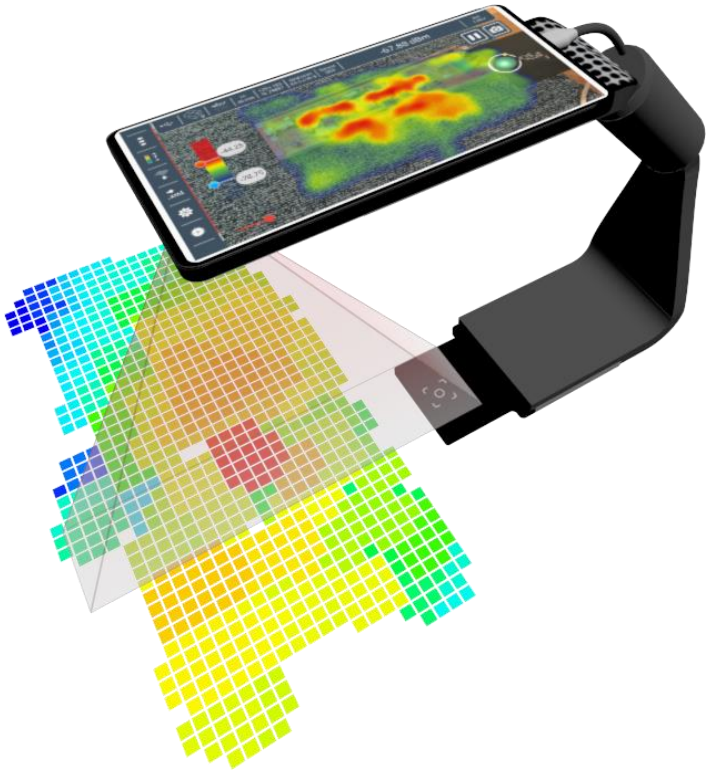
LUXONDES

See the electromagnetic waves



EM-SCANPHONE

User manual

04/2023 - EN

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Avenue de l'Europe
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Contents

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1 INTRODUCTION

To map or scan the electromagnetic EM emissions of electronic cards or any environment requires the use of relatively complex mechanical or electronic devices.

These systems may be difficult to transport and use, not well suited to perform measurements in confined environments.

Autonomous, compact and fast, the EM-Scanphone aims to overcome these constraints.

It makes it possible to map the electromagnetic environment directly on site or in locations difficult to access, such as inside a vehicle for example.

This 3D scanner is composed of a smartphone coupled to removable EM field sensors, allowing to cover different configurations.

Using augmented reality technology, it includes an interface that allows communication via an USB port between the smartphone and the various sensors.

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2 Presentation

2.1 THE SMARTPHONE

Evolution of smartphones and android versions forces us to test many configurations.

we'll make sure you always have the latest generation smartphone

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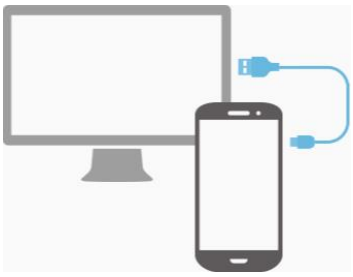
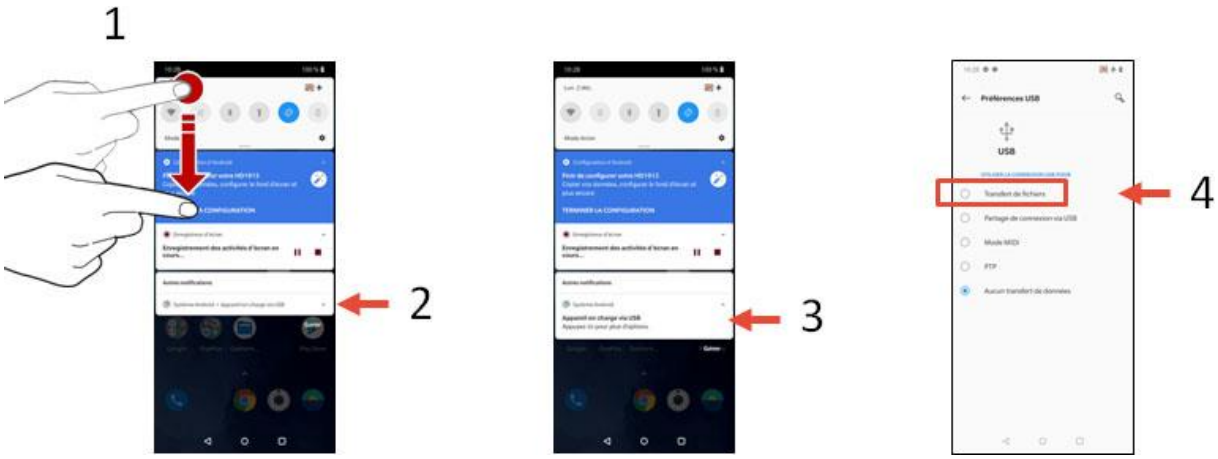
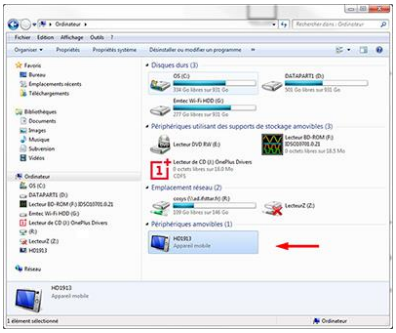
2.2 PC CONNECTION





To connect for example the One Plus 7T Pro to a PC, you must activate the File transfer function, which will then automatically open the communication via USB.



HD1913

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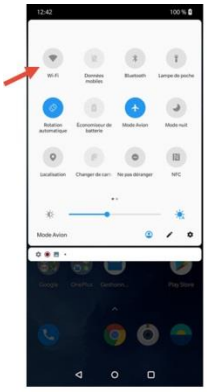
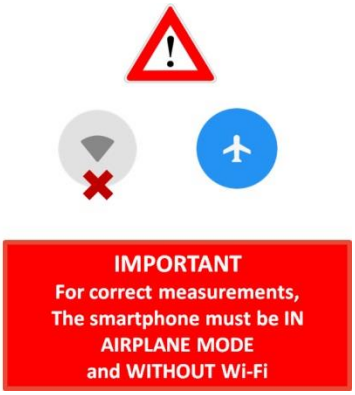
2.3 AIRPLANE MODE

When mapping in the “Telecom” frequency band (between 2 GHz and 3 GHz), data exchanges between the smartphone and the external environment could disturb the measurements.

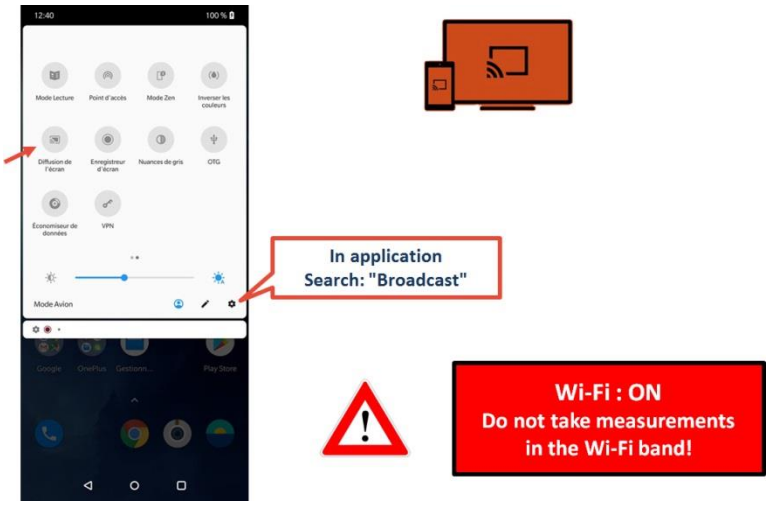
In this case, the smartphone must be placed in airplane mode and without Wi-Fi. This also significantly increases the autonomy of the EM-Scanphone.





2.4 CAST SCREEN ON TV OR PC

Duplicating the screen of the smartphone to a television or video projector allows sharing the experience to a wider audience (restitution of measurements, teaching, congress, demonstration ...)



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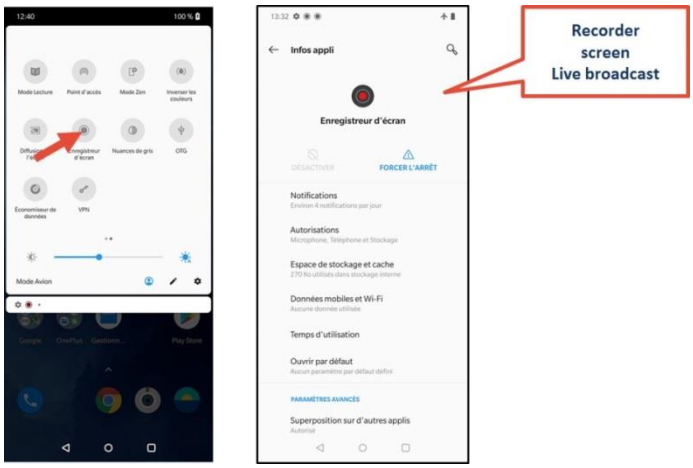
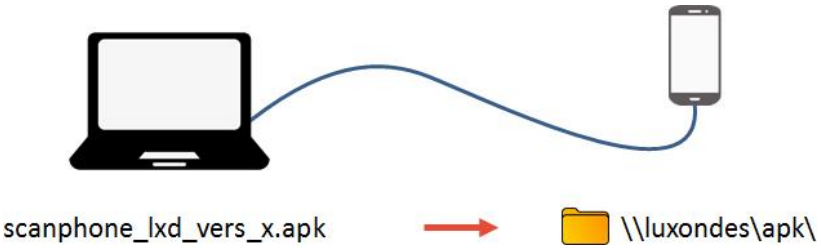
2.5 SCREEN RECORDER

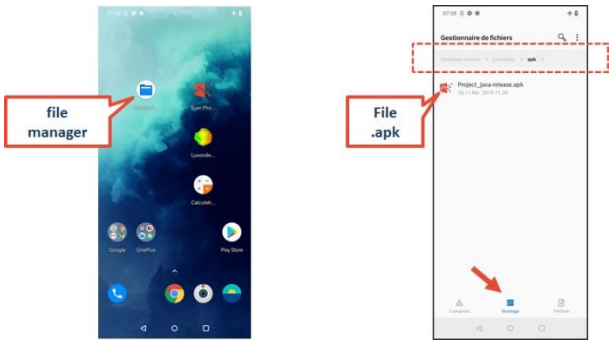
The OnePlus 7T smartphone has an internal application that can record the screen in full HD video format. This allows you to review a video of in lab or on-site measurements.



2.6 APPLICATION UPDATE



Place the new version of the APK in the corresponding folder on the smartphone and start the update.



With the file manager, click on the APK file for the update.

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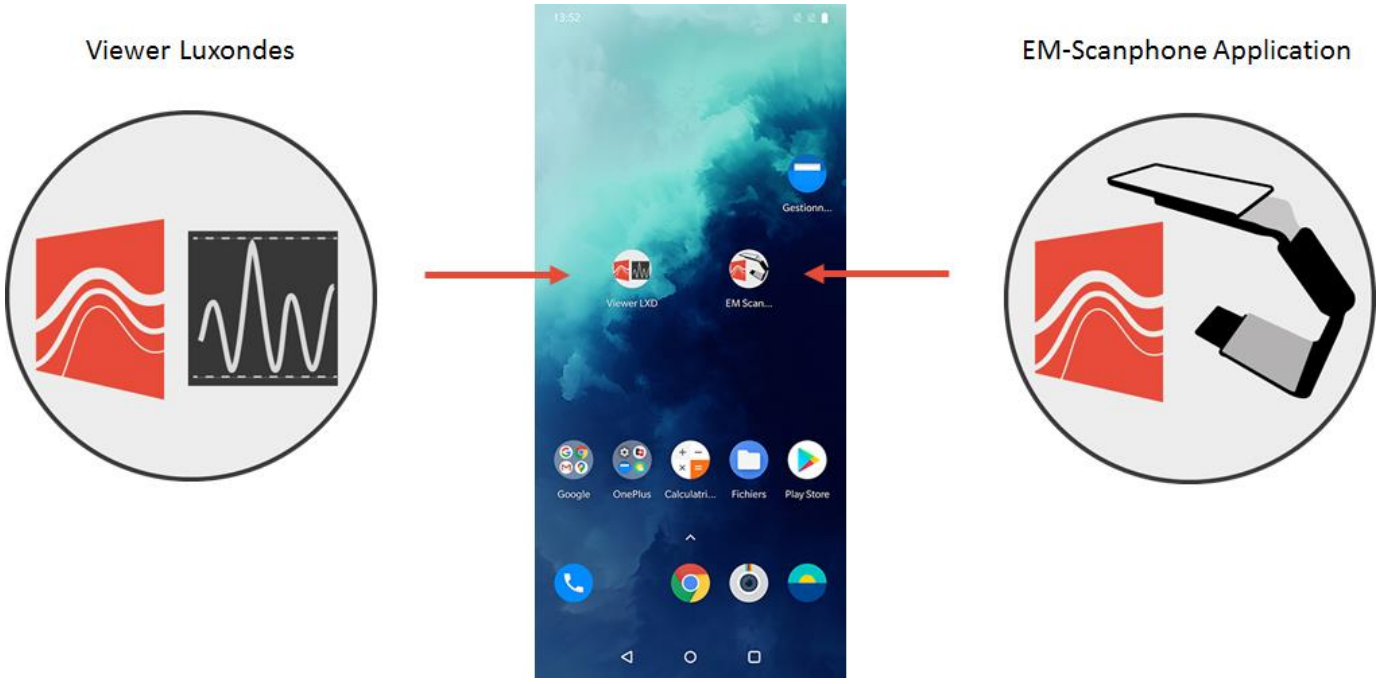
3 EM-Scanphone application



When the USB-C cord is connected the smartphone application starts automatically. Otherwise, launch it manually by clicking on the icon on the home page.

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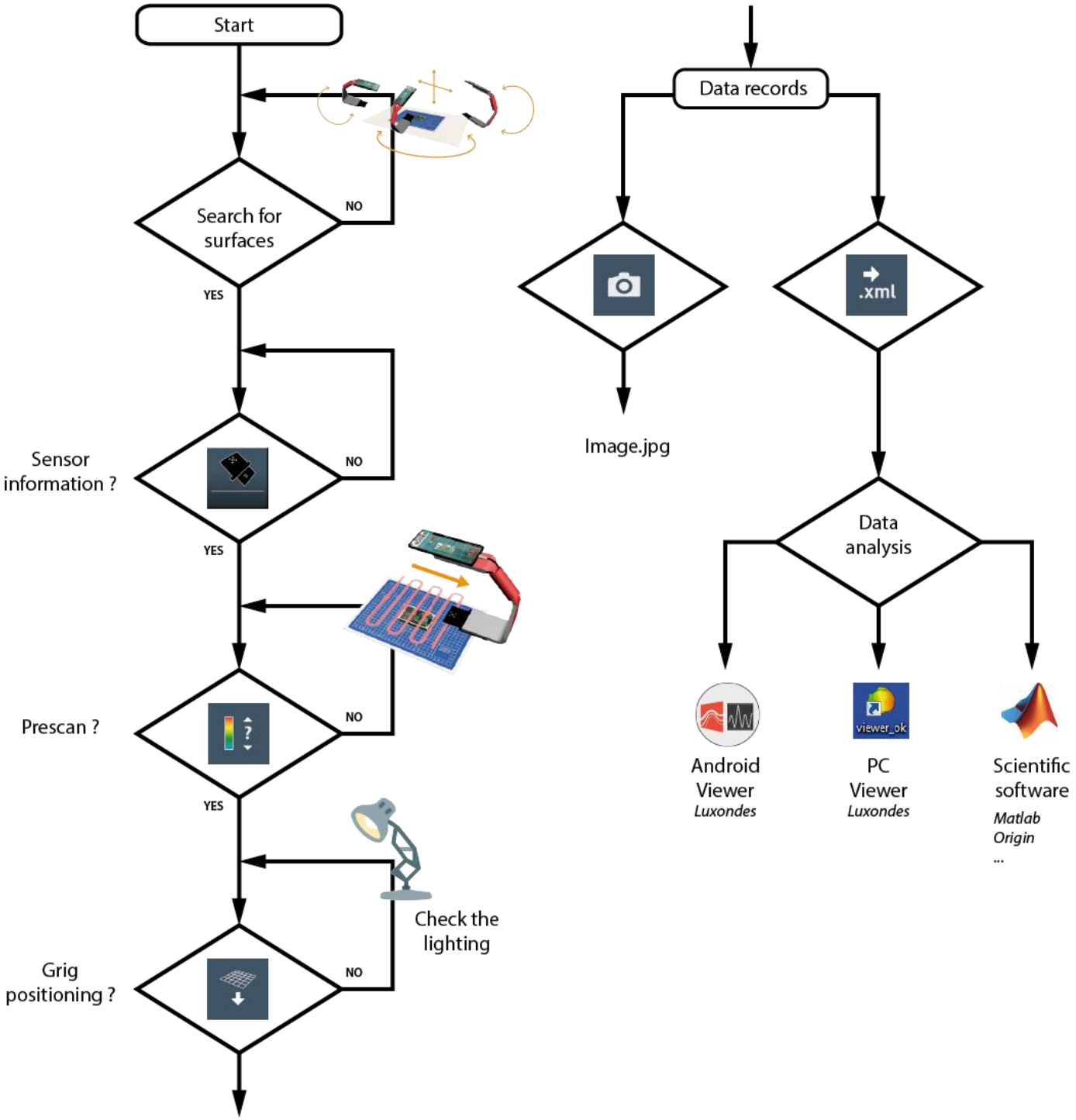
3.1 Organizational chart / Use EM-Scanphone



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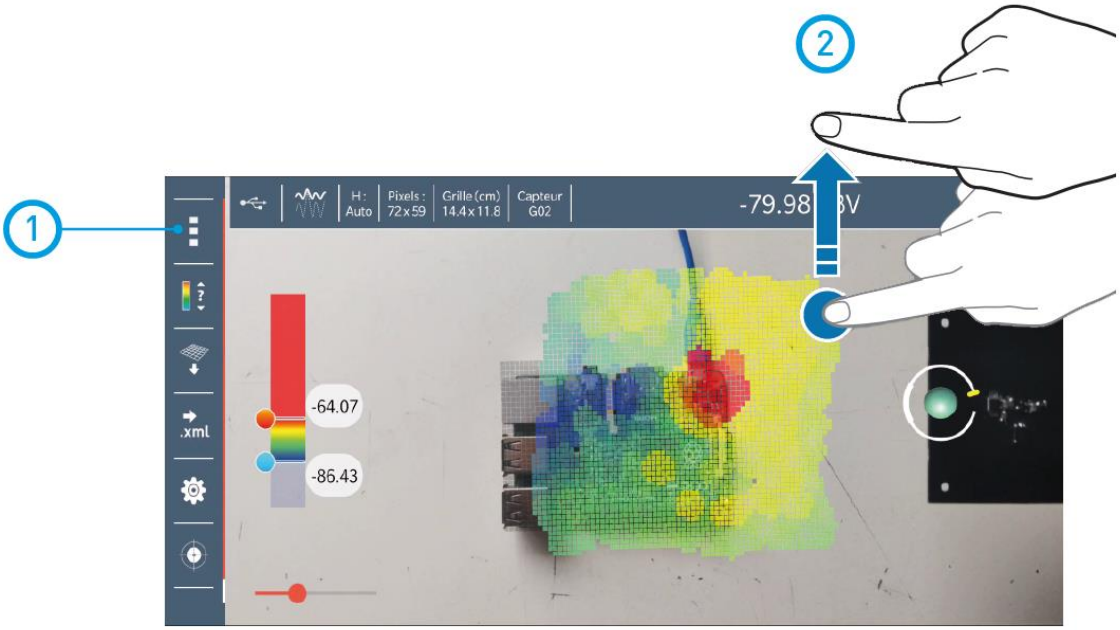
3.2 MAIN WINDOWS

Visible or hidden menu



① Left menu visible or hidden

② Top menu visible or hidden

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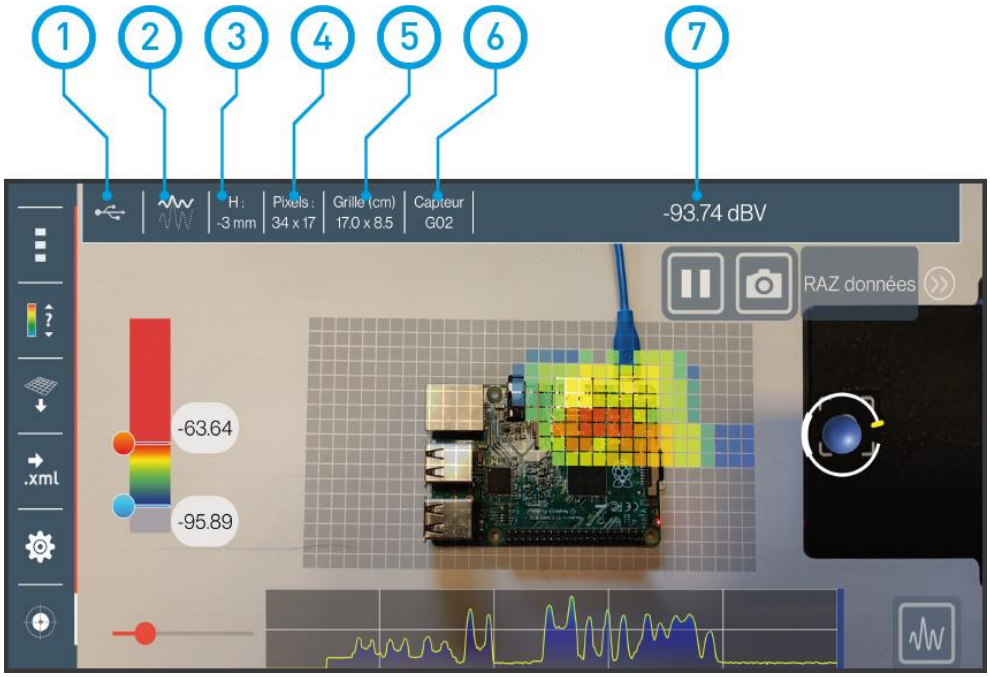
Main Windows / Top menu



① USB connection check

Validation of the USB-C connection between the smartphone and the electronic card

② Active MaxHold / Average function

Max Hold OFF: For each scan at the same place on the grid, the last value displayed.

