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SchlumbergerSema, Inc.
FCC Part 15, Certification Application
R300S

February 6, 2002

MEASUREMENT/TECHNICAL REPORT

COMPANY NAME: **SchlumbergerSema, Inc.**

MODEL: **R300S**

FCC ID: **F9CR300S-1**

DATE: **February 6, 2002**

This report concerns (check one): Original grant_X_
Class II change_____

Equipment type: **___Low Power Transmitter____**

Deferred grant requested per 47 CFR 0.457(d)(1)(ii)? yes_____ No_X_

If yes, defer until:_____
date

__N.A.__ agrees to notify the Commission by__N.A.____
date
of the intended date of announcement of the product so that the grant can be issued on that date.

Report prepared by:

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3505 Francis Circle
Alpharetta, GA 30004

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TABLE OF CONTENTS

LIST OF FIGURES AND TABLES

FIGURES

TABLES

SECTION 1

GENERAL INFORMATION

GENERAL INFORMATION

1.1 Product Description

The Equipment Under Test (EUT) is a SchlumbergerSema, Inc., Model R300S which is an RF option for the SENTINEL line of meters. The trade name for the meter is SENTINEL. The trade name for the optional broadcast board is the R300. It comes in two models that are physically identical and differ only in the number of unique ID's that are broadcast. A single ID unit is called an R300S and a dual ID unit is called an R300SD. The name SENTINAL and the model R300S or R300SD will be clearly marked on the label.

The SENTINEL product line are solid state electricity power meters which Schlumberger currently produces. The basic meter consists of an signal input circuit board, which scales the input voltages and has a switching power supply, permanently connected to register circuit board which does calculations and the display function. The register board has a small linear power supply. There are a few different models of the SENTINAL meter, but the differences are not considered to affect the transmitter board.

The R300S is an RF option for the SENTINEL meter which will periodically transmit the meter reading and an ID number to utility data collectors that may be stationary, handheld, or vehicular mounted. The R300S board may also pass signals from the register board to an optional solid state relay output board which is not related to the RF operation. The R300S physically consists of one small circuit board. The RF board has a linear power supply, a microprocessor, an RF oscillator and a stripline antenna.

The EUT transmits on different frequencies between 910 to 920 MHz. These frequencies are selected by changing the DC bias in a portion of the transmitter circuitry. The system data collectors' receiver range is 910 to 920 MHz. Each R300S uses approximately 6 MHz of this range. The R300S pseudorandomly hops to a new frequency within its range for each transmitted message. However because the receivers that are used with this transmitter do not meet with the spread spectrum receiver requirements of 15.247, the transmitter has been designed to meet the requirements of 15.249. Operation is one way; the R300S does not receive.

The R300S does not allow for customer programming of the RF parameters of a sealed meter. All RF programming and RF tuning of the product will be done by factory trained personnel during the manufacturing process. At that time the R300S is tested, tuned, and programmed in non-volatile memory for operating system parameters and FCC compliance.

Schlumberger plans to sell the SENTINAL meter with the R300S as a whole, but it may also be offered as an upgrade to the SENTINAL meters.

1.2 Related Submittal(s)/Grant(s)

The EUT will be used with part of a system to send/receive data. The transmitter presented in this report will be used with receivers which have been previously approved.

The EUT is subject to the following authorizations:

a) Certification as a transmitter
b) Verification as a digital device

The information contained in this report is presented for the certification & verification authorization(s) for the EUT.

SECTION 2

TESTS AND MEASUREMENTS

TEST AND MEASUREMENTS

2.1 Configuration of Tested System

The sample was tested per ANSI C63.4, Methods of Measurement from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (1992). Conducted and radiated emissions data were taken with the test receiver or spectrum analyzer's resolution bandwidth adjusted to 9 kHz and 120 kHz, respectively. All measurements are peak unless stated otherwise. The video filter associated with the spectrum analyzer was off throughout the evaluation process. Interconnecting cables were manipulated as necessary to maximize emissions. Interconnecting cables were manipulated as necessary to maximize emissions. A block diagram of the tested system is shown in Figure 1. Test configuration photographs for spurious and fundamental emissions are shown in Figure 2.

The sample used for testing was received by U.S. Technologies on January 15, 2002 in good condition.

