Conquest™ DE

by Sensors & Software Inc.

Transducer Module

USER'S GUIDE

s u b s u r f a c e i m a g i n g s o l u t i o n s

Sensors & Software Inc.
1040 Stacey Court
Mississauga, ON L4W 2X8 Canada

Tel: (905) 624-8909
Fax: (905) 624-9365

E-mail: sales@sensoft.ca
Website: www.sensoft.ca

SENSORS & SOFTWARE INC. PRODUCT LICENCE, COPYRIGHT, LIABILITY AND WARRANTY INFORMATION

Important

Please read this document carefully before removing the *SOFTWARE PRODUCT* storage media from their protective cover or assembling the *HARDWARE PRODUCT*. By removing the storage media or assembling the hardware, you are agreeing to be bound by the terms of this agreement. If you do not agree to the terms of this agreement, promptly contact Sensors & Software, Inc. at the address indicated at the end of this document.

Definition

The word *PRODUCT* as used herein defines any tangible item sold by Sensors & Software, Inc. and may be comprised of *HARDWARE PRODUCT* which consists of physical objects and *SOFTWARE PRODUCT* which means computer programs, codes and related support materials.

Software Product Licence Agreement

In order to preserve and protect its rights under the applicable laws, Sensors & Software, Inc. (hereafter S&S) does not sell any rights to its Software product. Rather, S&S grants the right to use its software, diskettes (or other storage media) and documentation (hereafter collectively called *SOFTWARE PRODUCT*) by means of a *SOFTWARE PRODUCT* licence. You acknowledge and agree that S&S retains worldwide title and rights to all its software and that the *SOFTWARE PRODUCT* contains proprietary materials protected under copyright, trademark and trade secret laws.

Grant of Software Product Licence

In consideration of payment of the licence fee which is the price you pay for the *SOFTWARE PRODUCT* and your agreement to abide by the terms and conditions of this Licence Agreement, S&S grants to you, the Licensee, a non-exclusive right to use the SOFTWARE PRODUCT under the following conditions:

You may:

- use the *SOFTWARE PRODUCT* on a single workstation owned, leased or otherwise controlled by you
- copy the *SOFTWARE PRODUCT* for backup purposes in support of your use of the product on a single workstation

You may not:

- copy, distribute or sell copies of the SOFTWARE PRODUCT or accompanying written materials, including modified or merged *SOFTWARE PRODUCT* to others
- sell, licence, sublicence, assign or otherwise transfer this licence to anyone without the prior written consent of S&S
- modify, adapt, translate, decompile, disassemble or create derivative works based on the *SOFTWARE PRODUCT*

Termination

This licence is effective until terminated. You may terminate the licence at any time by returning the *SOFTWARE PRODUCT* and all copies to S&S. The licence will automatically terminate without notice by S&S if you fail to comply with any terms or conditions of this agreement. Upon termination, you agree to return all copies of the *SOFTWARE PRODUCT* to S&S.

Update Policy

S&S may create, from time to time, updated versions of its *SOFTWARE PRODUCT*. At its option, S&S will make such updates available to licencees who have paid the update fee.

Product Warranty, Limited Remedy and Limited Liability

S&S warrants the *PRODUCT* to be free from defect in material and workmanship under normal use for a period of one year (365 days) from the date of shipment. Any third party computer systems or other items not manufactured directly by S&S purchased with any *PRODUCT* or independently from S&S are subject to the original manufacturer's warranty and not the responsibility of S&S.

S&S makes no other warranties including, but not limited to, any implied warranty of merchantability or fitness for a particular purpose. If this product is defective within the warranty period stated above, your exclusive remedy shall be, at S&S's option to replace or repair the S&S product or refund the purchase price of the S&S product. Except where prohibited by law, S&S will not be liable for any loss or damage arising from this S&S product, whether direct, indirect, special, incidental or consequential regardless of the legal theory asserted.

All statements, technical information, and recommendations related to S&S products are based on information believed to be reliable, but the accuracy or completeness is not guaranteed. Before using this product, you must evaluate it and determine if it is suitable for your intended application. You assume all risks and liability associated with such use. Any statements related to the product which are not contained in S&S current publications, or any contrary statements contained on your purchase order shall have not force or effect unless expressly agreed upon, in writing, by an authorized officer of S&S.

