Electrical (EMC)

DATE: 01 January 2002

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

EMC Test

for

Nexus Data (1993) Ltd.

Equipment under test:

Electric Meter

Schlumberger

Approved by: _____

I. Raz, EMC Laboratory Manager

Electrical (EMC)

Measurement/Technical Report for

Nexus Data (1993) Ltd.

Electric Meter:

Schlumberger

FCC ID:NL3EL0001

01 January 2002

This report concerns: Original Grant x Class II change

Class B verification ___ Class A verification___ Class I change

Equipment type: Radio Telemetry Transmitter

Request Issue of Grant:

__**x**__ Immediately upon completion of review

Limits used:

CISPR 22 _____ Part 15 __x

Measurement procedure used is ANSI C63.4-1992.

Application for Certification
prepared by:

Ishaishou Raz
ITL (Product Testing) Ltd.
Kfar Bin Nun
D.N. Shimshon 99780
Israel
e-mail Sraz@itl.co.il

Applicant for this device:
(different from "prepared by")

Shimon Zigdon
Nexus Data (1993) Ltd.
16 Hamelacha St.
Rosh Haayin 48091
Israel
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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: +972-3-9033299
Manufacturer's Representative:	Shai Versano Shimon Zigdon
Equipment Under Test (E.U.T):	Electric Meter
Equipment Model No.:	Schlumberger
Equipment Serial No.:	Not designated
Date of Receipt of E.U.T:	15.07.01
Start of Test:	15.07.01
End of Test:	05.09.01
Test Laboratory Location:	I.T.L (Product Testing) Ltd. Kfar Bin Nun, ISRAEL 99780
Test Specifications:	See Section 2

1.2 Product Description

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

The transmitter frequency band is 903.8-926.2 MHz and channel spacing is 400 kHz; i.e. it has 58 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. The duration of transmission is 150 msec. The minimum time interval between each transmission is 60 sec.

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

The device operates from a 230VAC/60Hz electric power utility grid.

1.3 Test Methodology

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

1.4 Test Facility

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

1.5 Measurement Uncertainty

Radiated Emission

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

2. Product Labeling

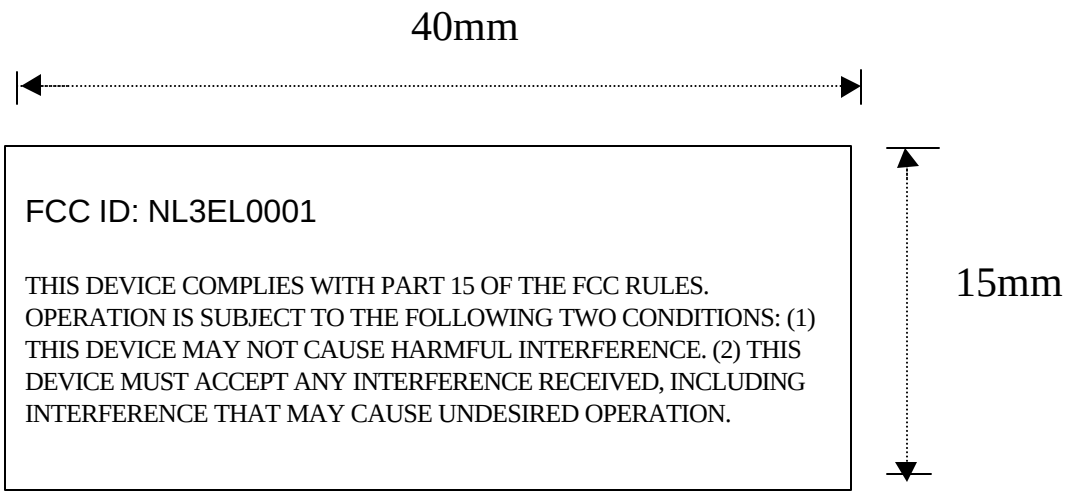


Figure 1. FCC Label

Figure 2. Location of Label on EUT

3. System Test Configuration

3.1 Justification

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

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

Conducted Emission on Power Lines Test:

The Conducted Emission test was performed with a power supply of 230VAC/60Hz, which is in the voltage range for which the electric meter is rated (192V-288V). Residential meters in the USA are typically rated for operation in this voltage.

Radiated Emission Test:

During the normal operation of the E.U.T., the maximum transmission time is 150 msec. And the minimum time interval to the next transmission is 60 sec., causing the search time for maximum radiated emission level to be impractical (many days).

The test method for this case was coordinated with Mr. Tom Phillips of the FCC (See the following correspondence).

From: Tom Phillips [TPHILLIP@fcc.gov]

To: emc@itl.co.il

Subject: Re: Radiated Emission Testing of Low Duty Cycle Intentional Radiator

Dear Mr. Raz,

Your proposed method of measurement would not be acceptable. The usual solution for such a device is to modify it so that transmits virtually continuously. I don't know of any other way to make the required measurements more quickly.

>>> EMC <emc@itl.co.il> 07/01/01 02:44AM >>>

Dear Mr. Phillips,

One of our customers has a spread spectrum intentional radiator (under Part 15,Sec. 15.247, 902-928 MHz), whose maximum transmission time is 150 msec., and the minimum time interval between each transmission is 60 seconds.

Due tohardware limitations,this is the best (highest) duty cycle that can be used.

Under the above conditions, the use of standard turntable/antenna mast signal maximization is impractical for the following reasons:

a. There is no synchronization between the transmitter ON time and the movement of the turntable/antenna.

b. During 150msec., the antenna or turntable move only a very small fraction of their range, therefore any hours are required to complete the level maximization for a single measured emission.

c. During the transmitter OFF time, there should be no movement of the turntable or antenna mast.

As a result of the above problems, a single operation frequency of the E.U.T. will require many weeks of testing, which is impractical.

We suggest to test the E.U.T. at four fixed positions (90° steps) of

the turntable and two fixed positions of the test antenna (1, 1.5 m vertical polarity, 1.5, 2 m horizontal polarity).

Please let us know if this approach is acceptable.

Best regards

Shaike Raz

EMC Laboratory Manager

EMC Laboratory

ITL (Product Testing) Ltd.

Kfar Bin Nun

Israel

Tel: +972-8-9797799

Fax: +972-8-9797702

Email: sraz@itl.co.il

From: Tom Phillips [tphillip@fcc.gov]

To: emc@itl.co.il

Subject: Re: Radiated Emission of Low Duty Cycle Intentional Radiatior

Dear Mr. Raz,

I suggest that you modify the power supply to provide continuous DC to the device. Option 1 does not appear to be a suitable way to make the measurements.

>>> EMC <emc@itl.co.il> 07/05/01 08:05AM >>>

Ref: My email message of 01 July 2001

Dear Mr. Phillips,

Thank you for your response of 02 July 2001.

Please be advised:

1. As the product operates, the transmission On/Off time is limited by the charging current of its power supply and discharge time constant of a storage capacitor (4700microF) that delivers the DC voltage to the R.F. section.
2. To enable continuous operation, the product must use an external power supply for the DC of its R.F. section. This hardware modification changes the original test conditions.

Please let us know if you accept option 1 (with a greater number of fixed test positions) or is option 2 preferred.

Thank you for your assistance.

Shaike Raz

EMC Laboratory Manager

EMC Laboratory

ITL (Product Testing) Ltd.

Kfar Bin Nun

Israel

Tel: +972-8-9797799

Fax: +972-8-9797702

Email: sraz@itl.co.il

The radiated emission test was performed with an external power source:

DC power supply

Manufacturer: TTi Thurlby Thundar Instrument

Model: PL330QMT

12V DC supplied to the display circuit

34V DC supplied to the transmitting circuit.

The regular operation mode of the E.U.T is: transmitting a short message every one hour using a charging capacitor.

The E.U.T was configured to transmit for 5 seconds with short intervals, by getting its' power supply from an external power source instead of an internal charged capacitor. The transmitting circuit uses 34VDC, all other circuits use 12VDC, both supplied by the external power source (see Figure 3).

The thicker lines in Figure 3, are 2 unshielded AC cables, 1 meter for simulating the 230VAC grid, which is connected to the E.U.T in normal operation mode.

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 all typical operational modes.

3.3 Special Accessories

No special accessories were needed to achieve compliance.

3.4 Equipment Modifications

A shield was added above the Power-Amplifier circuit for reducing the radiation level associated with this circuit, specifically addressing the problem detected in the radiated emission test above 1GHz.

3.5 Configuration of Tested System

The configuration of the tested system is described in the figure 3.1.

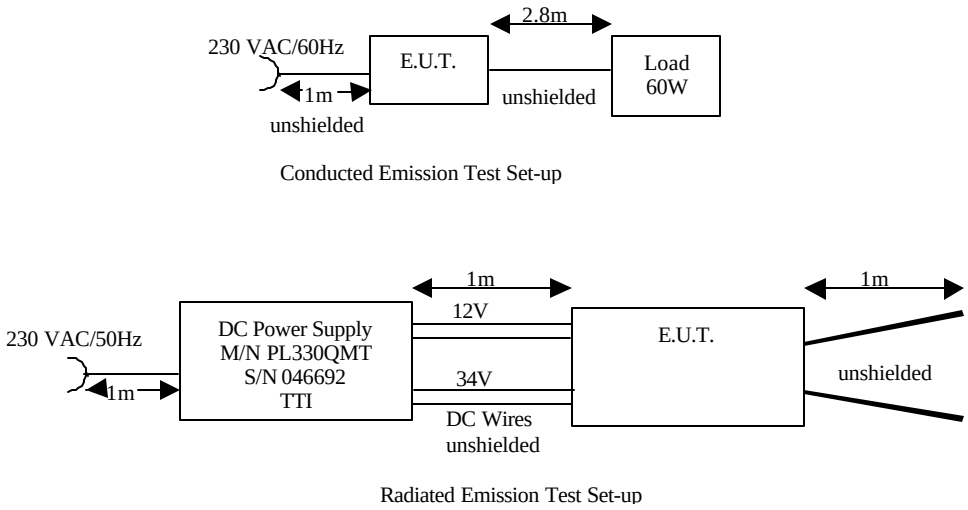


Figure 3. Configuration of Tested System

4. Block Diagram

4.1 Schematic Block/Connection Diagram

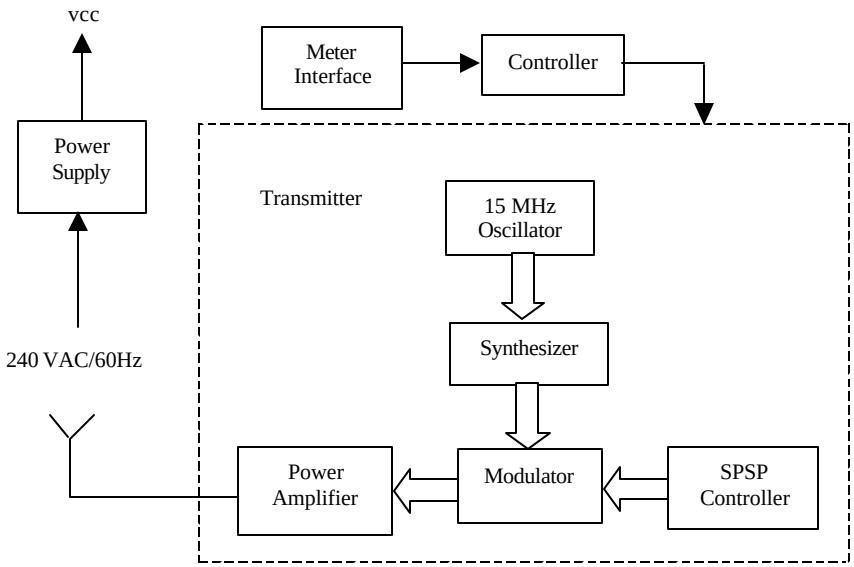


Figure 4. Block Diagram

4.2 Theory of Operation

The E.U.T receiving outputs from the Electric meter and converts them into 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 microcontroller.

Components

IO (input/output modules)
Transmitter module which includes the following components:
Microcontroller
ASIC (application Specific Integral Circuit)
Transmitter
External memory

5. Conducted and Radiated Measurement Photos

Figure 5. Conducted Emission Test. Front

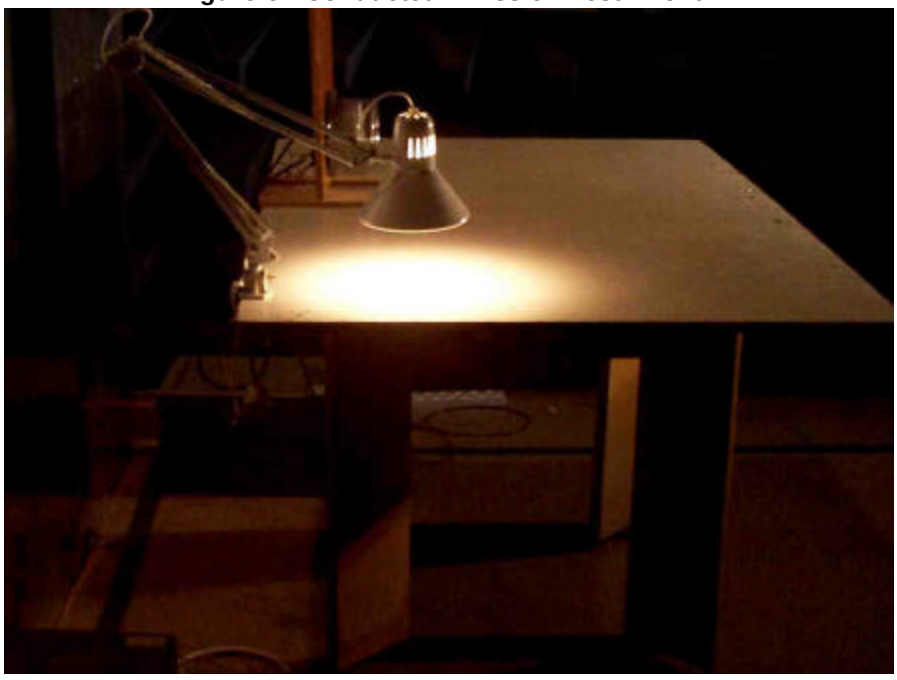


Figure 6. Conducted Emission Test. Rear

Figure 7. Radiated Emission Test. Front

Figure 8. Radiated Emission Test. Side

6. Conducted Emission

6.1 Test Specification

0.45 - 30 MHz, FCC Part 15, Subpart B, CLASS B

6.2 Test Procedure

The E.U.T operation mode and test setup are as described in Section 7.1. In order to minimize background noise interference, the conducted emission testing was performed inside a shielded room (see Section 3), with the E.U.T placed on an 0.8 meter high wooden table, 0.4 meter from the room's vertical wall.

The E.U.T was powered from 230 V AC / 60 Hz via 50 Ohm / 50 µHn Line Impedance Stabilization Network (LISN) on the phase and neutral lines. The LISN's were grounded to the shielded room ground plane (floor), and were kept at least 0.8 meters from the nearest boundary of the E.U.T

The center of the E.U.T.'s AC cable was folded back and forth, in order to form a bundle less than 0.40 meters and a total cable length of 1 meter.

