ACME TESTING, 2002 VALLEY HWY, P.O. BOX 3, ACME, WASHINGTON 98220-0003 888 226-3837.

FCC PART 101
REPORT OF MEASUREMENTS

DEVICE: NON-BROADCAST 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 THE 24 JULY 2000 AND COMPILED BY:

PAUL G. SLAVENS
CHIEF EMC ENGINEER

WORK ORDER: 2265

1. General

1.1 Purpose

These tests were conducted on a sample of the equipment for the purpose of compliance with FCC CFR 47 Parts 2 & 101.

1.2 Manufacturer

Company Name:	Itron, Inc.
Contact:	Dave Bellevue
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, Chief EMC Engineer

2. Test Results Summary

Summary of Test Results
Non-Broadcast Transmitter, model G5R

Para. No.	Test Criteria	Status
2.985	RF Power Output	Pass
2.989	Occupied Bandwidth	Pass
2.991	Spurious Emission at Antenna Terminals	Pass
2.993	Field Strength of Spurious Radiation	Pass
2.995	Frequency Stability	Pass

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.) is 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 referenced standards and all applicable Public Notices received prior to the date of testing. 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:	Non-Broadcast Transmitter
Model Number:	G5R
Serial Number:	352900
FCC ID	EO9G5R
Emission Designator	8K85A1D
Usage	Automatic interrogation and receiving of utility meter data
Modulation	AM pseudo-sinusoidal tones
Input Power	4.2 Vdc battery pack
Output Power (Nominal):	250 mW (24 dBm)
Grounding:	None
Antennas:	Vertical sleeve dipole
Channel Spacing	12.5 kHz
Lowest Frequency:	952.006250 MHz
Highest Frequency:	956.443750 MHz

3.2 Calculation of Necessary Bandwidth

It is not possible to calculate necessary bandwidth in accordance with CFR 47 part 2 section 2.202 (c) (1), (2), or (3), therefore, per section 2.202 (c4) the actual 99 percent bandwidth was measured. The measured 99 percent bandwidth is 8.85 kHz.

3.3 EUT Peripherals

None, the EUT is a stand alone device.

3.4 Description of Interface Cables

None, the EUT is a stand alone device.

4. RF Power Output

4.1 Test Requirement

Sec. 2.1046 Measurements required: RF power output.

(a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in Sec. 2.1033(c)(8). The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.

4.2 Test Technical Standard

Sec. 101.**113** Transmitter power limitations.

(a) On any authorized frequency, the average power delivered to an antenna in this service must be the minimum amount of power necessary to carry out the communications desired. Application of this principle includes, but is not to be limited to, requiring a licensee who replaces one or more of its antennas with larger antennas to reduce its antenna input power by an amount appropriate to compensate for the increased primary lobe gain of the replacement antenna(s). In no event shall the average equivalent isotropically radiated power (EIRP), as referenced to an isotropic radiator, exceed the values specified below. In cases of harmful interference, the Commission may, after notice and opportunity for hearing, order a change in the effective radiated power of this station. Further, the output power of a transmitter on any authorized frequency in this service may not exceed the following:

Frequency Band (MHz)	Maximum allowable EIRP [1 2]	
	Fixed	Mobile
	(dBW)	(dBW)
952.0 to 960.0 [2]	+40	

2) For multiple address operations, see Sec. 101.147. Remote alarm units that are part of a multiple address central station protection system are authorized a maximum of 2 watts.

4.3 Test Procedure

TIA/EIA-603:1993 Section 2.2.1

4.4 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

4.5 Test Results

Measured RF output power = 23.9 dBm or 245.5 milliwatts

Gain of antenna 2.15 dBi or 0 dB dipole.

E.I.R.P. = 26.1 dBm

5. Occupied Bandwidth

5.1 Test Requirement

Sec. 2.1049 Measurements required: Occupied bandwidth

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured under the following conditions as applicable:

(h) Transmitters employing digital modulation techniques--when modulated by an input signal such that its amplitude and symbol rate represent the maximum rated conditions under which the equipment will be operated. The signal shall be applied through any filter networks, pseudo-random generators or other devices required in normal service. Additionally, the occupied bandwidth shall be shown for operation with any devices used for modifying the spectrum when such devices are optional at the discretion of the user.

