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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-RMS Div Model: BAMM-CCSK

FCC ID:	F9C-CBAMM
GRANTEE:	Schlumberger - RMS Div. 125 Shoreway Road San Carlos, CA 94070
TEST SITE:	Elliott Laboratories, Inc. 684 W. Maude Avenue Sunnyvale, CA 94086
REPORT DATE:	September 27, 2001
FINAL TEST DATE:	September 21, 2001

AUTHORIZED SIGNATORY: _____

Mark Briggs
Director of Engineering

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SCOPE

An electromagnetic emissions test has been performed on the Schlumberger - RMS Div. Wireless electric meter model BAMM-CCSK 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 - RMS Div. model BAMM-CCSK and therefore apply only to the tested sample. The sample was selected and prepared by Jeff Webster of Schlumberger - RMS Div.

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 - RMS Div. model BAMM-CCSK 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 - RMS Div. model BAMM-CCSK. 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.

120V, 60Hz

Frequency MHz	Level dBuV	Power Lead	FCC B Limit	FCC B Margin	Detector QP/Ave	Comments
0.8072	34.8	Neutral	48.0	-13.2	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.

CCSK modulation

Frequency MHz	Level dBuV/m	Pol v/h	FCC 15.247 Limit	FCC 15.247 Margin	Detector Pk/QP/Avg	Azimuth degrees	Height meters	Comments
2752.866	52.7	V	54.0	-1.3	Avg	0	1.0	

OOK modulation

Frequency MHz	Level dBuV/m	Pol v/h	FCC 15.247 Limit	FCC 15.247 Margin	Detector Pk/QP/Avg	Azimuth degrees	Height meters	Comments
2752.418	71.5	H	74.0	-2.5	Pk	0	1.0	

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 23.8 dBm at 917.355 MHz using OOK modulation. The maximum power output was 23.04 dBm at 917.655 MHz using CCSK modulation. The minimum 6 dB bandwidth was 1.42 Megahertz at 917.58 MHz using OOK The minimum 6 dB bandwidth was 1.48 Megahertz at 917.58 MHz using CCSK modulation. The maximum power spectral density was 5.83 dBm at 917.355 MHz using OOK modulation. The maximum power spectral density was 4.84 dBm at 917.409 MHz using CCSK modulation. 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 - RMS Div. model BAMM-CCSK is a Wireless electric meter. The sample was received on September 9, 2001 and tested on September 21, 2001. The EUT consisted of the following component(s):

Manufacturer/Model/Description	Serial Number
Schlumberger/BAMM-CCSK/Wireless Electric Meter	N/A

ENCLOSURE

The EUT enclosure is primarily constructed of fabricated sheet steel. It measures approximately 30 cm wide by 20 cm deep by 15 cm high.

SUPPORT EQUIPMENT

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

Manufacturer	Model	Description	Serial Number	FCC ID
BK Precission	1682	DC Supply	282-00102	N/A
Cellnet	26-3500	Universal Shooter	N/A	N/A
Cellnet	26-0612	Lan Transceiver	N/A	N/A
Laptop	Dell	PPL	0009321C-12800-8514-1519	DoC

EXTERNAL I/O CABLING

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

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length (m)
AC	EUT	3 prong USA	Unshielded	1.8

TEST SOFTWARE

Transmitter was program to transmit either CCSK or OOK modulations at full power.

TEST SITE

GENERAL INFORMATION

Final test measurements were taken on September 21, 2001 at the Elliott Laboratories Open Area Test Site #2 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 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 & 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.

POWER METER

A power meter and thermister mount are used for all direct output power measurements from transmitters as they provide a broadband indication of the power output.

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 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 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

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

Radiated Emissions, 30 - 9175.8 MHz, 21-Sep-01 02:18 PM
Engineer: jmartinez

Manufacturer	Description	Model #	Assett #	Cal interval	Last Calibrated	Cal Due
EMCO	Horn Antenna, D. Ridge 1-18GHz	3115	868	12	10/26/00	10/26/01
EMCO	Log Periodic Antenna, 0.2-1 GHz	3146	1294	12	3/27/01	3/27/02
Filtek	High Pass Filter, 1GHz	HP12/1000-5BA	957	12	3/27/01	3/27/02
Hewlett Packard	EMC Spectrum Analyzer 9kHz - 6.5GHz	8595EM	787	12	2/14/01	2/14/02
Hewlett Packard	High Pass filter, 1.5GHz	P/N 84300-80037	1158	12	2/28/01	2/28/02
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	263	12	8/21/01	8/21/02
Hewlett Packard	Spectrum Analyzer 9KHz - 26GHz	8563E	284	12	2/22/01	2/22/02
Rohde & Schwarz	Test Receiver, 20-1300 MHz	ESVP	1317	12	5/9/01	5/9/02

EXHIBIT 2: Test Data Log Sheets

ELECTROMAGNETIC EMISSIONS

TEST LOG SHEETS

AND

MEASUREMENT DATA

T44708 (4 pages), T44709 (18 Pages)

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EMC Test Data

Client:	Schlumberger	Job Number:	J44691
Model:	BAMM-CCSK	T-Log Number:	T44709
		Proj Eng:	Mark Briggs
Contact:	Jeff Webster		
Emissions Spec:	FCC 15.247	Class:	Transmitter
Immunity Spec:	-	Environment:	-

EMC Test Data

For The

Schlumberger

Model

BAMM-CCSK

Client:	Schlumberger	Job Number:	J44691
Model:	BAMM-CCSK	T-Log Number:	T44709
		Proj Eng:	Mark Briggs
Contact:	Jeff Webster		
Emissions Spec:	FCC 15.247	Class:	Transmitter
Immunity Spec:	-	Environment:	-

EUT INFORMATION

General Description

The EUT is a Wireless Electric Meter which is designed to to provide electric home usage to Electric company Utility every once a mont. Normally, the EUT would be placed on a table top during operation. The EUT was, therefore, treated as table-top equipment during testing to simulate the end user environment. The electrical rating of the EUT is 120 V, 60 Hz, .05 Amps.

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
Schlumberger	BAMM-CCSK	Wireless Electric meter	N/A	

EUT Enclosure

The EUT enclosure is primarily constructed of fabricated sheet steel. It measures approximately 30 cm wide by 20 cm deep by 15 cm high.

