DIM-Loc - UHF, HF, and Acoustic Portable PD measurement (rev A)

User Guide

Contents

Safety tips for general use in a substation before testing

The test engineer must read and understand these precautions. The engineer must always comply with the safety rules and regulations for the substation. The following safety precautions apply to the DIM-Loc when field testing:

1) Avoid working alone.
2) Have the appropriate health and safety training for use of the DIM-Loc and sensors.
3) Should not interfere with any of the substation safety devices or equipment.
4) Inspect and check all the grounding cables that will be test points, that the signal cable is properly connected, and in good condition.
5) Users should read and understand the DIM-Loc user manual.
6) Select the correct sensor, connections and attachments.
7) DIM-Loc PD sensor design is only to be used on grounding metal housings, and cable or switch ground wire, or neutral points. In all cases, the DIM-Loc and the sensor are not allowed to be directly connected non-earthed high voltage components.
8) Ensure the high voltage equipment test point is in good order and safe to use.
9) All required safety PPE must be worn in the designated areas.

Check before entering substation:

The engineer must only enter a substation after permission from the appropriate authority. Any question regarding substation high-voltage safety rules should be address before entering.

On entering:

On entering the testing area, the engineers should observe around the test area, this will assist the engineers in finding the test equipment, local power supply, identify potential hazards. Understand the type of device that you want to test and testing methods. A good understanding of the test sensors and how they should be used is required before connecting them to the HV equipment.

1. DIM-Loc technical specifications

1.1 Introduction

The DIM-Loc is an acoustic and electrical partial discharge detector that combines various detection methods. Partial discharge (or PD) exists in high voltage equipment as a sign of insulation defects. The DIM-Loc device can measure and analyse the defects that cause partial discharge, and help locate the position.

The DIM-Loc detector covers current transformers, voltage transformers, power transformers, circuit breakers, switchgear, cables, GIS and other high voltage equipment.

The partial discharge detection for the instrument consists of three channels, corresponding to different frequency bands of PD:

- Acoustic channel (low frequency, LF): 30 ~ 300kHz, using acoustic sensors
- High frequency channel (high frequency, HF): 0.5 ~ 30MHz, using coupling capacitive sensors and high-frequency current sensors
- RF channel (very high frequency and ultra high frequency, VHF/UHF): 45 ~ 860MHz narrowband, 250 ~ 1200MHz wideband, using log-periodic antenna or GIS UHF sensors.

This device allows the engineer to configure it for various sensors and display results as needed. The test data is stored in the device itself. Some external sensors can be installed and used on high voltage equipment safely while the equipment is energised. Therefore, have a highly preferred if no outage is required. And for high voltage equipment not suitable or possible to install sensors, then the log-periodic antenna can detect PD from a distance, offering a "no-contact" measurement.

The DIM-Loc can be used quickly and efficiently for all aspects of the whole power system to assess the condition of high voltage equipment insulation. In turn, assessing the assets and preventing excessive maintenance, or failure leading to loss of human life and material resources.

The DIM-Loc uses a series of optimised algorithm for partial discharge signal de-noising. Real-time analysis results are displayed on the DIM-Loc screen, greatly simplifying the testing process. The DIM-Loc can be used in very hostile environments with many types of interference, and fully certified substation work environment.

The DIM-Loc equipment is protected by the highly durable metal casing. The useable ambient temperatures are from -20°C, this significantly expands the scope of the test environment. A membrane sealed keypad contains the control buttons, easy to operate on site. All survey information is reliably stored in the built-in memory. All data can be output to a computer for further processing and analysis.

In short, the DIM-Loc test equipment is portable and easy to use; has short testing cycles; covering multiple types of high voltage equipment without outages; a variety sensors and input types.

The DIM-Loc appearance is shown in Figure 1.1.

Figure 1.1

1.2 Main technical parameters

Main technical parameters of the DIM-Loc instrument as shown in the following table 1.1

Number	Parameters	Parameter value
1	Partial discharge measurement channels	3
2a	UHF Channel bandwidth (wideband)	250MHz ~ 1200MHz
2b	UHF Channel bandwidth (narrowband)	45MHz ~ 860MHz
3	HF Channel bandwidth	0.5MHz ~ 30MHz
4	Ultrasonic bandwidth	30kHz ~ 300kHz
5	Synchronisation channel	1
6	Synchronisation channel carrier frequencies	433MHz
7	Measurement of antenna types, VHF/UHF	Log periodic, rod, GIS
8	Synchronization type	Short portable antenna
9	Antenna directional error	±5°
10	Internal storage	256MB
11	Battery usage time	8 hour
12	Built-in battery type	Lithium-ion 2
13	The external power supply input	220V AC
14	Operating temperature range	-20 ~ +45 ℃
15	Equipment life	10 Year
16	Dimensions	220 × 170 × 35 (mm)
17	Communications interface	USB
18	DIM-Loc Host weight	1kg
19	Total weight (including boxes)	12kg

Table 1.1

1.3 External interface description

Figure 1.2

At the top of the instrument, the PD channels from left to right are:

- Acoustic channel
- HF channel
- RF channel

RF channel (VHF and UHF) for standard coaxial cables SMA female ends. Acoustics (LF) channel and high frequency (HF) channel are standard BNC female, as in Figure 1.2.

Apart from the three partial discharge measurement channels, there are:

- Synchronisation antenna channel,  at the top of the equipment at the far right
- External power input  , with the DC power symbol
- USB Connection interface marked “USB”.

1.4 RF antenna and sensor description

The instrument comes standard with three antennas shown in figure 1.3

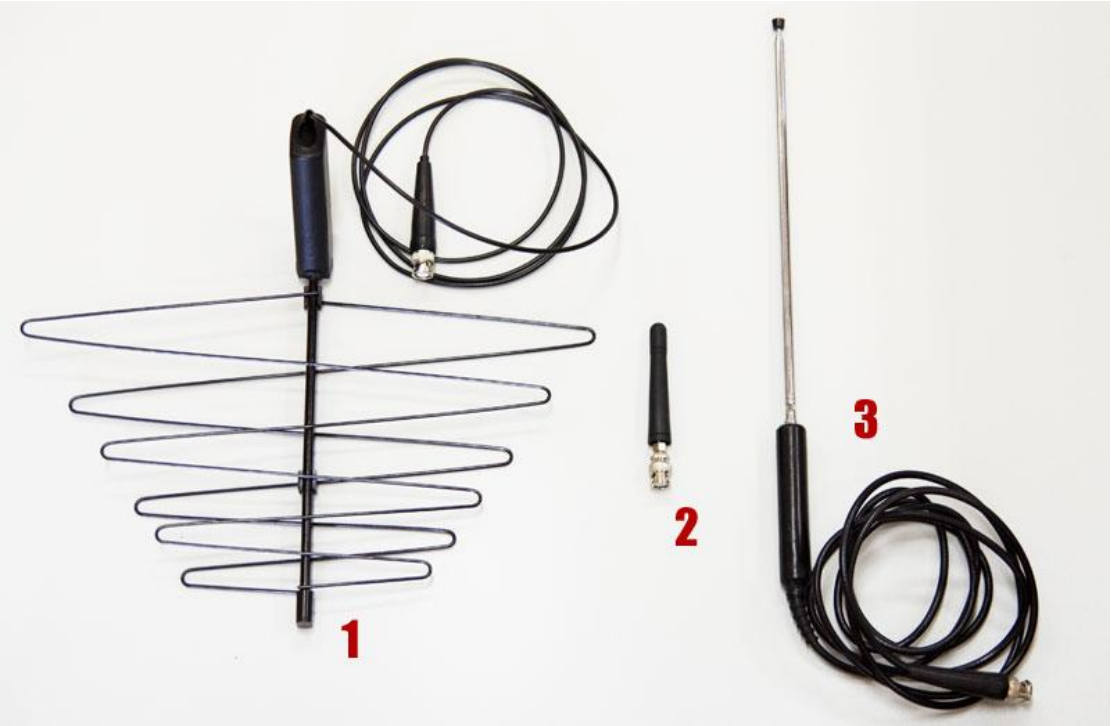


Figure 1.3

These are as follows:

1) Directional log periodic antenna for pointing at the target. Connect to the RF channel when measuring partial discharge.
2) Mobile whip antenna for signal synchronization, when used with synchronisation transceivers ACC-101.
3) Omnidirectional rod retractable antenna. Measurement of external noises to the RF channel.

The DIM-Loc has the following type of sensors for various applications. These must be connected to the correct channel for acoustic, HF or UHF. These are shown in figure 1.4

Figure 1.4

Each sensor model is described below:

1) Clip on RFCT-5. Connect to the HF input.
2) RFCT-6 sensor. Connect to the HF input.
3) UHF GIS sensor AES. Connect to the RF input.
3) TEV sensor TSM-1/HF-B. Connect to the HF input.
4) Acoustic sensors. Connect to the LF input.

1.5 Instrument description

The DIM-Loc measuring ranges cover multiple frequency bands, these correspond to different channels. RF channel data using a unique noise removal algorithms to improve the signal to noise ratio. Depending on the situation, the engineer can also select bandwidth of waveforms collected. The acquisition of characteristic parameters of the partial discharge test includes amplitude, pulse repetition rate and discharge power.

The DIM-Loc has built-in lithium-ion battery, it is modern, lightweight and small size, making it easy to carry and use for both in the field or laboratory tests.

The measurement of the pulse waveform and phase position integrate to form a PRPD plot, this helps the engineer to judge the type and severity of the insulation defects. Therefore, the correct phase information is required to ensure accurate measurement results. DIM-Loc synchronisation signal transceiver PFR-1can be connected to a local supply point or system VT through the external connections.

