

Test Report: 1R03687

Applicant: COMLINK Group Inc.
1800 Berlier Street
Laval, Quebec
H7L 4S4

Equipment Under Test: MICROFLEX 24-AD
(E.U.T.)

In Accordance With: **FCC Part 15, Subpart C**
Direct Sequence Transmitters 902 - 928 MHz

Tested By: Nemko Canada Inc.
(Formerly KTL Ottawa Inc.)
3325 River Road, R.R. 5
Ottawa, Ontario K1V 1H2

Authorized By:
R. Grant, Wireless Group Manager

Date:

Total Number of Pages: 36

Table Of Contents

Section 1. Summary Of Test Results.....	3
Section 2. General Equipment Specification	5
Section 3. Powerline Conducted Emissions	11
Section 4. Occupied Bandwidth.....	14
Section 5. Peak Power Output.....	18
Section 6. Spurious Emissions (Antenna Conducted)	19
Section 7. Spurious Emissions (Radiated).....	23
Section 8. Transmitter Power Density	28
Section 9. Processing Gain	32
Section 10. Test Equipment List	33
Annex A Block Diagrams.....	A1

Section 1. Summary Of Test Results**General****All measurements are traceable to national standards.**

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 15, Subpart C, Paragraph 15.247 for Direct Sequence Spread Spectrum devices.

<input checked="" type="checkbox"/>	New Submission	<input checked="" type="checkbox"/>	Production Unit			
<input type="checkbox"/>	Class II Permissive Change	<input type="checkbox"/>	Pre-Production Unit			
<table border="1"><tr><td>D</td><td>S</td><td>S</td></tr></table>	D	S	S	Equipment Code	<input type="checkbox"/>	Family Listing
D	S	S				

THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.**THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO, OR EXCLUSIONS FROM THE TEST SPECIFICATIONS HAVE BEEN MADE.**

See "Summary of Test Data".

**NVLAP LAB CODE: 100351-0****TESTED BY:** _____ **DATE:** _____
Glen Westwell, Technologist

Nemko Canada Inc. authorizes the above named company to reproduce this report provided it is reproduced in its entirety and for use by the company's employees only.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Nemko Canada Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

This report applies only to the items tested.

Nemko Canada Inc.

FCC PART 15, SUBPART C
DIRECT SEQUENCE TRANSMITTERS
PROJECT NO.: 1R03687

EQUIPMENT: MICROFLEX 24-AD

Summary Of Test Data

Name Of Test	Para. No.	Result
Powerline Conducted Emissions	15.207 (a)	Complies
Occupied Bandwidth	15.247 (a)(2)	Complies
Peak Power Output	15.247 (b)	Complies
Spurious Emissions (Antenna Conducted)	15.247 (c)	Complies
Spurious Emissions (Radiated)	15.247 (c)	Complies
Transmitter Power Density	15.247 (d)	Complies
Processing Gain	15.247 (e)	Complies

Footnotes For N/A's:

Test Conditions:

Indoor Temperature: 24 °C
 Humidity: 20 %

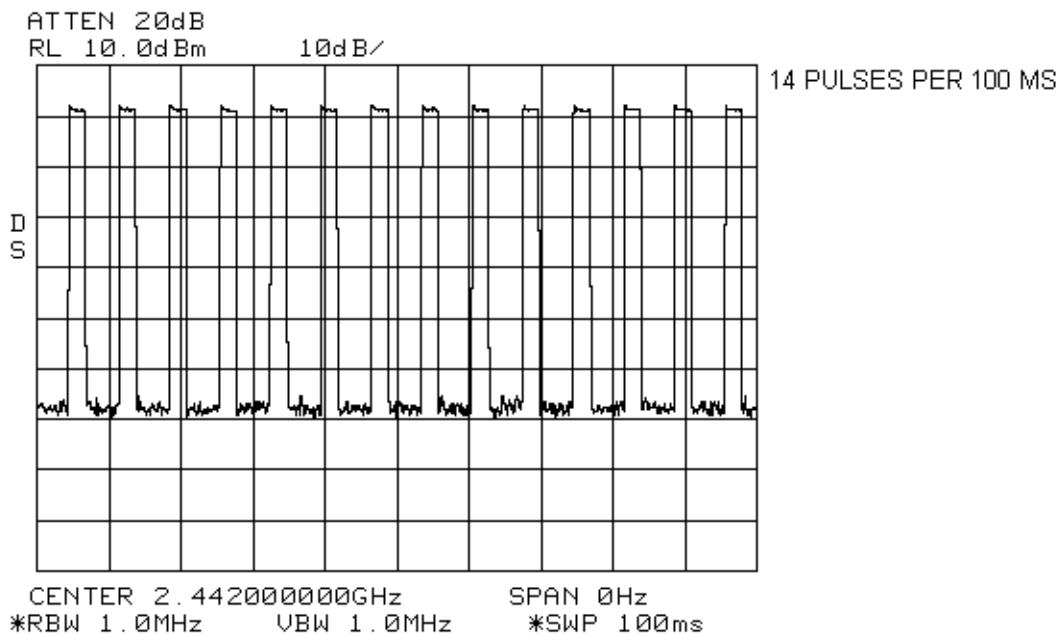
Outdoor Temperature: -5 °C
 Humidity: 16 %

Section 2. General Equipment Specification**Manufacturer:** COMLINK Group Inc.**Model No.:** 24-AD**Serial No.:** P4**Date Received In Laboratory:** February 10, 2000**Nemko Identification No.:** Item #2**Transmitter****Power Input:** 10-16 VDC**Frequency Range:** 2405MHz to 2475MHz**6 dB Bandwidth:** 3.70MHz**Type of Modulation** Direct Sequence Spread Spectrum**Emissions Designator:** 4M27F1D**Output Impedance:** 50Ω**RF Power Output (Rated):** 0.263W**Power Output Adjustment Capability:** Software Power Control 7 to 24.2dBm
Tested at 24.2dBm**Duty Cycle:** $20 \log \left(\frac{14 \times 2.417}{100} \right) = -9.4 \text{dB}$

Nemko Canada Inc.

FCC PART 15, SUBPART C
DIRECT SEQUENCE TRANSMITTERS
PROJECT NO.: 1R03687

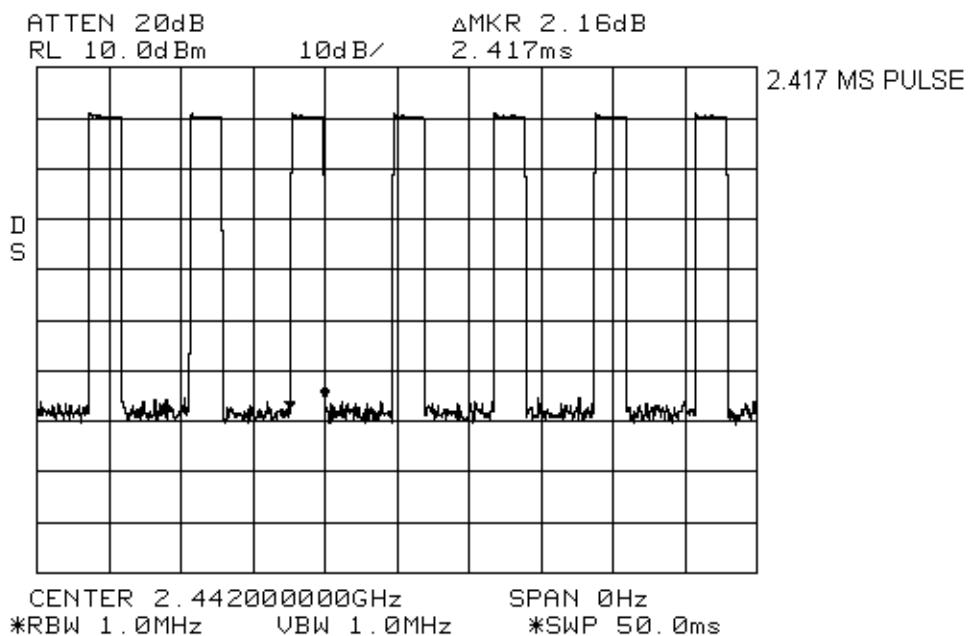
EQUIPMENT: MICROFLEX 24-AD



Nemko Canada Inc.

