

An Analysis of the  
Effect of IEEE  
Publications on the  
STMicroelectronics N.V.  
Patent Portfolio

Prepared by IEEE for  
STMicroelectronics N.V.

Based on a study conducted  
by CHI Research, Inc.



# An Analysis of the Effect of IEEE Publications on the STMicroelectronics N.V. Portfolio

## Executive Summary

### Introduction – Today's Patents Cite Scientific Literature

In 2003, the IEEE commissioned CHI Research Inc., a worldwide leader in intellectual property consulting, to analyze how IEEE-published information influences patents in today's top technologies. According to the studies, patents issued by the U.S. Patent office are citing scientific literature, primarily IEEE information, more than ever before. CHI found that patents today are based on the fundamental source – scientific and technical literature, representing a shift from just 20 years ago when patents issued in information technology cited primarily previous patents. In the study, CHI also identified the top 25 patenting organizations in 2002. See Figure 1.

**Figure 1: Top 25 Patenting Firms in 2002**

Rank	Company Name	#US Patents
1	IBM	3334
2	Canon Inc	1937
3	NEC Corporation	1920
4	Hitachi Ltd	1882
5	Micron Technology	1851
6	Matsushita Electric	1712
7	General Electric	1681
8	Sony Corporation	1601
9	Samsung Group	1563
10	Mitsubishi Electric	1474
11	Hewlett-Packard Co.	1391
12	Fujitsu Limited	1368
13	Siemens AG	1357

Rank	Company Name	#US Patents
14	Toshiba Corporation	1352
15	Philips Electronic N.V.	1276
16	Advanced Micro Devices	1152
17	Intel Corp	1088
18	Fuji Photo Film Co Ltd	1010
19	Lucent Technologies	818
20	Robert Bosch GmbH	800
21	Motorola Inc	778
22	Ericsson (LM) Telephone	767
23	Texas Instruments Inc.	744
24	Eastman Kodak Co	706
25	Honda	703

### IEEE is the Science Base for the Top Patenting Organizations

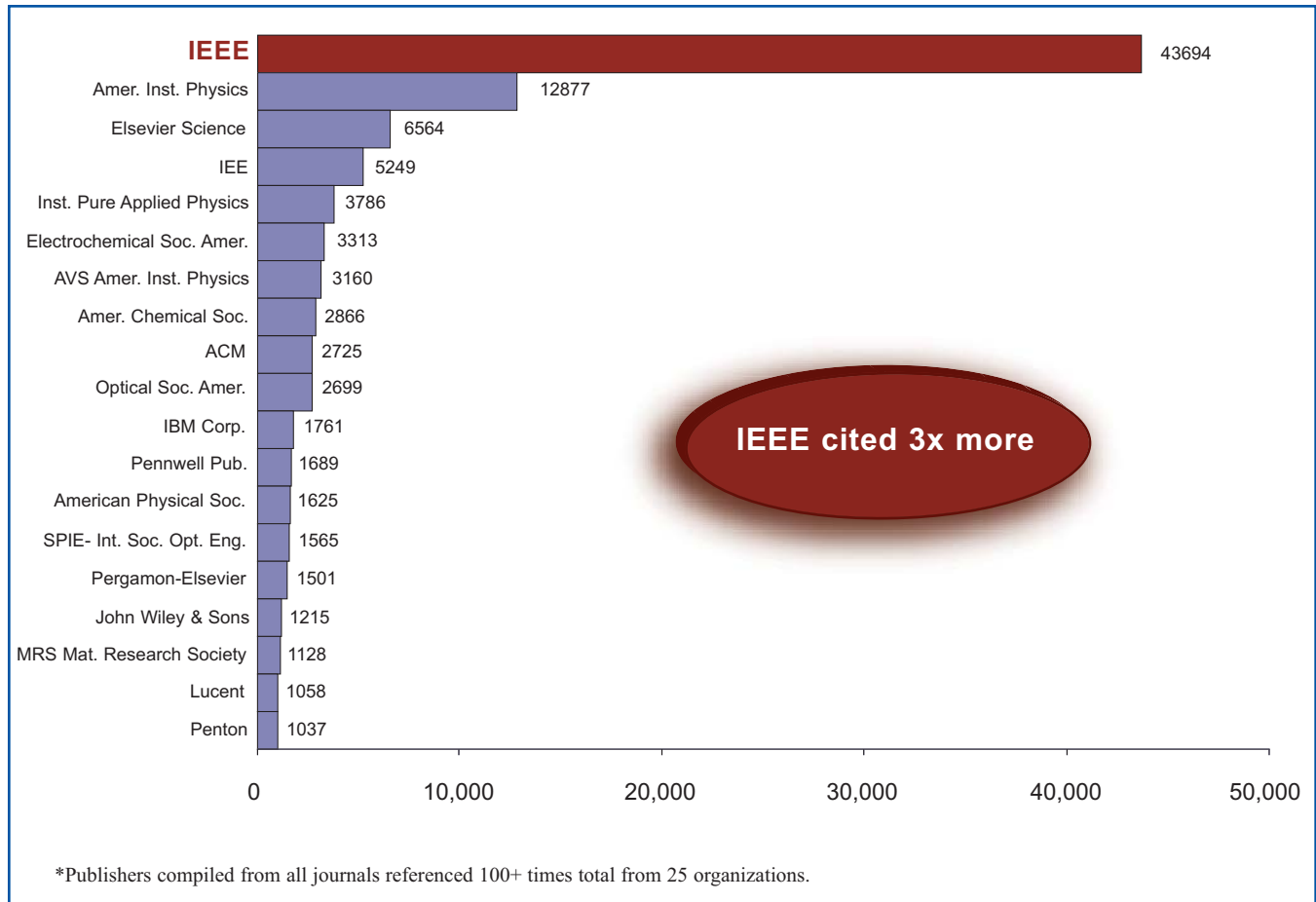
The analysis of the top 25 patenting organizations revealed that IEEE-published science was cited more often than that of other scholarly and commercial publishers:

- 38% of all science references from the patents of the top 25 patenting organizations go to articles that appear in IEEE journals. This is more than three times as many references to the second place publisher. See Figure 2.
- The results become even more impressive when we look at specific subcategories of patents.
  - Telecom: 58% of all science references come from IEEE
  - Computer hardware: 55% of all science references come from IEEE
  - Computer software: 45% of all science references come from IEEE
  - Semiconductors: 22% of all science references come from IEEE
  - Optics: 21% of all science references come from IEEE (see Report B: "Analysis of References to IEEE Articles from Patents in 5 Technology Areas," 23 March, 2004)
- Referencing to IEEE articles in patents has increased 267% in the last decade.

*Continued on page 2...*

- CHI has documented that high patent citation rankings for an organization have been shown to be associated with increases in sales, profits, and stock price. Technology that builds upon IEEE science is likely to be of more value than peer technology not built on IEEE science. Patents that reference the IEEE are cited more often than patents that do not reference IEEE.
- The most highly cited patents build on IEEE science. There are more than 1,000 highly cited patents, which CHI calls "blockbuster" patents, that reference at least three IEEE articles (see Report B: "Analysis of References to IEEE Articles from Patents in 5 Technology Areas," 23 March, 2004).

**Figure 2: Number of Patent References from Top 25 Patenting Organizations to Top Publishers\***



## STMicroelectronics is One of the Top 50 Patenting Firms That Cites IEEE Science

CHI Research also analyzed the top patenting organizations that reference IEEE most in several key technology categories. STMicroelectronics N.V. was identified as one of the top 50 firms with patent citations to IEEE published science in the following technology areas during the time period of 1983 to 2003:

Technology Category	Number of STMicroelectronics N.V. Patent Science References to IEEE	Total Number of STMicroelectronics N.V. Patent Science References	Percentage of STMicroelectronics N.V. References to IEEE
Computer Hardware	284	438	65%
Semiconductors	371	988	38%

Technology Category	Number of STMicroelectronics N.V. Patent Science References to IEEE	Total Number of STMicroelectronics N.V. Patent Science References	Percentage of STMicroelectronics N.V. References to IEEE
Software	62	112	55%
Telecommunications	178	289	62%

