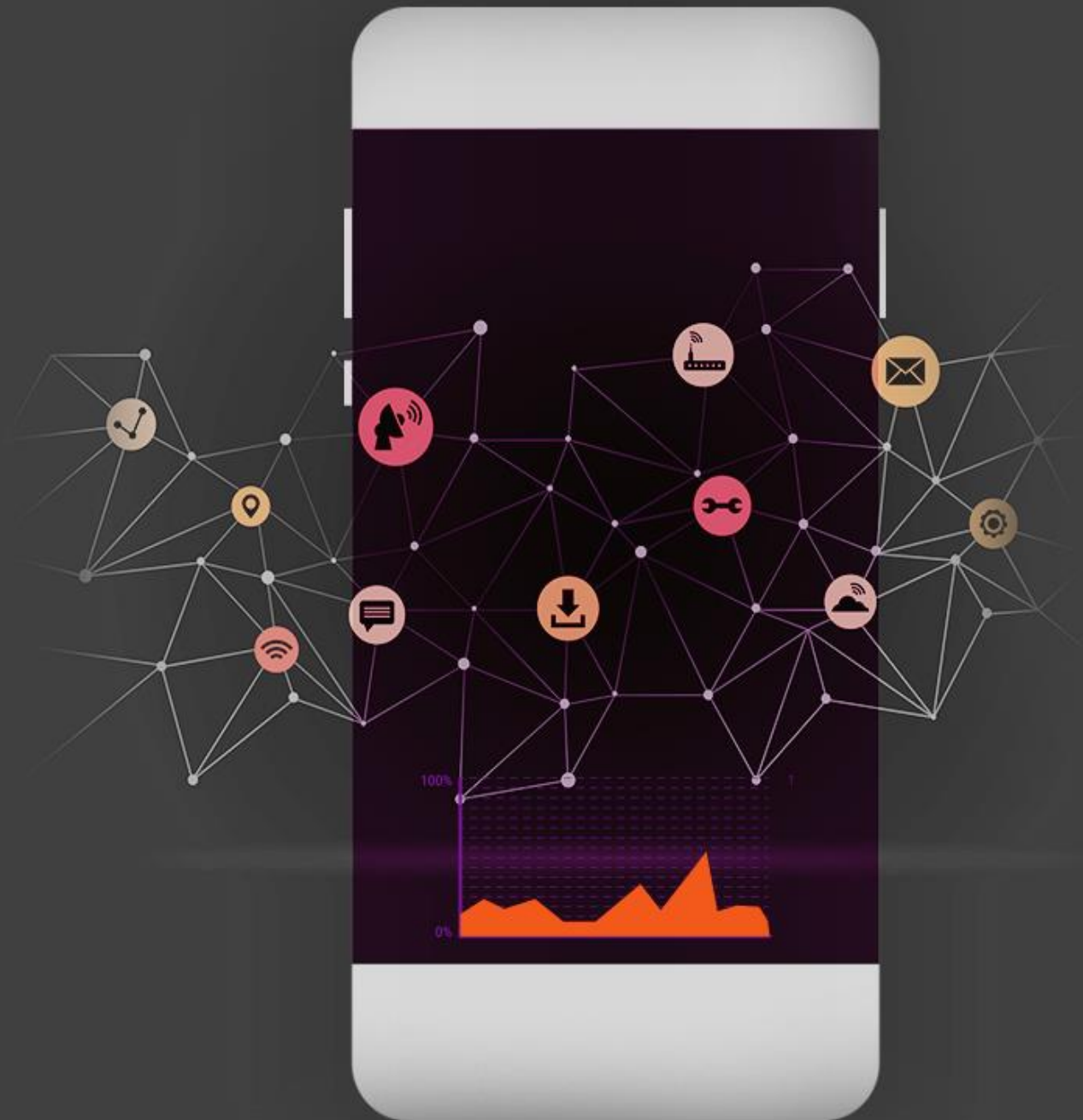


# Nokia

## Patent Portfolio Report



## Introduction

This report looks at Nokia's patent portfolio and provides analytics and insights into some of its key facets. A portfolio taxonomy is provided which is used to study the publishing trends for various sub-categories within the portfolio. The taxonomy is also used to assess the IP impact of Nokia's merger with Alcatel-Lucent.

## Portfolio Insights

We studied a total of 51448 patent applications currently in force for Nokia, of which 25485 are granted. Likewise, the numbers shown in this report are for patent applications that are currently in force. In the Taxonomy Statistics tables, the number of patent application are given for the highlighted categories.

### Portfolio Growth

The publishing trends in the last ten years have been relatively flat. The number of patents published have been roughly around 3000 per year. There was a dip in the published patents in 2011. In subsequent years the number of published patents has shown a steady upward trend, all the way to the present.

### Key Technologies

The top-level technology categories include wireless networks, data transmission, data processing, signal transmission, telephonic communications and switches & relays. The portfolio shares of each of these categories are given in a following section.

### Geographical Coverage

Close to half of Nokia's patent applications cover the US and EP jurisdictions. The rest are divided among other jurisdictions worldwide, with China being the highest among them.

