FCC ID: NUWØØ8CMIR8

Prepared for:

CI WIRELESS INC.
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Grapevine, Texas 76051

By:

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Submitted to:

Federal Communications Commission
Equipment Approval Services
P.O. Box 358315
Pittsburgh, Pennsylvania 15251-3315

October 1999

FCC Application for Certification of an Intentional Radiator

CI WIRELESS INC.
MirrorCell
800 MHz Cellular Band 8 Watt Repeater
(Transmitter Portion)

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Appendices

Certificate of Compliance

Applicant:	CI Wireless Inc.
Applicant's Address:	1211 Ira E. Woods Avenue Grapevine, Texas 76051
Model:	MirrorCell 800 MHz Cellular Band 8 Watt Repeater
Serial Number:	EN101
Project Number:	00219-10
Test Dates:	September 29 and 30, 1999

I, Jeffrey A. Lenk, for Professional Testing (EMI), Inc., being familiar with the FCC rules and test procedures have reviewed the test setup, measurement data and this report. I believe them to be true and accurate. The **CI Wireless Inc., MirrorCell 800 MHz Cellular Band 8 Watt Repeater** was tested and found to be in compliance with FCC Part 22 for Intentional Radiators.

_____

Jeffrey A. Lenk
President

1.0 Equipment Under Test (EUT) Description

The **CI Wireless Inc., MirrorCell 800 MHz Cellular Band 8 Watt Repeater** is a 8 watt 800 MHz Cellular Band Repeater System. This system is used to extend the radio frequency (RF) coverage of the base station. The repeater is well suited for providing RF coverage into shopping centers, convention centers, tunnels, office buildings, and other areas where the signal blockage does not allow direct coverage from the base station. **MirrorCell 800 MHz Cellular Band 8 Watt Repeater** supports CDMA communications in the U.S. cellular band.

The repeater is designed for TIA/EIA/IS-95, titled "Mobile Station-Base Station Compatibility Standard for Dual-Mode Wideband Spread Spectrum Cellular System."

Operations, Administration and Maintenance (OA&M) functionality of the repeater provides the service provider with local as well as remote monitor, control, configure and maintain the system. The system is capable of providing over 10,000 user-defined address to allow over 10,000 repeaters in the operator's system. Local access is provided through a RS232 port on the controller located inside the repeater. Remote access is provided through a RS232 modem connecting to a landline or via a CDMA subscriber unit mounted in the repeater.

An aluminum enclosure with cooling fins houses the repeater. Both transmit and receive antenna connections are located on the underside of the repeater. The external connections on the bottom are protected from unauthorized access with a cover, which can be opened only from the inside of the repeater.

The **CI Wireless Inc., MirrorCell 800 MHz Cellular Band 8 Watt Repeater** is intended for professional installation only in the type of environments described above. This device is intended for operation under the requirements of Part 22 (Subpart H). Specific test requirements include the following:

47 CFR 2.1049	Occupied Bandwidth
47 CFR 22.913	Effective Radiated Power (ERP)
47 CFR 22.917 (e)	Out of Band Emissions - Radiated
47 CFR 22.917 (e)	Out of Band Emissions - Conducted
47 CFR 1.1310	Radiofrequency Radiation Exposure Limits

The **CI Wireless Inc., MirrorCell 800 MHz Cellular Band 8 Watt Repeater** was tested in the CDMA transmit mode of operation. This unit does not possess frequency shifting components and does not re-modulate or re-key the signal. Based on the lack of frequency shifting or re-keying/re-modulation circuitry, the following tests were not performed:

47 CFR 2.1055(a) & 47 CFR 22.905	Frequency Stability vs. Temperature
47 CFR 2.1055(d)(1) & 47 CFR 22.905	Frequency Stability vs. AC Power
47 CFR 22.915	Modulation Requirements

The system tested consisted of the following:

Manufacturer & Model	Serial #	FCC ID #	Description
CI Wireless, Inc., CDR-812	EN101	NUW008CMIR8	800MHz Cellular Band Repeater
System Peripherals:			
Bird Model 8073-1	542	N/A	50 ohm Load

Cables and Cords:
Unshielded Power Cord (6 Ft.) (2 ea.)
RG-223 Coaxial Cable (1 M) (2 ea.)

The equipment within this report was tested to verify its compliance with FCC Rule Parts 2, and 22, for Intentional Radiators. A separate report pursuant to Part 15, Subpart B has been prepared for the **CI Wireless Inc., MirrorCell 800 MHz Cellular Band 8 Watt Repeater** as a Digital Device and as a receiver.

2.0 Occupied Bandwidth Measurements

Measurements were made on the **CI Wireless Inc., MirrorCell 800 MHz Cellular Band 8 Watt Repeater** to determine the occupied bandwidth in accordance with Part 2.1049.

2.1 Test Procedure

All measurements were performed in a controlled laboratory environment. The occupied bandwidth of the **CI Wireless Inc., MirrorCell 800 MHz Cellular Band 8 Watt Repeater** was measured using a Hewlett Packard HP 8566 Spectrum Analyzer with a test signal provided to the EUT from a Rhode-Schwartz signal generator. Occupied bandwidth plots were made for the test generator by itself to use as a comparison for possible spectral regrowth.

Occupied bandwidth was plotted. The shape of the occupied bandwidth was checked for each of the three channels for each modulation type. No change was detected versus channel for each modulation type. The occupied bandwidth was measured based on the emission width 26 dB below the peak emission level.

2.2 Test Criteria

Section 2.989 requires that the occupied bandwidth for Certification units be measured and reported as part of the device filing.

2.3 Test Results

Data for occupied bandwidth testing is located in Appendix A of this report. Data for the occupied bandwidth of the generator by itself is also contained in this appendix. The widest bandwidth for each of the modulation types used by the **CI Wireless Inc., MirrorCell 800 MHz Cellular Band 8 Watt Repeater** is 1.366 MHz. The emission bandwidth of the generator was also shown in the Appendix B. The emission bandwidth was reduced 80 kHz by the power amplifier of the EUT. The Occupied bandwidth was measured at both forward link and reverse link configuration.

3.0 Effective Radiated Power (ERP) Measurements

Measurements were made on the **CI Wireless Inc., MirrorCell 800 MHz Cellular Band 8 Watt Repeater** to verify compliance with the maximum effective radiated power (ERP) requirements of §22.913.

ERP measurements were made at the Professional Testing "Open Field" Site 2, located in Marble Falls, Texas, to determine the radio noise radiated from the EUT. A "Description of Measurement Facilities" has been submitted to the FCC and approved pursuant to Section 2.948 of CFR 47 of the FCC rules.

3.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The table was centered on a motorized turntable which allows 360 degree rotation. A measurement antenna was positioned at a distance of 3 meters as measured from the closest point of the EUT. The radiated emissions were maximized by configuring the EUT, by rotating the EUT, and by raising and lowering the antenna from 1 to 4 meters.

A Spectrum Analyzer with peak detection was used to find the maximums of the radiated emissions during the variability testing. All final measurements were taken using a Quasi-Peak Adapter with a measurement bandwidth of 120 kHz.

ERP testing of the **CI Wireless Inc., MirrorCell 800 MHz Cellular Band 8 Watt Repeater** was performed at 3 channel settings for CDMA transmission mode.

3.2 Test Criteria

Section 22.913 requires that the effective radiated power of repeaters shall be no greater than 500 watts. Since the EUT does not include an antenna, a typical antenna (a whip type antenna) was attached to the EUT and used for the ERP measurements. This process was also used for the spurious emission measurements. ERP testing was performed by measuring the maximum electric field from the **CI Wireless Inc., MirrorCell 800 MHz Cellular Band 8 Watt Repeater** and translating this level to ERP using the following formula:

$$\mathbf{ERP = \{(E*r)\text{^}2\}/(30)}$$

Where:

E = Electric Field in v/m

r = distance from the measurement antenna to the EUT in meters

This formula was obtained from the Industry Canada document, 'Guidelines for Measurement of Radio Frequency Fields at Frequencies from 10 kHz to 300 GHz, Document Reference NIR-E, dated January 1994'.

3.3 Test Results

Measurements were performed utilizing a spectrum analyzer IF/video bandwidth of 3 kHz/10 kHz. For final measurements, the frequency span was set for 3 MHz and was centered on the peak of the output signal.

Data for ERP testing is located in Appendix B of this report **CI Wireless Inc., MirrorCell 800 MHz Cellular Band 8 Watt Repeater** met the §22.913 ERP requirements.

4.0 Out of Band Emissions - Radiated

Radiated emissions measurements were made to determine out of band radiated noise produced by the **CI Wireless Inc., MirrorCell 800 MHz Cellular Band 8 Watt Repeater** in accordance with Section 22.917(e).

Radiated emissions measurements were made at the Professional Testing "Open Field" Site 2, located in Marble Falls, Texas, to determine the radio noise radiated from the EUT. A "Description of Measurement Facilities" has been submitted to the FCC and approved pursuant to Section 2.948 of CFR 47 of the FCC rules.

4.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The table was centered on a motorized turntable which allows 360 degree rotation. A measurement antenna was positioned at a distance of 3 meters as measured from the closest point of the EUT. The radiated emissions were maximized by configuring the EUT, by rotating the EUT, and by raising and lowering the antenna from 1 to 4 meters.