S&S warrants the diskettes or other storage media on which the *SOFTWARE PRODUCT* is furnished to be free from defects in material and workmanship under normal use for a period of ninety (90) days from the date of purchase as evidenced by a copy of your invoice.

Except as specified above, any *SOFTWARE PRODUCT* is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, the use or result of use of the product in terms of correctness, accuracy, reliability, currentness or otherwise. The entire risk as to the results and performance of the *PRODUCT* is assumed by you. If the *PRODUCT* is defective or used improperly, you, and not S&S or its dealers, distributors, agents, or employees, assume the entire cost of all necessary servicing, repair or correction.

S&S's entire liability and your exclusive remedy for *SOFTWARE PRODUCT* shall be, at S&S's option, either

- the replacement of any diskette or hardware components which do not meet S&S's Limited Warranty and which are returned to S&S postage prepaid with a copy of the receipt, or
- if S&S is unable to deliver a replacement diskette which is free of defects in material or workmanship, Licensee may terminate this agreement and have the licence fee refunded by returning all copies of the *SOFTWARE PRODUCT* postage prepaid with a copy of the receipt.

If failure of any *PRODUCT* resulted from accident, abuse or misapplication, S&S shall have no responsibility to replace the *SOFTWARE PRODUCT*, refund the licence fee, or replace or repair the *HARDWARE PRODUCT*.

Do not tamper with any ***PRODUCT*****.** ***PRODUCT*** **contains no user serviceable parts. If tampering is evident in S&S's opinion, warranty is void and null.**

No oral or written information or advice given by S&S, its dealers, distributors, agents or employees shall create a warranty or in any way increase the scope of this warranty and you may not rely on any such information or advice.

Neither S&S nor anyone else who has been involved in the creation, production or delivery of the *PRODUCT* shall be liable for any direct, indirect, special, exemplary, incidental or consequential damages, claims or actions including lost information, lost profits, or other damages arising out of the use or inability to use this *PRODUCT* even if S&S has been advised of the possibility of such damages.

This warranty gives you specific rights. You may have other rights which vary from province to province, territory to territory and certain limitations contained in this limited warranty may not apply to you.

General

pulseEKKO®, Noggin®, SpiView®, Conquest® and SnowScan® are registered trademarks of S&S. No right, licence, or interest to such trademarks is granted hereunder with the purchase of the *PRODUCT* or the *SOFTWARE PRODUCT* licence.

Governing Law

In the event of any conflict between any provision in this licence agreement and limited warranty and any applicable provincial legislation, the applicable provincial legislation takes precedence over the contravening provision. This agreement shall be governed and construed in accordance with the laws of the Province of Ontario, Canada.

Serviceability

Should any term of this agreement be declared void or not enforceable by any court of competent jurisdiction, the remaining terms shall remain in full effect.

Waiver

Failure of either party to enforce any of its rights in this agreement or take action against any other party in the event of a breach of this agreement shall not be considered a waiver of the right to subsequent enforcement of its rights or actions in the event of subsequent breaches by the other party.

Acknowledgement

You acknowledge that you have read this agreement, understand it and agree to be bound by its terms and conditions. You further agree that this agreement is the complete and exclusive statement of agreement between the parties and supersedes all proposals or prior agreements oral or written between the parties relating to the subject matter of this agreement.

Should you have any questions concerning this agreement, please contact in writing:

Sensors & Software Inc.
1040 Stacey Court
Mississauga, Ontario
Canada L4W 2X8
Tel:(905) 624-8909
Fax:(905) 624-9365
E-mail: sales@sensoft.ca

1 Overview

This manual describes how to use the Conquest DE Ground Penetrating Radar (GPR) system transducer module.

System Assembly & Startup: Section 2 on page 2 discusses in detail the step by step procedure for assembling the Conquest DE system and connecting the transducer module to it.

Troubleshooting: Section 3 on page 5 presents some simple steps the user should go through when the transducer is not working as it should.