### Portfolio Quality

Nokia holds 3802 patent applications (7.4% portfolio share) that are "high quality" with a Relecura Star Rating of 3.0 or more out of 5.0. A chart and table showing the spread of the high quality patents among the top sub-technologies are shown in a following section.

### Forward Citing (FC) Assignees

As expected, Nokia's portfolio is heavily cited by other mobile equipment and handset manufacturers. A list of these assignees and the top technologies cited are given in subsequent sections.

### Portfolio Age

A chart showing the number of unexpired applications at the end of each year going forward, indicates a gradual decrease all the way to 2037. This chart is based on the current portfolio assets held by Nokia. It shows that Nokia's portfolio has a healthy mix of patents in terms of their priority. This coupled with patents being filed (as indicated by the upward publishing trend mentioned above) should provide Nokia with good coverage and a healthy portfolio in future years.

## Portfolio Taxonomy

We created a taxonomy of the Nokia portfolio to take a closer look at different segments within it. The taxonomy shows the patent assets held in each of the top-level categories and sub-categories. Exporting the patent numbers published in each of the past six years gives us a view of the growing and declining segments of Nokia's portfolio. For the most part the publishing trends across the various categories are flat or declining, except in wireless networks where a fair number of sub-categories show an upward trend.

## Nokia-Alcatel Merger

Nokia and Alcatel-Lucent agreed to merge in mid-2015 and have been operating as a single company since January 2016 (called "Nokia Corporation"). This stock-swap merger was seen mostly as the coming together of equals. We analyzed this merger from an IP perspective.

Alcatel-Lucent has 44193 total patent applications that are in force, of which 24951 are granted. Of these, 1212 patent applications (2.7% portfolio share) are "high quality" with a Relecura Star Rating of 3.0 or more out of 5.0.

When compared across the various categories of the taxonomy, we see that there is reasonable parity between Nokia and Alcatel-Lucent in most of them. Alcatel-Lucent however bolsters Nokia's portfolio in two areas - in switches & relays (especially optical) and routing (within data transmission).

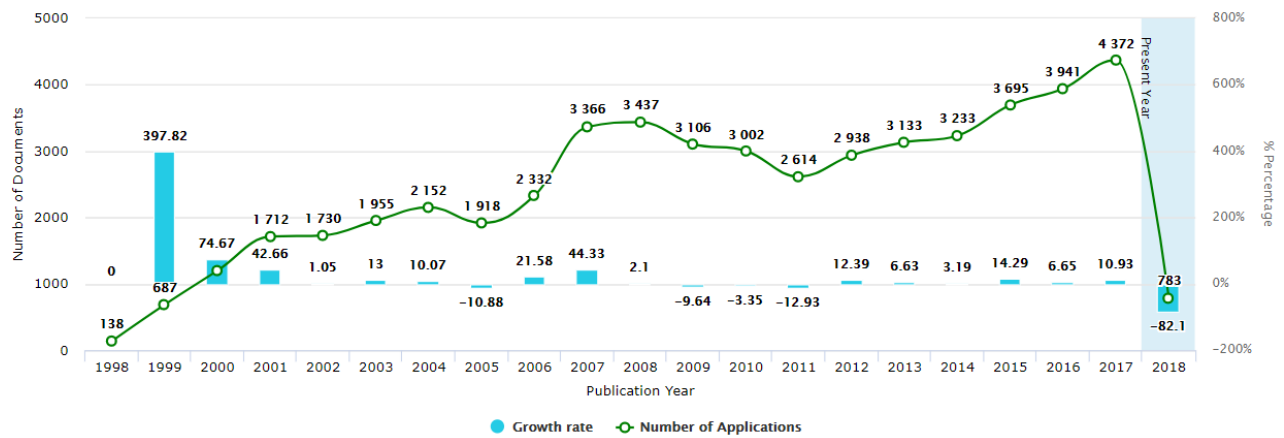
The portfolio of the combined entity also moves Nokia to a leadership position among the mobile equipment manufacturers such as Ericsson, Huawei and ZTE. This comparison is shown in the final taxonomy statistics tables.

## Conclusions

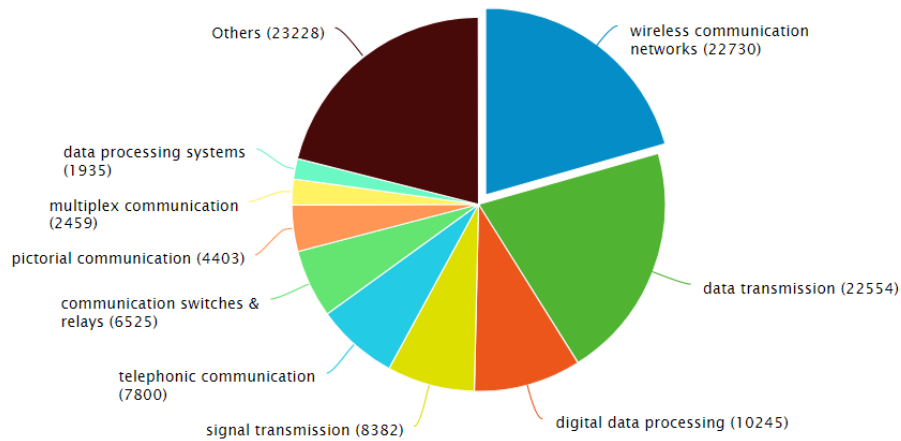
As noted above, the merger with Alcatel-Lucent brings great strength to Nokia's ability to compete in the mobile equipment space as a leader. Nokia now has access to technologies that can enable it to offer an expanded range of networking equipment and services in both wireless and wireline.

