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Abstract

A www-based database has been developed to create a first map of the European expertise in antenna measurements. The purpose was to provide the Scientific European Community with an overview of main research and development activities in this field. The collection of information was conceived to serve as a valid means for potential users of antenna measurements to identify and contact antenna measurement facilities. 39 institutions from 13 countries registered their data into the database showing a considerable expertise with more than 50 facilities and offering antenna measurement services in the range from 0.06GHz to 330GHz. Furthermore, many institutions have offered their facilities for external services and the web site is being used also to support other ACE WP (1.2-2 and 1.2-3). After the delivery date University of Calabria will continue the development of the database involving more non-ACE institutions and supporting additional promotional actions.

Keyword List

Antenna measurements facilities

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1. Introduction

This document is an additional and not formally required report presented as integration to the deliverable of the WP 1.2-1 "European Measurement Expertise Mapping". The WP activity has been coordinated by the University of Calabria, Italy with the support of other WP members.

In accordance with the work package objective, a www-based database has been developed to create a first map of the European expertise in antenna measurements. The purpose was to provide the ACE consortium with an overview of main European research and development activities in this field. The collection of information was conceived to serve as a valid means for potential users of antenna measurements, in particular from the wireless communication industry, to identify and contact antenna measurement facilities

2. Context and Structure

The database is directed to all the European institutions having research and/or development activities in the field of antenna measurement. Each institution joining the mapping program should be classified on the basis of its research activities, quality standards and primary equipments besides considering the features of the measurement facilities. Particular attention should be paid to map innovative measurement techniques and related research activities.

The collection of information should be made accessible to all ACE members, the European scientific community and to potential users of antenna measurements, in particular from the wireless communication industry, which should be able to identify and contact antenna measurement facilities. The accessibility and visibility criteria then require the use of www-accessible database where inputs can be collected and shared.

3. Key parameters

In the following are specified the most important data required for a comprehensive and clear characterization of each participating institution. The parameters have been structured to include data relevant to the following aspects:

General institute information

Identification of the institute and contact person

Quality standards and equipments

List of primary equipments

Certifications recognized to the institute

Research activities in the field of Antenna Measurements.

List of research activities in which is involved the institution.

Measurement facilities classification and description

General description - Measurements and error estimation - Measurement limits - Probe system -Special services - RF reflectivity - Shielding - Environmental characteristics - EMC - Data acquisition - Facility access - Notes - File upload

4. Implementation of the www-based questionnaire

In order to make the collection of information from responding institutions more efficient, a www-based questionnaire has been set up. In the following the database implementation will be briefly presented.

1.1. Access page

The home page of the database is accessible from the internet through the VCE web site at the address <http://ace.deis.unical.it>. The access page (Figure 1) has been uniformed to the official VCE skin and opportunely linked with the Antennas VCE site. There are three different modalities to navigate the site:

- I. guest mode
- II. registered mode
- III. registering mode
- IV. administrator

When connecting as a guest (I) one can access the information in the database and make queries. The second modality (II) is oriented to people that have to modify the data of a registered institution. Only one person per institution should be able to perform this operation after logging in the site. New institutions joining the mapping program should login using the keyword “userace” as both username and password. After this operation the system will recognise a new user and a registration procedure will be started (Figure 2). It is worth pointing out that the insertion of data in the database requires the keyword which can be required to the e-mail address indicated in the access page. This should be considered a controlled access rather than a restricted access.

The administrator of the site can access to special services like mailing lists and user management.

