Elliott

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January 21, 2000

Chief, Equipment Authorization Branch,
Authorization and Evaluation Division,
Office of Engineering and Technology
FEDERAL COMMUNICATIONS COMMISSION
P.O. Box 358315
Pittsburgh, PA 15251-5315

Gentlemen:

The enclosed documents constitute a formal submittal and request for a Class II Permissive Change pursuant to Subpart C of Part 15 of FCC Rules (CFR 47) regarding changes to intentional radiators. A change is being proposed to the Schlumberger Technology Corp model Water Wall MIU1, which would result in changes to the performance characteristics originally reported to the Commission. Since the Water Wall MIU1 is presently certified, an emissions test has been performed to demonstrate that it continues to comply with FCC Part 15 limits for intentional radiators.

Elliott Laboratories, as duly authorized agent prepared this submittal. A copy of the letter of our appointment as agent is enclosed. Please also find enclosed a check in the amount of $45.00 for the application fee.

If there are any questions or if further information is needed, please contact Elliott Laboratories for assistance.

Sincerely,

David W. Bare
Principal Engineer

DWB/dmg
Enclosures: Application Fee
FC Form 159
FCC Form 731
Agent Authorization Letter
Emissions Test Report with Exhibits

File: R35369

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Electromagnetic Emissions Test Report and Request for Class II Permissive Change pursuant to FCC Part 15, Subpart C Specifications for an Intentional Radiator on the Schlumberger Technology Corp Model: Water Wall MIU1

FCC ID:	F9CTALWCNMIU1
GRANTEE:	Schlumberger Technology Corp 1600 Alabama Highway 229 Tallassee, AL 36078
TEST SITE:	Elliott Laboratories, Inc. 684 W. Maude Avenue Sunnyvale, CA 94086
REPORT DATE:	January 21, 2000
FINAL TEST DATE:	January 17, 2000

AUTHORIZED SIGNATORY: David W Bare

David W. Bare
Principal Engineer

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SCOPE

An electromagnetic emissions test has been performed on the Schlumberger Technology Corp. model Water Wall MIU1 pursuant to Subpart C of Part 15 of FCC Rules for intentional radiators. Conducted and radiated emissions data has been collected, reduced, and analyzed within this report in accordance with measurement guidelines set forth in ANSI C63.4-1992 as outlined in Elliott Laboratories test procedures.

The intentional radiator above has been tested in a simulated typical installation to demonstrate compliance with the relevant FCC performance and procedural standards.

Final system data was gathered in a mode that tended to maximize emissions by varying orientation of EUT, orientation of power and I/O cabling, antenna search height, and antenna polarization.

Every practical effort was made to perform an impartial test using appropriate test equipment of known calibration. All pertinent factors have been applied to reach the determination of compliance.

The test results recorded herein are based on a single type test of the Schlumberger Technology Corp model Water Wall MIU1 and therefore apply only to the tested sample. The sample was selected and prepared by Mohammed Ali of Schlumberger Technology Corp.

OBJECTIVE

The primary objective of the manufacturer is compliance with Subpart C of Part 15 of FCC Rules for the radiated and conducted emissions of intentional radiators. Certification of these devices is required as a prerequisite to marketing as defined in Part 2 the FCC Rules.

Certification is a procedure where the manufacturer or a contracted laboratory makes measurements and submits the test data and technical information to the FCC. The FCC issues a grant of equipment authorization upon successful completion of their review of the submitted documents. Once the equipment authorization has been obtained, the label indicating compliance must be attached to all identical units subsequently manufactured.

STATEMENT OF COMPLIANCE

The tested sample of Schlumberger Technology Corp model Water Wall MIU1 complied with the requirements of Subpart C of Part 15 of the FCC Rules for low power intentional radiators.

Maintenance of FCC compliance is the responsibility of the manufacturer. Any modification of the product which may result in increased emissions should be checked to ensure compliance has been maintained (i.e., printed circuit board layout changes, different line filter, different power supply, harnessing or I/O cable changes, etc.).

EMISSION TEST RESULTS

The following emissions tests were performed on the Schlumberger Technology Corp model Water Wall MIU1. The actual test results are contained in an exhibit of this report.

LIMITS OF CONDUCTED INTERFERENCE VOLTAGE

The EUT does not connect to an AC power source and is powered from an internal battery. No conducted emissions tests were required.

LIMITS OF ANTENNA CONDUCTED POWER

The EUT tested complied with the limits detailed in FCC Rules Part 15 Section 15.247.

The highest out-of-band (Un-restricted) emission recorded in any 100 kHz band was 43.4 dB below the in-band level at 3670.2 MHz. The actual test data and any correction factors are contained an exhibit of this report.

LIMITS OF RADIATED INTERFERENCE FIELD STRENGTH

The EUT tested complied with the limits detailed in FCC Rules Part 15 Section 15.247 and 15.209 in the case of emissions falling within the frequency bands specified in Section 15.205.

The following measurement was extracted from the data recorded during the radiated electric field emissions scan and represents the highest amplitude emission relative to the specification limit. The actual test data and any correction factors are contained in an exhibit of this report.

1000 – 10000 MHz

Frequency MHz	Level dBuV/m	Pol v/h	Class B Limit	Class B Margin	Detector Pk/QP/Avg	Azimuth degrees	Height meters	Comments
2752.690	62.9	H	74.0	-11.1	Pk	177	1.7	

LIMITS OF POWER AND BANDWIDTH

The EUT tested complied with the limits detailed in FCC Rules Part 15 Section 15.247.

The maximum power output was 22.5 dBm. The maximum power density was 2.8 dBm. The minimum 6 dB bandwidth was 1.388 Megahertz. The actual test data and any correction factors are contained in an exhibit of this report.

MEASUREMENT UNCERTAINTIES

ISO Guide 25 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level and were calculated in accordance with NAMAS document NIS 81.

Measurement Type	Frequency Range (MHz)	Calculated Uncertainty (dB)
Conducted Emissions	0.15 to 30	± 2.4
Radiated Emissions	30 to 1000	± 3.2

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The Schlumberger Technology Corp model Water Wall MIU1 is a spread spectrum radio that uses Direct Sequence / Frequency Hopping spreading code. The sample was received on January 17, 2000 and tested on January 17, 2000. The EUT consisted of the following component(s):

Manufacturer/Model/Description	Serial Number	FCC ID Number
Schlumberger / MIU1 / Water Wall Mount Meter	32009965	F9CTALWCNMIU1

INPUT POWER

The EUT uses a 3.6 VDC Battery Internally.

Description	Manufacturer	Model
3.6 VDC battery	Tadiran	TL2300

PRINTED WIRING BOARDS

The EUT contained the following printed wiring boards during emissions testing:

Manufacturer/Description	Assembly #	Rev.	Serial #	Crystals (MHz)
Schlumberger Industries/ PCB	442161	A	3209965	32.768 kHz, 12.5, 20

SUBASSEMBLIES

The EUT contained the following subassembly modules during emissions testing:

Manufacturer/Description	Assembly #	Rev.	Serial Number
CellNet BAMM radio/ Fixed Network Meter Interface Unit	12279	D	32009965

ENCLOSURE

The EUT enclosure is primarily constructed of fabricated sheet steel. It measures approximately 11 cm wide by 6 cm deep by 16 cm high.

