consistent with known Industry Standards and Regulations.

The measurements contained in this report were made in accordance with the procedure ANSI C63.4 - 1992 and all applicable Public Notices received prior to the date of testing. All emissions from the device were found to be within the limits outlined in this report. Acme Testing assumes responsibility only for the accuracy and completeness of this data as it pertains to the sample tested.

Paul G. Slavens
Chief EMC Engineer

Date of Issuance

3. Description of Equipment and Peripherals

3.1 Equipment Under Test (EUT)

Device: Low Power Transmitter
Model Number: G5R
Serial Number: 352900
FCC ID: None
Power: Battery
Grounding: None
Antenna Distance: 3 meters
Size of EUT: 22.5 cm x 10 cm x 5 cm

3.2 EUT Peripherals for Emissions

Device	Manufacturer	Model Number	FCC ID	Serial Number
Data Acquisition Module	Itron Inc.	470-0113-003	None	000519

3.3 Description of Interface Cables for Emissions

EUT/Data Acquisition Module

Shielded	Unshielded	Flat	Round	Length	Ferrite
Yes	No	No	Yes	1 m	No

ARRANGEMENT OF INTERFACE CABLES: All interface cables were positioned for worst case maximum emissions within the manner assumed to be a typical operation condition (please reference photographs).

3.4 Mode of Operation During Testing

The EUT was modified to transmit in a constantly on state.

3.5 Modifications Required for Compliance

1. None.

4. Antenna requirement

4.1 Regulation

15.203 An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of Part 15C. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

4.2 Result

The antenna uses a standard SMA connector.

5. Conducted Emissions Tests

Test Requirement: FCC CFR47, Part 15C

Test Procedure: ANSI C63.4:1992

5.1 Purpose

The purpose of this test is to evaluate the level of conducted noise the EUT imposes on the AC mains.

5.2 Test Procedures

For tabletop equipment, the EUT is placed on a 1 meter by 1.5 meters wide and 0.8 meter high nonconductive table that is placed above the groundplane. Floor standing equipment is placed directly on the groundplane. Any supplemental grounding mechanisms are connected, if appropriate. The EUT is connected to its associated peripherals, with any excess I/O cabling bundled to approximately 1 meter. The EUT is connected to a dedicated LISN and all peripherals are connected to a second separate LISN circuit. The LISNs are bonded to the groundplane.

Preview tests are performed to determine the “worst case” mode of operation. With the EUT operating in “worst case” mode, final conducted measurements are taken. Conducted measurements are made on each current carrying conductor with respect to ground.

Conducted Emissions Test Characteristics

Frequency range	0.45 MHz - 30.0 MHz
Test instrumentation resolution bandwidth	9 kHz
Lines Tested	Line 1/Line 2

5.3 Test Results

Conducted Emissions is not required, the EUT is battery powered.

6. Periodic Operation

6.1 Regulation

15.231(a) The provisions of this Section are restricted to periodic operation within the band 40.66 - 40.70 MHz and above 70 MHz. Except as shown in paragraph (e) of this Section, the intentional radiator is restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc. Radio control of toys is not permitted. Continuous transmissions, such as voice or video, and data transmissions are not permitted. The prohibition against data transmissions does not preclude the use of recognition codes. Those codes are used to identify the sensor that is activated or to identify the particular component as being part of the system.

6.2 Result

The EUT does not meet the requirements of this section, therefore, section 15.231(e) is applicable.

7. Intentional Radiators not meeting Section 15.231(a)

7.1 Regulation

15.231(e) Intentional radiators may operate at a periodic rate exceeding that specified in paragraph (a) of this section and may be employed for any type of operation, including operation prohibited in paragraph (a) of this section, provided the intentional radiator complies with the provisions of paragraphs (b) through (d) of this section, except the field strength table in paragraph (b) of this section is replaced by the following:

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emission (microvolts/meter)
40.66-40.70.....	1,000.....	100
70-130.....	500.....	50
130-174.....	500 to 1,500 \1\..	50 to 150 \1\
174-260.....	1,500.....	150
260-470.....	1,500 to 5,000 \1\	150 to 500 \1\
Above 470.....	5,000.....	500

\1\ Linear interpolations.

In addition, devices operated under the provisions of this paragraph shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

7.2 Result

The EUT does not meet the last paragraph of the above section as the length of transmission is 1.5 seconds. Please see the next section for field strength

8. Radiated Spurious Emissions

8.1 Regulation

15.231(b) In addition to the provisions of Section 15.205, the field strength of emissions from intentional radiators operated under this Section shall not exceed the following:

Table from 15.231(e)

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emission (microvolts/meter)
40.66-40.70.....	1,000.....	100
70-130.....	500.....	50
130-174.....	500 to 1,500 \1\..	50 to 150 \1\
174-260.....	1,500.....	150
260-470.....	1,500 to 5,000 \1\	150 to 500 \1\
Above 470.....	5,000.....	500

\1\ Linear interpolations.

(1) The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges.

(2) Intentional radiators operating under the provisions of this Section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector. The specific method of measurement employed shall be specified in the application for equipment authorization. If average emission measurements are employed, the provisions in Section 15.35 for averaging pulsed emissions and for limiting peak emissions apply. Further, compliance with the provisions of Section 15.205 shall be demonstrated using the measurement instrumentation specified in that section.