Nokia also holds many high quality patents in areas such as GSM, 3G and 4G LTE, many of which are standard-essential. Off-loading its devices division to Microsoft in 2013-2014 but holding on to its patents, significantly reduced Nokia's cross-licensing pay-outs - which it did as a handset manufacturer. It also enabled Nokia to be far more aggressive on the licensing front, as shown by the number of big-ticket licensing deals it has done in the recent past. We can expect more of same in the coming months.

## Publishing trends

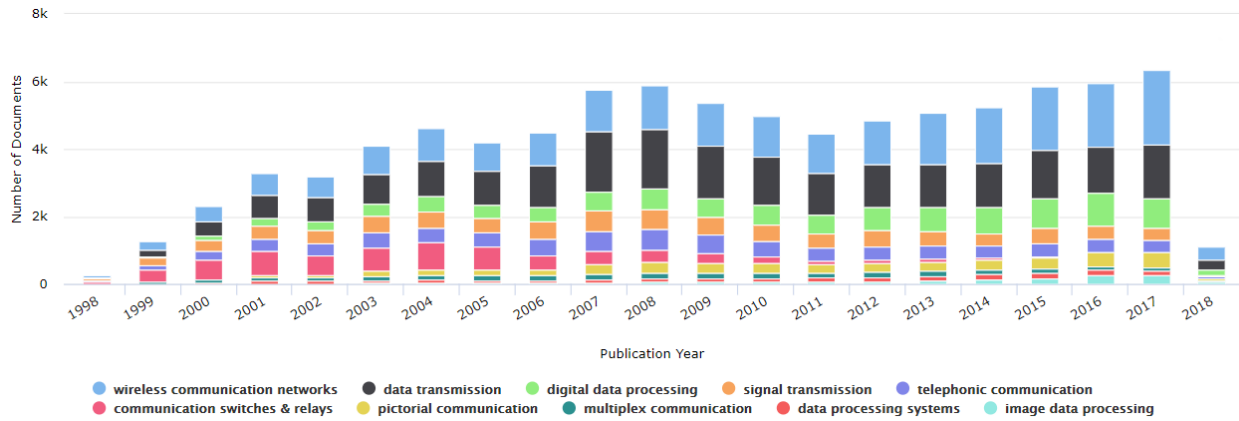


## Key Technologies

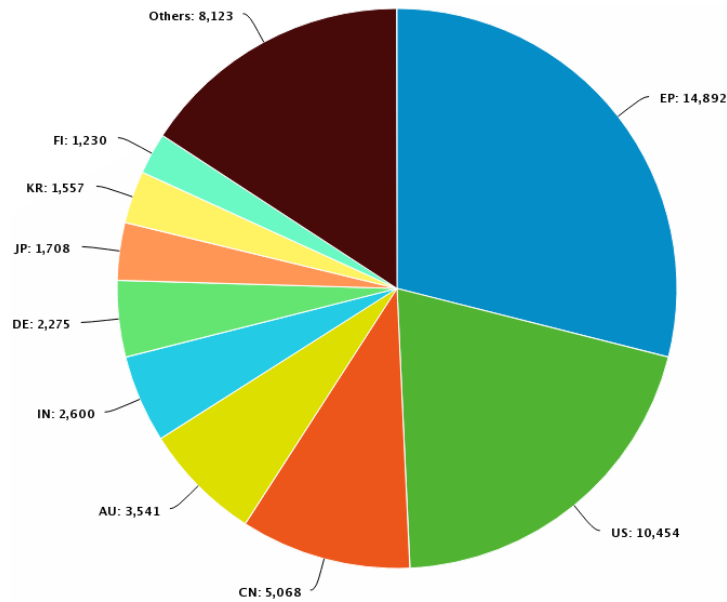


Technologies	Number of documents	Share of patent
wireless communication networks	22,730	20.61 %
data transmission	22,554	20.46 %
digital data processing	10,245	9.29 %
signal transmission	8,382	7.60 %
telephonic communication	7,800	7.07 %
communication switches & relays	6,525	5.92 %
pictorial communication	4,403	3.99 %
multiplex communication	2,459	2.23 %
data processing systems	1,935	1.75 %
Others	23,228	21.07 %

