NVLAP Lab Code 200087-0

SUBMITTAL APPLICATION REPORT

For Class 2 Permissible Changes

Grant of Certification

FOR

Model: XR2
2412.0 - 2462.0 MHz
Broadband Digital Transmission System
FCC ID: XAG-XR2

FOR

Netkrom Technologies Inc.

2134 NW 99th Ave.

Miami, FL 33122

Test Report Number: 090814

Authorized Signatory: Scot D Rogers
Scot D. Rogers

NVLAP Lab Code 200087-0

ROGERS LABS, INC.

4405 West 259th Terrace
Louisburg, KS 66053
Phone / Fax (913) 837-3214

ENGINEERING TEST REPORT
FOR
CLASS 2 PERMISSIVE CHANGE

FOR

CFR47, PART 15C - INTENTIONAL RADIATORS
Paragraph 15.247
Low Power License Exempt Intentional Radiator

For

Netkrom Technologies Inc.
2134 NW 99th Ave.
Miami, FL 33122

Model: XR2
Broadband digital Transmission System
Frequency Range 2412.0 - 2462.0 MHz
FCC ID#: XAG-XR2

Test Date: August 14, 2009

Certifying Engineer: Scot D Rogers

Scot D. Rogers
Rogers Labs, Inc.
4405 West 259th Terrace
Louisburg, KS 66053
Telephone/Facsimile: (913) 837-3214

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This report documents the supporting information for requesting a Class 2 permissible change to certified equipment. The request offers alternate antenna structure for use with the certified equipment. The electromagnetic emissions compatibility tests required for demonstration of continued compliance with the CFR47 Dated October 1, 2008, Paragraphs 2.1043, and 15.247 have been conducted on the XR2. The results have been reviewed and found to comply with all the requirements investigated for this report.

Name of Applicant:

Netkrom Technologies Inc.
2134 NW 99th Ave.
Miami, FL 33122

Model: XR2

FCC I.D.: XAG-XR2
Frequency Range: 2412.0 – 2462.0 MHz.

Operating Power: 0.977 Watts antenna conducted power
Frequency Range: 2412.0 – 2462.0 MHz.

Opinion / Interpretation of Results

Tests Performed	Results
Emissions Tests	
Emissions as per CFR47 paragraphs 2 and 15.205	Complies
Emissions as per CFR47 paragraphs 2 and 15.247	Complies

Environmental Conditions

Ambient Temperature	22.4° C
Relative Humidity	51%
Atmospheric Pressure	1014.6 mb

Equipment Tested

Equipment	Model	FCC I.D.#
EUT	XR2	XAG-XR2

2.1033(b) Application for Certification

(1) Manufacturer: Netkrom Technologies Inc.
2134 NW 99th Ave.
Miami, FL 33122

(2) Identification: Model: XR2
FCC I.D.: XAG-XR2

(3) Instruction Book: Refer to Exhibit for Instruction Manual.

(4) Description of Circuit Functions:
Refer to original submittal Exhibit of Operational Description.

(5) Block Diagram with Frequencies:
Refer to original submittal Exhibit of Operational Description.

(6) Report of Measurements:
Report of measurements in support of change follows in this Report. Refer to original submittal exhibits for additional information.

(7) Photographs: Construction, Component Placement, etc.:
Refer to original submittal Exhibit for photographs of equipment.

(8) Peripheral Equipment included interfacing with a computer network system and Power Over Ethernet (POE) AC/DC power adapter.

(9) Transition Provisions of 15.37 are not being requested.

(10) Not Applicable. The unit is not a scanning receiver.

(11) Not Applicable. The EUT does not operate in the 59 – 64 GHz frequency band.

Applicable Standards & Test Procedures

In accordance with the Federal Communications Code of Federal Regulations, dated October 1, 2008, Part 2, Subpart J, Paragraphs 2.907, 2.911, 2.913, 2.925, 2.926, 2.1043, and applicable parts of paragraph 15, and Part 15C Paragraph 15.247, the following information is submitted.