(3) The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in Section 15.209, whichever limit permits a higher field strength

8.2 Test Equipment

- ⇒ Spectrum Analyzer (yellow): Hewlett-Packard 8566B, Serial Number 2403A06519, Calibrated: 7 January 2000, Calibration due Date: 7 January 2001
- ⇒ RF Preselector (yellow): Hewlett-Packard 85685A, Serial Number 2926A00971, Calibrated: 17 March 2000, Calibration due Date: 17 March 2001
- ⇒ Quasi Peak Adapter (yellow): Hewlett-Packard 85650A, Serial Number 2521A-00689, Calibrated: 19 November 1999, Calibration due Date: 19 November 2000
- ⇒ Line Impedance Stabilization Network: Rhode & Schwarz ESH2-Z5, Serial Number ACMERS1, Calibrated: 1 September 1999, Calibration due Date: 01 September 2000
- ⇒ 2 GHz to 10 GHz Low Noise Preamplifier: Milliwave 593-2898, Serial Number 2494, No Calibration Required
- ⇒ Double Ridge Guide Horn Antenna: EMCO 3115, Serial Number 9807-5534, Calibrated: 30 December 1999, Calibration due Date: 30 December 2000
- ⇒ Broadband Biconical Antenna (red) (20 MHz to 200 MHz): EMCO 3110, Serial Number 1115, Calibrated: 28 December 1999, Calibration due Date: 28 December 2000
- ⇒ Broadband Log Periodic Antenna (red) (200 MHz to 1000 MHz): EMCO 3146, Serial Number 2853, Calibrated: 28 December 1999, Calibration due Date: 28 December 2000
- ⇒ EUT Turntable Position Controller: EMCO 1061-3M, Serial Number 9003-1441, No Calibration Required
- ⇒ Antenna Mast with Controller: EMCO 1051, Serial Number 9002-1457, No Calibration Required

8.3 Test Procedures

For tabletop equipment, the EUT is placed on a 1 meter by 1.5 meters wide and 0.8 meter high nonconductive table that sits on a flush mounted metal turntable. Floor standing equipment is placed directly on the flush mounted metal turntable. The EUT is connected to its associated peripherals with any excess I/O cabling bundled to approximately 1 meter.

Preview tests are performed to determine the “worst case” mode of operation. With the EUT operating in “worst case” mode, emissions from the unit are maximized by adjusting the polarization and height of the receive antenna and rotating the EUT on the turntable. Manipulating the system cables also maximizes EUT emissions.

Radiated Emissions Test Characteristics

Frequency range	30 MHz – 10,000 MHz
Test distance	3 m
Test instrumentation resolution bandwidth	120 kHz (30 MHz – 1,000 MHz) 1 MHz (1,000 MHz – 10,000 MHz)
Receive antenna scan height	1 m - 4 m
Receive antenna polarization	Vertical/Horizontal

8.4 Test Results

PRODUCT EMISSIONS
EUT LOWEST FREQUENCY
PEAK VALUES

No	EMISSION	SPEC LIMIT	MEASUREMENTS				SITE	
	FREQUENCY MHz		ABS	dLIM	MODE	POL	HGT cm	AZM deg
1	952.00	74.0	70.7	-3.3	PK	V	130	197
2	1904.00	54.0	41.5	-12.5	PK	H	171	252
3	2856.00	54.0	32.3	-21.7	PK	V	133	348
4	3808.00	54.0	26.0	-28.0	PK	V	100	0

PRODUCT EMISSIONS
EUT HIGHEST FREQUENCY
PEAK VALUES

No	EMISSION	SPEC LIMIT	MEASUREMENTS				SITE	
	FREQUENCY MHz		ABS	dLIM	MODE	POL	HGT cm	AZM deg
1	956.974	74.0	73.3	-0.7	PK	V	127	48
2	1914.00	54.0	38.3	-15.7	PK	H	177	221
3	2871.00	54.0	31.2	-22.8	PK	V	135	360
4	3828.00	54.0	21.6	-32.4	PK	V	159	0

9. 20 dB bandwidth

9.1 Regulation

15.231(c) The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

9.2 Test Equipment

- ⇒ Spectrum Analyzer (yellow): Hewlett-Packard 8566B, Serial Number 2403A06519, Calibrated: 7 January 2000, Calibration due Date: 7 January 2001
- ⇒ RF Preselector (yellow): Hewlett-Packard 85685A, Serial Number 2926A00971, Calibrated: 17 March 2000, Calibration due Date: 17 March 2001
- ⇒ Quasi Peak Adapter (yellow): Hewlett-Packard 85650A, Serial Number 2521A-00689, Calibrated: 19 November 1999, Calibration due Date: 19 November 2000

9.3 Calculation of 20 dB Bandwidth and Result

The 20 dB bandwidth limit = $0.005 * 952.0 \text{ MHz}$
4.76 MHz

The Measured 20 dB bandwidth is 35.6 kHz

This page was revised and re-issued on 4 October 2000

10. Miscellaneous Comments and Notes

1. None.

11. List of Attachments

1. 20 dB Bandwidth Plots (2).