FCC PART 15, SUBPART C
DIRECT SEQUENCE TRANSMITTERS
PROJECT NO.: 1R03687

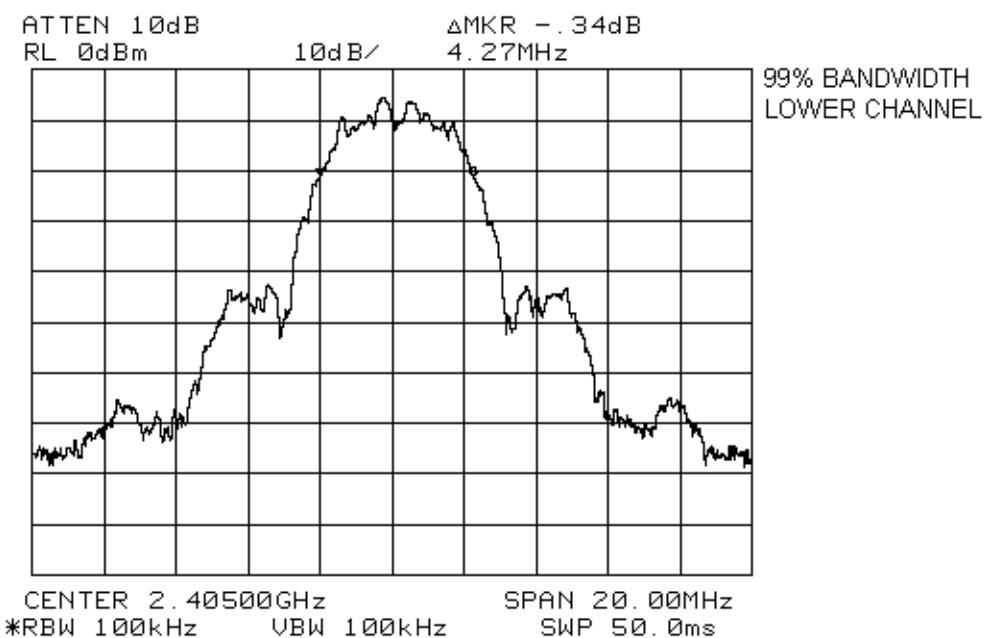
EQUIPMENT: MICROFLEX 24-AD



Nemko Canada Inc.

FCC PART 15, SUBPART C
DIRECT SEQUENCE TRANSMITTERS
PROJECT NO.: 1R03687

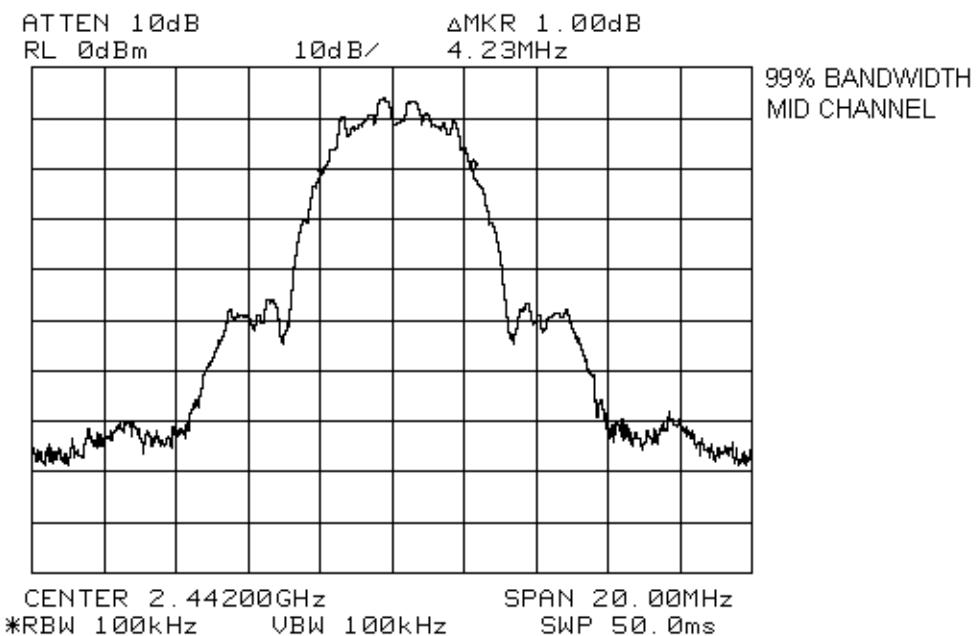
EQUIPMENT: MICROFLEX 24-AD



Nemko Canada Inc.

FCC PART 15, SUBPART C
DIRECT SEQUENCE TRANSMITTERS
PROJECT NO.: 1R03687

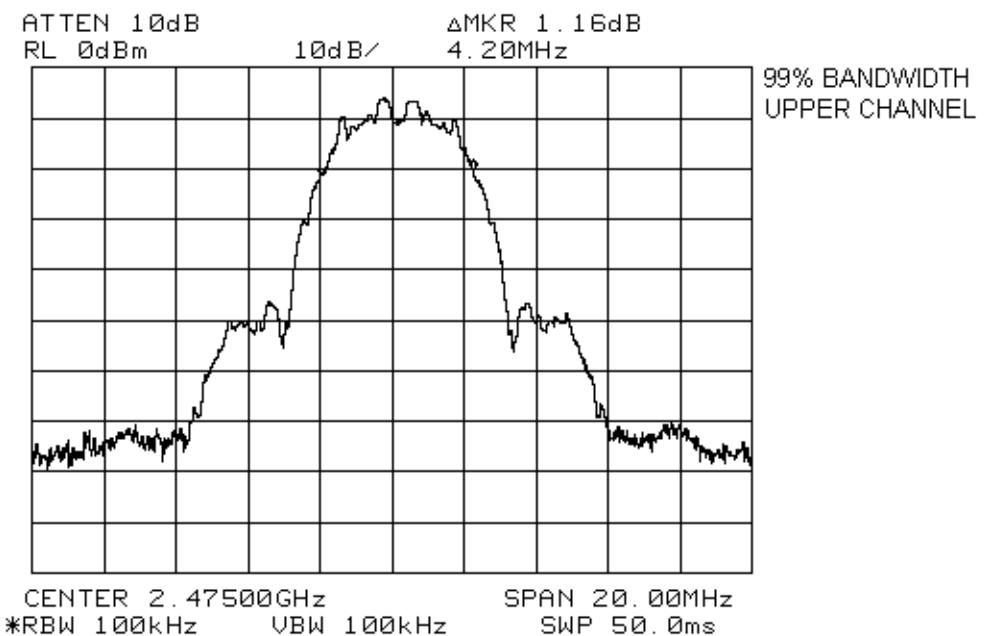
EQUIPMENT: MICROFLEX 24-AD



Nemko Canada Inc.

FCC PART 15, SUBPART C
DIRECT SEQUENCE TRANSMITTERS
PROJECT NO.: 1R03687

EQUIPMENT: MICROFLEX 24-AD



Nemko Canada Inc.

