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Electromagnetic Emissions Test Report
In Accordance With
FCC Part 22 Subpart H
on the
Cellular Module
Model: CRM4200

GRANTEE:	Standard Communications Corp. 1111 Knox St. Torrance, CA 90502
TEST SITE:	Elliott Laboratories, Inc. 684 W. Maude Ave Sunnyvale, CA 94086
REPORT DATE:	April 9, 2001
FINAL TEST DATE:	April 9, 2001

AUTHORIZED SIGNATORY: _____

David Bare
Chief Technical Officer

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FCC CERTIFICATION INFORMATION

The following information is in accordance with FCC Rules, 47CFR Part2, Subpart J, Section 2.1033(C).

2.1033(c)(1) Applicant: Standard Communication Corp.
1111 Knox St.
Torrance, CA 90502

2.1033(c)(2) FCC ID: **APV09002**

Technical Description

The CRM4200 is a 600 mW of maximum output power. The CRM4200 Cellular Radio Module is an OEM radio module for use in embedded wireless data and other applications. It is part of a series of modules providing solutions for customers with limited levels of RF expertise. The CRM4200 will be used with the highest gain antenna of 2.5 dBi Centurion's (Model: EXE-821-SM).

Standard Communication will use the Centurion dipole antenna with their developer kits and will be using the Astron antenna (2.5dBi) in the kits in the future. But, for now the Centurion (Model: EXE-821-SM) 2.5 dBi gain antenna will be sold in the kit.

* Centurion Antenna: Model: EXE-821-SM 2.5dBi gain
* Centurion Antenna: ½ wave center fed (dipole) design 0dBd gain (unity)
* Centurion Antenna: ¼ wave end fed 2 dBi gain

2.1033(c)(3) Instructions/Installation Manual

Please refer to Exhibit 7: User Manual, Theory of Operation

2.1033(c)(4) Type of emissions

AMPS: 40K0F8W
Wideband: 36K0F1D

2.1033(c)(5) Frequency Range

Transmitter: 824.01 – 848.97 MHz
Receiver: 869.01 – 893.97 MHz

2.1033(c)(6) Range of Operation Power

Maximum power: 600 mW (ERP) conducted at antenna terminal

	ERP (Watts)	EIPR(Watts)
Centurion Antenna: 2.5dBi gain	1.07	1.75
Centurion Antenna: 0dBd gain (unity)	.6	.984
Centurion Antenna: 2 dBi gain	.951	1.56

2.1033(c)(7) Maximum Power Rating

Section 22.913: limited to 7 Watts ERP

2.1033(c)(8) Applied voltage and currents into the final transistor elements

CRM4200: 5Vdc, Current 100 mA

2.1033(c)(9) Tune-up Procedure

The Tune-Up procedure is located in pg. 20 of the Theory of Operations and in Specification manuals. Refer to Exhibit 7: User Manual, Theory of Operation, and Tune-up Procedure.

2.1033(c)(10) Schematic Diagram of the Transmitter

Refer to Exhibit 6. The schematic diagram

2.1033(c)(10) Means for Frequency Stabilization

TCXO (QL03), main VCO (QP01). For more information refer to Exhibit 7: Theory of Operation page 5.

2.1033(c)(10) Means for Suppression of Spurious radiation

A bandpass filter (FT01) is located before the final power amplifier stage to eliminate harmonic and spurious signals.

2.1033(c)(10) Means for Limiting Modulation

The signal is passed trough a Soft limit circuit, BPF, LPF, Compressor circuit, Pre-emphasis circuit, and Hard limit circuit. For more information refer to Exhibit 7: Theory of Operation page 10.

2.1033(c)(10) Means for Limiting Power

Power Detector (QT04), Radio interface IC (QL01), APC circuit (QT05). For more information refer to Exhibit 7: Theory of Operation page 14.

2.1033(c)(11) Photographs or Drawing of the Equipment Identification Plate or Label

Refer to Exhibit 4

2.1033(c)(12) Photographs of equipment

Refer to Exhibit 5

2.1033(c)(13) Equipment Employing Digital Modulation

N/A

2.1033(c)(14) Data taken per Section 2.1046 to 2.1057

Refer to Exhibit 2

Section 22.919: Electronic Serial Number

The EUT meets the requirements of part 22.919 as follows:

- ?? The ESN Serial number is used by factory for trace control.
- ?? A Unique ESN Serial number is programmed at the factory for each Radio.
- ?? The Unique ESN Serial number programmed in the Radio is not removable part.
- ?? The ESN is stored by Multiplication by a polynomial
- ?? The ESN is spread over various non-sequential memory.
- ?? Customers do not have access to change the ESN value.

SECTION 22.921: 911 call processing procedure; 911-only calling mode

The E911 requirement does not apply in any way to the CMM products as they have no ability to place actual calls to any number, and they have no voice capability. The CRM products (4200) are exempt from the E911 requirement due to the fact that they are principally embedded data transceivers only. The current implementations of the CRM4250 and CRM4200 application interfaces do not support use of the transceiver on a stand-alone basis where internal E911 capability is required. In the event that the customer's final application has voice calling capability, that application will be required to comply with the E911 requirement.

At this time, the G2 CRM products (CRM4200) do not include any special handling provisions for 911 calling. The CRM does provide the application with access to the necessary radio control functions for use in implementing any of the 3 approved call-handling scenarios.

We do plan to implement and offer internal E911 call processing features in the future to simplify customer applications where this capability is required. The timeframe is within 2001 (target mid-year). The specific scenario(s) to be implemented have not yet been determined although it is anticipated that it will be a fully self-contained process, given the embedded nature of our products.

SCOPE

FCC Part 22 Subpart H testing was performed for the equipment mentioned in this report. The equipment was tested using Sections 2.1046 to 2.1057. TIA-603 was used as a test procedure guideline to perform the required test.

The intentional radiator above was 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.

OBJECTIVE

The primary objective of the manufacturer is compliance with FCC part 22 Subpart H. Certification of these devices is required as a prerequisite to marketing as defined in Section 2.1033.

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

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product that 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

Section 2.1046: RF Power Output

The EUT tested complied with the limits detailed in Section 22.213(a) with the EUT set to transmit continuously at maximum power. Refer to Setup Photo# 3 in Exhibit 3 and the test data in Exhibit 2: Test Measurement Data for full details.

SECTION 2.1047: MODULATION CHARACTERISTICS

Section 2.1047(a): Voice Modulated Communication Equipment (300 – 3000 Hz)

The constant input test method was used to measure the frequency response from 300 to 3000 Hz. Device complies with 22.915(d)(1).

Please refer to Setup Photo# 2 under Exhibit 3.
Please, refer to data included under **Exhibit 2**: Test Measurement Data.

Section 22.915(d)(i)(ii)(iii): Audio Filter Characteristics

Measure the Low Pass Filter frequency response from 3000 to 30,000 Hz. Device complies with 22.915(d)(1)(i)(ii)

Please refer to Setup Photo# 2 under Exhibit 3.
Please, refer to data included under **Exhibit 2**: Test Measurement Data.

Section 2.1047(b): Equipment which employs modulation limiting

No deviation, in access of +/- 12 kHz, was produce from 300 Hz to 15 kHz. Device complies with 22.915(b)(1).

The transmitter maximum rated deviation must not exceed +/- 12 kHz (+/- 10%).

Please refer to Setup Photo# 2 under Exhibit 3.
Please, refer to data included under **Exhibit 2**: Test Measurement Data.

SECTION 2.1049: OCCUPIED BANDWIDTH

Since EUT transmits AMPS and Wideband data Sections 22.917(b) and (d) were used to show compliance for the emission mask.

AMPS modulation: (+/- 12kHz audio and +/- 2kHz SAT)

The signal was modulated with a 2.5 kHz tone and input voltage adjusted to 16 dB greater than that required to produce 50% deviation.

Input Voltage: .5 Vp-p

The following Resolution and Video bandwidth was used per Section 22.917(h)(1)(i) to show compliance for the above requirement: 300 Hz.

Wideband Data modulation: (+/- 8kHz)

The following Resolution and Video bandwidth was used per Section 22.917(h)(2)(i) to show compliance for the above requirement: 300 Hz.

Please refer to Setup Photo# 3 under Exhibit 3.
Refer to data included under **Exhibit 2**: Test Measurement Data.

SECTION 2.1051: SPURIOUS EMISSION AT ANTENNA TERMINAL.

The Out-of-Band emissions from 1MHz to the 10^{th} harmonic of the fundamental were tested per Section 22.917(e) using the 30kHz resolution and video bandwidth instrumentation settings per 22.917(h)(2)(ii).

Mobile emissions in the base frequency band were also measured per Section 22.917(f) with the transmitter operating at full power on 849 MHz.

Both AMPS and Wideband were tested.

Please refer to Setup Photo# 3 under Exhibit 3.
Refer to data included under **Exhibit 2**: Test Measurement Data.

SECTION 2.1053: FIELD STRENGTH OF SPURIOUS RADIATION.

The following measurements were extracted from the data recorded during the radiated electric field emissions scan and represent the highest amplitude peaks relative to the specification limit. The actual test data is contained in the appendices of this report. The field reading includes the correction factors that were applied on the Test equipment by software means.

Maximized Radiated Unwanted Emissions

Frequency	Level	Pol	FCC 90.210(d)(3)		Detector	Azimuth	Height	Comments
MHz	dB?V/m	V/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
1669.880	81.7	H	84.4	-2.7	Pk	145	1.1	

Please refer to Setup Photo# 1 under Exhibit 3.
Please, refer to data included under **Exhibit 2**: Test Measurement Data.

SECTION 2.1055: FREQUENCY STABILITY

The EUT tested complies with Section 22.355.