Modification History

Mod. #	Test	Date	Modification
1	-	-	None

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EMC Test Data

Client:	Schlumberger	Job Number:	J44691
Model:	BAMM-CCSK	T-Log Number:	T44709
		Proj Eng:	Mark Briggs
Contact:	Jeff Webster		
Emissions Spec:	FCC 15.247	Class:	Transmitter
Immunity Spec:	-	Environment:	-

Test Configuration #1

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
None				

Remote Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
BK Precission	1682	DC Supply	282-00102	N/A
Cellnet	26-3500	Universal Shooter	N/A	N/A
Cellnet	26-0612	Lan Transceiver	N/A	N/A
Laptop	Dell	PPL	0009321C-12800-8514-1519	DoC

Interface Ports

		Cable(s)		
Port	Connected To	Description	Shielded or Unshielded	Length(m)
AC	EUT	3 prong USA	Unshielded	1.8

EUT Operation During Emissions

Transmitting continously at full power.

Client:	Schlumberger	Job Number:	J44691
Model:	BAMM-CCSK	T-Log Number:	T44709
		Proj Eng:	Mark Briggs
Contact:	Jeff Webster		
Spec:	FCC 15.247	Class:	N/A

Radiated Emissions

Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 9/13/2001 & 9/21/2001
Test Engineer: Elijah/Juan
Test Location: SVOATS #2
Config. Used: 1
Config Change: None
EUT Voltage: 120V/60Hz

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated spurious emissions testing.

For radiated emissions testing the measurement antenna was located 3 meters from the EUT. Since the Transmitter antenna is permantely attach all measurements were taken in field strength levels

Ambient Conditions:

Temperature: 23.9°C
Rel. Humidity: 47%

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	RE, 30 - 9175.8 MHz - Spurious Emissions	FCC Part 15.209 / 15.247(c)	Pass	-1.29dB @ 2752.866MHz
2	6dB Bandwidth	15.247(a)	Pass	1.48 MHz
3	Output Power	15.247(b)	Pass	23 dBm
4	Power Spectral Density (PSD)	15.247(d)	Pass	4.84 dBm
5	Bandedge Measurement	15.247(c)	Pass	Refer to plot
6	Processing Gain	15.247(e)	N/A	Manufacturer to provide data.

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

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EMC Test Data

Client:	Schlumberger	Job Number:	J44691
Model:	BAMM-CCSK	T-Log Number:	T44709
		Proj Eng:	Mark Briggs
Contact:	Jeff Webster		
Spec:	FCC 15.247	Class:	N/A

Run #1: Radiated Spurious Emissions, 30-9175.8 MHz. Single Channel @ 917.58 MHz, CCSK Modulation.

	H	V
Fundamental emission level @ 3m in 100kHz RBW:	113	118
Limit for emissions outside of restricted bands:	98 dBμV/m	

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2752.866	52.7	V	54.0	-1.3	Avg	0	1.0	Restricted emission. Note 1& 2
2752.629	72.4	V	74.0	-1.6	Pk	0	1.0	Restricted emission. Note 1
3670.515	52.4	H	54.0	-1.6	Avg	32	1.3	Restricted emission. Note 1& 2
3670.291	72.1	H	74.0	-1.9	Pk	32	1.3	Restricted emission. Note 1
2752.932	52.1	H	54.0	-2.0	Avg	359	1.5	Restricted emission. Note 1& 2
2752.629	71.8	H	74.0	-2.3	Pk	359	1.5	Restricted emission. Note 1
4588.275	49.8	V	54.0	-4.2	Avg	360	1.0	Restricted emission. Note 1& 2
4587.173	69.5	V	74.0	-4.5	Pk	361	1.0	Restricted emission. Note 1
3670.093	49.1	V	54.0	-4.9	Avg	0	0.0	Restricted emission. Note 1& 2
3670.583	68.8	V	74.0	-5.2	Pk	0	0.0	Restricted emission. Note 1
4587.862	45.6	H	54.0	-8.4	Avg	330	1.0	Restricted emission. Note 1& 2
4587.862	65.3	H	74.0	-8.7	Pk	330	1.0	Restricted emission. Note 1
611.000	35.2	v	46.0	-10.8	Pk	0	1.0	Restricted emission. Note 1
611.000	33.0	h	46.0	-13.0	Pk	0	1.0	Restricted emission. Note 1
7340.000	40.5	H	54.0	-13.5	Avg	328	1.4	Restricted emission. Note 1& 2
450.000	32.3	h	46.0	-13.7	Pk	123	1.0	Non-restricted. Note 1
7340.000	60.2	H	74.0	-13.8	Pk	328	1.4	Restricted emission. Note 1
450.000	31.2	v	46.0	-14.8	Pk	123	1.1	Non-restricted. Note 1
961.000	38.9	v	54.0	-15.1	Pk	0	1.0	Restricted emission. Note 1,3
8258.000	38.5	H	54.0	-15.5	Avg	328	1.4	Restricted emission. Note 1& 2
8258.000	58.2	H	74.0	-15.8	Pk	328	1.4	Restricted emission. Note 1
7340.000	37.1	V	54.0	-16.9	Avg	300	1.5	Restricted emission. Note 1& 2
7340.000	56.8	V	74.0	-17.2	Pk	300	1.5	Restricted emission. Note 1
8258.000	36.0	V	54.0	-18.0	Avg	300	1.5	Restricted emission. Note 1& 2
8258.000	55.7	V	74.0	-18.3	Pk	300	1.5	Restricted emission. Note 1
961.000	32.3	h	54.0	-21.7	Pk	0	1.0	Restricted emission. Note 1,3
1835.160	72.7	V	98.0	-25.3	Pk	51	1.3	Non-restricted. Note 1
1835.000	69.8	H	98.0	-28.3	Pk	87	1.6	Non-restricted. Note 1
6422.822	67.9	H	98.0	-30.1	Pk	340	1.1	Non-restricted. Note 1
6422.822	66.1	V	98.0	-31.9	Pk	51	1.0	Non-restricted. Note 1
5506.027	62.1	V	98.0	-35.9	Pk	0	1.0	Non-restricted. Note 1
5506.027	60.7	H	98.0	-37.3	Pk	330	1.1	Non-restricted. Note 1