EMI SUPPRESSION DEVICES

The EUT did not contain EMI suppression devices during emissions testing.

MODIFICATIONS

The EUT did not require modifications during testing in order to comply with the emission specifications.

SUPPORT EQUIPMENT

No support equipment was used during emissions testing.

EXTERNAL I/O CABLING

The I/O cabling configuration during emissions testing was as follows:

Cable Description	Length (m)	From Unit/Port	To Unit/Port
None	-	-	-

TEST SOFTWARE

The EUT was set to operate transmitting continuously on a single channel.

PROPOSED MODIFICATION DETAILS

GENERAL

This section details the modifications to the Schlumberger Technology Corp model Water Wall MIU1 being proposed. All performance and construction deviations from the characteristics originally reported to the FCC are addressed

PRINTED WIRING BOARD LAYOUT

The printing wiring board has been modified from the original and a shield can has been removed.

TEST SITE

GENERAL INFORMATION

Final test measurements were taken on January 17, 2000 at the Elliott Laboratories Open Area Test Site # located at 684 West Maude Avenue, Sunnyvale, California. The test site contains separate areas for radiated and conducted emissions testing. Pursuant to section 2.948 of the Rules, construction, calibration, and equipment data has been filed with the Commission.

The FCC recommends that ambient noise at the test site be at least 6 dB below the allowable limits. Ambient levels are below this requirement with the exception of predictable local TV, radio, and mobile communications traffic. The test site contains separate areas for radiated and conducted emissions testing. Considerable engineering effort has been expended to ensure that the facilities conform to all pertinent FCC requirements.

CONDUCTED EMISSIONS CONSIDERATIONS

Conducted emissions testing is performed in conformance with ANSI C63.4-1992. Measurements are made with the EUT connected to the public power network through a nominal standardized RF impedance, provided by a line impedance stabilization network, known as a LISN. A LISN is inserted in series with each current-carrying conductor in the EUT power cord.

RADIATED EMISSIONS CONSIDERATIONS

The FCC has determined that radiation measurements made in a shielded enclosure are not suitable for determining levels of radiated emissions. Radiated measurements are performed in an open field environment. The test site is maintained free of conductive objects within the CISPR defined elliptical area incorporated in ANSI C63.4 guidelines.

MEASUREMENT INSTRUMENTATION

RECEIVER SYSTEM

An EMI receiver as specified in CISPR 16-1 is used for emissions measurements. The receivers used can measure over the frequency range of 9 kHz up to 2000 MHz. These receivers allow both ease of measurement and high accuracy to be achieved. The receivers have Peak, Average, and CISPR (Quasi-peak) detectors built into their design so no external adapters are necessary. The receiver automatically sets the required bandwidth for the CISPR detector used during measurements.

For measurements above the frequency range of the receivers, a spectrum analyzer is utilized because it provides visibility of the entire spectrum along with the precision and versatility required to support engineering analysis. Average measurements above 1000MHz are performed on the spectrum analyzer using the linear-average method with a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz.

INSTRUMENT CONTROL COMPUTER

The receivers utilize either a Rohde and Schwarz EZM Spectrum Monitor/Controller or contain an internal Spectrum Monitor/Controller to view and convert the receiver measurements to the field strength at an antenna or voltage developed at the LISN measurement port, which is then compared directly with the appropriate specification limit. This provides faster, more accurate readings by performing the conversions described under Sample Calculations within the Test Procedures section of this report. Results are printed in a graphic and/or tabular format, as appropriate. A personal computer is used to record all measurements made with the receivers.

The Spectrum Monitor provides a visual display of the signal being measured. In addition, the controller or a personal computer run automated data collection programs which control the receivers. This provides added accuracy since all site correction factors, such as cable loss and antenna factors are added automatically.

LINE IMPEDANCE STABILIZATION NETWORK (LISN)

Line conducted measurements utilize a fifty microhenry Line Impedance Stabilization Network as the monitoring point. The LISN used also contains a 250 uH CISPR adapter. This network provides for calibrated radio frequency noise measurements by the design of the internal low pass and high pass filters on the EUT and measurement ports, respectively.

FILTERS/ATTENUATORS

External filters and precision attenuators are often connected between the receiving antenna or LISN and the receiver. This eliminates saturation effects and non-linear operation due to high amplitude transient events.

ANTENNAS

A biconical antenna is used to cover the range from 30 MHz to 300 MHz and a log periodic antenna is utilized from 300 MHz to 1000 MHz. Narrowband tuned dipole antennas are used over the entire 30 to 1000 MHz range for precision measurements of field strength. Above 1000 MHz, a horn antenna is used. The antenna calibration factors are included in site factors, which are programmed into the test receivers.

ANTENNA MAST AND EQUIPMENT TURNTABLE

The antennas used to measure the radiated electric field strength are mounted on a non-conductive antenna mast equipped with a motor-drive to vary the antenna height.

ANSI C63.4 specifies that the test height above ground for table mounted devices shall be 80 centimeters. Floor mounted equipment shall be placed on the ground plane if the device is normally used on a conductive floor or separated from the ground plane by insulating material from 3 to 12 mm if the device is normally used on a non-conductive floor. During radiated measurements, the EUT is positioned on a motorized turntable in conformance with this requirement.

INSTRUMENT CALIBRATION

All test equipment is regularly checked to ensure that performance is maintained in accordance with the manufacturer's specifications. All antennas are calibrated at regular intervals with respect to tuned half-wave dipoles. An exhibit of this report contains the list of test equipment used and calibration information.

TEST PROCEDURES

EUT AND CABLE PLACEMENT

The FCC requires that interconnecting cables be connected to the available ports of the unit and that the placement of the unit and the attached cables simulate the worst case orientation that can be expected from a typical installation, so far as practicable. To this end, the position of the unit and associated cabling is varied within the guidelines of ANSI C63.4, and the worst case orientation is used for final measurements.

CONDUCTED EMISSIONS

Conducted emissions are measured at the plug end of the power cord supplied with the EUT. Excess power cord length is wrapped in a bundle between 30 and 40 centimeters in length near the center of the cord. Preliminary measurements are made to determine the highest amplitude emission relative to the specification limit for all the modes of operation. Placement of system components and varying of cable positions are performed in each mode. A final peak mode scan is then performed in the position and mode for which the highest emission was noted on all current carrying conductors of the power cord.

RADIATED EMISSIONS

Radiated emissions measurements are performed in two phases as well. A preliminary scan of emissions is conducted in which all significant EUT frequencies are identified with the system in a nominal configuration. At least two scans are performed from 30 MHz up to the frequency required by the regulation specified on page 1. One or more of these is with the antenna polarized vertically while the one or more of these are with the antenna polarized horizontally. During the preliminary scans, the EUT is rotated through 360˚, the antenna height is varied and cable positions are varied to determine the highest emission relative to the limit.

