

*Electromagnetic Emissions Test Report  
In Accordance With  
FCC Part 24 Subpart E  
on the  
Two CDMA Channel PCS Repeater  
Model: RC1920C*

GRANTEE: Repeater Technologies  
1150 Morse Avenue  
Sunnyvale, CA 94089-1605

TEST SITE: Elliott Laboratories, Inc.  
684 W. Maude Ave  
Sunnyvale, CA 94086

REPORT DATE: September 6, 2001

FINAL TEST DATE: June 19, 2001



AUTHORIZED SIGNATORY:

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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: Repeater Technologies  
1150 Morse Avenue  
Sunnyvale, CA 94089-1605

**2.1033(c)(2)** FCC ID: **EK2RC1920C**

**2.1033(c)(3) Instructions/Installation Manual**

Please refer to Exhibit 7: User Manual and Theory of Operation.

**2.1033(c)(4) Type of emissions**

CDMA: 1M25F9W

**2.1033(c)(5) Frequency Range**

Main and Diversity Reverse: 1851.25 – 1908.75 MHz  
Forward: 1931.25 – 1988.75 MHz

**2.1033(c)(6) Range of Operation Power**

Forward: 10 Watts (40 dBm)  
Main Reverse: .063 Watts (18 dBm)  
Diversity Reverse: .063 Watts (18 dBm)

**2.1033(c)(7) Maximum Power Rating**

24.232(a): In no case may the peak output power of a base station transmitter exceed 100 watts

24.235(b): Mobile/portable stations are limited to 2 watts e.i.r.p. peak power and the equipment must employ means to limit the power to the minimum necessary for successful communications.

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

8Vdc, 1amp

**2.1033(c)(9) Tune-up Procedure**

The Tune-Up procedure is located in pg. 9-1 of the User Manual. Refer to Exhibit 7: User Manual and Theory of Operation.

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

Refer to Exhibit 6. The schematic diagram

## **2.1033(c)(10) Means for Frequency Stabilization**

For more information refer to Exhibit 7: Theory of Operation.

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

Refer to Exhibit 6: Schematics. Specifically the ones label “SCHEMATICS, REVERSE POWER AMPLIFIER” and “SCHEMATICS, FowardFrontEnd”.

## **2.1033(c)(10) Means for Limiting Modulation**

For more information please refer to Exhibit 7: Theory of Operation.

## **2.1033(c)(10) Means for Limiting Power**

Power is limited by Software means. Please refer to Exhibit 7: User Manual page 7-1 to 7-78.

## **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**

The repeater does not produce the CDMA internally. The repeater will only provide amplification for the transmission of CDMA modulation.

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

Refer to Exhibit 2

***SCOPE***

FCC Part 24 Subpart E 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 24 Subpart E. 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 24.213(a) & (b) with the EUT set to transmit continuously at maximum power.

Refer to Setup Photo# 1 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)

Not Applicable

#### Section 2.1047 (c) Single sideband and independent sideband radiotelephone transmitters which employ a device or circuit to limit peak envelope power.

Not Applicable

#### Section 2.1047(b): Equipment which employs modulation limiting

Not Applicable

#### Section 2.1047 (d) Other types of equipment.

The Repeater was modulated with an external signal generator source, which produce the actual signal that will be amplified.

Please refer to Setup Photo# 1 under Exhibit 3.

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

**SECTION 2.1049: OCCUPIED BANDWIDTH**

The EUT transmits CDMA modulation Sections 24.238 (b) was used to show compliance for the emission Bandwidth.

The signal was a CDMA modulation, which by industry standards the bandwidth should be 1.25 MHz wide. This was verified with a spectrum analyzer. Both the low and high channels were measured.

A resolution and video bandwidth of 10 kHz was used to measure the Occupied bandwidth.

Since the EUT is an amplification device, input and output plots were made to show that the bandwidth was in no way altered. By altered we refer to the bandwidth increasing in size, which by providing the plots, it will show it did not.

Please refer to Setup Photo# 1 under Exhibit 3.

Refer to data included under **Exhibit 2: Test Measurement Data.**

**SECTION 2.1051: SPURIOUS EMISSION AT ANTENNA TERMINAL.**

The low and high bandedge channels were tested for compliance per Section 24.232(a)(b) & (c). All output ports of the repeater were tested, which were the Base Station port (Forward), the Main Mobile port (Reverse), and the Diversity Port (Reverse).

The Out-of-Band emissions from 1MHz to the 10<sup>th</sup> harmonic of the fundamental were tested per Section 24.232(e) using a 1 MHz resolution and video bandwidth instrumentation setting per 24.232 (b).

Please refer to Setup Photo# 1 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. All emissions were 20-dB below the calculated field strength limit, so substitution method was not performed.

**Maximized Radiated Unwanted Emissions**

Frequency	Level	Pol	FCC 24.238(a)	Detector	Azimuth	Height	Comments
MHz	dB $\mu$ V/m	V/h	Limit	Margin	Pk/QP/Avg	degrees	meters
3977.500	64.2	H	84.2	-20.0	Pk	145	1.1

Please refer to Setup Photo# 2 under Exhibit 3.

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

**SECTION 2.1055: FREQUENCY STABILITY**

The EUT must comply to Section 24.235.

This test was waived due to the use of PLL technology, which prevents the transmitted signal from drifting over the bandedge. For more information please refer to Exhibit 7: Theory of operation.

## **TEST SITE**

### **GENERAL INFORMATION**

Final test measurements were taken on June 19, 2001 at the Elliott Laboratories Open Area Test Site #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 field 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.

Where Bandedge measurements are specified the following procedure was performed:

- 1) Set the transmitting signal as close as possible to the edge of the license frequency per section 24.238(c).
- 2) Set the Display line function to  $-13$  dBm.
- 3) The Spectrum Analyzer was also setup to show any emission, 2 MHz or more above or below the license frequency block, was not exceeding the  $-13$  dBm limit.
- 4) Steps 1 to 3 were repeated for all modulation that will be used and all output ports that will be used for transmission.

If the EUT is an amplification device the following procedure was performed:

- 1) Set the EUT to maximum power and to the low channel. Set the Resolution and Video Bandwidth to 1 or 3 kHz, with no averaging. These settings were used to show the true representation of the signal bandwidth.
- 2) Made a plot of the EUT output port and label it "Output"
- 3) Left the same setting on the spectrum analyzer, but connected the signal generator output port to it. Made a plot and label it "Input"
- 4) Repeated this for the high channel and all modulation that will be used, as well as all output ports that will be used for transmission

**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 1 MHz are used to measure the fundamental output power.

Where Bandedge measurements are specified the following procedure was performed:

- 1) Either a power meter or a spectrum analyzer was used to measure the power output.
- 2) If a spectrum analyzer was used a resolution and video bandwidth 1MHz was used to measure the power output.
- 3) Steps 1 and 2 were repeated for the low and high channels. Steps 1 and 2 were also repeated for all modulation that will be used and all output ports that will be used for transmission.

**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:  
$$\text{Audio Frequency response} = 20 * \log_{10} (\text{DEVfreq} / \text{DEVref})$$
  
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  $\pm 8$  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%. The manufacture or standard specified deviation was not exceeded.

***Section 2.1047 (d) Other types of equipment***

Either digital or data modulated signals were simulated, by software or external sources, to performed the required tests.

***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. The Temperature chamber was varied from  $-30$  to  $+50^{\circ}\text{C}$  in 10 degrees increment. The EUT was allowed to stabilize for each temperature variation.

For AC operated devices the nominal voltage is varied to 85% and to 115% at either room temperature or at a controlled  $+20^{\circ}\text{C}$  temperature.

For battery-powered devices the voltage battery end-point is determined by reducing the dc voltage until the unit ceases to function. This is performed at either room temperature or at a controlled  $+20^{\circ}\text{C}$  temperature.

***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.

**Section 2.1053: RADIATED EMISSIONS**

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. 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.

For the final measurement, Substitution method is performed on spurious emissions not being 20-dB below the calculated radiated limit. Substitution method is replacing the EUT with a horn antenna, which factors can be reference to a half-wave dipole, and with a signal generator. The signal generator power level was adjusted until a similar level, which was measured on the first scan, is achieved on the spectrum analyzer. The level on the signal generator is then added to the antenna factor, in dBi, which will give the corrected value.

**SPECIFICATION LIMITS AND SAMPLE CALCULATIONS****RADIATED EMISSIONS SPECIFICATION LIMITS**

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 (dB<sub>BuV/m</sub>). 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  $43 + 10\log_{10}$  (mean output power in watts) dB below the measured amplitude at the operating power.