Limit:
821 - 869 MHz: 2.5 ppm

The frequency of the transmitter varied by 467 Hz over the temperature range of –30 to +50 degrees Celsius.

For voltage stability, the EUT's is battery operated using a +5 or +12 Vdc variable power supply. The battery end point was determined to be at **4.7Vdc** CRM4200, this will be stated in the manufacturers manual. The frequency of the transmitter varied by 0 Hz.

Please, refer to data included under **Exhibit 2**: Test Measurement Data

TEST SITE

GENERAL INFORMATION

Final test measurements were taken on April 9, 2001 at the Elliott Laboratories Open Area Test Site #1 & 2 located at 684 West Maude Avenue, Sunnyvale, California. Pursuant to Section 2.948 of the FCC Rules, construction, calibration, and equipment data has been filed with the Commission.

CONDUCTED EMISSIONS CONSIDERATIONS

Conducted emissions testing are performed in conformance with Section 2 of FCC Rules. Measurements are made with the EUT connected to a spectrum analyzer through an attenuator to prevent overloading the analyzer.

RADIATED EMISSIONS CONSIDERATIONS

Radiated measurements are performed in an open field environment. The test site is maintained free of conductive objects within the CISPR 16-1 defined elliptical area.

MEASUREMENT INSTRUMENTATION

RECEIVER SYSTEM

An EMI receiver as specified in CISPR 16-1 is used for emissions measurements. The receivers are capable of measuring 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 particular 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. If average measurements above 1000MHz are performed, the linear-average method with a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz is used.

INSTRUMENT CONTROL COMPUTER

A personal computer is utilized to record the receiver measurements of the field strength at the antenna, which is then compared directly with the appropriate specification limit. The receiver is programmed with appropriate factors to convert the received voltage into filed strength at the antenna. Results are printed in a graphic and/or tabular format, as appropriate.

The test receiver also provides a visual display of the signal being measured.

POWER METER

A power meter and thermister mount may be used for 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 EUT and the receiver. This eliminates saturation effects and non-linear operation due to high amplitude transmitters and 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 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.

The requirements of ANSI C63.4 were used for configuration of the equipment turntable. It 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 appendix of this report contains the list of test equipment used and calibration information.

TEST PROCEDURES

Section 2.1047, 2.1049, and 2.1051: CONDUCTED EMISSIONS AT THE ANTENNA PORT

Direct measurements for output power, modulation characterization and frequency stability are performed with the antenna port of the EUT connected to either the power meter or spectrum analyzer via a suitable attenuator and/or filter. These are used to ensure that the front end of the measurement instrument is not overloaded or for input protection by the fundamental transmission. The EUT was set at the middle of the frequency band and operating at maximum output power.

Section 2.1046: RF OUTPUT POWER

The EUT is configured to operate in the middle of the EUT frequency range at full power. A spectrum analyzer with resolution and video bandwidths of 30 kHz are used to measure the fundamental output power.

Section 2.1047: MODULATION CHARACTERISTICS

Voice Modulated Communication Equipment (300 – 3000 Hz)

Used TIA/EIA-603 section 2.2.6.2.2 procedure. The constant input test method was used to measure the frequency response from 300 to 3000 Hz. The following steps were done.

1. Adjusted the transmitter per the manufacture's procedure for full rated system deviation.
2. Apply a 1000 Hz tone and adjusted the audio frequency generator to produce 20% of the rated system deviation.
3. Set the test receiver to measure rms deviation and record the deviation reading as DEVref.
4. Set the audio frequency generator to the desired test frequency between 300 and 3000 Hz.
5. Recorded the test receiver deviation reading as DEVfreq.

6. Calculated the audio frequency response at the present frequency as:
   Audio Frequency response = 20 * log10 (DEVfreq / DEVref)

7. Repeated steps 4 through 6 for all other test frequencies.

Section 22.915(d)(i)(ii)(iii): Audio Filter Characteristics

The following test method was used to measure the Low Pass Filter frequency response from 3000 to 30,000 Hz.

To test the band limiting condition: adjusted the audio input frequency to 1000 Hz, and adjusted the input level to 20 dB greater than that required to produce ± 8 kHz deviation. Noted the output level on the frequency deviation meter or the calibrated test receiver. Using this output level as reference (0 dB), vary the modulating frequency from 3000 Hz to 30,000 Hz, and record the change in output while maintaining a constant audio input level.

Section 2.1047(b): Equipment which employs modulation limiting

The following procedure was used to test the modulation limiting circuit.

The transmitter was connected to the test receiver. An attenuator was place in between to protect the test receiver's input port. The audio generator was set to 300, 1000, 2500, 3000, and 15,000 Hz and varied the test voltage for each audio frequency. Recorded the input voltage level that will produce 10 to 100% deviation. To further assure the limiting capability of the transmitter the voltage was increase beyond 100%. No deviation, in access of +/- 12 kHz, was produce.

Section 2.1055: FREQUENCY STABILITY

The EUT is placed inside a temperature chamber with all support and test equipment located outside of the chamber. The spectrum analyzer is configured to give a 6-digit display for the marker-frequency function. The spectrum analyzer's built-in frequency counter is used to measure the maximum deviation of the fundamental frequency at each temperature.

For battery-powered devices the voltage battery end-point is determined by reducing the dc voltage until the unit ceases to function.

EUT AND CABLE PLACEMENT

The FCC requires that for Radiated Emissions 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.

A .5 meter cable was connected to the EUT antenna port and a 50-ohm load was place at the end of the cable. The EUT was set to transmit continuously at maximum power. The frequency was set to the middle of the EUT frequency range.

The EUT was set on the turntable and the search antenna position 3 meters away. The output antenna terminal was terminated with a 50-ohm terminator. The EUT was set at the middle of the frequency band and set at maximum output power.

Radiated emissions measurements are performed in two phases. 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 the lowest frequency generated in the device up to the frequency required by the regulation specified on page 1. One or more of these is with the antenna polarized vertically while the one or more of these are with the antenna polarized horizontally. During the preliminary scans, the EUT is rotated through 360°, the antenna height is varied and cable positions are varied to determine the highest emission relative to the limit.

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

Final maximization is a phase in which the highest amplitude emissions identified in the spectral search are viewed while the EUT azimuth angle is varied from 0 to 360 degrees relative to the receiving antenna. The azimuth that 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 that have values close to the specification limit may also be measured with a tuned dipole antenna to determine compliance.

SPECIFICATION LIMITS AND SAMPLE CALCULATIONS

FREQUENCY STABILITY REQUIREMENTS, SECTION 22.917(e)

Frequency Range Stability
821 – 869 MHz: 2.5 ppm over the temperature range –30 to +50 degrees Celsius

RADIATED EMISSIONS SPECIFICATION LIMITS, SECTION 22.917(e)

The limits for radiated emissions are based on the power of the transmitter at the operating frequency. Data is measured in the logarithmic form of decibels relative to one milliwatt (dBm) or one microvolt/meter (dBuV/m,). The field strength of the emissions from the EUT is measured on a test site with a receiver.

For an operating power range of 3 watts the radiated emissions limit for spurious signals outside of the assigned frequency block is $43+10\text{Log}_{10}$(mean output power in watts) dB below the measured amplitude at the operating power.

CALCULATIONS – EFFECTIVE RADIATED POWER

$$E(V/m) = \frac{? \ 30 * P * G}{d}$$

E= Field Strength in V/m
P= Power in Watts
G= Gain of antenna in numeric gain (Assume 1.64 for ERP)
d= distance in meters

$$E(V/m) = \frac{? \ 30 * .6 \text{ watts} * 1.64 \text{ dB}}{3 \text{ meters}}$$

20 * log (1.81 V/m * 1,000,000) = 125.16 dBuV/m @ 3 meters

Section 22.917(e): Request an attenuation of 43 + 10 log (.6) or 40.78 dB for all emissions outside the assigned block, the limit for spurious and harmonic emissions is:

125.16 dBuV/m – 40.78 dB = 84.3 dBuV/m @ 3 meter.

EXHIBIT 1: Test Equipment Calibration Data

Antenna Conducted Emissions, 05-Mar-01 09:26 AM
Engineer: jmartinez

Manufacturer	Description	Model #	Assett #	Cal interval	Last Calibrated	Cal Due
Hewlett Packard	Frequency Generator, 10 Hz-10MHz	651B	264, (F132)	N/A		
Narda	20-dB attenuator (50W)	765-20	209	12	5/5/2000	5/5/2001
Rohde & Schwarz	Test Receiver, .009 - 2000 MHz	ESN	775	12	616/00	6/16/2001
Hewlett Packard	Spectrum Analyzer (9kHz-26.5 GHz)	8563EM	1141	12	1/16/2001	1/16/2002

Radiated Emissions, 1 - 6.5 GHz, 21-Dec-00 04:48 PM
Engineer: jmartinez

Manufacturer	Description	Model #	Assett #	Cal interval	Last Calibrated	Cal Due
EMCO	D. Ridge Horn Antenna, 1-18GHz	3115	786	12	1/18/2000	1/18/2001
Filtek	High Pass Filter	HP12/10(	956	12	3/29/2001	3/29/2002
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	785	12	12/2/2000	1/2/2001
Hewlett Packard	Spectrum Analyzer	8563E	284, (F194)	12	1/26/2000	1/26/2001

Temperature Stabiltity, 29-Dec-00 04:48 PM
Engineer: jmartinez

Manufacturer	Description	Model #	Assett #	Cal interval	Last Calibrated	Cal Due
Thermotron	Environmental Chamber	SM-32C	804	Not Required	Not Required	

EXHIBIT 2: Test Measurement Data

The following data includes conducted and radiated emission measurements of the Standard Communication, model CRM4200.