A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

Final maximization is a phase in which the highest amplitude emissions identified in the spectral search are viewed while the EUT azimuth angle is varied from 0 to 360 degrees relative to the receiving antenna. The azimuth which results in the highest emission is then maintained while varying the antenna height from one to four meters. The result is the identification of the highest amplitude for each of the highest peaks. Each recorded level is corrected in the receiver using appropriate factors for cables, connectors, antennas, and preamplifier gain. Emissions which have values close to the specification limit may also be measured with a tuned dipole antenna to determine compliance.

SPECIFICATION LIMITS AND SAMPLE CALCULATIONS

The limits for conducted emissions are given in units of microvolts, and the limits for radiated emissions are given in units of microvolts per meter at a specified test distance. Data is measured in the logarithmic form of decibels relative to one microvolt, or dB microvolts (dBuV). For radiated emissions, the measured data is converted to the field strength at the antenna in dB microvolts per meter (dBuV/m). The results are then converted to the linear forms of uV and uV/m for comparison to published specifications.

For reference, converting the specification limits from linear to decibel form is accomplished by taking the base ten logarithm, then multiplying by 20. These limits in both linear and logarithmic form are as follows:

CONDUCTED EMISSIONS SPECIFICATION LIMITS, SECTION 15.207

Frequency Range (MHz)	Limit (uV)	Limit (dBuV)
0.450 to 30.000	250	48

RADIATED EMISSIONS SPECIFICATION LIMITS, SECTION 15.209

Frequency Range (MHz)	Limit (uV/m @ 3m)	Limit (dBuV/m @ 3m)
0.009-0.490	$2400/F_{KHz}$ @ 300m	$67.6-20*\log_{10}(F_{KHz})$ @ 300m
0.490-1.705	$24000/F_{KHz}$ @ 30m	$87.6-20*\log_{10}(F_{KHz})$ @ 30m
1.705 to 30	30 @ 30m	29.5 @ 30m
30 to 88	100	40
88 to 216	150	43.5
216 to 960	200	46.0
Above 960	500	54.0

SAMPLE CALCULATIONS - CONDUCTED EMISSIONS

Receiver readings are compared directly to the conducted emissions specification limit (decibel form) as follows:

$$R_r - B = C$$

and

$$C - S = M$$

where:

R_r = Receiver Reading in dBuV

B = Broadband Correction Factor*

C = Corrected Reading in dBuV

S = Specification Limit in dBuV

M = Margin to Specification in +/- dB

* Broadband Level- Per ANSI C63.4, 13 dB may be subtracted from the quasi-peak level if it is determined that the emission is broadband in nature. If the signal level in the average mode is six dB or more below the signal level in the peak mode, the emission is classified as broadband.

SAMPLE CALCULATIONS - RADIATED EMISSIONS

Receiver readings are compared directly to the specification limit (decibel form). The receiver internally corrects for cable loss, preamplifier gain, and antenna factor. The calculations are in the reverse direction of the actual signal flow, thus cable loss is added and the amplifier gain is subtracted. The Antenna Factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements. A distance factor, when used for electric field measurements, is calculated by using the following formula:

$$F_d = 20*LOG_{10} (D_m/D_s)$$

where:

F_d = Distance Factor in dB

D_m = Measurement Distance in meters

D_s = Specification Distance in meters

Measurement Distance is the distance at which the measurements were taken and Specification Distance is the distance at which the specification limits are based. The antenna factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

The margin of a given emission peak relative to the limit is calculated as follows:

$$R_c = R_r + F_d$$

and

$$M = R_c - L_s$$

where:

R_r = Receiver Reading in dBuV/m

F_d = Distance Factor in dB

R_c = Corrected Reading in dBuV/m

L_s = Specification Limit in dBuV/m

M = Margin in dB Relative to Spec

EXHIBIT 1: Test Equipment Calibration Data

Test Equipment List - SVOATS#

January 4, 2000

	Manufacturer/Description		Model	Asset #	Interval	Last Cal	Cal Due
☐	A.H. Systems Inc.	Double Ridge Horn Antenna,	SAS-200/571	M24186, ME	12	10/25/99	10/25/2000
☐	Elliott Laboratories	FCC / CISPR LISN	LISN-4, OATS	362	12	6/10/99	6/10/2000
☒	EMCO	Biconical Antenna, 30-300 MHz	3110B	801	11	12/1/1999	12/1/2000
☒	EMCO	D. Ridge Horn Antenna, 1-18GHz	3115	486	12	3/24/99	3/24/2000
☐	EMCO	D. Ridge Horn Antenna, 1-18GHz	3115	868	12	9/25/99	9/25/2000
☒	EMCO	Log Periodic Antenna, 0.3-1 GHz	3146A	788	12	1/16/99	1/16/2000
☐	Filtek	High Pass Filter	HP12/1000-5B	955	12	4/17/99	4/17/2000
☐	Filtek	High Pass Filter	HP12/1000-5B	956	12	4/17/99	4/17/2000
☐	Filtek	High Pass Filter	HP12/1000-5B	957	12	4/17/99	4/17/2000
☐	Hewlett Packard	EMC Receiver /Analyzer	8595EM	780	12	1/3/2000	1/3/2001
☐	Hewlett Packard	EMC Recever /Analyzer	8595EM	787	12	12/3/1999	12/3/2000
☒	Hewlett Packard	EMC Spectrum Analyzer, Opt. 026	8593EM	1141	12	12/22/1999	12/22/2000
☐	Hewlett Packard	Microwave Preamplifier,	8449B	785	12	12/2/1999	12/2/2000
☒	Hewlett Packard	Microwave Preamplifier,	8449B	~~859~~ Rental	12	11/1$/1999	11/1$/2000
☐	Hewlett Packard	Power Meter	432A	259, (F304)	12	2/17/99	2/17/2000
☐	Hewlett Packard	Thermistor Mount	478A	652	12	2/17/99	2/17/2000
☒	Narda West	EMI Filter 2.4 GHz, High Pass	60583 HPF-161	248	12	4/23/99	4/23/2000
☐	Narda West	EMI Filter 5.6 GHz, High Pass	60583 HXF370	247	12	4/29/99	4/29/2000
☐	Narda West	High Pass Filter	HPF 180	821	12	8/10/99	8/10/2000
☐	Rohde & Schwarz	Pulse Limiter	ESH3Z2	372	12	6/10/99	6/10/2000
☒	Rohde & Schwarz	Test Receiver, 0.009-2000 MHz	ESN	775	12	6/10/99	6/10/2000
☐	Solar Electronics	Support Equipment LISN,	8012-50-R-24-B	305, (F111)	12	3/26/99	3/26/2000

File Number: T35247

Date: 1-4-2000

Engr: Mehran M Birgani

All calibration of equipment is traceable to a national standard of measurement such as NIST.

EXHIBIT 2:Test Data Log Sheets

ELECTROMAGNETIC EMISSIONS

TEST LOG SHEETS

AND

MEASUREMENT DATA

T 35415 9 Pages

Client:	Schlumberger Industries	Date:	1/17/2000	Test Eng:	Dan Anchondo
Product:	Water Wall MIU1	File:	T35415	Proj. Eng:	David Bare
Objective:	Final Qualification	Site:	SVOATS #2	Contact:	Muhammed Ali
Spec:	FCC Part 15	Page:	1 of 4	Approved:	
Revision	1.0				

Ambient Conditions		
Temperature:	11	°C
Humidity:	80	% RH

Test Objective

The objective of this test session is to perform final qualification testing the EUT defined below relative to the specification defined above.