FCC PART 15, SUBPART C
DIRECT SEQUENCE TRANSMITTERS
PROJECT NO.: 1R03687

EQUIPMENT: MICROFLEX 24-AD

Section 3. Powerline Conducted Emissions

Para. No.: 15.207(a)

Test Performed By: Glen Westwell	Date of Test: February 14, 2000
---	--

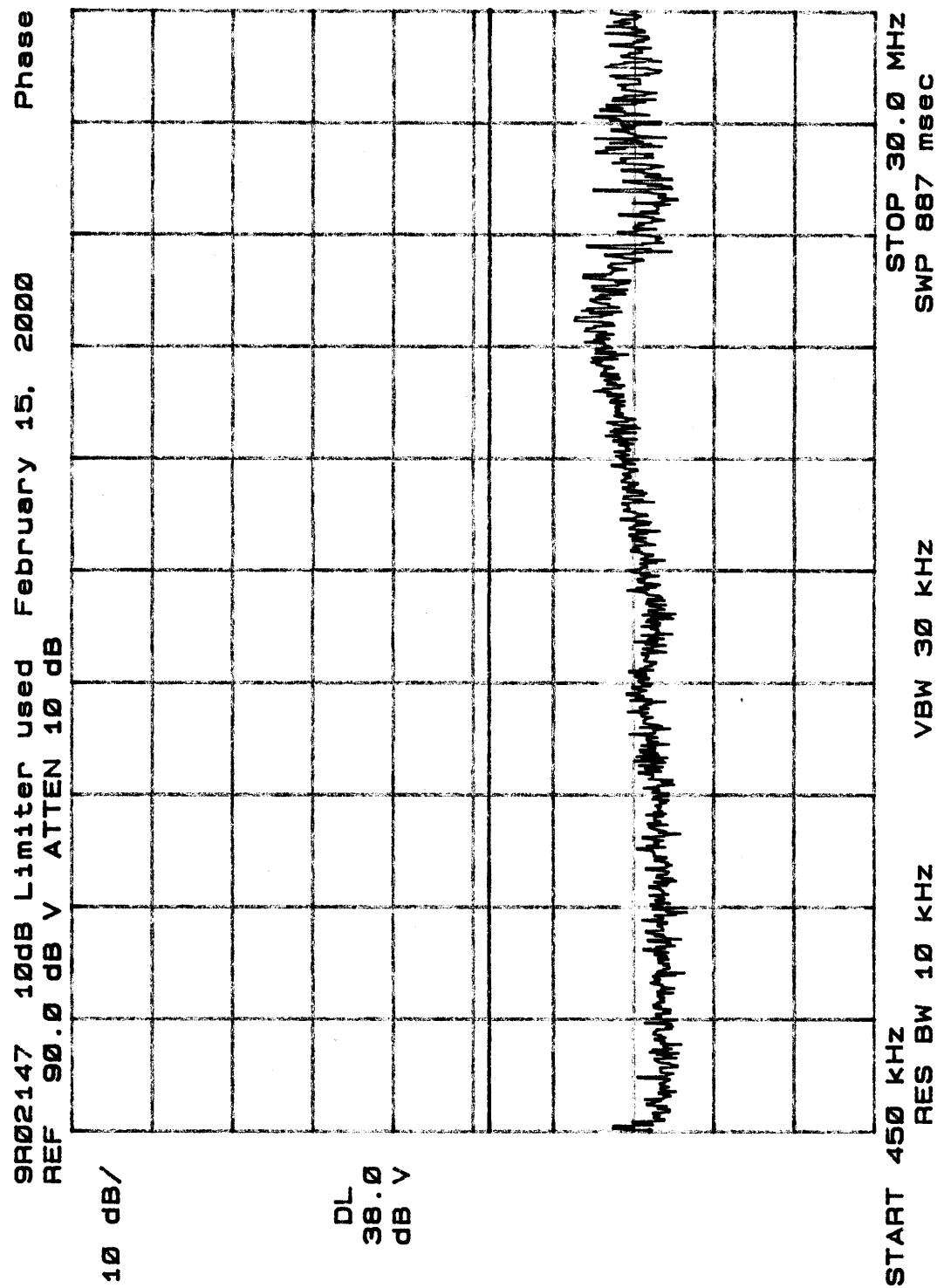
Test Results: Complies. See attached graph.

Measurement Data: See attached graph.

Nemko Canada Inc.

FCC PART 15, SUBPART C
DIRECT SEQUENCE TRANSMITTERS
PROJECT NO.: 1R03687

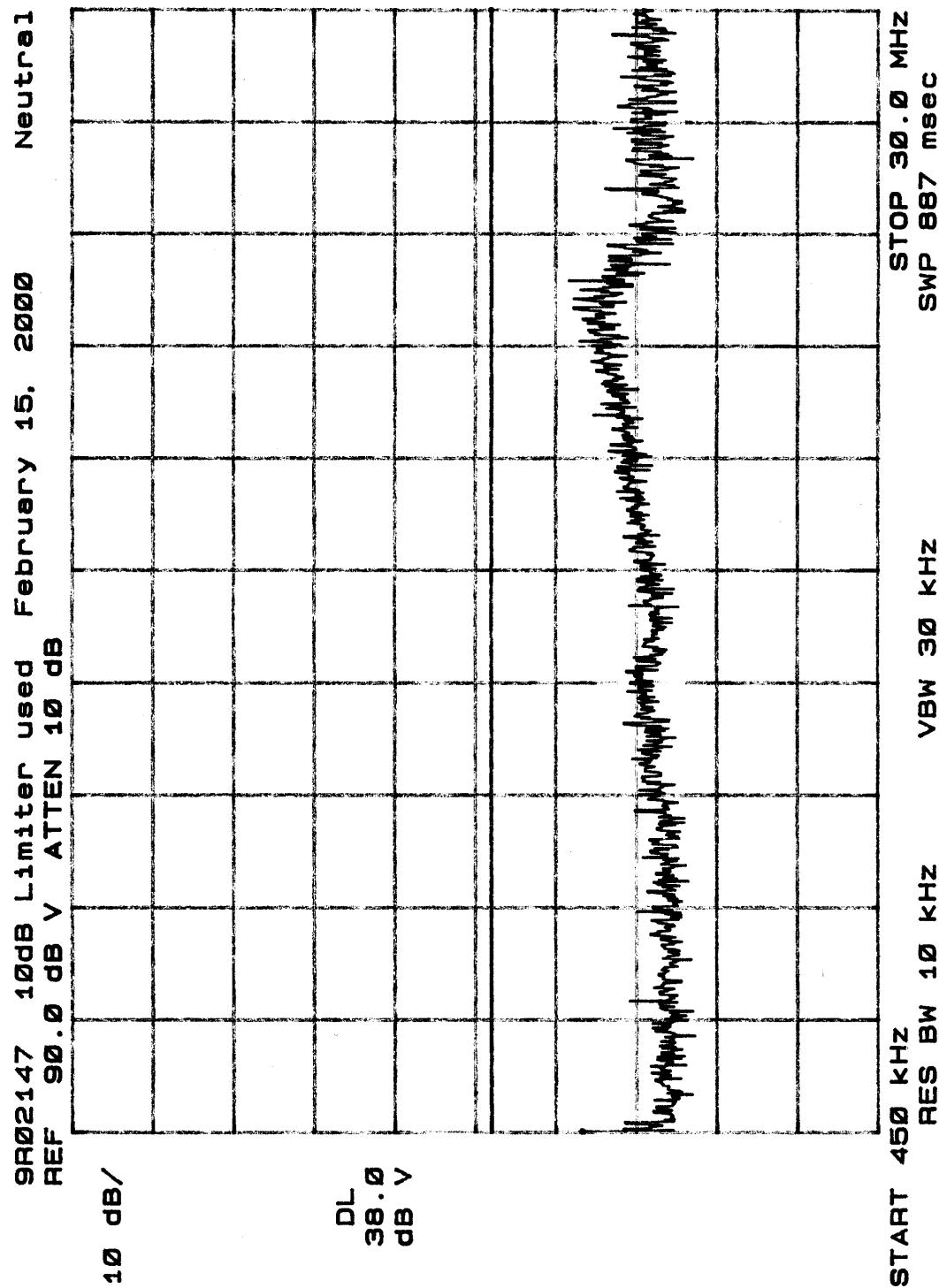
EQUIPMENT: MICROFLEX 24-AD



Nemko Canada Inc.

