Electrical (EMC)

DATE: 02 July 2001

I.T.L. (PRODUCT TESTING) LTD.

EMC Test

for

Nexus Data (1993) Ltd.

Equipment under test:

Industrial Gas Meter

American

Approved by: _____

I. Raz, EMC Laboratory Manager

Electrical (EMC)

Measurement/Technical Report for

Nexus Data (1993) Ltd.

Industrial Gas Meter:

American

FCC ID:NL3GA0006

02 July 2001

This report concerns: Original Grant x Class II change

Class B verification ___ Class A verification__Class I change

Equipment type: Radio Telemetry Transmitter

Request Issue of Grant:

__**x**__Immediately upon completion of review

Limits used:

CISPR 22 _____ Part 15 __x

Measurement procedure used is ANSI C63.4-1992.

Application for Certification
prepared by:

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Applicant for this device:
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1. General Information

1.1 Administrative Information

Manufacturer:	Nexus Data (1993) Ltd.
Manufacturer's Address:	16 Hamelacha St. Rosh Ha'ayin Israel 48091 Tel: +972-3-903-2288 Fax: +972-3-903-2299
Manufacturer's Representative:	Shimon Zigdon
Equipment Under Test (E.U.T):	Industrial Gas Meter
Equipment Model No.:	American
Equipment Serial No.:	Not designated
Date of Receipt of E.U.T:	06.06.01
Start of Test:	06.06.01
End of Test:	20.06.01
Test Laboratory Location:	I.T.L (Product Testing) Ltd. Kfar Bin Nun, ISRAEL 99780
Test Specifications:	See Section 2

1.2 Product Description

The device is a one-way messaging (burst) radio transmitter. It transmits 1 watt Direct Conversion, Direct sequence spread spectrum through a 0 dBi monopole antenna.

The transmitter frequency band is 903.8-926.2 MHz and channel spacing is 400 KHz; i.e. it has 58 channel. The transmitter local oscillator is synthesized using crystal oscillator reference of 15MHz. The modulation technique is SPSP Direct sequence BPSK with a chip rate of 1 Mchip/sec. The PN codes are 255 maximal length sequences.

This device measure the amount of gas that a consumer uses, and transmit the data to a workstation via base-station.

1.3 Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4:1992. Radiated testing was performed at an antenna to EUT distance of 3 meters.

1.4 Test Facility

The radiated emissions tests were performed at I.T.L.'s testing facility at Kfar Bin-Nun, Israel. This site is a FCC listed test laboratory (FCC Registration No. 90715, date of listing March 9, 2001).
I.T.L.'s EMC Laboratory is also accredited by A2LA, certificate No. 1152.01.
The other tests in this report were performed at the Nexus Data facility, Rosh Ha'ayin, Israel.

1.5 Measurement Uncertainty

Radiated Emission

The Open Site complies with the ±4 dB Normalized Site Attenuation requirements of ANSI C63.4-1992. In accordance with Paragraph 5.4.6.2 of this standard, this tolerance includes instrumentation calibration errors, measurement technique errors, and errors due to site anomalies.

2. Product Labeling

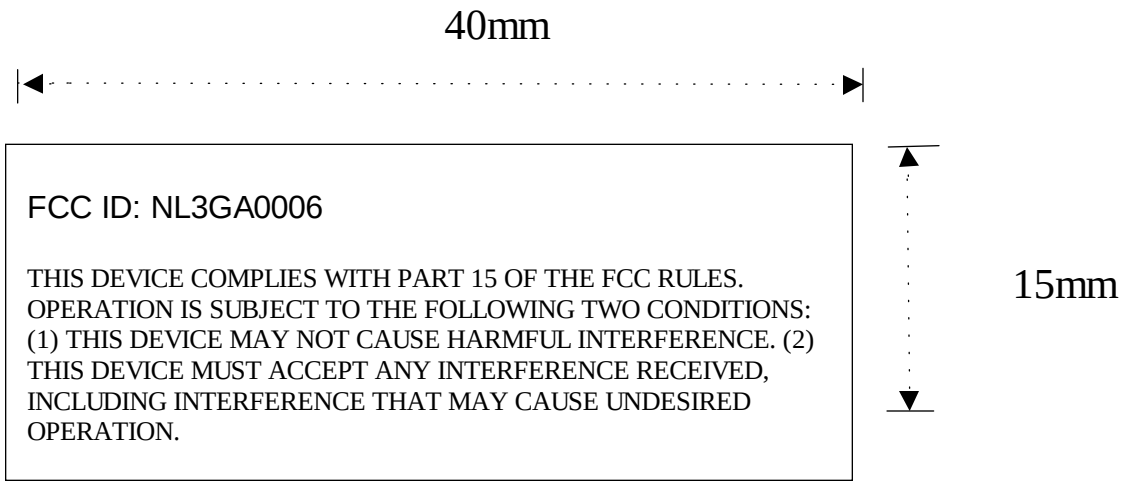


Figure 1. FCC Label

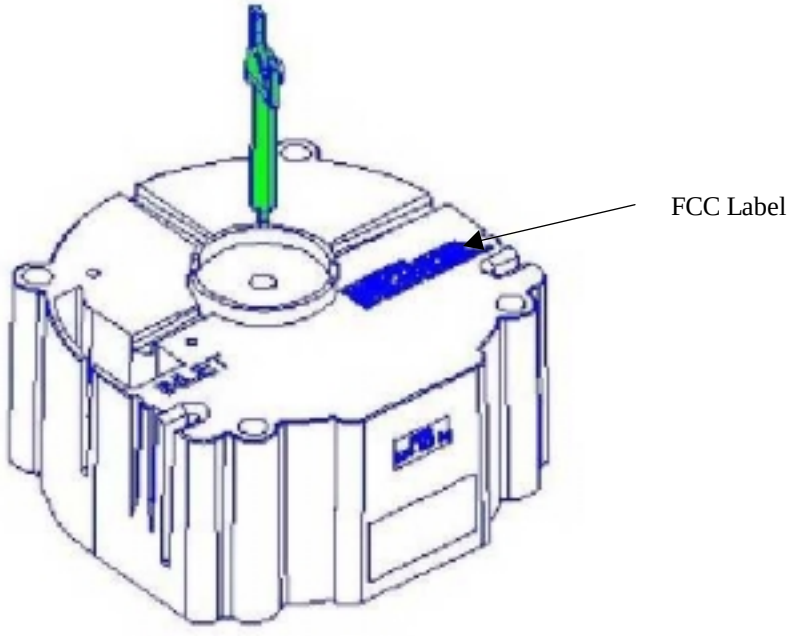


Figure 2. Location of Label on EUT

3. System Test Configuration

3.1 Justification

The E.U.T (end-unit transmitter) was configured to a frequent periodic transmission mode.

In this mode, all the sources of emissions were active. The E.U.T. output power is not programmable, and therefore it was tested when transmitting full 1watt peak output power. The E.U.T. configuration enabled investigation of emission power down, operating (housekeeping) and transmits modes.

3.2 EUT Exercise Software

The E.U.T. exercise program used in the testing procedures was the product's standard micro-controller operational firmware. The program was configured to operate the E.U.T. in 3 typical operational modes at the same time:

Only the I/O interface is under normal operating condition. The rest of the transmitter is in sleep mode.

House keeping mode in which the micro-controller wakes up in order to scan the external inputs.

Periodic transmission, in which the main micro-controller wakes up the transmitter section periodically in order to transmit a typical status message.

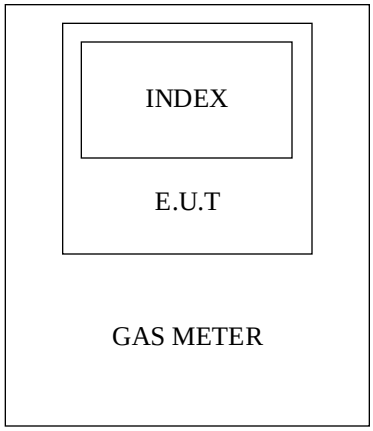
3.3 Special Accessories

No special accessories were needed to achieve compliance.

3.4 Equipment Modifications

No equipment modifications were necessary.

3.5 Configuration of Tested System



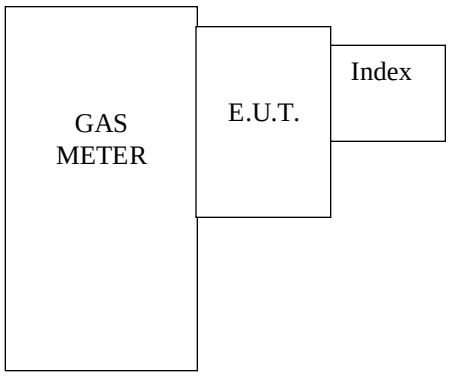


Figure 3. Configuration of Tested System

4. Block Diagram

4.1 Schematic Block/Connection Diagram

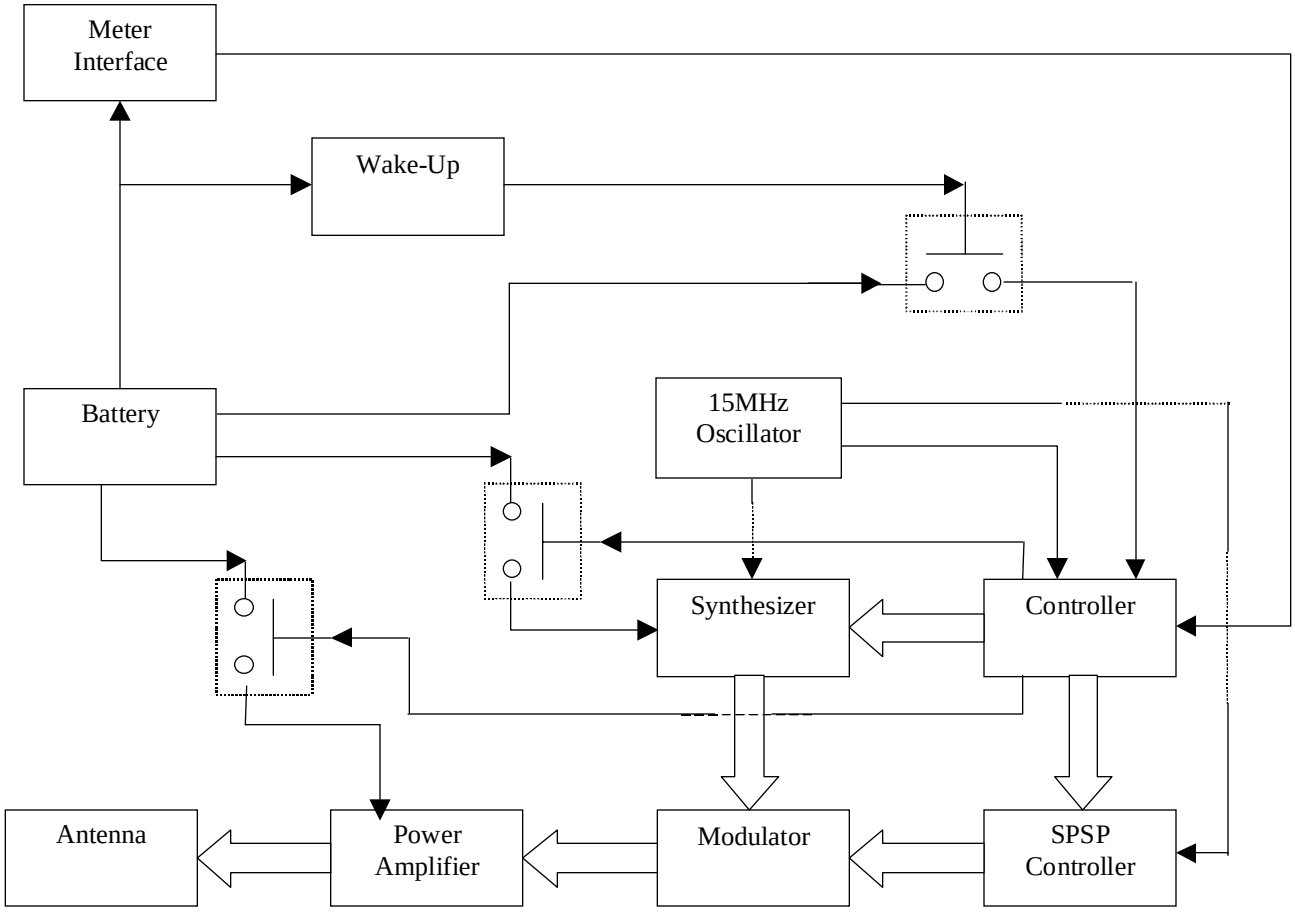


Figure 4. Block Diagram

4.2 Theory of Operation

The E.U.T receiving outputs from the gas meter and convert them into an Uplink messages. The E.U.T. transmits the Uplink messages to the base station by means of spread spectrum technology on ISM frequencies. The unit's operation is supervised and controlled by a micro-controller.

Components

IO (input/output modules)

Transmitter module which includes the following components:

Micro-controller

ASIC (application Specific Integral Circuit)

Transmitter

External memory

5. Radiated Measurement Photos

Figure 5. Radiated Emission Test. Front

Figure 6. Radiated Emission Test. Side

6. Radiated Emission, Below 1 GHz

6.1 Test Specification

30-1000 MHz, F.C.C., Part 15, Subpart C

6.2 Test Procedure

The E.U.T. operation mode and test set-up are as described in Section 3.

A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The effect of varying the position of the cables was investigated to find the configuration that produces maximum emission. The configuration tested is shown in Figure 3.1.

The frequency range 30-1000 MHz was scanned, and the list of the highest emissions was verified and updated accordingly.

The levels of the emissions within the frequency ranges of the restricted bands (Section 15.205 of FCC Part 15) were compared to the limits of the table in Section 15.209 (a), General Requirements.

The emission levels for other frequencies were compared to the fundamental carrier level and the requirement of Section 15.249 (c).

The emissions were measured using a computerized EMI receiver complying to CISPR 16 requirements. The specification limits and applicable correction factors are loaded to the receiver via a 3.5" floppy disk.

The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.

Verification of the E.U.T emissions was based on the following methods:

Turning the E.U.T on and off.
Using a frequency span less than 10 MHz.
Observation of the signal level during turntable rotation. Background noise is not affected by the rotation of the E.U.T.

6.3 Measured Data

JUDGEMENT: Passed by 0.7 dBµV/m

The EUT met the requirements of the F.C.C. Part 15, Subpart C, specification. The worst cases were:

for 903.8 MHz, 7.1 dB at 902.00 MHz frequency, vertical polarization.

for 915.0 MHz, 17.0 dB at 975.00 MHz frequency, vertical polarization

for 926.2 MHz, 0.7 dB at 928.00 MHz frequency, horizontal polarization

The details of the highest emissions are given in Figure 7 to Figure 18.

TEST PERSONNEL:

Tester Signature: _____ Date: 05.07.01

Typed/Printed Name: I. Raz

Radiated Emission

E.U.T Description Industrial Gas Meter
Type American
Serial Number: Not designated

Specification: F.C.C., Part 15, Subpart C

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 903.8 MHz
Frequency range: 30 MHz to 300 MHz
Detector: Peak, Quasi-peak

Frequency (MHz)	**Peak Amp** (dBµV/m)	**QP Amp** (dBµV/m)	**Correction** (dB)	**Specification** (dBµV/m)	**Margin** (dB)
75.16	24.3	9.7	10.3	40.0	-30.3
135.23	17.0	10.1	14.2	43.5	-33.4
150.19	19.0	26.0	15.0	43.5	-17.5
165.11	17.5	11.1	15.4	43.5	-32.4
180.01	18.4	14.4	16.1	43.5	-29.1
225.01	24.0	18.5	18.9	46.0	-27.5
240.00	25.9	20.8	19.5	46.0	-25.2

Figure 7. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Peak, Quasi-peak

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Radiated Emission

E.U.T Description	Industrial Gas Meter
Type	American
Serial Number:	Not designated

Specification: F.C.C., Part 15, Subpart C

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 903.8 MHz

Frequency range: 300 MHz to 1 GHz
Detector: Peak, Quasi-peak

Frequency (MHz)	**Peak Amp** (dBµV/m)	**QP Amp** (dBµV/m)	**Correction** (dB)	**Specification** (dBµV/m)	**Margin** (dB µV/m)
405.00	19.8	14.8	18.6	46.0 *	-31.2
902.00	84.5	79.3	27.1	87.0**	-7.7
903.80	110.5	107.0	27.2	N/A ***	
928.00	65.9	59.9	27.6	87.0**	-27.1
960.00	30.9	25.5	28.2	54.0*	-28.5
975.00	31.1	25.0	26.4	54.0*	-29.0

Figure 8. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Peak, Quasi-peak

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

*Note: It is the specified limit for QP detector at 3m distance for Frequency Restricted Band according to FCC Part15, Subpart C.