Test Summary

Runs 1–3 were performed on 1/4/2000 and originally recorded on test log T35247.

Run #1 - 6 dB Bandwidth Measurement @ 917.58 MHz, FCC Part §15.247(a)

PASS Results: 6 dB bandwidth was 1.388 MHz, meeting the minimum requirement of 500 kHz.

Run #1 - Output Power Measurements @ 917.5 MHz, FCC Part §15.247 (b)

PASS Results: Output power was calculated from the radiated field strength to be 22.5 dBm, -7.5 dBm below the maximum permitted output of 30 dBm (1 Watt).

Run #1 - Power Density Measurements @ 917.5 MHz, FCC Part §15.247 (d)

PASS Results: Output power density in 3 kHz bandwidth was calculated from the radiated field strength to be 2.8 dBm, -5.2 dBm below the maximum permitted density of 8 dBm/kHz.

Run #3 - Maximized Emissions Scan, 30–902 MHz and 928–1000 MHz

PASS Results: §15.209 -14.8 dB QP @ 974.925 MHz Horizontal

Note: Emissions lying in restricted bands were subject to the limits of §15.209. The limit at all other frequencies was 20 dB below the fundamental emission of 110.3 dBµV/m.

Run #4 - Maximized Spurious Emissions Falling In Restricted bands 1000–10000 MHz

PASS Results: §15.209 -7.1 dB Peak @ 3670.200 MHz Horizontal

All other spurious emissions that were not in the restricted bands were more than 20 dB below the fundamental emission level.

Note: AC conducted emission test was not required, as the EUT is battery operated.

Equipment Under Test (EUT) General Description

The EUT is a spread spectrum radio that uses Direct Sequence / Frequency Hopping spreading code. The EUT is designed for use as a wall mounted water meter. Normally, the EUT would be mounted on a wall so therefore we set the EUT on the table in an upright position simulating the wall-mounted unit. The electrical rating of the EUT is 3.6 VDC < 1.0 Amps.

Equipment Under Test (EUT)

Manufacturer/Model/Description	Serial Number	FCC ID Number
Schlumberger / MIU1 / Water Wall Mount Meter	32009965	F9CTALWCNMIU1

Power Supply and Line Filters

The EUT uses a 3.6 VDC Battery Internally.

Description	Manufacturer	Model
3.6 VDC battery	Tadiran	TL2300

Printed Wiring Boards in EUT

The manufacturer provided the following information:

Manufacturer/Description	Assembly #	Rev.	Serial Number	Crystals (MHz)
Schlumberger Industries/ PCB	442161	A	3209965	32.768 kHz, 12.5, 20

Subassemblies in EUT

The manufacturer provided the following information:

Manufacturer/Description	Assembly Number	Rev.	Serial Number
CellNet BAMM radio/ Fixed Network Meter Interface Unit	12279	D	32009965

Client:	Schlumberger Industries	Date:	1/17/2000	Test Eng:	Dan Anchondo
Product:	Water Wall MIU1	File:	T35415	Proj. Eng:	David Bare
Objective:	Final Qualification	Site:	SVOATS #2	Contact:	Muhammed Ali
Spec:	FCC Part 15	Page:	3 of 4	Approved:	
Revision	1.0				

EUT Enclosure(s)

The EUT enclosure is primarily constructed of fabricated sheet steel. It measures approximately 11 cm wide by 6 cm deep by 16 cm high.

EMI Suppression Devices (filters, gaskets, etc.)

The manufacturer provided the following information:

Description	Manufacturer	Part Number
None		

Modifications

No modification was made to the EUT during testing.

Local Support Equipment

Manufacturer/Model/Description	Serial Number	FCC ID Number
None	-	-

Remote Support Equipment

Manufacturer/Model/Description	Serial Number	FCC ID Number
None		

Interface Cabling

Cable Description	Length (m)	From Unit/Port	To Unit/Port
None			

Test Software

The EUT was set to operate transmitting continuously on a single channel.

Client:	Schlumberger Industries	Date:	1/17/2000	Test Eng:	Dan Anchondo
Product:	Water Wall MIU1	File:	T35415	Proj. Eng:	David Bare
Objective:	Final Qualification	Site:	SVOATS #2	Contact:	Muhammed Ali
Spec:	FCC Part 15	Page:	4 of 4	Approved:	
Revision	1.0				

General Test Conditions

During radiated testing, the EUT was operated by a 9 VDC battery as well as the 3.6 VDC battery cell within the unit.. The EUT and all local support equipment were located on the turntable for radiated testing.

Test Data Tables

See attached data

Emissions Test Data

Client:	Schlumberger Industries Inc.	Date:	01/04/2000	Test Engr:	Mehran M Birgani
Product:	Water Wall MIU1	File:	T35247	Proj. Engr:	David Bare
Objective	Final Qualification	Site:	SVOATS #2	Contact:	Mohamed Ali
Spec:	FCC Part 15.247	Distance:	3m	Approved:	

Ambient Conditions
Temperature: 11 °C
Humidity: 92 %

Run #1: Output Power Measurement, 6 dB Bandwidth, and Power Density Measurement, 917.580 MHz.

Frequency	Level	Pol	FCC Part 15.247		Detector	Azimuth	Height	Comments
MHz	dBuV/m	V/H	Correction	dBm	Pk/QP/Avg	degrees	meters	
917.580	117.7	V	95.27	22.5	Pk	324	1.1	**Note 1**
917.580		V			Pk	324	1.1	**Note 2**
917.517	98.1	V	95.27	2.8	Pk	324	1.1	**Note 3**

Note 1:	Output Power Measurement with 3 MHz RBW and VBW in linear mode.
Note 2:	6 dB Bandwidth with 100 kHz RBW and VBW in log mode **(refer to plot)**, Delta was 1.388 MHz.
Note 3:	Power Density measurement made at 3 kHz RBW, VBW in dBuV, 95.27 dB was subtracted to convert to dBm (see plot).

Run #2: Fundamental Measurement, 917.580 MHz.

Frequency	Level	Pol	Detector	Azimuth	Height	Comments
MHz	dBuV/m	V/H	Pk/QP/Avg	degrees	meters	
917.580	110.5	V	Pk	324	1.1	100 kHz RBW and VBW.
917.580	110.3	H	Pk	26	2.9	100 kHz RBW and VBW.

Run #3: Maximized Emissions Scan, 30 - 902 MHz and 928 - 1000 MHz

Frequencies that fall within the restricted band were measured with respect to FCC Class B.
Frequencies that do not fall within the restricted band must be -20 dB below the peak reading of fundamental frequency.
Measured at 3 m per FCC Class B requirement.