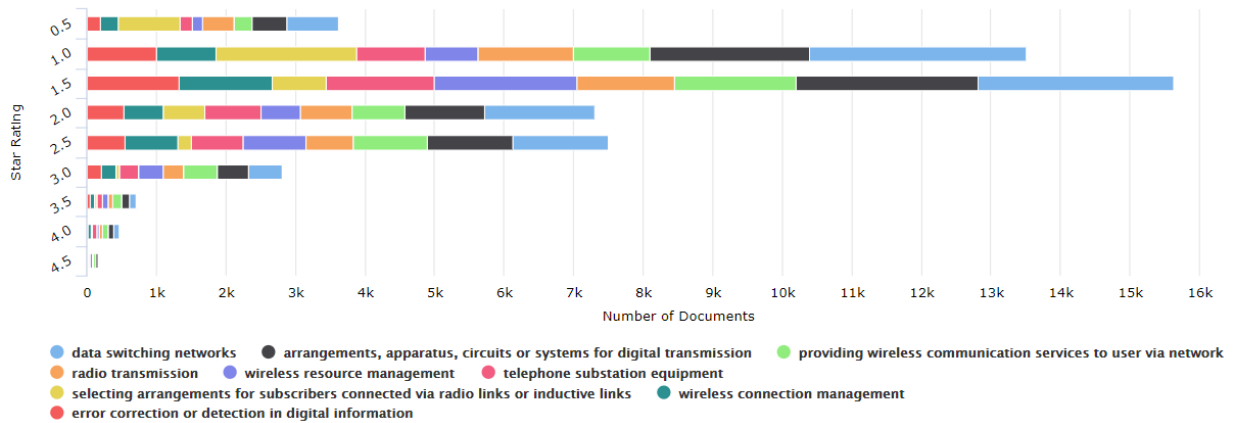
## Evolution of Key Technologies



## Key Geographies



## Patent Quality

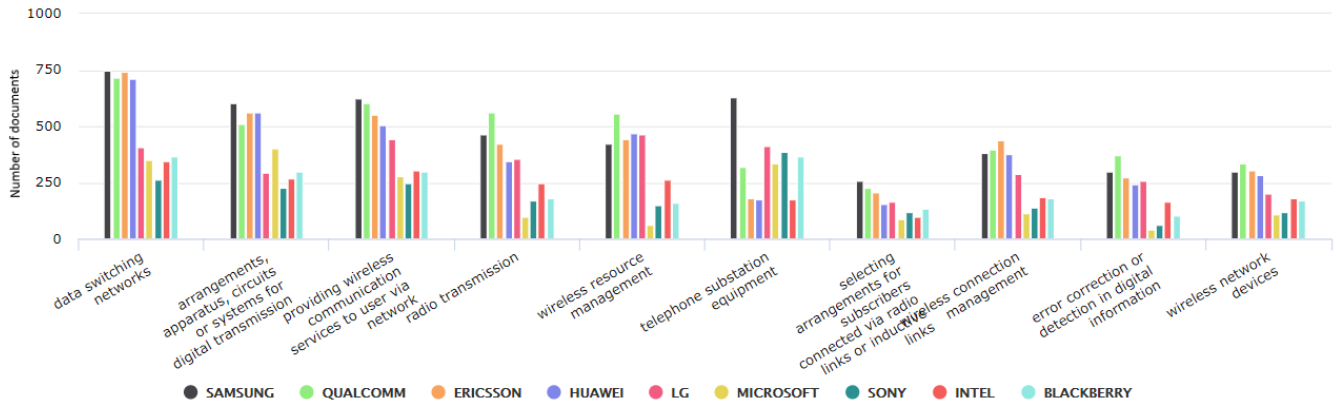


SUB TECHNOLOGIES	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5
data switching networks	740	3116	2810	1597	1362	487	109	78	29
arrangements, apparatus, circuits or systems for digital transmission	493	2293	2622	1142	1243	453	113	80	27
providing wireless communication services to user via network	265	1095	1742	754	1058	485	130	86	36
radio transmission	445	1377	1410	744	680	281	63	41	20
wireless resource management	155	767	2050	570	903	358	83	39	22
telephone substation equipment	181	971	1549	815	741	274	76	62	21
selecting arrangements for subscribers connected via radio links or inductive links	879	2030	786	589	198	53	29	19	2
wireless connection management	254	854	1337	570	761	203	62	45	19
error correction or detection in digital information	201	1002	1325	530	548	215	53	15	9
wireless network devices	267	826	1277	588	610	224	56	39	11