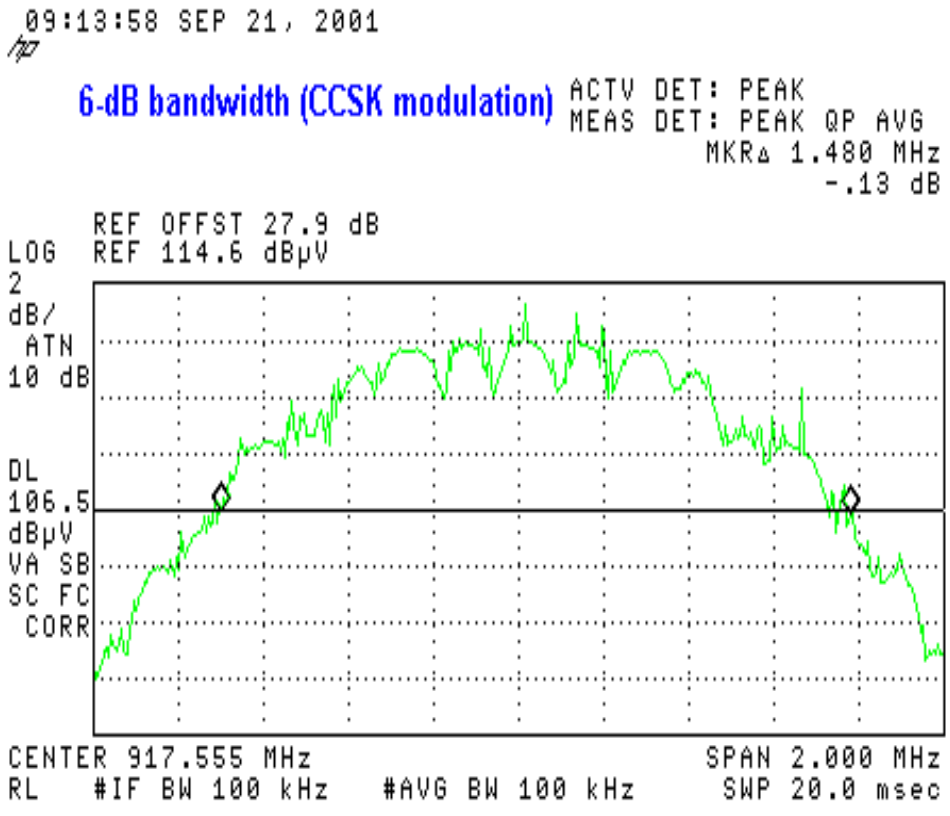
Notes on following page ...

Client:	Schlumberger	Job Number:	J44691
Model:	BAMM-CCSK	T-Log Number:	T44709
		Proj Eng:	Mark Briggs
Contact:	Jeff Webster		
Spec:	FCC 15.247	Class:	N/A

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 20dB below the level of the fundamental.
Note 2:	For Direct Sequence applied Duty Cycle (10.3mS/100mS = 19.7dB) correction factor to Peak Measurement to calculate the average value. No account made of average-to-peak difference in spread signal.
Note 3:	Peak reading compared to average or QP limit

Run #2: Signal Bandwidth

Channel	Frequency (MHz)	Resolution Bandwidth	6dB Signal Bandwidth
Mid	917.55	100 kHz	1.48 MHz



Client:	Schlumberger	Job Number:	J44691
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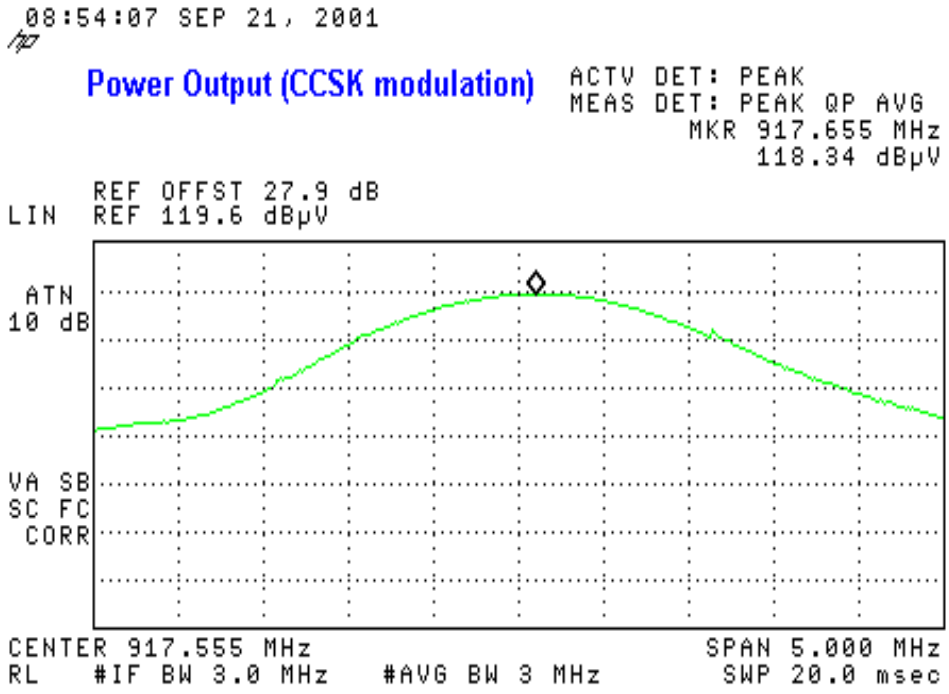
Contact:	Jeff Webster		
Spec:	FCC 15.247	Class:	N/A

Run #3: Output Power

Channel	Frequency (MHz)	Field Strength at 3m	Antenna Pol. (H/V)	Antenna Gain	Output Power (dBm)
Mid	917.55	112.9	H	0dBi	17.6
Mid	917.55	118.34	V	0dBi	23.04

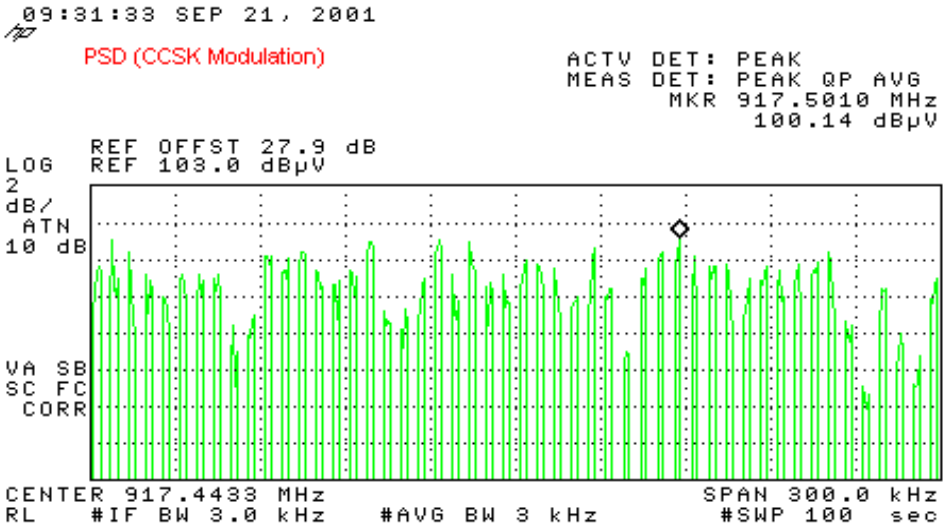


Refer to OOK data for output power level measured directly. **Actual output power is 23dBm**.

