FCC ID: HOLCL940

August 31, 1999

Federal Communications Commission
Authorization and Evaluation Division
7435 Oakland Mills Road
Columbia, MD 21046

Attention: Applications Examiner

Reference: FCC ID: HOLCL940
CIDCO Model CL940 Cordless Telephone Base Unit

Dear Examiner:

The following equipment authorization application is presented on behalf of CIDCO , Inc. for the certification of their Model CL940 Cordless Telephone Base unit. Enclosed, please find complete data and documentation package demonstrating that this device complies with the technical requirements of 47 CFR, Part 15, Subpart C for an Intentional Radiator. The manufacturer seeks authorization under the FCC ID: HOLCL940.

We look forward to an expeditious review of the report presented and a granting of the certification for CIDCO , Inc. If you have any questions or we can be of assistance, in this matter, please call us at (410) 354-3300.

Best regards,

Chris Harvey
EMC Laboratory Director,
MET Laboratories, Inc.

Enclosures

MET Laboratories, Inc. *Safety Certification - EMI - Telecom Environmental Simulation*
914 WEST PATAPSCO AVENUE ! BALTIMORE, MARYLAND 21230-3432 ! PHONE (410) 354-3300 ! FAX (410) 354-3313

ENGINEERING TEST REPORT

in support of the
Application for Grant of Equipment Authorization

EQUIPMENT:	Model CL940 Cordless Telephone Base Unit
FCC IDENTIFIER:	HOLCL940
SPECIFICATION:	15.247(a) thru (e); 15.209(a).
Manufacturer:	CIDCO , Inc. 220 Cochrane Circle Morgan Hill, CA 95037
TESTING DATE(S):	4 Aug. 1999
MANUFACTURER'S REPRESENTATIVE:	Mr. Can Nguyen

ENGINEERING STATEMENT

I ATTEST: the measurements shown in this report were made in accordance with the procedures indicated, and that the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them.

_____
Alvin Ilarina
Test Engineer, MET Laboratories, Inc.

MODIFICATIONS STATEMENT

I ATTEST: that the product will be manufactured with all modifications for Part 15 compliance as submitted in this report. Modifications made during testing appear below:

1. No modifications were made to the EUT.

1.0 INTRODUCTION

The following test report is presented on behalf of the Applicant, as verification of the compliance of the CIDCO Direct Sequence, Spread-Spectrum Telephone Base unit, Model: CL940.

2.0 TEST SITE

All testing was conducted at MET Laboratories, Inc., 33439 Western Avenue, Union City, CA 94587. A complete site description is on file with the FCC Laboratory Division as 31040/SIT/MET.

3.0 TEST EQUIPMENT USED

Manufacturer	Equipment	Calibration Due	Cal. Interval
Hewlett Packard	8593EM Spectrum Analyzer	12/1/99	annual
EMCO	Xwing Antenna 1145	4/1/00	annual
EMCO	Active Rod Antenna	2/15/00	annual
EMCO	Double Ridge Horn 3115	2/4/00	annual
EMCO	LISN 3825/2	9/29/99	annual
Schaffner	Biconilog Antenna	4/30/00	annual

4.0 TEST CONFIGURATION

The CIDCO Cordless Telephone Base model CL940 , was configured with the Model: CL9HS Handset in accordance with the manufacturer's instructions and operated in a manner representative of the typical usage of the equipment. During testing of the EUT, the Base unit Model # CL940 was manipulated within the confines of typical usage to maximize each emission.

6.0 TEST TYPE(S)

6.1 As required by §15.247(b) of CFR 47, *output power measurements* radiated measurements were performed to verify compliance with the conducted limit.

6.2 As required by §15.247(a)(2) of CFR 47, *6 dB bandwidth measurements* were performed

6.3 As required by §15.247(e) of CFR 47, *processing gain* Measurements were not performed. Data is provided instead, by the spread spectrum chipset manufacturer

6.4 As required by §15.247(c)(1)& (c)(2) of CFR 47, *out of band emissions measurements* were performed.

6.5 As required by §15.247(d) of CFR 47, *power density measurements* were performed

6.6 As required by §15.107 of CFR 47, *Line Conducted Emission measurements* were performed

7.0 EUT CONFIGURATION INFORMATION

Equipment:	Base Station (900MHz Cordless Telephone)
Model #:	CL940
Serial #:	not provided
FCC ID:	HOLCL940
Equipment:	Handset (900MHz cordless Telephone)
Model #:	CL9HS
Serial #:	not provided
FCC ID:	HOLCL9HS

Special Note:

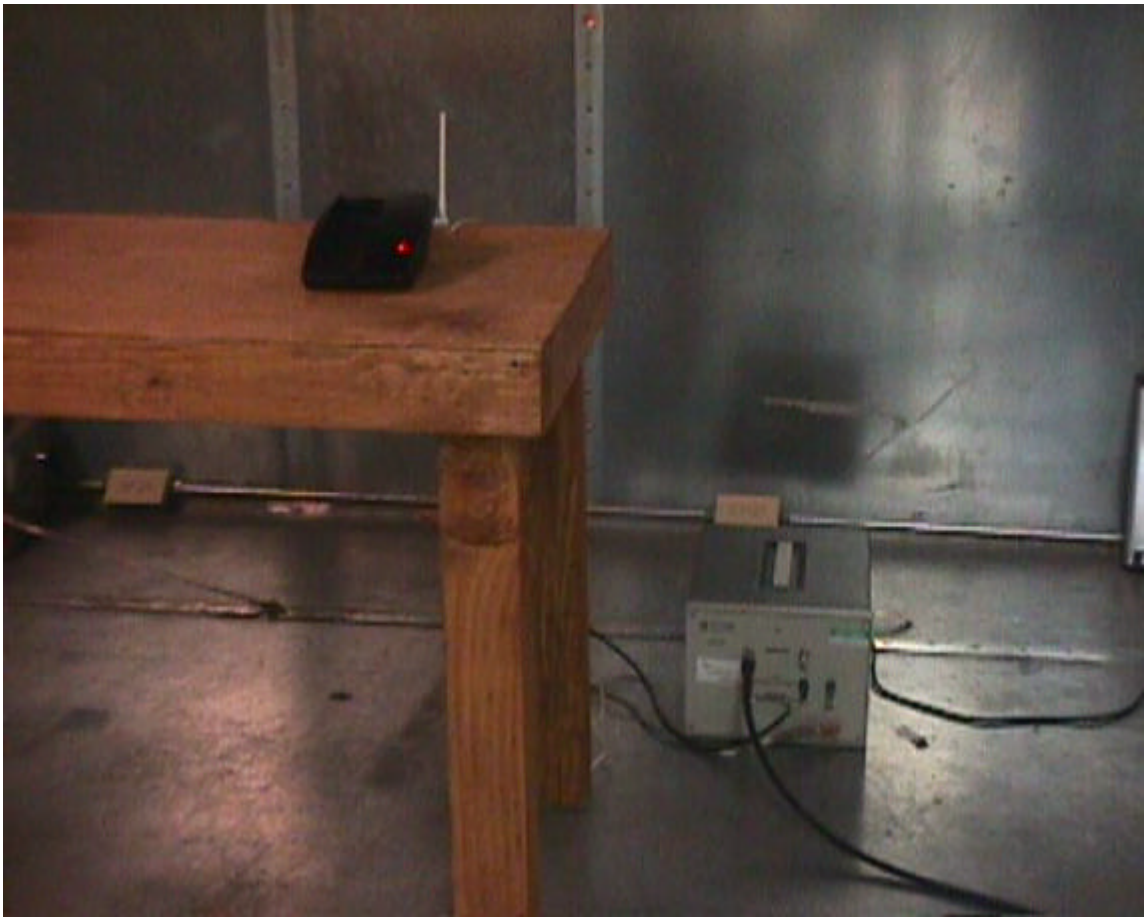
6.7 As required by §15.214 of CFR 47, *Security code requirments* were met based on the nature of the technology used. The EUT uses Direct Sequence, Spread Spectrum Technology which provides adequate security for any unintended receivers of the intended signal.

Photograph(s) of Radiated Emissions Test Configuration

CIDCO Model CL940 Cordless Telephone

Photograph(s) of Line Conducted Emissions Test Configuration

CIDCO Model CL940 Cordless Telephone Base



SUBJECT: Peak Output Power
15.247(b)
FCC Part 15, Subpart C
Intentional Radiator

MET REPORT: EM9561A
MFG: CIDCO
TESTED BY: Alvin Ilarina
TEST DATE(S): 4 Aug 1999

EUT: CIDCO
MODEL: CL940 (Telephone Base unit)

TECHNICAL SPECIFICATION: 15.247(b)

CARRIER POWER: Peak Output power was calculated through the following means:

The raw reading from the analyzer was added to the cable loss and antenna factor (for the specific frequency of measurement). The final E-field strength limit is derived from the conversion of the power limit specified in FCC Part. 15.247(b) to V/m , considering a 50Ω system.

Please see the attached plots

Handset/ Base	Freq (GHz)	Worst case Raw+ACF Reading (dBuV/m)	Dist (m)	Cbl/HPF/Con Loss (dB)	Pre amp (dB)	Corr level (dBµV/m)	Total (V/m)	Total watts
Base	903.83	112.19	3.0	2.8*	n/a	114.99	0.562	0.095

* - Cable losses only. No High-pass filter (i.e. insertion loss) factors, etc., associated with measurement.

The Model CL940 system results for the Base are provided as the highest level of the system. (Across the entire channel range)

Frequency Range (MHz)	Frequency (MHz)	Measured Signal (V/m)	E limit (V/m)	E margin (dB)
902-928	914.76	0.562	3.64	16.23