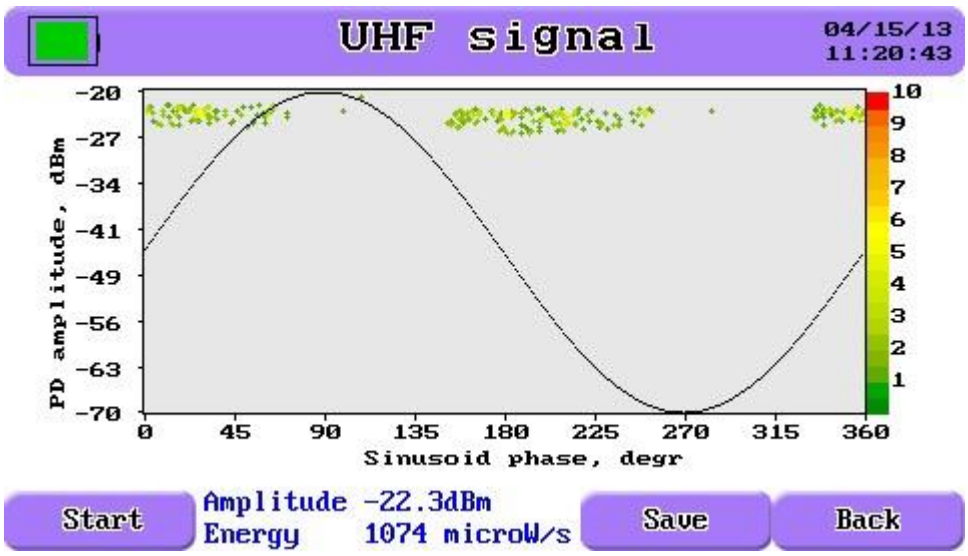


Figure 1.5 : UHF plot

Figure 1.5, UHF Frequency measurement of a partial discharge PRPD plot. Based on the partial discharge captured at the correct phasing, the insulation defects would be seen as a "floating potential" type.

The RF signals are uni-polar plots, ass results are shown as positive values.

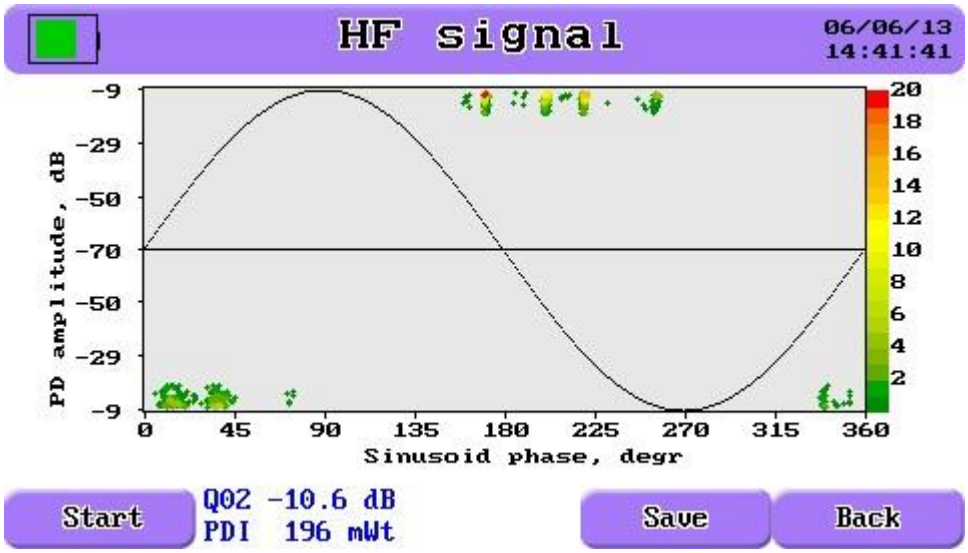


Figure 1.6 : HF plot

Figure 1.6, same defects shown on HF input for typical floating component. The HF input will be bi-polar, positive and negative signals can be shown.

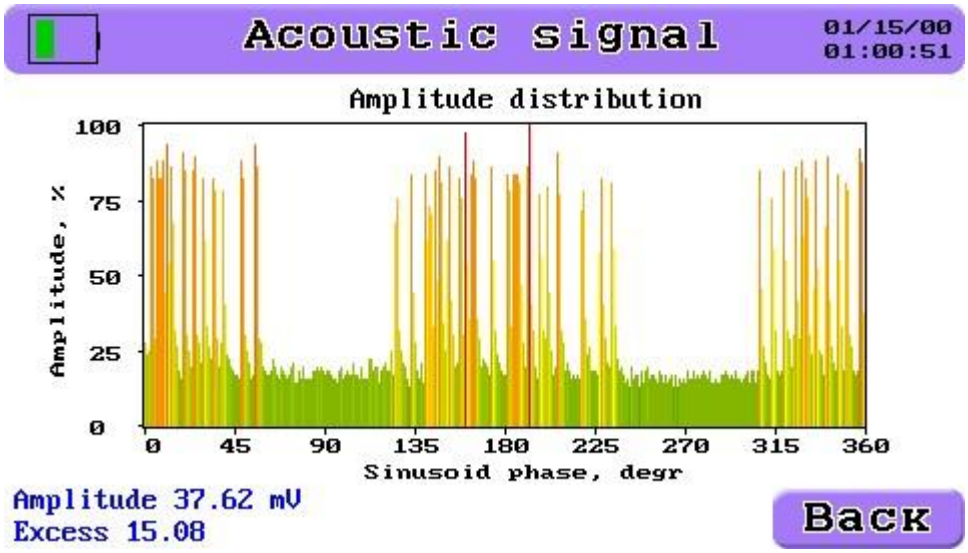


Figure 1.7 : acoustic

Figure 1.7, same defects again with peak pseudo-PRPD using LF input. The acoustic signals are always uni-polar, positive only.

1.6 sync signal transceiver PFR-1

Synchronisation signal transceiver PFR-1shown in figure 1.8, for external synchronisation signal receiving / sending. Wireless communication is use to the DIM-Loc, allowing maximum freedom. PFR-1can accept a PT signal or power of a substation wall socket outlet.

Figure 1.8

The PFR-1has an internal battery or can be powered from the 220V local power supply.

The PFR-1can be used as a synchronisation signal generator, and can also be used as receivers. The mode selection switch is located on the internal Board. Default will be generator, the PFR-1automatically synchronises to an external PT Terminal voltage (V_{in} terminals), and the waveform information transmitted digitally to the DIM-Loc. When selecting a receiver, transceiver receives the signals are processed, and then in the form of square wave signal output.

1.6.1 PFR-1Control and indication

The PFR-1circuit board contains the following control elements:

- On off switch 1 (Figure 1.9 SW1).
- Rotary switch 2 (Figure 1.9 item 2).

Switch 2 of SW1 of item has two positions used to select the “Receive” or “Send" mode, shown in Figure 1.9. “On” is for receiver mode.

Switch 1 of SW1 must remain off.

Rotary switch 2 is not used

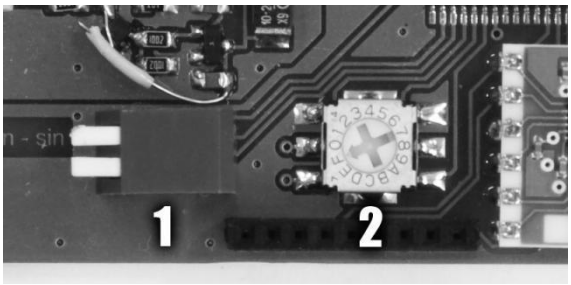


Figure 1.9

The PFR-1has a thumb-type power switch and 2 LED lights (power and synchronisation). Power supply (Power) red LED indicates power, either battery or AC. If the power light is flashing, this

indicates that the battery is charging. The green synchronisation LED lights up when the signal is being sent or received.

1.6.2 PFR-1Setting and using

Plug the antenna into the antenna socket. Connect the PFR-1to a wall socket, or connect the voltage transformer to the transceiver V_{in} input.

Change the " ON/OFF" switch or “On”, see figure 1.10. The power supply light should be bright red. After a few seconds, the synchronisation light should be bright green.

Figure 1.10

2. DIM-Loc Instructions for operation

The DIM-Loc body shell is a sealed metal case. The main display has a resolution of 480x272 pixels. Control buttons are embedded on the front membrane keypad, under the display. The control buttons are the following keys:

- cursor position: "▲", "▼", "◄", "►"
- enter / accept: "Ent"
- cancel / return: "Esc"
- alternate option: "Mod"
- storage: "Mem"
- help: "Help"
- hotkeys: "F1" to "F5"
- power: " ⏻ ".

2.1 Information editing and input

2.1.1 Use of function keys (soft keys)

Settings, archiving and measuring windows have prompts at the bottom of the screen. These are divided into 5 regions, and refer to the corresponding function key. Select on the corresponding function key to enter the corresponding interface. The function will change depending on the screen.

2.1.2 Parameter selection

In the parameters and setting windows, the cursor (or right arrow " ➡") can be positioned keys "▲", "▼".

2.1.3 Numerical parameter editing

Select the parameter to be modified, press "Ent" key to enter the parameter editing. If the parameter is a numeric value, use "◄" or "►" key to move the input line. "▲" and "▼" keys to select the number (0-9). Press the "Ent" key to confirm. Or press the "Esc" key, cancel the change, and the original values will not change.

2.1.4 Text parameter editing

For the parameter to be modified, select the parameter, and press "Ent" key for text editing. Text edit window as in Figure 2.1 and 2.2 below.

Figure 2.1

Figure 2.2

In this window, the keys are as follows:

- Direction button "◄", "►", "▲", "▼": control the screen cursor for input selection
- Confirm button - "Ent": selected character on the current cursor location
- Function keys - "F1": delete the current character
- Function keys - "F2": backspace. Deletes the character before the cursor
- Function keys - "F3" and "F4" : move the input line cursor left or right.
- Function keys - "F5": Language select.
- Cancel key - "Esc" : To exit without saving changes.
- Store key - "Mem" : exit and save changes.

2.2 Device boot

Press and hold the "⏻" button, wait for 2 to 3 seconds. The DIM-Loc enters the initial interface, as shown in Figure 2.3 shows.

Figure 2.3

The screen contains the factory boot information, date/time information; battery Information ("U"), the remaining storage space information ("Mem"), as well as the device name ("DIM-Loc"), firmware version, serial number and other relevant information.

After the device starts, it loads the last settings and waits for user commands. Users can then use control buttons to operate the equipment. At any point, pressing and hold the power button ("⏻") to turn off the DIM-Loc.

2.3 Main menu

Figure 2.4 lists the DIM-Loc's main menu.

Figure 2.4

In the top left corner of the screen is the battery indicator. In the top right corner is the current date and time.

In the middle of the screen are the main menu icons. Use "◄" and "►" keys to move through the menu options, and select an item that the arrow (⇧) points to by pressing the "Ent" key. This will enter the submenu and move on to the next level. Or select the "Esc" key to exit back boot interface.

