FCC PART 90 TYPE APPROVAL
EMI MEASUREMENT AND TEST REPORT

FOR

COMMUNICATION NETWORK INTERFACE, INC.

51-2, SungSan 1-dong, Mapo-gu
SEOUL 121-251, KOREA

FCC ID: N79CNI-800D

May 2, 1999

This Report Concerns:	**Equipment Type:**
☒ Original Report	Radio Packet Modem

Test Engineer:	John Chan
Test Date:	May 2, 1999
Certified By:	John Y. Chan - Director, Compliance Engineering
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1 - GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

The *Communication Network Interface, Inc.*, FCC ID *N79CNI-800D, RPM (RADIO PACKET MODEM) or the* "EUT" as referred to in this report is a digital data communication equipment in accordance with Motorola DataTac 5000 RD-LAP 19.2 specification. The frequency it uses ranges from 806 MHz to 821 MHz for transmission and from 851 MHz to 866 MHz for reception. The EUT measures 68.5mm L x 46.6 mm W x 10.4mm H.

Basic Specification include:

- Weight: 45g
- Power: 4.2 V from Host
- RF protocol: RD-LAP 19.2 on DataTAC 5000
- Host protocol: DataTAC NCL 1.2
- Etc.

1.2 Objective

This Class B report is prepared on behalf of *Communication Network Interface, Inc.* in accordance with Part 2, Subpart J, Part 15, Subparts A and B, and Part 90 Subpart I and Subpart S, of the Federal Communication Commissions rules.

The objective of the manufacturer is to demonstrate compliance with FCC rules for conducted and radiated margin for Information Technology Equipment.

1.3 Related Submittal(s)/Grant(s)

No Related Submittals

1.4 Test Methodology

All measurements contained in this report were conducted with ANSI C63.4 –1992, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz. All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratory, Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

1.5 Test Facility

The Open Area Test site used by Bay Area Compliance Laboratory Corporation to collect radiated and conducted emission measurement data is located in the back parking lot of the building at 230 Commercial Street, Suite 2, Sunnyvale, California, USA.

Test sites at Bay Area Compliance Laboratory Corporation has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-1992.

The Federal Communications Commission and Voluntary Control Council for Interference has the reports on file and is listed under FCC file 31040/SIT 1300F2 and VCCI Registration No.: C-674 and R-657. The test sites has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, Bay Area Compliance Laboratory Corporation is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (NVLAP). The scope of the accreditation covers the FCC Method - 47 CFR Part 15 - Digital Devices, IEC/CISPR 22: 1993, and AS/NZS 3548: Electromagnetic Interference - Limits and Methods of Measurement of Information Technology Equipment test methods under NVLAP Lab Code 200167.

1.6 Test Equipment List

Manufacturer	Description	Model	Serial Number	Cal. Due Data
HP	Spectrum Analyzer	8566B	2610A02165	12/6/99
HP	Spectrum Analyzer	8593B	2919A00242	12/20/99
HP	Amplifier	8349B	2644A02662	12/20/99
HP	Quasi-Peak Adapter	85650A	917059	12/6/99
HP	Amplifier	8447E	1937A01046	12/6/99
A.H. System	Horn Antenna	SAS0200/571	261	12/27/99
Com-Power	Log Periodic Antenna	AL-100	16005	11/2/99
Com-Power	Biconical Antenna	AB-100	14012	11/2/99
Solar Electronics	LISN	8012-50-R-24-BNC	968447	12/28/99
Com-Power	LISN	LI-200	12208	12/20/99
Com-Power	LISN	LI-200	12005	12/20/99
BACL	Data Entry Software	DES1	0001	12/20/99

1.7 Equipment Under Test (EUT)

Manufacturer	Description	Model	Serial Number	FCC ID
Communication Network Interface, Inc.	Radio Packet Modem	CNI-800D	None	N79CNI-800D

1.8 Support Equipment

Manufacturer	Description	Model	Serial Number	FCC ID
Fujitsu	Notebook	FPC03008A	8Y627225	Doc

1.9 EUT Configuration Details and List

NOT APPLICABLE

1.10 External I/O Cabling

Cable Description	Length (M)	Port/From	To
Shielded RS232 Cable	2.0	EUT	Serial / Fujitsu

2 - SYSTEM TEST CONFIGURATION

2.1 Justification

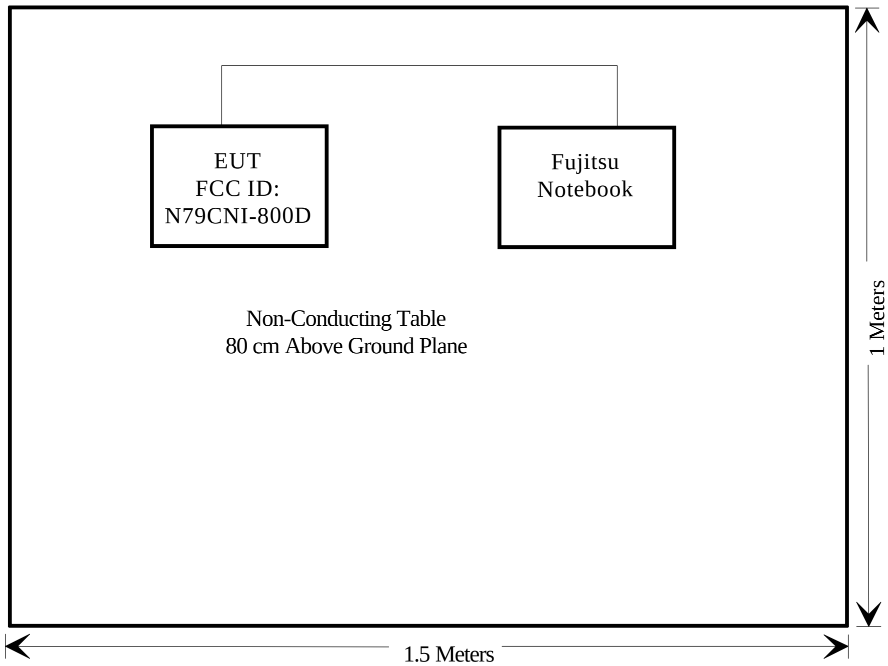
The EUT was configured for testing in a typical fashion (as normally used in a typical application).

The final qualification test was performed with the EUT operating at normal mode.

2.2 Block Diagram

Appendix A contains a copy of the EUT’s block diagram as reference.

2.3 Test Setup Block Diagram



2.4 Equipment Modifications

No modifications were necessary for the EUT to comply.

3.0 Summary of Test Results

FCC RULE	DESCRIPTION OF TEST	RESULT
2.1046	RF power output	Pass
90.635	Effective Radiated Power	Pass
2.1047	Modulating Deviation Limiting	N/A
2.1047	Audio Filter Characteristics	N/A
2.1049 90.210 (g)	Emission, Occupied Bandwidth	Pass
2.1051	Spurious emissions at antenna terminals	Pass
2.1053	Field strength of spurious radiation	Pass
2.1055 (a) 2.1055 (d)	Frequency stability vs. temperature Frequency stability vs. voltage	Pass Pass
15.107	AC Line Conducted emission	Pass
15.109	Radiated emissions	Pass

3.1.0 RF Power Output

Requirements: FCC Part 2.1046

3.1.1 Test Procedure

The antenna was removed and SMA connector was connected to the transmitter output. The transmitter output was connected to a calibrated coaxial attenuator (50 Ohm), the other end of which was connected to a spectrum analyzer. Transmitter output was read off the spectrum analyzer in dBm. The power output at the transmitter was determined by adding the value of the attenuator to the spectrum analyzer reading.

The test was performed at three frequencies (low, middle, and high channels) and on all power levels which can be setup on the transmitter.