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 the photograph, Figure 5. Conducted Emission Test.

The emission voltages at the LISN's outputs were measured using a computerized receiver, complying to CISPR 16 requirements. The specification limits are loaded to the receiver via a 3.5" floppy disk and are displayed on the receiver's spectrum display.

A frequency scan between 0.15 and 30 MHz was performed at 9 kHz I.F. band width, using peak detection.

The spectral components having the highest level on each line were measured using a quasi-peak detector.

6.3 Measured Data

JUDGEMENT: Passed by 17.7 dBµV

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

for 903.8 MHz, 18.6 dB at 29.36 MHz frequency, for the phase line and

for 903.8 MHz, 19.4 dB at 29.36 MHz frequency, neutral line.

for 915.0 MHz, 18.0 dB at 29.36 MHz frequency, phase line

for 915.0 MHz, 19.6 dB at 29.36 MHz frequency, neutral line

for 926.2 MHz, 17.7 dB at 29.6 MHz frequency, phase line

for 926.2 MHz, 19.4 dB at 29.6 MHz frequency, neutral line

The details of the highest emissions are given in Figure 9 to Figure 20.

TEST PERSONNEL:

Tester Signature: _____ Date: 26.11.01

Typed/Printed Name: Y. Mordukhovitch

Conducted Emission

E.U.T Description	Electric Meter
Type	Schlumberger
Serial Number:	Not designated

Specification:	FCC Part 15, Subpart B, Class B
Lead:	Phase
Detectors:	Peak, Quasi-peak
Operating Frequency	903.8 MHz

Frequency (MHz)	Peak Amplitude (dBµV)	Quasi-peak Amplitude (dBµV)	Specification (dB µV)	Pass/Fail	Margin (dB)
0.54	32.4	24.9	48.0	Pass	-23.1
1.03	30.6	23.9	48.0	Pass	-24.1
1.09	32.0	24.2	48.0	Pass	-23.8
1.15	32.3	24.0	48.0	Pass	-24.0
16.78	28.2	25.8	48.0	Pass	-22.2
20.97	30.3	28.2	48.0	Pass	-19.8
29.36	33.2	29.4	48.0	Pass	-18.6

Figure 9. Conducted Emission: PHASE. Detectors: Peak, QUASI-PEAK

Conducted Emission

E.U.T Description	Electric Meter
Type	Schlumberger
Serial Number:	Not designated

Specification:	FCC Part 15, Subpart B, Class B
Lead:	Phase
Detectors:	Peak, Quasi-peak
Operating Frequency	903.8 MHz

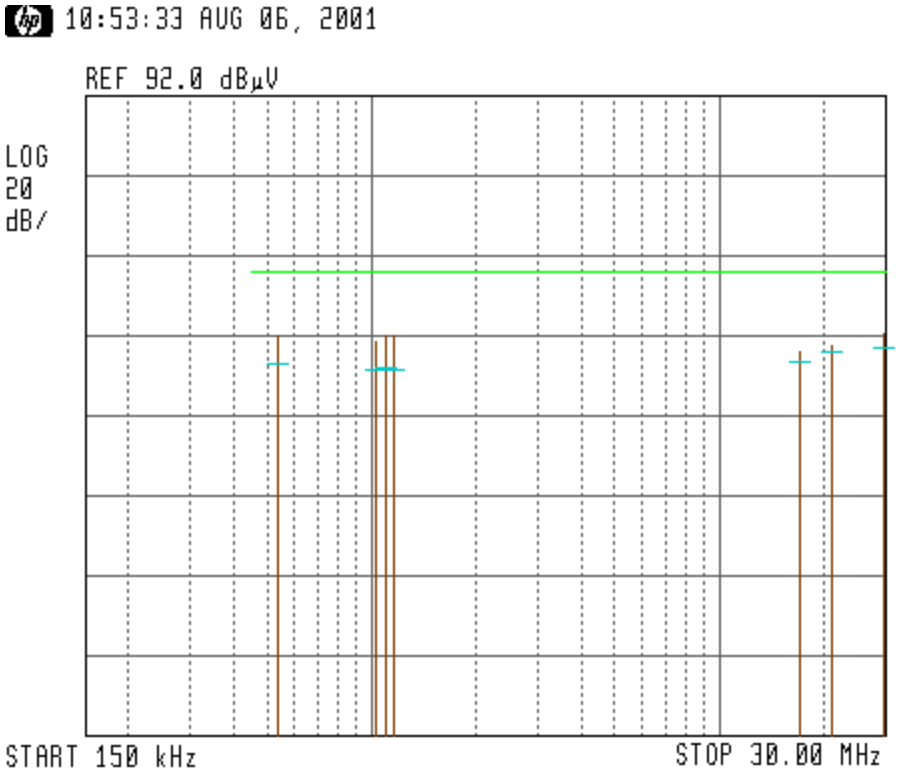


Figure 10. Detectors: Peak, Quasi-peak

Notes:

1. Horizontal axis shows logarithmic frequency scale.

2. The vertical axis shows amplitude (in dB µV).

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.

Conducted Emission

E.U.T Description	Electric Meter
Type	Schlumberger
Serial Number:	Not designated

Specification:	FCC Part 15, Subpart B, Class B
Lead:	Neutral
Detectors:	Peak, Quasi-peak
Operating Frequency	903.8 MHz

Frequency (MHz)	Peak Amplitude (dB µV)	Quasi-peak Amplitude (dB µV)	Specification (dB µV)	Pass/Fail	Margin (dB)
0.45	32.4	24.8	48.0	Pass	-23.2
1.05	32.2	24.2	48.0	Pass	-23.8
1.07	31.0	24.0	48.0	Pass	-24.0
2.05	29.7	22.8	48.0	Pass	-25.2
16.78	29.2	26.5	48.0	Pass	-21.5
20.97	30.0	28.1	48.0	Pass	-19.9
29.36	32.2	28.6	48.0	Pass	-19.4

Figure 11. Detectors: Peak, QUASI-PEAK

Conducted Emission

E.U.T Description	Electric Meter
Type	Schlumberger
Serial Number:	Not designated

Specification:	FCC Part 15, Subpart B, Class B
Lead:	Neutral
Detectors:	Peak, Quasi-peak
Operating Frequency	903.8 MHz

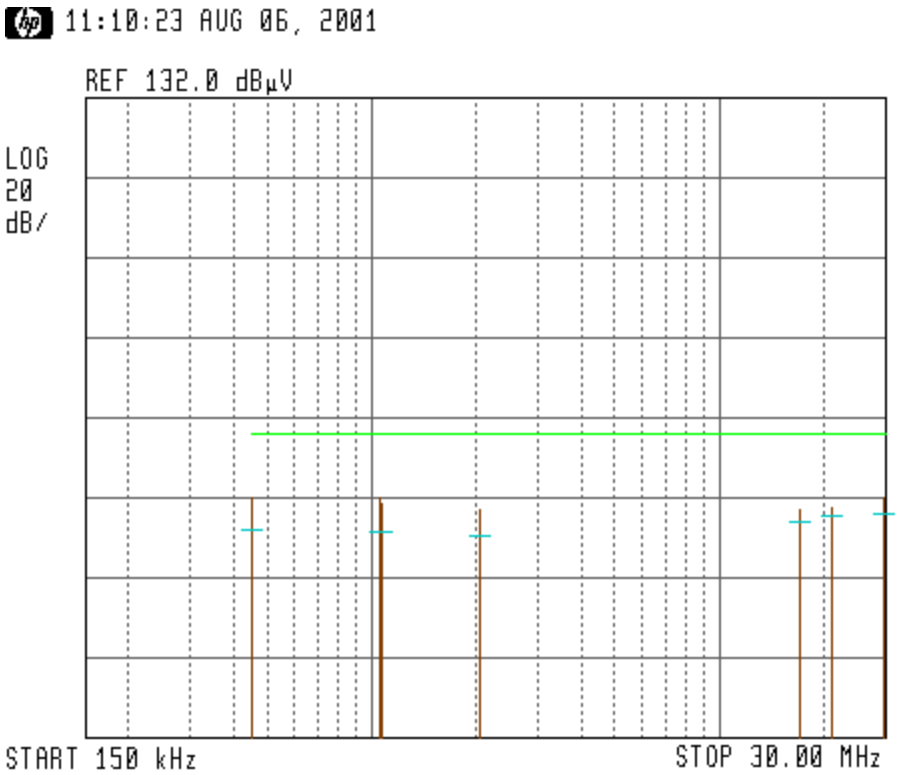


Figure 12 Conducted Emission: NEUTRAL
Detectors: Peak, Quasi-peak

Notes:

1. Horizontal axis shows logarithmic frequency scale.

2. The vertical axis shows amplitude (in dB µV).

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.

Conducted Emission

E.U.T Description	Electric Meter
Type	Schlumberger
Serial Number:	Not designated

Specification:	FCC Part 15, Subpart B, Class B
Lead:	Phase
Detectors:	Peak, Quasi-peak
Operating Frequency	915.0 MHz

Frequency (MHz)	Peak Amplitude (dBµV)	Quasi-peak Amplitude (dBµV)	Specification (dB µV)	Pass/Fail	Margin (dB)
0.52	31.3	24.9	48.0	Pass	-23.1
0.88	31.5	24.2	48.0	Pass	-23.8
1.09	33.3	24.0	48.0	Pass	-24.0
16.78	28.3	25.6	48.0	Pass	-22.4
20.97	30.2	28.0	48.0	Pass	-20.0
29.36	33.5	30.0	48.0	Pass	-18.0
30.00	28.1	26.4	48.0	Pass	-21.6

Figure 13. Conducted Emission: PHASE. Detectors: Peak, QUASI-PEAK

Conducted Emission

E.U.T Description	Electric Meter
Type	Schlumberger
Serial Number:	Not designated

Specification:	FCC Part 15, Subpart B, Class B
Lead:	Phase
Detectors:	Peak, Quasi-peak
Operating Frequency	915.0 MHz

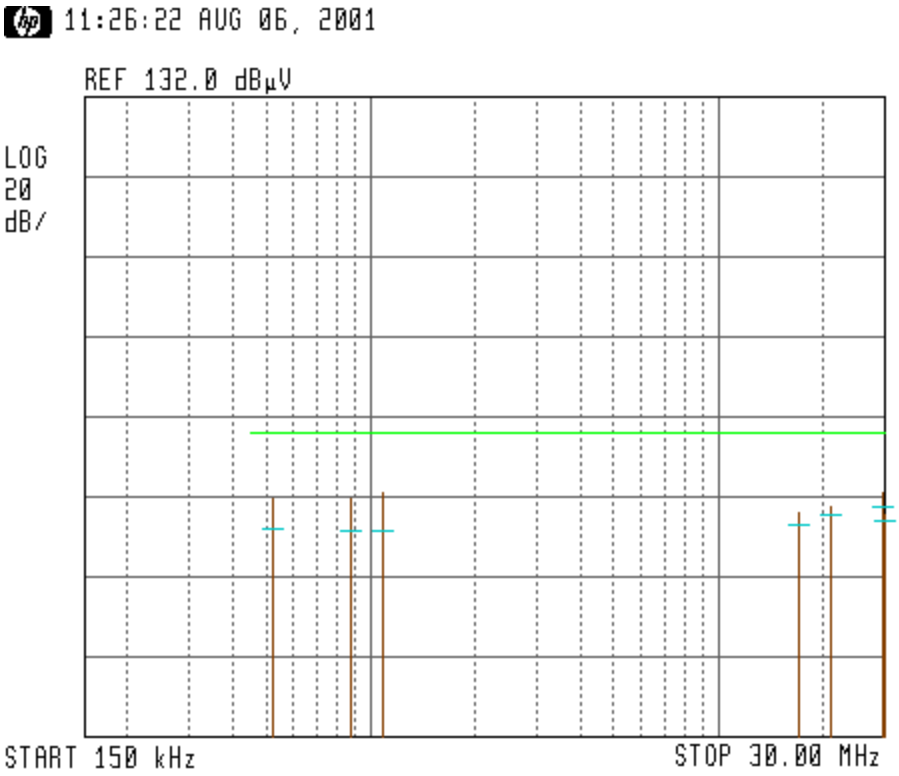


Figure 14. Detectors: Peak, Quasi-peak

Notes:

1. Horizontal axis shows logarithmic frequency scale.

2. The vertical axis shows amplitude (in dB µV).

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.

Conducted Emission

E.U.T Description	Electric Meter
Type	Schlumberger
Serial Number:	Not designated

Specification:	FCC Part 15, Subpart B, Class B
Lead:	Neutral
Detectors:	Peak, Quasi-peak
Operating Frequency	915.0 MHz

Frequency (MHz)	Peak Amplitude (dB µV)	Quasi-peak Amplitude (dB µV)	Specification (dB µV)	Pass/Fail	Margin (dB)
0.47	32.1	24.4	48.0	Pass	-23.6
0.72	29.9	24.2	48.0	Pass	-23.8
1.05	32.4	23.9	48.0	Pass	-24.1
16.78	28.7	26.1	48.0	Pass	-21.9
20.97	30.6	28.2	48.0	Pass	-19.8
29.36	31.2	28.4	48.0	Pass	-19.6
30.00	25.5	24.3	48.0	Pass	-23.7

Figure 15. Detectors: Peak, QUASI-PEAK

Conducted Emission

E.U.T Description	Electric Meter
Type	Schlumberger
Serial Number:	Not designated

Specification:	FCC Part 15, Subpart B, Class B
Lead:	Neutral
Detectors:	Peak, Quasi-peak
Operating Frequency	915.0 MHz

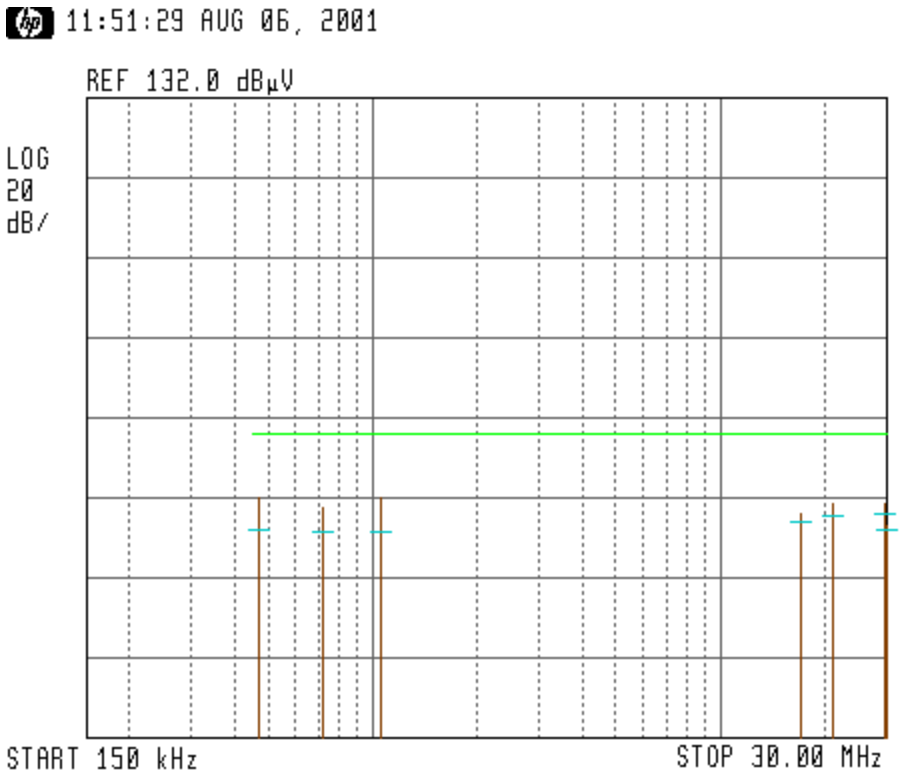


Figure 16 Conducted Emission: NEUTRAL
Detectors: Peak, Quasi-peak

Notes:

1. Horizontal axis shows logarithmic frequency scale.

2. The vertical axis shows amplitude (in dB µV).

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.

