

WAVECONTROL

Electromagnetic Field Meter SMP2

USER'S MANUAL



V 4.0

WAVECONTROL
Safety, Quality, Service

+34 93 320 80 55
www.wavecontrol.com
info@wavecontrol.com

W

Congratulations for your acquisition
of a **Wavecontrol SMP2**.

This Manual provides you with instructions
for using and handling your **SMP2**.

Please read this Manual carefully before
using your **SMP2**.

Disclaimer

Use of the product is controlled exclusively by the product manual (this document) and the product warranty. Wavecontrol assumes no responsibility or liability of any kind for errors or omissions in the contents of this document. Although the information contained herein is correct to the best of Wavecontrol's knowledge, it is provided with no guarantees of completeness, accuracy, usefulness or timeliness and without any warranties of any kind, express or implied. Wavecontrol provides all content in this document "AS IS" and "WITH ALL FAULTS." No use of this document or its contents shall be permitted without Wavecontrol's prior consent.

® Names and Logo are registered trademarks of Wavecontrol, S.L. Trade names are trademarks of the owners.

© Wavecontrol, S.L. 2020

Product specifications and descriptions in this document depend on the firmware version and are subject to change without notice.

Index

1. WARNINGS AND PRECAUTIONS	4
2. INTRODUCTION	6
3. FIRST STEPS	8
4. GETTING STARTED	10
4.1. Overview	10
4.2. Field probes	12
4.2.1. Connector type	13
4.2.2. Screw connector	13
4.2.3. Push-pull connector	14
4.3. External connections	14
4.3.1. USB	14
4.3.2. Fibre optic	15
5. SMP2 – INITIAL USE	16
5.1. Switching the apparatus on and off	16
5.2. Main screen	17
5.3. Menu screen	20
5.4. MEASUREMENT OPTIONS screen	21
5.5. MEASUREMENT LOG screen	25
5.6. Probe information	28
5.7. GPS screen	30
5.8. SETTINGS screen	31
6. FUNCTIONS	33
6.1. Measurement modes	33
6.1.1. Time domain measurement	34
6.1.2. FFT mode - frequency domain measurements	37
6.1.3. Single frequency time mode	41
6.1.4. Spatial average	42
6.2. Alarm	43
6.3. GPS	43
7. BATTERY INFORMATION	44
7.1. General information	44
7.2. Recharging	45

8.	SMP2 READER SOFTWARE	46
8.1.	Installation	46
8.2.	System requirements	48
8.3.	Using the software	48
8.3.1.	Measurements screen	49
8.3.2.	Screenshots screen	50
8.3.3.	Information screen	51
8.3.4.	Exporting spreadsheets	51
8.3.5.	Control centre screen	53
8.4.	Live measurements	54
9.	SOFTWARE AND FIRMWARE UPDATES	56
9.1.	SMP2 Reader (PC software) update	56
9.2.	SMP2 firmware update	56
10.	MAINTENANCE	59
10.1.	Cleaning the device and the screen	59
10.2.	Handling the device	59
10.3.	Regular recalibration	59
11.	TROUBLESHOOT	61
12.	TECHNICAL SPECIFICATIONS	62
APPENDIX 1.	AVAILABLE PROBES	64
APPENDIX 2.	APPLICATIONS	65
APPENDIX 3.	STATIC FIELD MEASUREMENTS: WPH-DC	68
APPENDIX 4.	LOW FREQUENCY ASSESSMENT	71
APPENDIX 5.	RADAR MEASUREMENTS	81
APPENDIX 6.	E-FIELD MEASUREMENT UNDER POWER LINE	82
APPENDIX 7.	COMMUNICATION PROTOCOL	83
APPENDIX 8.	WAVECONTROL INTRANET	89
APPENDIX 9.	ADDITIONAL SMP2 ACCESSORIES	90
	DECLARATION OF CONFORMITY (DoC)	91

1. WARNINGS AND PRECAUTIONS

- ⚠ Review this manual and become familiar with all the instructions for using and handling your **SMP2**.
- ⚠ Your **SMP2** is a portable apparatus with a rechargeable battery. Before taking any measurement, make sure that the battery is sufficiently charged for the time that you need for the measurement. If it is not, recharge the battery before.
- ⚠ Your **SMP2** is not watertight and it should be protected from moisture, such as rain.
- ⚠ Adjustment, maintenance or repair of the equipment must be performed only by qualified personnel. Please get in touch with **Wavecontrol** or your sales contact.
- ⚠ Never overtighten when screwing the **SMP2** on the tripod since the thread engagement could break down.

The **SMP2** is a professional measurement device that must be calibrated to ensure that it works properly. Check to make sure that its calibration is valid at all times.

If your equipment has been calibrated according to ISO 17025, the calibration report is valid only for the **SMP2** and probe. The probe can, however, be used with any other **SMP2**. The calibration report will not be valid if you switch the probe.

If you are unsure or need to recalibrate, please contact your distributor or contact us at service@wavecontrol.com (see section [10.3](#)).

Environmental information

Disposal of your old product:

Your product is designed and manufactured with high quality materials and components, which can be recycled and reused.

When this crossed-out wheeled bin symbol is attached to a product it means the product is covered by the European Directive 2002/96/EC.

Please get informed about the local separate collection system for electrical and electronic products.



Please act according to your local rules and do not dispose of your old products with your normal household waste. The correct disposal of your old product will help prevent potential negative consequences for the environment and human health.

2. INTRODUCTION



The **SMP2** is an instrument for measuring electromagnetic fields. Its frequency range is determined by the field probe used. A range of compatible probes is available, from DC (0 Hz) to 60 GHz.

It combines three instruments in one: static field measurements, broadband measurements and selective measurements (FFT), including % direct EMF exposure assessments to limit lines by using the weighted peak method (WPM).

We have developed the **SMP2** to meet the needs for personal safety assessment in connection with exposure to electromagnetic fields. Its versatility makes it a perfect measurement tool for many different sectors and industries such as Railway, Power, Manufacturing, Chemical, Medical, Defence, RFID and EAS, Telecommunications, etc.

Those measurements can be made quickly and easily anywhere because the **SMP2** is portable and simple to handle and use.

The **SMP2** can sample the field level continuously and store that data automatically in its built-in memory at user-configured intervals with a capacity of up to 1,000,000 samples.

The data stored in the memory can be easily downloaded to a computer via a USB or fibre optics port for later processing.

The **SMP2** is also available with a built-in GPS receiver (optional) to allow each measurement to be associated automatically with the geographic location where it was taken.

There are three basic **SMP2** models:

- **Broadband:** used with broadband probes.
- **Selective:** used with selective probes.
- **Dual:** used with all types of probes as it combines both features.

[Appendix 1](#) shows information on all the available type of probes.

3. FIRST STEPS

This section contains instructions for unpacking and checking the equipment when you receive it.



Figure 1: SMP2 Case

1. When you receive the equipment, check the packaging to see if it has been damaged in any way. Make a description of any damage on the delivery note before you sign it.

2. Check that all the components of the **SMP2** are there. The **SMP2** is delivered in a compact briefcase that should contain the following components:

- **SMP2**.
- 1 or more electromagnetic field probes.
- Battery charger.
- USB key containing the User's Manual and **SMP2** software.
- USB – mini USB cable.
- Fibre optic link (optional).

If any of those components is missing, please contact **Wavecontrol** at service@wavecontrol.com

4. GETTING STARTED

4.1. Overview

The front panel of the **SMP2** contains the user interface, made up of the screen and keypad.

The keyboard presents 8 standard buttons, 4 virtual buttons (below the screen) and 1 ON/OFF button.



Figure 2: Front

The 8 standard buttons are the following:

- ◀ ▶ ▲ ▼ These arrows allow you to move through the menu options and the data stored in memory.
- OK** allows to validate an option or enter in a menu.
-  always allows to come back to the main screen (measuring screen).
-  allows to get back to an earlier menu or to cancel a selection.
-  allows to take print-screens anytime.

The top of the **SMP2** holds the field probe connector.



Figure 3: Top

- **Probe connector:** (see 4.2).
- **ON / OFF button:** switches the equipment on and off.
- **Status LED:** when the unit is off, red means charging, green charged. When the unit is on, green LED should be always on.
- **Light sensor:** allows to control the automatic screen back-light intensity depending on ambient light.

The bottom of the **SMP2** holds the other connections of the equipment.

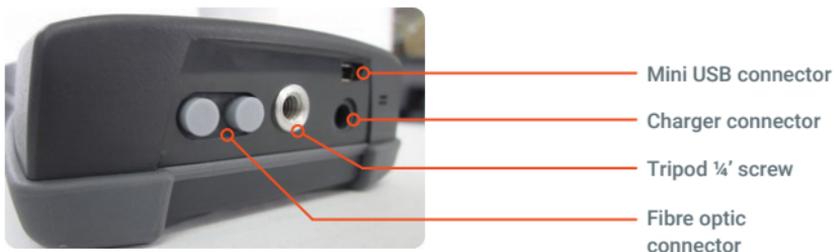


Figure 4: Bottom

- **Mini USB connector and fibre optics:** allows connection to a PC in order to:
 - Download data stored in the **SMP2** memory.
 - Update firmware for the equipment.
 - Control the unit remotely.
- **Battery charger connector:** allows the **SMP2** battery to be recharged using the charger supplied with the equipment.
- **1/4" screw connector:** takes a 1/4" screw, the standard screw used for most tripods, allowing the **SMP2** to be mounted on a tripod.

4.2. Field probes

The **SMP2** is a highly versatile EMF measurement device that requires connection of the proper field probe to obtain the best results for each application. Only **Wavecontrol** field probes will work with the device.

If the device is switched on with no field probe attached, it will not show any field value and therefore no measurement will be saved to memory. However, saved data and GPS positioning functions will be available.

The **SMP2** automatically detects the type of field probe and its calibration parameters.

4.2.1. Connector type

There are two types of connector: push-pull and screw.



Figure 5: Push-pull connector



Figure 6: Screw connector

4.2.2. Screw connector

4.2.2.1. How to connect the field probe

Connect the field probe by inserting the male connector into the female connector with the tab aligned. Once fully inserted, screw the connector until it is snug, without forcing it.



Figure 7: How to connect the field probe

4.2.2.2. How to disconnect the field probe

You do not need to switch the device off before disconnecting the probe. First unscrew the probe connector, then pull the connector to remove it.

⚠ Important: pull the connector. Do not try to twist or turn the probe tube.

4.2.3. Push-pull connector

4.2.3.1. How to connect the push-pull probe

With a push-pull connector, the field probe is connected by inserting the male connector into the female connector of the **SMP2** until it stops. The polarity of the connector must be observed and so the red marks on the male and female connectors must line up.



Figure 8: How to connect the field probe

4.3.2.2. How to disconnect the field probe

You do not need to switch the device off before disconnecting the probe. Pull the connector of the probe firmly with one hand (pulling with the thumb) while you hold the **SMP2** with your other hand as shown in the pictures.



Figure 9: How to disconnect the field probe

⚠ Important: pull the connector. Don't pull any other part of the probe!
Don't try to twist or unscrew the probe.

4.3. External connections

4.3.1. USB

A USB to mini USB cable is delivered with the **SMP2**. After installing the **SMP2** software (first install the software see [8.1](#)) just plug the cable to the **SMP2** and to the computer. You will be able to download stored measurements to the computer or update the **SMP2** firmware.

Note: it is not recommended to perform measurements while the USB is connected, it could affect the quality of the readings.

4.3.2. Fibre optic

A fibre optic link is available as an option in order to remotely control and see live readings of the instrument from a PC without interfering with the measurements. To connect the fibre optic link:

- Plug the fibre to the **SMP2** (respect the colour code, grey side is looking up).
- Plug the fibre to the USB to fibre converter (respect the colour code).
- Plug the USB of the converter to the PC.



Breakable part (see Note 2)

Note 1: *no need to install additional software, everything has been already installed with the main software.*

Note 2: *in case the connector does not fit into a small waveguide, you can break the connector in 2 parts.*

5. SMP2 – initial use

The **SMP2** is designed for simple and intuitive operation with 2 basic functions:

- Time or frequency domain field measurement.
- Storage of results in memory.

Several additional functions make the **SMP2** a very complete field measurement system.

The **SMP2** is controlled via the keypad and easy access to data is available through the different settings.

5.1. Switching the apparatus on and off

The apparatus is switched on and off with the ON / OFF button located on the upper part of the keyboard.

To power on the unit, click on the ON/OFF button. The status LED will stay in red for some milliseconds before turning green. A welcome screen is displayed until the software completely boots and shows the main screen.

To power off the unit, click once on the ON/OFF button. A pop-up will appear on the screen to confirm the command. F1 and F2 buttons will confirm the action, F3 and F4 buttons will cancel it. You can also select the option with the right and left arrows and click on OK to confirm. You can also switch the device off by pressing and holding the ON/OFF button.

Note: *All the device's configurations (alarm level, units, type of measurement, measurement interval, etc.) are saved when it is switched off and recovered automatically when it is switched on.*

5.2. Main screen

The main screen provides instantaneous and continuous information on the electromagnetic field being measured.



Figure 10: Main screen

- **Date and time:** date and time of the apparatus.
- **Icons:** the below icons provide information about the unit.



Alarm is activated



USB is connected



Fibre connection available



Scheduled measurement activated



Correction factors applied



Logging has started (Measurement is ongoing)

Note: CF means the connected field probe internal correction factors are being applied.

- **Battery:** battery charge level.



- **Probe information:** serial number of the field probe attached to the apparatus and its frequency information.

Measurement information:

- **Logging and average parameters:**

1. Average window time.
2. Average type (sliding or tumbling).
3. Sampling rate.
4. Logging time.

Field information: (updated twice per second)

The **SMP2** has a double screen display. Depending on the probe selected, you have the RMS and Peak values or RMS and Average values.

