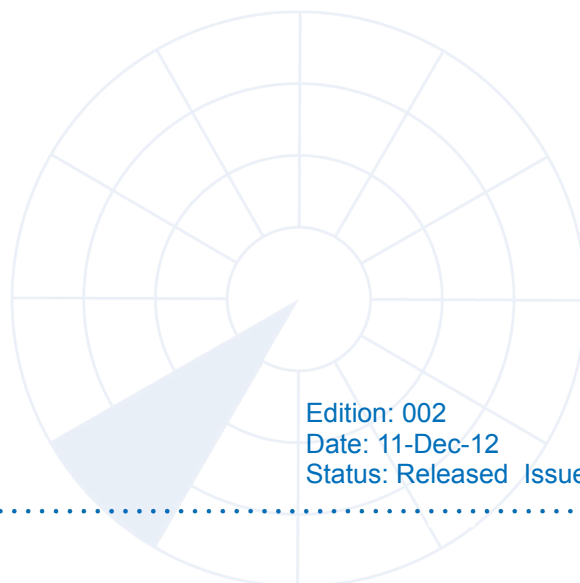
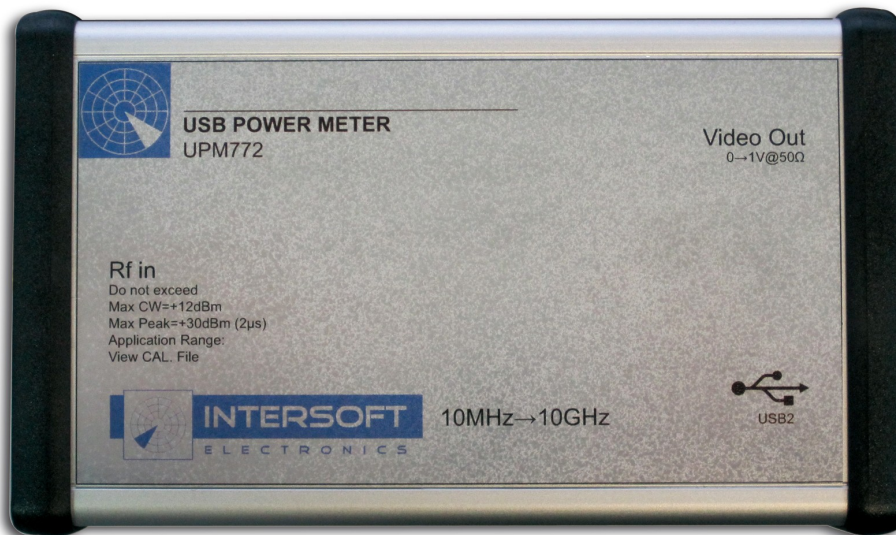


USB Power Meter - UPM772

User Manual



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TABLE OF CONTENTS

- 1. TECHNICAL MANUAL UPM772.....8**
 - 1.1. General Introduction.....8
 - 1.2. Key Features.....8
 - 1.3. Hardware Description.....9
 - 1.3.1. Block Diagram.....9
 - 1.3.2. Connectors.....9
- 2. USB POWER METER FUNCTION.....10**
 - 2.1. Theory.....10
 - 2.2. Software.....10
 - 2.2.1. Getting Started.....10
 - 2.2.2. Making a Recording.....11
 - 2.2.3. Analysis.....12
 - 2.3. Troubleshooting.....13
- 3. ELECTRICAL FIELD STRENGTH MEASUREMENT.....14**
 - 3.1. Theory.....14
 - 3.2. Software.....14
 - 3.2.1. Getting Started.....14
 - 3.2.2. Making a Recording.....15
 - 3.2.3. Analysis.....16
 - 3.3. Troubleshooting.....17
- 4. ANNEXES.....18**
 - 4.1. Annex 1: UPM Power Meter (on site measurement) Set-up.....18
 - 4.2. Annex 2: UPM Electrical Field Strength Measurement (field measurement) Set-up.....18
 - 4.3. Annex 3: Configuration List.....19