**CALCULATIONS – EFFECTIVE RADIATED POWER**

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

E= Field Strength in V/m

P= Power in Watts (for this example we use 3 watts)

G= Gain of antenna in numeric gain (Assume 1.64 for ERP)

d= distance in meters

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

$$20 * \log (4.049 \text{ V/m} * 1,000,000) = 132.14 \text{ dBuV/m} @ 3 \text{ meters}$$

Section 22.917(e): Request an attenuation of  $43 + 10 \log (3)$  or 47.8 dB for all emissions outside the assigned block, the limit for spurious and harmonic emissions is:

$$132.1 \text{ dBuV/m} - 47.8 \text{ dB} = 84.3 \text{ dBuV/m} @ 3 \text{ meter.}$$

**Note: Substitution Method is performed for spurious emission not being 20-dB below the calculated field strength.**

***EXHIBIT 1: Test Equipment Calibration Data***

**Antenna Conducted Emissions, 30-Jul-01 10:06 AM****Engineer: jmartinez**

<u>Manufacturer</u>	<u>Description</u>	<u>Model #</u>	<u>Assett #</u>	<u>Cal interval</u>	<u>Last Calibrated</u>	<u>Cal Due</u>
Hewlett Packard	Spectrum Analyzer, 9KHz - 22GHz	8593EM	1319	12	5/31/01	5/31/02

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**Radiated Emissions, 1 - 20 GHz, 30-Jul-01 10:07 AM****Engineer: jmartinez**

<u>Manufacturer</u>	<u>Description</u>	<u>Model #</u>	<u>Assett #</u>	<u>Cal interval</u>	<u>Last Calibrated</u>	<u>Cal Due</u>
Hewlett Packard	Microwave EMI test system (SA40, 30Hz - 40GHz)	84125C	1149	12	2/5/01	2/5/02

***EXHIBIT 2: Test Measurement Data***

The following data includes conducted and radiated emission measurements of the Repeater Technologies, Model No: RC1920C.

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## EMC Test Data

Client:	Repeater Technologies	Job Number:	J43477
Model:	RC1920C	T-Log Number:	T43891
		Proj Eng:	David Bare
Contact:	Dirk Kieger		
Emissions Spec:	FCC 24 & IC-RSS133	Class:	N/A
Immunity Spec:		Environment:	

## EMC Test Data

For The

### Repeater Technologies

Model

**RC1920C**



## EMC Test Data

Client:	Repeater Technologies	Job Number:	J43477
Model:	RC1920C	T-Log Number:	T43891
		Proj Eng:	David Bare
Contact:	Dirk Kieger		
Emissions Spec:	FCC 24 & IC-RSS133	Class:	N/A
Immunity Spec:	Enter immunity spec on cover	Environment:	

## EUT INFORMATION

### General Description

The EUT is an repeater amplifier which is designed to be used with base station PCS towers. 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 120V, 60 Hz, 12 Amps.

### Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
Repeater Technologies	RC1920C	amplifier	N/A	

### EUT Enclosure

The EUT enclosure is primarily constructed of fabricated sheet steel. It measures approximately 35.6 cm wide by 29.2 cm deep by 40.6 cm high.

### Modification History

Mod. #	Test	Date	Modification
1			
2			
3			



## EMC Test Data

Client:	Repeater Technologies	Job Number:	J43477
Model:	RC1920C	T-Log Number:	T43891
		Proj Eng:	David Bare
Contact:	Dirk Kieger		
Emissions Spec:	FCC 24 & IC-RSS133	Class:	N/A
Immunity Spec:	Enter immunity spec on cover	Environment:	

### Test Configuration #1

#### Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
HP	Pavilion 7840	PC	KR10504395	DoC
Mitsubishi	Diamond Plus 91	Monitor	011A34108	DoC
HP	5181	Keyboard	BD05106245	DoC
HP	M-S34	Mouse	LZS04915643	DoC
HP	2225C	Printer	Z714S40166	DS16XU2225

#### Remote Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
None				

#### EUT Interface Ports

EUT Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
USB	Unterminated	USB	Shielded	2
Ethernet	PC	RJ-45	Unshielded	1.5
Serial	PC	RS-232	Shielded	1.5
4xTelephone	Unterminated	RJ-11	Unshielded	2

#### EUT Operation During Emissions

A signal generator was used to provide CDMA modulation to EUT, which was set to produce maximum output power.



## *EMC Test Data*

Client:	Repeater Technologies	Job Number:	J43477
Model:	RC1920C	T-Log Number:	T43891
		Proj Eng:	David Bare
Contact:	Dirk Kieger		
Spec:	FCC 24 & IC-RSS133	Class:	N/A

## Section 2.1046 & RSS-133 (6.2): 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: 6/19/01 Config. Used: 1  
Test Engineer: jmartinez Config Change: None  
Test Location: SVOATS #2 EUT Voltage: 120V/60Hz

## General Test Configuration

The EUT was located on the turntable for radiated field strength measurements and the local support equipment was located underneath the table.

For radiated emissions testing the measurement antenna was located 3 meters from the EUT.

**Ambient Conditions:** Temperature: 23°C  
Rel. Humidity: 31%

## Summary of Results

Run #	Test Performed	Limit	Result	Comment
1	Conducted Output Power	24.232(a) & RSS-133(6.2)	Pass	Base (Forward) antenna
2	Conducted Output Power	24.232(b) & RSS-133(6.2)	Pass	Main Mobile (Reverse) antenna
3	Conducted Output Power	24.232(b) & RSS-133(6.2)	Pass	Diversity Mobile (Reverse) antenna

## 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.



## EMC Test Data

Client: Repeater Technologies

Job Number: J43477

Model: RC1920C

T-Log Number: T43891

Contact: Dirk Kieger

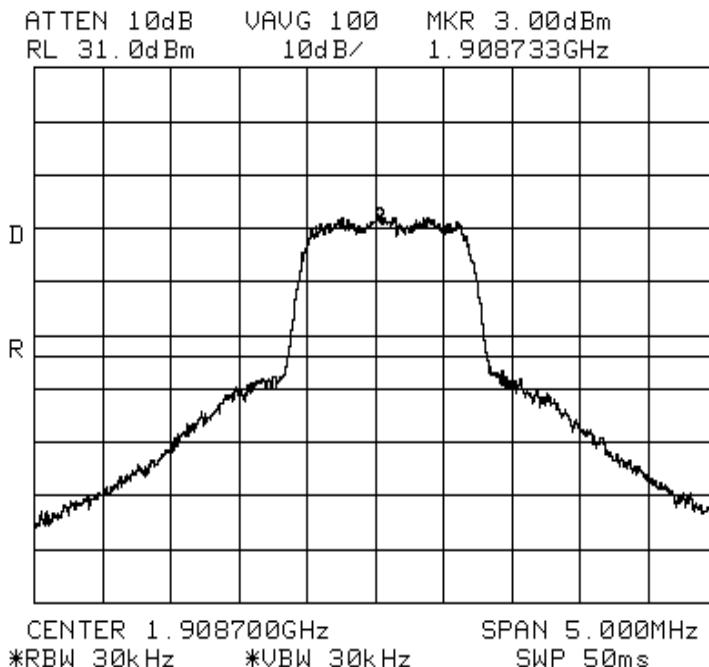
Proj Eng: David Bare

Spec: FCC 24 & IC-RSS133

Class: N/A

### Run #1: Conducted Output Power (Base (forward) antenna)

Measured Value	Corredion factor	Power Output	Resolution	Comments
(dBm)	(dB)	(dBm)	(kHz)	
3.0	15.2	18.2	30	Plot# 1
3.0	15.2	18.2	30	Plot# 2



Base (Forward) antenna  
Channel 1 (High Channel)  
CDMA Modulation  
Power Output  
Plot# 1



## EMC Test Data

Client: Repeater Technologies

Job Number: J43477

Model: RC1920C

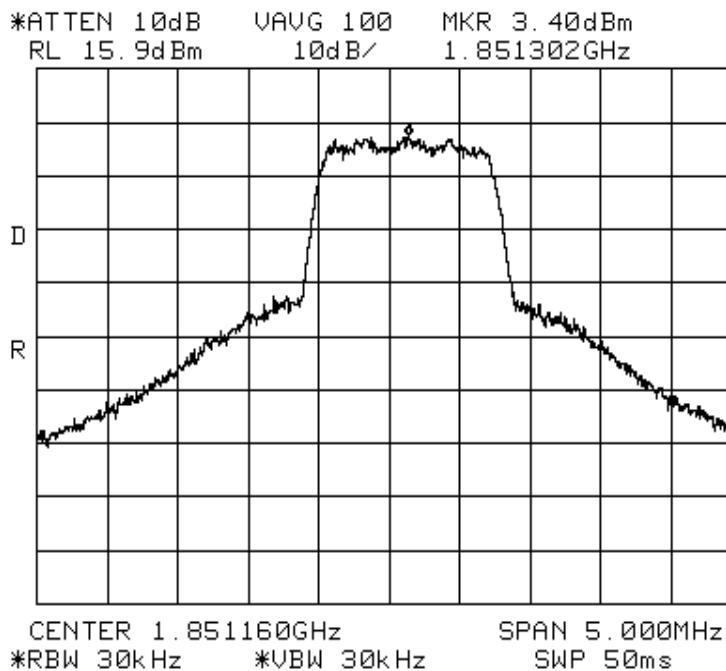
T-Log Number: T43891

Contact: Dirk Kieger

Proj Eng: David Bare

Spec: FCC 24 & IC-RSS133

Class: N/A



Note 1: The power output was measured with a 30 kHz resolution bandwidth. The output power was corrected using the following formula  $10 * \log (RB1 / RB2)$ . RB1 is the 1 MHz specified Resolution bandwidth and RB2 is the Resolution bandwidth used for the measurement.  $10 * \log (1MHz / 30KHz) = 15.2$  dB correction.