Conducted Emission

E.U.T Description	Electric Meter
Type	Schlumberger
Serial Number:	Not designated

Specification:	FCC Part 15, Subpart B, Class B
Lead:	Phase
Detectors:	Peak, Quasi-peak
Operating Frequency	926.2 MHz

Frequency (MHz)	Peak Amplitude (dBµV)	Quasi-peak Amplitude (dBµV)	Specification (dB µV)	Pass/Fail	Margin (dB)
0.49	36.2	24.8	48.0	Pass	-23.2
0.52	34.6	25.0	48.0	Pass	-23.0
0.66	35.2	24.8	48.0	Pass	-23.2
16.78	29.2	25.6	48.0	Pass	-22.4
20.97	30.6	28.0	48.0	Pass	-20.0
29.36	34.7	30.3	48.0	Pass	-17.7
30.00	27.6	24.3	48.0	Pass	-23.7

Figure 17. Conducted Emission: PHASE. Detectors: Peak, QUASI-PEAK

Conducted Emission

E.U.T Description	Electric Meter
Type	Schlumberger
Serial Number:	Not designated

Specification:	FCC Part 15, Subpart B, Class B
Lead:	Phase
Detectors:	Peak, Quasi-peak
Operating Frequency	926.2 MHz

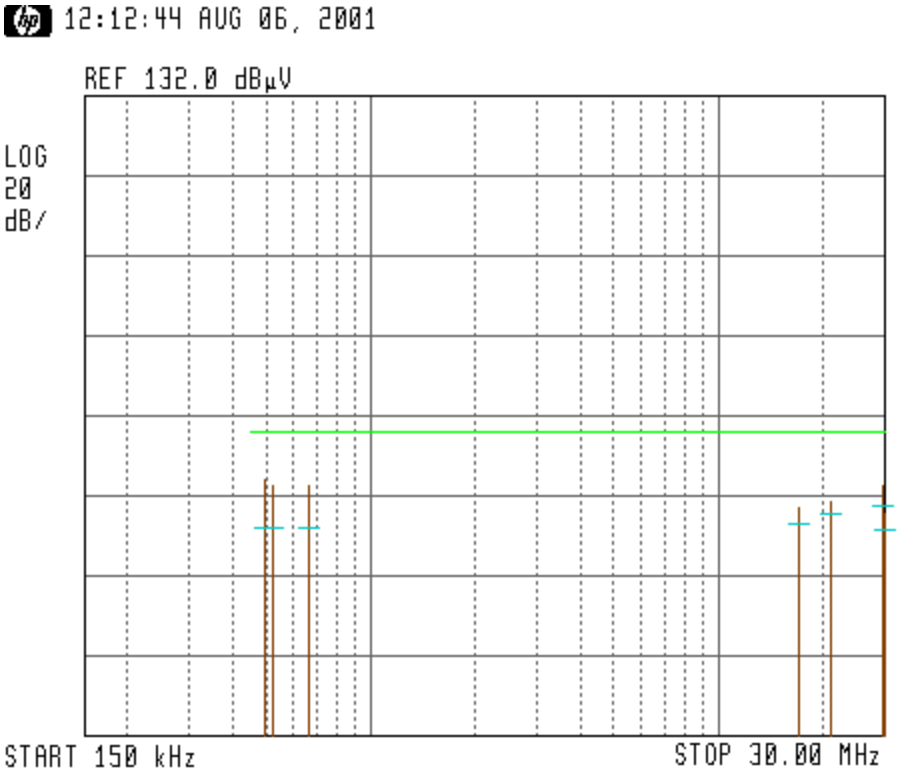


Figure 18. Detectors: Peak, Quasi-peak

Notes:

1. Horizontal axis shows logarithmic frequency scale.

2. The vertical axis shows amplitude (in dB µV).

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.

Conducted Emission

E.U.T Description	Electric Meter
Type	Schlumberger
Serial Number:	Not designated

Specification:	FCC Part 15, Subpart B, Class B
Lead:	Neutral
Detectors:	Peak, Quasi-peak
Operating Frequency	926.2 MHz

Frequency (MHz)	Peak Amplitude (dB µV)	Quasi-peak Amplitude (dB µV)	Specification (dB µV)	Pass/Fail	Margin (dB)
0.51	33.9	24.3	48.0	Pass	-23.7
0.63	33.3	24.3	48.0	Pass	-23.7
0.69	32.8	23.9	48.0	Pass	-24.1
16.78	29.5	26.3	48.0	Pass	-21.7
20.97	30.7	28.1	48.0	Pass	-19.9
29.36	31.5	28.6	48.0	Pass	-19.4
30.00	25.5	23.9	48.0	Pass	-24.1

Figure 19. Detectors: Peak, QUASI-PEAK

Conducted Emission

E.U.T Description	Electric Meter
Type	Schlumberger
Serial Number:	Not designated

Specification:	FCC Part 15, Subpart B, Class B
Lead:	Neutral
Detectors:	Peak, Quasi-peak
Operating Frequency	926.2 MHz

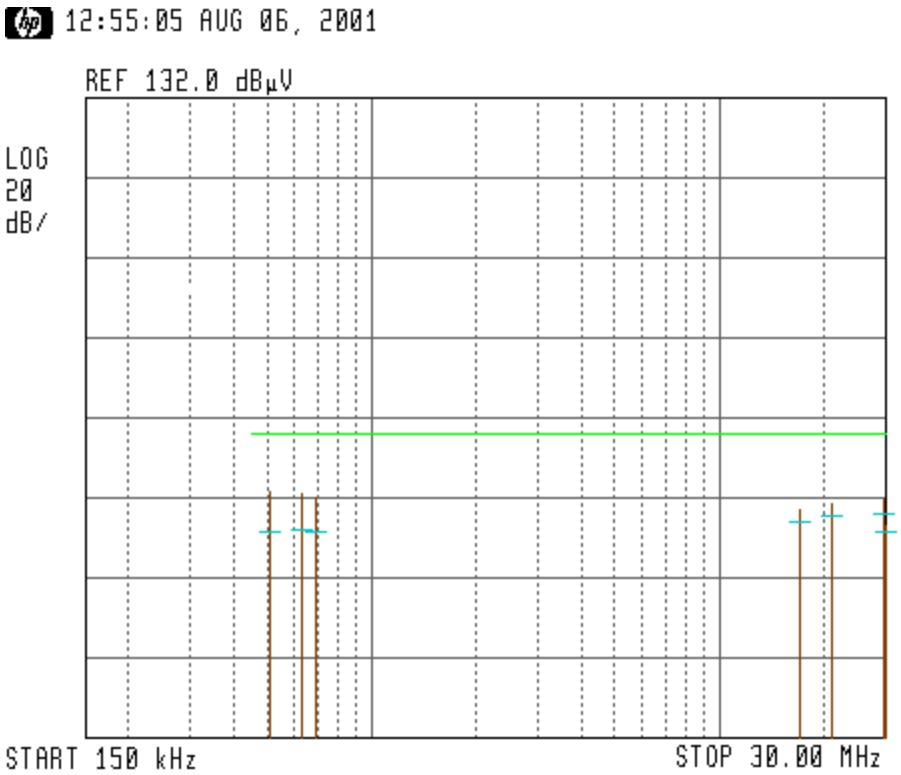


Figure 20 Conducted Emission: NEUTRAL
Detectors: Peak, Quasi-peak

Notes:

1. *Horizontal axis shows logarithmic frequency scale.*
2. *The vertical axis shows amplitude (in dB µV).*
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.*

6.4 Test Instrumentation Used, Conducted Measurement

Instrument	Manufacturer	Model	Serial No.	Calibration	Period
LISN	Fischer	FCC-LISN-2A	127	March 4, 2001	1 year
LISN	Fischer	FCC-LISN-2A	128	March 4, 2001	1 year
Receiver	HP	85420E/85422E	3427A00103/34	Nov. 30, 2000	1 year
Printer	HP	ThinkJet2225	2738508357	N/A	N/A

7. Radiated Emission, Below 1 GHz

7.1 Test Specification

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

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 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.

7.3 Measured Data

JUDGEMENT: Passed by 2.6 dBµV/m

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

for 903.8 MHz, 2.6 dB at 37.52 MHz frequency, horizontal polarization.

for 915.0 MHz, 6.8 dB at 37.97 MHz frequency, vertical polarization

for 926.2 MHz, 5.4 dB at 37.53 MHz frequency, vertical polarization

The details of the highest emissions are given in Figure 21 to Figure 32.

TEST PERSONNEL:

Tester Signature: _____ Date: 26.11.01

Typed/Printed Name: Y. Mordukhovitch

Radiated Emission

E.U.T Description Electric Meter
Type Schlumberger
Serial Number: Not designated

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

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

Frequency (MHz)	**Peak Amp** (dBµV/m)	**QP Amp** (dBµV/m)	**Correction** (dB)	**Specification** (dBµV/m)	**Margin** (dB)
31.33	34.6	29.8	15.4	93.1**	-63.3
37.87	26.6	23.8	13.7	40.0*	-16.2
73.74	21.9	17.9	10.3	40.0*	-22.1
75.00	24.5	21.8	10.3	40.0*	-18.2
110.31	23.6	22.2	13.0	43.5*	-21.3
135.85	31.4	24.0	14.2	43.5*	-19.5
275.40	30.2	23.9	21.7	46.0*	-22.1

Figure 21. 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.

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

**Note: The limit for field strength outside of Frequency Restricted Band is at least 20 dB below the field strength at the operating frequency 903.8 MHz. The limit is 93.1 dBµV/m.

Radiated Emission

E.U.T Description	Electric Meter
Type	Schlumberger
Serial Number:	Not designated

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

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

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

Frequency (MHz)	**Peak Amp** (dBµV/m)	**QP Amp** (dBµV/m)	**Correction** (dB)	**Specification** (dBµV/m)	**Margin** (dB µV/m)
324.07	27.5	22.8	15.6	46.0*	-23.2
407.88	27.0	20.0	18.6	46.0*	-26.0
611.03	31.0	24.2	22.4	46.0*	-21.8
903.75	115.6	113.1	27.1	N/A***	-
963.58	40.9	33.5	28.2	54.0*	-20.5
997.35	38.0	32.0	28.8	54.0*	-22.0

Figure 22. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Peak, Quasi-peak

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

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

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

Radiated Emission

E.U.T Description	Electric Meter
Type	Schlumberger
Serial Number:	Not designated

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

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

Frequency (MHz)	**Peak Amp** (dBµV/m)	**QP Amp** (dBµV/m)	**Correction** (dB)	**Specification** (dBµV/m)	**Margin** (dB)
32.15	48.0	43.9	15.2	89.7**	-45.8
37.52	36.0	37.4	13.8	40.0*	-2.6
73.62	32.2	28.3	10.3	40.0*	-11.7
75.01	33.6	29.6	10.4	40.0*	-10.4
110.71	37.2	30.2	13.1	43.5*	-13.3
131.47	36.3	30.8	14.0	43.5*	-12.7
267.46	30.1	22.9	21.5	46.0*	-23.1

Figure 23. 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.

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

**Note: The limit for field strength outside of Frequency Restricted Band is at least 20 dB below the field strength at the operating frequency 903.8 MHz. The limit is 89.7 dBµV/m.

Radiated Emission

E.U.T Description	Electric Meter
Type	Schlumberger
Serial Number:	Not designated

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

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

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

Frequency (MHz)	**Peak Amp** (dBµV/m)	**QP Amp** (dBµV/m)	**Correction** (dB)	**Specification** (dBµV/m)	**Margin** (dB µV/m)
335.38	26.5	21.3	16.1	46.0*	-24.7
349.11	29.1	24.7	16.6	46.0*	-21.3
360.02	27.8	23.1	17.0	46.0*	-22.9
409.58	27.6	20.7	18.6	46.0*	-25.3
610.38	31.4	24.3	22.4	46.0*	-21.7
847.32	39.1	32.4	26.1	46.0*	-13.6
903.8	112.2	109.7	-	N/A***	-
960.50	39.5	35.5	28.2	54.0*	-18.5
993.37	38.2	31.9	28.8	54.0*	-22.1

Figure 24. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Peak, Quasi-peak

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

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

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

Radiated Emission

E.U.T Description	Electric Meter
Type	Schlumberger
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)
31.61	37.6	33.8	15.4	40.0*	-6.2
37.97	28.5	22.9	13.6	40.0*	-17.1
74.99	23.6	19.2	10.3	40.0*	-20.8
116.03	29.7	22.1	13.4	43.5*	-21.4
134.97	27.5	23.1	14.2	43.5*	-20.4
150.01	26.4	24.7	15.0	43.5*	-18.8
269.49	29.4	22.9	21.5	46.0*	-23.1

Figure 25. 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.

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

Radiated Emission

E.U.T Description	Electric Meter
Type	Schlumberger
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)
324.29	26.0	20.3	15.7	46.0*	-25.7
324.96	25.9	20.1	15.7	46.0*	-25.9
407.77	27.4	20.1	18.6	46.0*	-25.9
611.13	30.9	24.2	22.4	46.0*	-21.8
915.00	120.3	118.0	27.4	N/A***	-
960.37	44.8	39.2	28.2	54.0*	-14.8
991.87	39.7	32.9	28.7	54.0*	-21.1

Figure 26. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Peak, Quasi-peak

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

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

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

Radiated Emission

E.U.T Description Electric Meter
Type Schlumberger
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)
32.29	47.2	45.0	15.2	95.9**	-40.9
37.97	36.5	33.2	13.6	40.0*	-6.8
74.99	33.6	29.9	10.3	40.0*	-10.1
121.02	37.2	32.2	13.7	43.5*	-11.3
129.70	38.5	33.2	13.9	43.5*	-10.3
150.01	29.0	24.2	15.0	43.5*	-19.3
269.49	29.4	22.9	21.5	46.0*	-23.1

Figure 27. 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.

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

**Note: The limit for field strength outside of Frequency Restricted Band is at least 20 dB below the field strength at the operating frequency 903.8 MHz. The limit is 95.9 dBµV/m.