Max Hold ON: For each scan at the same place on the grid, comparison and display of the Max value.

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Average ON: For displays an average signal value. **Do not use with logarithmic values**

③ Automatic grid height

When the grid is parallel to the ground mode: **height display**

When the grid is in automatic mode, display: **AUTO**

④ Number of grid pixels

Grid resolution or number of pixels

When you go beyond the limits of the grid, it automatically increases its size.

There is no grid size limit

⑤ Grid dimensions

Grid size display in cm

⑥ Name of sensor used

Name of the used sensor

**see the sensor section*

⑦ Instantaneous value measured by the sensor

Instantaneous display of the value read by the sensor, with the corresponding unit

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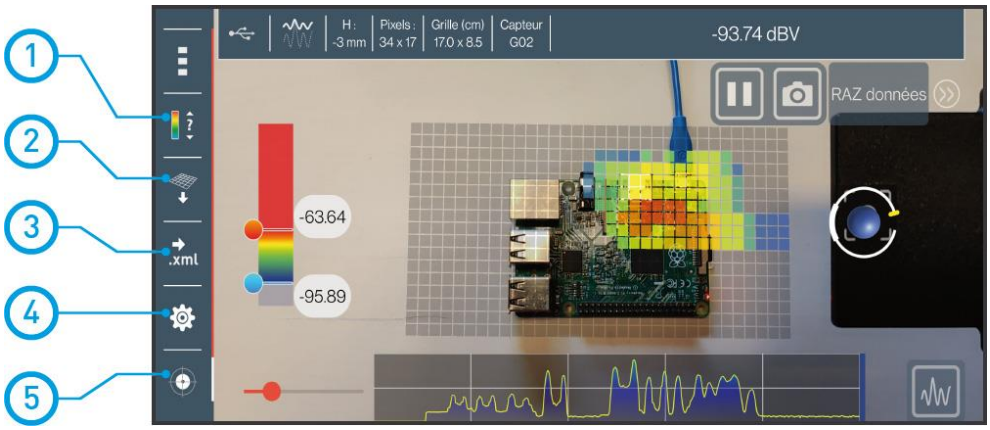
Main Windows / Left menu



① Pre-scan function

*see the Pre-scan section

② Fix the grid in the scene

*See the grid parameter section

③ Export data XML

*See the export data section

④ Setup / Configuration

*See the configuration section

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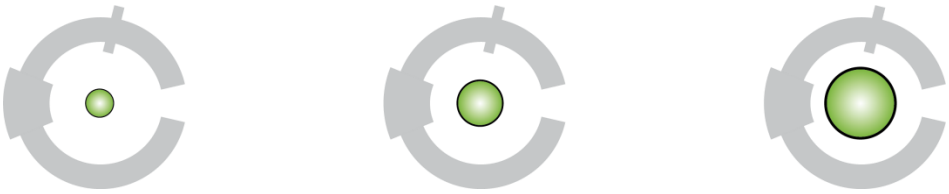
⑤ Sensor diameter



Depending on the type of mapping that you want to perform, it is possible to change the size of the (virtual) sensor to reach a higher or lower resolution. Three sizes are available.

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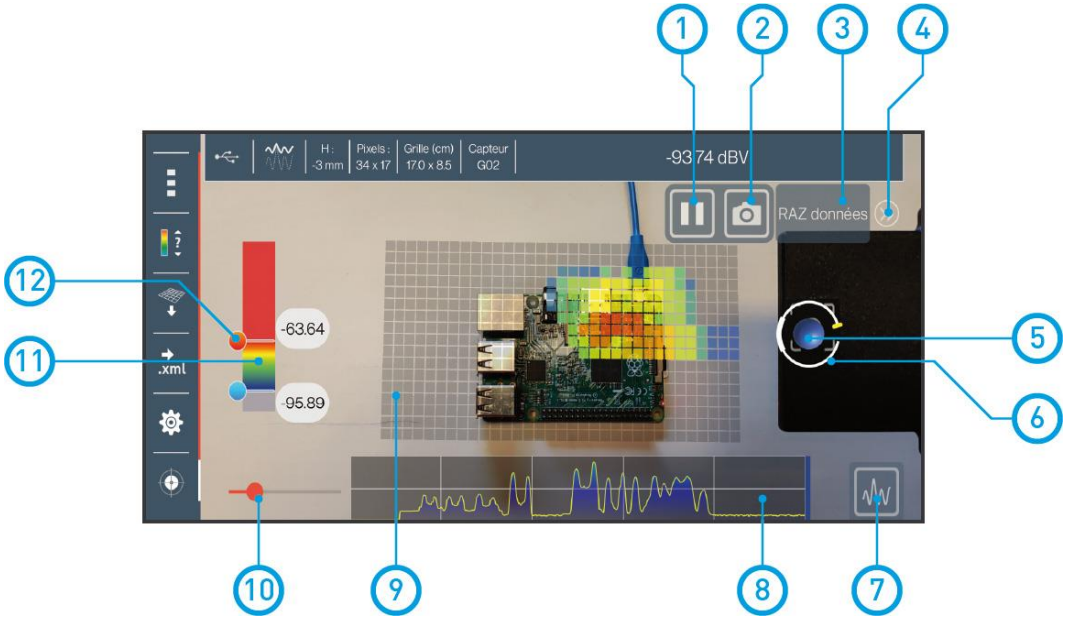
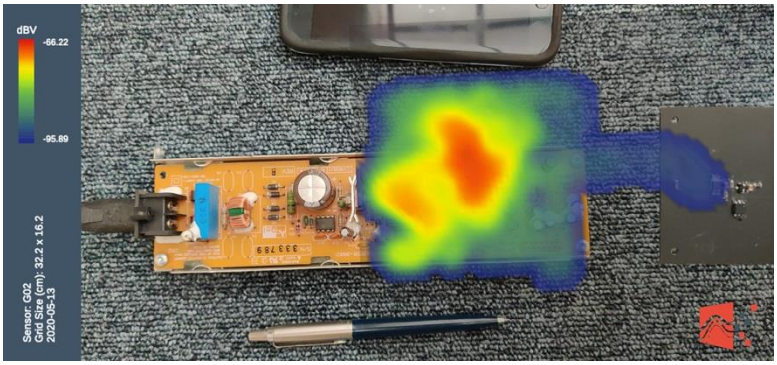
Main Windows / Various functions



① Run / Stop data acquisition (3D Mapping)

Record / Pause mode : Stops data acquisition. **If you are using the 3D grid, it's important to stop the acquisition so that you can step back and display the matrix from further.**

② Screenshot



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Screenshot example

The screenshots are in the folder: **`PC\HD1913\\\Luxondes\Screenshoots`**
Example file name: **`screen_2020-05-13_10-59-02_type_G02.jpg`**

The name of the file includes the date and the name of the probe

③ Reset / Clear grid

Clears data from the grid. Hold down for 2 seconds to erase the grid

④ Hide the buttons on the left

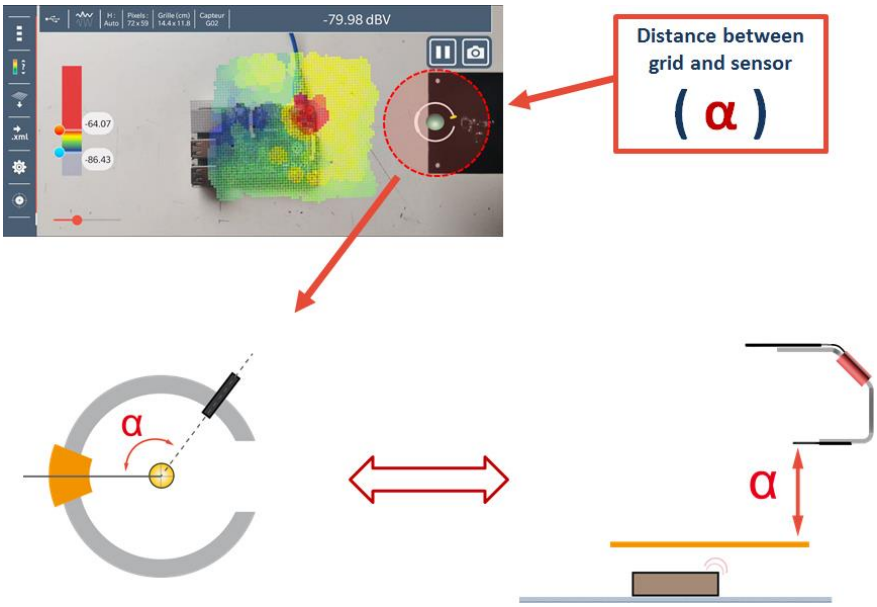
Allow to display or hide the pause and screenshot buttons

⑤ Representation of the sensor in space

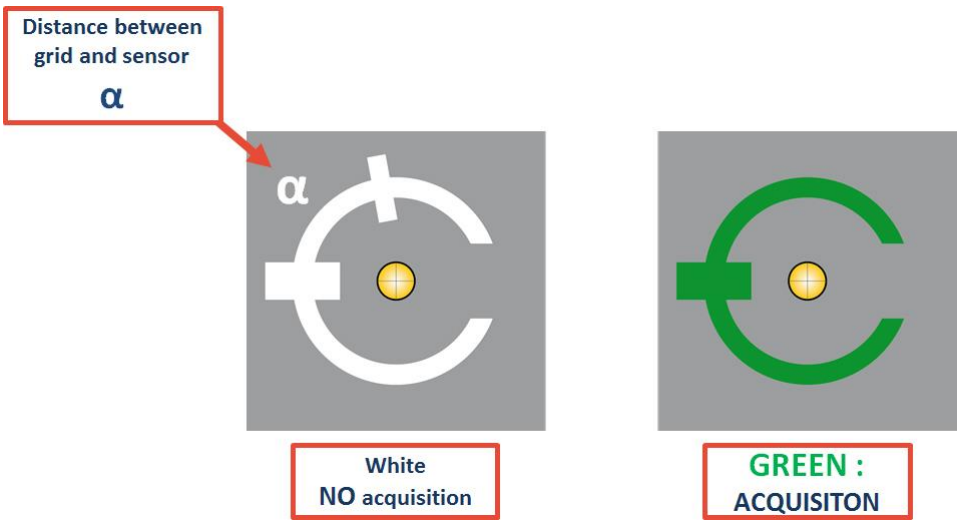
The sphere is positioned virtually at the location of the sensor
(see the parameter section to modify the position)

The color displayed represents the intensity of the signal received by the sensor

⑥ Distance between grid and sensor



On the screen, the distance between the grid and the sensor is represented by the movement of a cursor on the arc of a circle.



When the sensor and grid are correctly positioned relative to each other, **the arc of a circle turns green.**

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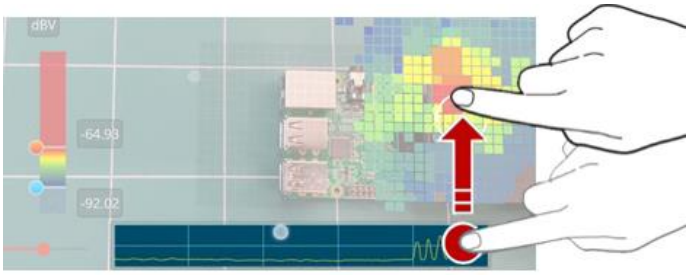
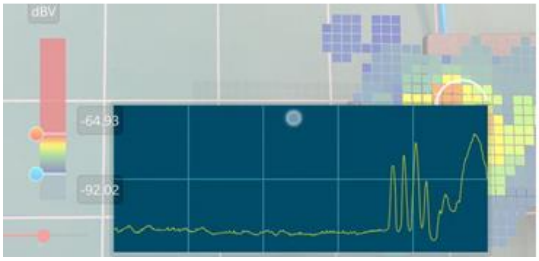
⑦ Hide the graph

Activate or deactivate the display of the scrolling graph.

⑧ Scrolling graph

Graph of the variation detected by the sensor. it is possible to enlarge the graph with your finger





⑨ Augmented reality mapping

Direct display of the measurement on the grid
(see the parameter section to modify the type of the grid)

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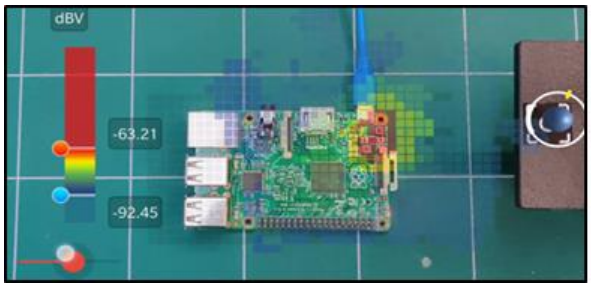
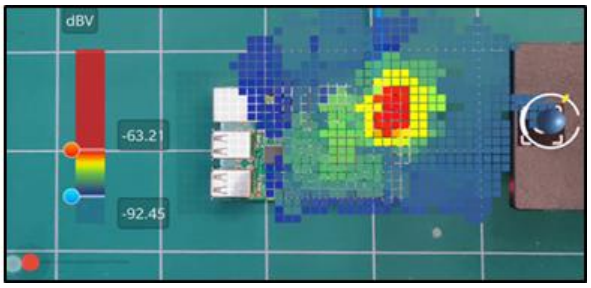
⑩ Setting the transparency of the grid





Modification of the transparency of the cartography

⑪ Color scale

The dynamic range of the signal is represented between the high and low tresholds

⑫ Setting the high and low thresholds

It's possible to modify in real time the high and low tresholds, which allows to change de dynamics and to visualize a small variation with a large color scale

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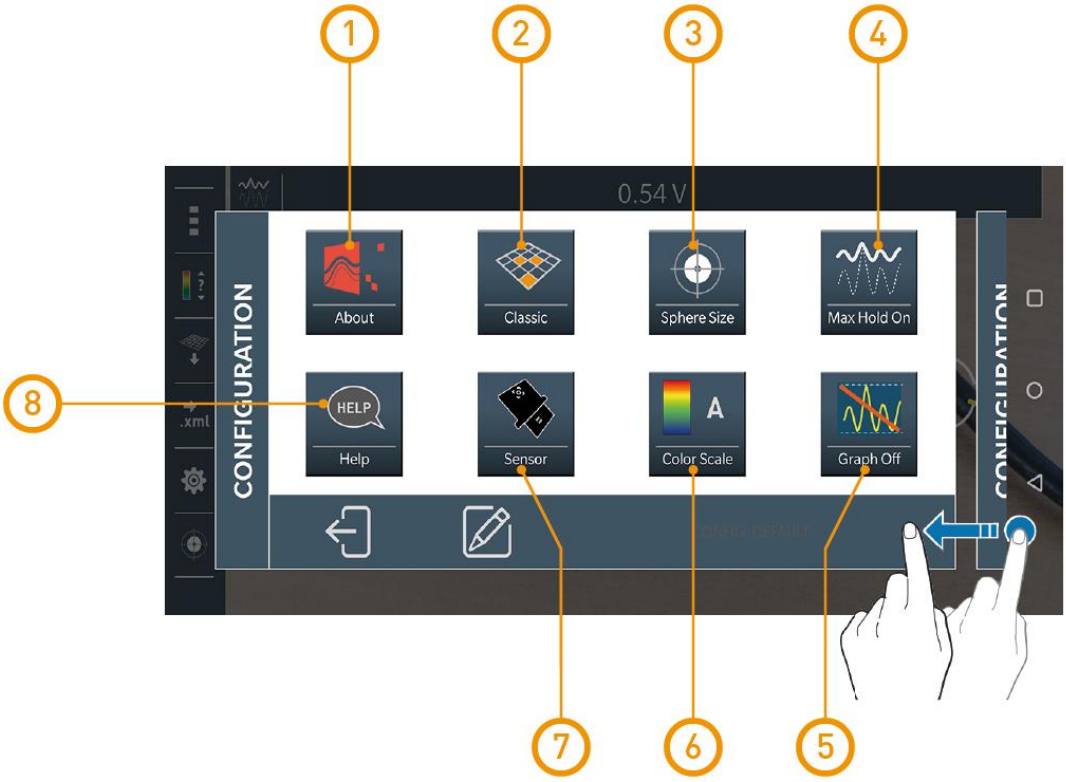
3.3 SETUP WINDOWS

Parameter menu 1



1 About

APK Version

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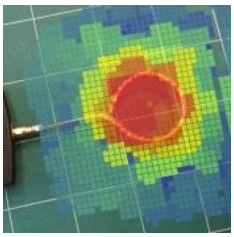
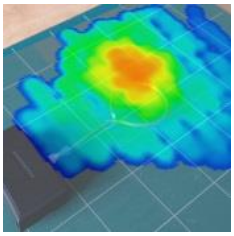
② Grid type selection

After scanning the environment (around the place to be mapped) it is possible to choose the type of grid that is displayed. By default, the standard grid is displayed (Classic).



Classic (Default)

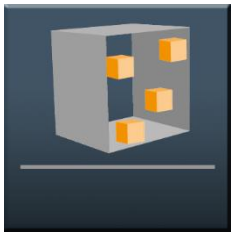
Each pixel corresponds to a square
with the color of the sensor intensity.

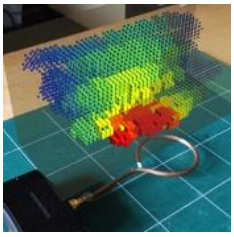


Landform

Mode of representation in relief with cloud effect.

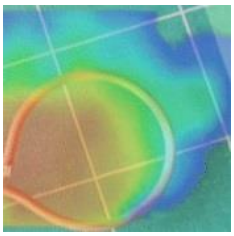
** Relief height in parameter*





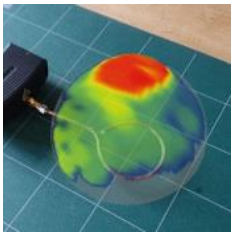
Simple 3D Mode

3d mode is used to map a grid stack.
Transparency allows you to change the size of
the pixels according to the amplitude. (*)



Cloud 3D

Cloud 3d allows
a kind of ghostly visualization. (*)



Half Sphere Mapping

With the half-sphere, it is possible to have an
overview of the distribution of
the field around an object under test.

(*) The luxondes viewer is not compatible with 3D modes

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③ Sensor diameter

As in the main menu, it is possible to select the size of the virtual sensor. Three sizes are available.

④ MaxHold function

As in the main menu,

Max Hold OFF

For each scan at the same place on the grid,
the last value is displayed.

Average ON

Moving average.

Max Hold ON
For each scan at the same place on the grid,
comparison and display of the Max value.

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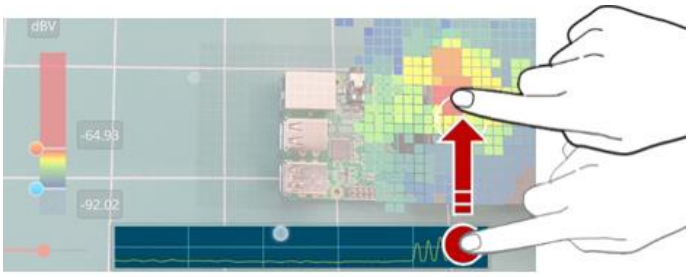
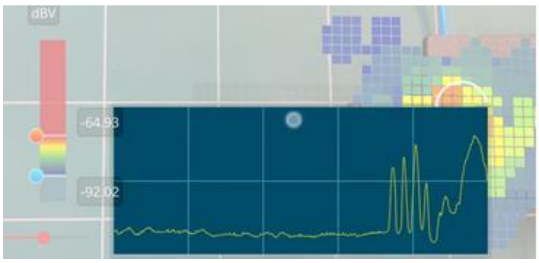
⑤ Curve display

With the curve display menu, a graph allows you to continuously view the variation of the measurement.





⑥ Color scale

For a better understanding it is possible to change the type of color scale.