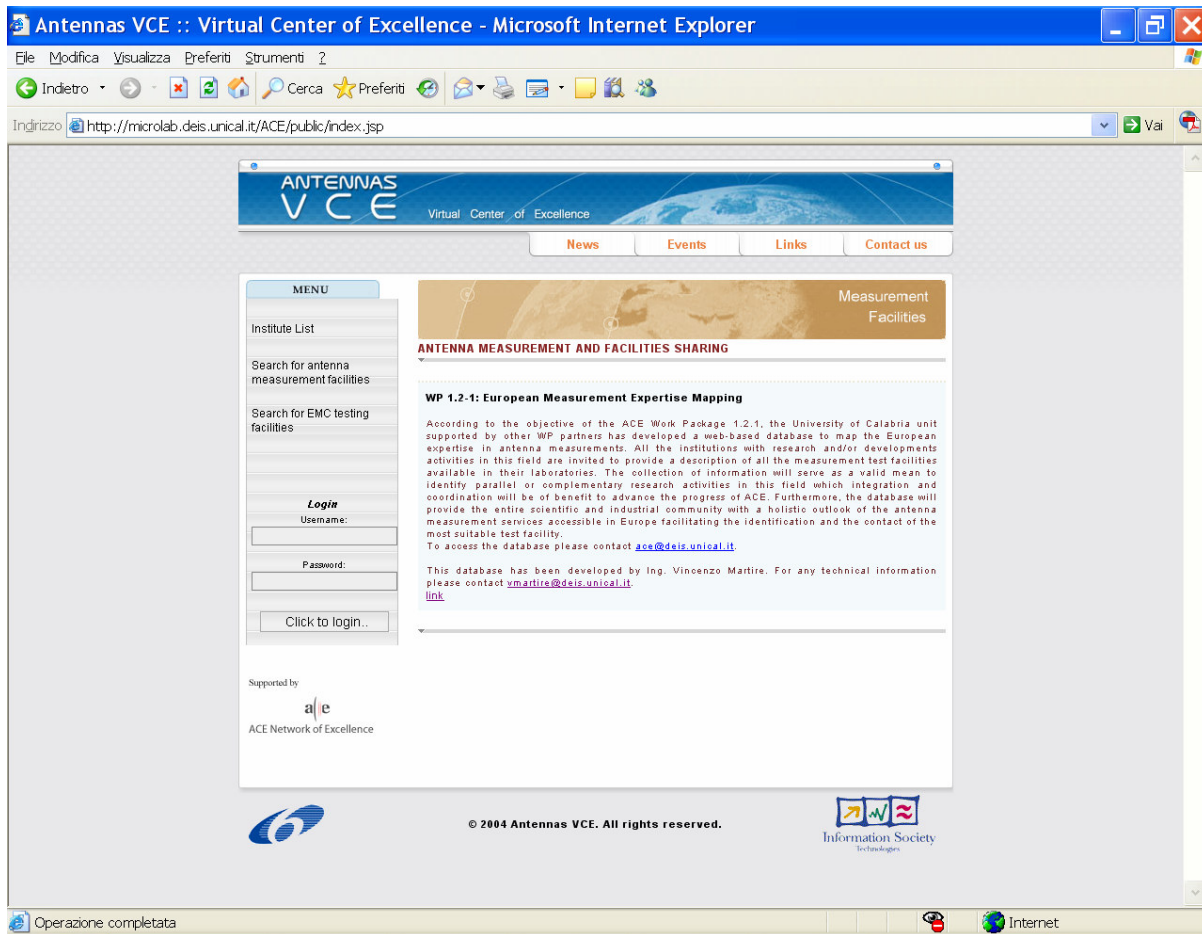


Figure 1. European Measurement Expertise Mapping web page: access page.

http://microlab.deis.uni...

a|e antenna center of excellence

New institute registration

Institute Name* microWaveLab - Univers

Address Dip. Elettronica, Informan

City Rende (Cs)

ZIP 87036

Country Italy

Contact person Giuseppe Di Massa

Phone +39.0984.494700

Fax +39.0984.494713

Email dimassa@deis.unical.it

Web Site www.deis.unical.it

Username *

Password *

Update Close

Internet

Figure 2. Registration of a new institution.

1.2. Quality Standards and equipments

This area it is important to identify the general quality standard and the equipment level offered by each institution. Data concerning these two aspects can be inserted in two different pages:

1. Certifications
2. Primary equipments

In the first page (Figure 3) it is possible to specify whether the institution is a competent body or a notified body. Furthermore, a blank space is left to specify any other certifications recognized to the institution.

A list of the primary equipments can be inserted (Figure 4) providing a potential user with a complete overview of the equipment level of the institution.

The screenshot shows a web browser window with the address bar displaying 'http://microlab.deis.uni...'. The page header features the 'a|e antenna center of excellence' logo. The main heading is 'Please, specify the certifications recognized to your institute'. Below this, there are two checkboxes: 'Competent Body' and 'Notified Body', both of which are unchecked. A label 'Certificates Comp' is positioned above a large text input area. The text 'ISO 9001' is entered into this field. The browser's status bar at the bottom shows 'Internet'.

Figure 3. Certifications recognized to the institution.