- **Total field:** instantaneous total field level.

Obtained for three-axis probes as:

- The quadratic sum of each axis field (for field intensity units):

$$E_{Tot} = \sqrt{E_X^2 + E_Y^2 + E_Z^2}$$

- The quadratic sum of each axis field (for field intensity units):

$$S_{Tot} = S_X + S_Y + S_Z$$

- **Field unit:** unit of measurement of the field value shown on the display. This unit applies to the total field, the field on each axis and the maximum, minimum and average values.

Maximum, minimum and average values: these values (below the total field values) are initialized when beginning a new log or can also be initialized with the virtual button "Reset". Average value is updated depending on the type of averaging and interval chosen in the Measurement Options.

- **Field on each axis:** the field measured on each axis for isotropic three-axis probes. Updated twice per second.

Graph:

In the time domain:

It shows a graphical view of the temporal evolution of the field. It represents the last measurements. This time scale can be modified in the settings menu (graph timespan).

"MENU" → "SETTINGS" → "Graph timespan"

In the frequency domain:

It shows the frequency information of the signal (horizontal axes value depend on the span). Also a vertical line represents the position of the cursor (with the associated information on the right top side of the graph).

GPS information:

Positioning information provided by the GPS receiver. This information is only displayed when the GPS is switched on.

- **Lat:** latitude.
- **Lon:** longitude.

On the right side a colour indicates the quality of the position:

- **Red:** bad.
- **Orange:** average.
- **Green:** good.

Functions:

These menus depend on the probe connected but general functions are as follows:

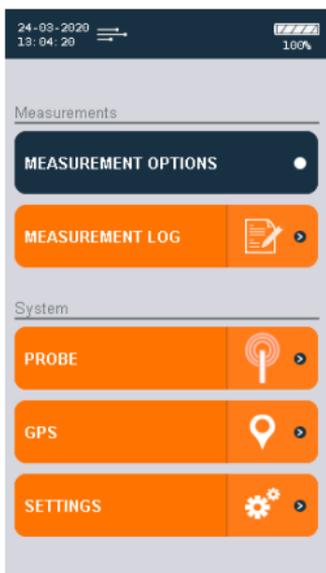
- **Menu:** access to the menu screen.
- **Log:** start a new measurement.

- **Units:** change the current units (this will reset the min, max, average and graph). With the up and down arrow you can select the unit. By pressing OK the highlighted unit will be selected.
- **Reset:** it resets the min, max, average and graph.
- **Keypad Arrows in frequency mode:**
 - Right-left arrows shift the cursor by one step.
 - Up-down arrows shift the cursor to the next right or left peak found in the FFT.

Note: When there are more than 4 functions available, the button on the right allows to show more functions available.

5.3. Menu screen

This is the main screen to access sub menus.



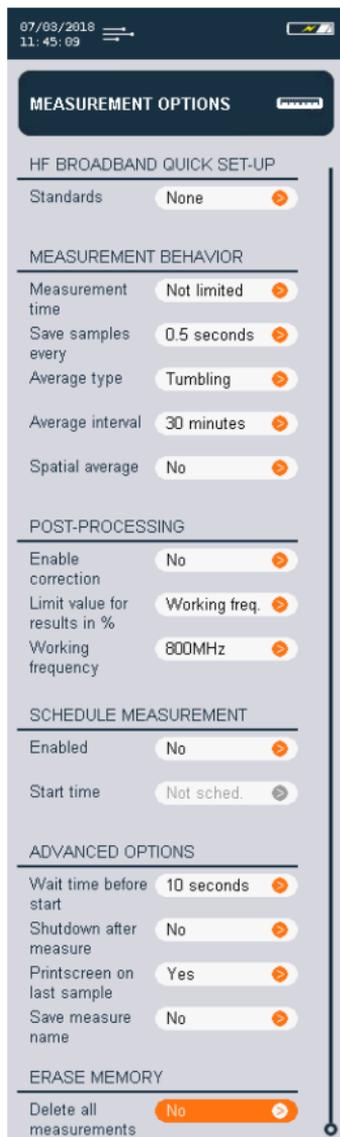
- **MEASUREMENT OPTIONS** (allows to change all the parameters related to measurement).
- **MEASUREMENT LOG** (allows to see the stored measurements).
- **PROBE** (allows to manage probe calibration)
- **GPS** (allows to change GPS parameters).
- **SETTINGS** (allows to change general parameters of the unit).
- **MESSAGES** (in case some events are available this menu will appear).

5.4. MEASUREMENT OPTIONS screen

This screen is used to configure different parameters related to measurement behaviour. It appears as a menu with a scrolling bar. The parameters to be configured are shown on the left and the different options for each parameter are shown on the right.

The keypad is used to move along the menu. The process for changing the value of a parameter is:

- Run through the different parameters using the arrows ▲▼.
- To change a parameter, press Enter when the cursor is on that parameter. A pop-up will appear showing all the possible values.
- Run through the different values using the arrows ▲▼ and click on OK to select the desired value. (you can cancel with the back button).
- When finished you can either press back to return to the menu screen or press the home button to come back to the main screen.



The following parameters can be configured:

HF BROADBAND QUICK SET-UP

- **Standard:** List of preselected standards.

This will affect other parameters that will not be editable. For example: if you choose ICNIRP standard then all the parameters in "MEASUREMENT BEHAVIOUR" section will not be editable as they are defined by the standard.

MEASUREMENT BEHAVIOUR

- **Measurement time:** allows to define a maximum time for the measurement. Available values are: not limited, 1 min, 5 min, 6 min, 10 min, 15 min, 30 min, 1 h, 1 day, or custom from 1 second to 100 hours.
- **Log interval:** used to select the time interval for storage of data in memory (see section [6.1.1](#)). A value will be stored every 'Log interval' seconds (or minutes). The available intervals are 0.5 s, 1 s, 5 s, 10 s, 15 s, 30 s, 1 min and 6 min. There are also available intervals with low power mode of 1 min, 2.5 min and 6min to allow for longer battery autonomy for all probes.
- **Average type:** two types of average are available, tumbling or sliding. Tumbling averages are taken at fixed intervals, while sliding averages are taken through sliding time window. By way of an example, imagine that we choose an average interval of 10 s. Since the device takes 2 samples per second, in those 10 seconds we will have 20 samples. In the case of tumbling averaging, we will have an average of samples 1 to 20, another average of samples 21 to 40, and so on. In the case of sliding averaging, we will have continuous averages as the window advances over time. In other words, we will have the same initial average with samples 1 to 20, but then immediately afterwards we will have another with samples 2 to 21, then another with samples 3 to 22, and so on.

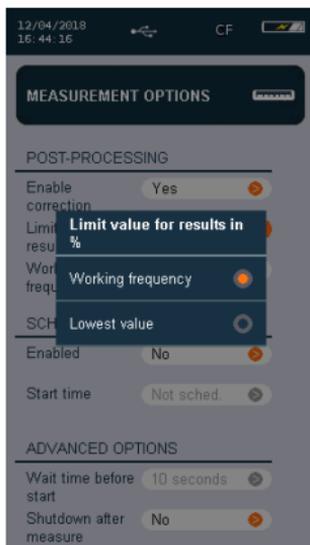


- **Average interval:** used to select the time interval for calculation of the average. The available intervals are 10 s, 15 s, 30 s, 1 min, 2 min, 5 min, 6 min, 10 min, 15 min and 30 min.
- **Spatial average:** choice between a single temporal log or several spatial measurements that will be represented in a column graphical chart (see [6.1.4](#)).

POST-PROCESSING

This menu is only available with broadband probes that have correction factors in memory. It has 3 parameters:

- **Enable correction:** allows correction of the value measured at a given frequency (Working frequency defined below) using the factors measured during the latest laboratory calibration.
- **Limit value for results in %:** allows direct reading of the field as a % of a limit defined on the main measurement screen. This is a software calculation taking the limit value in V/m and comparing it with the reading from the probe. You can select the lowest limit (minimum value) of the regulation (within the band width of the probe) or a specified frequency (Working frequency defined below).



Note: If the minimum value is selected, no working frequency can be defined and therefore the correction factors cannot be activated.

- **Working frequency:** allows definition of the working frequency for correction factors or for calculation of the value as %. Where the lower limit of the regulation is selected, this parameter will show as "Not available", since it is not compatible with that selected mode.

SCHEDULE MEASUREMENT

Allows to program a scheduled measurement in the following 24 hours.

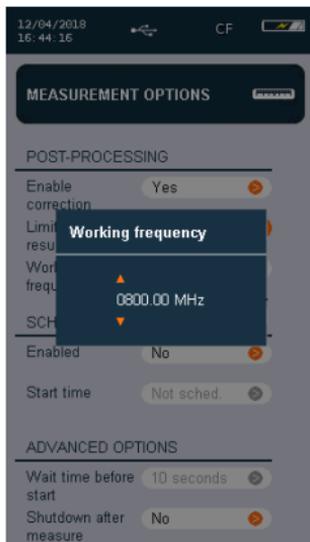
- **Enabled:** Yes/No
- **Start time:** Sets a start time. If the unit is off, it will go on at the programmed time and will run the measurement.

ADVANCED OPTIONS

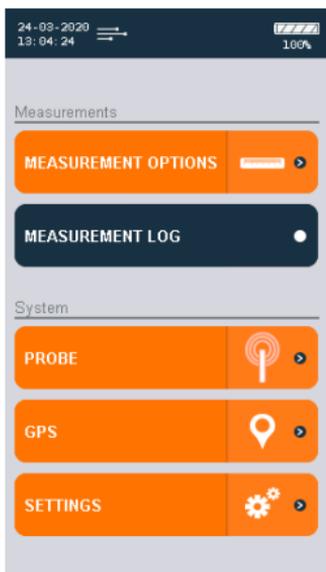
- **Wait time before start:** delay before the measurement really starts (it allows the technician to separate himself from the equipment). Available values are No delay, 5 s, 10 s, 15 s, 20 s, 30 s, 1 min.
- **Shut down after measurement:** useful option to power off the unit when measurement is done. It avoids having to wait to power off the unit manually.
- **Printscreen on last sample:** Allows to take a screenshot at the end of the measurement. When performing, for example, a 6-minute average measurement, this last sample screenshot will show the final average result. This image will be available for reporting with the **SMP2** Reader software.
- **Save measurement name:** permits to save a name for each measurement. In case it is activated, a pop-up will appear before the measurement starts in order to indicate a name.

ERASE MEMORY

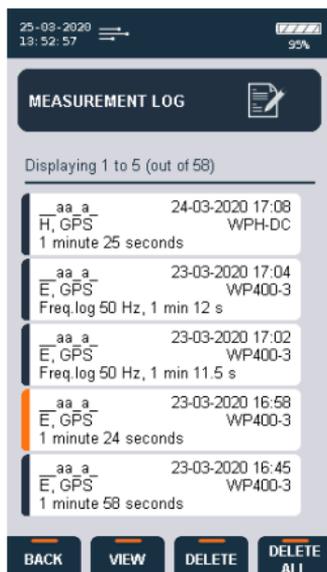
- **Delete all measurements:** will delete all measurements as well as all the screenshots related to these measurements. Depending on the number of data in memory this operation may last some time. We recommend you avoid overloading the built-in memory, so that the device can work more smoothly. To erase measurements selectively, see section [5.5](#).



5.5. MEASUREMENT LOG screen



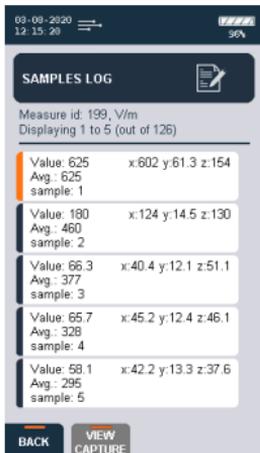
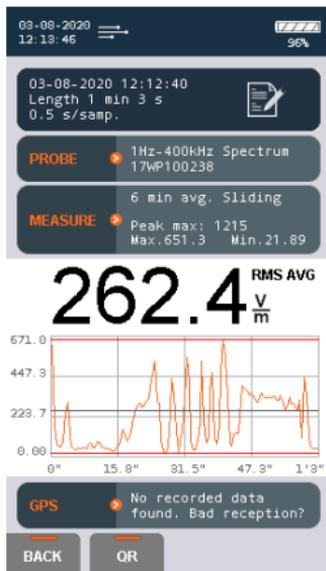
This screen shows all the available measurements. The ▲▼ arrows are used to select the next measurement or the preceding measurement. The ◀▶ arrows are used to select the next page or the preceding page.



From this menu you can use the "VIEW" virtual button to view a specific measurement (by pressing OK), "DELETE" to erase a single measurement, or "DELETE ALL" to erase all the memorised data (this is the same as "erase all measurements" on the measurement configuration screen).

When a measurement is entered, you can view a measurement summary screen. To view the data, use the "VIEW DATA" virtual button. To view the screenshots taken during the measurement press on "LIST IMAGES" to enter the SCREENSHOTS LOG screen.

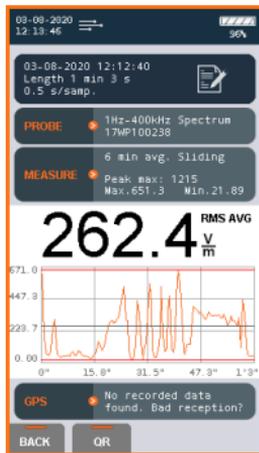
On the SAMPLES LOG screen, each rectangle represents a sample (see screenshot 1 below). You can use the up or left arrows to go directly to the latest sample (screenshot 2). Where a screenshot exists, you can display that image by pressing OK on the selected sample (screenshot 3).



Screenshot 1



Screenshot 2



Screenshot 3

Use the QR virtual button to obtain the QR code which can be scanned using a QR scanner or reader to obtain information about the measurement results (Date and time of measurement, type of value (RMS, Peak, Average), the final measured value, the unit of measurement, serial numbers of the SMP2 and probe, GPS information).

