Cert. No. 1152.01
Electrical (EMC)

DATE: 06 January 2005

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

FCC EMC Test Report

for

Sensus Metering Systems

Equipment under test:

Sensus/Equimeter Industrial Gas Meter Transmitter

GS0005

Written by: _____
D. Shidlowsky, Documentation

Approved by: _____
E. Pitt, Test Engineer

Approved by: _____
I. Raz, EMC Laboratory Manager

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This report relates only to items tested.

Cert. No. 1152.01
Electrical (EMC)

Measurement/Technical Report for
Sensus Metering Systems

Sensus/Equimeter Industrial Gas Meter Transmitter

GS0005

FCC ID: KCHGS0005

06 January 2005

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 C63.4-2003.

Application for Certification prepared by:
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Applicant for this device:
(different from "prepared by")
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1. General Information

1.1 Administrative Information

Manufacturer:	Sensus Metering Systems
Manufacturer's Address:	450 North Gallatin Ave., Uniontown PA 15401 USA Tel: 805-562-5363 Fax: 805-562-9134
Manufacturer's Representative:	Shimon Zigdon
Equipment Under Test (E.U.T):	Sensus/Equimeter Industrial Gas Meter Transmitter
Equipment Model No.:	GS0005
Equipment Serial No.:	Not designated
Date of Receipt of E.U.T:	23.12.04
Start of Test:	23.12.04
End of Test:	04.01.05
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 Direct Sequence Spread Spectrum burst transmitter for Automatic Meter Reading (AMR) of gas meters. This device is mechanically designed to fit on Sensus/Equimeter industrial gas meters and is part of a family of products designed to cover the majority of meters, both residential and industrial, in use in the USA.

The interface with the meter comprises a magnet mounted on a shaft extended from the meter and two reed switches mounted on the board of the unit. This battery operated device is maintained most of the time on stand-by and wakes up to accept and count pulses from the meter interface.

Once every pre-programmed number of hours the device wakes up and generates air message containing information on the meter reading. The air message is a burst DS SPSP transmission in one of number of pre-defined channels.

These messages are collected by network of base stations that covers the area of service.

The base station decodes the upcoming messages and sends them via a backbone connection to a central computer, the Data Operation Center (DOC).

1.4 Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4: 2003. 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 December 12, 2003).
I.T.L.'s EMC Laboratory is also accredited by A2LA, certificate No. 1152.01.

1.6 Measurement Uncertainty

Radiated Emission

The Open Site complies with the ±4 dB Normalized Site Attenuation requirements of ANSI C63.4-2003. 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

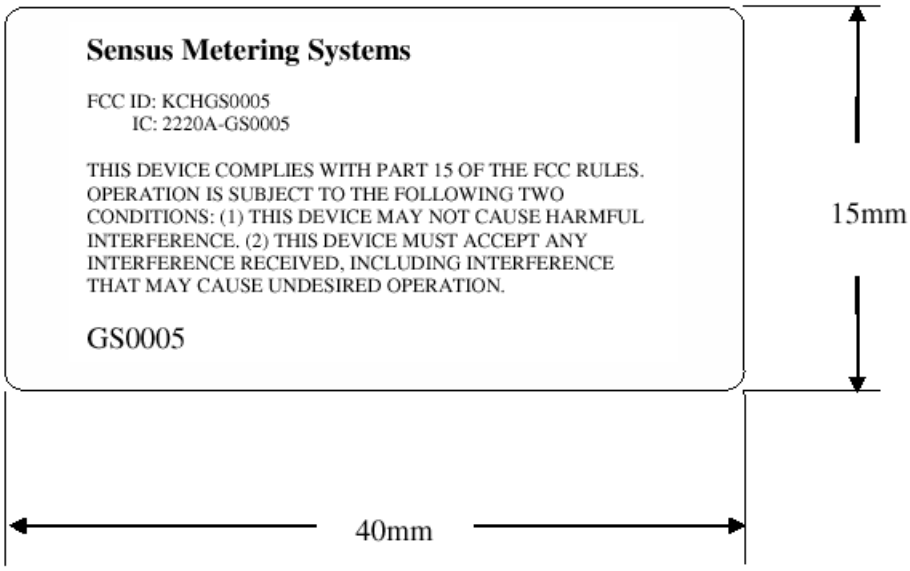


Figure 1. FCC Label

Figure 2. Location of Label on EUT

3. System Test Configuration

3.1 Justification

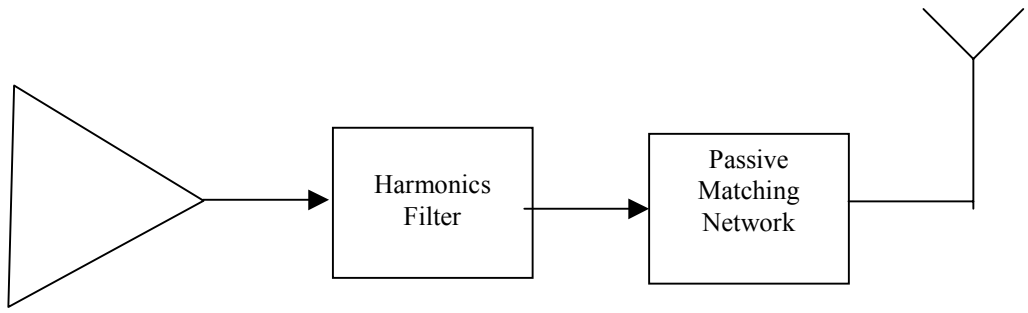
The EUT was mounted on a gas meter as in typical installation. Since in normal operation the EUT transmits short transmission (<160mSec.) every 6 hours (or more) external PC triggered the EUT to transmit more frequently (every 750mSec). This enabled complete investigation of the EUT emissions in a reasonable manners and time. The communication between the PC and the EUT was done through the EUT's local programming magnetic port. To communicate with the EUT through the local programming magnetic port, an interface card that converts RS232 signal from the PC's serial port to 42 kHz on-off keying signal was used. One end of the interface card was connected to the PC serial port and the other end to a coil that was attached to the EUT (in close proximity to the EUT's internal coil). The EUT's local programming port is used to program the EUT during the production of the unit with general parameters and later on with specific parameters during installation (~10 seconds programming routine). There is no any other use for the local magnetic programming port other than the use done during production and installation.

The E.U.T. programming magnetic port transmitted on 63.4 kHz, On/Off keying, 100 msec. "On", 400 msec. "Off" continuously.

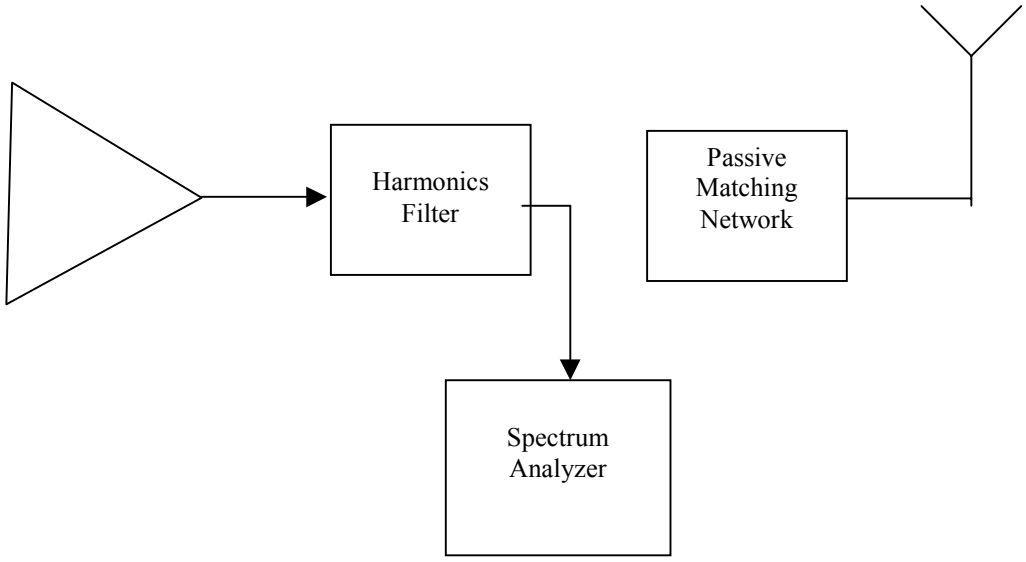
The device battery pack (7.2V) enables 15 years of field life but does not enable continuous transmission or frequent burst transmissions. To allow reasonable testing condition the E.U.T. was operated with different type of battery (6V) that allows frequent burst transmission. The use of different battery type does not affect the power generated by the E.U.T. or the radiated emissions since the E.U.T.'s circuitry is regulated to 3.3V, 3.6V and 4.2V, all below the 6V supplied by the battery pack used for testing.

Justification for Conducted Measurements Setup

At the end of the signal generation chain the circuit board comprises power amplifier that feeds harmonics filter and the harmonics filter feeds printed antenna. The printed antenna impedance is not 50ohm and as a result the circuit board comprises a passive matching network that matches the output of the harmonics filter to the antenna input.



The conducted measurements were taken at the output of the harmonics filter. The matching network and printed circuit were disconnected from the output of the harmonics filter and the output of the harmonics filter (50ohm impedance) was connected to a spectrum analyzer (50ohm impedance) to perform the measurements (power, power density etc.).



3.2 EUT Exercise Software

The EUT was tested with the product's standard micro controller operational firmware. No special firmware was used for the test. The EUT went through every mode of operation during the test as a result of the continuous normal operation

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

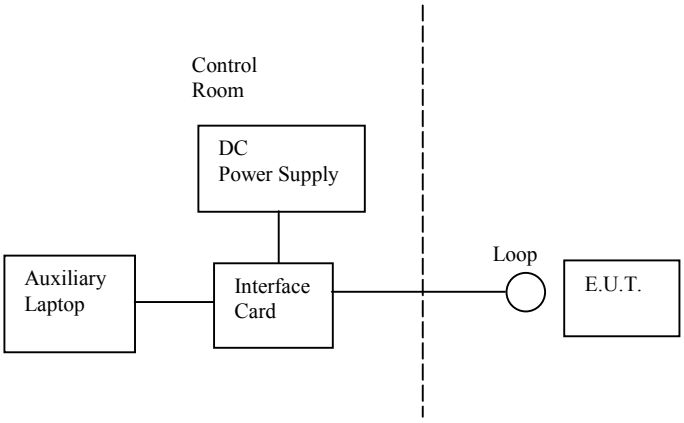


Figure 3. Configuration of Tested System

4. Block Diagram

4.1 Schematic Block/Connection Diagram

Intentionally Blank for Reasons of Confidentiality

4.2 Theory of Operation

The interface with the meter comprises a magnet mounted on a shaft extended from the meter and two reed switches mounted on the board of the unit. This battery operated device is maintained most of the time on stand-by and wakes up to accept and count pulses from the meter interface.

Once every pre-programmed number of hours the device wakes up and generates air message containing information on the meter reading. The air message is a burst DS SPSP transmission in one of number of pre-defined channels.

These messages are collected by network of base stations that covers the area of service.

The base station decodes the upcoming messages and sends them via a backbone connection to a central computer, the Data Operation Center (DOC).

Signal Description

Operation frequency band - 904.6 MHz (channel 5) to 925.4 MHz (channel 57).

Channel spacing - 0.4 MHz.

Modulation technique - BPSK, Direct Sequence Spread Spectrum.

Chip rate - 1 Mchip/Sec.

Spreading sequence - 255 Maximal Length sequence.

Raw data rate –3921 Bit/Sec.

Preamble length –300 bits.

Raw data length –320 bits.

Error correction code –Convolution code, R=1/2, K=5.

Interleaver depth –20 bits.

Message duration –158mSec.

Signal Generation

The transmitter is a direct conversation burst transmitter. The transmitter comprises synthesized local oscillator, that works with 15 MHz crystal reference and generates carrier in the 902 - 928 MHz band with channel spacing of 0.4 MHz, printed modulator that receives carrier signal from the synthesized local oscillator and base-band signal from the signal spreading module and generates direct sequence spread spectrum signal, and power amplifier module that amplifies and feeds a printed antenna with 29dBm signal.

5. Spurious Radiated Measurement Photo

Figure 4. Spurious Radiated Emission Test Front

6. Radiated Emission, For Low Frequency Transmitter (63.4 kHz)

6.1 Test Specification

9 kHz-30 MHz, FCC, Part 15, Section 15.209

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 loop antenna. 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 configuration tested is shown in *Figure 3*.

The frequency range 9 kHz-30 MHz was scanned, and the list of the highest emissions was verified and updated accordingly.

In the frequency range 9 kHz-30MHz, the loop antenna was rotated on its vertical axis. The antenna height (center of loop) was 1 meter at a distance of 3 meters.

The E.U.T. was operated at the frequency of 63.4 kHz

6.3 Test Data

JUDGEMENT: Passed by 50.9 dB

The EUT was tested and it met the requirements of the FCC Part 15, Subpart C, specification.

The margin between the carrier level (63.4 kHz) and the specification limit was 50.9 dB.

All other emissions were at least 40 dB below the limit.

See details in Figure 5.

Note: Based on FCC Part 15, Section 15.201 no certification is required for this low frequency transmitter.

TEST PERSONNEL:

Tester Signature: _____ Date: 17.01.05

Typed/Printed Name: E. Pitt

Radiated Emission, Below 1 GHz

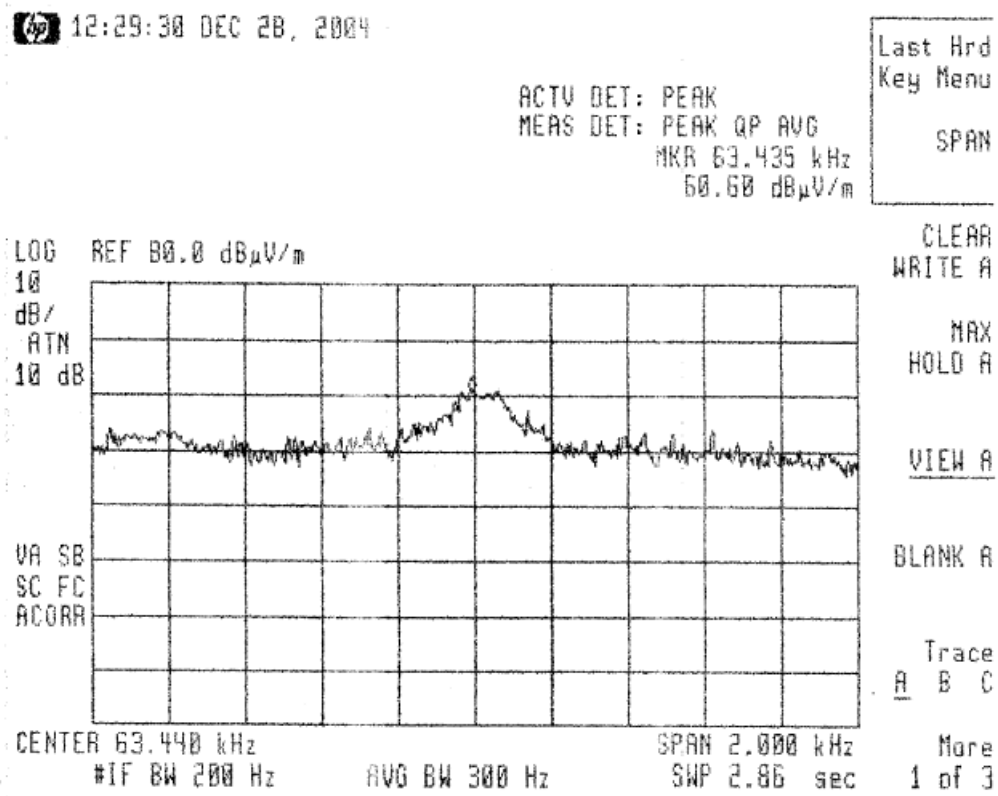


Figure 5 Spurious Radiated Emissions 9 kHz – 30 MHz

$$\text{Limit}_{3m} = 20\log\frac{2400}{63.4} + 40\log\frac{300}{3} = 111.56 db\mu V/m$$

6.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3411A00102	February 28, 2004	1 year
RF Section	HP	85420E	3427A00103	February 28, 2004	1 year
Antenna Bioconical	ARA	BCD 235/B	1041	April 11, 2004	1 year
Antenna Log Periodic	ARA	LPD-2010/A	1038	March 21, 2004	1 year
Active Loop Antenna	EMCO	6502	9506-2950	October 17, 2004	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

7. Spurious Radiated Emission in the Restricted Bands Below 1 GHz

7.1 Test Specification

9 kHz-1000 MHz, FCC Part 15, Subpart B, CLASS B

7.2 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 configuration tested is shown in *Figure 3*.

