Cert. No. 1152.01
Electrical (EMC)

DATE: 21 August 2003

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

EMC Test

for

Nexus Data (1993) Ltd.

Equipment under test:

Water Meter Transmitter

WMIN01

Approved by:_____

I. Raz, EMC Laboratory Manager

Cert. No. 1152.01
Electrical (EMC)

Measurement/Technical Report for

Nexus Data (1993) Ltd.

Water Meter Transmitter

(For Transmitter Section)

WMIN01

FCC ID:NL3WMIN01

21 August 2003

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 C63.4-2001.

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 Haayin 48091 Israel Tel: +972-3-9032288 Fax: +972-3-9036105
Manufacturer's Representative:	Shimon Zigdon
Equipment Under Test (E.U.T):	Water Meter Transmitter
Equipment Model No.:	WMIN01
Equipment Serial No.:	Not designated
Date of Receipt of E.U.T:	07.08.03
Start of Test:	07.08.03
End of Test:	11.08.03
Test Laboratory Location:	I.T.L (Product Testing) Ltd. Kfar Bin Nun, ISRAEL 99780
Test Specifications:	See Section 2

1.2 List of Accreditations

The EMC laboratory of I.T.L. is accredited by the following bodies:

1. The American Association for Laboratory Accreditation (A2LA) (U.S.A.), Certificate No. 1152.01.
2. The Federal Communications Commission (FCC) (U.S.A.), Registration No. 90715.
3. The Israel Ministry of the Environment (Israel), Registration No. 1104/01.
4. The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) (Japan), Registration Numbers: C-1350, R-1285.
5. Industry Canada (Canada), File No. IC 4025.
6. TUV Product Services, England, ASLLAS No. 97201.
7. Nemko (Norway), Authorization No. ELA 207.

I.T.L. Product Testing Ltd. is accredited by the American Association for Laboratory Accreditation (A2LA) and the results shown in this test report have been determined in accordance with I.T.L.'s terms of accreditation unless stated otherwise in the report.

1.3 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 printed inverted-F antenna.

The transmitter frequency band is 904.6-925.4 MHz and channel spacing is 400 kHz; i.e. it has 53 channels. 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.

1.4 Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4: 2001. Radiated testing was performed at an antenna to EUT distance of 3 meters.

1.5 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.

1.6 Measurement Uncertainty

Radiated Emission

The Open Site complies with the ±4 dB Normalized Site Attenuation requirements of ANSI C63.4-2001. In accordance with Paragraph 5.4.6.1 of this standard, this tolerance includes instrumentation calibration errors, measurement technique errors, and errors due to site anomalies.

2. Product Labeling

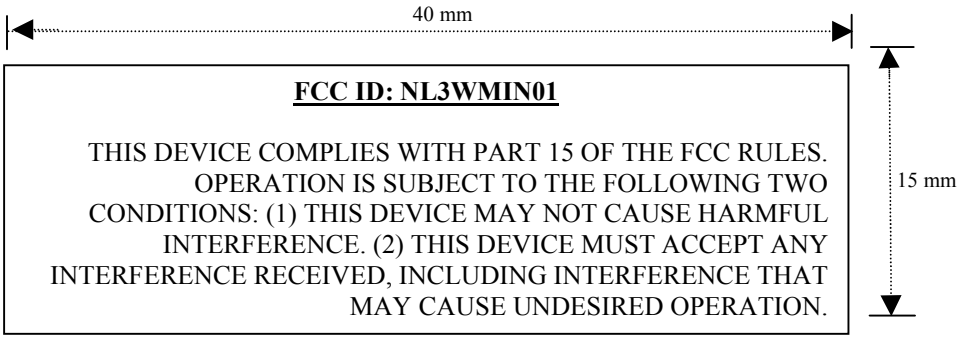

Figure 1. FCC Label

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:

1. Only the I/O interface is under normal operating condition. The rest of the transmitter is in sleep mode.
2. House keeping mode in which the micro-controller wakes up in order to scan the external inputs.
3. Periodic transmission, in which the main micro-controller wakes up the transmitter section up 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 modifications were needed to achieve compliance.

3.5 Configuration of Tested System

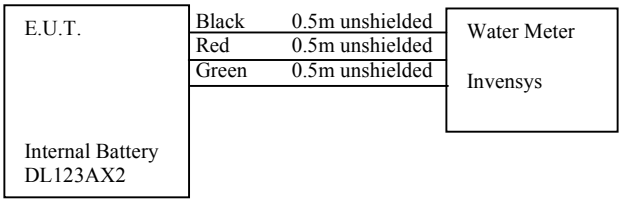

Figure 3. Configuration of Tested System

4. Block Diagram

4.1 Schematic Block/Connection Diagram

Intentionally Blank for Reasons of Confidentiality

Figure 4. E.U.T. Block Diagram

4.2 Theory of Operation

The E.U.T receiving outputs from the water 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. Spurious Radiated Measurement Photos

Figure 5. Spurious Radiated Emission Test. Front

Figure 6. Spurious Radiated Emission Test. Side

6. Spurious 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 15.6 dBµV/m

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

for 904.6 MHz, 15.6 dB at 150.00 MHz frequency, vertical polarization.

for 915.0 MHz, 18.8 dB at 329.99 MHz frequency, horizontal polarization

for 925.4 MHz, 16.3 dB at 329.99 MHz frequency, horizontal polarization

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

TEST PERSONNEL:

Tester Signature: _____ Date: 26.08.03

Typed/Printed Name: Y. Mordukhovitch

Radiated Emission

E.U.T Description Water Meter Transmitter
Type WMIN01
Serial Number: Not designated

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

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 904.6 MHz
Frequency range: 30 MHz to 300 MHz
Detector: Quasi-peak

Frequency (MHz)	Peak Amp (dBµV/m)	QP Amp (dBµV/m)	Correction (dB)	Specification (dBµV/m)	Margin (dB µV/m)
120.00	24.0	21.7	13.6	43.5	-21.8
135.00	29.0	22.7	14.2	43.5	-20.8
150.00	26.3	18.1	15.0	43.5	-25.4
165.87	26.7	17.0	15.4	43.5	-26.5
255.30	32.5	22.3	20.9	46.0	-23.7

Figure 7. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: 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	Water Meter Transmitter
Type	WMIN01
Serial Number:	Not designated

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

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 904.6 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)
329.99	30.5	57.6	15.9	46.0	-18.4
409.02	26.8	19.6	18.6	46.0	-28.4
612.72	32.3	24.2	22.5	46.0	-21.8
964.54	39.5	32.0	28.3	54.0	-22.0

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.

Radiated Emission

E.U.T Description Water Meter Transmitter
Type WMIN01
Serial Number: Not designated

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

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 904.6 MHz

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

Frequency (MHz)	**Peak Amp** (dBµV/m)	**QP Amp** (dBµV/m)	**Correction** (dB)	**Specification** (dBµV/m)	**Margin** (dB)
111.97	24.6	15.7	13.1	43.5	-27.8
135.00	23.6	15.7	14.2	43.5	-27.8
150.00	27.9	27.9	15.0	43.5	-15.6
170.00	37.5	26.9	15.5	43.5	-16.6
270.00	33.1	23.1	21.5	46.0	-22.9

Figure 9. Radiated Emission. Antenna Polarization: VERTICAL. Detector: 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	Water Meter Transmitter
Type	WMIN01
Serial Number:	Not designated

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

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 904.6 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)
329.990000	28.4	25.3	15.9	46.0	-20.7
402.000000	28.4	19.6	18.5	46.0	-26.4
612.000000	30.5	23.9	22.5	46.0	-22.1
965.000000	37.6	30.6	28.3	54.0	-23.4

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.