The function keys "F1" ~ "F5" can directly select the option above the function key. The icon meanings are as follows:

Main PD measurement functions

VHF/UHF narrowband spectrum mode

PD measurement setting

General device settings

Library and archive functions

2.3.1 PD measurement

Enter PD measurement (also called “direct measurement” on older devices) and the submenu screen is as shown in Figure 2.5. The start / stop measuring corresponds function key "F1". Press the "F1" key for the measurements to begin if not currently running. The settings for the measurement are shown in section 2.3.3 .

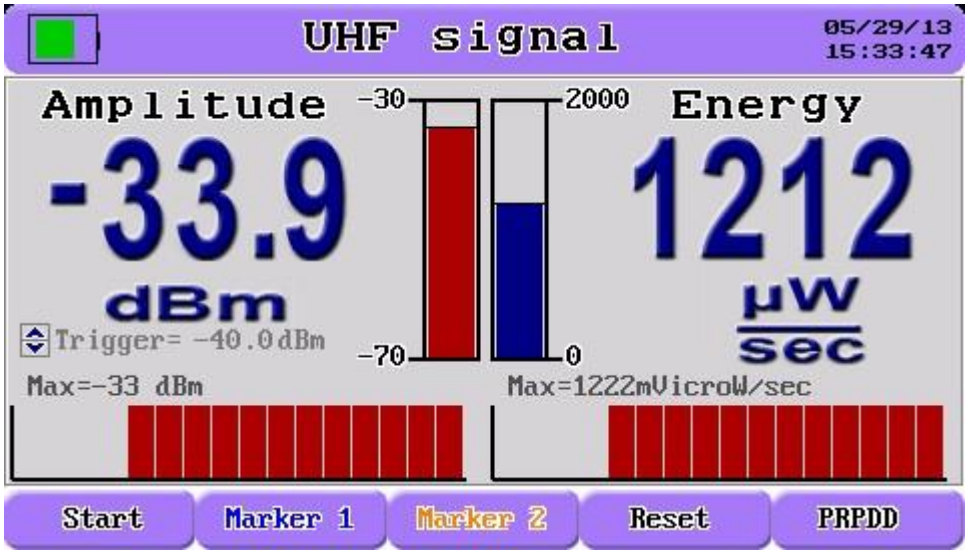
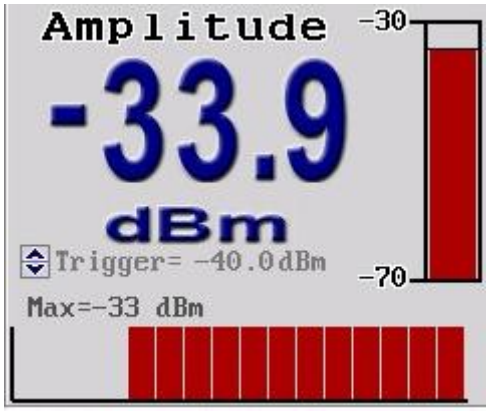


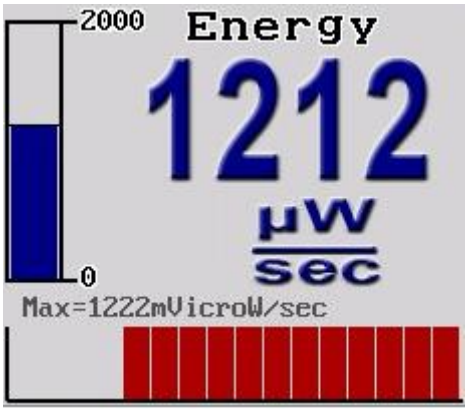
Figure 2.5

Measurement display is divided into two parts:

1) The partial discharge signal amplitude on the left.



2) On the right is the partial discharge signal power (energy).

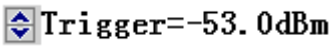


Each section displays the parameters as follows:

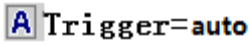
- Single measurement result displayed for the last reading in the middle of the screen.
- Bar graph displays the measurement values of the maximum scale value for the test period (such as maximum value is 473 maximum scale value is automatically taken 500).
- The last 16 values in a rolling trend plot.
- The maximum value for the most recent of the trend plot.

If the display is in red for a high value, then the corresponding to the trend values will also be in red.

Setting the trigger values:



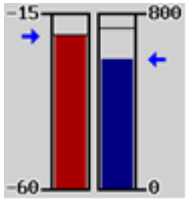
In fixed trigger mode, the direction keys "▲" and "▼" manually adjust the trigger values manually adjusted in 1dB steps.



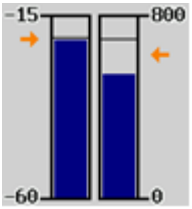
In auto mode, the trigger is set automatically by the DIM-Loc based on actual measurement values.

In this screen, the function keys "F1" ~ "F5" have the following meaning:

- "F1" key (Start/Stop): Starts or stops the measurements
- "F2" key (Marker 1): Allows the user to save the current values of the signal amplitude, and histogram display blue marker on that value:



- "F3" key (Marker 2): Allows the user to save the current values of the signal energy, and histogram display the orange markers:



- "F4" key (Reset): Trend data and all current values are cleared.
- "F5" key (PRPD): Changes the mode to display PRPD plots.
- "Mem" key: Save option is opened for the current measurements.
- "MOD" key: Short cut to the measurements configuration menu.

2.3.2 Spectrum measurements

From the main menu, select " Spectrum", or directly press the "F2" function key. This will enter into the spectrum measurement interface. The spectrum display is shown in figure 2.6.

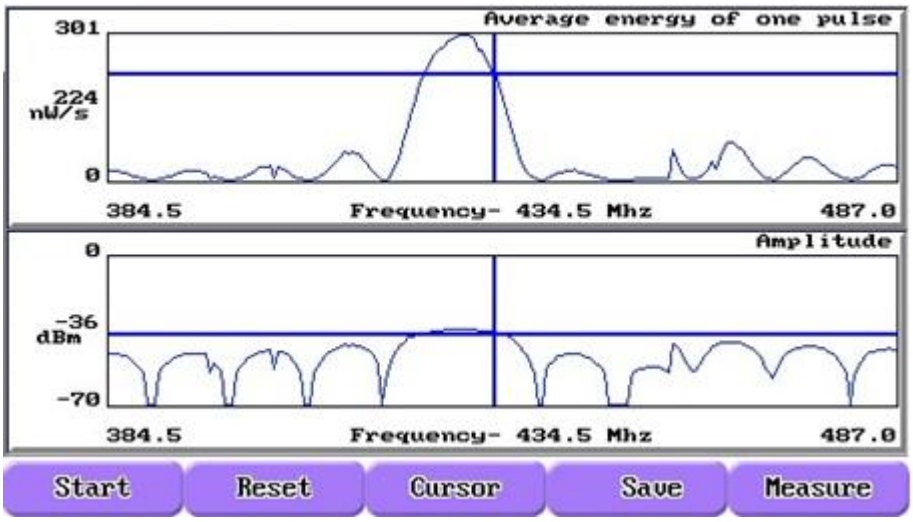


Figure 2.6

Spectrum measurement display shows each pulse amplitude, frequency, and pulse power. These graphs plot amplitude against frequency, and PD pulse energy against frequency.

The interface represents the meaning of function keys:

- "F1" key (Start/Stop): Starts or stop the measurement.
- "F2" key (Reset): Clears the display of current results.
- "F3" key (Cursor, or Cursor1/Cursor2): Selects the cursor. "Cursor" refers to a single cursor option, "Cursor1/Cursor2" means two cursors options. The location of the cursor is controlled by using the direction keys "◄" or "►".
- "F4" key (Save): Saved measurement results.

- "F5" key (Measure): The PD measurement will be selected on either the single frequency or the cursor, or the band set by two cursors. The interface will turn to the PD measurement (direct measurement) interface (see section 2.3.1). The peak values and trend measurement are displayed, with the option of PRPD plot.

When the spectrum sweep is running, it will use a progressive method to sweep, fast initial sweep on large steps, then reducing the step size each sweep, as the smaller step size will take longer to sweep. This allows quick identification of the key frequencies active.

In this screen, the "MOD" key can be pressed as a short cut to the settings. By default, bandwidth in the range of 45MHz~864MHz. Figure 2.7 shows the measurement range setting screen.

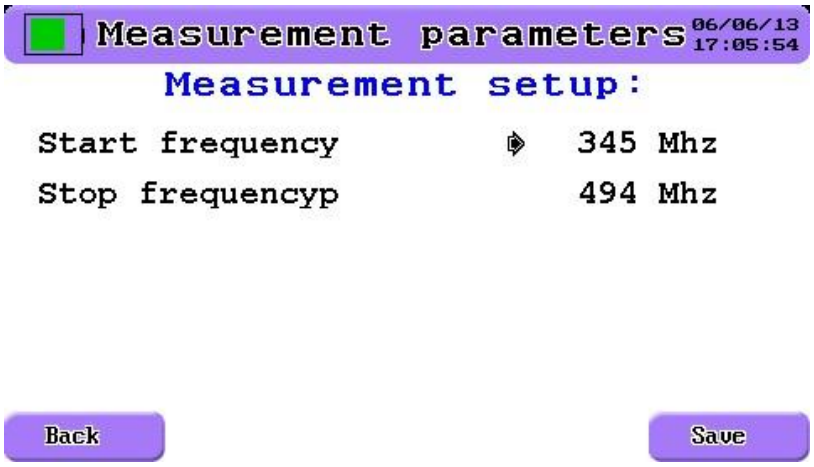


Figure 2.7

2.3.3 Partial discharge measuring set

This menu sets all parameters for partial discharge measurements and data display. From the main menu, select the "PD measurement Setup" or press the "F3" key. The partial discharge measurement settings screen is shown in figure 2.8.