Care and Maintenance: Section 4 on page 7 discusses procedures for the care and maintenance of your Conquest DE transducer module.

2 System Assembly

The modular design of the Conquest DE GPR makes the system very flexible and readily field-portable. There are three essential components to the radar system: the transducer module, the Digital Video Logger (DVL) and an AC mains power source. The transducer module is connected to the DVL via the transducer cable and the power source is connected to the DVL (Figure 2-1).

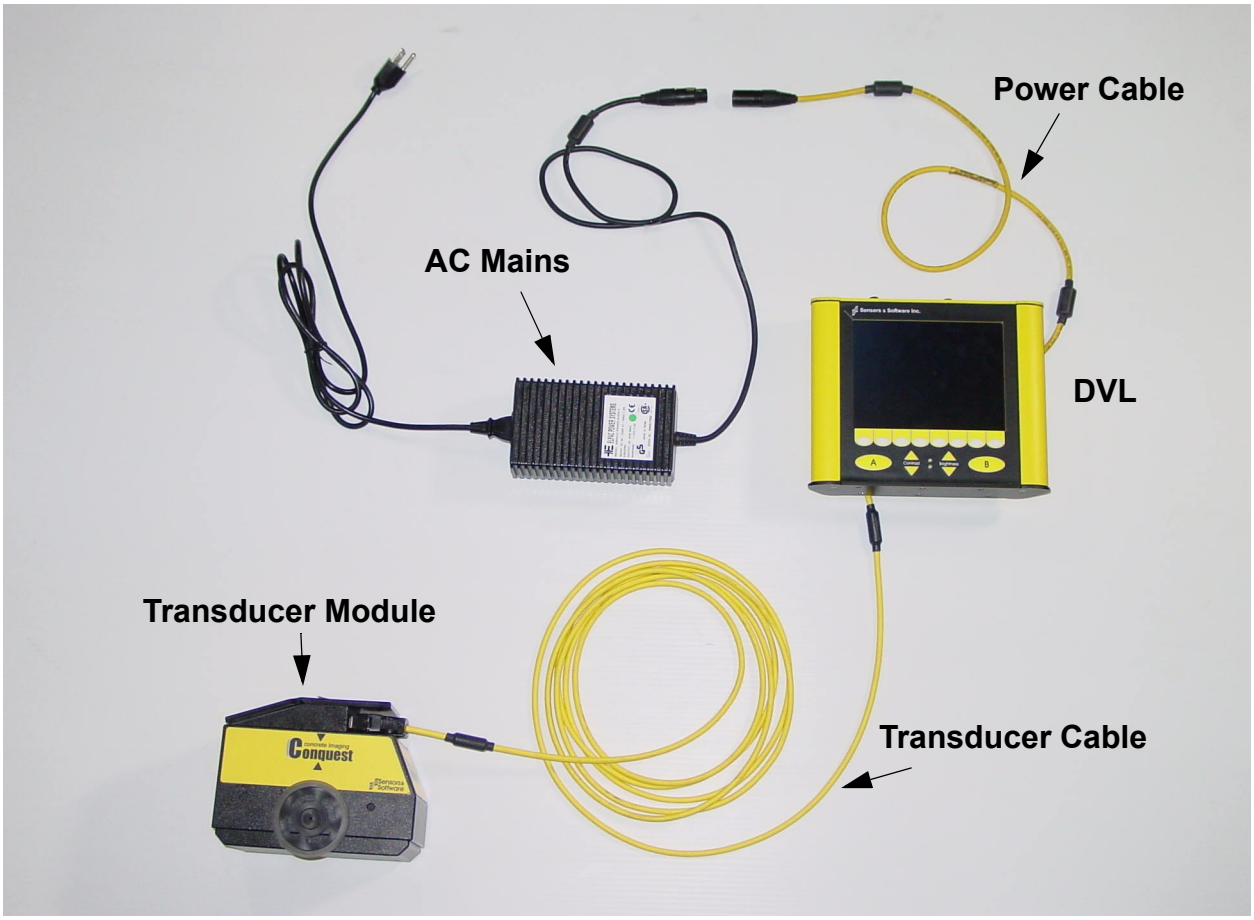

Figure: 2-1 Complete setup of the Conquest DE system.