## STMicroelectronics "Blockbuster" Patents Are Based on IEEE Science

The CHI report demonstrates that high citation rates are correlated with high impact patents. High patent citation rankings for an organization have been shown to be associated with increases in sales, profits, and stock price. There are more than 1000 highly cited patents that are based on IEEE science. The analysis finds that the following STMicroelectronics patent is both highly cited and extensively references IEEE articles:

STMicroelectronics N.V. Patent Name	Patent No.	IEEE Refs	Cites received	Expected citations	Citation index*
Digital-to-analog converting device and method	06329941	4	5	1.39	3.60

\*Examples pulled from list of the top 1000 patents in terms of citation index among those with at least 4 citations and at least 3 references to IEEE papers. Citation index is the number of citations divided by the expected citations; expected citations are the average number of citations for all patents in the same technology class and age.

## Conclusions

The data presented here demonstrates the value of IEEE information to technological innovation for the top patenting organizations. Patents today are citing scientific literature, primarily IEEE information, more than ever before. This new analysis of the top patenting organizations revealed that IEEE-published science was cited more often than that of other scholarly and commercial publishers and the most innovative "blockbuster" patents build on IEEE science, demonstrating that IEEE is the science base for the top patenting organizations.

## **About CHI Research Inc., the company BusinessWeek called "A Search Engine For Tech Prospectors"**

CHI Research, Inc. is a highly focused research consultancy internationally recognized for its leadership in the development and analysis of technology and science indicators. Formed in 1968, CHI pioneered the development of science and technology citation analysis. Working with the U.S. National Science Foundation, CHI developed the first national-scale bibliometric indicators of scientific performance in the early 1970s. Since then, CHI has produced all the literature-to-literature, patent-to-literature and patent-to-patent citation indicators ever used in the congressionally mandated Science and Engineering Indicators reports published by the U.S. National Science Board.

## **About IEEE**

The IEEE is the world's largest technical professional society with approximately 360,000 members in 170 countries. Through its members, the IEEE is a leading authority on areas ranging from aerospace, computers and telecommunications to biomedicine, electric power and consumer electronics. The IEEE produces 30 percent of the world's literature in the electrical and electronics engineering and computer science fields, and has developed more than 900 active industry standards. The organization also sponsors or cosponsors more than 300 international technical conferences each year. Additional information is available at [www.ieee.org](http://www.ieee.org).

## **For more information,**

- Read the enclosed CHI Studies:
  - Report A: "The Effect of IEEE Publications on Subsequent Patented Technology," 29 July, 2003.
  - Report B: "Analysis of References to IEEE Articles from Patents in 5 Technology Areas," 23 March, 2004.
- Contact Karen Hawkins, IEEE Senior Marketing Manager, at [k.hawkins@ieee.org](mailto:k.hawkins@ieee.org).

