Intertek Testing Services

APPLICATION FOR FCC CERTIFICATION

GVC Corporation

DSSS Cordless Telephone

Model: CT-9020

FCC ID: DK4CT9020

Job # J98036679/J99003068

Number of Pages: 15 + Supporting Data and Documents

Date of Report: July 6, 1999

Table of Contents

1.0 **Summary of Tests**

DSSS Cordless Telephone – Model No.: CT-9020
FCC ID: DK4CT9020

TEST	REFERENCE	RESULTS
Max. Output power	15.247(b)	Pass
6 dB Bandwidth	15.247(a)(2)	Pass
Max. Power Density	15.247(d)	Pass
Out of Band Antenna Conducted Emission	15.247(c)	Pass
Out of Band Radiated Emission	15.247(c)	N/A
Radiated Emission in Restricted Bands	15.35(b)(c)	Pass
AC Conducted Emission	15.207	Pass
Radiated Emission from Digital Part	15.109	Pass
Radiated Emission from Receiver L.O.	15.109	Not Applicable
Processing Gain Measurements	15.247(e)	Provided by applicant
Antenna Requirement	15.203	Pass

Test Engineer: _____ Date: July 6, 1999
Cleveland Kwan

Telco Manager: _____ Date: July 6, 1999
C.K.Li

2.0 General Description

2.1 Product Description

The Model CT-9020 is a DSSS cordless telephone. For more details, please refer to the attached page.

A production version of the sample was received on March 8, 1999 in good condition.

Overview of Model CT-9020

Applicant	GVC Corporation
Trade Name & Model No.	GVC, CT-9020
FCC Identifier	DK4CT9020
Use of Product	Cordless Telephone
Manufacturer & Model of Spread Spectrum Module	GVC Corporation
Type of Transmission	Direct Sequence
Rated RF Output (mW)	87 mW
Frequency Range (MHz)	903.6 – 926.4
Number of Channel(s)	20
Antenna(s) & Gain, dBi	0
Processing Gain Measurements	[X] Will be provided to ITS for submission with the application [ ] Will be provided directly to the FCC reviewing engineer by the client or manufacturer of the spread spectrum module
Antenna Requirement	[X] The EUT uses a permanently connected antenna. [ ] The antenna is affixed to the EUT using a unique connector which allows for replacement of a broken antenna, but DOES NOT use a standard antenna jack or electrical connector. [ ] The EUT requires professional installation (attach supporting documentation if using this option).
Manufacturer name & address	GVC Corporation 14F, 76 Tun-Hwa S. Rd, Sec. 2 Taipei, Taiwan, R.O.C.

2.2 Related Submittal(s) Grants

None.

- 20 CHANNEL POSSIBLE IN THE 902~928 MHz BAND WIDTH.
- TRANSMISSION RANGE UP TO 1.5K METERS IN FREE AREA, 200 METERS IN INHABITED AREA. LONGER RANGE THAN ANALOG 900MHz CORDLESS TELEPHONE

FEATURE

❑ BASIC FEATURE

LONGER RANGE
BETTER VOICE QUALITY
20 CHANNEL OPERATION
20 NUMBER MEMORY
AUTO ANSWER (When pick up the handy during incoming ring)
AUTO STAND-BY
1-WAY PAGE
3 STAGE OUTPUT POWER SELECTABLE
4 USER SELECTABLE RINGER TONE
ADJUSTABLE RECEIVER VOLUME CONTROL
16 MILLION AUTO-SECURITY CODE COMBINATION
AUDIBLE AND LCD INDICATOR OUT OF RANGE WARNING
HIGH PERFORMANCE ROCKWELL CHIPSET
EARPHONE JACK (HANDS FREE) *OPTION
HEARING AID COMPATIBLE
LOW BATTERY LCD INDICATOR
Indicates the battery needs to be replaced.
REDIAL UP TO 32 DIGITS
60 EA CALLER ID MEMEORY
DESK or WALL MOUNTING
ONE TOUCH PHONE (ANYKEY ANSWER)
20 MEMORY

2.3 Test Methodology

Both AC mains line-conducted and radiated emissions measurements were performed according to the procedures in ANSI C63.4 (1992). Radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the **"Data Sheet"** of this Application. All other measurements were made in accordance with the procedures in part 2 of CFR 47.