24 Pages

Elliott

EMC Test Data

Client:	Standard Communications	Job Number:	J42845
Model:	CRM4200	T-Log Number:	T42858
		Proj Eng:	David Bare
Contact:	Michael Malin		
Emissions Spec:	FCC 22 (Cellular)	Class:	N/A
Immunity Spec:		Environment:	

EMC Test Data

For The

Standard Communications

Model

CRM4200

Client:	Standard Communications	Job Number:	J42845
Model:	CRM4200	T-Log Number:	T42858
		Proj Eng:	David Bare
Contact:	Michael Malin		
Emissions Spec:	FCC 22 (Cellular)	Class:	N/A
Immunity Spec:	Enter immunity spec on cover	Environment:	

EUT INFORMATION

General Description

The EUT is a Cellular radio module which is designed to transmitt data from vendor machines, credit card transactions, GPS, and monitoring devices. 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 5 Vdc.

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
Standrad Communications	CRM4200	Cellular module	N/A	APV09002

Other EUT Details

EUT Enclosure

The EUT does not have a main enclouser, but does have shields for the RF circuit section. It measures approximately 4.9784 cm wide by 11.176 cm deep by 1.3462 cm high.

Modification History

Mod. #	Test	Date	Modificaiton
1			
2			
3			

Client:	Standard Communications	Job Number:	J42845
Model:	CRM4200	T-Log Number:	T42858
		Proj Eng:	David Bare
Contact:	Michael Malin		
Emissions Spec:	FCC 22 (Cellular)	Class:	N/A
Immunity Spec:	Enter immunity spec on cover	Environment:	

Test Configuration #1

Local Support Equipment

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

Remote Support Equipment

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

EUT Interface Ports

		Cable(s)		
EUT Port	Connected To	Description	Shielded or Unshielded	Length(m)
None	None	None		

EUT Operation During Emissions

EUT was set to transmit continously

Client:	Standard Communications	Job Number:	J42845
Model:	CRM4200	T-Log Number:	T42858
		Proj Eng:	David Bare
Contact:	Michael Malin		
Spec:	FCC 22 (Cellular)	Class:	N/A

Section 2.1046: RF Power

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: 4/5/2001
Test Engineer: jmartinez
Test Location: SVOATS #1

Config. Used: 1
Config Change: None
EUT Voltage: 5 Vdc

General Test Configuration

The EUT and all local support equipment were located on the table for testing. The Eut was connected directly to Test Receiver. A 20-dB attenuator was used between the EUT and Test Receiver.

Ambient Conditions:

Temperature: 14°C
Rel. Humidity: 52%

Summary of Results

Plot	Test Performed	Limit	Result	Comment
# 1	Power Output	22.917(a)	Pass	Level 0
# 2	Power Output	22.917(a)	Pass	Level 1
# 3	Power Output	22.917(a)	Pass	Level 2
# 4	Power Output	22.917(a)	Pass	Level 3
# 5	Power Output	22.917(a)	Pass	Level 4
# 6	Power Output	22.917(a)	Pass	Level 5

Modifications Made During Testing:

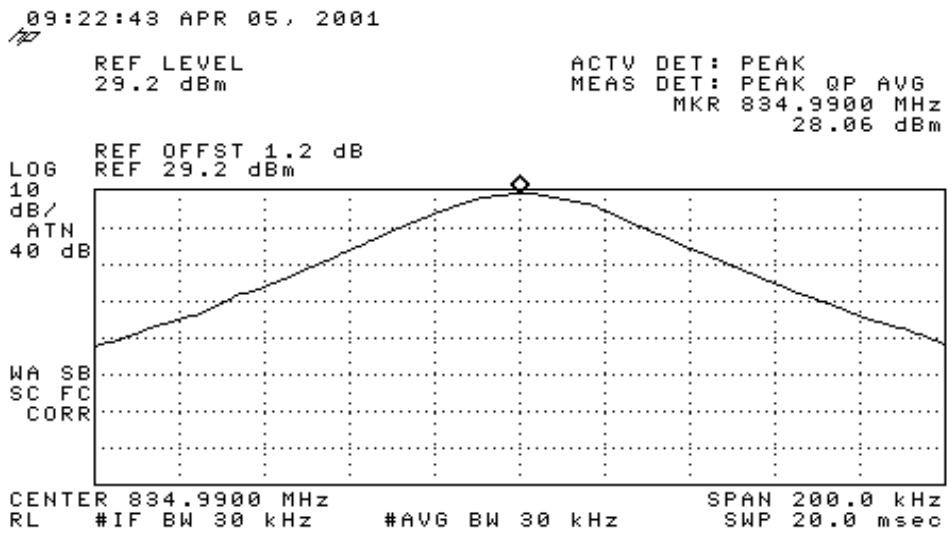
No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Client:	Standard Communications	Job Number:	J42845
Model:	CRM4200	T-Log Number:	T42858
		Proj Eng:	David Bare
Contact:	Michael Malin		
Spec:	FCC 22 (Cellular)	Class:	N/A

Plot# 1



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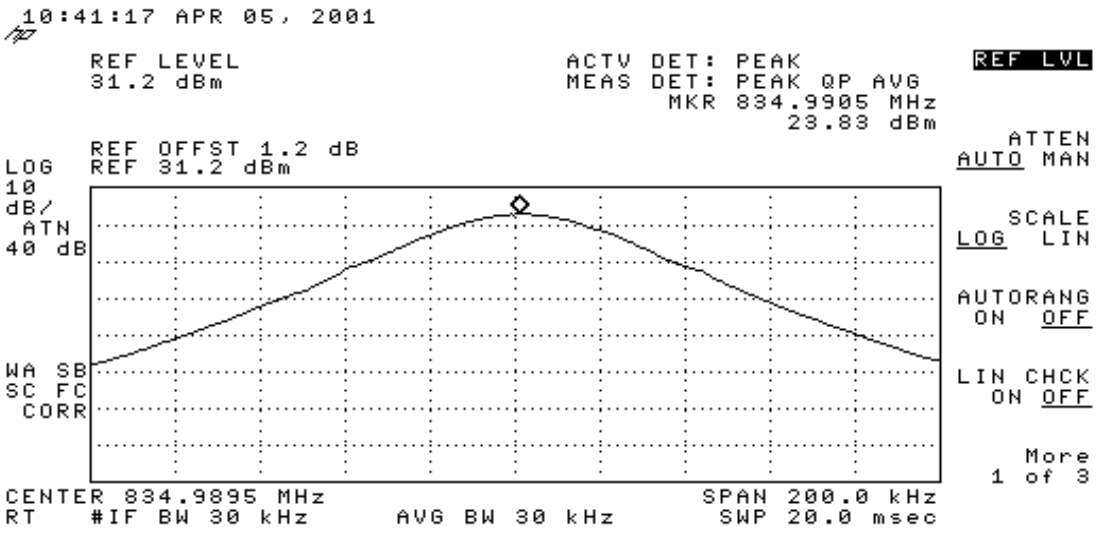

Client:	Standard Communications	Job Number:	J42845
Model:	CRM4200	T-Log Number:	T42858
		Proj Eng:	David Bare
Contact:	Michael Malin		
Spec:	FCC 22 (Cellular)	Class:	N/A

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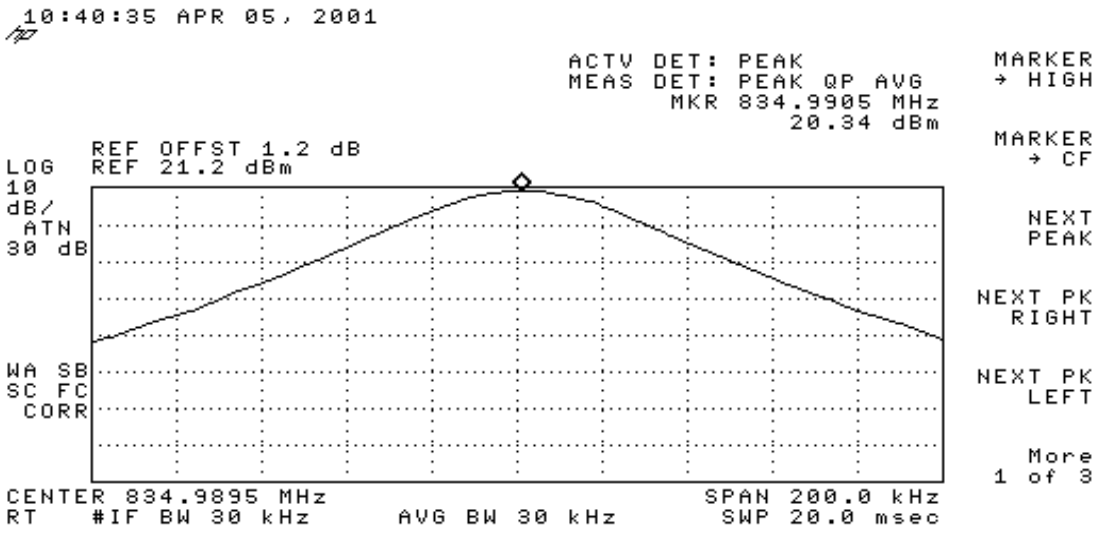