## Top 50 Organizations That Cite IEEE in Computer Hardware Patents

Organization	# IEEE Refs	# Total Science Refs	% IEEE Refs	Top Referenced Publisher	Second Most Referenced Publisher	# Refs	% Refs
1 IBM	1526	3549	43.0	IEEE	IBM CORP	229	6.5
2 Texas Instruments Incorporated	966	1558	62.0	IEEE	IEE	104	6.7
3 Mitsubishi Electric Corp	598	970	61.6	IEEE	INST PURE APPLIED PHYSICS	45	4.6
4 Micron Technology, Inc.	572	1092	52.4	IEEE	AMER INST PHYSICS	106	9.7
5 Toshiba Corporation	519	1066	48.7	IEEE	AMERICAN PHYSICAL SOC	65	6.1
6 Motorola Inc	489	805	60.7	IEEE	MILLER FREEMAN	93	11.6
7 Hitachi Ltd	457	1143	40.0	IEEE	AMER INST PHYSICS	66	5.8
8 NEC Corporation	447	801	55.8	IEEE	AMER INST PHYSICS	33	4.1
9 Lucent Technologies	434	835	52.0	IEEE	IEE	40	4.8
10 LSI Logic Corp.	425	632	67.2	IEEE	ELSEVIER SCIENCE	27	4.3
11 Hewlett-Packard Company	414	1107	37.4	IEEE	ACM	84	7.6
12 Intel Corp	382	567	67.4	IEEE	ACM	26	4.6
13 Seagate Technology	374	552	67.8	IEEE	AMER INST PHYSICS	61	11.1
14 Advanced Micro Devices Inc.	332	824	40.3	IEEE	CMP MEDIA	179	21.7
15 Matsushita Electric Industrial Co Ltd	308	759	40.6	IEEE	ELSEVIER SCIENCE	46	6.1
16 Koninklijke Philips Electronics N.V.	307	656	46.8	IEEE	PHILIPS CO	29	4.4
17 Fujitsu Limited	288	629	45.8	IEEE	AMER INST PHYSICS	26	4.1
18 STMicroelectronics N.V.	284	438	64.8	IEEE	IEE	21	4.8
19 Pioneer Corp	270	569	47.5	IEEE	OPTICAL SOC AMER	40	7.0
20 Seiko Epson Corporation	258	460	56.1	IEEE	ACM	31	6.7
21 Rambus Inc.	255	363	70.2	IEEE	PENTON	18	5.0
22 Siemens AG	241	543	44.4	IEEE	ELSEVIER SCIENCE	30	5.5
23 Cadence Design Systems, Inc.	241	438	55.0	IEEE	PENTON	31	7.1
24 Sony Corporation	228	479	47.6	IEEE	SOC MOTION PICTURE TV ENG INC	36	7.5
25 Cirrus Logic Inc.	205	307	66.8	IEEE	PENTON	22	7.2
26 General Electric Co	201	429	46.9	IEEE	OPTICAL SOC AMER	17	4.0
27 Sun Microsystems Inc	165	422	39.1	IEEE	ACM	73	17.3
28 Canon Inc	162	847	19.1	IEEE	AMER INST PHYSICS	144	17.0
29 Altera Corp.	146	346	42.2	IEEE	PENTON	79	22.8
30 Xerox Corporation	145	535	27.1	IEEE	SPIE-INT SOCIETY OPTICAL ENG	36	6.7
31 National Semiconductor Corporation	144	258	55.8	IEEE	PENTON	12	4.7
32 Eastman Kodak Co	134	392	34.2	IEEE	AMER INST PHYSICS	30	7.7
33 Synopsys Inc	127	165	77.0	IEEE	IEE	8	4.8
34 Komag Inc.	120	237	50.6	IEEE	AMER INST PHYSICS	73	30.8
35 Sharp Corporation	116	365	31.8	IEEE	INST PURE APPLIED PHYSICS	37	10.1
36 Microsoft Corp	112	386	29.0	IEEE	ACM	25	6.5
37 Samsung Group	112	257	43.6	IEEE	CMP MEDIA	34	13.2
38 Caterpillar Inc	103	187	55.1	IEEE	INDERSCIENCE ENTERPRISES LTD	12	6.4
39 Raytheon Company	99	201	49.3	IEEE	OPTICAL SOC AMER	17	8.5
40 Unisys Corp	98	202	48.5	IEEE	ACM	19	9.4
41 MIT/Mass Inst of Technology	95	387	24.5	IEEE	ELSEVIER SCIENCE	27	7.0
42 Xilinx Inc	81	142	57.0	IEEE	ACM	8	5.6
43 Microelectronics & Co	78	191	40.8	IEEE	AMER INST PHYSICS	27	14.1
44 Cypress Semiconductor Corp	75	99	75.8	IEEE	IECE	4	4.0
45 Sandisk Corp	72	107	67.3	IEEE	IECE	6	5.6
46 California Inst of Technology	72	163	44.2	IEEE	AMER INST PHYSICS	15	9.2
47 Analog Devices Inc	67	96	69.8	IEEE	IEE	6	6.3
48 Quantum Corp.	65	118	55.1	IEEE	IBM CORP	18	15.3
49 Hynix Semiconductor Inc.	63	75	84.0	IEEE	ACM	2	2.7
50 Honeywell Inc	61	126	48.4	IEEE	AMER INST PHYSICS	17	13.5