2.4 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is site . This test facility and site measurement data have been fully placed on file with the FCC and NVLAP accredited.

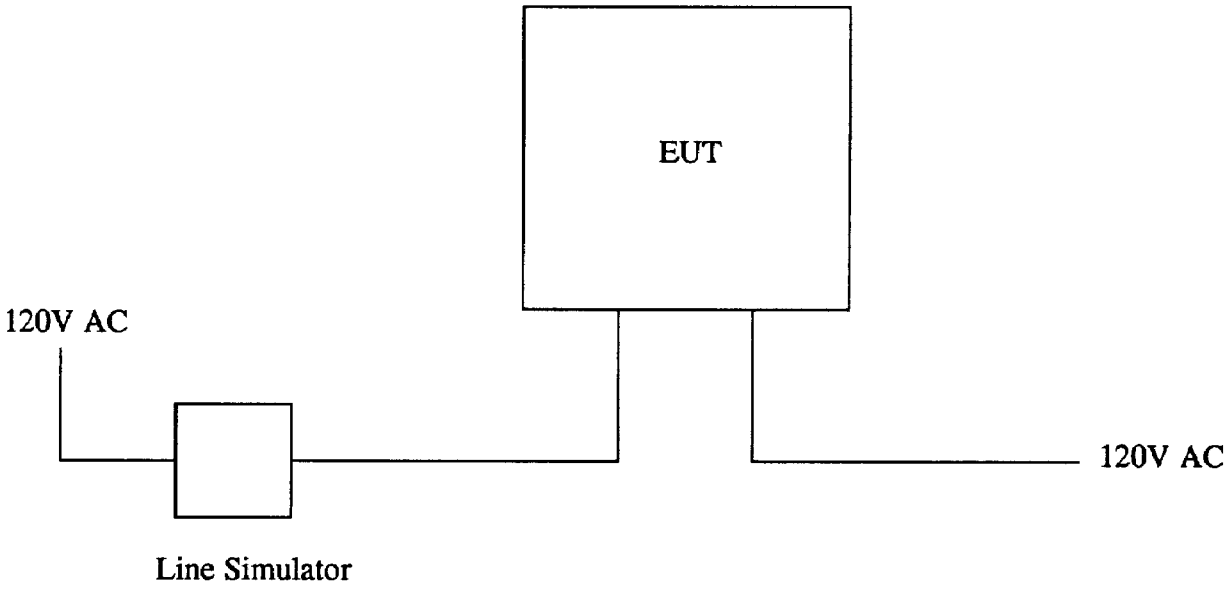
3.0 System Test Configuration

3.1 Support Equipment and description

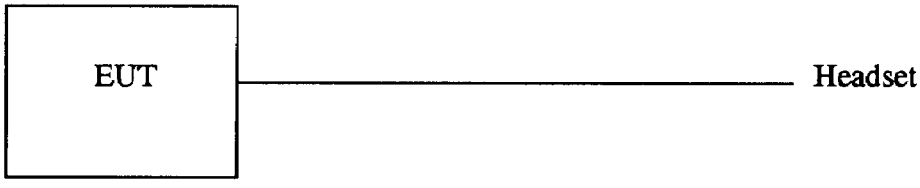
None, the EUT was tested as a standalone device.

3.2 Block Diagram of Test Setup

BASE



HANDSET



* = EUT ** = No ferrites on video cable	S = Shielded; U = Unshielded	F = With Ferrite

3.3 Justification

For emission testing, the equipment under test (EUT) was configured for testing in a typical fashion (as a customer would normally use it). During testing, all cables were manipulated to produce worst case emissions.

For radiated emission measurements, the EUT is attached to a cardboard box (if necessary) and placed on the wooden turntable. If the EUT attaches to peripherals, they are connected and operational (as typical as possible). The EUT is wired to transmit full power without modulation.

The signal is maximized through rotation and placement in the three orthogonal axes. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters. Detector function is in peak mode. Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance.

All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance.

3.4 Software Exercise Program

The EUT exercise program used during radiated and conducted testing was designed to exercise the various system components in a manner similar to a typical use. For emissions testing, the units were setup to transmit continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing.

3.5 Mode of Operation During Test

The EUT was running in a transmitting mode.