FCC PART 15, SUBPART C
DIRECT SEQUENCE TRANSMITTERS
PROJECT NO.: 1R03687

EQUIPMENT: MICROFLEX 24-AD



Section 4. Occupied Bandwidth**Para. No.: 15.247(a)(2)**

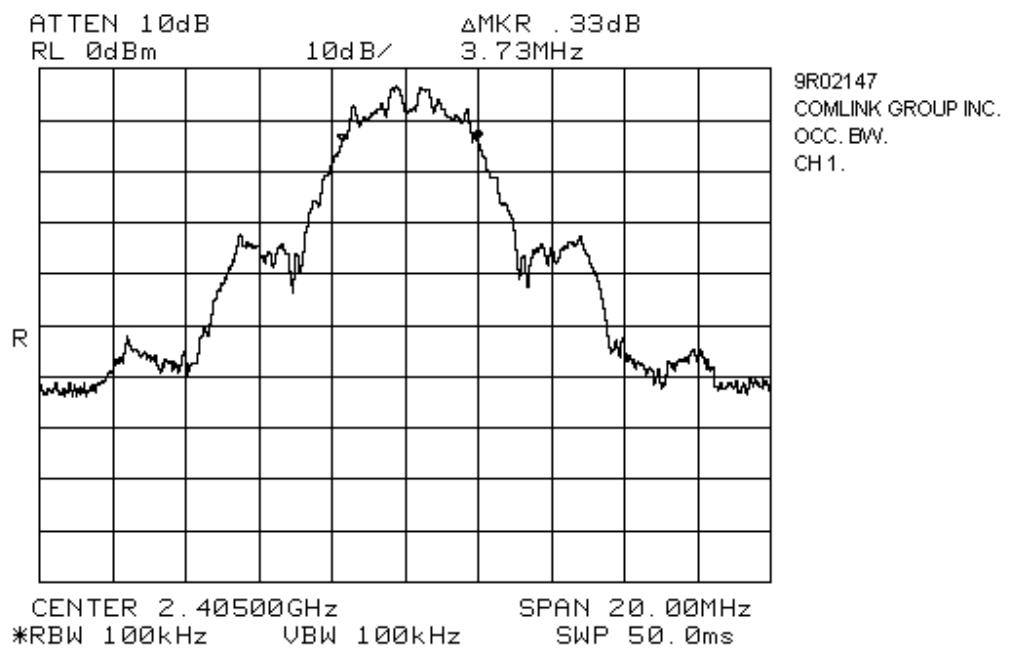
Test Performed By: Glen Westwell	Date of Test: February 11, 2000
---	--

Test Results: Complies. The 6 dB bandwidth is 3.70MHz.
See attached graph.**Measurement Data:** See attached graph.

Nemko Canada Inc.

FCC PART 15, SUBPART C
DIRECT SEQUENCE TRANSMITTERS
PROJECT NO.: 1R03687

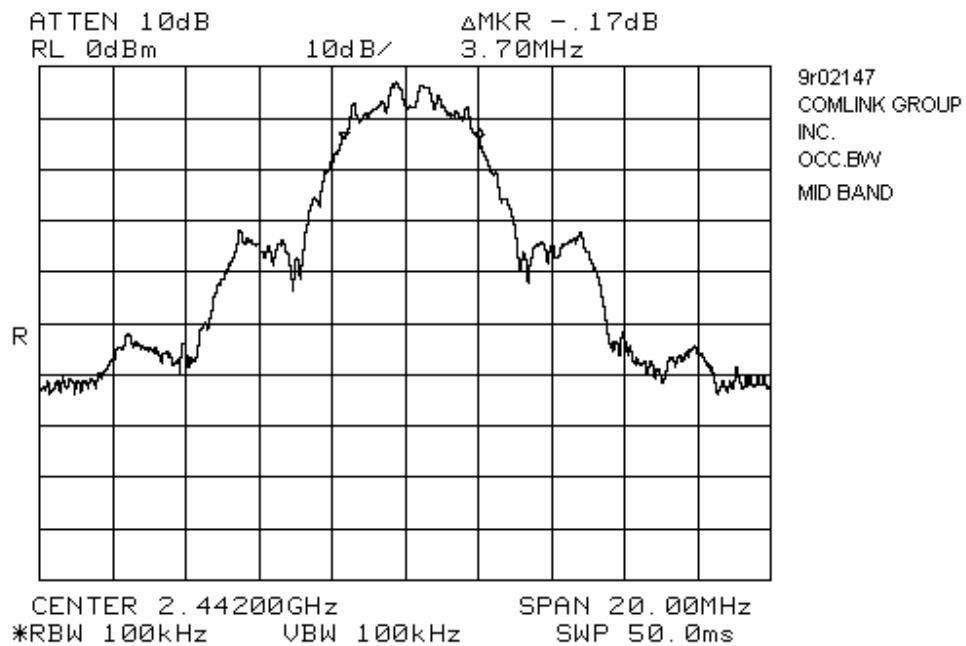
EQUIPMENT: MICROFLEX 24-AD



Nemko Canada Inc.

FCC PART 15, SUBPART C
DIRECT SEQUENCE TRANSMITTERS
PROJECT NO.: 1R03687

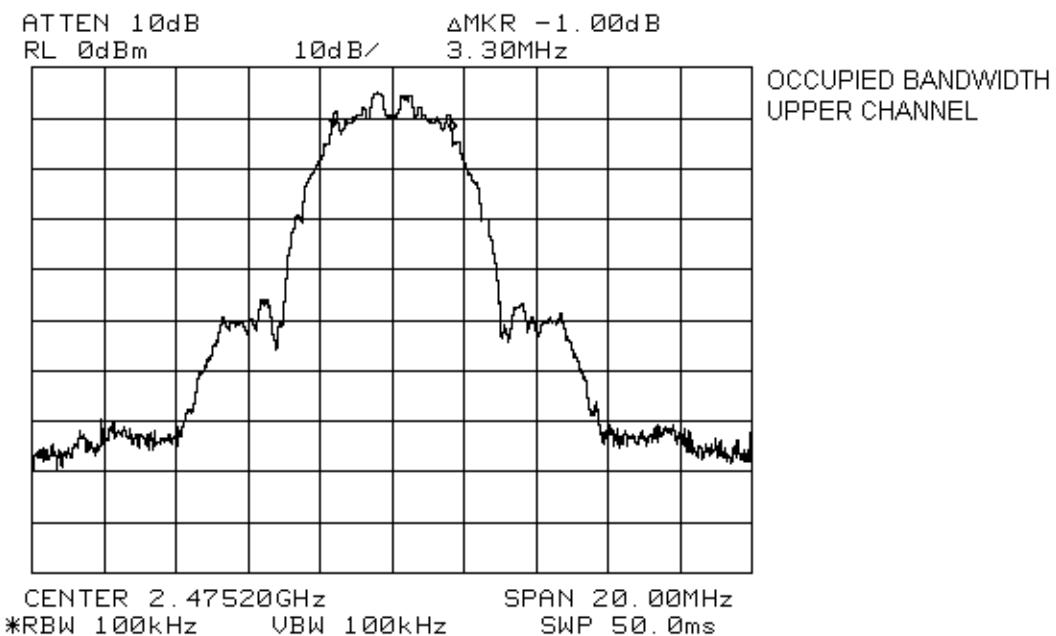
EQUIPMENT: MICROFLEX 24-AD



Nemko Canada Inc.

