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# PLT-600

User Manual

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# Note for users in USA and Canada

Operation of this device is restricted to law enforcement, fire and rescue officials, scientific research institutes, commercial mining companies and construction companies. Operation by any other party is a violation of 47U.S.C.301 and the operator may be subject to legal penalties.

Operation is subject to the following conditions:

1. This device may not cause harmful interference.

2. This device must accept any interference received, including interference that may cause undesired operation of the device.

3. Operation of this device shall only occur when in contact with or within 1 m of the ground.

# Hardware Overview

The ImpulseRadar PLT-600 is a single-channel GPR system based on a modern real-time sampling (RTS) technology platform, offering state-of-the-art data acquisition capabilities. It is a perfect tool for ice thickness studies.

| GPR UNIT | Centre Frequency |
|---|---|
| PLT | 600 MHz |

It is a hand-pulled GPR system fitted on a skid-plate as shown in Figure 1 below. Data collection is managed over a Wi-Fi link and a suitable Android device running the ImpulseRadar ViewPoint App (ViewPoint).

For more information, please contact your local ImpulseRadar representative, or contact our sales team at sales@impulseradar.se

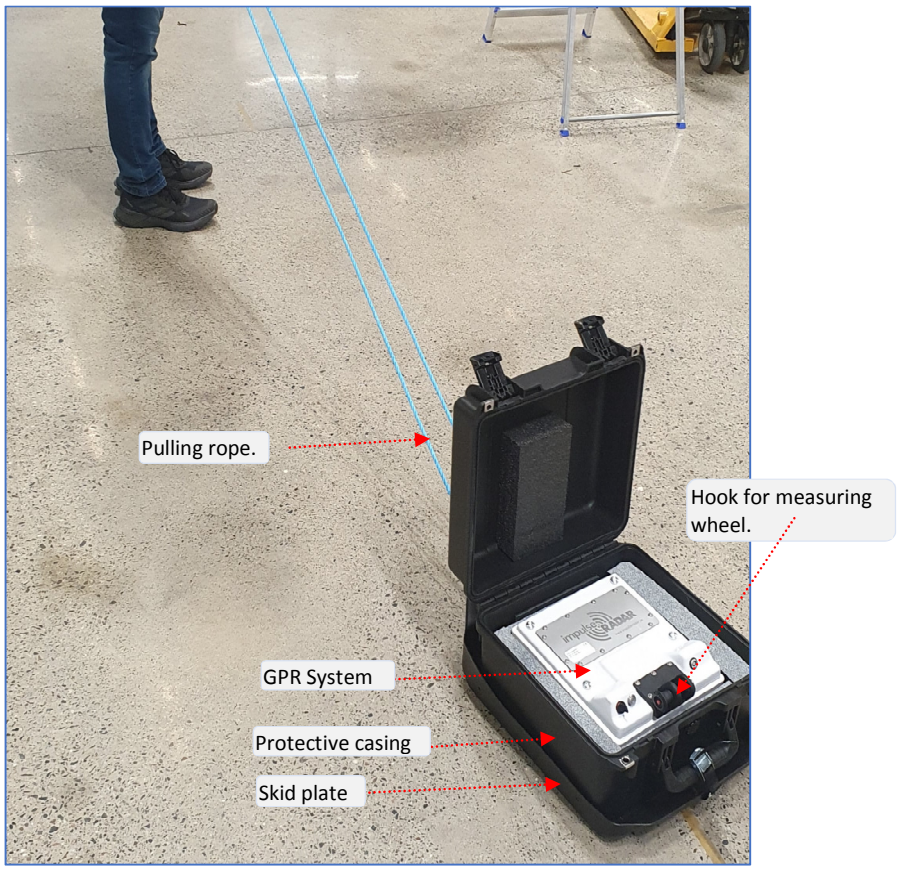


Figure 1: PLT GPR system along with a pull rope

## GPR Unit

The GPR unit has a field-rugged design equipped with a single 600 MHz channel. Power is supplied via a removable and rechargeable Li-ion battery, which is located inside the GPR unit. Figure 2 below shows the location of the ON/OFF button and the connector sockets for odometer and other components.