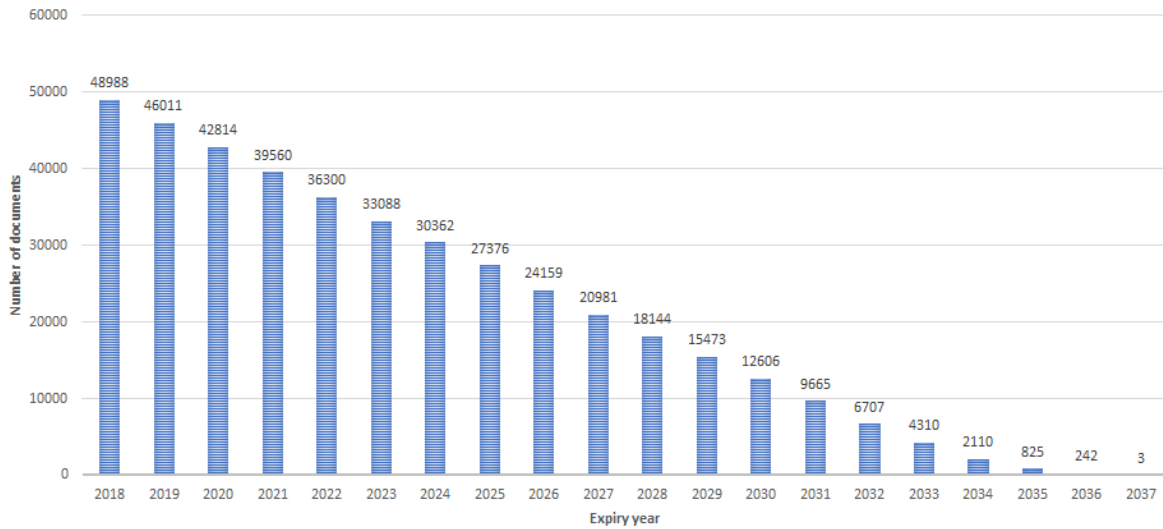
## Top Forward Citing (FC) Assignees

FC Assignee	Number of documents cited	Portfolio share
SAMSUNG	3,911	14.63%
QUALCOMM	3,468	12.97%
ERICSSON	2,660	9.95%
HUAWEI	2,611	9.77%
LG	2,397	8.97%
MICROSOFT	1,837	6.87%
SONY	1,769	6.62%
INTEL	1,748	6.54%
BLACKBERRY	1,604	6.00%

