Electromagnetic Emissions Test Report
and
Application for Grant of Equipment Authorization
pursuant to
FCC Part 15, Subpart C Specifications for an
Intentional Radiator on the
Schlumberger Resource Management Services, Inc.
Model: Centron RMC

FCC ID:	F9CC1C-1
GRANTEE:	Schlumberger Resource Management Services, Inc. 313-B North Highway 11 West Union, South Carolina 29696
TEST SITE:	Elliott Laboratories, Inc. 684 W. Maude Avenue Sunnyvale, CA 94086
REPORT DATE:	November 20, 1998
FINAL TEST DATE:	November 15, 16 1998
AUTHORIZED SIGNATORY:	________________________ David W. Bare Principal Engineer

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SCOPE

An electromagnetic emissions test has been performed on the Schlumberger Spread Spectrum Transmitter model Centron RMC 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.

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 model Centron RMC and therefore apply only to the tested sample. The sample was selected and prepared by Bill Larsen of Schlumberger Resource Management Services, Inc..

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 which are subsequently manufactured.

STATEMENT OF COMPLIANCE

The tested sample of Schlumberger model Centron RMC 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 model Centron RMC. The actual test results are contained in an exhibit of this report.

LIMITS OF CONDUCTED INTERFERENCE VOLTAGE

The EUT tested complied with the limits detailed in FCC Rules Part 15 Section 15.207.

The following measurement was extracted from the data recorded during the conducted 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.

0.45 - 30 MHz, 240V/60Hz

Frequency MHz	Level dBuV	Power Lead	§15.207 Limit	§15.207 Margin	Detector QP/Ave	Comments
0.996	29.7	Line	48.0	-18.3	QP	

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.

30 - 10,000 MHz (excluding designated band of 902 - 928 MHz)

Frequency MHz	Level dBuV/m	Pol v/h	§15.209 Limit	§15.209 Margin	Detector QP/Pk/Avg	Azimuth degrees	Height meters	Comments
2752.74	67.0	Line	54.0	-7.0	Pk	0	1.0	In restricted band

LIMITS OF POWER AND BANDWIDTH

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

The power output was 23.2 dBm. The 6 dB bandwidth was 1.35 MHz Megahertz. The power spectral density was 4.0 dBm in a 3KHz bandwidth averaged over 1 second. Power measurements were calculated from a radiated field strength measurement using:

$$P = \frac{E^2 d^2}{30G}$$

Where P = transmitted Power (watts), E = field strength (V/m), d = measurement distance (m) and G = Antenna Gain

The actual test data and any correction factors are contained in an exhibit of this report.

PROCESSING GAIN

The Processing Gain was measured by the manufacturer to be 14.8 dB. The actual test data and any correction factors are contained in an exhibit of this report.

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The Schlumberger model Centron RMC is a 917.5 MHz spread spectrum transmitter designed to transmit residential electric meter information. The sample was received on November 14, 1998 and tested on November 15, 16 1998. The EUT consisted of the following component:

Manufacturer/Model/Description	Serial Number	FCC ID Number
Schlumberger RMS/ Centron RMC/Transmitter	1836954	F9CC1C-1

INPUT POWER

The EUT input is rated at 240V/60 Hz which is taken from the delta wiring configuration of the AC line to which the meter is connected. The power components are contained within the main circuit board and receive power form the AC line via a dropper capacitor.

PRINTED WIRING BOARDS

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

Manufacturer/Description	Assembly #	Rev.	Serial #	Crystals (MHz)
Schlumberger RMS/ Main Tx PCB	442057-001	9	C182	14.56 , 0.032768
Schlumberger RMS/ Metrology PCB	442093-001	14	P6552	4.19

SUBASSEMBLIES

The EUT contained no subassembly modules during emissions testing.

ENCLOSURE

The EUT is enclosure is constructed from plastic measuring approximately 18 cm in diameter by 13 cm deep.

EMI SUPPRESSION DEVICES

The EUT contained no EMI suppression devices during emissions testing.

ANTENNA

The EUT antenna is etched onto the printed circuit board. The client stated that the antenna gain was 2dBi.

MODIFICATIONS

No modifications were made to the EUT.

SUPPORT EQUIPMENT

The following equipment was used as local support equipment for emissions testing:

Manufacturer/Model/Description	Serial Number	FCC ID Number
Elliott step-up Ac transformer	Elliott 263	N/A

The step-up transformer was used to provide the EUT with 240V/60Hz AC power from a 120V/60Hz AC source.

EXTERNAL I/O CABLING

There were no I/O cables other than the unshielded AC power cord.

TEST SOFTWARE

The EUT was set to transmit a typical data pattern (meter reading) once per second. In normal operation, the transmitter does not transmit more often than once every five minutes.

TEST SITE

GENERAL INFORMATION

Final test measurements were taken on November 15 and November 16 1998 at the Elliott Laboratories Open Area Test Site #3 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, which is 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 specification listed on page 1. One or more of these is with the antenna polarized vertically while the one or more of these is 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

The radiated emissions limits above were used in restricted bands. For all other radiated emissions the limit was set at 20dB below the fundamental field strength measured in 100 kHz band as per Section 15.247.

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#3

	Manufacturer/Description		Model	Asset #	Interval	Last Cal	Cal Due
[x]	Elliott Laboratories	300-1000 MHz Log Periodic	EL300.1000	55, (F130)	12	9/26/98	9/26/99
[x]	Elliott Laboratories	Biconical Antenna, 30-300 MHz	EL30.300	54, (F131)	12	11/24/97	11/24/98
[ ]	EMCO	D. Ridge Horn Antenna, 1-18 GHz	3115	Metric, 953	12	10/21/98	10/21/99
[ ]	EMCO	D. Ridge Horn Antenna, 1-18GHz	3115	487	12	6/18/98	6/18/99
[ ]	EMCO	D. Ridge Horn Antenna, 1-18GHz	3115	786	12	11/13/97	5/13/99
[x]	Fischer	LISN	FCC-LISN-50/2	810	12	1/29/98	1/29/99
[ ]	Hewlett Packard	EMC Receiver /Analyzer	8595EM	780	24	10/24/97	10/24/99
[x]	Hewlett Packard	EMC Receiver /Analyzer	8595EM	787	12	10/27/97	10/27/98
[ ]	Hewlett Packard	Microwave Preamplifier, 1-26.5	8449B	Metric, 644	12	9/15/98	9/15/99
[ ]	Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	263, (F303)	12	6/8/98	6/8/99
[ ]	Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	785	12	11/10/97	12/10/98
[ ]	Hewlett Packard	Power Meter	432A	259, (F304)	12	3/10/98	3/10/99
[ ]	Hewlett Packard	Spectrum Analyzer	8563E	284, (F194)	24	1/14/98	1/14/2000
[ ]	Hewlett Packard	Spectrum Analyzer, 9 KHz-6.5 GHz	8595E-041-103-	Metric, 885	12	5/11/98	5/11/99
[ ]	Hewlett Packard	Thermistor Mount	478A	652	12	3/10/98	3/10/99
[ ]	Narda-West	EMI Filter 2.4 GHz, High Pass	60583 HPF-161	248	12	8/10/98	8/10/99
[ ]	Narda-West	EMI Filter 5.6 GHz, High Pass	60583 HXF370	247	12	8/10/98	8/10/99
[ ]	Rohde& Schwarz	Pulse Limiter	ESH3Z2	812	12	2/5/98	2/5/99
[x]	Rohde & Schwarz	Test Receiver, 0.009-30 MHz	ESH3	274	12	4/8/98	4/8/99
[x]	Rohde &Schwarz	Test Receiver, 20-1300MHz	ESVP	213, (F196)	12	10/4/98	10/4/99