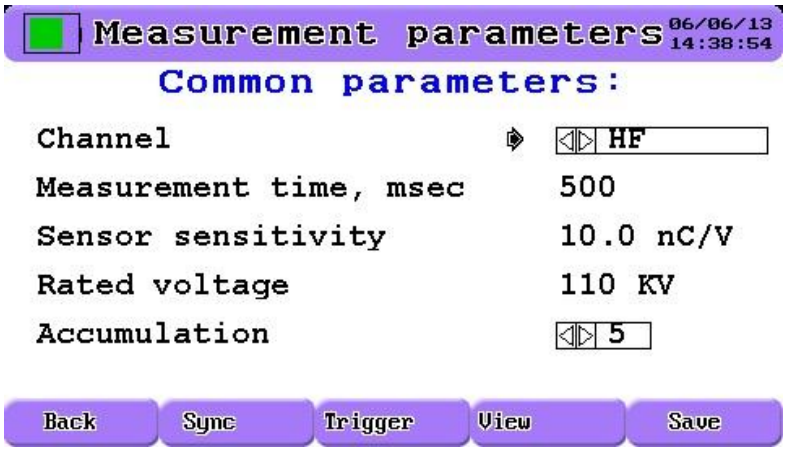


Figure 2.8

General parameter settings:

- "Channel": Measurement mode select, the DIM-Loc Support "UHF", "HF" and "acoustic". Three kinds of measuring methods, each selected through buttons "◄", "►".
- "Measurement time": The sampling time for a single measuring cycle (in milliseconds).
- "Sensor sensitivity": The conversion factor of the sensitivity, volts to nC coefficient (only for HF inputs).
- "Rated voltage": Rated voltage of the device under test, used as an energy correction factor.
- "Accumulation": Cumulative measurement number. The PRPD can have many sample combined on to one display. This values if the maximum number of measurements that will be superimposed on each other.

Partial discharge setting have additional setting on the function keys:

- "Back": Return to the previous menu. Corresponding function keys "F1".
- "Sync": The sync option menu. Corresponding function keys "F2".
- "Trigger": Trigger options and value set menu. Corresponding function key "F3".
- "View": PD displays settings menu. Corresponding function key "F4".
- "Save": Saves the changed settings. Corresponding function keys "F5".

Or pressing the "ESC" key: to exit without saving the changes.

2.3.3.1 Synchronization settings

Synchronization settings menu, as shown in figure 2.9.

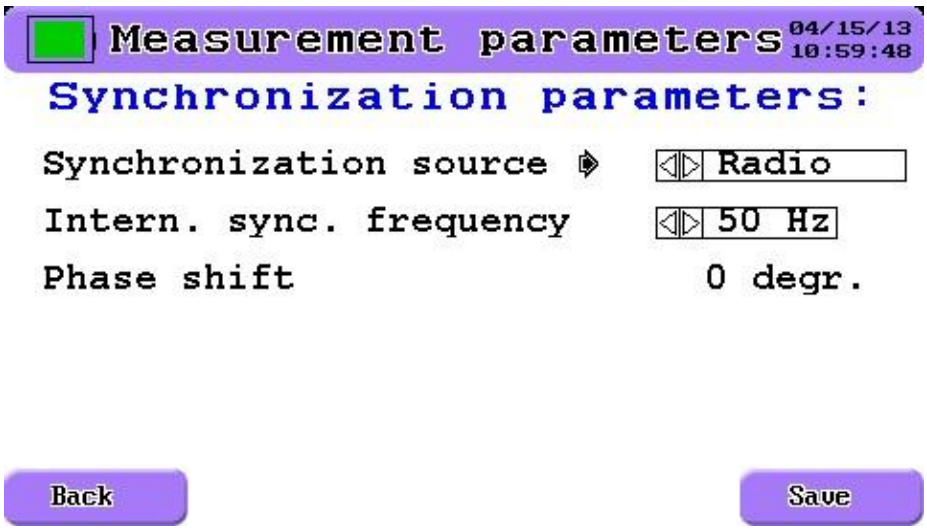


Figure 2.9

Synchronization parameter settings:

- "Sync Source": Source selection for synchronization sources include internal (free running), and external/Radio (ACC-101).
- "Internal Sync Frequency": Synchronising frequency selection for internal 50Hz or 60Hz. If a source selection is external synchronization then this is ignored.
- "Phase shift": Allows additional phase shift to be added to the sync reference.

2.3.3.2 Trigger setting

Trigger parameter settings screen is shown in Figure 2.10.

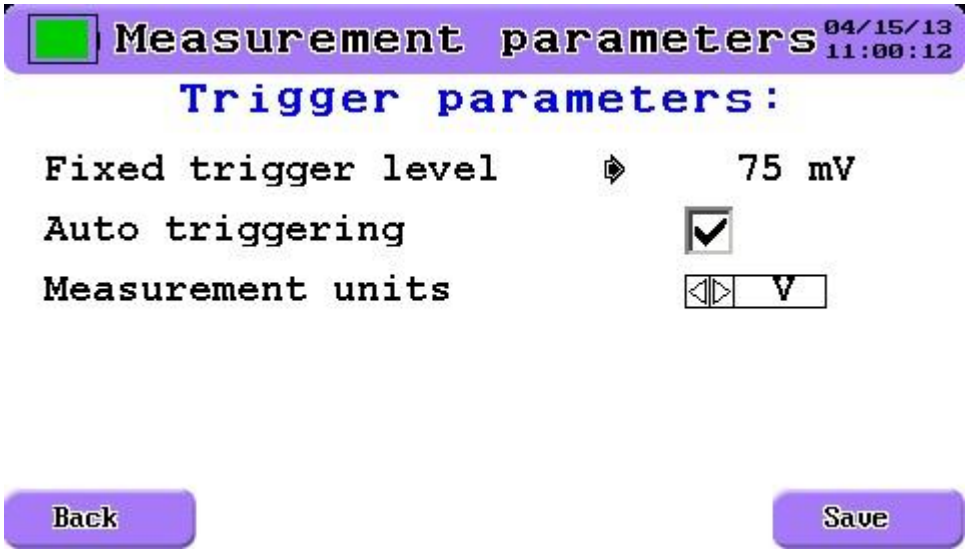


Figure 2.10

Trigger settings:

- "Fixed trigger level": Set the level of trigger if NOT on auto trigger.
- "Auto triggering": enables automatic trigger level selection based on input signal and noise..
- "Measurement Units": The choice of units of measurement include: V, nC, dBm.

2.3.3.3 Display settings

Display settings screen is shown as in Figure 2.11.

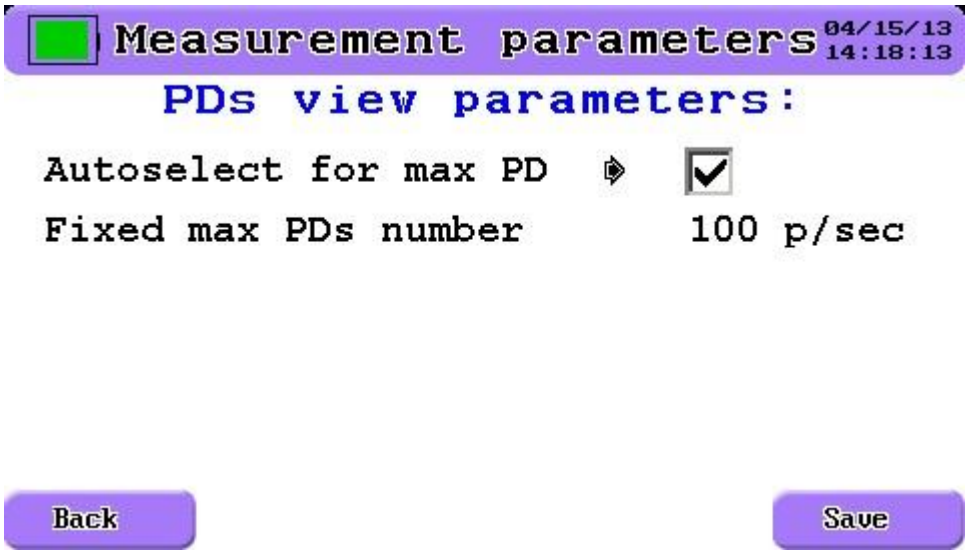


Figure 2.11

These parameter set the colour scale in the PRPD:

- "Autoselect for Max PD": Adapts automatically to the maximum count of PD.
- "Fixed Max PDs number": Set the maximum count if not on autoselect.

2.3.4 Device parameter settings

This menu sets the parameters of the DIM-Loc itself. In the main menu, select "Device Setting" or press "F4". Device parameter settings are as shown in Figure 2.12.

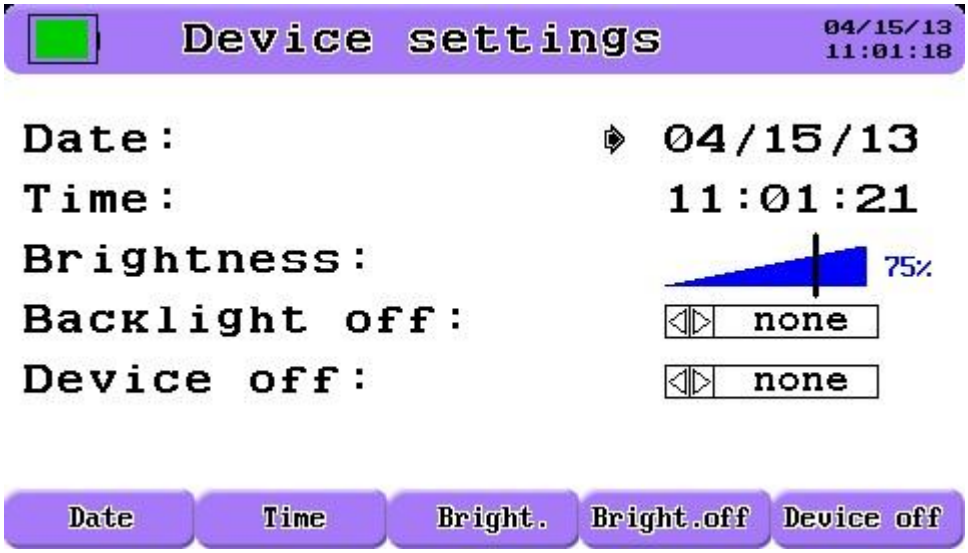


Figure 2.12

Device parameter settings:

- "Date": Sets current date, format: mm/dd/yy.
- "Time": Sets current time.
- "Brightness": The display brightness, 0~100% adjustable.
- "Backlight off": backlight standby time, the backlight will switch off to save battery power if no keypad activity after a set period. Options:
    - 15 Seconds
    - 30 Seconds
    - 45 Seconds
    - 60 Seconds
    - none : Never switches off
- "Device off": DIM-Loc standby time, the DIM-Loc will switch off to save battery power if no keypad activity after a set period. Options:
    - 5 Minutes
    - 10 Minutes
    - 15 Minutes after the
    - 30 Minutes
    - none : Never automatically shut down, to turn off the device press the power button "⏻".