**Note: The limit for field strength outside of Frequency Restricted Band is at least 20 dB below the field strength at the operating frequency 903.8 MHz. The limit is 87.0 dBµV/m.

***Note: The standard has no field limit for the operating frequency.

Radiated Emission

E.U.T Description: Industrial Gas Meter
Type: American
Serial Number: Not designated

Specification: F.C.C., Part 15, Subpart C

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 903.8 MHz

Frequency range: 30 MHz to 300 MHz
Detector: Peak, Quasi-peak

Frequency (MHz)	**Peak Amp** (dBµV/m)	**QP Amp** (dBµV/m)	**Correction** (dB)	**Specification** (dBµV/m)	**Margin** (dB)
75.15	18.8	6.8	10.3	40.0	-33.2
135.00	16.5	11.0	14.2	43.5	-32.5
165.00	19.2	13.7	15.4	43.5	-29.8
180.00	18.6	12.9	16.1	43.5	-30.6
195.00	22.0	14.2	17.1	43.5	-29.3
210.00	28.2	19.8	18.1	43.5	-23.7

Figure 9. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Peak, Quasi-peak

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Radiated Emission

E.U.T Description	Industrial Gas Meter
Type	American
Serial Number:	Not designated

Specification: F.C.C., Part 15, Subpart C

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 903.8 MHz

Frequency range: 300 MHz to 1 GHz
Detector: Peak, Quasi-peak

Frequency (MHz)	**Peak Amp** (dBµV/m)	**QP Amp** (dBµV/m)	**Correction** (dB)	**Specification** (dBµV/m)	**Margin** (dB µV/m)
405.00	26.4	20.1	18.5	46.0 *	-25.9
902.00	95.7	89.4	27.1	96.5 **	-7.1
903.80	119.1	116.5	27.2	N/A ***	
928.00	48.9	44.3	27.6	96.5 **	-52.2
960.00	38.7	30.2	28.2	54.0 *	-23.8
975.00	38.6	30.7	28.4	54.0*	-23.3

Figure 10. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Peak, Quasi-peak

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

*Note: It is the specified limit for QP detector at 3m distance for Frequency Restricted Band according to FCC Part15, Subpart C.

**Note: The limit for field strength outside of Frequency Restricted Band is at least 20 dB below the field strength at the operating frequency 903.8 MHz. The limit is 96.5 dBµV/m.

***Note: The standard has no field limit for the operating frequency.

Radiated Emission

E.U.T Description	Industrial Gas Meter
Type	American
Serial Number:	Not designated

Specification: F.C.C., Part 15, Subpart C

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 915 MHz

Frequency range: 30 MHz to 300 MHz
Detector: Peak, Quasi-peak

Frequency (MHz)	**Peak Amp** (dBµV/m)	**QP Amp** (dBµV/m)	**Correction** (dB)	**Specification** (dBµV/m)	**Margin** (dB)
75.00	27.5	8.6	10.3	40.1	-31.5
135.00	17.9	10.4	14.2	43.5	-33.1
165.00	18.9	12.0	15.4	43.5	-31.5
180.00	20.3	14.9	18.1	43.5	-28.6
195.00	22.6	17.0	17.1	43.5	-26.5
210.00	23.4	19.7	18.1	43.5	-23.8

Figure 11. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Peak, Quasi-peak

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Radiated Emission

E.U.T Description	Industrial Gas Meter
Type	American
Serial Number:	Not designated

Specification: F.C.C., Part 15, Subpart C

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 915 MHz

Frequency range: 300 MHz to 1 GHz
Detector: Peak, Quasi-peak

Frequency (MHz)	**Peak Amp** (dBµV/m)	**QP Amp** (dBµV/m)	**Correction** (dB)	**Specification** (dBµV/m)	**Margin** (dB µV/m)
405.00	22.9	14.9	18.6	46.0 *	-31.1
902.00	44.3	28.1	27.1	71.2 **	-43.1
915.00	106.1	91.2	27.4	N/A ***	
928.00	36.1	30.4	27.6	71.2 **	-40.8
960.00	32.4	25.1	28.2	54.0 *	-28.9
975.00	31.0	28.8	28.4	54.0 *	-25.2
995.00	32.8	26.3	28.8	54.0 *	-27.7

Figure 12. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Peak, Quasi-peak

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

*Note: It is the specified limit for QP detector at 3m distance for Frequency Restricted Band according to FCC Part15, Subpart C.

**Note: The limit for field strength outside of Frequency Restricted Band is at least 20 dB below the field strength at operating frequency 915.0 MHz. The limit is 71.2 dBµV/m.

***Note: The standard has no field limit for the operating frequency.

Radiated Emission

E.U.T Description Industrial Gas Meter
Type American
Serial Number: Not designated

Specification: F.C.C., Part 15, Subpart C

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 915 MHz

Frequency range: 30 MHz to 300 MHz
Detector: Peak, Quasi-peak

Frequency (MHz)	**Peak Amp** (dBµV/m)	**QP Amp** (dBµV/m)	**Correction** (dB)	**Specification** (dBµV/m)	**Margin** (dB)
75.00	36.7	16.2	10.3	40.0	-23.8
135.00	20.0	10.7	14.2	43.5	-32.8
165.00	23.5	12.8	15.4	43.5	-30.7
180.00	20.0	13.9	18.1	43.5	-29.6
195.00	23.3	13.1	17.1	43.5	-30.4
210.00	28.9	19.8	18.1	43.5	-23.7

Figure 13. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Peak, Quasi-peak

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Radiated Emission

E.U.T Description	Industrial Gas Meter
Type	American
Serial Number:	Not designated

Specification: F.C.C., Part 15, Subpart C

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 915 MHz

Frequency range: 300 MHz to 1 GHz
Detector: Peak, Quasi-peak

Frequency (MHz)	**Peak Amp** (dBµV/m)	**QP Amp** (dBµV/m)	**Correction** (dB)	**Specification** (dBµV/m)	**Margin** (dB µV/m)
405.00	23.4	16.7	18.6	46.0 *	-29.3
902.00	55.3	44.8	27.1	81.4 **	-36.6
915.00	117.9	101.4	27.4	N/A ***	
928.00	50.8	42.8	27.6	81.4 **	-38.6
960.00	40.4	25.1	28.2	54.0 *	-28.5
960.00	39.7	27.9	28.2	54.0 *	-26.1
975.00	42.0	37.0	28.4	54.0 *	-17.0
980.00	33.7	31.0	28.5	54.0 *	-23.0
994.00	32.3	30.3	28.8	54.0 *	-23.7

Figure 14. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Peak, Quasi-peak

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

*Note: It is the specified limit of field strength for QP detector at frequency restricted band at 3m distance according to FCC Part15, Subpart C.

**Note: The limit for field strength outside of Frequency Restricted Band is at least 20 dB below the field strength at operating frequency 915 MHz. The limit is 81.4 dBµV/m.

***Note: The standard has no field limit for the operating frequency.

Radiated Emission

E.U.T Description	Industrial Gas Meter
Type	American
Serial Number:	Not designated

Specification: F.C.C., Part 15, Subpart C

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 926.2 MHz

Frequency range: 30 MHz to 300 MHz
Detector: Peak, Quasi-peak

Frequency (MHz)	**Peak Amp** (dBµV/m)	**QP Amp** (dBµV/m)	**Correction** (dB)	**Specification** (dBµV/m)	**Margin** (dB)
75.00	13.3	7.5	10.3	40.0	-32.5
135.00	28.4	19.9	14.2	43.5	-23.6
165.00	17.8	11.6	15.4	43.5	-31.9
180.00	19.8	14.7	16.1	43.5	-28.8
195.00	22.0	16.5	17.1	43.5	-27.0
210.00	24.5	19.8	18.1	43.5	-23.7

Figure 15. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Peak, Quasi-peak

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Radiated Emission

E.U.T Description	Industrial Gas Meter
Type	American
Serial Number:	Not designated

Specification: F.C.C., Part 15, Subpart C

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 926.2 MHz

Frequency range: 300 MHz to 1 GHz
Detector: Peak, Quasi-peak

Frequency (MHz)	**Peak Amp** (dBµV/m)	**QP Amp** (dBµV/m)	**Correction** (dB)	**Specification** (dBµV/m)	**Margin** (dB µV/m)
405.00	26.1	26.1	18.6	46.0 *	-19.9
902.00	42.4	35.4	27.1	82.4 **	-47.0
926.20	108.3	102.4	27.6	N/A ***	
928.00	83.9	81.7	27.6	82.4 **	-0.7
960.00	32.0	28.3	28.2	54.0 *	-25.7
975.00	32.8	25.4	28.4	54.0 *	-28.6

Figure 16. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Peak, Quasi-peak

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

*Note: It is the specified limit for QP detector at 3m distance for Frequency Restricted Band according to FCC Part15, Subpart C.

**Note: The limit of field strength outside of Frequency Restricted Band is at least 20 dB below the field strength at operating frequency 926.2 MHz. The limit is 82.4 dBµV/m.

***Note: The standard has no field limit for the operating frequency.

Radiated Emission

E.U.T Description Industrial Gas Meter
Type American
Serial Number: Not designated

Specification: F.C.C., Part 15, Subpart C

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 926.2 MHz

Frequency range: 30 MHz to 300 MHz
Detector: Peak, Quasi-peak

Frequency (MHz)	**Peak Amp** (dBµV/m)	**QP Amp** (dBµV/m)	**Correction** (dB)	**Specification** (dBµV/m)	**Margin** (dB)
75.15	17.6	7.1	10.3	40.0	-32.9
135.00	16.2	11.1	14.2	43.5	-32.4
165.00	18.8	14.1	15.4	43.5	-29.4
180.00	20.3	13.4	16.1	43.5	-30.1
195.00	20.7	13.6	17.1	43.5	-29.9
210.00	27.5	22.0	18.1	43.5	-21.5

Figure 17. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Peak, Quasi-peak

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Radiated Emission

E.U.T Description	Industrial Gas Meter
Type	American
Serial Number:	Not designated

Specification: F.C.C., Part 15, Subpart C

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 926.2 MHz

Frequency range: 300 MHz to 1 GHz
Detector: Peak, Quasi-peak

Frequency (MHz)	**Peak Amp** (dBµV/m)	**QP Amp** (dBµV/m)	**Correction** (dB)	**Specification** (dBµV/m)	**Margin** (dB µV/m)
405.00	25.1	16.8	18.6	46.0 *	-29.2
405.00	28.1	22.1	18.6	46.0 *	-23.9
902.00	48.6	44.3	27.1	96.0 **	-51.7
926.20	115.9	116.0	27.6	N/A ***	
928.00	95.9	92.2	27.6	96.0 **	-3.8
960.00	31.3	29.0	28.2	54.0 *	-25.0
960.00	47.6	39.0	28.2	54.0 *	-15.0
975.00	39.5	33.6	28.4	54.0 *	-20.4
980.00	38.6	24.6	28.5	54.0 *	-29.4
995.00	37.4	26.6	28.8	54.0 *	-27.4

Figure 18. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Peak, Quasi-peak

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

*Note: It is the specified limit for QP detector at 3m distance for Frequency Restricted Band according to FCC Part15, Subpart C.

**Note: The limit for field strength outside of Frequency Restricted Band is at least 20 dB below the field strength at operating frequency 926.2 MHz. The limit is 96.0 dBµV/m.

***Note: The standard has no field limit for the operating frequency.

6.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3411A00102	November 30,2000	1 year
RF Section	HP	85420E	3427A00103	November 30,2000	1 year
Spectrum analyzer	HP	8591E	3414001226	August 8,2000	1 year
Antenna Bioconical HP	ARA	BCD 235/B	1041	April 01, 2001	1 year
Antenna –Log Periodic	ARA	LPD-2010/A	1038	March 29, 2001	1 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	ThinkJet 2225	2738508357.0	N/A	N/A

6.5 Field Strength Calculation

The field strength is calculated directly by the EMI Receiver software, and a "Correction Factors" data disk, using the following equation:

$$[dB\mu v/m]\ FS = RA + AF + CF$$

FS:	Field Strength [dBμv/m]
RA:	Receiver Amplitude [dBμv]
AF:	Receiving Antenna Correction Factor [dB/m]
CF:	Cable Attenuation Factor [dB]

No external pre-amplifiers are used.

7. Radiated Emission Above 1 GHz

7.1 Radiated Emission Above 1 GHz

The E.U.T operation mode and test set-up are as described in Section 3.

A preliminary measurement to characterize the E.U.T was performed inside the shielded room, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The effect of varying the position of the cables was investigated to find the configuration that produces maximum emission. The configuration tested is shown in Figure 3.1.

The levels of the emissions within the frequency ranges of the restricted bands (Section 15.205 of FCC Part 15) were compared to the limits of the table in Section 15.209 (a), General Requirements.

The emission levels for other frequencies were compared to the fundamental carrier level and the requirement of Section 15.249 (c).

In the frequency range 1-2.9 GHz, a computerized EMI receiver complying to CISPR 16 requirements and a High Pass Filter were used. The test distance was 3 meters.

In the frequency range 2.9-9.1 GHz, a spectrum analyzer including a low noise amplifier was used. The test distance was 3 meters. During peak measurements, the I.F. bandwidth was 1 MHz, and video bandwidth 3 MHz. During average measurements, the I.F. bandwidth was 1 MHz and video bandwidth was 100 Hz.

The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.

Verification of the E.U.T emissions was based on the following methods: turning the E.U.T on and off; using a frequency span less than 10 MHz; observation of the signal level during turntable rotation. (Background noise is not affected by the rotation of the E.U.T.)

7.2 Test Data

JUDGEMENT: Passed by 1.3 dBµV/m

The EUT met the requirements of the F.C.C. Part 15, Subpart C, specification. The worst cases were:

for 903.8 MHz, 4.3 dB at 9038.00 MHz frequency, horizontal polarization.

for 915.0 MHz, 1.3 dB at 2745.00 MHz frequency, vertical polarization

for 926.2 MHz, 3.6 dB at 2778.60 MHz frequency, vertical polarization

The details of the highest emissions are given in Figure 19 to Figure 42.

TEST PERSONNEL:

Tester Signature: _____ Date: 05.07.01

Typed/Printed Name: I. Raz

Radiated Emission Above 1 GHz

E.U.T Description	Industrial Gas Meter
Type	American
Serial Number:	Not designated

Specification: F.C.C., Part 15, Subpart C

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 903.8 MHz

Frequency range: 1 GHz to 2.9 GHz
Detector: Average

Freq. (MHz)	Avg. Amp (dBµV/m)	Correction HPF (dB)	Correction Antenna and Cable (dB)	Avg. Det. Spec. (dBµV/m)	Final Result FR(A) (dB µV/m) See Note *	Avg. Margin (dB)
1807.60	39.6	1.6	38.7	54.0	41.2	-12.8
2711.40	38.9	1.7	44.0	54.0	40.6	-13.4

Figure 19. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Average

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Note*: In the frequency range from 1 GHz to 2.9 GHz, the final result of field strength was calculated directly by the EMI Receiver HP85420E software by using disks for antenna and cable correction factors, and using the following equation:

FR(A) = AVG + HPF

Where:

FR(A) (dB µV/m) is the final result of field strength for average detector,

AVG (dB µV/m) is the average detector measurement,

HPF (dB) is the high pass filter attenuation.

Radiated Emission Above 1 GHz

E.U.T Description	Industrial Gas Meter
Type	American
Serial Number:	Not designated

Specification: F.C.C., Part 15, Subpart C

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 903.8 MHz

Frequency range: 1 GHz to 2.9 GHz
Detector: Peak

Freq. (MHz)	Peak Amp (dBµV/m)	Correction HPF (dB)	Correction Antenna and Cable (dB)	Peak Det. Spec. (dBµV/m)	Final Result FR(P) (dB µV/m) See Note *	Peak. Margin (dB)
1807.60	53.7	1.6	38.7	74.0	55.3	-18.7
2711.40	49.5	1.7	44.0	74.0	51.2	-22.8

Figure 20. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Peak

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Note *: In the frequency range from 1.0 GHz to 2.9 GHz, the final result of field strength is calculated by the EMI Receiver HP 85420E software, using disks for antenna and cable corrections factors and the following equation:

FR(P) (dBµV/m) = Peak + HPF

Where:

FR(P) is the final result of peak detector field strength,.

Peak (dBµV/m) is the peak detector measurement,

HPF is the high pass filter attenuation.