The screenshot shows a web browser window with the address bar displaying 'http://microlab.deis.unical...'. The page title is 'Equipments'. Below the title, there is a 'Clear Form' button. The main heading is 'List of Equipments available in your institute'. A table lists the following equipment:

Equipment Name
Anritsu 37225 Vector Network Analyzer
Anritsu 37269C Vector Network Analyzer
Anritsu 37379C Vector Network Analyzer
Anritsu ME7808A Broadband Vector Network Analyzer
Anritsu MS2667C Spectrum Analyzer
FM CW Scatterometer
Anritsu Microwave/mmWave Synthesizers 68C
Rhode & Schwartz power meter

Below the table, there are two input fields: 'Equipment Name' and 'Description'. The browser's status bar at the bottom shows 'Internet'.

Figure 4. Primary equipment web page.

1.3. Measurement facility description and classification

A registered institution enters the site as shown in Figure 5. A new facility can be inserted selecting one of the following classifications: far field, near field and reverberating chamber. Depending on the previous choice it is possible to select a typology (Outdoor, indoor, planar, cylindrical and spherical). In order to allow the classification of innovative and non conventional measurement systems it is possible to use a supplementary option.

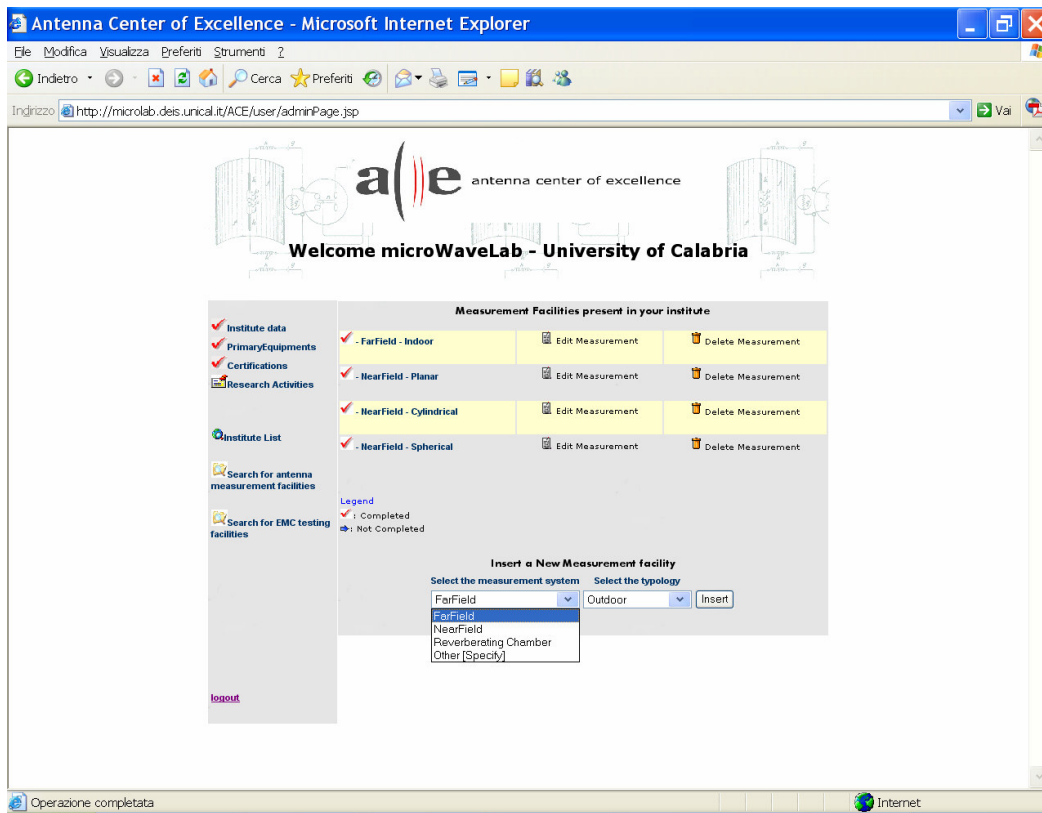


Figure 5. Access page of a registered institution.

1.4. Example: far-field indoor range

In the following it is described the complete procedure necessary to insert data relevant to a “Far field”- “Indoor” range. Once the opportune option is selected the page shown in Figure 6 appears and a first facility description can be provided. In this page can be specified some important data such as the dimensions of the set-up, the presence of the time domain option, the possibility to measure active and/or passive antennas and the general limits of the facility. Additional free text can be inserted to describe other details.

Figure 6. Facility description.

In a second stage (Figure 7) it will be possible to insert information about the measurements that can be performed in the facility specifying the maximum expected errors. This information can significantly depend from the frequency range. For this reason it is given the possibility to specify these data in different frequency ranges. Once a new frequency range is inserted the form shown in Figure 8 has to be filled. In this page can be specified what quantities can be measured (far field, near field or gain) indicating the maximum expected error for each measurements. In the same page it is also possible to indicate whether other additional parameters (S-parameters, phase centre, EIRP, etc.) can be measured and what error corrections are available.