Radiated Emission

E.U.T Description	Water Meter Transmitter
Type	WMIN01
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: Quasi-peak

Frequency (MHz)	**Peak Amp** (dBµV/m)	**QP Amp** (dBµV/m)	**Correction** (dB)	**Specification** (dBµV/m)	**Margin** (dB)
115.49	21.0	14.3	13.3	43.5	-29.2
125.19	21.1	14.3	13.8	43.5	-29.2
134.99	27.0	21.3	14.2	43.5	-22.2
165.09	22.4	16.2	15.4	43.5	-27.3
270.01	29.3	22.3	21.5	46.0	-23.7

Figure 11. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: 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	Water Meter Transmitter
Type	WMIN01
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)
329.99	30.4	27.2	15.9	46.0	-18.8
408.30	26.5	19.6	18.6	46.0	-26.4
610.00	31.5	23.9	22.4	46.0	-22.1
965.00	36.9	30.9	28.3	54.0	-23.1

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.

Radiated Emission

E.U.T Description Water Meter Transmitter
Type WMIN01
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: Quasi-peak

Frequency (MHz)	**Peak Amp** (dBµV/m)	**QP Amp** (dBµV/m)	**Correction** (dB)	**Specification** (dBµV/m)	**Margin** (dB)
73.95	19.9	13.8	10.3	43.5	-26.2
115.94	24.8	15.1	13.4	43.5	-28.4
156.80	23.4	15.9	15.2	43.5	-27.6
162.29	23.8	17.0	15.3	43.5	-26.5
264.94	29.1	22.0	21.4	46.0	-24.0

Figure 13. Radiated Emission. Antenna Polarization: VERTICAL. Detector: 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	Water Meter Transmitter
Type	WMIN01
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)
329.99	28.0	23.6	15.9	46.0	-22.4
400.91	26.4	19.4	18.5	46.0	-26.6
611.07	31.1	23.9	22.4	46.0	-22.1
975.00	37.1	30.8	28.4	46.0	-23.2

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.

Radiated Emission

E.U.T Description	Water Meter Transmitter
Type	WMIN01
Serial Number:	Not designated

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

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 925.4 MHz

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

Frequency (MHz)	**Peak Amp** (dBµV/m)	**QP Amp** (dBµV/m)	**Correction** (dB)	**Specification** (dBµV/m)	**Margin** (dB)
120.00	24.0	22.1	13.6	43.5	-21.4
135.00	37.1	23.3	14.2	43.5	-20.2
156.80	24.5	17.3	15.2	43.5	-26.2
170.00	25.9	17.4	15.5	43.5	-26.1
245.00	28.6	21.0	20.1	46.0	-25.0

Figure 15. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: 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	Water Meter Transmitter
Type	WMIN01
Serial Number:	Not designated

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

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 925.4 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)
329.99	31.1	29.7	15.9	46.0	-16.3
408.00	25.1	20.4	18.6	46.0	-25.6
611.32	29.3	24.0	22.4	46.0	-22.0
972.59	36.1	30.9	28.4	54.0	-23.1

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.

Radiated Emission

E.U.T Description Water Meter Transmitter
Type WMIN01
Serial Number: Not designated

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

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 925.4 MHz

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

Frequency (MHz)	**Peak Amp** (dBµV/m)	**QP Amp** (dBµV/m)	**Correction** (dB)	**Specification** (dBµV/m)	**Margin** (dB)
150.00	26.3	22.6	15.0	43.5	-20.9
245.00	30.6	20.9	20.1	46.0	-25.1
280.00	32.5	23.3	21.9	46.0	-22.7

Figure 17. Radiated Emission. Antenna Polarization: VERTICAL. Detector: 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	Water Meter Transmitter
Type	WMIN01
Serial Number:	Not designated

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

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 925.4 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)
328.00	23.4	16.8	15.8	46.0	-29.2
329.99	28.8	25.5	15.9	46.0	-20.5
402.02	26.5	19.7	18.5	46.0	-26.3
609.99	30.4	24.1	22.4	46.0	-21.9
962.60	44.2	35.3	28.2	54.0	-18.7

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.

6.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3411A00102	January 31, 2003	1 year
RF Section	HP	85420E	3427A00103	January 31, 2003	1 year
Antenna Bioconical	ARA	BCD 235/B	1041	April 20, 2003	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. Spurious 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 2.9-9.3 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 5.0 dBµV/m

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

for 904.6 MHz, 11.6 dB at 2713.80 MHz frequency, vertical polarization.
for 915.0 MHz, 11.2 dB at 2745.00 MHz frequency, vertical polarization
for 925.4 MHz, 5.0 dB at 2776.13 MHz frequency, horizontal and vertical polarizations

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

TEST PERSONNEL:

Tester Signature: _____ Date: 26.08.03

Typed/Printed Name: Y. Mordukhovitch

Radiated Emission Above 1 GHz

E.U.T Description	Water Meter Transmitter
Type	WMIN01
Serial Number:	Not designated

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

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 904.6 MHz

Frequency range: 1 GHz to 2.9 GHz
Detector: Average

Freq. (MHz)	Avg. Amp (dBµV/m)	Correction (dB)	Avg. Det. Spec. (dBµV/m)	Avg. Margin (dB)
2713.80	42.3	44.1	54.0	-11.7

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.

Radiated Emission Above 1 GHz

E.U.T Description	Water Meter Transmitter
Type	WMIN01
Serial Number:	Not designated

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

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 904.6 MHz

Frequency range: 1 GHz to 2.9 GHz
Detector: Peak

Freq. (MHz)	Peak Amp (dBµV/m)	Correction (dB)	Peak Det. Spec. (dBµV/m)	Peak. Margin (dB)
2713.80	53.3	44.1	74.0	-20.7

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.

Radiated Emission Above 1 GHz

E.U.T Description	Water Meter Transmitter
Type	WMIN01
Serial Number:	Not designated

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

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 904.6 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)
3618.40	38.6	33.8	2.0	30.5	74.0	43.9	-30.1
4523.0	37.0	35.2	2.6	30.5	74.0	44.3	-29.7
5427.60	37.3	36.6	2.8	30.4	74.0	46.3	-27.7
8141.40	40.3	40.0	3.7	29.9	74.0	54.1	-19.9
9046.0	39.1	40.8	4.3	30.0	74.0	54.2	-19.8

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 Water Meter Transmitter
Type WMIN01
Serial Number: Not designated

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

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 904.6 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)
3618.40	24.0	33.8	2.0	30.5	54.0	29.3	-24.7
4523.00	23.1	35.2	2.6	30.5	54.0	30.4	-23.6
5427.60	23.0	36.6	2.8	30.4	54.0	32.0	-22.0
8141.40	26.3	40.0	3.7	29.9	54.0	40.1	-13.9
9046.00	25.6	40.8	4.3	30.0	54.0	40.7	-13.3

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	Water Meter Transmitter
Type	WMIN01
Serial Number:	Not designated

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

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 904.6 MHz

Frequency range: 1 GHz to 2.9 GHz
Detector: Average

Freq. (MHz)	Avg. Amp (dBµV/m)	Correction (dB)	Avg. Det. Spec. (dBµV/m)	Avg. Margin (dB)
2713.80	42.4	44.1	54.0	-11.6

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.