TABLE OF FIGURES

Figure 1: UPM772 Block Diagram.....9
Figure 2: USB Power Meter-Recorder.....10
Figure 3: File Selection.....11
Figure 4: Progress bar.....12
Figure 5: USB Power Meter-Viewer.....12
Figure 6: USB Power Meter-Viewer-Zoomed.....13
Figure 7: UPM Field Strength-Recorder.....15
Figure 8: File Selection.....16
Figure 9: Progress bar.....16
Figure 10: UPM Field Strength-Viewer.....16
Figure 11: UPM on site measurement.....18
Figure 12: UPM field measurement.....18



CONVENTIONS USED



Note: This icon to the left of bold italicized text denotes a note, which alerts you to important information.



Caution: This icon to the left of bold italicized text denotes a caution, which alerts you to the possibility of data loss or a system crash.



Warning: This icon to the left of bold italicized text denotes a warning, which alerts you to the possibility of damage to you or your equipment.



GLOSSARY OF TERMS

Antenna factor	Ratio of the incident electromagnetic field strength to the voltage V (units: V or μV) on the line connection of an antenna
CW	Continuous wave
dB	Decibel
IE	Intersoft Electronics
PSR	Primary Surveillance Radar
Radar	Radio Detection And Ranging
Radome	Radio-transparent window used to protect an antenna principally against the effects of weather
RASS-S	Radar Analysis Support Systems – Site measurements
RF	Radio Frequency
RX	Receiver
SSR	Secondary Surveillance Radar
TX	Transmitter



1. TECHNICAL MANUAL UPM772

1.1. General Introduction

The UPM772 is a broadband log receiver (10MHz to 10GHz) and can operate on L/S/C/X band. In the field of radar the UPM772 can be used in different applications:

- As pulse power meter on site or in the field to investigate pulse shapes
- As measurement tool to investigate raw antenna diagrams
- As field strength meter for investigation of health and safety conditions
- As logarithmic receiver

For instance when the UPM772 is used as an antenna measurement device for maintenance purposes, verification of the radome influences or investigate safety:

- For maintenance: One can measure the raw antenna diagram after a predefined period of time to investigate the degradation of the antenna.
- For a radome: When a radome is placed over the antenna, it is recommended to measure the raw pattern before and after placement, comparing the results will show the influence of the radome.
- For safety: To measure the influence of a radar systems towards people. The UPM772 can also be used as field strength measurement tool in the environment of a radar.

1.2. Key Features

- Pulse Power Meter:
 - Measure and record amplitude, shape and timing of radar pulses from SSR or PSR radars
 - Visualisation of basic Tx power and pulse parameters such as:
 - pulse width
 - rise time
 - fall time
 - timed-sidelobes
 - ...
- Field Strength Measurement:
 - Measure average and maximum electric field strength in Volts per meter (V/m)
 - Measure the raw antenna diagram