The Spectrum Analyzer was used to find the maximums of the conducted emissions during the testing. All final measurements were made using a peak measurement method. The final measurements provided were determined by using the following formula:

Corrected Level = Recorded Level - Pre-Amp Gain + Antenna Factor + Cable Loss

Measurement of the fundamental signal was performed with a sample antenna attached to the EUT. Measurement of spurious radiated emissions was performed with a shielded load attached to the device (no antenna). The **CI Wireless Inc., MirrorCell 800 MHz Cellular Band 8 Watt Repeater** does not include an antenna as part of the EUT, so the interest regarding spurious for this device is case radiation. A test signal was provided to the EUT from a Rhode-Schwartz signal generator. The measurement was performed at both forward link and reverse link configuration.

4.2 Test Criteria

For this EUT, the data obtained for the occupied bandwidth tests indicated that the emissions from the **CI Wireless Inc., MirrorCell 800 MHz Cellular Band 8 Watt Repeater** were due to the generator, not the EUT (no spectral regrowth observed). For emissions beyond the immediate area of the intended emission, the attenuation required by §22.917 does not vary (43 + 10 log(P)) versus emission type. Based on this criteria, transmitter related emissions for the **CI Wireless Inc., MirrorCell 800 MHz Cellular Band 8 Watt Repeater** shall be reduced by 52 dB with respect to the level of the fundamental.

4.3 Test Results

The **CI Wireless Inc., MirrorCell 800 MHz Cellular Band 8 Watt Repeater** was tested for radiated spurious emissions at three channel settings for CDMA transmission mode. The signals were fully modulated for all tests. The test frequencies used for each modulation type are listed below. The primary difference between upper and lower frequencies for the modulation types involves the guard bands typically used for each type of traffic.

Radiated emission data sheets are contained in Appendix C of this report. The **CI Wireless Inc., MirrorCell 800 MHz Cellular Band 8 Watt Repeater** met the §22.917(e) radiated emission requirements.

Test Channel	Test Frequency (MHz)
Lower	869.70
Middle	881.49
Upper	893.30

5.0 Out of Band Emissions - Conducted

Conducted emissions measurements were made to determine out of band conducted antenna noise produced by the **CI Wireless Inc., MirrorCell 800 MHz Cellular Band 8 Watt Repeater** transmitter in accordance with Section 22.917(e).

Conducted emissions measurements were made at Professional Testing's Round Rock, Texas laboratory. All measurements were made in an environmentally controlled setting.

5.1 Test Procedure

The conducted spurious emissions of the **CI Wireless Inc., MirrorCell 800 MHz Cellular Band 8 Watt Repeater** was measured using a Hewlett Packard HP 8566 Spectrum Analyzer with a test signal provided to the EUT from a Rhode-Schwartz signal generator.

The Spectrum Analyzer was used to find the maximums of the conducted emissions during the testing. All final measurements were made using a peak measurement method. The final measurements provided were determined by using the following formula:

Corrected Level = Recorded Level + Cable Loss

The measurement was performed at both forward link and reverse link configuration.

5.2 Test Criteria

For this EUT, the data obtained for the occupied bandwidth tests indicated that the emissions from the **CI Wireless Inc., MirrorCell 800 MHz Cellular Band 8 Watt Repeater** were due to the generator, not the EUT (no spectral regrowth observed). For emissions beyond the immediate area of the intended emission, the attenuation required by §22.917 does not vary (43 + 10 log(P)) versus emission type. Based on this criteria, transmitter related emissions for the **CI Wireless Inc., MirrorCell 800**

MHz Cellular Band 8 Watt Repeater shall be reduced by 52 dB with respect to the level of the fundamental.

5.3 Test Results

The **CI Wireless Inc., MirrorCell 800 MHz Cellular Band 8 Watt Repeater** was tested for radiated spurious emissions at three channel settings for CDMA transmission mode. The signals were fully modulated for all tests. The test frequencies used for each modulation type are listed below. The primary difference between upper and lower frequencies for the modulation types involves the guard bands typically used for each type of traffic.

Radiated emission data sheets are contained in Appendix D of this report. The **CI Wireless Inc., MirrorCell 800 MHz Cellular Band 8 Watt Repeater** met the §22.917(e) radiated emission requirements.

Test Channel	Test Frequency (MHz)
Lower	869.70
Middle	881.49
Upper	893.30

6.0 Radiofrequency Radiation Exposure Evaluation

An evaluation was performed to provide data regarding the **CI Wireless Inc., MirrorCell 800 MHz Cellular Band 8 Watt Repeater** with respect to the Radiofrequency Radiation Exposure requirements of 47 CFR 1.1310.

6.1 Evaluation Procedure

The primary method of controlling radio frequency radiation exposure from the **CI Wireless Inc., MirrorCell 800 MHz Cellular Band 8 Watt Repeater** will be the responsibility of the installer of the equipment. The device is to be professionally installed by personnel trained and familiar with installation and configuration of wireless systems. The installer is responsible for antenna selection, site selection and final site configuration. Final compliance with Commission RF exposure regulations for this type of site is the responsibility of the installer and is addressed under separate OET documents.

This device is not marketed outside the wireless communications community. In order to install this system properly, the maximum output power versus the frequency range should be reported in the User's Manual for the device such that this issue can be addressed when the installation site of this device is designed.

6.2 Evaluation Results

The output power level for the **CI Wireless Inc., MirrorCell 800 MHz Cellular Band 8 Watt Repeater** is reported in the User's Manual as being 8 watts. In addition, the frequency range for this device is reported as being 869.0 to 894.0 MHz. Based on this information, the **CI Wireless Inc., MirrorCell 800 MHz Cellular Band 8 Watt Repeater** meets the necessary requirements regarding RF exposure.

7.0 Three Signal Intermodulation Test

The **CI Wireless Inc., MirrorCell 800 MHz Cellular Band 8 Watt Repeater** is intended to handle multiple channels, then three signal intermodulation tests are required for each emission kind. This test is a single test using three emission types of the same kind (i.e. three CDMA signals on three separate CDMA channels). The intent of this test is to determine if intermodulation products generated by multiple carriers will generate products which are over the conducted spurious emission limits. While this test is not documented in the Rules, it is a requirement for multiple channel equipment. The test configuration of this test should be:

(1) Configure 3 signal sources using the same modulation type to provide a multiple channel signal to the device. The recommended channel settings are:

(a) One channel at the lowest allowed frequency in the band
(b) One channel at the highest allowed frequency in the band
(c) One channel at either the 3rd lowest or 3rd highest channel setting. This will provide a 1 channel guard band from the end channel.

The total power for combined output signal should be maximized to the power rating of the EUT. All input channel settings should be equal.

(2) Measure (or plot) all intermodulation products inside and outside the allowed channel band. All intermodulation products must meet the 43 + 10 log (P) requirement for spurious emissions. This figure should come out to a maximum intermod (or spur) level of -13 dBm. Most measurements of the intermod levels are made using a peak method, however, fully accurate measurements of the intermod levels should be made using the average detection methods:

Repeat this test for all modulation types which the EUT will be licensed/authorized for.

ALTERNATE METHOD:

Due to the difficulty in providing three identical fully modulated signals, a method using two intermodulation sources (rather than 3) is allowed. The test was configured in the following manner:

(1) Set one carrier to either the highest or lowest allowed channel in the band.
(2) Set the second carrier two channels away from the first channel (this will either be the 3rd highest or lowest in the band, again providing a one channel guard band).
(3) Configure the output power for the signals such that the total output power is at the maximum rating of the EUT. Also, verify that the input levels for all signals are equal.
(4) Measure (or plot) all intermodulation products inside and outside the allowed channel band. All intermodulation products must meet the 43 + 10 log (P) requirement for spurious emissions. This figure came out to a maximum intermod (or spur) level of -13 dBm. Most measurements of the intermod levels are made using a peak method, however, fully accurate measurements of the intermod levels were made using the average methods:

(5) Repeat this test for all modulation types which the EUT will be licensed/authorized for.

The two channel method was used for this test. Plots of the data for this test are shown in the Appendix F.

8.0 Form 731 Information

The following information is provided for inclusion in the FCC Form 731 for the **CI Wireless Inc., MirrorCell 800 MHz Cellular Band 8 Watt Repeater.**

8.1 Emission Designator

Bandwidth:

The **CI Wireless Inc., MirrorCell 800 MHz Cellular Band 8 Watt Repeater** does not possess any circuitry which remodulates or changes the bandwidth of the signal that it receives and repeats. The only potential issue that can arise in this type of product regarding bandwidth is spectral regrowth immediately around the primary emission. This is due to the design and power handling capability of the amplifier.

The data contained in the occupied bandwidth test data does not indicate any spectral regrowth. Based on this information, the bandwidth of emissions from the **CI Wireless Inc., MirrorCell 800 MHz Cellular Band 8 Watt Repeater** would be that of the signal received by the repeater. Since the EUT does not contribute or modify the emission bandwidth, a bandwidth designator will not be included in the overall emission designators for the product.

Emission Designator::

As with the emission bandwidth, the emission type emitted by the **CI Wireless Inc., MirrorCell 800 MHz Cellular Band 8 Watt Repeater** are depended on the service that it operates with. Due to the intended installation of the system, the RF output signals of the **CI Wireless Inc., MirrorCell 800 MHz Cellular Band 8 Watt Repeater** are complaint with the CDMA protocol requirements. This output emission designators (based on Part 2.201) for these services is:

Service Type	**Emission Description**	**Emission Designator**
CDMA	(1) Modulation Type: Frequency Modulation (2) Nature of Modulating Signal: Composite Signal with one or more channels containing digital data & one or more channels containing analog data (3) Type of data being transmitted can be a combination of digital, voice, telegraphy, television, or facsimile	F9W

Based on the bandwidth and emission type discussions, the emission designator used for the FCC Form 731 is:

CDMA Mode

F9W - All data modes and types

8.2 Output Power

In the conducted power tests, the highest power attained for each of the power settings was 39.0 dBm (8 watts). This level was achieved at each of the 3 setting. Since the system automatically controls the maximum output power, this level should be constant for all single carrier operations.