Radiated Emission Above 1 GHz

E.U.T Description	Industrial Gas Meter
Type	American
Serial Number:	Not designated

Specification: F.C.C., Part 15, Subpart C

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 903.8 MHz

Frequency range: 2.9 GHz to 9.3 GHz
Detector: Peak

Freq.	Peak Amp	Correction Factors			Peak. Specification	Peak Final Result FR (P)*	Peak. Margin
		Antenna AF	Cable CF	Preamp PF			
(MHz)	(dBµV)	(dB)	(dB)	(dB)	(dB µV/m)	(dB µV/m) See Note *	(dB)
3615.00	43.7	34.0	4.4	30.0	74.0	52.1	-21.9
4519.00	41.5	35.2	5.0	30.0	74.0	51.7	-22.3
5422.00	36.4	36.7	5.4	30.0	74.0	48.5	-25.5
8134.00	39.3	40.0	7.5	29.0	74.0	57.8	-16.2
9038.00	41.2	40.9	9.2	28.0	74.0	63.3	-10.7

Figure 21. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Peak

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Note *: In the frequency range above 2.9 GHz, the field strength was manually calculated by using the following equation:

FR(P) = Peak + AF+CF-PF

Where: FR (P) is final peak detector result.

Peak is peak detector measurement.

AF is antenna factor.

CF is cable factor.

PF is preamplifier factor.

Radiated Emission Above 1 GHz

E.U.T Description Industrial Gas Meter
Type American
Serial Number: Not designated

Specification: F.C.C., Part 15, Subpart C

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 903.8 MHz

Frequency range: 2.9 GHz to 9.3 GHz
Detector: Average

Freq.	Avg Amp	Correction Factors			AVG Specification	AVG Final Result FR (A)	AVG Margin
		Antenna AF	Cable CF	Preamp PF			
(MHz)	(dBµV)	(dB)	(dB)	(dB)	(dB µV/m)	(dB µV/m) See Note *	(dB)
3615.00	36.5	34.0	4.4	30.0	54.0	44.9	-9.1
4519.00	32.6	35.2	5.0	30.0	54.0	42.8	-11.2
5422.00	25.1	36.7	5.4	30.0	54.0	37.2	-16.8
8134.00	26.1	40.0	7.5	29.0	54.0	44.6	-9.4
9038.00	27.6	40.9	9.2	28.0	54.0	49.7	-4.3

Figure 22. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Average

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Note*: In the frequency range above 2.9 GHz, the field strength was manually calculated by using the following equation:

FR(A) = AVG + AF+CF-PF

Where: FR(A) is final average detector result.
AVG is average detector measurement.
AF is antenna factor.
CF is cable factor.
PF is preamplifier factor.

Radiated Emission Above 1 GHz

E.U.T Description	Industrial Gas Meter
Type	American
Serial Number:	Not designated

Specification: F.C.C., Part 15, Subpart C

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 903.8 MHz

Frequency range: 1 GHz to 2.9 GHz
Detector: Average

Freq. (MHz)	Avg. Amp (dBµV/m)	Correction HPF (dB)	Correction Antenna and Cable (dB)	Avg. Det. Spec. (dBµV/m)	Final Result FR(A) (dB µV/m) See Note *	Avg. Margin (dB)
1807.60	39.6	1.6	38.7	54.0	41.2	-12.8
2711.40	34.4	1.7	44.0	54.0	36.1	-17.9

Figure 23. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Average

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Note*: In the frequency range from 1 GHz to 2.9 GHz, the final result of field strength was calculated directly by the EMI Receiver HP85420E software by using disks for antenna and cable correction factors, and the following equation:

FR(A) = AVG + HPF

Where :

FR(A) (dB µV/m) is the final result of field strength for average detector

AVG (dB µV/m) is the average detector measurement

HPF (dB) is the high pass filter attenuation

Radiated Emission Above 1 GHz

E.U.T Description	Industrial Gas Meter
Type	American
Serial Number:	Not designated

Specification: F.C.C., Part 15, Subpart C

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 903.8 MHz

Frequency range: 1 GHz to 2.9 GHz
Detector: Peak

Freq. (MHz)	Peak Amp (dBµV/m)	Correction HPF (dB)	Correction Antenna and Cable (dB)	Peak. Det. Spec. (dBµV/m)	Final Result FR(P) (dB µV/m) See Note *	Peak. Margin (dB)
1807.60	53.9	1.6	38.7	74.0	55.5	-18.5
2711.40	48.5	1.7	44.0	74.0	50.2	-23.8

Figure 24. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Peak

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Note*: In the frequency range from 1.0 GHz to 2.9 GHz, the final result of field strength is calculated by the EMI Receiver HP 85420E software by using disks for antenna and cable correction factors, and the following equation:

FR(P) (dBµV/m) = Peak + HPF

Where:

FR(P) is the final result of peak detection field strength,

Peak (dBµV/m) is the peak detector measurement,

HPF is the high pass filter attenuation.

Radiated Emission Above 1 GHz

E.U.T Description	Industrial Gas Meter
Type	American
Serial Number:	Not designated

Specification: F.C.C., Part 15, Subpart C

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 903.8 MHz

Frequency range: 2.9 GHz to 9.3 GHz
Detector: Peak

Freq.	Peak Amp	Correction Factors			Peak. Specification	Peak Final Result FR (P)	Peak. Margin
		Antenna AF	Cable CF	Preamp PF			
(MHz)	(dBµV)	(dB)	(dB)	(dB)	(dB µV/m)	(dB µV/m) See Note *	(dB)
3615.00	41.5	34.0	4.4	30.0	74.0	49.9	-24.1
4519.00	42.4	35.2	5.0	30.0	74.0	52.6	-21.4
5422.00	37.8	36.7	5.4	30.0	74.0	49.9	-24.1
8134.00	41.0	40.0	7.5	29.0	74.0	59.5	-14.5
9038.00	42.0	40.9	9.2	28.0	74.0	64.1	-9.9

Figure 25. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Peak

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Note*: In the frequency range above 2.9 GHz, the field strength was manually calculated by using the following equation:

FR(P) = Peak + AF+CF-PF

Where: FR (P) is final peak detector result,
Peak is peak detector measurement,
AF is antenna factor,
CF is cable factor,
PF is preamplifier factor.

Radiated Emission Above 1 GHz

E.U.T Description	Industrial Gas Meter
Type	American
Serial Number:	Not designated

Specification: F.C.C., Part 15, Subpart C

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 903.8 MHz

Frequency range: 2.9 GHz to 9.3 GHz
Detector: Average

Freq.	Avg Amp	Correction Factors			AVG Specification	AVG Final Result FR (A)*	AVG Margin
		Antenna AF	Cable CF	Preamp PF			
(MHz)	(dBµV)	(dB)	(dB)	(dB)	(dB µV/m)	(dB µV/m) See Note *	(dB)
3615.00	31.0	34.0	4.4	30.0	54.0	39.4	-14.6
4519.00	33.8	35.2	5.0	30.0	54.0	44.0	-10.0
5422.00	23.7	36.7	5.4	30.0	54.0	35.8	-18.2
8134.00	26.7	40.0	7.5	29.0	54.0	45.2	-8.8
9038.00	26.5	40.9	9.2	28.0	54.0	48.6	-5.4

Figure 26. Radiated Emission. Antenna Polarization: VERTICAL Detector: Average

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Note*: In the frequency range above 2.9 GHz, the field strength was manually calculated by using the following equation:

FR(A) = AVG + AF+CF-PF

Where: FR(A) is average detector result,

AVG is average detector measurement,
AF is antenna factor,

CF is cable factor,

PF is preamplifier factor.

Radiated Emission Above 1 GHz

E.U.T Description	Industrial Gas Meter
Type	American
Serial Number:	Not designated

Specification: F.C.C., Part 15, Subpart C

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 915 MHz

Frequency range: 1 GHz to 2.9 GHz
Detector: Average

Freq. (MHz)	Avg. Amp (dBµV/m)	Correction HPF (dB)	Correction Antenna and Cable (dB)	Avg. Det. Spec. (dBµV/m)	Final Result FR(A) (dB µV/m) See Note *	Avg. Margin (dB)
1830.00	35.8	1.6	39.0	54.0	37.4	-16.6
2745.00	34.6	1.7	44.3	54.0	36.3	-17.7

Figure 27. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Average

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Note*: In the frequency range from 1 GHz to 2.9 GHz, the final result of field strength was calculated directly by the EMI Receiver HP85420E software, using disks for antenna and cable correction factors , and the following equation:

FR(A) = AVG + HPF

Where:

FR(A) is the final result for average detector

AVG (dB µV/m) is the average detector measurement

HPF (dB) is the high pass filter attenuation

Radiated Emission Above 1 GHz

E.U.T Description	Industrial Gas Meter
Type	American
Serial Number:	Not designated

Specification: F.C.C., Part 15, Subpart C:
Class B

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 915 MHz

Frequency range: 1 GHz to 2.9 GHz
Detector: Peak

Freq. (MHz)	Peak Amp (dBµV/m)	Correction HPF (dB)	Correction Antenna and Cable (dB)	Peak Det. Spec. (dBµV/m)	Final Result FR(P) (dB µV/m) See Note *	Peak. Margin (dB)
1830.00	51.2	1.6	39.0	74.0	52.8	-21.2
2745.00	47.5	1.7	44.3	74.0	49.2	-24.8

Figure 28. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Peak

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Note*: In the frequency range from 1.0 GHz to 2.9 GHz, the final result of field strength is calculated by the software of the EMI Receiver HP 85420E, and using the disks for antenna and cable correction factors, and the following equation:

FR(P) = Peak + HPF

Where:

FR(P) is the final result of peak detector field strength,

Peak is the peak detector measurement,

HPF is the high pass filter attenuation.

Radiated Emission Above 1 GHz

E.U.T Description	Industrial Gas Meter
Type	American
Serial Number:	Not designated

Specification: F.C.C., Part 15, Subpart C

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 915 MHz

Frequency range: 2.9 GHz to 9.3 GHz
Detector: Peak

Freq.	Peak Amp	Correction Factor			Peak. Specification	Peak Final Result FR (P)	Peak. Margin
		Antenna AF	Cable CF	Preamp PF			
(MHz)	(dBµV)	(dB)	(dB)	(dB)	(dB µV/m)	(dB µV/m) See Note *.	(dB)
3660.00	41.0	33.8	4.5	30.0	74.0	49.3	-24.7
4575.00	45.0	35.2	5.0	30.0	74.0	55.2	-18.8
5490.00	39.0	37.2	5.4	29.0	74.0	52.6	-21.4
6405.00	39.0	38.1	5.8	29.0	74.0	53.9	-20.1
7320.00	42.0	39.1	6.2	29.0	74.0	58.3	-15.7
9150.00	41.2	40.8	9.2	28.0	74.0	63.2	-10.8

Figure 29. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Peak

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Note*: In the frequency range above 2.9 GHz, the field strength was manually calculated by using the following equation:

FR(P) = Peak + AF+CF-PF

Where: FR (P) is final peak detector result,
Peak is peak detector measurement,
AF is antenna factor,
CF is cable factor,
PF is preamplifier factor.

Radiated Emission Above 1 GHz

E.U.T Description	Industrial Gas Meter
Type	American
Serial Number:	Not designated

Specification: F.C.C., Part 15, Subpart C

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 915 MHz

Frequency range: 2.9 GHz to 9.3 GHz
Detector: Average

Freq.	Avg Amp	Correction Factors			AVG Specification	AVG Final Result FR (A)	AVG Margin
		Antenna AF	Cable CF	Preamp PF			
(MHz)	(dBµV)	(dB)	(dB)	(dB)	(dB µV/m)	(dB µV/m) See Note *.	(dB)
3660.00	29.0	33.8	4.5	30.0	54.0	37.3	-16.7
4575.00	37.6	35.2	5.0	30.0	54.0	47.8	-6.2
5490.00	25.2	37.2	5.4	29.0	54.0	38.8	-15.2
6405.00	27.5	38.1	5.8	29.0	54.0	42.4	-11.6
7320.00	27.3	39.1	6.2	29.0	54.0	43.6	-10.4
9150.00	26.7	40.8	9.2	28.0	54.0	48.7	-5.3

Figure 30. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Average

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Note*: In the frequency range above 2.9 GHz, the field strength was manually calculated by using the following equation:

FR(A) = AVG + AF+CF-PF

Where: FR(A) is final average detector result,
AVG is average detector measurement,
AF is antenna factor,
CF is cable factor,
PF is preamplifier factor.

Radiated Emission Above 1 GHz

E.U.T Description	Industrial Gas Meter
Type	American
Serial Number:	Not designated

Specification: F.C.C., Part 15, Subpart C

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 915 MHz

Frequency range: 1 GHz to 2.9 GHz
Detector: Average

Freq. (MHz)	Avg. Amp (dBµV/m)	Correction HPF (dB)	Correction Antenna and Cable (dB)	Avg. Det. Spec. (dBµV/m)	Final Result FR(A) (dB µV/m) See Note *.	Avg. Margin (dB)
1830.00	41.7	1.5	39.0	54.0	43.2	-10.8
2745.00	51.0	1.7	44.3	54.0	52.7	-1.3

Figure 31. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Average

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Note*: In the frequency range from 1 GHz to 2.9 GHz, the final result of field strength was calculated directly by the EMI Receiver HP85420E software, using the disks for antenna and cable correction factors and the following equation:

FR(A) = AVG + HPF

Where :

FR(A) is the final result for average detector

AVG (dB µV/m) is the average detector measurement

HPF (dB) is the high pass filter attenuation

Radiated Emission Above 1 GHz

E.U.T Description	Industrial Gas Meter
Type	American
Serial Number:	Not designated

Specification: F.C.C., Part 15, Subpart C

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 915 MHz

Frequency range: 1 GHz to 2.9 GHz
Detector: Peak

Freq. (MHz)	Peak Amp (dBµV/m)	Correction HPF (dB)	Correction Antenna and Cable (dB)	Peak Det. Spec. (dBµV/m)	Final Result FR(P) (dB µV/m) See Note*.	Peak. Margin (dB)
1830.00	57.1	1.5	39.0	74.0	58.6	-15.4
2745.00	51.0	1.7	44.3	74.0	52.7	-21.3

Figure 32. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Peak

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Note*: In the frequency range from 1.0 GHz to 2.9 GHz, the final result of field strength is calculated directly by the EMI Receiver HP 85420E software and using disks for antenna and cables correction factors and the following equation:

FR(P) = Peak + HPF

Where:

FR(P) is the final result of peak detector field strength,

Peak (dBµV/m) is the peak detector measurement,

HPF is the high pass filter attenuation

Radiated Emission Above 1 GHz

E.U.T Description	Industrial Gas Meter
Type	American
Serial Number:	Not designated

Specification: F.C.C., Part 15, Subpart C

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 915 MHz

Frequency range: 2.9 GHz to 9.3 GHz
Detector: Peak

Freq.	Peak Amp	Correction Factor			Peak. Specification **	Peak Final Result FR (P)	Peak. Margin
		Antenna AF	Cable CF	Preamp PF			
(MHz)	(dBµV)	(dB)	(dB)	(dB)	(dB µV/m)	(dB µV/m) See Note *.	(dB)
3660.00	40.6	33.8	4.5	30.0	74.0	48.9	-25.1
4575.00	46.7	35.2	5.0	30.0	74.0	56.9	-17.1
5490.00	38.5	37.2	5.4	29.0	74.0	52.1	-21.9
6405.00	40.7	38.1	5.8	29.0	74.0	55.6	-18.4
7320.00	40.8	39.1	6.2	29.0	74.0	57.1	-16.9
9150.00	41.2	40.8	9.2	28.0	74.0	63.2	-10.8

Figure 33. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Peak

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Note*: In the frequency range above 2.9 GHz, the field strength is manually calculated by using the following equation:

FR(P) = Peak + AF+CF-PF

Where: FR (P) is final peak detector result,
Peak is peak detector measurement,
AF is antenna factor,
CF is cable factor,
PF is preamplifier factor.

Radiated Emission Above 1 GHz

E.U.T Description	Industrial Gas Meter
Type	American
Serial Number:	Not designated

Specification: F.C.C., Part 15, Subpart C

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 915 MHz

Frequency range: 2.9 GHz to 9.3 GHz
Detector: Average

Freq.	AVG Amp	Correction Factors			AVG Specification	AVG Final Result FR (A)	AVG Margin
		Antenna AF	Cable CF	Preamp PF			
(MHz)	(dBµV)	(dB)	(dB)	(dB)	(dB µV/m)	(dB µV/m) See Note*.	(dB)
3660.00	29.4	33.8	4.5	30.0	54.0	37.7	-16.3
4575.00	38.8	35.2	5.0	30.0	54.0	49.0	-5.0
5490.00	28.3	37.2	5.4	29.0	54.0	41.9	-12.1
6405.00	23.3	38.1	5.8	29.0	54.0	38.2	-15.8
7320.00	26.0	39.1	6.2	29.0	54.0	42.3	-11.7
9150.00	26.4	40.8	9.2	28.0	54.0	48.4	-5.6

Figure 34. Radiated Emission. Antenna Polarization: VERTICAL Detector: Average

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Note*: In the frequency range above 2.9 GHz, the field strength was manually calculated by using the following equation:

FR(A) = AVG + AF+CF-PF

Where: FR(A) is average detector result,
AVG is average detector measurement,
AF is antenna factor,
CF is cable factor,
PF is preamplifier factor.