Radiated Emission

E.U.T Description	Electric Meter
Type	Schlumberger
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)
329.47	26.7	20.1	15.9	46.0*	-25.9
406.67	27.7	20.6	18.6	46.0*	-25.4
611.79	31.0	24.4	22.5	46.0*	-21.6
847.66	38.4	31.4	26.1	46.0*	-14.6
849.79	39.0	32.1	26.1	46.0*	-13.9
915.00	118.3	115.9	27.4	N/A***	-
961.96	43.1	36.8	28.2	54.0*	-17.2
999.10	40.1	33.4	28.9	54.0*	-20.6

Figure 28. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Peak, Quasi-peak

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

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

Radiated Emission

E.U.T Description	Electric Meter
Type	Schlumberger
Serial Number:	Not designated

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

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

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

Frequency (MHz)	**Peak Amp** (dBµV/m)	**QP Amp** (dBµV/m)	**Correction** (dB)	**Specification** (dBµV/m)	**Margin** (dB)
75.00	24.7	22.1	10.4	40.0*	-17.9
110.37	24.2	13.9	13.0	43.5*	-29.6
120.01	24.5	16.3	13.6	43.5*	-27.2
134.99	27.1	23.7	14.2	43.5*	-19.8
165.00	25.8	22.0	15.4	43.5*	-21.5
275.00	24.7	18.7	21.7	46.0*	-27.3

Figure 29. 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.

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

Radiated Emission

E.U.T Description	Electric Meter
Type	Schlumberger
Serial Number:	Not designated

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

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

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

Frequency (MHz)	**Peak Amp** (dBµV/m)	**QP Amp** (dBµV/m)	**Correction** (dB)	**Specification** (dBµV/m)	**Margin** (dB µV/m)
327.41	33.9	25.8	23.4	46.0*	-20.2
330.00	28.9	26.7	23.4	46.0*	-19.3
405.00	29.6	28.9	23.9	46.0*	-17.1
926.15	118.0	115.5	26.3	N/A***	-
960.00	37.8	37.8	26.4	46.0*	-8.2
975.00	33.5	33.0	26.5	54.0*	-21.0

Figure 30. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Peak, Quasi-peak

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

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

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

Radiated Emission

E.U.T Description Electric Meter
Type Schlumberger
Serial Number: Not designated

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

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 926.2 MHz
Frequency range: 30 MHz to 300 MHz
Detector: Quasi-peak

Frequency (MHz)	**Peak Amp** (dBµV/m)	**QP Amp** (dBµV/m)	**Correction** (dB)	**Specification** (dBµV/m)	**Margin** (dB)
31.59	45.0	42.2	15.4	94.6**	-52.4
37.53	38.8	34.6	13.8	40.0*	-5.4
38.06	37.6	33.7	13.6	40.0*	-6.3
73.82	31.3	27.9	10.3	40.0*	-12.1
75.00	30.9	27.8	10.4	40.0*	-12.2
150.00	26.8	22.4	15.0	43.5*	-21.1
270.00	33.3	27.8	21.5	46.0*	-18.2

Figure 31. 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.

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

**Note: The limit for field strength outside of Frequency Restricted Band is at least 20 dB below the field strength at the operating frequency 903.8 MHz. The limit is 94.6 dBµV/m.

Radiated Emission

E.U.T Description	Electric Meter
Type	Schlumberger
Serial Number:	Not designated

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

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

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

Frequency (MHz)	**Peak Amp** (dBµV/m)	**QP Amp** (dBµV/m)	**Correction** (dB)	**Specification** (dBµV/m)	**Margin** (dB µV/m)
329.96	34.8	26.1	23.4	46.0*	-19.9
404.99	31.5	29.9	23.9	46.0*	-16.1
494.98	33.2	29.5	24.6	46.0*	-16.5
926.23	116.4	114.6	26.3	N/A***	-
960.00	34.0	33.5	26.4	46.0*	-12.5
975.00	38.2	32.9	26.5	54.0*	-21.1

Figure 32. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Peak, Quasi-peak

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

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

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

7.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3411A00102	November 30,2000	1 year
RF Section	HP	85420E	3427A00103	November 30,2000	1 year
Antenna Bioconical HP	ARA	BCD 235/B	1041	April 1, 2001	1 year
Antenna –Log Periodic	ARA	LPD-2010/A	1037	March 29, 2001	1 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	ThinkJet 2225	2738508357.0	N/A	N/A

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. Radiated Emission 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.

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

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

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

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

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

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

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

8.2 Test Data

JUDGEMENT: Passed by 0.1 dBµV/m

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

for 903.8 MHz, 0.1 dB at 2711.23 MHz frequency, horizontal polarization.

for 915.0 MHz, 3.1 dB at 2744.95 MHz frequency, horizontal polarization

for 926.2 MHz, 3.5 dB at 2778.44 MHz frequency, vertical polarization

The details of the highest emissions are given in Figure 33 to Figure 56.

TEST PERSONNEL:

Tester Signature: _____ Date: 26.11.01

Typed/Printed Name: Y. Mordukhovitch

Radiated Emission Above 1 GHz

E.U.T Description	Electric Meter
Type	Schlumberger
Serial Number:	Not designated

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

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

Frequency range: 1 GHz to 2.9 GHz
Detector: Average

Freq. (MHz)	Avg. Amp (dBµV/m)	Correction HPF (dB)	Correction Antenna and Cable (dB)	Avg. Det. Spec. (dBµV/m)	Final Result FR(A) (dB µV/m) See Note *	Avg. Margin (dB)
2711.23	52.2	1.7	44.0	54.0	53.9	-0.1

Figure 33. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Average

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

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

FR(A) = AVG + HPF

Where:

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

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

HPF (dB) is the high pass filter attenuation.

Radiated Emission Above 1 GHz

E.U.T Description	Electric Meter
Type	Schlumberger
Serial Number:	Not designated

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

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

Frequency range: 1 GHz to 2.9 GHz
Detector: Peak

Freq. (MHz)	Peak Amp (dBµV/m)	Correction HPF (dB)	Correction Antenna and Cable (dB)	Peak Det. Spec. (dBµV/m)	Final Result FR(P) (dB µV/m) See Note *	Peak. Margin (dB)
2711.23	58.3	1.7	44.0	74.0	60.0	-14.0

Figure 34. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Peak

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

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

FR(P) (dBµV/m) = Peak + HPF

Where:

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

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

HPF is the high pass filter attenuation.

Radiated Emission Above 1 GHz

E.U.T Description	Electric Meter
Type	Schlumberger
Serial Number:	Not designated

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

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

Frequency range: 2.9 GHz to 9.3 GHz
Detector: Peak

Freq.	Peak Amp	Correction Factors			Peak. Specification	Peak Final Result FR (P)*	Peak. Margin
		Antenna AF	Cable CF	Preamp PF			
(MHz)	(dBµV)	(dB)	(dB)	(dB)	(dB µV/m)	(dB µV/m) See Note *	(dB)
3615.20	37.2	33.7	2.2	30.5	74.0	42.6	-31.4
4519.00	37.0	35.2	2.6	30.4	74.0	44.4	-29.6
5422.50	36.7	36.6	2.8	30.3	74.0	45.8	-28.2
6326.60	34.4	37.8	3.2	30.1	74.0	45.3	-28.7
7230.40	36.8	38.9	3.6	29.9	74.0	49.4	-24.6
8134.20	38.8	40.0	3.9	29.9	74.0	52.8	-21.2
9038.0	37.7	40.8	4.2	30.0	74.0	52.7	-21.3

Figure 35. 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 Electric Meter
Type Schlumberger
Serial Number: Not designated

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

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

Frequency range: 2.9 GHz to 9.3 GHz
Detector: Average

Freq.	Avg Amp	Correction Factors			AVG Specification	AVG Final Result FR (A)	AVG Margin
		Antenna AF	Cable CF	Preamp PF			
(MHz)	(dBµV)	(dB)	(dB)	(dB)	(dB µV/m)	(dB µV/m) See Note *	(dB)
3615.20	25.3	33.7	2.2	30.5	54.0	30.7	-23.3
4519.00	25.1	35.2	2.6	30.4	54.0	32.5	-21.5
5422.50	23.6	36.6	2.8	30.3	54.0	32.7	-21.3
6326.60	21.8	37.8	3.2	30.1	54.0	32.7	-21.3
7230.40	25.1	38.9	3.6	29.9	54.0	37.7	-16.3
8134.20	25.8	40.0	3.9	29.9	54.0	39.8	-14.2
9038.00	25.2	40.8	4.2	30.0	54.0	40.2	-13.7

Figure 36. 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	Electric Meter
Type	Schlumberger
Serial Number:	Not designated

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

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

Frequency range: 1 GHz to 2.9 GHz
Detector: Average

Freq. (MHz)	Avg. Amp (dBµV/m)	Correction HPF (dB)	Correction Antenna and Cable (dB)	Avg. Det. Spec. (dBµV/m)	Final Result FR(A) (dB µV/m) See Note *	Avg. Margin (dB)
2711.23	48.6	1.7	44.0	54.0	50.3	-3.7

Figure 37. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Average

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

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

FR(A) = AVG + HPF

Where :

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

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

HPF (dB) is the high pass filter attenuation

Radiated Emission Above 1 GHz

E.U.T Description	Electric Meter
Type	Schlumberger
Serial Number:	Not designated

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

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

Frequency range: 1 GHz to 2.9 GHz
Detector: Peak

Freq. (MHz)	Peak Amp (dBµV/m)	Correction HPF (dB)	Correction Antenna and Cable (dB)	Peak. Det. Spec. (dBµV/m)	Final Result FR(P) (dB µV/m) See Note *	Peak. Margin (dB)
2711.23	58.3	1.7	44.0	74.0	60.0	-14.0

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

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

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

FR(P) (dBµV/m) = Peak + HPF

Where:

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

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

HPF is the high pass filter attenuation.

Radiated Emission Above 1 GHz

E.U.T Description	Electric Meter
Type	Schlumberger
Serial Number:	Not designated

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

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

Frequency range: 2.9 GHz to 9.3 GHz
Detector: Peak

Freq.	Peak Amp	Correction Factors			Peak. Specification	Peak Final Result FR (P)	Peak. Margin
		Antenna AF	Cable CF	Preamp PF			
(MHz)	(dBµV/m)	(dB)	(dB)	(dB)	(dB µV/m)	(dB µV/m) See Note *	(dB)
3615.20	40.0	33.7	2.2	30.5	74.0	45.4	-28.6
4519.00	38.0	35.2	2.6	30.4	74.0	45.4	-28.6
5422.50	35.7	36.6	2.8	30.3	74.0	44.8	-29.2
6326.60	34.3	37.8	3.2	30.1	74.0	44.9	-29.9
7230.40	36.3	38.9	3.6	29.9	74.0	48.9	-25.1
8134.20	36.6	40.0	3.9	29.9	74.0	50.6	-23.4
9038.00	36.8	40.8	4.2	30.0	74.0	51.8	-22.2

Figure 39. 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	Electric Meter
Type	Schlumberger
Serial Number:	Not designated

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

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

Frequency range: 2.9 GHz to 9.3 GHz
Detector: Average

Freq.	Avg Amp	Correction Factors			AVG Specification	AVG Final Result FR (A)*	AVG Margin
		Antenna AF	Cable CF	Preamp PF			
(MHz)	(dBµV)	(dB)	(dB)	(dB)	(dB µV/m)	(dB µV/m) See Note *	(dB)
3615.20	28.6	33.7	2.2	30.5	54.0	34.0	-20.0
4519.00	25.2	35.2	2.6	30.4	54.0	32.6	-21.4
5422.50	23.0	36.6	2.8	30.3	54.0	32.1	-21.9
6326.60	21.8	37.8	3.2	30.1	54.0	32.7	21.3
7230.40	24.9	38.9	3.6	29.9	54.0	37.5	-16.5
8134.20	25.6	40.0	3.9	29.9	54.0	39.6	-14.4
9038.00	25.0	40.8	4.2	30.0	54.0	40.0	-14.0

Figure 40. 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	Electric Meter
Type	Schlumberger
Serial Number:	Not designated

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

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

Frequency range: 1 GHz to 2.9 GHz
Detector: Average

Freq. (MHz)	Avg. Amp (dBµV/m)	Correction HPF (dB)	Correction Antenna and Cable (dB)	Avg. Det. Spec. (dBµV/m)	Final Result FR(A) (dB µV/m) See Note *	Avg. Margin (dB)
2744.95	49.2	1.7	44.3	54.0	50.9	-3.1

Figure 41. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Average

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

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

FR(A) = AVG + HPF

Where:

FR(A) is the final result for average detector

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

HPF (dB) is the high pass filter attenuation

Radiated Emission Above 1 GHz

E.U.T Description	Electric Meter
Type	Schlumberger
Serial Number:	Not designated

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

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

Frequency range: 1 GHz to 2.9 GHz
Detector: Peak

Freq. (MHz)	Peak Amp (dBµV/m)	Correction HPF (dB)	Correction Antenna and Cable (dB)	Peak Det. Spec. (dBµV/m)	Final Result FR(P) (dB µV/m) See Note *	Peak. Margin (dB)
2744.95	59.8	1.7	44.3	74.0	61.5	-12.5

Figure 42. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Peak

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

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

FR(P) = Peak + HPF

Where:

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

Peak is the peak detector measurement,

HPF is the high pass filter attenuation.