## EMC Test Data

Client: Repeater Technologies

Job Number: J43477

Model: RC1920C

T-Log Number: T43891

Contact: Dirk Kieger

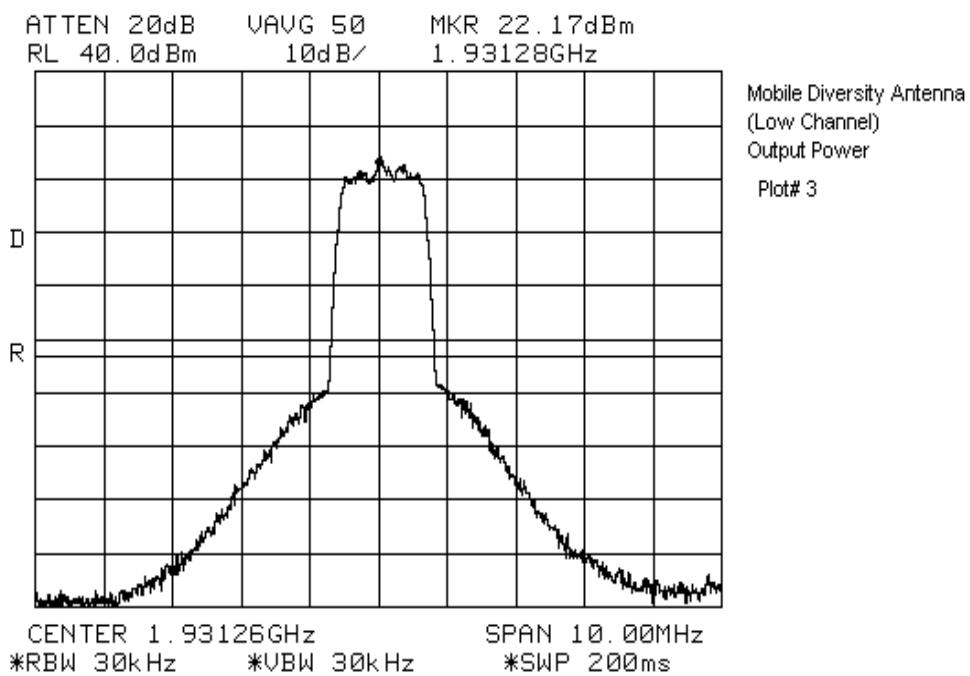
Proj Eng: David Bare

Spec: FCC 24 & IC-RSS133

Class: N/A

### Run #2: Conducted Output Power (Mobile Diversity (Reverse) antenna)

Measured Value	Corredion factor	Power Output	Resolution	Comments
(dBm)	(dB)	(dBm)	(kHz)	
22.2	15.2	37.4	30	Plot# 3

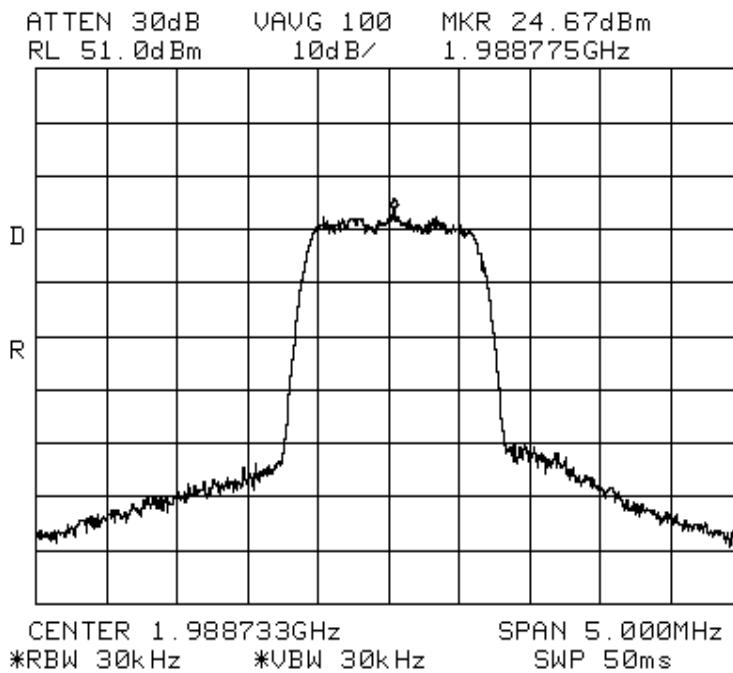


Note 1: The power output was measured with a 30 kHz resolution bandwidth. The output power was corrected using the following formula  $10 * \log (RB 1 / RB 2)$ . RB 1 is the 1 MHz specified Resolution bandwidth and RB 2 is the Resolution bandwidth used for the measurement.  $10 * \log (1MHz / 30KHz) = 15.2$  dB correction.

Client: Repeater Technologies	Job Number: J43477
Model: RC1920C	T-Log Number: T43891
	Proj Eng: David Bare
Contact: Dirk Kieger	
Spec: FCC 24 & IC-RSS133	Class: N/A

**Run #3: Conducted Output Power (Mobile Main (Reverse) antenna)**

Measured Value	Corredion factor	Power Output	Resolution	Comments
(dBm)	(dB)	(dBm)	(kHz)	
24.7	15.2	39.9	30	Plot# 4



Note 1:	The power output was measured with a 30 kHz resolution bandwidth. The output power was corrected using the following formula $10 * \log (RB1 / RB2)$ . RB1 is the 1 MHz specified Resolution bandwidth and RB2 is the Resolution bandwidth used for the measurement. $10 * \log (1MHz / 30KHz) = 15.2$ dB correction.
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## *EMC Test Data*

Client: Repeater Technologies	Job Number: J43477
Model: RC1920C	T-Log Number: T43891
	Proj Eng: David Bare
Contact: Dirk Kieger	
Spec: FCC 24 & IC-RSS133	Class: N/A

## Section 2.1049 & RSS-133 (5.6): 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: 6/19/01 Config. Used: 1  
Test Engineer: jmartinez Config Change: None  
Test Location: SVOATS #2 EUT Voltage: 120V/60Hz

## General Test Configuration

When performing conducted measurements from the EUT's antenna port, the antenna port of the EUT was connected to the spectrum analyzer or power meter via a suitable attenuator to prevent overloading the measurement system. All measurements are corrected. Modulation must not exceed manufacturers stated bandwidth.

For this specific test the occupied bandwidth was measured to provide the correct Resolution bandwidth that will be used for the bandedge measurements. This requirement is specified in 24.238(b) and RSS-133 (5.9) & (6.3)(a).

Because the EUT is an amplifier, input and output plots were made to show that the bandwidth was not altered. By altered we refer to the bandwidth increasing in width.

**Ambient Conditions:** Temperature: 23°C  
Rel. Humidity: 31%

## Summary of Results

Run	Test Performed	Limit	Result	Comment
1	Occupied Bandwidth	24.238(b) & RSS-133(5.6)	Pass	Base (Forward) Channel 1
2	Occupied Bandwidth	24.238(b) & RSS-133(5.6)	Pass	Base (Forward) Channel 2
3	Occupied Bandwidth	24.238(b) & RSS-133(5.6)	Pass	Main Mobile (Reverse) antenna
4	Occupied Bandwidth	24.238(b) & RSS-133(5.6)	Pass	Diversity Mobile (Reverse) antenna