## Technologies cited by FC Assignees

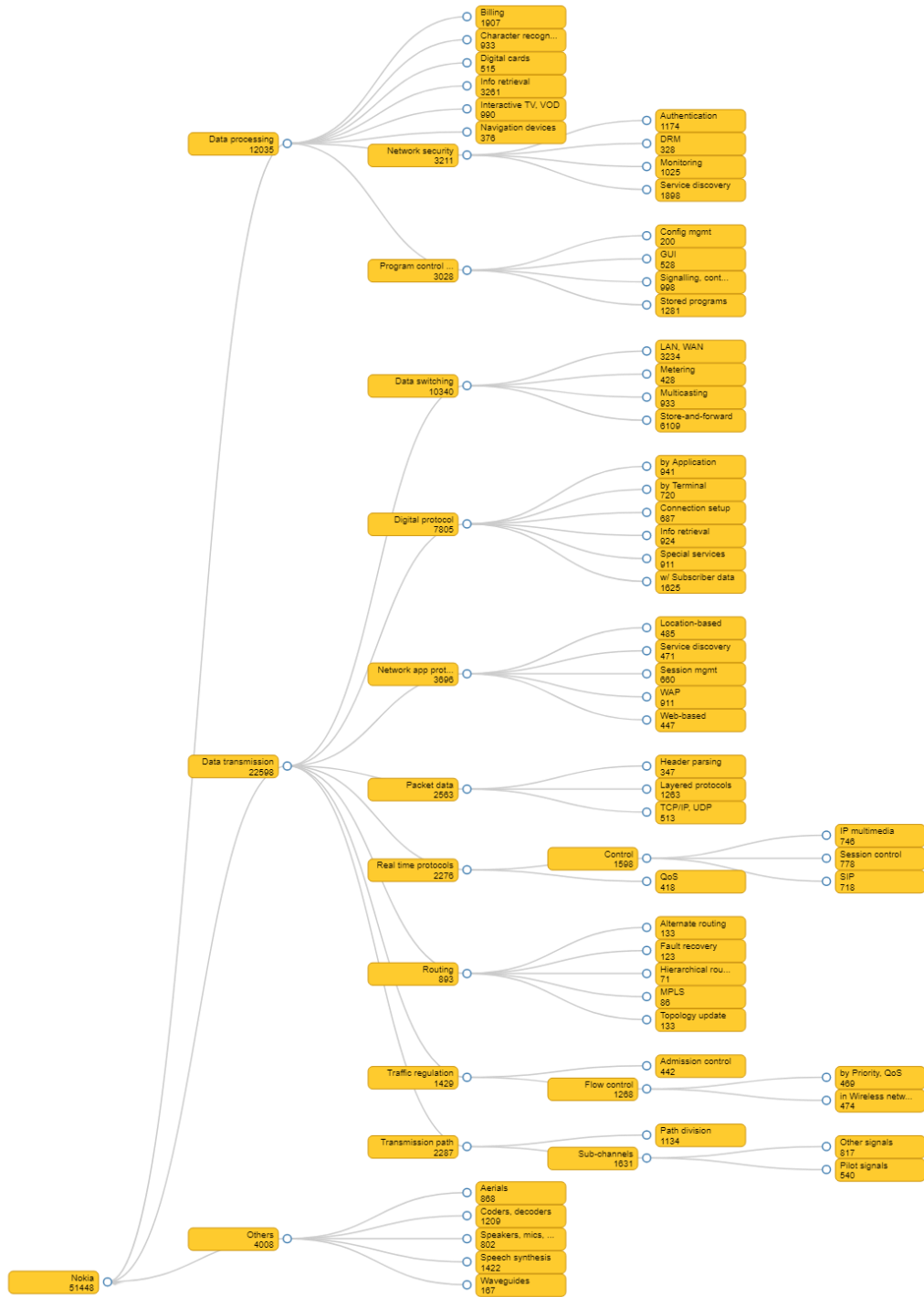


## Portfolio Age and Decay



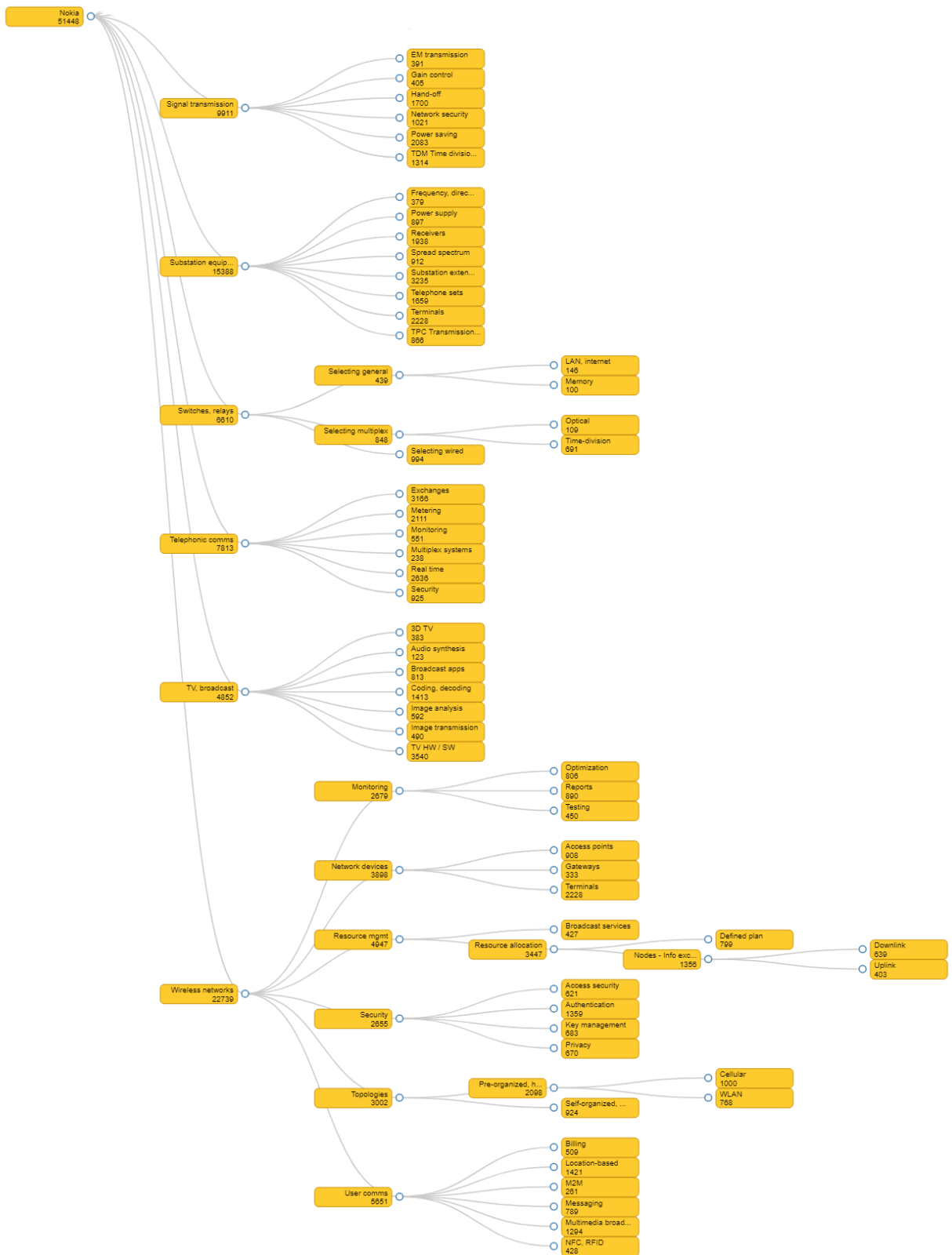
Unexpired patent applications at the end of each year based on current portfolio assets.