1.3. Hardware Description

1.3.1. Block Diagram

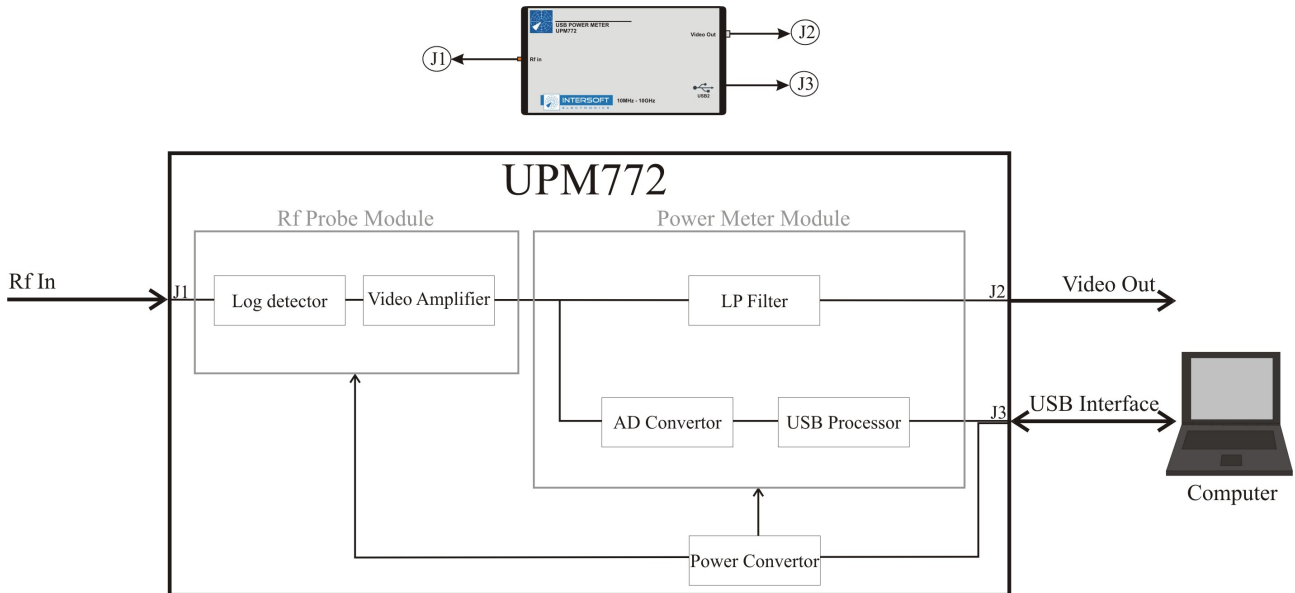


Figure 1: UPM772 Block Diagram

1.3.2. Connectors

1. J1: Rf In
 - a) SMA female connector
 - b) Frequency range: 10MHz to 10GHz
 - c) Input power: 0 to -60dBm
 - d) Max. CW input power: +12dBm
 - e) Max. peak input power: +30dBm (2µs)
 - f) Dynamic range: 60dB for 10MHz to 6GHz
 - g) Application range: view calibration file
2. J2: Video Out
 - a) BNC connector
 - b) Output voltage: 0 to 2V
 - c) Video bandwidth: 50MHz
 - d) Rise/Fall time: <20ns
 - e) Transfer function: Logarithmic
3. J3: USB2
 - a) USB2 interface
 - b) Power supply for UPM772

2. USB POWER METER FUNCTION


2.1. Theory

The USB Power Meter Function is developed to *investigate radar pulses* to measure and record the amplitude, shape and timing of radar pulses from SSR or PSR radars. It will create records showing the basic Tx power and pulse parameters (pulse width, rise time, fall time, timed-sidelobes, etc...). This allows the pulse power meter to be used for instance to examine the received pulse shape and verify whether pulses reach their maximum power level within the expected pulse width or to examine particular cases of a reflection or strange swapping of the pulse modes. In many occasions you can record and analyse the creation of erroneous modes at fixed points in the field.

The kit consists of a UPM772, a Huber&Suhner measurement antenna, a portable workstation and some accessories. The measurement antenna has an antenna factor of 5.0 and is omni-directional. The measurement is performed by recording the RF power while pointing the antenna in the horizontal and vertical direction. It is recommended to start with 30dB attenuation in between the UPM772 and the cable to the antenna and check the power level using the software as described in the next section.

2.2. Software

2.2.1. Getting Started

Make the set-up which is shown in annex 1 or 2. The UPM772 Power Meter measurement application can be loaded using the **Transmitter Tests** button  on the left-side of the RASS-S Toolbox.



When the vi is running, it is automatically set in the **Recorder** mode.

The UPM772 serial number is indicated and a number of controls are enabled when the device is detected.