Radiated Emission Above 1 GHz

E.U.T Description	Electric Meter
Type	Schlumberger
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)
3659.80	38.8	33.8	2.2	30.5	74.0	44.3	-29.7
4574.70	37.4	35.3	2.6	30.4	74.0	44.9	-29.1
5489.80	37.6	36.7	2.8	30.3	74.0	46.8	-27.2
6405.00	34.9	37.9	3.2	30.1	74.0	45.9	-28.1
7320.00	37.9	39.0	3.6	29.9	74.0	50.6	-23.6
8235.00	38.2	40.1	3.9	29.9	74.0	52.3	-21.7
9150.00	38.3	40.9	4.2	30.0	74.0	53.4	-20.6

Figure 43. 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	Electric Meter
Type	Schlumberger
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)
3659.80	27.2	33.8	2.2	30.5	54.0	32.7	-21.3
4574.70	23.2	35.3	2.6	30.4	54.0	30.7	-23.3
5489.80	23.8	36.7	2.8	30.3	54.0	33.0	-21.0
6405.00	22.0	37.9	3.2	30.1	54.0	33.0	-21.0
7320.00	25.2	39.0	3.6	29.9	54.0	37.9	-16.1
8235.00	25.6	40.1	3.9	29.9	54.0	39.7	-14.3
9150.00	25.3	40.9	4.2	30.0	54.0	40.4	-13.9

Figure 44. 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	Electric Meter
Type	Schlumberger
Serial Number:	Not designated

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

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

Frequency range: 1 GHz to 2.9 GHz
Detector: Average

Freq. (MHz)	Avg. Amp (dBµV/m)	Correction HPF (dB)	Correction Antenna and Cable (dB)	Avg. Det. Spec. (dBµV/m)	Final Result FR(A) (dB µV/m) See Note *.	Avg. Margin (dB)
2744.95	47.6	1.7	44.3	54.0	46.0	-8.0

Figure 45. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Average

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

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

FR(A) = AVG + HPF

Where :

FR(A) is the final result for average detector

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

HPF (dB) is the high pass filter attenuation

Radiated Emission Above 1 GHz

E.U.T Description	Electric Meter
Type	Schlumberger
Serial Number:	Not designated

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

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

Frequency range: 1 GHz to 2.9 GHz
Detector: Peak

Freq. (MHz)	Peak Amp (dBµV/m)	Correction HPF (dB)	Correction Antenna and Cable (dB)	Peak Det. Spec. (dBµV/m)	Final Result FR(P) (dB µV/m) See Note*.	Peak. Margin (dB)
2744.95	58.8	1.7	44.3	74.0	60.5	-13.5

Figure 46. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Peak

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

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

FR(P) = Peak + HPF

Where:

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

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

HPF is the high pass filter attenuation

Radiated Emission Above 1 GHz

E.U.T Description	Electric Meter
Type	Schlumberger
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)
3659.80	40.7	33.8	2.2	30.5	74.0	46.2	-27.8
4574.70	37.9	35.3	2.6	30.4	74.0	54.4	-28.6
5489.80	37.0	36.7	2.8	30.3	74.0	46.2	-27.8
6405.00	32.8	37.9	3.2	30.1	74.0	43.2	-30.2
7320.00	38.0	39.0	3.6	29.9	74.0	50.7	-23.3
8235.00	38.5	40.1	3.9	29.9	74.0	52.6	-21.4
9150.00	38.2	40.9	4.2	30.0	74.0	53.3	-20.7

Figure 47. 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	Electric Meter
Type	Schlumberger
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)
3659.80	29.9	33.8	2.2	30.5	54.0	35.4	-18.6
4574.70	25.0	35.3	2.6	30.4	54.0	32.5	-21.5
5489.80	22.6	36.7	2.8	30.3	54.0	31.8	-22.2
6405.00	22.0	37.9	3.2	30.1	54.0	33.0	-21.0
7320.00	25.2	39.0	3.6	29.9	54.0	37.9	-16.1
8235.00	25.6	40.1	3.9	29.9	54.0	39.7	-14.3
9150.00	25.2	40.9	4.2	30.0	54.0	40.3	-13.7

Figure 48. 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	Electric Meter
Type	Schlumberger
Serial Number:	Not designated

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

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

Frequency range: 1 GHz to 2.9 GHz
Detector: Average

Freq. (MHz)	Correction HPF (dB)	Avg. Amp (dBµV/m)	Correction Antenna and Cable (dB)	Avg. Det. Spec. (dBµV/m)	Final Result FR(A) (dB µV/m) See Note *.	Avg. Margin (dB)
2788.44	48.3	1.7	44.5	54.0	50.0	-4.0

Figure 49. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Average

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

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

$$FR(A) = AVG + HPF$$

Where:

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

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

HPF (dB) is the high pass filter attenuation.

Radiated Emission Above 1 GHz

E.U.T Description	Electric Meter
Type	Schlumberger
Serial Number:	Not designated

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

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

Frequency range: 1 GHz to 2.9 GHz
Detector: Peak

Freq.	Peak Amp	Correction HPF	Correction Antenna and Cable	Peak Det. Spec.	Final Result FR(P)	Peak. Margin
(MHz)	(dBµV/m)	(dB)	(dB)	(dBµV/m).	(dB µV/m) See Note *.	(dB)
2778.44	59.5	1.7	44.5	74.0	61.2	-12.8

Figure 50. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Peak

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

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

FR(P) (dBµV/m) = Peak + HPF

Where:

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

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

HPF is the high pass filter attenuation.

Radiated Emission Above 1 GHz

E.U.T Description	Electric Meter
Type	Schlumberger
Serial Number:	Not designated

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

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

Frequency range: 2.9 GHz to 9.3GHz
Detector: Peak

Freq.	Peak Amp	Correction Factors			Peak. Specification **	Peak Final Result FR (P)*	Peak. Margin
		Antenna AF	Cable CF	Preamp PF			
(MHz)	(dBµV)	(dB)	(dB)	(dB)	(dB µV/m)	(dB µV/m) See Note *.	(dB)
3704.60	38.6	33.7	2.2	30.5	74.0	44.0	-30.0
4630.70	37.5	35.3	2.6	30.4	74.0	45.0	-29.0
5557.00	37.6	36.7	2.8	30.3	74.0	46.8	-27.2
6483.40	33.7	38.1	3.2	30.1	74.0	44.9	-29.1
7409.60	37.5	39.2	3.6	29.9	74.0	50.4	-23.6
8335.80	37.7	40.2	3.9	29.9	74.0	51.9	-22.1
9262.00	36.8	41.0	4.2	30.0	74.0	52.0	-22.0

Figure 51. 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	Electric Meter
Type	Schlumberger
Serial Number:	Not designated

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

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

Frequency range: 2.9 GHz to 9.3 GHz
Detector: Average

Freq.	AVG Amp	Correction Factors			AVG Specification	AVG Final Result FR (A)	AVG Margin
		Antenna AF	Cable CF	Preamp PF			
(MHz)	(dBµV)	(dB)	(dB)	(dB)	(dB µV/m)	(dB µV/m) See Note *.	(dB)
3704.60	27.0	33.7	2.2	30.5	54.0	29.4	-24.6
4630.70	23.3	35.3	2.6	30.4	54.0	30.8	-23.2
5557.00	24.8	36.7	2.8	30.3	54.0	34.0	-20.0
6483.40	21.5	38.1	3.2	30.1	54.0	32.7	-21.3
7409.60	25.5	39.2	3.6	29.9	54.0	38.4	-15.6
8335.80	25.6	40.2	3.9	29.9	54.0	39.8	-14.2
9262.00	25.0	41.0	4.2	30.0	54.0	40.2	-13.8

Figure 52. 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	Electric Meter
Type	Schlumberger
Serial Number:	Not designated

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

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

Frequency range: 1 GHz to 2.9 GHz
Detector: Average

Freq.	Avg. Amp	Correction HPF	Correction Antenna and Cable	Avg. Det. Spec.	Final Result FR(A)	Avg. Margin
(MHz)	(dBµV/m)	(dB)	(dB)	(dBµV/m)	(dB µV/m) See Note*.	(dB)
2778.44	48.8	1.7	44.5	54.0	50.5	-3.5

Figure 53. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Average

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

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

FR(A) = AVG + HPF

Where :

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

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

HPF (dB) is the high pass filter attenuation.

Radiated Emission Above 1 GHz

E.U.T Description	Electric Meter
Type	Schlumberger
Serial Number:	Not designated

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

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

Frequency range: 1 GHz to 2.9 GHz
Detector: Peak

Freq. (MHz)	Peak Amp (dBµV/m)	Correction HPF (dB)	Correction Antenna and Cable (dB)	Peak Spec. (dBµV/m).	Final Result FR(P) (dB µV/m) See Note *.	Peak. Margin (dB)
2778.44	58.6	1.7	44.5	74.0	60.3	-13.7

Figure 54. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Peak

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

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

FR(P) (dBµV/m) = Peak + HPF

Where:

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

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

HPF is the high pass filter attenuation.

Radiated Emission Above 1 GHz

E.U.T Description	Electric Meter
Type	Schlumberger
Serial Number:	Not designated

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

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

Frequency range: 2.9 GHz to 9.3 GHz
Detector: Peak

Freq.	Peak Amp	Correction Factors			Peak. Specification	Peak Final Result FR (P)	Peak. Margin
		Antenna AF	Cable CF	Preamp PF			
(MHz)	(dBµV)	(dB)	(dB)	(dB)	(dB µV/m)	(dB µV/m) See Note *.	(dB)
3704.60	40.8	33.7	2.2	30.5	74.0	46.2	-27.8
4630.70	35.8	35.3	2.6	30.4	74.0	43.3	-30.7
5557.00	34.7	36.7	2.8	30.3	74.0	43.9	-30.1
6483.40	33.5	38.1	3.2	30.1	74.0	44.7	-29.3
7409.60	36.8	39.2	3.6	29.9	74.0	49.7	-24.3
8335.80	36.9	40.2	3.9	29.9	74.0	51.1	-22.9
9262.00	40.5	41.0	4.2	30.0	74.0	55.7	-18.3

Figure 55. 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	Electric Meter
Type	Schlumberger
Serial Number:	Not designated

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

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

Frequency range: 2.9 GHz to 9.3 GHz
Detector: Average

Freq.	AVG Amp	Correction Factors			AVG Specification	AVG Final Result FR (A)	AVG Margin
		Antenna AF	Cable CF	Preamp PF			
(MHz)	(dBµV)	(dB)	(dB)	(dB)	(dB µV/m)	(dB µV/m) See Note*.	(dB)
3704.60	32.3	33.7	2.2	30.5	54.0	37.7	-16.3
4630.07	23.9	35.3	2.6	30.4	54.0	31.4	-22.6
5557.00	23.2	36.7	2.8	30.3	54.0	32.4	-21.6
6483.40	21.4	38.1	3.2	30.1	54.0	32.6	-21.4
7409.60	25.5	39.2	3.6	29.9	54.0	38.4	-15.6
8335.80	25.7	40.2	3.9	29.9	54.0	39.9	-14.1
9262.00	29.4	41.0	4.2	30.0	54.0	44.6	-9.4

Figure 56. 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.

8.3 Test Instrumentation Used, Radiated Measurements Above 1 GHz

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Receiver	HP	85422E	3411A00102	November 30, 2000	1 year
RF Section	HP	85420E	3427A00103	November 30, 2000	1 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001.0	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	ThinkJet2225	2738508357.0	N/A	N/A
Antenna-Log Periodic	A.H.System	SA5-200/511	253.0	January 31,2001	1 year
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	April 3, 2001	1 year
1 GHz High Pass Filter	Technion Haifa	915-HPF	01	May 2, 2001	1 year
Spectrum Analyzer	HP	8592L	3745A08184	August 27, 2000	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 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.

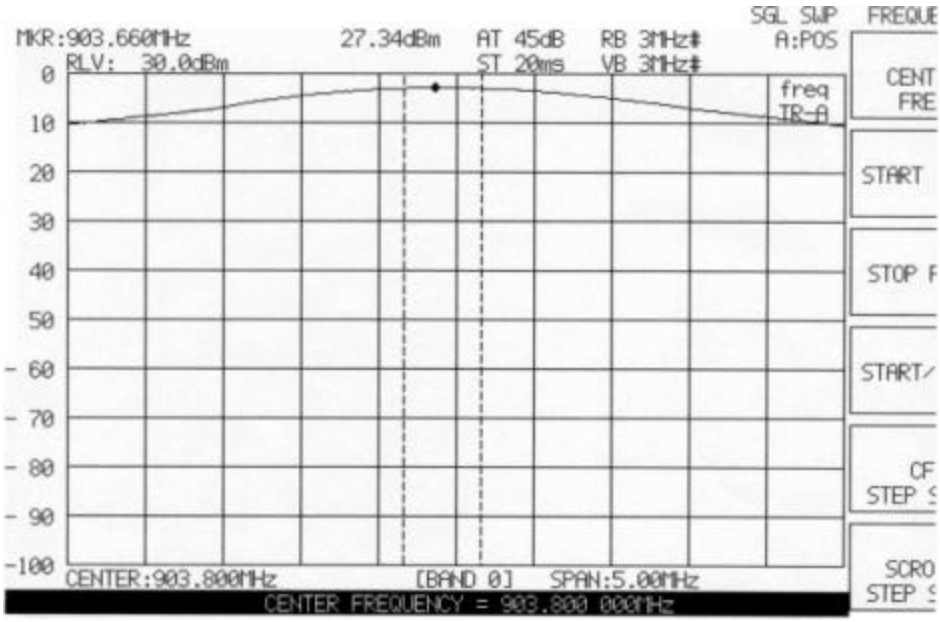


Figure 57.

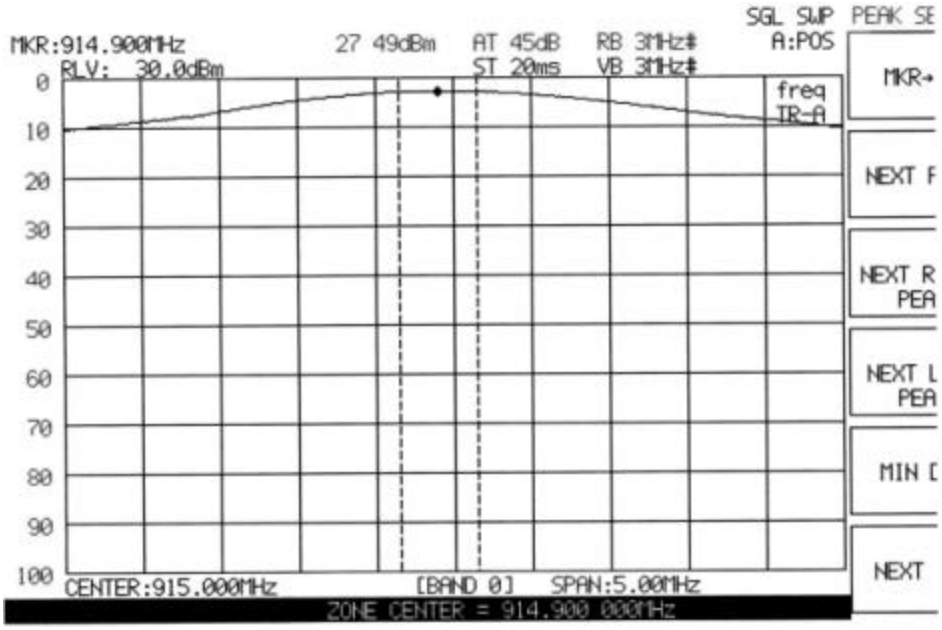


Figure 58.

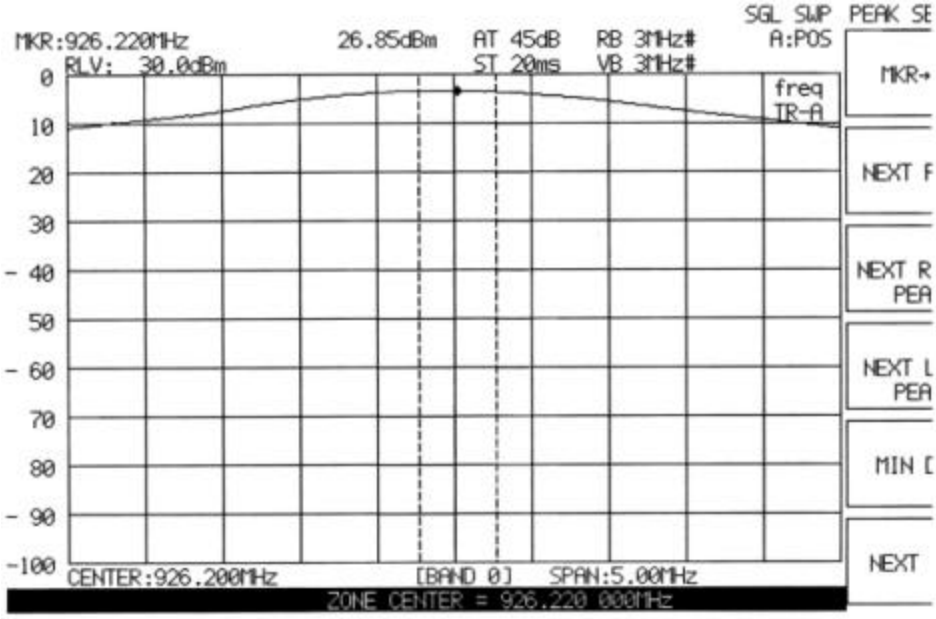


Figure 59.