Client:	Schlumberger	Job Number:	J44691
Model:	BAMM-CCSK	T-Log Number:	T44709
		Proj Eng:	Mark Briggs
Contact:	Jeff Webster		
Spec:	FCC 15.247	Class:	N/A

Run #4: Power Spectral Density

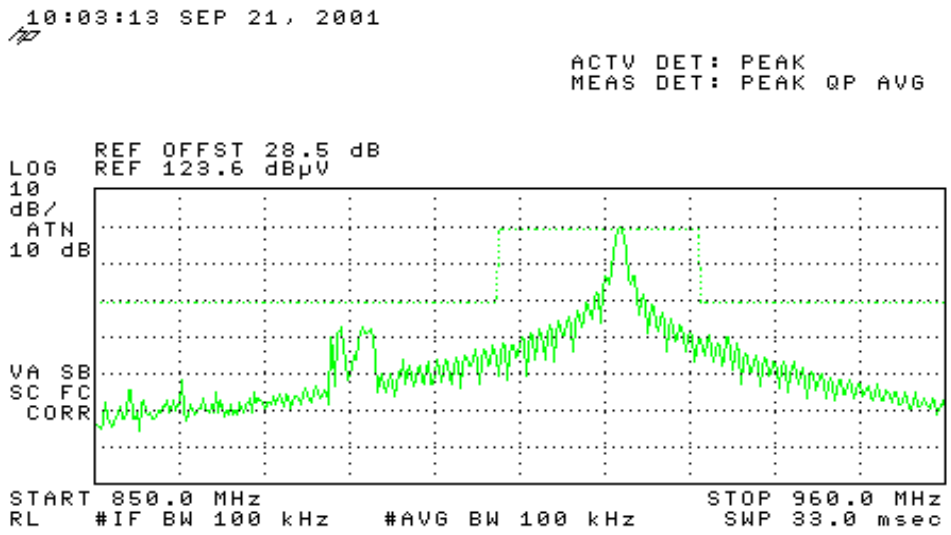
Channel	Frequency (MHz)	Field Strength at 3m	Antenna Pol. (H/V)	Res BW	P.S.D. (averaged over 1 second in a 3kHz bandwidth)
Mid	917.53	100.14	V	3 kHz	4.84



Client:	Schlumberger	Job Number:	J44691
Model:	BAMM-CCSK	T-Log Number:	T44709
		Proj Eng:	Mark Briggs
Contact:	Jeff Webster		
Spec:	FCC 15.247	Class:	N/A

Run# 5: Bandedge Measurement

Measurements made at 3m per FCC requirements.



Note 1:	Applied correction factors to measurement.

Client:	Schlumberger	Job Number:	J44691
Model:	BAMM-CCSK	T-Log Number:	T44709
		Proj Eng:	Mark Briggs
Contact:	Jeff Webster		
Spec:	FCC 15.247	Class:	N/A

Radiated Emissions

Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 9/13/2001 & 9/21/2001
Test Engineer: Elijah/Juan
Test Location: SVOATS #2
Config. Used: 1
Config Change: None
EUT Voltage: 120V/60Hz

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated spurious emissions testing.

For radiated emissions testing the measurement antenna was located 3 meters from the EUT. Since the Transmitter antenna is permantely attach all measurements were taken in field strength levels

Ambient Conditions:

Temperature: 23.9°C
Rel. Humidity: 47%

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	RE, 30 - 9175.8 MHz - Spurious Emissions	FCC Part 15.209 / 15.247(c)	Pass	-1.4dB @ 2752.521MHz
2	6dB Bandwidth	15.247(a)	Pass	1.42 MHz
3	Output Power	15.247(b)	Pass	23.8 dBm
4	Power Spectral Density (PSD)	15.247(d)	Pass	5.83 dBm
5	Bandedge Measurement	15.247(c)	Pass	Refer to plot
6	Processing Gain	15.247(e)	N/A	Manufacturer to provide data.

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Elliott

EMC Test Data

Client:	Schlumberger	Job Number:	J44691
Model:	BAMM-CCSK	T-Log Number:	T44709
		Proj Eng:	Mark Briggs
Contact:	Jeff Webster		
Spec:	FCC 15.247	Class:	N/A

Run #1: Radiated Spurious Emissions, 30-9175.8 MHz. Single Channel @ 917.58 MHz, OOK Modulation.

	H	V
Fundamental emission level @ 3m in 100kHz RBW:	114	119
Limit for emissions outside of restricted bands:	99 dBμV/m	

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2752.418	71.5	H	74.0	-2.5	Pk	0	1.0	Restricted emission. Note 1
3670.000	71.1	H	74.0	-2.9	Pk	332	1.1	Restricted emission. Note 1
2752.748	70.3	V	74.0	-3.7	Pk	31	1.1	Restricted emission. Note 1
2752.521	47.4	H	54.0	-6.6	Avg	0	1.0	Restricted emission. Note 1& 4
3670.000	47.1	H	54.0	-6.9	Avg	332	1.1	Restricted emission. Note 1& 4
3670.205	67.1	V	74.0	-6.9	Pk	282	1.1	Restricted emission. Note 1
4587.107	47.0	H	54.0	-7.0	Avg	339	1.2	Restricted emission. Note 1& 2
4588.687	46.6	V	54.0	-7.4	Avg	0	0.0	Restricted emission. Note 1& 2
2752.848	46.2	V	54.0	-7.8	Avg	31	1.1	Restricted emission. Note 1& 4
4587.862	65.9	H	74.0	-8.1	Pk	339	1.2	Restricted emission. Note 1
4587.862	65.5	V	74.0	-8.5	Pk	0	1.1	Restricted emission. Note 1
3670.154	43.1	V	54.0	-10.9	Avg	282	1.1	Restricted emission. Note 1& 4
611.000	34.3	v	46.0	-11.7	Pk	0	1.0	Restricted emission. Note 1,3
7340.000	41.4	H	54.0	-12.7	Avg	74	1.2	Restricted emission. Note 1& 2
7340.000	60.3	H	74.0	-13.8	Pk	74	1.2	Restricted emission. Note 1
611.000	31.0	h	46.0	-15.0	Pk	0	1.0	Restricted emission. Note 1,3
961.000	38.9	h	54.0	-15.1	Pk	0	1.0	Restricted emission. Note 1,3
450.000	30.2	v	46.0	-15.8	Pk	0	1.0	Non-restricted. Note 1
8258.000	37.9	V	54.0	-16.1	Avg	331	1.3	Restricted emission. Note 1& 2
450.000	29.5	h	46.0	-16.5	Pk	0	1.0	Non-restricted. Note 1
7340.000	37.0	V	54.0	-17.0	Avg	80	1.3	Restricted emission. Note 1& 2
8258.000	56.8	V	74.0	-17.2	Pk	331	1.3	Restricted emission. Note 1
961.000	36.7	v	54.0	-17.3	Pk	0	1.0	Restricted emission. Note 1,3
7340.000	55.9	V	74.0	-18.1	Pk	80	1.3	Restricted emission. Note 1
8258.000	34.8	H	54.0	-19.2	Avg	50	1.3	Restricted emission. Note 1& 2
8258.000	53.7	H	74.0	-20.3	Pk	50	1.3	Restricted emission. Note 1
1835.000	71.6	H	99.0	-27.4	Pk	130	1.1	Non-restricted. Note 1
1835.000	71.5	V	99.0	-27.5	Pk	351	1.0	Non-restricted. Note 1
6422.822	66.3	H	99.0	-32.7	Pk	55	1.0	Non-restricted. Note 1
5506.027	64.9	H	99.0	-34.1	Pk	77	1.2	Non-restricted. Note 1
6422.822	64.7	V	99.0	-34.3	Pk	47	1.1	Non-restricted. Note 1
5506.027	63.1	V	99.0	-35.9	Pk	361	1.1	Non-restricted. Note 1