# Portfolio Taxonomy (1)





## Portfolio Taxonomy (2)



## Category-wise Publishing Trends (1)

Nokia - Publishing Trends (1)			2012	2013	2014	2015	2016	2017	Trendline	
Data processing	Billing		324	309	297	259	255	143		
	Character recognition		127	196	182	204	252	209		
	Digital cards		78	74	71	78	56	54		
	Info retrieval		594	626	579	551	474	313		
	Interactive TV, VOD		125	177	153	161	175	148		
	Navigation devices		65	92	95	84	89	72		
	Network security	Authentication		191	147	163	173	171	156	
		DRM		31	32	34	26	32	23	
		Monitoring		143	159	148	161	160	134	
		Service discovery		187	171	186	271	219	202	
Program control unit	Config mgmt		17	20	19	24	24	39		
	GUI		89	95	87	63	60	49		
	Signalling, control or architecture		90	79	83	101	82	64		
	Stored programs		223	218	165	139	124	106		
Data transmission	Data switching	LAN, WAN	229	154	118	117	84	104		
		Metering	31	46	48	35	31	28		
		Multicasting	96	87	67	61	49	41		
		Store-and-forward	388	179	137	132	117	97		
	Digital protocol	Alternate routing		20	22	13	22	20	20	
		Config mgmt		16	13	18	28	13	23	
		Connection setup		50	45	30	61	50	51	
		Flow control		100	76	65	91	78	100	
		Info retrieval		102	112	106	136	103	86	
		Special services		74	67	48	55	49	49	
		by Application		44	36	18	14	7	14	
		by Terminal		59	47	37	60	31	47	
		w/ Subscriber data		132	105	109	153	136	137	
	Network app protocols	Location-based		55	47	55	67	38	31	
		Service discovery		47	36	38	56	45	21	
		Session mgmt		78	57	45	57	38	41	
		WAP		49	29	29	41	23	22	
	Packet data	Web-based		46	45	38	47	48	40	
		Header parsing		23	26	19	28	23	27	
		Layered protocols		60	36	27	40	29	37	
	Real time protocols	TCP/IP, UDP		27	16	20	17	13	32	
		Control	IP multimedia	70	88	54	59	55	49	
			SIP	60	65	35	37	37	40	
			Session control	103	110	59	76	65	59	
	QoS		35	52	35	33	14	25		
	Routing	Alternate routing		14	8	3	5	5	1	
		Fault recovery		15	8	6	5	6	0	
Interdomain routing, e.g. hierarchical routing			21	7	9	4	2	6		
MPLS			7	2	5	7	0	0		
Traffic regulation	Topology update		9	6	7	11	7	20		
	Admission control		56	40	38	39	23	25		
Transmission path	Flow control	by Priority, QoS in Wireless networks	39	23	38	30	35	51		
	Path division		54	33	33	24	14	30		
Others	Sub-channels	Other signals	205	306	278	259	231	218		
		Pilot signals	143	228	214	211	176	181		
	Aerials		78	147	119	163	122	107		
	Coders, decoders		85	111	95	106	135	101		
	Speakers, mics, stereo		95	70	53	47	56	54		
Speech synthesis		150	170	166	216	214	181			
Waveguides		156	166	136	157	147	109			
			8	7	14	9	22	19		

## Category-wise Publishing Trends (2)

Nokia - Publishing Trends (2)			2012	2013	2014	2015	2016	2017	Trendline	
Signal transmission	EM transmission		53	41	36	34	57	39		
	Gain control		33	27	19	25	21	14		
	Hand-off		210	162	126	124	123	87		
	Network security		65	57	45	58	74	55		
	Power saving		193	178	151	142	136	106		
	TDM Time division multiplexer		110	80	64	55	44	39		
Substation equipment	Frequency, direction characteristics		72	83	84	106	109	104		
	Power supply		153	145	136	122	100	93		
	Receivers		160	125	123	143	119	90		
	Spread spectrum		60	66	37	16	19	16		
	Substation extension		372	391	316	297	278	215		
	TPC Transmission power control		72	82	90	99	92	63		
	Telephone sets		221	204	171	201	136	108		
Terminals		282	296	272	305	271	261			
Switches, relays	Selecting general	LAN, internet	2	2	0	0	0	0		
		Memory	0	1	0	0	0	0		
	Selecting multiplex	Optical	21	9	2	1	0	2		
		Time-division	7	3	3	2	1	0		
	Selecting wired		14	21	6	5	4	4		
TV, broadcast	3D TV		45	74	96	122	116	150		
	Audio synthesis		15	24	24	25	25	33		
	Broadcast apps		122	88	52	41	37	37		
	Coding, decoding		166	164	173	179	198	181		
	Digital interface arrangements		112	136	129	126	127	127		
	Image analysis		77	105	129	154	170	163		
	Image transmission		66	59	56	61	40	46		
	Real time		133	135	104	85	66	60		
	TV HW / SW		492	505	450	431	425	364		
Telephonic comms	Exchanges		214	195	161	115	124	114		
	Metering		186	191	192	173	165	128		
	Monitoring		50	63	52	46	43	42		
	Multiplex systems		14	6	3	2	0	2		
	Real time		203	200	161	138	135	119		
	Security		94	70	79	64	71	57		
Wireless networks	Monitoring	Optimization	97	181	158	219	233	232		
		Reports	132	212	207	258	219	207		
		Testing	48	92	100	121	129	139		
	Network devices	Access points	97	114	138	153	133	124		
		Gateways	28	32	29	37	30	33		
		Terminals	282	296	272	305	271	261		
	Resource mgmt	Broadcast services	40	55	52	44	47	45		
		Resource allocation	Defined plan	96	145	155	222	197	195	
			Info exchange between nodes	87	119	120	152	141	123	
	Security	Access security	Downlink	54	82	83	118	79	80	
			Uplink	88	85	73	104	106	93	
		Authentication	154	149	136	144	131	160		
		Key management	99	110	121	132	122	112		
	Privacy	68	67	58	68	97	70			
	Topologies	Pre-organized, hierarchical	Cellular	201	233	207	243	186	172	
			WLAN	78	95	87	146	125	143	
		Self-organized, ad hoc		145	141	125	166	143	140	
	User comms	Billing		34	47	40	30	33	23	
		Location-based		212	272	248	270	251	226	
		M2M		31	58	55	98	93	83	
		Messaging		68	67	66	64	63	30	
Multimedia broadcast			159	131	122	130	124	101		
NFC, RFID			30	61	101	140	153	134		