Test procedures used are the established Methods of Measurement of Radio-Noise Emissions as described in the ANSI 63.4-2003 Document FCC, documents DA00-1407 and DA00-705 and/or TIA/EIA 603-1.

Equipment Function and Testing Procedures

The EUT is a broad band digital transmission system operating in 2400-2483.5 MHz frequency band used to transmit data in applications offering broadband wireless connectivity. The unit is marketed for use to incorporate a wireless link to exchange data information from one point to another. For testing purposes the XR2 transceiver was connected to each antenna configuration and operated for testing purposes. The device is marketed for professionally installed use and the additional antenna continues to demonstrate compliance with requirements.

Change to Equipment

The change to the equipment in relation to the original equipment submittal includes increasing the antenna options available for use. Testing was performed to verify the equipment continues to comply with all the applicable rules and requirements of the CFR47. Testing confirmed the changes made do not degrade the characteristics allowable and acceptable by the Commission. No change to transmitter or other specifications were affected by the antenna change.

Antennas covered in this report include

2.4 GHz Antennas	
24 dBi (Grid Dish)	W24-24G

Equipment and Cable Configurations

Radiated Emission Test Procedure

The EUT was placed on a rotating 1 x 1.5-meter wooden platform, 0.8 meters above the ground plane at a distance of 3 meters from the FSM antenna. EMI energy was maximized by equipment placement, raising and lowering the FSM antenna, changing the antenna polarization, and by rotating the turntable. Each emission was maximized before data was taken using a spectrum analyzer. Refer to photographs in the exhibits for EUT placement.

List of Test Equipment

A Rohde & Schwarz ESU40 and or Hewlett Packard 8591EM Spectrum Analyzer was used as the measuring device for the emissions testing of frequencies below 1 GHz. A Rohde & Schwarz ESU40 and or Hewlett Packard 8562A Spectrum Analyzer was used as the measuring device for testing the emissions at frequencies above 1 GHz. The analyzer settings used are described in the following table. Refer to the appendix for a complete list of test equipment.

Analyzer Settings		
Conducted Emissions:		
RBW	AVG. BW	Detector Function
9 kHz	30 kHz	Peak / Quasi Peak
Radiated Emissions:		
RBW	AVG. BW	Detector Function
120 kHz	300 kHz	Peak / Quasi Peak
Analyzer Settings		
RBW	Video BW	Detector Function
100 kHz	100 kHz	Peak
1 MHz	1 MHz	Peak / Average

Equipment	Manufacturer	Model	Calibration	Due
LISN	Comp. Design	FCC-LISN-2-MOD.CD	10/09	10/09
Antenna	ARA	BCD-235-B	10/09	10/09
Antenna	EMCO	3147	10/09	10/09
Antenna	EMCO	3143	5/10	5/10
Analyzer	Rohde & Schwarz	ESU40	2/10	2/10
Analyzer	HP	8591EM	5/10	5/10
Analyzer	HP	8562A	5/10	5/10

Units of Measurements

Conducted EMI — Data is in dBµV; dB referenced to one microvolt.

Radiated EMI — Data is in dBµV/m; dB/m referenced to one microvolt per meter.

Test Site Locations

Conducted EMI	The AC power line conducted emissions tests were performed in a shielded screen room located at Rogers Labs, Inc., 4405 W. 259th Terrace, Louisburg, KS.
Radiated EMI	The radiated emissions tests were performed at the 3 meters, Open Area Test Site (OATS) located at Rogers Labs, Inc., 4405 W. 259th Terrace, Louisburg, KS.
Site Registration	Refer to Appendix for FCC Site Registration Letter, Reference # 90910

Subpart C – Intentional Radiators

Radiated EMI

The EUT was arranged in a typical equipment configuration and operated through all available modes with worst-case data recorded. Radiated emissions measurements were performed to identify the frequencies, which produced the highest emissions. The highest radiated emission was maximized at the OATS location before final radiated emissions measurements were performed. Final data was taken with the EUT located at the OATS at a distance of 3 meters between the EUT and the receiving antenna. The frequency spectrum from 30 MHz to 25,000 MHz was searched for radiated emissions. Measured emission levels were maximized by EUT placement on the table, rotating the turntable through 360 degrees, varying the antenna height between 1 and 4 meters above the ground plane and changing antenna position between horizontal and vertical polarization. Antennas used were Broadband Biconical from 30 to 200 MHz, Biconilog from 30 to 1000 MHz, Log Periodic from 200 MHz to 5 GHz and or, pyramidal horns and mixers from 4 GHz to 60 GHz, notch filters and appropriate amplifiers were utilized.