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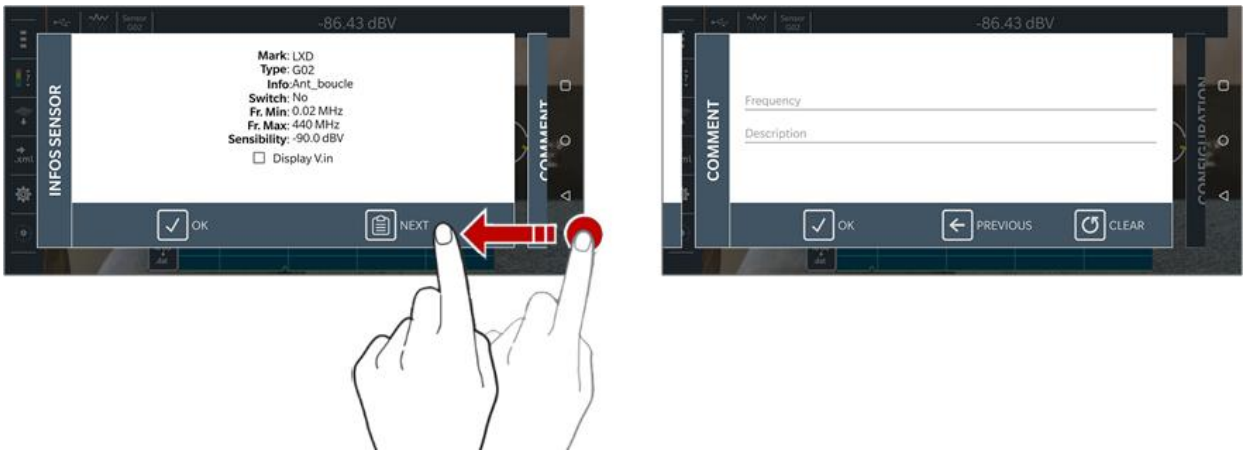
⑦ Sensor information



Reading the characteristics of the sensor automatically changes the measured values and the corresponding unit.

- **Brand:** Company name
- **Type:** Sensor name
- **Info:** Various information
- **Switch:** Sensor with switch – Yes / No
- **Min Fr. :** Min Frequency
- **Max Fr. :** Max Frequency
- **Sensitivity:** Detector sensitivity

The second window will allow you to write comments corresponding to the mapping as well as the used frequency.

⑧ Help

Simplified help document.

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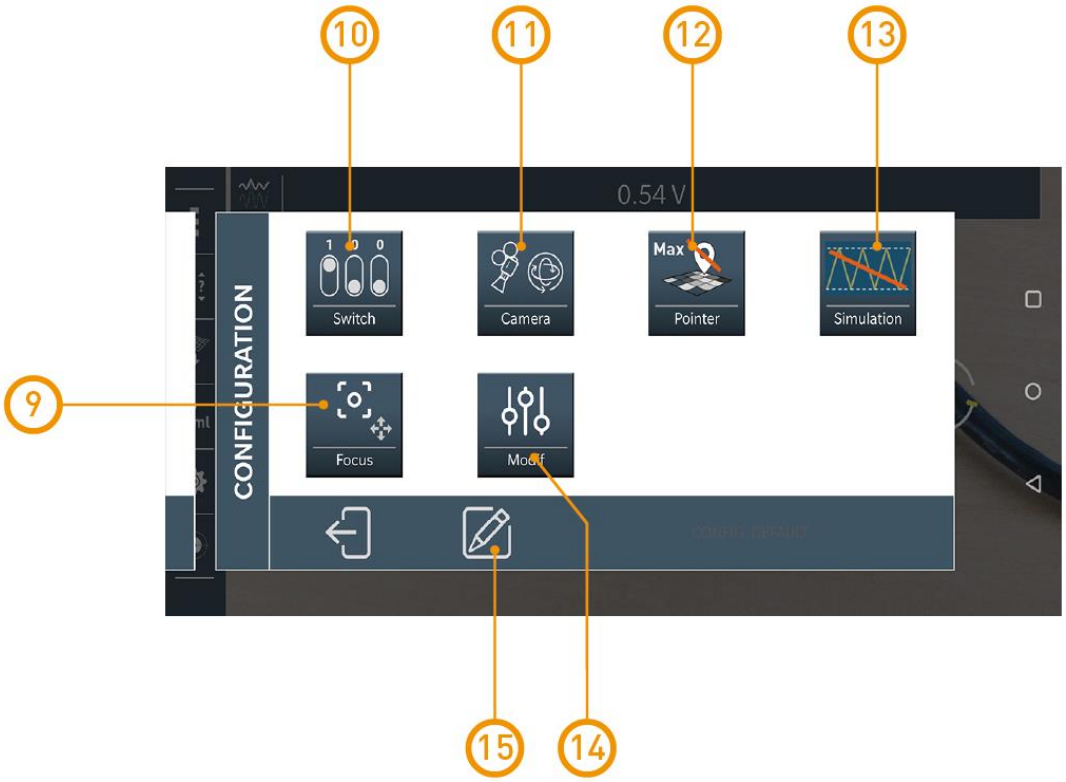
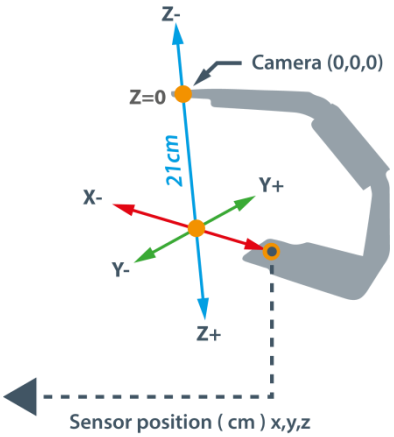
Parameter menu 2

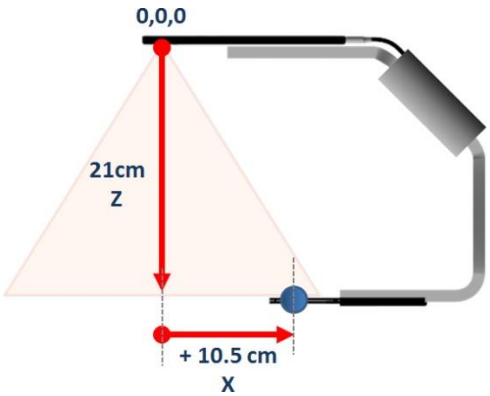


9 Sensor position adjustment

Adjustment of the position of the sensor in space

The camera lens corresponds to the zero point in space.





The position of the sensor relative to the camera is adjusted at the factory

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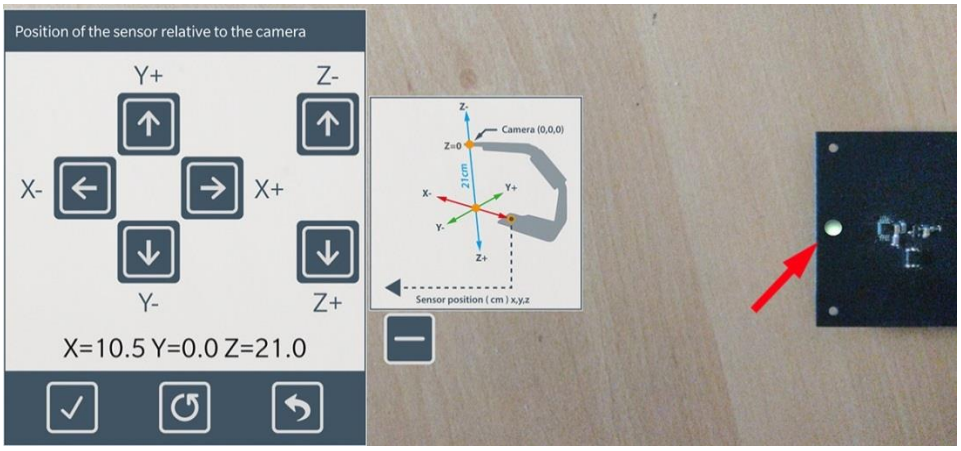

x, y, z position of the probe relative to the camera. By default (x=10.5 y=0 and z=21) mm

Example, with a custom probe you have to change the position of the sensor relative to the camera.

The new values can be saved with the parameters.

⑩ Switch

When the sensor is compatible with switches it is possible to select different measurements.

Example for a triaxial probe. *In development*

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⑪ Fixed camera

When you activate "Static Camera" a new button is visible in the main menu.

When it is active, the scene is frozen in black and white. Only the grid and the displacement of the sensor are active.

This mode allows you to view the scan by fixing the image of the environment. This allows you to make educational videos of experiments or vdo clips (Tutorial)

⑫ Display the maximum value

When this option is active, a pointer positions itself at the maximum value location of the mapping.

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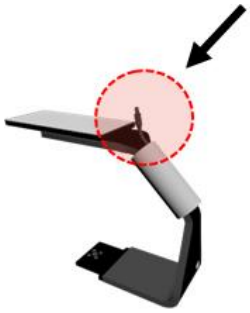
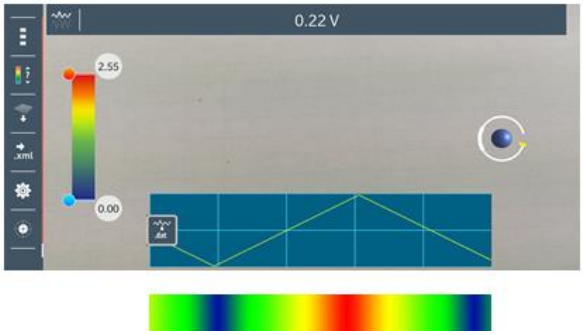
13 Simulation Mode



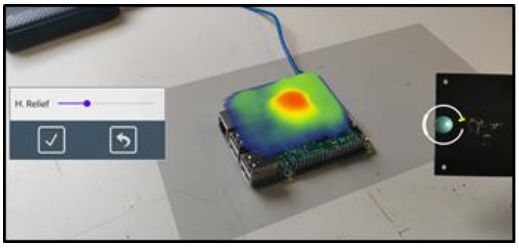


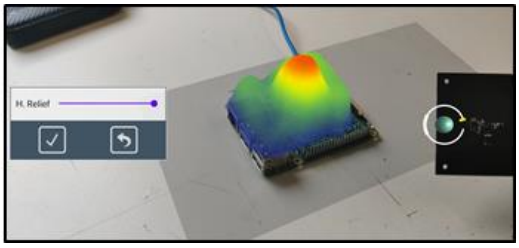
Important: To activate the simulation mode, the USB-C connector must be disconnected

The application will simulate a voltage variation between 0 and 2.5v in the shape of a triangle. This allows you to test different grids or different configurations of the application

14 Options setting – Relief Height

The relief grid must be selected





Relief height adjustment

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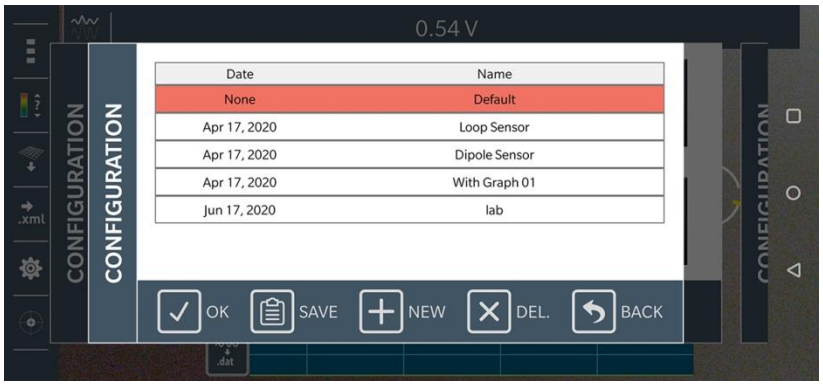
⑮ Settings management

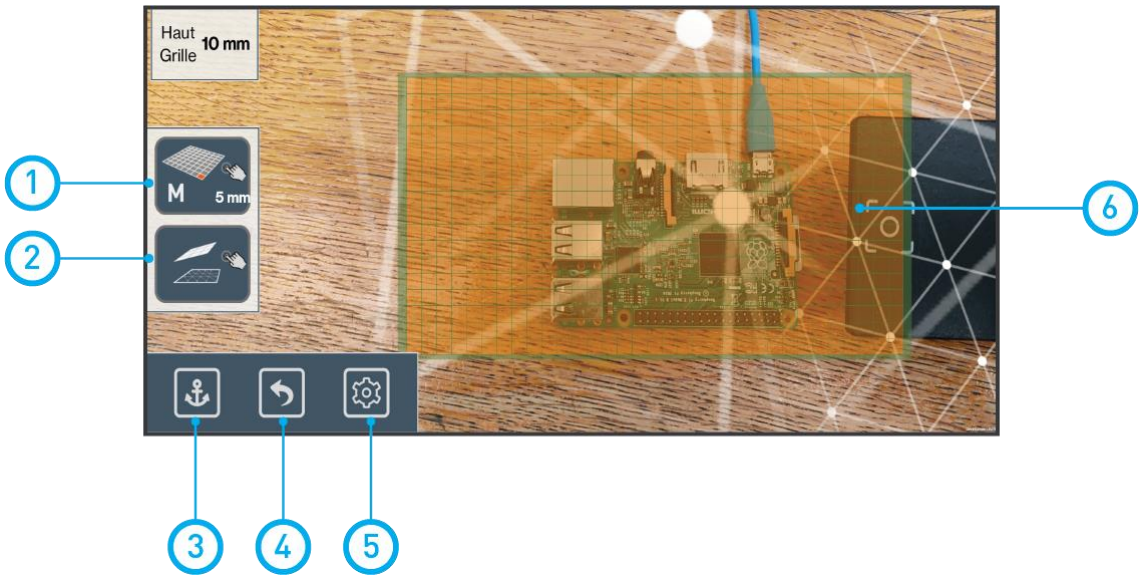


All parameters (menu 1 & 2) can be saved with a name. The setup also saves the set position of the sensor.

The factory mode cannot be changed

4 Grid settings

4.1 Environmental recognition



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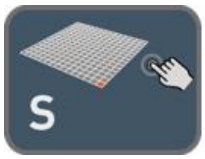
① Definition of the grid

Select the definition of the grid.



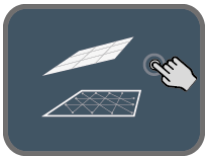
S = 2 mm

M = 5 mm

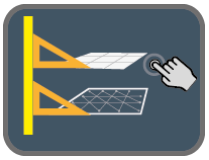
L = 10 mm

XL = 25 mm

② Select the orientation of the grid

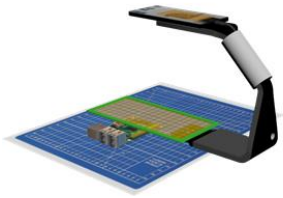


Free positioning of the grid

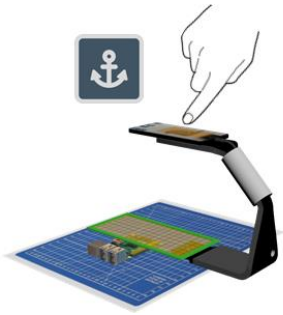


Grid positioning parallel to the ground

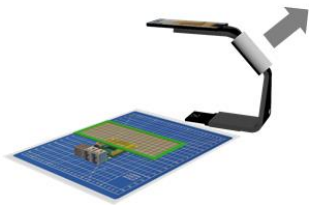
③ Anchoring the grid



Step1: Grid positioning



Step 2: Anchoring the grid



Step 3: Grid remains fixed

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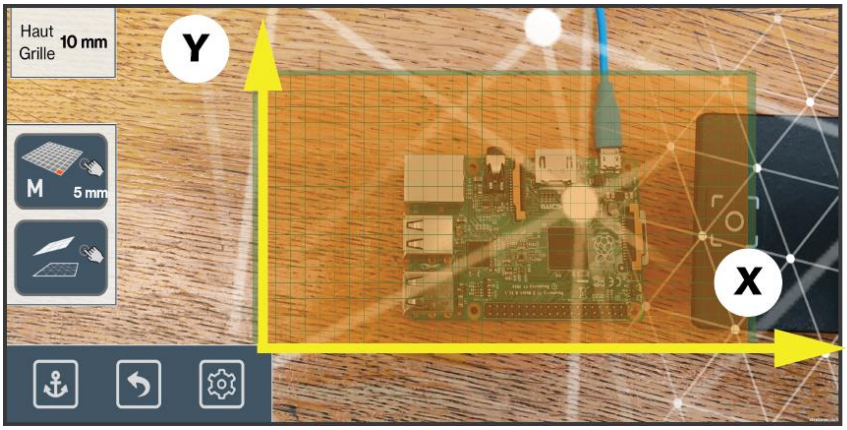
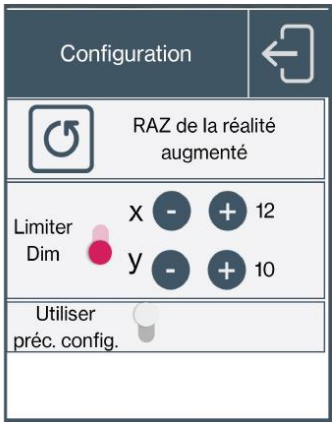
④ Return

Return to next menu

⑤ Size configuration

Size configuration





you can limit the size of the grid by setting xy(z). Without setting the grid will automatically expand

if you have done a mapping previously then you can take the old configuration (last config)

The application saves the size of the last grid used.

From the second scan, it is possible to recover the previous dimensions.

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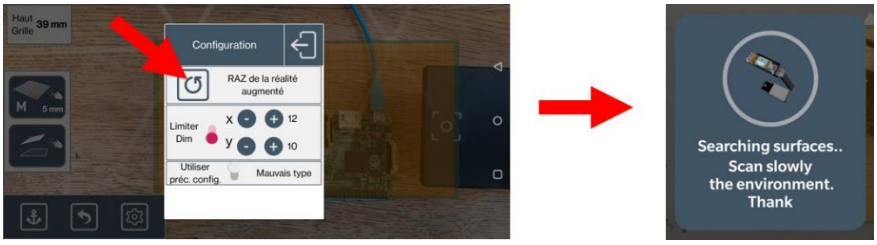
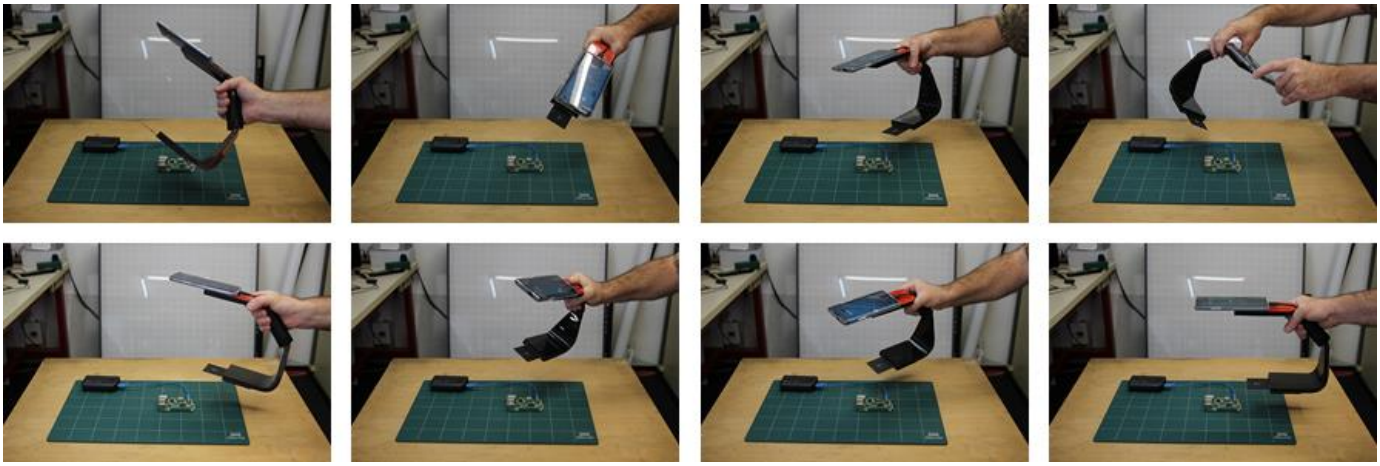
⑤ Reset augmented reality

In order to be able to build its augmented reality environment, the smartphone must initially have sufficient information linked to the visual cues constituting the object under test and its immediate environment (visual landmarks). It is therefore necessary to carry out a learning phase which consists in slowly sweeping the surface around the object with the smartphone over the surface to be mapped so that the application learns the necessary environmental cues.

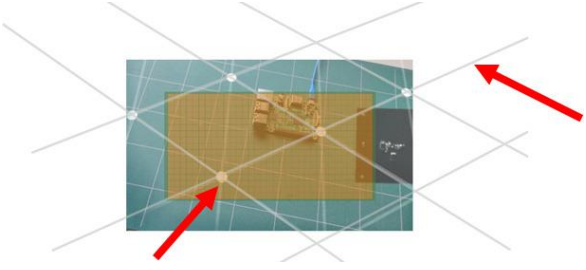


Sweep slowly the scene to be mapped

Ensure that the area to be mapped be well lit



In the virtual environment you can see the surfaces detected by the scanphone detection algorithm represented by lines and dots



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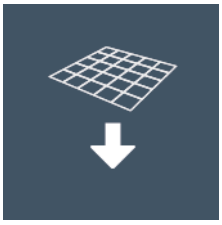
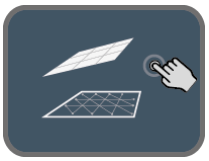
4.1 GRID ORIENTATION

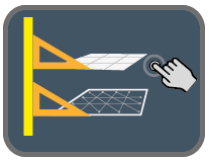


Positioning of the grid in the augmented reality environment

The grid can be positioned in any orientation (Mode free) or parallel to the plane(mode parallel).