2.2 Test Facility

Testing was performed at US Tech's measurement facility at 3505 Francis Circle, Alpharetta, GA. This site has been fully described and submitted to the FCC, and accepted in their letter marked 31040/SIT. Additionally this site has also been fully described and submitted to Industry Canada (IC), and has been approved under file number IC2982.

2.3 Test Equipment

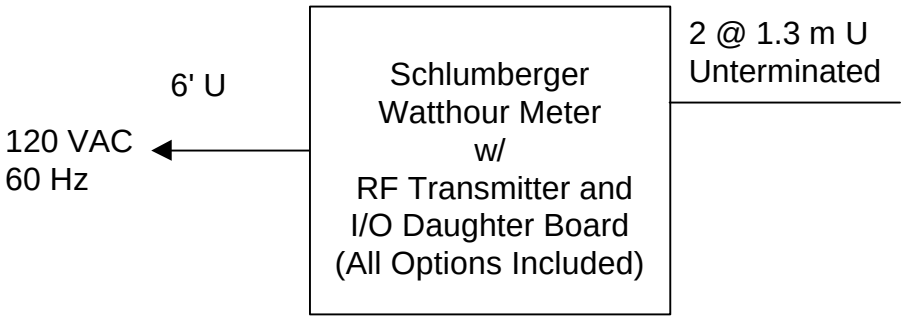
Table 2 describes test equipment used to evaluate this product.

2.4 Modifications

No modifications were necessary to bring the EUT into compliance with FCC Part 15 limits for the transmitter portion or digital device portion of the EUT.

FIGURE 1

TEST CONFIGURATION



S = Shielded
U = Unshielded

Test Date: January 16, 2002
UST Project: 02-0019
Customer: SchlumbergerSema, Inc.
Model: R300S

FIGURE 2a

Photograph(s) for Spurious and Fundamental Emissions (Front)

Test Photographs not Available

Test Date: January 16, 2002
UST Project: 02-0019
Customer: SchlumbergerSema, Inc.
Model: R300S

FIGURE 2b

Photograph(s) for Spurious and Fundamental Emissions (Back)

Test Photographs not Available

Test Date: January 16, 2002
UST Project: 02-0019
Customer: SchlumbergerSema, Inc.
Model: R300S

FIGURE 2c

Photograph(s) for Conducted Emissions

Test Photographs not Available

TABLE 1

EUT and Peripherals

PERIPHERAL MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC ID:	CABLES P/D
Watthour Meter Schlumberger	FM9S	N/A	F9CR300S-1 placed on outside	2@ 1.3 m U Unterm. 6’ U Power Cord
Transmitter Schlumberger	R300S Rev R5	None	F9CR300S-1 (Pending)	
I/O Daughter Board Schlumberger	KYZ I/O Module	None	None	

TABLE 2
TEST INSTRUMENTS

TYPE	MANUFACTURER	MODEL	SN.
SPECTRUM ANALYZER	HEWLETT-PACKARD	8593E	3205A00124
SPECTRUM ANALYZER	HEWLETT-PACKARD	8558B	2332A09900
S A DISPLAY	HEWLETT-PACKARD	853A	2404A02387
COMB GENERATOR	HEWLETT-PACKARD	8406A	1632A01519
RF PREAMP	HEWLETT-PACKARD	8447D	1937A03355
RF PREAMP	HEWLETT-PACKARD	8449B	3008A00480
HORN ANTENNA	EMCO	3115	3723
HORN ANTENNA	EMCO	3116	9505-2255
BICONICAL ANTENNA	EMCO	3110	9307-1431
LOG PERIODIC ANTENNA	EMCO	3146	9110-3600
LISN	SOLAR ELE.	8012	865577
LISN	SOLAR ELE.	8028	910494
LISN	SOLAR ELE.	8028	910495
THERMOMETER	FLUKE	52	5215250
MULTIMETER	FLUKE	85	53710469
FUNCTION GENERATOR	TEKTRONIX	CFG250	CFG250TW15059
PLOTTER	HEWLETT-PACKARD	7475A	2325A65394

2.6 Antenna Description (Paragraph 15.203)

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

The Model SchlumbergerSema, Inc. R300S incorporates an internal stripline antenna only.