9.2 Results table

E.U.T. Description: Radio Telemetry Transmitter
TYPE: Schlumberger
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)
903.8	27.34	29.34	30	0.66	2.0
915.0	27.49	29.49	30	0.51	2.0
926.2	26.85	28.85	30	1.15	2.0

Figure 60 Maximum Power Output

JUDGEMENT: Passed by 0.51 dB

TEST PERSONNEL:
Tester Signature: Shimon Zigdon Date: 19.11.01
Typed/Printed Name: S. Zigdon

9.3 Test Equipment Used.

Peak Power Output

Testing performed on 17 April 2001

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

Figure 61 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 appropriate coaxial cable. The spectrum analyzer was set to 100 kHz resolution BW. Frequency range from 10 kHz to 8.5 GHz was scanned. Level of spectrum components out of the 902-928 MHz was measured at the selected operation frequencies.

Frequency 903.8MHz

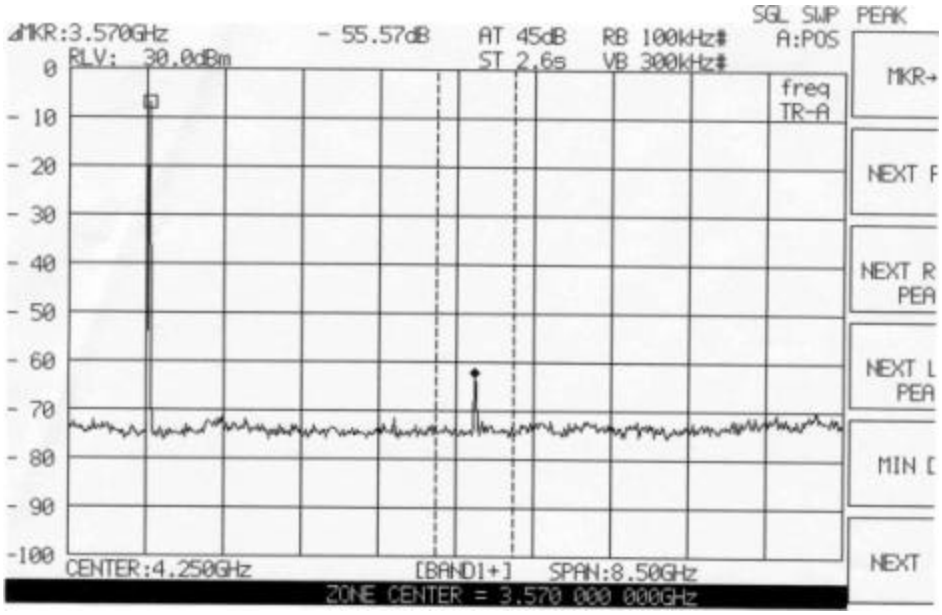
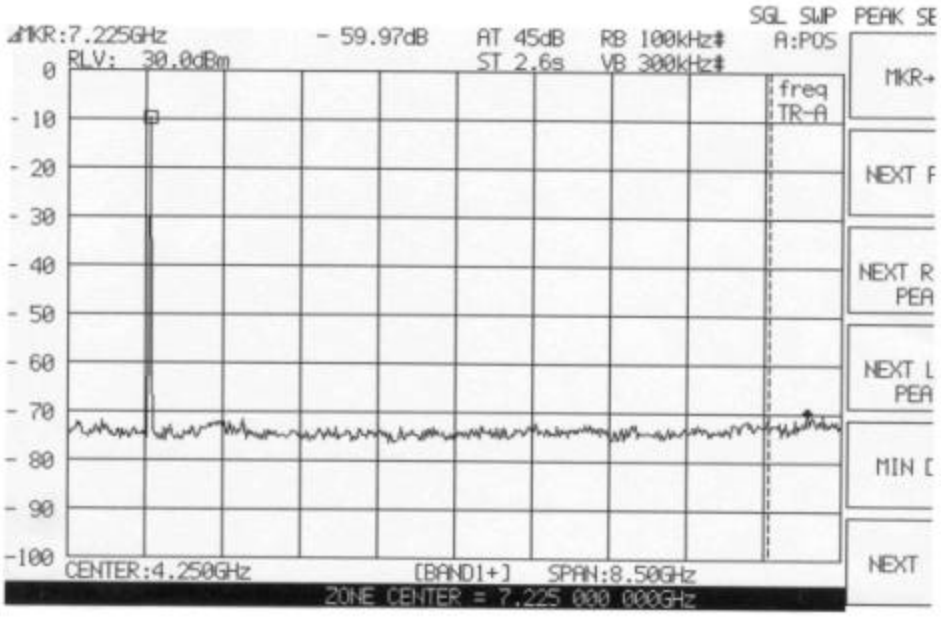


Figure 62



Frequency 915MHz

Figure 63

Frequency 926.2MHz

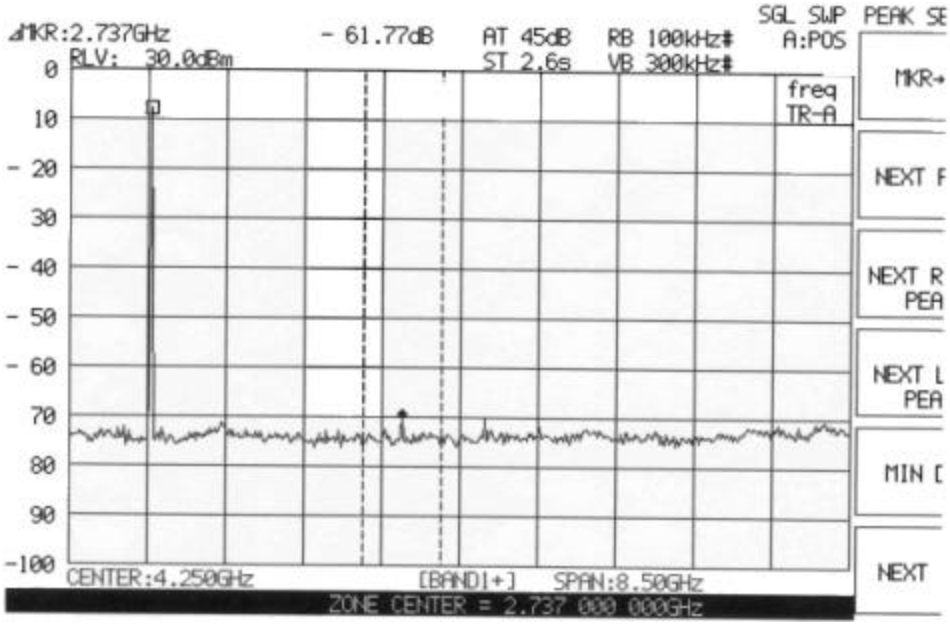


Figure 64

10.2 Results table

E.U.T Description: Radio Telemetry Transmitter
TYPE: Schlumberger
Serial Number: Not Designated
Specification: F.C.C. Part 15, Subpart C (15.247)

Operation Frequency (MHz)	Reading (dBc)	Specification (dBc)	Margin (dB)
903.8	55.57	20	35.57
915.0	59.97	20	39.97
926.2	61.77	20	41.77

Figure 65 Peak Power Output of 902-928 MHz Band

JUDGEMENT: Passed by 35.57 dB

TEST PERSONNEL:
Tester Signature: Shimon Zigdon Date: 19.11.01
Typed/Printed Name: S. Zigdon

10.3 Test Equipment Used.

Peak Power Output of 902-928 MHz Band

Testing Performed on 17 April 2001.

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

Figure 66 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 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.

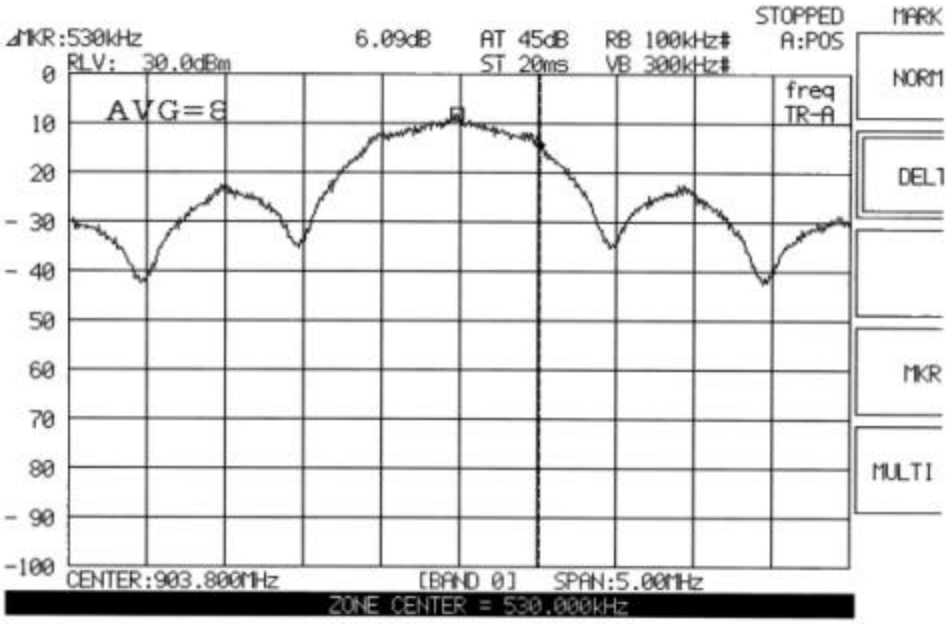


Figure 67

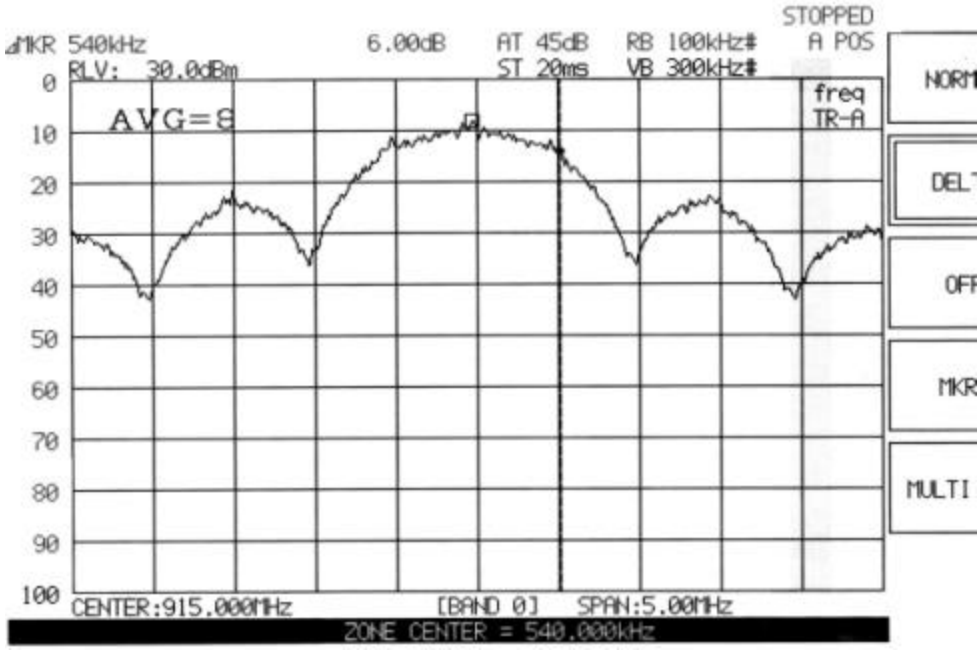


Figure 68

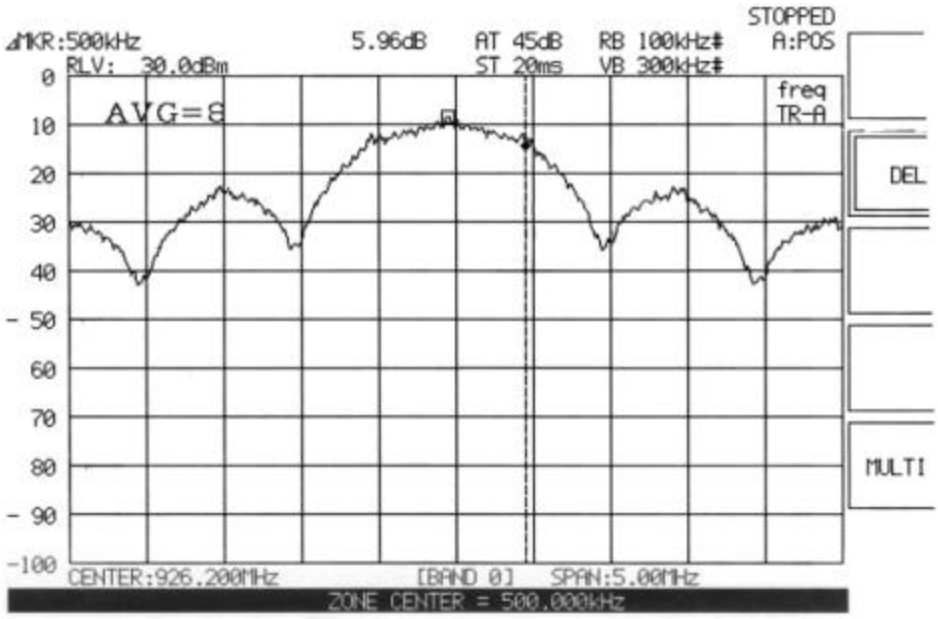


Figure 69

11.2 Results table

E.U.T Description: Radio Telemetry Transmitter
TYPE: Schlumberger
Serial Number: Not Designated
Specification: F.C.C. Part 15, Subpart C: (15.247-a2)

Operation Frequency (MHz)	Reading (MHz)	Specification (MHz)	Margin (MHz)
903.8	1.06	0.5	0.56
915.0	1.08	0.5	0.58
926.2	1.00	0.5	0.5

Figure 70 6 dB Minimum Bandwidth

JUDGEMENT: Passed by 0.5 MHz

TEST PERSONNEL:
Tester Signature: Shimon Zigdon Date: 19.11.01
Typed/Printed Name: S. Zigdon

11.3 Test Equipment Used.

6 dB Minimum Bandwidth

Testing performed on 17 April 2001

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

Figure 71 Test Equipment Used

12. Band Edge Spectrum

[In Accordance with section 15.247(c)]