Example:

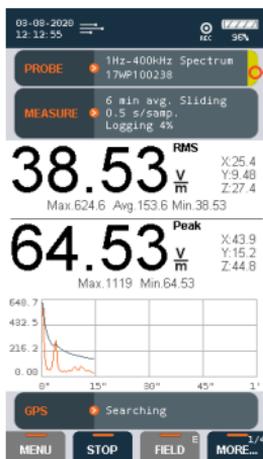
```
2*2020-07-17 10:53:46*RMS*3.7538*V/  
M*19SN0976*17WP100238*GPS  
LAT*41.446728*GPS LONG*1.975145
```



5.6. Probe information

This screen allows you to see information about the probe, activate or deactivate the calibration warning and configure calibration details in case of 3rd party calibration.

When your calibration is less than a month to expire, you will notice a colour indication in the probe information bar. In the case of red, this means your probe calibration has expired (see screenshot 2 below). A warning will be shown on the screen at most once a day, with 'Ignore' and 'Options'. Select 'Options' to go to the Calibration option directly or 'Ignore' to close the message.



Screenshot 1

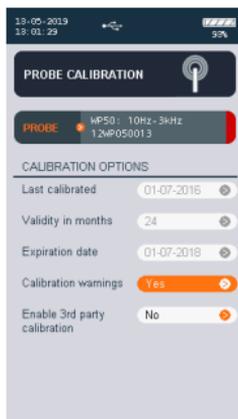
Information bar



Warning message

Screenshot 2

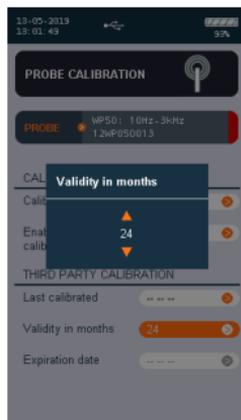
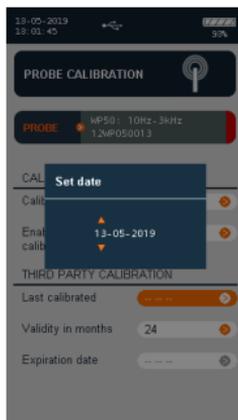
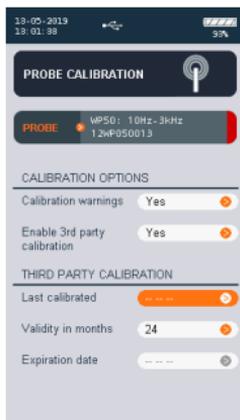
In calibration options, the warning can be disabled by selecting 'No' in the option Calibration warning, remove the screen message by clicking any button on the SMP2.



If the user chooses to use an external calibration, a new calibration date can be inserted and validity can be set by enabling 3rd party calibration.

In the tab, THIRD PARTY CALIBRATION, you will see:

- **Last calibrated:** Set the date of calibration
- **Validity in months:** Set the validity of the calibration (in months)
- **Expiration date:** Automatically sets according to the Validity setting



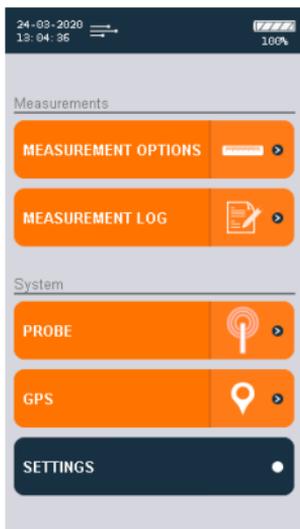
5.7. GPS screen



This screen has the same layout and behavior as the MEASUREMENT OPTIONS screen. It allows to modify the GPS parameters. Those parameters are:

- **Format:** allows to select 3 standard format for the latitude and longitude. You can choose between:
 - Degrees minutes seconds: example: 40° 26' 46" N 79° 58' 56" W.
 - Degrees decimal minutes: example: 40° 26.7671' N 79° 58.9331' W.
 - Decimal degrees: example: +40.446 -79.982°.
- **Turn on at startup:** defines the GPS state when the unit starts up.
- **Turn on for current session:** defines the GPS state only for this session. That means that next time you switch on the unit the GPS will be in the state defined by "Turn on at startup" parameter.

5.8. SETTINGS screen



This screen has the same layout and behavior as the MEASUREMENT OPTIONS screen. It allows to modify the general parameters of the **SMP2**. The following parameters can be configured:

ALARM

Allows to activate or deactivate the alarm. When activated, you can define the alarm threshold and units for electric and magnetic field (the ◀▶ arrows are used to select the figure to be changed and the ▲▼ arrows are used to change the figure value).



DATE AND TIME

- **Date format:** allows you to choose the following date formats: (dd-MM-YYYY, MM/dd/YYYY and YYYY-MM-dd)
- **Date:** allows to change the date of the system.
- **Time:** allows to change the time of the system.

GRAPHICS

- **Zero based time plots:** allow to scale the graph between 0 and the maximum of the measurement or between the minimum and maximum to have a precise view of the time variation of the field.
- **Graph timespan:** sets the duration of the representation of the graph up to 12 min.

DISPLAY

- **Language:** sets the desired language.
- **Adjust backlight automatically:** if enabled the **SMP2** will adjust backlight depending on ambient light.
- **Backlight level:** if automatic adjustment is disabled, manual level can be selected from 1 to 4 (4 is the brightest).
- **Screensaver delay:** defines the time before screen power off. When the screensaver is active the instrument will not stop measuring. To exit the screensaver just click any button.

SOUND

- **Enable:** enables or disables sound.

DEVICE

- **Turn off after inactivity period:** The instrument turns off after the specified period of inactivity. (Activity may be communicating with PC, keyboard pressing key). When log is activated, automatic turn off is disabled.
- **System info:** indicates the version of the **SMP2** software. By clicking on OK, you will have more information about the unit like disk space available.
- **Factory reset:** will erase all measurement data and restore configuration parameters to factory settings.

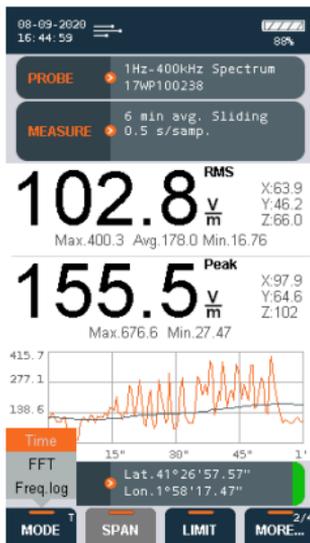
6. FUNCTIONS

This section describes the main functions of the **SMP2**, in addition to instantaneous measurement of the electromagnetic field.

6.1. Measurement modes

There are several working modes, depending on the probe being used. All probes have the time mode (6.1.1) with spatial average (6.1.4), but only the WP400, WP400-3 and WPH-DC have the FFT mode (6.1.2) and the Frequency Log mode (6.1.3). For these probes, on the main screen virtual menu you can see the 'MODE' function that allows you to switch between modes:

- **'Time'**: Records changes in the total field value over time (see section 6.1.1). This mode can also be used to take spatial measurements. To do so, select the option in MENU → MEASUREMENT OPTIONS → Spatial average (see section 6.1.4).
- **'FFT'**: Frequency mode. The main screen shows the spectral analysis (FFT) for the selected SPAN and the total field value (see section 6.1.2).
- **'Freq log'**: Frequency log. Records changes in the field level over time at a specific frequency.



6.1.1. Time domain measurement

If you are using a broadband probe, this is the default mode. If you are using a selective probe, select this mode on the main screen virtual menu ('MORE...' → 'MODE' → 'Time').

Measurements in the time domain contain field samples. One sample is saved each log interval as defined in section 5.4. For example, a 6-minute measurement with a 0.5 s log interval will record 720 samples. The log interval does not affect the sampling rate of the probe, since the device always uses 2 samples per second to calculate the average.

Measurements are stored in an SQL database. The memory of the SMP2 allows storage of up to 1,000 measurements and 1,000,000 samples.

Before starting the measurement, all the parameters must be configured. This is done through the virtual menu.

First of all, select 'MENU', then 'MEASUREMENT OPTIONS'. You will need to establish the desired parameters for each option, basically 'Measurement time', 'Log interval', 'Average type', 'Average interval' and 'Spatial average' (see 5.4).

Return to the main screen by pressing the 'Home' button.

Select the rest of the measurement parameters using the virtual menu:

- 'FIELD': E or H (if the probe allows).
- 'LIMIT': Normative limit.
- 'UNIT': Measurement units.



To start logging samples, press the 'LOG' button on the virtual menu. When logging starts, the device creates a new measurement record identified with its starting date.

To stop logging samples, press the 'END' button or wait until the defined measurement time is reached. A new screen will appear to show you a summary screen with all the important information. In this summary screen you can either go back or show a QR code to export easily the information to an external App for example.

△ Important: To store position information along with the field values, the GPS receiver must be enabled before logging is started.

Note 1: *During logging, the parameters of the SMP2 cannot be changed.*

Note 2: *With the broadband probes, if you select a limit you can go to the 'UNITS' and select a % in power density (%S) or field intensity (%E or %H).*

6.1.1.1. High frequency measurements

International standards have specific requirements for high frequency measurements. When you make a selection on MENU → MEASUREMENT OPTIONS → Standard, the following parameters will be adjusted to the pre-defined values:

- Measurement time
- Logging rate
- Average type
- Average interval

Then you are ready to measure. Just press the 'Home' button and press the 'LOG' button on the virtual menu:

- The device will wait the time specified in 'Wait time before start' (see 5.4) before starting the measurement to allow the technician to move away. A beep will indicate the start of the measurement.

- It will log samples for [Measurement time] minutes.
- The measurement will stop automatically and the alarm will sound. The device will calculate the average, display it on the screen and store the data in the memory.

The measurement can be stopped pressing the 'STOP' button.

6.1.1.2. Low frequency time domain measurement with WP50, WP400 or WP400-3

With this type of probe, other additional functions are available:

- **'FIELD'**: electric (E) or magnetic (H) field.
- **'LIMIT'**: select the standard to apply.
 - None: No weighting will be applied and the measurement will be displayed in the desired units.
 - One of the limits: The measurements will be weighted in accordance with the chosen limit and result displayed as a % of that limit (over 100% means the limit is being exceeded).

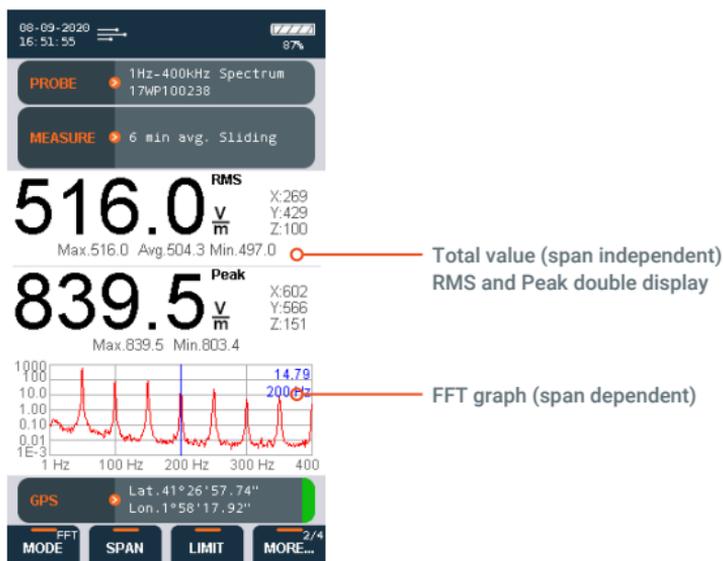
When a limit is activated with the **WP50** probe, an analogue filter is applied related to the selected limit. With the **WP50** probe only two limits can be selected: ICNIRP 2010 public and ICNIRP 2010 workers. The figures are shown as an RMS value, a % of the selected limit or in the selected units if no limit is chosen. The **WP50** probe is not suitable for analysis of pulsed signals because it is not equipped with the peak analysis function described below.

With the **WP400** and **WP400-3** probes, when a limit is activated, the weighted peak method is applied, as described by ICNIRP and recognized as the most suitable method for analysing complex non-sinusoidal and pulsed signals. In this case, the main value displayed is the % of the peak field value compared with the selected limit. The RMS value is also given. As a rule, at low frequencies the standards limit the peak field value, which is the one most likely to exceed the limit, although verification of the RMS value is also requested. If no limit is selected, the main value displayed by default is the RMS value, and the secondary value is the peak value. Please see [Appendix 4](#) for more details.

6.1.2. FFT mode - frequency domain measurements

This function is only available with a selective probe, such as the **WP400**, **WP400-3** or the **WPH-DC**.

Frequency domain measurements contain frequency information on the analysed field, obtained through calculation of the FFT of the signal.



Each frequency measurement (FFT) contains 400 points. The capacity of the **SMP2** allows storage of over 1,000 frequency measurements.

Note: In this mode the FFT graph is shown on the screen and you can use the cursor to select a frequency. The total RMS and peak field values are shown above the graph. Those values represent the whole field across the full bandwidth of the probe. The selected SPAN only affects the display of the FFT graph and does not affect the total shown on the screen.