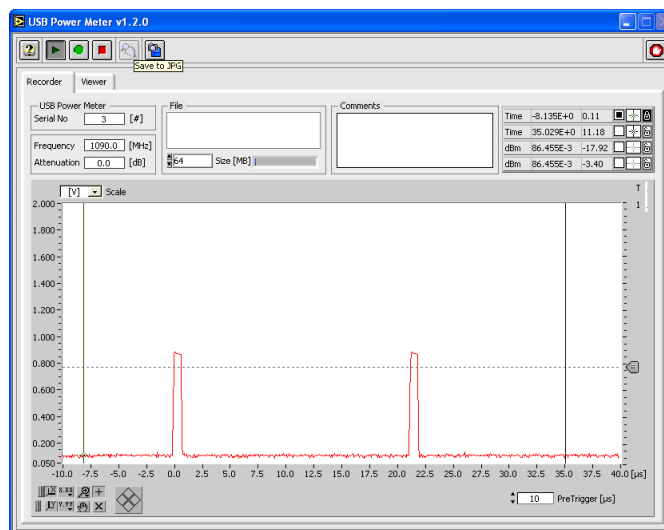


Figure 2: USB Power Meter-Recorder



When the UPM772 is connected, the start button is enabled and allows you to preview the data. The preview window consists of a received input power in dBm or V versus time and will be refreshed when the power or voltage exceeds the trigger level. The pretrigger defines the position in the window of the triggered pulse. The trigger level and the pretrigger values will have no influence on the recorded data.

2.2.2. Making a Recording

1. First enter the required parameters:

- Enter the frequency of the input signal. Although the UPM772 is a broadband log receiver (10MHz...10GHz) with a relatively flat response curve, we ask you to enter the approximate frequency of the input signal for maximum accuracy.
- Enter the attenuation; this contains the attenuators, cable loss and antenna gain (subtract 5dB if Huber&Suhner antenna is used). The attenuation to the UPM772 using the 15m sucoflex cable for L-Band is 7.5 dB, for S-band it is 15dB.



Note: Start with 30db extra attenuation. Add or remove attenuation as required. Make sure the input of the UPM772 is not saturated. A warning will appear if that is the case. After determining the correct attenuator adjust this attenuation parameter accordingly.

2. Select the recording size:

- The sample rate is 15MHz. This results in 15MB/s data recorded to disk. The default size is 64MB or 4.47s (the corresponding time period is calculated when the size changes). The maximum disc space depends on your free space on your local disc.



Caution: Check disc space before recording large files!

- By zipping the recorded files afterwards, these recordings can be compressed to 1/3th of the size.

3. Enter your comments in the **Comment** field: Please enter some environmental conditions and measurement conditions in the comment field, such as the location towards the source, in field, on site, distance, height, polarization of the measurement antenna.

4. Start the recording by clicking the  **Record** button.

A dialog box will prompt the user to select the location. The recording on disk consists of a folder containing the measurement data. Therefore each time a recording is performed, a new folder needs to be created. The default path is %CAMPAIGN%\VIDEO\UPM.

5. Click **New** to create a new folder. You will be prompted to enter a folder name. Click **Create** to create the new folder.

The new folder is now created and highlighted. Click the **Select** button to finally select the folder as the recording destination.

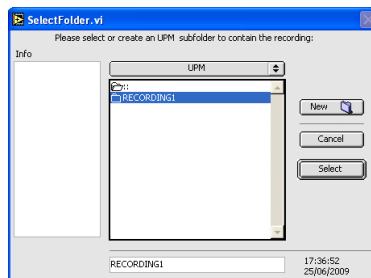


Figure 3: File Selection

6. The recording is now started. The toolbar will indicate this with a progress bar indicating recording progress.



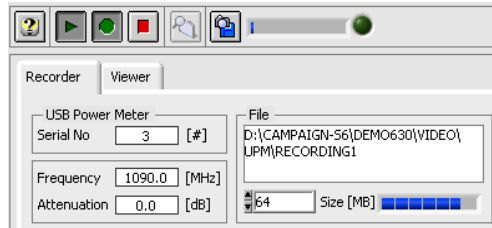


Figure 4: Progress bar

- 7. The buffer indicator and error LED will indicate whether the computer is fast enough to write the data to file. During a recording the data is sampled at 15MB/s and stored to disk as a continuous, uninterrupted data stream. This means the completed waveform vs time is stored on disk for further examining.

2.2.3. Analysis

When the recording is finished, the program switches automatically to the **Viewer** mode. The recorded data is read from the disk. This processing can take a few seconds up to a minute depending on the file size and computer speed.