2.7 Field Strength of Fundamental within the Band 902-928 MHz per FCC Section 15.249(a)

Peak power within the band 902-928 MHz has been measured with a spectrum analyzer. Peak measurements were made using a peak or quasi-peak detector. Average emissions are not considered applicable since the measurement was below 1000 MHz.

The results of the measurements for peak fundamental emissions are given in Table 3a and Figure 3a through Figure 3b.

Table 3a

FIELD STRENGTH OF FUNDAMENTAL EMISSION

Test Date: January 15, 2002
UST Project: 02-0019
Customer: SchlumbergerSema, Inc.
Model: R300S

(Low Channel / Worst Case Polarization)

FREQ. (MHz)	TEST DATA (dBm) @ 3m	ANTENNA FACTOR + CABLE ATTENUATION	RESULTS (uV/m) @ 3m	PEAK FCC LIMITS (uV/m) @ 3m
910.0	-49.4	30.5	25,293.0	50,000

SAMPLE CALCULATIONS:

RESULTS uV/m @ 3m = Antilog ((-49.4 + 30.5 + 107)/20) = 25,293.0
CONVERSION FROM dBm TO dBuV = 107 dB

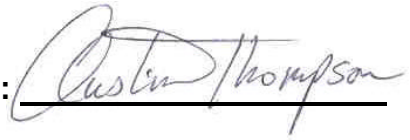
Tested By:  **Name: Austin Thompson**

Table 3b

FIELD STRENGTH OF FUNDAMENTAL EMISSION

Test Date: January 15, 2002
UST Project: 02-0019
Customer: SchlumbergerSema, Inc.
Model: R300S

(High Channel / Worst Case Polarization)

FREQ. (MHz)	TEST DATA (dBm) @ 3m	ANTENNA FACTOR + CABLE ATTENUATION	RESULTS (uV/m) @ 3m	PEAK FCC LIMITS (uV/m) @ 3m
920.0	-46.9	30.6	34,355.8	50,000

SAMPLE CALCULATIONS:

RESULTS uV/m @ 3m = Antilog ((-46.9 + 30.6 + 107)/20) = 34,355.8
CONVERSION FROM dBm TO dBuV = 107 dB

Tested By: Austin Thompson **Name:** Austin Thompson

Figure 3a.
Field Strength of Fundamental Emissions 15.249(a) (Low)