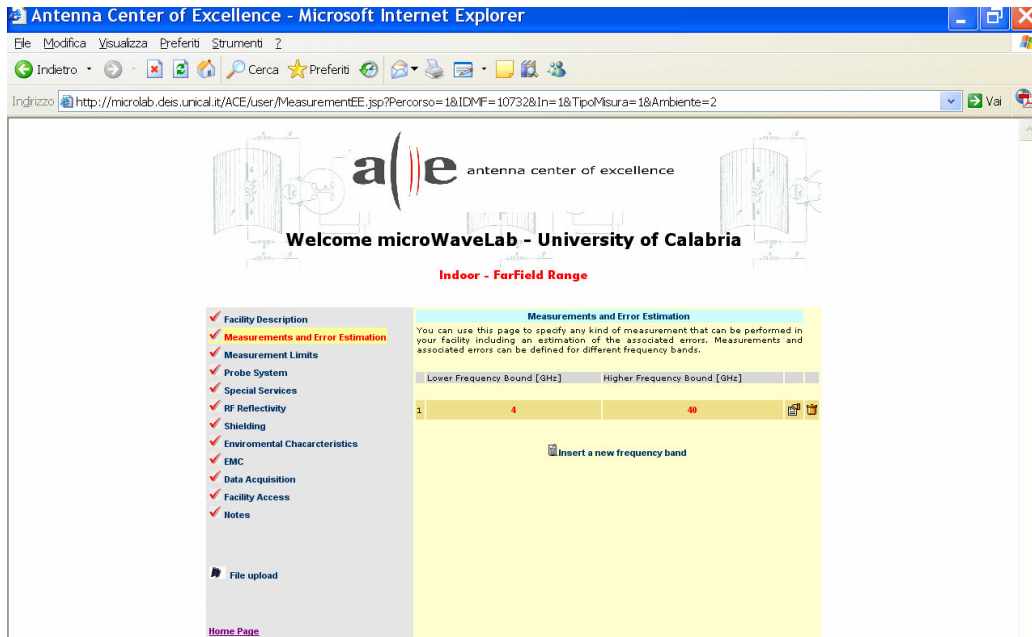


Figure 7. Measurements and error estimation.

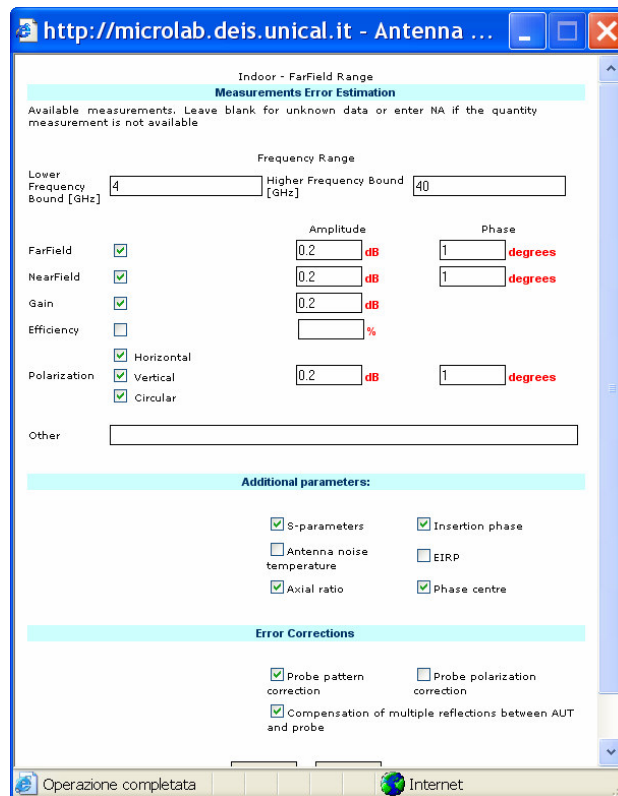


Figure 8. Measurements and error estimation for a certain frequency range.

Particular attention has been dedicated to the accurate identification of the measurement limits in terms of frequency range, maximum antenna dimensions and weight. This information, together with some data concerning the positioner, are grouped in the page shown in Figure 9.