Client: Repeater Technologies

Job Number: J43477

Model: RC1920C

T-Log Number: T43891

Contact: Dirk Kieger

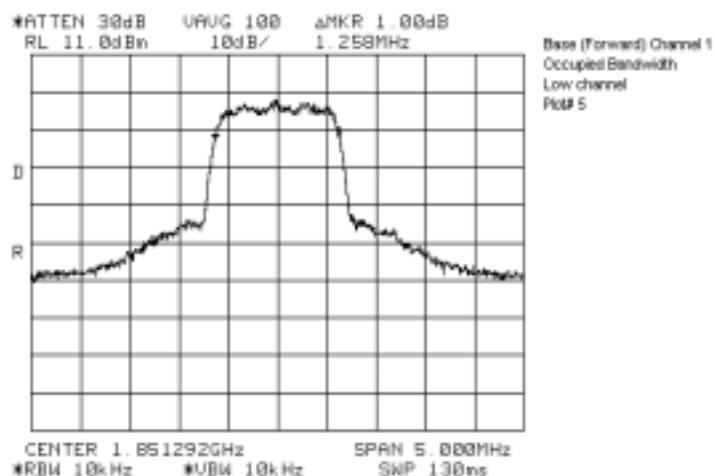
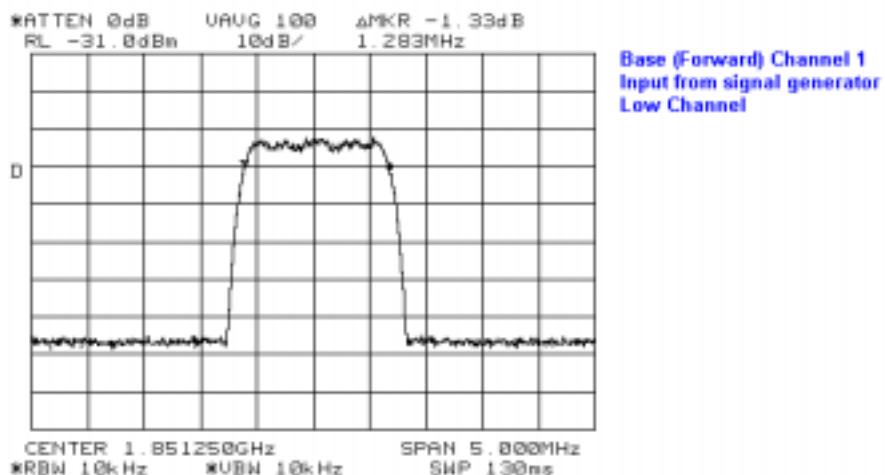
Proj Eng: David Bare

Spec: FCC 24 &amp; IC-RSS133

Class: N/A

**Run #1: Occupied Bandwidth (Base (forward) Channel 1)**

Measured Value	Specified Bandwidth	Resolution	Comments
(dBm)	MHz	(kHz)	
1.258	1.25	10	

**Output Plot**

**Input Plot**




## EMC Test Data

Client: Repeater Technologies

Job Number: J43477

Model: RC1920C

T-Log Number: T43891

Contact: Dirk Kieger

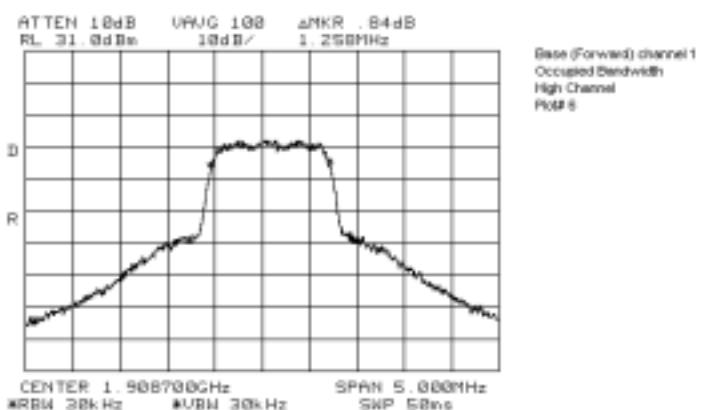
Proj Eng: David Bare

Spec: FCC 24 & IC-RSS133

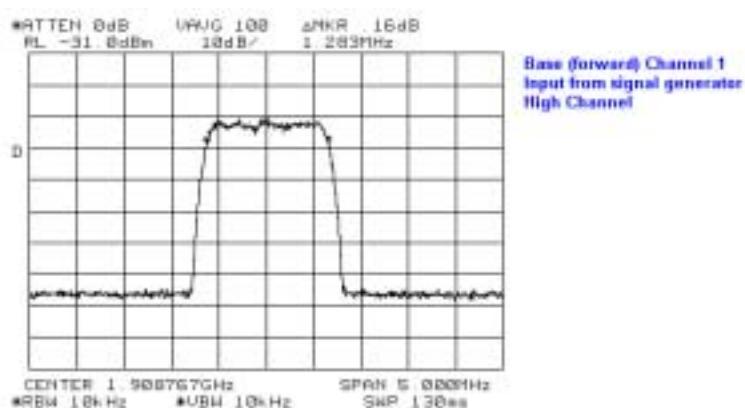
Class: N/A

Measured Value	Specified Bandwidth	Resolution	Comments
(dBm)	MHz	(kHz)	
1.258	1.25	10	

Output Plot



Input Plot



Client: Repeater Technologies

Job Number: J43477

Model: RC1920C

T-Log Number: T43891

Contact: Dirk Kieger

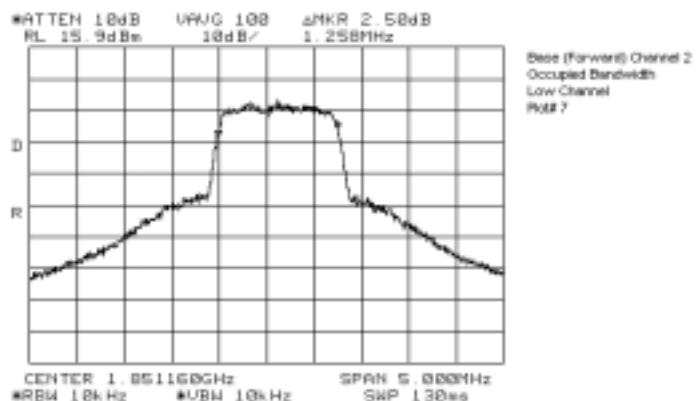
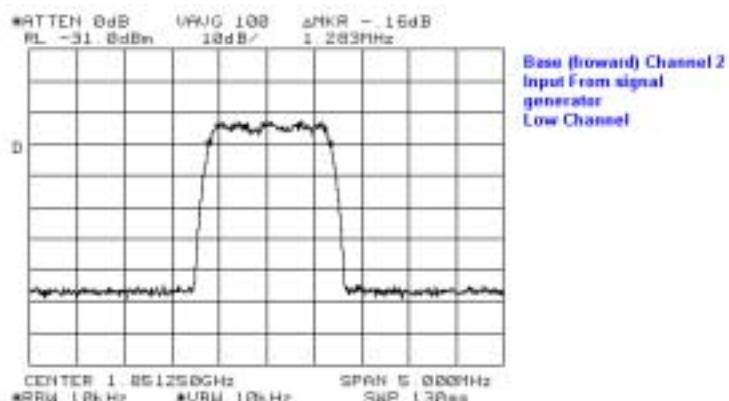
Proj Eng: David Bare

Spec: FCC 24 &amp; IC-RSS133

Class: N/A

**Run #2: Occupied Bandwidth (Base (forward) Channel 2)**

Measured Value	Specified Bandwidth	Resolution	Comments
(dBm)	MHz	(kHz)	
1.258	1.25	10	

**Output Plot**

**Input Plot**


Client: Repeater Technologies

Job Number: J43477

Model: RC1920C

T-Log Number: T43891

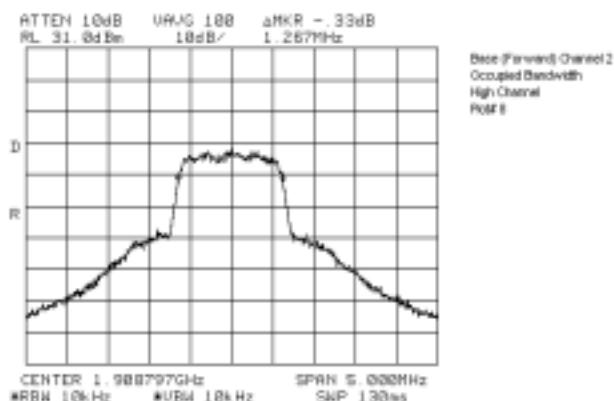
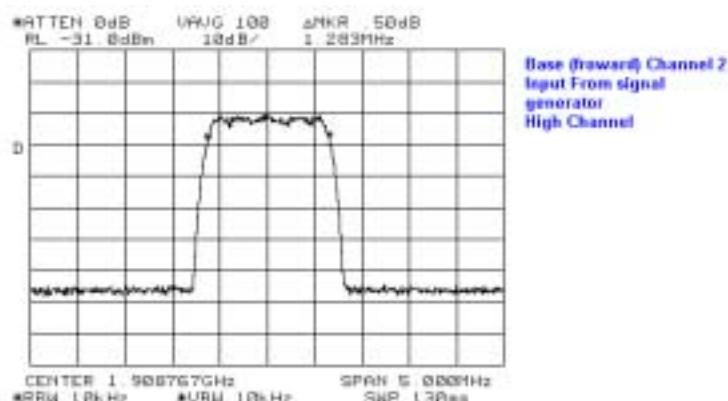
Contact: Dirk Kieger