3.6 Modifications Required for Compliance

The following modifications were installed during compliance testing in order to bring the product into compliance (Please note that this list does not include changes made specifically by prior to compliance testing):

No modifications were made to the EUT by Intertek Testing Services.

3.7 Additions, deviations and exclusions from standards

No additions, deviations or exclusion have been made from standard.

4.0 Measurement Results

4.1 Maximum Radiated Output Power, FCC RULES 15.247(b):

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 bandwidth of the spectrum analyzer were set to 1 MHz. To maximize emissions, the system was rotated through 360°, the antenna height was varied from 1m to 4m, and the antenna polarization was changed.

The ERP was calculated using equation:

$$E = \frac{\sqrt{30 \cdot P \cdot G}}{D}$$

Where E = Field Strength (V/m),
D = Distance between two antennae(m)
G = Numeric Gain of Antenna (1 for isotropic antenna),
P = ERP (W) = EIRP (G=1)

Base		
Frequency (MHz)	Output in dBm	Output in mWatt
Low Channel: 903.9	17.2	52.4
Middle Channel: 914.2	16.9	48.9
High Channel: 925.5	16.3	42.6

Please refer to the Appendix A for the following plots:

Plot B1a: Low Channel Output Power
Plot B1b: Middle Channel Output Power
Plot B1c: High Channel Output Power
Data Sheet - Radiated Emission (Output Power)

Handset		
Frequency (MHz)	Output in dBm	Output in mWatt
Low Channel: 904.01	18.3	67.5
Middle Channel: 914.16	19.4	87.0
High Channel: 925.54	17.7	58.8

Please refer to the Appendix A for the following plots:

Plot H1a: Low Channel Output Power
Plot H1b: Middle Channel Output Power
Plot H1c: High Channel Output Power

4.2 Minimum 6 dB RF Bandwidth, FCC Rule 15.247(a)(2):

The antenna port of the EUT was connected to the input of a spectrum analyzer. Analyzer RES BW was set to 100 kHz. For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier. A PEAK output reading was taken, a DISPLAY line was drawn 6 dB lower than PEAK level. The 6 dB bandwidth was determined from where the channel output spectrum intersected the display line.

Base		
Frequency (MHz)	Min. 6 dB Bandwidth (kHz)	Limit (kHz)
914.27	1496	500

Refer to the following plots in Appendix B for 6 dB bandwidth sharp:

Plot B2a: Low Channel 6 dB RF Bandwidth
Plot B2b: Middle Channel 6 dB RF Bandwidth
Plot B2c: High Channel 6 dB RF Bandwidth

Handset		
Frequency (MHz)	Min. 6 dB Bandwidth (kHz)	Limit (kHz)
914.45	1512	500

Refer to the following plots in Appendix B for 6 dB bandwidth sharp:

Plot H2a: Low Channel 6 dB RF Bandwidth
Plot H2b: Middle Channel 6 dB RF Bandwidth
Plot H2c: High Channel 6 dB RF Bandwidth

4.3 Maximum Power Density Reading, FCC Rule 15.247(d):

The spectrum analyzer RES BW was set to 3 kHz. The START and STOP frequencies were set to the band edges of the maximum output passband. If there is no clear maximum amplitude in any given portion of the band, it may be necessary to make measurements at a number of bands defined by several START and STOP frequency pairs. The specification calls for a 1 second interval at each 3 kHz bandwidth; total SWEEP TIME is calculated as follows:

SWEEP TIME (SEC) = (Fstop, kHz - Fstart, kHz)/3 kHz

Radiated method was used; power density was calculated from field strength.

$$P = (FD)^2/30$$
$$G = 1$$

Base		
Frequency (MHz)	Power Density (dBm)	Limit (dBm)
914.0	5.7	8

Handset		
Frequency (MHz)	Power Density (dBm)	Limit (dBm)
913.9	6.3	8

Frequency Span = 600 kHz

Sweep Time = 600 Frequency Span/3 kHz
= 200 seconds

Refer to Appendix C for the following plots:

Plot B3a.1 - B3a.2 Low Channel Power Density
Plot B3b.1 - B3b.2 Middle Channel Power Density
Plot B3c.1 - B3c.2: High Channel Power Density
Plot H3a.1 - H3a.2 Low Channel Power Density
Plot H3b.1 - H3b.2 Middle Channel Power Density
Plot H3c.1 - H3c.2: High Channel Power Density
Radiated Emission (Output Power Density) Handset and Base

4.4 Out of Band Conducted Emissions, FCC Rule 15.247(c):

In any 100 kHz bandwidth outside the EUT passband, the RF power produced by the modulation products of the spreading sequence, the information sequence, and the carrier frequency shall be at least 20 dB below that of the maximum in-band 100 kHz emission, or else shall meet the general limits for radiated emissions at frequencies outside the passband, whichever results in lower attenuation.