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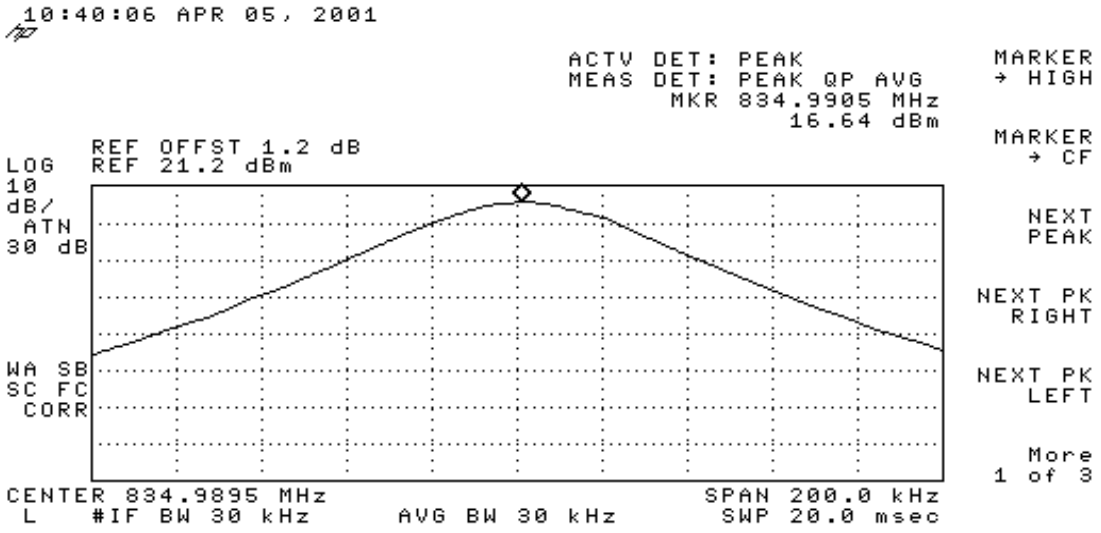
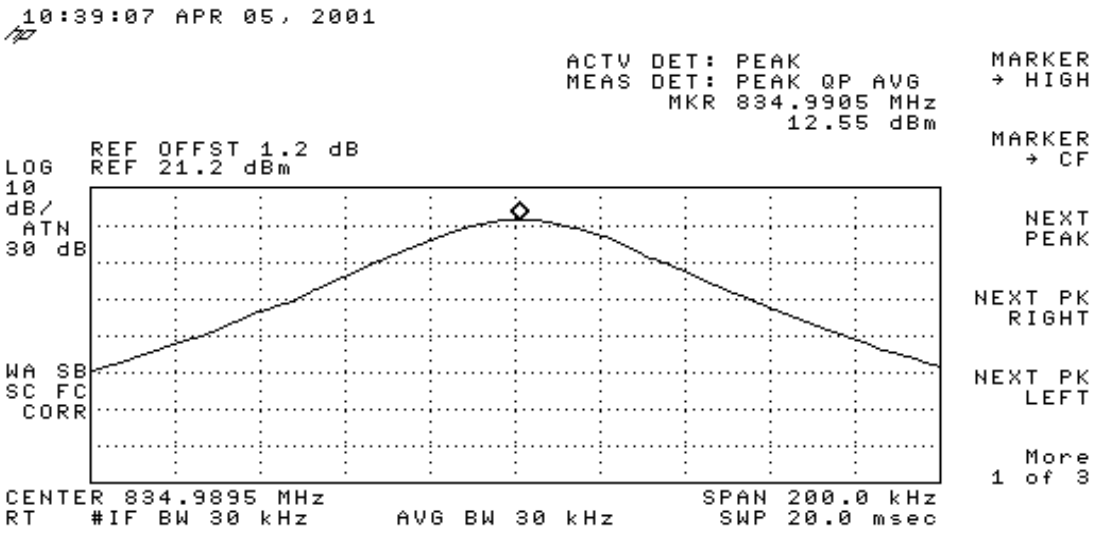
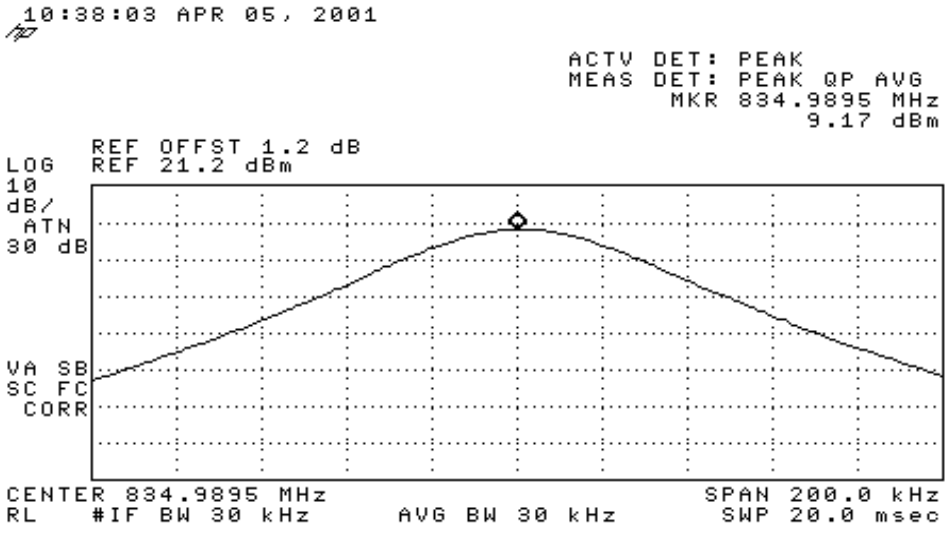


Client:	Standard Communications	Job Number:	J42845
Model:	CRM4200	T-Log Number:	T42858
		Proj Eng:	David Bare
Contact:	Michael Malin		
Spec:	FCC 22 (Cellular)	Class:	N/A

Plot# 5



Plot# 6



Client:	Standard Communications	Job Number:	J42845
Model:	CRM4200	T-Log Number:	T42858
		Proj Eng:	David Bare
Contact:	Michael Malin		
Spec:	FCC 22 (Cellular)	Class:	N/A

Section 2.1047: Modulation Characteristics

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: 12/26/2000
Test Engineer: jmartinez
Test Location: SVOATS #2

Config. Used: 1
Config Change: None
EUT Voltage: 12 Vdc and 5 Vdc

General Test Configuration

The EUT and all local support equipment were located on the table for testing. The Eut was connected directly to Test Receiver. A 20-dB attenuator was used between the EUT and Test Receiver.

Ambient Conditions:

Temperature: 23°C
Rel. Humidity: 31%

Summary of Results

Run	Test Performed	Limit	Result	Comment
#1	Modulation limiting	22.915(b)(1) & 22.915 (c)	Pass	

Plot	Test Performed	Limit	Result	Comment
# 7	Frequency Response (300 - 3000 kHz)	22.915(d)(1)	Pass	
# 8	Frequency Response (3000 - 30,000 kHz)	22.915(d)(1)	Pass	

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.

Client:	Standard Communications	Job Number:	J42845
Model:	CRM4200	T-Log Number:	T42858
		Proj Eng:	David Bare
Contact:	Michael Malin		
Spec:	FCC 22 (Cellular)	Class:	N/A

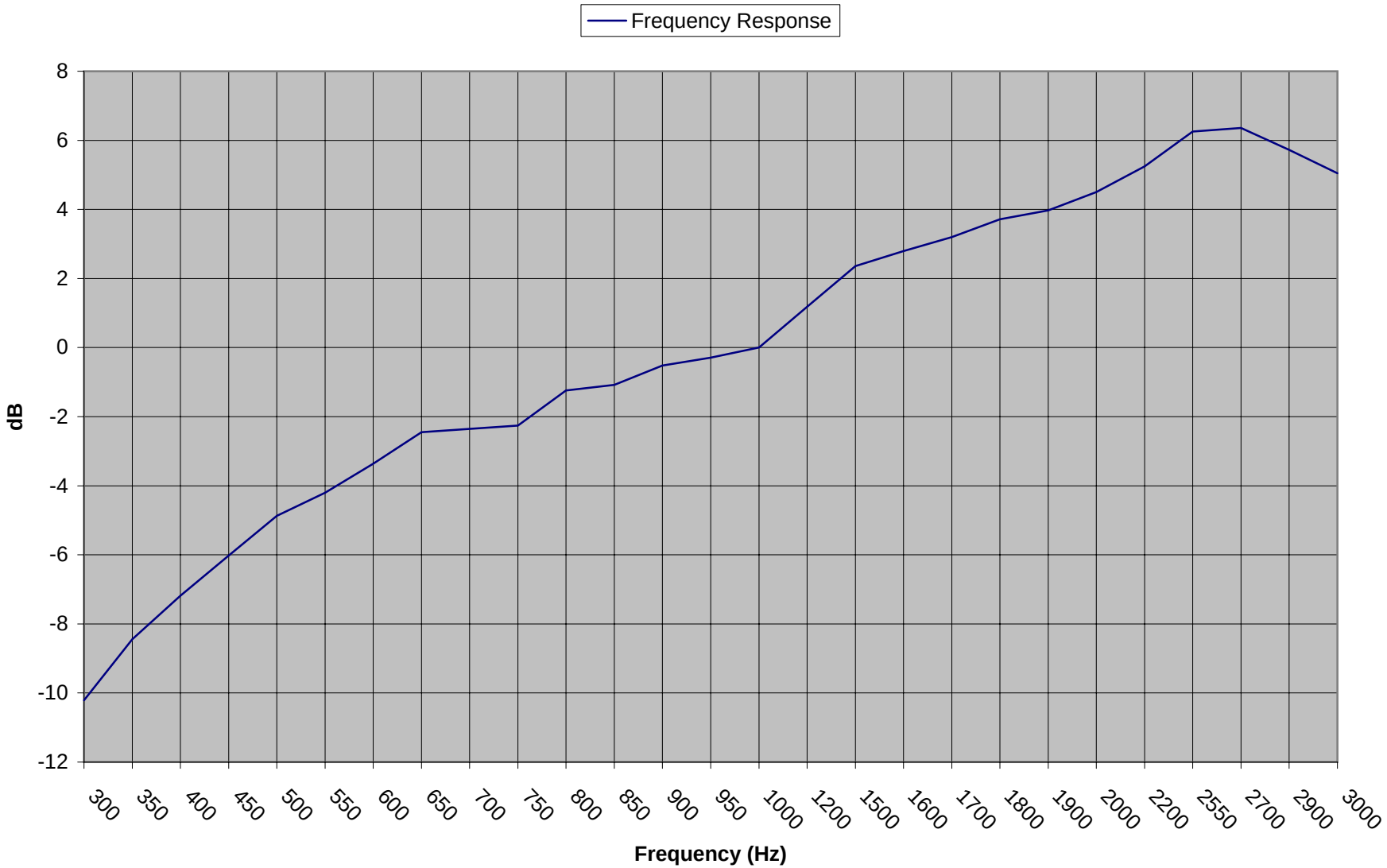
Run# 1: Modulation Limiting response.