The frequency range 9 kHz-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 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.

In the frequency range 9 kHz-30MHz, the loop antenna was rotated on its vertical axis. The antenna height (center of loop) was 1 meter.
In the frequency range 30-1000MHz, 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.

The E.U.T. was operated in the frequencies of 904.6, 915.0, and 925.4 MHz.

7.3 Test Results

The E.U.T met the requirements of the FCC Part 15, Subpart B ,Class B specification.

The signals in the band 9 kHz – 30 MHz were 20dB below the specification limit.

The margin between the emission level and the specification limit is 21.5 dB in the worst case at the frequency of 300.00 MHz, horizontal polarization.

The test results were the same for all 3 operating frequencies.

The details of the highest emissions are given in *Figure 6* to *Figure 9*.

TEST PERSONNEL:

Tester Signature: _____ Date: 17.01.05

Typed/Printed Name: E. Pitt

Radiated Emission

E.U.T Description	Sensus/Equimeter Industrial Gas Meter Transmitter
Type	GS0005
Serial Number:	Not designated

Specification: FCC Part 15, Subpart B, Class B

Antenna Polarization: Horizontal
Antenna: 3 meters distance

Frequency range: 30 MHz to 1000 MHz
Detectors: Peak, Quasi-peak

Frequency (MHz)	Peak Amp (dBµV/m)	QP Amp (dBµV/m)	Correction (dB)	Specification (dBµV/m)	Margin (dB)
105.00	24.9	18.3	12.6	43.5	-25.2
120.00	25.8	20.1	13.6	43.5	-23.4
150.00	27.0	20.6	15.0	43.5	-22.9
240.00	25.6	20.6	19.5	46.0	-25.4
285.00	27.7	23.1	22.2	46.0	-22.9
300.00	29.7	24.5	23.2	46.0	-21.5

Figure 6. Radiated Emission. Antenna Polarization: HORIZONTAL. Detectors: 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	Sensus/Equimeter Industrial Gas Meter Transmitter
Type	GS0005
Serial Number:	Not designated

Specification: FCC Part 15, Subpart B, Class B

Antenna Polarization: Horizontal
Antenna: 3 meters distance

Frequency range: 30 MHz to 1000 MHz
Detectors: Peak, Quasi-peak

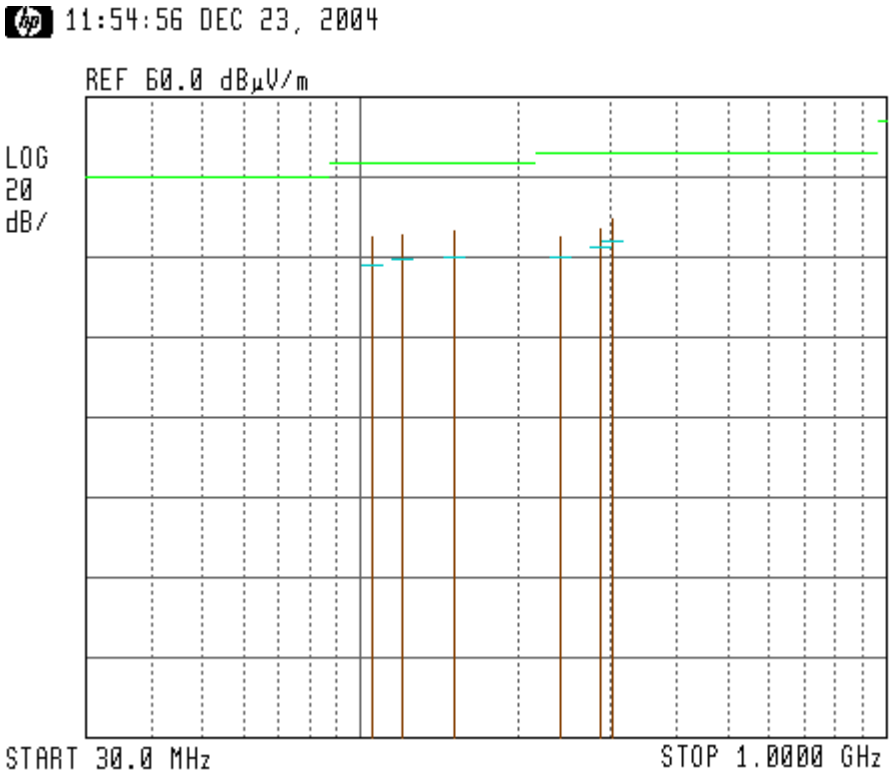


Figure 7. Radiated Emission. Antenna Polarization: HORIZONTAL
Detectors: Peak, Quasi-peak

Note:

1. *Horizontal axis shows logarithmic frequency scale.*
2. *The vertical axis shows amplitude (in dB µV/m).*
3. *Peak detection is designated by the top of each vertical line.*
4. *Quasi-peak detection is designated by the first dash mark (from the top) of each vertical line.*

Radiated Emission

E.U.T Description	Sensus/Equimeter Industrial Gas Meter Transmitter
Type	GS0005
Serial Number:	Not designated

Specification: FCC Part 15, Subpart B, Class B

Antenna Polarization: Vertical
Antenna: 3 meters distance

Frequency range: 30 MHz to 1000 MHz
Detectors: Peak, Quasi-peak

Frequency (MHz)	Peak Amp (dBµV/m)	QP Amp (dBµV/m)	Correction (dB)	Specification (dBµV/m)	Margin (dB)
120.00	25.7	20.1	13.6	43.5	-23.4
150.00	25.9	20.6	15.0	43.5	-22.9
210.00	24.2	18.9	18.1	43.5	-24.6
240.00	26.5	20.7	19.5	46.0	-25.3
285.00	29.8	23.3	22.2	46.0	-22.7
315.00	29.4	24.5	23.3	46.0	-21.5

Figure 8. Radiated Emission. Antenna Polarization: VERTICAL. Detectors: 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	Sensus/Equimeter Industrial Gas Meter Transmitter
Type	GS0005
Serial Number:	Not designated

Specification: FCC Part 15, Subpart B, Class B

Antenna Polarization: Vertical
Antenna: 3 meters distance

Frequency range: 30 MHz to 1000 MHz
Detectors: Peak, Quasi-peak

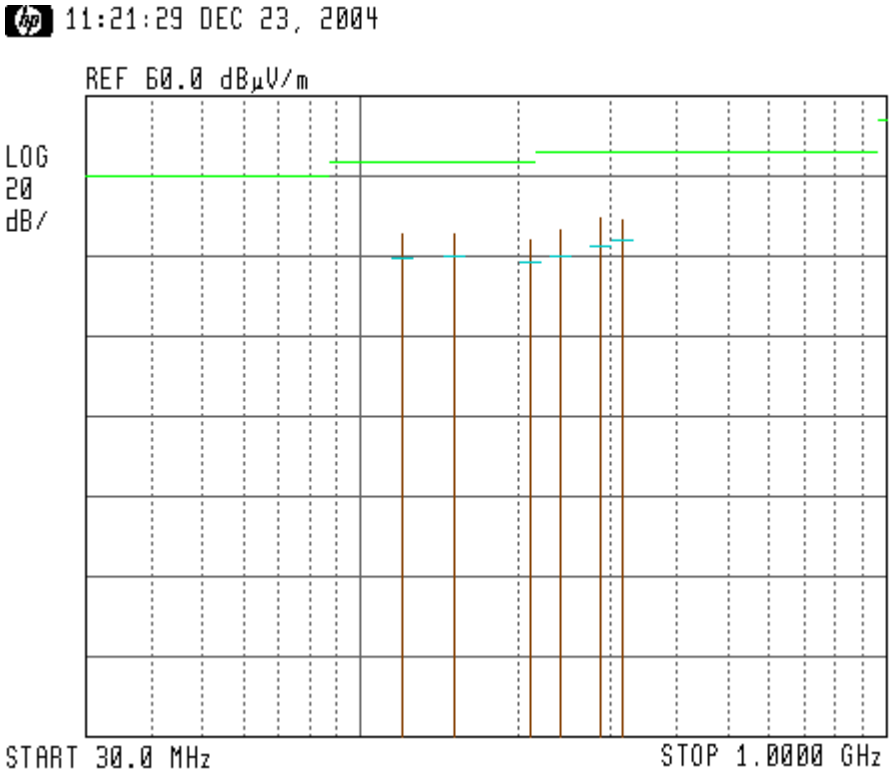


Figure 9. Radiated Emission. Antenna Polarization: VERTICAL. Detectors: Peak, Quasi-peak

Note:

1. *Horizontal axis shows logarithmic frequency scale.*
2. *The vertical axis shows amplitude (in dB µV/m).*
3. *Peak detection is designated by the top of each vertical line.*
4. *Quasi-peak detection is designated by the first dash mark (from the top) of each vertical line.*

7.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3411A00102	February 28, 2004	1 year
RF Section	HP	85420E	3427A00103	February 28, 2004	1 year
Antenna Bioconical	ARA	BCD 235/B	1041	April 11, 2004	1 year
Antenna Log Periodic	ARA	LPD-2010/A	1038	March 21, 2004	1 year
Active Loop Antenna	EMCO	6502	9506-2950	October 17, 2004	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

7.5 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.

8. Spurious Radiated Emission in the Restricted Band, Above 1 GHz

8.1 Radiated Emission Above 1 GHz

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

See Section 3.1 Justification of the System Test Configuration concerning the E.U.T. orientation for this test.

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 configuration tested is shown in *Figure 3*.

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.
In the frequency range 1-2.9 GHz, a computerized EMI receiver complying to CISPR 16 requirements was used.
In the frequency range 2.9-9.5 GHz, a spectrum analyzer including a low noise amplifier was used. During average measurements, the IF bandwidth was 1 MHz and the video bandwidth was 100Hz. During peak measurements, the IF bandwidth was 1 MHz and the video bandwidth was 3 MHz.
The test distance was 3 meters.

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.)

8.2 Test Data

JUDGEMENT: Passed by 7.2 dB

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

for 904.6 MHz, 7.2 dB margin at 9046.00 MHz frequency, horizontal polarization.

for 915.0 MHz, 7.5 dB margin at 9150.00 MHz frequency, horizontal polarization

for 925.4 MHz, 8.3 dB margin at 8328.60 MHz frequency, horizontal polarization

The details of the highest emissions are given in *Figure 10* to *Figure 21*.

TEST PERSONNEL:

Tester Signature: _____ Date: 17.01.05

Typed/Printed Name: E. Pitt

Radiated Emission Above 1 GHz

E.U.T Description	Sensus/Equimeter Industrial Gas Meter Transmitter
Type	GS0005
Serial Number:	Not designated

Specification: FCC, Part 15, Subpart C

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

Frequency range: 1.0 GHz to 9.5 GHz
Detector: Peak

Freq. (MHz)	Peak Amp (dBµV/m)	Peak. Specification (dB µV/m)	Peak. Margin (dB)
2713.80	45.3**	74.0	-28.7
3618.40	46.8*	74.0	-27.2
4523.00	48.5*	74.0	-25.5
5427.60	51.3*	74.0	-22.7
8141.40	57.2*	74.0	-16.8
9046.00	59.0*	74.0	-15.0

Figure 10. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Peak

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.

"Peak Amp" includes correction factor.

* "Correction Factor" = Antenna Factor + Cable Loss- Preamplifier Gain

** "Correction Factor" = Antenna Factor + Cable Loss

Radiated Emission Above 1 GHz

E.U.T Description	Sensus/Equimeter Industrial Gas Meter Transmitter
Type	GS0005
Serial Number:	Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal
Frequency range: 1.0 GHz to 9.5 GHz
Test Distance: 3 meters
Detector: Average
Operating Frequency: 904.6 MHz

Freq. (MHz)	Average Amp (dBµV/m)	Average Specification (dB µV/m)	Peak. Margin (dB)
2713.80	32.2**	54.0	-21.8
3618.40	34.2*	54.0	-19.8
4523.00	36.1*	54.0	-17.9
5427.60	39.3*	54.0	-14.7
8141.40	45.5*	54.0	-8.5
9046.00	46.8*	54.0	-7.2

Figure 11. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Average

Notes:

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.

"Average Amp" includes correction factor.

* Correction Factor = Antenna Factor + Cable Loss- Preamplifier Gain

** Correction Factor = Antenna Factor + Cable Loss

Radiated Emission Above 1 GHz

E.U.T Description	Sensus/Equimeter Industrial Gas Meter Transmitter
Type	GS0005
Serial Number:	Not designated

Specification: FCC, Part 15, Subpart C

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

Frequency range: 1.0 GHz to 9.5 GHz
Detector: Peak

Freq. (MHz)	Peak Amp (dBμV/m)	Peak. Specification (dB μV/m)	Peak. Margin (dB)
2713.80	45.7**	74.0	-28.3
3618.40	47.3*	74.0	-26.7
4523.00	48.4*	74.0	-25.6
5427.60	50.1*	74.0	-23.9
8141.40	57.5*	74.0	-16.5
9046.00	58.8*	74.0	-15.2

Figure 12. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Peak

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.

"Peak Amp" includes correction factor.

* "Correction Factor" = Antenna Factor + Cable Loss- Preamplifier Gain

** "Correction Factor" = Antenna Factor + Cable Loss

Radiated Emission Above 1 GHz

E.U.T Description	Sensus/Equimeter Industrial Gas Meter Transmitter
Type	GS0005
Serial Number:	Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Vertical
Frequency range: 1.0 GHz to 9.5 GHz
Test Distance: 3 meters
Detector: Average
Operating Frequency: 904.6 MHz

Freq. (MHz)	Average Amp (dBµV/m)	Average Specification (dB µV/m)	Peak. Margin (dB)
2713.80	33.6**	54.0	-20.4
3618.40	34.7*	54.0	-19.3
4523.00	35.6*	54.0	-18.4
5427.60	38.0*	54.0	-16.0
8141.40	45.2*	54.0	-8.8
9046.00	46.5*	54.0	-7.5

Figure 13. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Average

Notes:

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.