The screenshot shows a web browser window titled 'Antenna Center of Excellence - Microsoft Internet Explorer'. The address bar shows the URL: <http://microlab.des.unical.it/ACE/User/MeasurementLimits.jsp?Percorso=28;IDMF=107328;In=18;TipoMisura=18;Ambiente=2>. The page header includes the ACE logo and the text 'Welcome microWaveLab - University of Calabria' and 'Indoor - FarField Range'. On the left is a navigation menu with items: Facility Description, Measurements and Error Estimation, Measurement Limits (highlighted), Probe System, Special Services, RF Reflectivity, Shielding, Environmental Characteristics, EMC, Data Acquisition, Facility Access, and Notes. Below the menu is a 'File upload' button and a 'Home Page' link. The main content area is titled 'Measurements Limits' and contains the instruction: 'Please fill in with the frequency and mechanical limits of your facility'. It includes input fields for 'Lower Frequency Bound [GHz]' (0.0), 'Higher Frequency Bound [GHz]' (40.0), 'Maximum Antenna Dimensions (W, D, H) in [m]' (0.4, 0.4, 0.4), 'Load Capacity [kg]' (5.0), and 'Time of Support for the AUT'. There are checkboxes for 'Slide', 'Test Positioner', 'Azimuth', and 'Elevation'. At the bottom are 'Update', 'Delete', and 'Abort' buttons. The status bar at the bottom indicates 'Operazione completata'.

Figure 9. Measurements limits.

Using the form shown in Figure 10 can be specify what kind of probe system is being used. A multiple choice selection can be done from a list that can be updated by any user.

The screenshot shows a web browser window titled 'Antenna Center of Excellence - Microsoft Internet Explorer'. The address bar shows the URL: <http://microlab.des.unical.it/ACE/User/ProbeSystem.jsp?Percorso=38;IDMF=107328;In=18;TipoMisura=18;Ambiente=2>. The page header includes the ACE logo and the text 'Welcome microWaveLab - University of Calabria' and 'Indoor - FarField Range'. On the left is a navigation menu with items: Facility Description, Measurements and Error Estimation, Measurement Limits, Probe System (highlighted), Special Services, RF Reflectivity, Shielding, Environmental Characteristics, EMC, Data Acquisition, Facility Access, and Notes. Below the menu is a 'File upload' button and a 'Home Page' link. The main content area is titled 'Probe System' and contains the instruction: 'Please specify here what kind of probe systems are present in this measurement facility (Multiple choice)'. It includes a 'Probe System' dropdown menu with options: 'dual polarized', 'linearly polarized', 'circular polarized', and 'three axis probe'. Below the dropdown is a link: 'Add a new probe system to this list'. At the bottom are 'Update' and 'Abort' buttons. The status bar at the bottom indicates 'Operazione completata'.

Figure 10. Probe System.

The form shown in Figure 11 can be used to identify the special services offered by the measurement facility. A multiple choice can be done from a list which can be updated by any user.

At the sixth step, the users are invited to describe the reflectivity of the far-field indoor facility (Figure 12).

The screenshot shows a web browser window titled "Antenna Center of Excellence - Microsoft Internet Explorer". The address bar displays the URL: `http://microlab.deis.unical.it/ACE/User/SpecialServices.jsp?Percorso=48&IDMF=107328&In=1&TipoMisura=1&Ambiente=2`. The page features the ACE logo and the text "Welcome microWaveLab - University of Calabria" and "Indoor - FarField Range". On the left, a sidebar lists various facility options with checkboxes, including "Special Services" which is highlighted. The main content area is titled "Special Services" and contains a form with a dropdown menu for "Special Service" showing options like "Calibration of standard gain horns [SGH]", "Calibration of probe antennas for use in other facilities", and "No Special Service". There are "Update" and "Abort" buttons at the bottom of the form.

Figure 11. Special services offered by measurements facility.

The screenshot shows the same web browser window, but the "RF Reflectivity" form is active. The sidebar on the left still has "Special Services" highlighted. The main content area is titled "RF Reflectivity" and contains a form with two input fields: "Quiet zone radius [m]" with a value of "1" and "Reflectivity Level within the Quiet Zone [dB]" with a value of "0.1". There is also a checkbox labeled "Tapered" which is currently unchecked. "Update", "Delete", and "Abort" buttons are located at the bottom of the form.

Figure 12. RF reflectivity data.

Another section has been structured to provide a description of the shielding (Figure 13) and environmental characteristics (Figure 14) of the chamber.