2.1 Connecting up the System

Refer to Figure 2-1.

a) Connect the Transducer Module to the female end of the Transducer Cable.

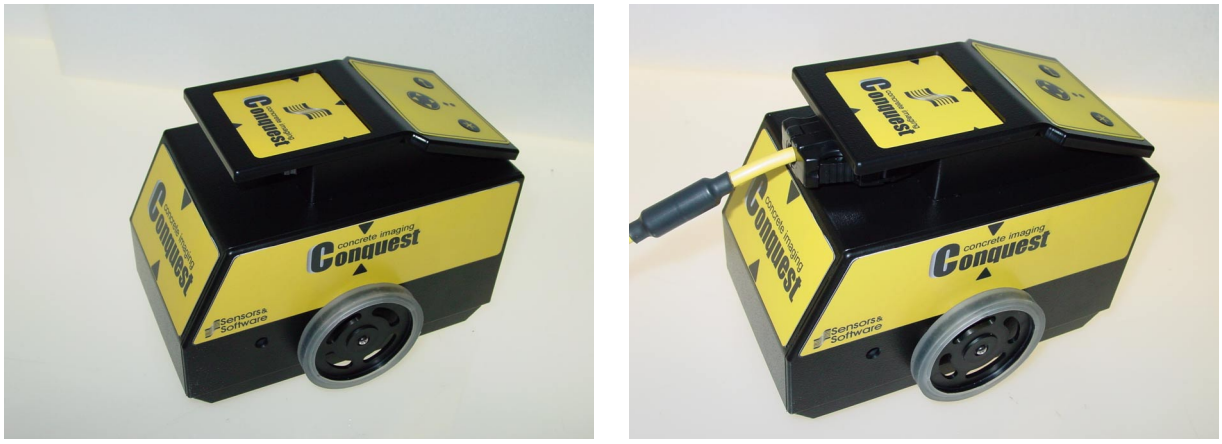

Figure: 2-2 Connecting the Transducer Cable to the Transducer Module.

b) Connect the male end of the Transducer Cable to the back of the DVL.

c) Connect the Power Cable to the back of the DVL.

d) Connect the 4 pin male end of the to Power Cable to AC Mains cable. When the DVL is receiving power the upper red LED on the front of the DVL will be illuminated. When the Transducer Module is receiving power the red and green LEDs will illuminate.

e) Turn the DVL ON by pressing any button on the front. As the DVL boots up, the lower red light will come on.

2.2 Transducer Module Control Buttons

The Transducer Module has a number of buttons on the top to control data collection. The 4 arrow buttons allow the operator to scroll up, down, left and right through menus on the display monitor (DVL or other) and the Enter button selects the current option.

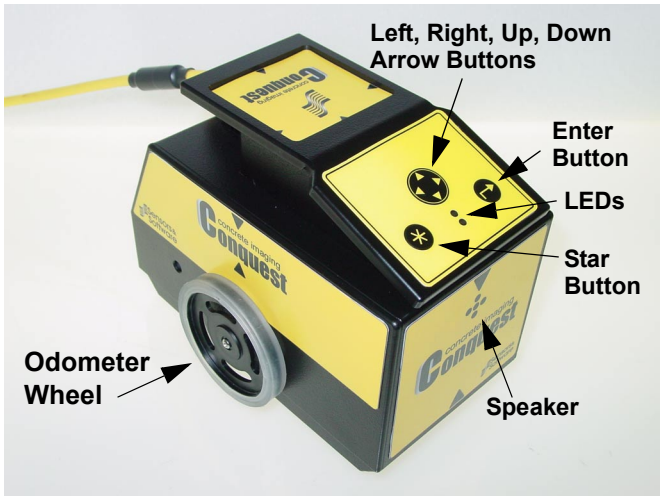

Figure: 2-3 Features of the Transducer Module.

3 Troubleshooting

The Transducer Module is designed to minimize user problems; however, all electronic devices are subject to possible failure. The following are troubleshooting hints if your system fails to operate.