Modulation Limiting

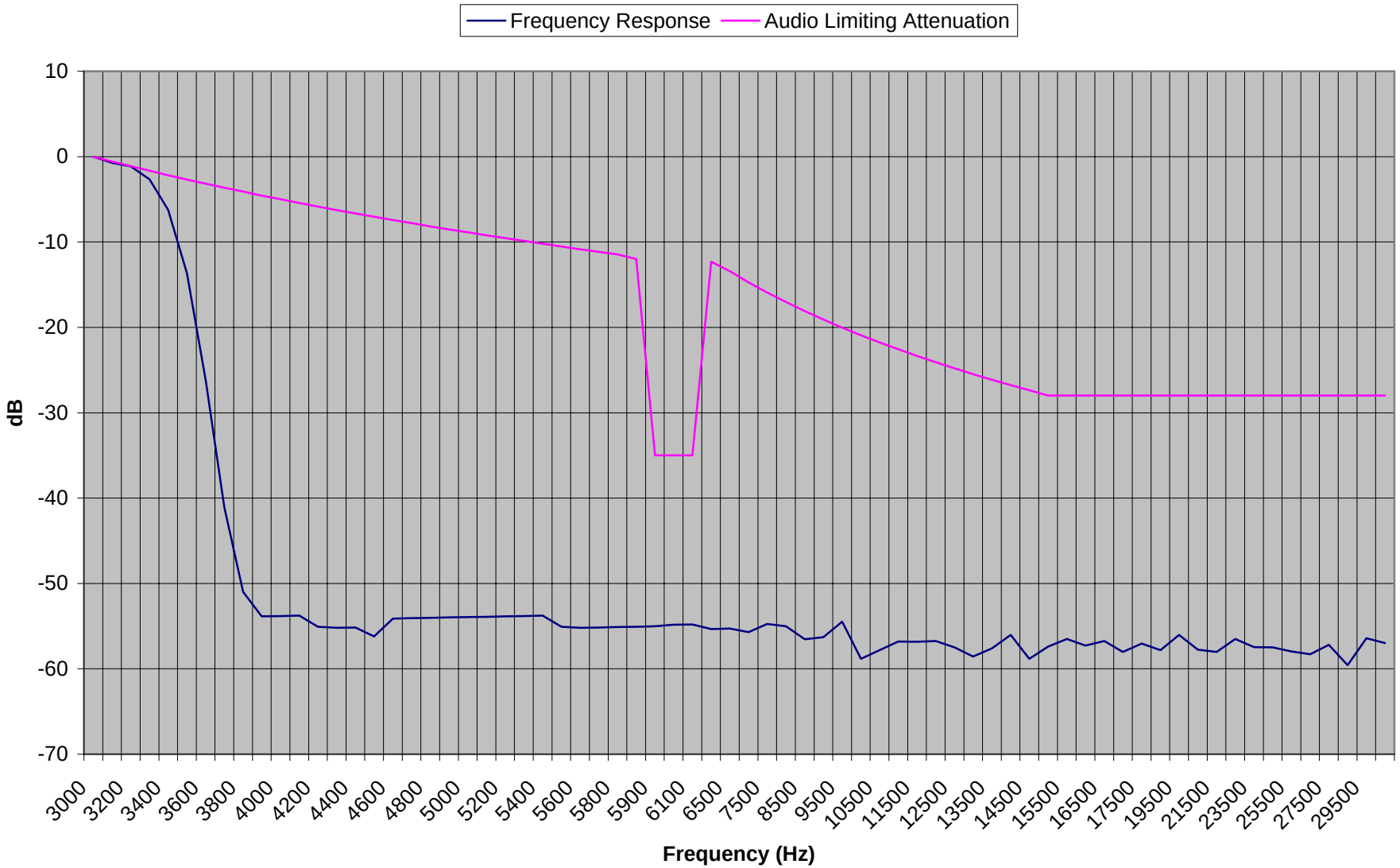
Limiting	300 Hz	1kHz	2.5 kHz	3kHz	15 kHz
10%	-58.4	-77.7	-80	-74	**-29.9**
20%	-45.4	-69.4	-75.9	-61.9	-
30%	-36.5	-62.9	-72	-69.1	-
40%	-32.8	-58.1	-68.9	-66.6	-
50%	**-29.9**	-54.4	-66	-63.2	-
60%	-	-51.4	-63.3	**-60.4**	-
70%	-	-48.6	-60.9	-	-
80%	-	-46.4	-58.8	-	-
90%	-	**-44.4**	-56.5	-	-
100%	-	-	**-49.3**	-	-
110%	-	-	-	-	-
120%	-	-	-	-	-
130%	-	-	-	-	-

Input levels are in dBm units.
Note: Although input levels are not stated, the input voltage was increase, but no deviation was produce beyond limiting point.

Frequency Response (.3 - 3000 MHz) Plot# 7



Frequency Response (3 - 30 kHz) Plot# 8



Client:	Standard Communications	Job Number:	J42845
Model:	CRM4200	T-Log Number:	T42858
		Proj Eng:	David Bare
Contact:	Michael Malin		
Spec:	FCC 22 (Cellular)	Class:	N/A

Section 2.1049: Occupied Bandwidth

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: 4/5/2001
Test Engineer: jmartinez
Test Location: SVOATS #1

Config. Used: 1
Config Change: None
EUT Voltage: 5 Vdc

General Test Configuration

The EUT and all local support equipment were located on the table for testing. The Eut was connected directly to Test Receiver. A 20-dB attenuator was used between the EUT and Test Receiver.

Ambient Conditions:

Temperature: 14°C
Rel. Humidity: 52%

Summary of Results

Plot	Test Performed	Limit	Result	Comment
# 9	Occupied Bandwidth	22.917(b)	Pass	Voice + SAT
# 10	Occupied Bandwidth	22.917(d)	Pass	Wideband data

Modifications Made During Testing:

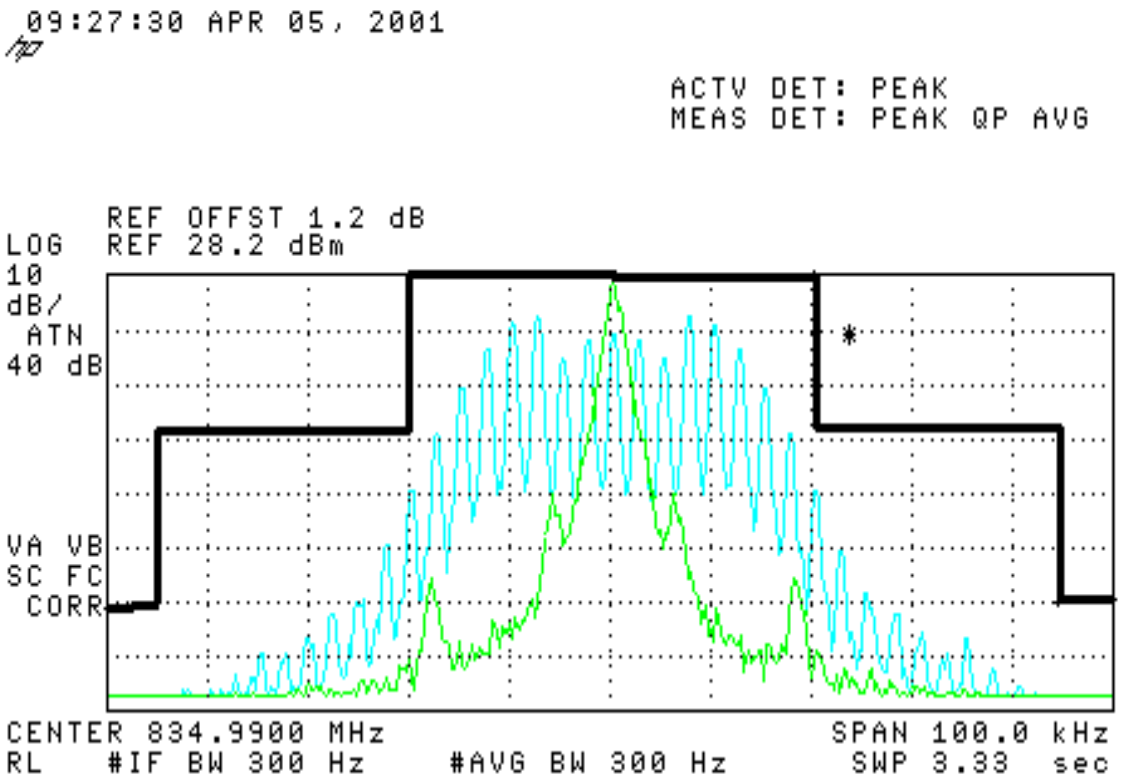
No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

