

## ACE Deliverable 3.2D8

### *Report on the degree of overlapping between scientific literature and patents*

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### Abstract

This document describes a number of analyses made on a large amount of data obtained by searching several databases from the major patent organizations (USPTO, EPO, etc.), with the objective of assessing the European presence as far as the intellectual property protection in the area of antennas is concerned. Selection criteria for the database entries have been established as well as crossed analyses with databases related with scientific literature and Internet search results, to understand the amount of overlap and interaction between scientific literature and patents. Quantitative results have been obtained and will be discussed in the document, together with comments and conclusions.

### Keyword List

Patents, intellectual properties, antennas

## 1) INTRODUCTION

### 1.1 Description of Work – ACE WP 3.2-4

The description of work of ACE WP3.4-4 was given in the Technical Annex, page 136, and is repeated here for convenience:

*The objective of this activity is to make aware all the European antenna community of the issues related to IP protection, and to act as a link between the two worlds. The objective is not to compete with Patent offices, that are “general purpose” but rather to make something more specialised on the subject, seen from the point of view of the antenna scientists.*

In particular, this deliverable is related to the part of the work of creating an organised database of European patents on antennas and to find relationships with what is in the existing literature, and aims to improve the communication between the world of scientific publications and that of patents.

### 1.2 Participants

The participating organizations in this work package are the following (the reference numbers are as in the Consortium Agreement and Technical Annex).

No.	Organization	Short Name	Country
2	Katholieke Universiteit Leuven	KUL	Belgium
12	Centre National de la Recherche Scientifique	CNRS-LEAT	France
16	IMST GmbH	IMST	Germany
20	Politecnico di Torino	POLITO	Italy
23	Università degli Studi di Siena	UNISI	Italy
27	Universidad Politécnica de Madrid	UPM	Spain
35	Ecole Polytechnique Fédérale de Lausanne	EPFL	Switzerland
38	The University of Birmingham	UNIBHAM	UK

Table 1: Participating organisations.

### 1.3 Contents of this document

This document describes the analyses made on a large amount of data obtained by analysing several databases of the major patent organizations (USPTO, EPO, etc.), with the objective of assessing the European presence as far as the intellectual property protection in the area of antennas is concerned. Selection criteria for the database entries have been established as well as cross analyses with databases related with scientific literature and Internet search results. Quantitative results have been obtained and will be discussed in the document, together with comments and conclusions.

## 2 METHOD OF ANALYSIS

Regardless of the fact that antennas are a very a small part of the general area of science and technology, the amount of data to be examined is very large, of the order of several thousands, and hidden in a much larger number (millions) of patent. The first step in the analysis has therefore been the selection of the data and eventually the setting up of the databases, in order to reduce the search area.

A number of databases are available on Internet, where it is possible to conduct many patent searches. For our scope, the search criterion has simply been the presence of the word “antenna” or “antennas” in the title. Of course, this may exclude entries that, although not using this term, are however related with antenna technology (what about a title as “*means of radiating and collecting electromagnetic waves for a mobile telephone*”, dealing with an antenna without mentioning it?), or, conversely include something which are only antenna accessories (e.g. “*an amplifier to be connected to an antenna*”), but, however, being the scope of this report to give a general view and, in a sense, make a statistical analysis, the number of omissions or wrong inclusions should be a very small fraction of the total. On the other hand, the choice whether, in this analysis, one type or another of antenna accessories have to be considered is certainly a matter of arbitrary choice.

The databases used to select the entries that have been included in the database used for this analysis have been taken from the following sites.

- a) The web site of the European Patent Office (EPO) (<http://www.european-patent-office.org/index.en.php>) and in particular its quick search option ([http://ep.espacenet.com/search97cgi/s97\\_cgi.exe?Action=FormGen&Template=ep/en/quick.hts](http://ep.espacenet.com/search97cgi/s97_cgi.exe?Action=FormGen&Template=ep/en/quick.hts)), has several databases, more or less extended.

1- The “Worldwide” database is the most complete, and allows to search for information on published patent documents from more than 70 countries and regions.

2 - The “EP - esp@cenet” database contains those patent documents which were published by the European Patent Office (EPO) in the last two years: this means that only new EP documents can be found here, while older EP applications can be found in the “Worldwide” database. The “EP - esp@cenet” database does not contain any patent applications submitted to a national patent office. The advantage of searching in the “EP - esp@cenet” database is that it may be quicker than a search in the “Worldwide” database.