"Average Amp" includes correction factor.

* Correction Factor = Antenna Factor + Cable Loss- Preamplifier Gain

** Correction Factor = Antenna Factor + Cable Loss

Radiated Emission Above 1 GHz

E.U.T Description	Sensus/Equimeter Industrial Gas Meter Transmitter
Type	GS0005
Serial Number:	Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 915.0 MHz

Frequency range: 1.0 GHz to 9.5 GHz
Detector: Peak

Freq. (MHz)	Peak Amp (dBµV/m)	Peak. Specification (dB µV/m)	Peak. Margin (dB)
2745.00	45.3**	74.0	-28.7
3660.00	48.1*	74.0	-25.9
4575.00	48.8*	74.0	-25.2
7320.00	55.3*	74.0	-18.7
8235.00	57.6*	74.0	-16.4

Figure 14. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Peak

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.

"Peak Amp" includes correction factor.

* "Correction Factor" = Antenna Factor + Cable Loss- Preamplifier Gain

** "Correction Factor" = Antenna Factor + Cable Loss

Radiated Emission Above 1 GHz

E.U.T Description	Sensus/Equimeter Industrial Gas Meter Transmitter
Type	GS0005
Serial Number:	Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal
Frequency range: 1.0 GHz to 9.5 GHz
Test Distance: 3 meters
Detector: Average
Operating Frequency: 915.0 MHz

Freq. (MHz)	Average Amp (dBµV/m)	Average Specification (dB µV/m)	Peak. Margin (dB)
2745.00	30.5**	54.0	-23.5
3660.00	35.4*	54.0	-18.6
4575.00	36.4*	54.0	-17.6
7320.00	44.8*	54.0	-9.2
8235.00	46.0*	54.0	-8.0
9150.00	46.5*	54.0	-7.5

Figure 15. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Average

Notes:

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.

"Average Amp" includes correction factor.

* Correction Factor = Antenna Factor + Cable Loss- Preamplifier Gain

** Correction Factor = Antenna Factor + Cable Loss

Radiated Emission Above 1 GHz

E.U.T Description	Sensus/Equimeter Industrial Gas Meter Transmitter
Type	GS0005
Serial Number:	Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 915.0 MHz

Frequency range: 1.0 GHz to 9.5 GHz
Detector: Peak

Freq. (MHz)	Peak Amp (dBµV/m)	Peak. Specification (dB µV/m)	Peak. Margin (dB)
2745.00	45.0**	74.0	-29.0
3660.00	45.5*	74.0	-28.5
4575.00	48.3*	74.0	-25.7
7320.00	55.8*	74.0	-18.2
8235.00	57.9*	74.0	-16.1

Figure 16. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Peak

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.

"Peak Amp" includes correction factor.

* "Correction Factor" = Antenna Factor + Cable Loss- Preamplifier Gain

** "Correction Factor" = Antenna Factor + Cable Loss

Radiated Emission Above 1 GHz

E.U.T Description	Sensus/Equimeter Industrial Gas Meter Transmitter
Type	GS0005
Serial Number:	Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Vertical
Frequency range: 1.0 GHz to 9.5 GHz
Test Distance: 3 meters
Detector: Average
Operating Frequency: 915.0 MHz

Freq. (MHz)	Average Amp (dBµV/m)	Average Specification (dB µV/m)	Peak. Margin (dB)
2745.00	33.5**	54.0	-20.5
3660.00	35.5*	54.0	-18.5
4575.00	35.7*	54.0	-18.3
7320.00	44.0*	54.0	-10.0
8235.00	45.7*	54.0	-8.3

Figure 17. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Average

Notes:

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.

"Average Amp" includes correction factor.

* Correction Factor = Antenna Factor + Cable Loss- Preamplifier Gain

** Correction Factor = Antenna Factor + Cable Loss

Radiated Emission Above 1 GHz

E.U.T Description	Sensus/Equimeter Industrial Gas Meter Transmitter
Type	GS0005
Serial Number:	Not designated

Specification: FCC, Part 15, Subpart C

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

Frequency range: 1.0 GHz to 9.5 GHz
Detector: Peak

Freq. (MHz)	Peak Amp (dBµV/m)	Peak. Specification (dB µV/m)	Peak. Margin (dB)
2776.20	44.9**	74.0	-29.1
3701.60	46.1*	74.0	-27.9
4627.00	48.7*	74.0	-25.3
7403.20	55.9*	74.0	-18.1
8328.60	58.4*	74.0	-15.6

Figure 18. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Peak

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.

"Peak Amp" includes correction factor.

* "Correction Factor" = Antenna Factor + Cable Loss- Preamplifier Gain

** "Correction Factor" = Antenna Factor + Cable Loss

Radiated Emission Above 1 GHz

E.U.T Description	Sensus/Equimeter Industrial Gas Meter Transmitter
Type	GS0005
Serial Number:	Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal
Frequency range: 1.0 GHz to 9.5 GHz
Test Distance: 3 meters
Detector: Average
Operating Frequency: 925.4 MHz

Freq. (MHz)	Average Amp (dBµV/m)	Average Specification (dB µV/m)	Peak. Margin (dB)
2776.20	33.0**	54.0	-21.0
3701.60	34.7*	54.0	-19.3
4627.00	35.7*	54.0	-18.3
7403.20	44.4*	54.0	-9.6
8328.60	45.7*	54.0	-8.3

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

Notes:

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.

"Average Amp" includes correction factor.

* Correction Factor = Antenna Factor + Cable Loss- Preamplifier Gain

** Correction Factor = Antenna Factor + Cable Loss

Radiated Emission Above 1 GHz

E.U.T Description	Sensus/Equimeter Industrial Gas Meter Transmitter
Type	GS0005
Serial Number:	Not designated

Specification: FCC, Part 15, Subpart C

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

Frequency range: 1.0 GHz to 9.5 GHz
Detector: Peak

Freq. (MHz)	Peak Amp (dBµV/m)	Peak. Specification (dB µV/m)	Peak. Margin (dB)
2776.20	43.0**	74.0	-31.0
3701.60	47.1*	74.0	-26.9
4627.00	48.6*	74.0	-25.4
7403.20	56.4*	74.0	-17.6
8328.60	57.9*	74.0	-16.1

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

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.

"Peak Amp" includes correction factor.

* "Correction Factor" = Antenna Factor + Cable Loss- Preamplifier Gain

** "Correction Factor" = Antenna Factor + Cable Loss

Radiated Emission Above 1 GHz

E.U.T Description	Sensus/Equimeter Industrial Gas Meter Transmitter
Type	GS0005
Serial Number:	Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Vertical
Frequency range: 1.0 GHz to 9.5 GHz
Test Distance: 3 meters
Detector: Average
Operating Frequency: 925.4 MHz

Freq. (MHz)	Average Amp (dBµV/m)	Average Specification (dB µV/m)	Peak. Margin (dB)
2776.20	32.8**	54.0	-21.2
3701.60	34.6*	54.0	-19.4
4627.00	35.2*	54.0	-18.8
7403.20	44.7*	54.0	-9.3
8328.60	45.5*	54.0	-8.5

Figure 21. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Average

Notes:

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.

"Average Amp" includes correction factor.

* Correction Factor = Antenna Factor + Cable Loss- Preamplifier Gain

** Correction Factor = Antenna Factor + Cable Loss

8.3 Test Instrumentation Used, Radiated Measurements Above 1 GHz

Receiver	HP	85422E	3411A00102	February 28, 2004	1 year
RF Section	HP	85420E	3427A00103	February 28, 2004	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	ThinkJet2225	2738508357	N/A	N/A
Antenna-Log Periodic	A.H.System	SAS-200/511	253	January 31,2003	2 year
Double Ridged Waveguide Horn Antenna	EMCO	3115	29845	March 17, 2004	1 year
Horn Antenna	ARA	SWH-28	1007	October 28, 2003	2 year
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	October 17, 2004	1 year
Spectrum Analyzer	HP	8592L	3926A01204	February 28, 2004	1 year

9. Maximum Transmitted Peak Power Output

9.1 Test procedure

The E.U.T. antenna terminal was connected to the Spectrum Analyzer through EXT ATT=32dB (4 × 8dB) and an appropriate coaxial cable=0.5dB. Special attention was taken to prevent Spectrum Analyzer RF input overload. The Spectrum Analyzer was set to 3 MHz RBW. Peak power level was measured at selected operation frequencies.

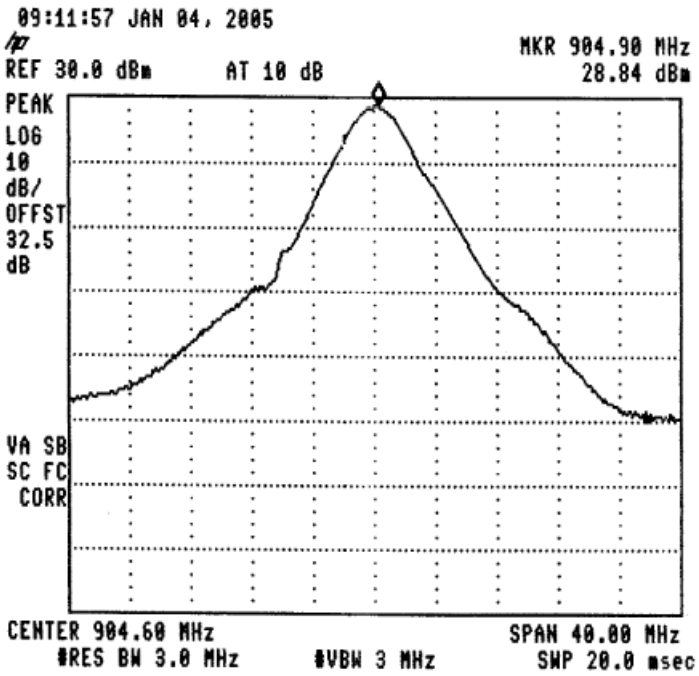


Figure 22 904.6 MHz

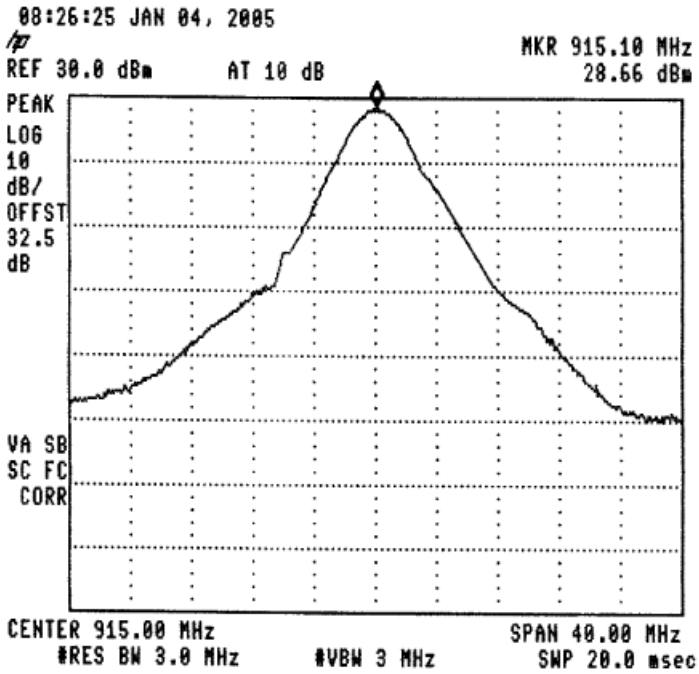


Figure 23 915.0 MHz

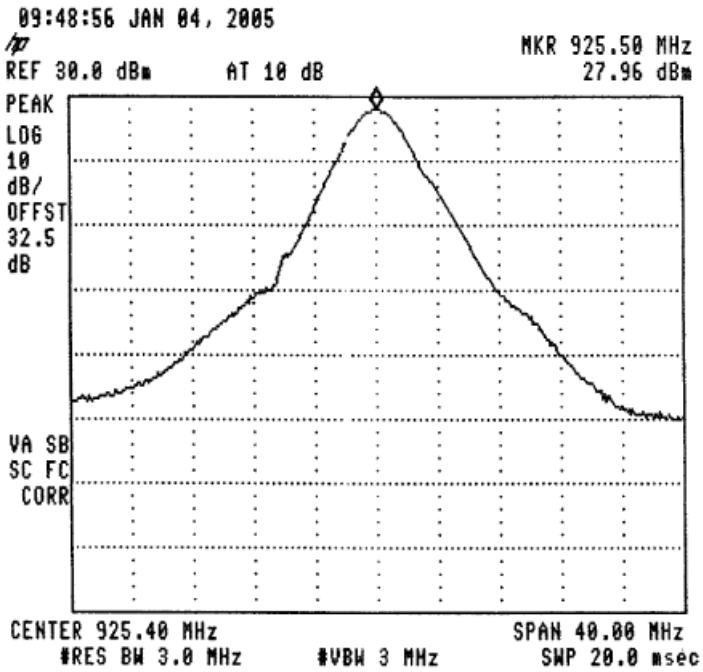


Figure 24 925.4 MHz

9.2 Results table

E.U.T. Description: Sensus/Equimeter Industrial Gas Meter Transmitter
Model No.: GS0005
Serial Number: Not designated
Specification: F.C.C. Part 15, Subpart C

Operation Frequency (MHz)	Peak Power (dBm)	Specification (dBm)	Margin (dB)
904.6	28.8	30.0	-1.2
915.0	28.7	30.0	-1.3
925.4	28.0	30.0	-2.0

Figure 25 Maximum Peak Power Output

JUDGEMENT: Passed by 1.2 dB

TEST PERSONNEL:
Tester Signature: _____ Date: 17.01.05
Typed/Printed Name: E. Pitt

9.3 Test Equipment Used.

Peak Power Output

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2004	1 year
Cable	Avnet	MTS	N/A	February 18, 2004	1 year
Attenuator	MACOM	M3933/25-74	0056	November 9, 2004	1 year
Attenuator	MACOM	M3933/25-74	0202	November 9, 2004	1 year
Attenuator	MACOM	M3933/25-74	0211	November 9, 2004	1 year
Attenuator	MACOM	M3933/25-74	0050	November 9, 2004	1 year

Figure 26 Test Equipment Used

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

10.1 Test procedure

The E.U.T. antenna terminal was connected to the spectrum analyzer through EXT ATT=32dB (4 × 8dB) and an appropriate coaxial cable=0.5dB. The spectrum analyzer was set to 3 kHz resolution BW for the frequency range 9 kHz-150 kHz, 30 kHz resolution BW for the frequency range 150 kHz-1.0 MHz, and 100 kHz resolution BW for the frequency range 1.0 MHz-9.30 GHz. The frequency range from 9 kHz to 9.3 GHz was scanned. Level of spectrum components out of the 902-928 MHz was measured at the selected operation frequencies.