5.2 Test Technical Standard

Sec. 101.**111 (a5)** Emission limitations

When using transmissions employing digital modulation techniques on the 900 MHz multiple address frequencies with a 12.5 KHz bandwidth, the power of any emission must be attenuated below the unmodulated carrier power of the transmitter (P) in accordance with the following schedule:

(i) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in KHz) of more than 2.5 KHz up to and including 6.25 KHz: At least 53 log (fd/2.5) decibels;

(ii) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in KHz) of more than 6.25 KHz up to and including 9.5 KHz: At least 103 log (fd/3.9) decibels;

(iii) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in KHz) of more than 9.5 KHz up to and including 15 KHz: At least 157 log (fd/5.3) decibels; and

(iv) On any frequency removed from the center of the authorized bandwidth by a displacement frequency greater than 15 KHz: At least 50 plus 10 log P or 70 decibels, whichever is the lesser attenuation.

5.3 Test Procedure

TIA/EIA-603:1993 Section 2.2.11

5.4 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

5.5 Test Results

See attached plots in the list of attachments.

6. Spurious Emission At Antenna Terminals

6.1 Test Requirement

Sec. 2.1051 Measurements required: Spurious emissions at antenna terminals

The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in Sec. 2.1049 as appropriate. The magnitude of spurious emissions, which are attenuated more than 20 dB below the permissible value, need not be specified.

6.2 Test Technical Standard

Sec. 101.**111 (a5 iv)** Emission limitations

On any frequency removed from the center of the authorized bandwidth by a displacement frequency greater than 15 KHz: At least 50 plus 10 log P or 70 decibels, whichever is the lesser attenuation.

6.3 Test Procedure

TIA/EIA-603:1993 Section 2.2.13

6.4 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

6.5 Test Results

Calculation of Limit

$10*\log_{10}$ (0.245 Watts) – (50 + $10*\log_{10}$(0.245 Watts)) = - 50 dBW or –20 dBm

Frequency (MHz)	Limit of spurious emission (dBm)	Measured spurious emission (dBm)	Delta to limit of spurious emission (dBm)
1908	-20	-43.1	-23.1
2862	-20	-55.4	-35.4
4770	-20	-35.6	-15.6

Please refer to plots in the list of attachments.

7. Field Strength of Spurious Radiation

7.1 Test Requirement

Sec. 2.**1053** Measurements required: Field strength of spurious radiation

(a) Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of Sec. 2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required, with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from halfwave dipole antennas.

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

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

7.2 Test Technical Standard

Sec. 101.**111 (a5 iv)** Emission limitations

On any frequency removed from the center of the authorized bandwidth by a displacement frequency greater than 15 KHz: At least 50 plus 10 log P or 70 decibels, whichever is the lesser attenuation.

7.3 Test Procedure

TIA/EIA-603:1993 Section 2.2.12

7.4 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

⇒ 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

7.5 Test Results

Frequency of Emissions (MHz)	Polarization H/V	Received Signal Field Strength dBµV/m @3m	Effective Radiated Power dBm	Limit Radiated Power dBm	Delta to Limit dB
1908	V	55.9	-39.3	-20.0	-19.3
4770	V	35.4	-59.8	-20.0	-39.8

CALCULATION OF RADIATED POWER LIMIT

All emissions below 1000 MHz are expressed in terms of the equivalent power that would have to be fed into a dipole antenna in order to produce the same electric field strength. All emissions above 1000 MHz are expressed in terms of equivalent isotropic power. The equivalent power was determined by using the following formula: $P_t = E^2R^2/30\ G$

Example: If the output power of the transmitter is 3 watts.

The minimum attenuation is 50 + l0 Log 3 = 54.8, so the maximum power of any spurious emission must not exceed 4.8 dBW – 54.8 dBW = - 50 dBW = - 20 dBm = 0.01 mW

Using the above relation we have E = $\sqrt{(30 * G * P)}$ /R

For emissions which are less than or equal to 1000 MHz
G =1.64 and E = $\sqrt{}$ (30 x 1.64 x 0.01 x 10^{-3}) / 3 = 7.4 mV/m
= 77.3 dBuV/m

Therefore the electric field strength of emissions must not exceed 77.3 dBuV/m at 3m.

Similarly for emissions which are greater than 1000 MHz, G=1 and the field strength must not exceed 75.2 dBµV/m at 3 m.

CALCULATION OF RADIATED POWER

All emissions below 1000 MHz are expressed in terms of the equivalent power that would have to be fed into a dipole antenna in order to produce the same electric field strength. All emissions above 1000 MHz are expressed in terms of equivalent isotropic power. The equivalent power was determined by using the following formula: $P_t = E^2R^2/30\ G$

Example:	Electric field strength is	E = 41.1 dBuV/m
	Measured at a distance of	R = 3 m
	The gain of a dipole antenna is	1.64

$P_t = [10^{(41.1/20)}\ X\ 10^{-6}]^2 \times 3^2/30 \times 1.64 = 2.36 \times 10^{-9}$ watts = -56.3 dBm

When calculating equivalent isotropic radiated power for emissions above 1000 MHz the gain is G=1.