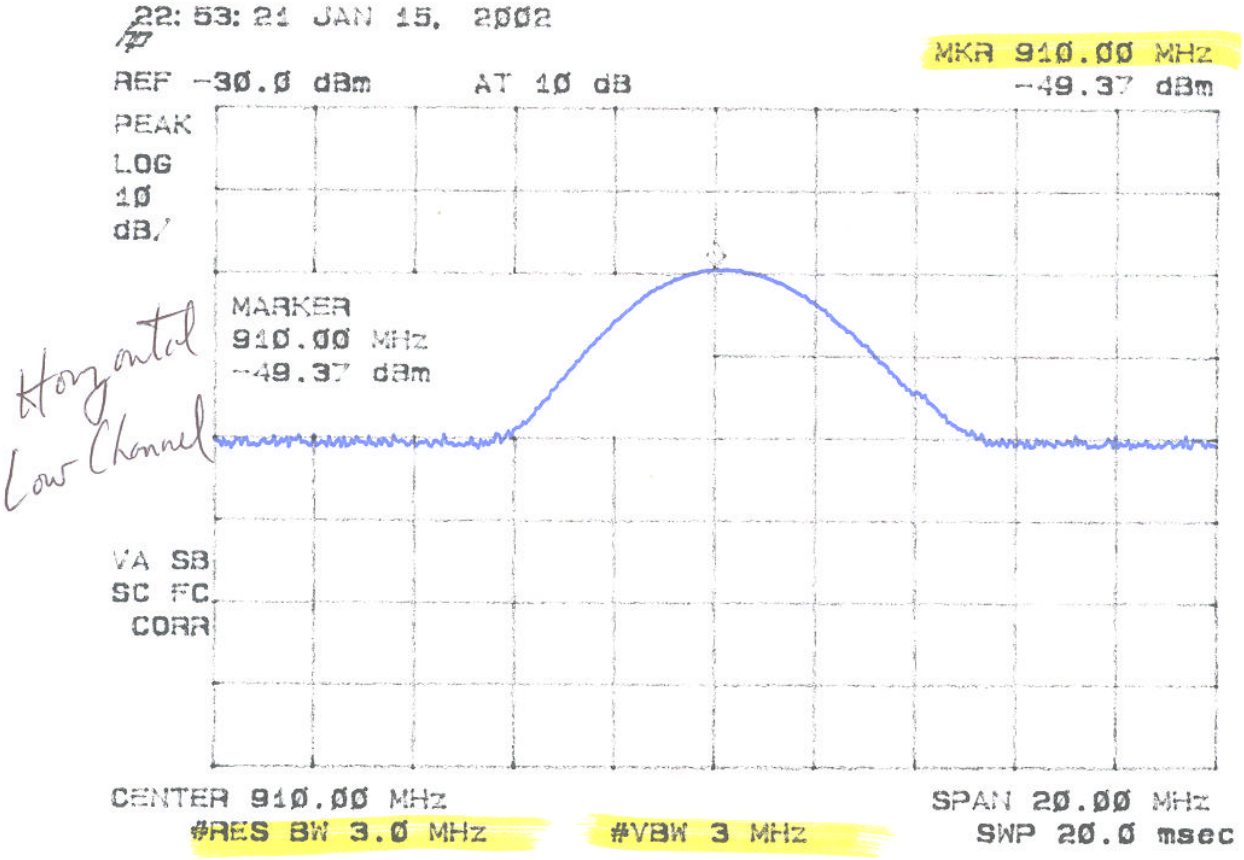
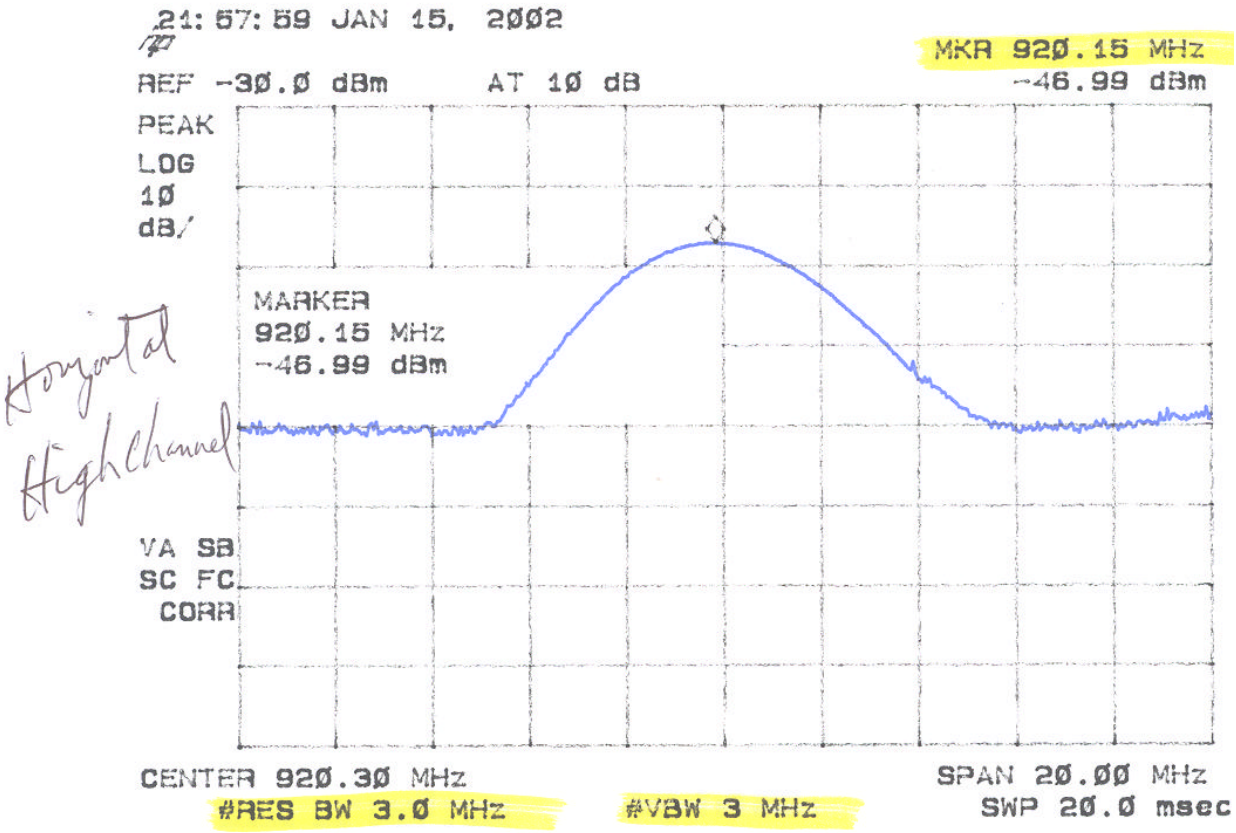