Due to the operating features of the EUT, this is the maximum composite power available from the device. Therefore, the power rating requested for the grant for the **CI Wireless Inc., MirrorCell 800 MHz Cellular Band 8 Watt Repeater** is:

8 watts

8.3 Output Power Ratings for Multi-Channel Operation

The total composite power for this device is 8 watts. The EUT has a power regulation system which will reduce the total individual channel power for the carriers to provide a constant 8 watt composite power regardless of the number of carriers. The worst peak power level is single channel operation, which results in a peak output power of 8 watts (composite power divided by 1). As channels are added to the EUT, the individual channel power is based on the composite power divided by the number of channels. For this reason, the individual channel powers used in the intermod test was 4 watts output per channel (4/2 = 2).

8.4 Frequency Band of Operation

The **CI Wireless Inc., MirrorCell 800 MHz Cellular Band 8 Watt Repeater** is rated to be used through the entire 800 MHz cellular (base station) communication band. Based on this requirement, the transmission range of the **CI Wireless Inc., MirrorCell 800 MHz Cellular Band 8 Watt Repeater** is:

869.0 to 894.0 MHz

8.5 Grant Notes

The only exceptions or notes that would normally be listed for this device are:

(1) The center frequency of the emissions for the CDMA should not be less than 1.25 MHz from the band edge (standard guard band).
(2) The power listed in the grant is the composite power for the device for all carriers.

9.0 Modifications

The **CI Wireless Inc., MirrorCell 800 MHz Cellular Band 8 Watt Repeater** was modified during the performance of the test by installing ferrite (Fair-Rite 0443665806) on the AC line of the remote unit to meet the unintended radiated and conducted emission requirement.

10.0 List of Test Equipment

A list of the test equipment utilized to perform the conducted and radiated emission measurements is given below. The date of calibration is given for each.

Device	Description	Date Last Calibrated	Calibration Due
HP 8596E	Spectrum Analyzer	10/09/98	10/09/99
HP 8566B	Spectrum Analyzer	10/30/98	10/30/99
HP 85650A	Quasi Peak Adapter	10/30/98	10/30/99
MITEQ AFS4-00101800-40-10P-N	Preamplifier	05/10/99	05/10/00
EMCO 3108	Biconical Antenna	07/10/99	07/10/99
EMCO 3146	Log Periodic Antenna	07/10/98	07/10/99
EMCO 3115	Double Ridged Horn Antenna	05/10/99	05/10/00
HP E4432B ESG-D	SIGNAL Generator S/N US38441285	07/04/98	07/04/99
Rohde-Schwartz Model SMI 03E	RF Generator S/N DE22176	1/30/98	1/30/00
HP 437B	Power Meter	06/10/99	06/10/00
HP 8482B	Power Sensor	12/09/98	12/09/99
Mini-Circuits ZAPD-2	RF Splitter	CNR	CNR

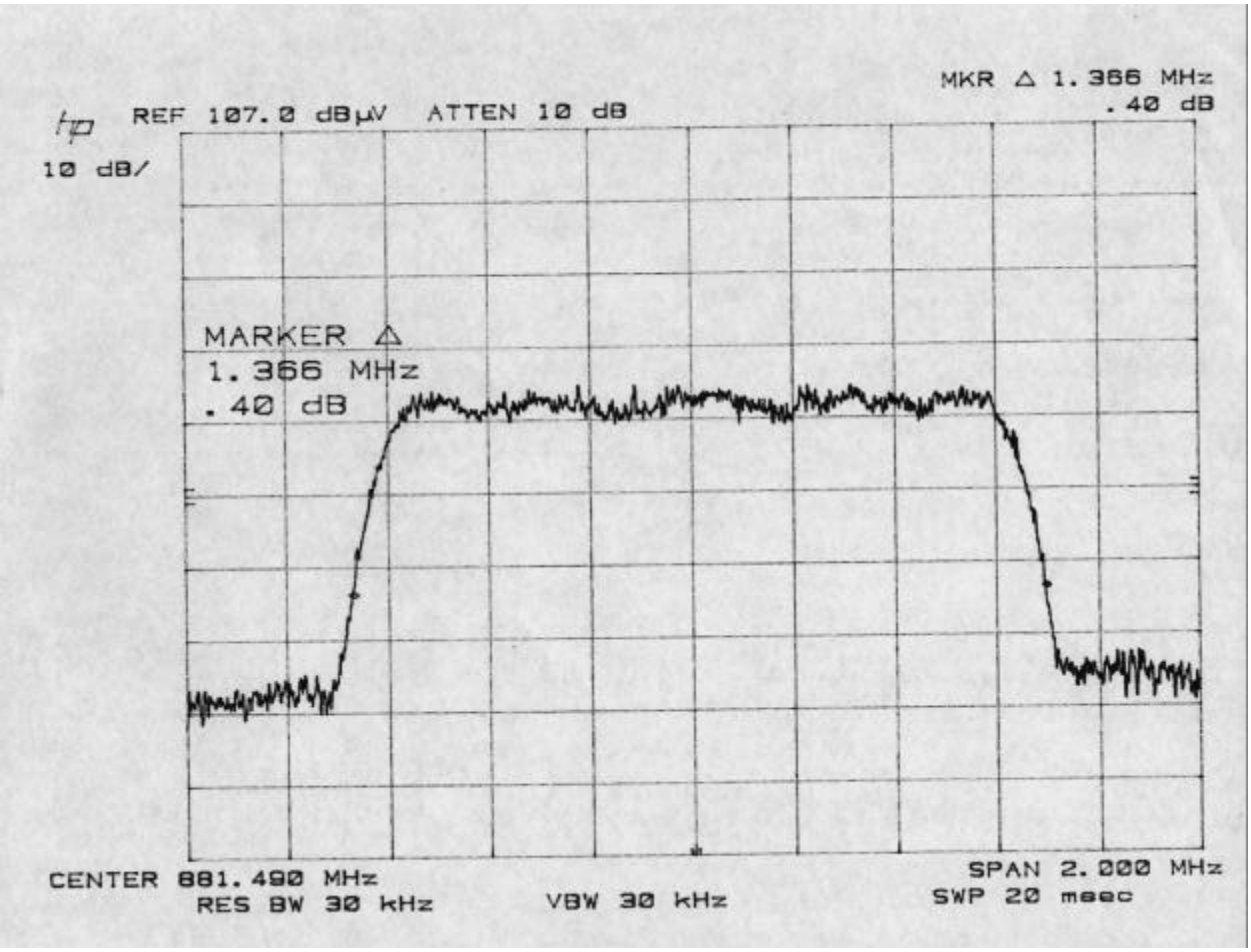
CNR = Calibration Not Required

Appendix A
Occupied Bandwidth Test Data

Occupied Bandwidth Data Sheet

CI Wireless Inc.
MirrorCell 800 MHz Cellular Band 8 Watt Repeater

SERIAL #: EN101 PROJECT #: 00219-10
CONFIGURATION: EUT, Forward Link DATE: September 29, 1999