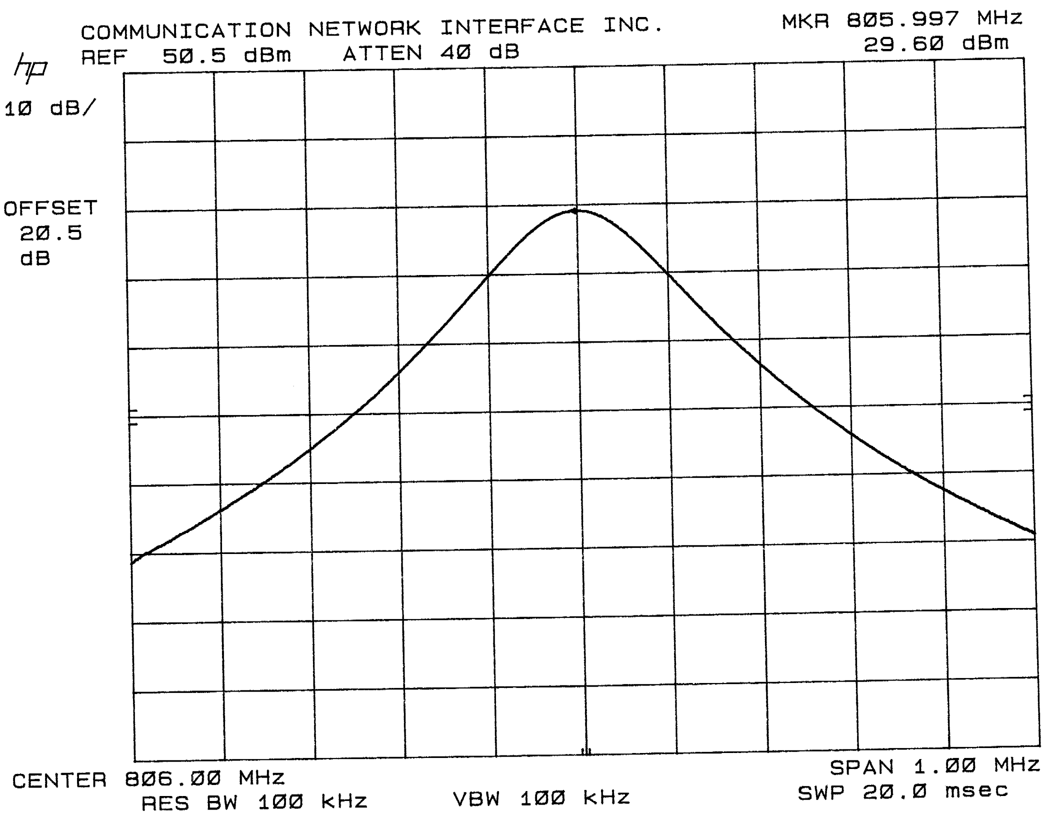
3.1.2 Test equipment

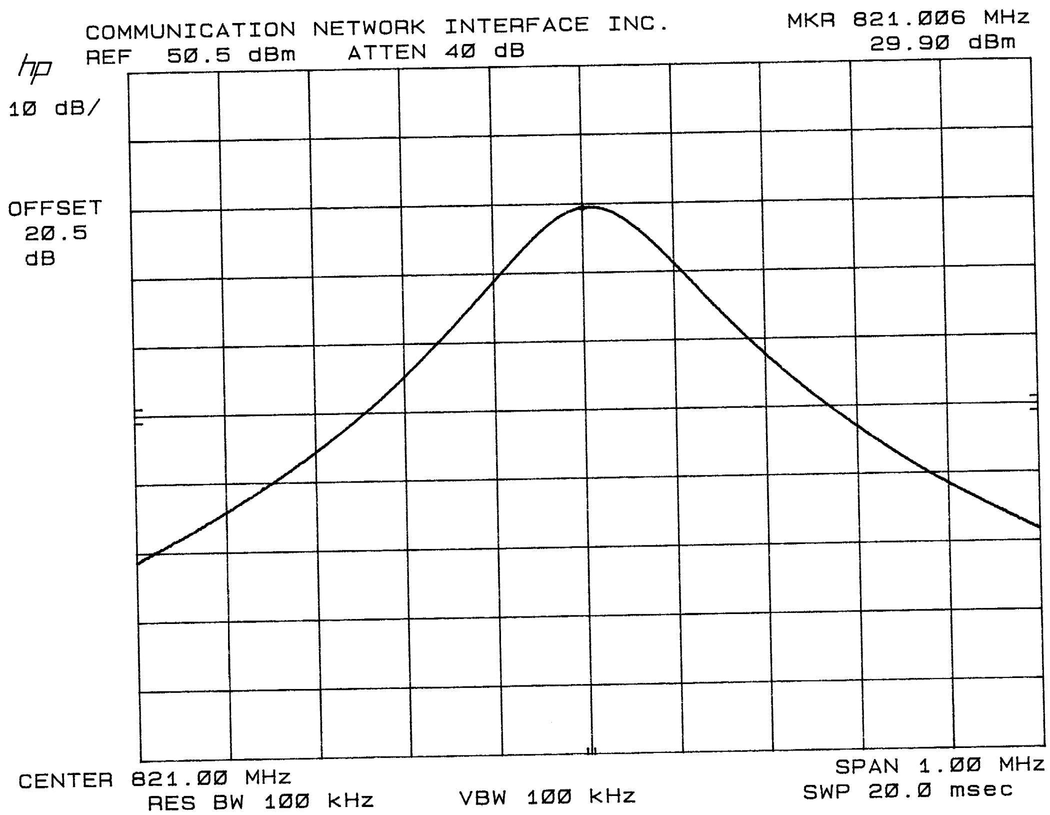
Hewlett Packard HP8566B Spectrum Analyzer
Hewlett Packard HP 7470A Plotter

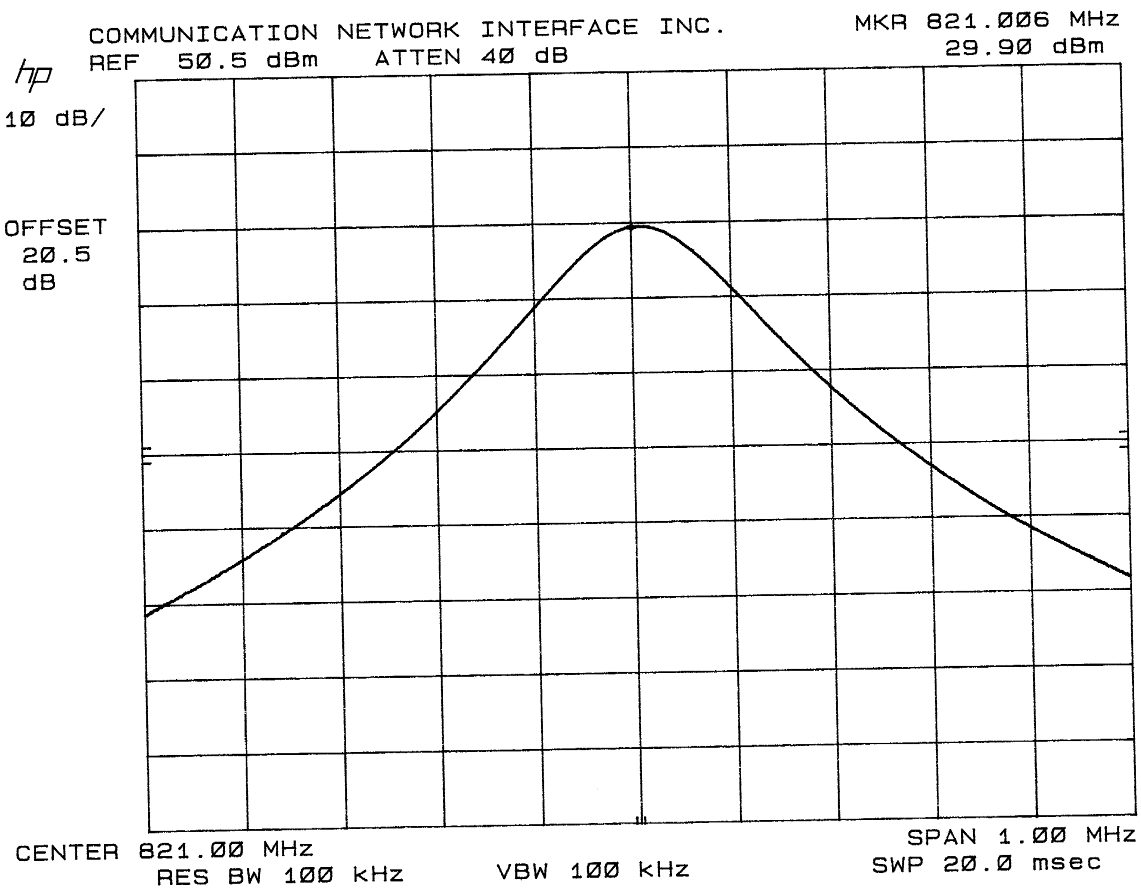
3.1.3 Test Results

Refer to the attached plots:

Plot #2.3.a
Plot #2.3.b
Plot #2.3.c


COMMUNICATION NETWORK INTERFACE INC.
REF 50.5 dBm ATTEN 40 dB
MKR 805.997 MHz
29.60 dBm
hp
10 dB/
OFFSET
20.5
dB
CENTER 806.00 MHz
RES BW 100 kHz
VBW 100 kHz
SPAN 1.00 MHz
SWP 20.0 msec


COMMUNICATION NETWORK INTERFACE INC.
MKR 821.006 MHz
29.90 dBm
hp
REF 50.5 dBm ATTEN 40 dB
10 dB/
OFFSET
20.5
dB
CENTER 821.00 MHz
RES BW 100 kHz
VBW 100 kHz
SPAN 1.00 MHz
SWP 20.0 msec



COMMUNICATION NETWORK INTERFACE INC.
MKR 821.006 MHz
29.90 dBm
hp
REF 50.5 dBm ATTEN 40 dB
10 dB/
OFFSET
20.5
dB
CENTER 821.00 MHz
RES BW 100 kHz
VBW 100 kHz
SPAN 1.00 MHz
SWP 20.0 msec

3.2.0 Effective Radiated Power

Requirements: FCC Part 90.635

The Effective Radiated Power (ERP) of mobile transmitter and auxiliary test transmitter must not exceed 7 Watts.

3.2.1 Test Procedure

The EUT was positioned on a non-conductive turntable, 0.8m above the ground plane on an open test site.

The radiated emission at the fundamental frequency was measured at 3m distance with a test antenna and spectrum analyzer. During the measurement, the resolution and video bandwidths of the spectrum analyzer were set to 100 KHz. Worst case emission was recorded with the rotation of the turntable and the raising and lowering of the test antenna. The spectrum analyzer reading (R_{EUT}) was recorded.

The ERP was calculated as follows:

$P = (VD)^2 / 30$

The test was performed at three frequencies (low, middle, and high channels)

3.2.2 Test Equipment

Hewlett Packard HP8566B Spectrum Analyzer

CD Robert Antenna

3.2.3 Test Results

Refer to the attached data sheet on 3.7.3.a, 3.7.3.b, and 3.7.3.c.

Frequency	Reading	Antenna Factor	Polarity	Cable Loss	Amplifier	Corr. Fa.(E.R.P.)
MHz	dBµV	dB	H/ V	dB	dBµV	dBµV
806.00	101.0	23.3	V	0.5	0.0	124.8
815.00	100.0	23.0	V	0.5	0.0	123.5
821.00	101.3	22.9	V	0.5	0.0	124.7

3.3.0 Modulation Deviation Limiting

Requirements: FCC 2.1047

3.3.1 Test Procedure

The RF output of the transceiver was connected to the input of an FM deviation meter through sufficient attenuation so as not to overload the meter or distort the readings An audio signal generator with a variable attenuator on the output was coupled into the external microphone jack of the transceiver, or alternatively, the microphone element was removed and the generator output was connected to the microphone wires by clip leads.

At three different modulating frequencies, the output level of the audio generator was varied and the FM deviation level was recorded (Table 4.1.a).

The audio input was adjusted for 8 KHz deviation at 1 KHz tone with the 2:1 compressor enabled and the SAT disabled. The audio input was increased by 20 dB in one step. Both the initial and the subsequent steaedy state values of the peak frequency deviation, at and following the time of the 20 dB increase, were measured and recorded in the frequency range 300 Hz-3 KHz (Table 4.1.b).

3.3.2 Test Equipment

Rhode & Schwartz ESVP (in FM deviation measurement mode)
Marconi 2955 Radio Communication Test Set
Leader LFG-1300S Function Generator
LMV-182 AC Millivoltmeter

3.3.3 Test Results

Not applicable, no analog input.

3.4.0 Audio Filter Characteristics

Requirements: FCC 2.1047

For mobile stations, these signals must be attenuated, relative to the level at 1 KHz, as follows:

(i) In the frequency ranges of 3.0 to 5.9 KHz and 6.1 to 15.0 Khz, signals must be attenuated by at least 40 log (f/3) dB, where f is the frequency of the signal in KHz.
(ii) In the frequency range of 5.9 to 6.1 KHz, signals must be attenuated at least 35 dB.
(iii) In the frequency range above 15 KHz, signals must be attenuated at least 28 dB.

3.4.1 Test Procedure

The RF output of the transceiver was connected to the input of an FM deviation meter through sufficient attenuation so as not to overload the meter or distort the readings An audio signal generator with a variable attenuator on the output was coupled into the external microphone jack of the transceiver, or alternatively, the microphone element was removed and the generator output was connected to the microphone wires by clip leads.

The audio signal at the transceiver audio input was adjusted to obtain 8-9 KHz deviation at the more sensitive modulation frequency (approximated 2.7 KHz). The audio frequency was varied from 300 Hz to 30 KHz and the deviation was measured while maintaining a constant input level. Using the level mesured at 1 KHz as reference (0dB), the audio filter response was calculated (See Table 5.1).

Thus the high noise floor level was not allowed to show requirement attenuation (35 dB) the additional measurements were performed using the block diagram of the test setup shown below.

On that block diagram, the HP 3885A spectrum analyzer having the tracking generator, and the Marconi 2955A Radio Communication Test Set having an output of a demodulator, are used. After the calibration was made (the –20 dBm reading of the spectrum analyzer corresponds to the 9 KHz deviation) the spectrum analyzer was set to scan the frequency from 300 Hz to 30 KHz, with the same audio input level as described above.

The audio filter response was plotted directly from the spectrum analyzer (Refer to Plots #5.1a & 5.1.b).

3.4.2 Test Equipment

Rohde & Schwartz ESVP (in FM deviation measurement mode)
Marconi Instrument 2955A Radio Communication Test Set
HP 3588A Spectrum Analyzer
Leader LFG-1300 Function Generator
LMV-182 AC Millivoltmeter

3.4.3 Test Results

Not applicable, no analog input.