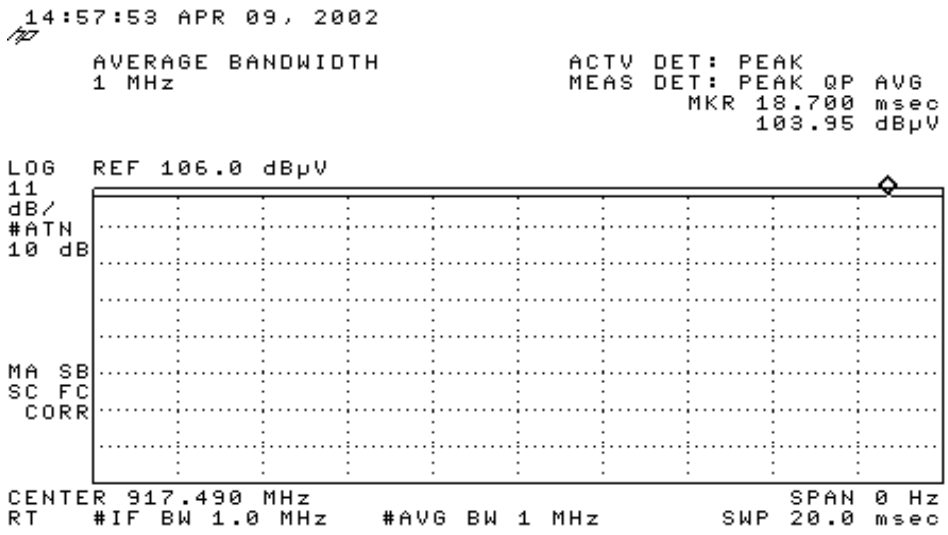
Continue on next page..

Client:	Schlumberger	Job Number:	J44691
Model:	BAMM-CCSK	T-Log Number:	T44709
		Proj Eng:	Mark Briggs
Contact:	Jeff Webster		
Spec:	FCC 15.247	Class:	N/A

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 20dB below the level of the fundamental.
Note 2:	For Direct Sequence applied Duty Cycle (-13.15 dB) correction and Peak-to-average correction factor (-5.8dB) to Peak Measurement to calculate the average value. See plots below:
Note 3:	Peak reading compared to average or QP limit
Note 4:	Applied Duty Cycle (-13.15 dB) correction and Peak-to-average correction factor (-11dB) to Peak Measurement to calculate the average value. See plots below:

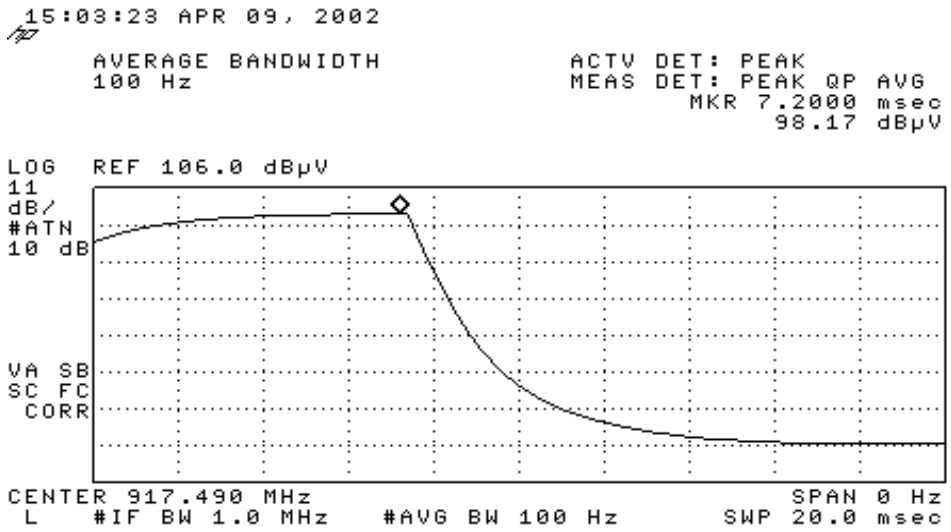
The graphs and table below demonstrate how the peak to average correction factor was determined. Due to the low duty cycle of the equipment the correction was applied to the peak levels of the recorded signal. The difference between the peak reading and the average reading for the fundamental signal is 5.78dB. For the 2.75GHz and 3.67GHz signals the difference is > 11dB. The maximum duty cycle (measured over a 100mS period) is 22mS/100mS (22%), which gives a duty cycle correction of 13.15dB.
The total correction factor applied to the peak reading to calculate the average value of the signal was 18.9 dB.