File Number: T29208

Date: 11/15/98

Engr: ANIL A

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

Test Equipment List - SVOATS#3

	Manufacturer/Description		Model	Asset #	Interval	Last Cal	Cal Due
☐	Elliott Laboratories	300-1000 MHz Log Periodic	EL300.1000	55, (F130)	12	9/26/98	9/26/99
☐	Elliott Laboratories	Biconical Antenna, 30-300 MHz	EL30.300	54, (F131)	12	11/24/97	11/24/98
☐	EMCO	D. Ridge Horn Antenna, 1-18 GHz	3115	Metric, 953	12	10/21/98	10/21/99
☑	EMCO	D. Ridge Horn Antenna, 1-18GHz	3115	487	12	6/18/98	6/18/99
☐	EMCO	D. Ridge Horn Antenna, 1-18GHz	3115	786	12	11/13/97	5/13/99
☐	Fischer	LISN	FCC-LISN-50/2	810	12	1/29/98	1/29/99
☐	Hewlett Packard	EMC Receiver /Analyzer	8595EM	780	24	10/24/97	10/24/99
☐	Hewlett Packard	EMC Receiver /Analyzer	8595EM	787	12	10/27/97	10/27/98
☐	Hewlett Packard	Microwave Preamplifier, 1-26.5	8449B	Metric, 644	12	9/15/98	9/15/99
☑	Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	263, (F303)	12	6/8/98	6/8/99
☐	Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	785	12	11/10/97	12/10/98
☐	Hewlett Packard	Power Meter	432A	259, (F304)	12	3/10/98	3/10/99
☑	Hewlett Packard	Spectrum Analyzer	8563E	284, (F194)	24	1/14/98	1/14/2000
☐	Hewlett Packard	Spectrum Analyzer, 9 KHz-6.5 GHz	8595E-041-103-	Metric, 885	12	5/11/98	5/11/99
☐	Hewlett Packard	Thermistor Mount	478A	652	12	3/10/98	3/10/99
☑	Narda-West	EMI Filter 2.4 GHz, High Pass	60583 HPF-161	248	12	8/10/98	8/10/99
☐	Narda-West	EMI Filter 5.6 GHz, High Pass	60583 HXF370	247	12	8/10/98	8/10/99
☐	Rohde& Schwarz	Pulse Limiter	ESH3Z2	812	12	2/5/98	2/5/99
☐	Rohde & Schwarz	Test Receiver, 0.009-30 MHz	ESH3	274	12	4/8/98	4/8/99
☐	Rohde &Schwarz	Test Receiver, 20-1300MHz	ESVP	213, (F196)	12	10/4/98	10/4/99

File Number: T29209

Date: 11/16/98

Engr: J. Dickinson

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

T29208	***13 Pages***
T29209	***4 Pages***
Processing Gain Measurements	***4 Pages***

Elliott

EMC Test Log

Client:	Schlumberger RMS	Date:	11/15/98	Test Engr:	Anil Allamaneni
Product:	Centron RMC	File:	T29208	Proj. Eng:	Mark Briggs
Objective:	Final Qualification	Site:	SVOATS # 3	Contact:	Bill Larsen
Spec:	FCC B Part §15.247	Page:	1 of 4	Approved:	
Revision	Final 1.0				

Ambient Conditions	
Temperature:	10 °C
Humidity:	67 %

Test Objective

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

Test Summary

Run #1 - Transmitted power Measurements @ 917.58 MHz in accordance with §15.247 (b)

PASS Results: Output power was measured and calculated from the radiated field strength to be 21.2 dBm, 8.8 dBm below the maximum permitted output of 30dBm (1 Watt).

Run #2 - 6 dB Bandwidth measurement @ 917.58 MHz in accordance with §15.247 (a) (2)

PASS Results: 6 dB bandwidth was measured to be 1.35MHz, meeting the minimum requirement of 500 KHz.

Run #3 - Power Density Measurements @ 917.58 MHz in accordance with §15.247 (d).

PASS Results: Output power density in 3 KHz bandwidth was calculated from the radiated field strength to be 4.0 dBm, 4.0 dBm below the maximum permitted density of 8 dBm/3KHz.

Run #4 - Unmaximized Preliminary Radiated Emissions Scan, 30-902 MHz and 928-1000 MHz.

Results: §15.209 -16.8 dB QP @ 974.898 MHz Vertical

Run #5 - Maximized Radiated Emissions from Run #4

PASS Results: §15.209 -16.8 dB QP @ 974.898 MHz Vertical

Emissions lying in the restricted bands was compared to FCC Class B Limits. The limits at all other frequencies were 20dB below the fundamental emission of 121.1 dBuV/m

Run #6 - Conducted Emissions Scan of EUT, 0.45-30.00 MHz, **240V, 60Hz**

PASS Results: §15.209 -18.3 dB QP @ 0.996 MHz Line

Equipment Under Test (EUT) General Description

The EUT is a solid state electricity meter with an integrated CellNet RF transmitter. . Normally, the EUT would be placed into a wall mounted meter socket. For the purpose of testing the EUT was treated as table top equipment. The electrical rating of the EUT is **240** V, **60** Hz.

Equipment Under Test (EUT)

Manufacturer/Model/Description	Serial Number	FCC ID Number
Schlumberger RMS/ Centron RMC/Transmitter	1836954	F9CC1C-1

Power Supply and Line Filters

Description	Manufacturer	Model

The power supply is built into the transmitter printed circuit board and receive its power via a dropper capacitor.

Printed Wiring Boards in EUT

The following information was provided by the manufacturer:

Manufacturer/Description	Assembly #	Rev.	Serial Number	Crystals (MHz)
Schlumberger RMS/ Main Tx PCB	442057-001	9	C182	14.56 , 0.032768
Schlumberger RMS/ Metrology PCB	442093-001	14	P6552	4.19

Elliott

EMC Test Log

Client:	Schlumberger RMS	Date:	11/15/98	Test Engr:	Anil Allamaneni
Product:	Centron RMC	File:	T29208	Proj. Eng:	Mark Briggs
Objective:	Final Qualification	Site:	SVOATS # 3	Contact:	Bill Larsen
Spec:	FCC B Part §15.247	Page:	3 of 4	Approved:	
Revision	Final 1.0				

Subassemblies in EUT

Manufacturer/Description	Assembly Number	Rev.	Serial Number
None			

EUT Enclosure(s)

The EUT enclosure is primarily constructed of molded plastic. It measures approximately 17 cm deep by 16 cm diameter.

EMI Suppression Devices (filters, gaskets, etc.)

Description	Manufacturer	Part Number
None		

Local Support Equipment

Manufacturer/Model/Description	Serial Number	FCC ID Number
Elliott TC-2000 Step up transformer	263	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			

EMC Test Log

Client:	Schlumberger RMS	Date:	11/15/98	Test Engr:	Anil Allamaneni
Product:	Centron RMC	File:	T29208	Proj. Eng:	Mark Briggs
Objective:	Final Qualification	Site:	SVOATS # 3	Contact:	Bill Larsen
Spec:	FCC B Part §15.247	Page:	4 of 4	Approved:	
Revision	Final 1.0				

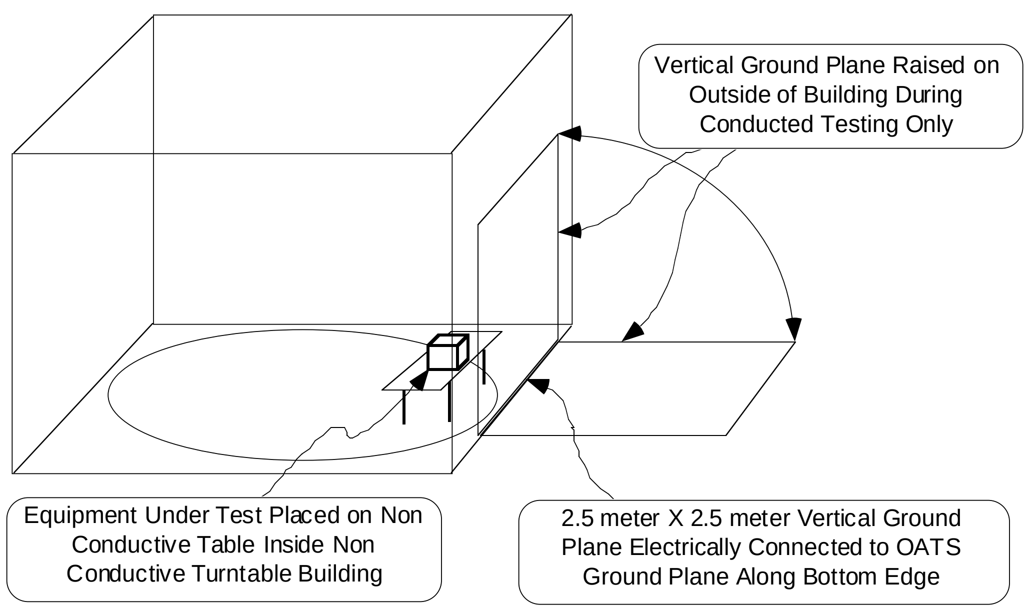
Test Software

The EUT was set to transmit once per second.