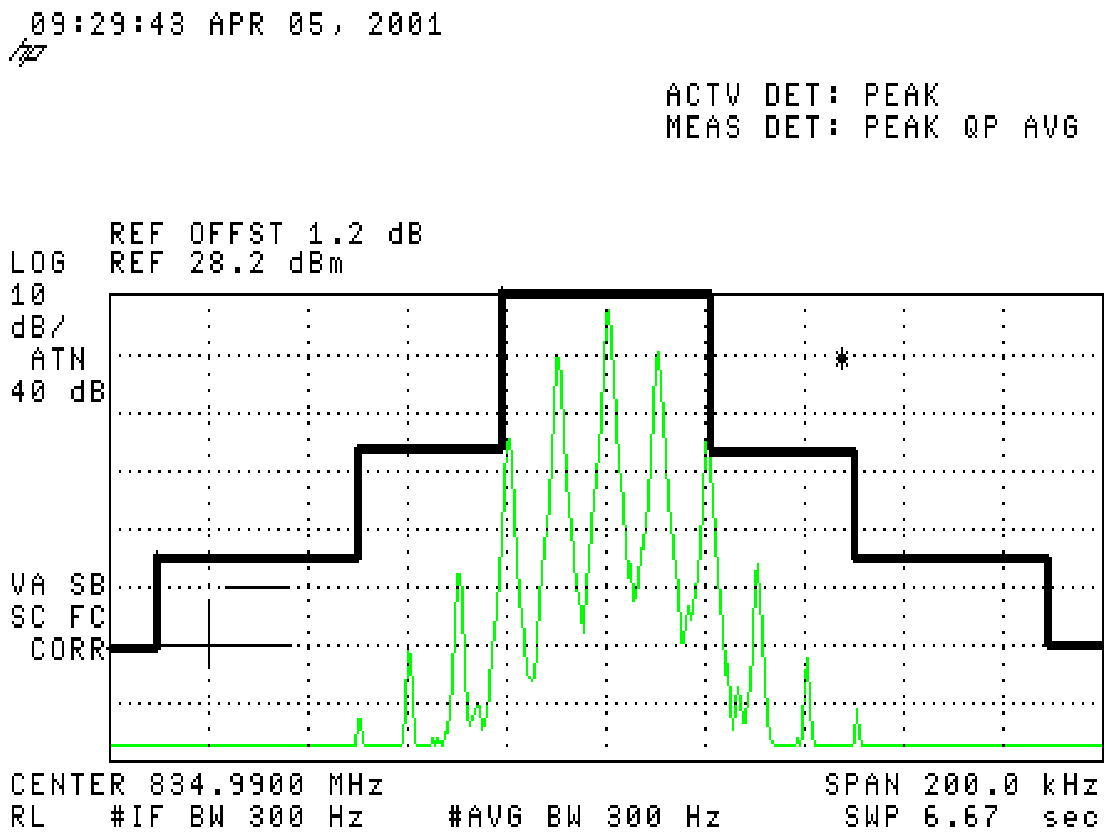
Client:	Standard Communications	Job Number:	J42845
Model:	CRM4200	T-Log Number:	T42858
		Proj Eng:	David Bare
Contact:	Michael Malin		
Spec:	FCC 22 (Cellular)	Class:	N/A

Plot# 9



Client:	Standard Communications	Job Number:	J42845
Model:	CRM4200	T-Log Number:	T42858
		Proj Eng:	David Bare
Contact:	Michael Malin		
Spec:	FCC 22 (Cellular)	Class:	N/A

Plot# 10



Client:	Standard Communications	Job Number:	J42845
Model:	CRM4200	T-Log Number:	T42858
		Proj Eng:	David Bare
Contact:	Michael Malin		
Spec:	FCC 22 (Cellular)	Class:	N/A

Section 2.1051: Spurious emission at the Antenna Terminal

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: 4/5/2001
Test Engineer: jmartinez
Test Location: SVOATS #1
Config. Used: 1
Config Change: None
EUT Voltage: 5 Vdc

General Test Configuration

The EUT and all local support equipment were located on the table for testing. The Eut was connected directly to Test Receiver. A 20-dB attenuator was used between the EUT and Test Receiver.

Ambient Conditions:

Temperature: 14°C
Rel. Humidity: 52%

Summary of Results

Plot	Test Performed	Limit	Result	Comment
# 11	Out-Of-Band	22.917(e)	Pass	Voice + SAT
# 12	Out-Of-Band	22.917(e)	Pass	Voice + SAT
# 13	Out-Of-Band	22.917(e)	Pass	Wideband data
# 14	Out-Of-Band	22.917(e)	Pass	Wideband data
# 15	Mobile Emission	22.917 (f)	Pass	Voice + SAT
# 16	Mobile Emission	22.917 (f)	Pass	Voice + SAT
# 17	Mobile Emission	22.917 (f)	Pass	Wideband data
# 18	Mobile Emission	22.917 (f)	Pass	Wideband data

Modifications Made During Testing:

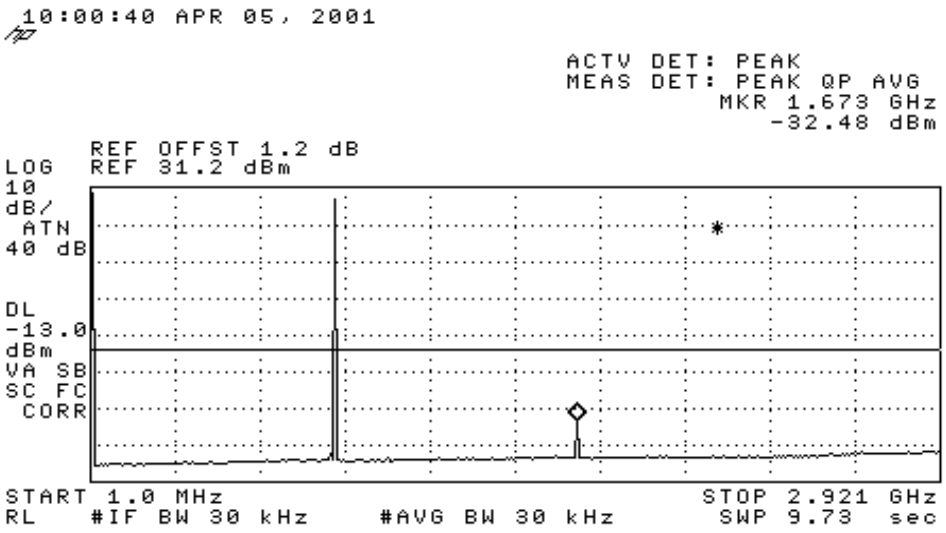
No modifications were made to the EUT during testing

Deviations From The Standard

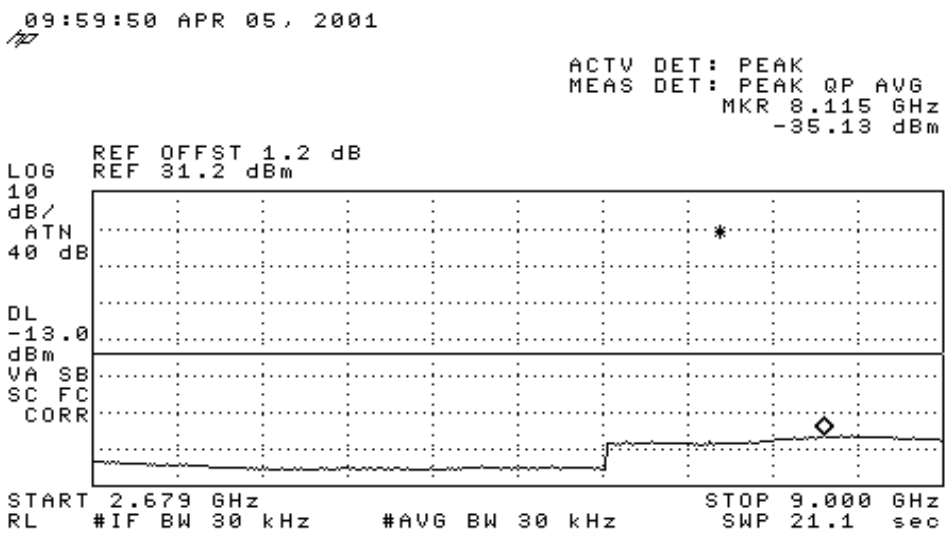
No deviations were made from the requirements of the standard.

Client:	Standard Communications	Job Number:	J42845
Model:	CRM4200	T-Log Number:	T42858
		Proj Eng:	David Bare
Contact:	Michael Malin		
Spec:	FCC 22 (Cellular)	Class:	N/A