SUBJECT: 6 dB Bandwidth
15.247(a)(2)
FCC Part 15, Subpart C
Intentional Radiator

MET REPORT: EM9561A
MFG: CIDCO
TESTED BY: Alvin Ilarina
TEST DATE(S): 4 Aug 1999

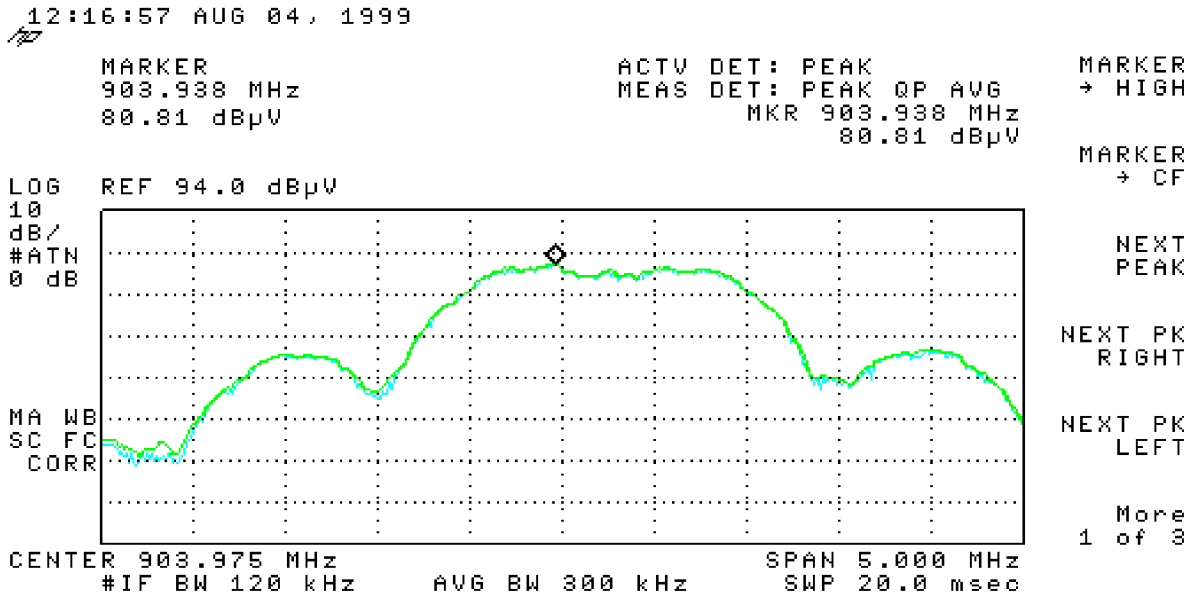
EUT: CIDCO
MODEL: CL940 Base Unit

TECHNICAL SPECIFICATION: 15.247(a)(2)

Please see the attached plots

The 6 dB bandwidth was determined from the plot provided as follows:

EUT	Frequency (MHz)	6 dB Bandwidth (MHz)
Base	904.225 (worst case)	1.50


12:16:57 AUG 04, 1999
MARKER
903.938 MHz
80.81 dBµV
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 903.938 MHz
80.81 dBµV
MARKER
→ HIGH
MARKER
→ CF
LOG
10
dB/
#ATN
0 dB
REF 94.0 dBµV
NEXT
PEAK
NEXT PK
RIGHT
NEXT PK
LEFT
More
1 of 3
MA WB
SC FC
CORR
CENTER 903.975 MHz
#IF BW 120 kHz
AVG BW 300 kHz
SPAN 5.000 MHz
SWP 20.0 msec

SUBJECT: Processing Gain
15.247(e)
FCC Part 15, Subpart C
Intentional Radiator
chipset

MET REPORT: EM9561A
MFG: CIDCO
TESTED BY: Alvin Ilarina
DATE: (Provided by Manufacturer)

EUT: CIDCO
MODEL: CL940 (Telephone Base unit)

TECHNICAL SPECIFICATION: 15.247(e)

Processing Gain Measurements, per CFR 47, Part 15.247(e) were performed by the spread spectrum chipset manufacturer, Rockwell Semiconductor. Testing results as performed by Rockwell, have been included for reference and comparrison to the applicable limit.

Refer to the following 3 pages for tables, notes, and data, from the processing gain measurements provided by the spread spectrum chip manufacturer:

Introduction

1.1 Scope

This document is a Rockwell Semiconductor Systems (RSS) Engineering report. This document details the results of measurement of the processing gain of a DCT FFF phone.

1.2 Intended Readers

The intended readers of this document are RSS marketing, application, engineering, test engineering, technical publication, and management personnel. This document is not intended for distribution outside of RSS.

1.3 Reference Documents

This section lists documents that are referenced within or are materially relevant to this document.

Code of Federal Regulations, Title 47, Chapter 1, Part 15 Radio Frequency Devices (FCC)

1.4 Definitions

FCC	Federal Communications Commission
SNR	Signal to Noise Ratio
JSR	Jammer to Signal Ratio
CW	Continuous wave (jammer)
HS	Handset
BS	Basestation
DBPSK	Differential Binary Phase Shift Keying

Table 1: Definitions and Abbreviations

2. An Overview of the FCC Method for measuring Processing Gain

Two methods are specified for measuring processing gain by the FCC in 15.247 (e). The first method simply involves calculating the signal to ratio noise (SNR) with the spreading code switched on with the SNR when the spreading code is switched off. The difference between the two is the processing gain. The SNR is measured at the demodulated output of the receiver. In principle this an acceptable method to measure the processing gain of any direct sequence spread spectrum communication system, however, it does not take into consideration that the non-spread spectrum portion of the system may operate under the assumption that the signal being transmitted is a spread spectrum signal and when the spreading code is switched off the system may fail to operate or operate at greatly reduced efficiency. In either case the measurement of processing gain will be meaningless.

The second method specified by the FCC to measure processing gain is detailed in 15.247 (e)(1). This involves transmitting a CW jammer in the RF passband of the system and measuring the jammer to signal ratio (JSR) required to achieve a certain bit error rate. The choice of the actual value of the bit error rate is left up to the tester. The jammer is stepped in 50 kHz increments across the entire passband and in each case the JSR to achieve the desired bit error rate is measured. The JSR is measured at the RF input to the system under test.

