EXHIBIT U – Technical Report

FCC ID# PEL640-0001

Measurement/Technical Report

NextComm Inc.

700-0002

FCC ID: PEL640-0001

January 19, 2001

This report concerns (check one):	Original Grant__*X* *Class II Change*____
Equipment Type: Unlicensed Spread Spectrum Transmitter	Rule Part: 47 CFR 15.247

Deferred grant requested per 47 CFR 0.457 (d)(1)(ii)? Yes_____ no__X__

If yes, defer until: _____N/A_____ date

NextComm Inc. agrees to notify the Commission by: _____N/A_____ date

of the intended date of announcement of the product so that the grant can be issued on that date.

Transition Rules Request per 15.37: yes_____ no__X__

If no, assumed Part 15, Subpart C for intentional radiators – new 47 CFR [10-1-92] provision.

Report prepared by:

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Table of Contents

1.0 General Information

1.1 Product Description

Manufactured By ..... NextComm Inc.

Address..... 12413 Willows Road, N.E., Suite 210, Kirkland WA 98034

Test Requested By:..... Robert Chiang

Model..... 700-0002

FCC ID PEL640-0001

Serial Number(s) ..... 19E, 19F, & 1A0

Date of Test ..... January 10 thru 19, 2001

Job Number NEXC0006

Prepared By:

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Vicki Albertson, Technical Report and Documentation Manager

Technical Review By:

Greg Kiemel, Director of Engineering

Approved By:

Donald Facteau, IS Manager

1.1 Product Description con't

The Equipment Under Test (EUT) is the NextComm Inc. Wireless LAN PC Card, Model 700-0002, a spread spectrum transmitter that operates from 2412 MHz to 2462 MHz (center frequency of lowest channel to the center frequency of the highest channel) and uses direct sequence modulation. The EUT is seeking authorization under 47 CFR 15.247 as a direct sequence transmitter.

This device is an extended type II PC card (PCMCIA card) intended for use in laptop computers. It is compatible with wireless local area networks found in general enterprise office computing, small or home offices, and public space markets. The EUT is designed to be inter-operable with any wireless IEEE 802.11 and IEEE 802.11b LAN product that is based on Direct Sequence Spread Spectrum (DSSS) radio technology, and is compliant to the IEEE 802.11 Standard on Wireless LANs (Revision B).

This device contains two patch antennas (0 & 1) that are integral to the unit. The antennas are oriented in different polarizations, with the output of the transmitter switched between the two. It is impossible for the transmitter to simultaneously broadcast from both antennas. This application package demonstrates the compliance of this radio for both antennas. There is no provision for attachment of any other antennas.

The Wireless LAN PC Card has also been tested and found compliant with FCC Part 15 Subpart B rules as a Class B computer peripheral*.

**** A copy of the DoC certificate may be referenced in Exhibit "V", file name"DoC Certificate.pdf"***

1.2 Related Submittals/Grants

None

1.3 Tested System Details

EUT and Peripherals

Item	FCC ID	Description and Serial No.
EUT	PEL640-0001	NextComm Inc. Wireless LAN PC Card, Model 700-0002, S/N 19E, 19F, & 1A0.
Laptop PC	N/A	Compaq Armada 1500C, S/N C366/T/4000/D/M/3
Laptop PC Power Supply	N/A	PP2032, S/N DCD9931149733
Keyboard	N/A	Microsoft Natural Keyboard Elite, S/N 71305-584-8294874-18278
Monitor	N/A	Shinho Electronics, SM 585F-NB, S/N 7D904028
Parallel Printer	N/A	Epson LX300, S/N 1YLY287431
Serial Printer	N/A	Epson LX300, S/N 1YLY172974

Cables

Cable Type	Shield	Length (meters)	Ferrite	Connection Point 1	Connection Point 2
Keyboard	PA	1.8	PA	Keyboard	PC
Video	PA	1.2	PA	Monitor	PC
Monitor Power	No	1.8	No	Monitor	AC mains
Parallel	Yes	1.0	No	Parallel Printer	PC
Serial	Yes	1.3	No	Serial Printer	PC
Parallel Printer Power	No	1.7	No	Parallel Printer	AC mains
Serial Printer Power	No	1.7	No	Serial Printer	AC mains
Laptop PC Power	PA	3.9	PA	PC	AC mains

PA = Permanently attached. Cable is attached at the factory to a peripheral (e.g. mouse). The type of shielding or presence of ferrite is unknown.