COMMENT #1: Channel Setting = Middle

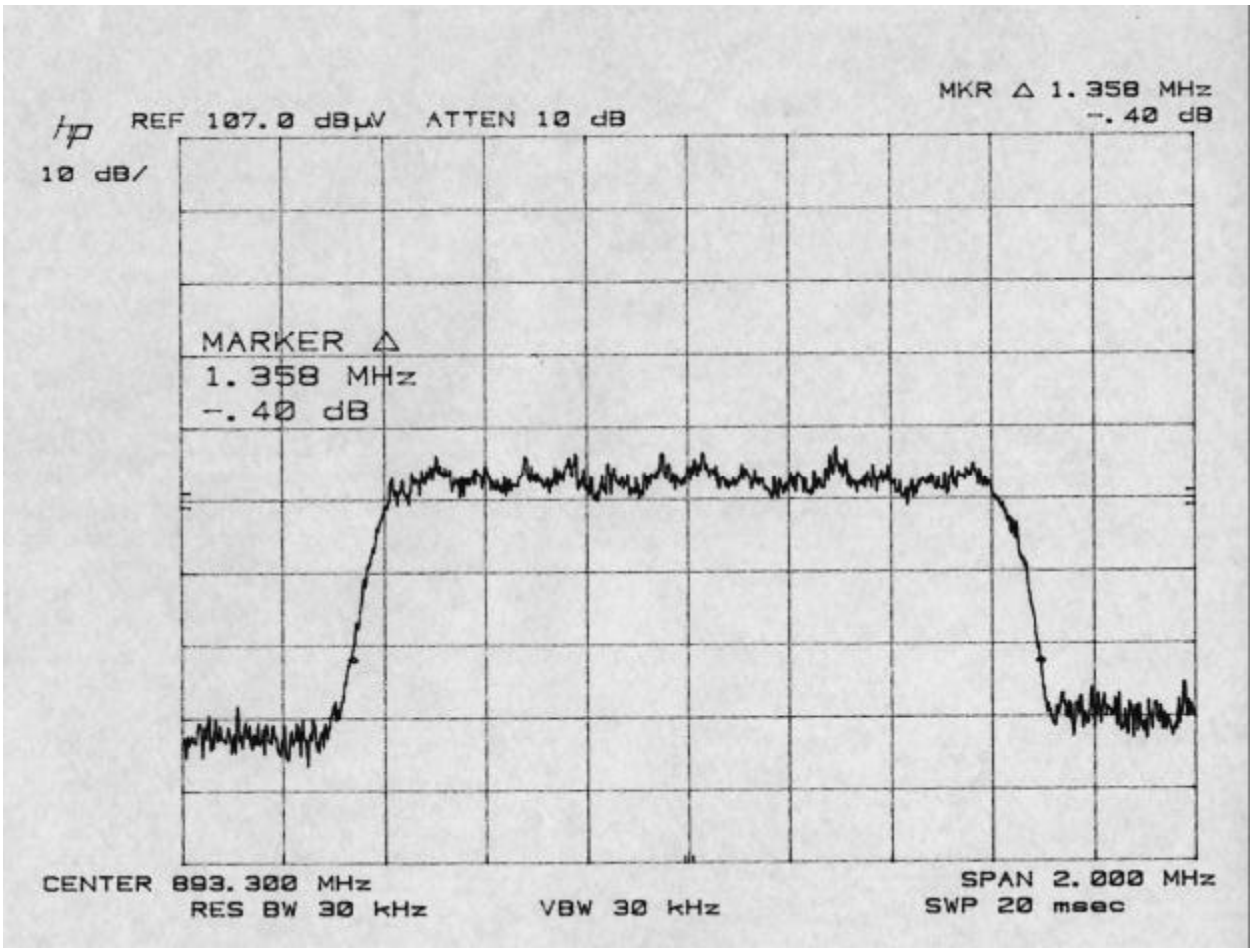
COMMENT #2: 26 dB Bandwidth = 1.336 MHz

COMMENT #3: Occupied Bandwidth of Reverse Link is same.

TEST ENGINEER:_____ **APPROVED BY**: _____
Larry Zhou **Jeffrey A. Lenk**

CI Wireless Inc.
MirrorCell 800 MHz Cellular Band 8 Watt Repeater

SERIAL #: EN101 PROJECT #: 00219-10
CONFIGURATION: EUT, Forward Link DATE: September 29, 1999



COMMENT #1: Channel Setting = High

COMMENT #2: 26 dB Bandwidth = 1.358 MHz

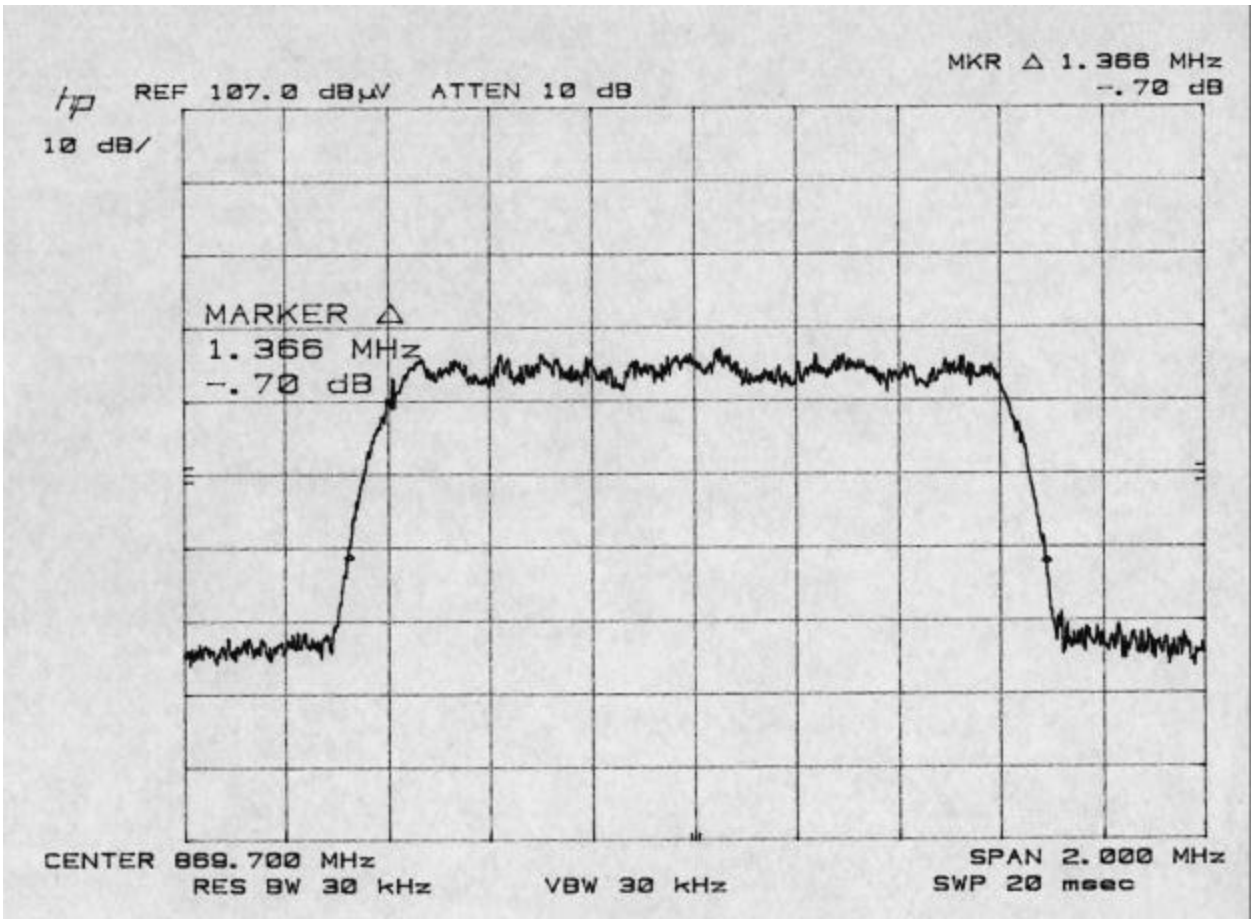
COMMENT #3: Occupied Bandwidth of Reverse Link is same.

TEST ENGINEER:_____ **APPROVED BY**: _____
Larry Zhou **Jeffrey A. Lenk**

Occupied Bandwidth Data Sheet

CI Wireless Inc.
MirrorCell 800 MHz Cellular Band 8 Watt Repeater

SERIAL #: EN101 PROJECT #: 00219-10
CONFIGURATION: EUT, Forward Link DATE: September 29, 1999



COMMENT #1: Channel Setting = Low

COMMENT #2: 26 dB Bandwidth = 1.336 MHz

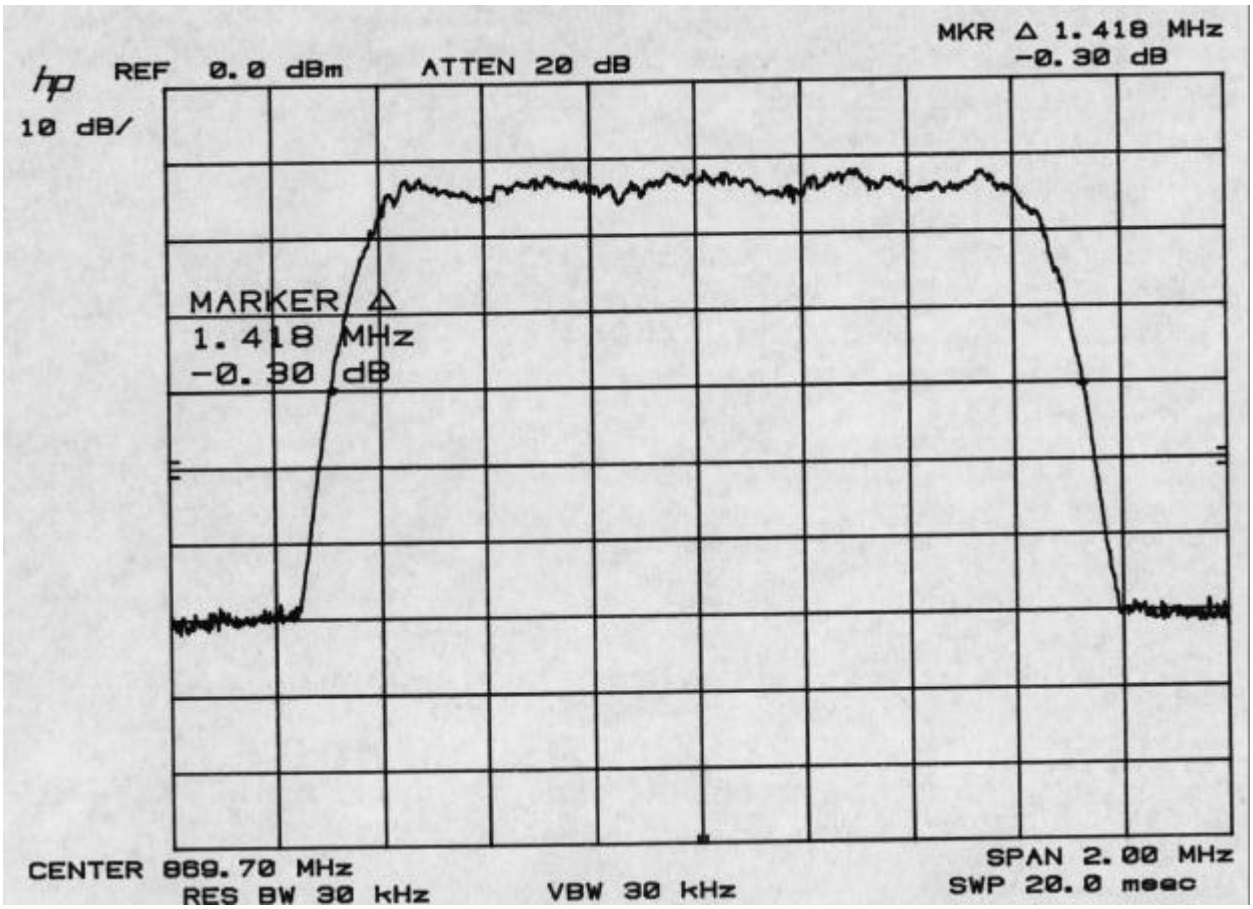
COMMENT #3: Occupied Bandwidth of Reverse Link is same.