Frequency	Level	Pol	FCC Class B		Detector	Azimuth	Height	Comments
MHz	dBuV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
974.925	39.2	H	54.0	-14.8	QP	69	1.6	
974.925	38.3	V	54.0	-15.7	QP	320	1.2	
150.000	22.1	V	43.5	-21.4	QP	285	1.0	
401.384	23.8	V	46.0	-22.2	QP	321	1.1	
401.384	22.7	H	46.0	-23.3	QP	62	2.1	
172.011	18.6	V	43.5	-24.9	QP	250	1.0	

Emissions Test Data

Client:	Schlumberger Industries Inc.	Date:	01/04/2000	Test Engr:	Mehran M Birgani
Product:	Water Wall MIU1	File:	T35247	Proj. Engr:	David Bare
Objective	Final Qualification	Site:	SVOATS #2	Contact:	Mohamed Ali
Spec:	FCC Part 15.247	Distance:	3m	Approved:	

Run #4: Maximized Radiated Scan, 1000-10000 MHz, Sorted by Margin.

Frequencies that falls within the restricted band were measured with respect to FCC class B.

Frequencies that does not fall within restricted band must be -20 dB below the peak reading of fundamental frequency.

Measured at 3m per FCC Class B requirement.

Horn Antenna: **487** Hi Pass Filter: **248**

Premp: **Rental** EMC Analyzer: **1141**

Cables: **Yellow Cables**

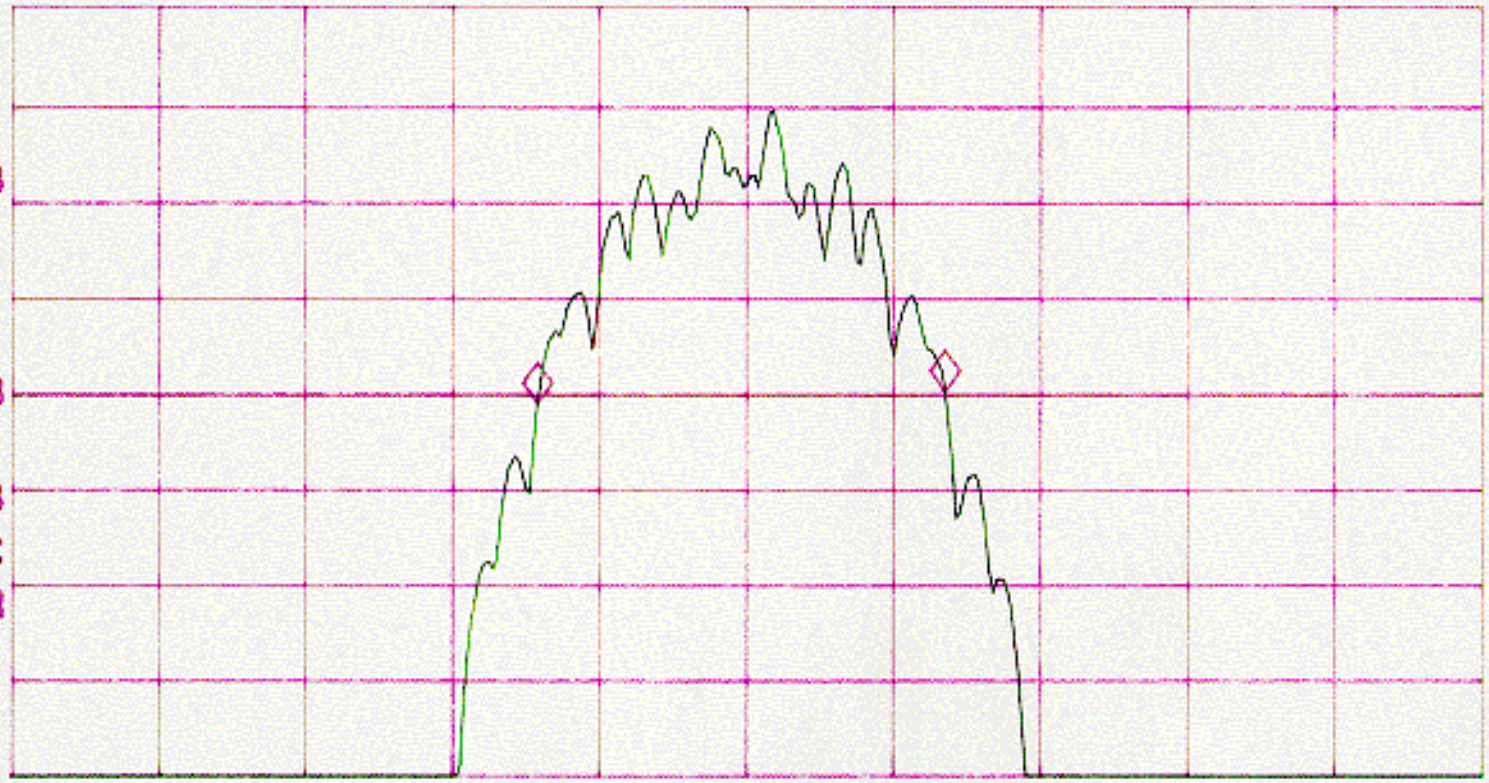
Frequency	Level	Pol	FCC B		Detector	Azimuth	Height	Comments
MHz	dBuV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
2752.740	72.6	V	74.0	-1.4	Pk	15	1.1	
3670.258	65.7	H	74.0	-8.3	Pk	338	1.0	
6423.060	65.5	H	74.0	-8.5	Pk	338	1.0	
3670.258	64.5	V	74.0	-9.5	Pk	30	1.1	
2752.740	42.0	V	54.0	-12.0	Avg	15	1.1	
4587.860	61.9	V	74.0	-12.1	Pk	330	1.1	
3670.258	41.6	H	54.0	-12.4	Avg	338	1.0	
6423.060	39.6	H	54.0	-14.4	Avg	338	1.0	
3670.258	39.5	V	54.0	-14.5	Avg	30	1.1	
2752.740	59.5	V	74.0	-14.5	Pk	340	1.0	
4587.860	59.1	V	74.0	-14.9	Pk	351	1.0	
6423.060	38.0	V	54.0	-16.0	Avg	332	1.1	
2752.740	37.8	V	54.0	-16.2	Avg	340	1.0	
6423.060	55.9	V	74.0	-18.1	Pk	332	1.1	
4587.860	35.8	V	54.0	-18.2	Avg	330	1.1	
4587.860	35.4	V	54.0	-18.6	Avg	351	1.0	