1.4 Test Methodology

Radiated testing was performed according to the procedures in ANSI C63.4 (1992) and FCC 97-114. Radiated testing was performed at an antenna to EUT distance of 3 meters, from 30 MHz to 10 GHz, and at 1 meter from 10 GHz to 25 GHz.

1.5 Test Facility

The semi-anechoic chamber and conducted measurement facility used to collect the radiated and conducted data is located at

Northwest EMC, Inc.
14128 339th Avenue SE
Sultan, WA 98924

This site has been fully described in a report filed with the FCC (Federal Communications Commission), and accepted by the FCC in a letter maintained in our files.

Northwest EMC, Inc. is recognized under the United States Department of Commerce, National Institute of Standards and Technology, National Voluntary Laboratory Accreditation Program (NVLAP) for satisfactory compliance with criteria established in Title 15, Part 285 Code of Federal Regulations. These criteria encompass the requirements of ISO/IEC Guide 25 and the relevant requirements of ISO 9002 (ANSI/ASQC Q92-1987) as suppliers of calibration or test results. NVLAP Lab Code: 200059-0.

2.0 System Test Configuration

2.1 Justification

2.1.1 Operating Modes

For each test, the EUT was configured for low, mid, and high band transmit frequencies. The EUT transmitted data in a PRBS format at the maximum data rate of 11 Mbps. During spurious radiated emissions testing, the spectrum was investigated from 30 MHz to 25 GHz for both antennas.

2.2 EUT Exercise Software

The software used to exercise the EUT is engineering developmental software designed to provide manual control over the transceiver functions. The software operates on a laptop computer in a Linux OS environment and commands the EUT via the PCMCIA slot on the computer. The test software is capable of the following radio control operations:

1. Set the radio to transmit continuously.
2. Set the radio operating channel.
3. Set the transmit power level.
4. Read the ADC which records the transmit power.

The Intersil Prism II chipset firmware provides a specific test command that causes the radio to transmit continuously. This test command is invoked by sending Continuous TX test command to the MAC (HFA3841). The firmware also provides a test command that is used to change the channel. The transmit power level is set by writing directly to the DAC register (CR31) on the baseband processor (HFA3861B). The TX ADC is read by reading from CR58 on the baseband processor (HFA3861B). During testing, these commands were used to set the transmit channel to either the lowest, the highest, or a middle channel in the operational band. Then the output power was set to the maximum permissible level (63 mW).

The transmitter also uses firmware from Intersil called CW10 Secondary Firmware Version 0.8, Variant 12. The firmware provides 802.11 station functionality.

The packets selected for transmission during EUT testing were the maximum packet density allowed in the 802.11 protocol to create a worst case emissions. The carrier was modulated by a PRBS at a maximum data rate