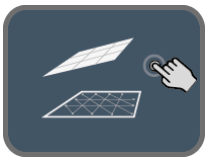


Free positioning of the grid

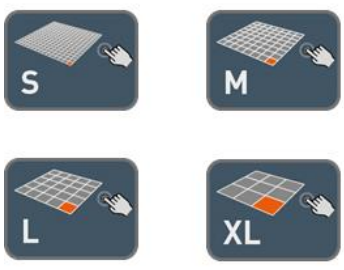


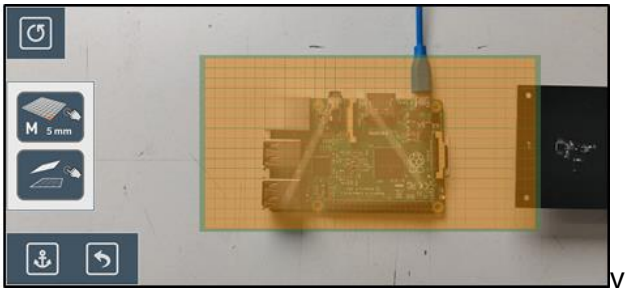
Grid positioning parallel to the ground

4.2 FREE POSITIONING OF THE GRID



To start, select the definition of the grid.





S = 2 mm **M = 5 mm** **L = 10 mm** **XL = 25 mm**

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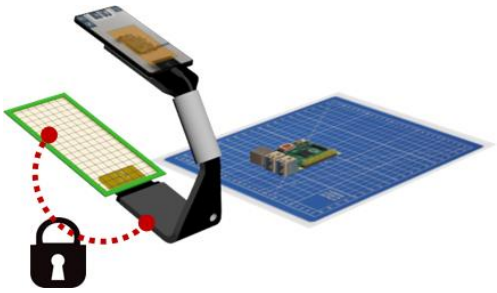
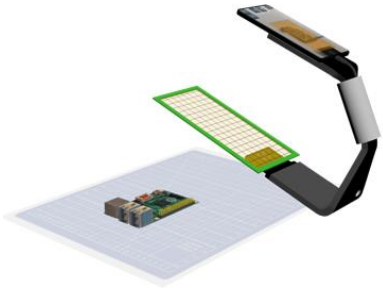
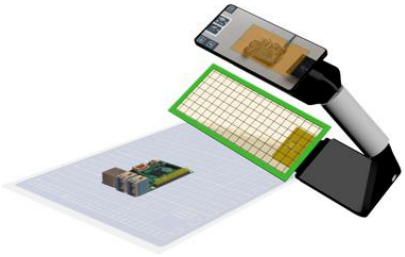
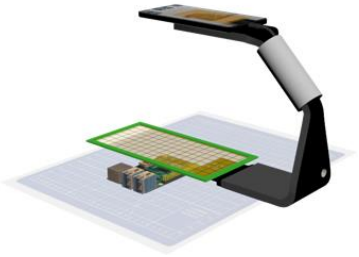
Select the place where you want to position the grid

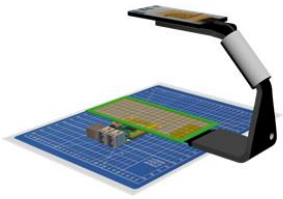


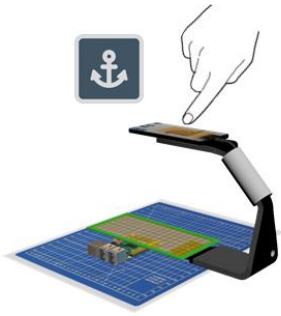


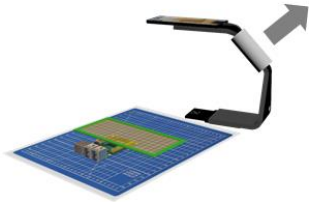




The grid is virtually linked to the EM-Scanphone at the location of the sensor







Step1: Grid positioning

Step 2: Anchoring the grid

Step 3: Grid remains fixed

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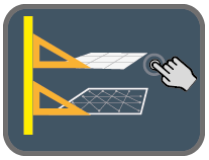
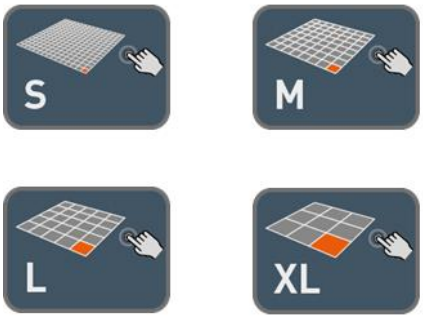
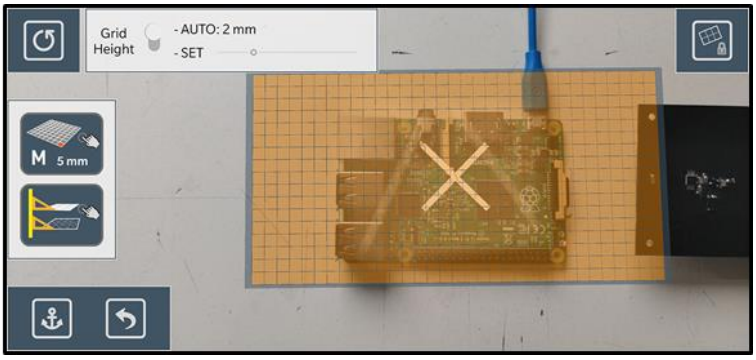
4.3 GRID POSITIONING PARALLEL TO THE GROUND



To start, select the definition of the grid and size of pixels.





S = 2 mm **M = 5 mm** **L = 10 mm** **XL = 25 mm**

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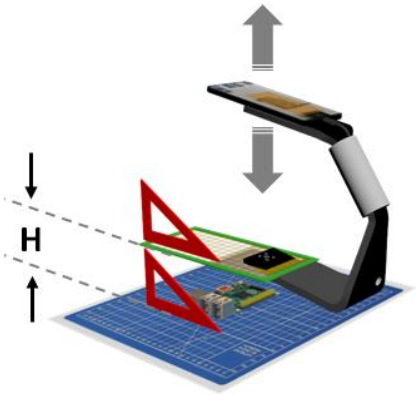
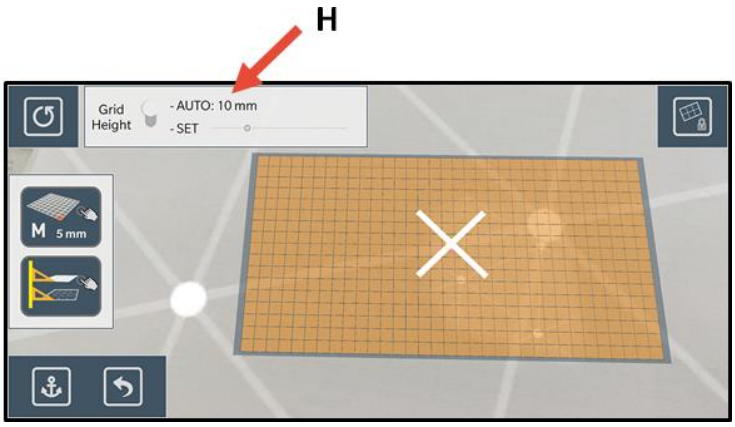
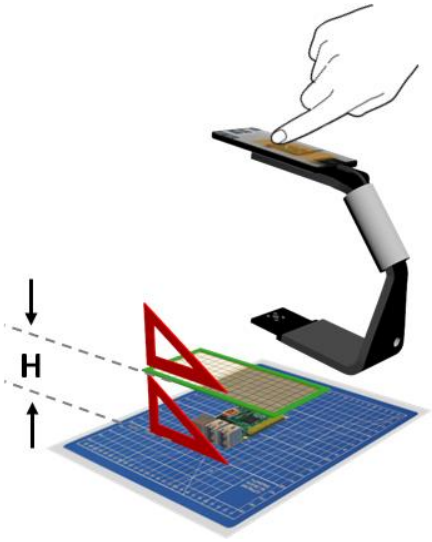
Mode Auto

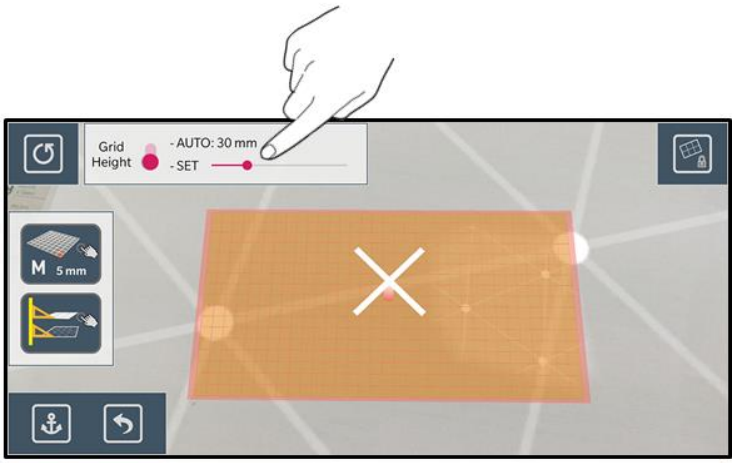




In automatic mode the grid is virtually locked with the sensor and the height varies depending on the position of the scanner. When you have positioned the grid in the desired location to carry out the mapping, click on the anchor to fix it and be able to start filling it.

Mode Manuel





In manual mode you set the height with the cursor.

When you have positioned the grid at the desired location to perform the mapping, click on the anchor to fix it and be able to start filling it.

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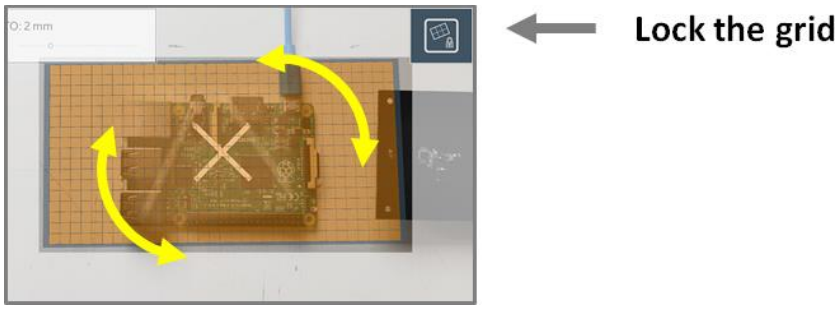
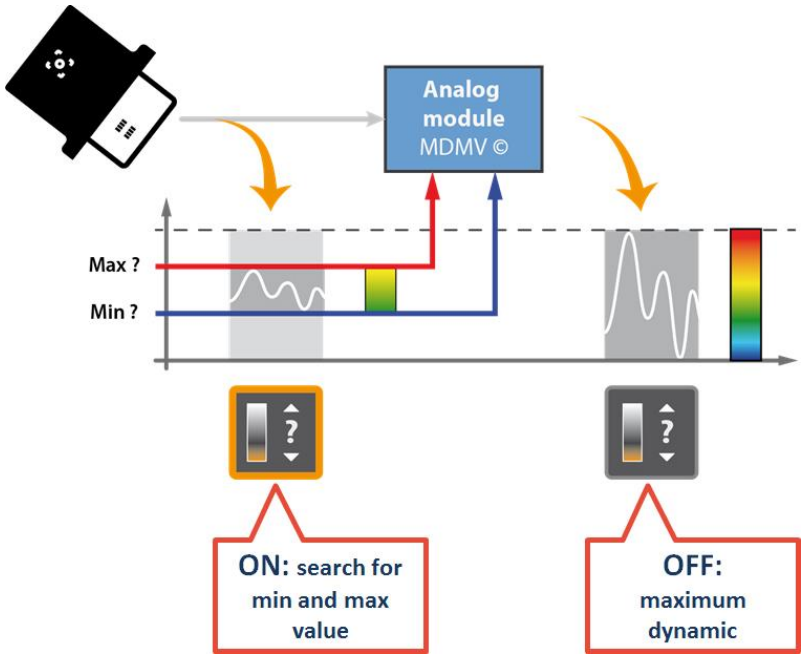
4.4 LOCK THE GRID



in parallel mode, when the grid is unstable it is possible to block it

5 Pres-scan function



The Pre-scan function automatically detects the Min and Max values measured above the surface to be scanned. For this, the operator shall slowly scan the entire surface to be mapped. During this sweep, the Min and Max values are automatically read by the device. Once this operation has been carried out, the operator will activate the MDMV module.

This module uses this Min and Max values to define the appropriate measurement scale allowing exploiting a maximum measurement dynamic. It may be seen as an Auto-Scale function.

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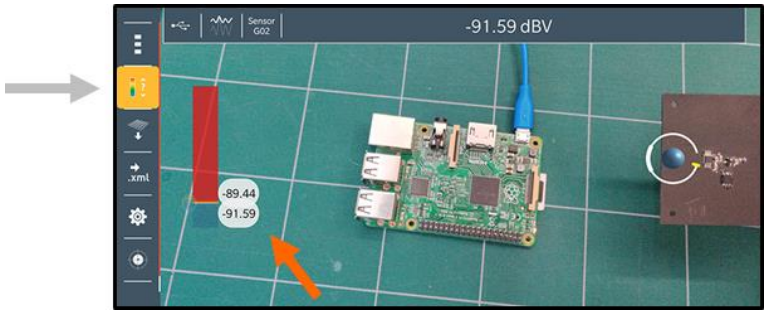
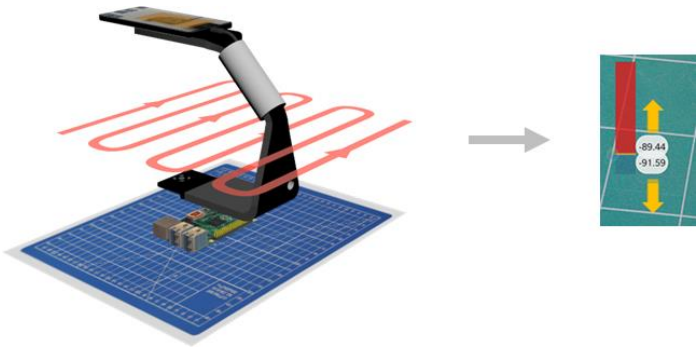
1



When the pres-can is activated, the high and low thresholds are minimum and maximum

2



Scan with the EM-Scanphone over the area to be mapped, detection of the Min and Max measurement values. **Find min and max values moving slowly above the surface to be mapped.**

3

Memorization of min and max values

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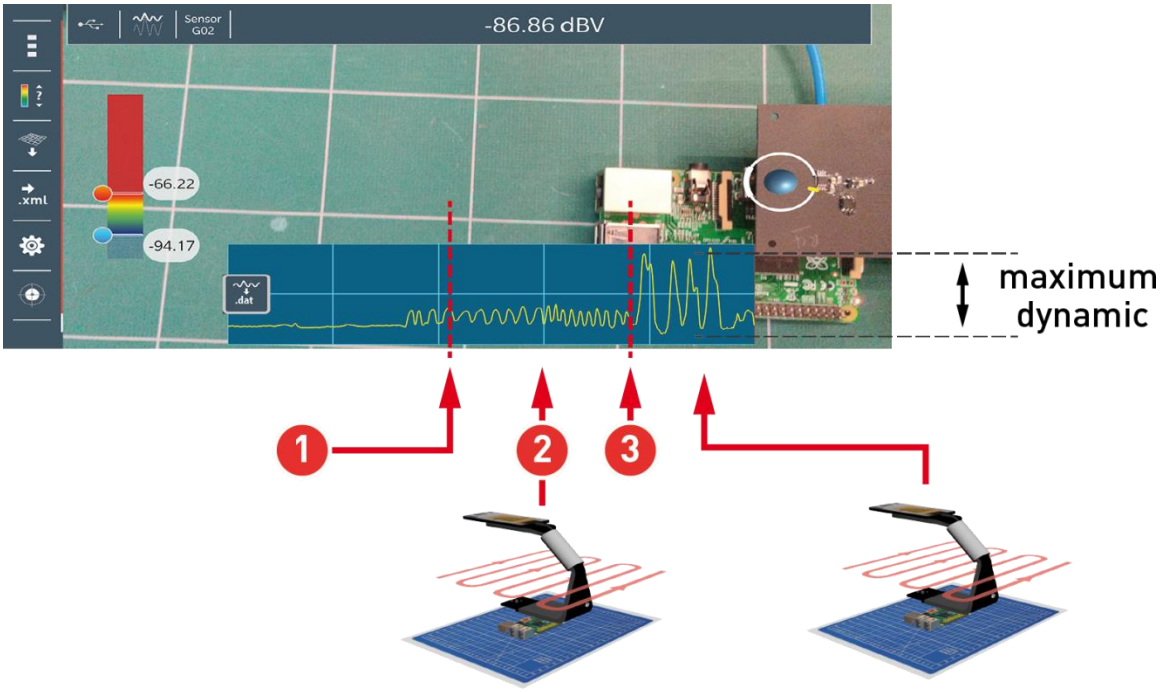
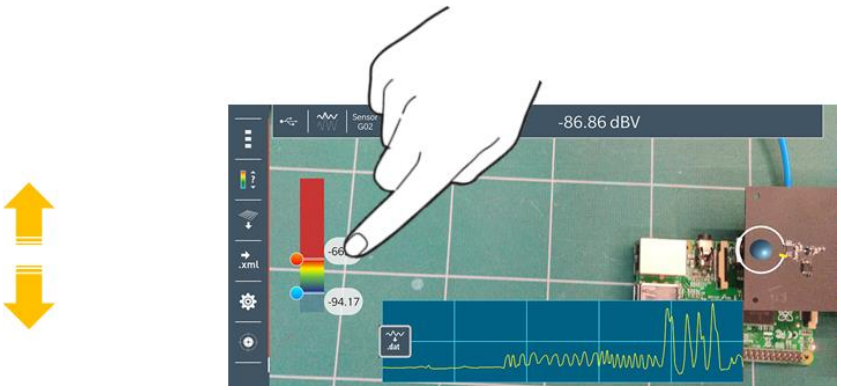


After performing the Pre-scan, it is possible, at this stage, to manually adjust these Min and Max thresholds to improve the measurement dynamics.



Manual a posteriori modification of thresholds and associated measurement dynamics.

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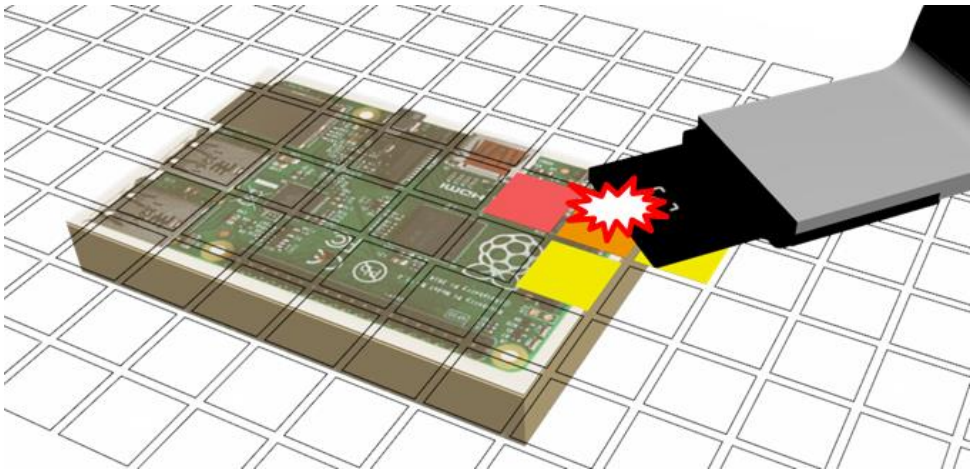
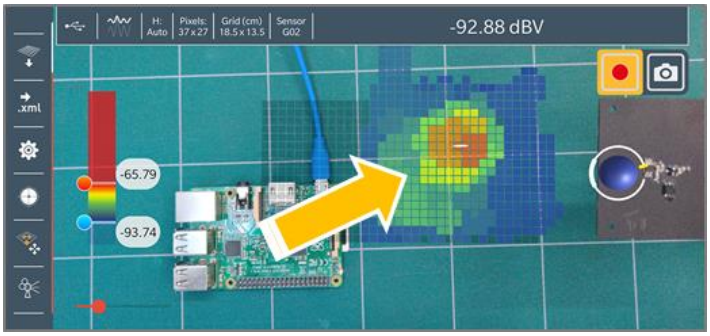
6 Grid filling



First make a pre-scan. When the application detects that the sensor touches an element of the virtual grid, an acquisition trigger occurs automatically and the pixel is filled with the color corresponding to the amplitude of the measurement, according to the measurement dynamics. These acquisitions are then linked automatically for each position of the grid element identified during the manual scanning of the EM-Scanphone over the measurement surface by the operator. The acquisition process is very fast and the operator follows in real time the construction of the measurement result from the scan.

6.1 Repositioning of the grid



In augmented reality, a moving shadow, a lack of light or landmarks information can make the grid to move unintentionally.
To avoid making another scan, it is possible to manually reposition the grid with the button: grid positioning.