12.1 Test procedure

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

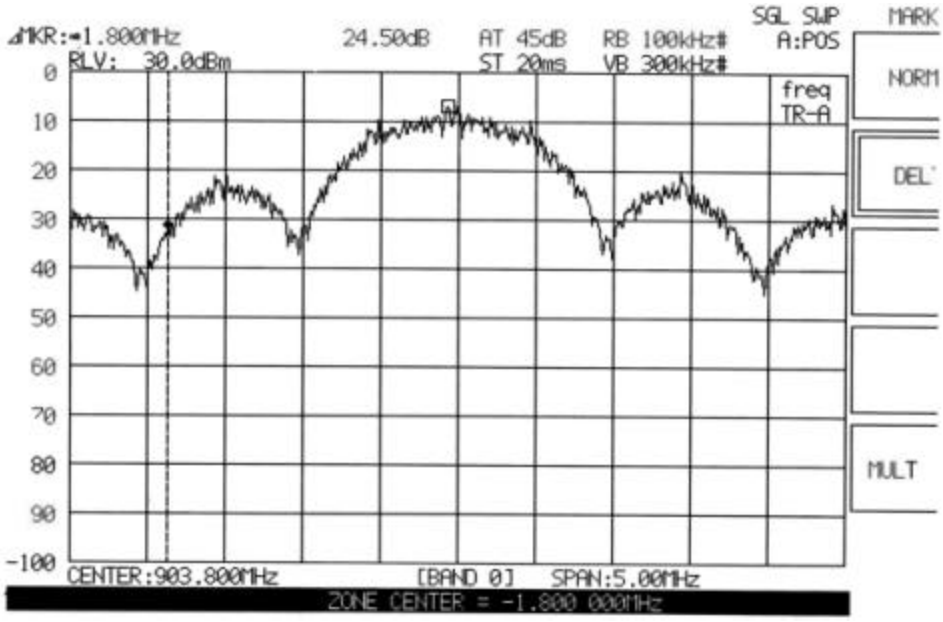


Figure 72

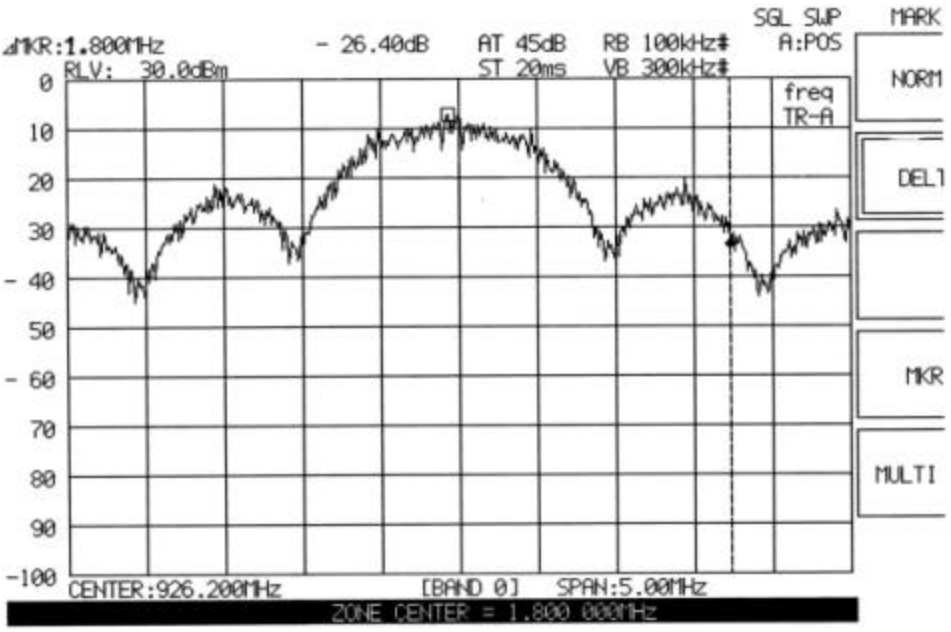


Figure 73

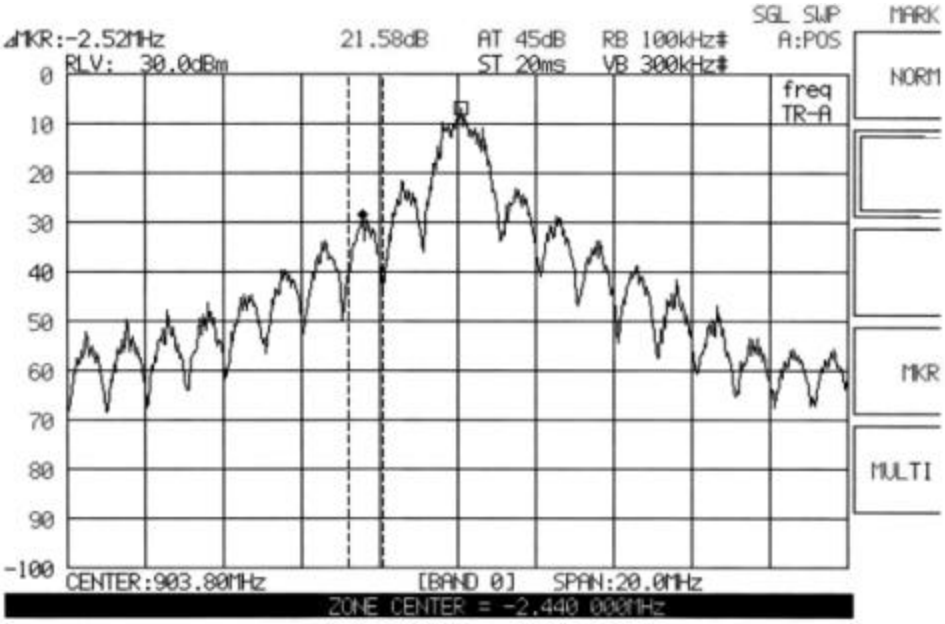


Figure 74

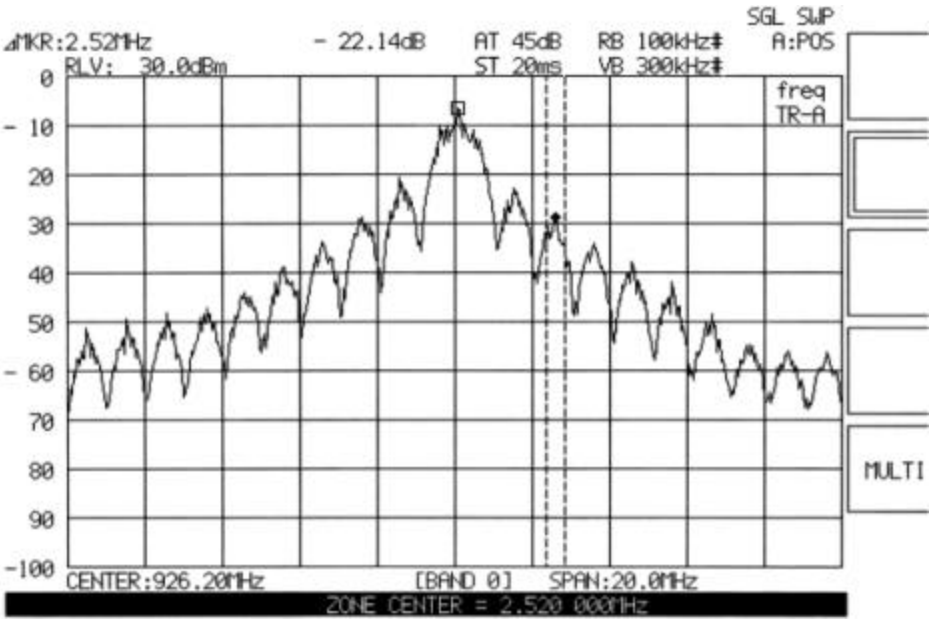

SGL SWP
ΔMKR:2.52MHz
- 22.14dB
AT 45dB
RB 100kHz#
A:POS
RLV: 30.0dBm
ST 20ms
VB 300kHz#
freq
TR-A
0
- 10
20
30
40
50
- 60
70
80
90
-100
MULTI
CENTER:926.20MHz
[BAND 0]
SPAN:20.0MHz
ZONE CENTER = 2.520 000MHz

Figure 75

12.2 Results table

E.U.T. Description: Radio Telemetry Transmitter
TYPE: Schlumberger
Serial Number: Not Designated
Specification: F.C.C. Part 15, Subpart C (15.247)

Operation Frequency (MHz)	Band Edge Frequency (MHz)	Spectrum Level (dBc)	Specification (dBc)	Margin (dB)
903.8	902	21.58	20	1.58
926.2	928	22.14	20	2.14

Figure 76 Band Edge Spectrum

JUDGEMENT: Passed by 1.58 dB

TEST PERSONNEL:

Tester Signature: Shimon Zigdon Date: 19.11.01

Typed/Printed Name: S. Zigdon

12.3 Test Equipment Used.

Band edge Spectrum

Testing was performed on 17 April 2001

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

Figure 77 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 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.

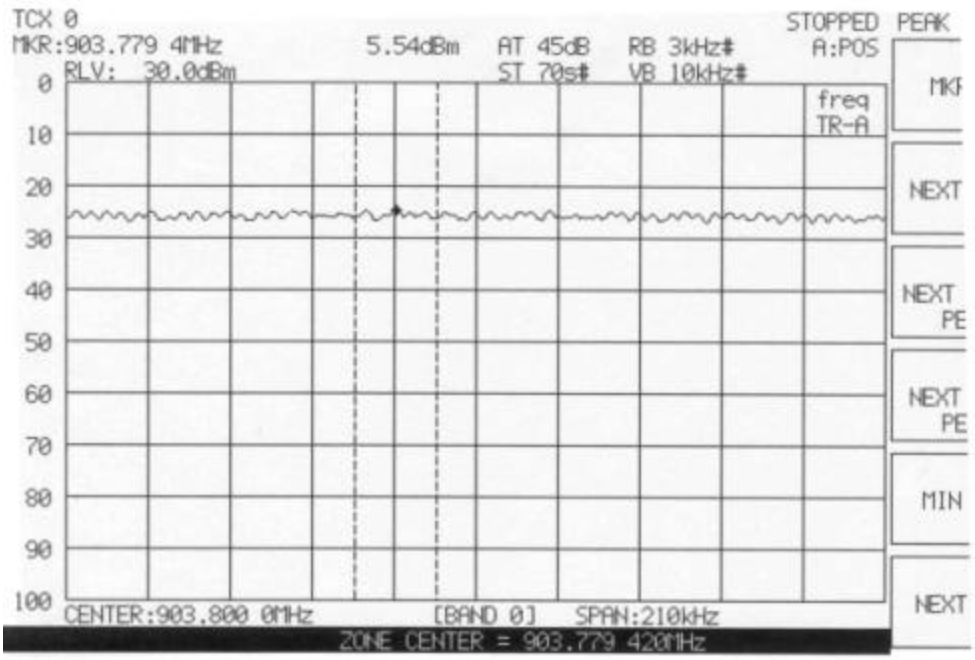


Figure 78

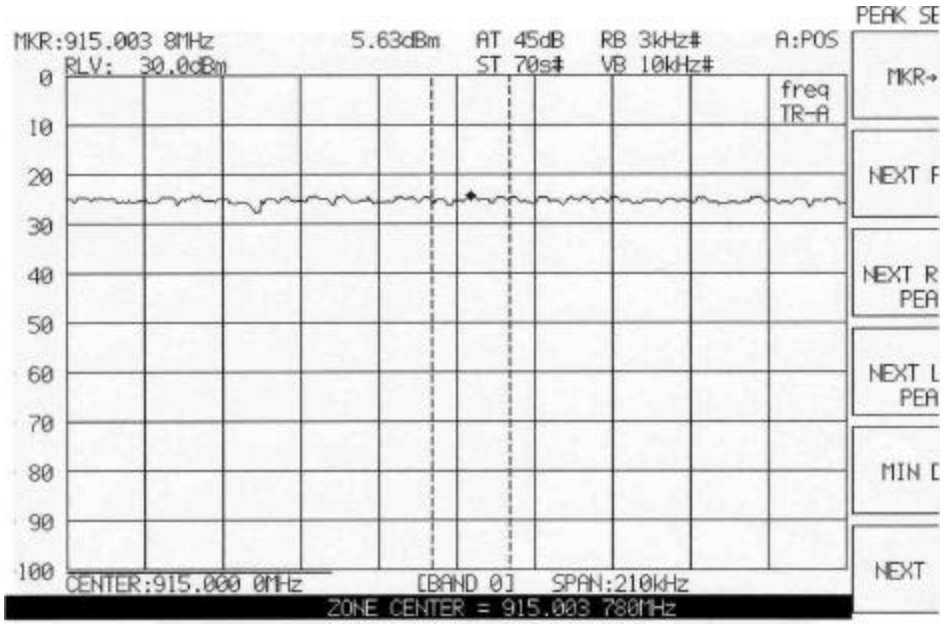


Figure 79

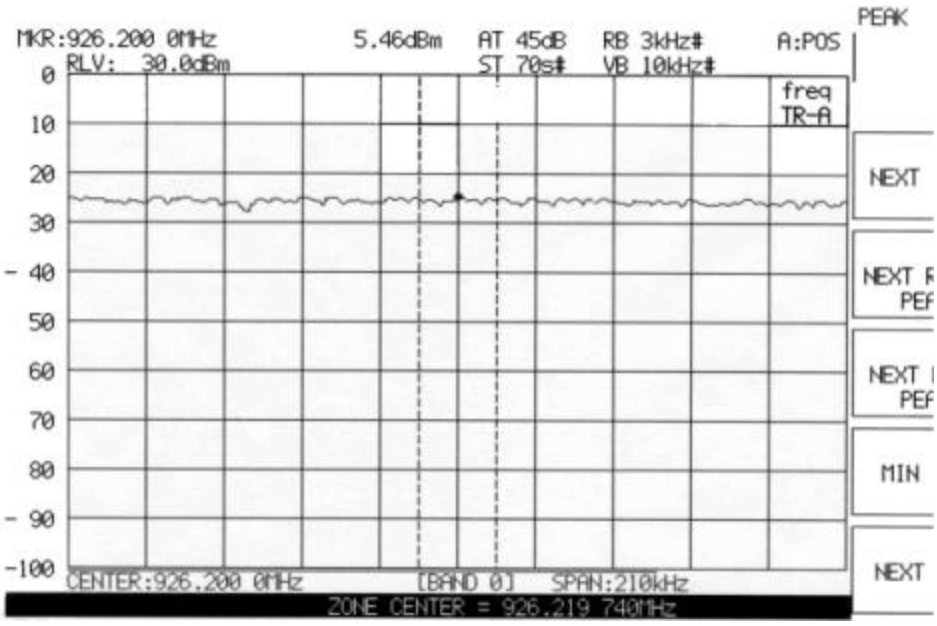


Figure 80

13.2 Results table

E.U.T. Description: Radio Telemetry transmitter
TYPE: Schlumberger
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)
903.8	5.54	7.54	8	0.46	2.00
915.0	5.63	7.63	8	0.37	2.00
926.2	5.46	7.46	8	0.54	2.00

Figure 81 Test Equipment Used

JUDGEMENT: Passed by 0.37 dB

TEST PERSONNEL:

Tester Signature: Shimon Zigdon Date: 19.11.01

Typed/Printed Name: S. Zigdon

13.3 Test Equipment Used.

Transmitted Power Density

Testing was performed on 17 April 2001

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

Figure 82 Test Equipment Used

14. Processing Gain

[In accordance with section 15.247(e)]