Plot# 11

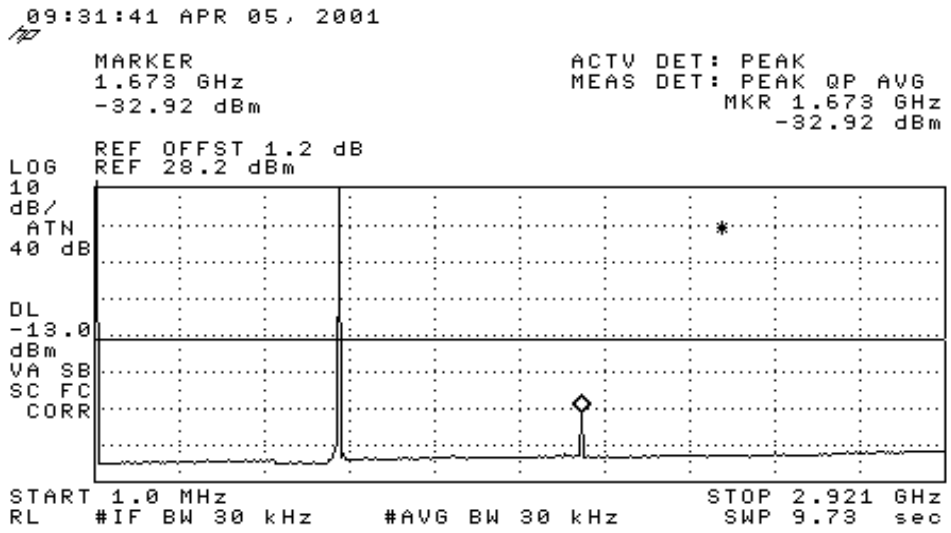


Plot# 12

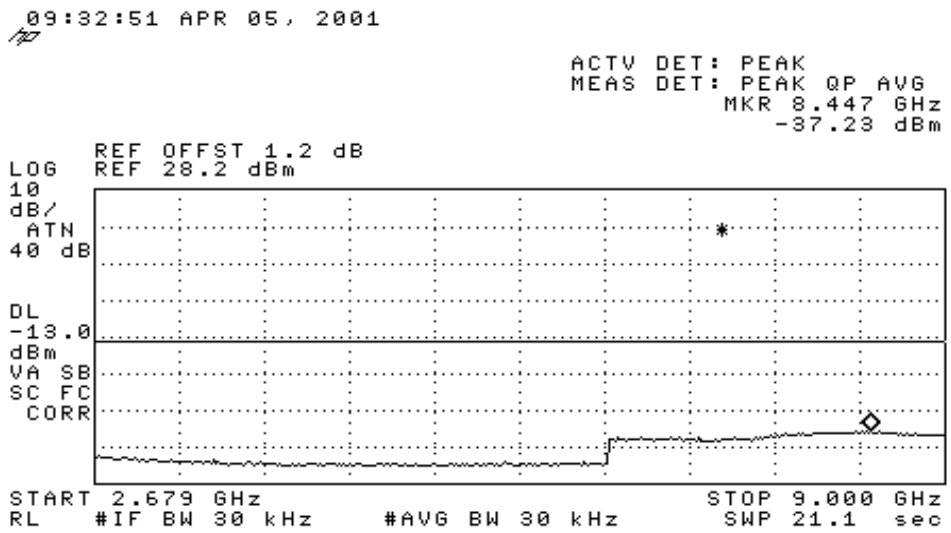


Client:	Standard Communications	Job Number:	J42845
Model:	CRM4200	T-Log Number:	T42858
		Proj Eng:	David Bare
Contact:	Michael Malin		
Spec:	FCC 22 (Cellular)	Class:	N/A

Plot# 13

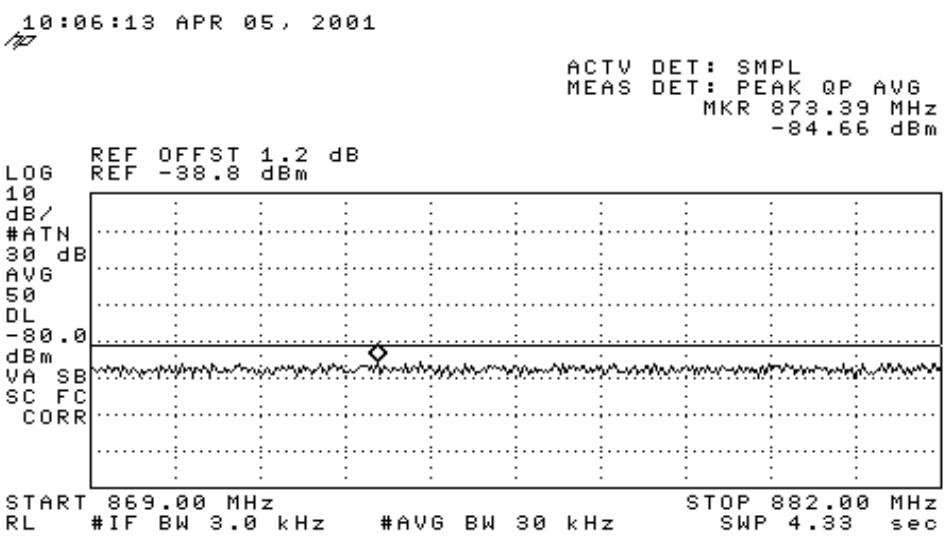


Plot# 14

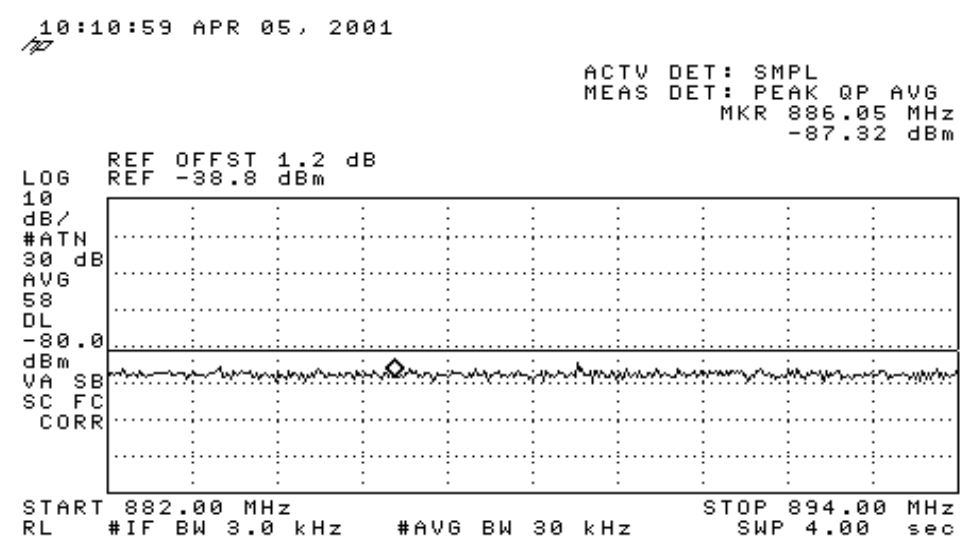


Client:	Standard Communications	Job Number:	J42845
Model:	CRM4200	T-Log Number:	T42858
		Proj Eng:	David Bare
Contact:	Michael Malin		
Spec:	FCC 22 (Cellular)	Class:	N/A

Plot# 15

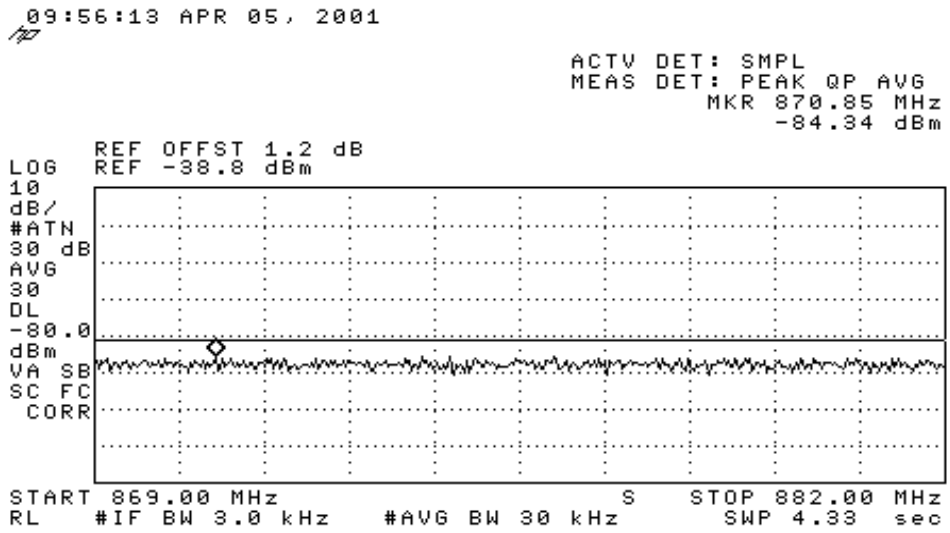


Plot# 16

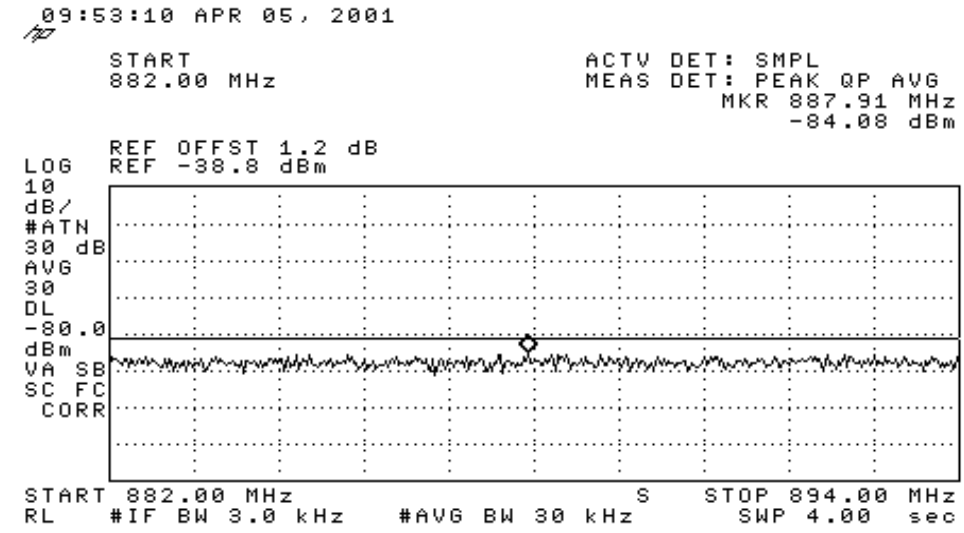


Client:	Standard Communications	Job Number:	J42845
Model:	CRM4200	T-Log Number:	T42858
		Proj Eng:	David Bare
Contact:	Michael Malin		
Spec:	FCC 22 (Cellular)	Class:	N/A

Plot# 17



Plot# 18



Client:	Standard Communications	Job Number:	J42845
Model:	CRM4200	T-Log Number:	T42858
		Proj Eng:	David Bare
Contact:	Michael Malin		
Spec:	FCC 22 (Cellular)	Class:	N/A

Section 2.1053: Field strenght of Spurious 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: 12/21/2000
Test Engineer: jmartinez
Test Location: SVOATS #2

Config. Used: 1
Config Change: None
EUT Voltage: 12 Vdc and 5 Vdc

General Test Configuration

The EUT was located on the turntable for radiated emissions testing.