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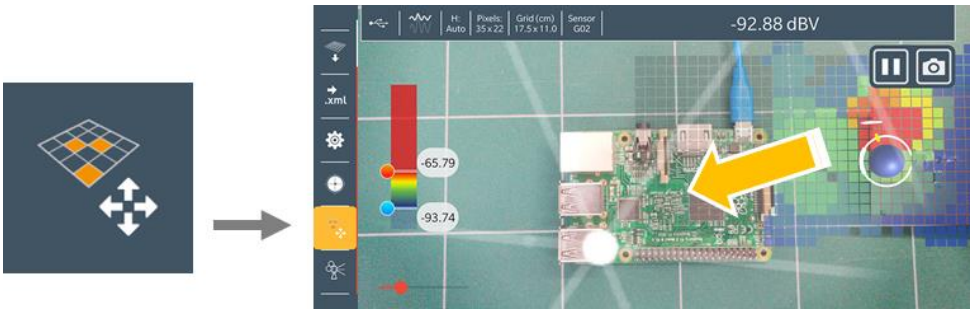
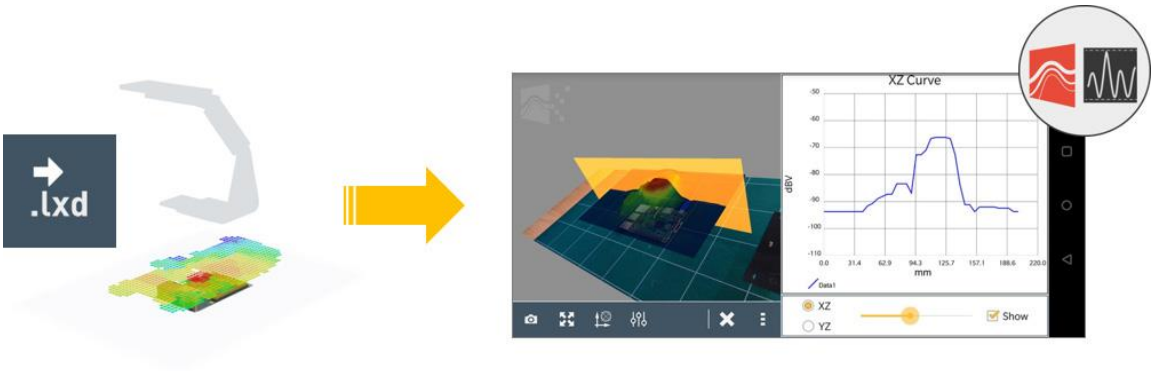


Repositioning manual of the cartography.

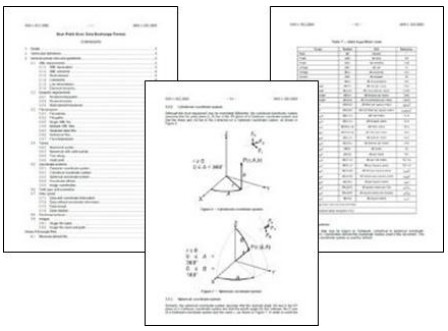
7 Data export (.lxd) / XML – NFS

7.1 XML STANDARD

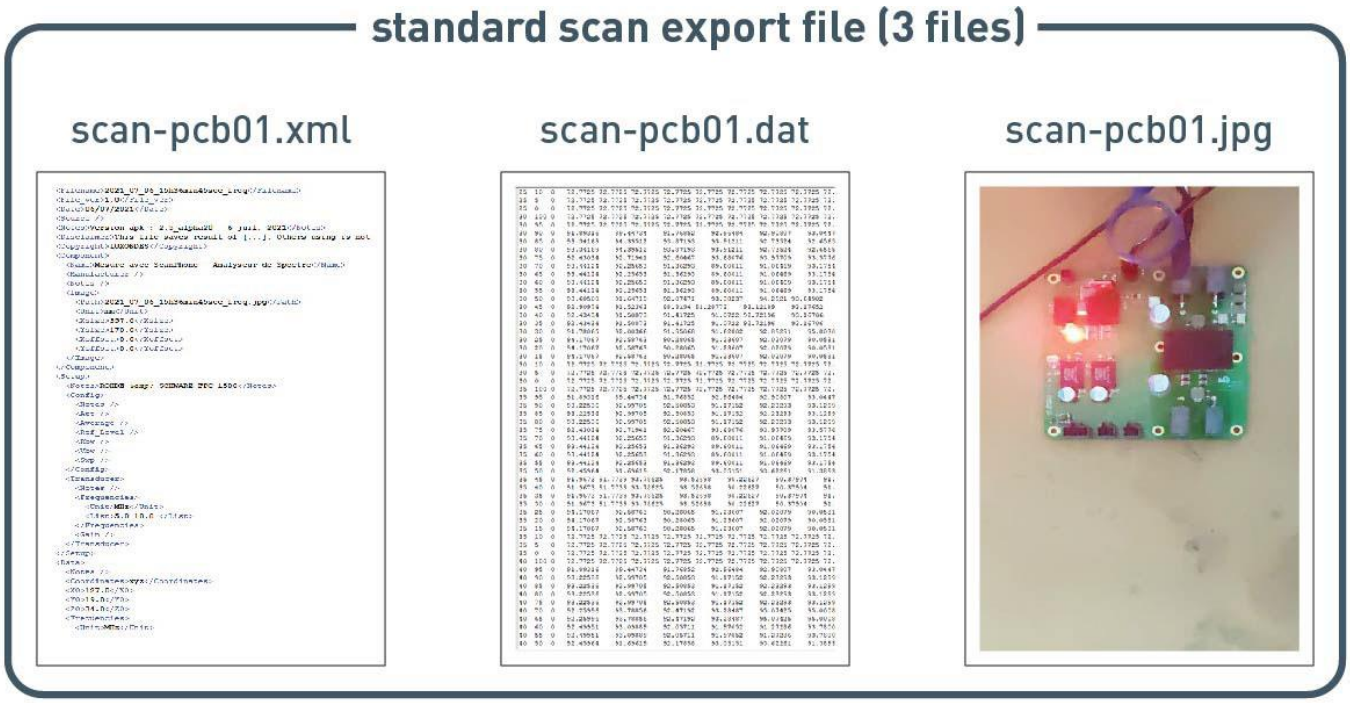


NFS - Near-Field Scan Data Exchange Format

(Norme IEC 61967-1-1)



The XML / NFC (Normalization Form Canonical Composition) data format is intended to facilitate the exchange of data between industry, academia, vendors and end customers. It is based on the widely used XML- (eXtensible Markup Language) format, which is readable by both machine and human. Its structure allows data to be exploited on any operating system.



you can rename the .lxd to .zip to unzip it and analyze the xml files

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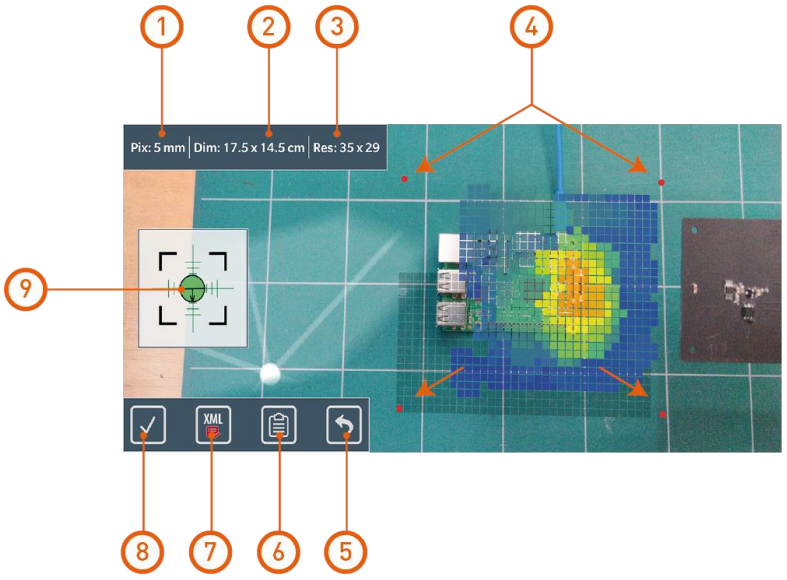
7.2 MENU EXPORT LXD



① Pixel

Pixel side size

② Grid size

Grid size in cm

③ Grid resolution

Number of rows and columns

④ Alignment points

Alignment points to position the photo. In order to be able to position the photo in relation to the cartography it is necessary that the 4 points are visible by the camera

⑤ Return

Return to previous menu

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⑥ Temporary storage

Activate the backup, if you want to find the same grid configuration (size and position) for the next mapping.

⑦ Export format

The cartography files (XML) are saved in the following location:

```
PC\HD1913\\Luxondes\Data_XML

              \2020_06_07_22h21min36sec_capt_G02.xml      XML: Description of the measure
              \2020_06_07_22h21min36sec_capt_G02.dat      DAT: Data
              \2020_06_07_22h21min36sec_capt_G02.jpg      JPG: Picture
```

The **.lxd** extension allows you to zip the 3 files and save space

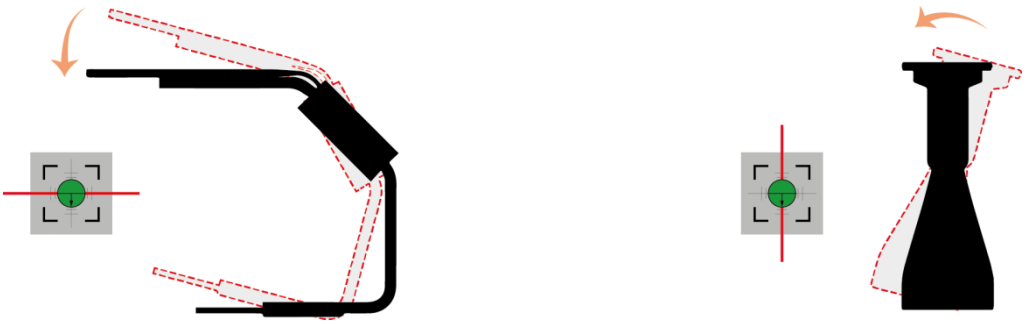
```
PC\HD1913\\Luxondes\Data_LXD

              \2020_06_07_22h21min36sec_capt_G02.lxd      LXD: Zip file with: .xml, .dat, .jpg
```

⑧ Ok to export

After validating the export, automatic creation of files in the corresponding folder.

⑨ Planar orientation

To ensure that the camera plane is parallel to the mapping, the bubble level must be green.



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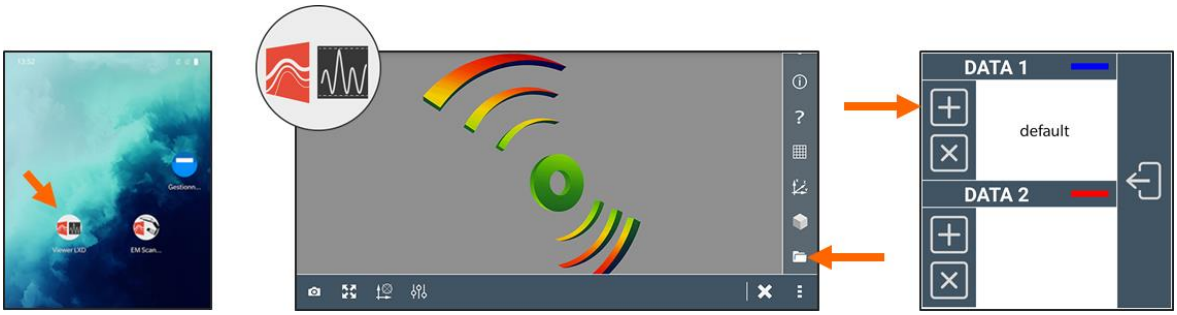
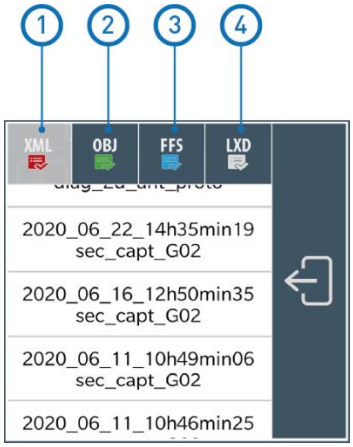
8 Analysis with the viewer

The viewer has 2 databases (**DATA 1 & DATA 2**) which allow you to compare and load different types of files



8.1 File format



① XML. Format

Default folder

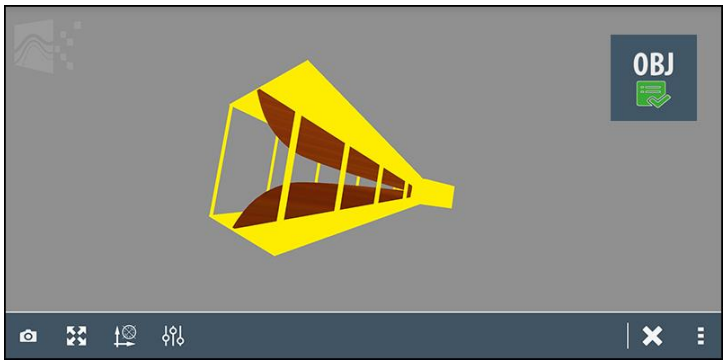
`PC\HD1913\\Luxondes\Data_XML`

IEC TR 61967-1-1:2015(E) provides guidance for exchanging data generated by near-field scan measurements. The described exchange format could also be used for near-field scan data generated by simulation or computation software.
The exchange format can be applied to emission and immunity near-field scan data in the frequency and time domains.

② OBJ. Format

Default folder

`PC\HD1913\\Luxondes\Data_XML`

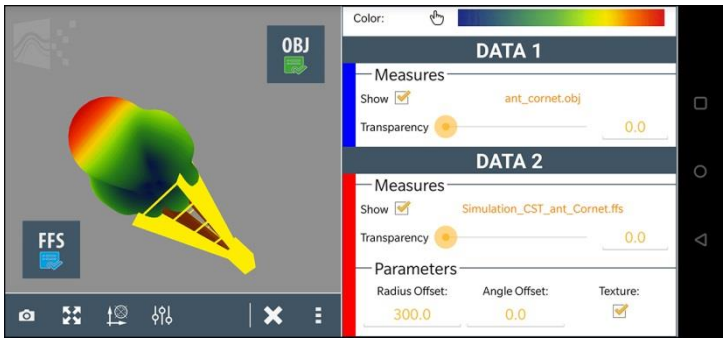


In the xml standard, it is possible to replace the image with a 3D object. This can also be done with 3D software. The texture file must have the same name as the object.

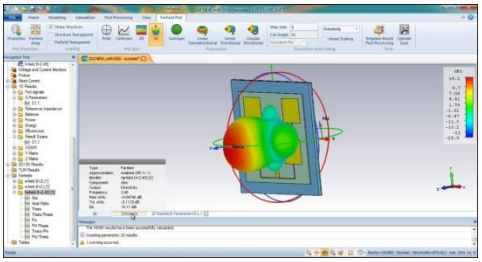
③ FFS. Format

Default folder

`PC\HD1913\\Luxondes\Data_FFS`



With a software like CST-Studio it is possible to export a file in .ffs format which represents FarFieldSource



example:
antenna simulation with CST Studio software

④ LXD. Format

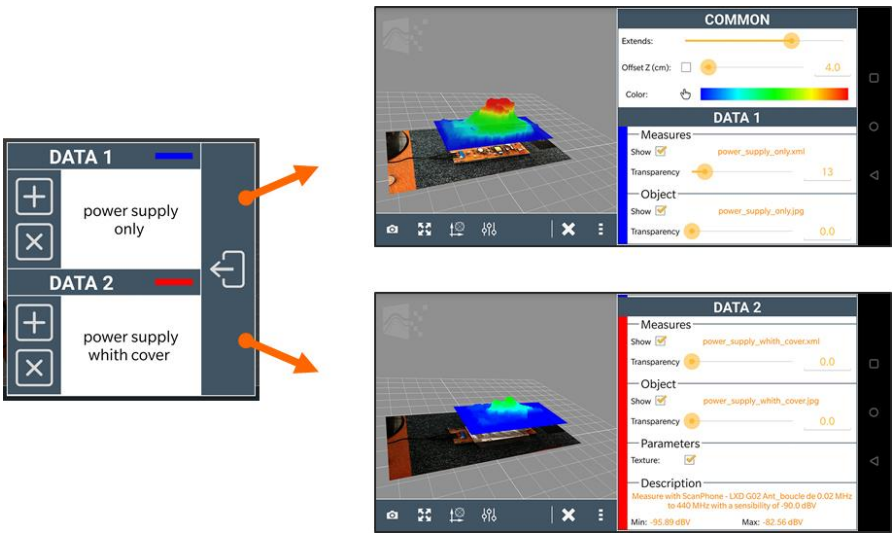
Default folder

```
PC\HD1913\\Luxondes\Data_LXD
```

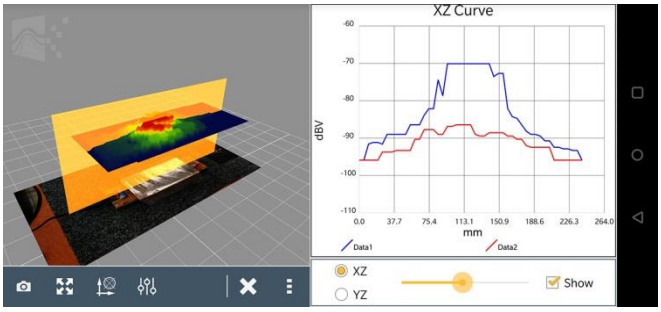
.lxd type files used to compress the 3 xml files

8.2 SAMPLE FILE

Comparison of the radiation of a switching power supply with and without shielding



Load the 2 files in data 1 and data 2



Direct display of the shield attenuation

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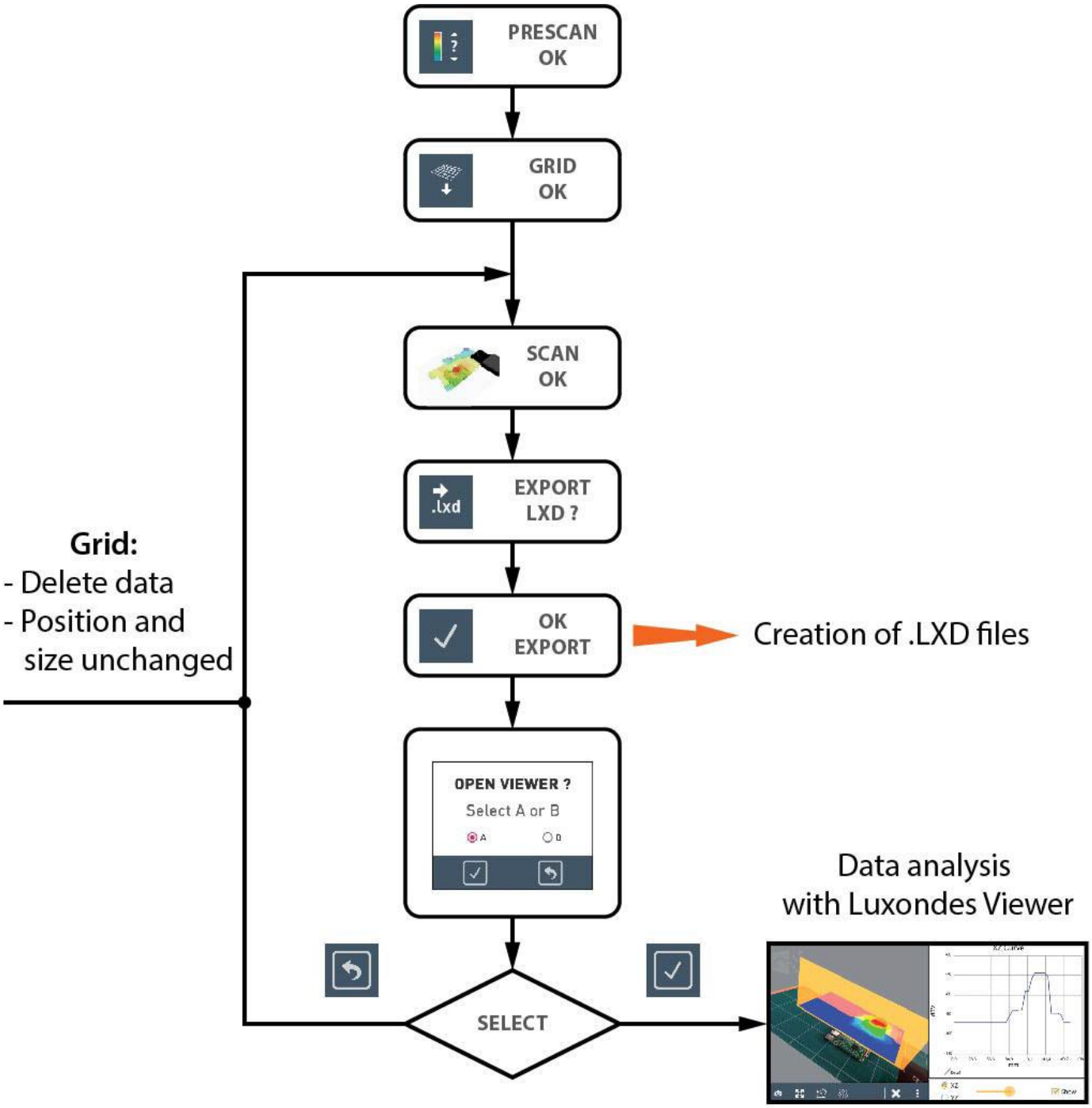
9 Step by step acquisition