3 - the “WIPO – [esp@cenet](http://esp@cenet) database”. The World Intellectual Property Organization (WIPO) monitors international co-operation in the area of patenting as well as PCT applications, i.e. WO patents; the “WIPO - esp@cenet” database only contains patent documents which were published in the last two years.

- b) The web site of the US Patent and Trademark Office (USPTO) allows to search in the US issued patents (full text since 1976, full page images since 1790), and applications published since 2001. This leads indeed to a very large number of patent data, as it will be shown in the following.
- c) National Patent Offices databases. They have little interest for the scope of this search at European level, and, although some search has been done, they have not been considered. On the other hand, national patents, especially in Europe, have become less attractive because of the costs involved to cover a sufficiently large number of countries.
- d) Another important source of patent information is from Japan. The Japanese Patent Office (JPO) has been publishing the Patent Abstracts of Japan (PAJ or JAPIO) (offered by esp@cenet for searching

in its site), since 1976. Not all patent applications published since then have been published in the Patent Abstracts of Japan. The International Patent Classification (IPC) symbols have only been complete since 1989, and since 1998 documents with foreign priority have also been available. Prior to that, only home country applications (Japanese priority) were published. Indeed, the data available, more than 5 million patent applications, enables comprehensive statistical evaluations of the international state of the art to be carried out.

Although the non-European database, as we will see, are very wide, for our scope, mainly focused on the European aspects, the EP database was considered the most suitable for the purpose of this work.

As an additional source on information, also in view of a relationship with the scientific literature, the selection of USPTO patents on antennas published on the *IEEE Antenna and Propagation Magazine* in the years 1999-2004

The number of entries of interest, of course, varies continuously because of the activity of such offices and the increase of the number of patents. A first search in January 2005 provided the following results:

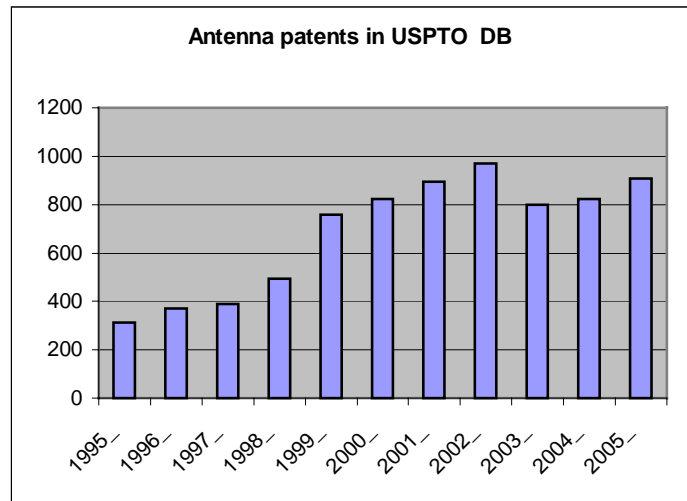
- US Patent & Trademark Office: 9901 results with antenna(s) in the title (since 1976, over 3 M); 3150 since 2001
- EPO database: 1726 results with antenna(s) in the title.

A very recent search (end of 2005) has given the following results:

•**US Patent & Trademark Office** (<http://www.uspto.gov/patf/index.html>): the search gives 11404 results with antenna(s) in the title (since 1976). A more detailed analysis on the most recent years (since 1995, see fig.1) reveals a continuous and strong growth (almost the twice in 2 years, from 1997 to 1999) of issued patents on this subject up to 2002, followed by a relatively sharp decrease (about -18%) in 2003 and a new continuous growth in the last two years. However, the number of patents in 2002 is still the maximum. Just for sake of curiosity, the same analysis for the same keywords in the abstract gives approximately the twice of results, and the ratio is almost constant through the years.

Patent issued since 2001 have been collected in a database as Annex to this report, available in the VCE file sharing section for this WP (file **uspto 2001-05.xls**).

year	antenna(s)	antenna(s) in abstract	title/ abstract
1995	314	584	53.77%
1996	371	782	47.44%
1997	389	754	51.59%
1998	494	1006	49.11%
1999	758	1380	54.93%
2000	822	1498	54.87%
2001	894	1647	54.28%
2002	969	1734	55.88%
2003	798	1445	55.22%
2004	823	1585	51.92%
2005	910	1650	55.15%



Totals	7542	14065	53.62%
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Fig. 1: USPTO, issued patents detailed year by year.