On the OATS, the measurement antenna was located 3m from the EUT for the frequency range 1 - 10 GHz.

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: 21°C
Rel. Humidity: 35%

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	RE, 1000 - 9000 MHz Maximized Emissions	22.917(e)	Pass	-2.7dB @ 1669.88 MHz

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:	Standard Communications	Job Number:	J42845
Model:	CRM4200	T-Log Number:	T42858
		Proj Eng:	David Bare
Contact:	Michael Malin		
Spec:	FCC 22 (Cellular)	Class:	N/A

Run #1: Maximized readings, 1000 - 9000 MHz

Harmonic measurments of the Fudamental Frequency of 834.99 MHz

Frequency	Level	Pol	FCC 22.917(e)		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
Power set to Maximum.								
1669.880	81.7	H	84.4	-2.7	Pk	145	1.1	Peak reading, peak limit
2504.877	66.2	H	84.4	-18.2	Pk	203	1.0	Peak reading, peak limit
3339.877	65.3	H	84.4	-19.1	Pk	165	1.2	Peak reading, peak limit
4174.930								Analyzer Noise floor
5010.072								Analyzer Noise floor
5845.163								Analyzer Noise floor
6680.000								Analyzer Noise floor
7515.000								Analyzer Noise floor
8350.000								Analyzer Noise floor
1669.942	81.6	V	84.4	-2.8	Pk	140	1.0	Peak reading, peak limit
2504.876	68.7	V	84.4	-15.7	Pk	193	1.0	Peak reading, peak limit
3339.837	64.8	V	84.4	-19.6	Pk	169	1.1	Peak reading, peak limit
4174.930	59.4	V	84.4	-25.0	Pk	228	1.1	Peak reading, peak limit
5010.072	62.0	V	84.4	-22.4	Pk	125	1.1	Peak reading, peak limit
5845.163	64.1	V	84.4	-20.3	Pk	132	1.1	Peak reading, peak limit
6680.000								Analyzer Noise floor
7515.000								Analyzer Noise floor
8350.000								Analyzer Noise floor

Client:	Standard Communications	Job Number:	J42845
Model:	CRM4200	T-Log Number:	T42858
		Proj Eng:	David Bare
Contact:	Michael Malin		
Spec:	FCC 22 (Cellular)	Class:	N/A

Section 2.1055: Frequency Stability

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: 12/29/2000
Test Engineer: jmartinez
Test Location: Enviromental Chamber
Config. Used: 1
Config Change: None
EUT Voltage: 12 Vdc and 5 Vdc

General Test Configuration

EUT was place inside the Temperature Chamber and all local support equipment were located outside on a table for testing. The Eut was connected directly to Test Receiver. A 20-dB attenuator was used between the EUT and Test Receiver.

Chamber was set to -30 to 50 degrees Celsius (60 degrees Celsius for Canada). Incremented 10 degress per temperature and let unit stabilized for every temperature.

Voltage stability was done at 25 degress Celsius. For battery operated units decrease DC voltage until battery end-point was found. For Canada testing set to 80% of the nominal voltage.

Ambient Conditions:

Temperature: N/A
Rel. Humidity: N/A

Summary of Results

Run #	Test Performed	Limit	Result	Comment
1a & 1b	Temperature Vs. Frequency	22.355	Pass	
2a & 2b	Voltage Vs. Frequency	22.355	Pass	Battery end point is Model 4200: 2.3 Vdc.

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.

Client:	Standard Communications	Job Number:	J42845
Model:	CRM4200	T-Log Number:	T42858
		Proj Eng:	David Bare
Contact:	Michael Malin		
Spec:	FCC 22 (Cellular)	Class:	N/A

Run# 1a: Temperature Vs. Frequency

2.5ppm * 834.99 = 2087.475 Hz

Temperature (Celsius)	Drift (Hz)	Limit (Hz)
-30	-308.0	2087.475
-20	-208.0	2087.475
-10	-108.0	2087.475
0	25.0	2087.475
10	-25.0	2087.475
20	467.0	2087.475
30	-230.0	2087.475
40	-360.0	2087.475
50	110.0	2087.475
60	390.0	2087.475

Run# 1b: Temperature Vs. Power

Reference Power = 35.17 dBm

Temperature (Celsius)	Deviation (dB)	Power (dBm)
-30	0.33	35.5
-20	0.03	35.2
-10	0.00	35.17
0	0.33	35.5
10	0.03	35.2
20	0.33	35.5
30	0.03	35.2
40	0.03	35.2
50	0.13	35.3
60	0.016	35.3

Client:	Standard Communications	Job Number:	J42845
Model:	CRM4200	T-Log Number:	T42858
		Proj Eng:	David Bare
Contact:	Michael Malin		
Spec:	FCC 22 (Cellular)	Class:	N/A

Run# 2a: Voltage Vs. Frequency

Model 4200 (5 Vdc):

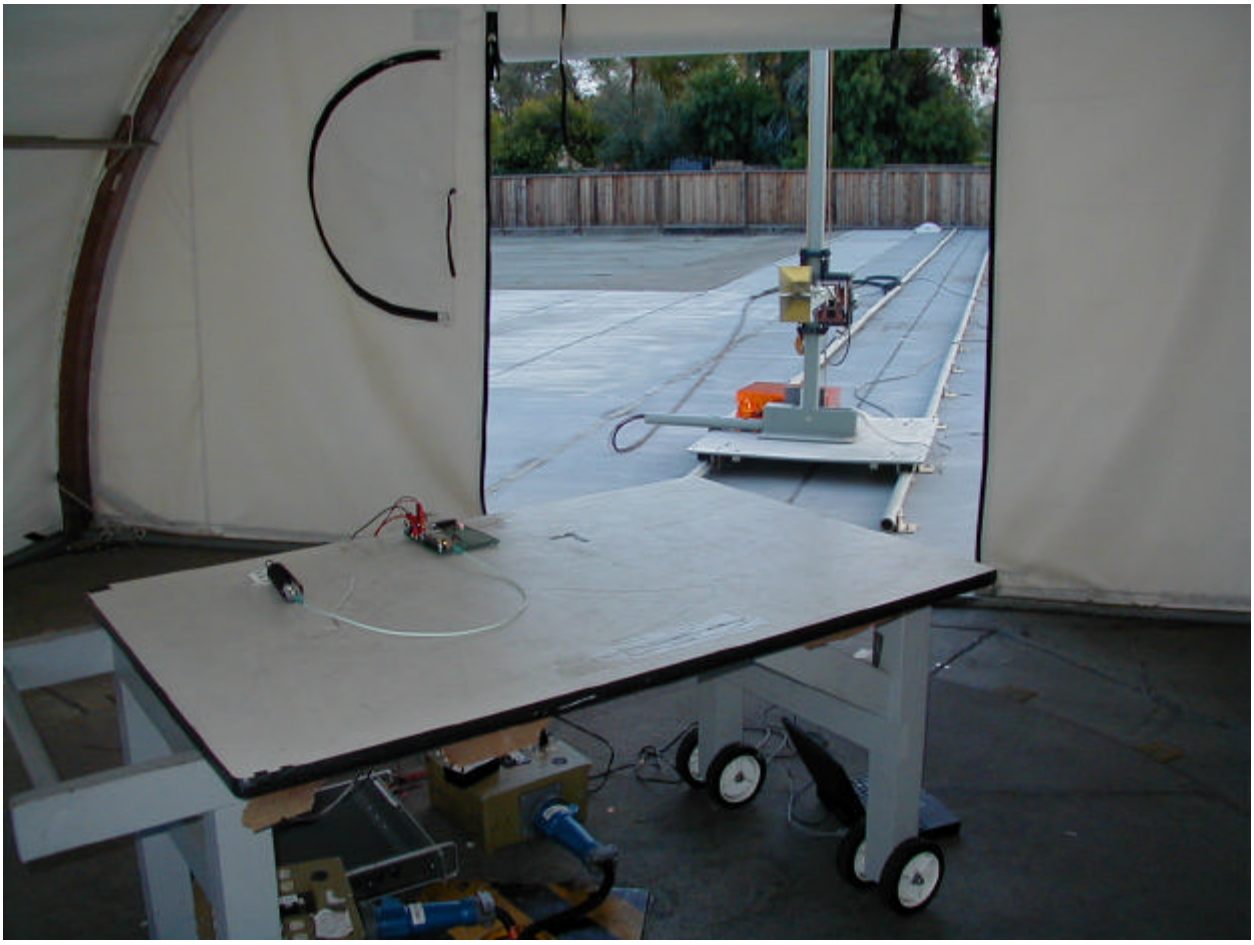
Battery end point is **2.3Vdc**. This will be stated by the manufacturer. No frequency drift occurred, only power decreased as voltage decreased.

Run# 2b: Voltage Vs. Frequency

Nomianl Voltage is 12Vdc.

Voltage	Drift	Limit
(Dc)	(Hz)	(Hz)
80%	3.0	2087.475

EXHIBIT 3: Photographs of Test Configuration



Setup Photo# 1

Setup Photo# 2

Setup Photo# 3

EXHIBIT 4: FCC ID Label and Location

1 page

EXHIBIT 5: Internal and External Photos

EXHIBIT 6: Schematics, Block Diagram, and Parts list

EXHIBIT 7: User Manual, Theory of Operation, and Tune-Up procedure