- Window size: length of the preview window
- Start time: start of the defined window

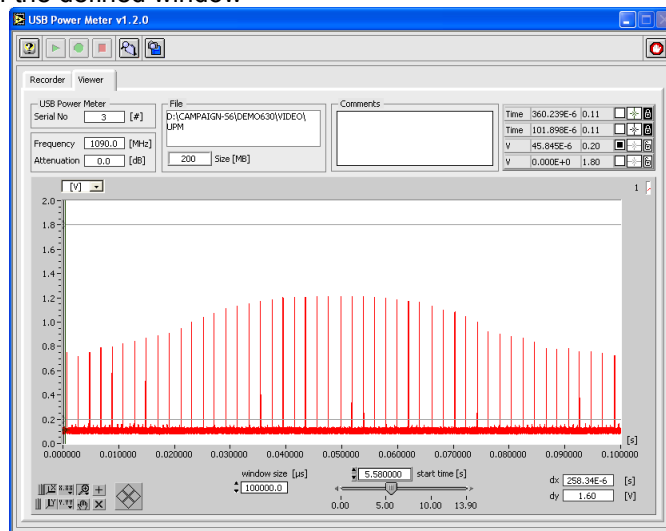


Figure 5: USB Power Meter-Viewer

- Zoom functions: To examine the data more in detail.



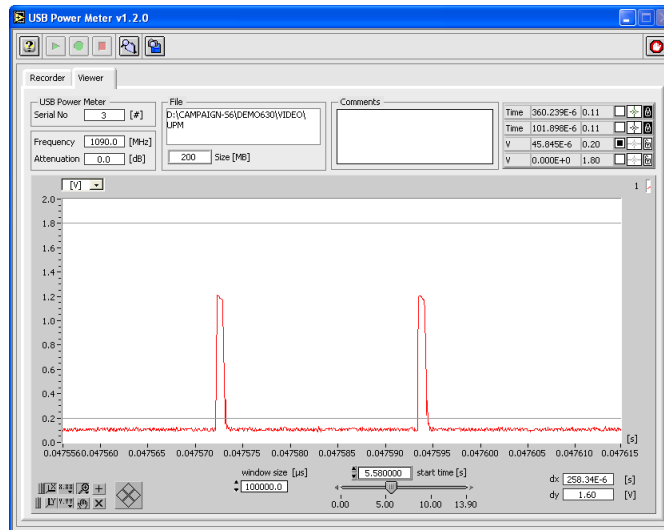





Figure 6: USB Power Meter-Viewer-Zoomed

In case you want to view an existing recording, click the  **Select Folder** button and a dialog will appear to select a recorded folder.

Please note that it is possible to use the program without the UPM772 connected for viewing purposes only.

2.3. Troubleshooting

The preview window doesn't show any pulses or no pulses are recorded.

- Check trigger level.
- Check auto scale: ON  OFF 
- Check antenna connection.
- Check video output on the oscilloscope.

Record button is disabled.

- Check USB connection.



3. ELECTRICAL FIELD STRENGTH MEASUREMENT

3.1. Theory

The UPM772 based Electrical Field Strength Measurement kit was developed to investigate the safety conditions around radar systems, to determine the influences between radar systems towards people. Each country has its own legislation for the field strength, the tool calculates the mean value and represents this mean value and the peak value in a simple user interface. The field strength kit can also be used to preview, record and review a raw antenna diagram.

The view function creates the possibility to recall the selected field measurement done at a earlier point in time, so the influences of the radar can be determined by comparing the measurement before and after switching on the radar under test. Same principal can be applied to measure the influence of the radome: compare the measurements before and after placing the radome.

The kit consists of a UPM772, a Huber&Suhner measurement antenna, a portable workstation and some accessories. The standard measurement antenna has an antenna factor of 5.0 and is omni-directional. The measurement is performed by recording the RF power while pointing the antenna in the horizontal and vertical direction. It is recommended to start with 30dB attenuation in between the UPM772 and the cable to the antenna and check the power level using the software as described in the next section.