TEST ENGINEER:_____ **APPROVED BY**: _____
Larry Zhou **Jeffrey A. Lenk**

Occupied Bandwidth Data Sheet

CI Wireless Inc.
MirrorCell 800 MHz Cellular Band 8 Watt Repeater

SERIAL #: EN101 PROJECT #: 00219-10
DATE: September 29, 1999 CONFIGURATION: Generator



COMMENT #1: Channel Setting = Low

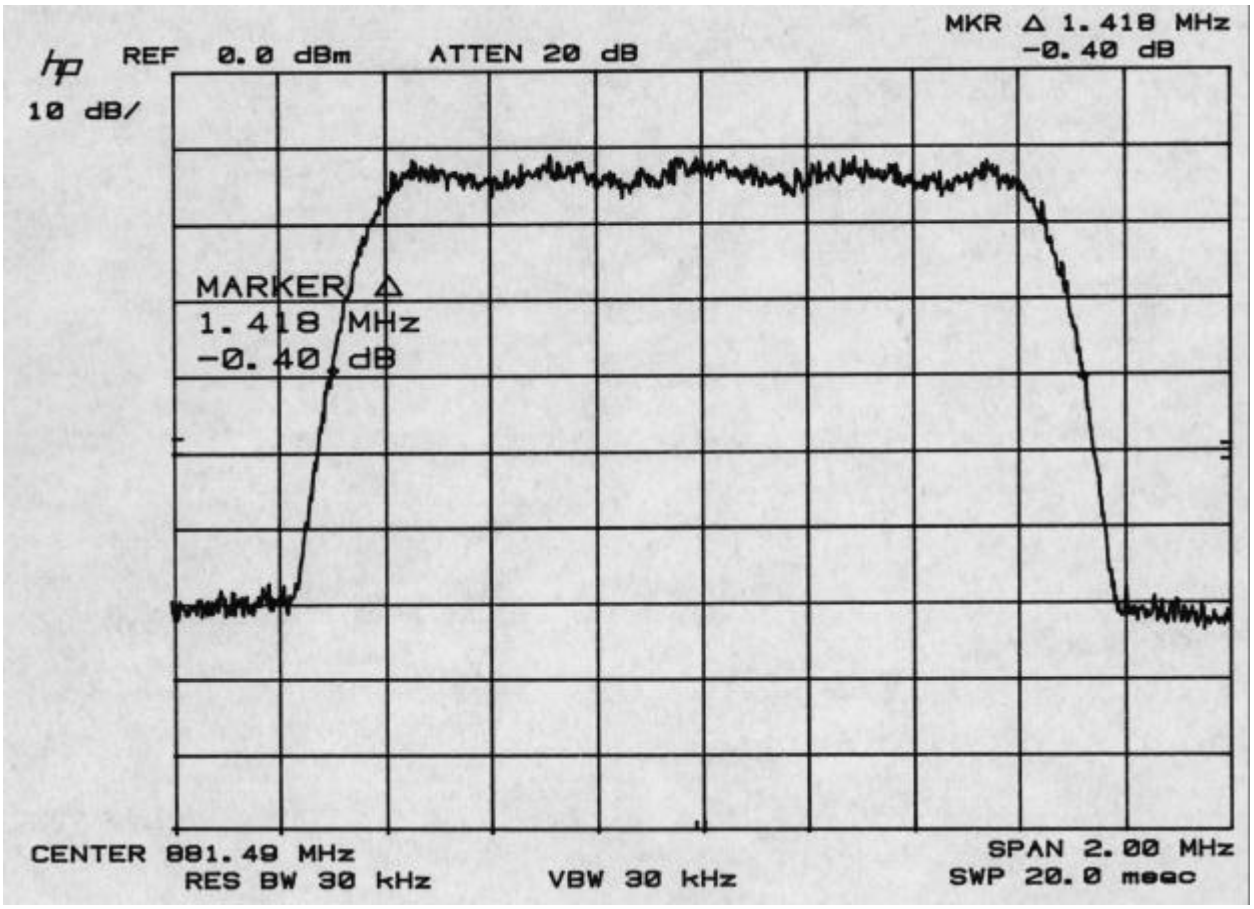
COMMENT #2: 26 dB Bandwidth = 1.418 MHz

TEST ENGINEER:_____ **APPROVED BY**: _____
Larry Zhou **Jeffrey A. Lenk**

Occupied Bandwidth Data Sheet

CI Wireless Inc.
MirrorCell 800 MHz Cellular Band 8 Watt Repeater

SERIAL #: EN101 PROJECT #: 00219-10
DATE: September 29, 1999 CONFIGURATION: Generator



COMMENT #1: Channel Setting = Middle

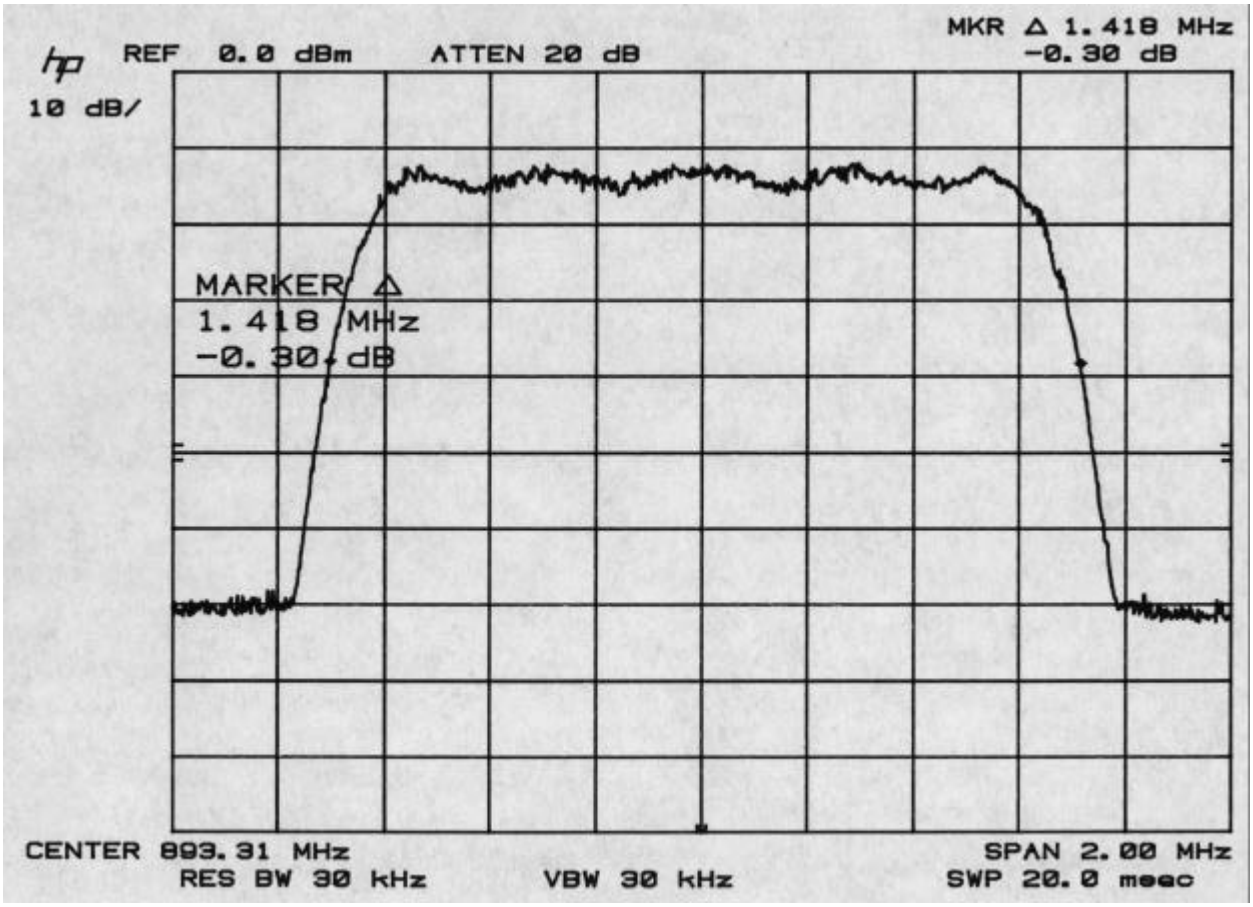
COMMENT #2: 26 dB Bandwidth = 1.418 MHz

TEST ENGINEER:_____ **APPROVED BY**: _____
Larry Zhou **Jeffrey A. Lenk**

Occupied Bandwidth Data Sheet

MirrorCell 800 MHz Cellular Band 8 Watt Repeater

SERIAL #: EN101 PROJECT #: 00219-10
DATE: September 29, 1999 CONFIGURATION: Generator



COMMENT #1: Channel Setting = High

COMMENT #2: 26 dB Bandwidth = 1.418 MHz

TEST ENGINEER:_____ **APPROVED BY**: _____
Larry Zhou **Jeffrey A. Lenk**

Appendix B — Effective Radiated Power Test Data

Effective Radiated Power Data Sheet

CI Wireless Inc.
MirrorCell 800 MHz Cellular Band 8 Watt Repeater

SERIAL #: EN101 PROJECT #: 00219-10
DATE: September 29, 1999 CONFIGURATION: Forward Link