Radiated Emission Above 1 GHz

E.U.T Description	Industrial Gas Meter
Type	American
Serial Number:	Not designated

Specification: F.C.C., Part 15, Subpart C

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 926.2 MHz

Frequency range: 1 GHz to 2.9 GHz
Detector: Average

Freq. (MHz)	Avg. Amp (dBµV/m)	Correction HPF (dB)	Correction Antenna and Cable (dB)	Avg. Det. Spec. (dBµV/m)	Final Result FR(A) (dB µV/m) See Note *.	Avg. Margin (dB)
1852.40	33.7	1.6	39.2	54.0	35.3	-18.7
2778.60	48.2	1.7	44.5	54.0	49.9	-4.1

Figure 35. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Average

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Note*: In the frequency range from 1 GHz to 2.9 GHz, the final result of field strength was calculated directly by the EMI Receiver HP85420E software, using disks for antenna and cable correction factors and the following equation:

FR(A) = AVG + HPF

Where:

FR(A) is the final result for average detector,

AVG (dB µV/m) is the average detector measurement,

HPF (dB) is the high pass filter attenuation.

Radiated Emission Above 1 GHz

E.U.T Description	Industrial Gas Meter
Type	American
Serial Number:	Not designated

Specification: F.C.C., Part 15, Subpart C

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 926.2 MHz

Frequency range: 1 GHz to 2.9 GHz
Detector: Peak

Freq. (MHz)	Peak Amp (dBµV/m)	Correction HPF (dB)	Correction Antenna and Cable (dB)	Peak Det. Spec. (dBµV/m).	Final Result FR(P) (dB µV/m) See Note *.	Peak. Margin (dB)
1852.40	48.8	1.6	39.2	74.0	50.4	-23.6
2778.60	48.2	1.7	44.5	74.0	49.9	-24.1

Figure 36. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Peak

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Note*: In the frequency range from 1.0 GHz to 2.9 GHz, the final result of field strength is calculated directly by the EMI Receiver HP 85420E software using disks for antenna and cable correction factors and the following equation:

FR(P) (dBµV/m) = Peak + HPF

Where:

FR(P) is the final result of peak detector field strength,

Peak (dBµV/m) is the peak detector measurement,

HPF is the high pass filter attenuation.

Radiated Emission Above 1 GHz

E.U.T Description	Industrial Gas Meter
Type	American
Serial Number:	Not designated

Specification: F.C.C., Part 15, Subpart C

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 926.2 MHz

Frequency range: 2.9 GHz to 9.3GHz
Detector: Peak

Freq.	Peak Amp	Correction Factors			Peak. Specification **	Peak Final Result FR (P)*	Peak. Margin
		Antenna AF	Cable CF	Preamp PF			
(MHz)	(dBµV)	(dB)	(dB)	(dB)	(dB µV/m)	(dB µV/m) See Note *.	(dB)
3704.00	40.0	34.0	4.4	30.0	74.0	48.4	-25.6
4631.00	44.8	35.3	5.1	30.0	74.0	55.2	-18.8
5557.00	40.0	37.4	5.5	29.0	74.0	53.9	-20.1
6483.00	42.7	38.2	5.9	29.0	74.0	57.8	-16.2
8335.00	40.7	40.2	7.6	29.0	74.0	59.5	-14.5
9262.00	41.2	40.9	9.3	28.0	74.0	63.4	-10.6

Figure 37. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Peak

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Note*: In the frequency range above 2.9 GHz, the field strength was manually calculated by using the following equation:

FR(P) = Peak + AF+CF-PF

Where: FR (P) is final peak detector result,
Peak is peak detector measurement,
AF is antenna factor,
CF is cable factor,
PF is preamplifier factor.

Radiated Emission Above 1 GHz

E.U.T Description	Industrial Gas Meter
Type	American
Serial Number:	Not designated

Specification: F.C.C., Part 15, Subpart C

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 926.2 MHz

Frequency range: 2.9 GHz to 9.3 GHz
Detector: Average

Freq.	AVG Amp	Correction Factors			AVG Specification	AVG Final Result FR (A)	AVG Margin
		Antenna AF	Cable CF	Preamp PF			
(MHz)	(dBµV)	(dB)	(dB)	(dB)	(dB µV/m)	(dB µV/m) See Note *.	(dB)
3704.00	28.5	34.0	4.4	30.0	54.0	36.9	-17.1
4631.00	36.0	35.3	5.1	30.0	54.0	46.4	-7.6
5557.00	25.0	37.4	5.5	29.0	54.0	31.3	-22.7
6483.00	24.1	38.2	5.9	29.0	54.0	39.2	-14.8
8335.00	27.0	40.2	7.6	29.0	54.0	45.8	-8.2
9262.00	28.0	40.9	9.3	28.0	54.0	50.2	-3.8

Figure 38. Radiated Emission. Antenna Polarization: AVERAGE. Detector: Peak

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Note*: In the frequency range above 2.9 GHz, the field strength was manually calculated by using the following equation:

FR(A) = AVG + AF+CF-PF

Where: FR(A) is final average detector result,
AVG is average detector measurement,
AF is antenna factor,
CF is cable factor.
PF is preamplifier factor.

Radiated Emission Above 1 GHz

E.U.T Description	Industrial Gas Meter
Type	American
Serial Number:	Not designated

Specification: F.C.C., Part 15, Subpart C

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 926.2 MHz

Frequency range: 1 GHz to 2.9 GHz
Detector: Average

Freq. (MHz)	Avg. Amp (dBµV/m)	Correction HPF (dB)	Correction Antenna and Cable (dB)	Avg. Det. Spec. (dBµV/m)	Final Result FR(A) (dB µV/m) See Note*.	Avg. Margin (dB)
1852.40	32.0	1.6	39.2	54.0	33.6	-20.4
2778.60	48.7	1.7	44.5	54.0	50.4	-3.6

Figure 39. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Average

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Note*: In the frequency range from 1 GHz to 2.9 GHz, the final result of field strength was calculated directly by the EMI Receiver HP85420E software, and using disks for antenna and cable correction factors and the following equation:

FR(A) = AVG + HPF

Where :

FR(A) (dB µV/m) is the final result for average detector,

AVG (dB µV/m) is the average detector measurement,

HPF (dB) is the high pass filter attenuation.

Radiated Emission Above 1 GHz

E.U.T Description	Industrial Gas Meter
Type	American
Serial Number:	Not designated

Specification: F.C.C., Part 15, Subpart C

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 926.2 MHz

Frequency range: 1 GHz to 2.9 GHz
Detector: Peak

Freq. (MHz)	Peak Amp (dBµV/m)	Correction HPF (dB)	Correction Antenna and Cable (dB)	Peak Spec. (dBµV/m).	Final Result FR(P) (dB µV/m) See Note *.	Peak. Margin (dB)
1852.40	46.8	1.6	39.2	74.0	48.4	-25.6
2778.60	48.7	1.7	44.5	74.0	50.4	-23.6

Figure 40. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Peak

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Note*: In the frequency range from 1.0 GHz to 2.9 GHz, the final result of field strength is calculated by the EMI Receiver HP 85420E software using disks for antenna and cable correction factors and the following equation:

FR(P) (dBµV/m) = Peak + HPF

Where:

FR(P) is the final result of peak detection field strength,

Peak (dBµV/m) is the peak detector measurement,

HPF is the high pass filter attenuation.

Radiated Emission Above 1 GHz

E.U.T Description	Industrial Gas Meter
Type	American
Serial Number:	Not designated

Specification: F.C.C., Part 15, Subpart C

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 926.2 MHz

Frequency range: 2.9 GHz to 9.3 GHz
Detector: Peak

Freq.	Peak Amp	Correction Factors			Peak. Specification	Peak Final Result FR (P)	Peak. Margin
		Antenna AF	Cable CF	Preamp PF			
(MHz)	(dBµV)	(dB)	(dB)	(dB)	(dB µV/m)	(dB µV/m) See Note *.	(dB)
3704.00	40.5	34.0	4.4	30.0	74.0	48.9	-25.1
4631.00	44.5	35.3	5.1	30.0	74.0	54.9	-19.1
5557.00	37.1	37.4	5.5	29.0	74.0	51.0	-23.0
6483.00	37.9	38.2	5.9	29.0	74.0	53.0	-21.0
8335.00	39.2	40.2	7.6	29.0	74.0	58.0	-16.0
9262.00	40.7	40.9	9.3	28.0	74.0	62.9	-11.1

Figure 41. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Peak

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Note*: In the frequency range above 2.9 GHz, the field strength was manually calculated by using the following equation:

FR(P) = Peak + AF+CF-PF

Where: FR (P) is final peak detector result,
Peak is peak detector measurement,
AF is antenna factor,
CF is cable factor,
PF is preamplifier factor.

Radiated Emission Above 1 GHz

E.U.T Description	Industrial Gas Meter
Type	American
Serial Number:	Not designated

Specification: F.C.C., Part 15, Subpart C

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 926.2 MHz

Frequency range: 2.9 GHz to 9.3 GHz
Detector: Average

Freq.	AVG Amp	Correction Factors			AVG Specification	AVG Final Result FR (A)	AVG Margin
		Antenna AF	Cable CF	Preamp PF			
(MHz)	(dBµV)	(dB)	(dB)	(dB)	(dB µV/m)	(dB µV/m) See Note*.	(dB)
3704.00	26.7	34.0	4.4	30.0	54.0	35.1	-18.9
4631.00	35.7	35.3	5.1	30.0	54.0	46.1	-7.9
5557.00	24.7	37.4	5.5	29.0	54.0	38.6	-15.4
6483.00	26.3	38.2	5.9	29.0	54.0	41.4	-12.6
8335.00	26.9	40.2	7.6	29.0	54.0	45.7	-8.3
9262.00	26.6	40.9	9.3	28.0	54.0	48.8	-5.2

Figure 42. Radiated Emission. Antenna Polarization: VERTICAL Detector: Average

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Note*: In the frequency range above 2.9 GHz, the field strength was manually calculated by using the following equation:

FR(A) = AVG + AF+CF-PF

Where: FR(A) is average detector result,

AVG is average detector measurement,
AF is antenna factor,

CF is cable factor,

PF is preamplifier factor.

7.3 Test Instrumentation Used, Radiated Measurements Above 1 GHz

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Receiver	HP	85422E	3411A00102	November 30, 2000	1 year
RF Section	HP	85420E	3427A00103	November 30, 2000	1 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001.0	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	ThinkJet2225	2738508357.0	N/A	N/A
Antenna-Log Periodic	A.H.System	SAS-200/511	253.0	January 31,2001	1 year
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	002	June 18, 2000	1 year
1 GHz High Pass Filter	Technion Haifa	915-HPF	01	May 5, 2000	1 year
Spectrum Analyzer	HP	8592L	3745A08184	August 27, 2000	1 year

8. Maximum Transmitted Peak Power Output

8.1 Test procedure

The E.U.T. antenna terminal was connected to the Spectrum Analyzer through appropriate coaxial cable. Special attention was taken to prevent Spectrum Analyzer RF input overload. The Spectrum Analyzer was set to 3 MHz resolution BW. Peak power level was measured at selected operation frequencies.

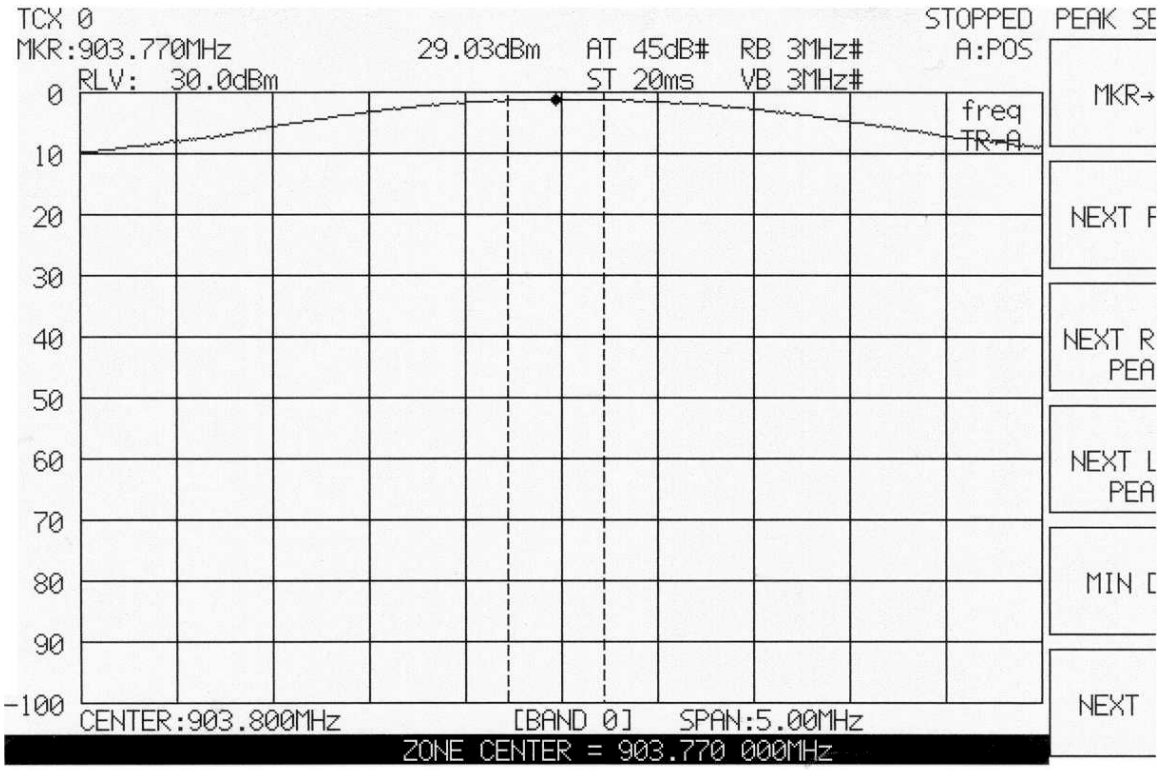


Figure 43.

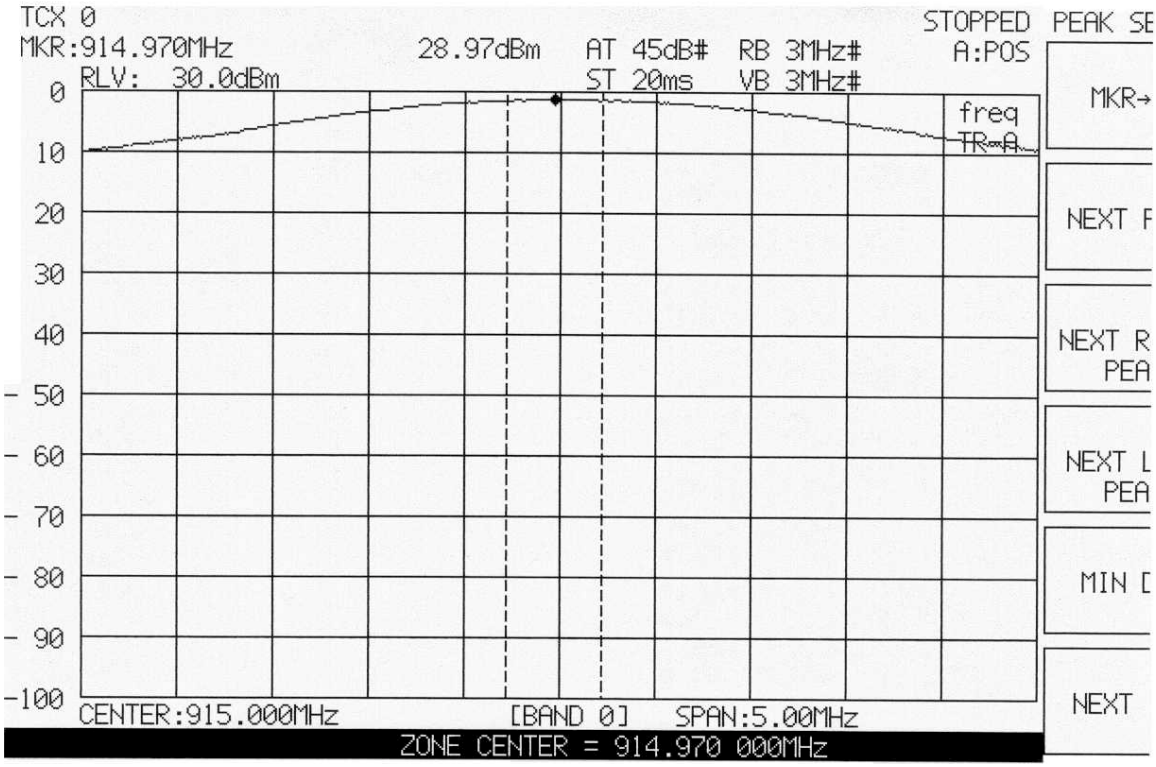


Figure 44.