Proj Eng: David Bare

Spec: FCC 24 &amp; IC-RSS133

Class: N/A

Measured Value	Specified Bandwidth	Resolution	Comments
(dBm)	MHz	(kHz)	
1.258	1.25	10	

**Output Plot**

**Input Plot**


Client: Repeater Technologies

Job Number: J43477

Model: RC1920C

T-Log Number: T43891

Contact: Dirk Kieger

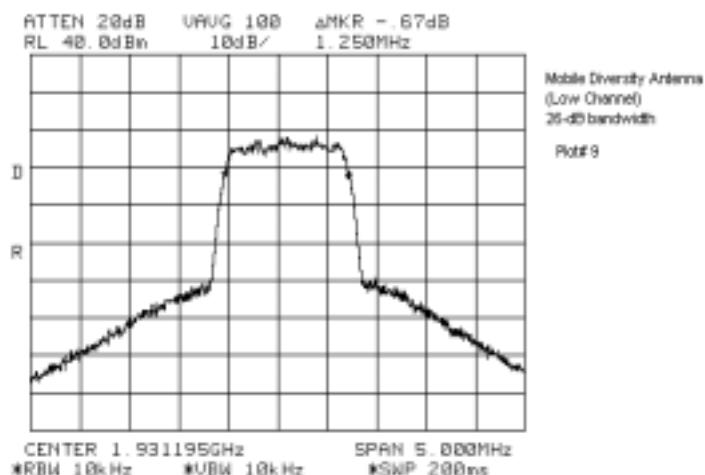
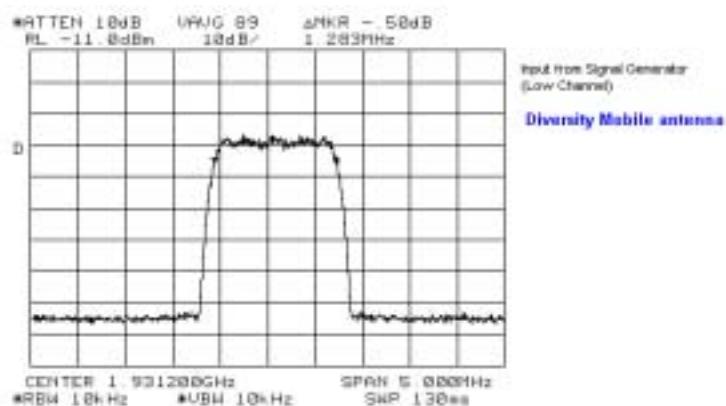
Proj Eng: David Bare

Spec: FCC 24 &amp; IC-RSS133

Class: N/A

**Run #3: Occupied Bandwidth (Diversity Mobile (Reverse) antenna)**

Measured Value	Specified Bandwidth	Resolution	Comments
(dBm)	MHz	(kHz)	
1.250	1.25	10	

**Output Plot**

**Input Plot**


Client: Repeater Technologies

Job Number: J43477

Model: RC1920C

T-Log Number: T43891

Contact: Dirk Kieger

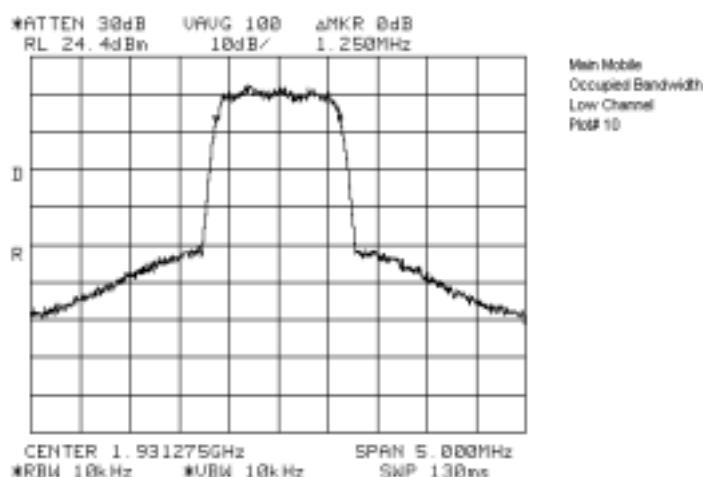
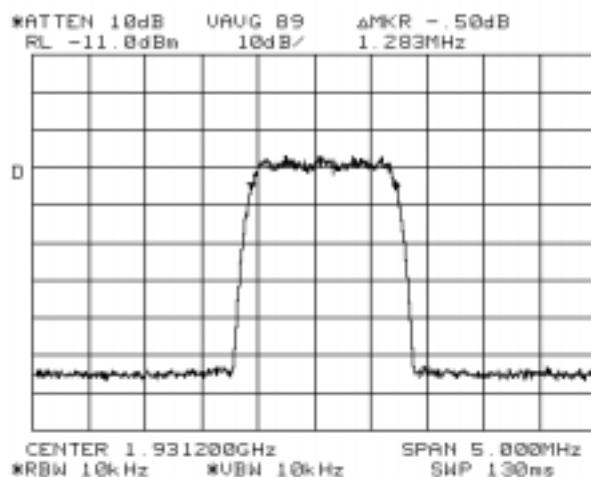
Proj Eng: David Bare

Spec: FCC 24 &amp; IC-RSS133

Class: N/A

**Run #4: Occupied Bandwidth (Main Mobile (Reverse) antenna)**

Measured Value	Specified Bandwidth	Resolution	Comments
(dBm)	MHz	(kHz)	
1.250	1.25	10	

**Output Plot**

**Input Plot**




## *EMC Test Data*

Client: Repeater Technologies	Job Number: J43477
Model: RC1920C	T-Log Number: T43891
	Proj Eng: David Bare
Contact: Dirk Kieger	
Spec: FCC 24 & IC-RSS133	Class: N/A

## **Section 2.1051, RSS-133 (6.3): 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: 6/19/01

Config. Used: 1

Test Engineer: jmartinez

Config Change: None

Test Location: SVOATS #2

EUT Voltage: 120V/60Hz

## 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	Bandedge Measurement & Out-Of-Band emission	24.238(a) & RSS-133 (6.3)	Pass	Base (Forward) Channel 1
2	Bandedge Measurement & Out-Of-Band emission	24.238(a) & RSS-133 (6.3)	Pass	Base (Forward) Channel 2
3	Bandedge Measurement & Out-Of-Band emission	24.238(a) & RSS-133 (6.3)	Pass	Main Mobile (Reverse) antenna
4	Bandedge Measurement & Out-Of-Band emission	24.238(a) & RSS-133 (6.3)	Pass	Diversity Mobile (Reverse) antenna

### 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.



## EMC Test Data

Client: Repeater Technologies

Job Number: J43477

Model: RC1920C

T-Log Number: T43891

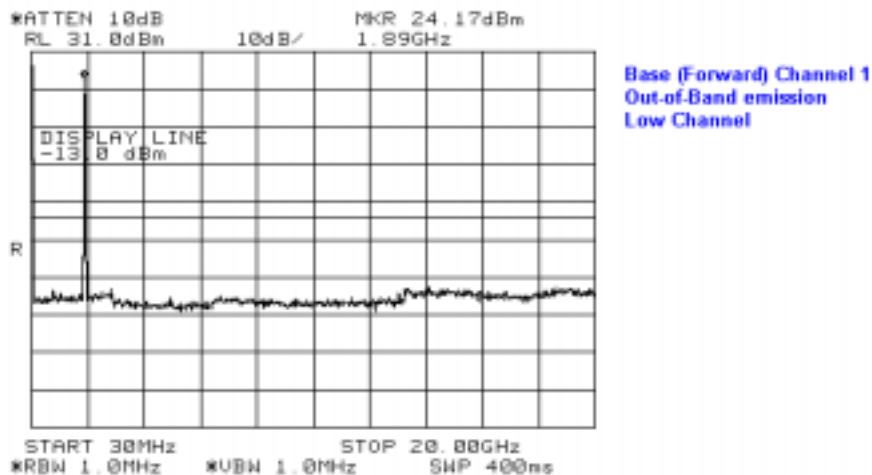
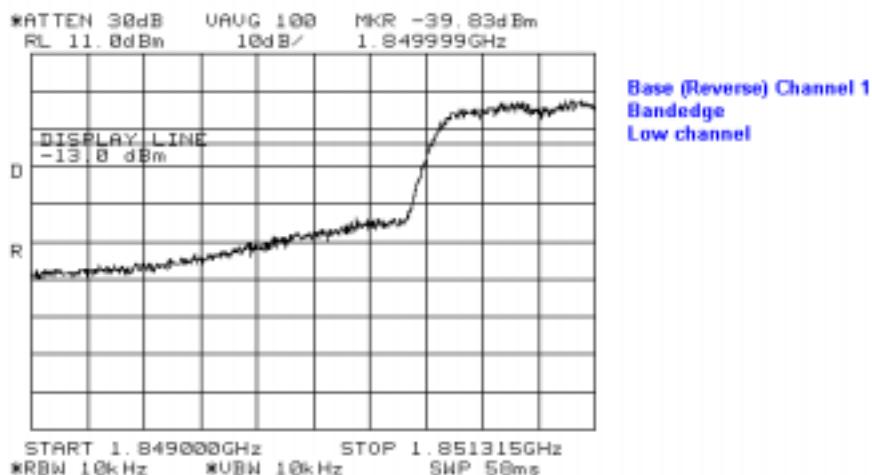
Contact: Dirk Kieger