Antenna Vertical

Freq. (MHz)	EUT Direction (Deg)	Recorded Level (dBuV)	Antenna Factor (dB/m)	Attenuator + Cable Loss (dB)	Corrected Level (dBuV/m)	Level ERP (watts)	Limit (watts)	Margin (watts)
869.70	317.00	72.70	23.00	37.60	133.30	6.414	500.00	-493.59
881.49	308.00	72.20	23.20	37.70	133.10	6.125	500.00	-493.87
893.31	334.00	73.10	23.40	37.70	134.20	7.891	500.00	-492.11

Antenna Horizontal

Freq. (MHz)	EUT Direction (Deg)	Recorded Level (dBuV)	Antenna Factor (dB/m)	Attenuator + Cable Loss (dB)	Corrected Level (dBuV/m)	Level ERP (watts)	Limit (watts)	Margin (watts)
869.70	58.00	64.00	23.00	37.60	124.60	0.865	500.00	-499.13
881.49	49.00	64.00	23.20	37.70	124.90	0.927	500.00	-499.07
893.31	312.00	62.50	23.40	37.70	123.60	0.687	500.00	-499.31

COMMENT #1: Worst Case Height (All measurement): 1.0 meters

COMMENT #2: ERP at the reverse link configuration is 3 dB below the forward link.

TEST ENGINEER:_____ **APPROVED BY**: _____
Larry Zhou **Jeffrey A. Lenk**

Appendix C

Out of Band Emissions (Radiated) Test Data

Out of Band Emission - Radiated Data Sheet

CI Wireless Inc.
MirrorCell 800 MHz Cellular Band 8 Watt Repeater

SERIAL #: EN101 PROJECT #: 00219-10
DATE: September 29, 1999 POLARIZATION: Vertical
CONFIGURATION: Forward Link

Freq. (MHz)	EUT Direction (Deg)	Recorded Level (dBuV)	Cable Loss (dB)	Antenna Factor (dBuV/m)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
869.700	317.0	102.70	7.6	23.0	133.3	Ref	Ref
1739.400	317.0	50.80	2.0	26.8	79.6	82.3	-2.7
2609.10	317.0	26.10	2.6	29.3	58.0	82.3	-24.3
3478.80	317.0	25.80	3.0	31.3	60.1	82.3	-22.2
4348.50	317.0	25.80	3.4	32.6	61.8	82.3	-20.5
5218.20	317.0	25.70	3.7	34.0	63.4	82.3	-18.9
6087.90	317.0	33.00	4.1	36.1	73.2	82.3	-9.1
6957.60	317.0	32.90	4.4	35.4	72.7	82.3	-9.6
7827.30	317.0	31.90	4.7	37.0	73.6	82.3	-8.7
8697.00	317.0	30.80	5.1	36.5	72.4	82.3	-9.9

COMMENT #1: Channel = Low Setting, 869.70 MHz

COMMENT #2: All Measurements were made at 3 meters.

COMMENT #3: Worst case emissions were for EUT antenna in vertical position. Data is presented for this configuration.

COMMENT #4: All Measurements at the reverse link configuration is 12 dB below the forward link.

TEST ENGINEER:_____ **APPROVED BY**: _____
Larry Zhou **Jeffrey A. Lenk**

Out of Band Emission - Radiated Data Sheet

CI Wireless Inc.
MirrorCell 800 MHz Cellular Band 8 Watt Repeater

SERIAL #: EN101 PROJECT #: 00219-10
DATE: September 29, 1999 POLARIZATION: Horizontal
CONFIGURATION: Forward Link

Freq. (MHz)	EUT Direction (Deg)	Recorded Level (dBuV)	Cable Loss (dB)	Antenna Factor (dBuV/m)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
869.700	58.0	94.00	7.6	23.0	124.6	Ref	Ref
1739.400	44.0	31.60	2.0	26.8	60.4	82.3	-21.9
2609.10	44.0	21.40	2.6	29.3	53.3	82.3	-29.0
3478.80	44.0	20.90	3.0	31.3	55.2	82.3	-27.1
4348.50	44.0	21.00	3.4	32.6	57.0	82.3	-25.3
5218.20	44.0	20.80	3.7	34.0	58.5	82.3	-23.8
6087.90	44.0	28.60	4.1	36.1	68.8	82.3	-13.5
6957.60	44.0	28.30	4.4	35.4	68.1	82.3	-14.2
7827.30	44.0	27.30	4.7	37.0	69.0	82.3	-13.3
8697.00	44.0	26.10	5.1	36.5	67.7	82.3	-14.6

COMMENT #1: Channel = Low Setting, 869.70 MHz

COMMENT #2: All Measurements were made at 3 meters.

COMMENT #3: Worst case emissions were for EUT antenna in vertical position. Data is presented for this configuration.

COMMENT #4: All Measurements at the reverse link configuration is 12 dB below the forward link.

TEST ENGINEER:_____ **APPROVED BY**: _____
Larry Zhou **Jeffrey A. Lenk**

Out of Band Emission - Radiated Data Sheet

CI Wireless Inc.
MirrorCell 800 MHz Cellular Band 8 Watt Repeater

SERIAL #: EN101 PROJECT #: 00219-10
DATE: September 29, 1999 POLARIZATION: Vertical
CONFIGURATION: Forward Link

Freq. (MHz)	EUT Direction (Deg)	Recorded Level (dBuV)	Cable Loss (dB)	Antenna Factor (dBuV/m)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
881.490	308.0	102.20	7.7	23.2	133.1	Ref	Ref
1762.980	317.0	51.50	2.0	26.8	80.3	82.3	-2.0
2644.47	327.0	26.20	2.6	29.3	58.1	82.3	-24.2
3525.96	327.0	25.80	3.0	31.3	60.1	82.3	-22.2
4407.45	327.0	26.20	3.4	32.6	62.2	82.3	-20.1
5288.94	327.0	26.10	3.7	34.0	63.8	82.3	-18.5
6170.43	327.0	32.40	4.1	36.1	72.6	82.3	-9.7
7051.92	327.0	31.80	4.4	35.4	71.6	82.3	-10.7
7933.41	327.0	30.90	4.7	37.0	72.6	82.3	-9.7
8814.90	327.0	30.60	5.1	36.5	72.2	82.3	-10.1

COMMENT #1: Channel = Middle Setting, 881.49 MHz

COMMENT #2: All Measurements were made at 3 meters.

COMMENT #3: Worst case emissions were for EUT antenna in vertical position. Data is presented for this configuration.

COMMENT #4: All Measurements at the reverse link configuration is 12 dB below the forward link.

TEST ENGINEER:_____ **APPROVED BY**: _____
Larry Zhou **Jeffrey A. Lenk**

Out of Band Emission - Radiated Data Sheet

CI Wireless Inc.
MirrorCell 800 MHz Cellular Band 8 Watt Repeater

SERIAL #: EN101 PROJECT #: 00219-10
DATE: September 29, 1999 POLARIZATION: Horizontal
CONFIGURATION: Forward Link

Freq. (MHz)	EUT Direction (Deg)	Recorded Level (dBuV)	Cable Loss (dB)	Antenna Factor (dBuV/m)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
869.700	49.0	94.00	7.7	23.2	124.9	Ref	Ref
1739.400	47.0	35.60	2.0	26.8	64.4	82.3	-17.9
2609.10	47.0	26.20	2.6	29.3	58.1	82.3	-24.2
3478.80	47.0	25.80	3.0	31.3	60.1	82.3	-22.2
4348.50	47.0	26.20	3.4	32.6	62.2	82.3	-20.1
5218.20	47.0	26.00	3.7	34.0	63.7	82.3	-18.6
6087.90	47.0	32.40	4.1	36.1	72.6	82.3	-9.7
6957.60	47.0	31.70	4.4	35.4	71.5	82.3	-10.8
7827.30	47.0	30.80	4.7	37.0	72.5	82.3	-9.8
8697.00	47.0	30.90	5.1	36.5	72.5	82.3	-9.8

COMMENT #1: Channel = Middle Setting, 881.49 MHz

COMMENT #2: All Measurements were made at 3 meters.

COMMENT #3: Worst case emissions were for EUT antenna in vertical position. Data is presented for this configuration.

COMMENT #4: All Measurements at the reverse link configuration is 12 dB below the forward link.

TEST ENGINEER:_____ **APPROVED BY**: _____
Larry Zhou **Jeffrey A. Lenk**

Out of Band Emission - Radiated Data Sheet

MirrorCell 800 MHz Cellular Band 8 Watt Repeater

SERIAL #: EN101 PROJECT #: 00219-10
DATE: September 29, 1999 POLARIZATION: Vertical
CONFIGURATION: Forward Link

Freq. (MHz)	EUT Direction (Deg)	Recorded Level (dBuV)	Cable Loss (dB)	Antenna Factor (dBuV/m)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
893.300	334.0	103.10	7.7	23.4	134.2	Ref	Ref
1786.600	335.0	50.80	2.0	26.8	79.6	82.3	-2.7
2679.90	335.0	26.50	2.6	29.3	58.4	82.3	-23.9
3573.20	335.0	26.10	3.0	31.3	60.4	82.3	-21.9
4466.50	335.0	26.50	3.4	32.6	62.5	82.3	-19.8
5359.80	335.0	25.70	3.7	34.0	63.4	82.3	-18.9
6253.10	335.0	32.20	4.1	36.1	72.4	82.3	-9.9
7146.40	335.0	31.80	4.4	35.4	71.6	82.3	-10.7
8039.70	335.0	31.10	4.7	37.0	72.8	82.3	-9.5
8933.00	335.0	30.80	5.1	36.5	72.4	82.3	-9.9

COMMENT #1: Channel = High Setting, 893.30 MHz

COMMENT #2: All Measurements were made at 3 meters.