3.2. Software

3.2.1. Getting Started

Make the set-up which is shown in annex 2. The UPM772 Electrical Field Strength measurement application can be loaded using the **Transmitter Tests** button  on the left-side of the RASS-S Toolbox.

When the vi is running, it is automatically set in the **Recorder** mode.



The UPM772 serial number is indicated and a number of controls are enabled when the device is detected.



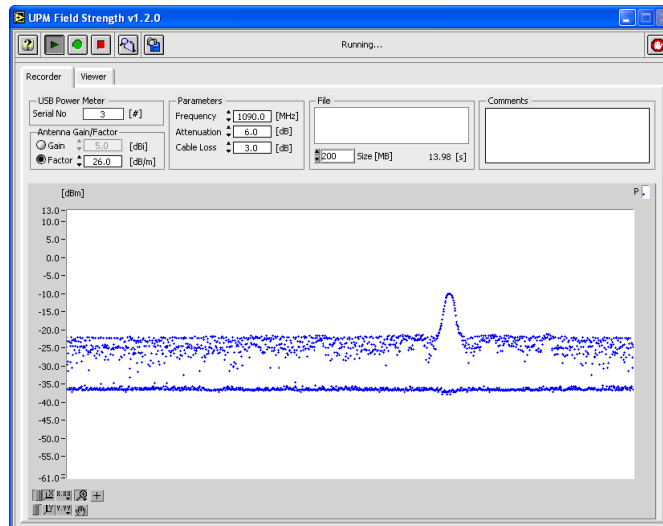


Figure 7: UPM Field Strength-Recorder

When the UPM772 is connected, the start button is enabled and allows you to preview the data. The preview window consists of a continuously scrolling window that shows the received input power in dBm vs time. Each data point represents the max power received in a (approx.) 4ms time period .

3.2.2. Making a Recording

1. First enter the required parameters:

- o Enter the frequency of the input signal. Although the UPM772 is a broadband log receiver (10MHz...10GHz) with a relatively flat response curve, we ask you to enter the approximate frequency of the input signal for maximum accuracy.
- o Enter the attenuation and cable loss. The antenna is connected to the UPM772 using the 15m sucoflex cable. Its attenuation for L-Band is 7.5 dB, for S-band it is 15dB.



Note: Start with 30db extra attenuation. Add or remove attenuation as required. Make sure the input of the UPM772 is not saturated. A warning will appear if that is the case. After determine the correct attenuator adjust this attenuation parameter accordingly.

- o Antenna Factor: The antenna factor of the Huber&Suhner measurement antenna is 5.0.

2. Select the recording size:


- o The sample rate is 15MHz. This results in 15MB/s data recorded to disk. The default size is 64MB or 4.47s (the corresponding time period is calculated when the size changes). The maximum disc space depends on your free space on your local disc.



Caution: Check disc space before recording large files!

- o By zipping the recorded files after wards these recordings can be compressed to 1/3th of the size.

3. Enter your comments in the Comment field: Please enter some environmental conditions and measurement conditions in the comment fields, such as the location towards the source (distance, height) and the polarisation of the measurement antenna.

4. Start the recording by clicking the  **Record** button.

A dialog box will prompt the user to select the location. The recording on disk consists of a folder containing the measurement data. Therefore each time a recording is performed, a new folder needs to be created. The default path is %CAMPAIGN%\VIDEO\UPM.

5. Click **New** to create a new folder. You will be prompted to enter a folder name. Click **Create** to create the new folder.

The new folder is now created and highlighted. Click the **Select** button to finally select the folder as the recording destination.



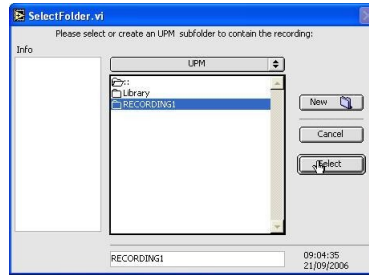


Figure 8: File Selection

- 6. The recording is now started. The toolbar will indicate this with the **Recording** message and a progress bar indicating recording progress.