3.5.0 Emission Limitations, Occupied Bandwidth

Requirements: FCC 2.1049, 90.210(g)

3.5.1 Test Procedure

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation. The audio generator was connected to the audio input of the transmitter.

The resolution bandwidth of the spectrum analyzer was set at 300 Hz and the spectrum was recorded in the frequency band ±50 KHz from the carrier frequency. Data pattern 010101… was used to generate the modulating signal.

Note: The theoretical calculation of necessary bandwith is 20 KHz.

Some of the plots were only done in the frequency band of ±100 KHz because it was clear from these plots, that the levels of emissions were well below the limits.

3.5.2 Test Equipment

HP 8566B Spectrum Analyzer

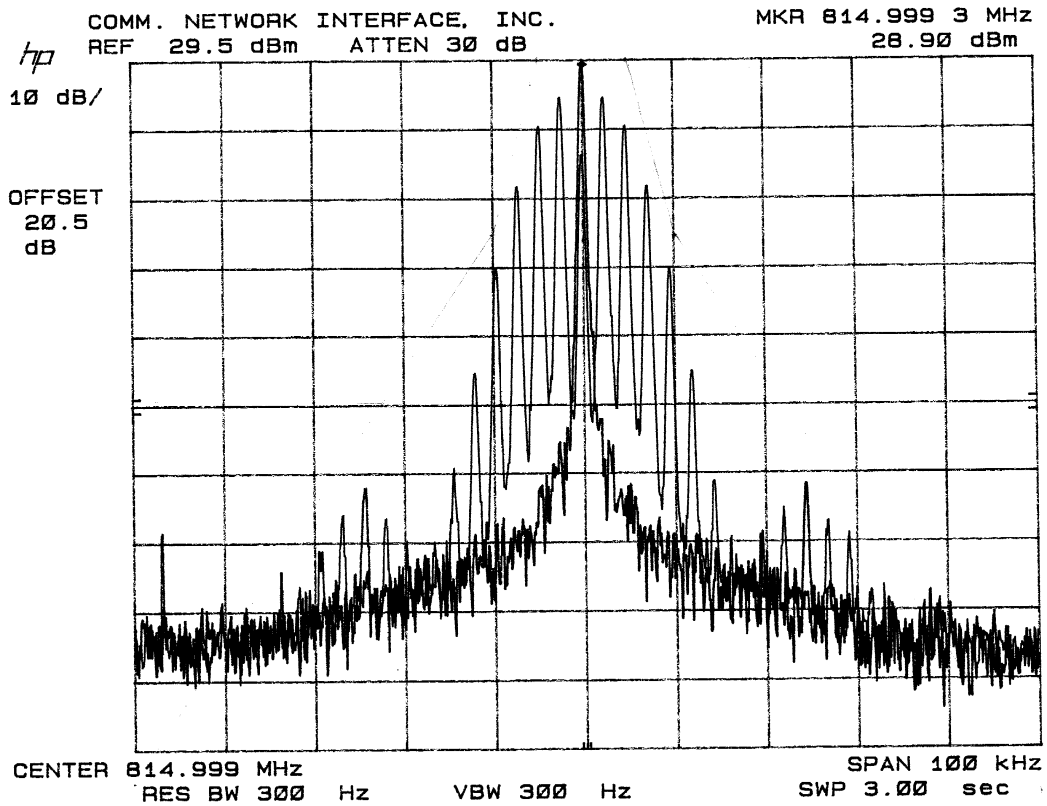
HP 7470A Plotter

3.5.3 Test Results

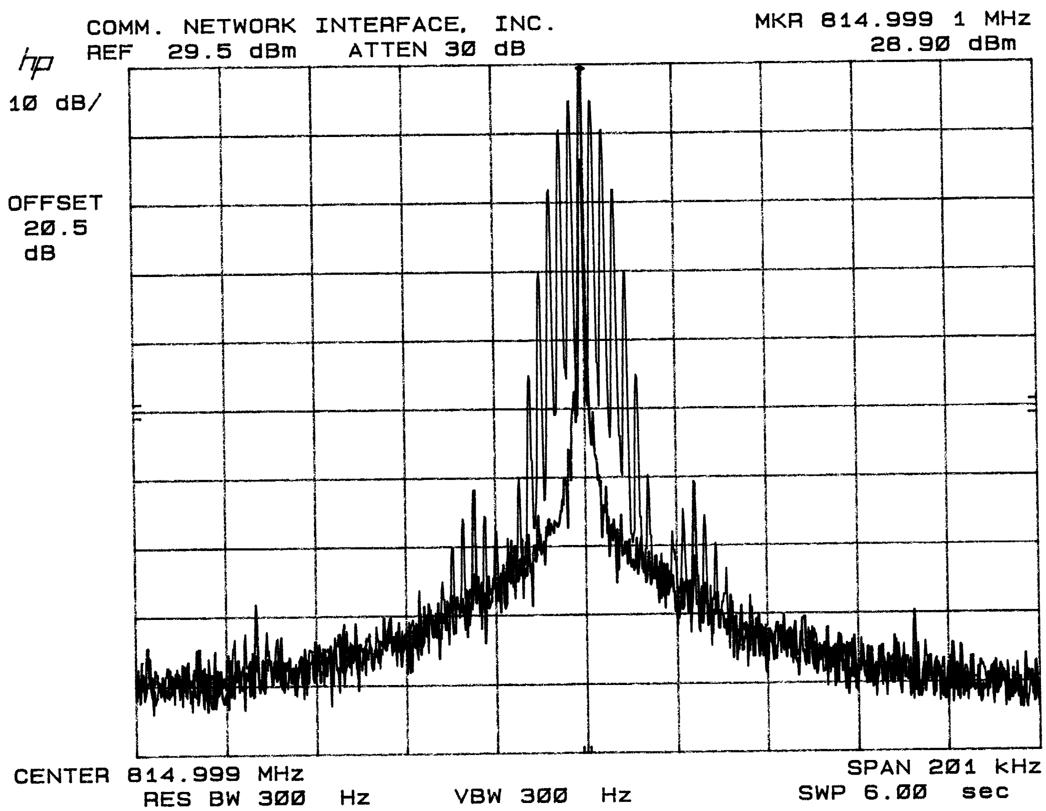
Refer to the attached Plots

PLOT NO.	DESCRIPTION
6.3.a	Carrier frequency, no modulation
6.3.b	010101… data, scan 100 KHz
6.3.c	010101…data, scan 250 KHz

Plot 1, mid channel occupied bandwidth



plot #2 occupied Bandwidth @ 200 kHz



3.6.0 Out of Band Emissions at Antenna Terminals

Requirements : FCC 90.210

Out of Band Emissions:

The means power of emissions must be attenuated below the mean power of the unmodulated carrier (P) on any frequency twice or more than twice the fundamental frequency by at least 43 + 10 log P dB.

Mobile Emissions in Base Frequency Range:

The mean power of any emissions apprearing in the base station frequency range from cellular mobile transmitters operated must be attenuated to a level not to exceed –80 dBm at the transmit antenna connector.

3.6.1 Test Procedure

The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100 kHz. Sufficient scans were taken to show any out of band emissions up to 10^{th} harmonic.

3.6.2 Test Equipment

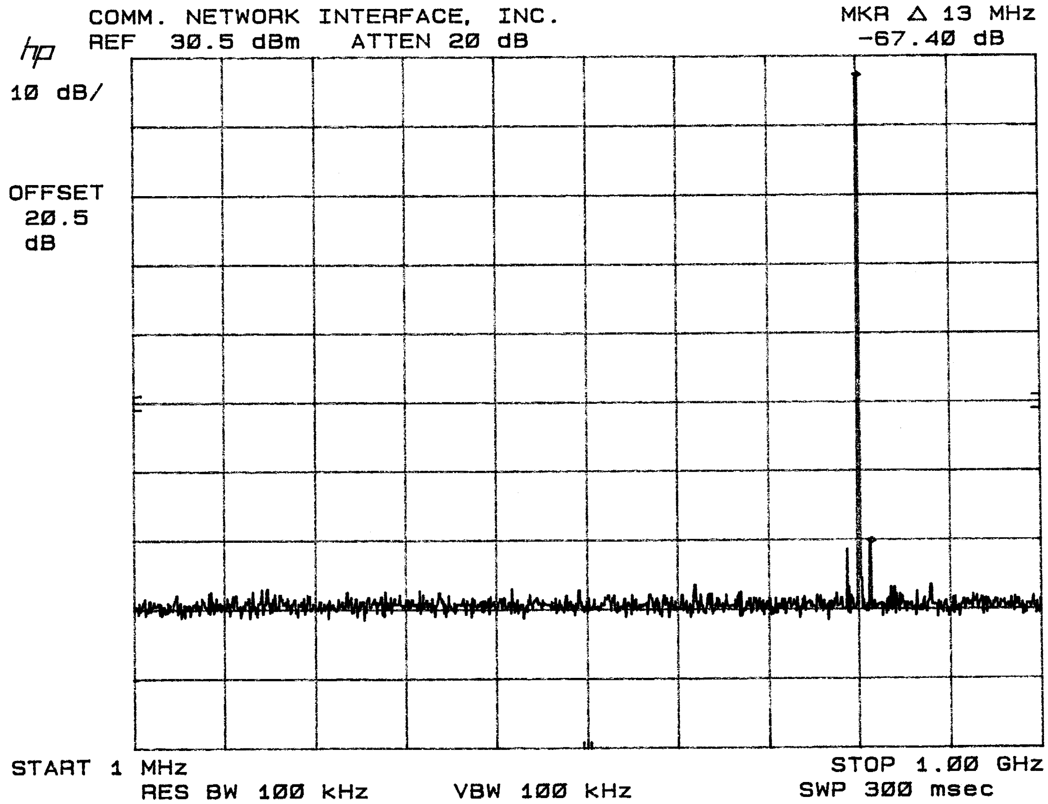
HP 8566B Spectrum Analyzer
HP 7470A Plotter