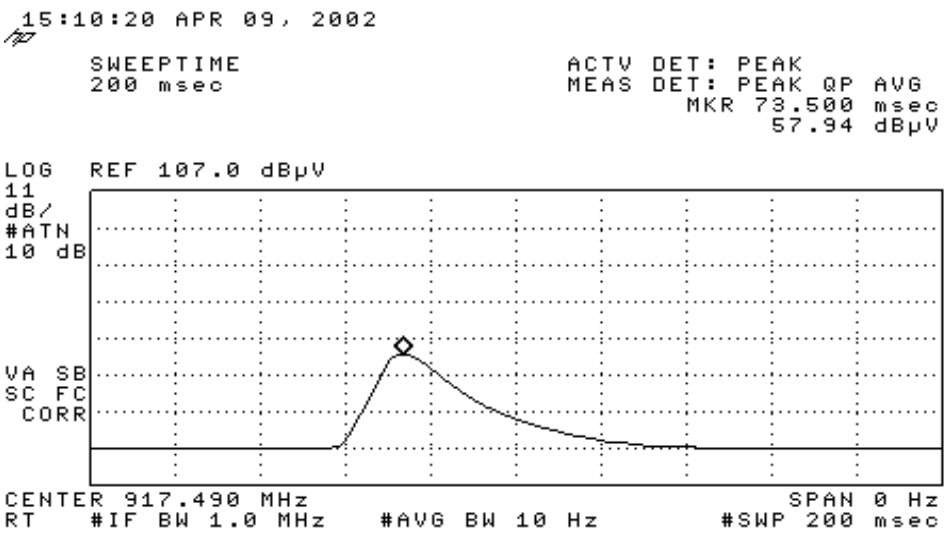
RBW	VBW	Signal Level
1 MHz	1 MHz	103.95 dBuV
1 MHz	100 kHz	103.95 dBuV
1 MHz	10kHz	99.88 dBuV
1 MHz	1kHz	98.73 dBuV
1 MHz	100Hz	98.17 dBuV
1 MHz	10Hz	57.96 dBuV



continued plots on following page ...

Client:	Schlumberger	Job Number:	J44691
Model:	BAMM-CCSK	T-Log Number:	T44709
		Proj Eng:	Mark Briggs
Contact:	Jeff Webster		
Spec:	FCC 15.247	Class:	N/A

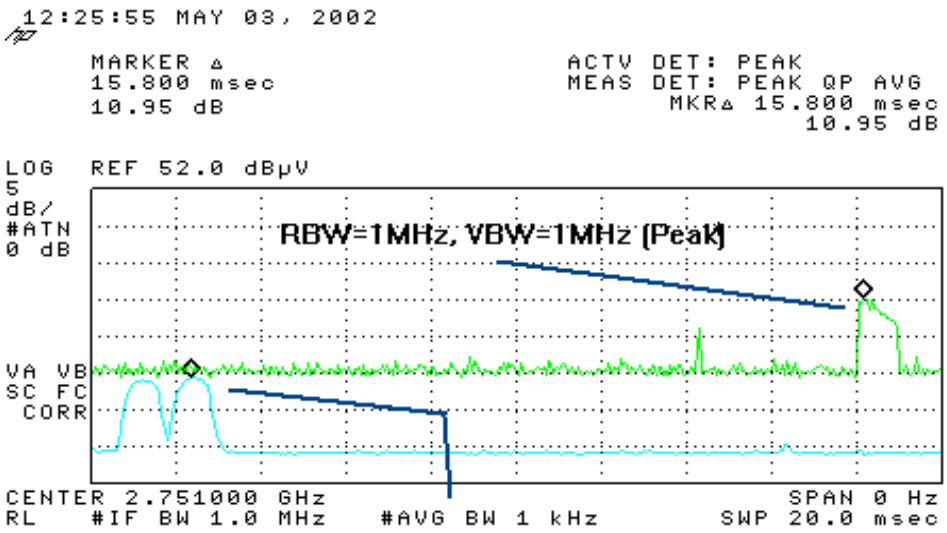


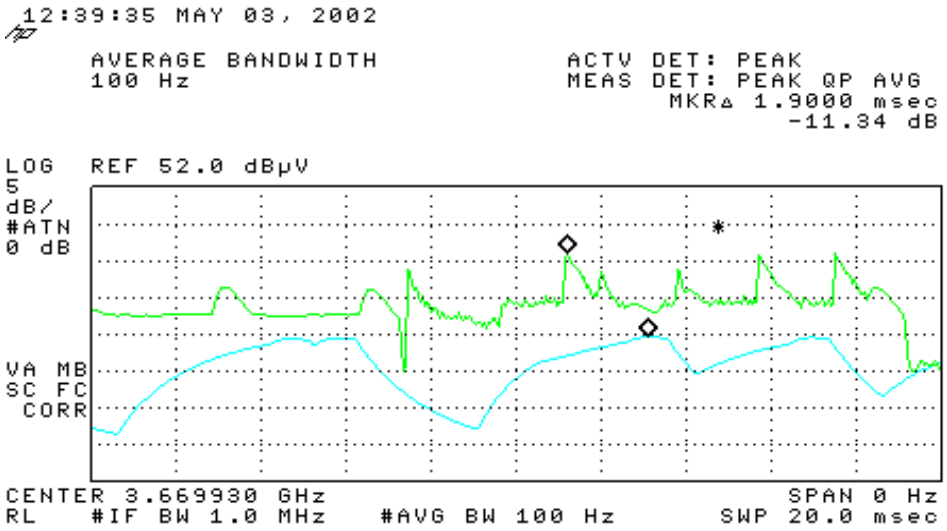


Plots showing peak-to-average differences at the fundamnetal frequency. VBW set to various values from 1MHz to 10Hz as per request of TCB.

Measuring the average level of the signal using RBW=1MHz and VBW=10Hz gives a delta of greater than 40dB between peak and average measurements. This delta correlates with the results of making the same measurements using a Rohde and Schwarz test receiver (ESCS) with built-in average detector.

Client:	Schlumberger	Job Number:	J44691
Model:	BAMM-CCSK	T-Log Number:	T44709
		Proj Eng:	Mark Briggs
Contact:	Jeff Webster		
Spec:	FCC 15.247	Class:	N/A





