

1.0 Equipment Under Test (EUT) Description

The CI Wireless, Inc., EKO-19 PCS Extender/Enhancer is a 1.9 GHz PCS service base station signal extender/enhancer. This system is comprised of a Hub and a Microcell unit.

Hub Unit

The Hub unit provides the hardware interface to the base station and the fiber optic cables that will transport the RF signals to the Microcell Units. The Hub will support up to 4 Microcell Units by installing additional Fiber Optic Transceivers. Each of these Microcell Units will be individually alarmed and controlled. The optical path to each of the Microcell Units may be up to 20 kilometers in length.

Microcell Unit

The Microcell Unit provides all of the electronic hardware to interface to the fiber optic cable and the required amplifiers to process the up link and down link RF signals. The up link and down link signals are duplexed to a single radiating antenna via a coaxial cable. Access to alarms and controls for the hub and other Microcell Units is available via the control module.

The Hub unit and Microcell were tested together as a complete system (the **EKO-19**). The Microcell can be configured to operate in the A, B or D PCS bands. The EKO-19 was tested for compliance in the A, B, and D bands with CDMA, GSM, and NADC modulation.

Measurements were performed to demonstrate compliance with FCC Rule Parts 2, and 24 subpart E, for Intentional Radiators. A separate verification report pursuant to Part 15, Subpart B has been prepared for the **CI Wireless Inc. EKO-19 PCS extender** as a Digital Device. Based on Part 15.101, testing and generation of a report for the receiver portion of the EKO-19 is not required because it operates above 960 MHz. The unit is subject to the provisions of Part 15.5. Specific test requirements include the following:

47 CFR 2.985 & 47 CFR 24.232	Power and antenna height limits
47 CFR 2.995 & 47 CFR 24.235	Frequency stability
47 CFR 2.987	Modulation characteristics
47 CFR 2.989	Occupied bandwidth
47 CFR 2.991 & 47 CFR 24.238	Spurious emissions at antenna terminals
47 CFR 2.993 & 47 CFR 24.238	Field strength of spurious emissions

47 CFR 15.107 & 47 CFR 15.109

Radiated and Conducted Emissions

2.0 47 CFR 24.232 Power And Antenna Height Limits

47 CFR 24.232 provides limits for antenna height, peak equivalent isotropically radiated power and power measured at the output terminals for PCS base stations. Antenna height and radiated power limits only apply as the system is installed. The unit as manufactured is required to meet the limit for power at the output terminals.

2.1 Test Procedure

The EKO-19 was set up as per the tune-up procedure described in section 9.5.3 of the product manual. The signal generator was setup to output CW signal. The signal was fed into the EKO-19 Hub unit. The power was measured at the output terminal of the EKO-19 microcell unit. The EKO-19 extender was operated with a 10dB attenuator connected to the antenna port then connected to an HP-436A power meter.

2.2 Test Criteria

The power output measured at the antenna terminal shall not exceed 100 Watts.

2.3 Test Results

The output power measured was below the limit. Power output was 32.3 dBm or 2 Watts. The test data appears in appendix A. Test set-up photographs appear in appendix E.

3.0 47 CFR 2.995 & 47 CFR 24.235 Frequency Stability

Frequency stability requirements are not applicable to the EKO-19 because there are no frequency altering stages in this device.

4.0 47 CFR 2.987 Modulation Characteristics

Modulation characteristics requirements are not applicable to the EKO-19 because the system simply receives, distributes, and rebroadcasts already modulated signals. Signal in vs. signal out tests were done to demonstrate signal purity through the EKO-19. See measurement section 8.

5.0 47 CFR 2.989 Occupied Bandwidth

Occupied bandwidth requirements are not applicable to the EKO-19 because the system simply receives, distributes, and rebroadcasts already modulated signals. Signal in vs. signal out tests were done to demonstrate signal purity through the EKO-19. See measurement section 8.

6.0 47 CFR 2.991 & 47 CFR 24.238 Spurious Emissions At Antenna Terminals

The radio frequency power generated within the equipment and appearing on a spurious frequency shall be measured at the output terminals.

6.1 Test Procedure

The EKO-19 extender was operated with 30dB attenuators connected to the antenna port then connected to an HP-8566B spectrum analyzer. Two tone CDMA, GSM, and NADC modulation was employed at frequencies closest to the upper and lower edges of bands A, B, and D.