19: 15: 59 JAN Ø4, 2ØØØ
6 dB BANDWIDTH

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 1.388 MHz
.26 dB

REF OFFST 27.7 dB
LOG REF 112.9 dBµV
2
dB/
ATN
1Ø dB

DL
1Ø4.8
dBµV
MA SB
SC FC
CORR



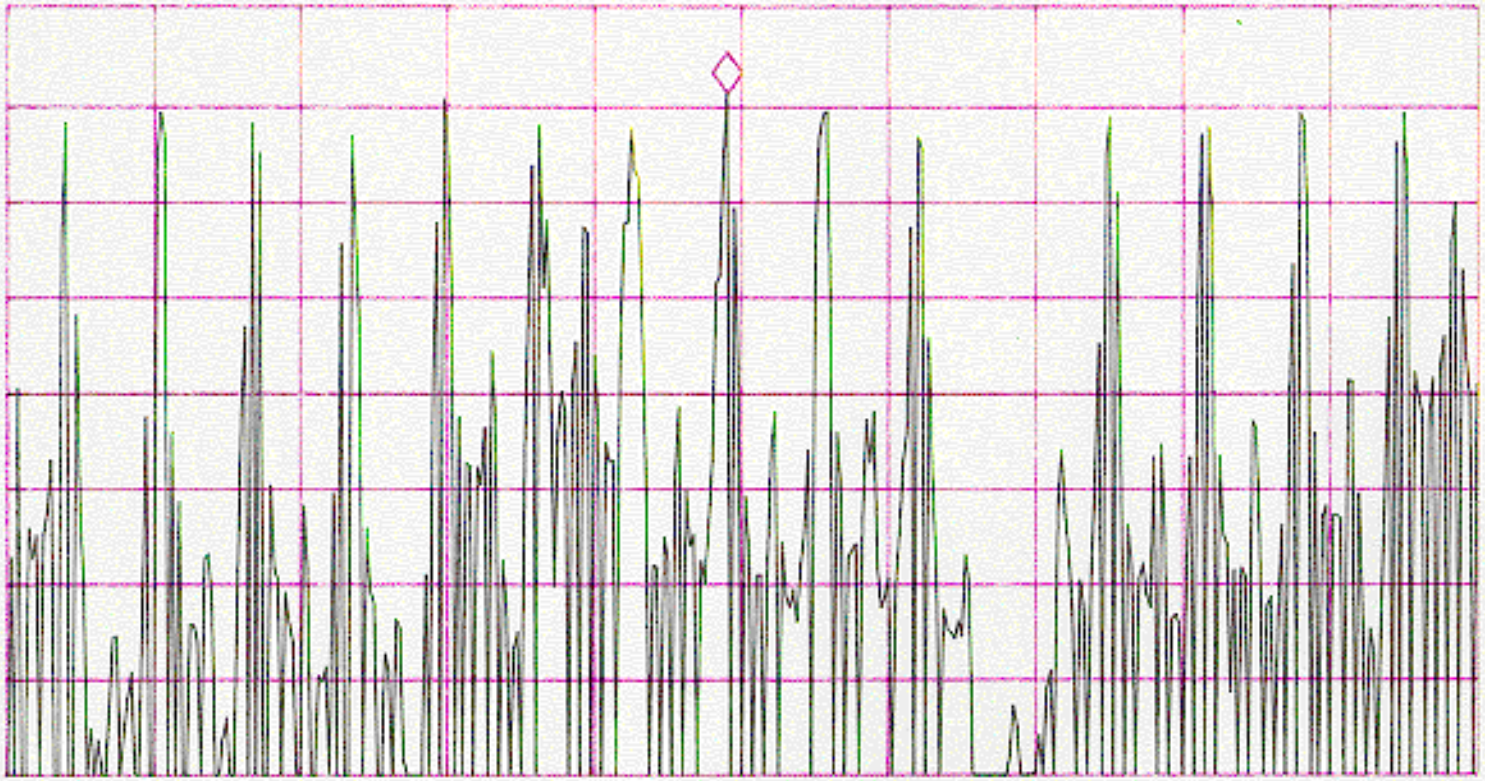
CENTER 917.58Ø MHz
#IF BW 1ØØ kHz #AVG BW 1ØØ kHz
SPAN 5.ØØØ MHz
SWP 2Ø.Ø msec

19: 37: Ø6 JAN Ø4, 2ØØØ

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 917.517Ø MHz
98.Ø7 dBµV

REF OFFST 27.7 dB
LOG REF 99.9 dBµV
2
dB/
ATN
1Ø dB

DL
91.8
dBµV
VA SB
SC FC
CORR



CENTER 917.52ØØ MHz
SPAN 3ØØ.Ø kHz
#IF BW 3.Ø kHz
#AVG BW 3 kHz
#SWP 1ØØ sec

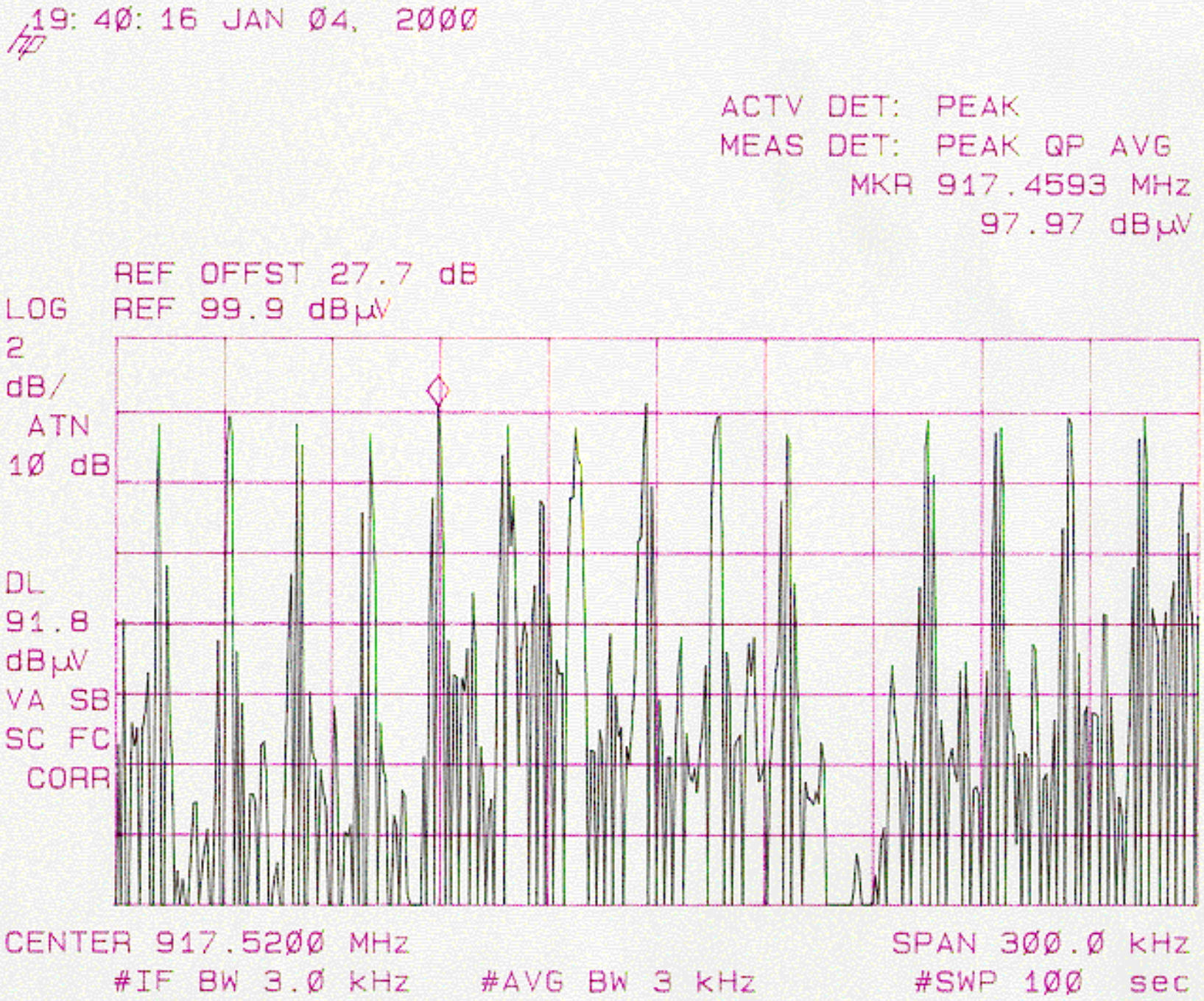

19: 40: 16 JAN 04, 2000
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 917.4593 MHz
97.97 dBµV
REF OFFST 27.7 dB
LOG REF 99.9 dBµV
2
dB/
ATN
10 dB
DL
91.8
dBµV
VA SB
SC FC
CORR
CENTER 917.5200 MHz
SPAN 300.0 kHz
#IF BW 3.0 kHz
#AVG BW 3 kHz
#SWP 100 sec