**The EP database**, that includes patents of approximately the last two years (i.e. 2005, 2004 and a fraction of 2003), has a number of slightly more than 500 entries per full year. In this way a database has been prepared with 1315 entries, that includes almost all the patent in the EP database of the last two years, with indication of the inventor(s), applicant(s), title and a number of other data. Also this database is an Annex to this report, available in the VCE in the file sharing section for this WP (file **EPO antenna(s) DB.xls**).

## 2.1: Steps of the analysis: statistical study of distribution of patents

A very first analysis was made in January 2005 on the basis of the selection of patents from USPTO database published on the *IEEE Antenna and Propagation Magazine*. The number of such patents is much lower than those than can be found in the database, but it is however large enough to try some statistical analysis. Some results of such preliminary analysis are shown in the following figures. The total number of patents reported and examined is 761, of which 143 from Europe (approximately 19%), a percentage substantially stable ( $\pm 2\%$ ) through the period (6 years) considered. When considering the full USPTO data base, the percentage of EU contribution remains substantially unchanged: 550 out of the 3150 entries with “antenna(s)” in the title is about 17.5%; when including the abstract, the number rise respectively to about 1300 and 7000 (18.5%).

In this analysis on a reduced set of data the European countries giving the largest contribution to the patent activity are France, Germany and Sweden: this result will be confirmed also on an analysis on a much larger database.

This preliminary analysis shows that patents are applied mainly by companies, while the share of the universities is very low (about 1.5%...). Among the companies, some names are more frequent than others, in this first study the main contributors have found to be Ericsson, Alcatel, Thales/Thomson, etc. The analysis was also extended to classify the patents among the different types of antennas (horns, printed antennas, wires, etc.). A sample of the results is shown in Table 1. Other results not shown here because not in the main scope of the work.