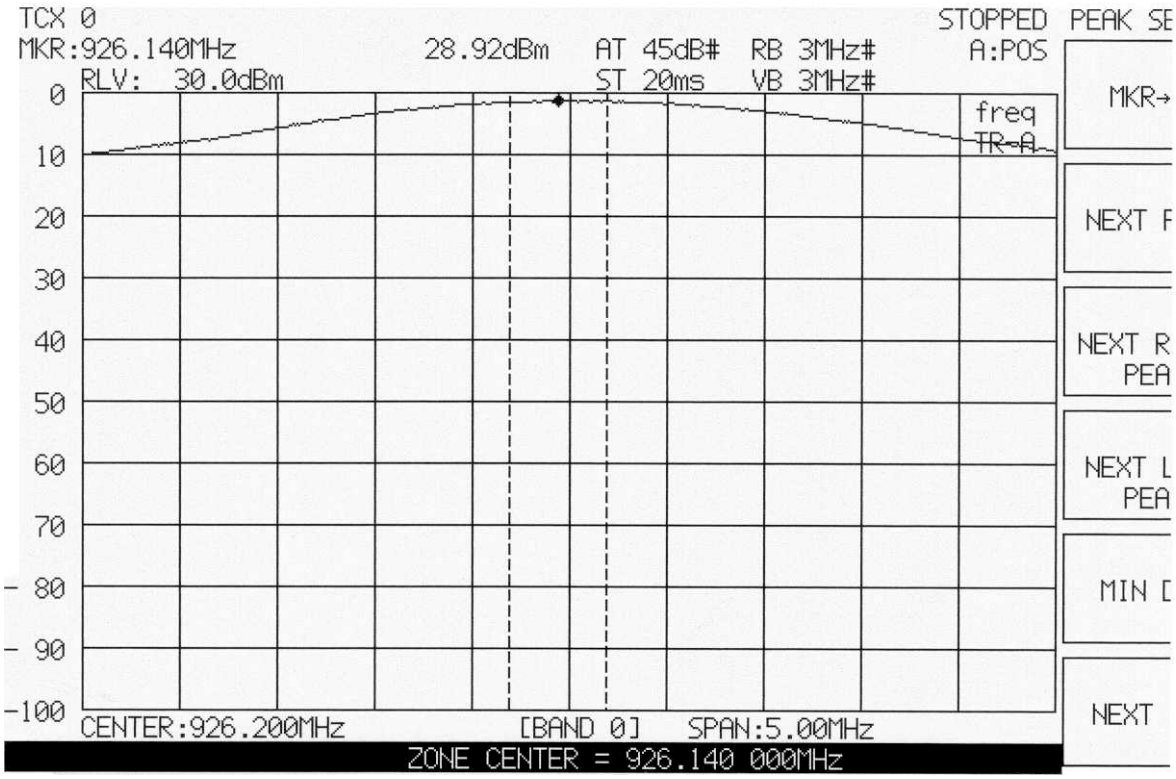


Figure 45.

8.2 Results table

E.U.T. description: Industrial Gas Meter
TYPE: American
Serial Number:
Specification: F.C.C. Part 15, Subpart C

Operation Frequency (MHz)	Reading (dBm)	Final Result (dBm)	Specification (dBm)	Margin (dB)	Cable Attenuation (dB)
903.8	29.03	29.53	30	0.47	0.5
915.0	28.97	29.47	30	0.53	0.5
926.2	28.92	29.42	30	0.58	0.5

Figure 46 Maximum Power Output

JUDGEMENT: Passed by 0.47 dB

TEST PERSONNEL:
Tester Signature: Shimon Zigdon Date: 03.07.01
Typed/Printed Name: S. Zigdon

8.3 8.3 Test Equipment Used.

Peak Power Output

Test Performed on April 17, 2001

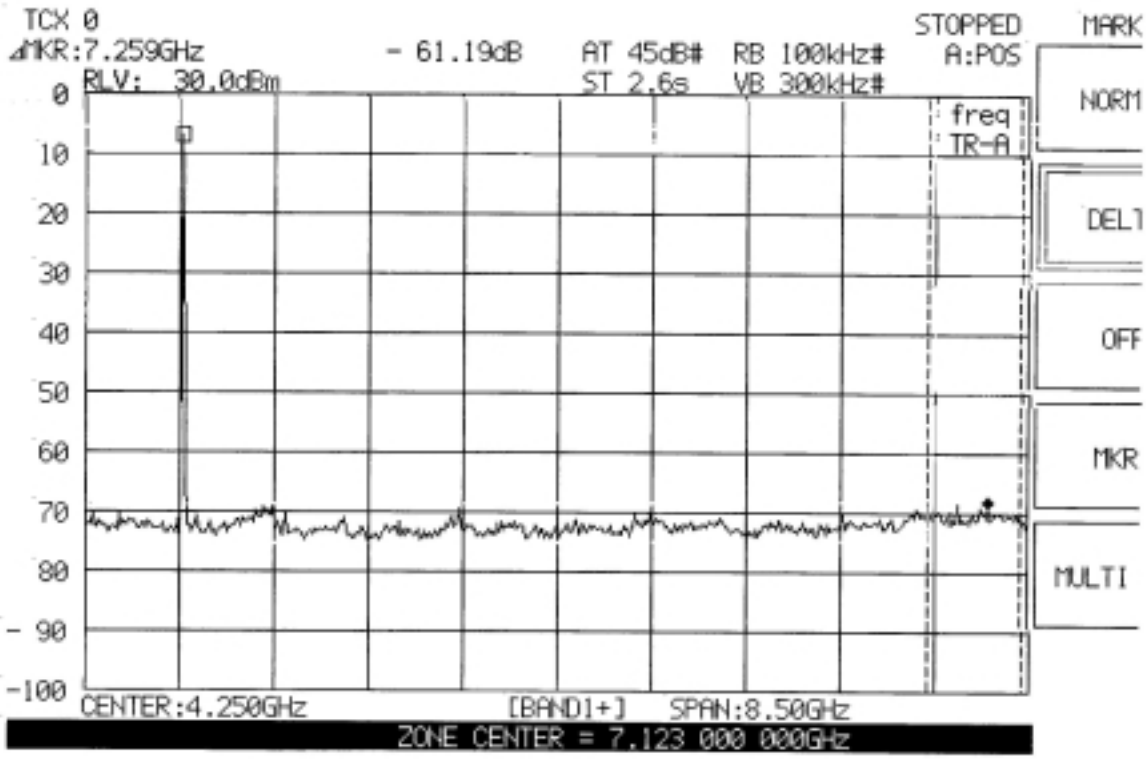
Instrument	Manufacture	Model	Serial Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	Anritzu	MS 2602A	MT12370	2.5.2000	1 year
Cable	Huber Suhner	RG142	None	2.5.2000	1 year

Figure 47 Test Equipment Used

9. Peak Power Output Out of 902-928 MHz Band

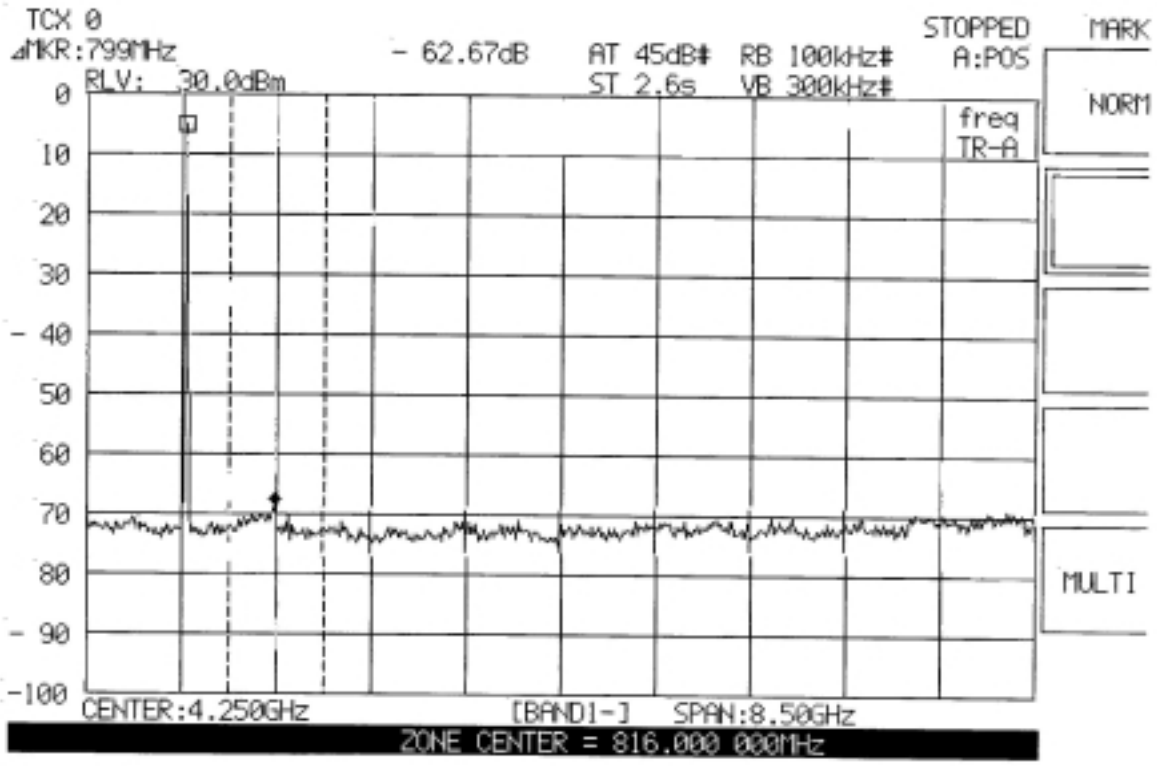
9.1 Test procedure

The E.U.T. antenna terminal was connected to the spectrum analyzer through appropriate coaxial cable. The spectrum analyzer was set to 100 kHz resolution BW. Frequency range from 10 kHz to 8.5 GHz was scanned. Level of spectrum components out of the 902-928 MHz was measured at the selected operation frequencies.



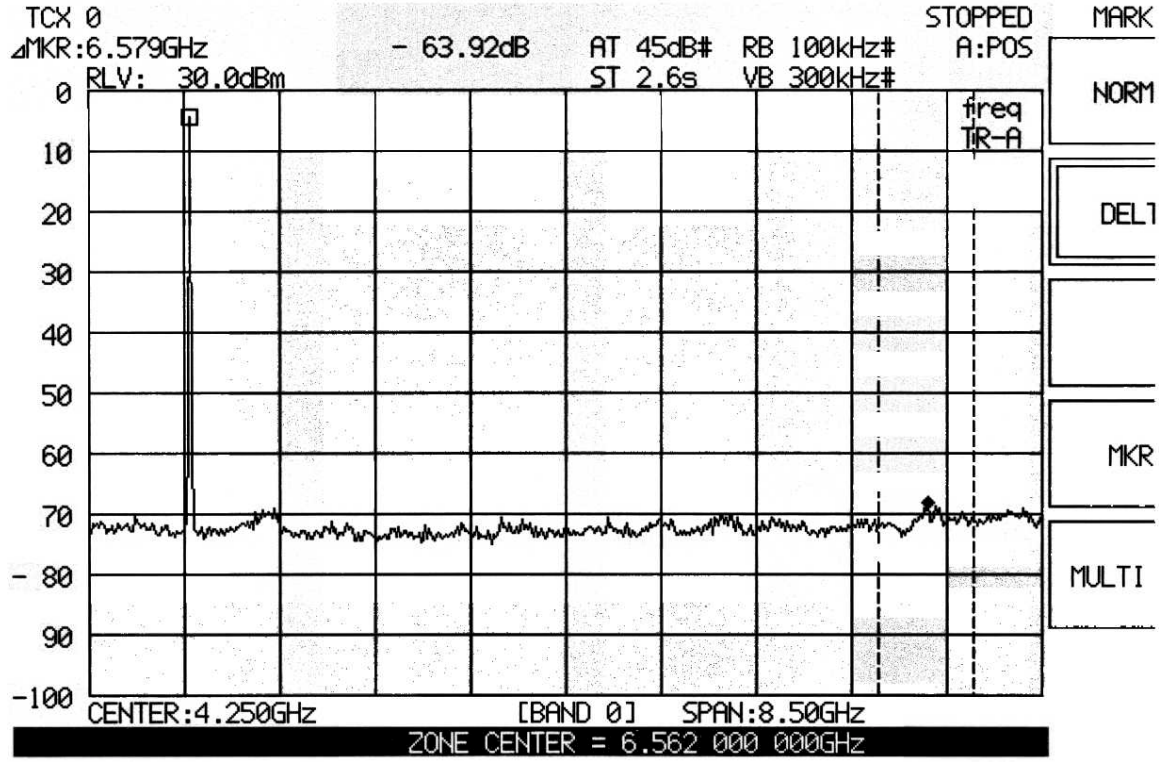
Frequency 903.8MHz

Figure 48



Frequency 915MHz

Figure 49



Frequency 926.2MHz

Figure 50

9.2 Results table

E.U.T description: Industrial Gas Meter
TYPE: American
Serial Number: Not Designated
Specification: F.C.C. Part 15, Subpart C

Operation Frequency (MHz)	Reading (dBc)	Specification (dBc)	Margin (dB)
903.8	61.19	20	41.19
915.0	62.67	20	42.67
926.2	63.92	20	43.92

Figure 51 Peak Power Output of 902-928 MHz Band

JUDGEMENT: Passed by 41.19 dB

TEST PERSONNEL:
Tester Signature: Shimon Zigdon Date: 03.07.01
Typed/Printed Name: S. Zigdon

9.3 Test Equipment Used.

Peak Power Output of 902-928 MHz Band

Test Performed on April 17, 2001

Instrument	Manufacture	Model	Serial Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	Anritzu	MS 2602A	MT12370	2.5.2000	1 year
Cable	Huber Suhner	RG142	None	2.5.2000	1 year

Figure 52 Test Equipment Used

10. 6 dB Minimum Bandwidth

10.1 Test procedure

The E.U.T. was set to the applicable test frequency. The E.U.T. antenna terminal was connected to the spectrum analyzer through an appropriate coaxial cable section. The spectrum analyzer was set to 100 kHz resolution BW. The spectrum bandwidth of the E.U.T. at the point of 6 dB below maximum peak power was measured and recorded.