After changing the settings, press the " Mem "Key to save them to the DIM-Loc.

2.3.5 Data archiving

Measurement data is stored in a tree-like list of equipment. Within the tree contains there are three types of data object: root directory, directoiesy, and measured data (see figure 2.13). These can be accessed through the function keys.

"Esc" or "F5" key will exit the Archive window.

Current active directory object is set to black background (see figure 2.13 on the "Object"). "▲" and "▼" keys are used to move around the tree, and select the active object.

On the archive screen, each directory will have "+" or "-" symbol depending on if they are expanded or not. On the tree move the cursor, and press “Select” to set the active directory object. A directory can be expanded or collapsed by pressing the "◄" or "►" button.

Figure 2.13

Root directory for DIM-Loc Is marked “DIM-Loc”. Sub directories can be added for site and test objects. All measured values are stored in the selected directory. To rename a directory use the "F2" key, the directory selected can have up to 32 characters.

To add a directory, select the root directory, press "F1" button, there will be a window to enter the directory name, as shown in Figure 2.14.

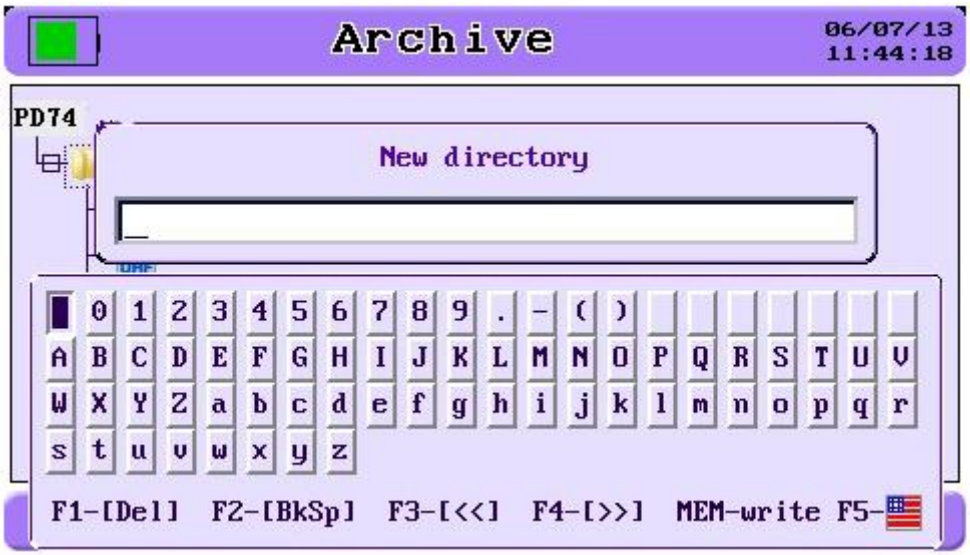


Figure 2.14

Directory names must be unique, otherwise it will display the error:

“Database already exists in the name!”

Maximum character of directories is 32, if directory are illegal then it will display the error:

“Cannot add to this list!”

On the Active Directory, the following action is used to access directory:

- "Select" (F1 key): the directory is selected, after selection, the measurement data will be stored by default in the directory;
- "Rename" (F2 key): enter an appropriate name, and then press "Mem" key.
- "Delete" (F3 key): data will be deleted. **Note: this action is not reversible! All data is permanently deleted!**

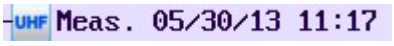
If you delete the original default storage directory, the device will automatically select the first directory in the root directory as the default storage directory.

The stored measurement data is listed in the directory. The direction keys are used to select. Each measurement has the measuring method, measurement the time and date. Select the measurement data, press the "Ent" key or the "F1" key to open the data , or press the "F3" key to delete the data. **Note: this action is not reversible! All data is permanently deleted!**

The measurement data storage display interfaces as shown in 2.15.

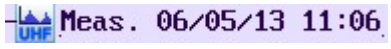
Figure 2.15

The DIM-Loc records the different types of measurements, these have different data storage icons.

1)  : Wideband UHF measuring method using RF channel, contains the PD measurement, PRPD and 3d stored plots.

2)  : HF measuring method using high frequency channel, contains the PD measurement, PRPD and 3d stored plots.

3)  : LF measuring method using acoustic channel, raw waveforms and pseudo -PRPD stored plots.

4)  : Narrowband UHF spectrum measurement using RF channels. spectrums are stored for amplitude and energy. In addition, if using bandwidth limited measurements, the PRPD and 3d stored plots.

Press the "Ent" key or the "F1" key to open the data, as shown in Figure 2.16:

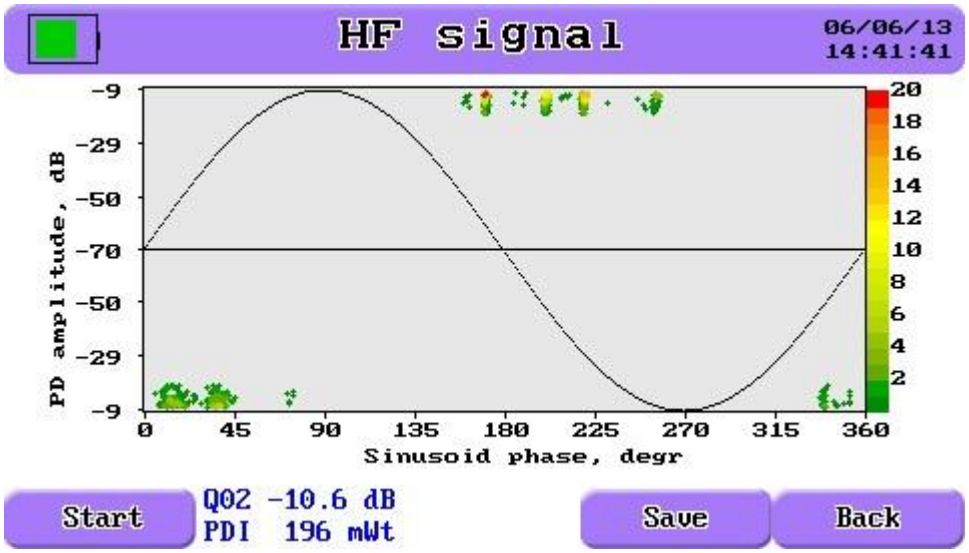
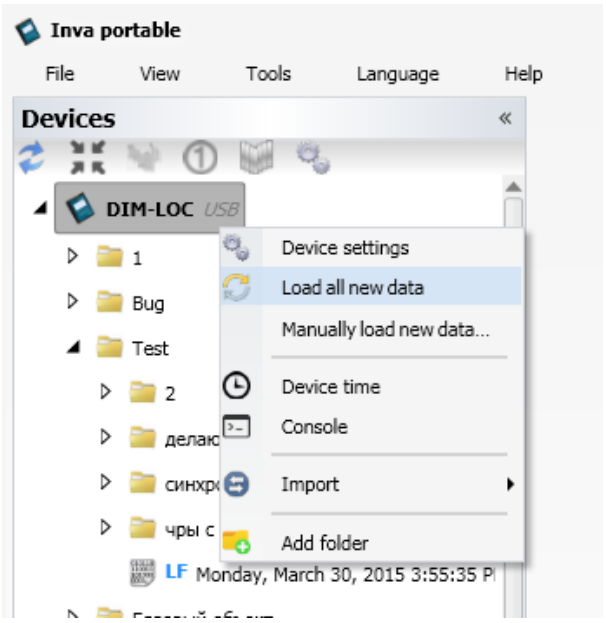


Figure 2.16

3. Software Description

3.1 INVA(PORTABLE) Software introduction

The DIM-Loc uses software for Dimrus's general software platform for portable devices, INVA(PORTABLE). It is suitable for downloading, data management, storage and viewing.



When testing, the DIM-Loc test parameters and settings corresponding to the capture, processing and calculations, are saved with results in DIM-Loc memory. Once the tests are complete, the DIM-Loc can be connected to the computer, and manually download the new data, or all new data into the INVA(PORTABLE).

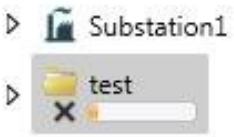
The DIM-Loc test data that has been downloaded to the computer is not automatically deleted from the DIM-Loc. It can be downloaded to the computer again if lost. The DIM-Loc device will automatically delete the oldest data when the memory is full.

3.2 Data import

Connect the DIM-Loc to a computer via USB, there is a choice of two types of data import.

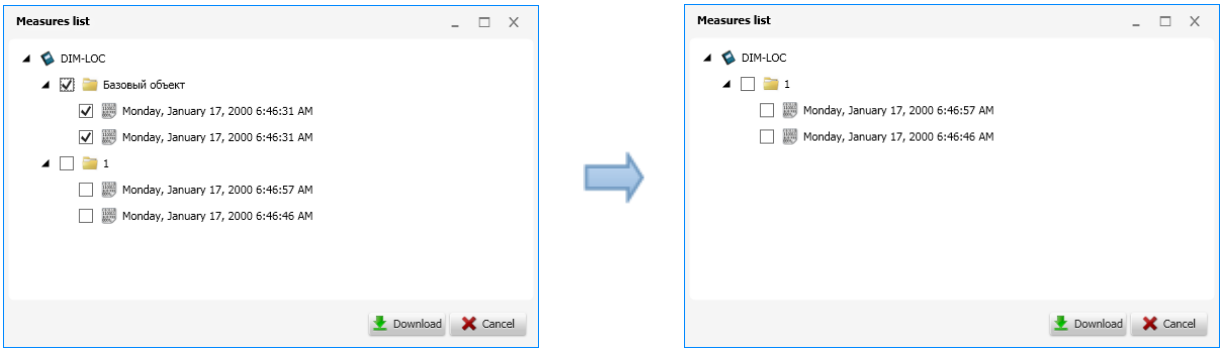
a) All new data is loaded

The INVA(PORTABLE) automatically loads all of the device's internal storage data to a user-specified folder. Only data that has not been downloaded previously will be downloaded, the old data will not be downloaded again.