FCC PART 15, SUBPART C
DIRECT SEQUENCE TRANSMITTERS
PROJECT NO.: 1R03687

EQUIPMENT: MICROFLEX 24-AD



*EQUIPMENT: MICROFLEX 24-AD***Section 5. Peak Power Output****Para. No.: 15.247(b)**

Test Performed By: Glen Westwell	Date of Test: February 11, 2000
---	--

Test Results: Complies. The maximum peak power output of the transmitter is 0.263 watts**Measurement Data:** Detachable antenna? Yes No

If yes, state the type of non-standard connector used at the antenna port: N Type Professionally Installed.

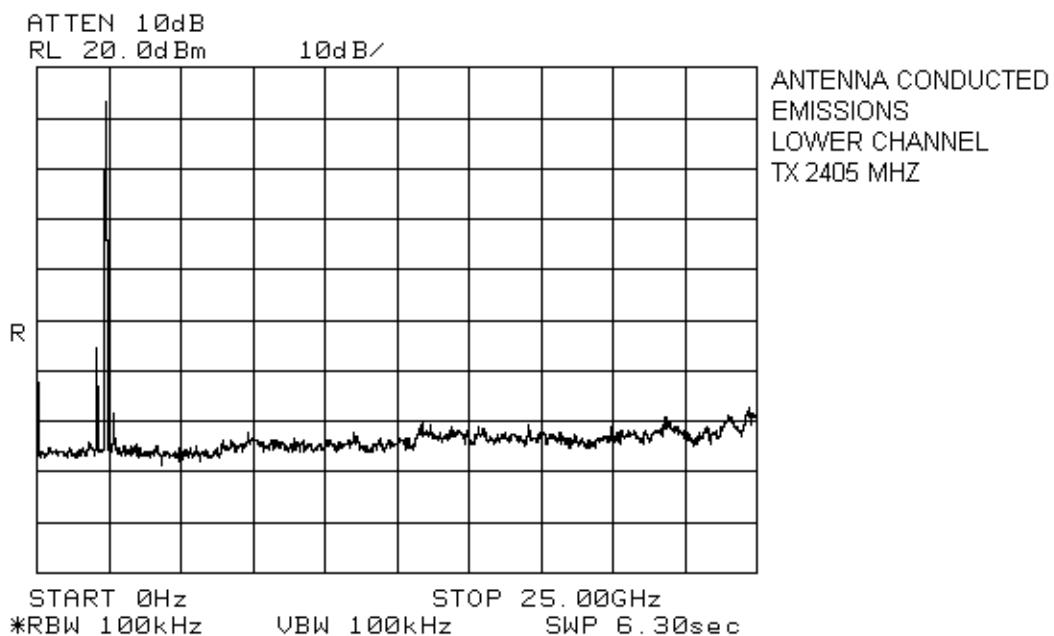
Directional Gain of Antenna: 11dBi
Andrew DL-2412Peak Power Output: 24.2dBm
(HP E4418B Digital Power Meter)

Section 6. Spurious Emissions (Antenna Conducted)**Para. No.: 15.247****Test Performed By:** Glen Westwell**Date of Test:** February 11, 2000**Test Results:** Complies.**Measurement Data:** See attached graphs.

Nemko Canada Inc.

FCC PART 15, SUBPART C
DIRECT SEQUENCE TRANSMITTERS
PROJECT NO.: 1R03687

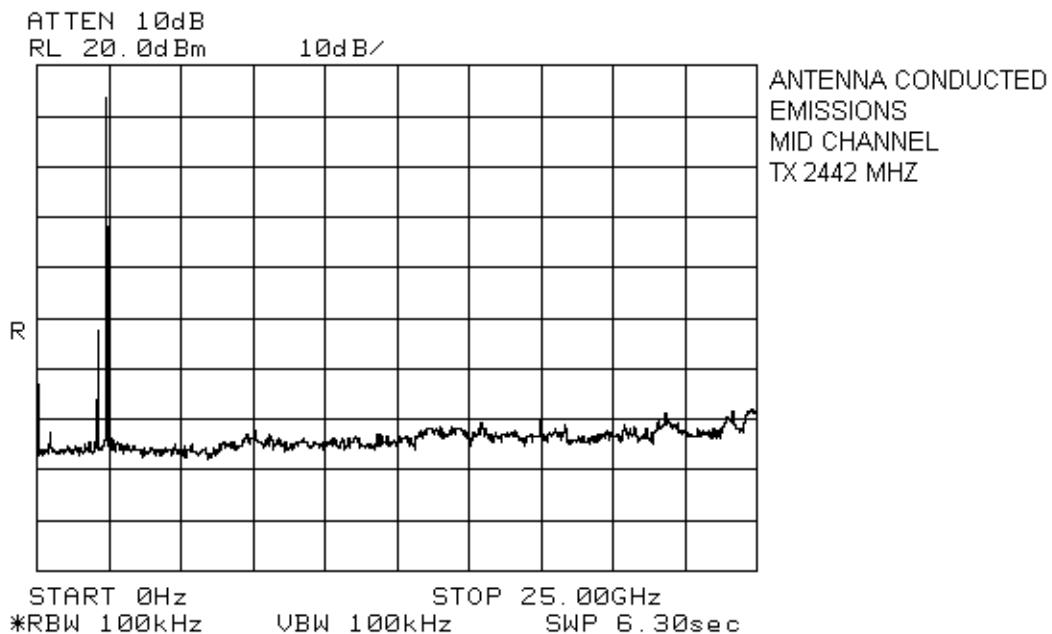
EQUIPMENT: MICROFLEX 24-AD



Nemko Canada Inc.

FCC PART 15, SUBPART C
DIRECT SEQUENCE TRANSMITTERS
PROJECT NO.: 1R03687

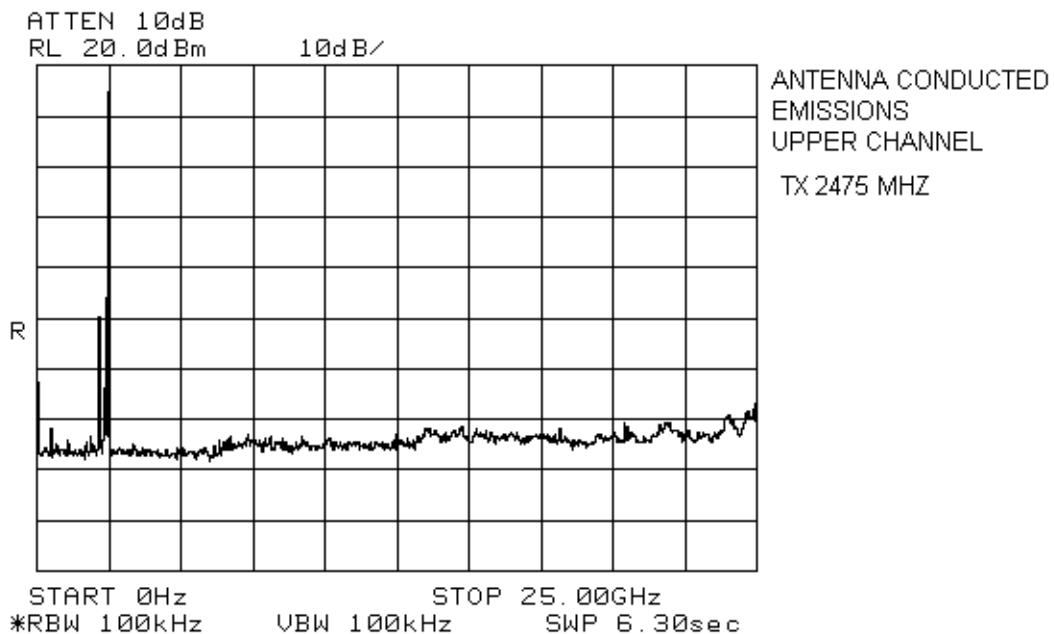
EQUIPMENT: MICROFLEX 24-AD



Nemko Canada Inc.