In frequency mode the parameters of the "MEASUREMENT OPTIONS" menu have no effect. All parameters have to be chosen from the virtual menu of the main screen:

- **"MODE"**: Time, FFT or Freq. log (see section [6.1](#)).
- **"FIELD"**: electric (E) or magnetic (H) field (H-field only available for **WPH-DC**).
- **"SPAN"**: select the frequency range available depending on the probe (affects only the FFT):
 - 40 Hz (0.1 Hz resolution)
 - 400 Hz (1 Hz resolution)
 - 4 kHz (10 Hz resolution)
 - 40 kHz (100 Hz resolution)
 - 400 kHz (1 kHz resolution)
- **"LIMIT"**: allows selection of desired standard.
 - None: No weighting will be applied and the measurement will be displayed in the desired units.
 - One of the limits: The measurements will be weighted in accordance with the chosen limit and result displayed as a % of that limit (over 100% means the limit is being exceeded).
- **"HOLD"**:
 - Off: no "Max Hold" applied. FFT values updated on screen every half second.
 - Max: "Max Hold" applied. All values keep the maximum level detected. This option is recommended for taking a single measurement to check compliance with a limit: just select the desired limit, activate 'Max Hold', wait the appropriate time and press Log to save the maximum peak, RMS and FFT values. Duration of "Max Hold" function is displayed in measurement information during measurement and in the final screen of the saved result.
The "Max Hold" function can be reset by either a long press of the "Max Hold" or "Reset" button in the dynamic menu.
- **"AXIS"**: useful for applications where finding the source of the emission is important.
 - T: shows the FFT for the total field value.
 - X: FFT of the X axis.
 - Y: FFT of the Y axis.
 - Z: FFT of the Z axis.

Note: *If data is downloaded to a PC, the FFTs for all the axes and the total field can be displayed in a single graph.*

To save an FFT, go to the main screen (direct access available by pressing the "Home" button) and press the "LOG" function. The device will save the current FFT.

6.1.2.1. Case scenarios

This section sets out recommendations for using the selective system in different situations:

- **Checking harmonic content of power lines:**

Select:

- "MODE": FFT
- "SPAN": 400 Hz
- "FILTER": 10 Hz

You will obtain an FFT showing 50 Hz and the main harmonics within the frequency domain (10 to 400 Hz). You can switch between the electric and magnetic fields using the 'FIELD' option.

- **Measurement of power lines:**

Select:

- "MODE": Time
- "FILTER": 10 Hz

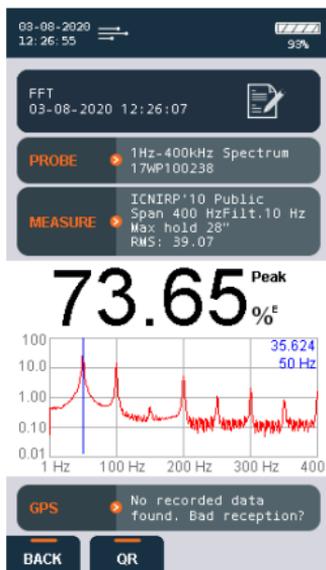
In this mode you will obtain the total field value, as with a broadband probe. Repeat for the magnetic and electric fields.

- **Measurement when the field type is unknown:**

- We recommend always using a filter of 10 Hz or higher, because below 10Hz any movement of the device or in its vicinity can affect the measurement. If you are not sure that there is no field below 10 Hz, use a filter of 1 Hz, and in this case always take the measurement with the device set on a tripod to prevent movement.

- If you only need to check compliance in % of a standard, the time mode is suitable. This will give a complete and instantaneous result as a % of the limit.
- If you need to check the frequency content of the field, use the FFT mode. First select the highest SPAN (400 kHz). If no field is detected above 40 kHz, change the SPAN to 40 kHz. If no field is detected above 4 kHz, change the SPAN to 4 kHz. Finally, if no field is detected above 400 Hz, change the SPAN to 400 Hz. This reduction of the SPAN, wherever possible, will provide better frequency resolution to analyse the signal. When you have the suitable SPAN, press "LOG" to save the FFT.

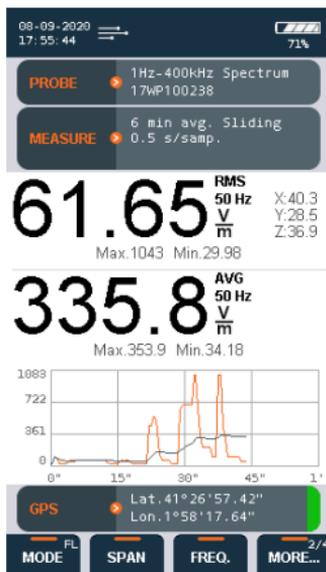
Note: In the FFT mode as well, the total field value, values for the axes, maximum, minimum and peak values are updated every half second, representing the field values over the full frequency range.



6.1.3. Single frequency time mode

In this mode, a log is kept of the changes in a single frequency over time. An example is shown in the figure above. There are two ways to select the frequency:

- In the FFT mode**, place the cursor on the desired frequency (you may need to change the SPAN in order to choose the desired frequency), then change to the Frequency Log mode.
- Directly in the Frequency Log mode**, using the SPAN and FREQ functions. With a SPAN of 400 Hz you can select frequencies with 1 Hz resolution, with a SPAN of 4 kHz with 10 Hz resolution, with a SPAN of 40 kHz with 100 Hz resolution, and with a SPAN of 400 kHz with 1 kHz resolution.



Note that in this mode, even if you have selected a limit to obtain a value directly as a %, only the RMS will be given and not the peak value.

6.1.4. Spatial average

Activate this option through MENU → MEASUREMENT OPTIONS → Spatial average.

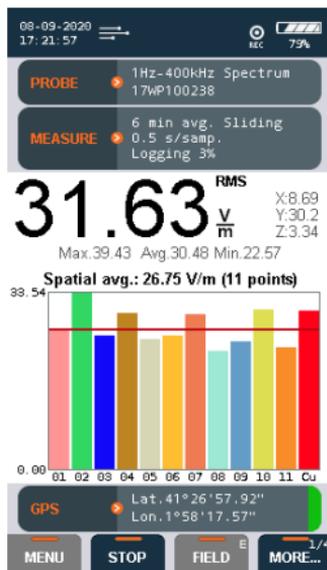
This mode can be used along with the Time mode and the Frequency Log mode.

With this mode you can automate the process if you need to take several measurements at different positions. The screen does not show changes over time but rather the average at each position on a bar graph.

When a log is launched, the measurement will be taken at the first position. At the end of each measurement a window will ask whether to continue with a new position, repeat the previous position or end the measurements.

The number of positions measured and the cumulative spatial average are shown at the top of the graph, as seen in the figure to the right.

Note: You will need to configure the "Measurement time" parameter before launching a measurement (see section [5.4](#)).



6.2. Alarm

The alarm function allows the person taking the measurements to define a warning level. When that level is exceeded, the device will give an audible warning. The alarm will only sound if the alarm function has been activated on the configuration screen and the sound is switched on.

6.3. GPS

The **SMP2** has a built-in state-of-the-art GPS that allows it to display and memorize the position of the device when taking measurements. The incorporation of ublox functions makes the receiver highly sensitive and accurate, allowing exact positioning even in areas with poor satellite visibility.

The GPS is enabled and disabled through the configuration menu as explained in section [5.6](#).

If the position obtained by the GPS is invalid, the main screen displays the message "Searching". If the position obtained by the receiver is valid, the latitude and longitude are shown on the screen with a colour indicator of the quality of the position.

Note: *Enabling the GPS increases power consumption and reduces autonomy. It is important to keep it disabled when not in use, to avoid unnecessary drain on the battery.*

7. BATTERY information

7.1. General information

The **SMP2** includes a rechargeable Li-ion battery allowing the device to run for over 20 hours (in selective mode that time is reduced to just over 6.5 hours). You can check the battery charge level at any time in the upper right-hand corner of the main screen.

Li-ion batteries have no "memory effect" and so there is no need to let the battery run down completely. We recommend charging the battery completely before its first use.

- Always switch the device off when it is not in use.
- Recharge the battery regularly (e.g. every 2 months) even if the device goes for long periods with no use.



The battery of the **SMP2** should be recharged when the indicator shows the minimum level.

- ⚠ Measurements should be taken without the charger or the USB connected, to avoid any alteration of the results.

The battery will function normally at temperatures between -10°C and $+50^{\circ}\text{C}$. However, we recommend avoiding low temperatures to prevent its useful life from being shortened.

- ⚠ We recommend using only the battery charger supplied by **Wavecontrol** to recharge the battery of the **SMP2**.

7.2. Recharging

The battery charge time is 5-7 hours. We recommend switching the **SMP2** off before charging the battery. The procedure is as follows:

- Plug the charger into an electrical outlet (110-240 V AC).
- Connect the charger to the **SMP2**. The red LED will light up. If it does not light up, the charger is not properly connected.
- The battery is fully charged when the LED shows green. Disconnect the charger from the **SMP2** and unplug it from the mains.



Battery charging icon

The **SMP2** has a battery charge controller so you can leave the device charging for longer than the recommended 7 hours without harming the battery.

Note 1: *We recommend fully charging the battery from time to time to ensure that the battery is properly calibrated.*

Note 2: *If the red light begins blinking during the charge, it means that the battery is too warm to be charged properly. Disconnect the charger, wait for at least one hour and then reconnect the charger. If the problem persists, it could mean that the battery is damaged.*

8. SMP2 Reader Software

8.1. Installation

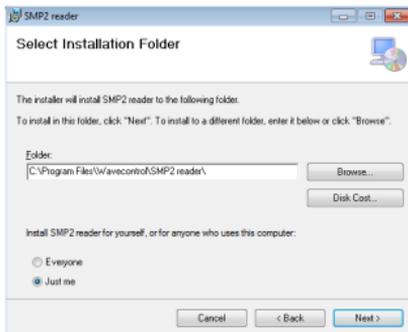
The software is available in the USB memory included with the device. You will find the most recent version on the **Wavecontrol** intranet (exclusive service for registered customers, see [chapter 9](#) and [appendix 8](#)).

Before connecting the **SMP2** to your PC, run the Setup file.

During the process the Setup file will install the software and all the necessary drivers.

When the installation is complete, connect the **SMP2** and Windows will install the drivers automatically.

The following images show the full process:



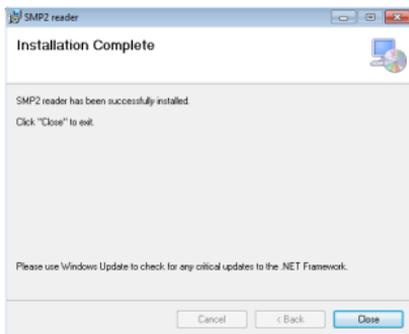
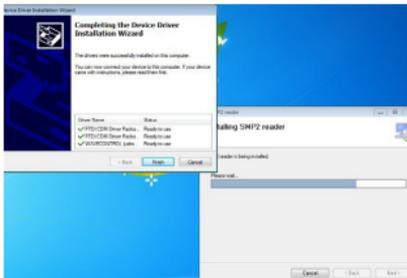
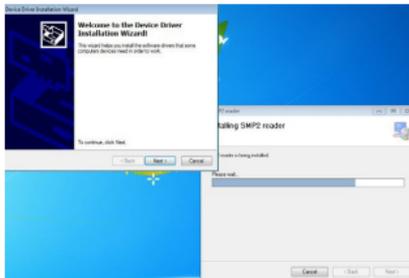
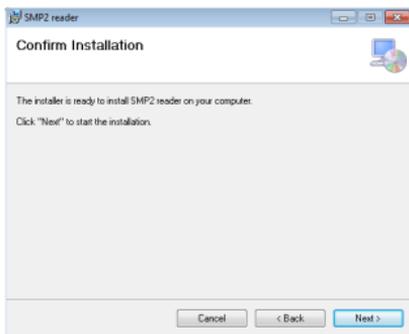


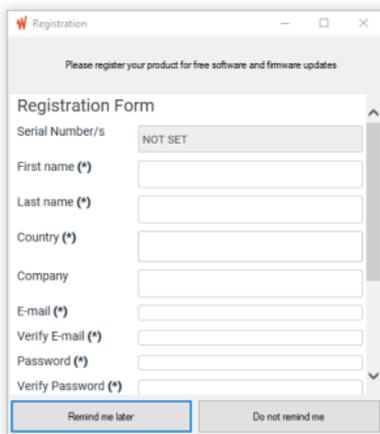
Figure 11: Installation of the program

8.2. System requirements

- Operating system: Windows 7 or later.
- Microsoft .NET Framework 4 (4.5 recommended).
- RAM: 2 GB.

8.3. Using the software

When running the software and connecting the **SMP2** for the first time, a pop-up window will open to allow you to register to the **Wavecontrol** intranet. This is required for free software and firmware updates (see [chapter 9](#) for updates and [appendix 8](#) for the intranet).



The image shows a registration window titled "Registration" with a sub-header "Please register your product for free software and firmware updates". The form contains the following fields:

- Serial Number/s: NOT SET
- First name (*): [Text Input]
- Last name (*): [Text Input]
- Country (*): [Text Input]
- Company: [Text Input]
- E-mail (*): [Text Input]
- Verify E-mail (*): [Text Input]
- Password (*): [Text Input]
- Verify Password (*): [Text Input]

At the bottom, there are two buttons: "Remind me later" and "Do not remind me".

Main features of the **SMP2** Reader software:

- Download stored measurements.
- Display measurements as graphs and tables.
- Access to stored screenshots.
- Export measurements and screenshots to Excel.
- Access to general information on the **SMP2**.
- Send measurements directly to a web server.

8.3.1. Measurements screen

Measurements are loaded automatically when the **SMP2** is connected by USB. A list will appear on the left with the measurements stored in the **SMP2**. When you select a measurement, a table and a graph will appear on the right with all the field samples taken. A window will open to the left of the table with general information on the measurement. This window includes a button for direct access to the screenshots associated with the measurement. With an Internet connection, a map will also appear with a position indicator if the GPS was switched on during the measurement.

If you select a sample from the table, the program will trace a vertical red line in the graph, and if you click on a point in the graph, the vertical line will move to the position of the cursor and the corresponding sample will be highlighted in the table. You can use this to find maximum values, ordering samples by value, by clicking on the Field heading.