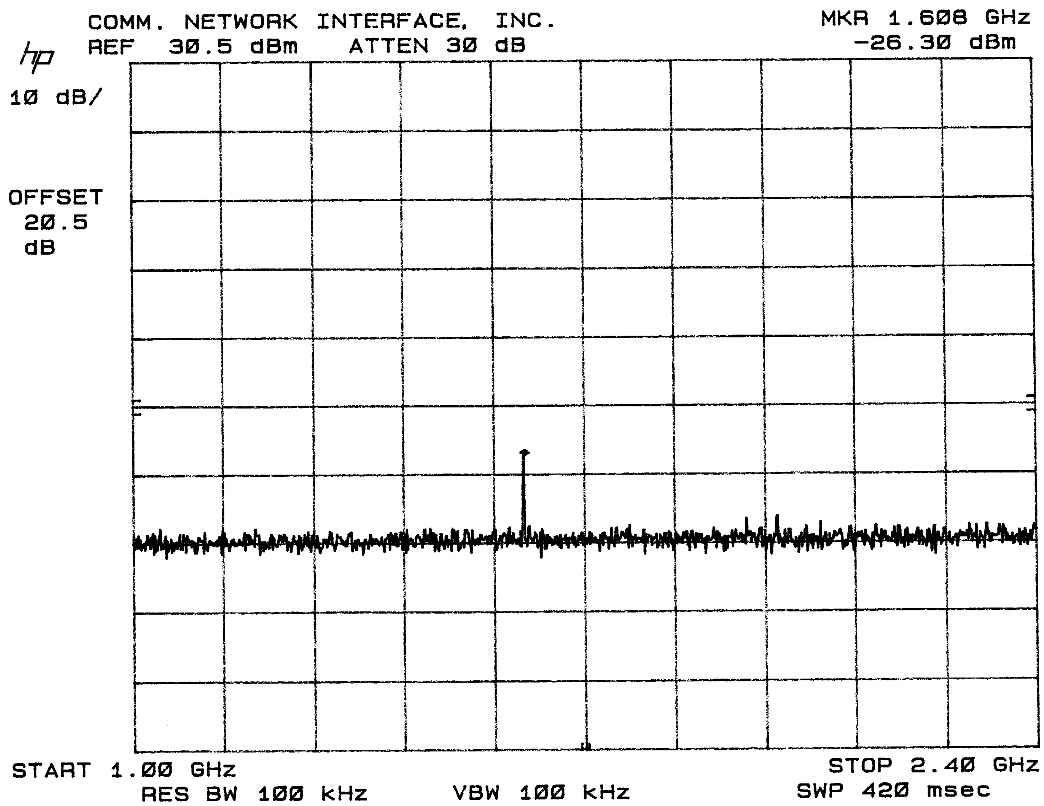
3.6.3 Test Results

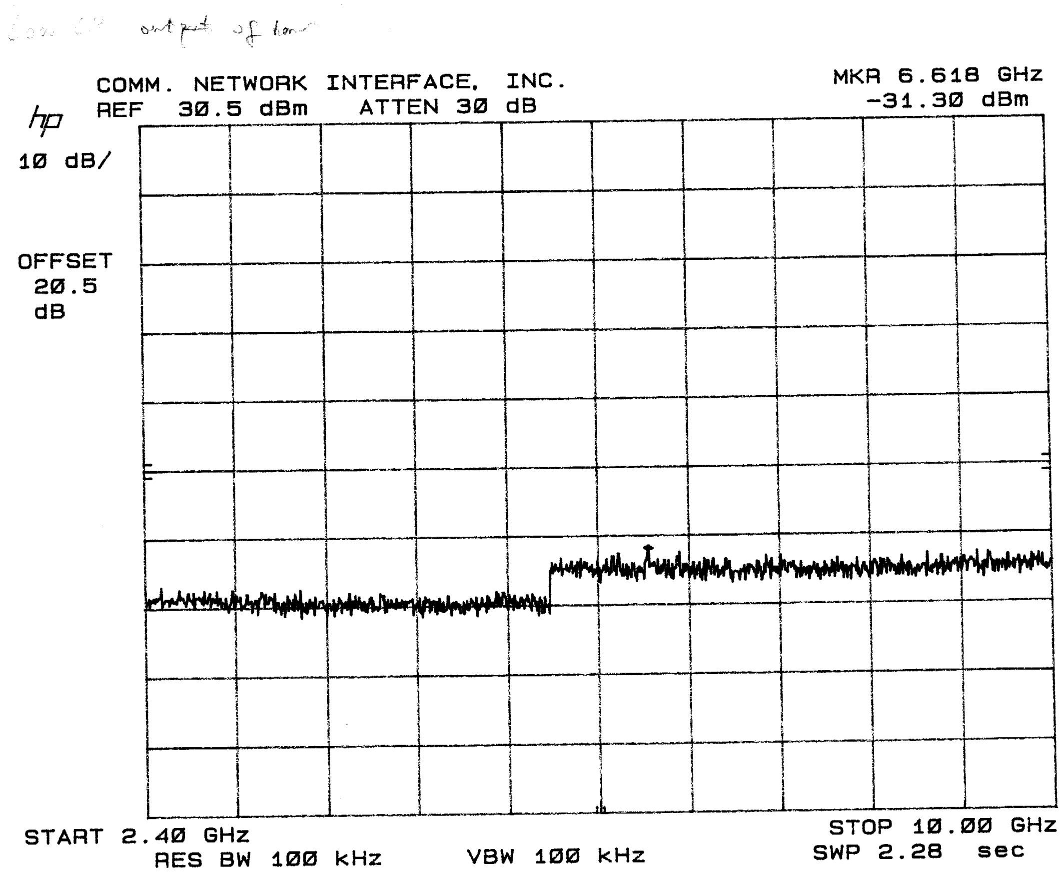
Refer to the attached plots.

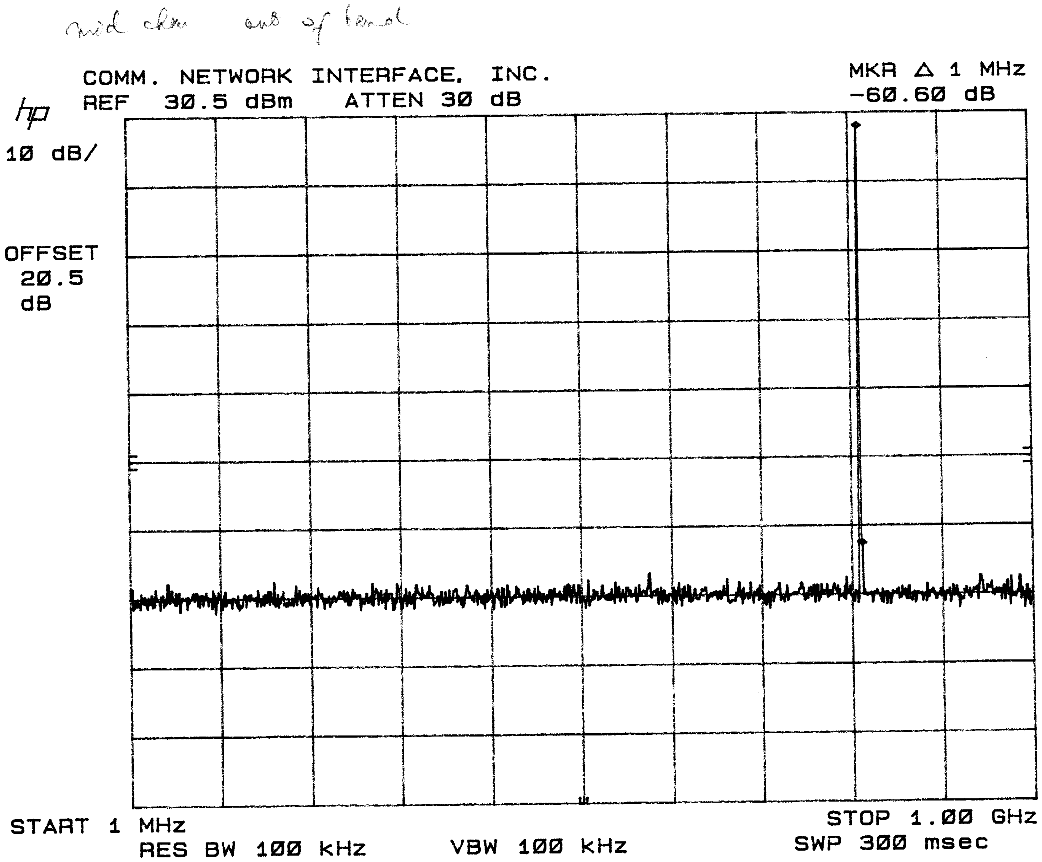
PLOT NO.	DESCRIPTION
Low Channel:	
7.3.a	1 MHz – 1 GHz
7.3.b	1 GHz- 2.4 GHz
7.3.c	2.4 GHz – 10 GHz
Middle Channel	
7.3.d	1 MHz – 1 GHz
7.3.e	1 GHz- 2.4 GHz
7.3.f	2.4 GHz – 10 GHz
High Channel	
7.3.g	1 MHz – 1 GHz
7.3.h	1 GHz- 2.4 GHz
7.3.i	2.4 GHz – 10 GHz