All other types of emissions from the EUT shall meet the general limits for radiated frequencies outside the passband.

Refer to Appendix D for the following plots for out of band conducted emissions data:

Plot B4a.1 - B4a.4: Low Channel Emissions
Plot B4b.1 - B4b.3: Middle Channel Emissions
Plot B4c.1 - B4c.4: High Channel Emissions

Plot H4a.1 - H4a.4: Low Channel Emissions
Plot H4b.1 - H4b.3: Middle Channel Emissions
Plot H4c.1 - H4c.4: High Channel Emissions

4.5 Out of Band Radiated Emissions (for emissions in 4. above that are less than 26 dB below carrier), FCC Rule 15.247(c):

For out of band emissions that are close to or that exceed the 20 dB attenuation requirement described in the specification, radiated measurements were performed at a 3 m separation distance to determine whether these emissions complied with the general radiated emission requirement.

[x] Not required
[ ] See attached data sheet

4.6 Transmitter Radiated Emissions in Restricted Bands, FCC Rule 15.35(b), (c):

Radiated emission measurements were performed from 30 MHz to < > MHz.
Analyzer resolution is 100 kHz or greater for 30 MHz to 1000 MHz, 1 MHz for > 1000 MHz.

Data is included of the worst case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included. All measurements were performed with peak detection unless otherwise specified.

The data on Appendix E list the significant emission frequencies, the limit and the margin of compliance.

4.7 AC Line Conducted Emission, FCC Rule 15.207:

[ ] Not required; battery operation only

[x] Refer to Appendix F for the test data.

4.8 Radiated Emissions from Digital Section of Transceiver (Transmitter), FCC Ref: 15.109

[ ] Not required - No digital part
[X] Test results are attached
[X] Included in the separate DOC report.

4.9 Radiated Emissions from Receiver Section of Transceiver (L.O. Radiation), FCC Ref: 15.109, 15.111

[X] Not required - EUT operation above 960 MHz only

[ ] Not required - EUT is transmitter only

[ ] Not performed; exempt until June 1999

[ ] Test results are attached

4.10 Processing Gain Measurements, FCC Rule 15.247(e)

The processing gain shall be determined from the ratio in dB of the signal to noise ratio with the system spreading code turned OFF, to the signal to noise ratio with the system spreading code turned ON, as measured at the demodulated output of the receiver. The processing gain shall be at least 10 dB for a direct sequence spread spectrum system.

X	Refer to attached test procedure and data sheets.
	Refer to circuit analysis and processing gain calculations provided by manufacturer.

4.11 Transmitter Duty Cycle Calculation and Measurements, FCC Rule 15.35(b), (c)

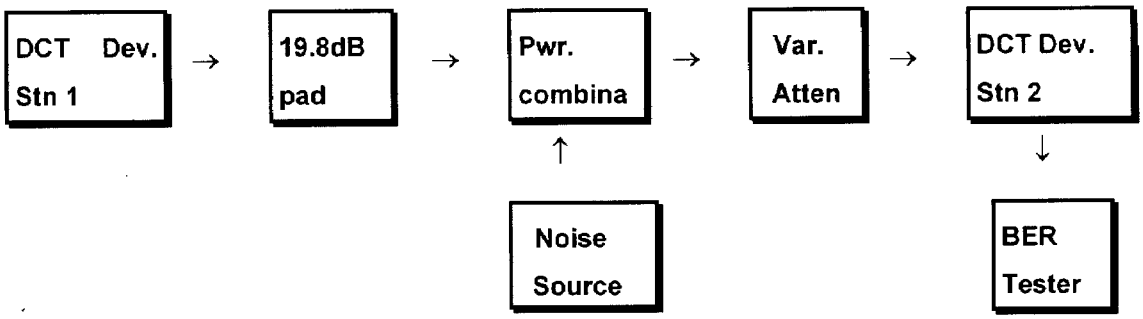
The EUT antenna output port was connected to the input of the spectrum analyzer. The analyzer center frequency was set to EUT RF channel carrier. The SWEEP function on the analyzer was set to ZERO SPAN. The transmitter ON time was determined from the resultant time-amplitude display:

Duty cycle = Maximum ON time in 100 msec/100

Duty cycle correction, dB = 20 * log(DC)

	See attached spectrum analyzer chart(s) for transmitter timing
X	Not applicable, duty cycle was not used.