EXHIBIT 3: Radiated Emissions Test Configuration Photographs

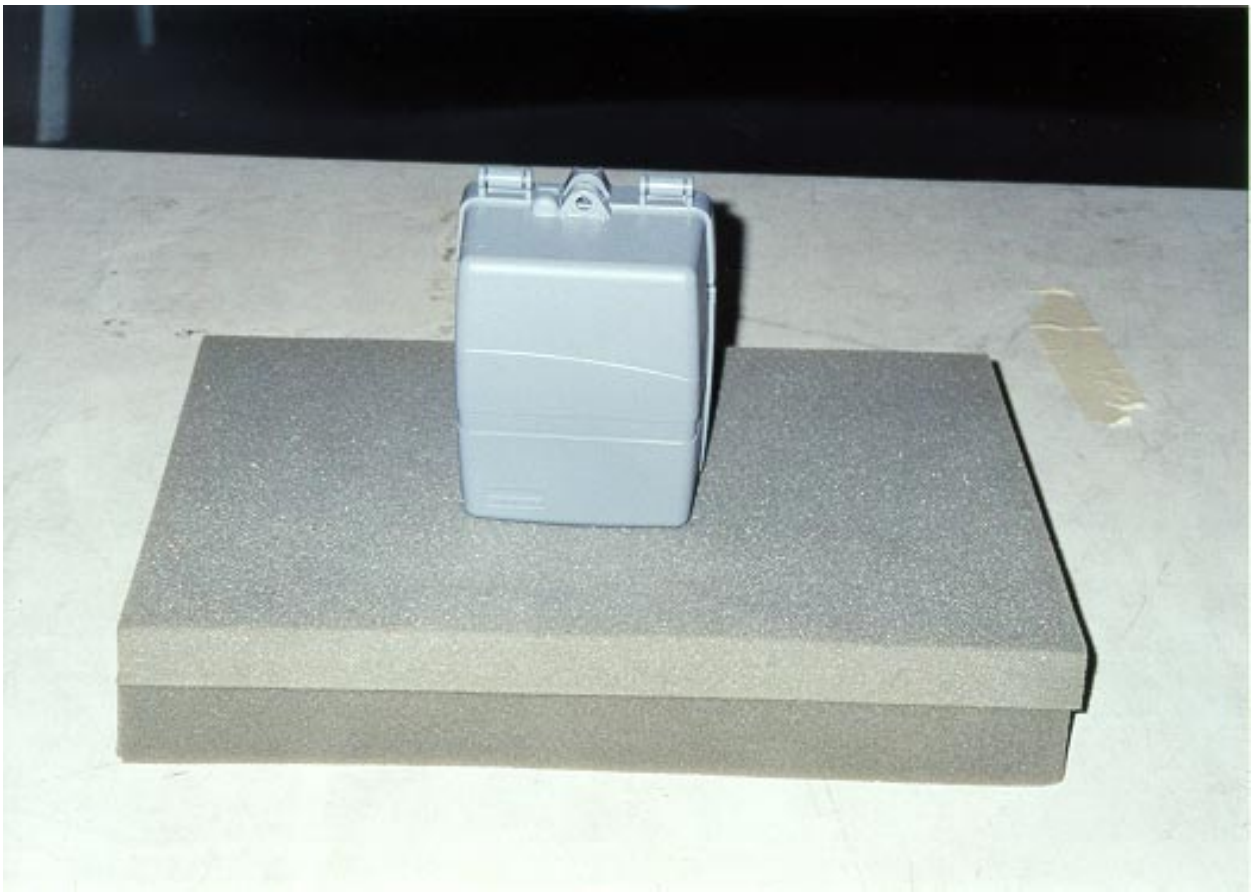


EXHIBIT 3: Radiated Emissions Test Configuration Photographs

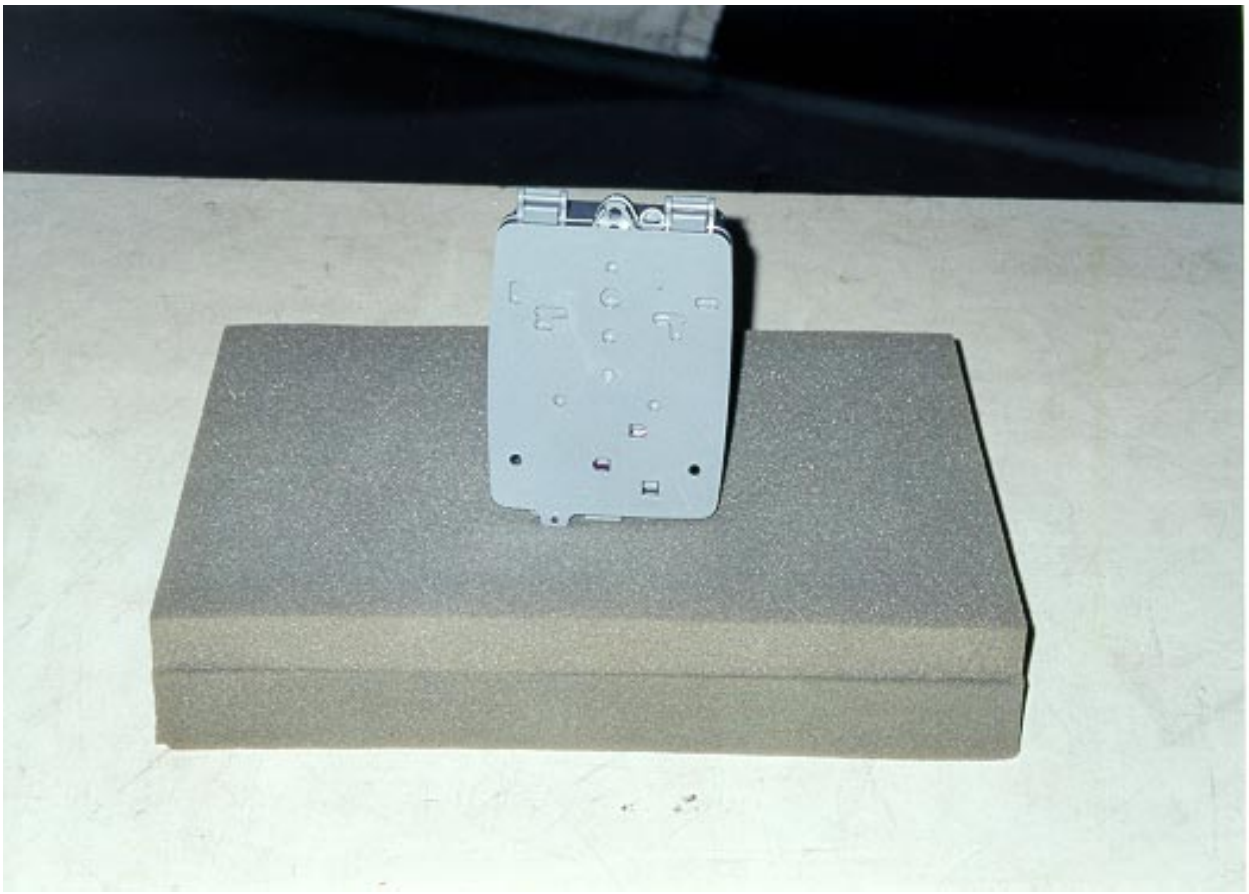


EXHIBIT 4:Detailed Photographs of Schlumberger Technology Corp Model Water Wall MIU1 Modified Construction