The lowest 20% of the JSR data (in dB) is discarded. The processing gain can then be calculated as follows:-

$$G_P = (S/N)_{theory} + (J/S)_{meas} + L_{system}$$

where G_p is the processing gain, the SNR is that theoretically predicted for the system under the test to achieve the desired bit error rate, the JSR is the lowest value (in dB) in the remaining data set and L_{sys} adjusts for non-ideal system losses. L_{sys} can not be greater than 2 dB.

3. Processing Gain Measurement Results

The following parameters were used in the test setup.

HS Tx power (dBm)	-1.9	
BS LNA gain (dB)	0	
Channel attenuation (dB)	-50	
Test system losses (signal) (dB)	-11.75	-4.05 dB (system), -6 dB (signal combiner), -1.7 dB (2 cables)
Test system losses (jammer) (dB)	-12.85	-12 dB (signal combiner), -0.85 dB (cable)

Table 2: Test Setup Parameters

The following measurement results were taken at the basestation. The desired bit error rate was set at 10^{-3}.

Jammer Frequency	BER (BS)	Received jammer	Received signal	Jammer/Signal ratio
913.80	9.4×10^{-4}	-59.55	-63.65	4.1
913.85	9.6×10^{-4}	-57.95	-63.65	5.7
913.90	9.6×10^{-4}	-60.15	-63.65	3.5
913.95	9.6×10^{-4}	-64.25	-63.65	-0.6
914.00	1.1×10^{-3}	-61.55	-63.65	2.1
914.05	9.8×10^{-4}	-61.55	-63.65	2.1
914.10	1.1×10^{-3}	-61.95	-63.65	1.7
914.15	9.2×10^{-4}	-62.85	-63.65	0.8
914.20	1.0×10^{-3}	-59.85	-63.65	3.8
914.25	1.0×10^{-3}	-61.15	-63.65	2.5
914.30	1.1×10^{-3}	-62.05	-63.65	1.6
914.35	1.0×10^{-3}	-57.65	-63.65	6.0
914.40	1.1×10^{-3}	-55.65	-63.65	8.0
914.45	1.0×10^{-3}	-49.35	-63.65	14.3
914.50	1.1×10^{-3}	-59.25	-63.65	4.4
914.55	1.0×10^{-3}	-62.35	-63.65	1.3
914.60	9.7×10^{-4}	-59.05	-63.65	4.6
914.65	1.0×10^{-3}	-61.05	-63.65	2.6
914.70	1.1×10^{-3}	-62.55	-63.65	1.1
914.75	9.0×10^{-4}	-61.95	-63.65	1.7
914.80	1.0×10^{-3}	-61.05	-63.65	2.6
914.85	9.9×10^{-4}	-62.35	-63.65	1.3
914.90	1.1×10^{-3}	-64.05	-63.65	-0.4
914.95	9.2×10^{-4}	-56.25	-63.65	7.4
915.00	1.0×10^{-3}	-59.85	-63.65	3.8
915.05	1.1×10^{-3}	-57.25	-63.65	6.4
915.10	9.9×10^{-4}	-58.15	-63.65	5.5

Table 3: Test Results

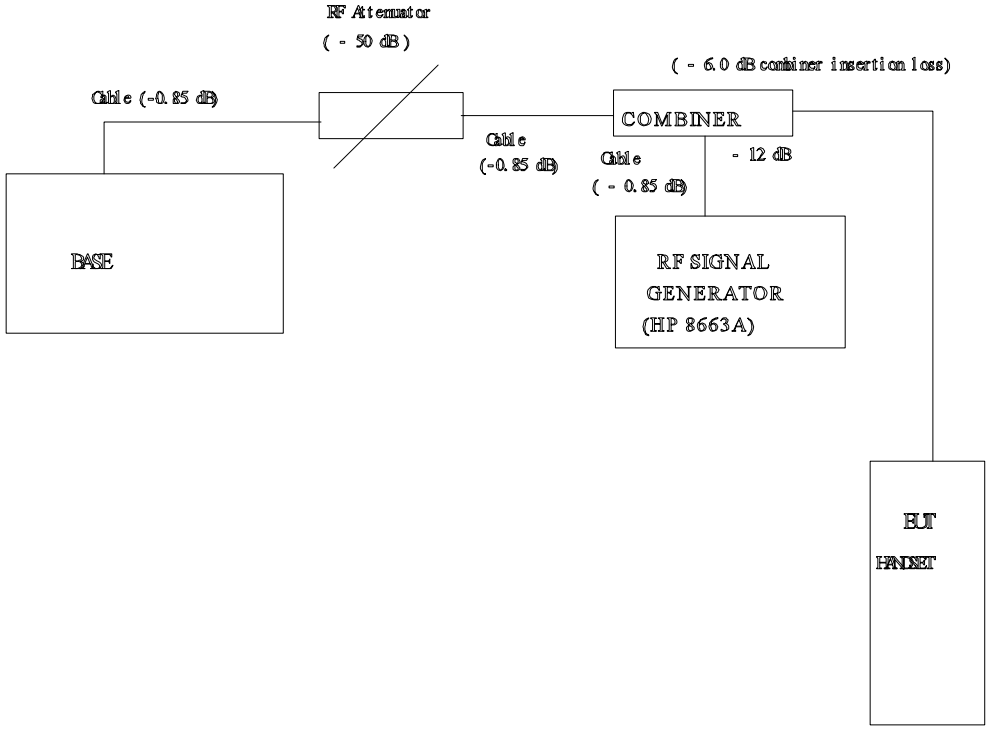


Figure 1:

Test Setup

For DBPSK at 10^{-3} bit error rate the required SNR is 8.0 dB. Using the results above and the data in the table below the processing gain is calculated to be 11.3 dB.

required SNR (dB)	8.0
system losses (dB)	2.0
J/S ratio at 80% point (dB)	1.30
FCC Processing gain (dB)	**11.3**

Table 4: Processing Gain Calculation data

4. Conclusions

The result measured for processing gain of 11.3 dB is close to the actual processing gain due to a 12 chip spreading code of

$$10 \times \log_{10}(12) = 10.8 \text{ dB}$$

SUBJECT:	Spurious Emissions 15.247(c)(paragraphs 1 & 2) FCC Part 15, Subpart C Intentional Radiator	**MET REPORT:** **MFG:** **TESTED BY:** **TEST DATE(S):**	EM9561A CIDCO Alvin Ilarina 4 Aug 1999

EUT: CIDCO
MODEL: CL940 (Telephone Base unit)

TECHNICAL SPECIFICATION: 15.247(c)(paragraphs 1 & 2)

Test data is presented on the following plot @ 100 kHz RBW:

The marker was placed on the highest emission inside the band and the marker recorded.

w/ RBW = 100 kHz, the highest emission within the band of operation was found to be = 114.99 dBuV. Therefore;

all spurs harmonics must be 114.99 - 20 dB = 94.99 dBuV.

spurs that fall **in Restricted Band** (per 15.205) must meet the **limits of 15.209 (i.e. 54 dBuV)**:

Freq (MHz)	Ant	Raw Reading (dBµV)	Ant Factor (dB/m)	Cbl/HPF/ Conn Loss (dB)	d (m)	Corr. Level (dBµV/m)	Limits (dBµV/m)	*Comments*
55.05	H	14.46	9.75	1.3	3.0	25.51	40.0	*Restricted band*
55.05	V	23.13	9.75	1.39	3.0	34.18	40.0	*Restricted band*
82.56	H	16.76	7.55	0.98	3.0	25.24	40.0	*Restricted Band*
82.56	V	18.75	7.55	0.98	3.0	27.23	40.0	*Restricted Band*
111.54	H	13.17	7.20	1.1	3.0	21.47	43.5	*Restricted Band*
111.54	V	13.68	6.65	1.1	3.0	21.43	43.5	*Restricted Band*
221.51	H	16.4	10.10	1.3	3.0	27.8	46.0	*Restricted Band*
221.51	V	14.10	11.02	1.3	3.0	26.42	46.0	*Restricted Band*
414.36	H	13.09	16.0	1.9	3.0	30.99	46.0	*Restricted Band*
414.36	v	13.76	15.85	1.9	3.0	31.51	46.0	*Restricted Band*
441.50	H	13.14	16.2	2.0	3.0	31.34	46.0	*Restricted Band*
441.50	V	13.11	16.25	2.0	3.0	31.36	46.0	*Restricted Band*
1829.00	H	27.6	28	3.1	9.54	49.16	94.96	*Spur*
1829.00	V	35.26	26	3.1	9.54	54.82	94.96	*Spur*
2743.00	H	14.8	26.1	4.2	9.54	35.56	54.0	*Spur*
2743.00	V	17.2	29	4.2	9.54	35.56	54.0	*Spur*
5000.00	H	16.06	33.6	7.0	9.54	47.12	54	*Spur*
5000.00	V	17.8	33.4	7.0	9.54	48.66	54	*Spur*
10,000.00	H	24.4	38.3	10.1	9.54	63.26	94.96	*Spur*
10,000.00	V	24.37	38.2	10.1	9.54	63.13	94.96	*Spur*

***Note - All levels taken above, were with VBW set to 10 Hz to simulate an average measurement. These levels are pulsed in nature, but HAVE NOT been adjusted for the peak-average correction factor.**

SUBJECT:	Transmitted Power Spectural Density 15.247(d) FCC Part 15, Subpart C Intentional Radiator	**MET REPORT:**	EM9561A
		MFG:	CIDCO
		TESTED BY:	Alvin Ilarina
		TEST DATE(S):	4 Aug 1999

EUT: CIDCO
MODEL: CL940
TECHNICAL SPECIFICATION: 15.247(d)

Power density limit is stated as +8 dBm.

Test data is presented on the plots following this section:

Base : Model: CL940 (Telephone base unit)

The largest value found within a 3 kHz bandwidth for the Base unit of the EUT, was found to be:

For the Base : -34.32 + 23.44 dB = -10.88 dBm or 96.12 dBµV/m (or 0.064 V/m).

(Note: were 23.44 dB is Aantenna Factor for antenna used.)