Processing Gain Measurement



TEST METHOD

THE PROCESSING GAIN MAY BE MEASURED USING THE **CW** JAMMING MARGIN METHOD. FIGURE 1 SHOWS THE TEST CONFIGURATION. THE TEST CONSIST OF STEPPING A SIGNAL GENERATOR IN 50 **KHz** INCREMENTS ACROSS THE PASSBAND OF THE SYSTEM (UP TO 960 **KHz** AWAY IN **RI,S DCT**).

AT EACH POINT, THE GENERATOR LEVEL REQUIRED TO PRODUCE THE RECOMMENDED BIT ERROR RATE (**BER**) (SET AT **BER = 10e-3**) IS RECORDED.

THE LEVEL IS JAMMING LEVEL. THE OUTPUT POWER OF THE TRANSMITTING UNIT IS MEASURED AT THE SAME POINT. THE JAMMER TO SIGNAL (**J/S**) RATIO IS THEN CALCURATED.

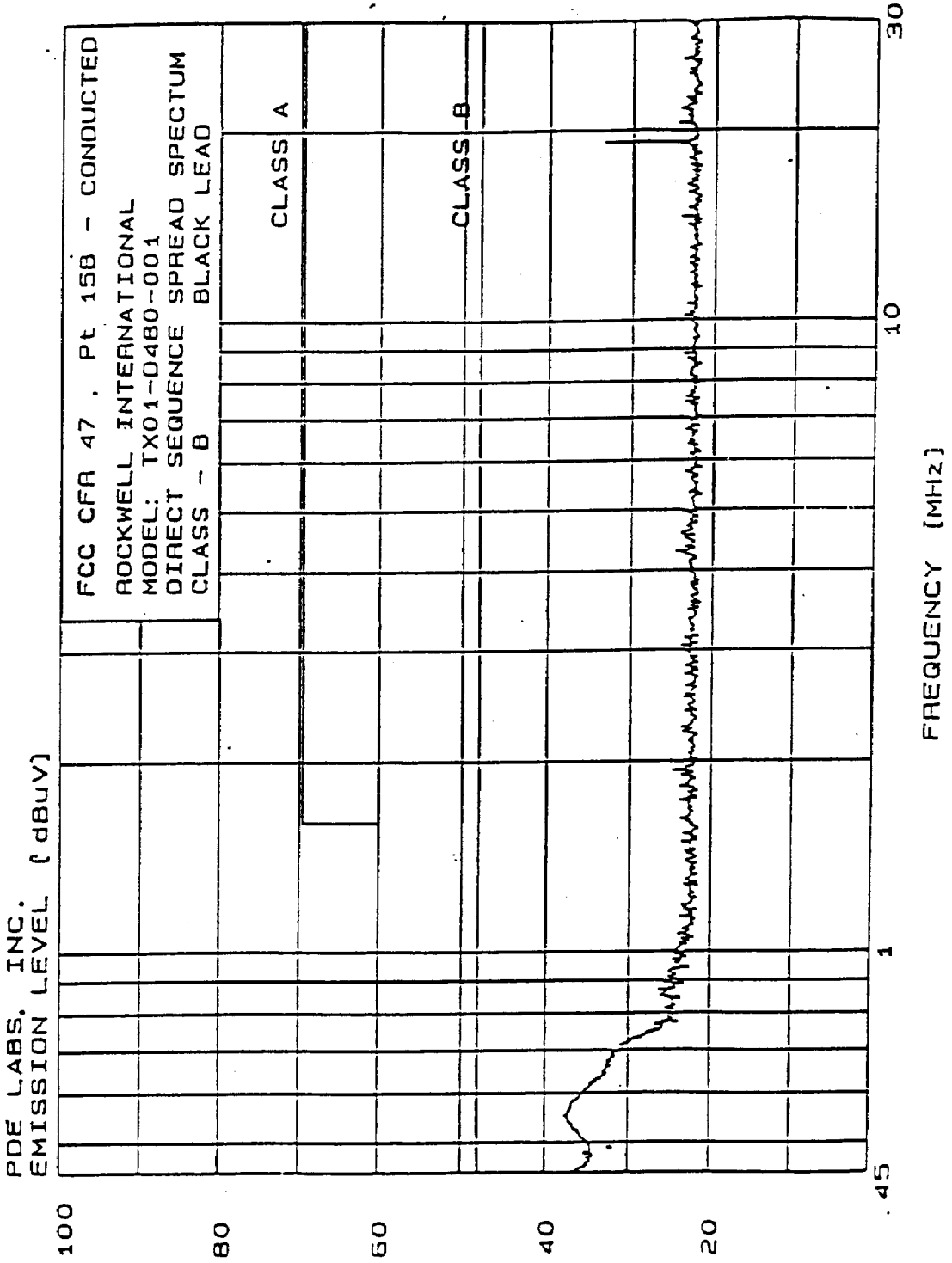
DISCARD THE WORST 20 % OF THE J/S DATA POINTS. THE LOWEST REMAINNING **J/S** RATIO IS USED TO CALCURATE THE PROCESSING GAIN.