Radiated Emission Above 1 GHz

E.U.T Description	Water Meter Transmitter
Type	WMIN01
Serial Number:	Not designated

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

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 904.6 MHz

Frequency range: 1 GHz to 2.9 GHz
Detector: Peak

Freq. (MHz)	**Peak Amp** (dBµV/m)	**Correction** (dB)	**Peak. Det. Spec.** (dBµV/m)	**Peak. Margin** (dB)
2713.80	56.7	44.1	74.0	-17.3

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.

Radiated Emission Above 1 GHz

E.U.T Description	Water Meter Transmitter
Type	WMIN01
Serial Number:	Not designated

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

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 904.6 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/m)	(dB)	(dB)	(dB)	(dB µV/m)	(dB µV/m) See Note *	(dB)
3618.40	38.6	33.8	2.0	30.5	74.0	43.9	-30.1
4523.00	37.0	35.2	2.6	30.5	74.0	44.3	-29.7
5427.60	37.3	36.6	2.8	30.4	74.0	46.3	-27.7
8141.40	40.3	40.0	3.7	29.9	74.0	54.1	-19.9
9046.00	39.1	40.8	4.3	30.0	74.0	54.2	-19.8

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	Water Meter Transmitter
Type	WMIN01
Serial Number:	Not designated

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

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 904.6 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)
3618.40	24.0	33.8	2.0	30.5	54.0	29.3	-24.7
4523.00	23.1	35.2	2.6	30.5	54.0	30.4	-23.6
5427.60	23.0	36.6	2.8	30.4	54.0	32.0	-22.0
8141.40	26.3	40.0	3.7	29.9	54.0	40.1	-13.9
9046.00	25.6	40.8	4.3	30.0	54.0	40.7	-13.3

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	Water Meter Transmitter
Type	WMIN01
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 (dB)	Avg. Det. Spec. (dBµV/m)	Avg. Margin (dB)
2745.00	42.6	44.3	54.0	-11.4

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.

Radiated Emission Above 1 GHz

E.U.T Description	Water Meter Transmitter
Type	WMIN01
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 (dB)	Peak Det. Spec. (dBµV/m)	Peak. Margin (dB)
2745.00	56.3	44.3	74.0	-17.7

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.

Radiated Emission Above 1 GHz

E.U.T Description	Water Meter Transmitter
Type	WMIN01
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	37.8	33.8	2.0	30.5	74.0	43.1	-30.9
4575.00	36.5	35.4	2.6	30.5	74.0	44.0	-30.0
7320.00	39.7	39.0	3.4	29.8	74.0	52.3	-21.7
8235.00	40.4	40.1	3.8	29.9	74.0	54.4	-19.6
9150.00	39.7	41.0	4.4	30.0	74.0	55.1	-18.9

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	Water Meter Transmitter
Type	WMIN01
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	24.2	33.8	2.0	30.5	54.0	24.5	-24.5
4575.00	23.0	35.4	2.6	30.5	54.0	30.5	-23.5
7320.00	25.8	39.0	3.4	29.8	54.0	38.4	-15.6
8235.00	26.6	40.1	3.8	29.9	54.0	40.6	-13.4
9150.00	25.7	41.0	4.4	30.0	54.0	41.1	-12.9

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	Water Meter Transmitter
Type	WMIN01
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 (dB)	Avg. Det. Spec. (dBµV/m)	Avg. Margin (dB)
2745.00	42.8	44.3	54.0	-11.2

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.

Radiated Emission Above 1 GHz

E.U.T Description	Water Meter Transmitter
Type	WMIN01
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 (dB)	Peak Det. Spec. (dBµV/m)	Peak. Margin (dB)
2745.00	57.2	44.3	74.0	-16.8

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.

Radiated Emission Above 1 GHz

E.U.T Description	Water Meter Transmitter
Type	WMIN01
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	37.8	33.8	2.0	30.5	74.0	43.1	-30.9
4575.00	36.5	35.4	2.6	30.5	74.0	44.0	-30.0
7320.00	39.7	39.0	3.4	29.8	74.0	52.3	-21.7
8235.00	40.4	40.1	3.8	29.9	74.0	54.4	-19.6
9150.00	39.7	41.0	4.4	30.0	74.0	55.1	-18.9

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	Water Meter Transmitter
Type	WMIN01
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	24.2	33.8	2.0	30.5	54.0	29.5	-24.5
4575.00	23.0	35.4	2.6	30.5	54.0	30.5	-23.5
7320.00	25.8	39.0	3.4	29.8	54.0	38.4	-15.6
8235.00	26.6	40.1	3.8	29.9	54.0	40.6	-13.4
9150.00	25.7	41.0	4.4	30.0	54.0	41.1	-12.9

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	Water Meter Transmitter
Type	WMIN01
Serial Number:	Not designated

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

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 925.4 MHz

Frequency range: 1 GHz to 2.9 GHz
Detector: Average

Freq. (MHz)	Avg. Amp (dBµV/m)	Correction (dB)	Avg. Det. Spec. (dBµV/m)	Avg. Margin (dB)
2776.13	49.0	44.5	54.0	-5.0

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.

Radiated Emission Above 1 GHz

E.U.T Description	Water Meter Transmitter
Type	WMIN01
Serial Number:	Not designated

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

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 925.4 MHz

Frequency range: 1 GHz to 2.9 GHz
Detector: Peak

Freq.	Peak Amp	Correction	Peak Det. Spec.	Peak. Margin
(MHz)	(dBµV/m)	(dB)	(dBµV/m).	(dB)
2776.13	63.0	44.5	74.0	-11.0

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.

Radiated Emission Above 1 GHz

E.U.T Description	Water Meter Transmitter
Type	WMIN01
Serial Number:	Not designated

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

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 925.4 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)
3701.60	37.2	33.9	2.0	30.5	74.0	42.6	-31.4
4627.00	37.6	35.4	2.6	30.5	74.0	45.1	-28.9
7403.20	40.0	39.1	3.4	29.8	74.0	53.2	-19.8
8328.60	40.5	40.3	3.8	29.9	74.0	54.7	-19.3

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	Water Meter Transmitter
Type	WMIN01
Serial Number:	Not designated

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

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 925.4 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)
3701.60	23.2	33.9	2.0	30.5	54.0	28.6	-25.4
4627.00	23.0	35.4	2.6	30.5	54.0	30.5	-23.5
7403.20	27.0	39.1	3.4	29.3	54.0	40.2	-13.8
8328.60	27.0	40.3	3.8	29.9	54.0	41.2	-12.8

Figure 38. Radiated Emission. Antenna Polarization: AVERAGE. 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	Water Meter Transmitter
Type	WMIN01
Serial Number:	Not designated

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

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 925.4 MHz

Frequency range: 1 GHz to 2.9 GHz
Detector: Average

Freq.	Avg. Amp	Correction	Avg. Det. Spec.	Avg. Margin
(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dB)
2776.13	49.0	44.5	54.0	-5.0

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.