General Test Conditions

During radiated testing, the 120V, 60Hz host input power was connected to Elliott Lab step up transformer which provided 240V, 60Hz power to the EUT. During Radiated and Conducted emissions testing the EUT was placed on the table top and the transformer was located on the turntable.

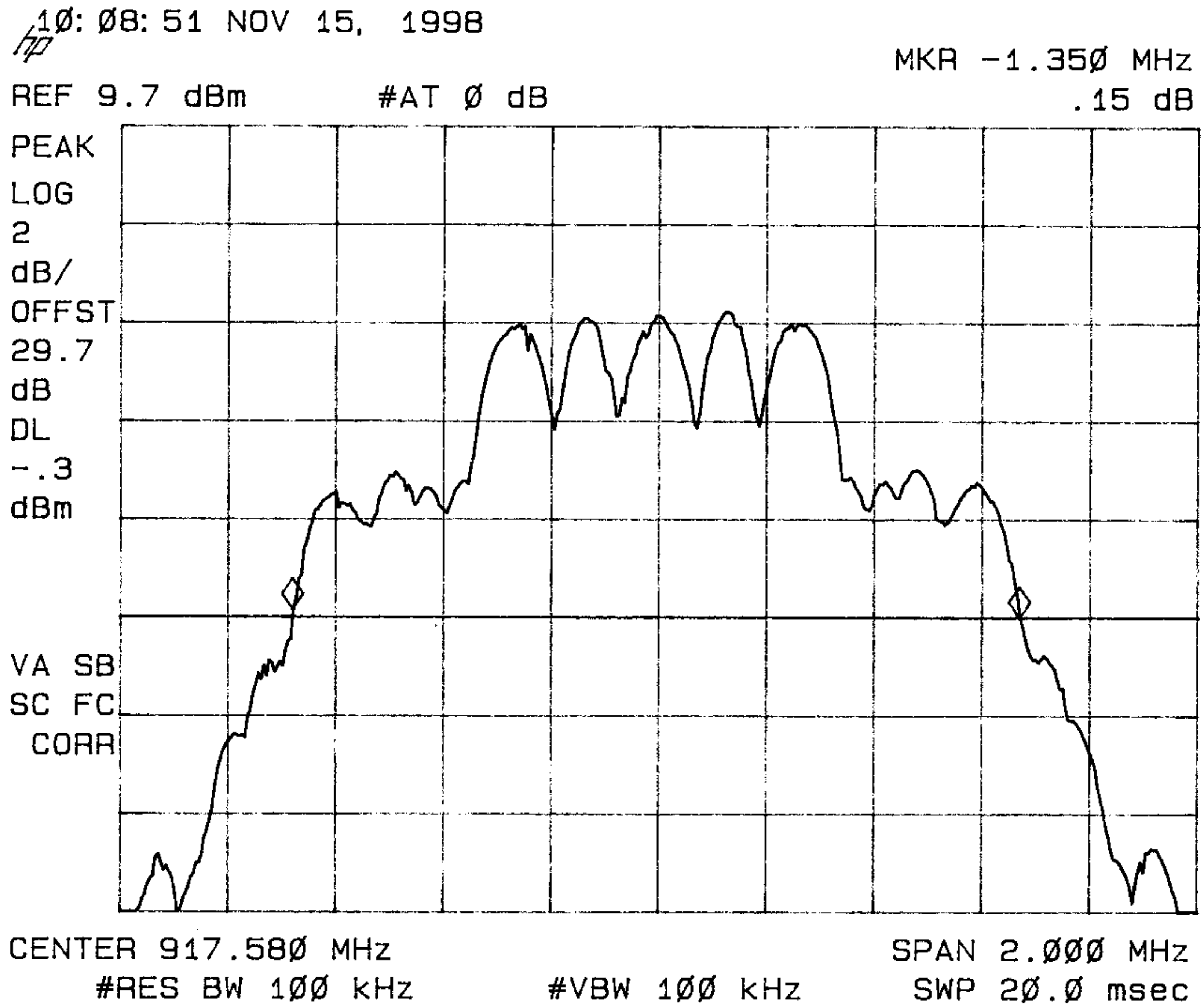
A 2.5 meter X 2.5 meter ground plane was raised to a vertical position 40 cm from the EUT as shown below:



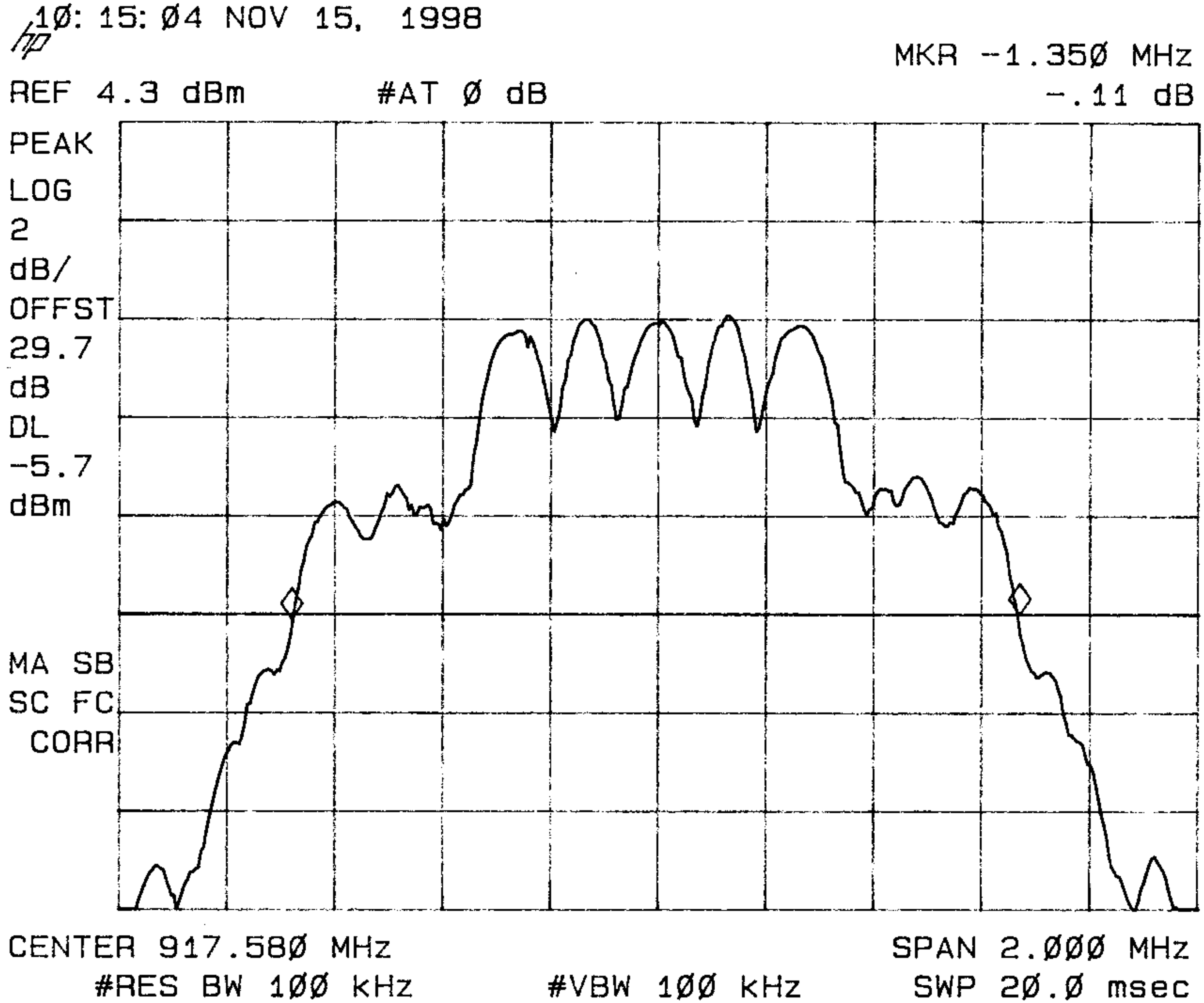
Test Data Tables

See attached data

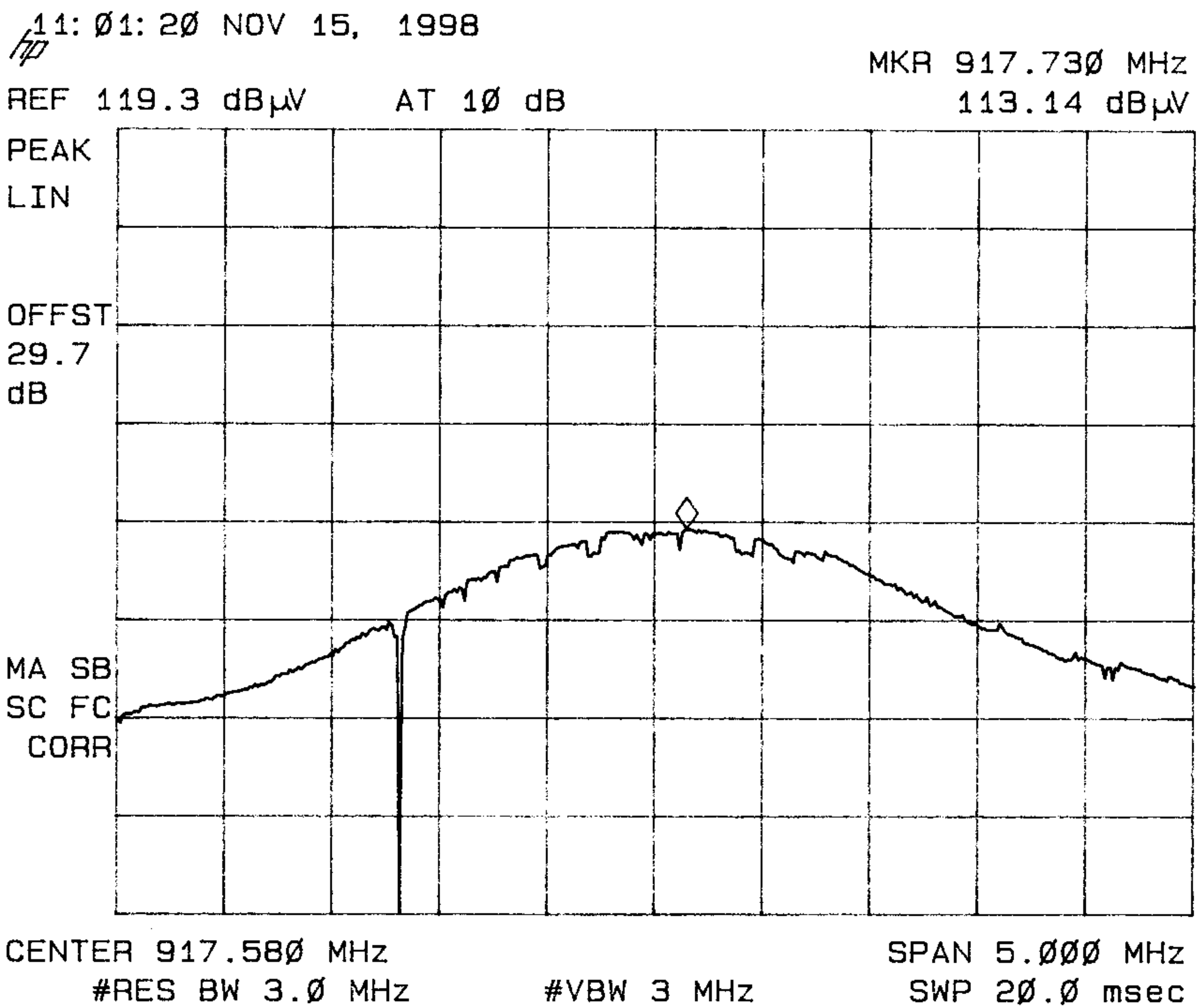
T29208 / 6 dB Bandwidth for VERTICAL



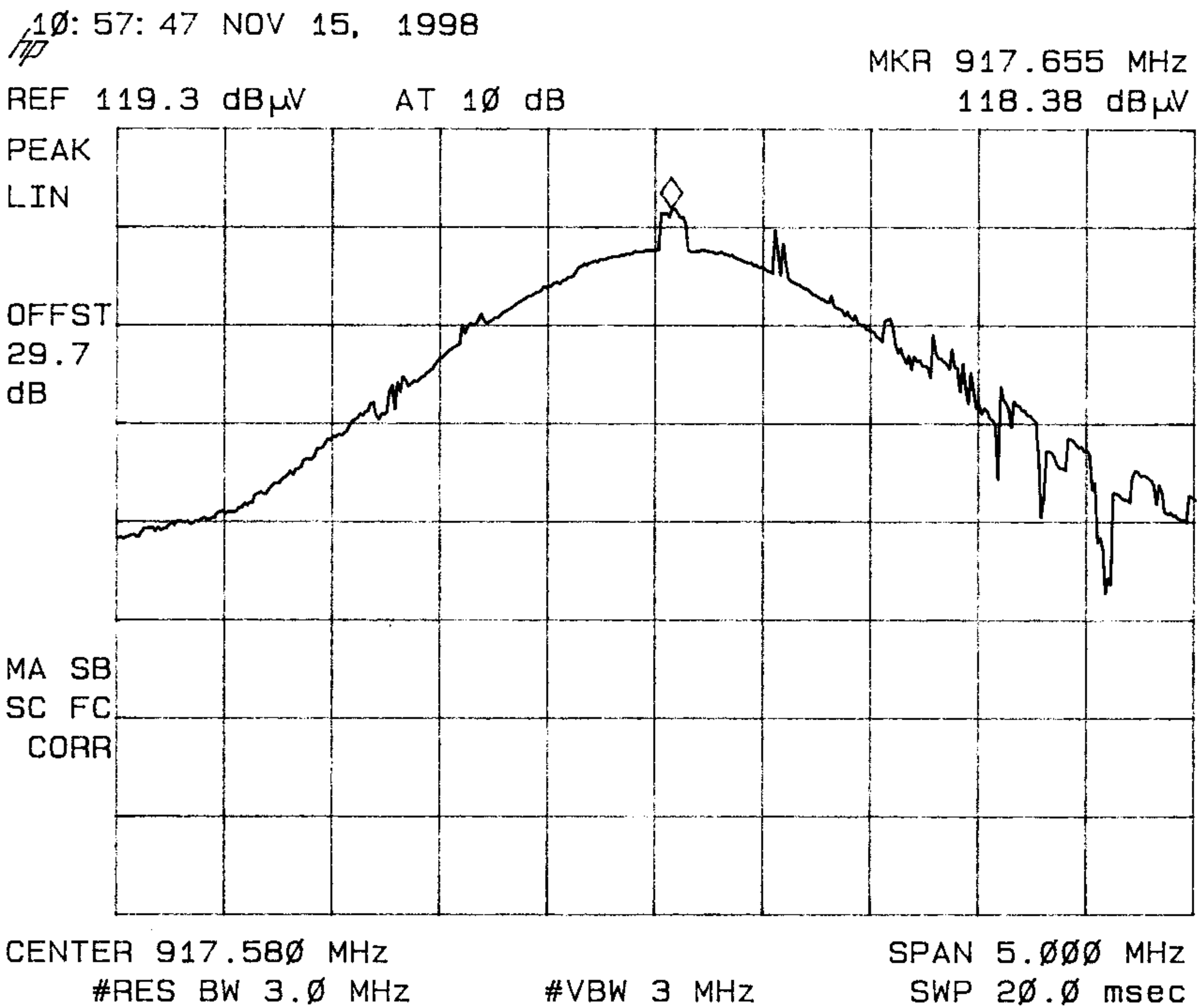
T29208 / 6dB Bandwidth for HORIZONTAL



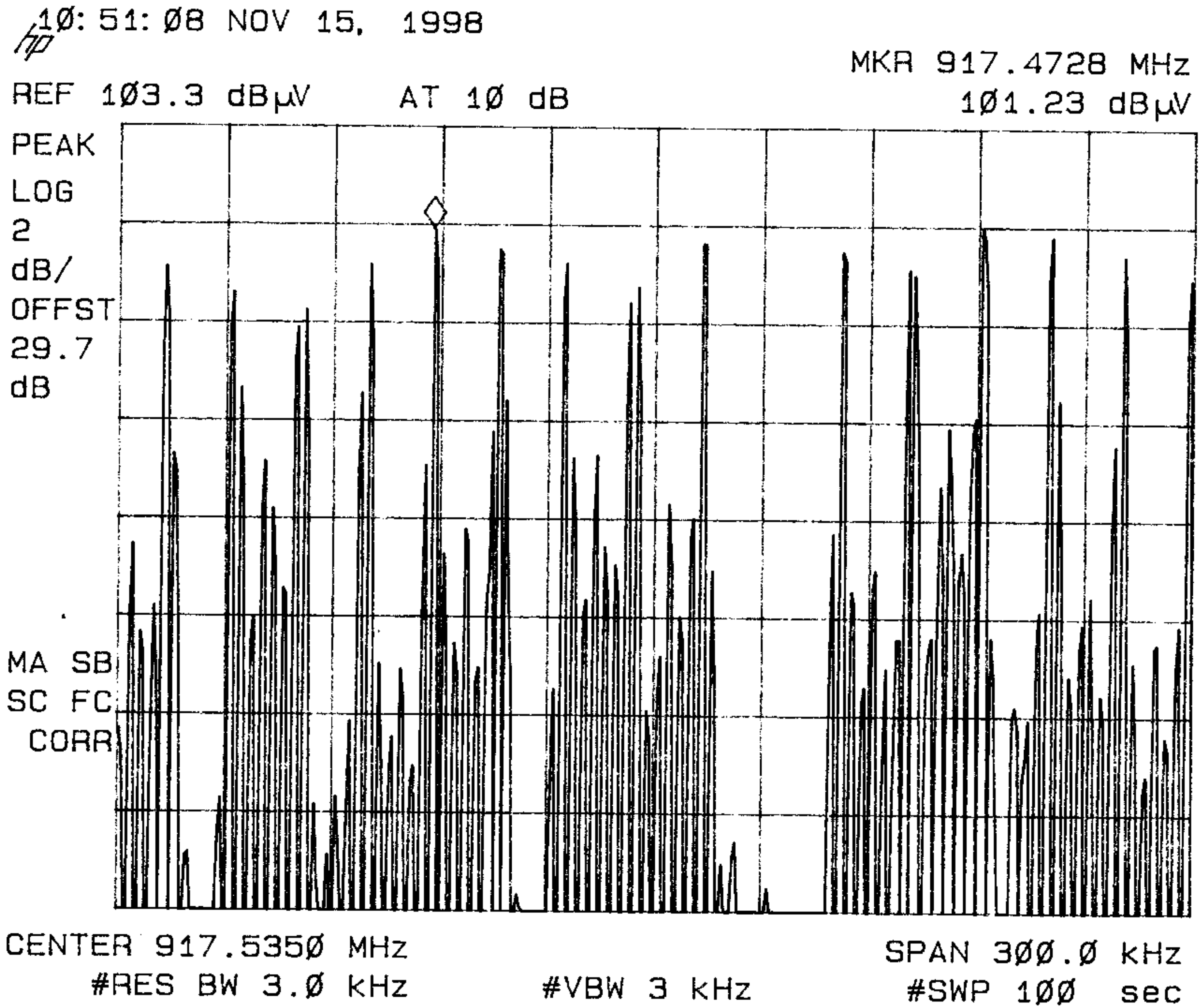
