EXHIBIT V – Northwest EMC Test Report for Antenna

FCC ID# PGU3021-100

Measurement/Technical Report

Welch Allyn Protocol, Inc.

Propaq G Series Wireless Option

FCC ID: PGU3021-100

September 5, 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
Welch Allyn Protocol, 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:	Northwest EMC, Inc. 22975 NW Evergreen Pkwy., Ste 400 Hillsboro, OR 97124 (503) 844-4066 fax: (503) 844-3826
Report No. PROT0166	

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1.0 General Information

1.1 Product Description

Manufactured By ..... Welch Allyn Protocol, Inc.

Address ..... 8500 S.W. Creekside Place, Beaverton, Oregon 97008-7107, USA

Test Requested By:..... Steve Baker

Model.....Propaq G Series Wireless Option

FCC ID PGU3021-100

Serial Number(s) ..... none

Date of Test..... September 4 - 5, 2001

Job Number.....PROT0166

Prepared By:

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Approved By:

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1.1 Product Description con't

The Equipment Under Test (EUT) is the Symbol LA3021-100-US WLAN PC Card Module used in the Welch Allyn Protocol, Inc. Propaq G Series Wireless Option. It operates from 2402 – 2480 MHz (center frequency to center frequency), with a peak output power of 112 mW. It is a spread spectrum transmitter that utilizes frequency hopping techniques. This RF module is compliant with IEEE 802.11 specifications, and will be used only in the applicant's patient monitors as a mobile transmitter.

The EUT can be configured with one antenna (microstrip, RangeStar , P/N 100902) that is installed inside the patient monitor and is not user accessible. This technical report (Northwest EMC technical report) and associated spurious emissions data are supplied in support of this antenna.

Symbol was previously granted certification for this same radio (FCC ID: H9PLA3021-100), but it did not include the RangeStar 100902 antenna. The applicant will OEM this radio from Symbol, but is seeking their own grant of certification that includes the RangeStar antenna. The applicant is not seeking to modify or alter the Symbol grant in any way.

A separate technical report prepared by ITS for the Symbol application documents compliance of the radio. The applicant certifies that the radios described in both technical reports are identical.

1.2 Related Submittals/Grants

Radio was previously granted certification under FCC ID H9PLA3021-100. The applicant is using this same radio with a new antenna (documented in this application - RangeStar 100902)

1.3 Tested System Details

EUT and Peripherals

Item	FCC ID	Description and Serial No.
EUT	PGU3021-100	Welch Allyn Protocol, Inc., Propaq G Series Wireless Option, Spread Spectrum Transmitter, S/N none
Notebook PC	HFSB93P	AST Ascentia 800N, S/N 01356
AC Adapter for PC	none	AST ADP-BK, S/N 94483824

Cables

Cable Type	Shield	Length (meters)	Ferrite	Connection Point 1	Connection Point 2
AC Power	No	2	No	AC Adapter for PC	AC mains
DC Power	No	1	No	AC Adapter for PC	DC input of PC

1.4 Test Methodology

Radiated testing was performed according to the procedures in ANSI C63.4 (1992) and DA 00-705. 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.
22975 NW Evergreen Pkwy., Ste 400
Hillsboro, OR 97124
(503) 844-4066
Fax: 844-3826

The semi-anechoic chamber, and conducted measurement facility is located in Hillsboro, OR, at the address shown above. 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.

3.0 System Test Configuration

3.1 Justification

3.1.1 Operating Modes

All operating modes of the EUT were investigated. During spurious emissions testing, the carrier was put into a no-hop mode while being modulated with a PRBS signal at the maximum data rate. In this configuration, the EUT was tested at low, mid, and high transmit frequencies.

3.1.2 Test Configuration

This technical report and associated data are intended to document compliance of the microstrip antenna made by RangeStar, P/N 100902. The EUT and antenna will be installed inside the patient monitor and will not be user accessible. However, due to software constraints, the radio could not be put into a no-hop mode when installed in the patient monitor. The test software is designed to work only in a personal computer. Therefore, a laptop with a compatible PC Card slot was used as the host device. All of the antenna, and a portion of the card was exposed. During radiated emissions testing, the laptop was oriented in all three orthogonal axes to maximize the level of emissions. Due to the lack of shielding, it was determined that the laptop presented a much worse-case condition for the operation of the EUT than the patient monitor it will be used in.

3.2 EUT Exercise Software

The test software used to exercise the EUT is Bench-24, Ver. 2.77. It is engineering developmental software designed to provide manual control over the transmitter functions. The software operates on a laptop computer in a DOS environment and commands the EUT via the PC Card slot on the computer.

The EUT firmware is SLA_FW.BIN Ver. 2.16.

The carrier was modulated by a PRBS at a maximum data rate to create worse case emissions.

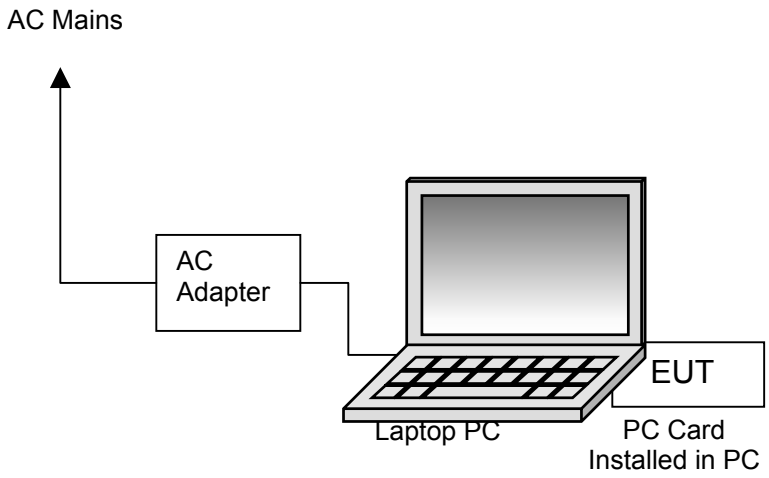
3.3 Special Accessories

None

3.4 Equipment Modifications

None.