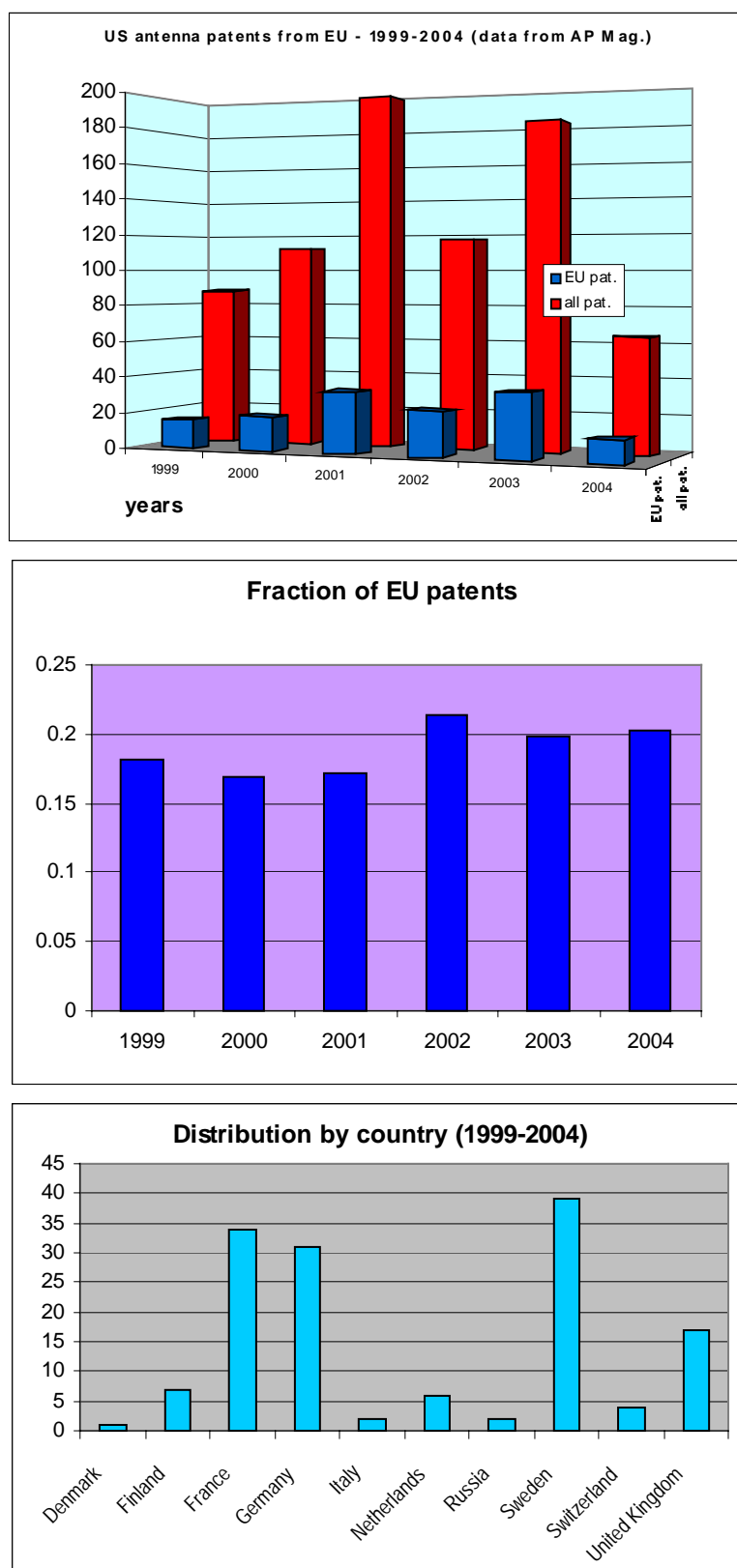


Fig. 2: Results of a preliminary analysis on a reduced set of data.

## ***EU in US Patents 2003 (from AP Magazine)***

APM Issue	page	first author	Company	Country	Title	Category
Aug. 03	107	Vaisanen	Nokia Mobile Phone	Finland	Symmetrical antenna and method for its manufacture ...	Active antennas
Jun. 03	179	Haapanen	Nokia Networks	Finland	Apparatus for suppressing mutual interference between	Microstrip antennas
Oct. 03	143	Mollanen	Nokia Networks	Finland	Antenna radiator	Dipole antennas
Jun. 03	179	Herve	Alcatel	France	Dual-band transmission device and antenna..	
Jun. 03	177	Le Balier	Alcatel	France	Vertical polarization antenna	Dipole Antennas
Oct. 03	145	Ngounu Kouam	Alcatel	France	Planar antenna and dual band transmitting device includ	Integrated antennas
Feb. 03	165	Reineix	CNRS	France	Laminated dielectric reflector for parabolic antenna	Reflectors
Jun. 03	180	Thevenot	CNRS	France	Antenna provided with an assembly of filtering materials	EBG
Feb. 03	155	Roederer	ESA	France	Reflector antenna comprising a plurality of panels	Reflectors
Oct. 03	147	Sharaiha	France Telecom	France	Helical antenna with buolt in duplexing means, and man	Wire antennas
Oct. 03	144	Ngo Bui Hung	Thales	France	Radiating antenna with galvanic insulation	Wire antennas
Feb. 03	158	Hirtzlin	Thomson Licensing	France	evice for emitting and/or receiving elm waves comprising	Lens antennas
Dec. 03	141	Bettin	Fraunhofer-Gesellschaft zur ...	Germany	High impedance structure for multifrequency antennas a	Artificial materials
Dec. 03	141	Bettin	Fraunhofer-Gesellschaft zur ...	Germany	Antenna for receiving satellite signals and terrestrial sign	Dipole antennas
Oct. 03	144	Lindenmeier	Fura Automotive	Germany	Diversity antenna on a dielectric surface in a motor vehic	Mobile antennas
Dec. 03	138	Schmidt	Robert Bosch GmbH	Germany	Multibeam radar sensor with a fixing device for a focusing body	
Feb. 03	156	Zeitz	SELVerteidigungssysteme GmbH	Germany	Integrated adaptive antenna of multibeam antenna	Multibeam antennas