Sample Calculations:

RFS = Radiated Field Strength
dBµV/m @ 3 m = dBµV + A.F. - Amplifier Gain
dBµV/m @ 3 m = 19.4 + 32.9 - 20
= 32.3

Data: 2.4 GHz Transmitter Radiated Emissions 24 dBi Grid

Frequency in MHz	FSM Horz. (dBµV)	FSM Vert. (dBµV)	A.F. (dB/m)	Amp. Gain (dB)	RFS Horz. @ 3 m (dBµV/m)	RFS Vert. @ 3 m (dBµV/m)	FCC Class B Limit @ 3 m (dBµV/m)
4824.0	19.4	26.5	32.9	20	32.3	39.4	54.0
7236.0	17.8	17.9	36.4	20	34.2	34.3	54.0
9648.0	17.9	17.5	38.1	20	36.0	35.6	54.0
12060.0	17.6	17.6	40.0	20	37.6	37.6	54.0
4884.0	20.2	30.1	32.9	20	33.1	43.0	54.0
7326.0	18.6	18.7	36.4	20	35.0	35.1	54.0
9768.0	17.8	17.9	38.2	20	36.0	36.1	54.0
12210.0	17.2	17.4	40.4	20	37.6	37.8	54.0
4924.0	20.7	27.1	32.9	20	33.6	40.0	33.1
7386.0	18.5	19.6	36.4	20	34.9	36.0	28.6
9848.0	17.4	18.6	38.3	20	35.7	36.9	29.3
12310.0	17.7	17.7	40.5	20	38.2	38.2	33.3
Band Edge							
2400.0	19.8	21.6	28.1	20	27.9	29.7	54.0
2483.5	19.1	20.4	28.1	20	27.2	28.5	54.0
Restricted Bands of Operation							
2390.0	19.4	20.0	28.1	20	27.6	28.1	54.0
4824.0	20.2	26.5	32.9	20	32.3	39.4	54.0
4884.0	20.7	30.1	32.9	20	33.1	43.0	54.0
4924.0	17.8	27.1	32.9	20	33.6	40.0	54.0
7236.0	18.6	17.9	36.4	20	34.2	34.3	54.0
7326.0	18.5	18.7	36.4	20	35.0	35.1	54.0
7386.0	17.6	19.6	36.4	20	34.9	36.0	54.0
12060.0	17.2	17.6	40.0	20	37.6	37.6	54.0
12210.0	17.7	17.4	40.4	20	37.6	37.8	54.0
12310.0	19.4	17.7	40.5	20	38.2	38.2	54.0

Other emissions present had amplitudes at least 20 dB below the limit.

Summary of Results for Radiated Emissions

The EUT demonstrated compliance with the general radiated emissions requirements of CFR47 paragraph 15.247. The EUT demonstrated a worst-case margin below the limit of 11.0 dB for the harmonic emissions. The EUT demonstrated a worst-case margin below the limit of 11.0 dB for the restricted bands of operation. There are no measurable emissions in the restricted bands with amplitudes less than 20 dB below requirements other than those recorded in this report. Other emissions were present with amplitudes at least 20 dB below the limits. The specifications of 15.247 were met; there are no deviations or exceptions to the requirements.

Statement of Modifications and Deviations

No modifications to the EUT were required for the unit to demonstrate compliance with the requirements of CFR47 15C requirements. There were no deviations or exceptions to the specifications.