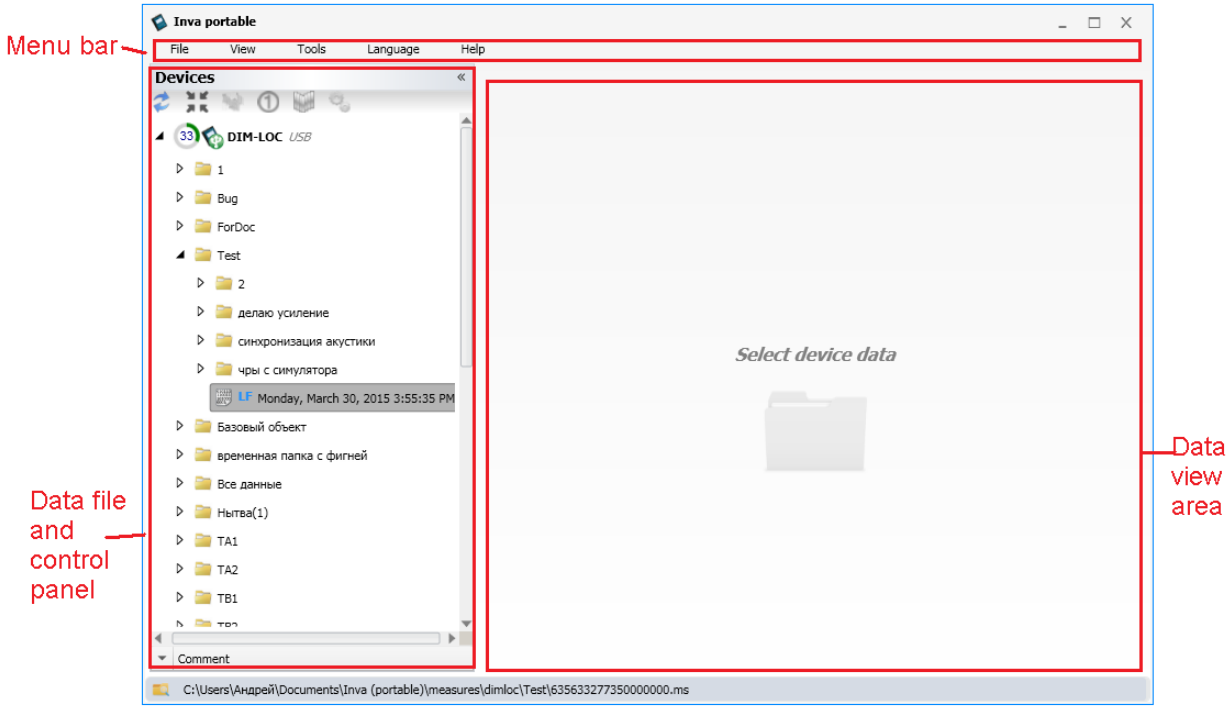


b) Load new data manually

The INVA(PORTABLE) will show all the directories and data stored within the DIM-Loc. The user can manually select which datasets have to be downloaded by ticking the datasets



3.3 The main interface



INVA(PORTABLE) Including the main interface four parts, the menu bar at the top, device list on the left side, data display on the right, and the information bar at the bottom. The information bar displays the current folder for the data address.

When a device is successfully connected, the USB icon is shown on the DIM-Loc, along with the battery status (if available).

Click the sign above the devices to hide the equipment bar.

3.4 The menu bar

Menu bar structure and function are as follows:

- File
  - Open simulator: not used for DIM-Loc.
  - Importing data archive: Advanced feature not used for DIM-Loc.
  - Create a data archive: Advanced feature not used for DIM-Loc.

    - Exit: Close INVA(PORTABLE) .
- View
    - Show trends: Display / Hides the current data trends over time in the selected folder.
- Tools
    - Settings:
        - General: Change the current data folder or other user settings.
        - Trends: Selected trend chart options to be displayed.
    - Console: Advanced feature not used for DIM-Loc.
- Language
    - Chinese Simplified
    - English
    - Russian
- Help
    - Check for updates: Software update via the Internet
    - Version information

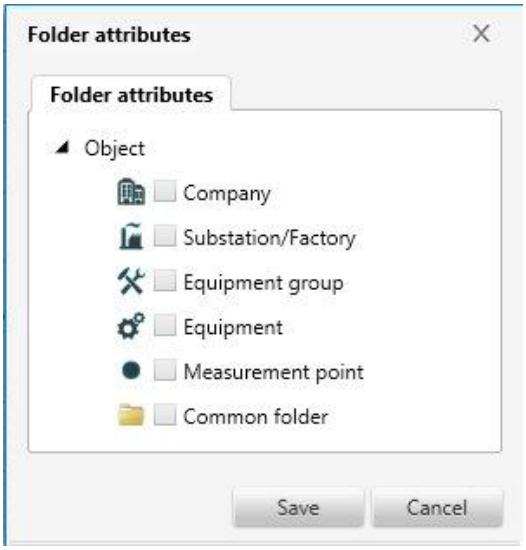
3.5 Data sorting

3.5.1 Creation and management of the data folders

The INVA(PORTABLE) uses a file system save measurement data. In the menu bar "settings", specify INVA(PORTABLE) data folder path. The default path is in “My Documents”. The folder structure is left open and up to the user to define and order. Best practice would be to group by customer, site or substation. Then have subfolders for equipment tested on that site or location.

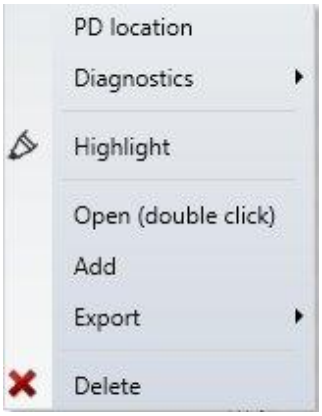
To add a new folder, select "Add folder" in the context menu. Repeat as required for adding more folders according to site requirements and test data storage structure.

In General, a "company" - "substation / workshop" - "device groups" - "equipment" - "point" structure will facilitate the archiving structure of the test data, and help subsequent analysis. It is also possible to create a new "regular” folders. All folders are actual INVA(PORTABLE) subfolder of the data folder, these can be rearranged using windows explorer.



3.5.2 Data file operations

Left clicking on any datafile will open that file. Right click data files, the INVA(PORTABLE) options are listed for that datafile.



Datafiles and be moved by holding down the left mouse button and dragging data files between folders.

Press and hold the shift key to select more than one data file. Multiple files can be added if the data is too sparse to analyse properly

Comments can be added to a folder. Select the file or folder, click on device column to the left of the "remarks" column, notes can be added to the file or folder. If notes exist to items display then the icon appears on the file or folder. Hovering the mouse over the item will automatically display notes.

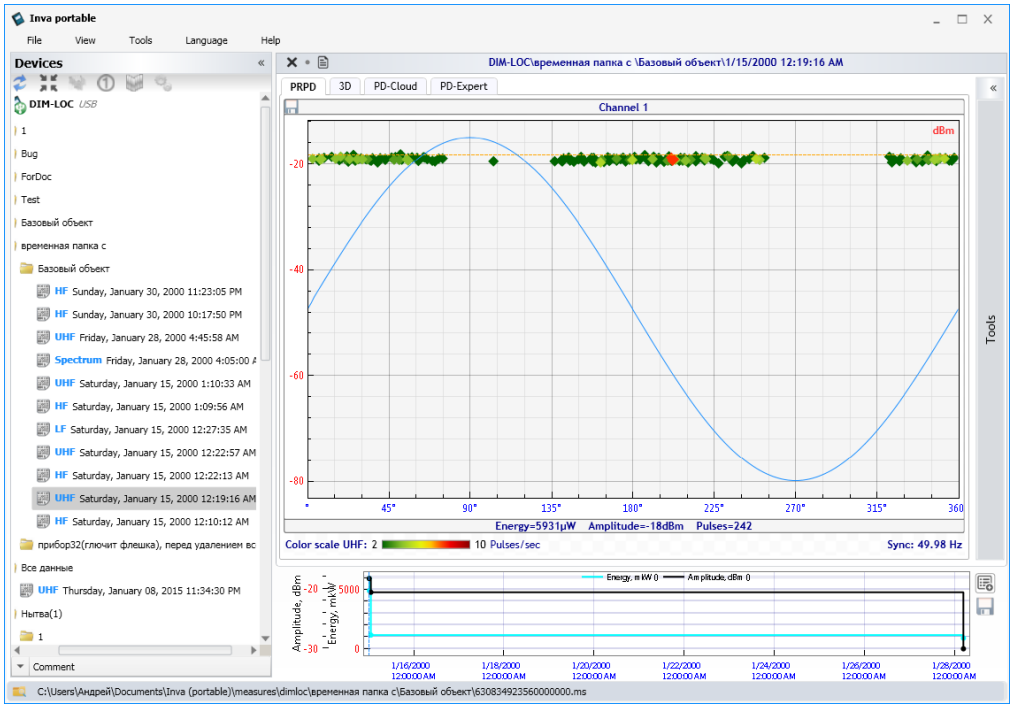
Notes are added or edited in the comment box under the device tree.

3.6 Data analysis

Select a data file from the DIM-Loc in the device. The main window will open and display the PD data from that file.

The main PD displays are PRPD, 3d (or PRPS) and PD-Cloud. The PRPD is a longer term build up of PD pulses. The display plots amplitude vs phase vs count rate. Each cycle is plotted on the same graph and the if there are points in the same area this is considered the count for that area, the count value is shown as a colour to represent the 3rd axis.