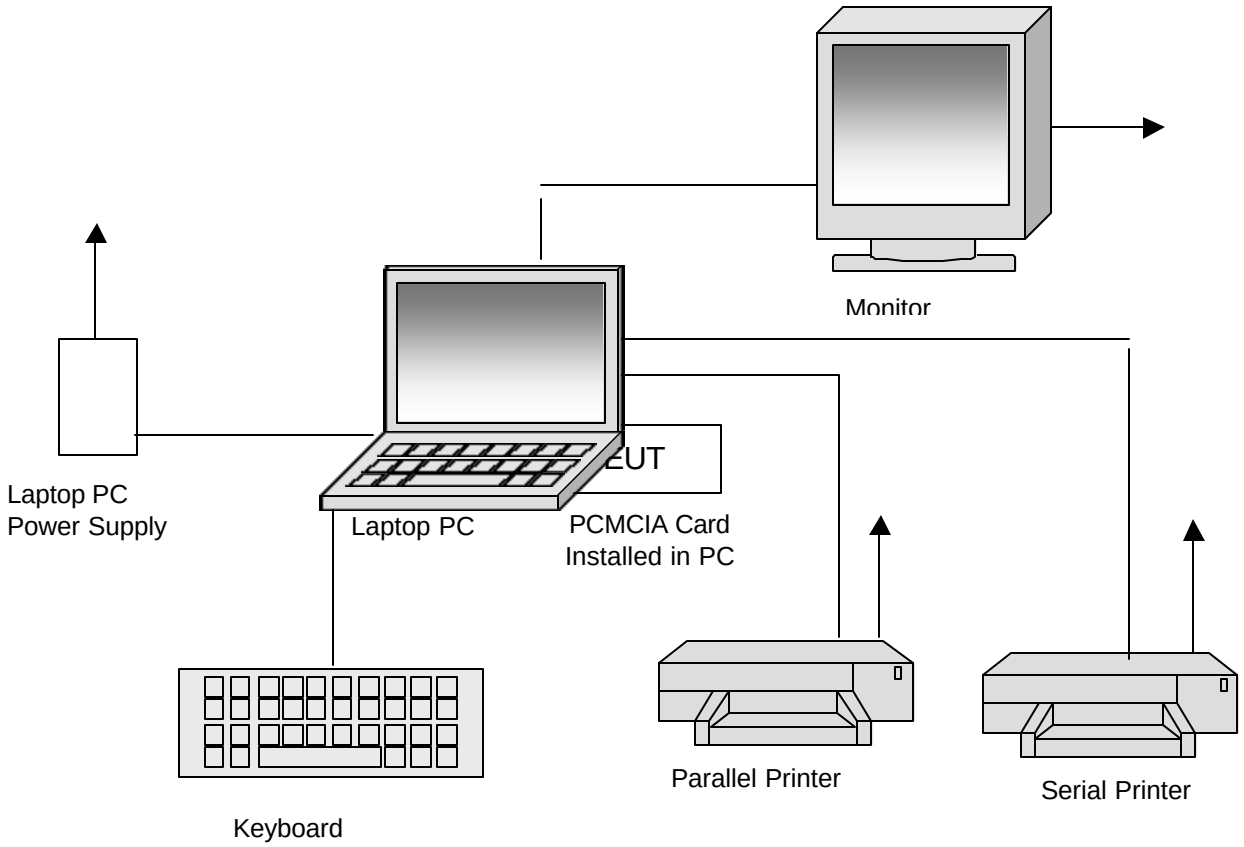
2.3 Special Accessories

None

2.4 Equipment Modifications

None.

Figure 2.1: Configuration of Tested System



3.0 Antenna Requirement

Per 47 CFR 15.203, the EUT uses antennas that are designed to ensure that no other antennas other than those that are integral to the unit will be used. The EUT uses microstrip patch antennas that are etched onto the PCB. There are no provisions for connection of other antennas.

3.1 Antenna Information

Per 47 CFR 15.204 (c), the following is a description of antennas tested with the EUT:

This device contains two microstrip patch antennas (0 & 1) that are integral to the unit. The antennas are etched onto the PCB and are identical, except that they are oriented in different polarizations, with the output of the transmitter switched between the two. It is impossible for the transmitter to simultaneously broadcast from both antennas. This application package demonstrates the compliance of this radio for both antennas. There is no provision for attachment of any other antennas.

The maximum gain for the antennas is 1.85 dBi

Please reference exhibit "W", file name "Antenna Gain Plots.pdf" for that information.

Photographs of those antennas are in exhibit "F", file name "Internal Photos.pdf"

3.2 De Facto EIRP Limit

Per 47 CFR 15.247 (b)(1-3), the EUT meets the de facto EIRP limit of +36dBm. The peak output power of the EUT is approximately 18 dBm, and the maximum gain of the antennas used with the EUT is less than 2 dBi. Therefore, the EUT's maximum EIRP is less than +20dBm.