9.1 Simple acquisition



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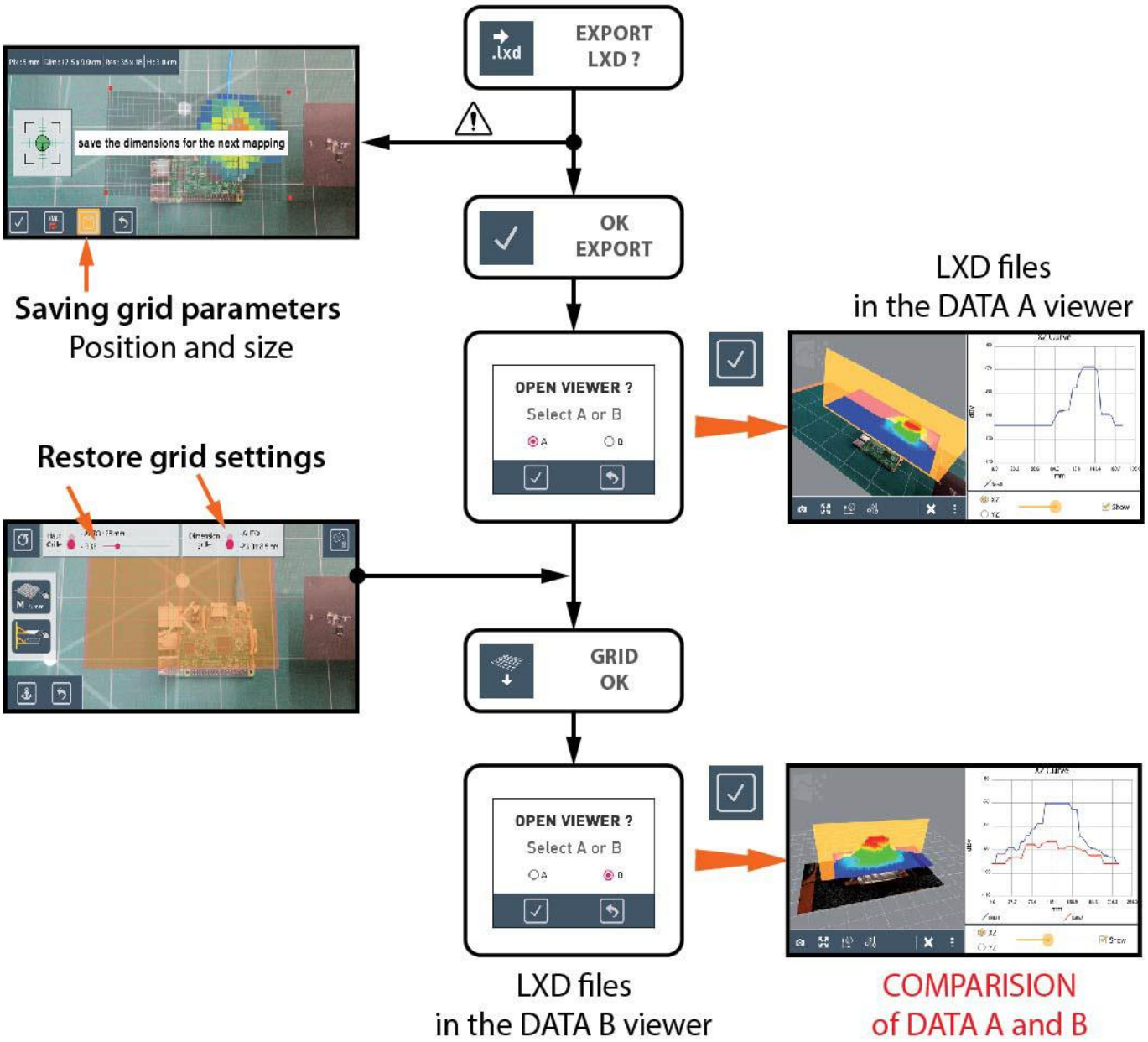
9.2 DIRECT COMPARISON BETWEEN 2 SCANS

To be able to compare 2 measurements, **the grids must be of the same dimensions**. It is therefore important to save the grid parameters



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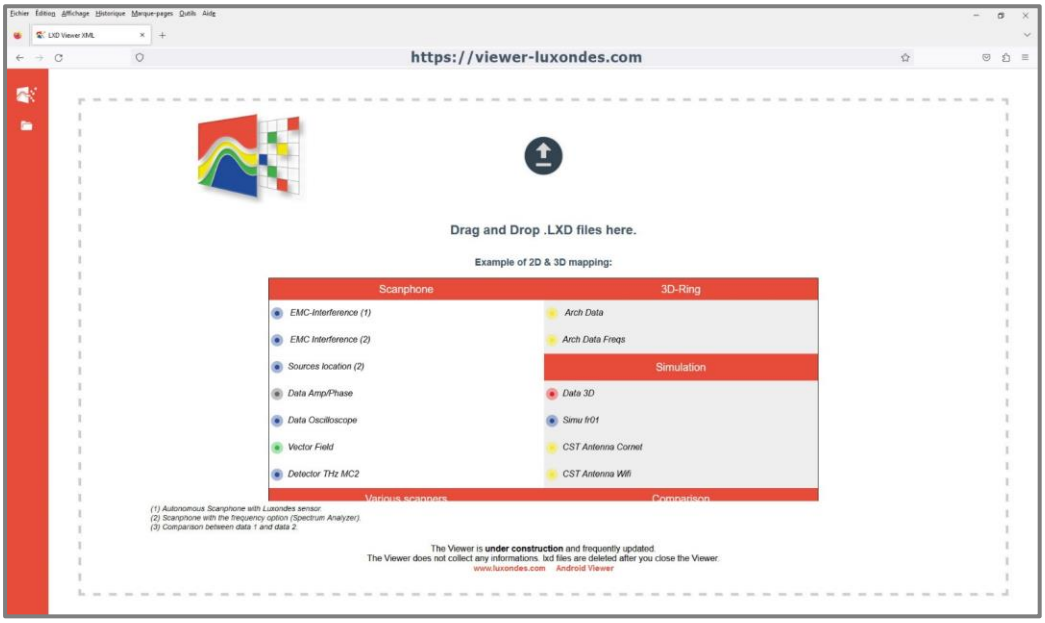
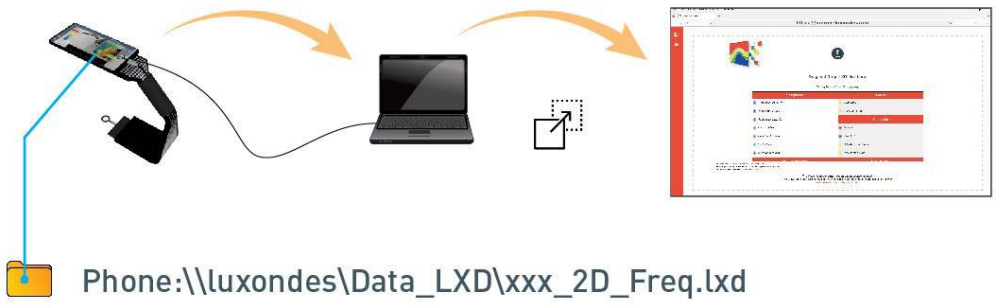
10 Online viewer

A online viewer allows you to analyze the data

https://viewer-luxondes.com





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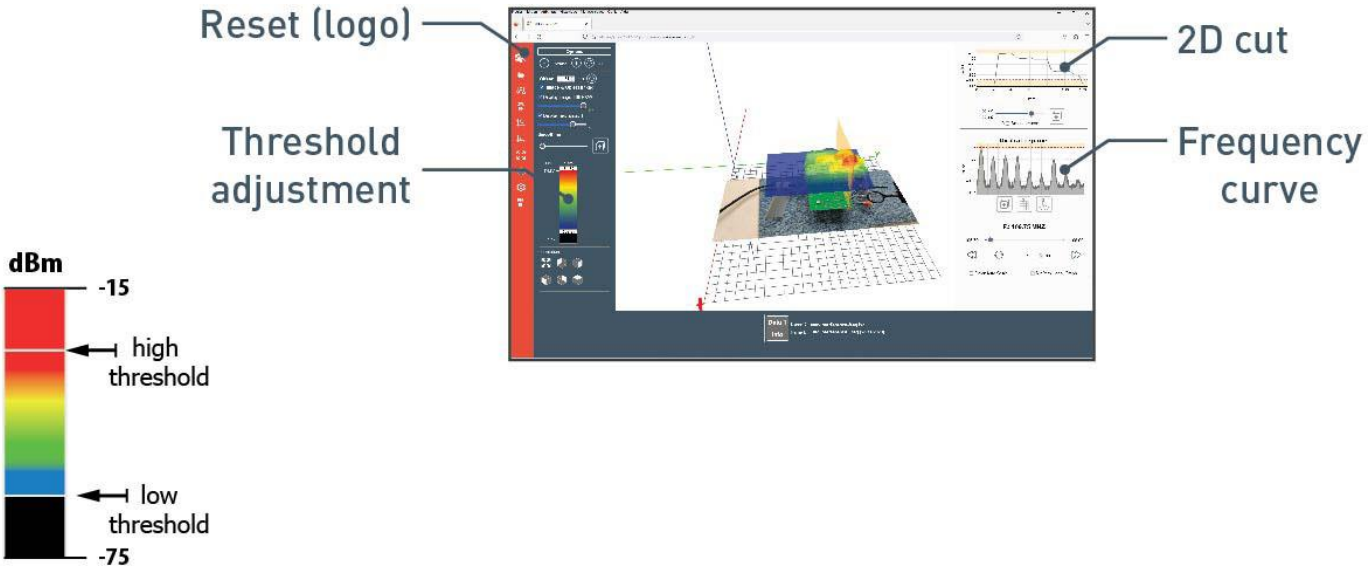
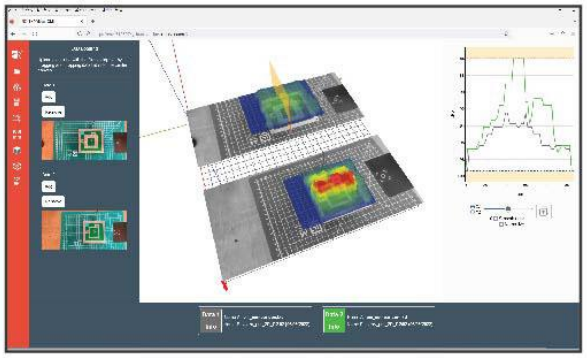


Comparison of 2 scanners example with and without ground plane



XML data (asci) can also be used with scientific analysis software such as MatLab™.

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CE

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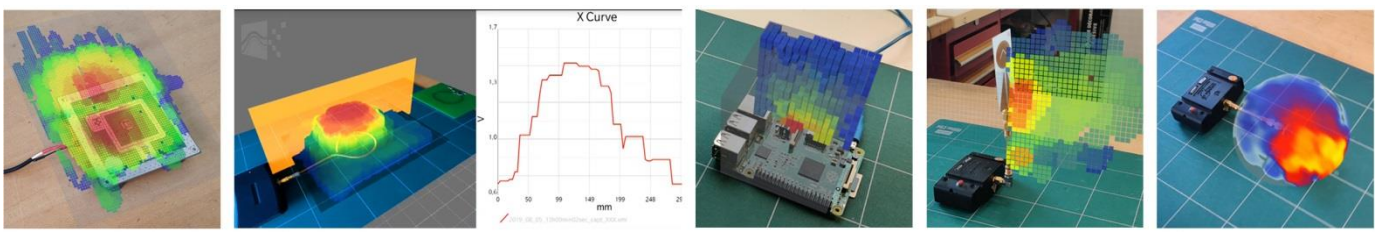
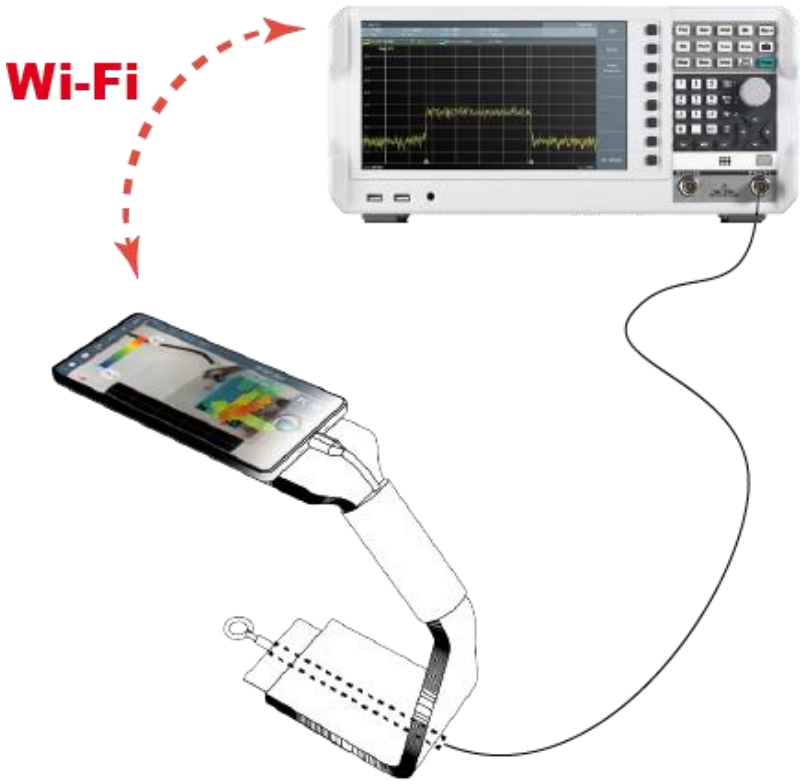
See the electromagnetic waves



LUXONDES

See the electromagnetic waves



EM-SCANPHONE

Options W & WLG & W2C

03/2024 - EN

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Contents

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1 COMPATIBLE DEVICES

March 2023

Rohde & Schwarz
FPC
ESU
FSV – FSW
FPH
Anritsu
MS2090A
MS2036C/37C/38C
MS2667C
Agilent / Keysight
E7402A
MXA & PXA
ATektronix
MSRSA 500 series

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2 INTRODUCTION

The frequency option allows you to establish a connection between the EM-Scanphone and a spectrum analyzer (or oscilloscope) via a Wi-Fi connection.

If you have a spectrum analyzer with the Wi-Fi option, e.g. the FPC1500 from Rohde & Schwarz or the MS2090A from Anritsu, then it is possible to directly establish a Wi-Fi link between the EM-Scanphone and the spectrum analyzer. (Figure 01)

Option W

Figure 01

If your analyzer does not have any Wi-Fi option, then it is possible to connect it to a fixed Access Point (AP) via the LAN socket or via a GPIB / LAN interface (Figure 02).

Option WLG

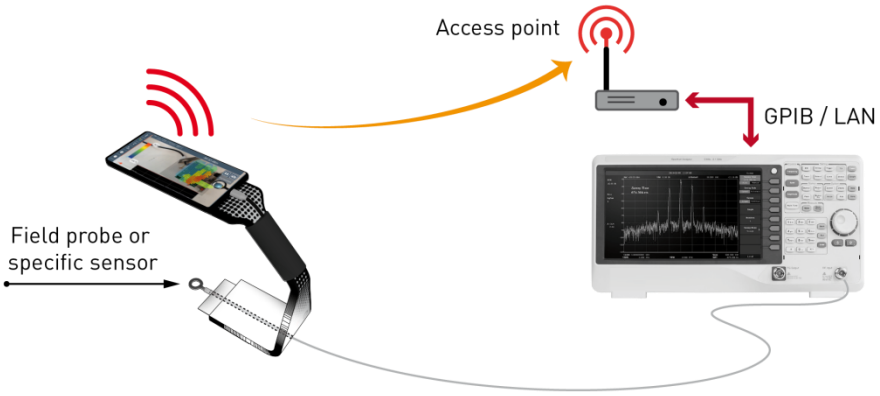

Figure 02

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3 Setup of the W option

W Option	In the box
	Activation card

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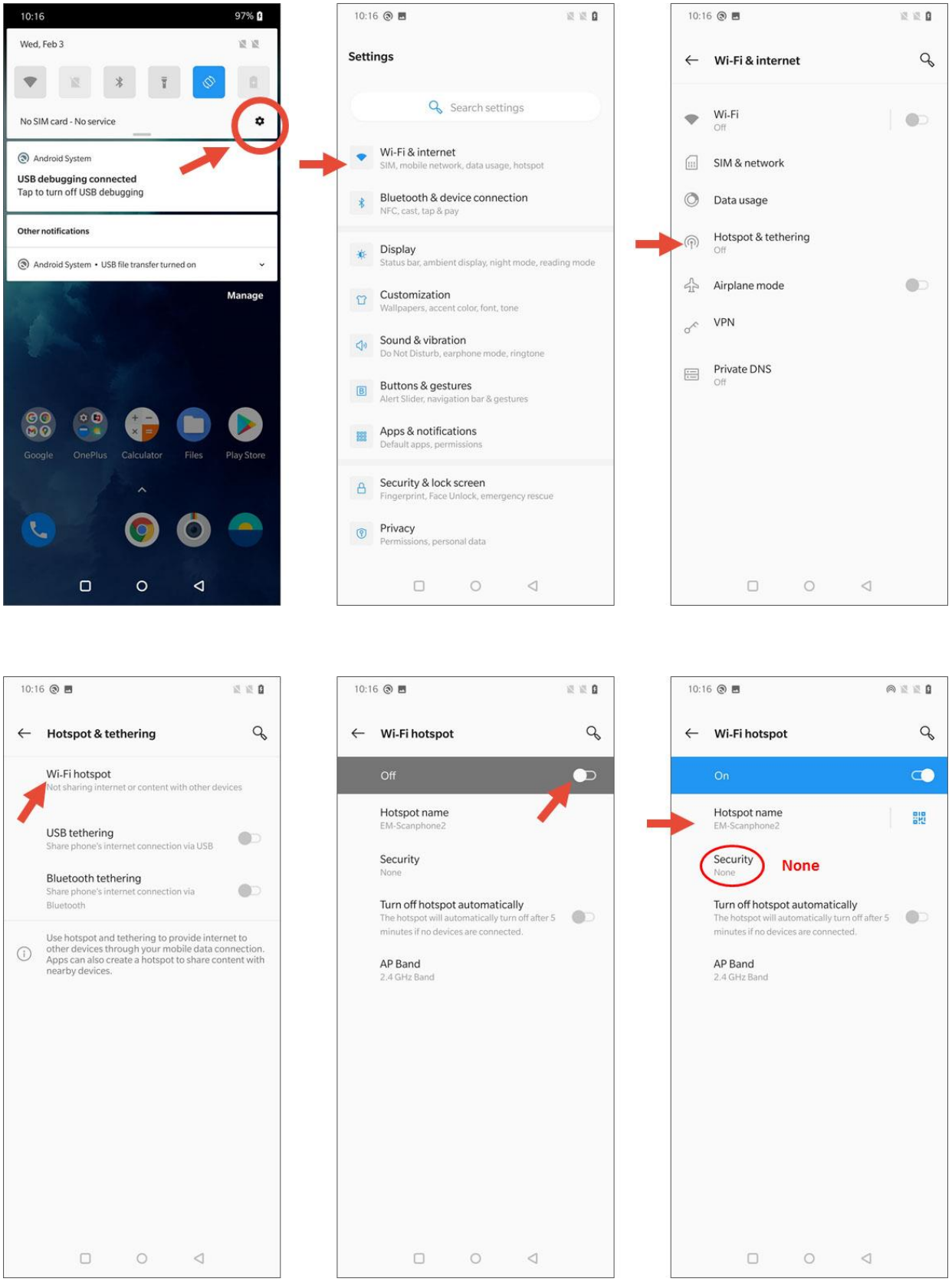
3.1 CREATION OF A WI-FI ACCESS POINT ON THE SMARTPHONE

You can change the name of the Hotspot. Example here: “EM-Scanphone2”



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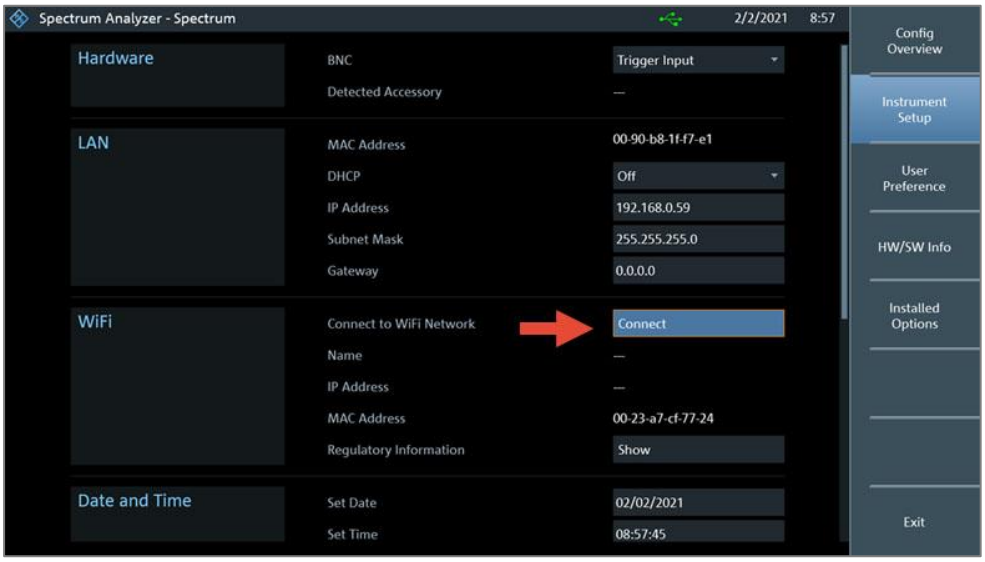
3.2 ACTIVATE THE WI-FI CONNECTION OF THE SPECTRUM ANALYZER

Example with the R&S FPC1500.