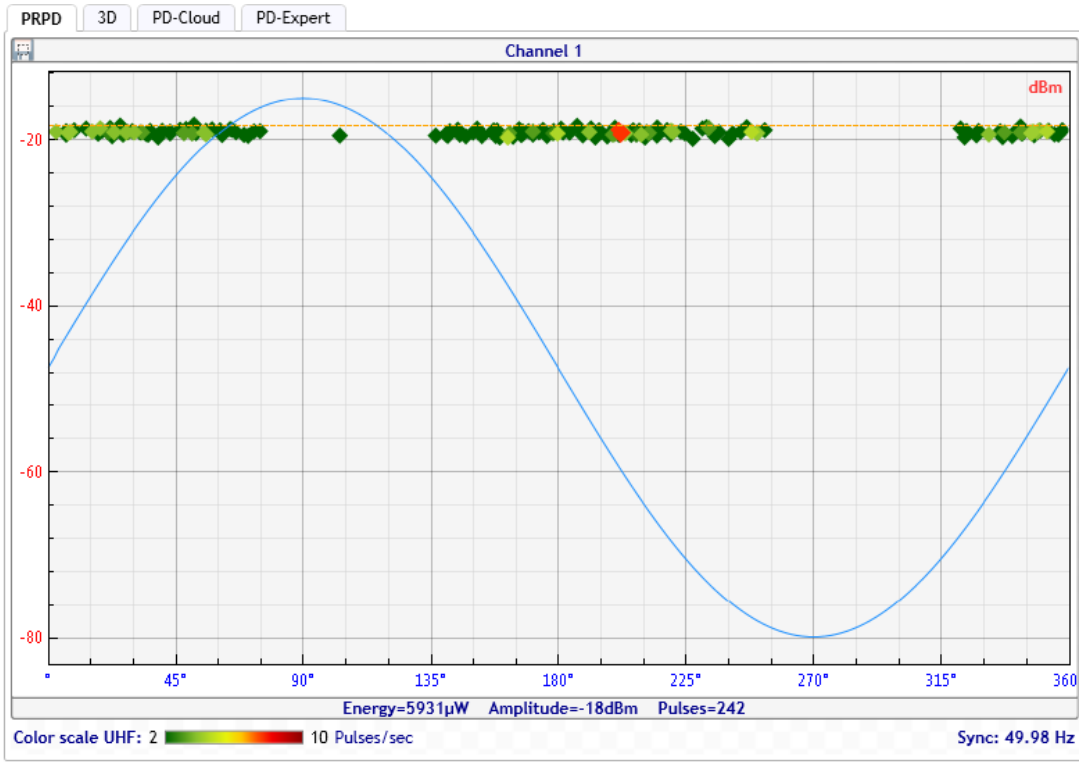
The 3d plots amplitude vs phase, and the 3rd axis is subsequent cycles. For example, if 25 cycles are captures, then the 3rd axis would contain the amplitude/phase results plotted as cycle 1, cycle 2, cycle 3….. PD pulses that occur at similar places on the cycle are easily seen.



3.6.1 PRPD

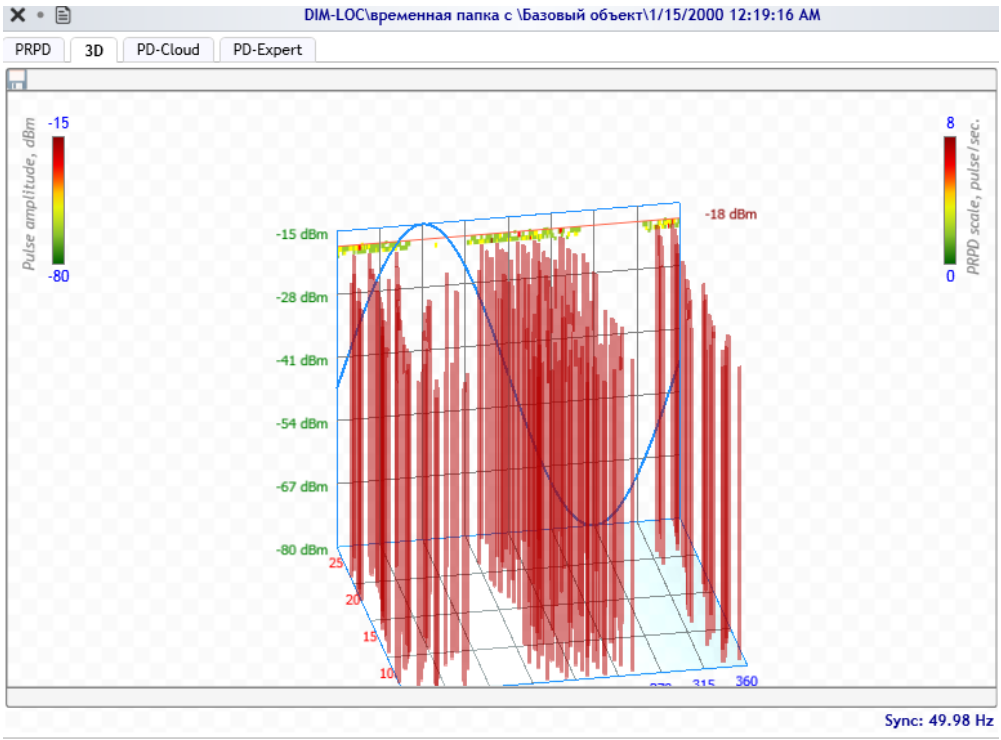
The PRPD tab is displays data in the form of PRPD plots, along with the power (energy), amplitude, pulse-count information. Double click on channel name to full screen displays the channel data (if more than one channel shown). Hold down the left mouse button to select the magnification area. Hold down the right mouse button to pan area. double middle-click will restore the view.

Click to save as a picture. If the original waveform information is available, then "CTRL + left click" on a point to see the source data of the original waveform.



3.6.2 PRPS(3D)

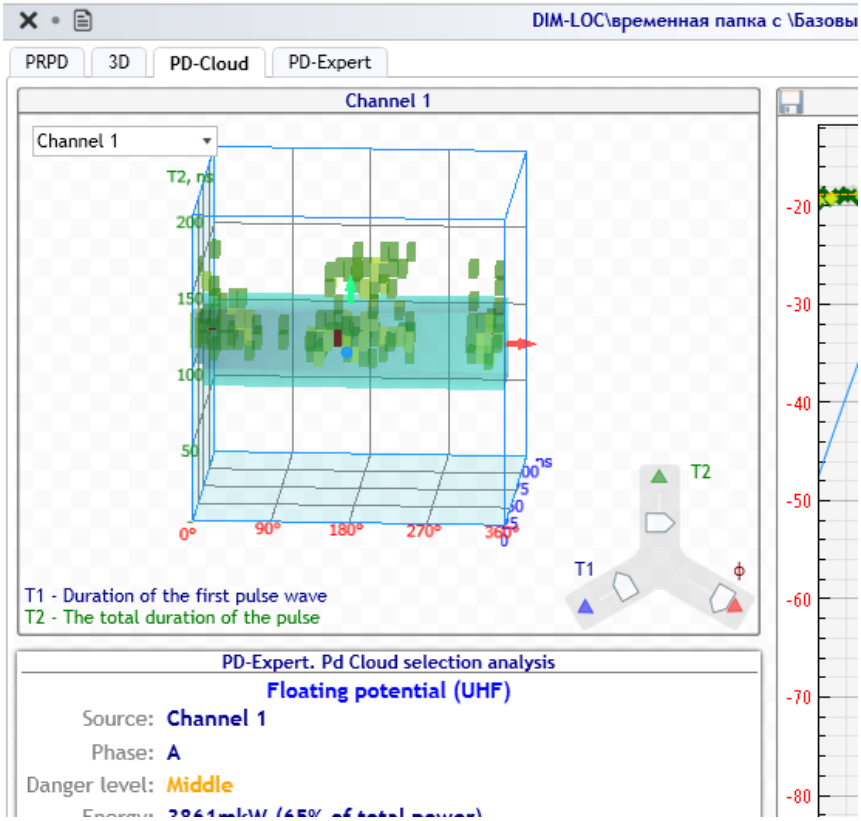
The PRPS(3D) tab displays the same data in the form of PRPS or 3d plot. Double click on channel name to full screen displays the channel data (if more than one channel open). Click to save as a picture.



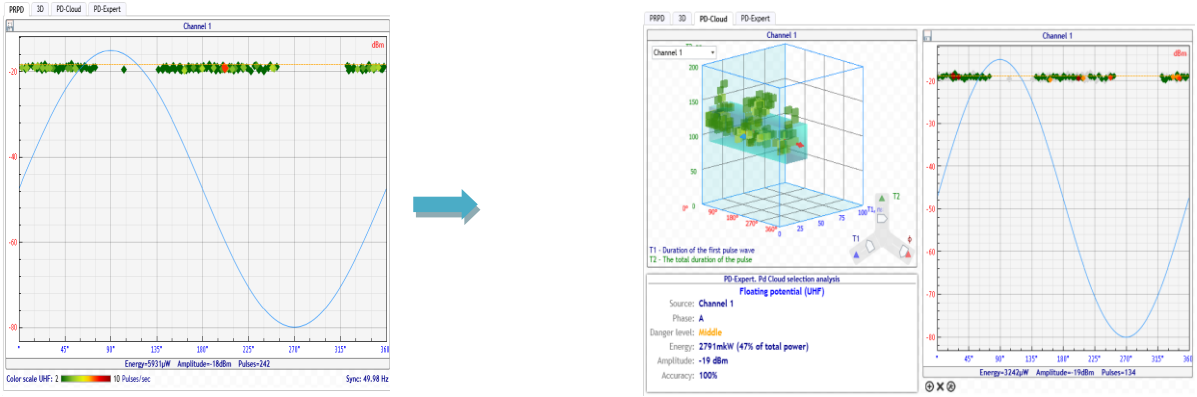
3.6.3 PD Cloud map

The PD Cloud map tab displays pulses in a 3d plot on axes of rise time (T1), pulse length (T2) and phase. The upper left corner of the main screen displays the current channel selection,

lower right for pulse cluster controller (a 3d cursor). Main screen size can be adjusted by adjusting the border. Hold down the right mouse button and drag, you can adjust and rotate the plot in 3 dimensions. The mouse wheel is used to zoom the plot.