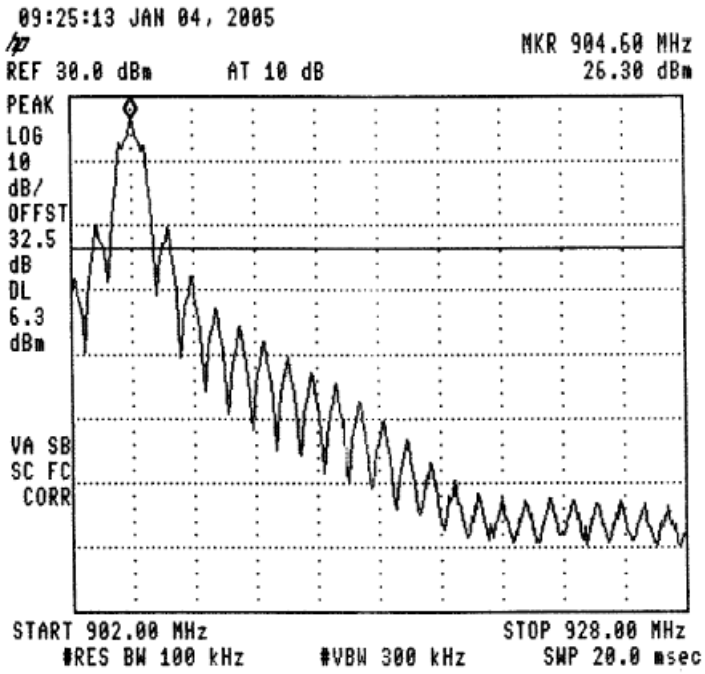


Figure 27 —904.6 MHz

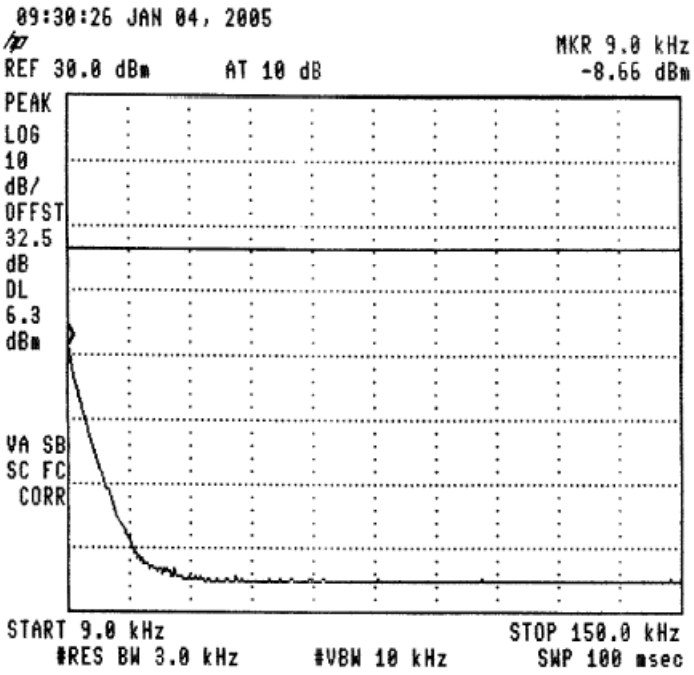


Figure 28 —904.6 MHz

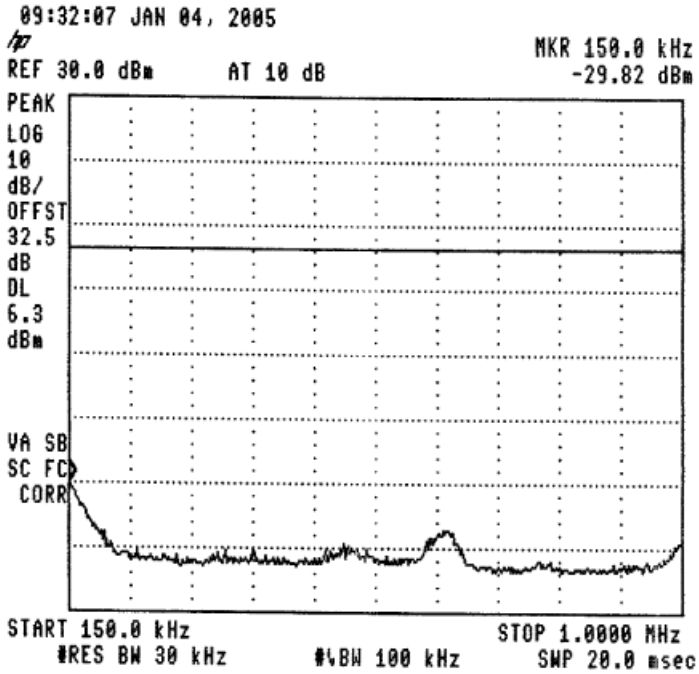


Figure 29 —904.6 MHz

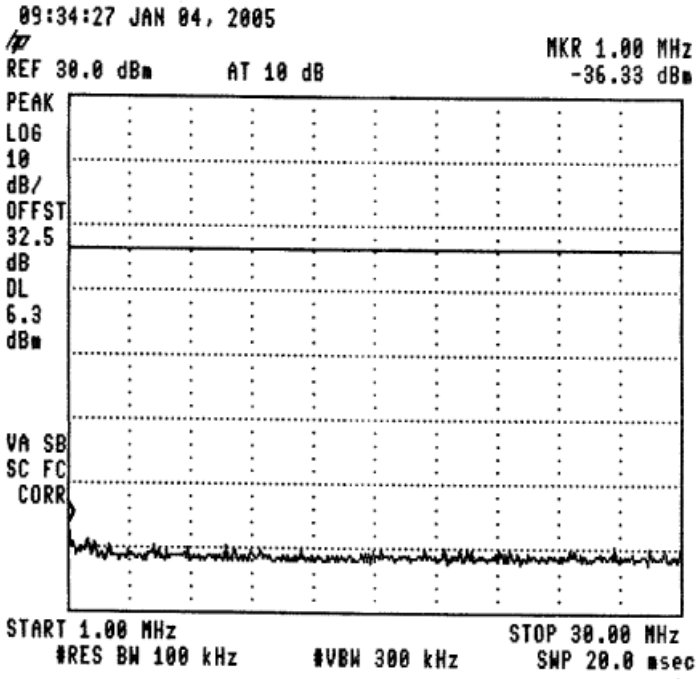


Figure 30 —904.6 MHz

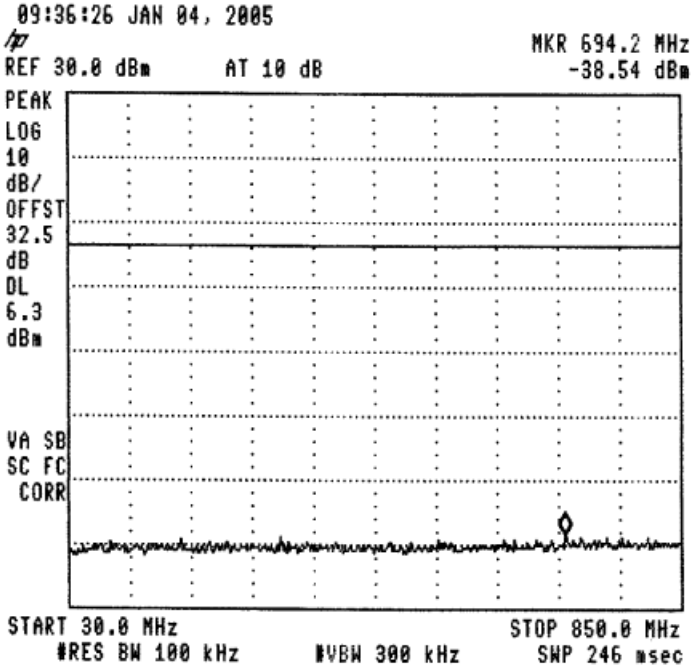


Figure 31 —904.6 MHz

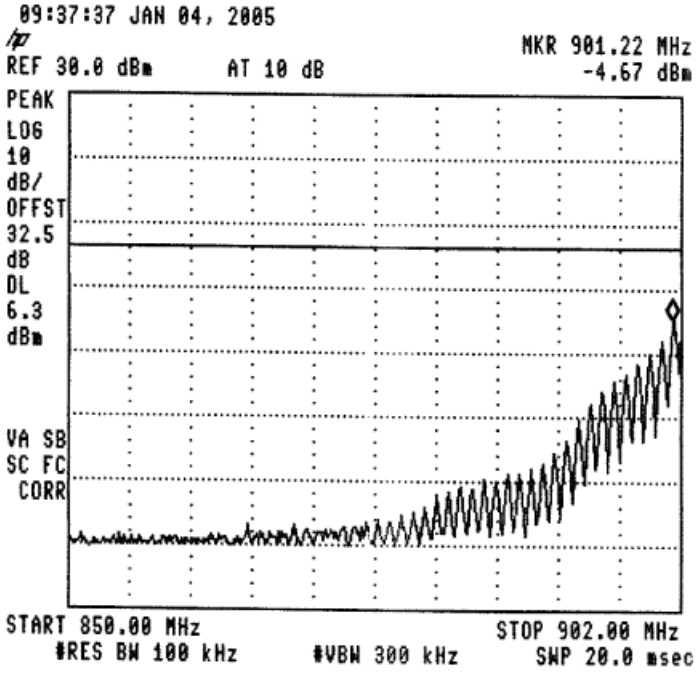


Figure 32 —904.6 MHz

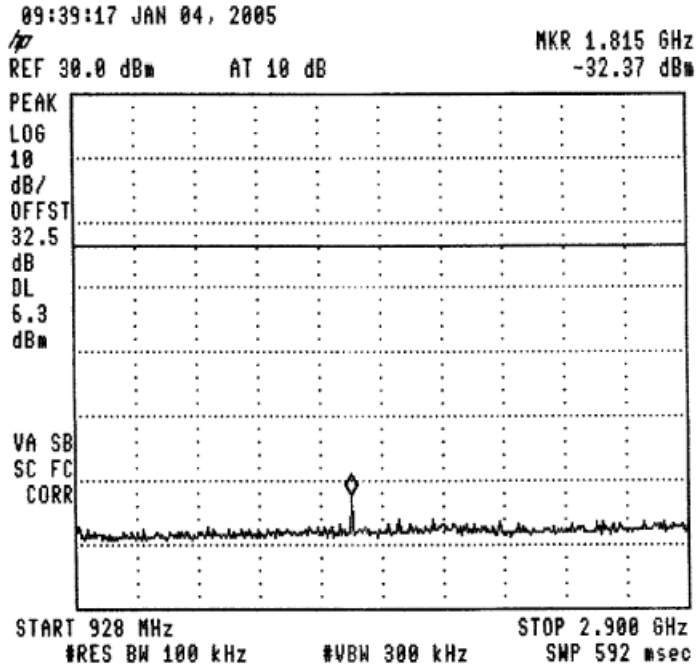


Figure 33 —904.6 MHz

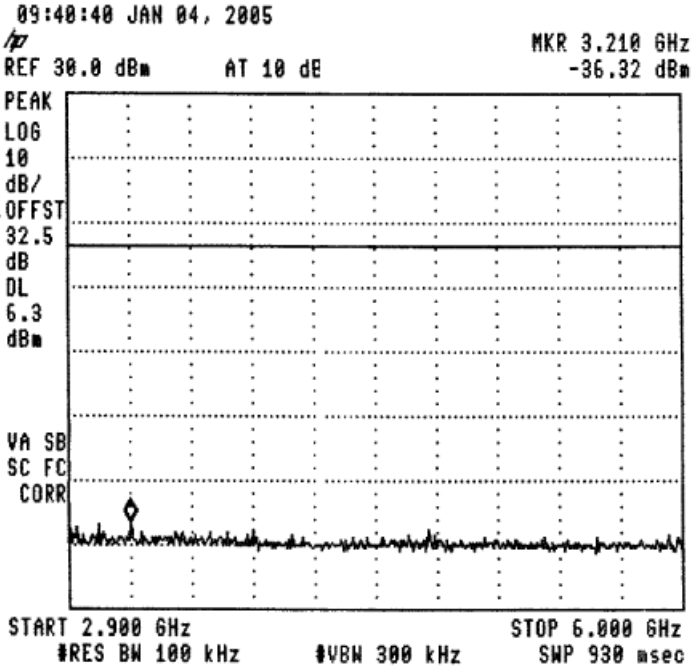


Figure 34 —904.6 MHz

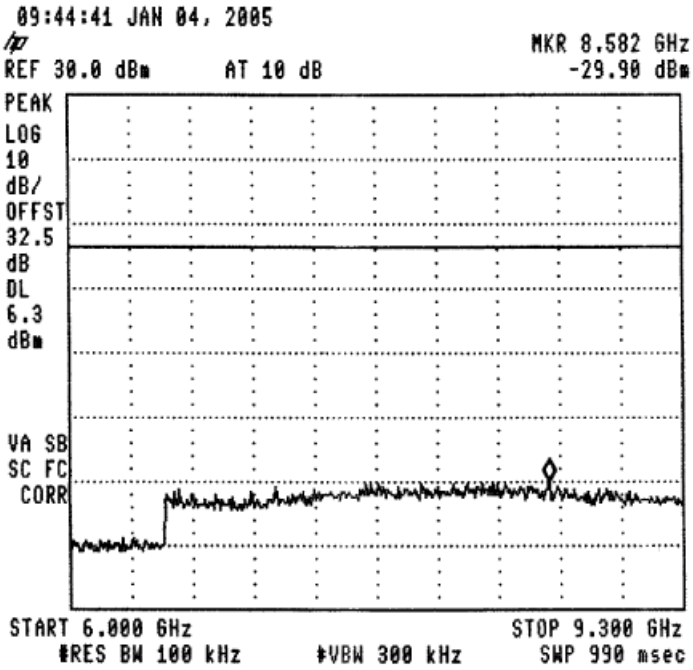


Figure 35 —904.6 MHz

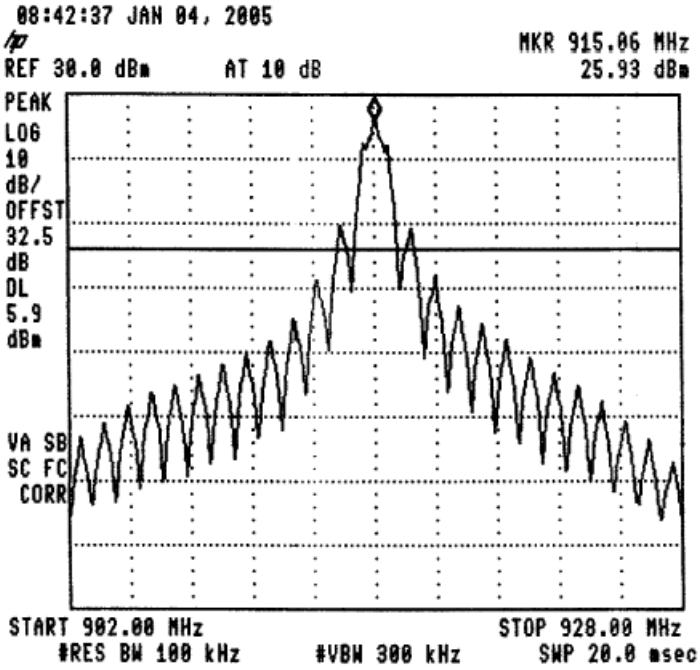


Figure 36 —915.0 MHz

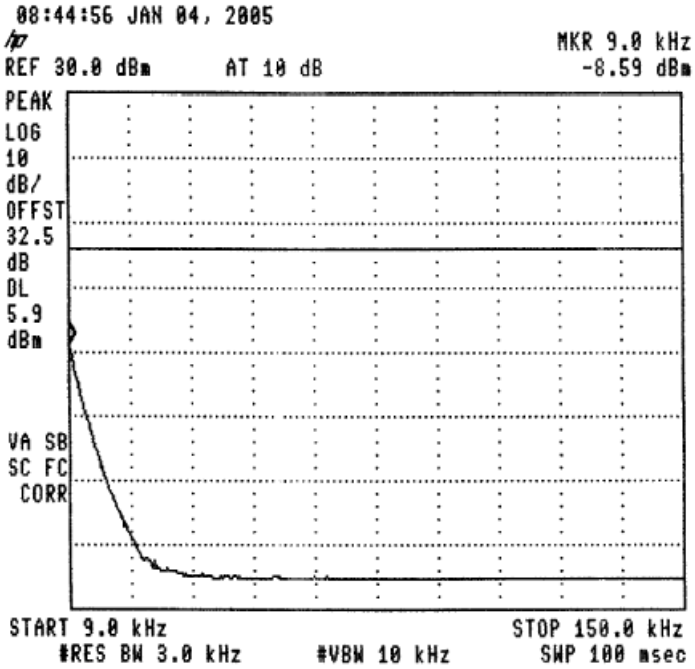


Figure 37 —915.0 MHz

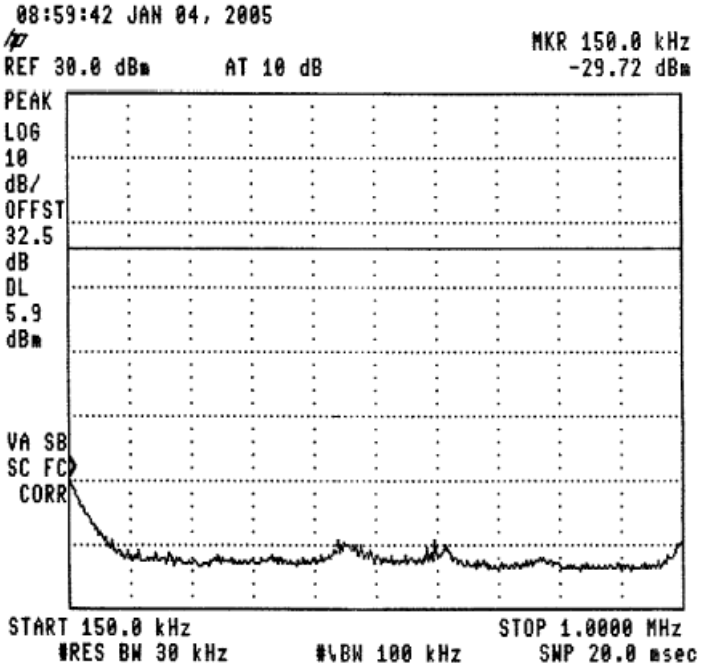


Figure 38 —915.0 MHz

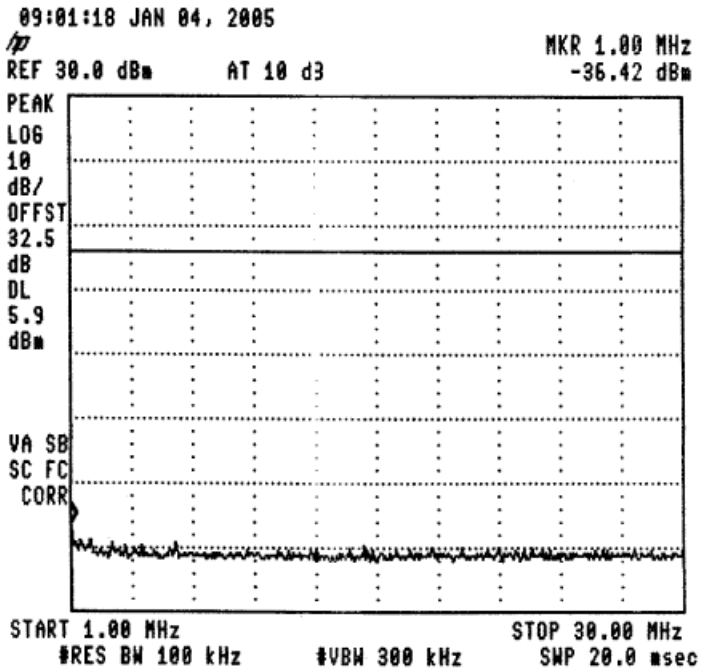


Figure 39 —915.0 MHz

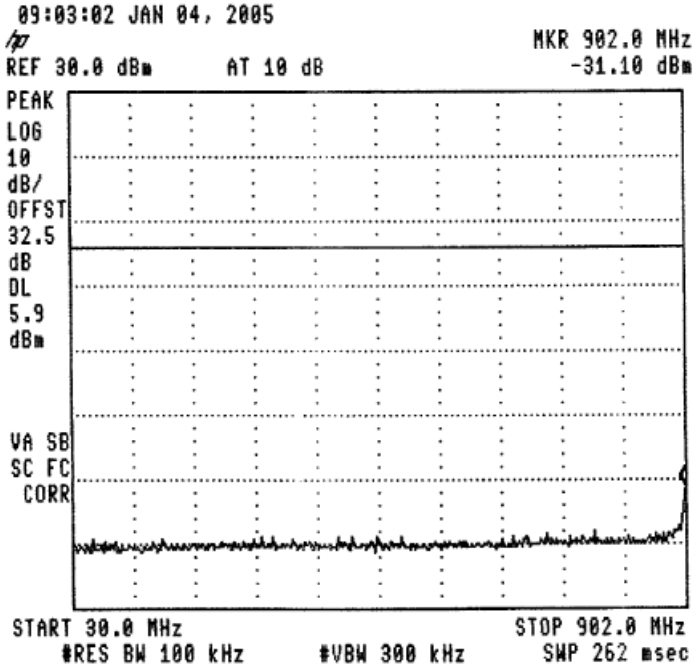


Figure 40 —915.0 MHz

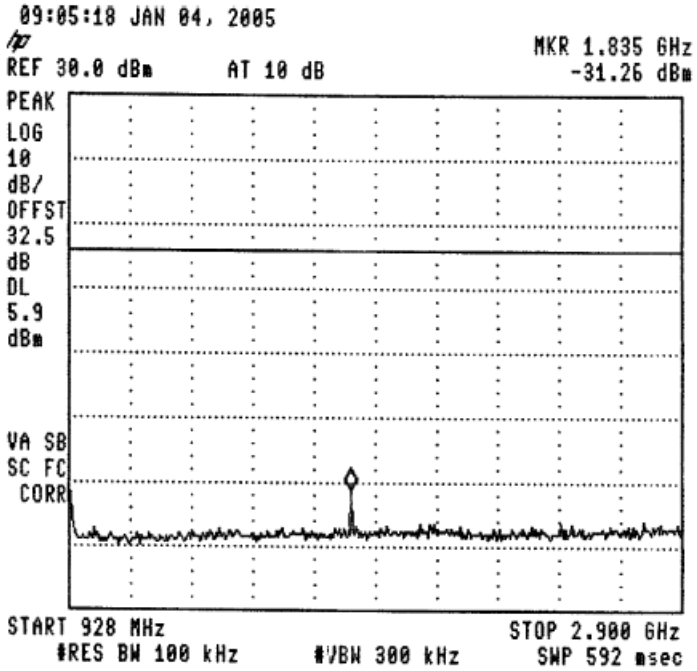


Figure 41 —915.0 MHz

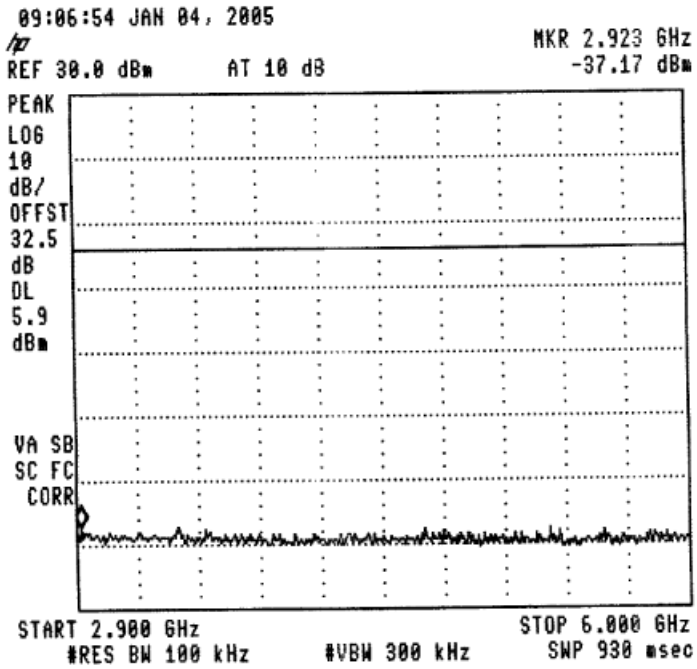


Figure 42 —915.0 MHz

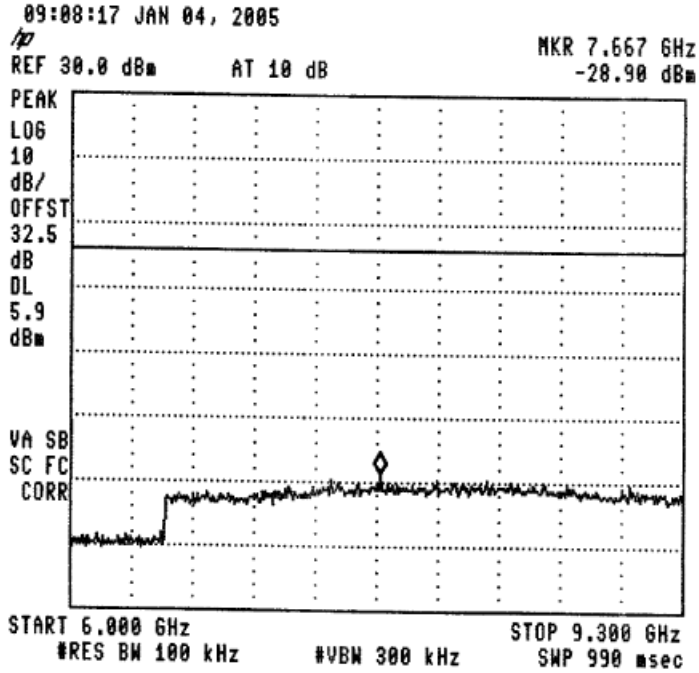


Figure 43 —915.0 MHz

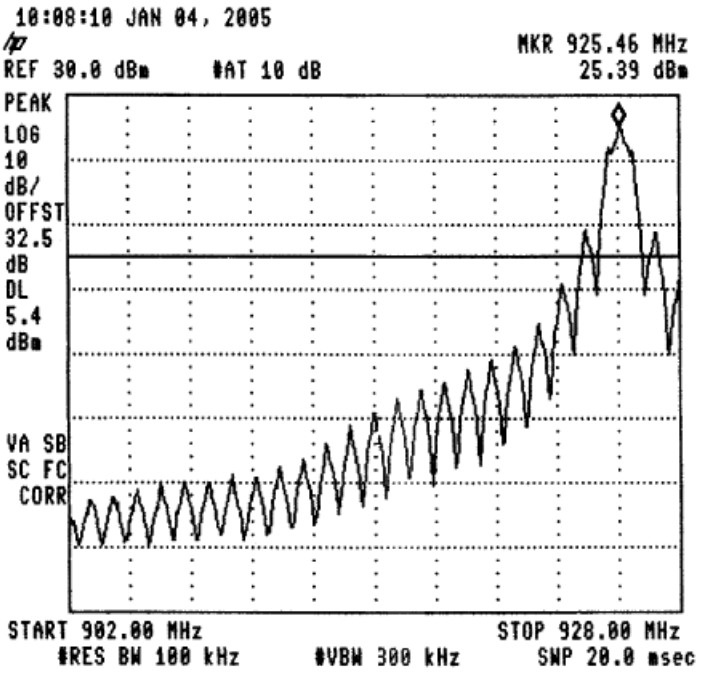


Figure 44 —925.4 MHz

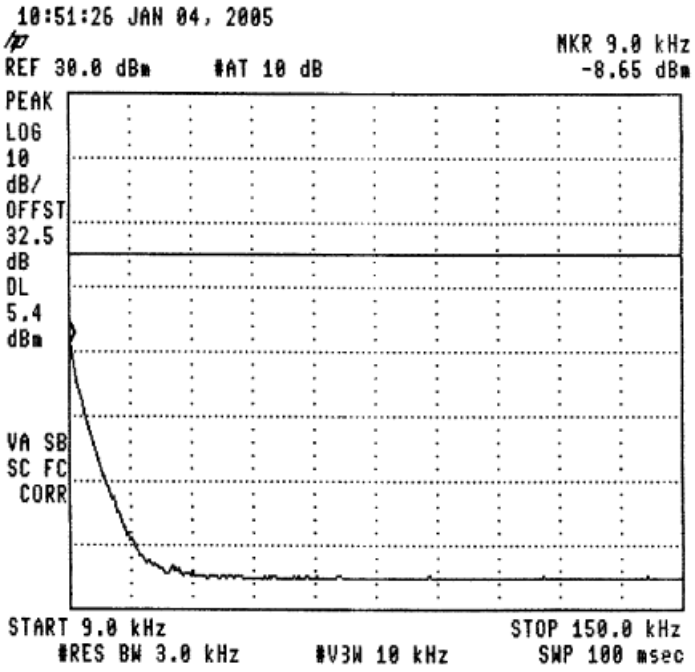


Figure 45 —925.4 MHz

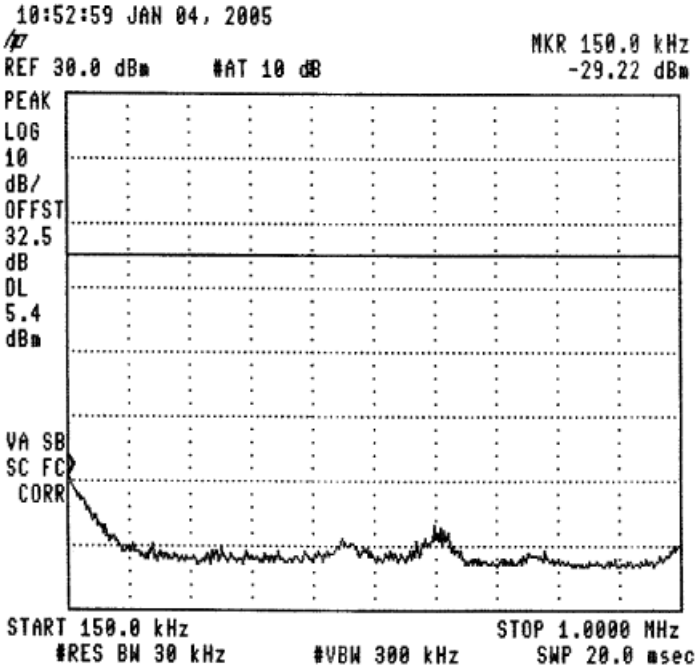


Figure 46 —925.4 MHz

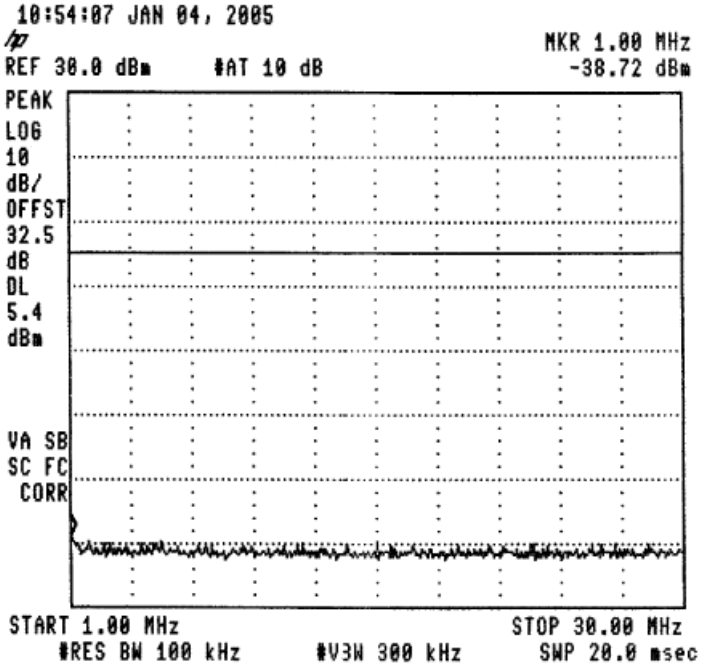


Figure 47 —925.4 MHz