If the radar is not running properly, an error message will be displayed indicating the possible cause of the problem.

Check Connections: If a problem occurs during system initialization, the first step is to check the connections. Make sure that cable connections are tight and that they have “clicked” into place.

Reset the System by Powering Down: If the connections are OK but the error persists, try powering down the system completely. Then power everything back on and see if the system runs.

3.1 Power Supply

Another common problem that can occur while trying to run a system is insufficient power. There may be a problem with the AC power supply or adapter.

3.1.1 DVL Power Requirements

The DVL and pulseEKKO PRO control module are designed to operate from a 12 volt DC, 3 to 4 amp source such as batteries or AC Mains power supply. The input voltage tolerance is 10.2 volts to 15 volts.

If there is enough power to run the DVL, the upper red LED on the front of the DVL will light up when the power source is plugged into the system. If this light is on and the DVL boots up, runs and displays the main menu then there is sufficient power for the DVL.

If the voltage is less than about 10.2 volts, the DVL may not turn on and the upper red LED will flash or not illuminate.

3.1.2 Transducer Module Power Requirements

The Transducer Module does not require a separate power source for operation. It is powered by the same 12 V battery that powers the DVL and Control Module (see above). Power is sent to the transducers through the transducer cable.

3.2 Transmitter Problem: No Signal on Screen

If the pulse cannot be found do the following checks:

1) Make sure the system is properly powered and connected.

2) Check the condition of the transducer cable, looking for any signs of stress or damage. Replace or repair if needed.

3) Check that the pins at the connections of the transducer cable. Make sure that they are straight and clean to ensure proper contact.

If the signal is still not found, contact Sensors & Software Inc.

3.3 Contacting Sensors & Software Inc.

If you develop problems with your GPR system, contact your agent or Sensors & Software Inc.

Sensors & Software Inc.'s hours of operation are 9:00 AM to 5:00 PM Eastern Standard Time, Monday to Friday. You can contact Sensors & Software Inc. at:

Sensors & Software Inc.
1040 Stacey Court
Mississauga, Ontario
Canada L4W 2X8
Tel: (905) 624-8909
Fax: (905) 624-9365
E-mail: sales@sensoft.ca

When contacting Sensors & Software Inc., please have the following information available:

DVL and transducer module Serial Numbers.

Version number of the data acquisition software.

The error number or message appearing.

A brief description of when the error is happening and the operating conditions (temperature, humidity, sunshine, system and survey setup, etc.).

4 Care and Maintenance

4.1 General

To operate the Transducer Module equipment in a field environment, the user should exercise the normal care afforded other field instrumentation. Items that require specific maintenance procedures are listed below together with detailed descriptions of the procedures.

The interior of the transmitter and receiver can become very hot very quickly if exposed to strong, direct sunlight. High temperatures can affect system electronics and may lead to failures. If a suspected heat failure does occur, stop the system and allow it to cool down before retrying.

4.2 Cable Care

1) The cable connectors as well as the connectors on the DVL need to stay clean and free of dust and moisture. Use a brush or air spray to clean dust, lint and other foreign particles from these connectors.

2) When the system is not being used, make sure the connections are done up to prevent dust and moisture from collecting inside. If the connectors are exposed, cover them with some sort of dust cap.

3) Cables are designed to be as tough as practical.

4) Careless use of cables making them carry loads that they are not designed for can cause internal damage.

5) Connectors are weak points in any system. With the use of this product in rough, dusty and outdoor environments, users can minimize potential down time if they care for cables and treat connectors with respect.

6) Cables and connectors are not designed to suspend or tow or otherwise carry the weight of systems. They are part of the electronic circuit and should be treated accordingly. When not in use they should be placed in their storage box.

Appendix A: Health & Safety Certification

Radio frequency electromagnetic fields may pose a health hazard when the fields are intense. Normal fields have been studied extensively over the past 30 years with no conclusive epidemiology relating electromagnetic fields to health problems. Detailed discussions on the subject are contained in the references and the web sites listed below.