THE MAXIMUM IMPLEMENTATION LOSS A SYSTEM CAN CLAIM IN CALCURATING PROCASSING GAIN IS 2 **dB** . THE EQUATION TO CALCURATE THE PROCESSING GAIN (**Gp**) IS THE FOLLOWING.

Gp	= $(S/N)_0$ + Mj + Lsys
$(S/N)_0$	= Signal to Noise Ratio reqd @ BER of 8dB for DBPSK
Mj	= Jamming Marjin (J/S) in dB
Lsys	= system implementation Losses = 2dB
S	= Signal power - Attn - comb loss - cable loss
	= 4.0 - 19.8 - 3.6 - 0.5 -27.9 = -28.2dB
J	= Sig Gen O/PLvl(N) - Cal factor - Comb loss
	= N - 0.3 - 3.6 dB

TEST DATA

Jammer Freq.(MHz)	Signal Lvl dB	CW Noise N dB	Mj J / S dB	Proc. Gain dB
915.6	- 27.9	- 15.1	8.8	19
915.65	- 27.9	- 15	8.9	19.1
915.7	- 27.9	- 22.9	1	11.2
915.75	- 27.9	- 19.9	4	14.2
915.8	- 27.9	- 19.6	4.3	14.5
915.85	- 27.9	- 20.3	3.6	13.8
915.9	- 27.9	- 21.3	2.6	12.8
915.95	- 27.9	- 19.3	4.6	14.8
916.0	- 27.9	- 21	2.9	13.1
916.05	- 27.9	- 11.8	12.1	22.3
916.1	- 27.9	- 19.5	4.4	14.6
916.15	- 27.9	- 11.8	12.1	22.3
916.2	- 27.9	- 17	6.9	17.1
916.25	- 27.9	- 14.2	9.7	19.9
916.3	- 27.9	- 12.5	11.4	21.6
916.35	- 27.9	- 10	13.9	24.1
916.4	- 27.9	- 6	17.9	28.1
916.45	- 27.9	- 4	19.9	30.1
916.5	- 27.9	- 1.2	22.7	32.9
916.55	- 27.9	- 1.8	22.1	32.3


FCC CFR 47 , Pt 15B - CONDUCTED
ROCKWELL INTERNATIONAL
MODEL: TX01-0480-001
DIRECT SEQUENCE SPREAD SPECTUM
CLASS - B
BLACK LEAD
CLASS A
CLASS B
PDE LABS, INC.
EMISSION LEVEL (dBuV)
100
80
60
40
20
30
10
1
.45
FREQUENCY (MHz)

5.0 Appendices: Test Data & Plots

Appendix A: Maximum Conducted Output Power at Antenna Terminals
Appendix B: Minimum 6 dB RF Bandwidth
Appendix C: Maximum Power Density
Appendix D: Out of Band Conducted Emissions
Appendix E: Transmitter Radiated Emission in Restricted Band
Appendix F: AC Line Conducted
Appendix G: Radiated Emission for Digital Section