Apr. 03	136	Oberschmidt	Sony International (Europe) GmbH	Germany	V-slot antenna for circular polarization	Slot antennas
Aug. 03	109	Oberschmidt	Sony International (Europe) GmbH	Germany	Dual-spiral-slot antenna for circular polarization	Microstrip/slot antennas
Apr. 03	135	Nevermann		Germany	Multiband helical antenna	Helical antennas
Apr. 03	137	Boyle	Knonklijke Philips Electronics	Netherlands	Antenna arrangement	Multiband antennas
Dec. 03	140	Boyle	Knonklijke Philips Electronics	Netherlands	Dual band patch antenna	Microstrip antennas
Oct. 03	145	Visser	TNO	Netherlands	Waveguide array antenna	Arrays
Feb. 03	164	Granhed	Magnus Granhed Lidingo	Sweden	Encapsulated antennas in passive transponders	Integrated antennas
Feb. 03	157	Bergstedt	Telefonaktiebolaget LM Ericsson	Sweden	Method and arrangement pertaining to microwave lenses	Lens antennas
Apr. 03	137	Falk	Telefonaktiebolaget LM Ericsson	Sweden	One apeerture simultaneous RX-TX antenna	Waveguide antennas
Oct. 03	147	Hook	Telefonaktiebolaget LM Ericsson	Sweden	Group antenna with narrower side lobes in the horizontal	Arrays
Jun. 03	178	Johannisson	Telefonaktiebolaget LM Ericsson	Sweden	Dual-polarized antenna	Microstrip antennas
Jun. 03	177	Stjernman	Telefonaktiebolaget LM Ericsson	Sweden	Arrangement related to antennas and a method of..	Reflectors
Feb. 03	161	Hellsten	Totalforsvarets Forskninginstitut	Sweden	SAR radar system	Radars
Jun. 03	179	Falk		Sweden	Tunable antenna	Waveguide antennas
Feb. 03	158	Petersson		Sweden	Antenna of waveguide type for receiving satellite signals	Waveguide antennas
Oct. 03	142	Junod	Logitech Europe	Switzerland	Loop antenna parasitics reduction technique	Wire antennas
Jun. 03	178	Johnson	Tyco Electronics Logistics	Switzerland	Wide beamwidth ultra-compact antenna with multiple po	Multiple polarization anten
Aug. 03	110	Fitz	Radiant Networks PLC	United Kingdom	Transmitter, receiver and transreceiver apparatus	
Aug. 03	105	Leisten		United Kingdom	Antenna	Wire antenna