Radiated Emission Above 1 GHz

E.U.T Description	Water Meter Transmitter
Type	WMIN01
Serial Number:	Not designated

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

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 925.4 MHz

Frequency range: 1 GHz to 2.9 GHz
Detector: Peak

Freq. (MHz)	**Peak Amp** (dBµV/m)	**Correction** (dB)	**Peak Spec.** (dBµV/m).	**Peak. Margin** (dB)
2776.13	62.6	44.4	74.0	-11.4

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.

Radiated Emission Above 1 GHz

E.U.T Description	Water Meter Transmitter
Type	WMIN01
Serial Number:	Not designated

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

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 925.4 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)
3701.60	37.2	33.9	2.0	30.5	74.0	42.6	-31.4
4627.00	37.6	35.4	2.6	30.5	74.0	45.1	-28.9
7403.20	40.0	39.1	3.4	29.8	74.0	53.2	-19.8
8328.60	40.5	40.3	3.8	29.9	74.0	54.7	-19.3

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	Water Meter Transmitter
Type	WMIN01
Serial Number:	Not designated

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

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 925.4 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)
3701.60	23.2	33.9	2.0	30.5	54.0	28.6	-25.4
4627.00	23.0	35.4	2.6	30.5	54.0	30.5	-23.5
7403.20	27.0	39.1	3.4	29.3	54.0	40.2	-13.8
8328.60	27.0	40.3	3.8	29.9	54.0	41.2	-12.8

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	January 31, 2003	1 year
RF Section	HP	85420E	3427A00103	January 31, 2003	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 31,2003	2 year
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	April 10, 2003	1 year
Spectrum Analyzer	HP	8592L	3745A08184	January 31,2003	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.

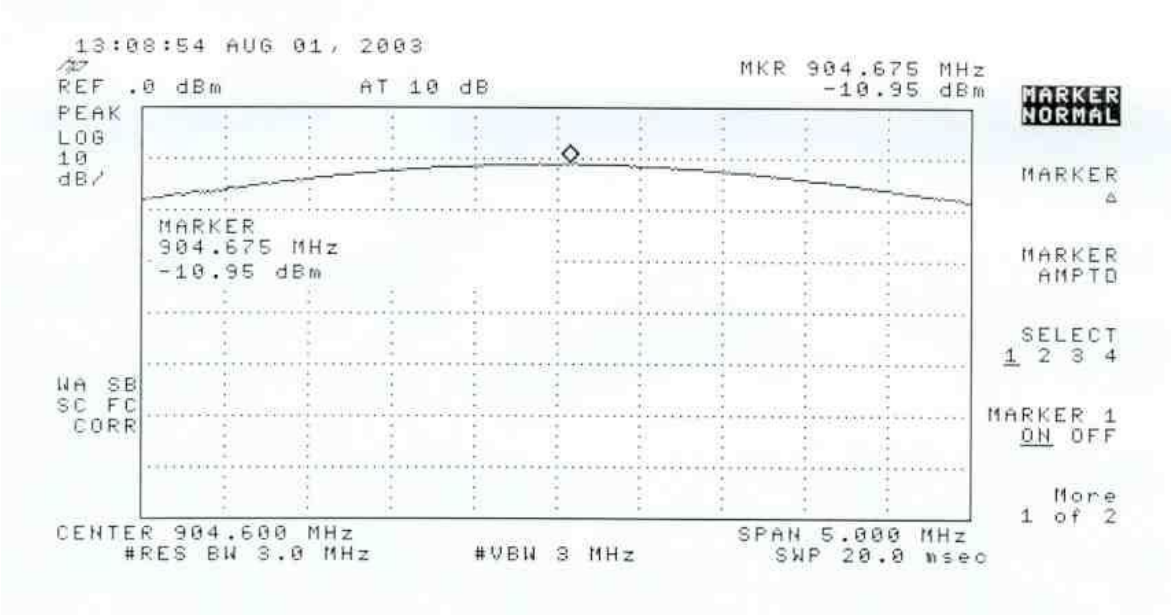

Figure 43.

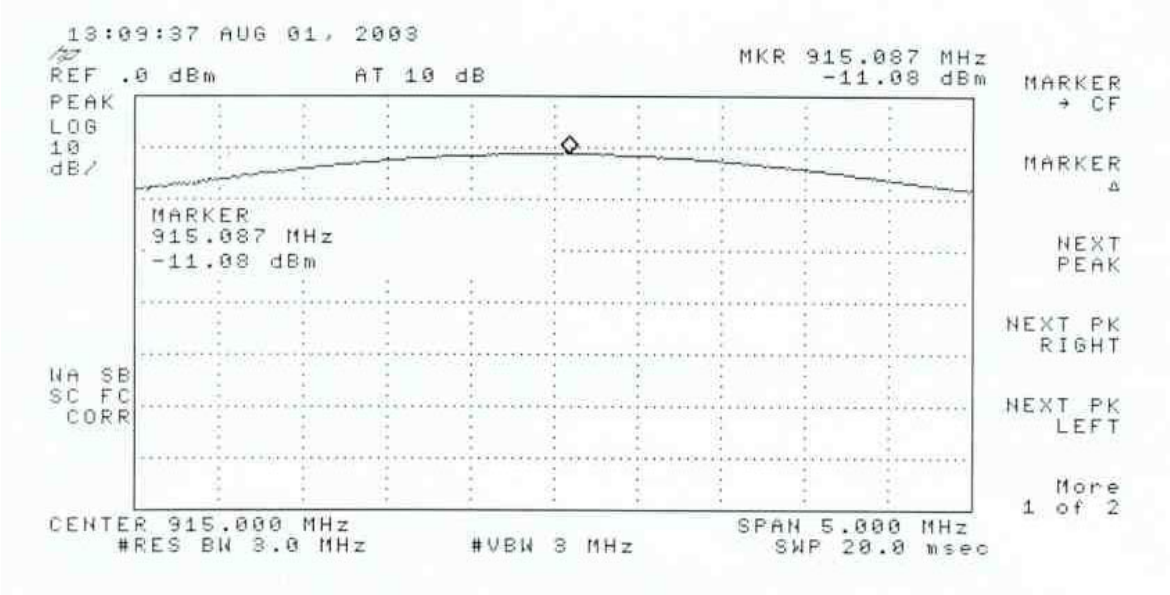

Figure 44.