Proj Eng: David Bare

Spec: FCC 24 & IC-RSS133

Class: N/A

### Run #1: Bandedge Measurement & Out-Of-Band emissions; (Base (forward) Channel 1)





## EMC Test Data

Client: Repeater Technologies

Job Number: J43477

Model: RC1920C

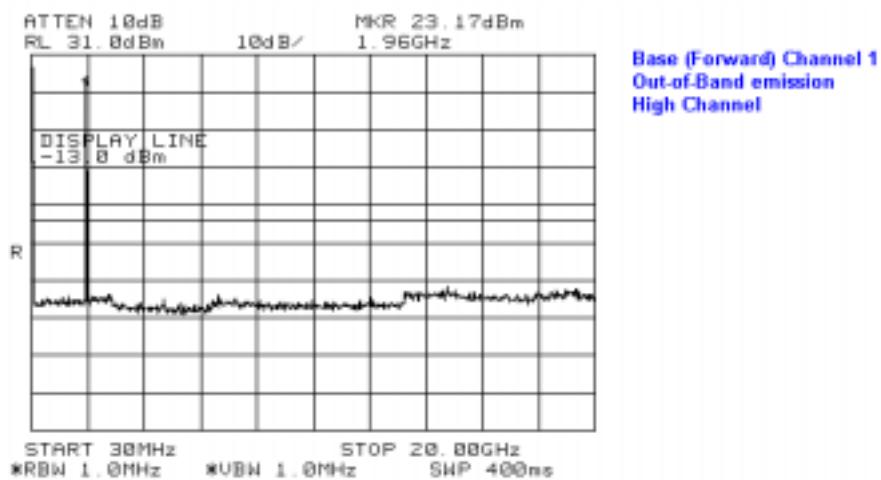
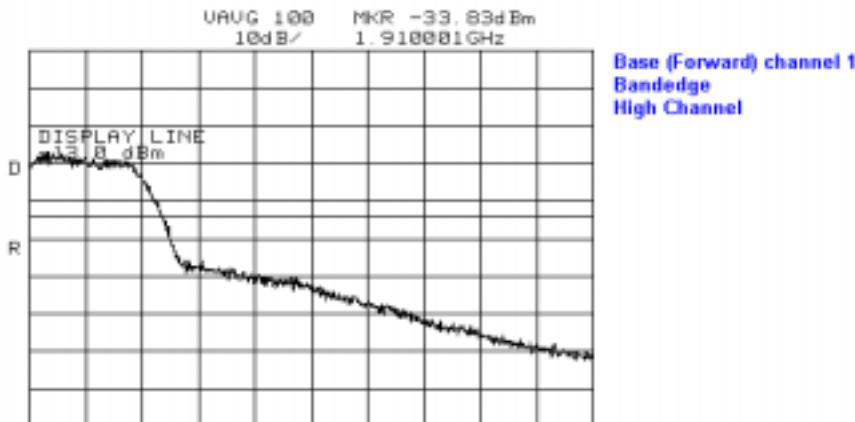
T-Log Number: T43891

Contact: Dirk Kieger

Proj Eng: David Bare

Spec: FCC 24 & IC-RSS133

Class: N/A





## EMC Test Data

Client: Repeater Technologies

Job Number: J43477

Model: RC1920C

T-Log Number: T43891

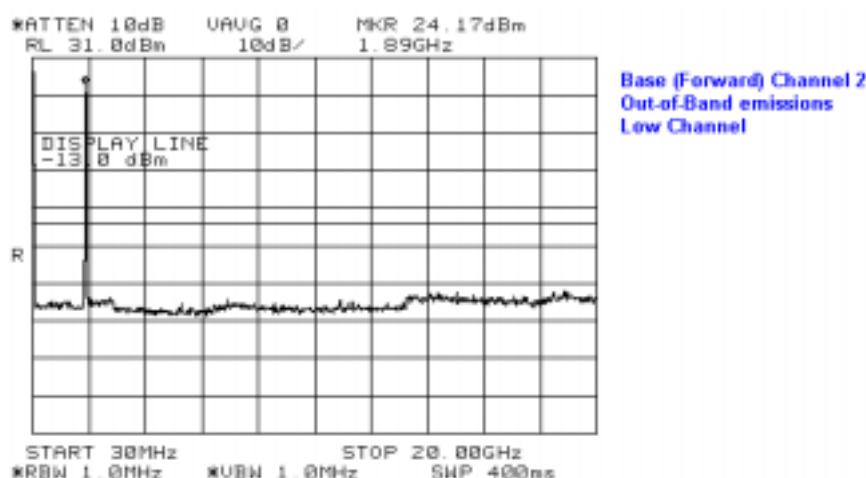
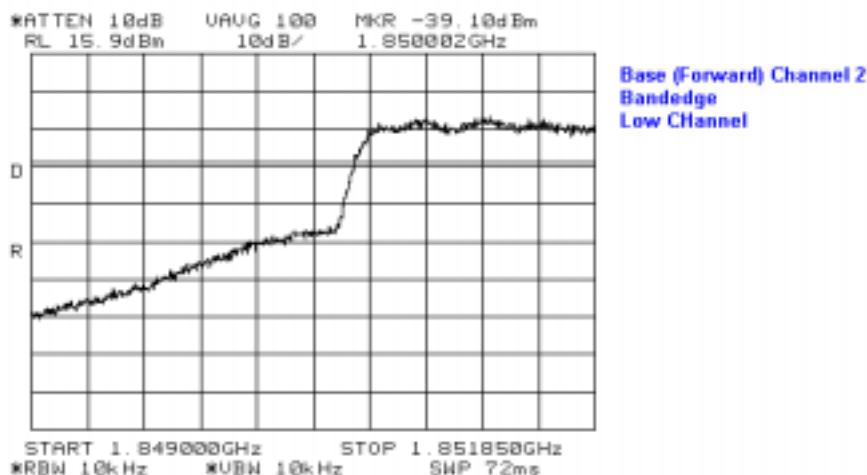
Contact: Dirk Kieger