COMMENT #3: Worst case emissions were for EUT antenna in vertical position. Data is presented for this configuration.

COMMENT #4: All Measurements at the reverse link configuration is 12 dB below the forward link.

TEST ENGINEER:_____ **APPROVED BY**: _____
Larry Zhou **Jeffrey A. Lenk**

Out of Band Emission - Radiated Data Sheet

SERIAL #: EN101 PROJECT #: 00219-10
DATE: September 29, 1999 POLARIZATION: Horizontal
CONFIGURATION: Forward Link

Freq. (MHz)	EUT Direction (Deg)	Recorded Level (dBuV)	Cable Loss (dB)	Antenna Factor (dBuV/m)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
893.300	312.0	92.50	7.7	23.4	123.6	Ref	Ref
1786.600	310.0	32.60	2.0	26.8	61.4	82.3	-20.9
2679.90	310.0	0.40	2.6	29.3	32.3	82.3	-50.0
3573.20	310.0	25.90	3.0	31.3	60.2	82.3	-22.1
4466.50	310.0	26.40	3.4	32.6	62.4	82.3	-19.9
5359.80	310.0	25.70	3.7	34.0	63.4	82.3	-18.9
6253.10	310.0	32.10	4.1	36.1	72.3	82.3	-10.0
7146.40	310.0	31.80	4.4	35.4	71.6	82.3	-10.7
8039.70	310.0	31.10	4.7	37.0	72.8	82.3	-9.5
8933.00	310.0	30.70	5.1	36.5	72.3	82.3	-10.0

COMMENT #1: Channel = High Setting, 893.30 MHz

COMMENT #2: All Measurements were made at 3 meters.

COMMENT #3: Worst case emissions were for EUT antenna in vertical position. Data is presented for this configuration.

COMMENT #4: All Measurements at the reverse link configuration is 12 dB below the forward link.

TEST ENGINEER:_____ **APPROVED BY**: _____
Larry Zhou **Jeffrey A. Lenk**

Appendix D — Out of Band Emissions (Conducted) Test Data

Out of Band Emission - Conducted Data Sheet

CI Wireless Inc.
MirrorCell 800 MHz Cellular Band 8 Watt Repeater

SERIAL #: EN101 PROJECT #: 00219-10
DATE: September 30, 1999 CONFIGURATION: Forward Link

Freq. (MHz)	Recorded Level (dBuV)	Cable Loss (dB)	Corrected Level (dBuV)	Limit (dBuV)	Margin (dB)
869.700	113.70	30.4	144.1	Ref	Ref
1739.400	58.40	30.7	89.1	94.0	-4.9
2609.10	33.40	32.2	65.6	94.0	-28.4
3478.80	33.00	31.8	64.8	94.0	-29.2
4348.50	33.00	32.0	65.0	94.0	-29.0
5218.20	32.00	32.4	64.4	94.0	-29.6
6087.90	38.70	32.6	71.3	94.0	-22.7
6957.60	38.50	32.6	71.1	94.0	-22.9
7827.30	37.30	32.6	69.9	94.0	-24.1
8697.00	37.60	33.6	71.2	94.0	-22.8

COMMENT #1: Channel = Low Setting, 869.7 MHz

COMMENT #2: Cable Loss adjusted to compensate for 30 dB attenuator installed in signal path prior to taking reading.

COMMENT #3: All Measurements at the reverse link configuration is 12 dB below the forward link.

TEST ENGINEER:_____ **APPROVED BY**: _____
Larry Zhou **Jeffrey A. Lenk**

Out of Band Emission - Conducted Data Sheet

CI Wireless Inc.
MirrorCell 800 MHz Cellular Band 8 Watt Repeater

SERIAL #: EN101 PROJECT #: 00219-10
DATE: September 30, 1999 CONFIGURATION: Forward Link

Freq. (MHz)	Recorded Level (dBuV)	Cable Loss (dB)	Corrected Level (dBuV)	Limit (dBuV)	Margin (dB)
881.490	114.40	30.4	144.8	Ref	Ref
1762.980	55.00	30.7	85.7	94.0	-8.3
2644.47	33.20	32.2	65.4	94.0	-28.6
3525.96	34.60	31.8	66.4	94.0	-27.6
4407.45	32.90	32.0	64.9	94.0	-29.1
5288.94	33.60	32.4	66.0	94.0	-28.0
6170.43	38.80	32.6	71.4	94.0	-22.6
7051.92	38.00	32.6	70.6	94.0	-23.4
7933.41	36.90	32.6	69.5	94.0	-24.5
8814.90	36.80	33.6	70.4	94.0	-23.6

COMMENT #1: Channel = Middle Setting, 881.49 MHz

COMMENT #2: Cable Loss adjusted to compensate for 30 dB attenuator installed in signal path prior to taking reading.

COMMENT #3: All Measurements at the reverse link configuration is 12 dB below the forward link.

TEST ENGINEER:_____ **APPROVED BY**: _____
Larry Zhou **Jeffrey A. Lenk**

Out of Band Emission - Conducted Data Sheet

CI Wireless Inc.
MirrorCell 800 MHz Cellular Band 8 Watt Repeater

SERIAL #: EN101 PROJECT #: 00219-10
DATE: September 30, 1999 CONFIGURATION: Forward Link

Freq. (MHz)	Recorded Level (dBuV)	Cable Loss (dB)	Corrected Level (dBuV)	Limit (dBuV)	Margin (dB)
893.310	114.50	30.4	144.9	Ref	Ref
1786.620	55.60	30.7	86.3	94.0	-7.7
2679.93	30.70	32.2	62.9	94.0	-31.1
3573.24	33.20	31.8	65.0	94.0	-29.0
4466.55	36.60	32.0	68.6	94.0	-25.4
5359.86	32.60	32.4	65.0	94.0	-29.0
6253.17	38.60	32.6	71.2	94.0	-22.8
7146.48	38.90	32.6	71.5	94.0	-22.5
8039.79	37.50	32.6	70.1	94.0	-23.9
8933.10	37.20	33.6	70.8	94.0	-23.2

COMMENT #1: Channel = High Setting, 893.31 MHz

COMMENT #2: Cable Loss adjusted to compensate for 30 dB attenuator installed in signal path prior to taking reading.

COMMENT #3: All Measurements at the reverse link configuration is 3 dB below the forward link.

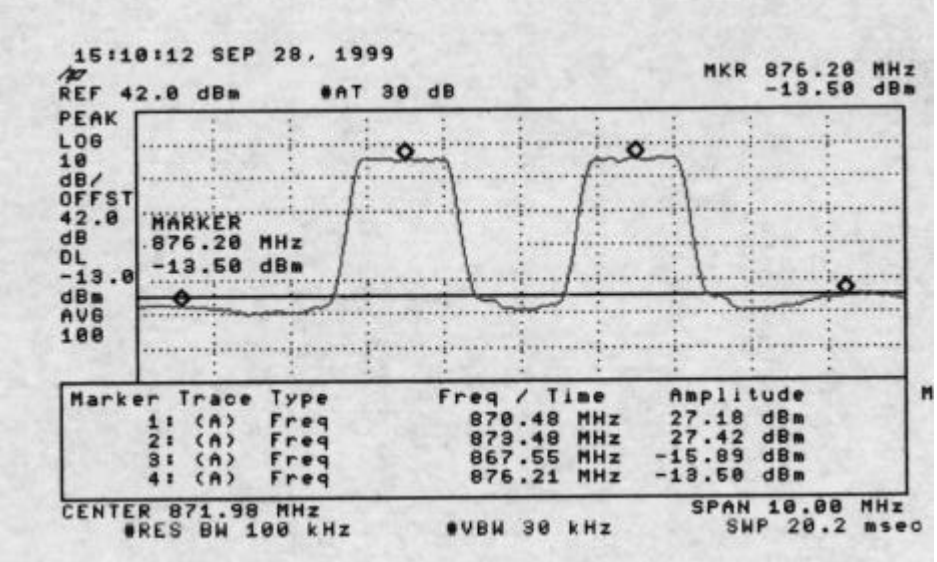
TEST ENGINEER:_____ **APPROVED BY**: _____
Larry Zhou **Jeffrey A. Lenk**

Appendix E Intermodulation Product Data Sheets

Intermodulation Product Data Sheet

CI Wireless Inc.
MirrorCell 800 MHz Cellular Band 8 Watt Repeater

SERIAL #: EN101 PROJECT #: 00219-10
DATE: September 30, 1999 LINE MEASURED: Antenna
DETECTOR FUNCTION: Average