The USA Federal Communication Commission (FCC) and Occupational Safety and Health Administration (OSHA) both specify acceptable levels for electromagnetic fields. Similar power levels are mandated by corresponding agencies in other countries. Maximum permissible exposures and time duration specified by the FCC and OSHA vary with excitation frequency. The lowest threshold plane wave equivalent power cited is 0.2 mW/cm^2 for general population over the 30 to 300 MHz frequency band. All other applications and frequencies have higher tolerances as shown in graphically in Figure A-1.

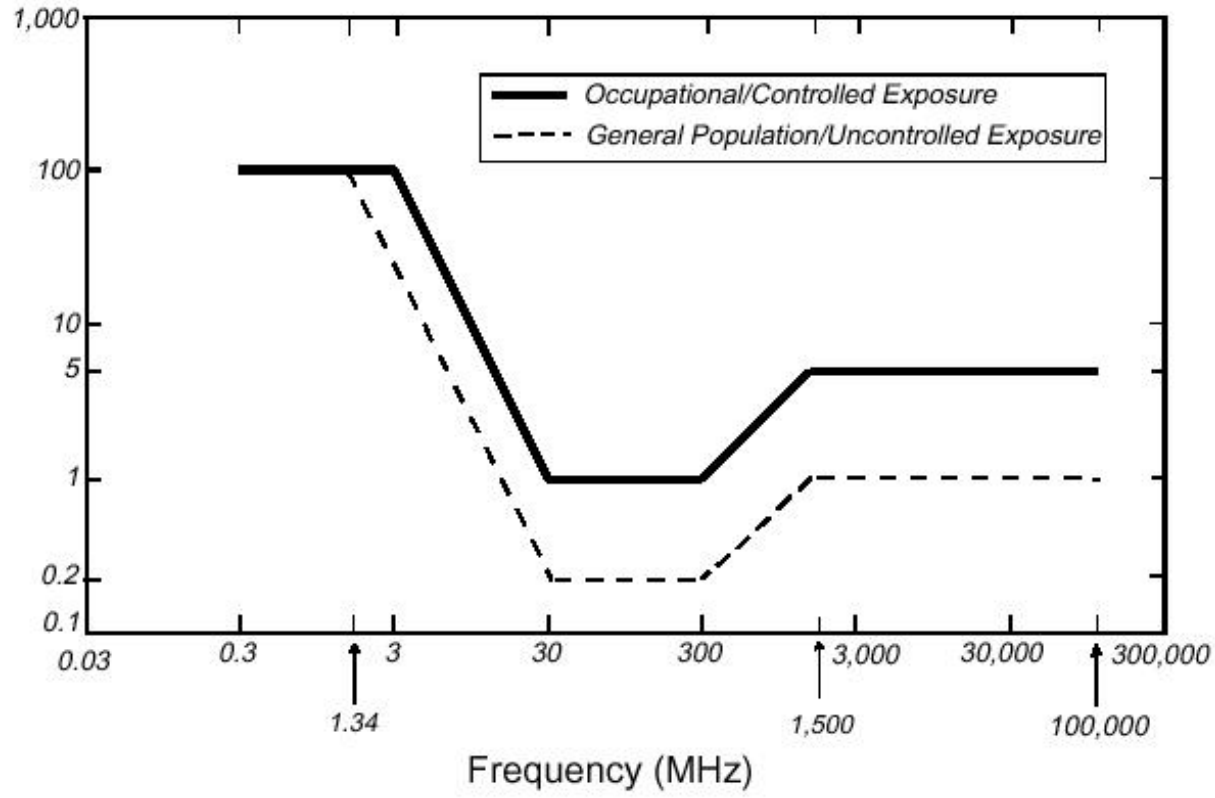

Figure A-1: FCC limits for maximum permissible exposure (MPE) plane-wave equivalent power density mW/cm^2.

All Sensors & Software Inc. pulseEKKO, Noggin and Conquest products are normally operated at least 1 m from the user and as such are classified as “mobile” devices according to the FCC. Typical power density levels at a distance of 1 m or greater from any Sensors & Software Inc. product are less than 10^{-3} mW/cm^2 which are 200 to 10,000 times lower than mandated limits. As such, Sensors & Software Inc. products pose no health and safety risk when operated in the normal manner of intended use.