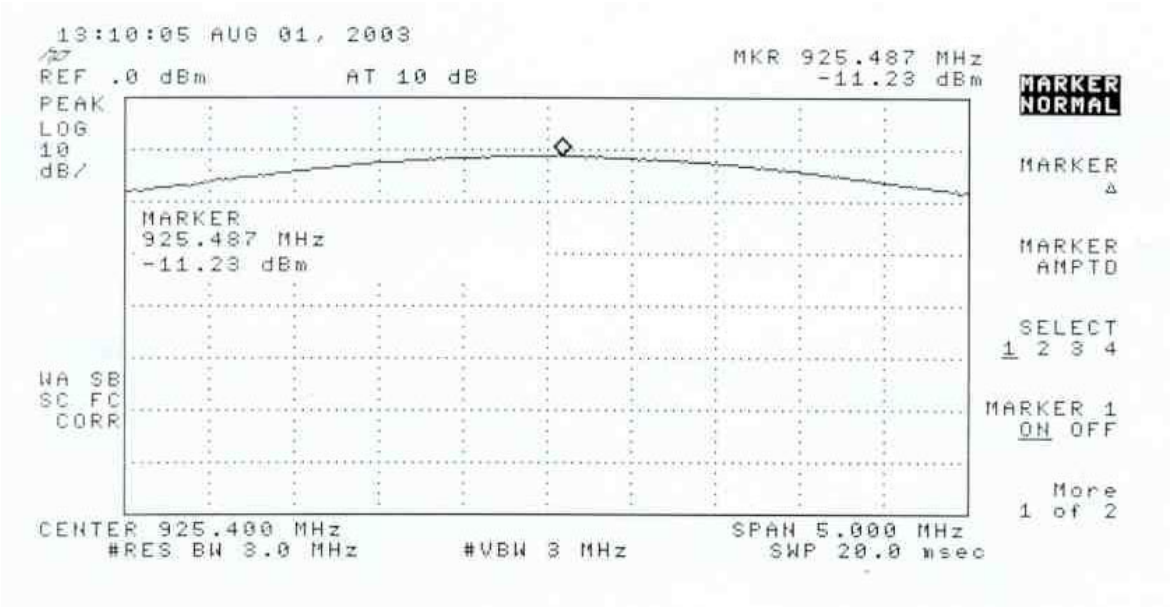

Figure 45.

8.2 Results table

E.U.T. Description: Water Meter Transmitter
Model No.: WMIN01
Serial Number: Not Designated
Specification: F.C.C. Part 15, Subpart C

Operation Frequency (MHz)	Reading (dBm)	Final Result (dBm)	Specification (dBm)	Margin (dB)	Cable Attenuation (dB)
904.6	-10.95	29.55	30	0.45	40.5
915.0	-11.08	29.42	30	0.58	40.5
925.4	-11.23	29.27	30	0.73	40.5

Figure 46 Maximum Power Output

JUDGEMENT: Passed by 0.45 dB

TEST PERSONNEL:
Tester Signature: Shimon Zigdon Date: 26.08.03
Typed/Printed Name: S. Zigdon

8.3 Test Equipment Used.

Peak Power Output

Instrument	Manufacture	Model	Serial Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	HP8594E	3543A02712	29.5.03	1 year
Cable	Huber Suhner	RG142	None	31.7.03	1 year
Attenuator	Mini Circuit	SAT-30	None	31.7.03	1 year
Attenuator	Mini Circuit	SAT-10	None	31.7.03	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.

9.2 Results table

E.U.T Description: Water Meter Transmitter
Model No.: WMNI01
Serial Number: Not Designated
Specification: F.C.C. Part 15, Subpart C (15.247)

Operation Frequency (MHz)	Reading (dBc)	Specification (dBc)	Margin (dB)
904.6	64	20	44
915.0	65	20	45
925.4	65	20	45

Figure 48 Peak Power Output of 902-928 MHz Band

JUDGEMENT: Passed by 44 dB

TEST PERSONNEL:
Tester Signature: Shimon Zigdon Date: 26.08.03
Typed/Printed Name: S. Zigdon

9.3 Test Equipment Used.

Peak Power Output of 902-928 MHz Band

Instrument	Manufacture	Model	Serial Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	Anritzu	MS 2602A	MT12370	29.5.03	1 year
Cable	Huber Suhner	RG142	None	31.7.03	1 year

Figure 49 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.