3.3 RF Exposure Compliance Requirements

Per 47 CFR 15.247 (b)(4), the EUT meets the requirement that it be operated in a manner that ensures the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines (ref . 47 CFR 1.1307, 1.1310, 2.1091, and 2.1093. Also OET Bulletin 65, Supplement C).

The EUT will only be used in laptop and desktop computers and can therefore be considered a mobile transmitter per 47 CFR 2.1091. It will not be used in "palm-top" computers or other handheld devices. The EUT supports the use of only one antenna at a time.

The MPE estimates are as follows:

Table 1 in 47 CFR 1.1310 defines the maximum permissible exposure (MPE) for the general population as 1mW/cm^2. The distance from the EUT's transmitting antenna where the exposure level reaches the maximum permitted level is calculated using the general equation:

$$S = (PG)/4\pi R^2$$

Where: S = power density (1mW/cm^2 maximum permitted level)
P = power input to the antenna (63 mW)
G = linear power gain relative to an isotropic radiator (1.85 dBi = numeric gain of 1.53)
R = distance to the center of the radiation of the antenna

Solving for R, the 1mW/cm^2 limit is reached 2.77 cm or closer to the transmitting antenna. Therefore, no warning labels, no RF exposure warnings in the manual, or other protection measures will be used with the EUT.

3.4 AC Powerline Conducted Emissions

Requirement: Per 47 15.207(d), if the EUT is connected to the AC powerline indirectly, obtaining its power from another device that is connected to the AC powerline, then it should be tested to demonstrate compliance with the conducted limits of 15.207.

Configuration: The EUT will be powered from a host computer that could be connected to the AC power line. Therefore, the measurements were made on the host laptop PC used to power the EUT. The AC powerline conducted emissions were measured with the EUT operating at the lowest, the highest, and a middle channel in the operational band. The EUT was transmitting at its maximum data rate. For each mode, the spectrum was scanned from 450 kHz to 30 MHz. The test setup and procedures were in accordance with ANSI C63.4-1992.

Result: Per 47 CFR 15.207, the radio frequency voltage that is conducted back onto the AC power line from the EUT, on any frequency within the 450 kHz to 30 MHz band, does not exceed 250 microvolts.

The AC Powerline conducted emissions data may be referenced in Exhibit "L", file name "AC Mains Conducted Emissions.pdf".

3.5 Spurious Radiated Emissions

Requirement: The field strength of any spurious emissions or modulation products that fall in a restricted band, as defined in 47 CFR 15.205, is measured. The peak level must comply with the limits specified in 47 CFR 15.35(b). The average level (taken with a 10Hz VBW) must comply with the limits specified in 15.209.

Configuration: Each antenna to be used with the EUT was tested. The EUT was configured for low, mid, and high band transmit frequencies. For each configuration, the spectrum was scanned from 30 MHz to 25 GHz. In addition, measurements were made in the restricted band of 2.4835 to 2.5 GHz to verify compliance.

While scanning, emissions from the EUT were maximized by rotating the EUT and adjusting the measurement antenna height and polarization (per ANSI C63.4:1992). A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.

Result: The peak level complies with the limits specified in 47 CFR 15.35 (b). The average level (taken with a 10Hz VBW) complies with the limits specified in 15.209.

The final radiated data may be referenced in Exhibit "S", file name "Radiated Spurious Emissions.pdf".

3.6 Occupied Bandwidth

Requirement: Per 47 CFR 15.247(a)(2), the 6 dB bandwidth of a direct sequence channel must be at least 500kHz. The measurement is made with the spectrum analyzer's resolution bandwidth set to 100kHz, and the video bandwidth set to greater than or equal to the resolution bandwidth

Configuration: The occupied bandwidth was measured with the EUT set to low, medium, and high transmit frequencies. The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The EUT was transmitting at its maximum data rate using direct sequence modulation.