With the Connect button, search for the EM-Scanphone2 Wi-Fi network.



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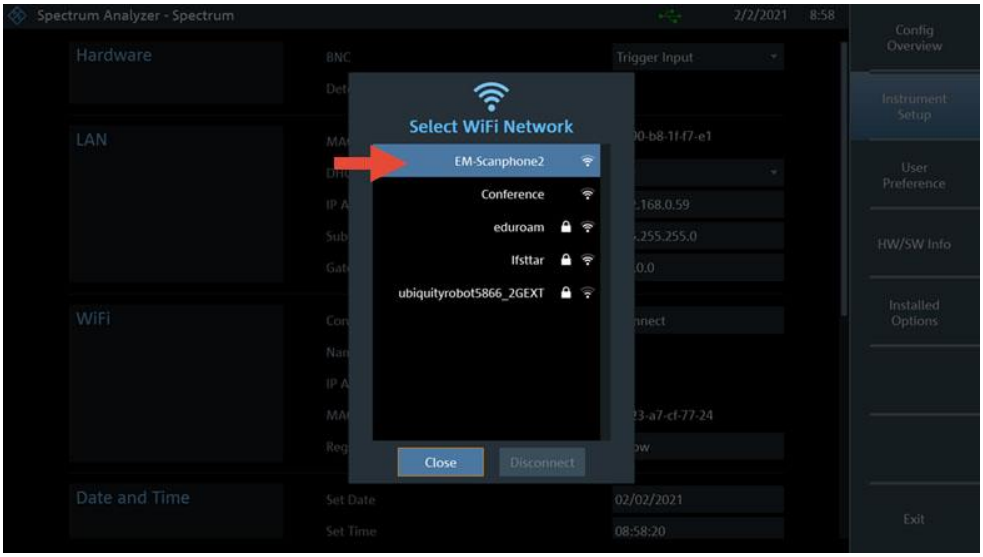

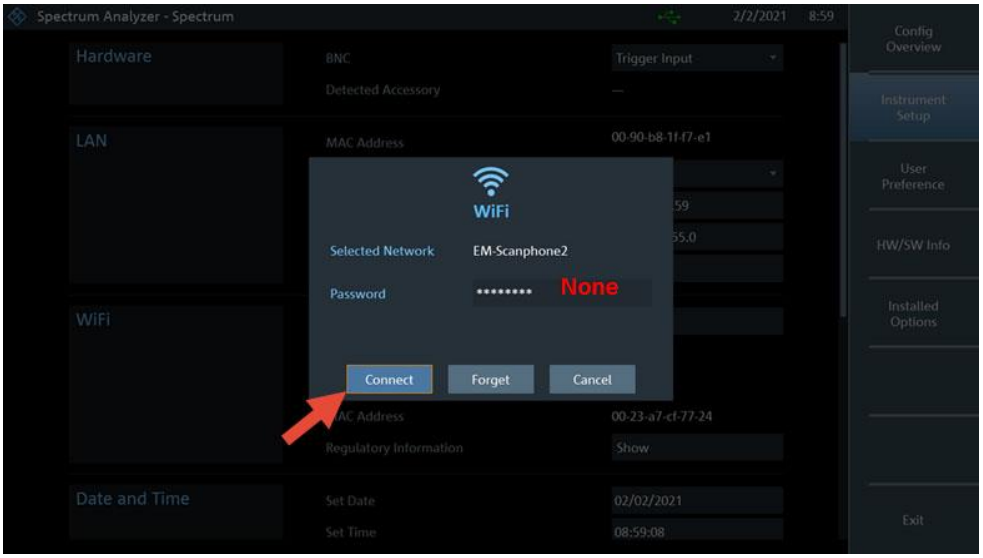

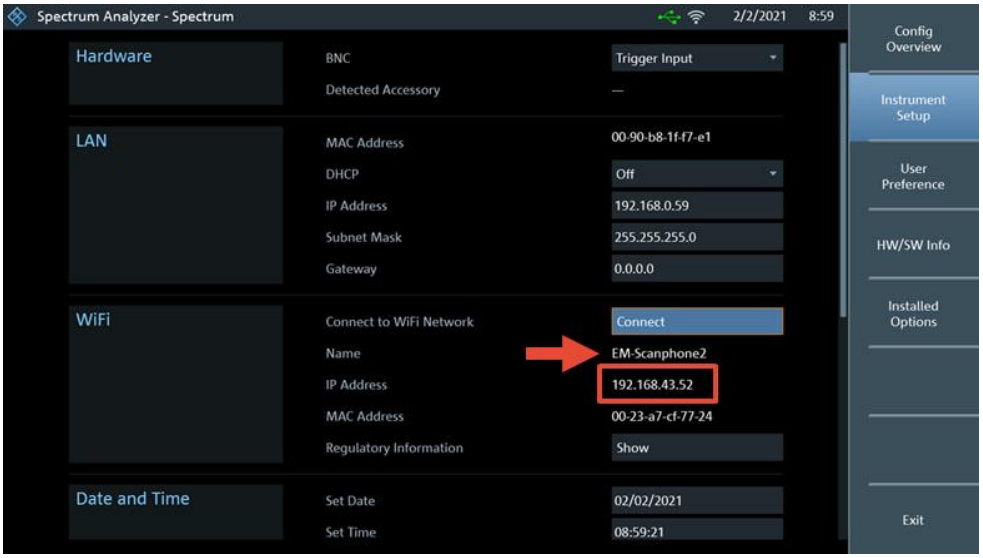

Connect the spectrum analyzer to the access point of the EM-Scanphone.

Note the IP number (here: 192.168.43.52).

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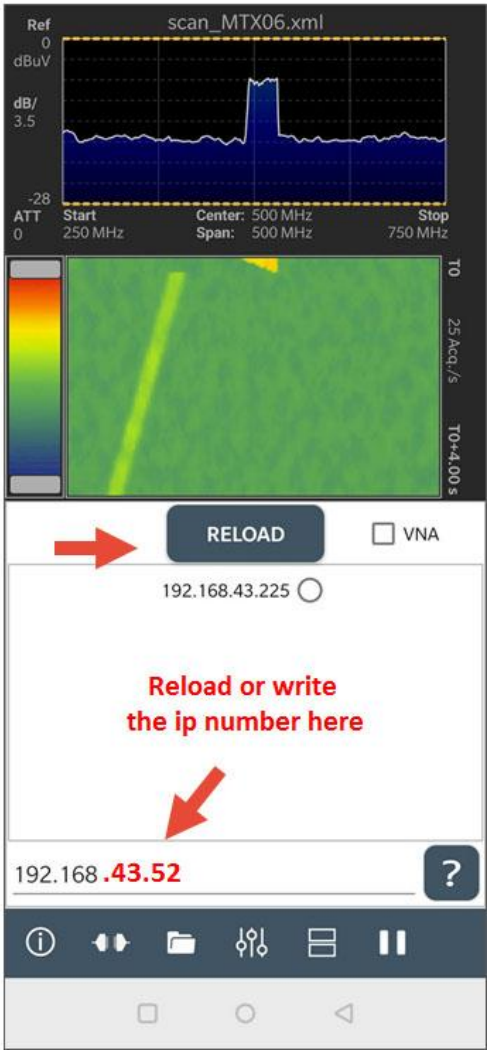
3.3 LAUNCH THE CONSOLE APPLICATION



Press Reload several times to find the IP corresponding to your device.

In our example, we are looking for the IP number 192.168.43.52.

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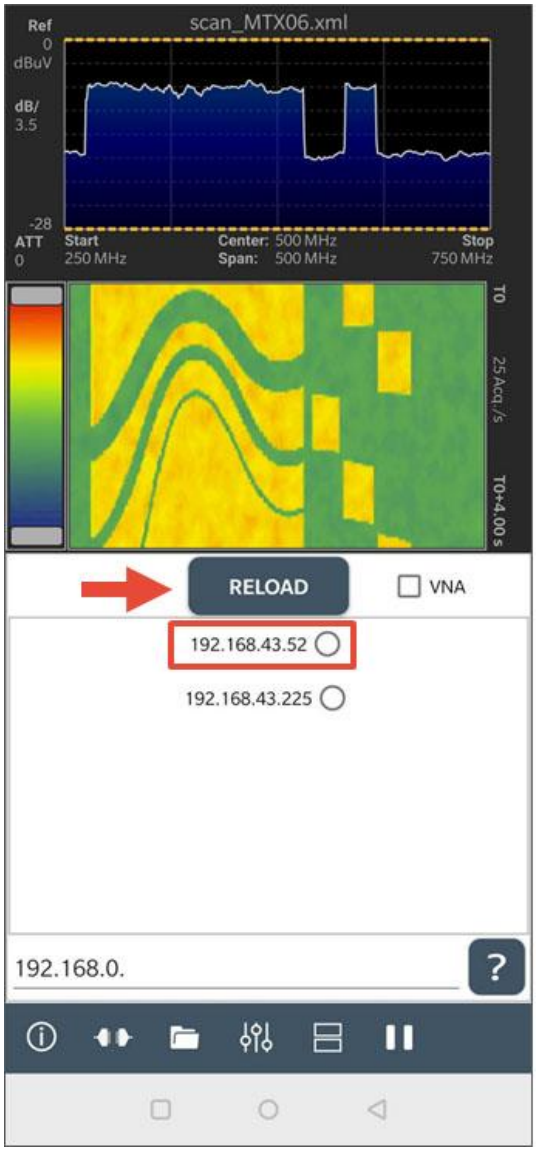

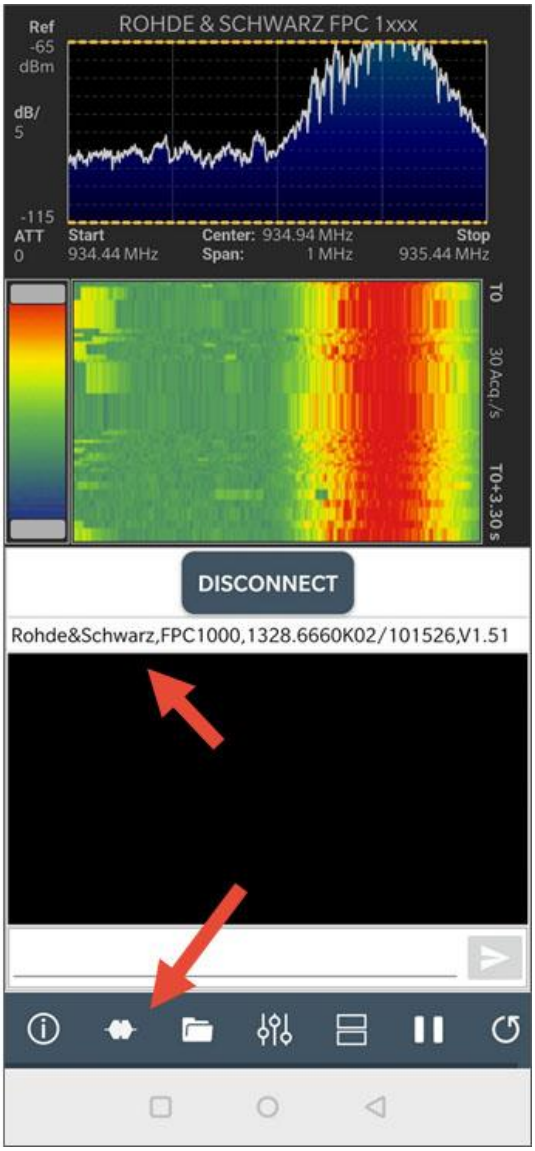

With the console, we can check that the connection is established.

Close the console.

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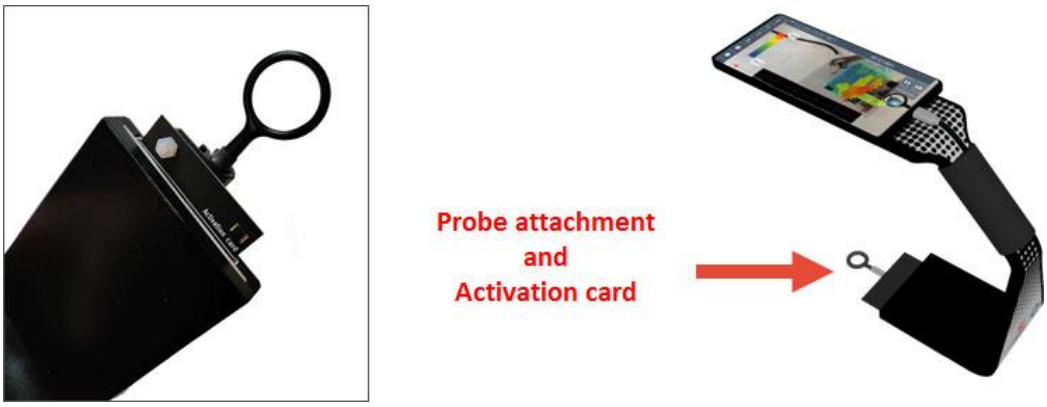
3.4 Activation of the Wi-Fi option



The activation card will enable the W & WLG options to be activated and also to hang the probe.

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3.5 START THE EM-SCANPHONE APPLICATION

When you connect the USB socket, the application should start.

If not, it must be started manually.

Reload to find the analyzer IP.

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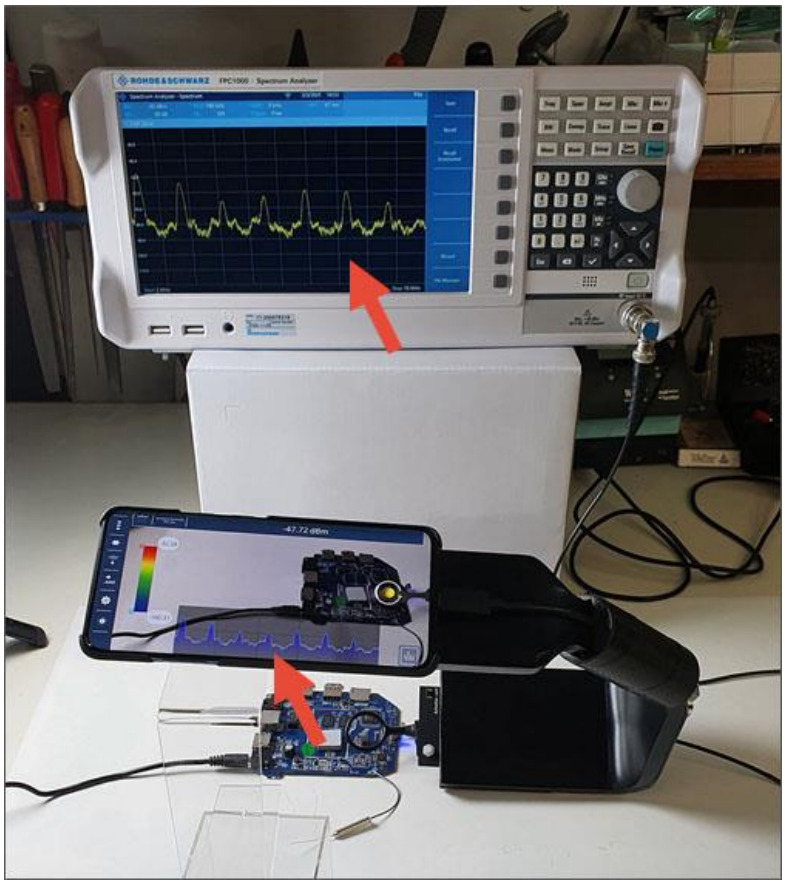

You have now connected the analyzer to the EM-Scanphone.

You can start scanning.

See the EM-Scanphone user manual for further information

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4 Setup of the WLG option

4.1 ACCESS POINT CONFIGURATION

D-Link DAP-1665

	Name	Password
Wi-Fi 2.4GHz	Dlink-LXD	00000000

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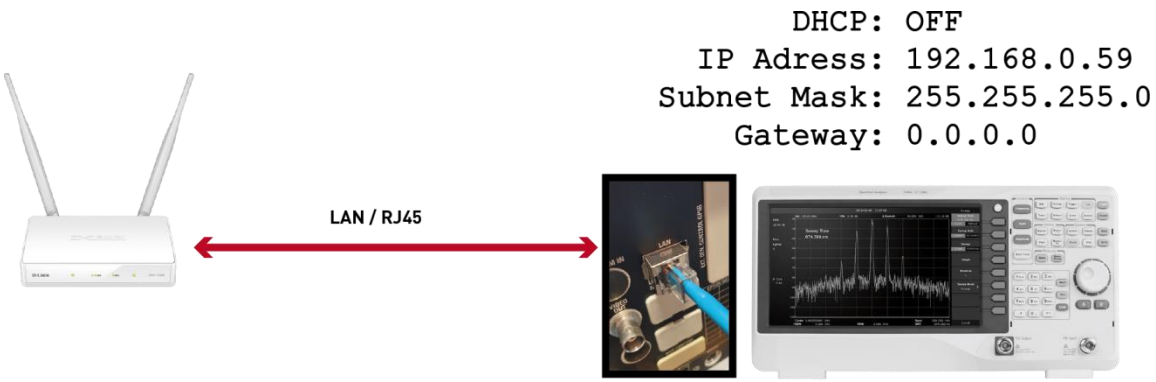
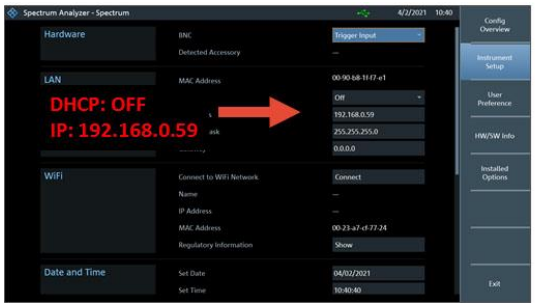
4.2 CONNECTION BETWEEN THE ANALYZER AND THE ACCESS POINT

LAN Only

In the network configuration menu of your analyzer, enter the following parameters: IP.FIX



Example with R&S FPC1000 and ESU



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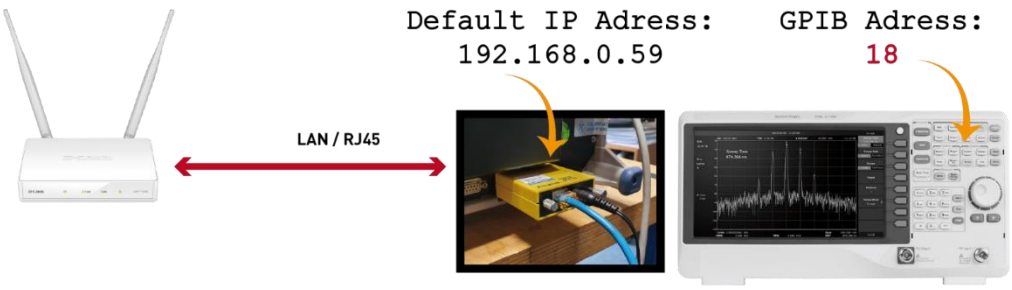
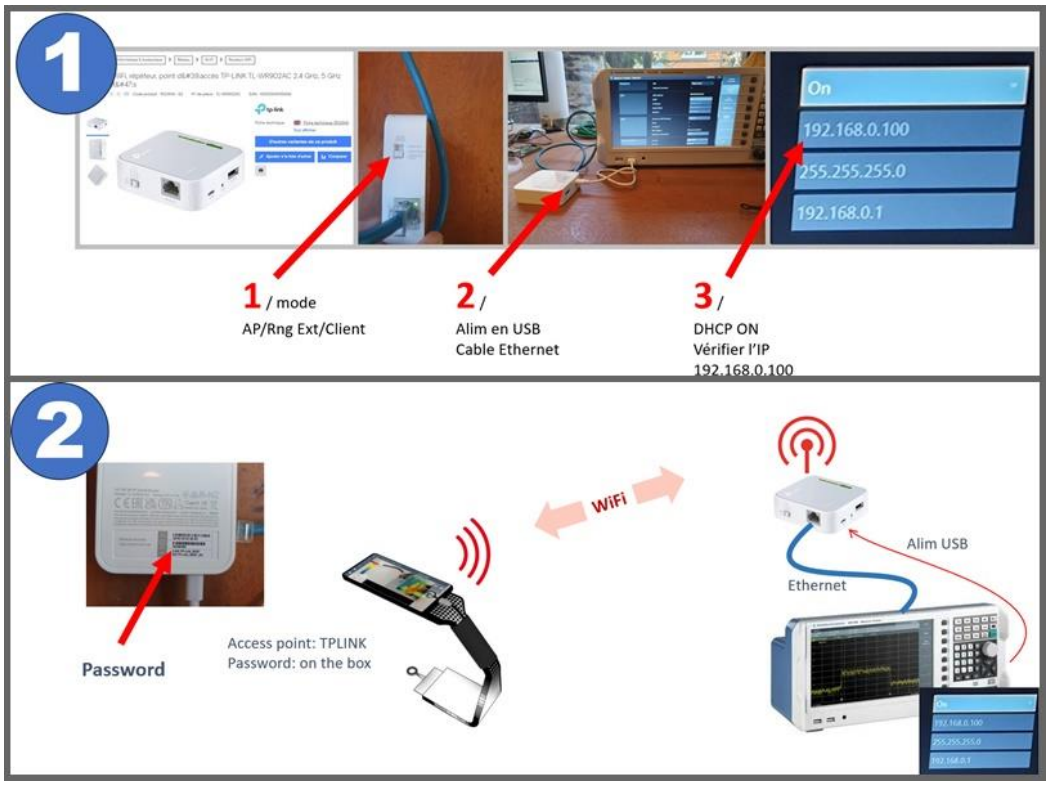
LAN with GPIB Interface