Annex

- Annex A Measurement Uncertainty Calculations
- Annex B Test Equipment List
- Annex C Rogers Qualifications
- Annex D FCC Site Registration Letter

Annex A Measurement Uncertainty Calculations

Radiated Emissions Measurement Uncertainty Calculation

Measurement of vertically polarized radiated field strength over the frequency range 30 MHz to 1 GHz on an open area test site at 3m and 10m includes following uncertainty:

Contribution	Probability Distribution	Uncertainty (dB)
Antenna factor calibration	normal (k = 2)	±0.58
Cable loss calibration	normal (k = 2)	±0.2
Receiver specification	rectangular	±1.0
Antenna directivity	rectangular	±0.1
Antenna factor variation with height	rectangular	±2.0
Antenna factor frequency interpolation	rectangular	±0.1
Measurement distance variation	rectangular	±0.2
Site Imperfections	rectangular	±1.5

Combined standard uncertainty $u_c(y)$ is

$$U_c(y) = \pm \sqrt{\left[\frac{1.0}{2}\right]^2 + \left[\frac{0.2}{2}\right]^2 + \left[\frac{1.0^2 + 0.1^2 + 2.0^2 + 0.1^2 + 0.2^2 + 1.5^2}{3}\right]}$$

$U_c(y) = \pm 1.6$ dB

It is probable that $u_c(y) / s(q_k) > 3$, where $s(q_k)$ is estimated standard deviation from a sample of n readings unless the repeatability of the EUT is particularly poor, and a coverage factor of k = 2 will ensure that the level of confidence will be approximately 95%, therefore:

$$s(q_k) = \sqrt{\frac{1}{(n-1)} \sum_{k-1}^{n} (q_k - \bar{q})^2}$$

$U = 2\ U_c(y) = 2 \times \pm 1.6$ dB $= \pm 3.2$ dB

Notes:

1.1 Uncertainties for the antenna and cable were estimated, based on a normal probability distribution with k = 2.

1.2 The receiver uncertainty was obtained from the manufacturer's specification for which a rectangular distribution was assumed.

1.3 The antenna factor uncertainty does not take account of antenna directivity.

1.4 The antenna factor varies with height and since the height was not always the same in use as when the antenna was calibrated an additional uncertainty is added.

1.5 The uncertainty in the measurement distance is relatively small but has some effect on the received signal strength. The increase in measurement distance as the antenna height is increased is an inevitable consequence of the test method and is therefore not considered a contribution to uncertainty.

1.6 Site imperfections are difficult to quantify but may include the following contributions:
-Unwanted reflections from adjacent objects.
-Ground plane imperfections: reflection coefficient, flatness, and edge effects.
-Losses or reflections from "transparent" cabins for the EUT or site coverings.
-Earth currents in antenna cable (mainly effect biconical antennas).

The specified limits for the difference between measured site attenuation and the theoretical value (± 4 dB) were not included in total since the measurement of site attenuation includes uncertainty contributions already allowed for in this budget, such as antenna factor.

Conducted Measurements Uncertainty Calculation

Measurement of conducted emissions over the frequency range 9 kHz to 30 MHz includes following uncertainty:

Contribution	Probability Distribution	Uncertainty (dB)
Receiver specification	rectangular	±1.5
LISN coupling specification	rectangular	±1.5
Cable and input attenuator calibration	normal (k=2)	±0.5

Combined standard uncertainty $u_c(y)$ is

$$U_c(y) = \pm \sqrt{\left[\frac{0.5}{2}\right]^2 + \frac{1.5^2 + 1.5^2}{3}}$$

$U_c(y) = \pm 1.2$ dB

As with radiated field strength uncertainty, it is probable that $u_c(y) / s(q_k) > 3$ and a coverage factor of k = 2 will suffice, therefore:

$U = 2\ U_c(y) = 2 \times \pm 1.2$ dB $= \pm 2.4$ dB

Annex B Test Equipment List For Rogers Labs, Inc.

The test equipment used is maintained in calibration and good operating condition. Use of this calibrated equipment ensures measurements are traceable to national standards.