- Solving the above for power density output using the equation: $P_D = \frac{(E \cdot d)^2}{30G}$

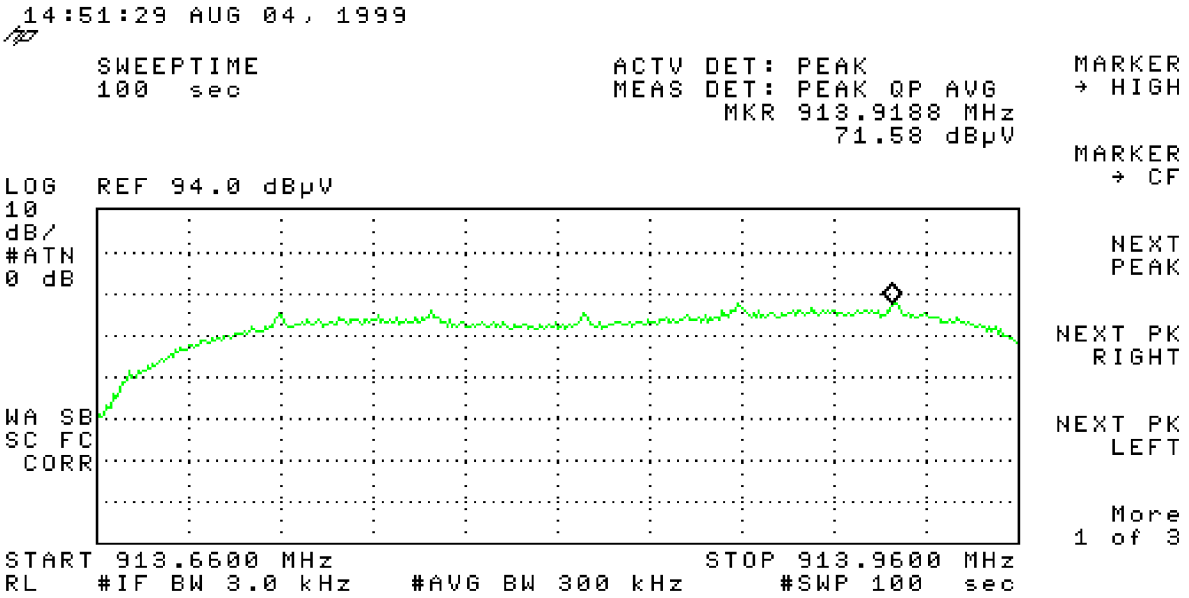
  Where; E = 0.064 V/m , d = 3.0 m , and G = 1.0 for isotropic antenna

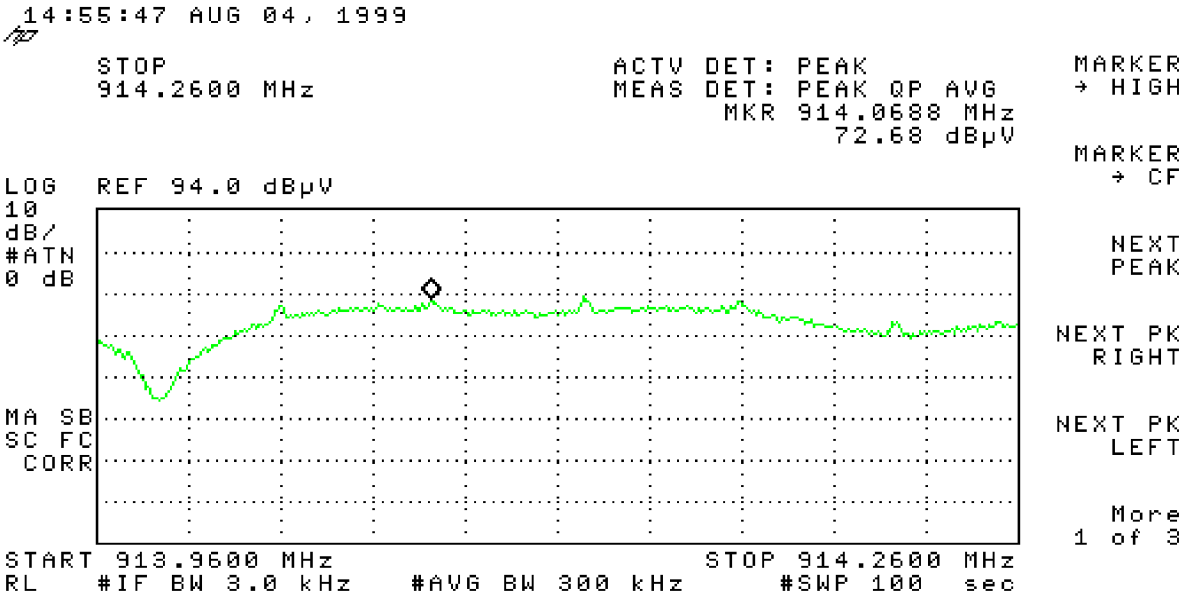
  Therefore; $P_D = (0.064 * 3)^2 / 30(1) = 0.001227$ W or 1.23 mW