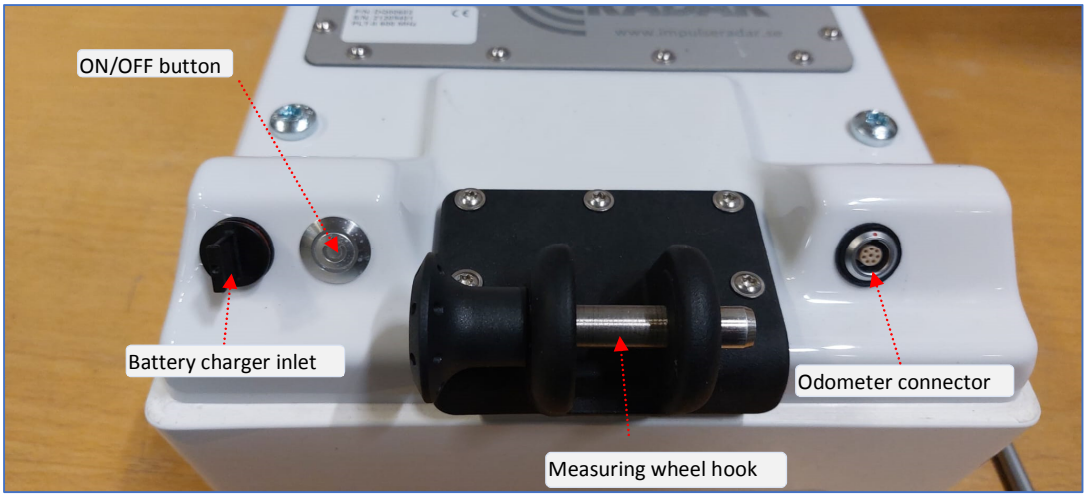


Figure 2: PLT GPR system

# Software Overview

The PLT-600 is set-up and controlled wirelessly via the ImpulseRadar ViewPoint App once installed on a suitable Android Tablet ("Device"). Refer to Appendix A – Specifications for a list of specification requirements.

## Setup & Connection

1. Download and install ViewPoint from 'Google Play Store' by searching for 'ViewPoint' in the search-bar. It is also available on ImpulseRadar website.

2. Now, start the PLT-600 GPR system and turn the Wi-Fi 'ON' on your android device. It might take few minutes for the GPR system's Wi-Fi to be detected by the android device. System's Wi-Fi id is like 'PLT_XXXXXXXX' where 'XXXXXXXX' is the serial number of the GPR system.

3. Use password ‘impulseradar’ to connect with the GPR system. If prompted, allow the android device to connect to this network without internet access.

4. Now open the App. If prompted, allow it to access device location and photos, videos, music, & audios.

5. Accept End User License Agreement.

6. Upon successful connection, the app will show connected antenna information and the GPR battery status will be displayed as shown in the Figure 3.

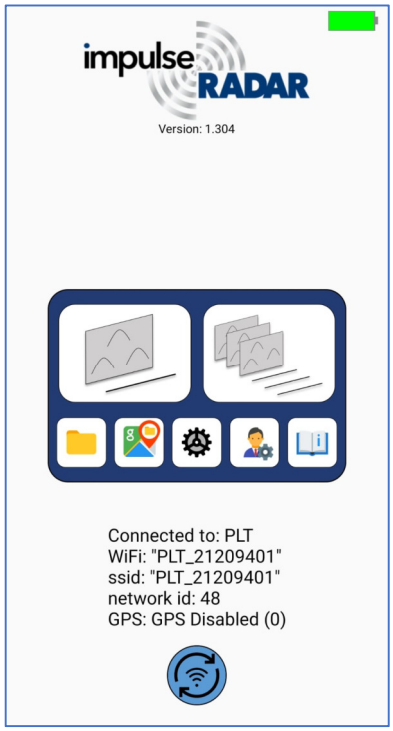


Figure 3: ViewPoint main screen when connected to the GPR system

## Survey Settings

1. To access ‘Antenna Settings’, tap this icon on the main start screen. You can select trigger source either wheel, time, or manual trigger. Also, several other antenna parameters such as trace interval & samples, soil velocity, GPS type and data mode can be set here.

2. Tap user ‘Preferences Menu’ if you wish to modify measurement system, vertical scale type or want to add company information etc. in the generated pdf report.

3. Two project types are available: Single Line and Reference-Line (RL) Project. Normally, Single line project is sufficient for most survey needs. RL project associates and orientates GPR profiles to a physical straight-line in the survey area. In this project, the acquired data can be easily displayed and managed in our CrossPoint program regardless of whether the measurement is based on GPS or not.