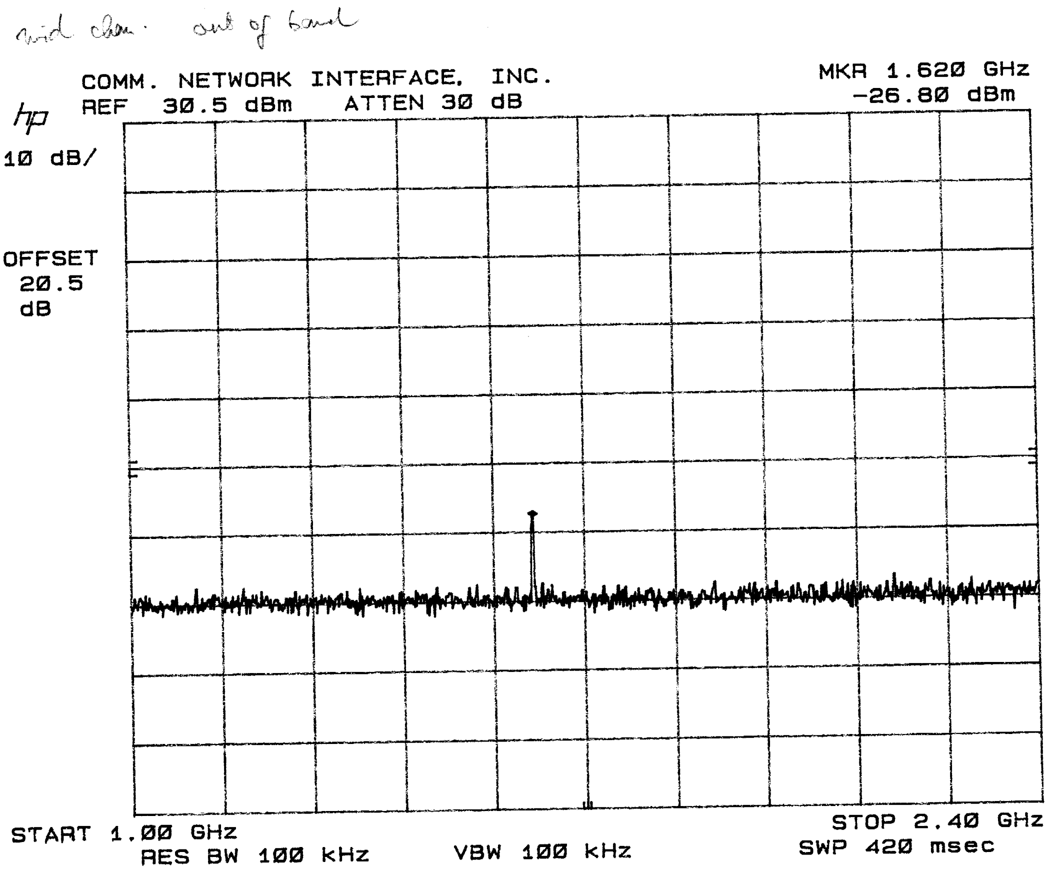
Low Ch. out of band

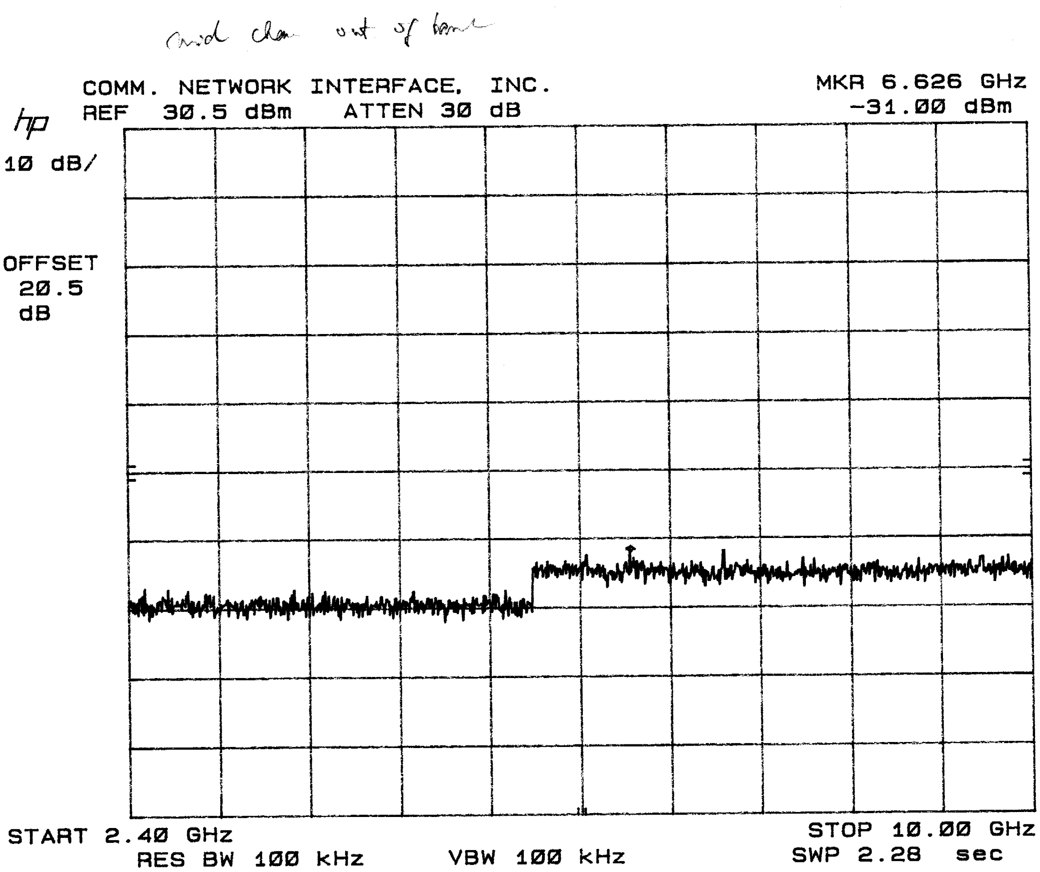


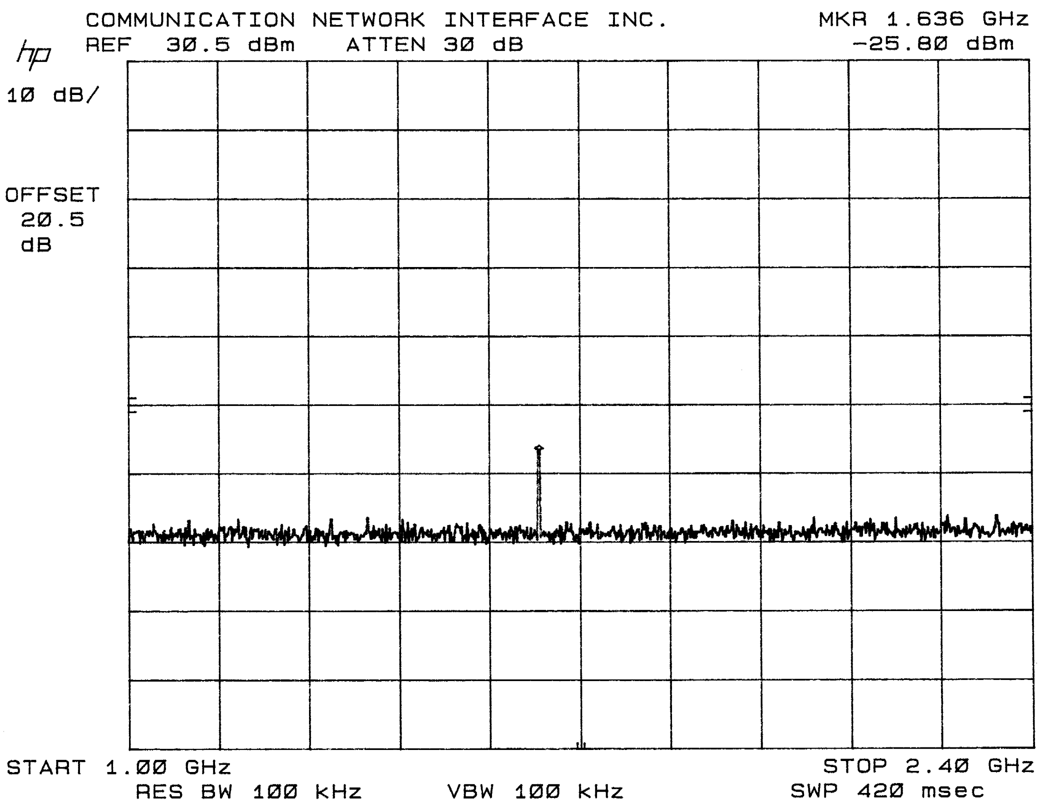

COMM. NETWORK INTERFACE, INC.
REF 30.5 dBm ATTEN 30 dB
MKR 1.608 GHz
-26.30 dBm
hp
10 dB/
OFFSET
20.5
dB
START 1.00 GHz
STOP 2.40 GHz
RES BW 100 kHz
VBW 100 kHz
SWP 420 msec

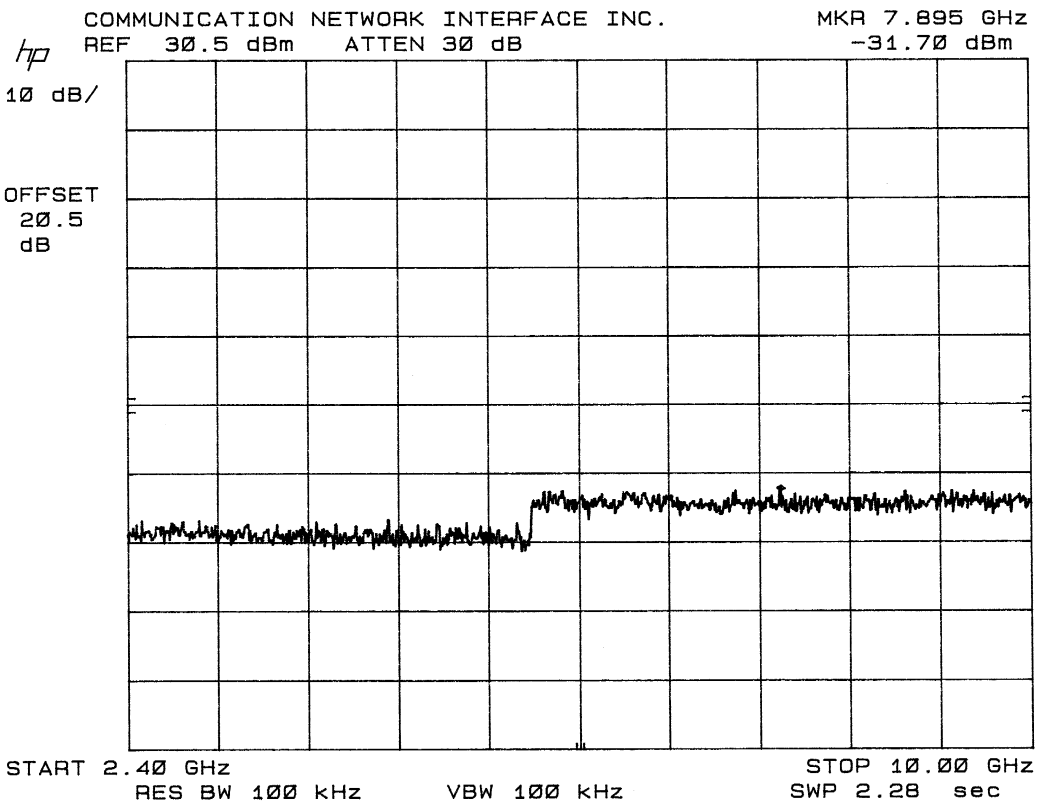

COMM. NETWORK INTERFACE, INC.
REF 30.5 dBm ATTEN 30 dB
MKR 6.618 GHz
-31.30 dBm
hp
10 dB/
OFFSET
20.5
dB
START 2.40 GHz
RES BW 100 kHz
VBW 100 kHz
STOP 10.00 GHz
SWP 2.28 sec

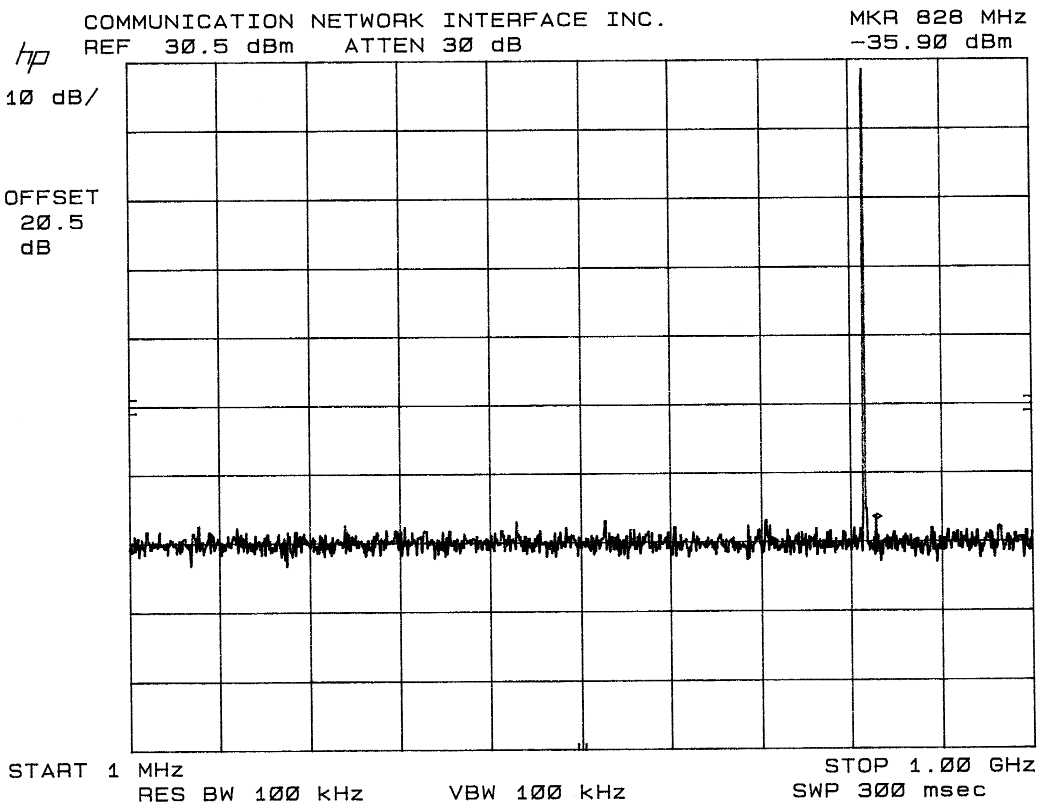

mid chan out of band
COMM. NETWORK INTERFACE, INC.
REF 30.5 dBm ATTEN 30 dB
MKR Δ 1 MHz
-60.60 dB
hp
10 dB/
OFFSET
20.5
dB
START 1 MHz
RES BW 100 kHz
VBW 100 kHz
STOP 1.00 GHz
SWP 300 msec


mid chan. out of band
COMM. NETWORK INTERFACE, INC.
REF 30.5 dBm ATTEN 30 dB
MKR 1.620 GHz
-26.80 dBm
hp
10 dB/
OFFSET
20.5
dB
START 1.00 GHz
STOP 2.40 GHz
RES BW 100 kHz
VBW 100 kHz
SWP 420 msec


mid chan out of band
COMM. NETWORK INTERFACE, INC.
REF 30.5 dBm ATTEN 30 dB
MKR 6.626 GHz
-31.00 dBm
hp
10 dB/
OFFSET
20.5
dB
START 2.40 GHz
RES BW 100 kHz
VBW 100 kHz
STOP 10.00 GHz
SWP 2.28 sec