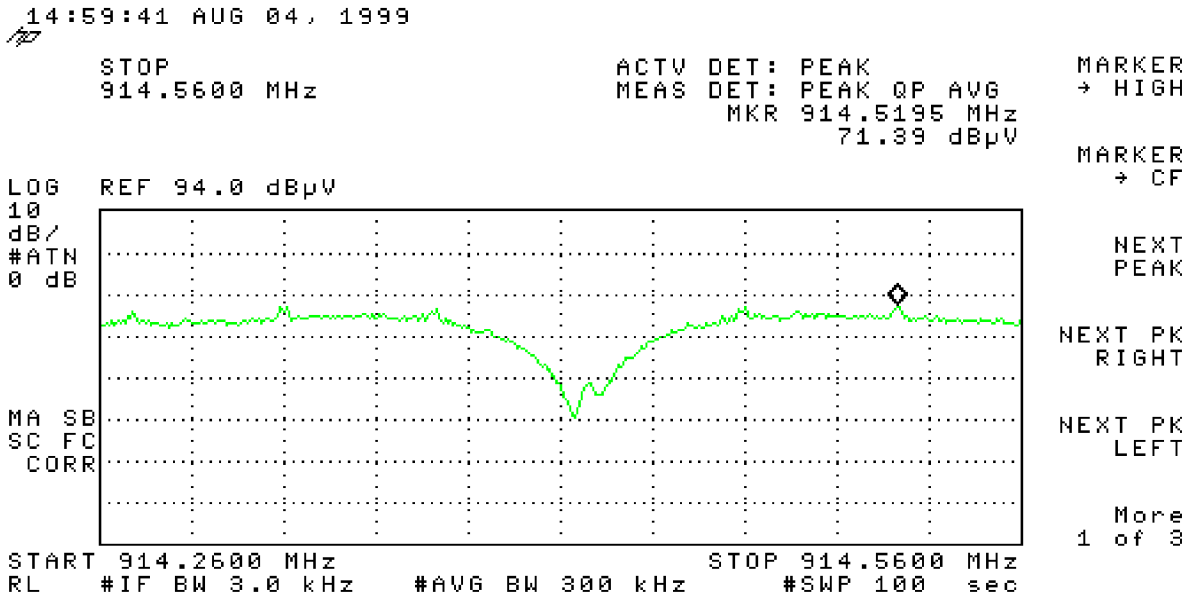
  P_D = 1.23 m W = 1.0 dBm $_{meas}$

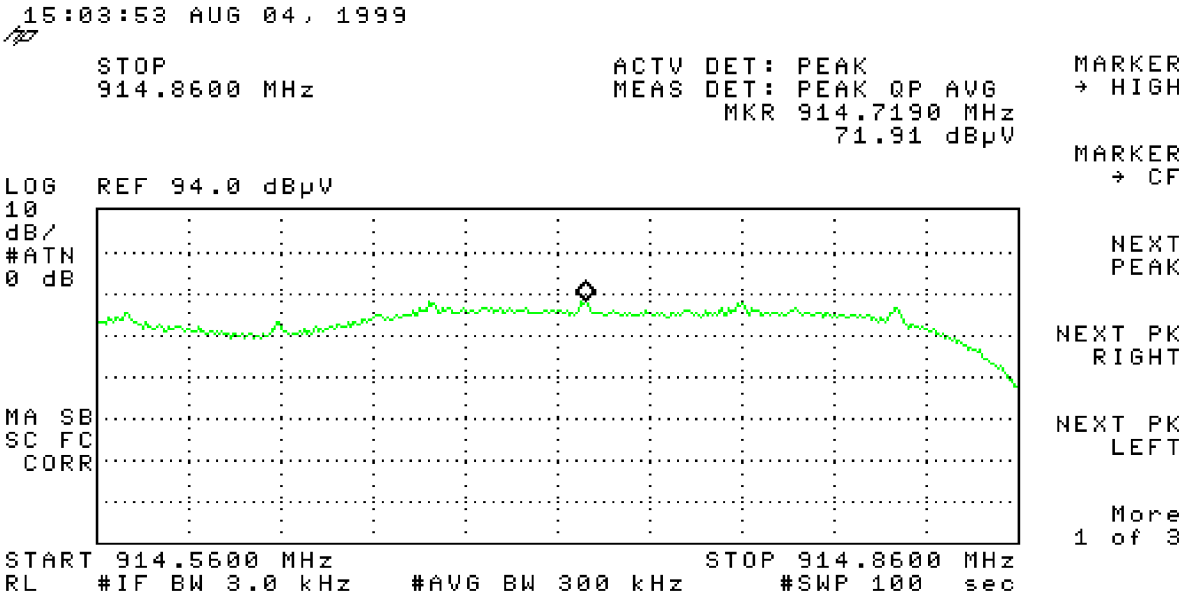
  P_D Limit = + 8 dBm

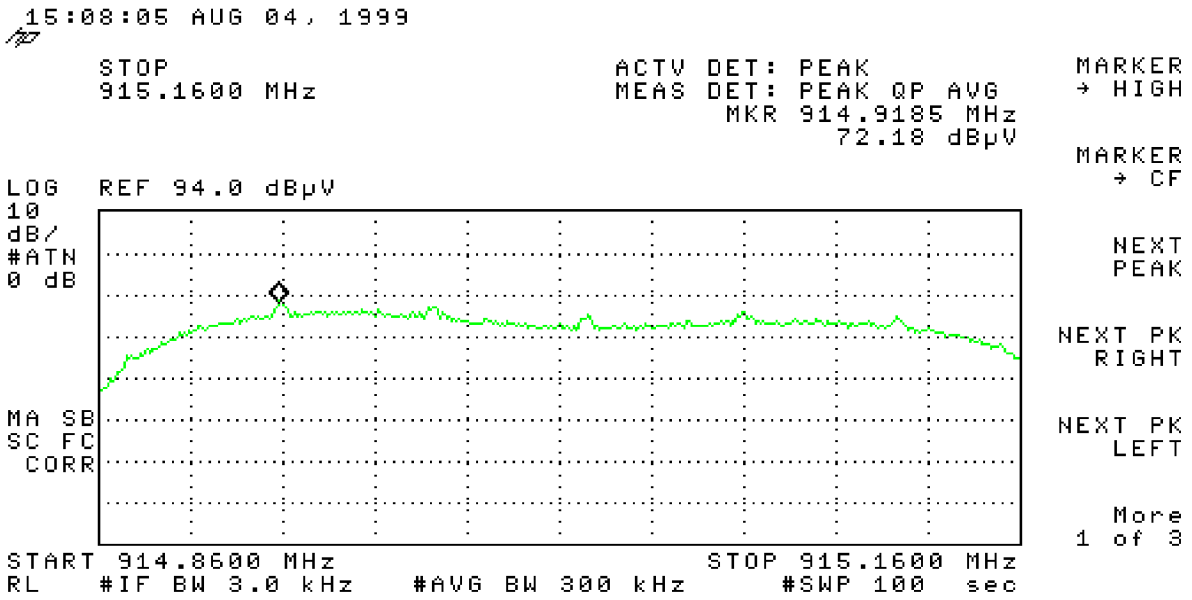
Please see the following 5 plots on the next 3 pages.