COMMENT #1: Display Line Set to Limit of -13 dBm

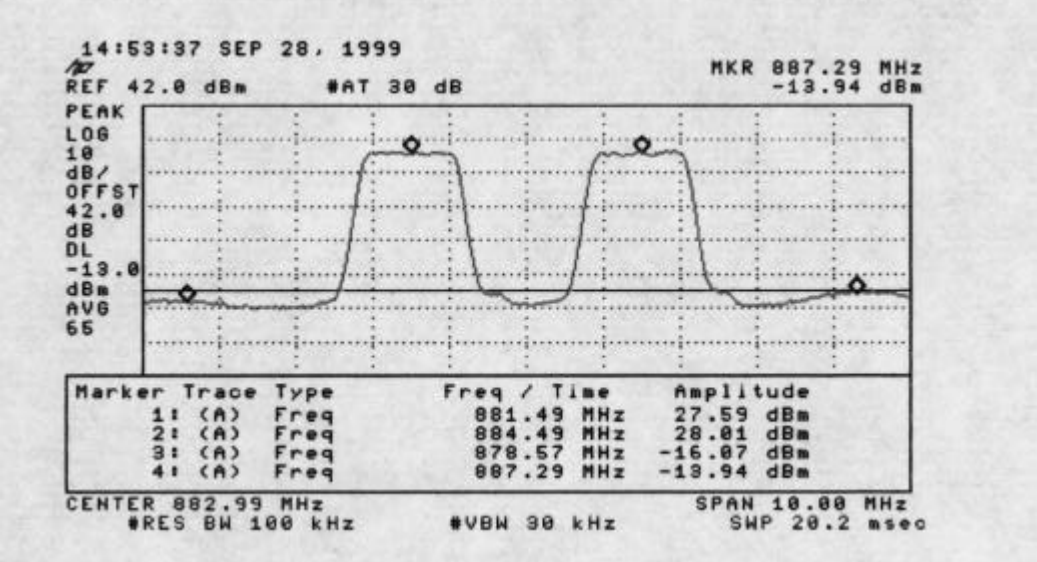
COMMENT #2: Cellular A Band, Forward Link (Power = 39 dBm)

TEST ENGINEER:_____ **APPROVED BY**: _____
Larry Zhou **Jeffrey A. Lenk**

Intermodulation Product Data Sheet

CI Wireless Inc.
MirrorCell 800 MHz Cellular Band 8 Watt Repeater

SERIAL #: EN101 PROJECT #: 00219-10
DATE: September 30, 1999 LINE MEASURED: Antenna
DETECTOR FUNCTION: Average



COMMENT #1: Display Line Set to Limit of -13 dBm

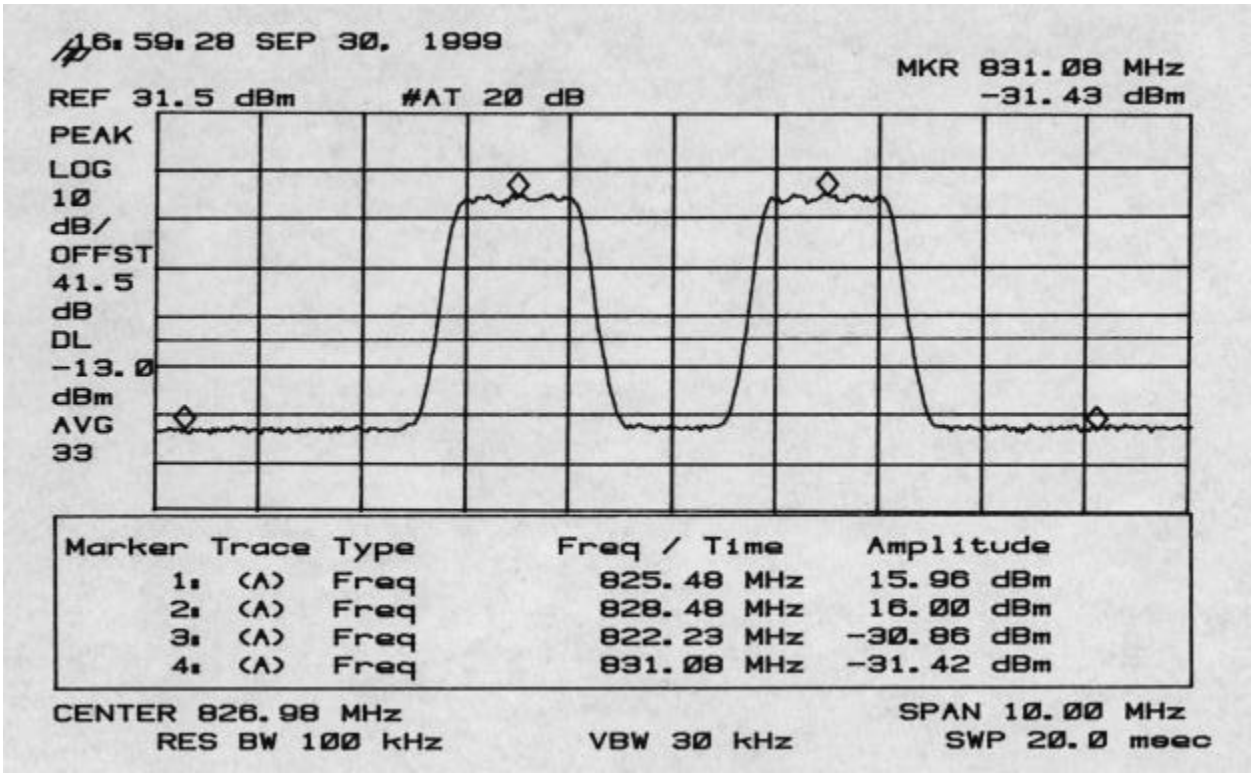
COMMENT #2: Cellular B Band, Forward Link (Power = 39.5 dBm)

TEST ENGINEER:_____ **APPROVED BY**: _____
Larry Zhou **Jeffrey A. Lenk**

Intermodulation Product Data Sheet

CI Wireless Inc.
MirrorCell 800 MHz Cellular Band 8 Watt Repeater

SERIAL #: EN101 PROJECT #: 00219-10
DATE: September 30, 1999 LINE MEASURED: Antenna
DETECTOR FUNCTION: Average



COMMENT #1: Display Line Set to Limit of -13 dBm

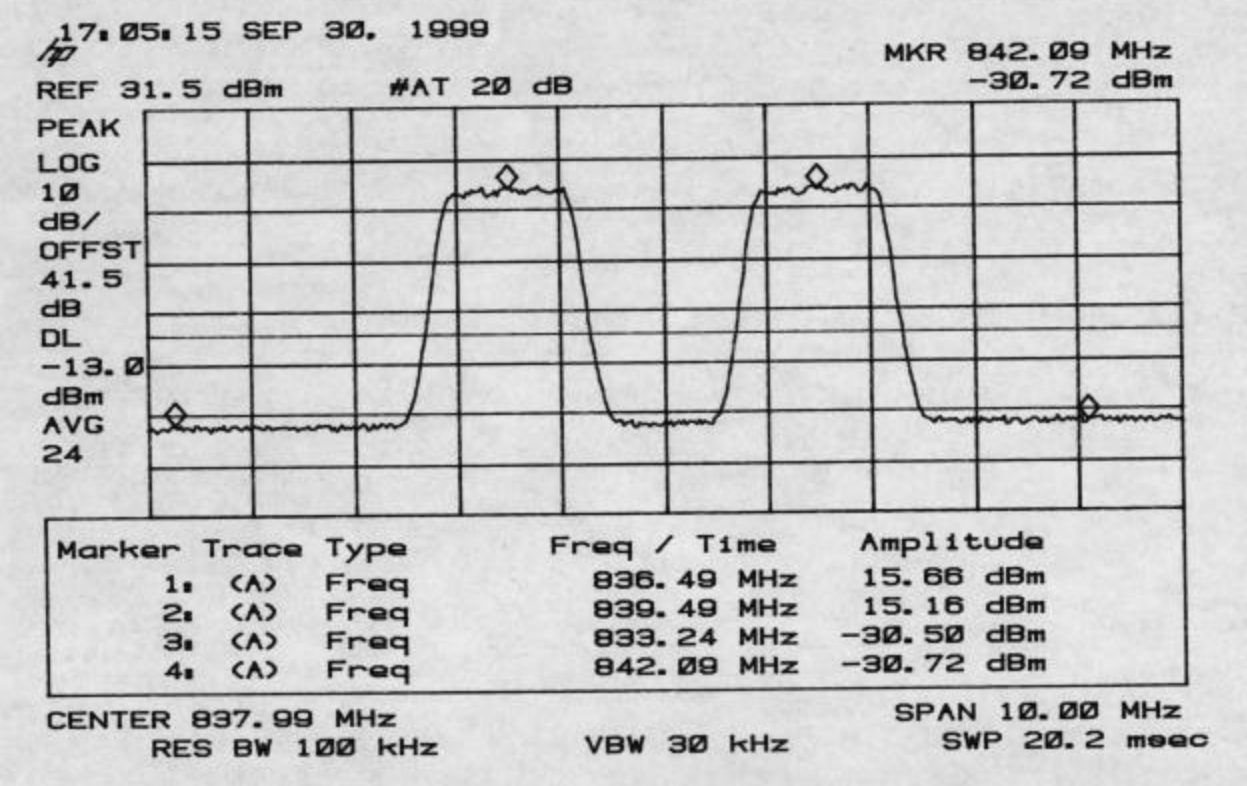
COMMENT #2: Cellular A Band, Reverse Link (Power = 27 dBm)

TEST ENGINEER:_____ **APPROVED BY**: _____
Larry Zhou **Jeffrey A. Lenk**

Intermodulation Product Data Sheet

CI Wireless Inc.
MirrorCell 800 MHz Cellular Band 8 Watt Repeater

SERIAL #: EN101 PROJECT #: 00219-10
DATE: September 30, 1999 LINE MEASURED: Antenna
DETECTOR FUNCTION: Average



COMMENT #1: Display Line Set to Limit of -13 dBm

COMMENT #2: Cellular A Band, Forward Link (Power = 27 dBm)

TEST ENGINEER:_____ **APPROVED BY**: _____
Larry Zhou **Jeffrey A. Lenk**