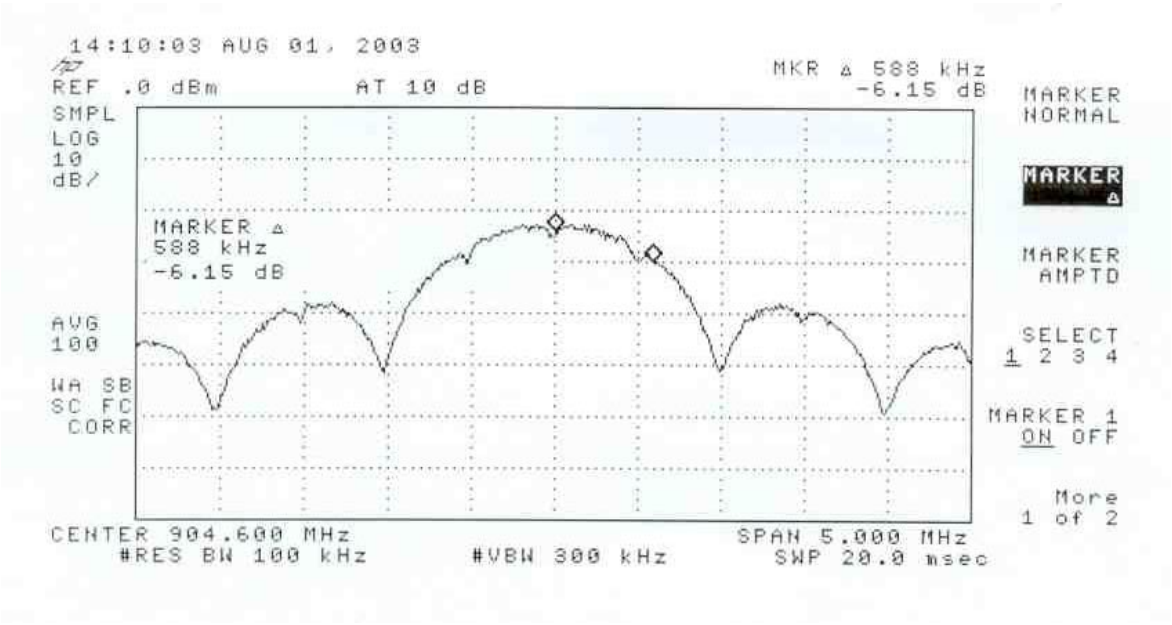

Figure 50

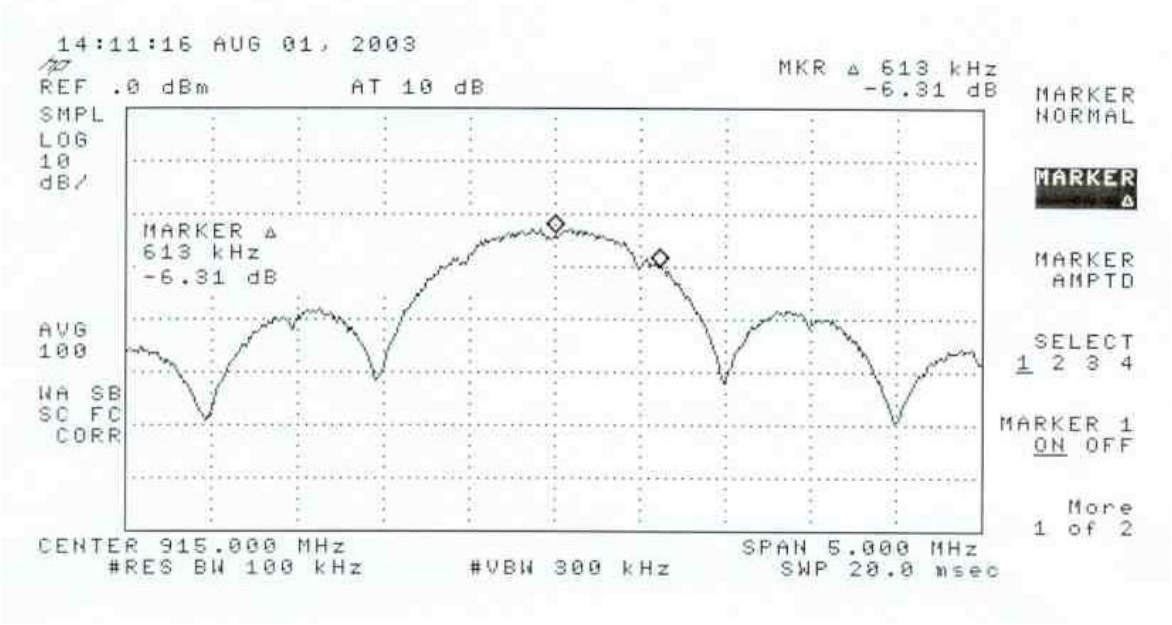

Figure 51

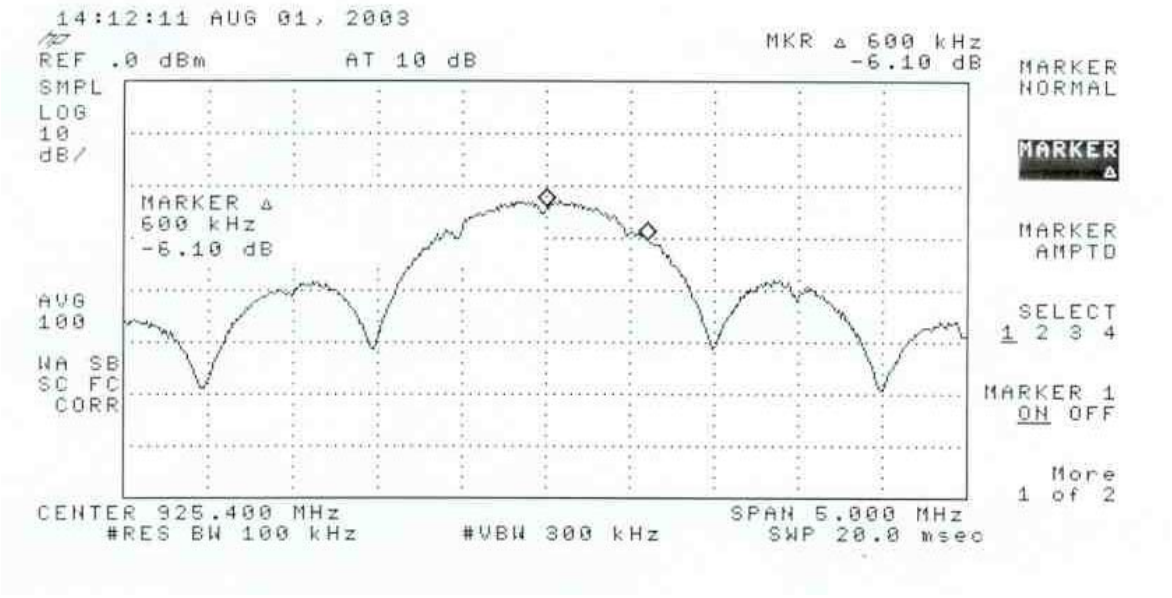

Figure 52

10.2 Results table

E.U.T Description: Water Meter Transmitter
Model No.: WMIN01
Serial Number: Not Designated
Specification: F.C.C. Part 15, Subpart C: (15.247-a2)

Operation Frequency (MHz)	Reading (MHz)	Specification (MHz)	Margin (MHz)
904.6	1.17	0.5	0.67
915.0	1.22	0.5	0.72
925.4	1.20	0.5	0.70

Figure 53 6 dB Minimum Bandwidth

JUDGEMENT: Passed by 0.67 MHz

TEST PERSONNEL:
Tester Signature: Shimon Zigdon Date: 26.08.03
Typed/Printed Name: S. Zigdon

10.3 Test Equipment Used.

6 dB Minimum Bandwidth

Instrument	Manufacture	Model	Serial Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	HP8594E	3543A02712	29.5.03	1 year
Cable	Huber Suhner	RG142	None	31.7.03	1 year
Attenuator	Mini Circuit	SAT-30	None	31.7.03	1 year
Attenuator	Mini Circuit	SAT-10	None	31.7.03	1 year

Figure 54 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 (904.6 MHz) and the highest operation frequency (925.4 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 904.6 MHz and 925.4 MHz correspondingly.