Proj Eng: David Bare

Spec: FCC 24 & IC-RSS133

Class: N/A

### Run #2: Bandedge Measurement & Out-Of-Band emissions; (Base (forward) Channel 2)





## EMC Test Data

Client: Repeater Technologies

Job Number: J43477

Model: RC1920C

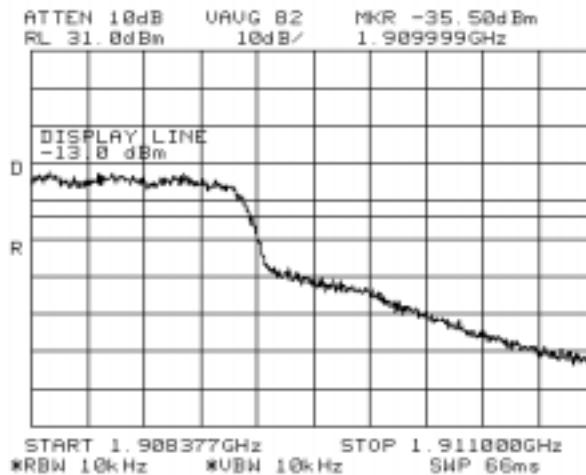
T-Log Number: T43891

Contact: Dirk Kieger

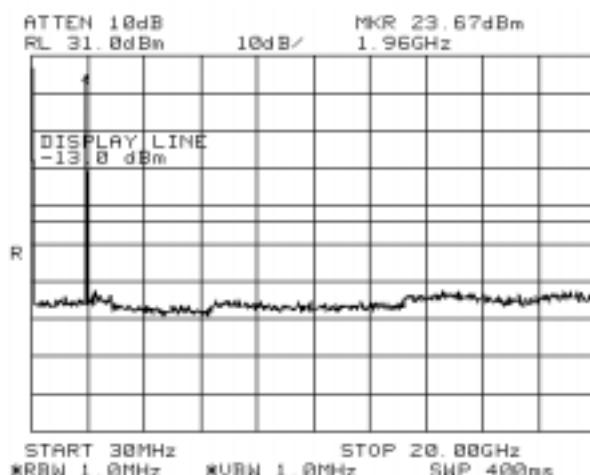
Proj Eng: David Bare

Spec: FCC 24 & IC-RSS133

Class: N/A



Base (forward) Channel 2  
Bandedge  
High Channel



Base (forward) Channel 2  
Out-of-Band emissions  
High Channel



## EMC Test Data

Client: Repeater Technologies

Job Number: J43477

Model: RC1920C

T-Log Number: T43891

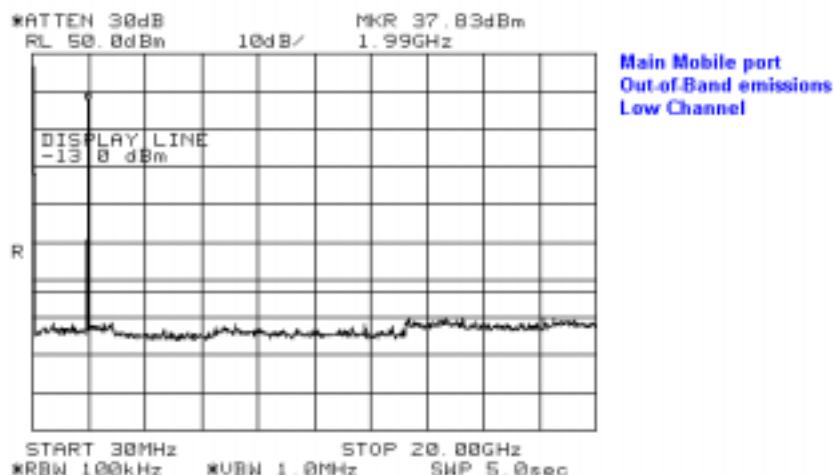
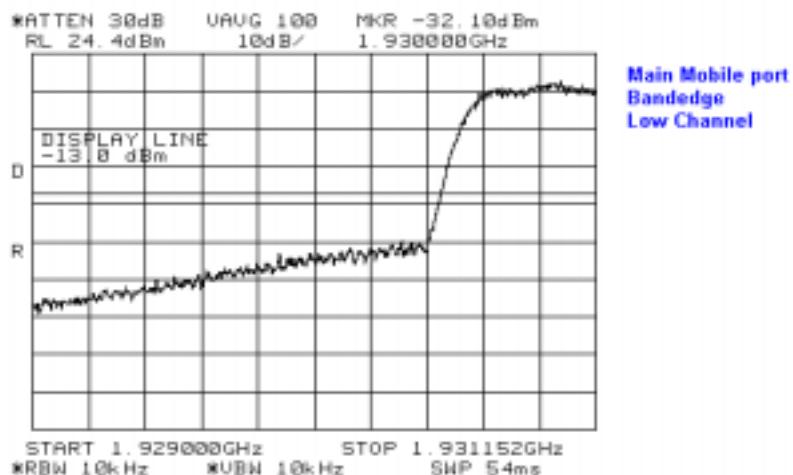
Contact: Dirk Kieger

Proj Eng: David Bare

Spec: FCC 24 & IC-RSS133

Class: N/A

### Run #3: Bandedge Measurement & Out-Of-Band emissions; (Main Mobile port)





## EMC Test Data

Client: Repeater Technologies

Job Number: J43477

Model: RC1920C

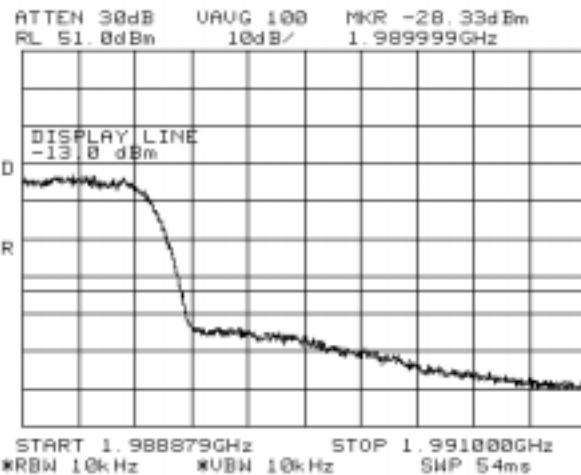
T-Log Number: T43891

Contact: Dirk Kieger

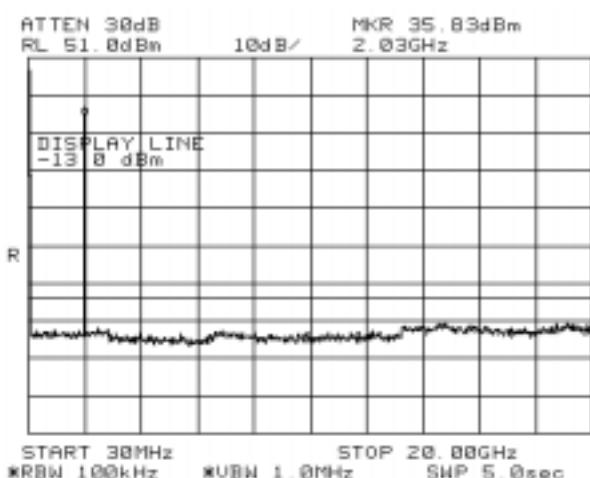
Proj Eng: David Bare

Spec: FCC 24 & IC-RSS133

Class: N/A



Main Mobile port  
Bandedge  
High Channel



Main Mobile port  
Out-of-Band  
High Channel



## EMC Test Data

Client: Repeater Technologies

Job Number: J43477

Model: RC1920C

T-Log Number: T43891

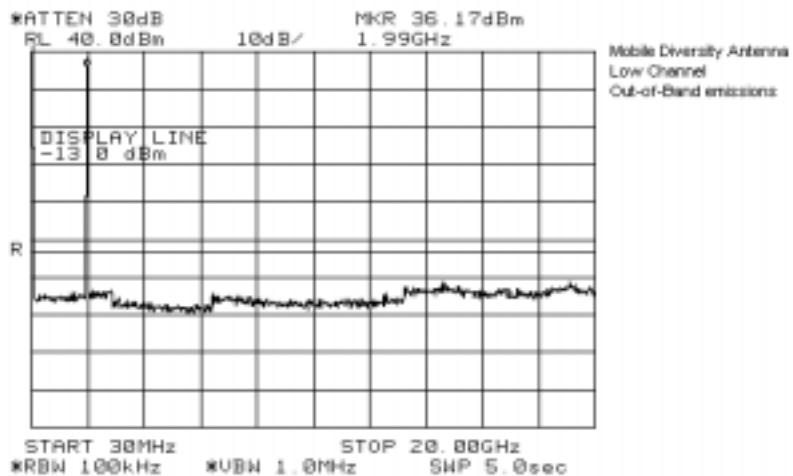
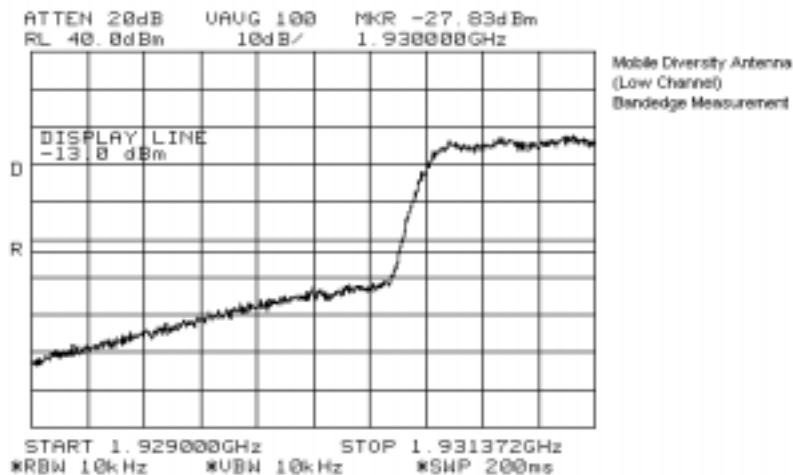
Contact: Dirk Kieger