FCC PART 15, SUBPART C
DIRECT SEQUENCE TRANSMITTERS
PROJECT NO.: 1R03687

EQUIPMENT: MICROFLEX 24-AD



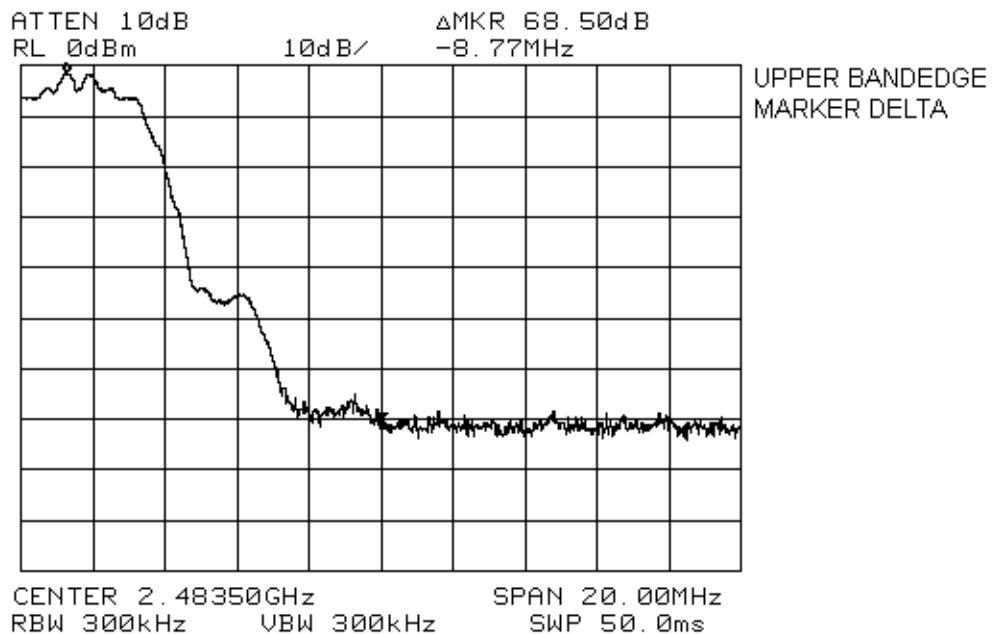
Section 7. Spurious Emissions (Radiated)**Para. No.: 15.247(c)**

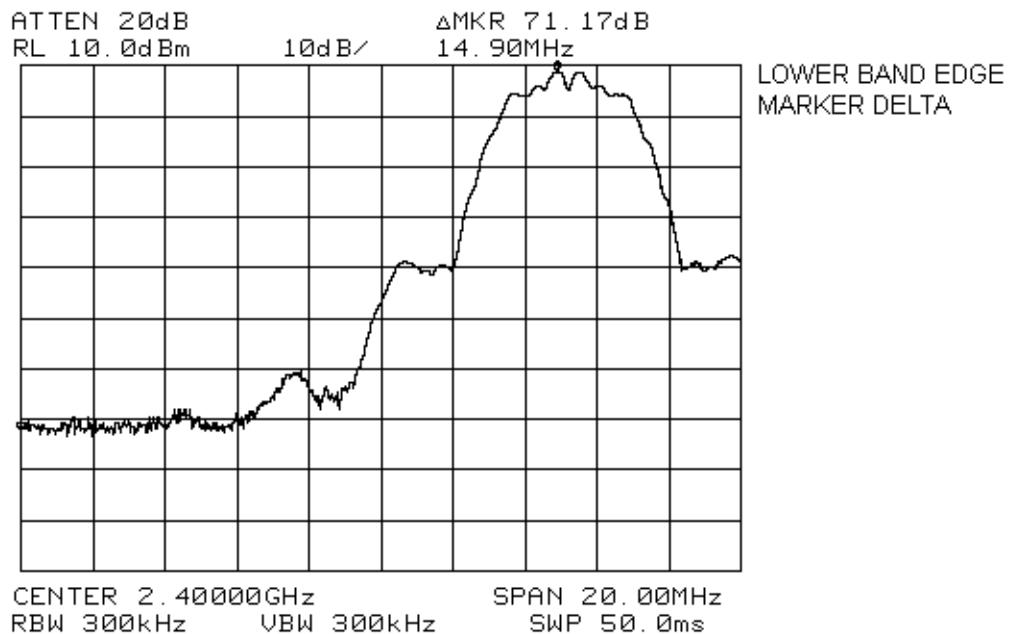
Test Performed By: Glen Westwell	Date of Test: February 11, 2000
---	--

Test Results: Complies. The worst-case emission level is 53.2 dB μ V/m @ 3m at 2483.5MHz. This is 0.8dB below the specification limit.**Measurement Data:** See attached graphs.

*EQUIPMENT: MICROFLEX 24-AD***Test Data - Radiated Emissions**

Test Distance (meters) : 3m		Range: A Tower		Receiver: Spectrum Analyzer		RBW(kHz): 1000		Detector: Peak	
Freq. (MHz)	Ant.	Pol. (V/H)	RCVD Signal (dB μ V/m)	Ant. Factor (dB)**	Amp. Gain (dB)***	Dist. Corr. (dB)	Field Strength (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
2405.0	Hrn2	V	95.8	36.0			131.8		
2475.0	Hrn2	V	94.7	36.4			131.1		
Lower Channel									
4810.0	Hrn2	V	42.0	43.6	-55.6		30.0	54.0	24.0
4810.0	Hrn2	H	38.0	43.6	-55.6		26.0	54.0	28.0
Mid. Channel									
4884.0	Hrn2	V	41.0	43.9	-55.4		29.5	54.0	24.5
4884.0	Hrn2	H	42.0	43.9	-55.4		30.5	54.0	23.5
Upper Channel									
4950.0	Hrn2	V	35.0	44.2	-55.2		24.0	54.0	30.0
4950.0	Hrn2	H	44.0	44.2	-55.2		33.0	54.0	21.0
Notes: The spectrum was searched up to the 10 th harmonic of the fundamental frequency of operation.									