Note: *If the GPS was switched on during the measurements, the position data will also appear in the table.*

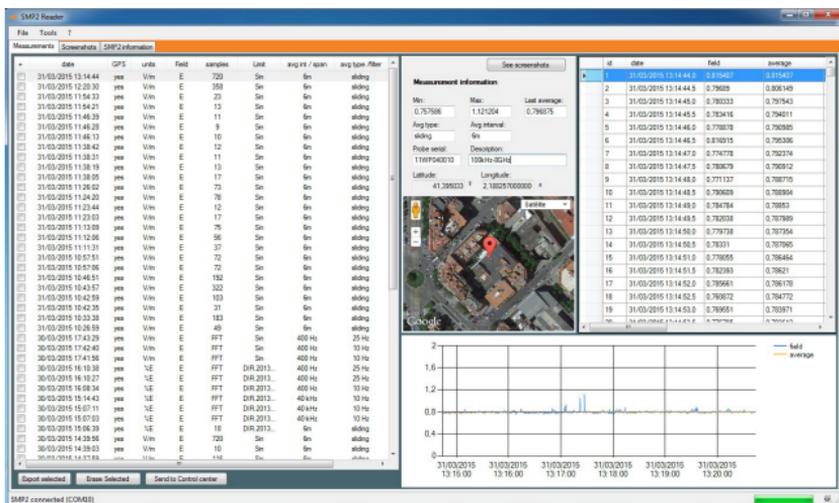


Figure 12: SMP2 software measurement screen

At the bottom of the window showing the measurements, you will find the following options:

- **Export:** export all the measurements that you have selected.
- **Delete:** delete all the selected measurements. This will take several minutes if a large number of measurements are to be erased. If you wish to delete all the measurements, we recommend doing so from the **SMP2** directly (MENU → MEASUREMENT OPTIONS → Delete all measurements).
- **Send to Control Centre:** only compatible measurements can be sent, i.e. broadband averaged measurements. Select a measurement and click on this button. A new window will open where you can review and complete the information to be sent to the control centre. See section [8.3.5](#) for further details.

Note: *Only measurements with 6-minute averages are compatible with this function.*

8.3.2. Screenshots screen

In this tab you can display and download **SMP2** screenshots. Select a measurement from the list to view the associated screenshots.

Each line contains: a selection box, the date of the screenshot and the sample reference. This last parameter gives the internal database ID of the sample.

This is used to know which screenshot corresponds to which measurement (if the screenshot was taken with logging activated).

The next column, "Action", allows access to the measurements associated with a screenshot. Click on "Click here for measurements" to download the data from the **SMP2** and display it on the screen.

Below, there are two buttons:

- Save
- Delete

Select one or more boxes from the list before clicking on either of those buttons.

8.3.3. Information screen

This tab shows internal SMP2 information, such as the firmware version, storage capacity, and so on.

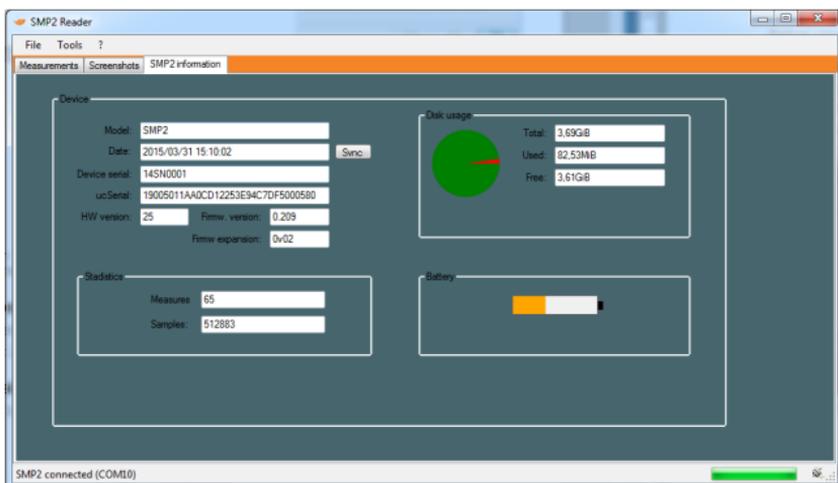


Figure 13: SMP2 software information screen

8.3.4. Exporting spreadsheets

On the Measurements screen you can click on "Export" to start downloading and exporting to an Excel file. One or more files will be created for each measurement, depending on your preferences.

The downloaded files use the Open XML format and so they can be opened with Office (2007 or later), LibreOffice or OpenOffice (version 3.3 or later), for example.

On the menu "Tools" → "Parameters" in the "Export" tab you can select different options, including the type of report (page format or no format), whether to export all the measurements to a single file or to a file for each measurement, to export screenshots, to create a graph or to paste a position map using the GPS coordinates.

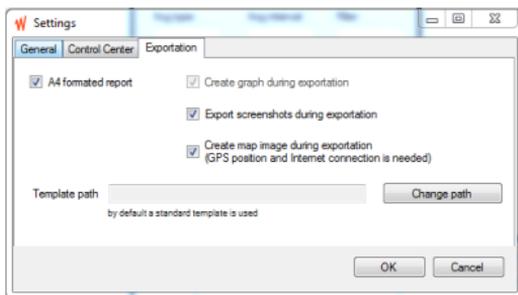


Figure 14: SMP2 Export parameters

In the exported report, the "Report" tab of the page format report shows the main data of the measure, the associated graph, the GPS position with a map, and the final screenshot (if any), depending on the configuration (see figures 14 and 15).

The first lines show information on the software, the device, the probe and the measurement parameters.

The data for all the samples are found in the "Data" tab.

If there are additional screenshots, they will be saved in the "Screenshots" tab.

The template for this report is found in the program installation file in the "Template" directory (e.g. C:\Program Files (x86)\Wavecontrol\SMP2 reader\template). It can be copied to another folder and changed (e.g. to change the logo). In this case you will need to tell the program where to find it.



Figure 15: Example of export in page format

The no format report has only two tabs. In the first, "Report" you will have the general data, graph, map and table with all the samples. You will find all the screenshots in the "Screenshots" tab.

Note: *Generating graphs can take some time, especially in the case of measurements with a large number of samples.*

8.3.5. Control centre screen

If you have access to a **Wavecontrol** Control Centre for managing **MonitEM** and **SMP2** devices, you can upload your **SMP2** measurements directly to the Control Centre.

Note: *You can only upload one measurement at a time. You will need an Internet connection to use this feature.*

Make sure that you have entered a valid URL, a user name and a password in the Settings menu (see Figure 16).

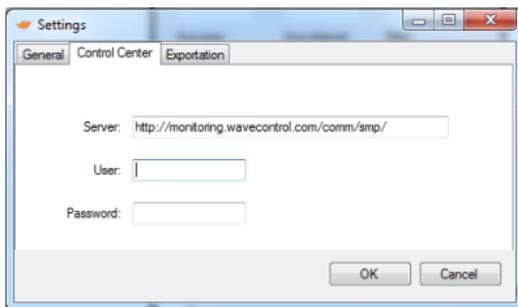


Figure 16: Settings screen

In the measurements screen, first click on the measurement to upload the data, then click on "Send to Control Centre".

A new window will open with a new tab "Control Centre" (Figure 17), where you can:

- Find the co-ordinates using an address.
- Find the address using the co-ordinates.
- Adjust the actual position of the measurement by dragging the position icon on the map.
- Upload a photograph associated with the measurement. When this is done, click on "Send to Control Centre".

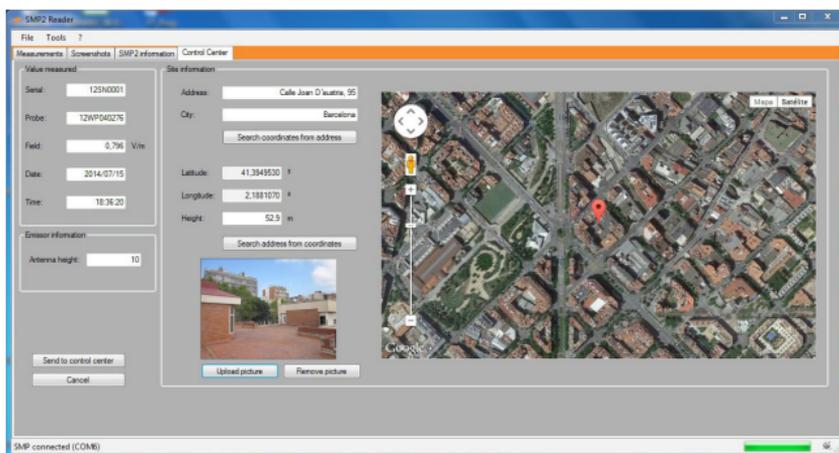


Figure 17: Settings screen to upload data to a control centre

8.4. Live measurements

This screen is only available with a fibre optic connection (see section 4.3.2). It provides a real-time display on your PC screen of the data being measured by the **SMP2**. It also allows you to change settings for the device, such as:

- Measurement mode (time, frequency or time at one frequency).
- Field type (electric or magnetic).
- Limit, span, filter (for **WP400** and **WP400-3**).

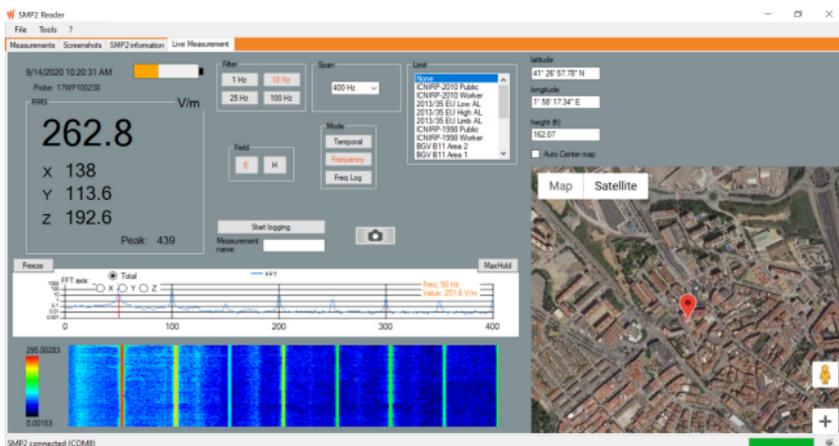


Figure 18: live screen

At the top on the left you will see the instantaneous field value for each axis and, depending on which probe you are using, several options to change measurement parameters.

You can start or stop logging data and take screenshots.

In the frequency mode, you will see a graph with the FFT of the signal. Click on the graph to position the cursor, which will show the value for that frequency.

Note: With the Control button pressed, you can also use the arrows on the keyboard to move the cursor on the graph in the same way as the arrows of the SMP2 keypad.

When the GPS is switched on with a fixed position, a map will show the position of the SMP2 (this requires an Internet connection).

Note: The software in live measurement mode is not compatible with the spatial average mode. You cannot launch a measurement in that mode.

9. Software and firmware updates

9.1. SMP2 Reader (PC software) update

You can update the **SMP2 Reader** by downloading the most recent version from the **Wavecontrol** intranet: www.wavecontrol.com, Home → Log-in.

Step 1: Registration

You can register with the intranet in one of these two ways:

- from www.wavecontrol.com (Home → Create an account), or
- when connecting the SMP2 with the software (see [8.3](#)).

Step 2: Download and install

Once registered, please go to:
www.wavecontrol.com → Home → login, and enter your login and password.
You will be directed to the download page.

Once in the download page, click on **SMP2** → **SMP2 software**. Download and install the file: SMP2_software.zip.

9.2. SMP2 firmware update

Please follow these steps:

1. Update **SMP2 Reader** (please follow the instruction in [9.1](#)).
2. Run the **SMP2 Reader** software
3. Connect the **SMP2** to the PC using the USB cable.

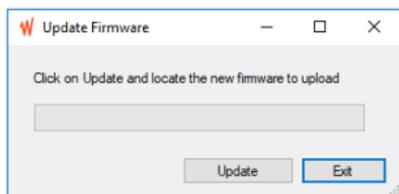
The **SMP2 Reader** will automatically detect whether a more recent version of the firmware or the expansion board firmware is available.

4. Click on "Update".

If the latest version of the firmware or expansion board firmware was delivered to you by hand, you can update it by:

- Following steps 1 to 3,
- going to Tools → Update → Update Firmware (or Update Expansion Board Firmware), and
- selecting "Update" and locating the firmware file to update.

The screenshot shows the SMP2 Reader application window. The 'Tools' menu is open, highlighting the 'Update' option, which has a sub-menu with 'Update Firmware' and 'Update Expansion Board Firmware'. The main window displays a list of measurements with columns for date, time, location, and frequency. A 'Measurement information' panel on the right shows RMS values in V/m, frequencies, and a map. A graph at the bottom shows V/m over time with 'field' and 'average' data series.



The SMP2 firmware will update in three steps:

- Firmware transfer to the SMP2.
- Firmware integrity check.
- Firmware recording to the SMP2.

Note 1: Depending on the type of update the process may take from 10 to 30 minutes.

Note 2: *In case the **SMP2** cannot be connected to the mains, please be sure there is enough battery.*

Note 3: *It is recommended to update the firmware without any field probe connected to the **SMP2***

10. MAINTENANCE

The **SMP2** requires very little maintenance, although it should be handled with care, as with any professional measurement equipment.

Maintenance by the user is limited to the outside of the device, its connections and management of regular calibrations. Any maintenance or repair for which the device needs to be opened must be carried out by **Wavecontrol** to avoid invalidating the warranty.

10.1. Cleaning the device and the screen

To avoid damaging the surface, use a soft anti-static cloth to clean the device and the screen. Use extra care when cleaning the screen to avoid scratching it.

10.2. Handling the device

The **SMP2** and its field probes are not watertight. When using them outdoors, protect them from rain.