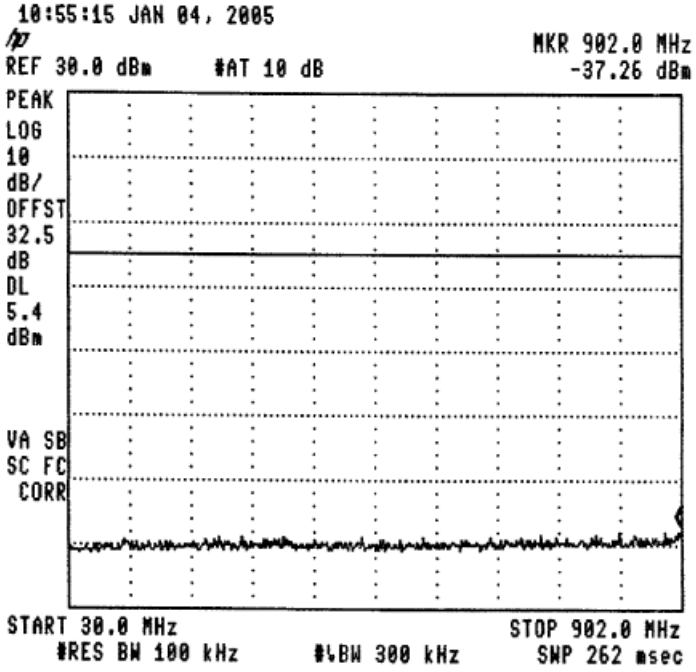


Figure 48 —925.4 MHz

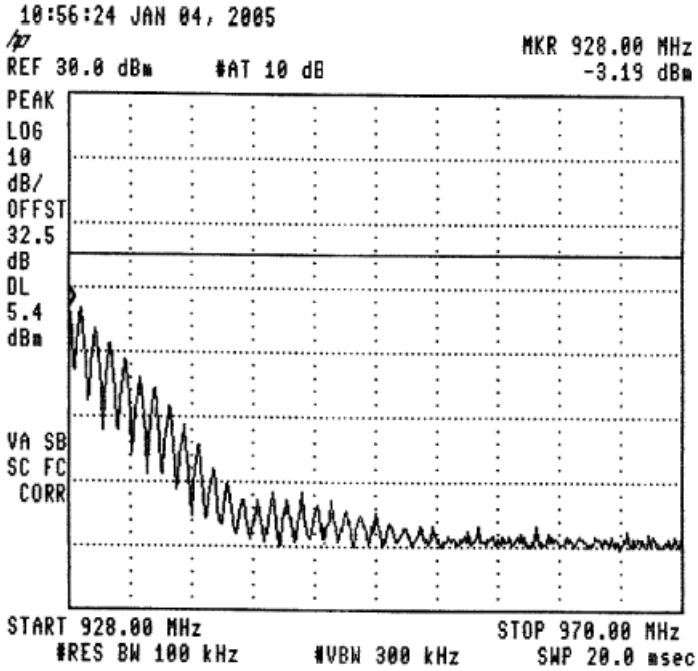


Figure 49 —925.4 MHz

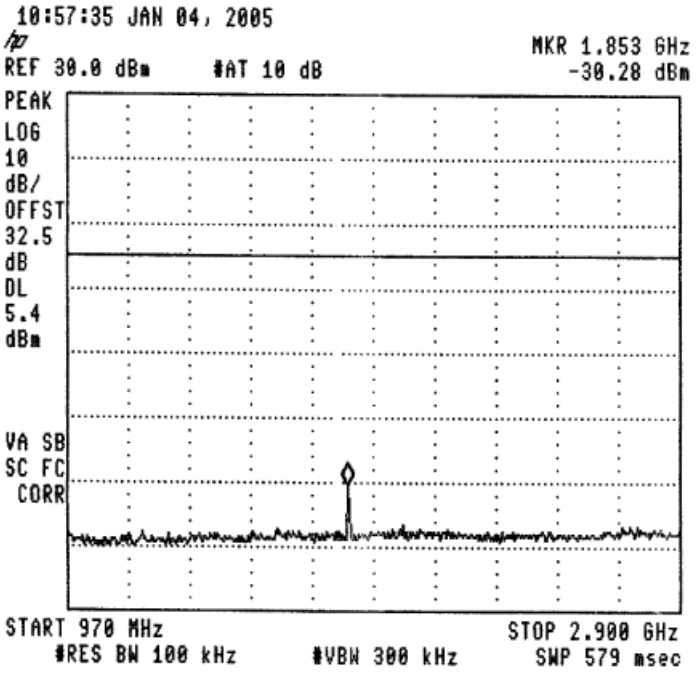


Figure 50 —925.4 MHz

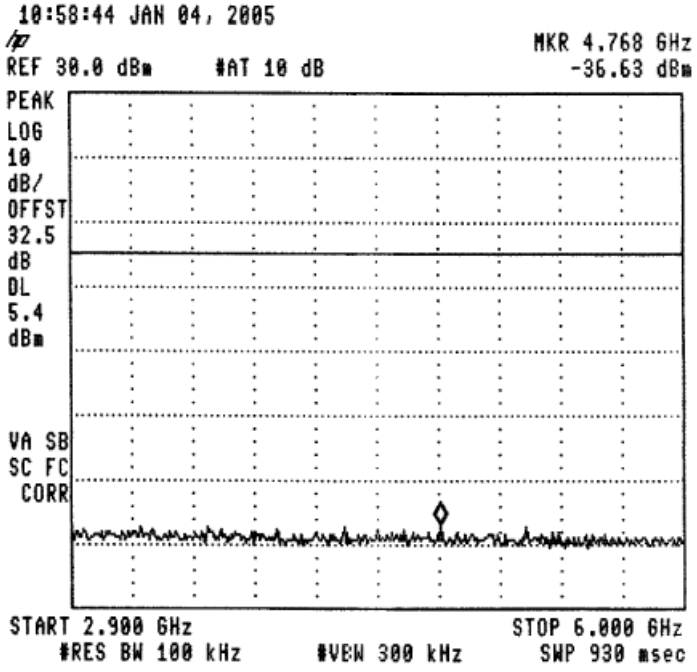


Figure 51 —925.4 MHz

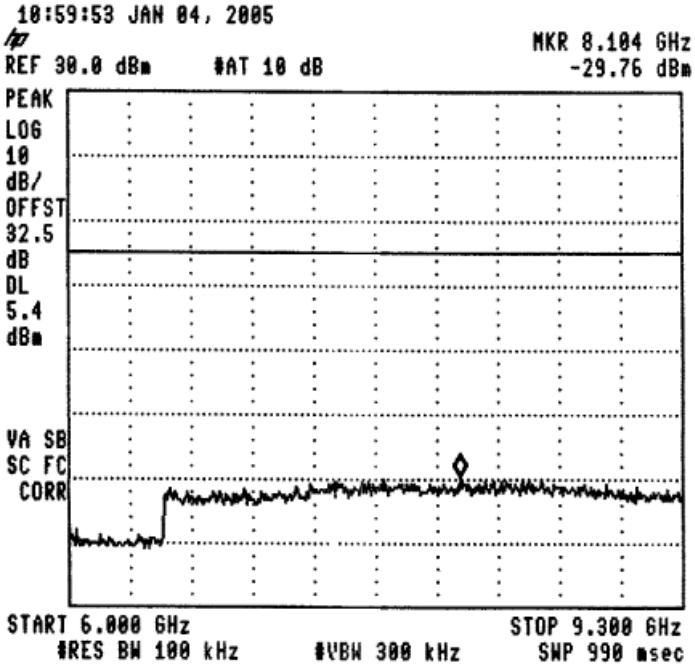


Figure 52 —925.4 MHz

10.2 Results table

E.U.T. Description: Sensus/Equimeter Industrial Gas Meter Transmitter
Model No.: GS0005
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	31.0	20.0	11.0
915.0	34.5	20.0	14.5
925.4	28.6	20.0	8.6

Figure 53 Peak Power Output of 902-928 MHz Band

JUDGEMENT: Passed by 8.6 dB

TEST PERSONNEL:

Tester Signature: _____ Date: 17.01.05

Typed/Printed Name: E. Pitt

10.3 Test Equipment Used.

Peak Power Output of 2400-2438.5 MHz Band

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2004	1 year
Cable	Avnet	MTS	N/A	February 18, 2004	1 year
Attenuator	MACOM	M3933/25-74	0056	November 9, 2004	1 year
Attenuator	MACOM	M3933/25-74	0202	November 9, 2004	1 year
Attenuator	MACOM	M3933/25-74	0211	November 9, 2004	1 year
Attenuator	MACOM	M3933/25-74	0050	November 9, 2004	1 year

Figure 54 Test Equipment Used

11. 6 dB Minimum Bandwidth

11.1 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 EXT ATT=32dB (4 × 8dB) and an appropriate coaxial cable=0.5dB. 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.