The screenshot shows a web browser window titled "Antenna Center of Excellence - Microsoft Internet Explorer". The address bar displays the URL: <http://microlab.deis.unical.it/ACE/User/Shielding.jsp?Percorso=6&IDMF=10732&In=1&TipoMura=1&Ambiente=2>. The page features a logo for "a|e antenna center of excellence" and a welcome message: "Welcome microWaveLab - University of Calabria". Below this, it says "Indoor - FarField Range". A left sidebar contains a menu with items like "Facility Description", "Measurements and Error Estimation", "Measurement Limits", "Probe System", "Special Services", "RF Reflectivity", "Shielding" (highlighted), "Environmental Characteristics", "EMC", "Data Acquisition", "Facility Access", "Notes", and "File upload". The main content area is titled "Shielding" and contains input fields for "Lower Frequency Bound [GHz]" (set to 1), "Upper Frequency Bound [GHz]" (set to 4), "Electric Field" (checked), "Magnetic Field" (unchecked), "Electric Field Attenuation" (set to 40 dB), and "Magnetic Field Attenuation" (set to 180 dB). There are "Update", "Delete", and "Abort" buttons at the bottom of the form.

Figure 13. Shielding characteristics.

The screenshot shows the same web browser window, but the URL is now: <http://microlab.deis.unical.it/ACE/User/EnvironmentalCharacteristics.jsp?Percorso=7&IDMF=10732&In=1&TipoMura=1&Ambiente=2>. The left sidebar menu is identical, but "Environmental Characteristics" is now highlighted. The main content area is titled "Environmental Characteristics" and contains input fields for "Cleanliness Class", "Temperature", and "Humidity". There are "Update", "Delete", and "Abort" buttons at the bottom of the form.

Figure 14. Environmental characteristics.

In Figure 15 are shown the forms that can be used to insert data concerning the EMC measurement features that include both maximum field strength and EMC tests that can be done in the facility.

A description of the data acquisition system can be provided using the forms shown in Figure 16. A sample of the data format can be inserted in the field “description”.

The screenshot shows a web browser window titled "Antenna Center of Excellence - Microsoft Internet Explorer". The address bar shows the URL: <http://microlab.des.unical.it/ACE/User/EMC.jsp?Percorso=8&IDMF=10732&In=1&TipoMstra=1&Ambiente=2>. The page header includes the ACE logo and the text "Welcome microWaveLab - University of Calabria". Below the header, it says "Indoor - FarField Range". On the left, there is a navigation menu with a list of items: Facility Description, Measurements and Error Estimation, Measurement Limits, Probe System, Special Services, RF Reflectivity, Shielding, Environmental Characteristics, EMC (highlighted), Data Acquisition, Facility Access, and Notes. Below the menu is a "File upload" button and a "Home Page" link. The main content area is titled "EMC" and contains a form with the following fields: "Max Field Strength" (text input), "[V/m] Emission Testing" (checkbox), "Immunity Testing" (checkbox), and "Susceptibility" (checkbox). At the bottom of the form are three buttons: "Update", "Delete", and "Abort". The status bar at the bottom of the browser window shows "Operazione completata" and "Internet".

Figure 15.EMC.

The screenshot shows the same web browser window as Figure 15, but the "Data Acquisition" form is displayed. The address bar shows the URL: <http://microlab.des.unical.it/ACE/User/DataAcquisition.jsp?Percorso=9&IDMF=10732&In=1&TipoMstra=1&Ambiente=2>. The navigation menu on the left is the same, but "Data Acquisition" is now highlighted. The main content area is titled "Data Acquisition" and contains a form with the following fields: "Scan Speed [mm/sec] or [degrees/sec]" (text input), "Acquisition Rate [Hz]" (text input with "1000" entered), "Acquisition Mode" (dropdown menu with "Automated" selected), and "Data Format" (dropdown menu with "ASCII" selected). Below these fields is a large text area labeled "Description". At the bottom of the form are three buttons: "Update", "Delete", and "Abort". The status bar at the bottom of the browser window shows "Operazione completata" and "Internet".

Figure 16.Data acquisition.

Data concerning the facility access modality, availability and costs can be inserted as shown in Figure 17.
A last form (Figure 18) is left for additional notes that can be inserted using a free text field.

The screenshot shows a web browser window titled "Antenna Center of Excellence - Microsoft Internet Explorer". The address bar displays the URL: `http://microlab.deis.unical.it/ACE/user/FacilityAccess.jsp?Percorso=10&IDMF=10732&In=1&TipoMisura=1&Ambiente=2`. The page features the ACE logo and the text "Welcome microWaveLab - University of Calabria" and "Indoor - FarField Range". On the left, a sidebar lists various facility options with checkboxes, including "Facility Access" which is highlighted. The main content area is titled "Facility Access" and contains a form with the following fields: "Availability [Days per Month]" with a value of 6, "Daily Rate [Euros per day]" with a value of 0, and "Other Costs" with a value of 0. Below these fields are "Update", "Delete", and "Abort" buttons. A "File upload" button is located at the bottom left of the form area.