References

1. Questions and answers about biological effects and potential hazards of radio-frequency electromagnetic field

   USA Federal Communications Commission, Office of Engineering & Technology

   OET Bulletin 56
   (Contains many references and web sites)

2. Evaluation Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields.

   USA Federal Communications Commission, Office of Engineering & Technology

   OET Bulletin 56
   (Contains many references and web sites)

3. USA Occupational Safety and Health Administration regulations paragraph 1910.67 and 1910.263.

Web Sites

www.fcc.gov/Bureau/EngineeringTechnlogy/Documents/bulletin

www.osha-slc.gov/SLTC (see radio frequency)

Appendix B: GPR Emissions, Interference and Regulations

All governments have regulations on the level of electromagnetic emissions that an electronic apparatus can emit. The objective is to assure that one apparatus or device does not interfere with any other apparatus or device in such a way as to make the other apparatus non-functional.

Sensors & Software Inc. extensively test their pulseEKKO, Noggin and Conquest subsurface imaging products using independent professional testing houses and comply with latest regulations of the USA, Canada, European Community, and other major jurisdictions on the matter of emissions.

GPR instruments are considered to be UWB (ultra wideband) devices. The regulatory regimes worldwide are devising new rules for UWB devices. Sensors & Software Inc. maintains close contact with the regulators to help guide standard development and assure that all products conform. You should continually monitor the "News" link on our website (www.sensoft.ca) for updates on standards.

Electronic devices have not always been designed for proper immunity. If a GPR instrument is placed in close proximity to an electronic device, interference may occur. While there have been no substantiated reports of interference to date, if any unusual behavior is observed on nearby devices, test if the disturbance starts and stops when the GPR instrument is turned on and off. If interference is confirmed, stop using the GPR.

Where specific jurisdictions have specific GPR guidelines, these are described below.

B-1 FCC Regulations

This device complies with Part 15 of the USA Federal Communications Commission (FCC) Rules. Operation in the USA is subject to the following two conditions:

(1) this device may not cause harmful interference and
(2) this device must accept any interference received, including interference that may cause undesired operation.

Part 15 – User Information

This equipment has been tested and found to comply with the limits for a Class A digital device, where applicable, and for an ultrawide bandwidth (UWB) device where applicable, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

WARNING

Changes or Modifications not expressly approved by Sensors & Software Inc. could void the user's authority to operate the equipment.

Certification of this equipment has been carried out using approved cables and peripheral devices. The use of non-approved or modified cables and peripheral devices constitutes a Change or Modification outlined in the warning above.

Operating Restrictions

Operation of this device is limited to purposes associated with law enforcement, fire fighting, emergency rescue, scientific research, commercial mining, or construction. Parties operating this equipment must be eligible for licensing under the provisions of Part 90 of this chapter.

FCC Interpretation of Operation Restrictions issued July 12, 2002
(FCC Order DA02-1658, paragraph 9)

The regulations contain restrictions on the parties that are eligible to operate imaging systems. [1] Under the new regulations, GPRs and wall imaging systems may be used only by law enforcement, fire and emergency rescue organizations, by scientific research institutes, by commercial mining companies, and by construction companies. Since the adoption of the *Order*, we have received several inquiries from the operators of GPRs and wall imaging systems noting that these devices often are not operated by the users listed in the regulations but are operated under contract by personnel specifically trained in the operation of these devices. We do not believe that the recent adoption of the UWB rules should disrupt the critical safety services that can be performed effectively only through the use of GPRs and wall imaging systems. We viewed these operating restrictions in the broadest of terms. For example, we believe that the limitation on the use of GPRs and wall imaging systems by construction companies encompasses the inspection of buildings, roadways, bridges and runways even if the inspection finds no damage to the structure

1. See 47 C.F.R. §§15.509(b), 15.511(b), and 15.513(b)

and construction does not actually result from the inspection; the intended purpose of the operation of the UWB device is to determine if construction is required. We also believe that the GPRs and wall imaging systems may be operated for one of the purposes described in the regulations but need not be operated directly by one of the described parties. For example, a GPR may be operated by a private company investigating forensic evidence for a local police department.