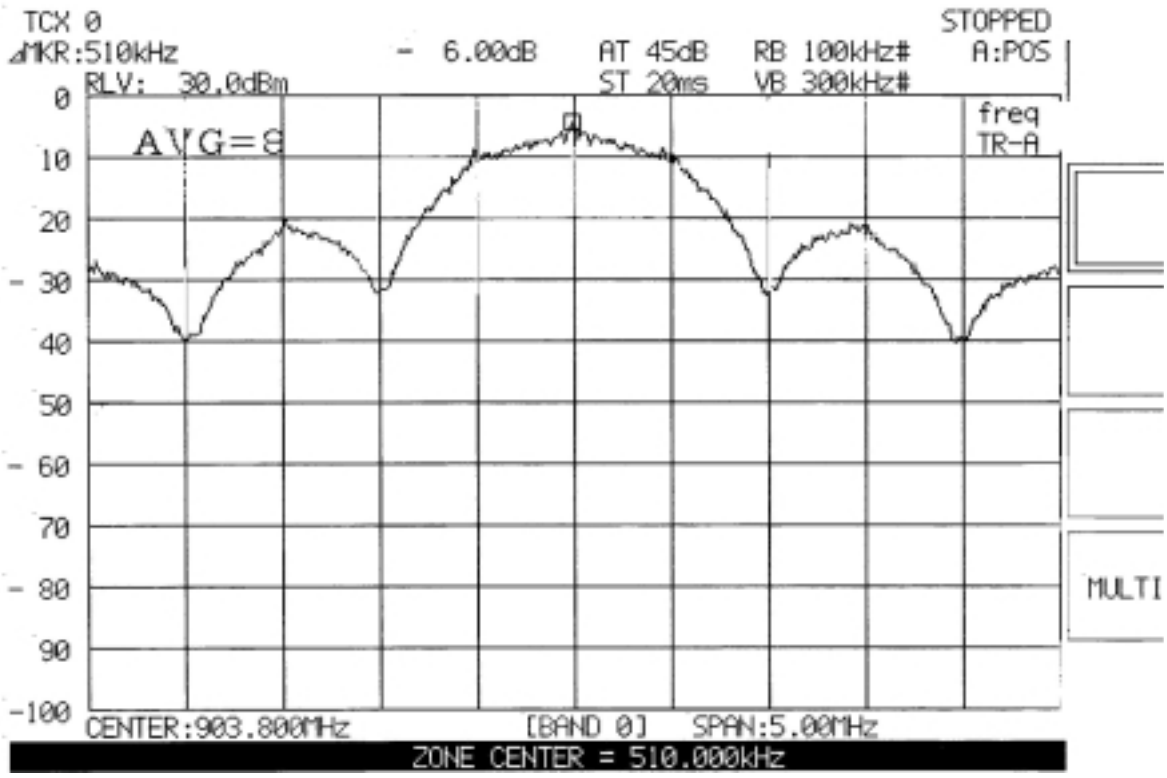


Figure 53

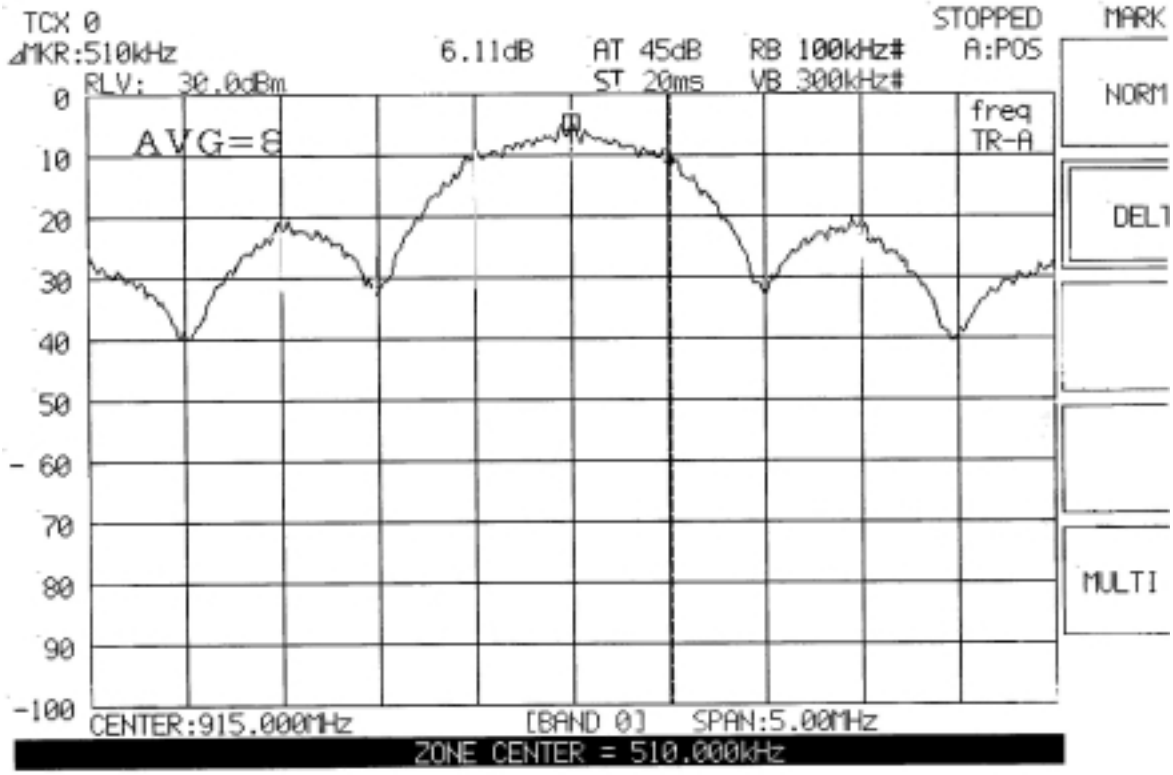


Figure 54

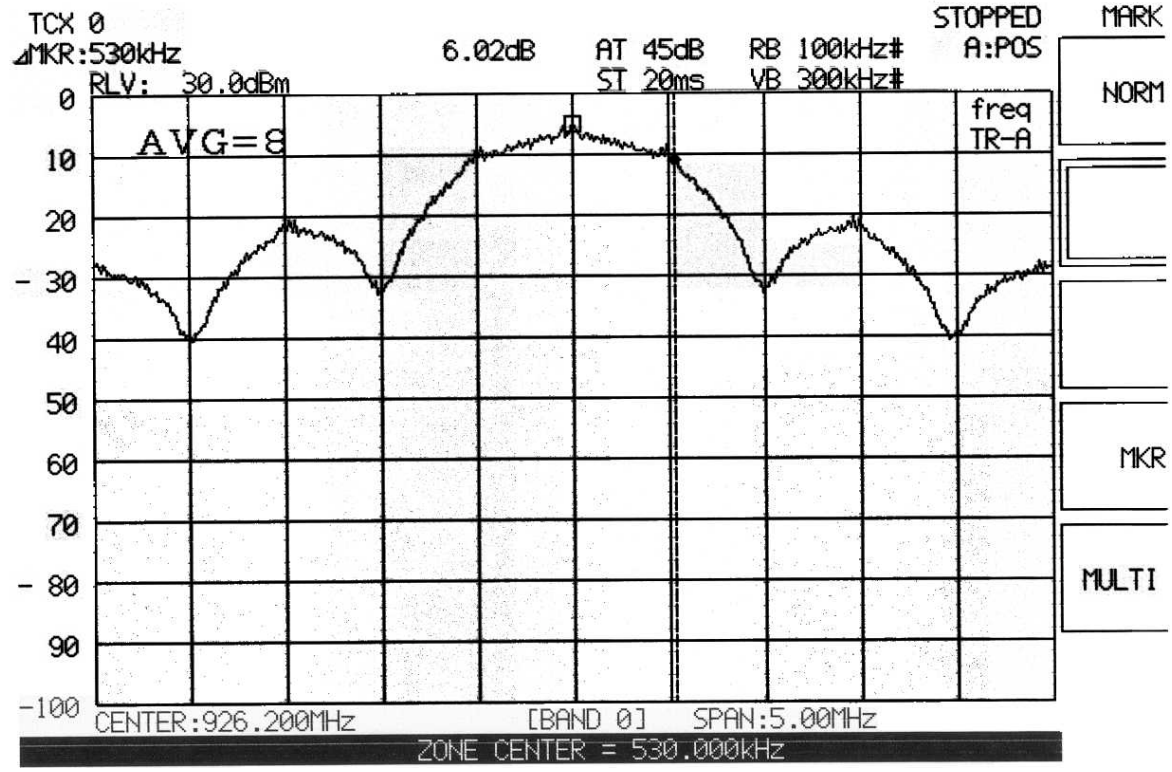


Figure 55

10.2 Results table

E.U.T description: Industrial Gas Meter
TYPE: American
Serial Number: Not Designated
Specification: F.C.C. Part 15, Subpart C: (15.247-a2)

Operation Frequency (MHz)	Reading (MHz)	Specification (MHz)	Margin (MHz)
903.8	1.1	0.5	0.6
915.0	1.1	0.5	0.6
926.2	1.1	0.5	0.6

Figure 56 6 dB Minimum Bandwidth

JUDGEMENT: Passed by 0.6 MHz

TEST PERSONNEL:
Tester Signature: Shimon Zigdon Date: 03.07.01
Typed/Printed Name: S. Zigdon

10.3 Test Equipment Used.

6 dB Minimum Bandwidth

Test Performed on April 17, 2001

Instrument	Manufacture	Model	Serial Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	Anritzu	MS 2602A	MT12370	2.5.2000	1 year
Cable	Huber Suhner	RG142	None	2.5.2000	1 year

Figure 57 Test Equipment Used

11. Band Edge Spectrum

[In Accordance with section 15.247(c)]

11.1 Test procedure

Enclosed are spectrum analyzer plots for the lowest operation frequency (903.8 MHz) and the highest operation frequency (926.2 MHz) in which the E.U.T. is planned to be used.
The E.U.T. antenna terminal was connected to the spectrum analyzer through an appropriate coaxial cable. The spectrum analyzer was set to 100 kHz resolution BW. Maximum power level below 902 MHz and above 928 MHz was measured relative to power level at 903.8 MHz and 926.2 MHz correspondingly.