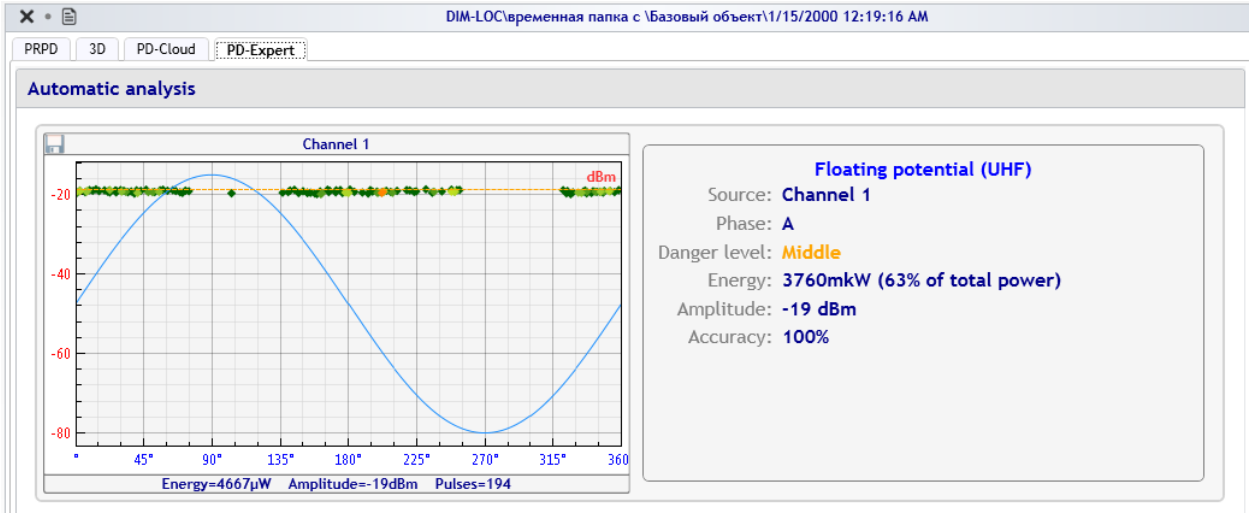


Adjust the lower right cluster controller T1-T2- Φ by moving the slider to adjust the selection box size. Use the mouse to drag the selection box around the display plot. Only pulses in the box selection are shown on the right side of the PRPD window displays. The analysis window below the PD Cloud show the result for the filtered PRPD.

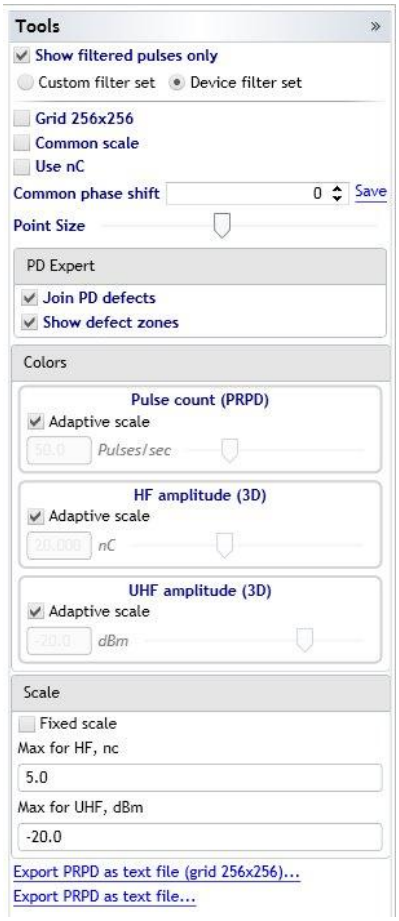


3.6.4 PD-Expert

PD-Expert tab displays offers the expert software PRPD custom designed for PD pattern recognition.


DIM-LOC\временная папка с \Базовый объект\1/15/2000 12:19:16 AM
PRPD
3D
PD-Cloud
PD-Expert
Automatic analysis
Channel 1
dBm
-20
-40
-60
-80
45°
90°
135°
180°
225°
270°
315°
360
Energy=4667µW Amplitude=-19dBm Pulses=194
Floating potential (UHF)
Source: Channel 1
Phase: A
Danger level: Middle
Energy: 3760mkW (63% of total power)
Amplitude: -19 dBm
Accuracy: 100%

3.6.5 Sidebar options

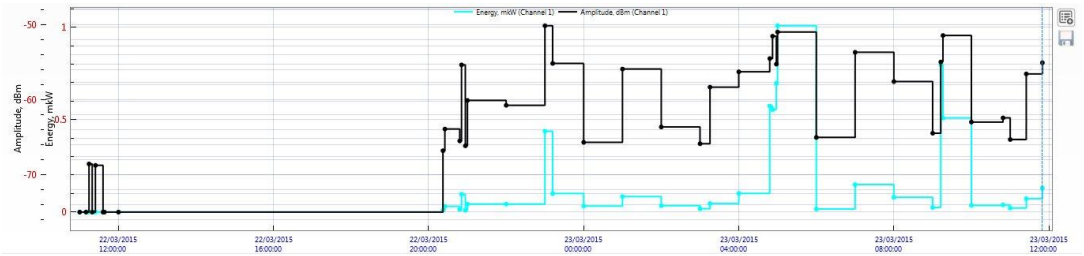


PD display options have “Tools” to compensate synchronisation signal phase deviation, pulse filter, adjust the display settings, and so on.

- Show only the filtered Pulse: not used in DIM-Loc.
- Resolution 256 x 256 : Select PRPD format of grid or point.
- Common scale uses the same scale for all plots shown
- Common phase shift: add a user value to the phase shift.
- Point size: PRPD data points display size.
- PD-Expert : Options for PD expert analysis.
- Colour: colour scale for PRPD selects fixed or adaptive (automatic).
- Scale: Fixed scale lock for the peak to a user value for PRPD and 3d.
- Export PRPD: exporting maps to a text file.

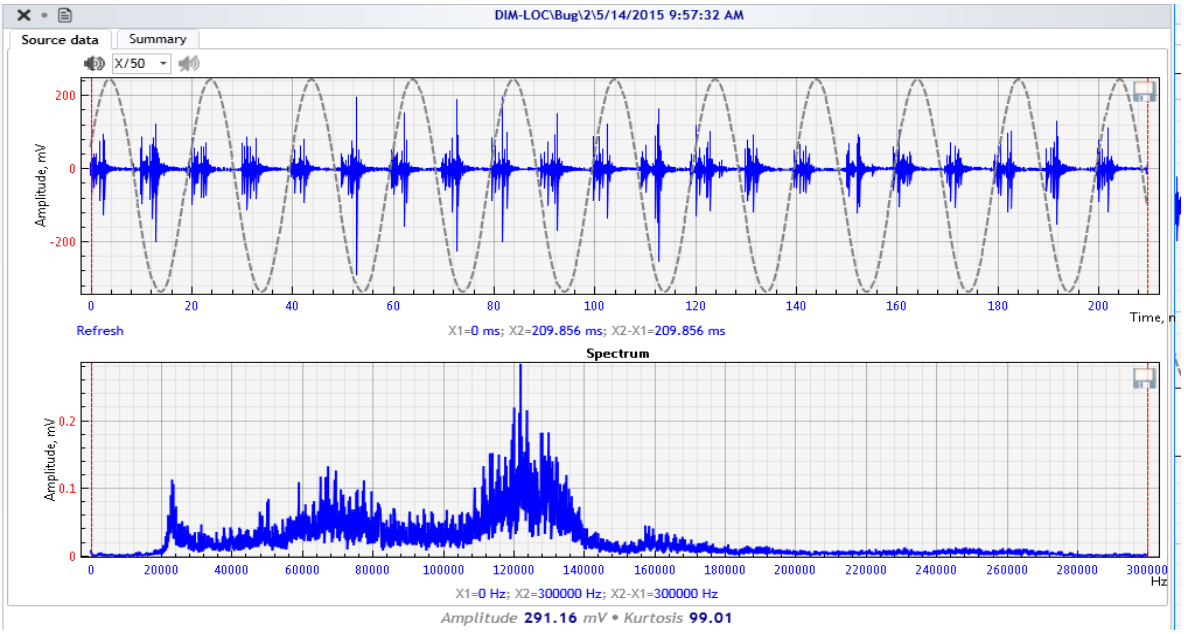
3.6.6 Trend analysis

In the menu "Tools" -> "Settings" -> "Trend", if checked for "display trends" then trend is shown for the selected folder and its subfolders over time. Click on button to display the channel selection settings.



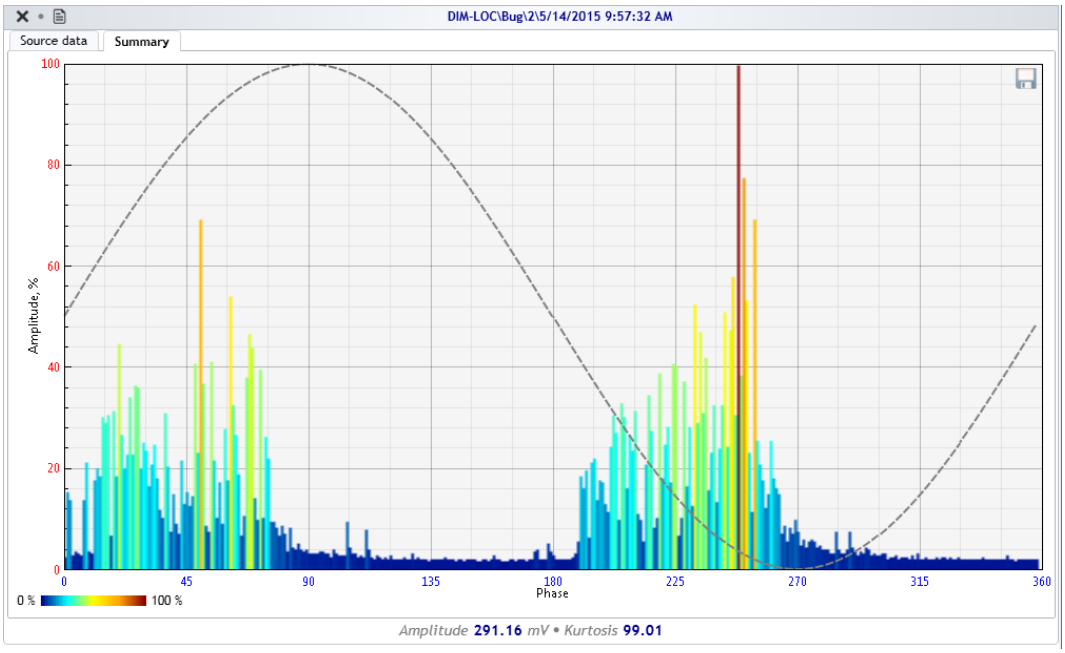
3.6.7 Acoustic

The acoustic data includes the raw data, and pseudo PRPD. Raw data looks as follows:



The original data contains time vs amplitude, and frequency vs amplitude plots. Users can adjust the cursor X1 and cursor X2 to read precise values. Users can select a specific frequency range spectrum analysis, and then data shows that extract from that frequency range.

The pseudo PRPD plot shows amplitude with phase as follows:



The colour is intensity, not based on amplitude. Continuous hits on the same amplitude and same phase will increase the count of hits to that point. The count of the hits to a single point determine the colour.

4. Contact information

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