The analyzer GPIB Address must be **18**



4.3 Connection with TP-LINK Router

In the network configuration menu of your analyzer, enter the following parameters: IP.FIX



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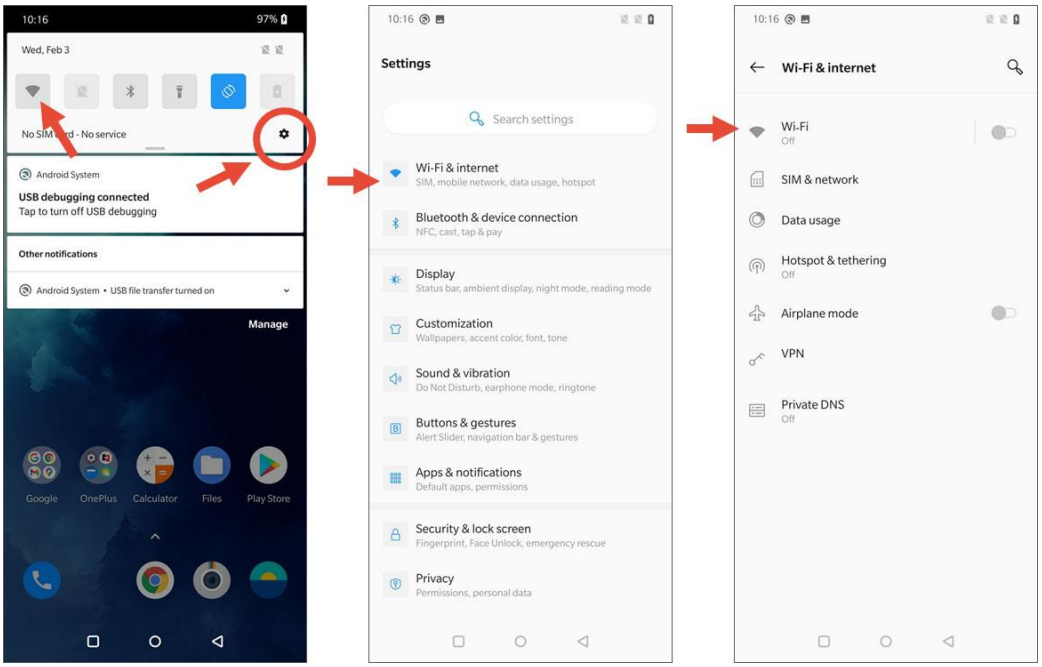
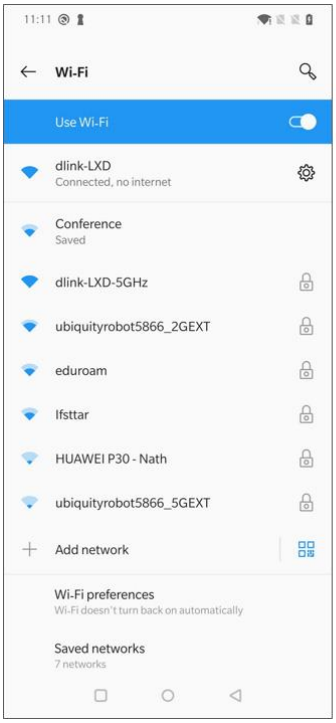
4.4 CONNECT THE SMARTPHONE TO THE D-LINK ACCESS POINT





Dlink-LXD

Select the network
Dlink-LXD

Password: 00000000

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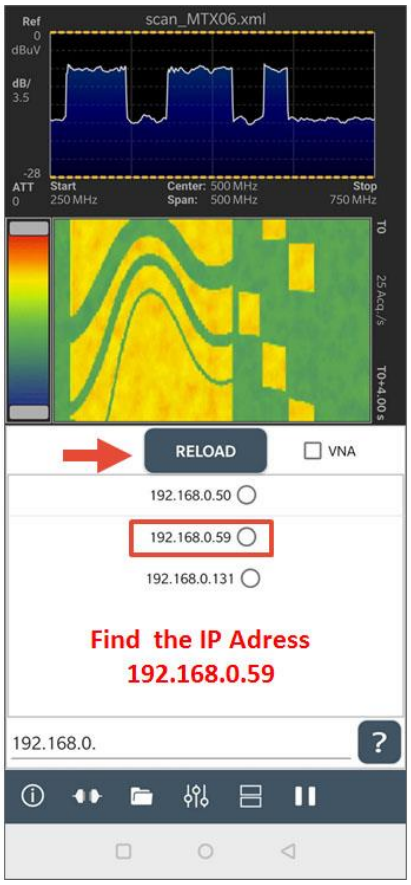
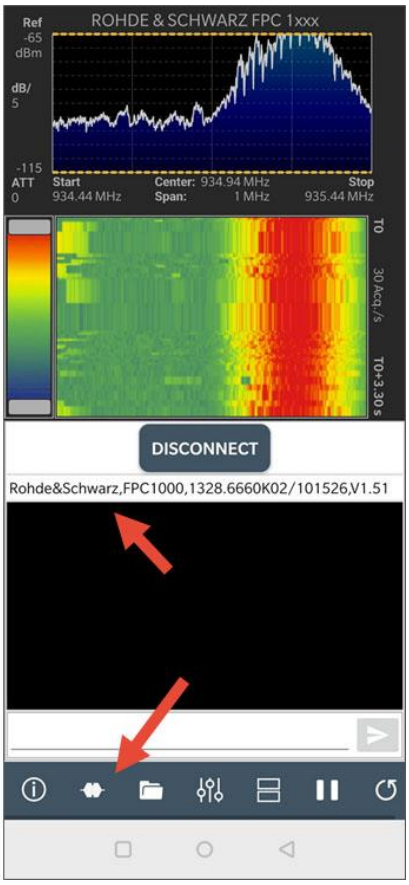
4.5 LAUNCH THE CONSOLE APPLICATION





4.6 GO TO THE SECTION 2.4 (ACTIVATION OF THE WI-FI OPTION)

Click here

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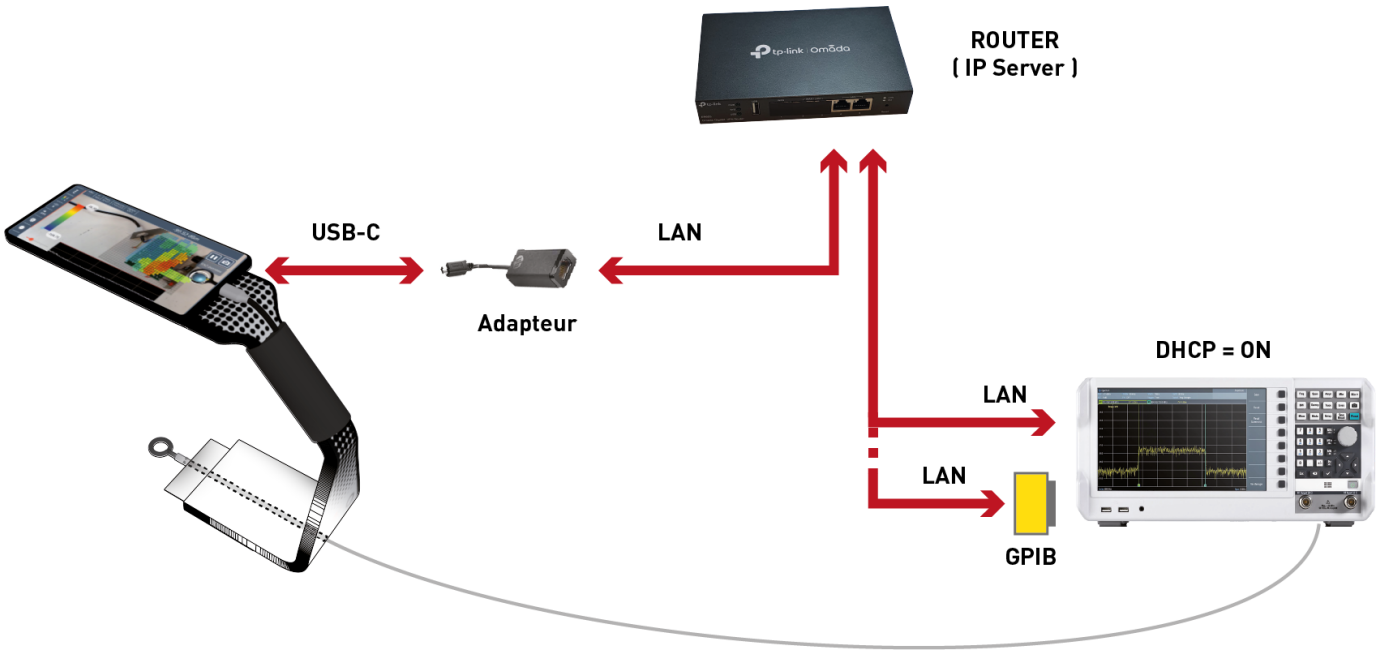
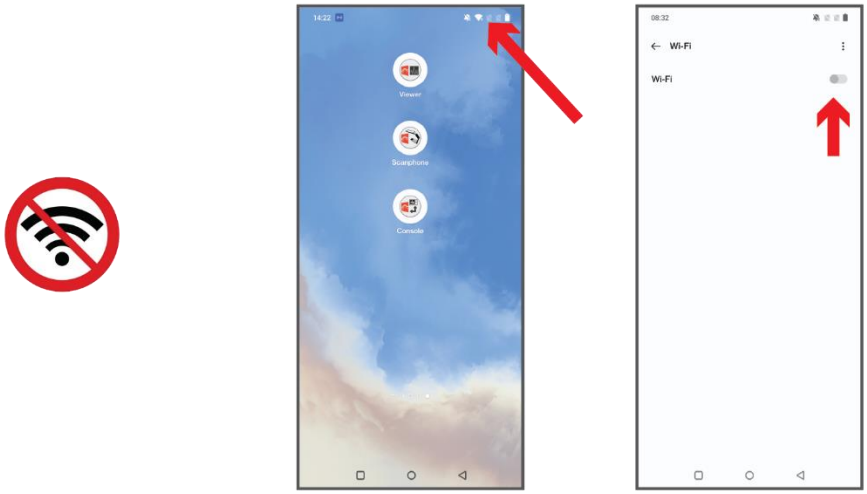
5 Setup of the W2C option



5.1 CHECK BEFORE CONNECTION

Turn off smartphone Wi-Fi.



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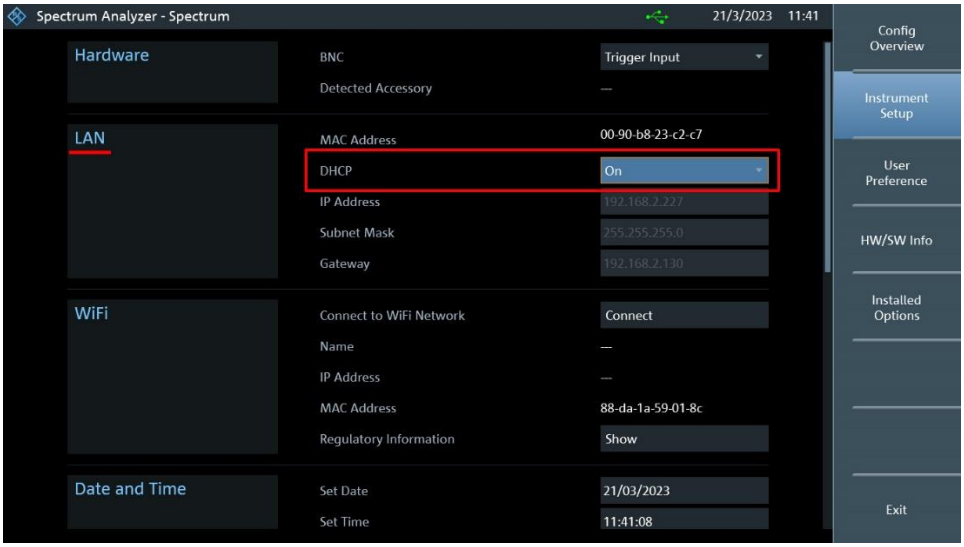
Power the nanopi and wait 2 minutes.

Enable DHCP

In the network menu of your spectrum analyzer activate the DHCP.



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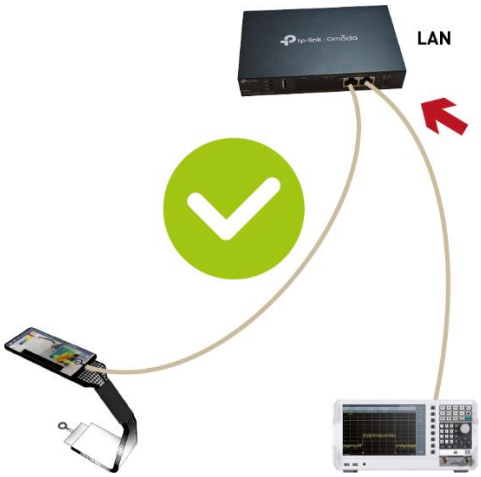
5.2 LAN CONNECTION TO THE ROUTER

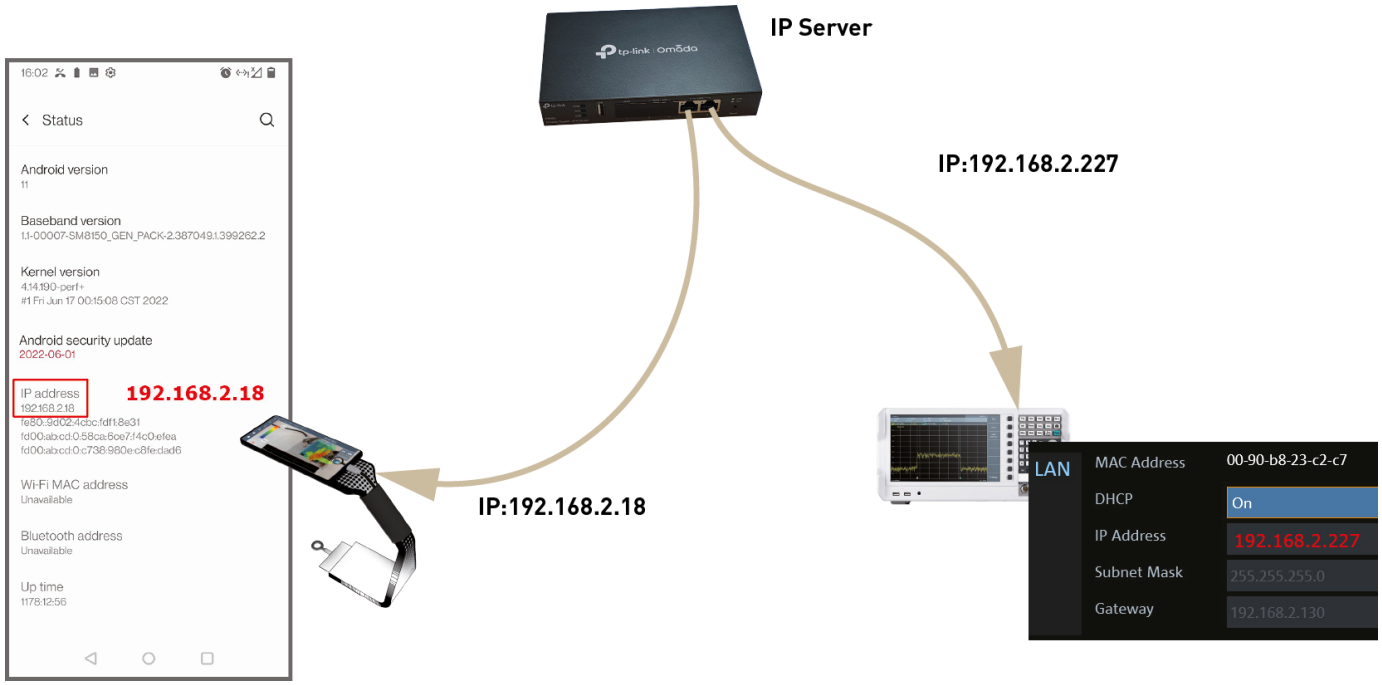
Connect the router power supply to mains adapter



⚠ : **Connect on LAN**

5.3 CHECK IP ADDRESS

The LAN IP server will allocate IP addresses to the analyzer and to the smartphone. Example on drawing



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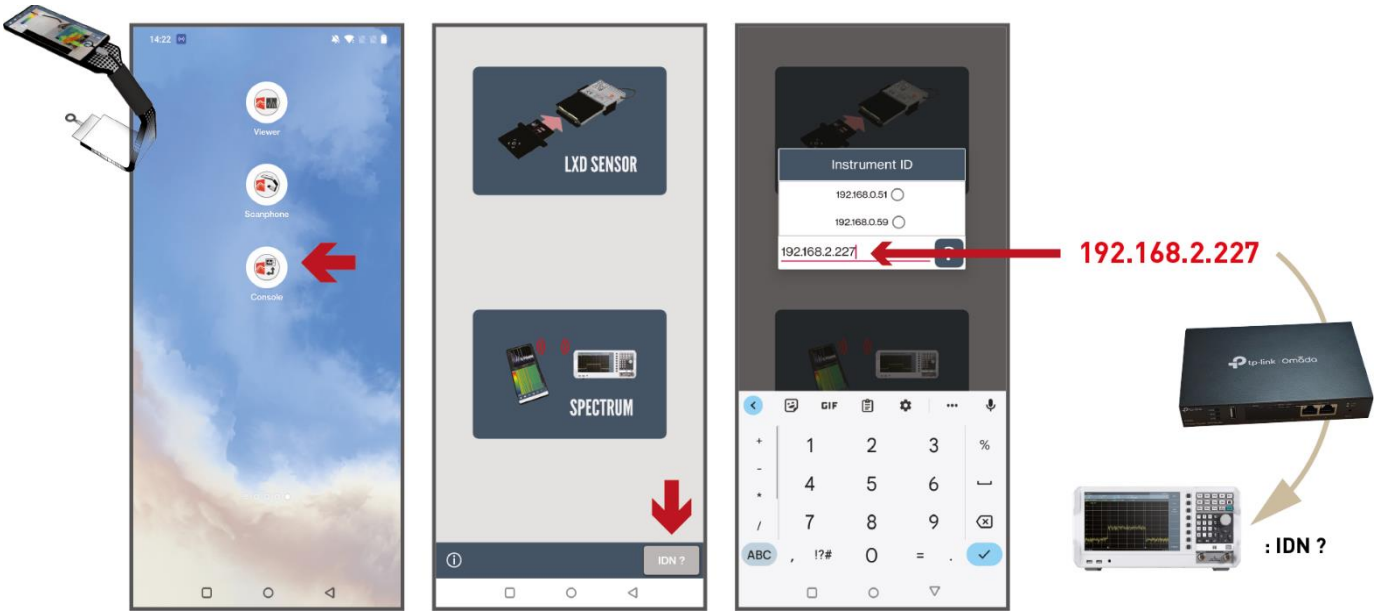
5.4 CHECK IDN

With the console application check the identifier (idn) of the spectrum analyzer



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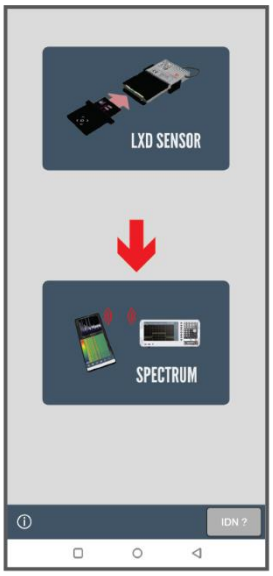
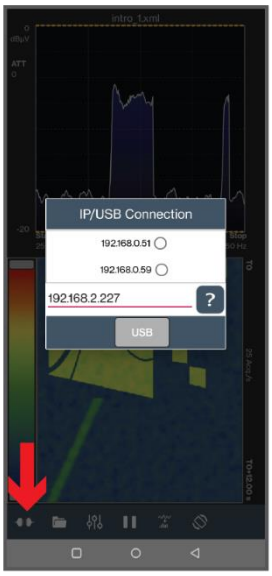
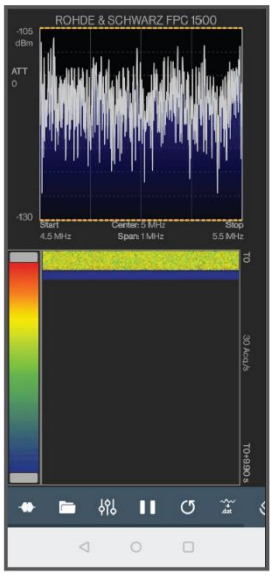
5.5 CHECK SPECTRUM ANALYZER SIGNAL

With the console application verify to receive the spectrum analyzer curve.







Close the console application

5.6 START THE EM-SCANPHONE APPLICATION

Go to the section 3.5 (Start the EM-Scanphone application)

Click here

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