Note: The Table Above Represents Data Collected From 1983-2003

## Top 50 Organizations That Cite IEEE in Semiconductors Patents

Organization	# IEEE Refs	# Total Science Refs	% IEEE Refs	Top Referenced Publisher	Second Most Referenced Publisher	# Refs	% Refs
1 Micron Technology, Inc.	1296	4003	32.4	IEEE	AMER INST PHYSICS	605	15.1
2 Lucent Technologies	928	4148	22.4	AMER INST PHYSICS	IEEE	928	22.4
3 Mitsubishi Electric Corp	658	2035	32.3	IEEE	AMER INST PHYSICS	466	22.9
4 Texas Instruments Incorporated	608	2760	22.0	IEEE	AMER INST PHYSICS	525	19.0
5 IBM	581	2959	19.6	AMER INST PHYSICS	IEEE	581	19.6
6 NEC Corporation	506	1865	27.1	IEEE	AMER INST PHYSICS	426	22.8
7 Toshiba Corporation	493	1812	27.2	IEEE	AMER INST PHYSICS	340	18.8
8 Motorola Inc	395	1415	27.9	IEEE	AMER INST PHYSICS	209	14.8
9 STMicroelectronics N.V.	371	988	37.6	IEEE	ELECTROCHEMICAL SOC INC	179	18.1
10 Fujitsu Limited	360	1563	23.0	AMER INST PHYSICS	IEEE	360	23.0
11 Siemens AG	345	1395	24.7	IEEE	AMER INST PHYSICS	215	15.4
12 National Semiconductor Corporation	284	573	49.6	IEEE	AMER INST PHYSICS	54	9.4
13 Advanced Micro Devices Inc.	279	762	36.6	IEEE	ELECTROCHEMICAL SOC INC	96	12.6
14 General Electric Co	260	1100	23.6	IEEE	AMER INST PHYSICS	207	18.8
15 Hitachi Ltd	256	1402	18.3	AMER INST PHYSICS	IEEE	256	18.3
16 MIT/Mass Inst of Technology	237	1510	15.7	AMER INST PHYSICS	IEEE	237	15.7
17 Matsushita Electric Industrial Co Ltd	236	1275	18.5	AMER INST PHYSICS	IEEE	236	18.5
18 Koninklijke Philips Electronics N.V.	214	873	24.5	IEEE	AMER INST PHYSICS	111	12.7
19 Sharp Corporation	194	1210	16.0	AMER INST PHYSICS	IEEE	194	16.0
20 Raytheon Company	192	999	19.2	AMER INST PHYSICS	IEEE	192	19.2
21 Hewlett-Packard Company	179	860	20.8	AMER INST PHYSICS	IEEE	179	20.8
22 Canon Inc	177	1822	9.7	AMER INST PHYSICS	ELSEVIER SCIENCE	261	14.3
23 Xerox Corporation	161	1038	15.5	AMER INST PHYSICS	IEEE	161	15.5
24 US Navy	143	1121	12.8	AMER INST PHYSICS	IEEE	143	12.8
25 Northrop Grumman Corporation	141	710	19.9	AMER INST PHYSICS	IEEE	141	19.9
26 Nortel Networks Corp	138	380	36.3	IEEE	AMER INST PHYSICS	86	22.6
27 Vishay Intertechnology, Inc.	137	216	63.4	IEEE	PERGAMON-ELSEVIER	14	6.5
28 JDS Uniphase Corp	126	441	28.6	IEEE	AMER INST PHYSICS	106	24.0
29 Honeywell Inc	126	443	28.4	IEEE	AMER INST PHYSICS	88	19.9
30 Sumitomo Electric Industries Ltd	125	969	12.9	AMER INST PHYSICS	ELSEVIER SCIENCE	135	13.9
31 University of California	122	1040	11.7	AMER INST PHYSICS	ELSEVIER SCIENCE	121	11.6
32 North Carolina State University	119	760	15.7	AMER INST PHYSICS	IEEE	119	15.7
33 Semiconductor Energy Laboratory Co Ltd	118	1984	5.9	AMER INST PHYSICS	ELSEVIER SCIENCE	300	15.1
34 US Air Force	117	409	28.6	IEEE	AMER INST PHYSICS	95	23.2
35 LSI Logic Corp.	107	306	35.0	IEEE	AMER INST PHYSICS	57	18.6
36 Samsung Group	106	279	38.0	IEEE	AMER INST PHYSICS	30	10.8
37 British Telecommunications PLC	105	528	19.9	IEE	IEEE	105	19.9
38 Thales Group	102	360	28.3	IEEE	AMER INST PHYSICS	80	22.2
39 US DOE	101	690	14.6	AMER INST PHYSICS	IEEE	101	14.6
40 General Motors Corporation	101	564	17.9	AMER INST PHYSICS	IEEE	101	17.9
41 Hynix Semiconductor Inc.	100	251	39.8	IEEE	AMER INST PHYSICS	34	13.5
42 ABB Asea Brown Boveri	99	246	40.2	IEEE	AMER INST PHYSICS	35	14.2
43 Intel Corp	96	370	25.9	IEEE	ELECTROCHEMICAL SOC INC	73	19.7
44 France Telecom	95	320	29.7	IEEE	AMER INST PHYSICS	85	26.6
45 Sony Corporation	92	404	22.8	AMER INST PHYSICS	IEEE	92	22.8
46 Eastman Kodak Co	90	330	27.3	IEEE	AMER INST PHYSICS	83	25.2
47 Taiwan Semiconductor Mfg. Co. Ltd.	88	192	45.8	IEEE	ELECTROCHEMICAL SOC INC	35	18.2
48 Alcatel	85	258	32.9	IEEE	IEE	67	26.0
49 Stanford University	82	542	15.1	AMER INST PHYSICS	IEEE	82	15.1
50 Nippon Telegraph and Telephone Corp.	81	453	17.9	AMER INST PHYSICS	IEEE	81	17.9