Table 2: Sample of the analysis and classification of patents.

A further, more detailed and accurate analysis was later conducted on the DB obtained by analyzing the EP database, by classifying the 1315 entries by the country of the applicant; in case (although not very frequent: only 70 cases, slightly more than 5%) of more than one applicant, it has been selected the first applicant listed in the EP DB. In this analysis it can be clearly seen that the majority (more than 58%) of the European patents is... non-European. This value can be compared with the USPTO database, where EU patents are around 18%: in EU is much larger, but still less than half. In antenna field, the largest number of European patents of the database is held by Japan and US, approximately at the same level (around 300), followed at large distance by Germany, with about half of the patents of each of them. In this analysis have been considered “European” those countries belonging, at least in part, to the European continent (as Russia), or not in Europe but considered in the “European space”, i.e. participating to EU programs, etc. (as Israel). The inclusion of such countries, however, is not particularly significant for the numbers. Among the European countries, the most active in the antenna patent activity are Germany, France and Sweden. These results confirm the preliminary search, and are reported in Figs.3-4 and Table 3.

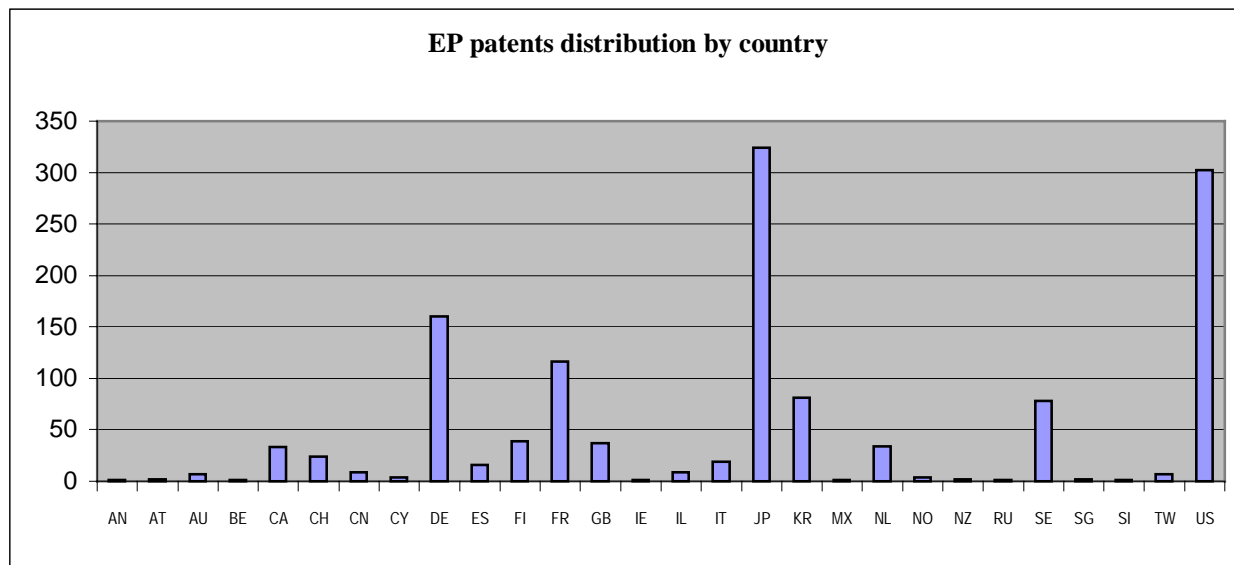


Fig. 3: distribution of European patents by country.

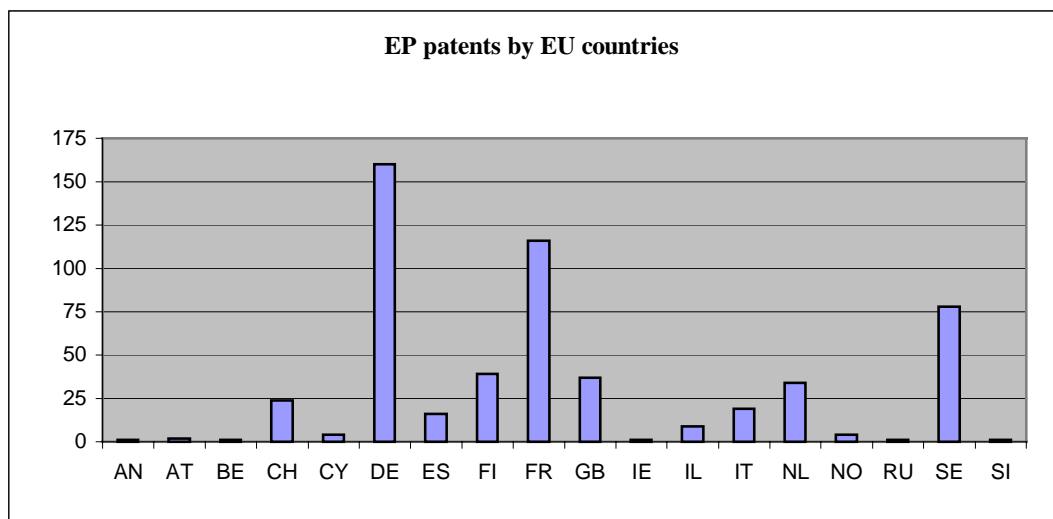


Fig. 4: distribution of European patents among EU countries.

It can also be seen that the applicants are essentially companies, or research centers, or single individuals. Only 10 (ten!) among the 1315 patents (from 411 applicants) are from universities (10 patents from 10 different universities, of which 5 are European). Also here, the percentage around 1% confirms the preliminary analysis. Of course, the number of University professors among the inventors is somewhat higher, but often their invention is not granted to their University. The reasons may be different (results obtained under contract with a company, characteristics of the country legislation, etc.), however it seems



clear that the policy of the universities, at least in the antenna area, is a lack of interest in patenting their results.

country	partial	cumulative	NON EU.
AN	1	1	
AT	2	3	
AU	7	10	7
BE	1	11	
CA	33	44	33
CH	24	68	
CN	9	77	9
CY	4	81	
DE	160	241	
ES	16	257	
FI	39	296	
FR	116	412	
GB	37	449	
IE	1	450	
IL	9	459	
IT	19	478	
JP	324	802	324
KR	81	883	81
MX	1	884	1
NL	34	918	
NO	4	922	
NZ	2	924	2
RU	1	925	
SE	78	1003	
SG	2	1005	2
SI	1	1006	
TW	7	1013	7
US	302	1315	302
	<b>1315</b>		<b>768</b>

Table 3: distribution of European patents by country.