Proj Eng: David Bare

Spec: FCC 24 & IC-RSS133

Class: N/A

### Run #4: Bandedge Measurement & Out-Of-Band emissions; (Mobile Diversity Antenna)





## EMC Test Data

Client: Repeater Technologies

Job Number: J43477

Model: RC1920C

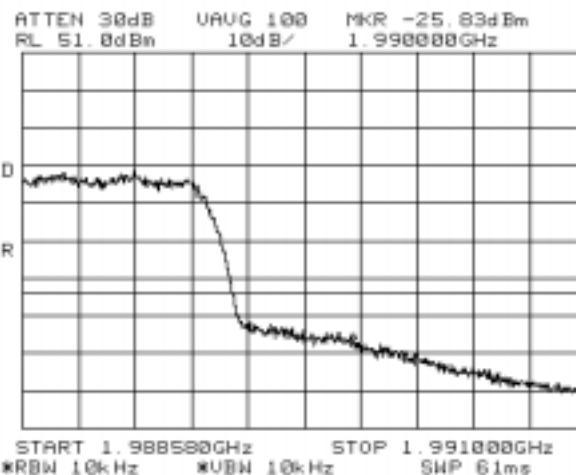
T-Log Number: T43891

Contact: Dirk Kieger

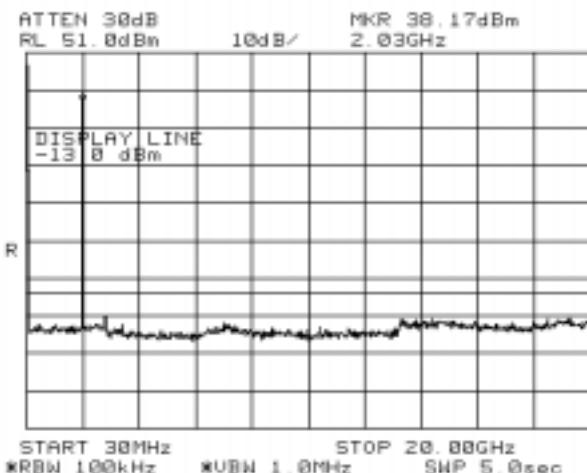
Proj Eng: David Bare

Spec: FCC 24 & IC-RSS133

Class: N/A



Mobile diversity antenna  
High Channel  
Bandedge Measurement



Mobile Diversity antenna  
High Channel  
Out-of-Band Emissions



## *EMC Test Data*

Client: Repeater Technologies	Job Number: J43477
Model: RC1920C	T-Log Number: T43891
	Proj Eng: David Bare
Contact: Dirk Kieger	
Spec: FCC 24 & IC-RSS133	Class: N/A

## Section 2.1053 & RSS-133 (6.3): Field strength 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: 6/19/01

Config. Used: 1

Test Engineer: jmartinez

Config Change: None

Test Location: SVOATS #2

EUT Voltage: 120V/60Hz

## 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 - 20 GHz.

For radiated emissions testing the measurement antenna was located 3 meters from the EUT. For any Spurious emission more than 20-dB of the field strength limit, substitution was performed. Substitution Method is not required for Spurious emissions 20-dB below the calculated field strength limit.

### Ambient Conditions:

Temperature: 21°C

Rel. Humidity: 35%

## Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	RE, 1000 - 19000 MHz Maximized Emissions	24.238(a) & RSS-133 (6.3)(a)(ii)	Pass	-20dB @ 3977.5 MHz
2	RE, 1000 - 19000 MHz Maximized Emissions	24.238(a) & RSS-133 (6.3)(a)(ii)	Pass	-22.45dB @ 3952 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



## EMC Test Data

Client: Repeater Technologies	Job Number: J43477
Model: RC1920C	T-Log Number: T43891
	Proj Eng: David Bare
Contact: Dirk Kieger	
Spec: FCC 24 & IC-RSS133	Class: N/A

### Run #1: Maximized readings, 1000 - 19000 MHz

Harmonic measurements of the Fundamental Frequency of 1988.75 MHz

Frequency	Level	Pol	24.238(a)		Detector	Azimuth	Height	Comments
MHz	dB $\mu$ V/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
<b>Power set to Maximum.</b>								
3977.500	64.2	H	84.2	-20.0	Pk	145	1.1	Peak reading, peak limit (Note 2)
3977.500	63.8	V	84.2	-20.4	Pk	140	1.0	Peak reading, peak limit (Note 2)
7955.000	49.2	H	84.2	-35.0	Pk	165	1.2	Peak reading, peak limit (Note 2)
7955.000	47.4	V	84.2	-36.8	Pk	169	1.1	Peak reading, peak limit (Note 2)
5966.250	47.3	H	84.2	-37.0	Pk	203	1.0	Peak reading, peak limit (Note 2)
5966.250	46.6	V	84.2	-37.6	Pk	193	1.0	Peak reading, peak limit (Note 2)
9943.75	45.3	H	84.2	-38.9	Pk	125	1.1	Peak reading, peak limit (Note 2)
13921.25	44.5	H	84.2	-39.7	Pk	0	1.1	Note 1
19887.50	44.3	V	84.2	-39.9	Pk	0	1.1	Note 1
11932.50	44.2	H	84.2	-40.0	Pk	0	1.1	Note 1
19887.50	44.2	H	84.2	-40.0	Pk	0	1.1	Note 1
17898.75	44.2	V	84.2	-40.0	Pk	0	1.1	Note 1
17898.75	44.1	H	84.2	-40.1	Pk	0	1.1	Note 1
15910.00	43.2	H	84.2	-41.0	Pk	0	1.1	Note 1
9943.75	43.2	V	84.2	-41.0	Pk	228	1.1	Peak reading, peak limit (Note 2)
13921.25	42.2	V	84.2	-42.0	Pk	0	1.1	Note 1
15910.00	40.5	V	84.2	-43.7	Pk	0	1.1	Note 1
11932.50	40.2	V	84.2	-44.0	Pk	0	1.1	Note 1

Note 1: No other emission detected, within 20-dB of the limit, beyond the 4th harmonic.

Note 2: Substitution was not performed since the measured field strength is 20-dB below the limit.



## EMC Test Data

Client: Repeater Technologies	Job Number: J43477
Model: RC1920C	T-Log Number: T43891
	Proj Eng: David Bare
Contact: Dirk Kieger	
Spec: FCC 24 & IC-RSS133	Class: N/A

### Run #2: Maximized readings, 1000 - 19000 MHz

Harmonic measurements of the Fundamental Frequency of 1976.25 MHz

Frequency	Level	Pol	24.238(a)		Detector	Azimuth	Height	Comments
MHz	dB $\mu$ V/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
<b>Power set to Maximum.</b>								
3952.000	61.8	V	84.2	-22.5	Pk	56	1.1	Peak reading, peak limit (Note 2)
3952.000	57.8	H	84.2	-26.4	Pk	91	1.2	Peak reading, peak limit (Note 2)
5928.000	51.3	V	84.2	-32.9	Pk	25	1.1	Peak reading, peak limit (Note 2)
5928.000	48.8	H	84.2	-35.4	Pk	45	1.2	Peak reading, peak limit (Note 2)
7905.000	47.6	V	84.2	-36.6	Pk	35	1.1	Peak reading, peak limit (Note 2)
7905.000	47.1	H	84.2	-37.1	Pk	315	1.2	Peak reading, peak limit (Note 2)
19762.00	44.8	V	84.2	-39.4	Pk	0	1.1	Note 1
17786.00	44.5	V	84.2	-39.7	Pk	0	1.1	Note 1
9881.00	44.2	H	84.2	-40.0	Pk	0	1.1	Note 1
13833.00	44.2	V	84.2	-40.0	Pk	0	1.1	Note 1
15810.00	44.1	H	84.2	-40.1	Pk	0	1.1	Note 1
11857.00	43.2	H	84.2	-41.0	Pk	0	1.1	Note 1
15810.00	43.2	V	84.2	-41.0	Pk	0	1.1	Note 1
19762.00	42.3	H	84.2	-41.9	Pk	0	1.1	Note 1
13833.00	42.1	H	84.2	-42.1	Pk	0	1.1	Note 1
11857.00	42.1	V	84.2	-42.1	Pk	0	1.1	Note 1
17786.00	40.2	H	84.2	-44.0	Pk	0	1.1	Note 1
9881.00	40.2	V	84.2	-44.0	Pk	0	1.1	Note 1

Note 1: No other emission detected, within 20-dB of the limit, beyond the 3th harmonic.

Note 2: Substitution was not performed since the measured field strength is 20-dB below the limit.



## EMC Test Data

Client:	Repeater Technologies	Job Number:	J43477
Model:	RC1920C	T-Log Number:	T43891
		Proj Eng:	David Bare
Contact:	Dirk Kieger		
Spec:	FCC 24 & IC-RSS133	Class:	N/A

### Section 2.1055 & RSS-133 (7): 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: Config. Used:  
Test Engineer: Config Change:  
Test Location: Environmental Chamber EUT Voltage:

#### General Test Configuration

EUT was placed 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. An 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 degrees per temperature and let unit stabilize for every temperature.

Voltage stability was done at 20 degrees Celsius. For battery operated units decrease DC voltage until battery end-point was found.

Voltage stability was done at 20 degrees Celsius. For AC operated units varied voltage at 85% and 115% of the nominal AC voltage.

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

#### Summary of Results

Run #	Test Performed	Limit	Result	Comment
1a	Temperature Vs. Frequency	24.235		No test

#### 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.



## EMC Test Data

Client:	Repeater Technologies	Job Number:	J43477
Model:	RC1920C	T-Log Number:	T43891
		Proj Eng:	David Bare
Contact:	Dirk Kieger		
Spec:	FCC 24 & IC-RSS133	Class:	N/A

### Run# 1a: Temperature Vs. Frequency

Customer has provided explanation as to the frequency correction during extreme temperature or voltage changes.  
Please refer to Schematics label "S87-1304-01 rev. 11a" page 5 of 7.