COMMUNICATION NETWORK INTERFACE INC.
MKR 1.636 GHz
REF 30.5 dBm ATTEN 30 dB
-25.80 dBm
hp
10 dB/
OFFSET
20.5
dB
START 1.00 GHz
STOP 2.40 GHz
RES BW 100 kHz
VBW 100 kHz
SWP 420 msec


COMMUNICATION NETWORK INTERFACE INC.
MKR 7.895 GHz
REF 30.5 dBm ATTEN 30 dB
-31.70 dBm
hp
10 dB/
OFFSET
20.5
dB
START 2.40 GHz
STOP 10.00 GHz
RES BW 100 kHz
VBW 100 kHz
SWP 2.28 sec


COMMUNICATION NETWORK INTERFACE INC.
REF 30.5 dBm ATTEN 30 dB
MKR 828 MHz
-35.90 dBm
10 dB/
OFFSET
20.5
dB
START 1 MHz
STOP 1.00 GHz
RES BW 100 kHz
VBW 100 kHz
SWP 300 msec

3.7.0 Field Strength of Spurious Radiation

Requirements: FCC2.1053

3.7.1 Test Procedure

The measurement antenna was placed at a distance of 3 meter from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT.

The frequency range up to tenth harmonics of each of the three fundamental frequency (low, middle, and high channels) was investigated.

The spurious emissions attenuation was calculated as the difference between EIRP in dB(pW) at the fundamental frequency (See Section 3) and at the spurious emissions frequency.

3.7.2 Test Equipment

A.H. System Horn Antenna

HP 8566B Spectrum Analyzer

High Pass Filter

Preamplifier

3.7.3 Test Results

Refer to the attached data sheets.

3.7.3.a Final Scan, EUT transiting mode in low channel

Frequency	Reading	Antenna Factor	Polarity	Cable Loss	Amplifier	Corr. Fa.	Limit	Margin
MHz	dBμV	dB	H/ V	dB	dBμV	dBμV	dBμV	dBμV
806.00	101.0	23.3	V	0.5	0.0	124.8		
1612.00	48.0	26.0	H	2.8	22.0	54.8	81.8	-27.0
1612.00	47.0	26.0	V	2.8	22.0	53.8	81.8	-28.0
2418.00	46.0	29.0	V	3.7	15.0	63.7	81.8	-18.1
2418.00	45.0	29.0	H	3.7	15.0	62.7	81.8	-19.1
3224.00	51.2	30.3	V	4.2	15.0	70.7	81.8	-11.1
3224.00	49.0	30.3	H	4.2	15.0	68.5	81.8	-13.3
4030.00	38.0	30.4	V	4.3	15.0	57.7	81.8	-24.1
4030.00	35.0	30.4	H	4.3	15.0	54.7	81.8	-27.1
4836.00	32.0	33.3	V	5.1	15.0	55.4	81.8	-26.4
4836.00	31.0	33.3	H	5.1	15.0	54.4	81.8	-27.4
5642.00	29.1	34.3	H	5.4	15.0	53.8	81.8	-28.0
5642.00	28.0	34.3	V	5.4	15.0	52.7	81.8	-29.1
6448.00	31.0	36.5	H	5.8	15.0	58.3	81.8	-23.5
6448.00	30.0	36.5	V	5.8	15.0	57.3	81.8	-24.5
7254.00	32.0	36.8	V	6.1	15.0	59.9	81.8	-21.9
7254.00	32.0	36.8	H	6.1	15.0	59.9	81.8	-21.9
8060.00	33.0	37.4	H	6.3	15.0	61.7	81.8	-20.1
8060.00	32.7	37.4	V	6.3	15.0	61.4	81.8	-20.4

3.7.3.b Final Scan , EUT transiting mode in middle channel

Frequency	Reading	Antenna Factor	Polarity	Cable Loss	Amplifier	Corr. Fa.	Limit	Margin
MHz	dBμV	dB	H/ V	dB	dBμV	dBμV	dBμV	dBμV
815.00	100.0	23.0	V	0.5	0.0	123.5		
1630.00	44.6	26.0	V	2.8	22.0	51.4	80.5	-29.1
1630.00	45.0	26.0	H	2.8	22.0	51.8	80.5	-28.7
2445.00	50.7	29.0	V	3.7	15.0	68.4	80.5	-12.1
2445.00	46.0	29.0	H	3.7	15.0	63.7	80.5	-16.8
3260.00	46.0	30.3	V	4.2	15.0	65.5	80.5	-15.0
3260.00	46.0	30.3	H	4.2	15.0	65.5	80.5	-15.0
4075.00	36.0	30.4	V	4.3	15.0	55.7	80.5	-24.8
4075.00	36.0	30.4	H	4.3	15.0	55.7	80.5	-24.8
4890.00	30.0	33.3	V	5.1	15.0	53.4	80.5	-27.1
4890.00	30.0	33.3	H	5.1	15.0	53.4	80.5	-27.1
5705.00	29.6	34.3	V	5.4	15.0	54.3	80.5	-26.2
5705.00	30.0	34.3	H	5.4	15.0	54.7	80.5	-25.8
6520.00	31.0	36.5	H	5.8	15.0	58.3	80.5	-22.2
6520.00	30.0	36.5	V	5.8	15.0	57.3	80.5	-23.2
7335.00	32.0	36.8	V	6.1	15.0	59.9	80.5	-20.6
7335.00	32.7	36.8	H	6.1	15.0	60.6	80.5	-19.9
8150.00	32.2	37.4	H	6.3	15.0	60.9	80.5	-19.6
8150.00	32.0	37.4	V	6.3	15.0	60.7	80.5	-19.8

3.7.3.c Final Scan , EUT transiting mode in high channel

Frequency	Reading	Antenna Factor	Polarity	Cable Loss	Amplifier	Corr. Fa.	Limit	Margin
MHz	dBμV	dB	H/ V	dB	dBμV	dBμV	dBμV	dBμV
821.00	101.3	22.9	V	0.5	0.0	124.7		
1642.00	42.6	26.0	V	2.8	22.0	49.4	82.1	-32.3
1642.00	40.9	26.0	H	2.8	22.0	47.7	82.1	-34.4
2463.00	47.7	29.0	V	3.7	15.0	65.4	82.1	-16.7
2643.00	45.9	29.0	H	3.7	15.0	63.6	82.1	-18.5
3284.00	51.6	30.3	V	4.2	15.0	71.1	82.1	-11.0
3284.00	53.0	30.3	H	4.2	15.0	72.5	82.1	-9.6
4105.00	34.4	30.4	V	4.3	15.0	54.1	82.1	-28.0
4105.00	34.4	30.4	H	4.3	15.0	54.1	82.1	-28.0
4926.00	30.0	33.3	V	5.1	15.0	53.4	82.1	-28.7
4926.00	31.0	33.3	H	5.1	15.0	54.4	82.1	-27.7
5747.00	30.0	34.3	V	5.4	15.0	54.7	82.1	-27.4
5747.00	29.5	34.3	H	5.4	15.0	54.2	82.1	-27.9
6568.00	30.0	36.5	H	5.8	15.0	57.3	82.1	-24.8
6548.00	30.0	36.5	V	5.8	15.0	57.3	82.1	-24.8
7389.00	32.0	36.8	V	6.1	15.0	59.9	82.1	-22.2
7389.00	32.0	36.8	H	6.1	15.0	59.9	82.1	-22.2
8210.00	32.3	37.4	H	6.3	15.0	61.0	82.1	-21.1
8210.00	32.0	37.4	V	6.3	15.0	60.7	82.1	-21.4

3.8.0 Frequency Stability vs Temperature

Requirements: FCC 2.1055

3.8.1 Test Procedure

The equipment under test was connected to an external DC power supply and the RF output was connected to a frequency counter via feed-through attenuators. The EUT was placed inside the temperature chamber. The DC leads and RF output cable exited the chamber through an opening made for the purpose.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the counter.

3.8.2 Test Equipment

Temperature Chamber –50^0 to +100^0C
Hewlett Packard 5383A Frequency Counter
Goldstar DC Power Supply, GR303
Rohde & Schwarz ESVP Test Receiver

3.8.3 Test Results

Refer to the attached data sheet.

Frequency Stability vs. Temperature
Frequency: 815.00010 MHz
Tolerance: +/- 20375 Hz

TEMPERATURE(C)	FREQUENCY(MHZ)	DIFFERENCE (HZ)
-30	815.00018	180
-25	815.00020	200
-15	815.00035	350
-5	815.00075	750
5	815.00025	250
15	814.99985	-150
25	814.99935	-650
35	814.99890	-1100
45	814.99990	-100
55	814.99895	-1050

3.9.0 Frequency Stability vs Voltage

Requirements: FCC 2.1055

Frequency Tolerance: ± 2.5 ppm

3.9.1 Test Procedure

An external variable DC power supply was connected to the battery terminals of the equipment under test. The voltage was set to 115% of the nominal value and was then decreased until the transmitter light no longer illuminated; i.e., the battery end point. The output frequency was recorded for each battery voltage.

3.9.2 Test Equipment

Hewlett Packard 5883A Frequency Counter
DC Power Supply
Goldstar Rohde & Schwarz ESVPGR303 Test Receiver

3.9.3 Test Results

Refer to the attached Sheet

Frequency Stability vs. Voltage
Frequency: 815.00010
Tolerance: +/- 20375

DC VOLTS	FREQUENCY (MHZ)	DIFFERENCE (HZ)
3.60	815.00015	150
4.20	815.00010	100
4.62	815.00015	150

- 3.6 V – Voltage that shut off the system.

4 - CONDUCTED EMISSIONS TEST DATA

4.1 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, and LISN.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement at BACL is ±2.4 dB.

4.2 EUT Setup

The measurement was performed at the **O**pen **A**rea **T**est **S**ite, using the same setup per ANSI C63.4 - 1992 measurement procedure. The specification used was with FCC Class B limits.