## Data Acquisition & Export

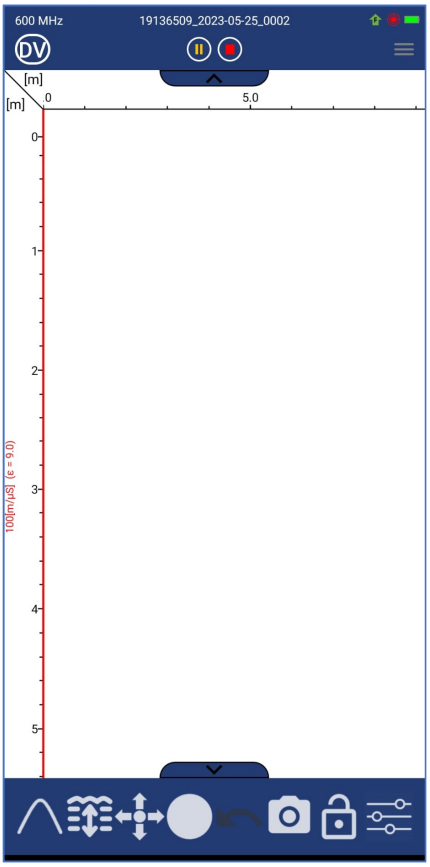


Figure 4: ViewPoint data acquistion screen

1. Select the project type (single vs. reference line) and then start the project. A data acquisition window will open (Figure 4).

2. Now tap to start the profile. A cursor (vertical red-line |) will show data acquired so far. You can either pause/resume the profile by tapping while pressing will stop the profile.

3. GPR channel frequency is shown on top-left of the header toolbar 600 MHz . In 'Dual View' (DV) mode , data from previous profile is displayed above the current profile. It is intended for easier interpretation to verify if reflectors line-up in similar positions across the profiles. On top-right of the header toolbar, information about the profile direction (-Forward vs. -Reverse), GPS signal quality and Device's battery status is displayed. To access Antenna/User settings, tap icon located on the right-side of the header toolbar. These settings are available only when data acquisition is not active.

4. In the footer toolbar, several options are available. To calculate the velocity of the media, tap the hyperbola fitting tool to activate a simulated hyperbola superimposed on top of the A-scan. After fitting simulated hyperbola to the measured hyperbolic response, tap to assign new velocity field. You can also depth-calibrate the A-scan by adjusting to a known depth via tool. Marker assignment tool is displayed as a solid dot . Press it to toggle to quick marker mode . Now, every tap on the radar data will result in assignment of a marker. You can fine-tune the marker position by the arrow tool . Press to delete last marker. In the filter settings menu , several different filter options are available such as background removal, dynamic and manual gains, and contrast settings.

5. By default, beside the rardargram, the App displays a map showing profile tracks and markers. Active profile colour is green, the previous profile is in 'yellow' while all the other profile tracks are marked in red colour.

6. Press usual android controls to close the project. Upon leaving the current project, ViewPoint will ask for generating 'Field Summary Report' pdf and KMZ file for later use in GIS applications. Acquired data can be accessed and shared from the 'File Explorer' located on the main start screen.

# Appendix A – Specifications

ImpulseRadar products are under continuous development, and we reserve the right to change specifications at any time and without prior notice. You may verify product specifications at any time by contacting our headquarters at; support@impulseradar.se

**PLT-600**

| **GPR UNIT** | |
|---|---|
| Technology | ImpulseRadar real-time sampling |

| | |
|---|---|
| Antenna type | PLT 600 – single channel |
| Centre frequency | 600 MHz |
| Significant/useful number of bits | > 16 bits |
| Scans/second | > 800 |
| Time window | 400 ns |
| Acquisition mode | Wheel, time, or manual |
| Positioning | Wheel encoder |
| Power supply | 12 V Li-Ion rechargeable battery, or external 12 V DC source |
| Power consumption | 0.95 A |
| Operating time | 7 hours |
| Dimensions | 280 x 250 x 165 mm |
| Weight | 3.03 kg (including battery) |
| Operating temperature | -20° to +50°C |
| Environmental | IP65 |
| **USER INTERFACE** | |
| Display | 720 x 1280 pixel or better |
| Operating system | Android™ >ver. 6.0 (Marshmallow) or later |
| Memory | 2.7 GB SDRAM or better |
| Processor | Intel Atom x5-Z8550, Quad-core 2.3 GHz Krait 400 or better |
| **Recommendation** | **Samsung Galaxy Tab Active Pro, or equivalent** |