14:51:29 AUG 04, 1999
SWEEPTIME
100 sec
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 913.9188 MHz
71.58 dBµV
MARKER
→ HIGH
MARKER
→ CF
LOG
10
dB/
#ATN
0 dB
REF 94.0 dBµV
NEXT
PEAK
NEXT PK
RIGHT
NEXT PK
LEFT
More
1 of 3
WA SB
SC FC
CORR
START 913.6600 MHz
STOP 913.9600 MHz
RL
#IF BW 3.0 kHz
#AVG BW 300 kHz
#SWP 100 sec


14:55:47 AUG 04, 1999
STOP
914.2600 MHz
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 914.0688 MHz
72.68 dBµV
MARKER
→ HIGH
MARKER
→ CF
LOG
10
dB/
#ATN
0 dB
REF 94.0 dBµV
NEXT
PEAK
NEXT PK
RIGHT
NEXT PK
LEFT
More
1 of 3
MA SB
SC FC
CORR
START 913.9600 MHz
STOP 914.2600 MHz
RL
#IF BW 3.0 kHz
#AVG BW 300 kHz
#SWP 100 sec


14:59:41 AUG 04, 1999
STOP
914.5600 MHz
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 914.5195 MHz
71.39 dBµV
MARKER
→ HIGH
MARKER
→ CF
LOG
10
dB/
#ATN
0 dB
REF 94.0 dBµV
NEXT
PEAK
NEXT PK
RIGHT
NEXT PK
LEFT
More
1 of 3
MA SB
SC FC
CORR
START 914.2600 MHz
STOP 914.5600 MHz
RL
#IF BW 3.0 kHz
#AVG BW 300 kHz
#SWP 100 sec


15:03:53 AUG 04, 1999
STOP
914.8600 MHz
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 914.7190 MHz
71.91 dBµV
MARKER
→ HIGH
MARKER
→ CF
LOG
10
dB/
#ATN
0 dB
REF 94.0 dBµV
NEXT
PEAK
NEXT PK
RIGHT
MA SB
SC FC
CORR
NEXT PK
LEFT
More
1 of 3
START 914.5600 MHz
STOP 914.8600 MHz
RL
#IF BW 3.0 kHz
#AVG BW 300 kHz
#SWP 100 sec


15:08:05 AUG 04, 1999
STOP
915.1600 MHz
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 914.9185 MHz
72.18 dBµV
MARKER
→ HIGH
MARKER
→ CF
LOG
10
dB/
#ATN
0 dB
REF 94.0 dBµV
NEXT
PEAK
NEXT PK
RIGHT
MA SB
SC FC
CORR
NEXT PK
LEFT
More
1 of 3
START 914.8600 MHz
STOP 915.1600 MHz
RL
#IF BW 3.0 kHz
#AVG BW 300 kHz
#SWP 100 sec

SUBJECT: Conducted Emissions
Neutral Side
FCC Part 15, Subpart C
Intentional Radiator

MET REPORT: EM9561A
MFG: CIDCO
TESTED BY: Alvin Ilarina
TEST DATE(S): 4 Aug 1999

EUT: CIDCO
MODEL: CL940 (Telephone Base unit)

TECHNICAL SPECIFICATION:

Equipment meets the specifications of Part 15.207(a)

SUMMARY — 3 Worst-Case Emissions

Frequency (MHZ)	Quasi-Peak Level (dBµV)	Limit (dBµV)
0.587	32.45	47.95
3.385	29.68	47.95
6.75	27.59	47.95

SUBJECT: Conducted Emissions
Phase Side
FCC Part 15, Subpart C
Intentional Radiator

MET REPORT: EM9561A
MFG: CIDCO
TESTED BY: Alvin Ilarina
TEST DATE(S): 4 August 1999

EUT: CIDCO
MODEL: CL940 (Telephone Base unit)

TECHNICAL SPECIFICATION: 15.207(a)

LIMITS: 0.45 - 30MHZ : 250 µV (47.9 dBµV)

Equipment meets the specifications of Part 15.207(a)

SUMMARY — 3 Worst-Case Emissions

Frequency (MHz)	Level (dBµV)	Limit (dBµV)
0.600	33.20	47.95
3.26	30.53	47.95
5.10	29.05	47.95