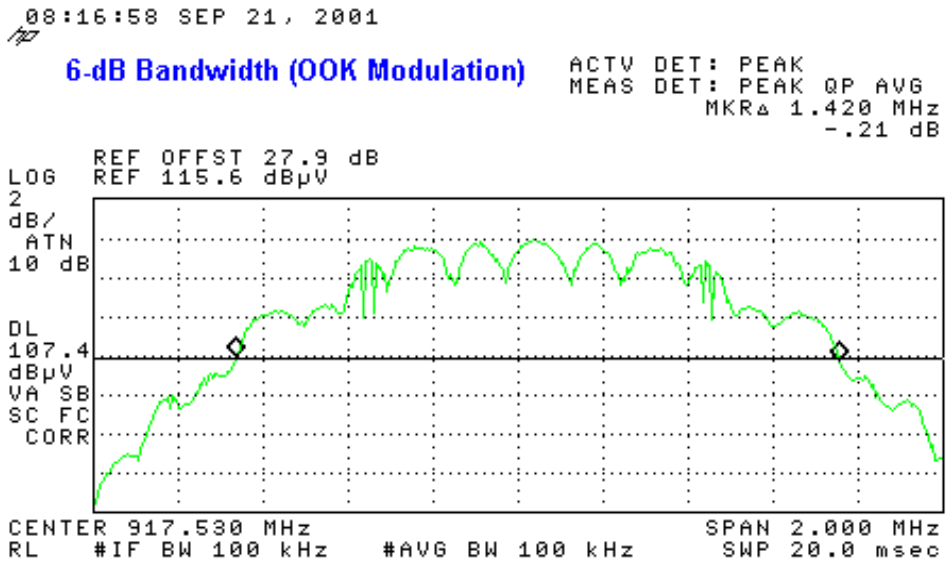
Plots showing peak-to-average differences at the third and fourth harmonics. VBW set to greater than 10Hz as per request of TCB for the "average"measurement.

Measuring the average level of the signal using RBW=1MHz and VBW=10Hz gives a delta of greater than 40dB between peak and average measurements. This delta correlates with the results of making the same measurements using a Rohde and Schwarz test receiver (ESCS) with built-in average detector.

Client:	Schlumberger	Job Number:	J44691
Model:	BAMM-CCSK	T-Log Number:	T44709
		Proj Eng:	Mark Briggs
Contact:	Jeff Webster		
Spec:	FCC 15.247	Class:	N/A

Run #2: Signal Bandwidth

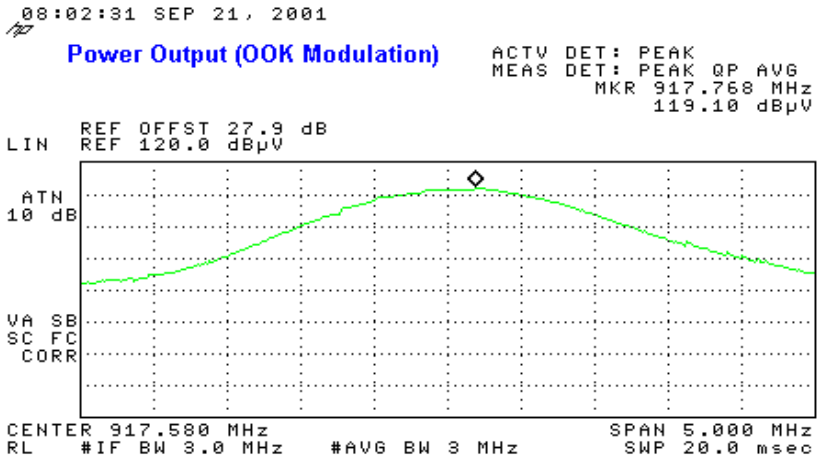
Channel	Frequency (MHz)	Resolution Bandwidth	6dB Signal Bandwidth
Mid	917.53	100 kHz	1.42 MHz



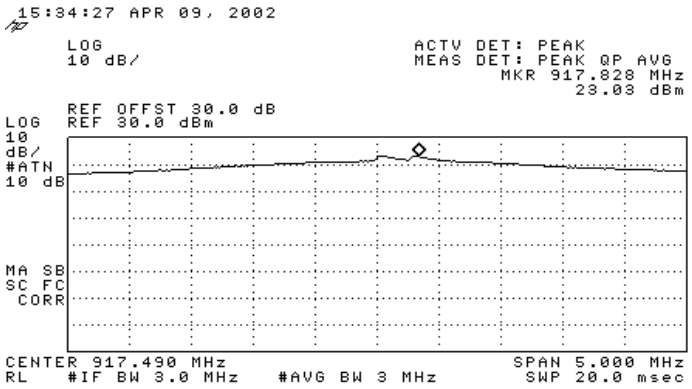
Client:	Schlumberger	Job Number:	J44691
Model:	BAMM-CCSK	T-Log Number:	T44709
		Proj Eng:	Mark Briggs
Contact:	Jeff Webster		
Spec:	FCC 15.247	Class:	N/A

Run #3: Output Power

Channel	Frequency (MHz)	Field Strength at 3m	Antenna Pol. (H/V)	Antenna Gain	Output Power (dBm)
Mid	917.53	113.5	H	0dBi	18.2
Mid	917.53	119.1	V	0dBi	23.8



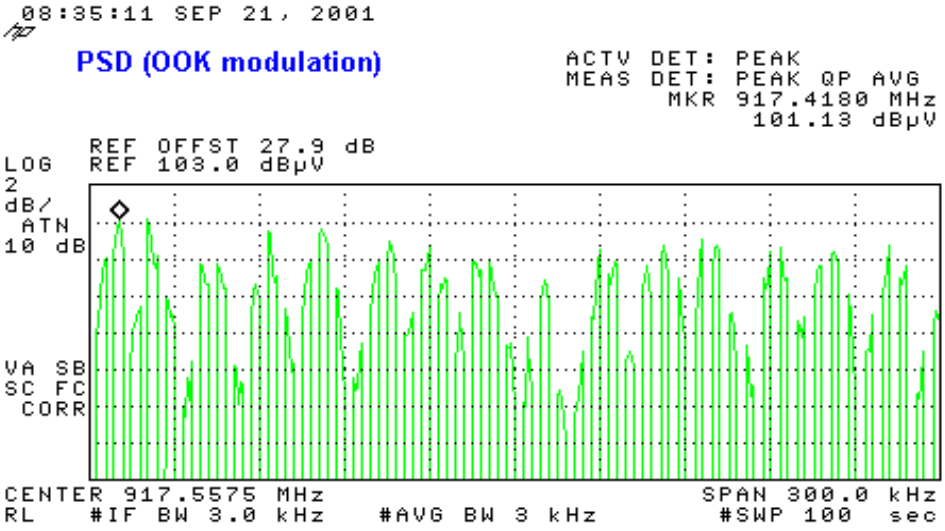
Re-measured power using a direct connection to the EUT: **Result = 23dBm**



Client:	Schlumberger	Job Number:	J44691
Model:	BAMM-CCSK	T-Log Number:	T44709
		Proj Eng:	Mark Briggs
Contact:	Jeff Webster		
Spec:	FCC 15.247	Class:	N/A