The device and the probes must also be protected from heavy vibrations or blows.

10.3. Regular recalibration

Wavecontrol recommends that the **SMP2** and its probes should be recalibrated every 2 years. This is strictly a recommendation and it is up to the owner of the device to decide how often to recalibrate. That decision may depend on a number of factors. For example, if the device is used very frequently, it may be advisable to recalibrate it more often, as would also be the case if the device has had any accident that might make its accuracy questionable, or where specific regulations require a stipulated regularity for recalibration, or simply at the request of the organisation or client for which the device is being used, among other circumstances.

To recalibrate your equipment, please contact your local distributor or **Wavecontrol** at service@wavecontrol.com.

Wavecontrol offers ISO 17025 accredited calibrations at its **LabCal Wavecontrol** laboratory.

We are aware of the importance of recalibration to the management of your operations. We strive to offer you the best service in terms of quality, price and delivery time. If you have a special need, we will do our best to help you.

11. TROUBLESHOOT

Description of issue

Resolution

When powering on the **SMP2**, the LED indicator stays in red and the screen does not show anything

This indicates the equipment is not responding. You need to restart your device pushing the ON/OFF button for 5 seconds. This should fix the problem. If the problem persists after 2 – 3 trials, contact your local distributor or **Wavecontrol** directly at service@wavecontrol.com.

I try to enter the menu and the **SMP2** returns to the main screen every time.

This happens because your **SMP2** reader is on Live measurement. Exit live measurement and you will be able to enter the menu.

SMP2 autonomy seems low

Recalibrate the battery by doing a full charge and discharge. If you still experience this problem, you should consider changing the battery. For more information on steps to change your battery. Please contact your local distributor or **Wavecontrol** directly at service@wavecontrol.com

For more information on handling any other issue

Contact us at:
info@wavecontrol.com

12. TECHNICAL SPECIFICATIONS

Measurement Functions	
Measurement field probes	Interchangeable; automatic probe detection and recognition system
Measurement units	V/m, kV/m, $\mu\text{W}/\text{cm}^2$, mW/cm^2 , W/m^2 , A/m, nT, μT , mT, T, mG, G, %
Acquisition time	2 samples per second (expect in low power mode)
Measurement display	Total field and axis field value (X, Y, Z), maximum, minimum and average
Average type	Sliding (continuous, normative) or Tumbling (fixed)
Averaging time	10s, 15s, 30s, 1min, 2min, 5min, 6min, 10min, 15min, 30min
Alarm	audible signal, 2800 Hz; adjustable threshold
Memory	
Sample acquisition adjustable period	Normal: 0,5s, 1s, 5s, 10s, 15s, 30s, 1min, 6min, Low Power (LP): 1min LP, 2.5min LP, 6min LP
Capacity	1 000 000 samples Up to 1000 measurements
Interfaces	
Probe	Automatic detection and recognition
Data download	Mini USB connector / Fibre optic
Firmware update	Mini USB connector
Battery charger	coaxial jack connector + LED
Display	
Display type	TFT 4,3" (272 x 480 pixels)
Backlight	White LED

GPS (optional)	
Chip set	56-channel u-blox 7 engine, embedded
Position accuracy	Position 2.5 m CEP / 4.0 m
Sensitivity	Tracking: -162 dBm / -158 dBm
SBAS (Satellite Based Augmentation System)	WAAS/EGNOS/MSAS support
Geodetic system	WGS 84
General Specifications	
Battery	rechargeable Li-ion battery
Operation time	> 24 hours
Standby time	> 3 years
Recharge time	5 – 7 hours at 20°C (68 °F)
Temperature range	-10 °C to +50 °C (14 °F to 122 °F)
Size (without field probe)	100 x 215 x 40 mm (3.94 x 8.46 x 1.57 in)
Weight (without probe)	Broadband version: 560 g (1.23 lb) including the internal GPS receiver Selective version: 635 g (1.39 lb) including the internal GPS receiver Dual version: 635 g (1.39 lb) including the internal GPS receiver
Accessories	Hardcase, battery charger, USB-mini USB cable, SMP2 Reader software, user manual, probe calibration certificate

Appendix 1. Available probes

The **SMP2** has a wide range of probes that make it adaptable to every sector and application. They include probes for the electric field, magnetic field, electric and magnetic fields, low or high frequencies, high sensitivity or high power, broadband or selective.

The probes available as of the date of this version of the Manual are:

Field Probe	Field	Frequency	Measurement Type
WP50	E/H	10 Hz – 3 kHz	Broadband
WP400	E/H	1 Hz – 400 kHz	Selective & Broadband
WP400-3	E/H	1 Hz – 400 kHz	Selective & Broadband
WPF3	E	100 kHz – 3 GHz	Broadband
WPF6	E	100 kHz – 6 GHz	Broadband
WPF8	E	100 kHz – 8 GHz	Broadband
WPF18	E	300 kHz – 18 GHz	Broadband
WPF40	E	1 MHz – 40 GHz	Broadband
WPF60	E	1 MHz – 60 GHz	Broadband
WPT	E	Mobile frequencies	Broadband selective
WP-WIFI	E	Wifi 2.4G Frequency	Broadband selective
WPH-DC	H	DC – 40 kHz	Selective & Broadband
WPH60	H	300 kHz – 60 MHz	Broadband
WPH1000	H	30 MHz – 1000 MHz	Broadband

You can always find up-to-date technical information at:
<http://www.wavecontrol.com/rfsafety/en/products/probes>

Appendix 2. Applications

The **SMP2** is an ideal measurement system for analysing electric and magnetic fields in public spaces and workplaces. The wide range of probes that can be used with the **SMP2** make a unique system that can easily and accurately measure low and high frequency fields as well as static fields.

The **SMP2** can be used to take measurements in accordance with many international exposure standards applicable to different industrial sectors. In order to get the most out of your **SMP2**, it is important to choose the proper configuration, so that it will be suitable to the characteristics of the field to be measured.

The table below shows some normal applications where the general public or workers may be exposed to EMFs. For each application, the table shows the general field characteristics, the normal working frequency range, the standards for the sector and the suitable combination of device and probe.

Application	Type of field	Frequency range	Standard	SMP2 + probe configuration
Broadcast	Electric and magnetic fields.	Tens to hundreds of MHz.	IEC 62577 EN 50420 EN 50421 EN 50475 EN 50476 EN 50496 EN 50554 IEEE Std C95.1 IEEE Std C95.3	<ul style="list-style-type: none"> • Broadband measurement. • Spatial average. • Probes: WPF3, WPF6, WPF8, WPH60 y WPH1000
Wireless telecommunication networks	Electric and magnetic fields.	kHz - 40/60 GHz	IEC/EN 62232 EN 50385 EN 50400 EN 50401 EN 50492 IEEE Std C95.1 IEEE Std C95.3	<ul style="list-style-type: none"> • Broadband measurement. • Spatial average. • Probes: WPF3 WPF6, WPF8, WPF18, WPF40, WPF60 y WPH1000

Resistance and arc welding	Magnetic fields.	0 - 10 MHz, pulsed	EN 50505 IEC/EN 62822-1 IEC/EN 62822-2 IEC/EN 62822-3 IEEE Std C95.1 IEEE Std C95.3.1 IEEE Std C95.6	<ul style="list-style-type: none"> • Broadband measurement and weighted measurement. • Probes: WPH-DC, WP400, WP400-3
Induction heating / smelting	Magnetic fields.	50 Hz to 20 kHz	EN 50519 IEEE Std C95.1 IEC/EN 62822-1 IEEE Std C95.6	<ul style="list-style-type: none"> • Broadband measurement and weighted measurement. • Probes: WP400
Household appliances	Magnetic fields.	50 Hz	IEC/EN 62233 IEEE Std C95.3.1 IEEE Std C95.6	<ul style="list-style-type: none"> • Broadband measurement and weighted measurement. • Probes: WP400, WP400-3
Microwave ovens	Electric fields.	2.45 GHz	IEC/EN 62233 IEEE Std C95.1 IEEE Std C95.3	<ul style="list-style-type: none"> • Broadband measurement. • Probes: WPF3, WPF6, WPF8, WPF18, WPF40, WPF60
RF industrial ovens	Electric fields.	27.12 MHz	IEEE Std C95.1 EN 50413 IEEE Std C95.3	<ul style="list-style-type: none"> • Broadband measurement. • Probes: WPF3, WPF6, WPF8, WPF18, WPF40, WPF60
Energy	Electric and magnetic fields.	50/60 Hz	IEC/EN 62110 IEEE Std 644	<ul style="list-style-type: none"> • Broadband measurement and weighted measurement. • Probes: WP400 or WP50

EAS/ RFID	Magnetic fields.	LF: 1Hz – 500 kHz MF: 2-30 MHz HF: few GHz	EN 50364 IEC/EN 62369-1 IEEE Std C95.1 IEEE Std C95.3 IEEE Std C95.3.1 IEEE Std C95.6	<ul style="list-style-type: none"> • Broadband measurement and weighted measurement. • LF: WP400 • MF: WPH60 • HF: WPH1000
Medical	Electric and magnetic fields.	MRI: DC – 60 kHz Diathermy: 27 MHz Electrosurgery: 300-600 kHz, 13 MHz, 27 MHz	IEC/EN 60601 IEEE Std C95.1 IEEE Std C95.3 IEEE Std C95.3.1 IEEE Std C95.6	<ul style="list-style-type: none"> • Broadband measurement and weighted measurement. • Probes: WPH-DC, WP400 and WPF8
Railway	Magnetic fields.	DC - 20 kHz	EN 50500 IEEE Std C95.3.1 IEEE Std C95.6	<ul style="list-style-type: none"> • Broadband measurement and weighted measurement. • Probes: WPH-DC, WP400

Appendix 3. Static field measurements: WPH-DC

Warning:

- Under high field conditions (above 30 mT), it is not recommended to connect the **SMP2** directly to the **WPH-DC** probe as the **SMP2** contains ferromagnetic elements. In these cases, you must use the 5-meter extension cable to keep the **SMP2** as far away as possible.

Important note: *if it is suspected that the measuring point may perhaps have an elevated field, it is recommended to carry out a preliminary assessment around that point, approaching progressively. If it is found that the field is close to 30 mT, where the **SMP2** will be placed to take the final measurement, precautions should be taken to prevent the **SMP2** from moving, or using the extension cable as mentioned previously.*

- The **WPH-DC** probe integrates hall sensor technology that allows very high fields to be measured (up to 10 T) but these sensors have a residual voltage (without the presence of a magnetic field) that must be compensated to perform an accurate measurement. For this, you would have to use the “zero Gauss” camera delivered with the equipment and make the zeroing of the probe. (More detail below).

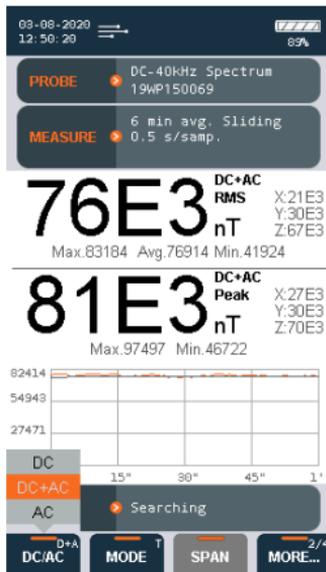
Special functions:

DC/AC: Allows to choose between static field DC (0 Hz), variable AC (without the static component) or DC + AC (static and variable).

To be able to measure the static fields very precisely, you have to use the DC mode. This also allows not to take into account the noise or signals that may exist above 1 Hz.

Zero: this function allows to make the zeroing of the hall sensor integrated in the probe. It is very important to do this operation before making an accurate measurement or to correct a deviation in temperature. How to proceed:

- Turn on the equipment with the probe connected and get into the desired mode (DC, AC or DC+AC).
- Wait 2 minutes (even more if the equipment was at a temperature different from the place of measurement).
- Position the tip of the probe in the Zero Gauss chamber.
- Press the "Zero" button in the **SMP2** menu.
- Repeat these last 2 operations each time you want to compensate for any change in temperature.



Range: selects the behavior of the measurement range of the probe.

- **Auto:** range will increase and decrease depending on the field to be measured.
- **Auto-increasing:** range will only increase. This is important when measuring sporadic peaks. This option should be used when high level single peaks occur at more than 1 second separation. To reset range, press the reset button.

Filter: allows you to define the best filter for each measurement. The available values depend on the type of field you want to measure (static, variable or both).

Appendix 4. Low frequency assessment

Introduction

The **SMP2 + WP400** or **WP400-3** field probe combination is the most complete and compact available on the market for evaluation of human exposure to low frequency electromagnetic fields. It allows evaluation of the electric field (E) and the magnetic field (H) using a single probe, over a frequency range of 1 Hz to 400 kHz.

In addition, using the **WPH-DC** you can measure static magnetic fields (0 Hz) and variable fields up to 40 kHz.

This document describes the different measurement options available:

- **Broadband**
- **Selective (FFT)**
- **Single frequency evaluation**

The choice of option will depend upon the specific application and the objective of the measurement or evaluation.

This appendix also describes the **Weighted Peak Method (WPM)**, which may be used with any of those three options.

Measurement methods

The **SMP2** + any of the selective field probe (**WP400**, **WP400-3** or **WPH-DC**) combination allows you to choose any of 3 measurement methods.

1. Broadband measurement

Broadband measurements may be made of the electric field (E) and the magnetic field (H). In this case, the device takes the full spectrum into account, measuring all the energy present within the 1 Hz to 400 kHz frequency range (up to 40 kHz for the **WPH-DC** probe). The result is a single value in units of electric field intensity or magnetic flux density, for aggregate exposure across the full range.

The "MEASUREMENT OPTIONS" menu is used to select the measurement time, the log interval, the average interval and the average type, as shown in the figure below (screenshot 1A). Please note that the average interval is not an important parameter in low frequency as limits are based on instant values.