6.2 Test Criteria

Section 24.238 states that on any frequency outside a frequency block, the power of any emission shall be attenuated below the transmitter power by at least $43 + 10 \log(\text{power})$ dB. The limit, at the operating power of the EKO-19 extender is -16 dBm.

6.3 Test Results

Spurious emissions outside of the allowed frequency block were below the -16 dBm limit. The test data appears in appendix B. Test set-up photographs appear in appendix E.

7.0 47 CFR 2.993 & 47 CFR 24.238 Field Strength Of Spurious Emissions

The EKO-19 was measured for case radiation as operated with a dummy load at the antenna terminals.

7.1 Test Procedure

The EKO-19 extender was operated with 30dB attenuators connected to the antenna port. The EUT was placed on a non-conductive table 0.8 meter high in a 20' x 26' x 10' semi-anechoic shielded room. The receiving antenna was placed 1 meter from the EUT. The antenna height was 0.8 meter. A HP-8566B spectrum analyzer was used to measure the emissions. The EKO-19 was operated at rated power in CW mode.

7.2 Test Criteria

Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from a halfwave dipole antenna. Limits were set assuming a -13 dBm transmitter radiating through a half wave dipole. This method was approved by Mr. Greg Czumak of the FCC. Calculations for the limits appear in Table 1 of appendix C.

7.3 Test Results

The field strength of spurious emissions was below allowed limits for the CI Wireless EKO-19. The test data appears in appendix C. Test set-up photographs appear in appendix E.

8.0 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.

<u>Device</u>	<u>Description</u>	<u>Date Last Calibrated</u>	<u>Calibration Due Date</u>
HP 8566B, S/N 2950A06265	Spectrum Analyzer	09/22/97	09/22/98
Rhode & Schwarz SMIQ-03E, S/N 73719	Signal Generator	03/16/98	03/16/98
Rhode & Schwarz SMIQ-03E, S/N 73607	Signal Generator	02/26/98	02/26/99
EMCO 3109, S/N 2025	Antenna	09/22/97	09/22/98
EMCO 3106, S/N 2044	Double Ridged Horn Antenna	10/06/97	10/06/98
EMCO 3115, S/N 3578	Double Ridged Horn Antenna	04/30/97	04/30/98
HP-436A, S/N 2709A2921	Power Meter	01/21/98	01/21/99

Table 1. Calculation of Limit for Field Strength of Spurious Emissions

Start frequency	Stop frequency	Frequency for calculation of test limit, MHz	Gain over isotropic of half wave dipole (dB) *	EIRP (dBm) from half-wave dipole at rated output (2 Watts, 33 dBm)	Free Space path loss, dB *	Receive antenna gain, dBi	Calculated limit (@ receive antenna)
26	60	39	2.15	35.16	4.38	-11.6	19.18
60	200	110	2.15	35.16	13.24	-0.6	21.32
200	500	316	2.15	35.16	22.45	6.9	19.61
500	1000	707	2.15	35.16	29.44	9	14.72
1000	2500	1581	2.15	35.16	36.43	8.5	7.23
2500	4000	3162	2.15	35.16	42.45	9.1	1.81
4000	5500	4690	2.15	35.16	45.87	10.6	-0.12
5500	7000	6205	2.15	35.16	48.30	11.2	-1.95
7000	8500	7714	2.15	35.16	50.20	10.8	-4.24
8500	10000	9220	2.15	35.16	51.74	11.5	-5.09

1. EIRP from half-wave dipole at rated output calculated as follows:
33 dBm (rated output)+2.15 dB (Gain over isotropic)
Gain over isotropic source: ITT Reference for Radio Engineers, page 27-44,
Howard
W. Sams & Co © 1968)
2. Free space path loss calculated based on the formula:
Free space loss = $92.45 + 20 \text{ LOG}(f) + 20 \text{ LOG}(d)$
where f is in Ghz and d is in kilometers
source:ITT Reference for Radio Engineers, page 33-3, Howard W. Sams &
Co. ©
1968)
3. Calculated limit at receiving antenna calculated as follows:
Limit = EIRP (dBm) from half-wave dipole at rated output - free space loss +
antenna gain
4. Measurement distance: 1 meter
5. Reference lines shown on plots are 46 dB less than the limit. These lines are
based on -13 dBm output levels (standard industry reference).