EQUIPMENT: MICROFLEX 24-AD**Emission Level at Band Edge:**Peak: 131.1 - 68.5 = 62.6dB μ V/m @ 3mAverage: 131.1 - 68.5 - 9.4 = 53.2dB μ V/m @ 3m

EQUIPMENT: MICROFLEX 24-AD**Emission Level at Band Edge:**Peak: $131.8 - 71.2 = 60.6 \text{ dB}\mu\text{V/m} @ 3\text{m}$ Average: $71.2 - 9.4 = 51.2 \text{ dB}\mu\text{V/m} @ 3\text{m}$

EQUIPMENT: MICROFLEX 24-AD

Radiated Photographs (Worst Case Configuration)

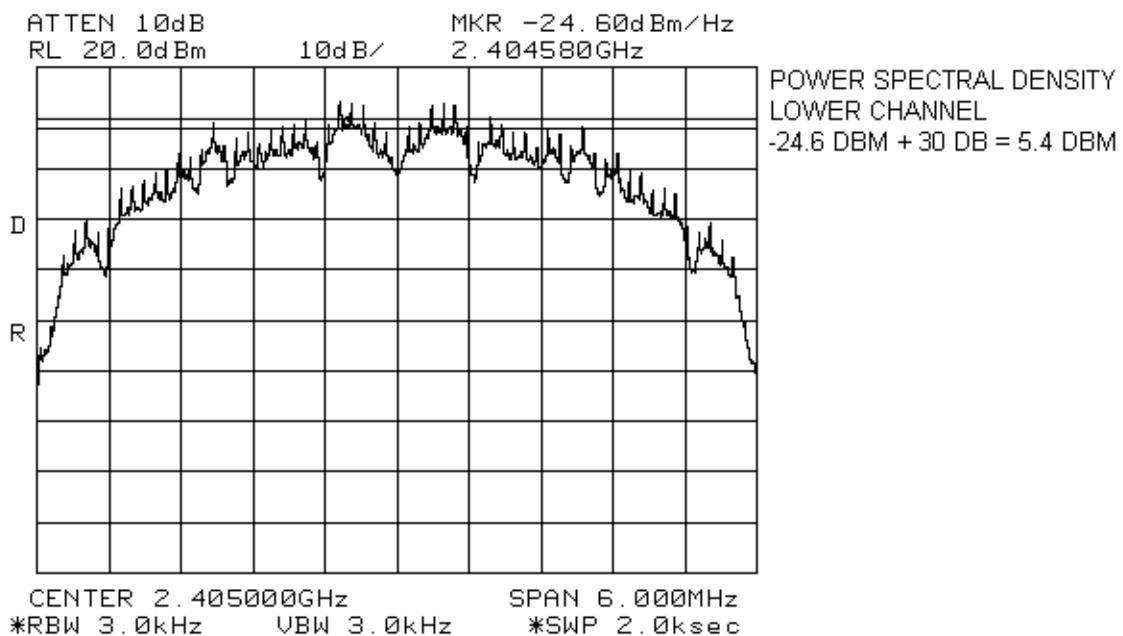
Side View

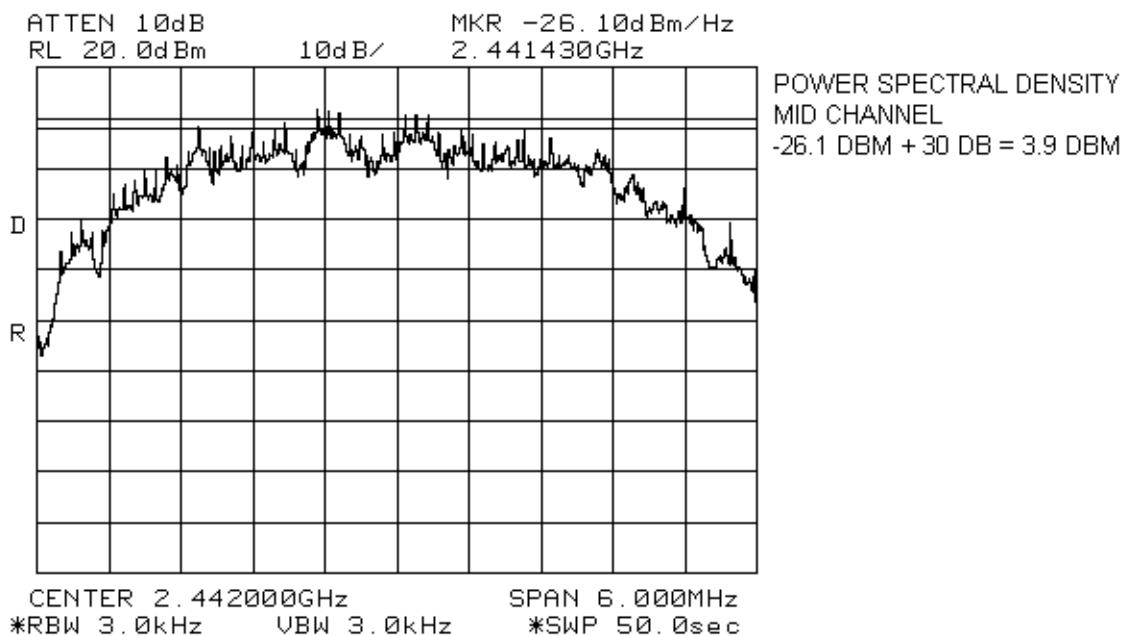


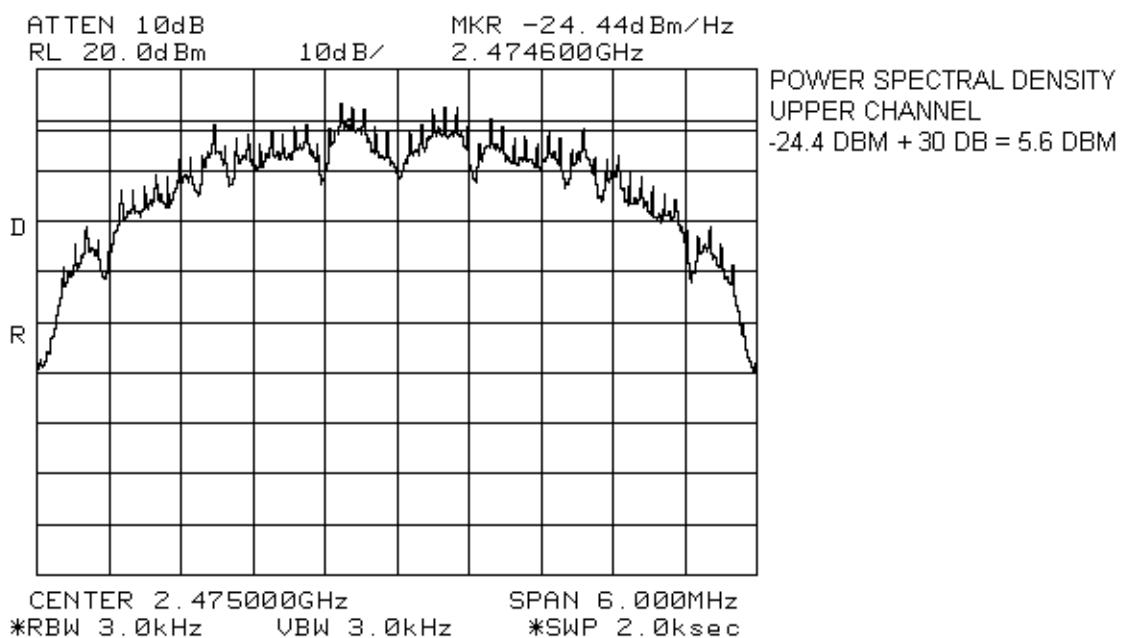
Section 8. Transmitter Power Density**Para. No.: 15.247(d)**

Test Performed By: Glen Westwell	Date of Test: February 11, 2000
---	--

Test Results: Complies.**Measurement Data:** See attached graphs.

EQUIPMENT: MICROFLEX 24-AD

EQUIPMENT: MICROFLEX 24-AD

EQUIPMENT: MICROFLEX 24-AD

Section 9. Processing Gain**Para. No.: 15.247(e)**

Test Performed By: Glen Westwell	Date of Test: February 11, 2000
---	--

Test Results: Complies. The processing gain of the system is 11.2dB.**Measurement Data:** See data below.