FCC Permitted Mode of Usage

The GPR antenna must be kept on the surface to be in compliance with FCC regulations. Use of the antenna is not permitted if it is lifted off the surface. Use as a through-the-wall imaging device is prohibited.

GPR Use Coordination

FCC regulation 15.525(c) requires users of GPR equipment to coordinate the use of their GPR equipment as described below:

a) UWB imaging systems require coordination through the FCC before the equipment may be used. The operator shall comply with any constraints on equipment usage resulting from this coordination.

b) The users of UWB imaging devices shall supply operational areas to the FCC Office of Engineering and Technology, which shall coordinate this information with the Federal Government through the National Telecommunications and Information Administration. The information provided by the UWB operator shall include the name, address, and other pertinent contact information of the user, the desired geographical area(s) of operation, and the FCC ID number and other nomenclature of the UWB device. If the imaging device is intended to be used for mobile applications, the geographical area(s) of operation may be the state(s) or county(ies) in which the equipment will be operated. The operator of an imaging system used for fixed operation shall supply a specific geographical location or the address at which the equipment will be operated. This material shall be submitted to the following address:

Frequency Coordination Branch., OET
Federal Communications Commission
445 12th Street, SW
Washington, D.C. 20554

ATTN: UWB Coordination

The form given on the following page is a suggested format for performing the coordination.

FCC GROUND PENETRATING RADAR COORDINATION NOTICE

NAME:

ADDRESS:

CONTACT INFORMATION [CONTACT NAME AND PHONE NUMBER]:

AREA OF OPERATION [COUNTIES, STATES OR LARGER AREAS]:

FCC ID: [E.G. QJQ-PE-PRO-TLF-A)]

EQUIPMENT NOMENCLATURE: [E.G. PULSEEKKO PRO TLF-A]

Send the information to:

Frequency Coordination Branch., OET
Federal Communications Commission
445 12th Street, SW
Washington, D.C. 20554
ATTN: UWB Coordination
Fax: 202-418-1944

INFORMATION PROVIDED IS DEEMED CONFIDENTIAL

B-2 ETSI Regulations for the EC

In the European Community (EC), GPR instruments must conform to ETSI (European Technical Standards Institute) standard EN302066. Details on individual country requirements for licensing are coordinated with this standard. For more information, contact Sensors & Software's technical staff.

Appendix C: Instrument Compatibility

Immunity regulations place the onus on instrument/apparatus/device manufacturers to assure that extraneous interference will not unduly cause an instrument/apparatus/device to stop functioning or to function in a faulty manner.

Based on independent testing house measurements, Sensors & Software Inc. systems comply with such regulations in Canada, USA, European Community and most other jurisdictions. GPR devices can sense electromagnetic fields. External sources of electromagnetic fields such as TV stations, radio stations and cell phones, can cause signals detectable by a GPR which may degrade the quality of the data that a GPR device records and displays.

Such additive signal is unavoidable but sensible survey practice and operation by an experienced GPR practitioner can minimize such problems. In some geographic areas emissions from external sources may be so large as to preclude useful measurements. Such conditions are readily recognized and accepted by the professional geophysical community as a fundamental limitation of geophysical survey practice. Such interference being present in the GPR recordings is not considered as an equipment fault or as a failure to comply with immunity regulations.

Appendix D: Safety Around Explosive Devices

Concerns are expressed from time to time on the hazard of GPR products being used near blasting caps and unexploded ordnance (UXO). Experience with blasting caps indicates that the power of Sensors & Software Inc.'s GPR products are not sufficient to trigger blasting caps. Based on a conservative independent testing house analysis, we recommend keeping the GPR transmitters at least 5 feet (2m) from blasting cap leads as a precaution. Some customers do experimental trials with their particular blasting devices to confirm with safety. We strongly recommend that GPR users routinely working with explosive devices develop a systematic safety methodology in their work areas.

The UXO issue is more complex and standards on fuses do not exist for obvious reasons. To date, no problems have been reported with any geophysical instrument used for UXO. Since proximity and vibration are also critical for UXO, the best advice is to be cautious and understand the risks.