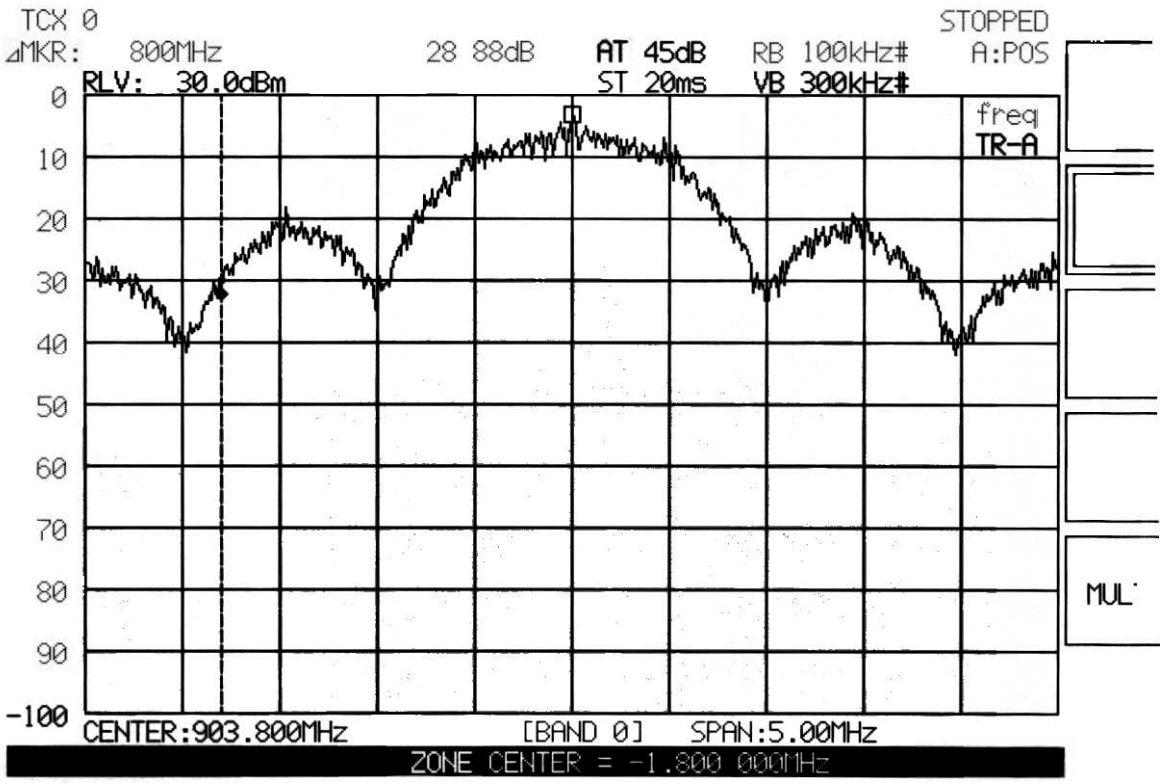


Figure 58

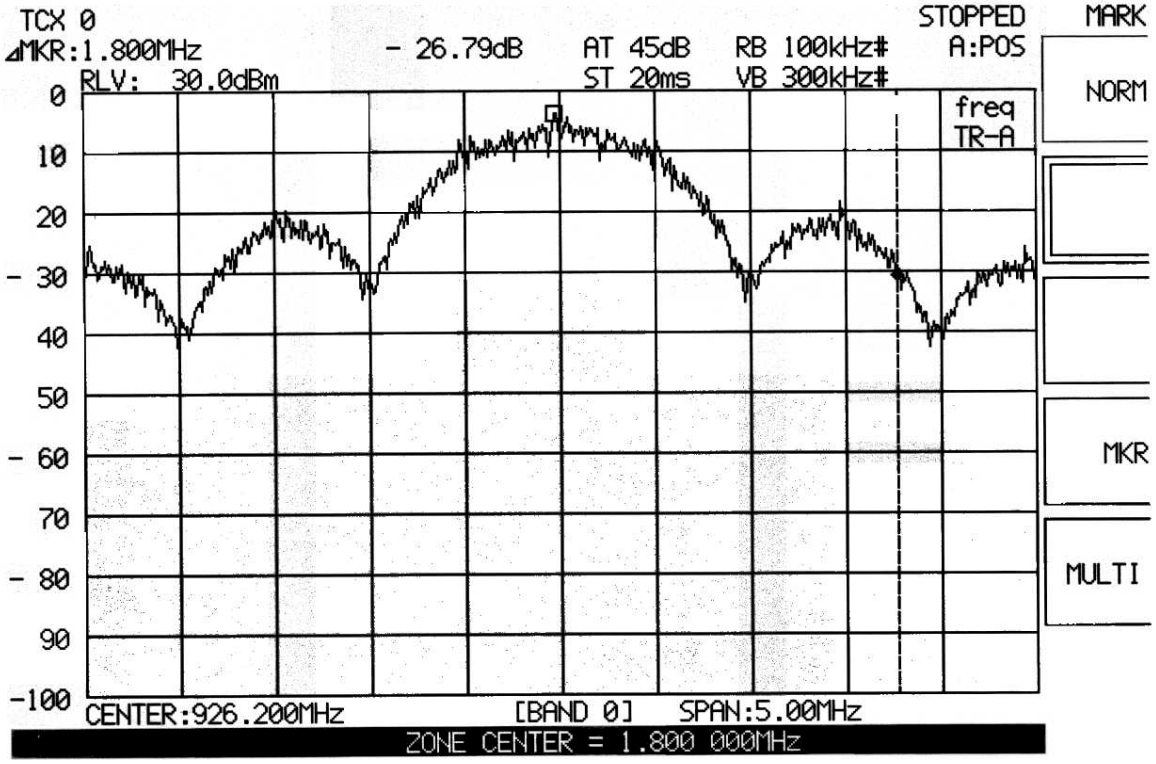


Figure 59

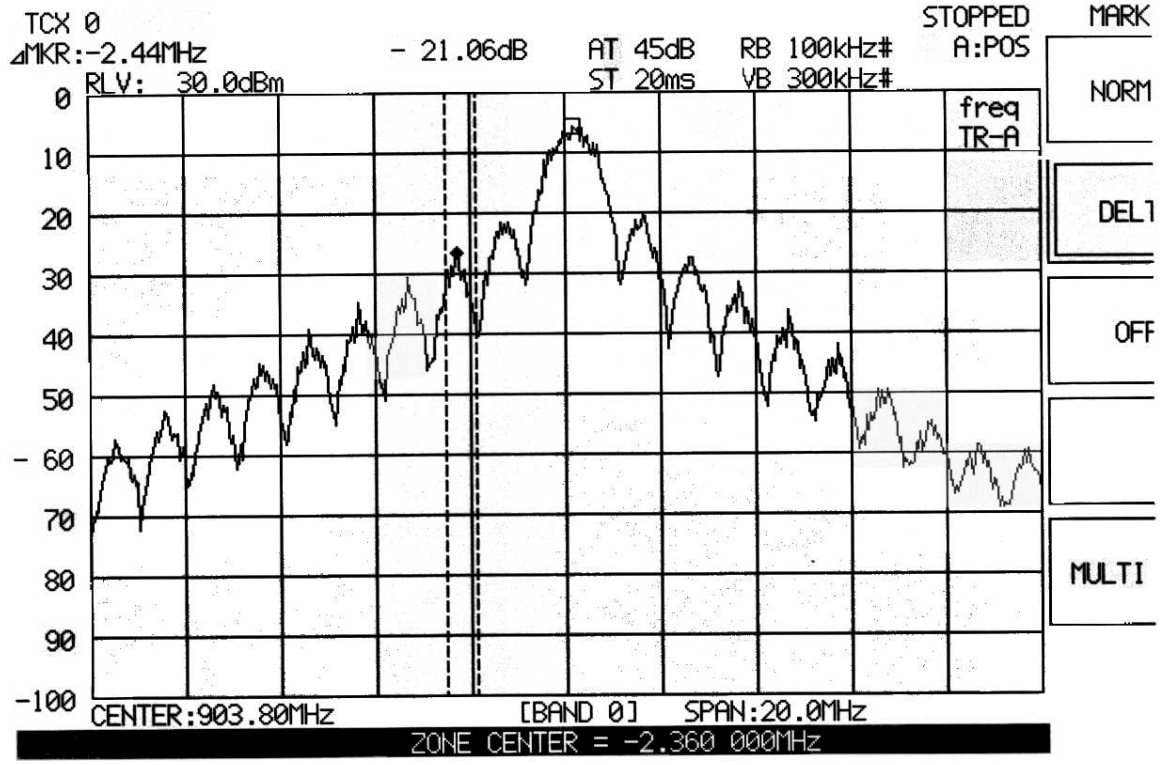


Figure 60

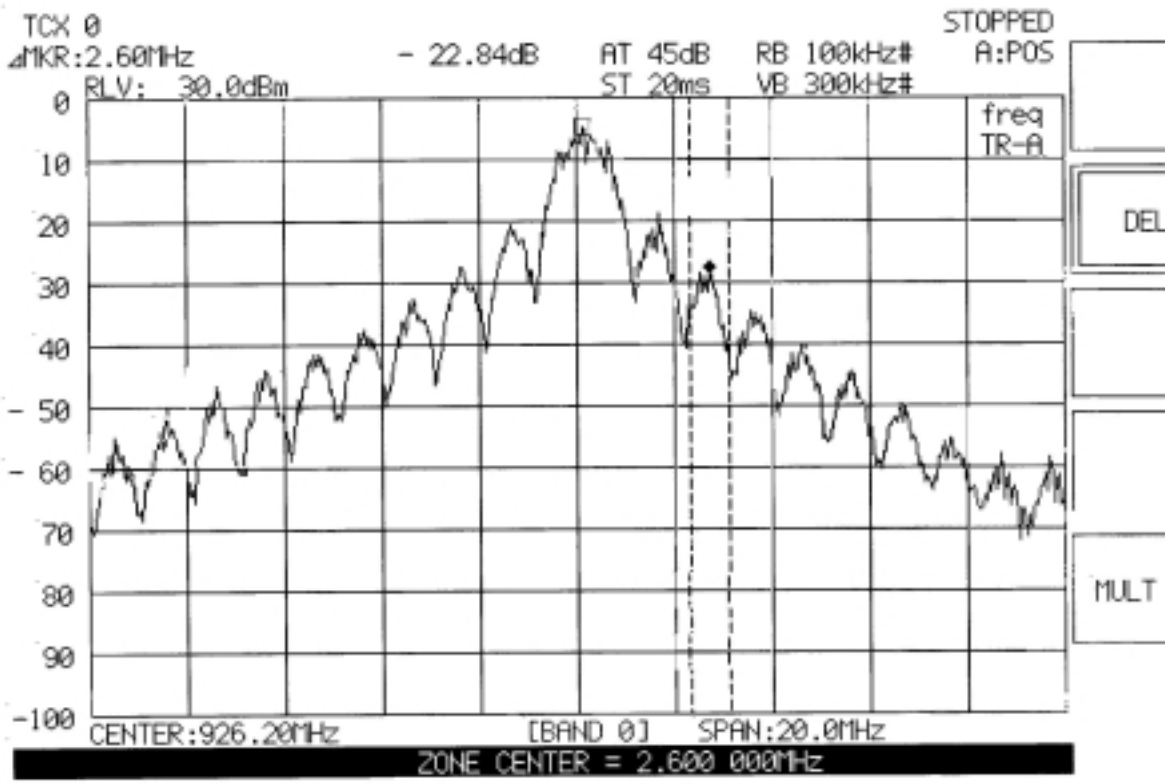

TCX 0
STOPPED
⊿MKR:2.60MHz
- 22.84dB
AT 45dB
RB 100kHz#
A:POS
RLV: 30.0dBm
ST 20ms
VB 300kHz#
freq
TR-A
DEL
MULT
0
10
20
30
40
- 50
- 60
70
80
90
-100
CENTER:926.20MHz
[BAND 0]
SPAN:20.0MHz
ZONE CENTER = 2.600 000MHz

Figure 61

11.2 Results table

E.U.T. description: Industrial Gas Meter
TYPE: American
Serial Number: Not Designated
Specification: F.C.C. Part 15, Subpart C (15.247)

Operation Frequency (MHz)	Band Edge Frequency (MHz)	Spectrum Level (dBc)	Specification (dBc)	Margin (dB)
903.8	902	23.79	20	3.79
926.2	928	22.08	20	2.08

Figure 62 Band Edge Spectrum

JUDGEMENT: Passed by 2.08 dB

TEST PERSONNEL:
Tester Signature: Shimon Zigdon Date: 03.07.01
Typed/Printed Name: S. Zigdon

11.3 Test Equipment Used.

Band edge Spectrum

Test Performed on April 17, 2001

Instrument	Manufacture	Model	Serial Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	Anritzu	MS 2602A	MT12370	2.5.2000	1 year
Cable	Huber Suhner	RG142	None	2.5.2000	1 year

Figure 63 Test Equipment Used

12. Transmitted Power Density

[In accordance with section 15.247(d)]

12.1 Test procedure

The E.U.T. antenna terminal was connected to the spectrum analyzer through an appropriate coaxial cable. The spectrum analyzer was set to 3 kHz resolution BW, 10 kHz video BW and sweep time of 1 second for each 3 kHz “window”. The spectrum peaks were located at each of the 3 operating frequencies.

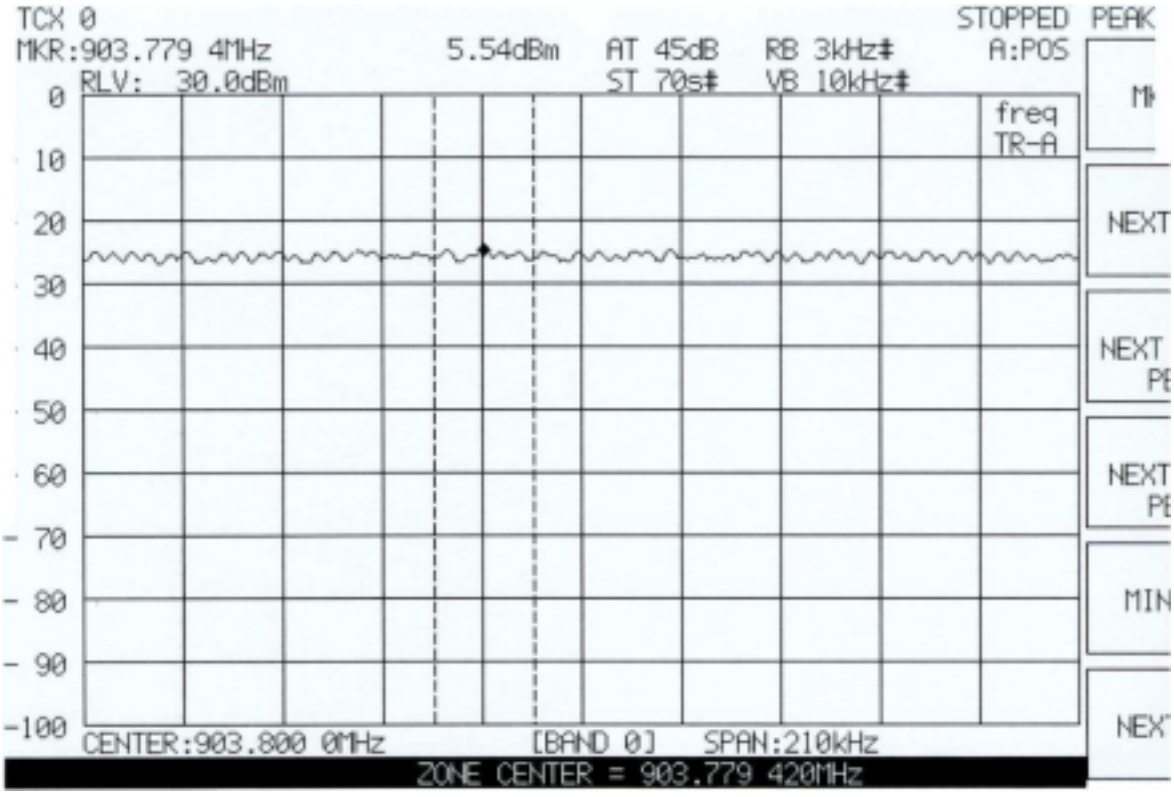


Figure 64

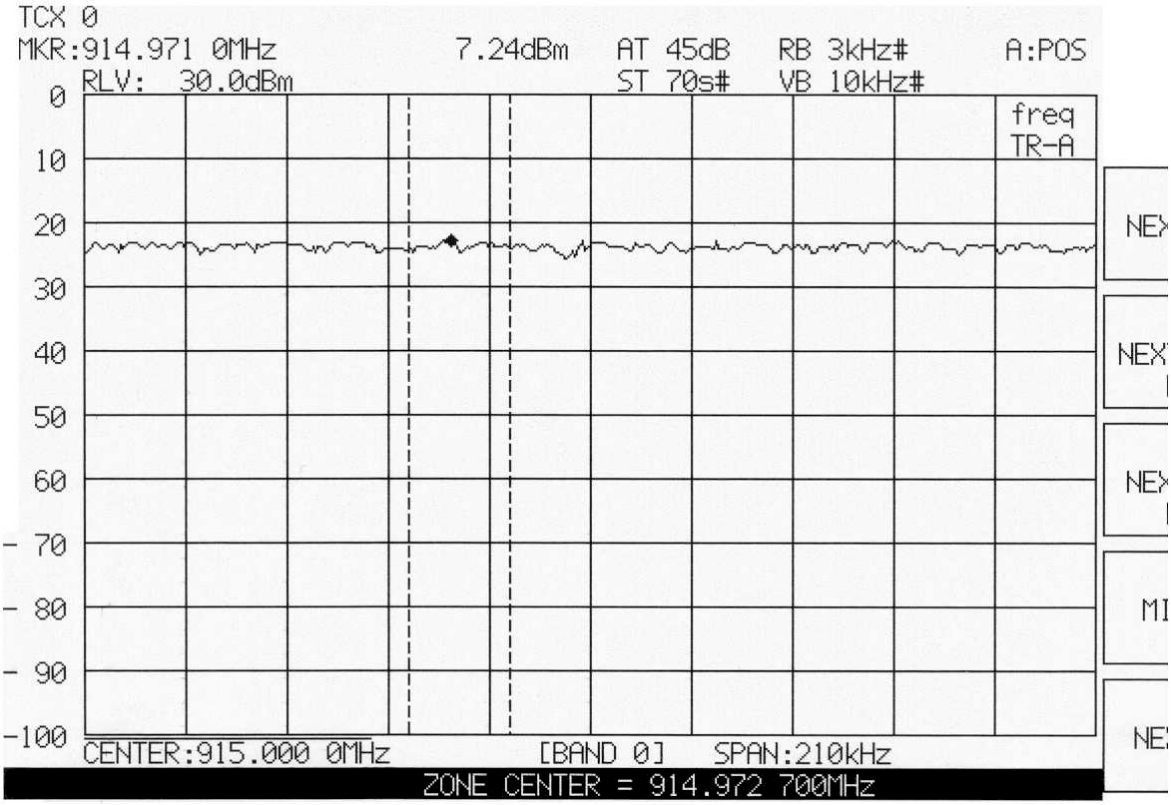


Figure 65

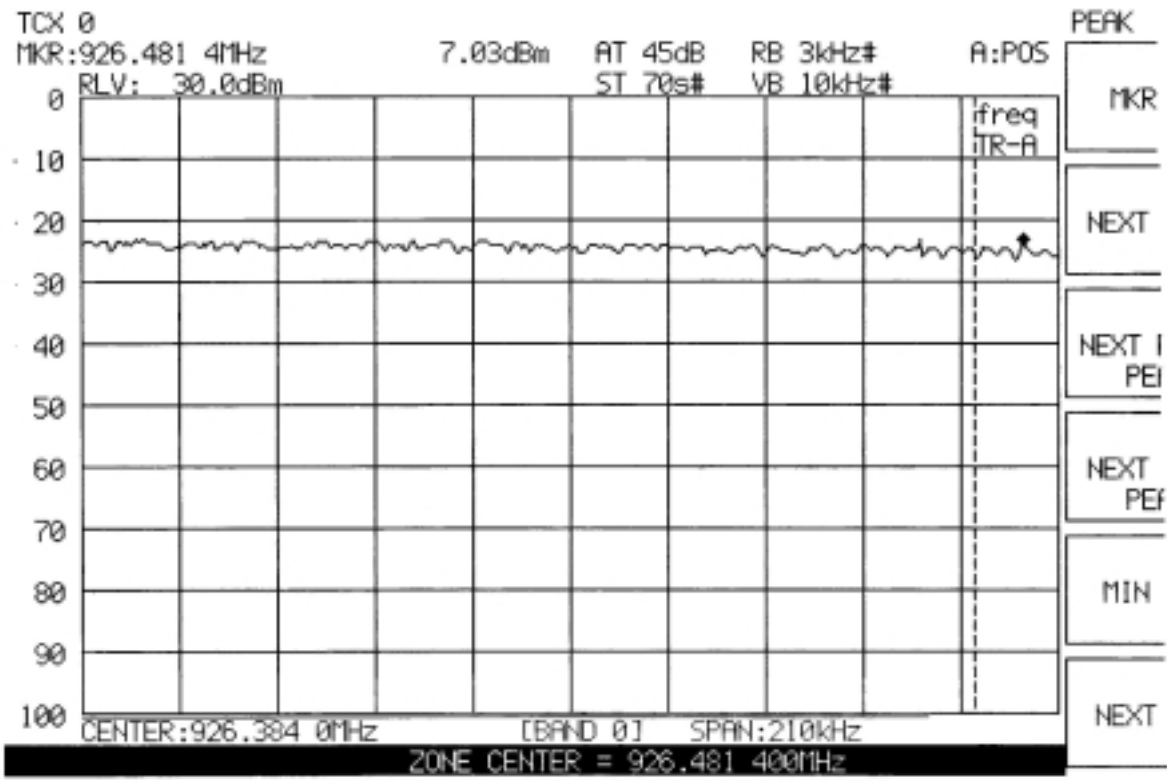


Figure 66

12.2 Results table

E.U.T. description: Industrial Gas Meter
TYPE: American
Serial Number: Not Designated
Specification: FCC Part 15, Subpart C (15.247)

Operation Frequency (MHz)	Reading (dBm)	Final Result (dBm)	Specification (dBm)	Margin (dB)	Cable Attenuation (dB)
903.8	5.54	6.04	8	1.96	0.5
915.0	7.24	7.74	8	0.26	0.5
926.2	7.03	7.53	8	0.46	0.5

Figure 67 Test Equipment Used

JUDGEMENT: Passed by 0.26 dB

TEST PERSONNEL:
Tester Signature: Shimon Zigdon Date: 03.07.01
Typed/Printed Name: S. Zigdon

12.3 Test Equipment Used.

Transmitted Power Density

Test Performed on April 17, 2001

Instrument	Manufacture	Model	Serial Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	Anritzu	MS 2602A	MT12370	2.5.2000	1 year
Cable	Huber Suhner	RG142	None	2.5.2000	1 year

Figure 68 Test Equipment Used

13. Processing Gain

[In accordance with section 15.247(e)]

13.1 Test procedure

The processing gain was measured according to the guideline in section 15.247(e). The transmitter was enclosed in a small RF chamber and configured to transmit periodically typical length burst messages. The jammer was simulated by HP8647A signal generator. The composed signal (transmitter and jammer) was fed to the SPSP receiver and the demodulated was fed to a PC with decoding and analyzing program. Instead of pointing out a required BER, the criteria that was used is 80% success rate in detecting and decoding burst messages (error free decoding messages). This criteria, which is related to probability of detection rather then to "required BER", is more suitable in measuring the performance in our system because of its burst nature. By simulating we can show that for criteria of 80% success rate, the required S/N ratio is 13db. The test consists of stepping signal generator in 50 kHz increments across the pass-band. The measurement was taken in 3 different frequencies- near the lower edge of the band in 903.8 MHz, in the center frequency 915MHz and near the upper edge of the band 926.2MHz. The measurement was taken when the system was configured to work with 255 PN maximal length codes.