4.3 Spectrum Analyzer Setup

The spectrum analyzer was set with the following configurations during the conduction test:

Start Frequency...450 kHz
Stop Frequency...30 MHz
Sweep Speed ....Auto
IF Bandwidth...100 kHz
Video Bandwidth...100 kHz
Quasi-Peak Adapter Bandwidth ....9 kHz
Quasi-Peak Adapter Mode ....Normal

4.4 Test Procedure

During the conducted emission test, the power cord of the host system was connected to the auxiliary outlet of the first LISN.

Maximizing procedure was performed on the six (6) highest emissions of each modes tested to ensure EUT is compliant with all installation combination.

All data was recorded in the peak detection mode. Quasi-peak readings were only performed when an emission was found to be marginal (less than -4 dBμV). Quasi-peak readings are distinguished with a "**Qp**".

4.5 Summary of Test Results

According to the data in section 3.6, the EUT complied with the FCC Conducted margin for a Class B device and these test results is deemed satisfactory evidence of compliance with ICES-003 of the Canadian Interference-Causing Equipment Regulations, with the *worst* margin reading of:

-7.6 dBμV at **0.450 MHz** in the **Line** mode power supply.

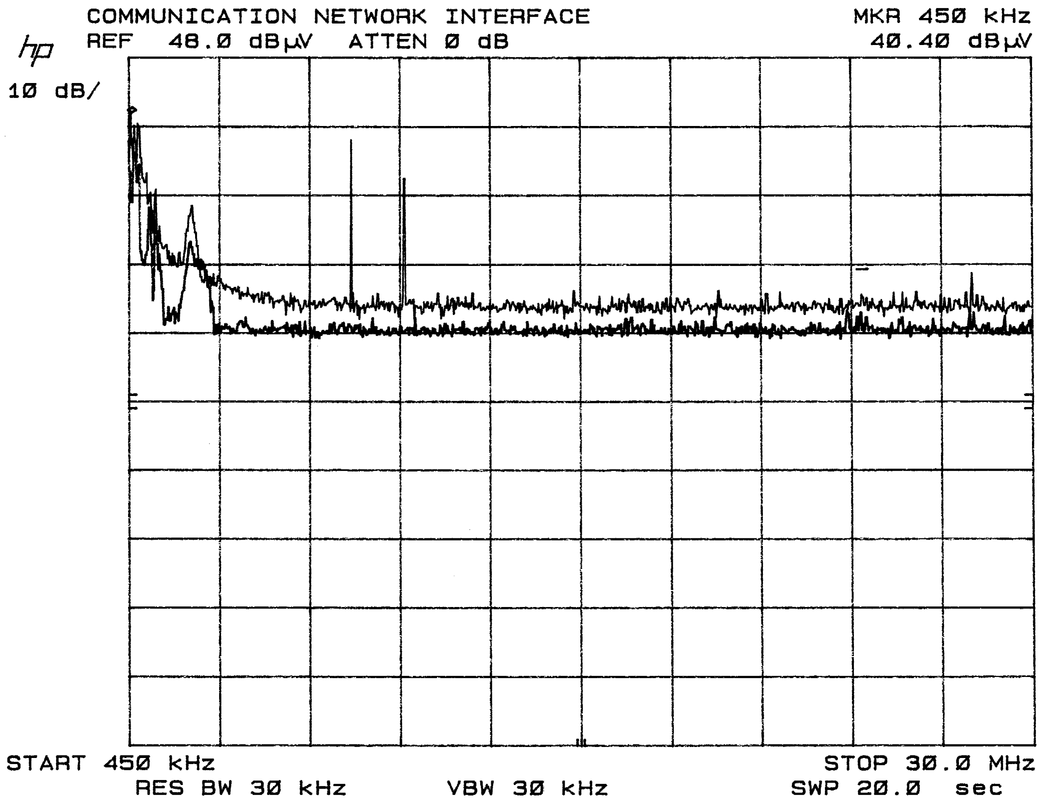
4.6 Conducted Emissions Test Data

4.6.1 Test Data with SPI Power Supply, 0.45 - 30 MHz.

LINE CONDUCTED EMISSIONS				FCC CLASS B	
Frequency	Amplitude	Detector	Phase	Limit	Margin
MHz	dBμV	Qp/Ave/Peak	Line/Neutral	dBμV	dB
0.450	40.4	QP	Line	48	-7.6
7.720	36.1	QP	Line	48	-11.9
0.450	35.6	QP	Neutral	48	-12.4
0.630	33.9	QP	Neutral	48	-14.1
0.780	32.3	QP	Neutral	48	-15.7
9.490	30.5	QP	Line	48	-17.5

4.7 Plot of Conducted Emissions Test Data

Plot(s) of Conducted Emissions Test Data is presented in Appendix B of this report as reference.


COMMUNICATION NETWORK INTERFACE
MKR 450 kHz
hp REF 48.0 dBμV ATTEN 0 dB
40.40 dBμV
10 dB/
START 450 kHz
STOP 30.0 MHz
RES BW 30 kHz
VBW 30 kHz
SWP 20.0 sec

5 - RADIATED EMISSION DATA

5.1 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement at BACL is ±4.0 dB.

5.2 EUT Setup

The radiated emission tests were performed in the open area 3 Meters test site, using the setup accordance with the ANSI C63.4 - 1992. The specification used was the FCC Class B limits.

The spacing between the peripherals was 10 cm.

5.3 Spectrum Analyzer Setup

According to FCC Rules, 47 CFR 15.33, since the internal clock speed of the EUT operates at 850 MHz, the system was tested to 5000 MHz.

During the radiated emission test, the spectrum analyzer was set with the following configurations:

Start Frequency ....30 MHz
Stop Frequency ....5000 MHz
Sweep Speed..Auto
IF Bandwidth ....100 KHz
Video Bandwidth ....1 MHz
Quasi-Peak Adapter Bandwidth.................................120 kHz
Quasi-Peak Adapter Mode..Normal
Resolution Bandwidth 1MHz

5.4 Test Procedure

For the radiated emissions test, all support equipment was connected to the AC floor outlet.

Maximizing procedure was performed on the highest emissions to ensure that the EUT is compliant with all installation combinations.

All data was recorded in the peak detection mode. Quasi-peak readings was performed only when an emission was found to be marginal (less than -4 dBμV), and are distinguished with a "**Qp**" in the data table.

5.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corr. Ampl. = Indicated Reading + Antenna Factor + Cable Factor - Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dBμV means the emission is 7dBμV below the maximum limit for Class B. The equation for margin calculation is as follows:

Margin = Corr. Ampl. – Class B Limit

5.6 Summary of Test Results

According to the data in section 4.7, the EUT, complied with the FCC Class B standards and these test results are deemed satisfactory evidence of compliance with ICES-003 of the Canadian Interference-Causing Equipment Regulations, and had the worst margin of:

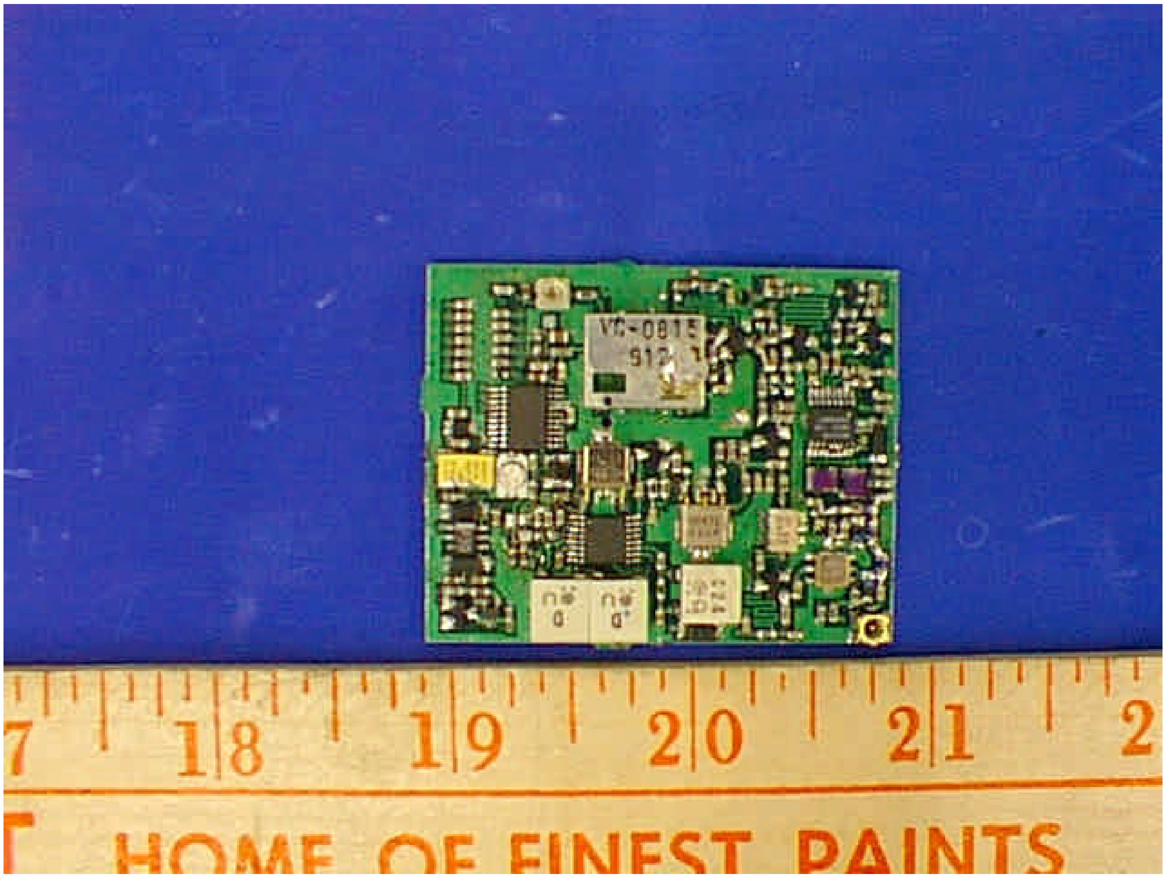
-11.7 dBμV at **210.00 MHz** in the **Horizontal** polarization with Normal Mode, 30 – 5000 MHz, 3 meters**.**