T29208 Power Output w/ HORIZONTAL



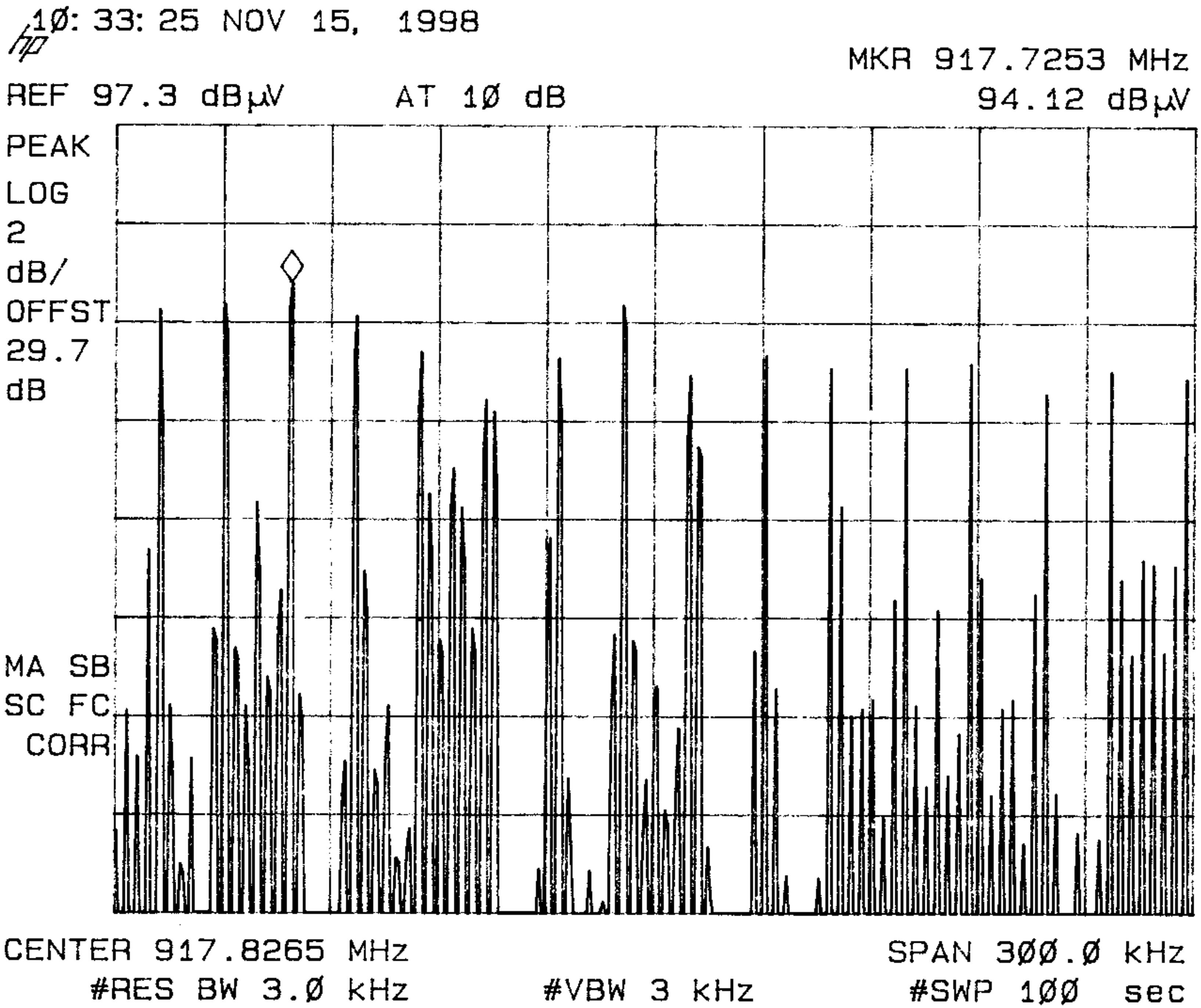
T29208 Power Output w/ VERTICAL

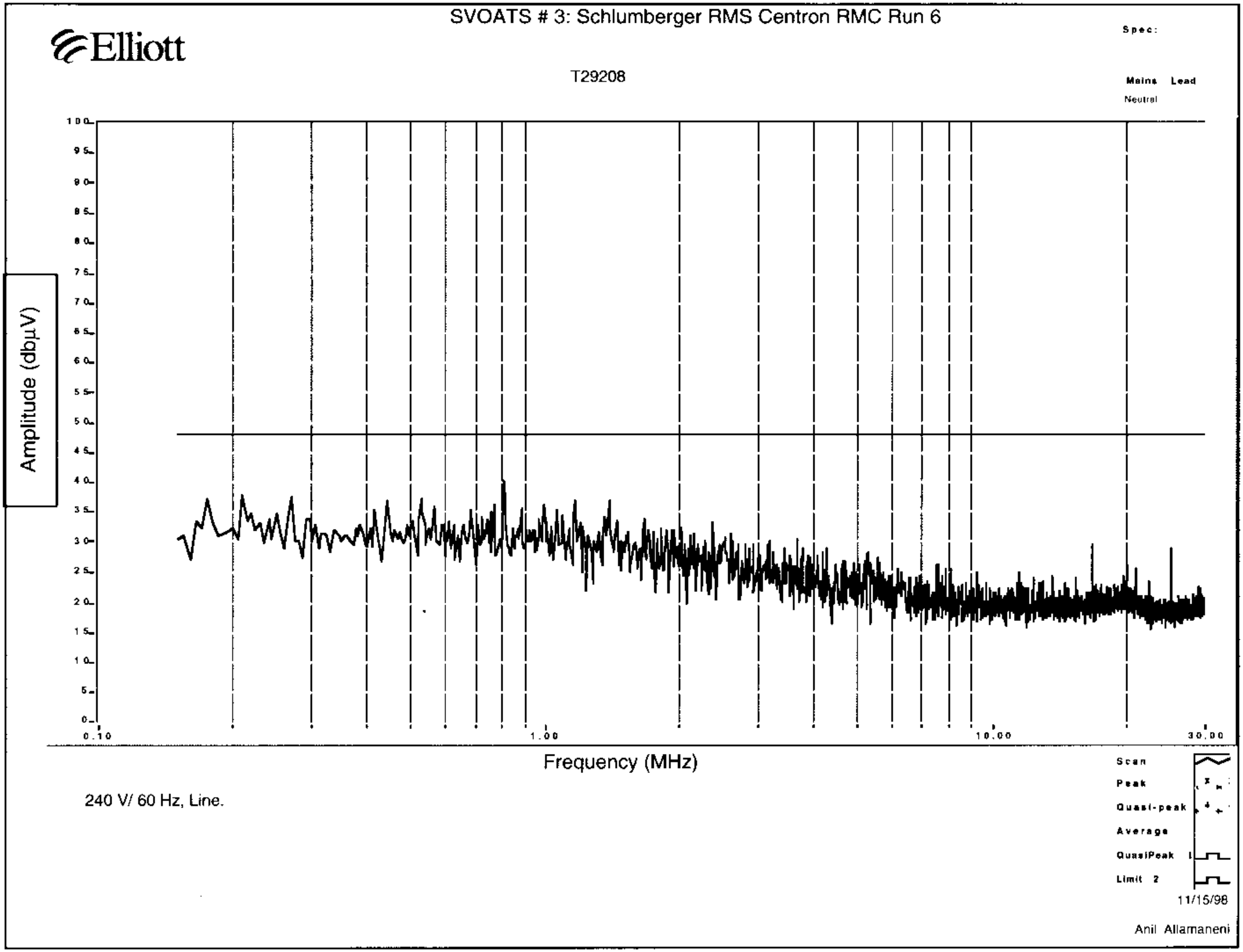


T29 208 Power Density
w/ VERTICAL



T29 208 Power Density
w/ HORIZONTAL



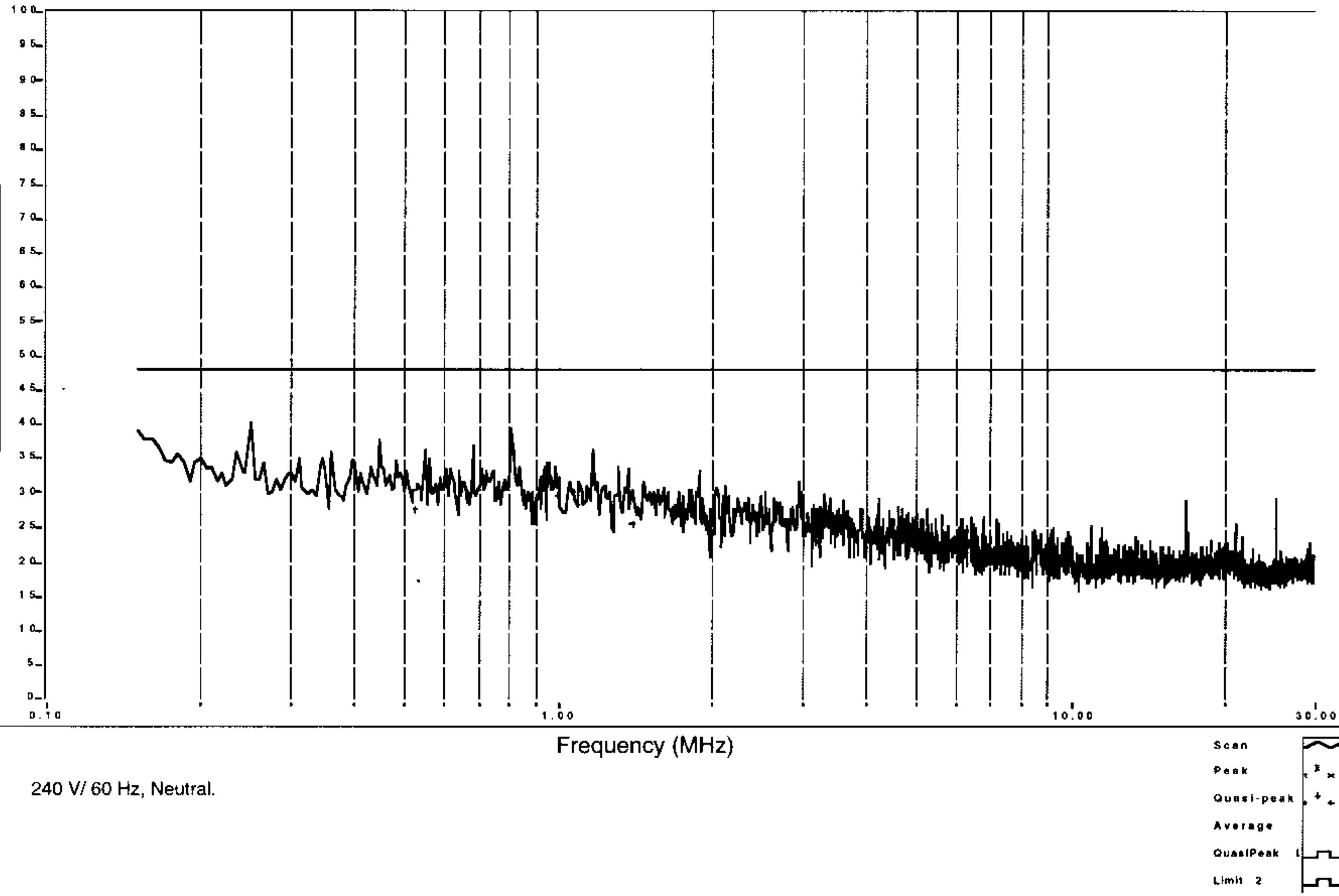


Elliott
SVOATS # 3: Schlumberger RMS Centron RMC Run 6
T29208
Spec:
Mains Lead
Neutral
Amplitude (dbµV)
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
0.10
1.00
10.00
30.00
Frequency (MHz)
240 V/ 60 Hz, Line.
Scan
Peak
Quasi-peak
Average
QuasiPeak 1
Limit 2
11/15/98
Anil Allamaneni