Result: Per 47 CFR 15.247(a)(2), the 6 dB bandwidth of a hopping channel is at least 500kHz. The spectrum analyzer's resolution bandwidth was 100kHz, and the video bandwidth was greater than or equal to the resolution bandwidth

The occupied bandwidth data may be referenced in Exhibit "O", file name "Occupied Bandwidth"

3.7 Peak Output Power

Requirement: Per 47 CFR 15.247(b)(1), the maximum peak output power must not exceed 1 Watt. The measurement is made using either a peak power meter, or a spectrum analyzer using the following settings:

- Resolution bandwidth set to greater than the 6 dB bandwidth of the modulated carrier, and
- The video bandwidth set to greater than or equal to the resolution bandwidth.

Configuration: The peak output power was measured with the EUT set to low, medium, and high transmit frequencies. The measurement was made using a direct connection between the RF output of the EUT and a peak power meter. The EUT was transmitting at its maximum data rate using direct sequence modulation.

Result: Per 47 CFR 15.247(b)(1), the maximum peak output power does not exceed 1 Watt.

The Peak Output Power data may be referenced in Exhibit "P",
file name "Output Power.pdf"

3.8 Spurious RF Conducted Emissions

Requirement: Per 47 CFR 15.247(c), in any 100 kHz bandwidth outside the authorized band, the maximum level of radio frequency power must be at least 20dB down from the highest emission level within the authorized band. The measurement is made with the spectrum analyzer's resolution bandwidth set to 100 kHz, and the video bandwidth set to greater than or equal to the resolution bandwidth.

Configuration: The spurious RF conducted emissions were measured with the EUT set to low, medium, and high transmit frequencies. The measurements were made using a direct connection between the RF output of the EUT and the spectrum analyzer. The EUT was transmitting at its maximum data rate using direct sequence modulation. For each transmit frequency, the spectrum was scanned from 0 MHz to 25 GHz.

Result: Per 47 CFR 15.247(c), in any 100 kHz bandwidth outside the authorized band, the maximum level of radio frequency power is at least 20dB down from the highest emission level within the authorized band. The spectrum analyzer's resolution bandwidth was 100 kHz, and the video bandwidth was greater than or equal to the resolution bandwidth.

The spurious RF conducted emissions data may be referenced in Exhibit "M", file name "Antenna Conducted Spurious Emission.pdf"

3.9 Band Edge Compliance of RF Conducted Emissions

Requirement: Per 47 CFR 15.247(c), in any 100 kHz bandwidth outside the authorized band, the maximum level of radio frequency power must be at least 20dB down from the highest emission level within the authorized band. The measurement is made with the spectrum analyzer's resolution bandwidth set to 100 kHz, and the video bandwidth set to greater than or equal to the resolution bandwidth.

Configuration: The spurious RF conducted emissions at the edges of the authorized band were measured with the EUT set to low and high transmit frequencies. The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The EUT was transmitting at its maximum data rate using direct sequence modulation. The channels closest to the band edges were selected. The spectrum was scanned across each band edge from 5 MHz below the band edge to 5 MHz above the band edge.

Result: Per 47 CFR 15.247(c), in any 100 kHz bandwidth outside the authorized band, the maximum level of radio frequency power is at least 20dB down from the highest emission level within the authorized band. The spectrum analyzer's resolution bandwidth was 100 kHz and the video bandwidth was greater than or equal to the resolution bandwidth.

The data for spurious RF conducted emissions at the edges of the authorized band may be referenced in Exhibit "N", file name "Band Edge Compliance.pdf"

4.0 Power Spectral Density

Requirement: Per 47 CFR 15.247(d), the peak power spectral density conducted from the antenna port of a direct sequence transmitter must not be greater than +8 dBm in any 3 kHz band during any time interval of continuous transmission.