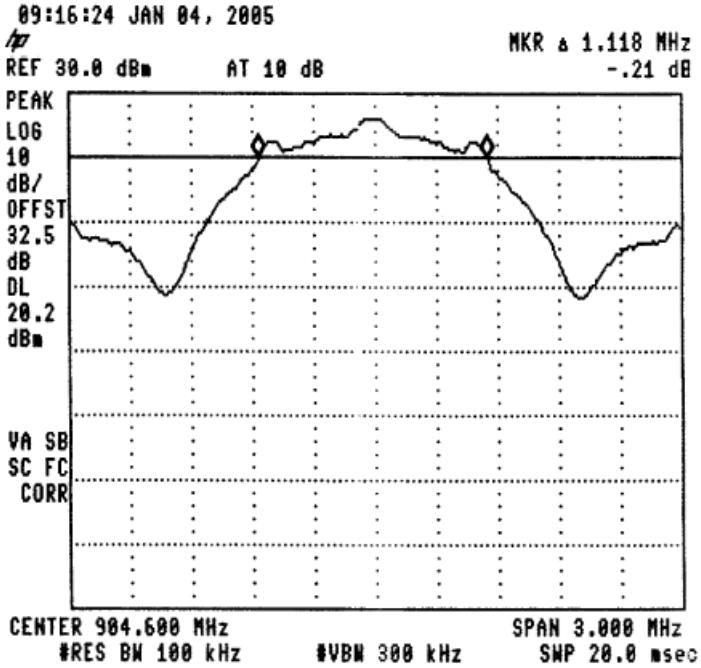


Figure 55 —904.6 MHz

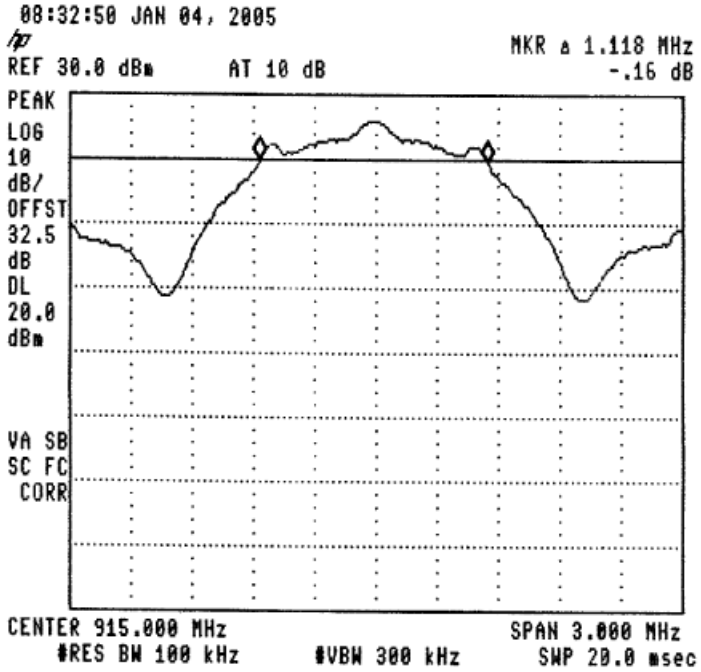


Figure 56 —915.0 MHz

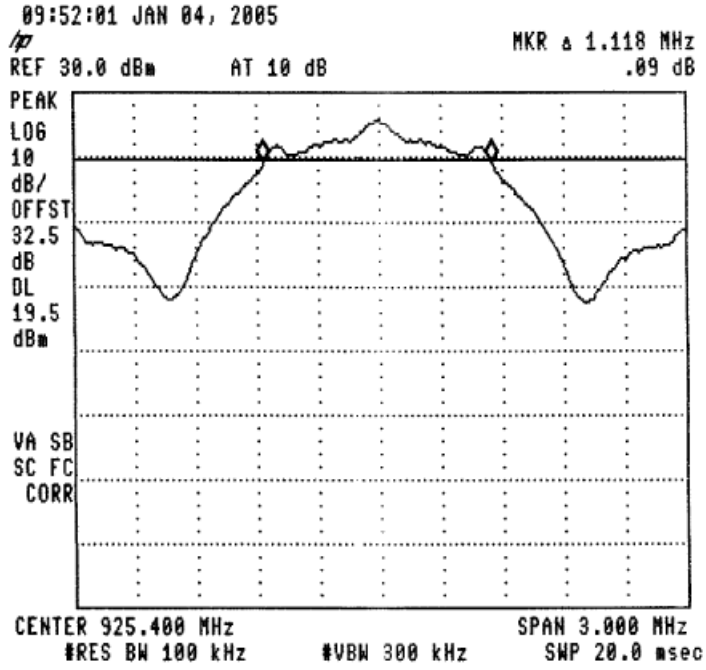


Figure 57 —925.4 MHz

11.2 Results table

E.U.T. Description: Sensus/Equimeter Industrial Gas Meter Transmitter
Model No.: GS0005
Serial Number: Not designated
Specification: F.C.C. Part 15, Subpart C: (15.247-a2)

Operation Frequency (MHz)	Reading (MHz)	Specification (MHz)
904.6	1.118	0.5
915.0	1.118	0.5
925.4	1.118	0.5

Figure 58 6 dB Minimum Bandwidth

JUDGEMENT: Passed

TEST PERSONNEL:
Tester Signature: _____ Date: 17.01.05
Typed/Printed Name: E. Pitt

11.3 Test Equipment Used.

6 dB Minimum Bandwidth

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2004	1 year
Cable	Avnet	MTS	N/A	February 18, 2004	1 year
Attenuator	MACOM	M3933/25-74	0056	November 9, 2004	1 year
Attenuator	MACOM	M3933/25-74	0202	November 9, 2004	1 year
Attenuator	MACOM	M3933/25-74	0211	November 9, 2004	1 year
Attenuator	MACOM	M3933/25-74	0050	November 9, 2004	1 year

Figure 59 Test Equipment Used

12. Band Edge Spectrum

[In Accordance with section 15.247(c)]

12.1 Test procedure

The E.U.T. antenna terminal was connected to the spectrum analyzer through EXT ATT=32dB (4 × 8dB) and an appropriate coaxial cable=0.5dB. 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, 915.0 MHz and 925.4 MHz correspondingly.