Figure 3b.
Field Strength of Fundamental Emissions 15.249(a) (High)



2.8 Peak Radiated Spurious Emissions in the Frequency Range 30 - 10000 MHz (FCC Section 15.249(c))

A preliminary scan was performed on the EUT to determine frequencies that were caused by the transmitter portion of the product. Radiated measurements below 1 GHz were tested with a RBW = 120 kHz. Radiated measurements above 1 GHz were measured using a RBW = VBW = 1 MHz. The results of peak radiated spurious emissions are given in Table 4a (low) – Table 4b (high).

Table 4a Peak Radiated Spurious Emissions (Low)

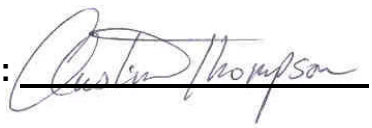
Freq. (GHz)	Test Data* (dBm) @3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) @3m	FCC Limits (uV/m) @3m
1.82	-35.5	35.2	28.5	3.1	2471.2	5000
2.73	-55.7	34.8	30.9	4.8	407.4	5000
3.64	-49.3	34.2	33.1	5.3	1251.4	5000
4.55	-46.1	33.9	34.0	6.2	2305.4	5000
5.46	-48.6	33.7	35.7	7.0	2339.4	5000
6.37	-61.0	33.5	36.2	7.4	637.5	5000
7.28	-64.8	33.7	37.3	7.9	485.5	5000

Table 4b Peak Radiated Spurious Emissions (High)

Freq. (GHz)	Test Data* (dBm) @3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) @3m	FCC Limits (uV/m) @3m
1.84	-36.8	35.2	28.5	3.1	2161.7	5000
2.79	-46.6	34.8	31.0	4.9	1191.6	5000
3.68	-42.9	34.2	33.2	5.3	2653.4	5000
4.60	-41.5	33.9	34.1	6.3	4008.7	5000
5.52	-42.8	33.7	35.7	7.1	4621.7	5000
6.44	-52.4	33.5	36.2	7.5	1711.6	5000
7.36	-65.8	33.7	37.4	7.9	435.9	5000
8.27	-69.4	33.9	37.4	8.3	294.4	5000

Note: To frequencies that were not considered harmonics, the general limits of 15.209 were applied.

SAMPLE CALCULATION:
RESULTS (uV/m @ 3m) = Antilog ((-35.5 - 35.2 + 28.4 + 3.1 + 107)/20) = 2471.2
CONVERSION FROM dBm TO dBuV = 107 dB

Tester Signature:  **Name: Austin Thompson**

2.9 Average Spurious Emission in the Frequency Range 30 - 10000 MHz (FCC Section 15.247(c))

The Average measurement was derived from applying any possible duty cycle correction to the peak reading.

Duty Cycle Correction During 100 msec:

The EUT is a frequency hopping transmitter. Data packets are < 6 ms in length and the minimum broadcast period is 125 ms between data packets.