Figure 9: Progress bar

- 7. The buffer indicator and error LED will indicate whether the computer is fast enough to write the data to file. During a recording the data is sampled at 15MB/s and stored to disk as a continuous, uninterrupted data stream. This means the completed waveform vs time is stored on disk for further examining.

3.2.3. Analysis

When the recording is finished, the program switches automatically to the **Viewer** mode.

The recorded data is read from the disk. The maximum and mean field strength are calculated. The parameters used for the calculation are the parameters that were entered when making the recording. This processing can take a few seconds up to a minute depending on the file size and computer speed.

If the parameters were not completely correct it is still possible to adjust these. The power and field strength will be recalculated. The data only needs to be completely reprocessed in case the **Frequency** parameter is changed.

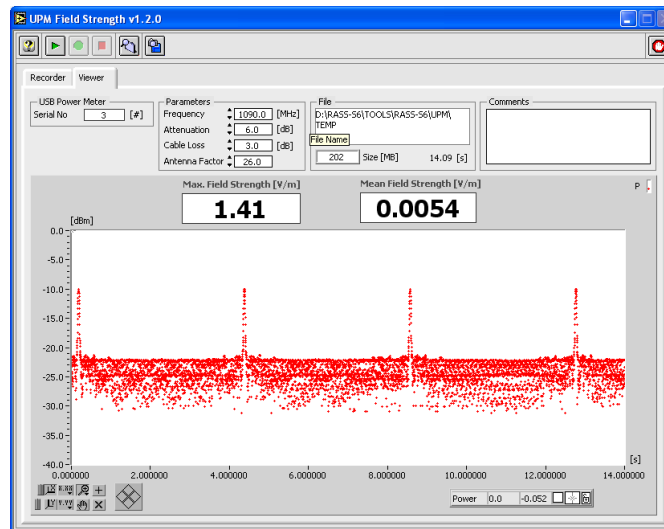


Figure 10: UPM Field Strength-Viewer



In case you want to view an existing recording, click the  **Select Folder** button and a dialog will appear to select a recorded folder.

Please note that it is possible to use the program without the UPM772 connected for viewing purposes only.



3.3. Troubleshooting

The preview window doesn't show any points in the continuously running window or no pulses are recorded.

- Check auto scale: ON  OFF 
- Check antenna connection.
- Check video output on the oscilloscope.

Record button is disabled.

- Check USB connection.