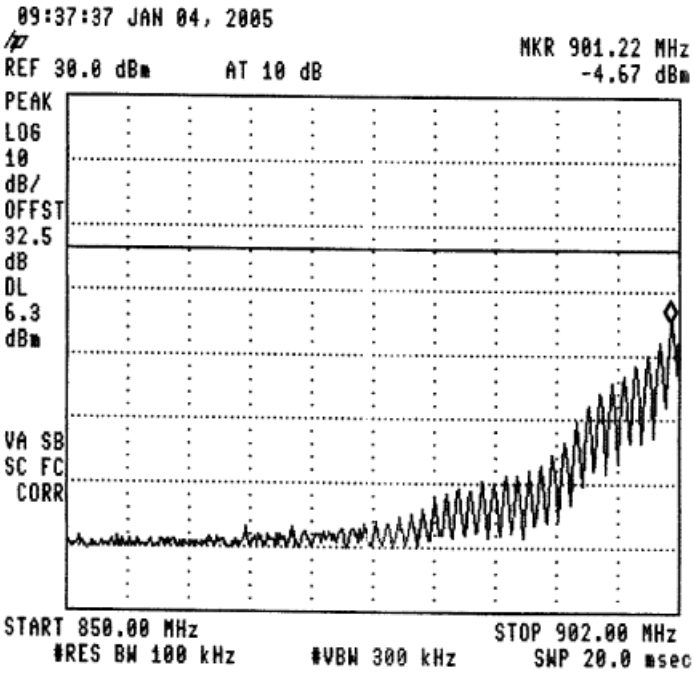


Figure 60 —904.6 MHz

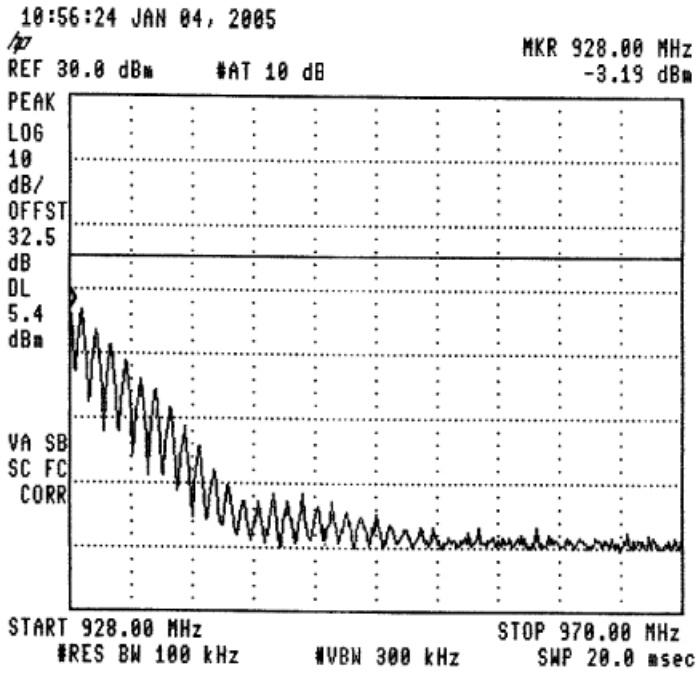


Figure 61 —925.4 MHz

12.2 Results table

E.U.T. Description: Sensus/Equimeter Industrial Gas Meter Transmitter
Model No.: GS0005
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	901.2	31.0	20.0	11.0
925.4	928.0	28.6	20.0	8.6

Figure 62 Band Edge Spectrum

JUDGEMENT: Passed by 8.6 dB

TEST PERSONNEL:

Tester Signature: _____ Date: 17.01.05

Typed/Printed Name: E. Pitt

12.3 Test Equipment Used.

Band edge Spectrum

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2004	1 year
Cable	Avnet	MTS	N/A	February 18, 2004	1 year
Attenuator	MACOM	M3933/25-74	0056	November 9, 2004	1 year
Attenuator	MACOM	M3933/25-74	0202	November 9, 2004	1 year
Attenuator	MACOM	M3933/25-74	0211	November 9, 2004	1 year
Attenuator	MACOM	M3933/25-74	0050	November 9, 2004	1 year

Figure 63 Test Equipment Used

13. Transmitted Power Density

[In accordance with section 15.247(d)]

13.1 Test procedure

The E.U.T. antenna terminal was connected to the spectrum analyzer through EXT ATT=32dB (4 × 8dB) and an appropriate coaxial cable=0.5dB. 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.

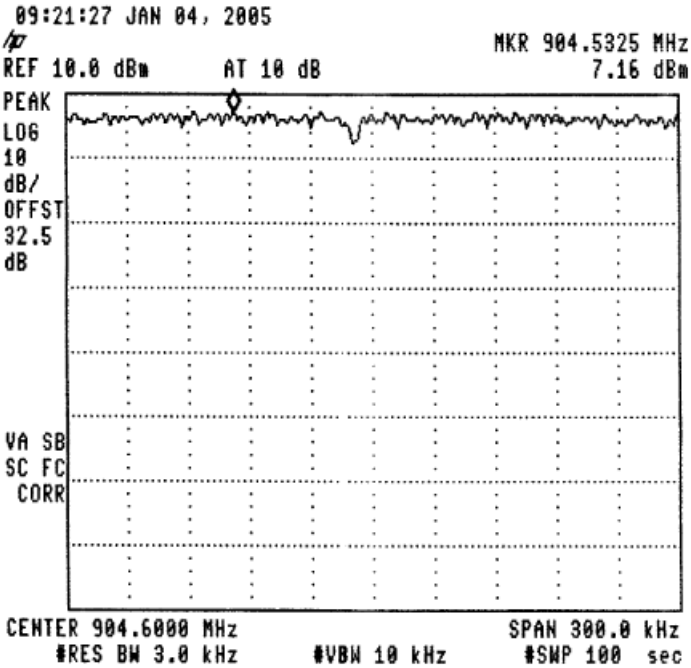


Figure 64 —904.6 MHz

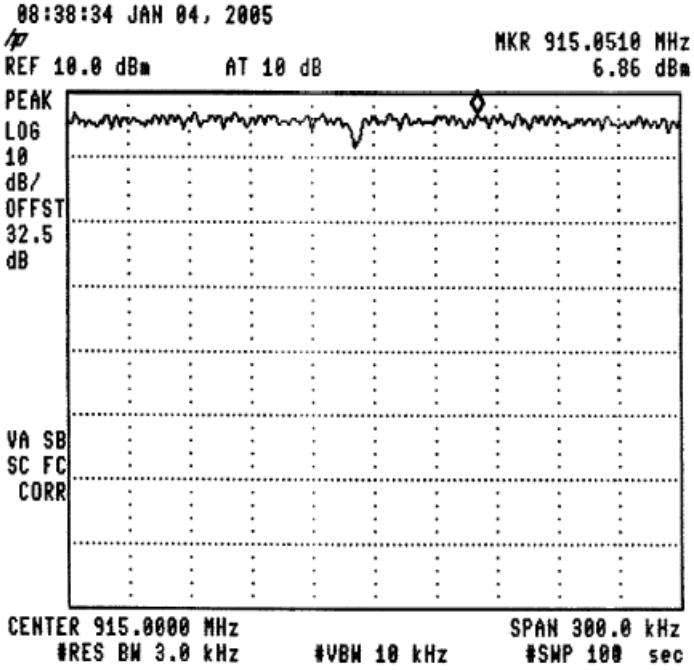


Figure 65 —915.0 MHz

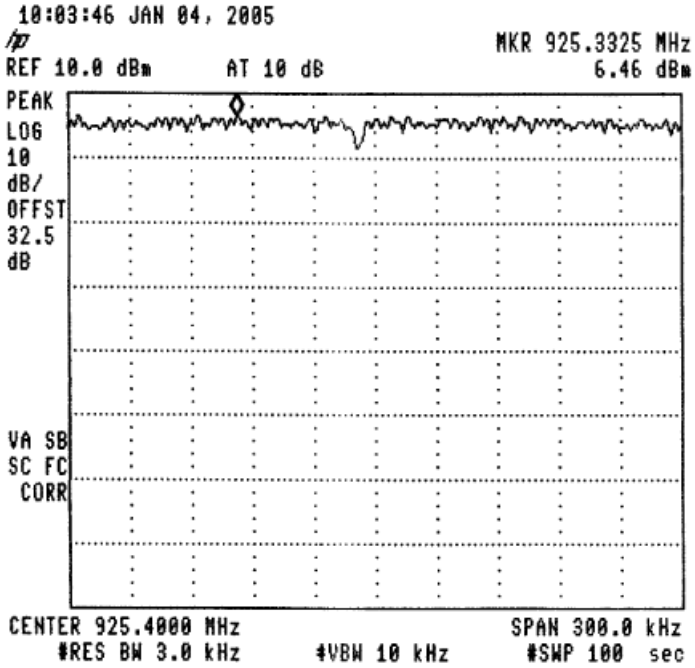


Figure 66 —925.4 MHz

13.2 Results table

E.U.T. Description: Sensus/Equimeter Industrial Gas Meter Transmitter
Model No.: GS0005
Serial Number: Not designated
Specification: F.C.C. Part 15, Subpart C (15.247)

Operation Frequency (MHz)	Reading Signal Analyzer (dBm)	Specification (dBm)	Margin (dB)
904.6	7.16	8.0	-0.84
915.0	6.86	8.0	-1.14
925.4	6.46	8.0	-15.4

Figure 67 Test Results

JUDGEMENT: Passed by 0.84 dB

TEST PERSONNEL:

Tester Signature: _____ Date: 17.01.05

Typed/Printed Name: E. Pitt

13.3 Test Equipment Used.

Transmitted Power Density

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2004	1 year
Cable	Avnet	MTS	N/A	February 18, 2004	1 year
Attenuator	MACOM	M3933/25-74	0056	November 9, 2004	1 year
Attenuator	MACOM	M3933/25-74	0202	November 9, 2004	1 year
Attenuator	MACOM	M3933/25-74	0211	November 9, 2004	1 year
Attenuator	MACOM	M3933/25-74	0050	November 9, 2004	1 year

Figure 68 Test Equipment Used

14. Antenna Gain

The antenna gain is 5 dBi (customer's information).

15. R.F Exposure/Safety

The E.U.T. is a fixed installation transmitter.

Calculation of Maximum Permissible Exposure (MPE)
Based on Section 1.1307(b)(1) Requirements

(a) FCC limits at 915 MHz is: $S = \frac{f}{1500} = \frac{915}{1500} = 0.61 \frac{mW}{cm^2}$

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 765.6mW (Peak) (28.84 dBm)

G_T- Antenna Gain, 3.16 = 5 dBi

R- Distance from Transmitter using 100cm worst case

(c) The peak power density is :

$$S_p = \frac{765.6 \times 3.16}{4\pi (100)^2} = 1.9 \times 10^{-2} \frac{mW}{cm^2}$$

(d) The E.U.T. transmission in actual worst case is 158 millisecond pulse per 6 hours. The average power over 30 minutes is:

$$P_{AV} = \frac{765.6 \times 0.158}{30 \times 60} = 0.067 mW$$

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

$$S_{AV} = \frac{0.067 \times 3.16}{4\pi (100)^2} = 1.6 \times 10^{-6} \frac{mW}{cm^2}$$

(f) This is significantly below the FCC limit.