Elliott

SVOATS # 3: Schlumberger RMS Centron RMC Run 6

T29208



240 V/ 60 Hz, Neutral.

11/15/98

Anil Allamaneni

Test Name: **Processing Gain** **Test #: 3.B.1**
Test Summary: Verifies compliance to receiver processing gain specification at +25°C with an input signal level of -104 dBm.
Applies to Specification 3.2.2.7

Pass / Fail Criteria:
Every point must exhibit => 12 dB process gain. (FCC Requirement ≥ 10 dB)

Required Test Equipment:
HP9664B Signal Generator
Variable attenuator(s)
Power supply
Boonton Power Meter
HP8594E Spectrum Analyzer
IBM PC compatible computer with serial interface
Transceiver power cable, twisted pair, extended length
Transceiver serial cable, RJ45, extended length

Equipment Set Up:
The processing gain of the DSP receiver is measured by the spread signal to unspread signal method whereby a CW signal is injected in 50 KHz intervals from 917.3800 to 917.7800 MHz. The difference (in dB) of the correlated spread signal level applied separately, is the system process gain.

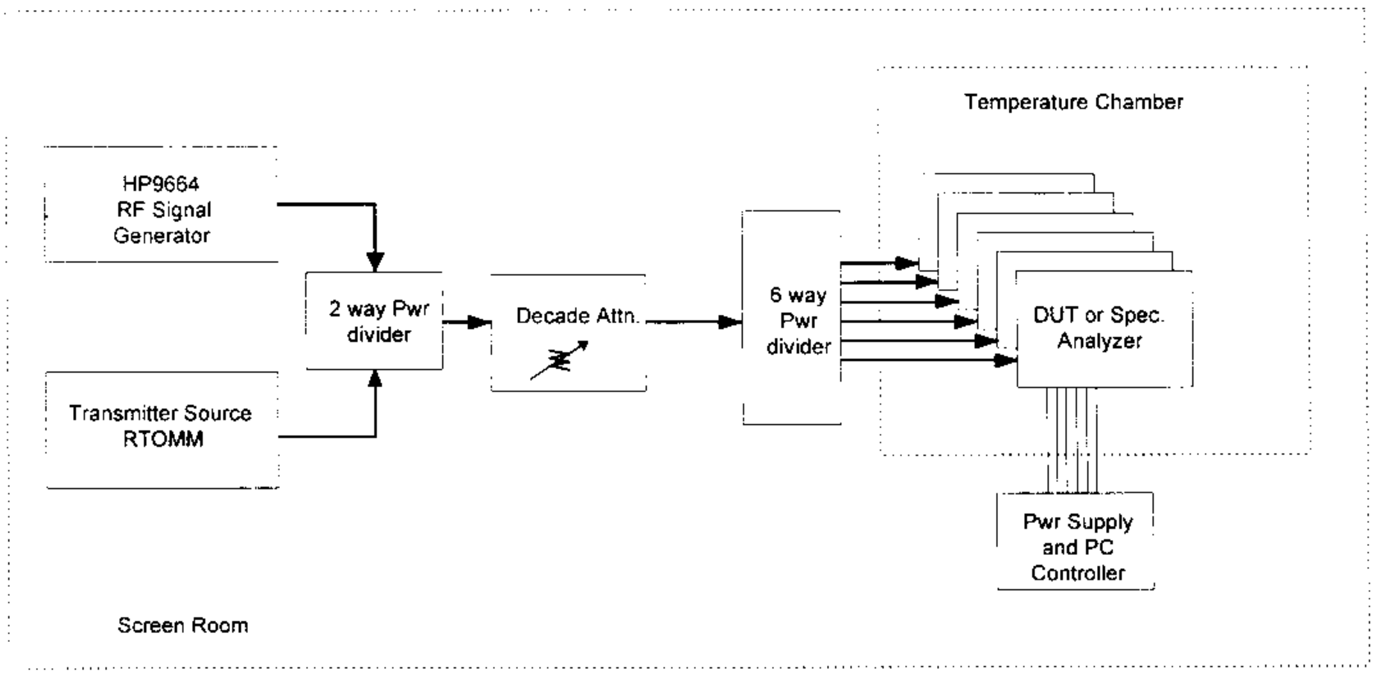
1. Each transceiver receive section will be programmed with default parameters using appropriate software/firmware. Select a receive frequency of 917.58 MHz for all tests.

2. HP9664A Signal Generator:
   Center Frequency = 917.38000 MHz
   Signal Level = -30 dBm

3. HP8594E Spectrum Analyzer
   Resolution Bandwidth = 3 MHz
   Video Bandwidth = 1 MHz
   Sweep = 50 msec
   Span = 0 MHz
   Attenuation = 10 dB

4. Variable Attenuator = as required to achieve a -95 dBm spread signal.

Note: Ensure that all test equipment has been warmed up for 30 minutes and calibrated before measurements are taken.



3.B.1 Test Configuration for Process Gain

Procedure:

1. Place the transceiver(s) to be tested in the temperature chamber.
2. Label and route each wire and cable described below outside the temperature chamber.
3. Use the transceiver power cable to connect the device under test to the DC supply. Set the DC supply to provide 13.5 VDC to the device under test.
4. Determine the amount of power difference between the injected spread signal at 917.58 MHz and the injected CW signal at 917.58 MHz that produced the same signal level on the spectrum analyzer.
   a. Measure and record the power of the spread signal present at the input to any one of the DUTs by connecting it to the spectrum analyzer. Measure power during preamble portion of the message packet.
   b. Then, after turning the Spread signal OFF and switching ON the CW signal, measure and record the power of the CW signal present at the input of the same DUT by routing again the spectrum analyzer.
   c. Determine a calibration factor based on the difference between the measurements made in steps a. and b. This amount of attenuation shall be added or removed (as appropriate) from the circuit when configured for CW input measurements.
5. Apply a spread signal to the receiver. Record the indicated level of this signal after correlation.
6. Reconfigure the set-up to apply a CW signal at 917.58 MHz to the DSP input.
7. Apply (or remove) the appropriate amount of attenuation, as determined in step 4 above, such that the CW signal is at the same indicated input power level as the spread signal from step 5.
8. Input a spread signal level at - 80 dBm at 917.58 MHz, and then, input a CW signal beginning at 917.3800 MHz, and increment up in 50 KHz steps to 917.7800, record the delta (change in attenuator settings) that produces the same indicated output for the CW signal as the - 80 dBm spread signal. The indicated output is first of the last three bites in the reported packet as is a number between 0 and 255 which roughly corresponds to -128 and -30 dBm respectively.
9. Determine average process gain by averaging the linear equivalent in Watts of the values in the table below and then converting back to dB's.