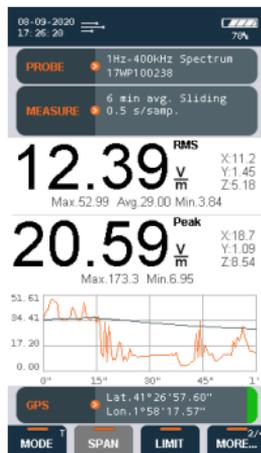
Spatial averages may also be made using the "Spatial average" option.



Screenshot 1A



Screenshot 1B

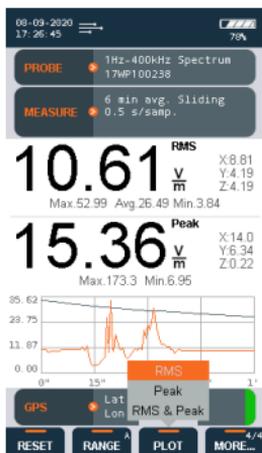


Screenshot 1C

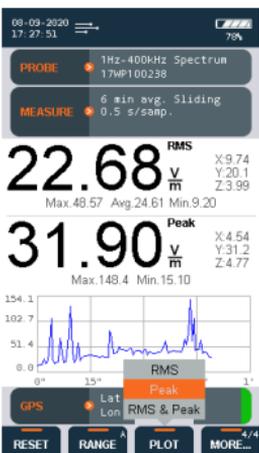
Once the measurement behavior is defined, the next step is to choose the "Time" option on the "MODE" dynamic menu (screenshot 1B).

To start the measurement, now all that you need to do is select "LOG" on the dynamic menu (screenshot 1C).

In time mode, the WP400, WP400-3 and WPH-DC (DC+AC or AC) have a PLOT function in the dynamic menu, where the user can select the RMS only (screenshot 1D) or Peak only (screenshot 1E) or both RMS and Peak (screenshot 1F) plots.



Screenshot 1D



Screenshot 1E



Screenshot 1F

2. Selective measurement (FFT)

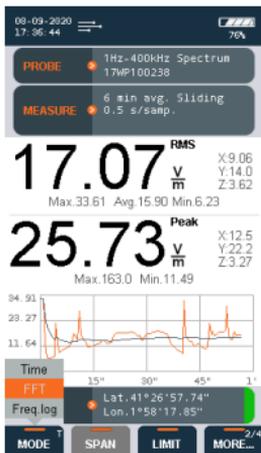
The **SMP2 + WP400** (or **WP400-3** or **WPH-DC**) allows you to make selective measurements by means of real-time FFT-based signal analysis using digital signal processing techniques. This can be done for both the E field and the H field, over different frequency spans: 40 Hz, 400 Hz, 4 kHz, 40 kHz or 400 kHz (depending on the probe):

- **WP400 and WP400-3:** 40 Hz, 4 kHz, 40 kHz or 400 kHz (E and H)
- **WPH-DC:** 40 Hz, 400 Hz, 4 kHz, 40 kHz (H field only)

First of all, select the "FFT" option on the "MODE" (screenshot 2A).

The spectrum then appears on the **SMP2** display. You may now select the desired span (screenshot 2B).

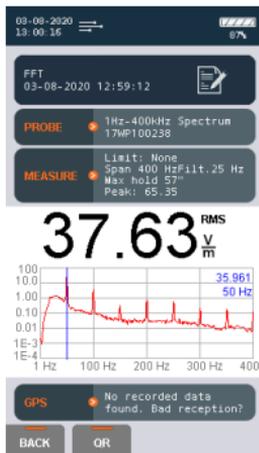
If you then press "LOG" on the dynamic menu, the FFT of the signal will be saved, which displays information about the limit selected, span, max hold duration and filter (screenshot 2C).



Screenshot 2A



Screenshot 2B



Screenshot 2C

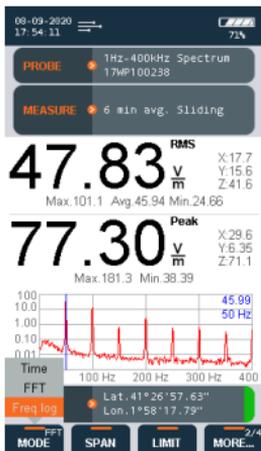
3. Single frequency evaluation

This measurement mode allows you to track changes in a given frequency over time. The display shows the values in real time as they are obtained (each second).

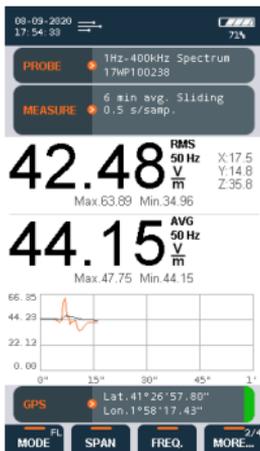
This tracking can be done in two ways:

- In FFT mode (screenshot 3A) place the cursor on the desired frequency and change to "Freq. log" on the "MODE" menu (screenshot 3B).

- Select the "Freq. log" mode directly on the "MODE" menu, then specify the desired frequency (screenshot 3C).



Screenshot 3A



Screenshot 3B



Screenshot 3C

Weighted Peak Method (available for probes **WP400** or **WP400-3**)

In the area of low frequencies considered here, which affects a wide variety of industrial processes, it is normal to find complex non-sinusoidal signals that are difficult to measure.

The Weighted Peak Method (WPM) is the most appropriate method to obtain the best results. There are other methods, such as the multifrequency fields summation method, which may give gross overestimates, since they fail to take signal phase into account.

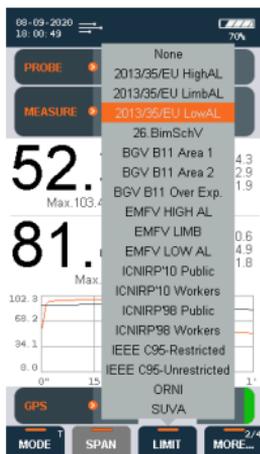
WPM performs inverse digital filtering, using a function that is the complement or inverse of the reference limits curve that we wish to use (selectable). This gives a result directly as a percentage (%) of the limits for which we are measuring exposure.

The **SMP2** offers an extensive list of limits corresponding to the different standards or laws of different countries. You can use WPM for any existing limits.

Weighted measurements using WPM can be taken with any of the three measurement methods mentioned above. All you need to do is select the reference limit from the list of available limits, then take the measurement as indicated for each method. To choose a limit, select "LIMIT" on the dynamic menu, as shown in the figure screenshot 4A.

The figure screenshot 4B below shows the weighted result for the broadband electric field in respect of the "Low AL" limits of Directive 2013/35/EU.

With the limit chosen, you can assess the EMF by ensuring that both the peak and the RMS value are below 100%. Please note that the Peak value, given by the **SMP2**, is already divided by Square of 2 for a direct reading to comply with the limits.

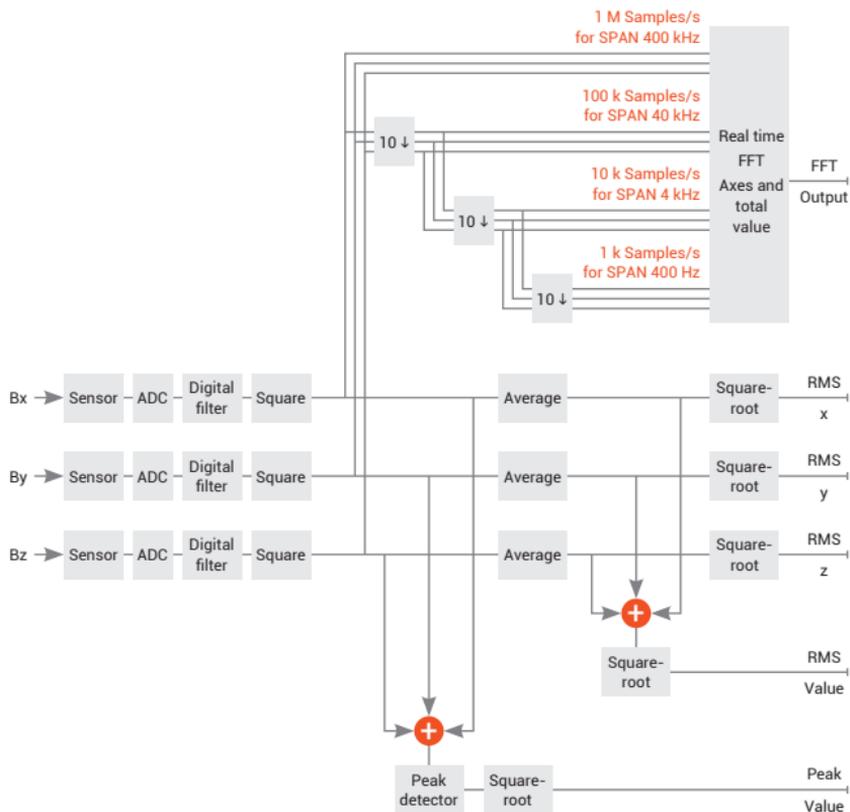


Screenshot 4A



Screenshot 4B

Simplified block diagram of RMS-Peak-FFT analysis for the **WP400** and **WP400-3** probes



Special functions of the WP400 and WP400-3 probes

These probes have certain specific functions, given their spectral analysis capacity.

- **RANGE:** Select how the probe will adapt to field levels. With changes in levels, the electronics processing the signal must adapt to high or low levels in order to give accurate results under both conditions. That adaptation takes time, which needs to be taken into account in special cases.
 - **Automatic:** the measurement range of the probe adapts automatically to the signal, with either increase or decrease in the level. Suitable in most cases.
 - **Auto-increase:** the range will only increase, adapting to higher levels detected and maintaining those conditions for accurate immediate reading of high levels. This is very important in the case of signals with non-repeating high levels, e.g. signals with sporadic peaks (at intervals of more than one second). If they are very fast and short with high levels, the device might not have time to adapt to the first pulses and could measure a level lower than the actual level. If this function is activated, the device will already be adapted to measure the following pulses correctly. This function could be useful, for example, to measure pulses generated by welding equipment.
- **FILTER:** Select the high pass filter
 - **1 Hz.** No filter is applied. Using this option requires special care. In this mode all operations are slower due to the integration time required for having the RMS value at 1 Hz. The device will take longer to adapt to changes in the field, so any movements must be slower or the device should remain still for several moments at those positions where you want to take a reading. Another effect is that if a static field is present and you take measurements moving the device, that movement will make the probe detect the field as dynamic and it will contribute to the end result. In both cases, we recommend using a tripod and keeping anyone at a distance when taking measurements.
 - **10 Hz (-3dB at 10 Hz).** Recommended if you know there are no signals under 10 Hz (true in most cases).
 - **25 Hz (-3dB at 25 Hz).** To attenuate readings below 25 Hz.

- **100 Hz (-3dB at 100 Hz, < -18dB at 50Hz).** Useful for attenuating the signal at 50/60 Hz. Gives a better signal-to-noise ratio for measuring harmonics in mains or measuring weak signals at high frequencies without the fundamental overloading the dynamic range.

Response with the different filters, slightly different if a limit has been selected or not.

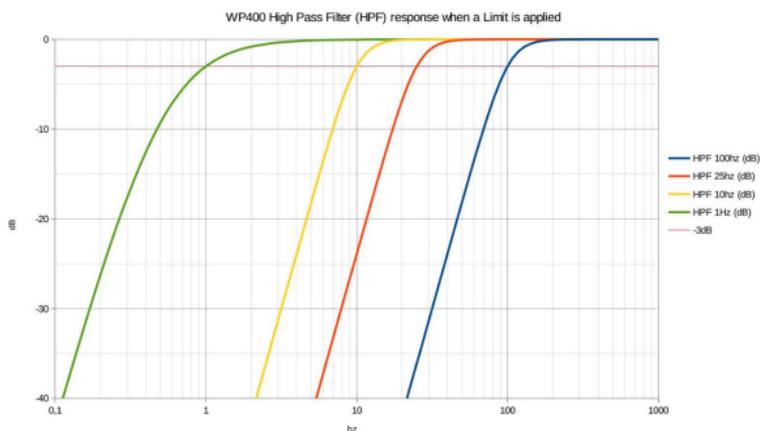


Figure 19: Filter response when a limit is applied

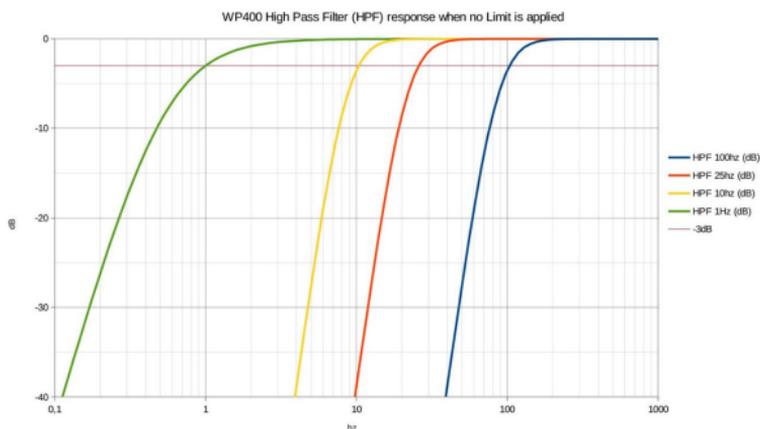


Figure 20: Filter response when no limit is applied

Appendix 5. Radar measurements

The high frequency field probes with the fast option have a special feature called Max Fast RMS. It can be activated on the main screen with the "MODE" button.

This function affects the integration time of the probe, i.e. the time needed to take the reading of the field level. Under normal conditions, the probes of this type available on the market take several hundred milliseconds. This unique feature allows an integration time of just 4 milliseconds.