## 2.2 Overlapping between scientific literature and patents

If we consider the previous result of a negligible presence of universities in registering patents, and we compare it with the known fact that, conversely, the share of universities in the scientific literature, in particular in the antenna area, is very high, this can give an immediate idea of how low is “degree of overlap” between patents and scientific literature.

To get quantitative data, the entries of the above mentioned database have been used to search for publications on similar subjects, by the same authors, in the scientific literature, in particular in the IEEE database (IEEE-Xplore), that includes the most important scientific journals, as well as the most popular and attended international conferences, on antennas. The search was also extended to Internet, through Google, combining name of inventors, applicants, keywords, that has allowed in several cases to find additional references to the patented work.

From the above mentioned reasons, due to the particular interest of this analysis, the search has been limited to the European inventions (i.e. about 42% of the database).

The search criteria have been the following, rating DB entries at different levels.

- A. Existence of papers by the same inventors or group on the same, or very similar, subject; this indicates that the inventors present their activity also to the scientific community.
- B. Existence of papers by the same inventors or group on different subjects: this is an indicator of how the inventors are interested in publishing their results;
- C. none of the above, but mention in Internet of the activity of the inventor and of the company (e.g. with patent applications out of Europe);
- D. no presence in Internet of such activities.

As a result, it has been seen that about 1/3 of the inventors are also authors of journal papers, or conference papers, but often related to topics other than their patent activity, or to different periods of their work (sometimes with other companies); the correspondence between the patents and the scientific literature (journal papers, conference papers) is limited to not much more than 10%.

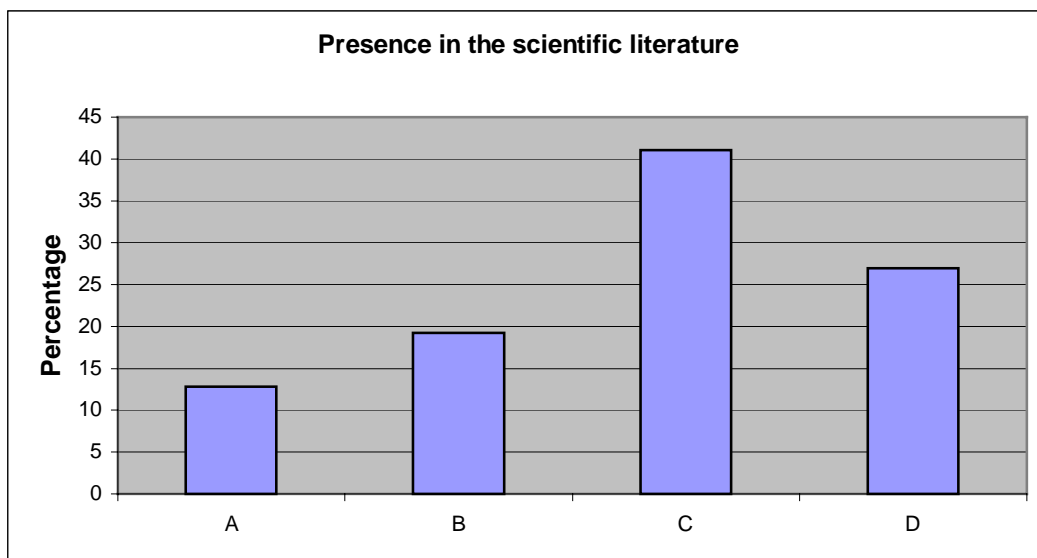


Fig.5: Presence of patents or authors in the scientific literature.

### 3 CONCLUSIONS

The analysis reported in this document has confirmed the original feeling that the world of the scientific literature and that of patents and intellectual property protection and exploitation are very far apart and not communicating. It has been shown that it is true that the academic community looks preferably towards journal/conference publications as a mean of scientific success, disregarding the patent activity. On the other side, sometimes patent activity seems not to be aware of the existing scientific literature, and often a large part of the scientific content of patents does not have a further publication, also because its scientific importance is not very high. However, authors of scientific publication must consider the increasing importance of the IP protection, because nowadays patents are granted not only to “physical objects”, but also to algorithms and software. The improvement of the current patent situation in this area, that sees Europe, even in its entirety, in a weaker position with respect to its main world competitors (Japan, US) should be considered carefully, and could be one of the tasks of a future European Antenna association.