# Appendix B – File Formats

## Files Stored in the Project Directory

<project name> - current project name (project data directory has the same name)

| **ImpulseRadar File Types & Descriptions** | | | |
|---|---|---|---|
| **File Type** | **Description** | **Naming Convention** | **Explanation** |

| | | | |
|---|---|---|---|
| ***. iprh** | Profile header file | <project name>_XXXX_0/1.iprh | where XXXX is the profile number and '0' = Ch-1 or '1' = Ch-2. |
| ***. iprb** | Profile binary data file | <project name>_XXXX_0/1.iprb | where XXXX is the profile number and '0' = Ch-1 or '1' = Ch-2. |
| ***.mrk** | Marker file | <project name>_XXXX_0/1.mrk | where XXXX is the profile number and '0' = Ch-1 or '1' = Ch-2. |
| ***. mlproj** | Multi Line - Reference line project | <project name>_XXX.mlproj | Contains information about name, type, and separation of all profiles in the project. |
| ***.txt** | Log file | <project name>_LOG.txt | Temperature, wifi and missed traces log file |

* Naming convention for single line projects is **<project name>_*XXXX*.*file_type** while for reference line, it is **<project name>_*XXX*.*file_type** where xxx is the profile number.

# Files/Information Stored in the System

## Profile Header File (*. iprh)

| Example of the File Header | Explanations |
|---|---|
| HEADER VERSION: 20 | Version number |
| DATA VERSION: 16 | 16b data format |
| DATE: 2022-12-09 | Measurement date |
| START TIME: 14:48:13 | Measurement start time |
| STOP TIME: 14:48:38 | Measurement stop time |
| ANTENNA: 600 MHz | Antenna frequency |
| ANTENNA SEPARATION: 0.090 | Antenna separation in meters |
| SAMPLES: 500 | Number of samples in a trace |
| SIGNAL POSITION: 6 | Signal position |
| CLIPPED SAMPLES: 0 | Clipped samples (not in use now) |
| RUNS: 64 | Number of runs |
| MAX STACKS: 512 | Maximum number of stacks |
| AUTOSTACKS: 1 | Autostacks (1 = ON) |
| FREQUENCY: 10240 | Sampling Frequency |
| TIMEWINDOW: 48.828 | Time Window in ns |
| LAST TRACE: 1741 | Number of traces in the Profile |
| TRIG SOURCE: wheel | Trig Source – time or wheel |
| TIME INTERVAL: 0.010 | Trig Interval if the trig source is time (sec) |
| DISTANCE INTERVAL: 0.009778 | Trig interval if the trig source is wheel (m) |
| USER DISTANCE INTERVAL: 0.010000 | Distance interval for interface |
| STOP POSITION: 17.024 | Stop Position in meters |
| WHEEL NAME: wheel1 | Wheel name (max 20 chars) |
| WHEEL CALIBRATION: 306.799877930 | Wheel calibration (ticks per meter) |
| ZERO LEVEL: 58 | Zero Level |

| | |
|---|---|
| SOIL VELOCITY: 100 | Soil Velocity (m/us) |
| PREPROCESSING: Unknown Pre-processing | Pre-processing information |
| OPERATOR COMMENT: 'Android SDK: 28 (9)' | Android Version and Device Name |
| ANTENNA F/W: 49000072 | Receiver Firmware Version |
| ANTENNA H/W: F1702 | Not in use now |
| ANTENNA FPGA: D085 | Receiver FPGA Version |
| ANTENNA SERIAL: PLT_117755 | Receiver serial number |
| ANTENNA NAME: | Antenna name |
| SOFTWARE VERSION: CO 1.163 | Software version |
| POSITIONING: 0 | Positioning: (0-NO; 1-TS; 2-GPS) |
| CHANNELS: 2 | Number of channels used |
| CHANNEL CONFIGURATION: 1 | This channel configuration |
| CH_X_OFFSET: 0.000 | Channel Position relative to ext. positioning |
| CH_Y_OFFSET: 0.000 | Channel Position relative to ext. positioning |
| MEASUREMENT DIRECTION: 1 | Forward = 1, Reverse = -1 |
| RELATIVE DIRECTION: 90 | Direction to RL start (clockwise 360°) |
| RELATIVE DISTANCE: 1.000 | Distance from RL start to cross-section |
| RELATIVE START: 0.000 | Distance from profile start to cross-section |
| START TEMPERATURE: | Device temperature at start of the profile |
| STOP TEMPERATURE: | Device temperature at the end of profile |

## Profile Data File (*. iprb)

This is a binary data file. ViewPoint can create data files with a 16-bit or 32-bit data format (see the field 'DATA VERSION' in the header file). Samples are stored as signed 16-bit or 32-bit integers. The traces are stored sequentially.