Test Setup

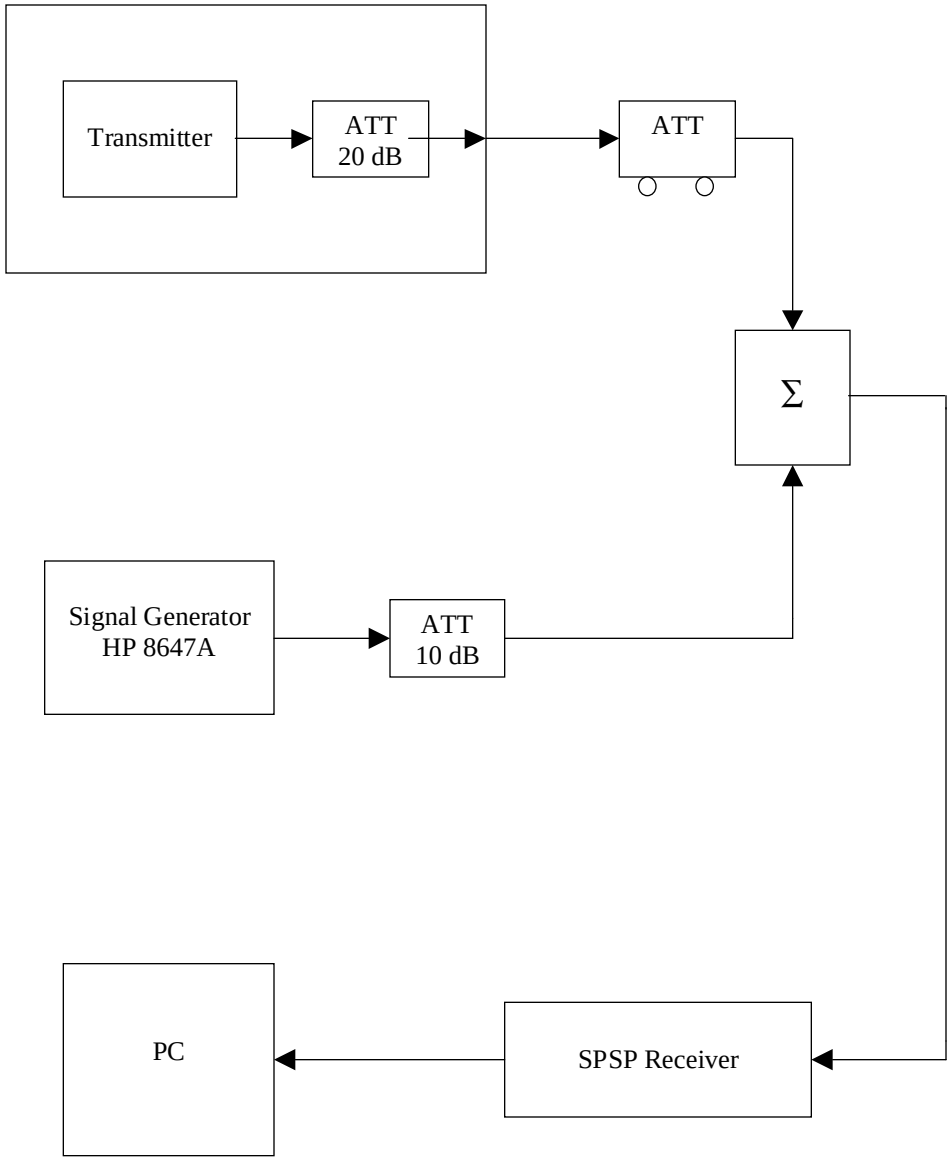


Figure 69 Processing Gain, Block Scheme

Processing Gain PN Code Length 255

Frequency 903.8 MHz

DeltaF, MHZ	J/S, dB
0	7 Discard
0.05	8
0.1	8
0.15	8
0.2	8
0.25	8
0.3	9
0.35	9
0.4	9
0.45	9
0.5	10
0.55	11
0.6	12
-0.05	8 Discard
-0.1	8
-0.15	8
-0.2	8
-0.25	8
-0.3	9
-0.35	9
-0.4	10
-0.45	11
-0.5	11
-0.55	12
-0.6	13

Figure 70 Processing Gain: 13+8=21

Processing Gain PN Code Length 255

Frequency 915 MHz

DeltaF, MHZ	J/S, dB
0	7 Discard
0.05	8 Discard
0.1	8
0.15	8
0.2	9
0.25	9
0.3	9
0.35	10
0.4	11
0.45	11
0.5	12
0.55	12
0.6	13
-0.05	8
-0.1	8
-0.15	8
-0.2	8
-0.25	9
-0.3	9
-0.35	10
-0.4	10
-0.45	11
-0.5	11
-0.55	12
-0.6	13

Figure 71 Processing Gain: 13+8=21

Processing Gain PN Code Length 255

Frequency 926.2 MHz

DeltaF, MHZ	J/S, dB
0	7 Discard
0.05	8
0.1	8
0.15	8
0.2	9
0.25	9
0.3	9
0.35	10
0.4	10
0.45	10
0.5	11
0.55	12
0.6	13
-0.05	8 Discard
-0.1	8
-0.15	8
-0.2	8
-0.25	9
-0.3	9
-0.35	9
-0.4	9
-0.45	10
-0.5	11
-0.55	11
-0.6	12

Figure 72 Processing Gain: 13+8=21

TEST PERSONNEL:

Tester Signature: Shimon Zigdon Date: 03.07.01

Typed/Printed Name: S. Zigdon

13.2 Test Equipment Used.

Transmitted Power Density
Test Performed on April 17, 2001

Instrument	Manufacture	Model	Serial Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	Anritzu	MS 2602A	MT12370	2.5.2000	1 year
Cable	Huber Suhner	RG142	None	2.5.2000	1 year
Signal Generator	HP	8648A	3416u00103	1.5.2000	1 year
Power Splitter	Mini Circuits	ZAPD21	09716	2.5.2000	1 year
Variable Attenuator	HP	8496A	3308A14531	2.5.2000	1 year
20 dB Attenuator	Mini Circuits	SAT 20	8992612	2.5.2000	1 year
10 dB Attenuator	Mini Circuits	SAT10	942312	2.5.2000	1 year
PC					
Receiver	NEXUS DATA	AP-BX	None	1.7.2000	1 year

Figure 73 Test Equipment Used

14. Antenna Gain

The antenna implemented in the device is a small, wire antenna. The length of the antenna is less than a quarter wavelength. A theoretical upper limit of the gain of small wire antenna, is the gain of theoretical dipole antenna (2.5dBi). Then considering the inferiority of the implemented antenna vs. the theoretical dipole and the sub optimal efficiency of the antenna, the gain of the antenna is estimated to be 0dBi.

15. R.F Exposure/Safety

The E.U.T. is installed in fixed locations for application of transmitting data of gas consumption to central data collection offices. The distance between the E.U.T. and the general population is at least several meters.

Calculation of Maximum Permissible Exposure (MPE)

Based on Section 1.1307(b)(1) Requirements

(a) FCC limits at 915 MHz

$$S = \frac{f}{300} = \frac{915}{1500} = 3.05 \frac{mw}{cm^2}$$

Using table 1 of Section 1.1310 limit for general population/uncontrolled exposures, the above level is an average over 30 minutes.

(b) The power density produced by the E.U.T. is

$$S = \frac{P_t G_t}{4\pi R^2}$$

P_t- Transmitted Power 1000mw (Peak)

G_T- Antenna Gain, 1(0dB)

R- Distance from Transmitter using 100cm worst case

(c) The peak power density is :

$$S_p = \frac{10^3 x1}{4\pi (100)^2} = 7.96 \frac{mw}{cm^2}$$

(d) The duty cycle of transmission in actual case is 4 X 160 msec pulses per 24 hours.

The average power over 30 minutes is:

$$P_{AV} = \frac{1000.64}{30X60} = 0.35mw$$

(e) The averaged power density (over 30 minutes) of the E.U.T. is:

$$S_{AV} = \frac{0.35X1}{4\pi x(100)^2} = 2.8X10^{-6} \frac{mw}{cm^2}$$

(f) This is significantly below the FCC limit.

16. Photographs of Tested E.U.T.

Figure 74 Front View

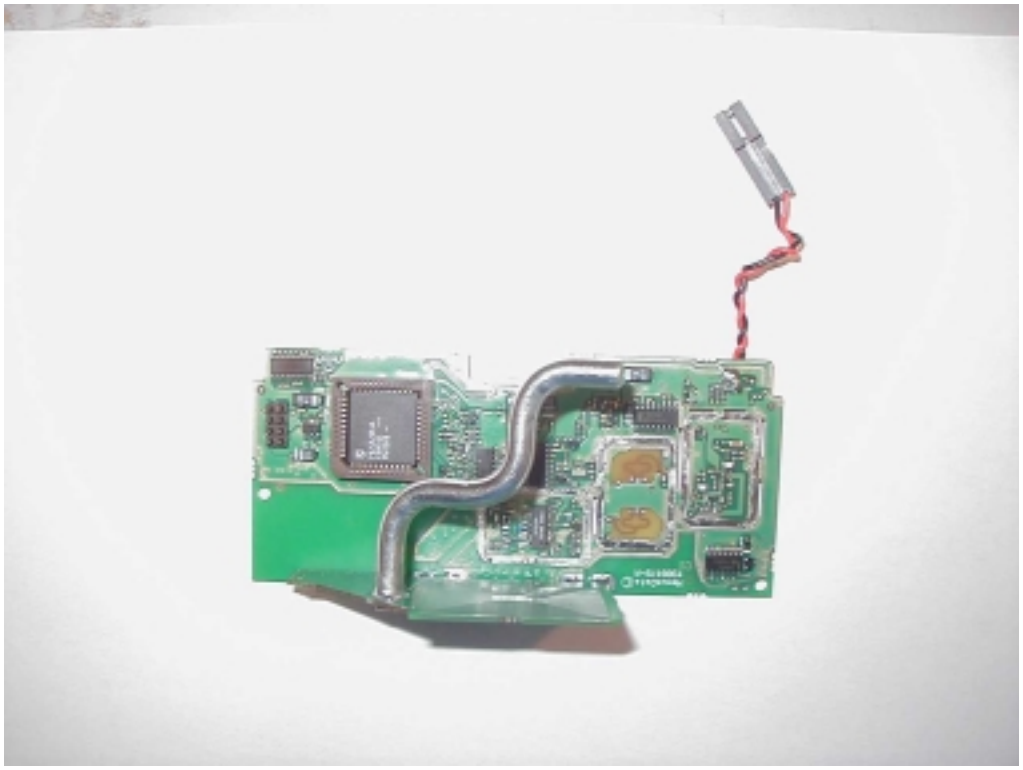


Figure 75 Printed Circuit Side 1

Figure 76 Printed Circuit Side 2

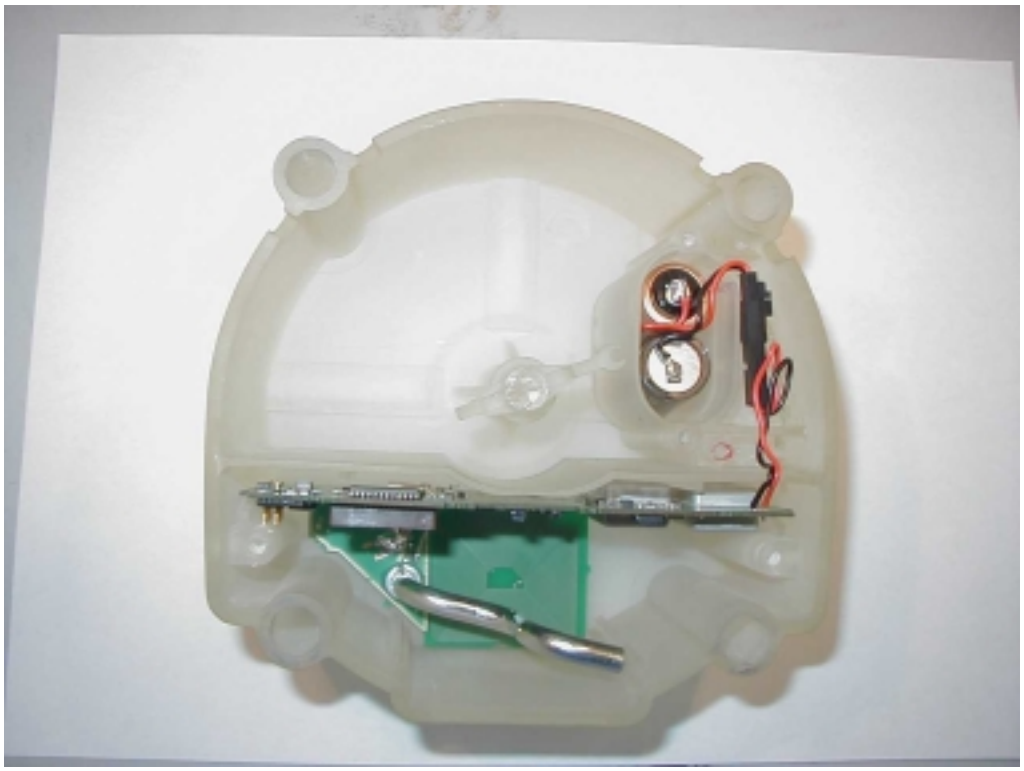


Figure 77 Printed Circuit Mounted in Housing

Figure 78 Closed Cover

Figure 79 External View

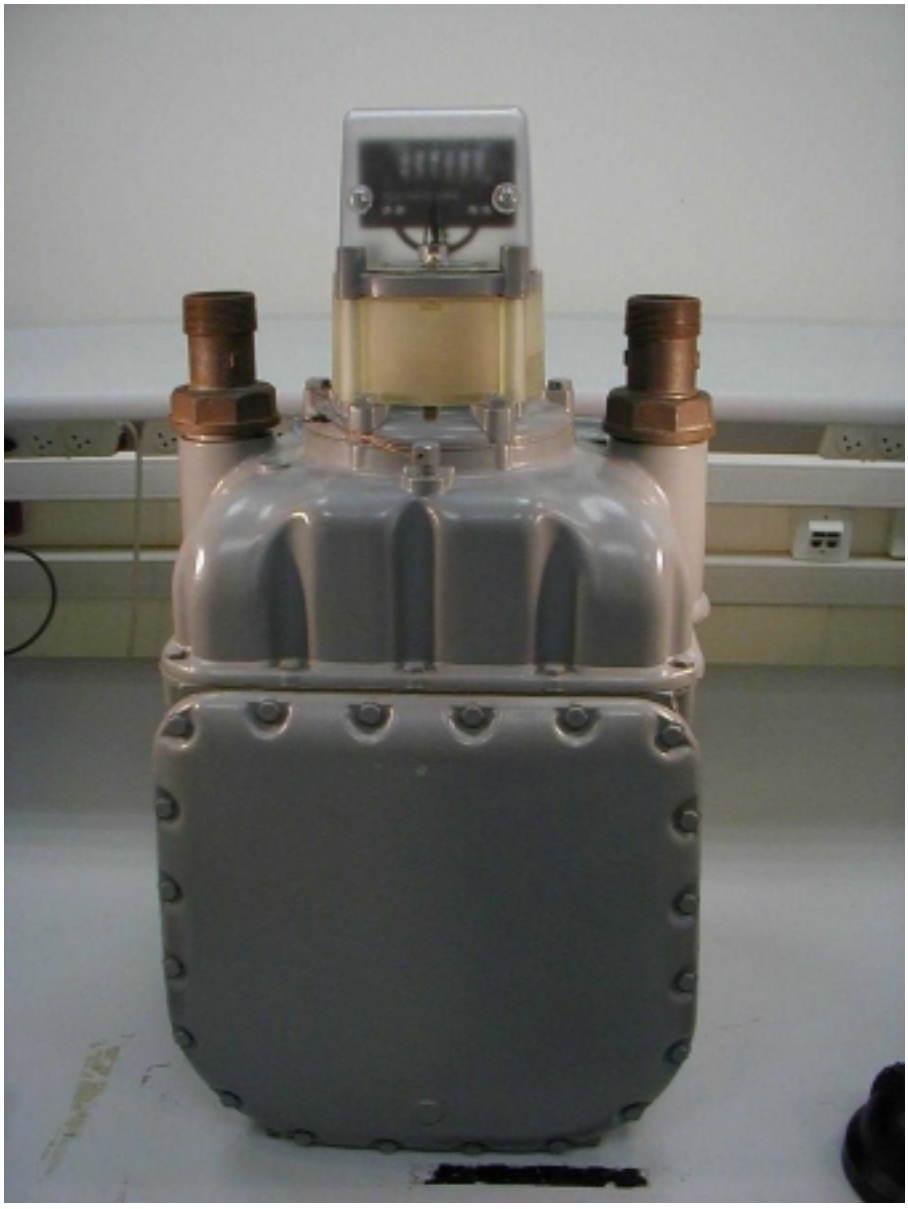


Figure 80 External View