List of Test Equipment	Calibration Date
Oscilloscope Scope: Tektronix 2230	2/09
Wattmeter: Bird 43 with Load Bird 8085	2/09
Power Supplies: Sorensen SRL 20-25, SRL 40-25, DCR 150, DCR 140	2/09
H/V Power Supply: Fluke Model: 408B (SN: 573)	2/09
R.F. Generator: HP 606A	2/09
R.F. Generator: HP 8614A	2/09
R.F. Generator: HP 8640B	2/09
Spectrum Analyzer: Rohde & Schwarz ESU40	2/09
Spectrum Analyzer: HP 8562A, Mixers: 11517A, 11970A, 11970K, 11970U, 11970V, 11970W HP Adapters: 11518, 11519, 11520	5/09
Spectrum Analyzer: HP 8591EM	5/09
Frequency Counter: Leader LDC825	2/09
Antenna: EMCO Biconilog Model: 3143	5/09
Antenna: EMCO Log Periodic Model: 3147	10/08
Antenna: Antenna Research Biconical Model: BCD 235	10/08
Antenna: EMCO Dipole Set 3121C	2/09
Antenna: C.D. B-101	2/09
Antenna: Solar 9229-1 & 9230-1	2/09
Antenna: EMCO 6509	2/09
Audio Oscillator: H.P. 201CD	2/09
R.F. Power Amp 65W Model: 470-A-1010	2/09
R.F. Power Amp 50W M185- 10-501	2/09
R.F. PreAmp CPPA-102	2/09
LISN 50 µHy/50 ohm/0.1 µf	10/08
LISN Compliance Eng. 240/20	2/09
LISN Fischer Custom Communications FCC-LISN-50-16-2-08	2/09
Peavey Power Amp Model: IPS 801	2/09
Power Amp A.R. Model: 10W 1010M7	2/09
Power Amp EIN Model: A301	2/09
ELGAR Model: 1751	2/09
ELGAR Model: TG 704A-3D	2/09
ESD Test Set 2010i	2/09
Fast Transient Burst Generator Model: EFT/B-101	2/09
Current Probe: Singer CP-105	2/09
Current Probe: Solar 9108-1N	2/09
Field Intensity Meter: EFM-018	2/09
KEYTEK Ecat Surge Generator	2/09

NVLAP Lab Code 200087-0

Annex C Qualifications

Scot D. Rogers, Engineer

Rogers Labs, Inc.

Mr. Rogers has approximately 17 years experience in the field of electronics. Six years working in the automated controls industry and 6 years working with the design, development and testing of radio communications and electronic equipment.

Positions Held:

Systems Engineer: A/C Controls Mfg. Co., Inc. 6 Years

Electrical Engineer: Rogers Consulting Labs, Inc. 5 Years

Electrical Engineer: Rogers Labs, Inc. Current

Educational Background:

Bachelor of Science Degree in Electrical Engineering from Kansas State University

Bachelor of Science Degree in Business Administration Kansas State University

Several Specialized Training courses and seminars pertaining to Microprocessors and Software programming

Scot D Rogers

Scot D. Rogers

NVLAP Lab Code 200087-0

Annex D FCC Site Registration Letter

FEDERAL COMMUNICATIONS COMMISSION

Laboratory Division
7435 Oakland Mills Road
Columbia, MD 21046

June 18, 2008

Registration Number: 90910

Rogers Labs, Inc.
4405 West 259th Terrace,
Louisburg, KS 66053

Attention: Scot Rogers

Re: Measurement facility located at Louisburg
3 & 10 meter site
Date of Renewal: June 18, 2008

Dear Sir or Madam:

Your request for renewal of the registration of the subject measurement facility has been received. The information submitted has been placed in your file and the registration has been renewed. The name of your organization will remain on the list of facilities whose measurement data will be accepted in conjunction with applications for Certification under Parts 15 or 18 of the Commission's Rules. Please note that the file must be updated for any changes made to the facility and the registration must be renewed at least every three years.

Measurement facilities that have indicated that they are available to the public to perform measurement services on a fee basis may be found on the FCC website www.fcc.gov under E-Filing, OET Equipment Authorization Electronic Filing, Test Firms.

Sincerely,

Phyllis Parrish
Industry Analyst