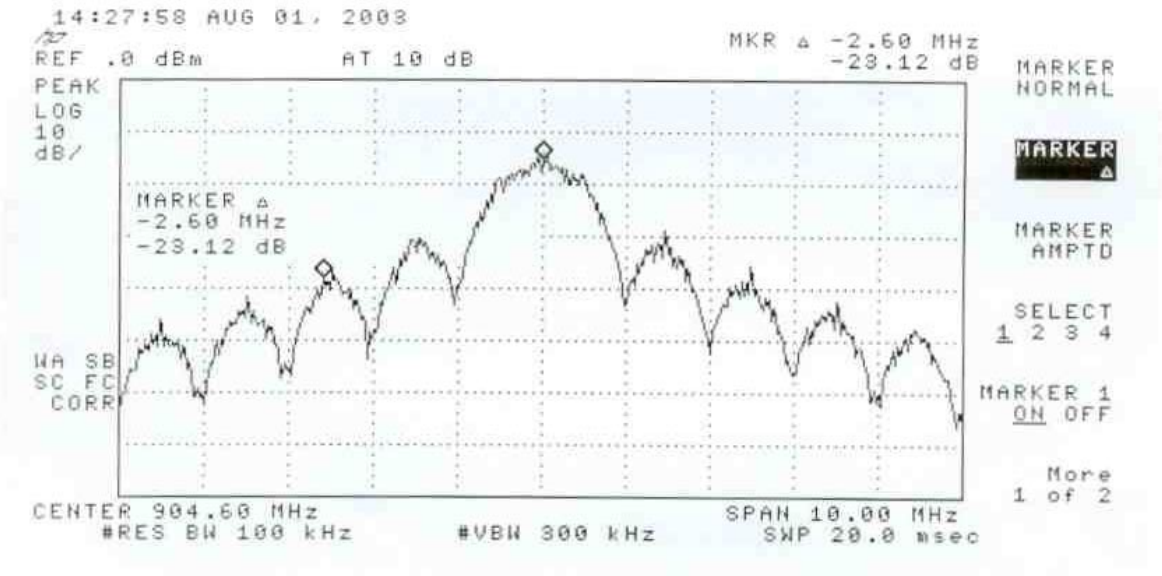

Figure 55

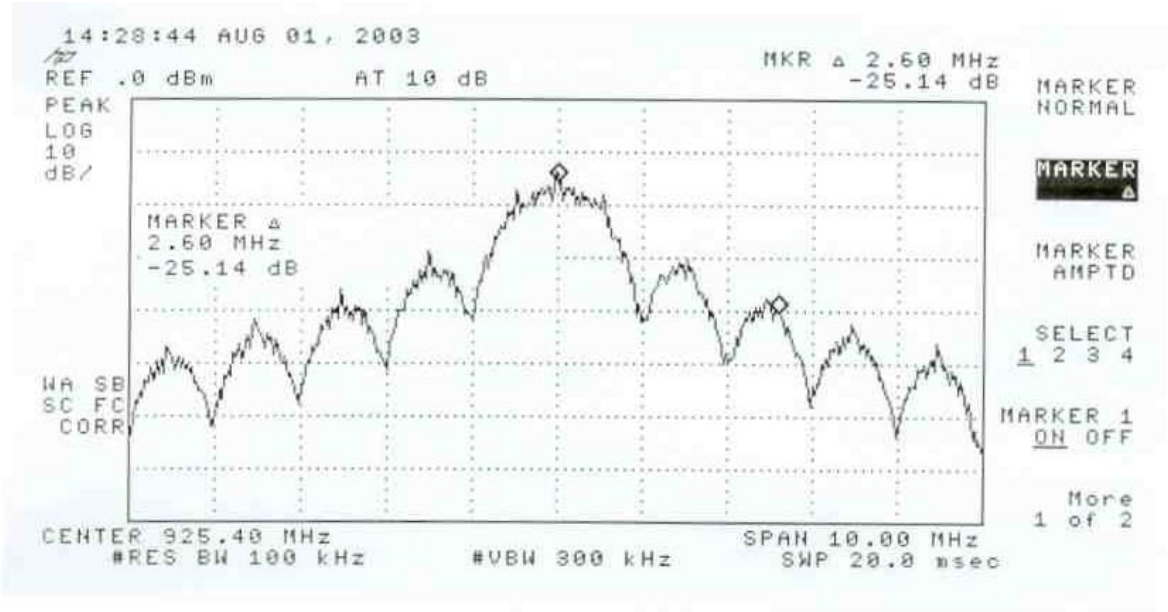
14:28:44 AUG 01, 2003
REF .0 dBm
AT 10 dB
MKR Δ 2.60 MHz
-25.14 dB
PEAK
LOG
10
dB/
MARKER Δ
2.60 MHz
-25.14 dB
MARKER
NORMAL
MARKER
MARKER
AMPTD
SELECT
1 2 3 4
MARKER 1
ON OFF
More
1 of 2
WA SB
SC FC
CORR
CENTER 925.40 MHz
#RES BW 100 kHz
#VBW 300 kHz
SPAN 10.00 MHz
SWP 20.0 msec

Figure 56

11.2 Results table

E.U.T. Description: Water Meter Transmitter
Model No.: WMIN01
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)
904.6	902	23.12	20	3.12
925.4	928	25.14	20	5.14

Figure 57 Band Edge Spectrum

JUDGEMENT: Passed by 3.12 dB

TEST PERSONNEL:
Tester Signature: Shimon Zigdon Date: 26.08.03
Typed/Printed Name: S. Zigdon

11.3 Test Equipment Used.

Band edge Spectrum

Instrument	Manufacture	Model	Serial Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	HP8594E	3543A02712	29.5.03	1 year
Cable	Huber Suhner	RG142	None	31.7.03	1 year
Attenuator	Mini Circuit	SAT-30	None	31.7.03	1 year
Attenuator	Mini Circuit	SAT-10	None	31.7.03	1 year

Figure 58 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.