16. Photographs of Tested E.U.T.

Figure 69 Front Panel With Cover

Figure 70 Front Panel Without Cover

Figure 71 Rear View

Figure 72 Front Panel Rear View

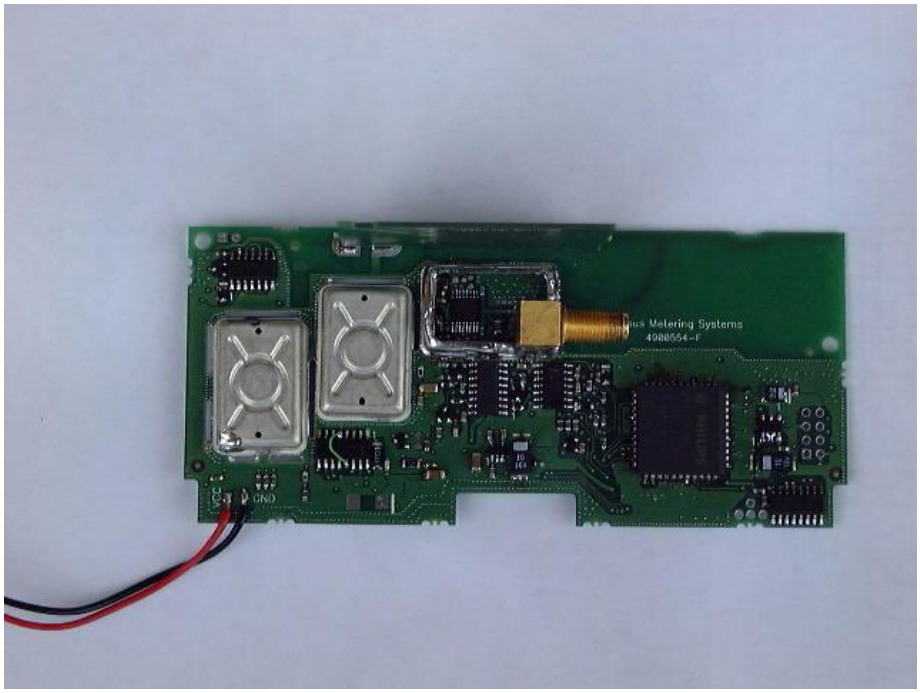


Figure 73 PCB Side 1

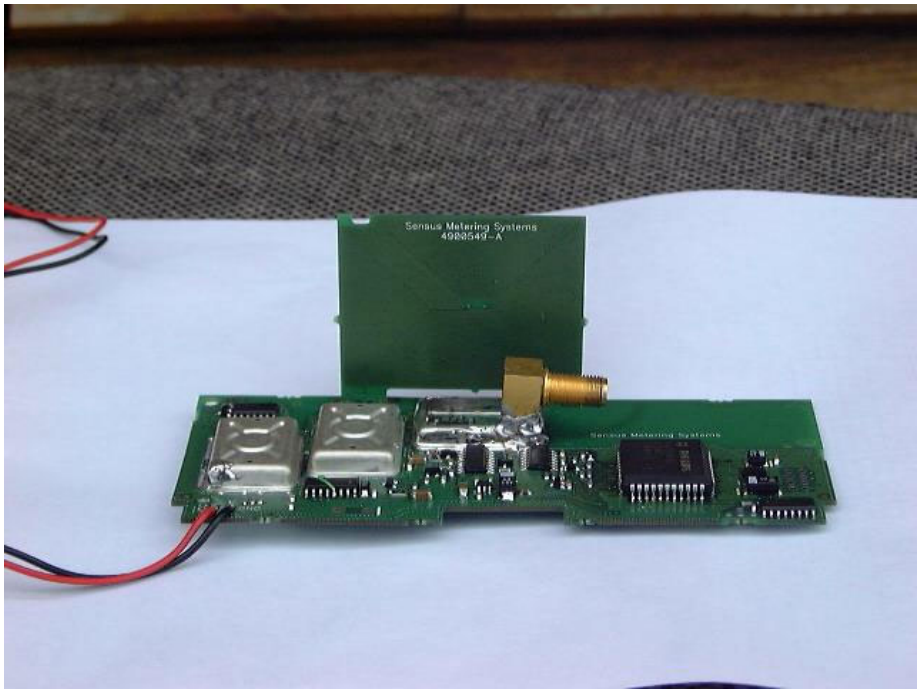


Figure 74 PCB Side 1

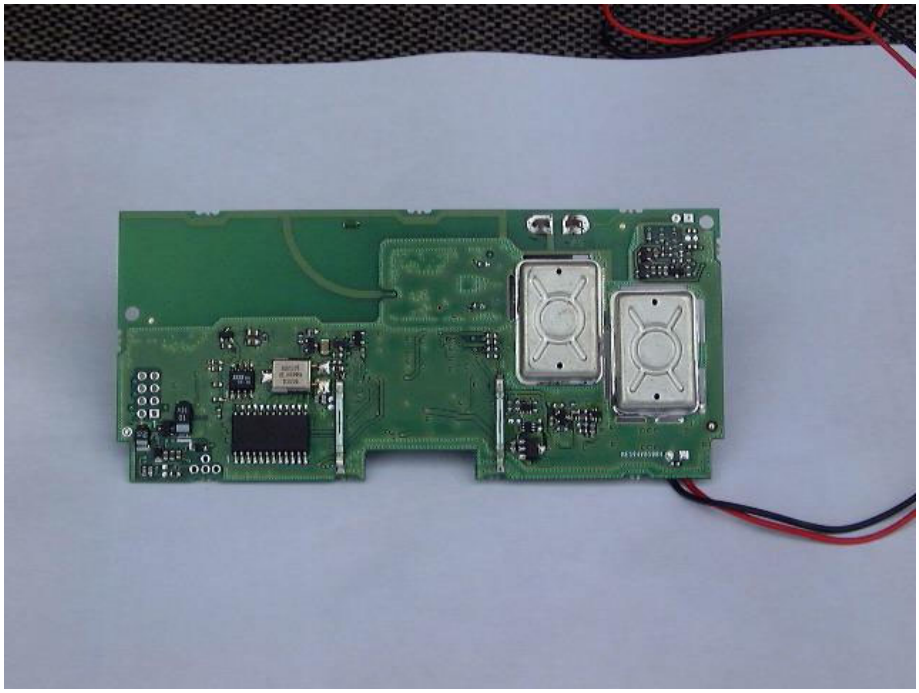


Figure 75 PCB Side 2

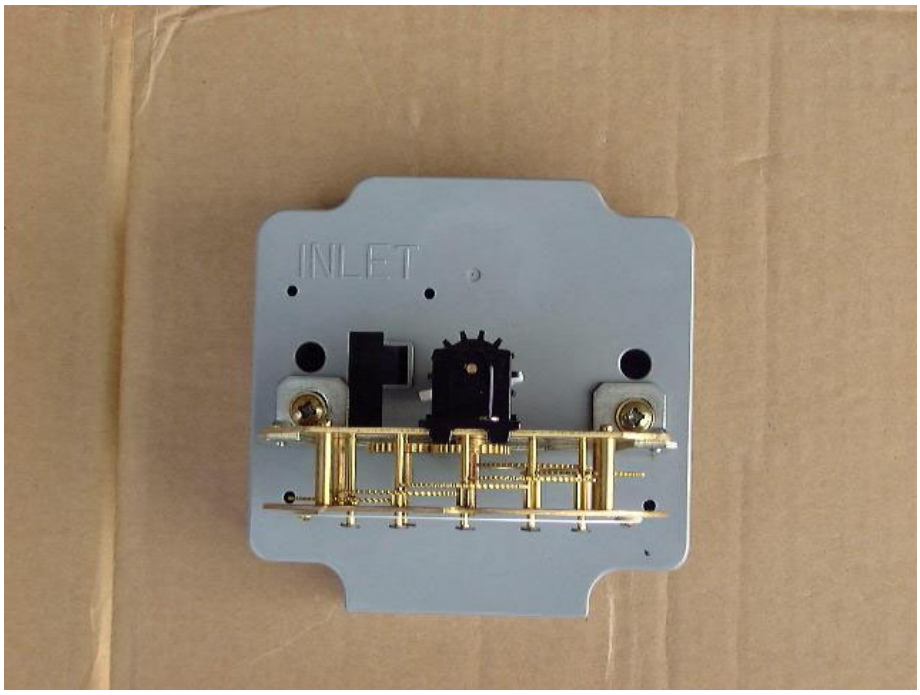


Figure 76 Top View

Figure 77 Bottom View

17. APPENDIX A - CORRECTION FACTORS

17.1 Correction factors for CABLE

from EMI receiver to test antenna at 3 meter range.

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
10.0	0.5
20.0	0.7
30.0	1.0
40.0	1.2
50.0	1.3
60.0	1.5
70.0	1.6
80.0	1.7
90.0	1.8
100.0	1.9
150.0	2.4
200.0	2.7
250.0	3.0
300.0	3.3
350.0	3.7
400.0	4.0
450.0	4.3
500.0	4.7
600.0	4.9
700.0	5.4
800.0	5.8
900.0	6.3
1000.0	6.7

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
1200.0	7.5
1400.0	8.2
1600.0	9.0
1800.0	9.6
2000.0	10.7
2300.0	11.1
2600.0	11.8
2900.0	12.8

NOTES:

1. *The cable type is RG-214.*
2. *The overall length of the cable is 27 meters.*
3. *The above data is located in file 27MO3MO.CBL on the disk marked "Radiated Emission Tests EMI Receiver".*

17.2 Correction factors for CABLE

from EMI receiver to test antenna at 3 meter range.

FREQUENCY (GHz)	CORRECTION FACTOR (dB)
1.0	1.2
2.0	1.6
3.0	2.0
4.0	2.4
5.0	3.0
6.0	3.4
7.0	3.8
8.0	4.2
9.0	4.6
10.0	5.0
12.0	5.8

NOTES:

1. The cable type is RG-8.

2. The overall length of the cable is 10 meters.

17.3 Correction factors for CABLE

from EMI receiver to test antenna

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
10.0	0.1
20.0	0.1
30.0	0.2
40.0	0.2
50.0	0.2
60.0	0.2
70.0	0.3
80.0	0.3
90.0	0.3
100.0	0.3
150.0	0.4
200.0	0.4
250.0	0.4
300.0	0.5
350.0	0.6
400.0	0.6
450.0	0.6
500.0	0.7
600.0	0.8
700.0	0.8
800.0	1.0
900.0	1.1
1000.0	1.1

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
1200.0	1.4
1400.0	1.5
1600.0	1.5
1800.0	1.7
2000.0	1.7
2300.0	2.0
2600.0	2.1
2900.0	2.2

NOTES:

1. The cable type is RG-214.

2. The overall length of the cable is 5.5 meters.

17.4 Correction factors for CABLE

from EMI receiver to test antenna at 10 meter range.

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
10.0	0.6
20.0	1.1
30.0	1.3
40.0	1.6
50.0	1.7
60.0	1.9
70.0	2.0
80.0	2.2
90.0	2.3
100.0	2.4
150.0	3.1
200.0	3.6
250.0	4.2
300.0	4.5
350.0	4.8
400.0	5.2
450.0	5.5
500.0	6.2
600.0	6.4
700.0	7.0
800.0	7.5
900.0	8.1
1000.0	8.6

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
1200.0	9.7
1400.0	10.5
1600.0	11.5
1800.0	12.6
2000.0	13.5
2300.0	14.3
2600.0	15.5
2900.0	16.4

NOTES:

1. *The cable type is RG-214.*
2. *The overall length of the cable is 34 meters.*
3. *The above data is located in file 34M10MO.CBL on the disk marked "Radiated Emissions Tests EMI Receiver".*

17.5 Correction factors for LOG PERIODIC ANTENNA

Type LPD 2010/A
at 3 and 10 meter ranges.

Distance of 3 meters

FREQUENCY (MHz)	AFE (dB/m)
200.0	9.1
250.0	10.2
300.0	11.4
400.0	14.5
500.0	15.2
600.0	17.3
700.0	19.0
850.0	20.1
1000.0	22.2

Distance of 10 meters

FREQUENCY (MHz)	AFE (dB/m)
200.0	9.0
250.0	10.1
300.0	11.2
400.0	14.4
500.0	15.2
600.0	17.2
700.0	19.0
850.0	20.1
1000.0	22.1

NOTES:

1. *Antenna serial number is 1038.*
2. *The above lists are located in file number 38M3O.ANT for a 3 meter range, and file number 38M100.ANT for a 10 meter range.*
3. *The files mentioned above are located on the disk marked "Radiated Emission Test EMI Receiver".*

17.6 Correction factors for BICONICAL ANTENNA

Type BCD-235/B,
at 3 meter range

FREQUENCY (MHz)	AFE (dB/m)
20.0	19.4
30.0	14.8
40.0	11.9
50.0	10.2
60.0	9.1
70.0	8.5
80.0	8.9
90.0	9.6
100.0	10.3
110.0	11.0
120.0	11.5
130.0	11.7
140.0	12.1
150.0	12.6
160.0	12.8
170.0	13.0
180.0	13.5
190.0	14.0
200.0	14.8
210.0	15.3
220.0	15.8
230.0	16.2
240.0	16.6
250.0	17.6
260.0	18.2
270.0	18.4
280.0	18.7
290.0	19.2
300.0	19.9
310	20.7
320	21.9
330	23.4
340	25.1
350	27.0

NOTES:

1. Antenna serial number is 1041.

2. The above list is located in file 19BC10M1.ANT on the disk marked "Radiated Emissions Tests EMI Receiver".

17.7 Correction factors for BICONICAL ANTENNA

Type BCD-235/B,
10 meter range

FREQUENCY (MHz)	AFE (dB/m)
30.0	12.1
40.0	10.6
50.0	10.6
60.0	8.9
70.0	8.5
80.0	9.6
90.0	9.4
100.0	9.6
110.0	10.3
120.0	10.7
130.0	12.6
140.0	12.7
150.0	12.7
160.0	13.8
170.0	13.7
180.0	14.9
190.0	13.4
200.0	13.1
210.0	14.0
220.0	14.5
230.0	15.8
240.0	16.0
250.0	16.6
260.0	16.7
270.0	18.3
280.0	18.5
290.0	19.3
300.0	20.9

NOTES:

1. *Antenna serial number is 1041.*
2. *The above list is located in file 41BC10M1.ANT on the disk marked "Radiated Emissions Tests EMI Receiver".*

17.8 Correction factors for ACTIVE LOOP ANTENNA

Model 6502
S/N 9506-2950

FREQUENCY (MHz)	Magnetic Antenna Factor (dB)	Electric Antenna Factor (dB)
.009	-35.1	16.4
.010	-35.7	15.8
.020	-38.5	13.0
.050	-39.6	11.9
.075	-39.8	11.8
.100	-40.0	11.6
.150	-40.0	11.5
.250	-40.0	11.6
.500	-40.0	11.5
.750	-40.1	11.5
1.000	-39.9	11.7
2.000	-39.5	12.0
3.000	-39.4	12.1
4.000	-39.7	11.9
5.000	-39.7	11.8
10.000	40.2	11.3
15.000	-40.7	10.8
20.000	-40.5	11.0
25.000	-41.3	10.2
30.000	42.3	9.2

17.9 Correction factors for LOG PERIODIC ANTENNA

Type SAS-200/511
at 3 meter range.

FREQUENCY (GHz)	ANTENNA FACTOR (dB)
1.0	24.9
1.5	27.8
2.0	29.9
2.5	31.2
3.0	32.8
3.5	33.6
4.0	34.3
4.5	35.2
5.0	36.2
5.5	36.7
6.0	37.2
6.5	38.1

FREQUENCY (GHz)	ANTENNA FACTOR (dB)
7.0	38.6
7.5	39.2
8.0	39.9
8.5	40.4
9.0	40.8
9.5	41.1
10.0	41.7
10.5	42.4
11.0	42.5
11.5	43.1
12.0	43.4
12.5	44.4
13.0	44.6

NOTES:

1. *Antenna serial number is 253.*
2. *The above lists are located in file number SAS3M0.ANT for a 3 meter range.*
3. *The files mentioned above are located on the disk marked "Antenna Factors".*

17.10 Correction factors for BICONICAL ANTENNA

Type 3109,
1.0 meter range

FREQUENCY (MHz)	AFE (dB/m)
20.0	11.1
30.0	12.0
40.0	12.0
50.0	11.4
60.0	10.3
70.0	10.7
80.0	8.3
90.0	9.0
100.0	10.0
110.0	11.6
120.0	13.6
130.0	14.2
140.0	13.5
150.0	12.7
160.0	12.7
170.0	13.6
180.0	15.3
190.0	14.6
200.0	14.7
210.0	15.3
220.0	15.8
230.0	17.0
240.0	18.0
250.0	18.1
260.0	18.0
270.0	17.5
280.0	18.2
290.0	19.7
300.0	21.8

NOTES:

1. Antenna serial number is 3244.

2. The above list is located in file 44BIC10M1.ANT on the disk marked "Radiated Emissions Tests EMI Receiver"

17.11 Correction factors for BICONICAL ANTENNA

Type 3109,
3 meter range

FREQUENCY (MHz)	AFE (dB/m)
20.0	18.4
30.0	14.0
40.0	12.3
50.0	10.6
60.0	8.3
70.0	8.7
80.0	7.2
90.0	8.6
100.0	10.1
110.0	11.2
120.0	11.8
130.0	12.3
140.0	12.7
150.0	12.5
160.0	12.4
170.0	12.1
180.0	12.2
190.0	12.8
200.0	13.7
210.0	14.5
220.0	15.4
230.0	15.9
240.0	16.3
250.0	16.7
260.0	17.1
270.0	17.2
280.0	17.5
290.0	18.1
300.0	18.9

NOTES:

1. *Antenna serial number is 3244.*
2. *The above list is located in file 44BIC3M1.ANT on the disk marked "Radiated Emissions Tests EMI Receiver"*