Figure 3.1: Configuration of Tested System



4.0 Antenna Requirement

Per 47 CFR 15.203, the EUT uses antennas that are designed to ensure that no other antennas other than those supplied by Intel will be used with the device.

The EUT and antenna will be installed inside the patient monitor and will not be user accessible.

Details about the antenna may be referenced in exhibit "A", file name "Antenna Description.pdf", and in exhibit "U" External Photos of EUT & Antenna installed in Host Unit.pdf"

4.1 Antenna Information

Per 47 CFR 15.204 (c), a list of antennas tested with the EUT is provided. The type, manufacturer, model number, and gain with reference to an isotropic radiator is given.

Details about the antenna may be referenced in exhibit "A", file name "Antenna Description.pdf"

4.2 Frequency Hopping System

Per 47 CFR 15.247(a), a description of how the EUT meets the definition (found in 47 CFR 2.1) of a frequency hopping spread spectrum system is provided.

The description includes the number of hopping frequencies, the time of occupancy (dwell time) per hopping channel, and an explanation of how the hopping sequence is generated (an example is provided of the hopping channel sequence). Also, a description of how the EUT's hopping channels are used equally on average is provided.

In an effort to avoid the simultaneous occupancy of individual hopping frequencies by multiple transmitters; a description is provided of how the EUT does not have the ability to coordinate with other frequency hopping systems.

Please reference the first page of exhibit "I", file name "Theory of Operation.pdf" for that information

4.3 Frequency Hopping Receiver

Per 47 CFR 15.247 (a)(1), a description is provided of how the EUT's associated receiver complies with the requirement that the input bandwidth matches the hopping channel bandwidth of the transmitter, and shifts frequencies in synchronization with the transmitted signals.

Please reference the first page of exhibit "I", file name "Theory of Operation.pdf" for that information

4.4 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 20.5 dBm, and the maximum gain of the antenna to be used with the EUT is +2 dBi. Therefore, the EUT's maximum EIRP is +22.5 dBm.

4.5 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 be used only in the applicant's patient monitors and can therefore be considered a mobile transmitter per 47 CFR 2.1091. The EUT supports the connection 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 (112 mW)
G = linear power gain relative to an isotropic radiator (2dBi = numeric gain of 1.58)
R = distance to the center of the radiation of the antenna

Solving for R, the $1mW/cm^2$ limit is reached 3.76 cm or closer to the transmitting antenna.

On page 4 of the **User Manual Addendum for Radio**, it states the following warning:

> "The radio in this monitor has been authorized by the FCC for mobile use only. Mobile use as defined by the FCC is for operation 20 cm or more away from a person's head or torso. The distance does not apply to transient exposure due to incidental passage closer than the maximum permissible exposure (MPE) limit."

4.6 Spurious Radiated Emissions

The field strength of any spurious emissions or modulation products that fall in a restricted band, as defined in 47 CFR 15.205, was measured. 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.

While scanning, emissions from the EUT were maximized by rotating the EUT, adjusting the measurement antenna height and polarization, and manipulating the EUT antenna in 3 orthogonal planes (per ANSI C63.4:1992). A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.

4.6.1 Results

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.

Since the dwell time per channel of the hopping signal was less than 100 ms, the readings obtained with the 10 Hz VBW were further reduced by a "duty cycle correction factor" of 20 dB, derived from 20log(dwell time/100ms). The maximum dwell time during any 100mS was measured to be 10mS.

Band-edge compliance for peak emissions in the restricted band of 2.4835 GHz to 2.5 GHz was confirmed by using the "marker-delta" method described in FCC Public Notice DA 00-705:

1. In-band peak and average field strength levels of the fundamental were measured in both polarities.
2. Amplitude delta between the fundamental and highest band-edge emission was measured in both polarities.
3. For each polarity, the amplitude delta from step #2 was subtracted from the peak and average field strength levels of step #1. The resultant field strength levels were used to determine compliance of peak and average emissions with band-edge requirements.

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

The dwell time data may be referenced in Exhibit "O", file name "Dwell Time.pdf"

4.7 Spurious RF Conducted Emissions

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 in a no-hop mode with a modulated carrier. For each mode, the spectrum was scanned from 0 MHz to 25 GHz.

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 Conducted Spurious Emissions data may be referenced in Exhibit "N", file name "Antenna Conducted Spurious Emissions.pdf""

5.0 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

5.1 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

6.0 Measurement Equipment

Instrument	Manufacturer	Model	Serial No	Cal Due
Spectrum Analyzer	Hewlett-Packard	8566B	2747A05213	02/19/2002
Pre-Amplifier	Amplifier Research	LN1000A	25660	12/04/2001
Antenna, Biconilog	EMCO	3141	9906-1146	12/14/2001
Antenna, Horn	EMCO	3115	9804-5441	07/17/2002
Pre-Amplifier 0.5-18 GHz	Miteq	AMF-4D-005180-24-10P	621707	07/07/2002
Spectrum Analyzer	Tektronix	2784	B010105	03/18/2002
Pre-Amplifier 18-26 GHz	Miteq	JSD4-18002600-26-8P	577858	04/10/2002
Antenna, Horn	EMCO	3160-09	9911-1189	01/15/2003
High Pass Filter	RLC Electronics	-100-4000-5-R	0430	04/10/2002