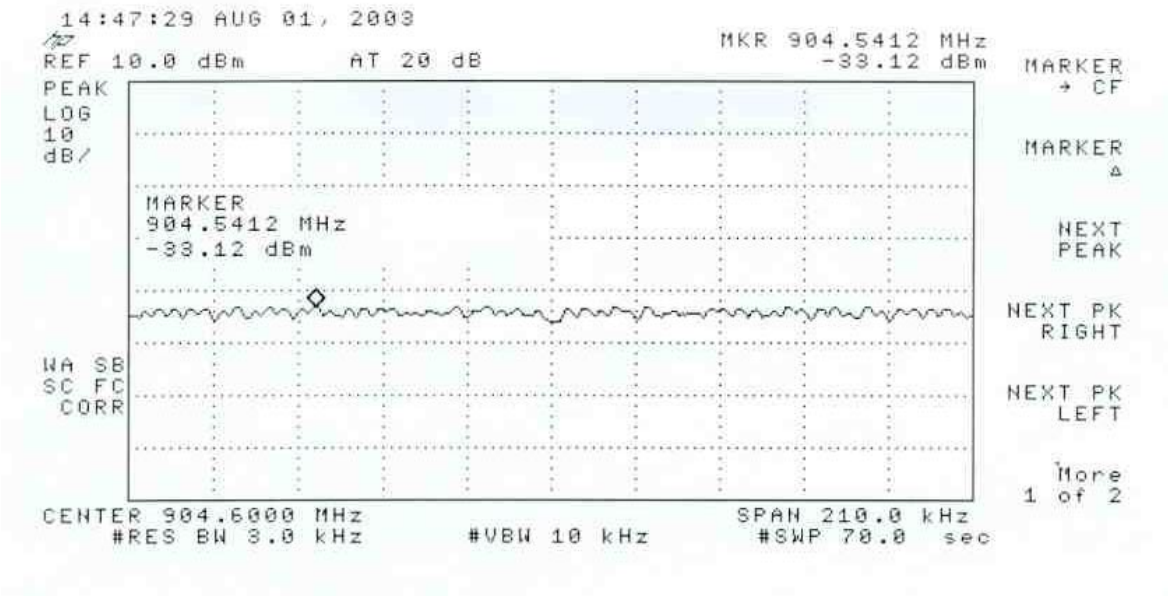

Figure 59

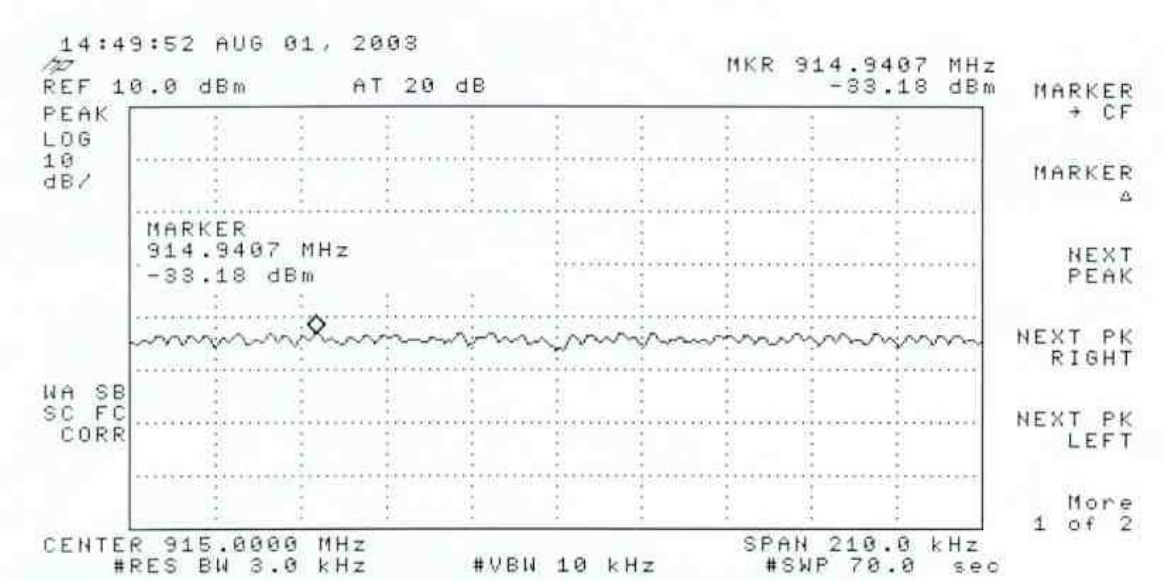

Figure 60

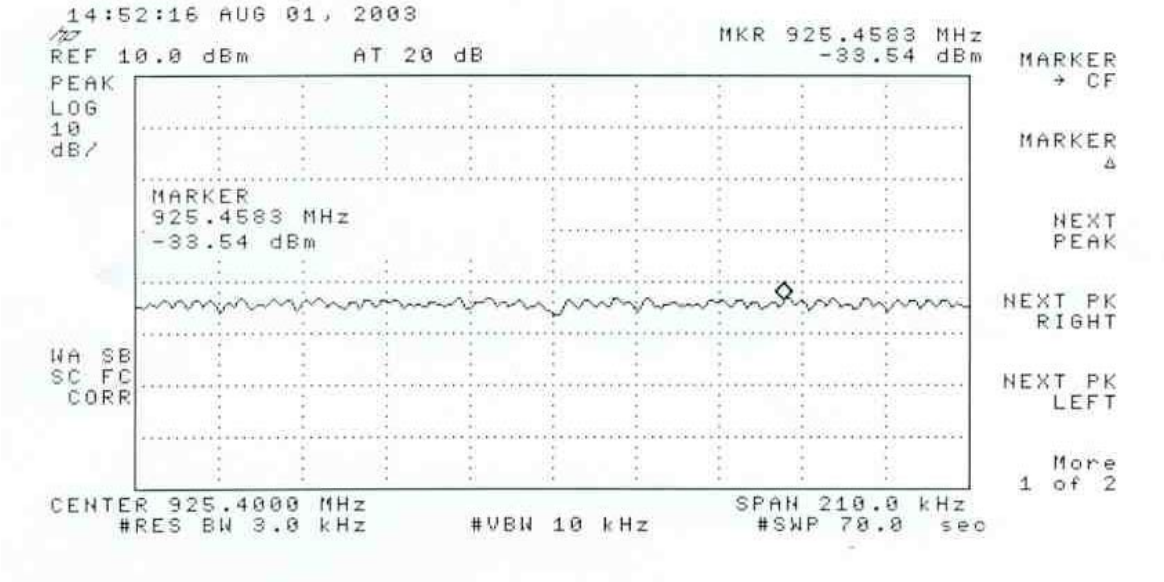

Figure 61

12.2 Results table

E.U.T. Description: Water Meter Transmitter
Model No.: WMIN01
Serial Number: Not Designated
Specification: F.C.C. Part 15, Subpart C (15.247)

Operation Frequency (MHz)	Reading (dBm)	Final Result (dBm)	Specification (dBm)	Margin (dB)	Cable Attenuation (dB)
904.6	-33.12	7.38	8	0.62	40.5
915.0	-33.18	7.32	8	0.68	40.5
925.4	-33.54	6.96	8	1.04	40.5

Figure 62 Test Equipment Used

JUDGEMENT: Passed by 0.62 dB

TEST PERSONNEL:
Tester Signature: Shimon Zigdon Date: 26.08.03
Typed/Printed Name: S. Zigdon

12.3 Test Equipment Used.

Transmitted Power Density

Instrument	Manufacture	Model	Serial Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	HP8594E	3543A02712	29.5.03	1 year
Cable	Huber Suhner	RG142	None	31.7.03	1 year
Attenuator	Mini Circuit	SAT-30	None	31.7.03	1 year
Attenuator	Mini Circuit	SAT-10	None	31.7.03	1 year

Figure 63 Test Equipment Used

13. 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.

14. R.F Exposure/Safety

The E.U.T. is installed in fixed locations for application of transmitting data of water consumption to central data collection offices. The distance between the E.U.T. and the general population in normal use 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

$$S = \frac{915}{1500} = 0.61 \frac{mW}{cm^2}$$

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, 1.78(2.5dBi)

R- Distance from Transmitter using 100cm worst case

(c) The peak power density is :

$$S_p = \frac{10^3 x 1.78}{4\pi (100)^2} = 14.2 x 10^{-3} \frac{mW}{cm^2}$$

(d) The duty cycle of transmission in actual worst case is 3 sec “on” and 6 hours “Off”.
The average power over 30 minutes is:

$$P_{AV} = \frac{1000 \times 3}{1800} = 1.6 mW$$

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

$$S_{AV} = \frac{1.66 X 1.78}{4\pi x (100)^2} = 2.35 X 10^{-5} \frac{mW}{cm^2}$$

(f) This is more than 4 orders of magnitude below the FCC limit.

15. Photographs of Tested E.U.T.

Figure 64 Top View External

Figure 65 Transmitter Connected to Water Meter

Figure 66 Rear Side View

Figure 67 Rear View

Figure 68 Transmitter Unit Open

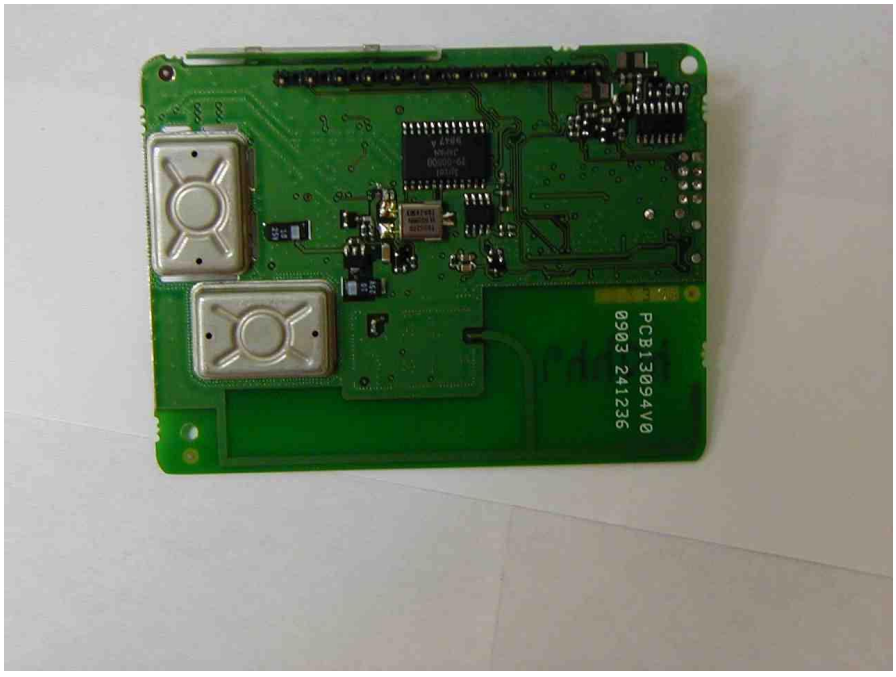

Figure 69 PCB Side 1

Figure 70 PCB Side 2

Figure 71 PCB Shields Removed

Figure 72 PCB Side 2 Shields Removed