Processing gain calculation was done according to Para. No. 15.247(e)(1).

Data was taken over $f_0 \pm 2.5\text{MHz}$
Worst Case J/S = -1.5dB @ $f_0 - 1.50\text{MHz}$
Best Case J/S = +5.5dB @ $f_0 + 2.50\text{MHz}$
Discarding the worst 20% J/S data points, all remaining data points are within $\pm 1.0\text{dB}$.

Accuracy of measurements is $\pm 1.0\text{dB}$

BER:	1×10^{-5}
S/N _{out} :	10.2dB
J/S Ratio:	-1.0dB
L _{sys} :	2.0dB

Processing Gain = $10.2 + (-1.0) + 2.0 = 11.2\text{dB}$

*EQUIPMENT: MICROFLEX 24-AD***Section 10. Test Equipment List**

CAL CYCLE	EQUIPMENT	MANUFACTURER	MODEL	SERIAL	LAST CAL.	NEXT CAL.
1 Year	Spectrum Analyzer	Hewlett Packard	8565E	FA000981	June 16/99	June 16/00
1 Year	Attenuator	Narda	769-20	4153	Oct. 1/99	Oct. 1/00
2 Year	Horn Antenna	EMCO #2	3115	4336	Nov. 11/99	Nov. 11/00
1 Year	Low Noise Amplifier	Avantek	AWT-8035	1005	Sept. 20/99	Sept. 20/00
1 Year	Low Noise Amplifier	DWT	186N23U40	01	Sept. 20/99	Sept. 20/00
1 Year	Digital Power Meter	Hewlett Packard	E4418B	2069	Nov. 1999	Dec. 2000
	High Pass Filter	K&L	11SH10-4000	FA001340	COU	COU

NA: Not Applicable

NCR: No Cal Required

COU: CAL On Use

Nemko Canada Inc.

FCC PART 15, SUBPART C
DIRECT SEQUENCE TRANSMITTERS
PROJECT NO.: 1R03687
ANNEX A

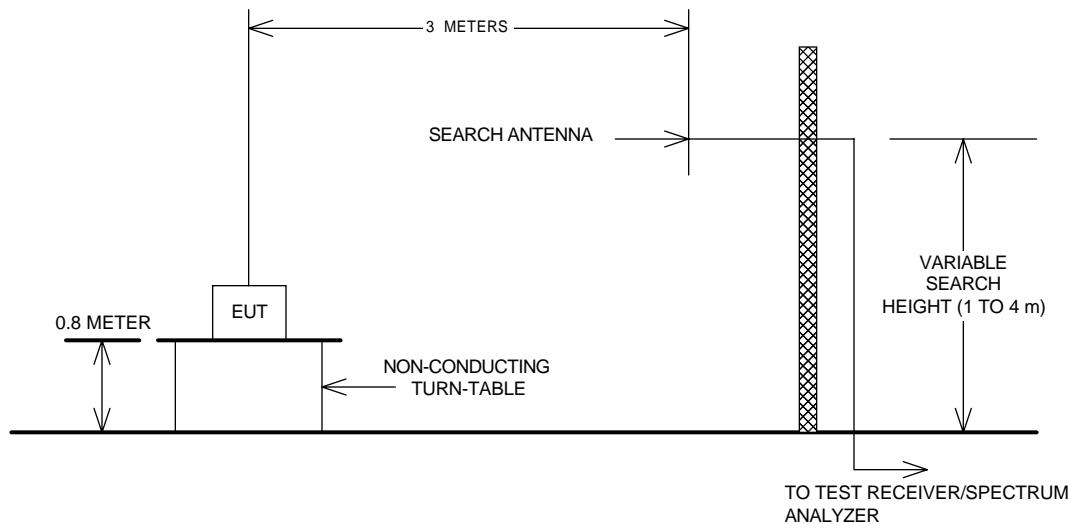
EQUIPMENT: MICROFLEX 24-AD

Annex A

Block Diagrams

EQUIPMENT: MICROFLEX 24-AD

Test Site For Radiated Emissions



Below 1 GHz

Peak detector.
RBW = 100 kHz

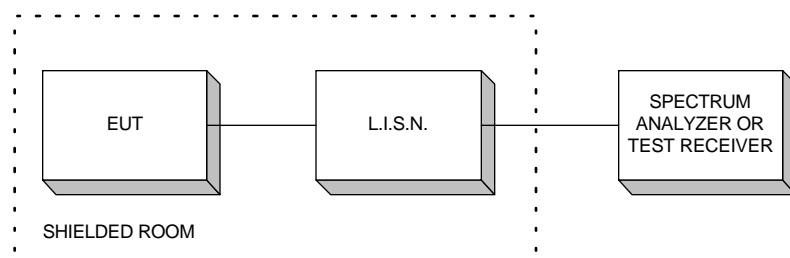
Above 1 GHz For Peak Emission Levels

Peak detector
RBW = 1 MHz
VBW = >RBW

Above 1 GHz For Average Emission Levels

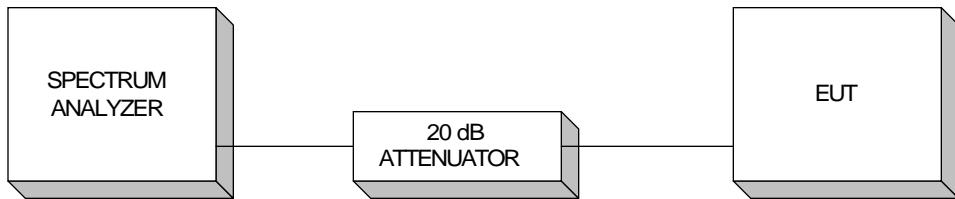
Peak detector
RBW = 1 MHz
VBW = 10 Hz

Conducted Emissions



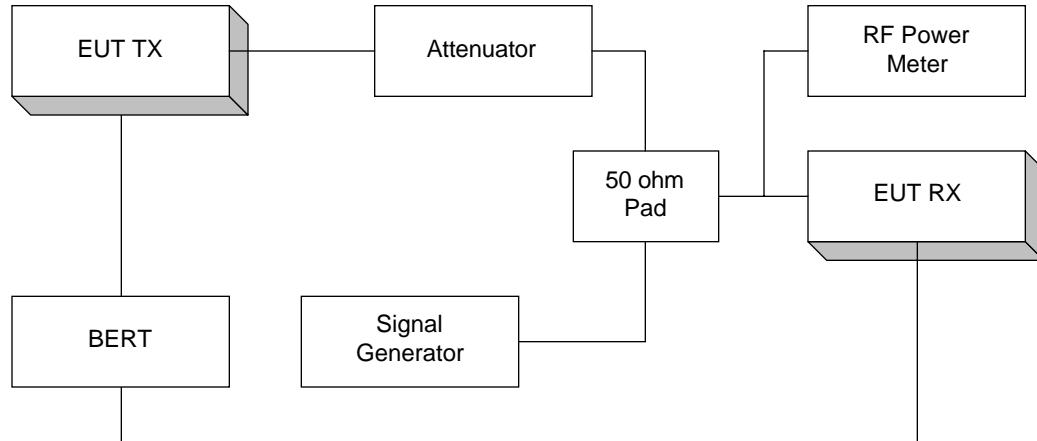
EQUIPMENT: MICROFLEX 24-AD

**Transmitter Power Density & Peak Power At Antenna Terminals
Antenna Conducted Emissions**



If the EUT has an integral (non-detachable) antenna, the above test is performed as a radiated measurement and the result is reported as EIRP.

Processing Gain



NOTE: This is a typical setup. The setup may vary slightly since many devices have BER test functions built into the device.