## Marker File (*.mrk)

Each marker is represented by a <tab> separated row in the .mrk file.

Each row has the following fields:

Trace <tab> Sample <tab> Marker Standard <tab> RGB colour code <tab> Marker Type <tab> User Comment <tab> Latitude <tab> North/South <tab> Longitude <tab> East/West <tab> Altitude <tab> Altitude Unit <tab> GPS Status <tab> Precision Marker Flag <CRLF>

## Multi Line Project Header (*. mlproj)

**Multi Line - Reference Line Project**

ML_PROJECT_TYPE: REF_LINE
<profiles>
2ch refline nr2_001_0
2ch refline nr2_001_1
2ch refline nr2_002_0
2ch refline nr2_002_1
</profiles>
TYPE: 2
SEPARATION: 0.25

# Appendix C

## IMPORTANT NOTE FOR US CUSTOMERS

### FCC ID: 2ALZQ-PLT600

This device complies with part 15 of the FCC Rules:

Operation is subject to the following 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

**Warning: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.**

Operation of this device is restricted to law enforcement, fire and rescue officials, scientific research institutes, commercial mining companies, and construction companies. Operation by any other party is a violation of 47 U.S.C. § 301 and could subject the operator to serious legal penalties.

Note

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

**Coordination Requirements.**

(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 detailed operational areas to the FCC Office of Engineering and Technology who 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 of operation, and the FCC ID number and other nomenclature of the UWB device. 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*

(c) The manufacturers, or their authorized sales agents, must inform purchasers and users of their systems of the requirement to undertake detailed coordination of operational areas with the FCC prior to the equipment being operated.

(d) Users of authorized, coordinated UWB systems may transfer them to other qualified users and to different locations upon coordination of change of ownership or location to the FCC and coordination with existing authorized operations.

(e) The NTIA/FCC coordination report shall include any needed constraints that apply to day-to-day operations. Such constraints could specify prohibited areas of operations or areas located near authorized radio stations for which additional coordination is required before operation of the UWB equipment. If additional local coordination is required, a local coordination contact will be provided.

(f) The coordination of routine UWB operations shall not take longer than 15 business days from the receipt of the coordination request by NTIA. Special temporary operations may be handled with an expedited turn-around time when circumstances warrant. The operation of UWB systems in emergency situations involving the safety of life or property may occur without coordination provided a notification procedure, similar to that contained in CFR47 Section 2.405(a)-(e), is followed by the UWB equipment user.

**Notice**

This device devices may not be employed for the operation of toys. Operation onboard an aircraft, a ship or a satellite is prohibited.

# IMPORTANT NOTE FOR CANADIAN CUSTOMERS

**IMPORTANT NOTE FOR THE CANADIAN CUSTOMERS**

IC Certification Number: 24904-PLT600

This device complies with the requirements of IC Standard RSS-220

This Ground Penetrating Radar Device shall be operated only when in contact with or within 1 m of the ground.

This Ground Penetrating Radar Device shall be operated only by law enforcement agencies, scientific research institutes, commercial mining companies, construction companies, and emergency rescue or firefighting organizations.

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

1. This device may not cause interference.

2. This device must accept any interference, including interference that may cause undesired operation of the device.

**NOTE IMPORTANTE POUR LES UTILISATEURS CANADIENS**

Numéro de certification : 24904-PLT600

Cet appareil est conforme aux exigences de la norme RSS IC-220

Cet équipement géoradar doit être utilisé que lorsqu'il est en contact ou à moins de 1 mètre du sol.

Cet équipement géoradar doit être utilisé que par des organismes d'application de la loi, des instituts de recherche scientifique, des sociétés minières commerciales, des entreprises de construction et de secours d'urgence ou les organisations de lutte contre les incendies.

Cet appareil contient des émetteurs/récepteurs exempts de licence qui sont conformes aux RSS(s) exempts de licence d'Innovation, Sciences et Développement économique Canada. L'exploitation est soumise aux deux conditions suivantes :

1. Cet appareil ne peut pas causer d'interférence.

2. Cet appareil doit accepter toute interférence, y compris les interférences qui peuvent provoquer un fonctionnement indésirable de l'appareil.