Run #4: Power Spectral Density

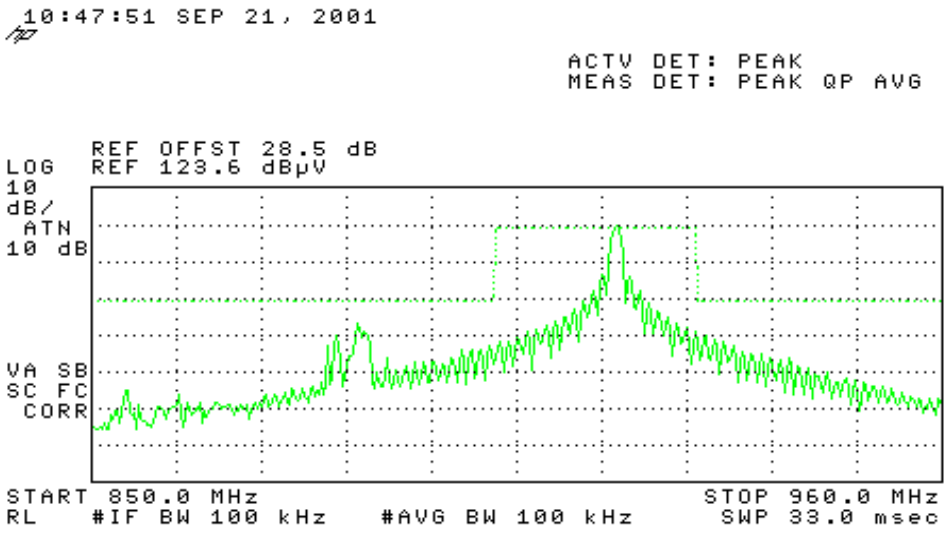
Channel	Frequency (MHz)	Field Strength at 3m	Antenna Pol. (H/V)	Res BW	P.S.D. (averaged over 1 second in a 3kHz bandwidth)
Mid	917.53	101.13	V	3 kHz	5.83



Client:	Schlumberger	Job Number:	J44691
Model:	BAMM-CCSK	T-Log Number:	T44709
		Proj Eng:	Mark Briggs
Contact:	Jeff Webster		
Spec:	FCC 15.247	Class:	N/A

Run# 5: Bandedge Measurement

Measurements made at 3m per FCC requirements.



Note 1:	Applied correction factors to measurement.

Elliott

EMC Test Data

Client:	Schlumberger	Job Number:	J44691
Model:	BAMM-CCSK	T-Log Number:	T44708
		Proj Eng:	Mark Briggs
Contact:	Jeff Webster		
Spec:	FCC	Class:	B

Radiated Emissions

Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 9/10/01
Test Engineer: jmartinez
Test Location: SVOATS #1

Config. Used: 1
Config Change: None
EUT Voltage: 120V/60Hz

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated emissions testing.
On the OATS, the measurement antenna was located 10 meters from the EUT for the measurement range 30 - 1000 MHz.
Note, **preliminary** testing indicates that the emissions were maximized by orientation of the EUT and elevation of the measurement antenna. **Maximized** testing indicated that the emissions were maximized by orientation of the EUT, elevation of the measurement antenna, and manipulation of the EUT's interface cables.

Ambient Conditions:

Temperature: 26°C
Rel. Humidity: 44%

Summary of Results

Run #	Test Performed	Limit	Result	Margin
2	RE, 30 - 1000MHz - Maximized Emissions	FCC B	Pass	-17dB @ 73.6MHz

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Elliott

EMC Test Data

Client:	Schlumberger	Job Number:	J44691
Model:	BAMM-CCSK	T-Log Number:	T44708
		Proj Eng:	Mark Briggs
Contact:	Jeff Webster		
Spec:	FCC	Class:	B

Run #1: Preliminary Radiated Emissions, 30-1000 MHz

Frequency	Level	Pol	FCC B		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
73.600	23.0	v	40.0	-17.0	QP	185	1.0	Note 1
670.000	28.6	h	46.0	-17.4	QP	78	1.0	Note 1
44.500	22.3	v	40.0	-17.7	QP	215	1.0	Note 1
539.488	26.4	h	46.0	-19.6	QP	132	1.0	Note 1
117.000	23.7	v	43.5	-19.8	QP	220	1.0	Note 1
364.768	22.3	h	46.0	-23.7	QP	188	1.0	Note 1

Note 1:	No emission detected within 20-dB of the limit. All readings are noise floor measurements.

Run #2: Maximized Readings From Run #1

Frequency	Level	Pol	FCC B		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
73.600	23.0	v	40.0	-17.0	QP	185	1.0	Note 1
670.000	28.6	h	46.0	-17.4	QP	78	1.0	Note 1
44.500	22.3	v	40.0	-17.7	QP	215	1.0	Note 1
539.488	26.4	h	46.0	-19.6	QP	132	1.0	Note 1
117.000	23.7	v	43.5	-19.8	QP	220	1.0	Note 1
364.768	22.3	h	46.0	-23.7	QP	188	1.0	Note 1

Note 1:	No emission detected within 20-dB of the limit. All readings are noise floor measurements.

Client:	Schlumberger	Job Number:	J44691
Model:	BAMM-CCSK	T-Log Number:	T44708
		Proj Eng:	Mark Briggs
Contact:	Jeff Webster		
Spec:	FCC	Class:	B

Conducted Emissions - Power Ports

Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test:	9/10/01	Config. Used:	1
Test Engineer:	jmartinez	Config Change:	None
Test Location:	SVOATS #1	EUT Voltage:	120V/60Hz

General Test Configuration

For tabletop equipment, the EUT was located on a wooden table, 40 cm from a vertical coupling plane and 80cm from the LISN.

Ambient Conditions:

Temperature: 26°C

Rel. Humidity: 44%

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	CE, AC Power 120V/60Hz	FCC B	Pass	-13.2dB @ .8072MHz

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Elliott

EMC Test Data

Client:	Schlumberger	Job Number:	J44691
Model:	BAMM-CCSK	T-Log Number:	T44708
		Proj Eng:	Mark Briggs
Contact:	Jeff Webster		
Spec:	FCC	Class:	B

Run #1: AC Power Port Conducted Emissions, 0.48 - 30 MHz 120 V / 60 Hz

Frequency	Level	Interface	FCC B		Detector	Comments
MHz	dBµV	Port	Limit	Margin	QP/Ave	
0.8072	34.8	Neutral	48.0	-13.2	QP	
0.8072	30.6	Line 1	48.0	-17.4	QP	
0.6798	30.6	Neutral	48.0	-17.4	QP	
1.3741	19.8	Line 1	48.0	-28.2	QP	
27.0133	14.4	Neutral	48.0	-33.6	QP	
15.0537	11.6	Line 1	48.0	-36.4	QP	

Note 1:	No Average readings made - QP readings were more than 6dB below the Average limit