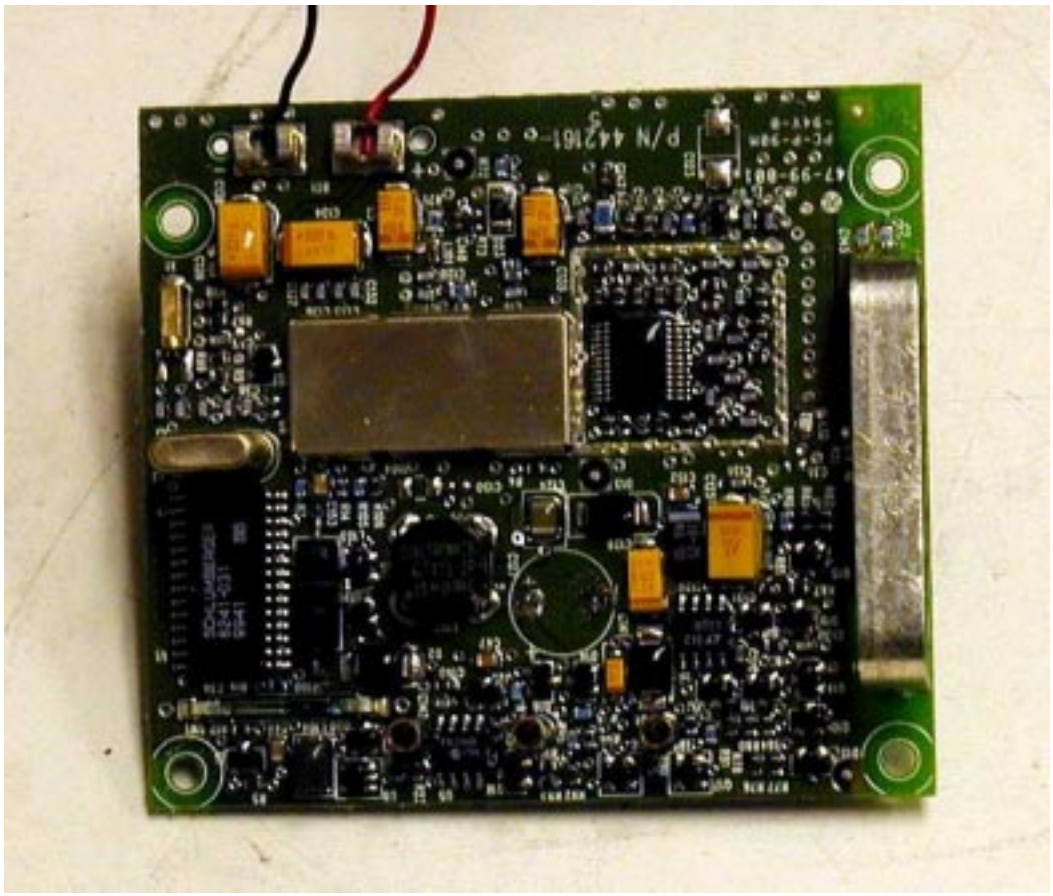


EXHIBIT 4:Detailed Photographs of Schlumberger Technology Corp Model Water Wall MIU1 Modified Construction

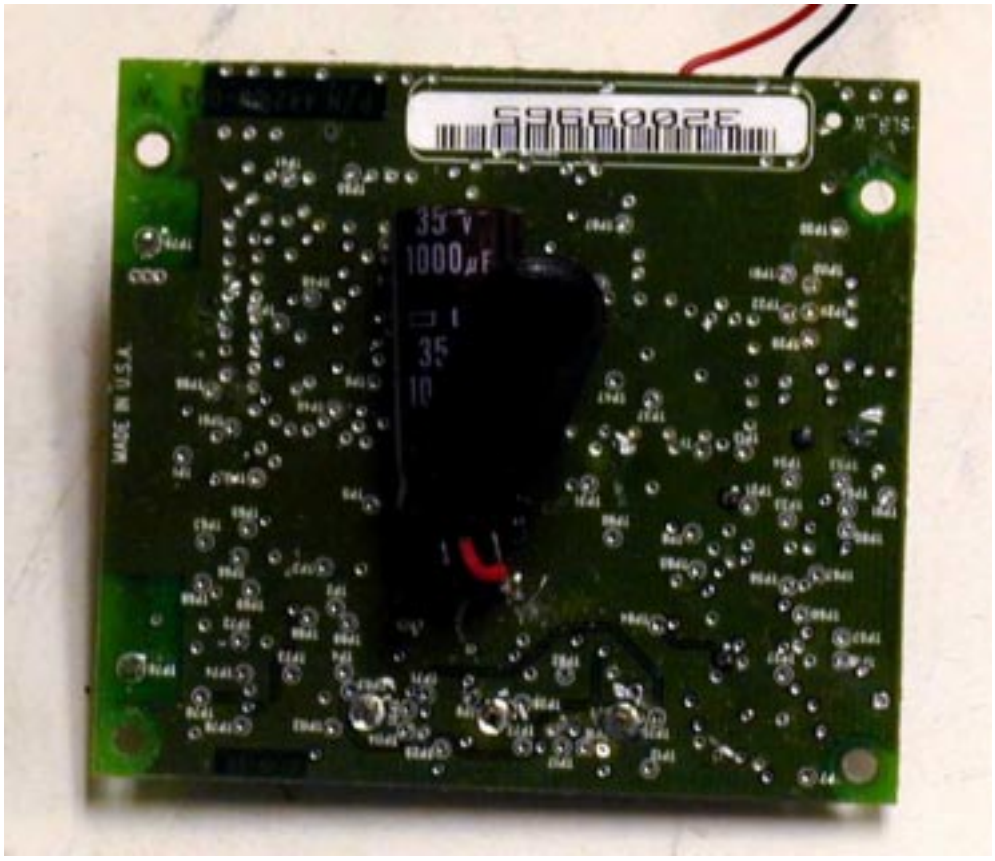


EXHIBIT 5: Schematic Diagrams for Schlumberger Technology Corp Model Water Wall MIU1

6 Pages