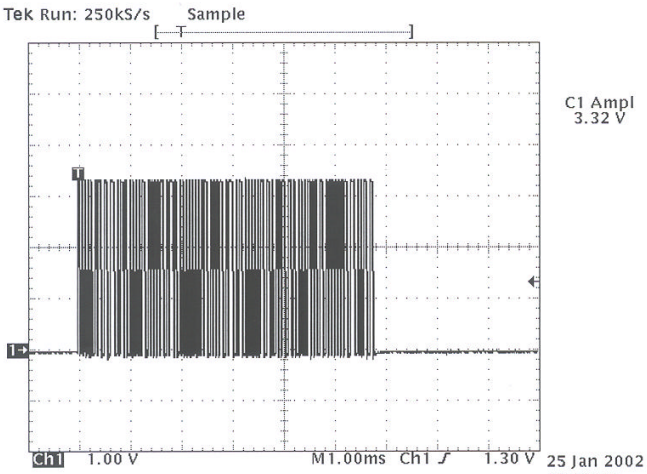


Figure 1 - 6mS broadcast

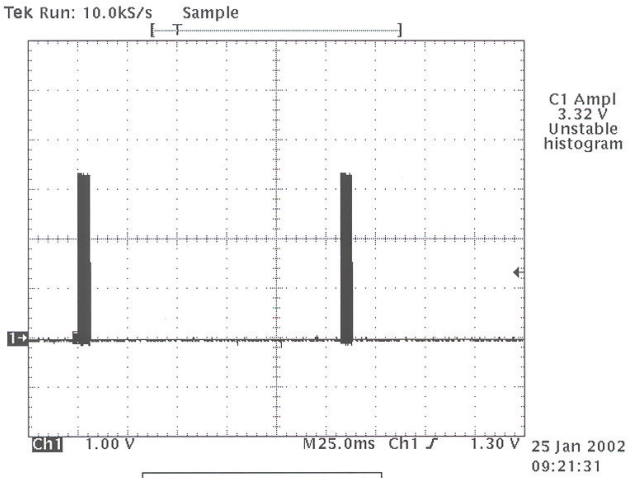


Figure 2 - 125mS separation

Schlumberger has specified that the maximum transmit duty cycle of the R300S is 6.00 msec per 125 msec. Therefore for purposes of average measurements, the following duty cycle has been applied:

Duty Cycle Correction = 20 log (0.06) = -24.4 dB

Since all peak data may be corrected by 24.4 dB (greater than the 20 dB peak to average ratio), all average emissions derived from the peak measurements in the previous section will meet the average limits.

2.10 Power Line Conducted Emissions for Transmitter FCC Section 15.207

The conducted voltage measurements have been carried out in accordance with FCC Section 15.207, with a spectrum analyzer connected to a LISN and the EUT placed into a continuous mode of transmit. The results are given in Table 6.

Table 6A. Conducted Emissions Data
Class B

Test Date: January 16, 2002
UST Project: 02-0019
Customer: SchlumbergerSema, Inc.
Product: R300S

Transmit on Low Channel

FREQ. (MHz)	TEST DATA (dBm) PHASE	TEST DATA (dBm) NEUTRAL	LISN LOSS (dB) PHASE	LISN LOSS (dB) NEUTRAL	CABLE FACTOR (dB)	RESULTS (uV) PHASE	RESULTS (uV) NEUTRAL	FCC LIMITS (uV)	MARGIN BELOW LIMIT (dB) PHASE	MARGIN BELOW LIMIT (dB) NEUTRAL
0.49	-62.0*	-61.0*	0.1	0.1	0.1	182.0	204.2	250	2.8	1.8
0.54	-65.0*	-64.0*	0.1	0.1	0.1	128.8	144.5	250	5.8	4.8
0.58	-65.0	-68.0	0.1	0.1	0.1	128.8	91.2	250	5.8	8.8
0.63	-67.0	-67.0	0.1	0.1	0.1	102.3	102.3	250	7.8	7.8
3.32	-72.0	-76.0	0.0	0.0	0.4	58.7	37.2	250	12.6	16.6
6.46	-68.0	-72.0	0.0	0.0	0.4	93.3	58.9	250	8.6	12.6

* - Quasi-Peak

SAMPLE CALCULATIONS:
RESULTS uV = ANTILOG ((-62.0 + 0.1 + 0.1 +107)/20) = 182.0
CONVERSION FROM dBm TO dBuV = 107 dB

Tester Signature:  **Name: Austin Thompson**

Table 6B Conducted Emissions Data
Class B

Test Date: January 16, 2002
UST Project: 02-0019
Customer: SchlumbergerSema, Inc.
Product: R300S