Figure 17. Facility Access.

The screenshot shows a web browser window titled "Antenna Center of Excellence - Microsoft Internet Explorer". The address bar displays the URL: `http://microlab.deis.unical.it/ACE/user/Notes.jsp?Percorso=11&IDMF=10732&In=1&TipoMisura=1&Ambiente=2`. The page features the ACE logo and the text "Welcome microWaveLab - University of Calabria" and "Indoor - FarField Range". On the left, a sidebar lists various facility options with checkboxes, including "Notes" which is highlighted. The main content area is titled "Notes" and contains a large text input field for additional information or comments. Below the text field are "Update", "Delete", and "Abort" buttons. A "File upload" button is located at the bottom left of the form area.

Figure 18. Free text field for additional notes.

Any other information regarding the measurement facility can be inserted making use of a file upload utility. By means of this system (Figure 19), files like visual presentations, images and technical forms can be uploaded and classified.

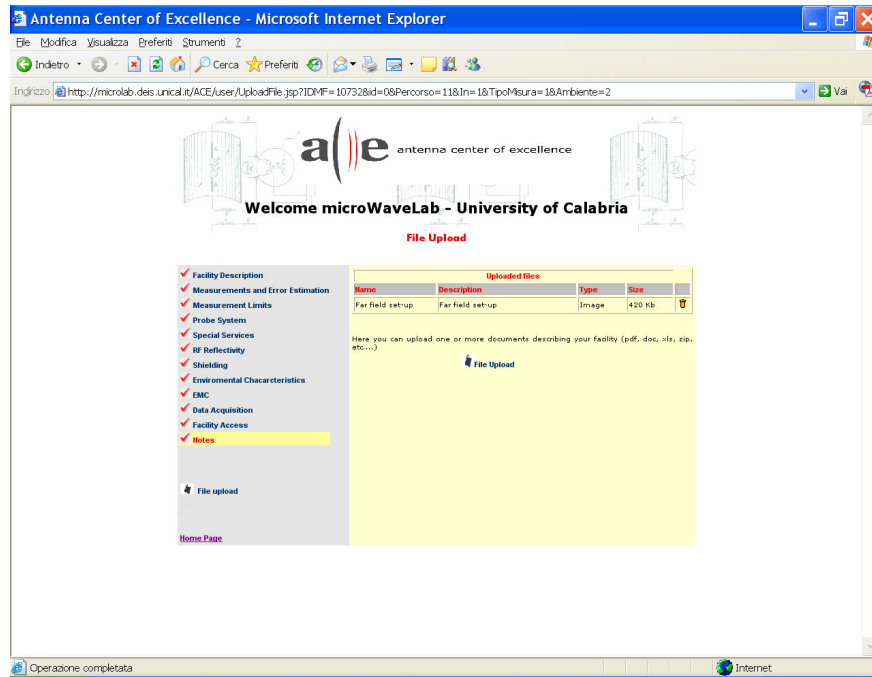


Figure 19. File upload page.

The procedure to register other facilities is similar to the one so far described except that many fields change depending on the measurement facility typology.

5. A look up in the database

In the public part of the database it is possible to view and search the registered institutions and the measurements facilities. A full list of registered institutions is available (Figure 20). All the data are accessible in html form. Additionally, in order to facilitate the consultation of the database a pdf report (Figure 21) can be generated for each institution.

Two search tools have been created to easily identify antenna measurement facilities and EMC testing facilities. Both the search tools are very user friendly. In fact, a search can be conducted considering only the data relevant to the particular kind of measurement that is required and finding only the facilities that have compatible frequency ranges and physical limits. The search results are grouped per institution. An example of an antenna measurement search is presented in Figure 22 and Figure 23.