5.7 Radiated Emissions Test Data

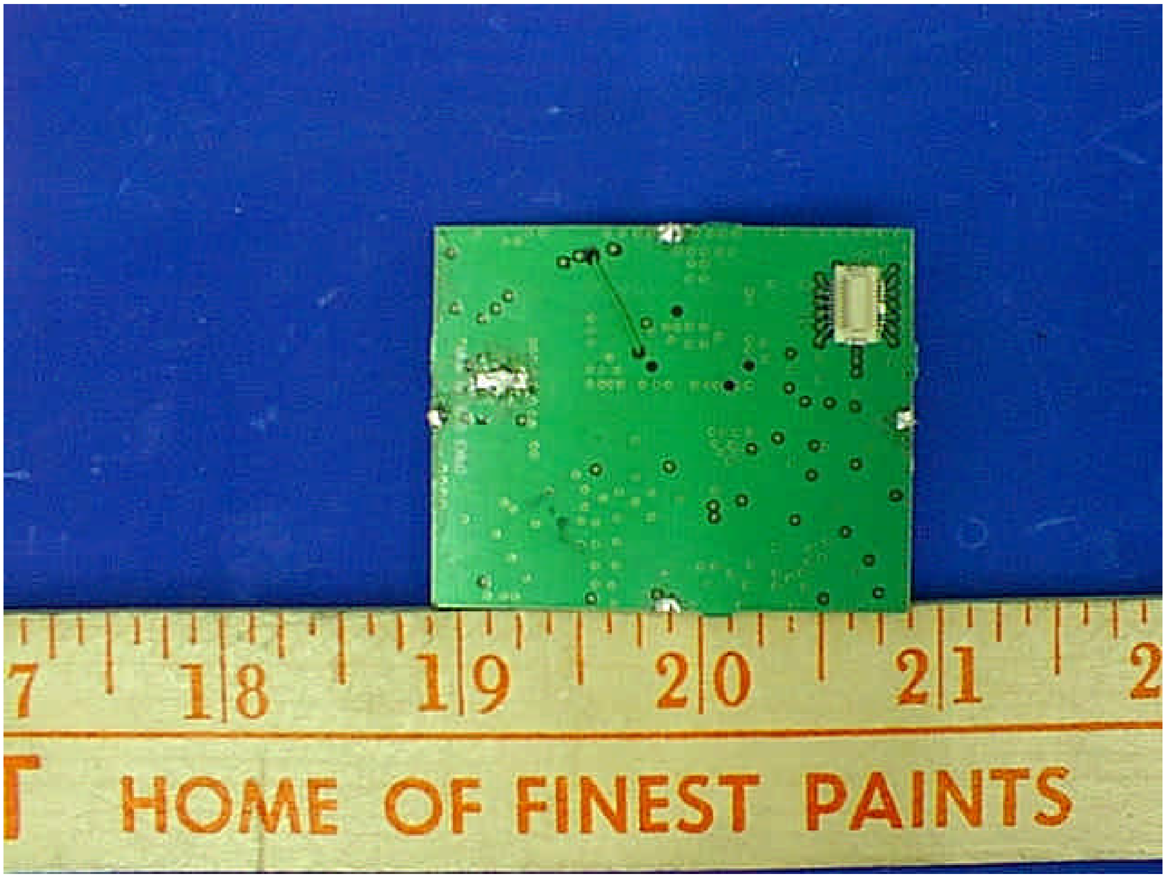
5.7.1 Final Test Data, 30 – 5000 MHz, 3 meters.

INDICATED		TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC CLASS B	
Frequency MHz	Ampl. dBμV/m	Angle Degree	Height Meter	Polar H/ V	Antenna dBμV/m	Cable dB	Amp. dB	Corr. Ampl. dBμV/m	Limit dBμV/m	Margin dB
210.00	37.0	210	1.6	H	12.5	4.7	22.4	31.8	43.5	-11.7
396.17	32.0	70	1.8	H	16.5	2.8	20.2	31.1	46.0	-14.9
409.75	33.0	170	2.7	H	16.5	2.9	22.5	29.9	46.0	-16.1
365.68	31.0	135	1.6	H	15.5	5.2	22.6	29.1	46.0	-16.9
80.00	30.0	225	1.1	V	9.6	1.4	20.9	20.1	40.0	-19.9
140.15	30.3	225	1.6	H	13.2	1.0	21.2	23.3	43.5	-20.2
160.00	29.0	180	1.6	H	13.2	1.6	21.0	22.8	43.5	-20.7
266.15	29.0	180	1.9	H	13.3	4.9	22.8	24.4	46.0	-21.6
218.00	29.0	200	1.8	H	12.5	4.7	22.4	23.8	46.0	-22.2

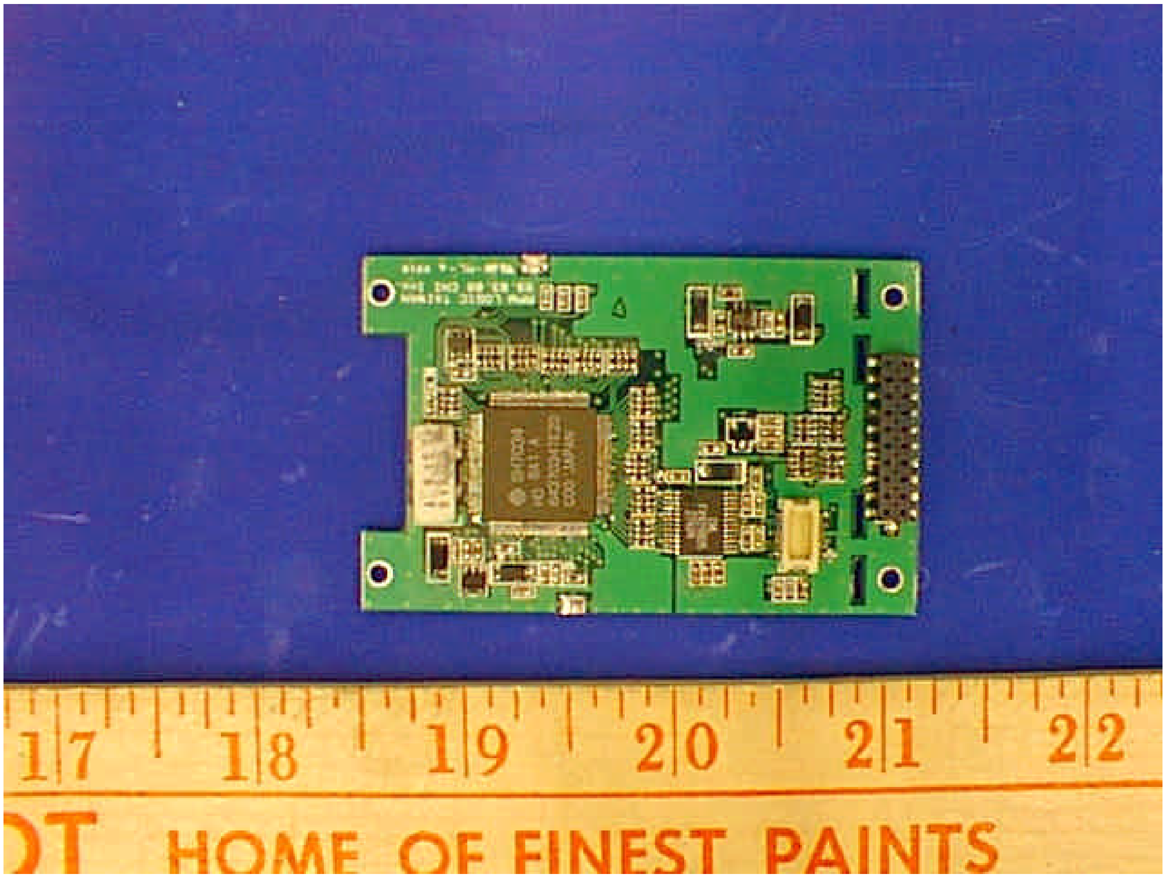
8.5 EUT: Enclosure Off Transmitting Unit Top View



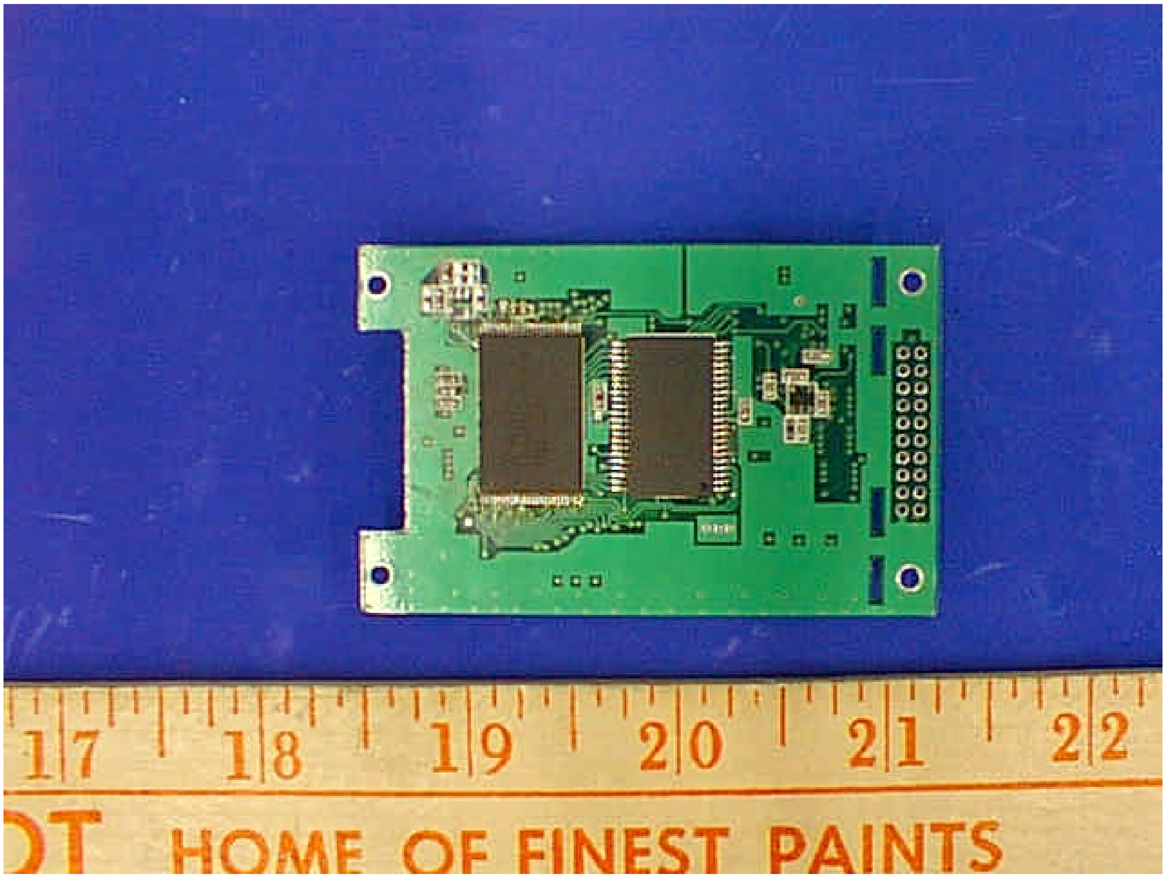
8.6 EUT: Enclosure Off Transmitting Unit Bottom View



8.7 EUT: Enclosure Off Control Board Top View



8.8 EUT: Enclosure Off Control Board Bottom View



Appendix A – AGENVY AUTHORIZATION LETTER

51-2 Sungsan 1-dong,
Mapo-gu, Seoul, Korea 121-251
Tel: 82-2-330-5621
Fax: 82-2-330-5733

April 14, 1999

FEDERAL COMMUNICATIONS COMMISSIONS
Authorization and Evaluation Division
7435 Oakland Mills Road
Columbia, MD 21046

To whom it may concern,

CNI Inc. hearby authorizes Bay Area Compliance Laboratory corporation to act on its behalf in all matters relating to application for equipment authorization, including the signing of all documents relating to these matters. All acts carried out by Bay Area Compliance Laboratory Corporation on our behalf shall have the same effect as our own action.

Sincerely,

K. J. Baek

Kwang-Jo Baek
General manager of Overseas Sales Team
CNI Inc.