MODE: select the sampling mode for the probe

- **Normal RMS:** obtain the RMS value for the field with normal integration time. Suitable for most applications.
- **Max fast RMS:** allows measurement of the maximum RMS for the field over a very short integration time (4 ms). The maximum RMS value measured is displayed every 0.5 sec.

Note 1: *The Max fast RMS is very useful e.g. for measuring radiation from a rotating radar antenna to determine its radiated power.*

Note 2: *Max fast RMS does not allow averaging, since the value obtained every 0.5 sec is the maximum value.*

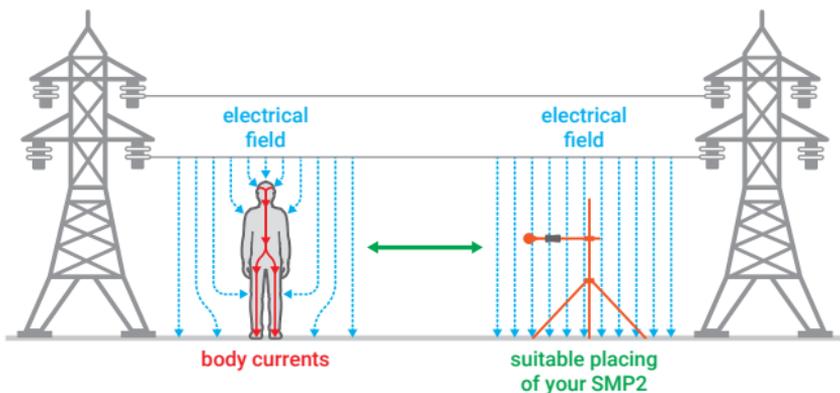


Appendix 6. E-field Measurement under Powerline

When measuring electric field below a power line, it is advisable to place the **SMP2** in horizontal and and be separated from the unit with a tripod or a wood stick or extension.

In high frequency measurements, placing the device horizontally will increase the LF (low frequency) immunity and obtain more accurate results.

For low frequency electric field measurements using the **WP400** and **WP50** probes, the body should not be close to the device. A person holding the device during measurement would perturb the field. It is therefore advised that the user places the device at a horizontal position and stays away from the device (1.5m minimum, 3m recommended as per **IEC 62110**) to obtain more accurate (unperturbed) results.



To achieve this, we provide the tripod horizontal extension (**WSNA0002**). The fiber optic connection could also support in keeping the user farther from the device. See accessories in [Appendix 9](#).

Appendix 7. Communication Protocol

This communication protocol is valid for USB or fibre. The main difference between the two is the port settings.

Ports

USB: it emulates a serial port service with CDC, automatically negotiated rate, 8 bits, no parity, 1 bit stop. The Vendor ID and Product 0x1FC9 ID 0x807B of the USB may be used to find the port number opened by the driver.

Fibre: 230400 bps, 8 bits, no parity, 1 bit stop. The 0x0403 Vendor ID and Product ID 0x6001 may be used to find the number of communication port opened by the FTDI driver.

Format of commands and responses

Communication is done through the exchange of strings with the XML format. The **SMP2** checks the frames received and rejects them if not well formed.

The XML format accepted by the **SMP2** parser is as follows:

Command:
PC → SMP2

General format of commands

```
<?xml version="1.0" encoding="ISO-8859-1"?>
  <cmd>
    <instruction>[String to identify the command]</instruction>
    <params>
      [Settings needed by the command]
    </params>
    <timeout_msec>[optional; max time to run the command]</timeout_msec>
    <md5>
      [MD5 of string from "<?xml" to the character previous to tag "<md5>", in ASCII hex]
    </md5>
  </cmd>
```

There are 5 characters that can not be used in the XML content and must be replaced by the following syntax.

Character	Syntax
"	"
&	&
'	'
<	<

The XML format used by **SMP2** is as follows:

Response: PC → SMP2	OK	General format of the correct reply
<pre><?xml version="1.0" encoding="ISO-8859-1"?> <reply> <result> <instruction>[String that identifies the command]</instruction> [Specific results of the command] </result> <md5> [MD5 of the string from "<?xml" to the previous character of the "<md5>", tag in ASCII hex] </md5> </reply></pre>		

Response: PC → SMP2	ERROR	General format of the error reply
<pre><?xml version="1.0" encoding="ISO-8859-1"?> <reply> <error> <code>[Numeric code of error]</code> <msg>[Error description]</msg> </error> <md5> [MD5 of the string from "<?xml" to the previous character of the "<md5>", tag in ASCII hex] </md5> </reply></pre>		

Commands and responses

Instruction	Parameters	Response
GET_SAMPLE get the field measured		field_type: 0 electric, 1 magnetic value: field in V/m or uT unit: units displayed on the screen (see Units section) x, y, z: field in axis avg: average field peak: peak value of WP400 probe gps_lat_deg: latitude in decimal degrees gps_lon_deg: longitude in decimal degrees gps_height: height in meters
GET_TIME get time		local_time: time in format YYYY-MM-DD HH:mm:ss
SET_TIME set time	new_date_time: time in format YYYY-MM-DD HH:mm:ss	local_time: time in format YYYY-MM-DD HH:mm:ss
INFO_SYSTEM get info about device		device: identify device SMP2 serial_micro: unique ID of micro controller firmware_version: firmware version serial_device: device serial number hardware_version: hardware version
MEASURE_START start measurement		
MEASURE_START start measurement		
SET_DATA_TYPE to select time or frequency measurement mode	data: time or freq	data: time or freq

KEY take a screenshot	key: PRINTSCREEN	data: time or freq
BATTERY_INFO get battery level		capacity_mAh: capacity in mA/h charge_mAh: current charge in mA/h
GET_FFT (SET_DATA_TYPE has to be in FFT mode first)		

Units

Below it is described in c# the units of **SMP2** with the identification number that the command GET_SAMPLE returns.

```
typedef enum
{
    E_FIELD_V_m           = 0,    /* E - V/m    */
    E_FIELD_kV_m          = 1,    /* E - kV/m   */
    E_FIELD_uW_cm2        = 2,    /* E - uW/cm2 */
    E_FIELD_mW_cm2        = 3,    /* E - mW/cm2 */
    E_FIELD_W_m2          = 4,    /* E - W/m2   */
    E_FIELD_A_m           = 5,    /* E - A/m    */
    E_FIELD_STRENGTH_PERCENT = 6, /* E - %      */
    E_FIELD_S_PERCENT     = 15,   /* E - S%     */
} E_FieldUnit;
```

```
typedef enum
{
    H_FIELD_A_m           = 7,    /* H - A/m    */
    H_FIELD_uT            = 8,    /* B - uT     */
    H_FIELD_nT            = 9,    /* B - nT     */
    H_FIELD_mT            = 10,   /* B - mT     */
    H_FIELD_T             = 11,   /* B - T      */
    H_FIELD_STRENGTH_PERCENT = 12, /* H - %      */
    H_FIELD_mG            = 13,   /* B - mG     */
    H_FIELD_G             = 14,   /* B - G      */
    H_FIELD_S_PERCENT     = 16,   /* H - S%     */
} H_FieldUnit;
```

Limitations and Timeout

The XML commands from the PC to the **SMP2** can be up to 32768 bytes. The **SMP2** expects to receive complete commands in less than 3 seconds (counting from the time of receipt of the first byte); If after this time it does not have a full and valid response, an error message is sent and discards the information received so far. If you send a message without the initial "<" XML tag, the **SMP2** will not send any response.

When connecting the USB to the computer, the **SMP2** will interrupt listening the fibre port.

Example of Commands

These examples have been automatically generated by the software **SMP2** and should be sent unformatted (ie no spaces and line breaks between tags).

System info

```
<?xml version="1.0" encoding="ISO-8859-1"?><cmd><instruction>INFO_SYSTEM</instruction></md5>c1c0060ec77a5b477c8e164012df8e4f</md5></cmd>
```

SMP2 time

```
<?xml version="1.0" encoding="ISO-8859-1"?><cmd><instruction>GET_TIME</instruction></md5>81c73f231ba30eca41b76577ad6f7f9f</md5></cmd>
```

Field level

```
<?xml version="1.0" encoding="ISO-8859-1"?><cmd><instruction>GET_SAMPLE</instruction></md5>d8dd6be74a3df920ca20b397a0f49bc0</md5></cmd>
```

FFT Total

```
<?xml version="1.0" encoding="ISO-8859-1"?><cmd><instruction>GET_FFT</instruction></md5>a03a5727db05e5662a096c1bdf208dc4</md5></cmd>
```

Example c# code to generate the MD5

```
using System;
using System.Text;
using System.Security.Cryptography;

private string AddMd5(string cmd)
{
    String formatted_xml = cmd;
    String result = string.Empty;
    string[] string_parts;
    /* Add a <md5>MD5_VALUE</md5> tag before the closing </cmd> tag. */
    if (!formatted_xml.Contains("<md5>"))
    {
        /* Split result: before "</cmd>" and after "</cmd>": */
        string[] tokenizer = new string[1];
        tokenizer[0] = "</cmd>";
        string_parts = formatted_xml.Split(tokenizer, 3,
StringSplitOptions.None);
        if (string_parts.Length == 2)
        {
            //Calculate MD5 of the chunk before "</cmd>"
            using (var md5 = MD5.Create())
            {
                string md5_str = BitConverter.ToString(md5.
ComputeHash(Encoding.UTF8.GetBytes(string_parts[0]))).Replace("-", "").ToLower();
                //Add it to the result
                result = string_parts[0] + "<md5>" + md5_str + "</md5></
cmd>";
            }
        }
    }
    return result;
}
```

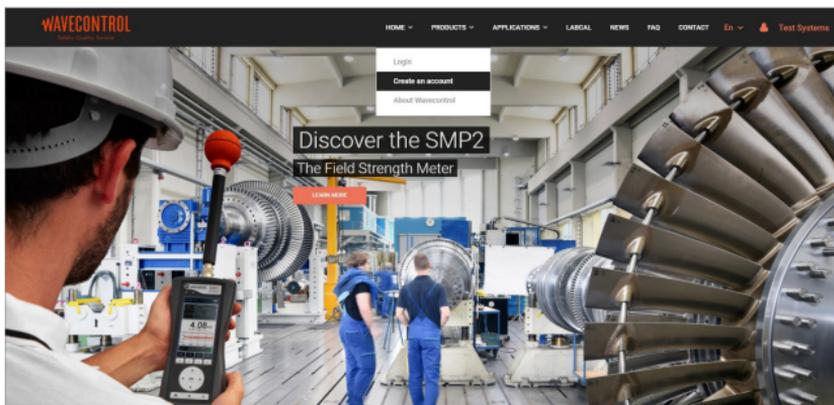
Appendix 8. Wavecontrol intranet

Wavecontrol provides an exclusive intranet space for its customers with pertinent information on its products, such as specification sheets, application notes, etc.

One of the important things that you can do via the intranet is keep your **SMP2** device always up to date. **Wavecontrol** offers you regular updates of the **SMP2** firmware and the **SMP2 Reader** software, free of charge. Those updates may contain:

- Error corrections
- Operating improvements
- New features

You can enter the intranet through the **Wavecontrol** web page. You will have to register with the system through the Home menu:



Appendix 9. Additional SMP2 Accessories

There are optional items which could be requested additionally with the standard accessories mentioned in [section 3](#):

Accessory	Part number
GPS (internal)	WSN00001
Non-reflective wooden tripod + transport cover	WSNA0001
Tripod horizontal extension	WSNA0002
Probe support for tripod	WSNA0013
Fibre Optic cable (10m) + USB-PC Converter	WSNA0004
Fibre Optic cable (up to 45 m) + USB-PC Converter	WSNA0010
5 meters probe extension cable for magnetic LF measurement	WSNA0011
SMP2 protective pouch	WSNA0005
Vehicle charger	WSNA0007
Soft backpack	WSNA0008



DECLARATION OF CONFORMITY (DoC)

Manufacturer: Wavecontrol, S.L.
C/ Pallars, 65-71 · 08018 Barcelona (Spain)

Object of the declaration: **SMP2 Electromagnetic Field Meter**

The above mentioned product complies with the essential requirements, which are specified in the 2004/108/EC Directive on the approximation of the laws of the Member States relating to electromagnetic compatibility.

The product of the declaration described above is in conformity with the requirements of the following specifications:

Documents-No. and description:

• **IEC-EN 61326-1:2013**

Electrical equipment for measurement, control and laboratory use.

• **EN 55011:2011 + A1:2011**

Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement.

• **IEC-EN 61000-3-2:2006 + A1:2010 + A2:2010**

Electromagnetic compatibility (EMC) – Part 3-2: Limits - Limits for harmonic current emissions (equipment input current \leq 16 A per phase).

• **IEC-EN 61000-3-3:2009**

Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current \leq 16 A per phase and not subject to conditional connection.

• **IEC-EN 61000-4-2:2010**

Testing and measurement techniques - Electrostatic discharge immunity test.

• **IEC-EN 61000-4-3:2007 + A1:2008 + A2:2011**

Testing and measurement techniques- Radiated, radio-frequency, electromagnetic field immunity test.

• **IEC-EN 61000-4-4:2005 + CORR:2010 + A1:2010**

Testing and measurement techniques - Electrical fast transient/burst immunity test.

- **IEC-EN 61000-4-5:2007 + CORR:2010**

Testing and measurement techniques - Surge immunity test.

- **IEC-EN 61000-4-6:2009**

Electromagnetic compatibility (EMC) -- Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields.

- **IEC-EN 61000-4-8:2011**

Electromagnetic compatibility (EMC) -- Part 4-8: Testing and measurement techniques - Power frequency magnetic field immunity test.



Barcelona 18th of June 2014

Ernest Cid - CEO

W

WAVECONTROL

Safety, Quality, Service

+34 93 320 80 55

www.wavecontrol.com

info@wavecontrol.com