Configuration: The peak power spectral density measurements were measured with the EUT set to low, mid, and high transmit frequencies. The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The EUT was transmitting at its maximum data rate using direct sequence modulation. Per the procedure outlined in FCC 97-114, the spectrum analyzer was used as follows:

> The emission peak(s) were located and zoom in on within the passband. The resolution bandwidth was set to 3 kHz, the video bandwidth was set to greater than or equal to the resolution bandwidth. The sweep speed was set equal to the span divided by 3 kHz (sweep = (SPAN/3 kHz)). For example, given a span of 1.5 MHz, the sweep should be $1.5 \times 10^6 \div 3 \times 10^3 = 500$ seconds. External attenuation was used and added to the reading. The following FCC procedure was used for modifying the power spectral density measurements:
>
> *"If the spectrum line spacing cannot be resolved on the available spectrum analyzer, the noise density function on most modern conventional spectrum analyzers will directly measure the noise power density normalized to a 1 Hz noise power bandwidth. Add 34.7 dB for correction to 3 kHz*."

Result: Per 47 CFR 15.247(d), the peak power spectral density conducted from the antenna port of the EUT is not greater than +8 dBm in any 3 kHz band during any time interval of continuous transmission. Data was taken using the 1 Hz noise power bandwidth on an Tektronix 2784 spectrum analyzer. The data sheets referenced below includes the 34.7 dB correction to 3 kHz. The cable loss and external attenuation were corrected internal to the spectrum analyzer.

The data for Power Spectral Density may be referenced in Exhibit "Q", file name "Power Spectral Density.pdf"

4.1 Processing Gain

Processing gain measurements were performed in accordance with the definitions, calculations, and explanation in the test report provided by NextComm Inc., found in Exhibit R, file name “Processing Gain Report.pdf” .

4.2 Field Strength Calculations

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured level. The basic equation with a sample calculation is as follows:
FS = RA + AF + CF - AG

where : FS = Field Strength

RA = Measured Level

AF = Antenna Factor

CF = Cable Attenuation Factor

AG = Amplifier Gain

Assume a receiver reading of 52.5 dBuV is obtained. The Antenna Factor of 7.4 and a Cable Factor of 1.1 is added. The Amplifier Gain of 29 dB is subtracted, giving a field strength of 32 dBuV/meter.

FS = 52.5 + 7.4 + 1.1 - 29 = 32 dBuV/meter
Level in uV/m = Common Antilogarithm [(32 dBuV/m)/20] = 39.8 uV/m

4.3 Measurement Bandwidths

Resolution Bandwidth

Peak Data

150 kHz - 30 MHz ..... 10 kHz
30 MHz - 1000 MHz ..... 100 kHz
1000 MHz - 25000 MHz ..... 1000 kHz

Quasi-peak Data

150 kHz - 30 MHz ..... 9 kHz
30 MHz - 1000 MHz ..... 120 kHz

Average Data.

1000 MHz - 25000 MHz ..... 1000 kHz

Video Bandwidth

The video bandwidth was greater than or equal to the resolution bandwidth for all measurement data except average measurements:

Average Data.

1000 MHz - 25000 MHz ..... 10 Hz

5.0 Measurement Equipment

Instrument	Manufacturer	Model	Serial No	Cal Due
Spectrum Analyzer	Hewlett-Packard	8566B	2747A05213	2/19/2001
Pre-Amplifier	Amplifier Research	LN1000A	25660	12/4/2001
Antenna, Biconilog	EMCO	3141	9906-1146	12/14/2001
Antenna, Horn	EMCO	3115	9804-5441	7/17/2001
Pre-Amplifier 0.5-18 GHz	Miteq	AMF-4D-005180-24-10P	621707	7/7/2001
Spectrum Analyzer	Tektronix	2784	B010105	3/18/2001
Pre-Amplifier 18-26 GHz	Miteq	JSD4-18002600-26-8P	577858	4/10/2001
Antenna, Horn	EMCO	3160-09	9911-1189	01/15/2003
High Pass Filter	Microlab	FXR HD-40N	8402	4/10/2001
Power Meter	Hewlett-Packard	435B	2702A15817	7/10/01
Power Sensor	Hewlett-Packard	8481H	2349A07714	7/10/01