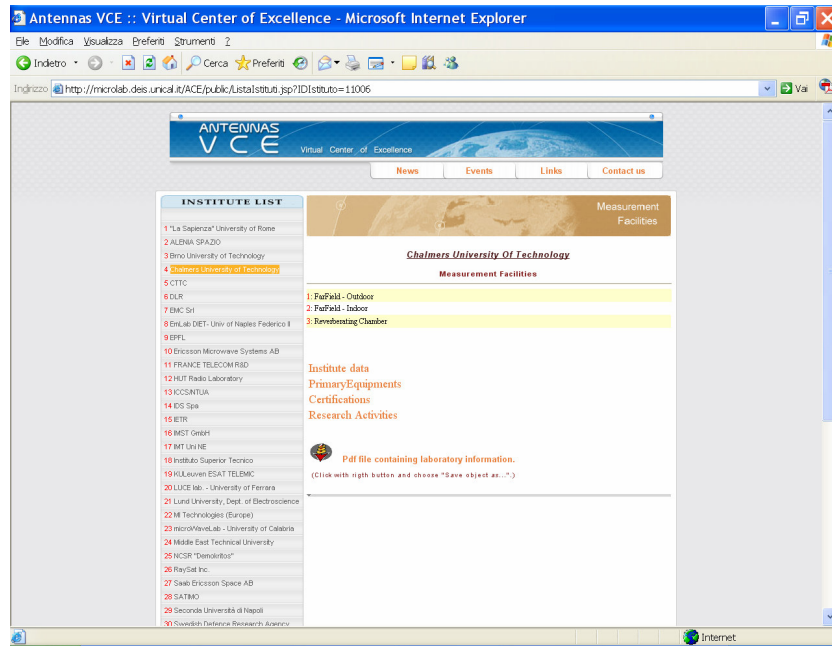


Figure 20. List of registered insitutions.



Figure 21. First page of the pdf report generated through the web based database.

Figure 22. Search antenna measurements.

Figure 23. Search results.

6. Advertisement campaign

A Beta-version of the www-based questionnaire has been first published on-line on April 22, 2004 making use of a server located at the University of Calabria, Italy. A final version of the database has been issued on June 2004. Call for requests have been sent to all the ACE members in September 2004.

The questionnaire has been actively promoted in several occasions. Call for contributions have been issued to ESA, to the Italian Society in Electromagnetics, distributed at JINA and sent to all the COST 284 members. Other potential non-ACE European and non European institutions have been identified and they will be contacted through calls announced at technical meetings, in journals and through mailing lists.

After the delivery date University of Calabria will continue the development of the database involving more non-ACE institutions and supporting additional promotional actions.

7. Results

So far, some 39 institutions from 13 countries (Figure 24) registered their data into the database: 37% are non ACE members. Three of them are classified as a notified body and competent body. The number of participating institutions is expected to increase in the next few months in consequence of a more pervasive promotion of the web site outside ACE.

Anyhow, the mapped institutions show a considerable expertise with more than 50 facilities (Figure 25) offering antenna measurement services in the range from 0.06GHz to 330GHz. Furthermore, many institutions have offered their facilities for external services and the web site is being used also to support other ACE WP (1.2-2 and 1.2-3).

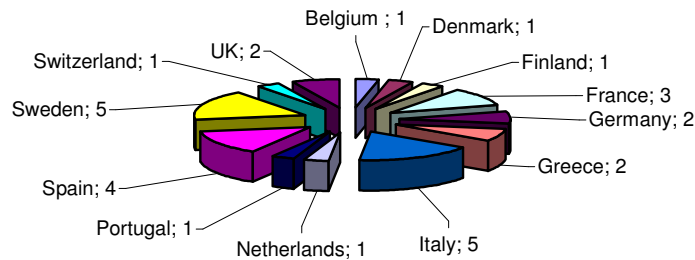


Figure 24. Participating countries.

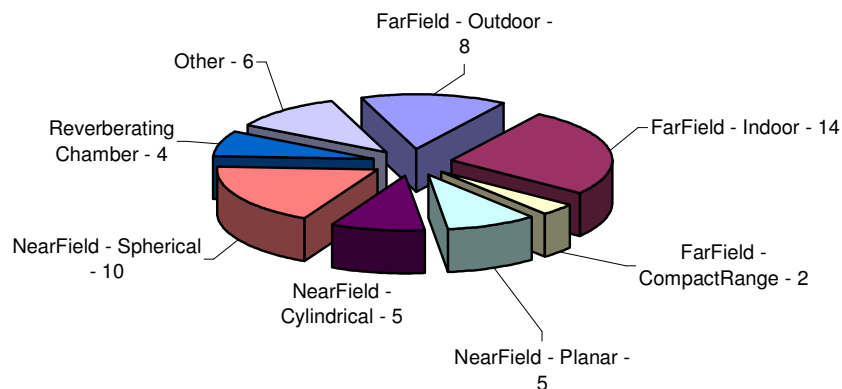


Figure 25. Available measurement facilities.