8. Frequency Stability

8.1 Test Requirement

Sec. 2.1055 Measurements required: Frequency stability.

(a) The frequency stability shall be measured with variation of ambient temperature as follows: (1) From -30 deg. to +50 deg. centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.

(b) Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than 10 deg. centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. The short term transient effects on the frequency of the transmitter due to keying (except for broadcast transmitters) and any heating element cycling normally occurring at each ambient temperature level also shall be shown. Only the portion or portions of the transmitter containing the frequency determining and stabilizing circuitry need be subjected to the temperature variation test.

(d) The frequency stability shall be measured with variation of primary supply voltage as follows:

(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, battery 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. Effects on frequency of transmitter keying (except for broadcast transmitters) and any heating element cycling at the nominal supply voltage and at each extreme also shall be shown.

8.2 Test Technical Standard

Sec. 101.**107** (a) Frequency tolerance.

The carrier frequency of each transmitter authorized in these services must be maintained within the percentage of the reference frequency except as otherwise provided in paragraph (b) of this section or in the applicable subpart of this part (unless otherwise specified in the instrument of station authorization the reference frequency will be deemed to be the assigned frequency).

For private operational fixed point-to-point microwave systems, with a channel greater than or equal to 50 kHz bandwidth, ±0.00015%; for multiple address master stations, regardless of bandwidth, ±0.00015%; for multiple address remote stations with 12.5 kHz bandwidths, ±0.00015%; for multiple address remote stations with channels greater than 12.5 kHz bandwidth, ±0.00015%.

Limit = ±0.00015% * 954,000,000 Hz = 1431 Hz.

8.3 Test Procedure

TIA/EIA-603:1993 Section 2.2.1

8.4 Test equipment

⇒ 10 Hz - 3 GHz Frequency Counter: Optoelectronics 3000A Plus, , Calibrated: 06 June 2000, Calibration Due Date: 06 June 2001

⇒ Digital Multimeter: Fluke 73-2, Serial Number 649-81430, Calibrated: 10 January 2000, Calibration Due Date: 10 January 2001

⇒ Environmental Chamber: Tenney Environmental: Model TJR, Serial Number 25275-14, No Calibration Required

⇒ Temperature Meter: Hewlett Packard 34970A Data Acquisition Unit, Serial Number US37073006, Calibrated: 16 June 2000, Calibration due Date: 16 June 2001

8.5 Test Results

FREQUENCY ERROR AT TEMPERTURE

Time	Frequency	Frequency	Frequency	Frequency	Frequency
(Minutes)	at -30 C	at -20 C	at -10 C	at 0 C	at 10 C
0.0	954,000,013	954,000,019	954,000,012	953,999,988	953,999,997
0.5	954,000,013	954,000,019	954,000,012	953,999,988	953,999,997
1.0	954,000,011	954,000,018	954,000,010	953,999,988	953,999,996
1.5	954,000,011	954,000,018	954,000,009	953,999,988	953,999,996
2.0	954,000,011	954,000,018	954,000,009	953,999,988	953,999,997
2.5	954,000,010	954,000,017	954,000,008	953,999,988	953,999,997
3.0	954,000,010	954,000,017	954,000,007	953,999,988	953,999,997
Max Error (Hz)	13	19	12	12	4
Max Error (ppm)	0.01	0.02	0.01	0.01	0.00

Time	Frequency	Frequency	Frequency	Frequency
(Minutes)	at 20 C	at 30 C	at 40 C	at 50 C
0.0	954,000,003	953,999,996	953,999,992	953,999,988
0.5	954,000,004	953,999,997	953,999,992	953,999,987
1.0	954,000,004	953,999,995	953,999,992	953,999,987
1.5	954,000,004	953,999,995	953,999,991	953,999,988
2.0	954,000,005	953,999,995	953,999,991	953,999,988
2.5	954,000,005	953,999,995	953,999,991	953,999,988
3.0	954,000,005	953,999,996	953,999,991	953,999,987
Max Error (Hz)	5	5	9	13
Max Error (ppm)	0.01	0.01	0.01	0.01

FREQUENCY ERROR AT BATTERY END POINT

Time	Frequency
(Minutes)	at 3.3 Vdc
0.0	953,999,973
0.5	953,999,973
1.0	953,999,974
1.5	953,999,974
2.0	953,999,973
2.5	953,999,974
3.0	953,999,974
Max Error (Hz)	27
Max Error (ppm)	0.03

9. Miscellaneous Comments and Notes

1. None.

10. List of Attachments

1. Test Set Up Photos. (2)
2. Occupied Bandwidth. (1)
3. Antenna Conducted Spurious. (3)