PROCESS CAIN TEST

+25 C (only)	Frequency Offset (KHz)								
UNIT #	**-200**	**-150**	**-100**	**-50**	**0**	**+50**	**+100**	**+150**	**+200**
1	*14.8*	*14.5*	*14.5*	*14.0*	*15.0*	*14.4*	*15.0*	*15.7*	*15.1*
2	*16.3*	*16.0*	*15.7*	*15.0*	*15.0*	*15.7*	*16.1*	*17.0*	*16.2*
3	*16.2*	*15.8*	*15.7*	*15.2*	*16.0*	*15.8*	*16.4*	*16.6*	*16.6*
4	*16.0*	*16.0*	*15.0*	*14.4*	*15.0*	*14.5*	*15.3*	*15.6*	*15.5*
Pass/Fail (dB)	**≥ 12**	**≥ 12**	**≥ 12**	**≥ 12**	**≥ 12**	**≥ 12**	**≥ 12**	**≥ 12**	**≥ 12 dB**

DUT # 1 Average Process Gain = *14.8* dB
DUT # 2 Average Process Gain = *16.0* dB
DUT # 3 Average Process Gain = *16.1* dB
DUT # 4 Average Process Gain = *15.3* dB

Acceptance Block:	**A signature below denotes that this test has met all pass criteria.**
Signature:	*Gordon Furze* Gordon Furze
Date:	*July 30, 1997* July 30 1997

Elliott EMC Test Log

Client:	Schlumberger RMS	Date:	11/16/98	Test Engr:	Jay Dickinson
Product:	Centron RMC	File:	T29209	Proj. Eng:	Mark Briggs
Objective:	Final Qualification	Site:	SVOATS # 3	Contact:	Bill Larsen
Spec:	FCC Part 15	Page:	1 of 3	Approved:	
Revision	Final 1.0				

Ambient Conditions
Temperature: 16 °C
Humidity: 70 %

Test Objective

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

Test Summary

Run #1 - Maximized Radiated Spurious Emissions, 1-10 GHz

PASS Results: §15.247 (c) -7.0 dB Pk @ 2752.74 MHz Horizontal

Equipment Under Test (EUT) General Description

The EUT is a solid state electricity meter with an integrated Cellnet RF transmitter. . Normally, the EUT would be placed into a wall mounted meter socket. For the purpose of testing the EUT was treated as table top equipment. The electrical rating of the EUT is **240** V, **60** Hz.

Equipment Under Test (EUT)

Manufacturer/Model/Description	Serial Number	FCC ID Number
Schlumberger RMS/ Centron RMC/Transmitter	1836954	F9CC1C-1

Power Supply and Line Filters

The power supply is built into the transmitter printed circuit board and receive its power via a dropper capacitor.

Printed Wiring Boards in EUT

The following information was provided by the manufacturer:

Manufacturer/Description	Assembly #	Rev.	Serial Number	Crystals (MHz)
Schlumberger RMS/ Main Tx PCB	442057-001	9	C182	14.56 , 0.032768
Schlumberger RMS/ Metrology PCB	442093-001	14	P6552	4.19

Elliott

EMC Test Log

Client:	Schlumberger RMS	Date:	11/16/98	Test Engr:	Jay Dickinson
Product:	Centron RMC	File:	T29209	Proj. Eng:	Mark Briggs
Objective:	Final Qualification	Site:	SVOATS # 3	Contact:	Bill Larsen
Spec:	FCC Part 15	Page:	2 of 3	Approved:	
Revision	Final 1.0				

Subassemblies in EUT

Manufacturer/Description	Assembly Number	Rev.	Serial Number
None			

EUT Enclosure(s)

The EUT is enclosed in a molded plastic housing for a residential utility meter. It measures approximately 17 cm deep by 16 cm diameter.

EMI Suppression Devices (filters, gaskets, etc.)

Description	Manufacturer	Part Number
None		

Local Support Equipment

Manufacturer/Model/Description	Serial Number	FCC ID Number
Elliott TC-2000 Step up transformer	263	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 transmit once per second.

Elliott

EMC Test Log

Client:	Schlumberger RMS	Date:	11/16/98	Test Engr:	Jay Dickinson
Product:	Centron RMC	File:	T29209	Proj. Eng:	Mark Briggs
Objective:	Final Qualification	Site:	SVOATS # 3	Contact:	Bill Larsen
Spec:	FCC Part 15	Page:	3 of 3	Approved:	
Revision	Final 1.0				

General Test Conditions

During radiated testing, the 120V, 60Hz host input power was connected to Elliott Lab step up transformer which provided 240V, 60Hz power to the EUT. During testing the EUT was placed on the table top and the transformer was located on the turntable.

Test Data Tables

See attached data

Elliott **Emissions Test Data**

Client:	Schlumberger RMS	Date:	11/16/98	Test Engr:	Jay Dickinson
Product:	Centon RMC	File:	T29209	Proj. Engr:	Mark Briggs
Objective	Final Qualification	Site:	SVOATS #3	Contact:	Bill Larsen
Spec:	FCC part 15	Distance:	3 m	Approved:	

Frequency MHz	Level dBuV/m	Pol v/h	FCC B Limit	FCC B Margin	Detector Pk/QP/Avg	Azimuth degrees	Height meters	Comments
2752.740	67.0	h	74.0	**-7.0**	Pk	0	1.0	**Note 1**
5505.480	46.7	v	54.0	**-7.3**	Ave	0	1.0	**Note 1, Note 2**
3670.320	65.5	h	74.0	**-8.5**	Pk	0	1.0	**Note 1**
5505.480	43.8	h	54.0	**-10.2**	Ave	0	1.0	**Note 1, Note 2**
4587.900	43.4	h	54.0	**-10.6**	Ave	0	1.0	**Note 1, Note 2**
2752.740	63.2	v	74.0	**-10.8**	Pk	0	1.0	**Note 1**
3670.320	62.6	v	74.0	**-11.4**	Pk	0	1.0	**Note 1**
6423.060	42.0	h	54.0	**-12.0**	Ave	0	1.0	**Note 1, Note 2**
7340.640	41.9	h	54.0	**-12.1**	Ave	0	1.0	**Note 1, Note 2**
5505.480	59.7	h	74.0	**-14.3**	Pk	0	1.0	**Note 1**
5505.480	59.3	v	74.0	**-14.7**	Pk	0	1.0	**Note 1**
9175.800	38.8	v	54.0	**-15.2**	Ave	0	1.0	**Note 1, Note 2**
9175.800	38.8	h	54.0	**-15.2**	Ave	0	1.0	**Note 1, Note 2**
6423.060	38.2	v	54.0	**-15.8**	Ave	0	1.0	**Note 1, Note 2**
4587.900	58.1	v	74.0	**-15.9**	Pk	0	1.0	**Note 1**
6423.060	57.9	h	74.0	**-16.1**	Pk	0	1.0	**Note 1**
7340.640	57.8	h	74.0	**-16.2**	Pk	0	1.0	**Note 1**
7340.640	37.2	v	54.0	**-16.8**	Ave	0	1.0	**Note 1, Note 2**
8258.220	37.1	h	54.0	**-16.9**	Ave	0	1.0	**Note 1, Note 2**
8258.220	36.6	v	54.0	**-17.4**	Ave	0	1.0	**Note 1, Note 2**
4587.900	56.4	h	74.0	**-17.6**	Pk	0	1.0	**Note 1**
9175.800	54.7	v	74.0	**-19.3**	Pk	0	1.0	**Note 1**
9175.800	54.7	h	74.0	**-19.3**	Pk	0	1.0	**Note 1**
6423.060	54.1	v	74.0	**-19.9**	Pk	0	1.0	**Note 1**
7340.640	53.1	v	74.0	**-20.9**	Pk	0	1.0	**Note 1**
8258.220	53.0	h	74.0	**-21.0**	Pk	0	1.0	**Note 1**
8258.220	52.5	v	74.0	**-21.5**	Pk	0	1.0	**Note 1**
1835.160	78.2	h	101.0	**-22.8**	Pk	0	1.0	
1835.160	75.8	v	101.0	**-25.2**	Pk	0	1.0	
4587.900	27.9	v	54.0	**-26.1**	Ave	0	1.0	**Note 1, Note 2**
3670.320	26.2	h	54.0	**-27.8**	Ave	0	1.0	
3670.320	26.1	v	54.0	**-27.9**	Ave	0	1.0	
2752.740	25.4	v	54.0	**-28.6**	Ave	0	1.0	
2752.740	25.4	h	54.0	**-28.6**	Ave	0	1.0	

Note1: Use 1.4GHz High Pass Filter
Note 2: Ave. Meas. recorded by adding the DC correction factor (-15.9dB) to PK Meas.