4. ANNEXES

4.1. Annex 1: UPM Power Meter (on site measurement) Set-up

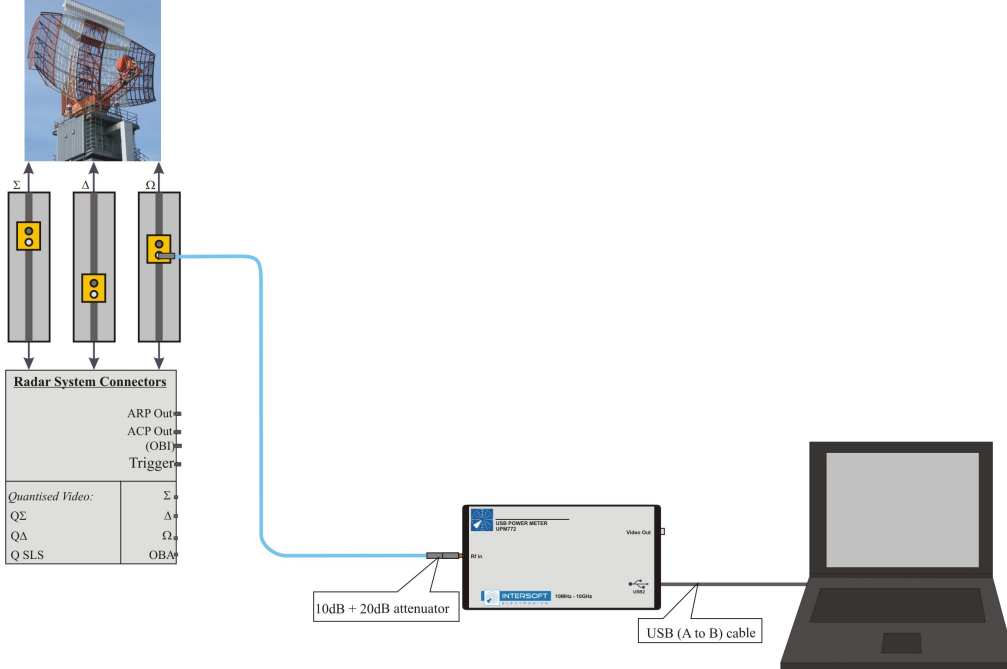


Figure 11: UPM on site measurement

4.2. Annex 2: UPM Electrical Field Strength Measurement (field measurement) Set-up

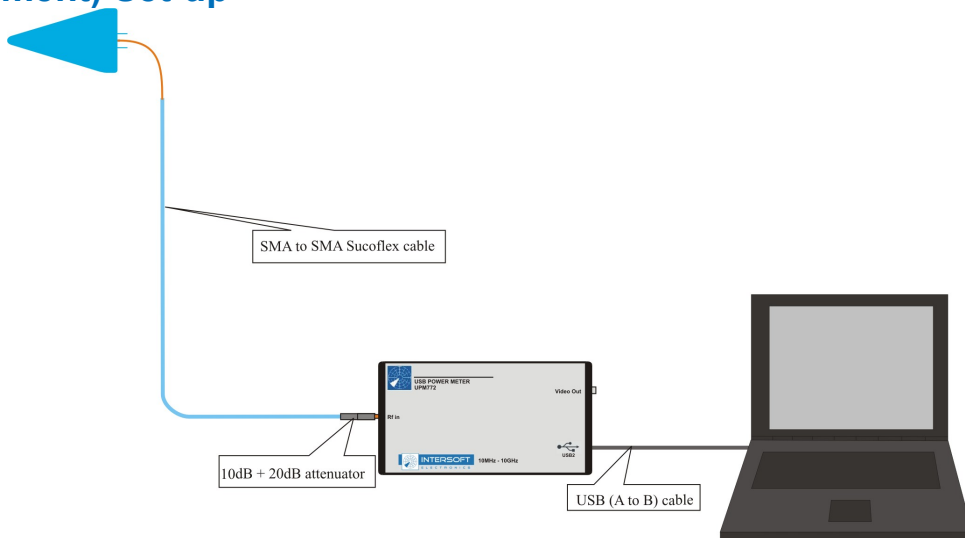


Figure 12: UPM field measurement



4.3. Annex 3: Configuration List

Check	Qty	Description/Item List
USB Power Meter		
<input type="radio"/>	1	USB Power Meter UPM772
<input type="radio"/>	1	USB A to B cable
UPM Accessories Standard Configuration (for use as former LRU)		
<input type="radio"/>	1	N(m)-SMA(m) adapter
<input type="radio"/>	1	2m BNC cable
UPM Accessories for Power Meter Function		
<input type="radio"/>	1	SMA(m)-SMA(m) adapter
<input type="radio"/>	1	SMA(f)-SMA(f) adapter
<input type="radio"/>	4	N(m)-SMA(m) adapter
<input type="radio"/>	1	N(m)-SMA(f) adapter
<input type="radio"/>	1	2m SMA cable
<input type="radio"/>	2	0.25m N-SMA cable
<input type="radio"/>	1	10dB SMA attenuator
<input type="radio"/>	1	20dB SMA attenuator
<input type="radio"/>	1	30dB SMA attenuator
<input type="radio"/>	1	Directional coupler SMA(f)
<input type="radio"/>	1	2m BNC cable
UPM Accessories for Electrical Field Strength Measurement		
<input type="radio"/>	1	N(m)-SMA(f) adapter
<input type="radio"/>	1	15m SMA cable
<input type="radio"/>	1	10dB SMA attenuator
<input type="radio"/>	2	20dB SMA attenuator
<input type="radio"/>	1	Antenna