Note: The Table Above Represents Data Collected From 1983-2003

## Top 50 Organizations That Cite IEEE in Software Patents

Organization	# IEEE Refs	# Total Science Refs	% IEEE Refs	Top Referenced Publisher	Second Most Referenced Publisher	# Refs	% Refs
1 IBM	1389	4593	30.2	IEEE	ACM	688	15.0
2 Lucent Technologies	784	1725	45.4	IEEE	ACM	150	8.7
3 Hewlett-Packard Company	631	2395	26.3	IEEE	ACM	346	14.4
4 Microsoft Corp	418	1670	25.0	IEEE	ACM	215	12.9
5 Hitachi Ltd	331	992	33.4	IEEE	ACM	107	10.8
6 Motorola Inc	310	505	61.4	IEEE	CMP MEDIA	22	4.4
7 NEC Corporation	277	539	51.4	IEEE	ACM	37	6.9
8 Intel Corp	248	538	46.1	IEEE	ACM	56	10.4
9 Sony Corporation	219	497	44.1	IEEE	LUCENT TECHNOLOGIES	36	7.2
10 Siemens AG	217	533	40.7	IEEE	ACM	42	7.9
11 Sun Microsystems Inc	204	1291	15.8	ACM	IEEE	204	15.8
12 Xerox Corporation	204	770	26.5	IEEE	ACM	141	18.3
13 Matsushita Electric Industrial Co Ltd	203	508	40.0	IEEE	ELSEVIER SCIENCE	38	7.5
14 Fujitsu Limited	197	529	37.2	IEEE	ACM	41	7.8
15 Toshiba Corporation	192	496	38.7	IEEE	ACM	60	12.1
16 MIT/Mass Inst of Technology	173	487	35.5	IEEE	ACM	78	16.0
17 Canon Inc	173	502	34.5	IEEE	ACM	43	8.6
18 Koninklijke Philips Electronics N.V.	170	415	41.0	IEEE	ACM	31	7.5
19 Apple Computer Inc.	167	683	24.5	IEEE	ACM	92	13.5
20 Mitsubishi Electric Corp	154	383	40.2	IEEE	ELSEVIER SCIENCE	21	5.5
21 Silicon Graphics Inc.	148	647	22.9	IEEE	ACM	60	9.3
22 Ricoh Company Ltd	144	271	53.1	IEEE	ACM	20	7.4
23 Verizon Communications	143	238	60.1	IEEE	ACM	11	4.6
24 Texas Instruments Incorporated	142	321	44.2	IEEE	ACM	21	6.5
25 E I DuPont de Nemours & Co	125	212	59.0	IEEE	AMER INST CHEMICAL ENGINEERS	15	7.1
26 Ericsson (LM) Telephone Co Inc	124	232	53.4	IEEE	ACM	11	4.7
27 A T & T Corp.	111	296	37.5	IEEE	ACM	31	10.5
28 Secure Computing Corp.	110	350	31.4	ACM	IEEE	110	31.4
29 Digimarc Corp	108	330	32.7	IEEE	CMP MEDIA	28	8.5
30 Digital Voice Systems, Inc.	107	119	89.9	IEEE	IEE	1	0.8
31 General Electric Co	104	267	39.0	IEEE	ELSEVIER SCIENCE	20	7.5
32 British Telecommunications PLC	95	294	32.3	IEEE	IEE	17	5.8
33 Nortel Networks Corp	94	178	52.8	IEEE	LUCENT TECHNOLOGIES	11	6.2
34 NCR Corporation	91	252	36.1	IEEE	ACM	51	20.2
35 Alcatel	84	216	38.9	IEEE	ELSEVIER SCIENCE	16	7.4
36 Micron Technology, Inc.	82	120	68.3	IEEE	IECE	11	9.2
37 Fuji Photo Film Co Ltd	82	207	39.6	IEEE	ACM	13	6.3
38 Cray Inc.	76	118	64.4	IEEE	ACM	9	7.6
39 SRI International	75	121	62.0	IEEE	ACM	8	6.6
40 Washington University	73	237	30.8	IEEE	AMER INST PHYSICS	23	9.7
41 Sharp Corporation	71	149	47.7	IEEE	ELSEVIER SCIENCE	7	4.7
42 Dolby Labs Licensing Corp.	67	133	50.4	IEEE	AUDIO ENGINEERING SOC	23	17.3
43 LSI Logic Corp.	67	119	56.3	IEEE	ELSEVIER SCIENCE	10	8.4
					ACOUSTICAL SOC AMER		
44 University of California	66	146	45.2	IEEE	AMER INST PHYSICS	13	8.9
45 Enterasys Networks Inc.	63	161	39.1	IEEE	MILLER FREEMAN	12	7.5
					ACOUSTICAL SOC AMER		
46 Lockheed Martin Corp.	63	151	41.7	IEEE	AMER INST PHYSICS	14	9.3
47 Unisys Corp	63	193	32.6	IEEE	ACM	60	31.1
48 STMicroelectronics N.V.	62	112	55.4	IEEE	IEE	8	7.1
49 EMC Corp	58	253	22.9	IEEE	ACM	37	14.6
50 Science Applications Int'l	58	192	30.2	IEEE	ACM	35	18.2