14.1 Test procedure

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

Test Setup

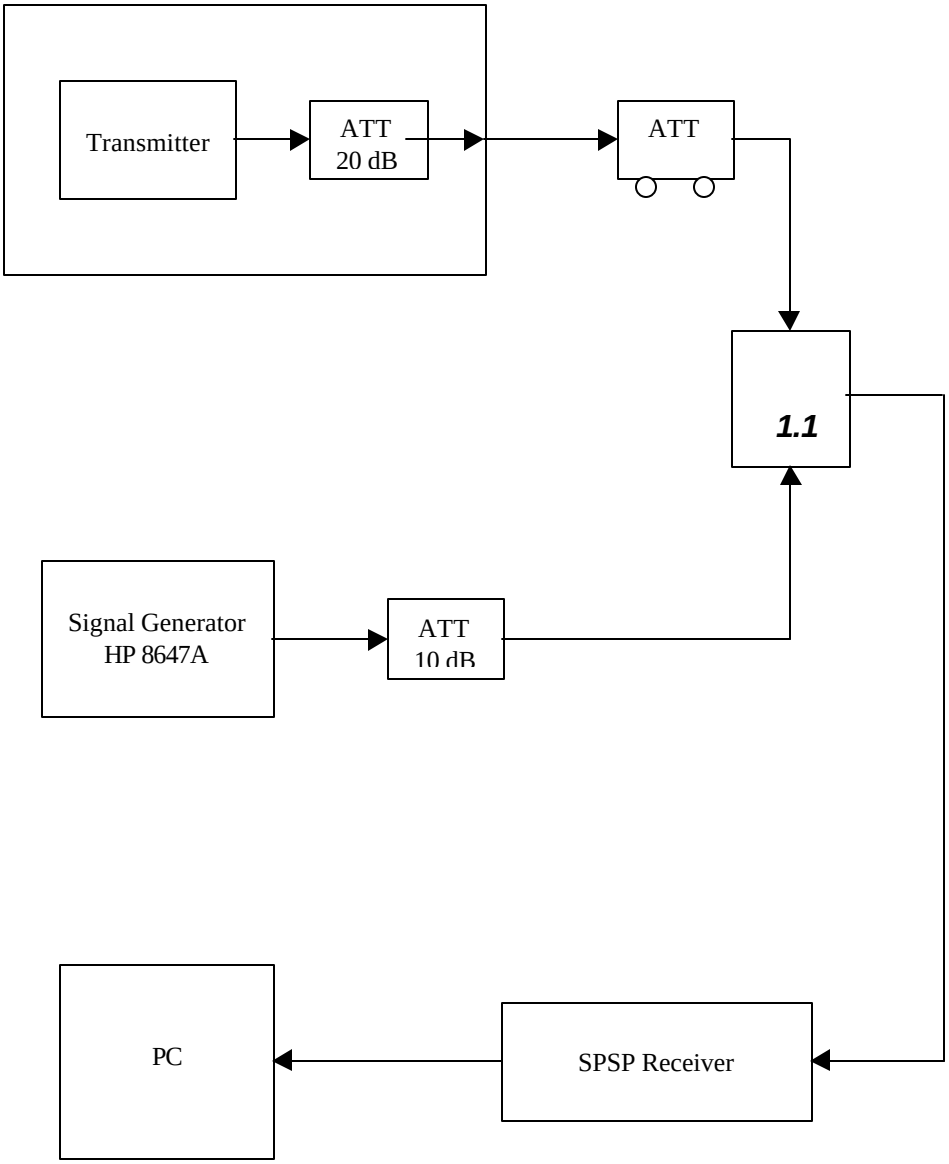


Figure 83 Processing Gain, Block Scheme

Processing Gain PN Code Length 255

Frequency 903.8 MHz

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

Figure 84 Processing Gain: 13+8=21

Processing Gain PN Code Length 255

Frequency 915 MHz

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

Figure 85 Processing Gain: 13+8=21

Processing Gain PN Code Length 255

Frequency 926.2 MHz

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

Figure 86 Processing Gain: 13+8=21

TEST PERSONNEL:

Tester Signature: Shimon Zigdon Date: 19.11.01

Typed/Printed Name: S. Zigdon

14.2 Test Equipment Used.

Transmitted Power Density

Testing was performed on 17 April 2001

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

Figure 87 Test Equipment Used

15. 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.

16. R.F Exposure/Safety

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

Calculation of Maximum Permissible Exposure (MPE)

Based on Section 1.1307(b)(1) Requirements

(a) FCC limits at 915 MHz

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

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(0dB)

R- Distance from Transmitter using 100cm worst case

(c) The peak power density is :

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

(d) The duty cycle of transmission in actual worst case is 150 msec pulses per 60 sec intervals.

The average power over 30 minutes is:

$$P_{AV} = \frac{1000 \times 0.15}{60} = 2.5mW$$

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

$$S_{AV} = \frac{2.5X1}{4\pi x (100)^2} = 2X10^{-5} \frac{mW}{cm^2}$$

(f) This is significantly below the FCC limit.

17. Photographs of Tested E.U.T.

Figure 88 Top View Closed Cover

Figure 89 Bottom View

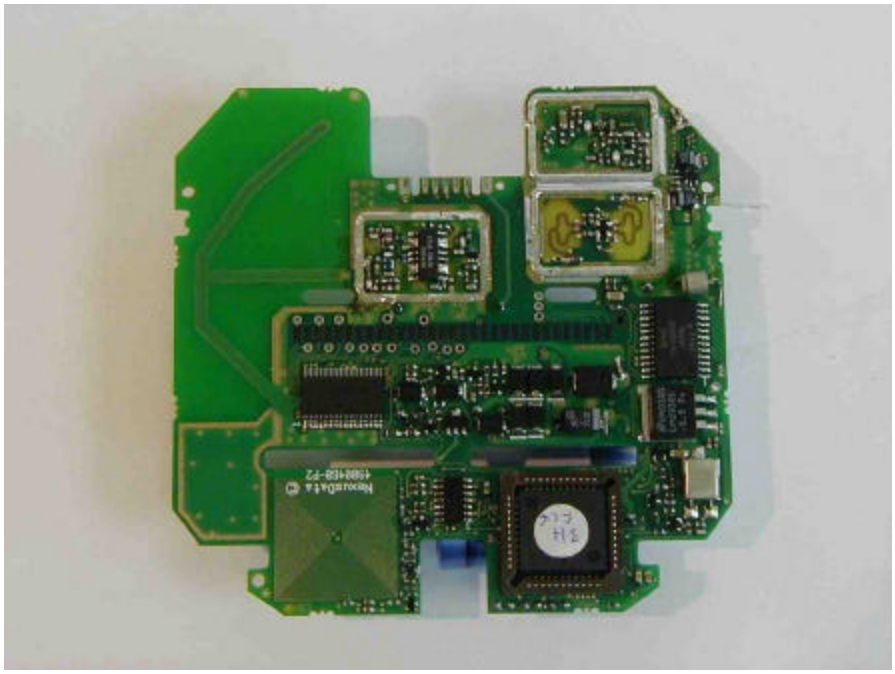


Figure 90 Printed Circuit Side 1

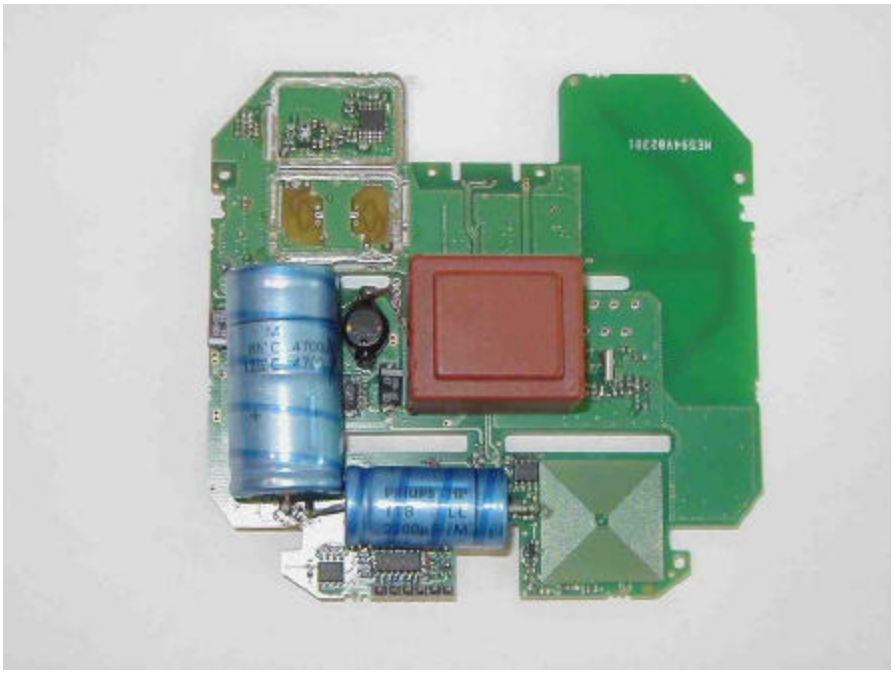


Figure 91 Printed Circuit Side 2

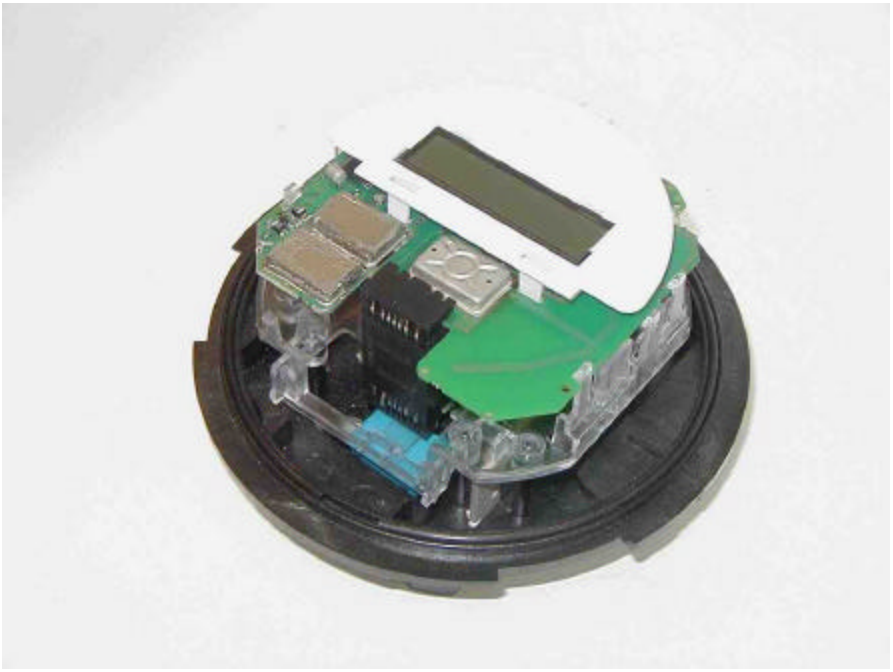


Figure 92 Printed Circuit Mounted in Housing

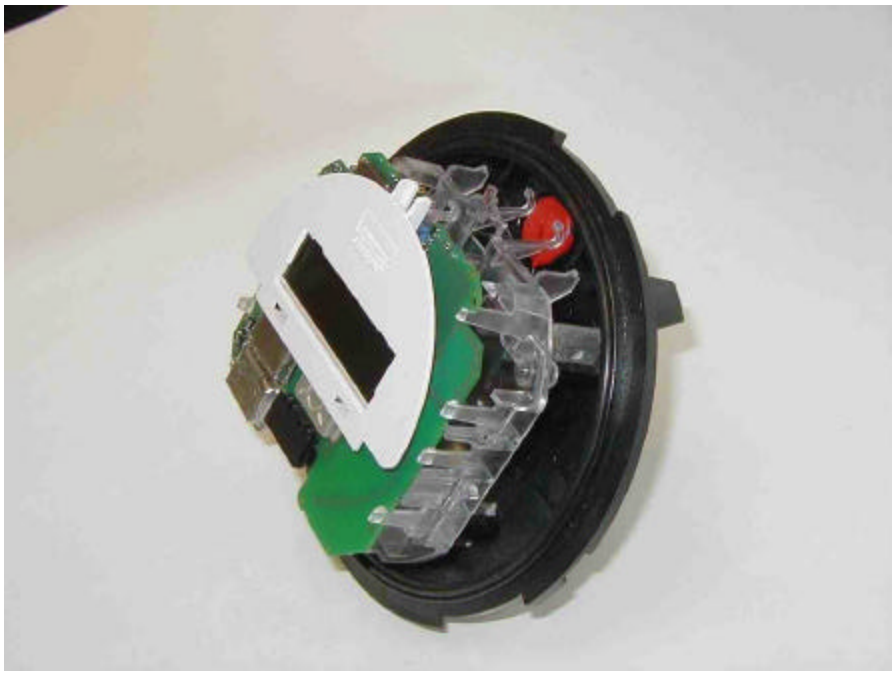


Figure 93 Printed Circuit Mounted in Housing

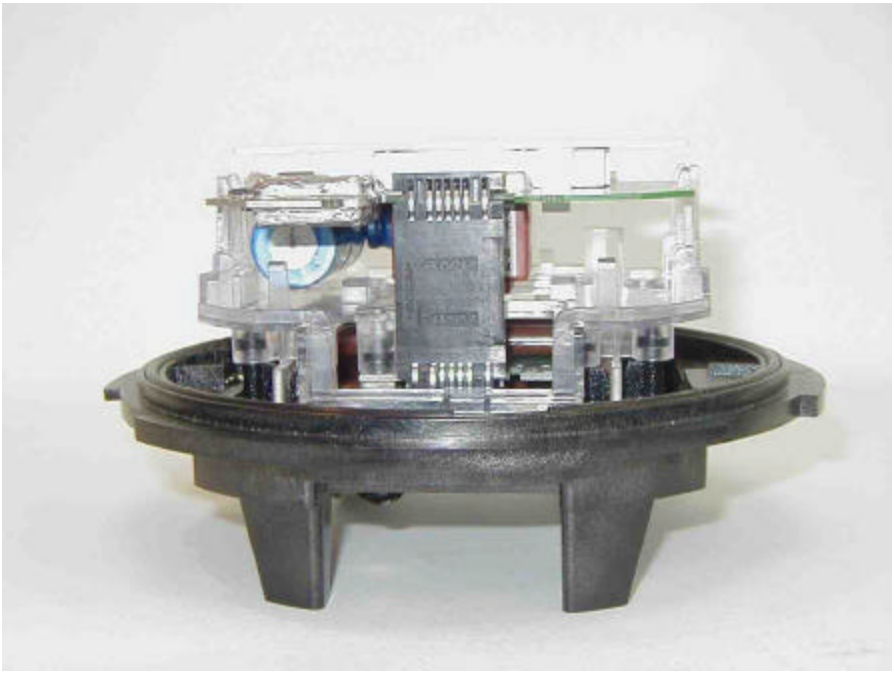


Figure 94 Side View without Covers