Transmit on High Channel

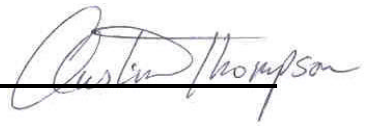
FREQ. (MHz)	TEST DATA (dBm) PHASE	TEST DATA (dBm) NEUTRAL	LISN LOSS (dB) PHASE	LISN LOSS (dB) NEUTRAL	CABLE FACTOR (dB)	RESULTS (uV) PHASE	RESULTS (uV) NEUTRAL	FCC LIMITS (uV)	MARGIN BELOW LIMIT (dB) PHASE	MARGIN BELOW LIMIT (dB) NEUTRAL
0.46	-63.0*	-66.0	0.1	0.1	0.1	162.0	114.8	250	3.8	6.8
0.49	-63.0*	-61.0*	0.1	0.1	0.1	162.2	204.2	250	3.8	1.8
0.53	-66.0*	-65.0	0.1	0.1	0.1	114.8	128.8	250	6.8	5.8
0.58	-67.0	-66.0	0.1	0.1	0.1	102.3	114.8	250	7.8	6.8
0.62	-70.0	-67.0	0.1	0.1	0.1	72.4	102.3	250	10.8	7.8
0.67	-70.0	-68.0	0.1	0.1	0.1	72.4	91.2	250	10.8	8.8

*** - Quasi-Peak**

SAMPLE CALCULATIONS:

RESULTS uV = ANTILOG ((-63.0 + 0.1 + 0.1 + 107)/20) = 162.0

CONVERSION FROM dBm TO dBuV = 107 dB

Tester Signature:  **Name: Austin Thompson**

2.11 Radiated Emissions (47 CFR 15.109a)

Radiated emissions were evaluated from 30 to 5000 MHz. Measurements were made with the analyzer's bandwidth set to 120 kHz for measurements made less than 1 GHz and 1 MHz for measurements made 1 GHz and higher. Results for less than 1 GHz are shown in Table 7a. Measurements made over 1 GHz results are shown in Table 7b.

Table 7a. Radiated Emissions Data

Test Date: January 16, 2002
UST Project: 02-0019
Customer: SchlumbergerSema, Inc.
Product: R300S

Frequency (MHz)	Receiver Reading (dBm) @3m	Correction Factor (dB)	Corrected Reading (uV/m)	FCC Limit (uV/m) @3m
54.2	-84.0	11.7	54.5	100
54.5	-82.0	11.7	68.5	100
59.0	-86.0*	11.5	42.4	100
60.3	-79.0*	11.5	94.4	100
83.5	-87.0*	11.8	38.9	100
84.3	-84.0	11.8	55.1	100

*** = Quasi-Peak**

Tester Signature: Austin Thompson **Name:** Austin Thompson

2.12 Power Line Conducted Emissions for Digital Device FCC Section 15.107

The conducted voltage measurements have been carried out in accordance with FCC Section 15.107, with a spectrum analyzer connected to a LISN and the EUT placed into a continuous mode of transmit. The results are given in Table 8.

Table 8. Conducted Emissions Data – Digital Device

Test Date: January 16, 2002
UST Project: 02-0019
Customer: SchlumbergerSema, Inc.
Product: R300S

Idle Mode

FREQ. (MHz)	TEST DATA (dBm) PHASE	TEST DATA (dBm) NEUTRAL	LISN LOSS (dB) PHASE	LISN LOSS (dB) NEUTRAL	CABLE FACTOR (dB)	RESULTS (uV) PHASE	RESULTS (uV) NEUTRAL	FCC LIMITS (uV)	MARGIN BELOW LIMIT (dB) PHASE	MARGIN BELOW LIMIT (dB) NEUTRAL
0.49	-62.0*	-61.0*	0.1	0.1	0.1	182.0	204.2	250	2.8	1.8
0.53	-66.0*	-64.0	0.1	0.1	0.1	114.8	144.5	250	6.8	4.8
0.57	-67.0	-67.0	0.1	0.1	0.1	102.3	102.3	250	7.8	7.8
7.55	-72.0	-72.0	0.0	0.1	0.4	58.9	59.6	250	12.6	12.5
7.82	-70.0	-72.0	0.0	0.1	0.4	74.1	59.6	250	10.6	12.5
9.55	-69.0	-75.0	0.0	0.0	0.5	84.1	42.2	250	9.5	15.5

*** - Quasi-Peak**

SAMPLE CALCULATIONS:

RESULTS uV = ANTILOG ((-62.0 + 0.1 + 0.1 + 107)/20) = 182.0

CONVERSION FROM dBm TO dBuV = 107 dB

Tester Signature: Austin Thompson **Name:** Austin Thompson