Note: The Table Above Represents Data Collected From 1983-2003

## Top 50 Organizations That Cite IEEE in Telecommunications Patents

Organization	# IEEE Refs	# Total Science Refs	% IEEE Refs	Top Referenced Publisher	Second Most Referenced Publisher	# Refs	% Refs
1 Lucent Technologies	2349	4543	51.7	IEEE	IEE	402	8.8
2 Motorola Inc	1261	1747	72.2	IEEE	IEE	105	6.0
3 Ericsson (LM) Telephone Co Inc	1120	1741	64.3	IEEE	L M ERICSSON	84	4.8
4 Texas Instruments Incorporated	823	1010	81.5	IEEE	IEE	26	2.6
5 NEC Corporation	713	1265	56.4	IEEE	IEE	96	7.6
6 IBM	678	1325	51.2	IEEE	IBM CORP	90	6.8
7 Deutsche Telekom AG	672	861	78.0	IEEE	ELSEVIER SCIENCE	68	7.9
8 Koninklijke Philips Electronics N.V.	549	1041	52.7	IEEE	IEE	77	7.4
9 General Electric Co	511	900	56.8	IEEE	SOC MOTION PICTURE TV ENG INC	112	12.4
10 Matsushita Electric Industrial Co Ltd	503	1113	45.2	IEEE	ELSEVIER SCIENCE	64	5.8
11 Hitachi Ltd	493	1002	49.2	IEEE	ELSEVIER SCIENCE	52	5.2
12 Alcatel	472	1185	39.8	IEEE	IEE	168	14.2
13 Toshiba Corporation	463	837	55.3	IEEE	IEE	42	5.0
14 Siemens AG	423	1063	39.8	IEEE	IEE	97	9.1
15 Fujitsu Limited	412	922	44.7	IEEE	IEE	109	11.8
16 Sony Corporation	399	867	46.0	IEEE	SOC MOTION PICTURE TV ENG INC	60	6.9
17 InterDigital Communications Corp.	394	657	60.0	IEEE	LUCENT TECHNOLOGIES	37	5.6
18 Nortel Networks Corp	379	661	57.3	IEEE	IEE	45	6.8
19 Hewlett-Packard Company	362	1001	36.2	IEEE	IEE	43	4.3
20 Mitsubishi Electric Corp	339	596	56.9	IEEE	SOC MOTION PICTURE TV ENG INC	32	5.4
21 Raytheon Company	336	749	44.9	IEEE	AMER INST PHYSICS	64	8.5
22 Science Applications Int'l	316	545	58.0	IEEE	IEE	54	9.9
23 Verizon Communications	311	521	59.7	IEEE	IEE	53	10.2
24 MIT/Mass Inst of Technology	299	676	44.2	IEEE	OPTICAL SOC AMER	47	7.0
25 Analog Devices Inc	272	360	75.6	IEEE	IEE	25	6.9
26 British Telecommunications PLC	258	691	37.3	IEEE	IEE	134	19.4
27 Intel Corp	249	348	71.6	IEEE	IEE	10	2.9
28 Thomson	243	398	61.1	IEEE	ELSEVIER SCIENCE	17	4.3
29 PARKERVISION, INC.	240	534	44.9	IEEE	IEE	151	28.3
30 Thales Group	236	520	45.4	IEEE	IEE	33	6.3
31 Sprint Corp	230	329	69.9	IEEE	IEE	25	7.6
32 Advanced Micro Devices Inc.	225	391	57.5	IEEE	IEE	49	12.5
33 Canon Inc	215	871	24.7	IEEE	AMER INST PHYSICS	97	11.1
34 Qualcomm Inc	211	303	69.6	IEEE	IEE	18	5.9
35 National Semiconductor Corporation	208	303	68.6	IEEE	PENTON	21	6.9
36 A T & T Corp.	205	491	41.8	IEEE	AT&T	49	10.0
37 Altera Corp.	204	431	47.3	IEEE	ACM	61	14.2
38 STMicroelectronics N.V.	178	289	61.6	IEEE	IEE	23	8.0
39 Nippon Telegraph and Telephone Corp.	170	340	50.0	IEEE	IEE	47	13.8
40 Micron Technology, Inc.	167	299	55.9	IEEE	IBM CORP	33	11.0
41 Cirrus Logic Inc.	150	233	64.4	IEEE	IEE	23	9.9
42 Actel Corp.	149	213	70.0	IEEE	TAYLOR & FRANCIS	9	4.2
43 Northrop Grumman Corporation	146	326	44.8	IEEE	OPTICAL SOC AMER	30	9.2
44 Nokia Group	145	274	52.9	IEEE	IEE	24	8.8
45 General Motors Corporation	144	248	58.1	IEEE	AMER INST PHYSICS	11	4.4
46 Sun Microsystems Inc	134	215	62.3	IEEE	JOHN WILEY & SONS	8	3.7
47 US Navy	133	393	33.8	IEEE	AMER INST PHYSICS	53	13.5
48 Microsoft Corp	132	274	48.2	IEEE	ACM	29	10.6
49 Optex Corp.	132	173	76.3	IEEE	IBM CORP	15	8.7
50 Lockheed Martin Corp.	130	320	40.6	IEEE	AMER INST PHYSICS	40	12.5

Note: The Table Above Represents Data Collected From 1983-2003



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