## Nokia, Alcatel-Lucent – Portfolio Comparison (1)

Nokia, Alcatel-Lucent Comparison (1)				Nokia	Alcatel-Lucent	
Data processing	Billing			1907	1059	
	Character recognition			933	214	
	Digital cards			515	99	
	Info retrieval			3261	1686	
	Interactive TV, VOD			990	353	
	Navigation devices			376	50	
	Network security	Authentication			1174	495
		DRM			328	102
		Monitoring			1025	556
		Service discovery			1898	1003
		Config mgmt			200	293
	Program control unit	GUI			528	77
		Signalling, control or architecture			998	617
		Stored programs			1281	1041
		LAN, WAN			3234	3366
Data transmission	Data switching	Metering		428	670	
		Multicasting		933	797	
		Store-and-forward		6109	4441	
		Alternate routing		237	225	
	Digital protocol	Config mgmt		176	188	
		Connection setup		687	123	
		Flow control		1349	758	
		Info retrieval		924	456	
		Special services		911	440	
		by Application		941	529	
		by Terminal		720	493	
	w/ Subscriber data		1625	562		
	Network app protocols	Location-based		485	184	
		Service discovery		471	186	
		Session mgmt		660	362	
WAP			911	158		
Web-based			447	259		
Packet data	Header parsing		347	205		
	Layered protocols		1263	498		
	TCP/IP, UDP		513	327		
Real time protocols	Control	IP multimedia		746	509	
		SIP		718	406	
		Session control		778	630	
	QoS		418	400		
Routing	Alternate routing		133	306		
	Fault recovery		123	373		
	Interdomain routing, e.g. hierarchical routing		71	230		
	MPLS		86	397		
	Topology update		133	323		
Traffic regulation	Admission control		442	542		
	Flow control	by Priority, QoS in Wireless networks		469	687	
Transmission path	Path division		474	295		
	Sub-channels	Other signals		1134	673	
		Pilot signals		817	320	
Others	Aerials		540	284		
	Coders, decoders		868	925		
	Speakers, mics, stereo		1209	771		
	Speech synthesis		802	74		
	Waveguides		1422	417		
			167	498		

## Nokia, Alcatel-Lucent – Portfolio Comparison (2)

Nokia, Alcatel-Lucent Comparison (2)				Nokia	Alcatel-Lucent	
Signal transmission	EM transmission			391	3391	
	Gain control			405	305	
	Hand-off			1700	1039	
	Network security			1021	719	
	Power saving			2083	1442	
Substation equipment	TDM Time division multiplexer			1314	1929	
	Frequency, direction characteristics			379	19	
	Power supply			897	321	
	Receivers			1938	935	
	Spread spectrum			912	659	
	Substation extension			3235	736	
	TPC Transmission power control			866	709	
	Telephone sets			1659	101	
	Terminals			2228	906	
	Switches, relays	Selecting general	LAN, internet		146	195
Memory				100	211	
Selecting multiplex		Optical		109	764	
		Time-division		691	1169	
Selecting wired				994	1406	
TV, broadcast	3D TV			383	84	
	Audio synthesis			123	32	
	Broadcast apps			813	352	
	Coding, decoding			1413	291	
	Digital interface arrangements			708	181	
	Image analysis			592	123	
	Image transmission			490	107	
	Real time			1073	701	
	TV HW / SW			3540	1611	
Telephonic comms	Exchanges			3166	3660	
	Metering			2111	1503	
	Monitoring			551	272	
	Multiplex systems			238	297	
	Real time			2636	2251	
	Security			925	436	
Wireless networks	Monitoring	Optimization		806	535	
		Reports		890	336	
		Testing		450	271	
	Network devices	Access points			908	983
		Gateways			333	257
		Terminals			2228	906
	Resource mgmt	Broadcast services			427	315
			Defined plan		799	486
			Info exchange between nodes	Downlink	639	336
			Uplink	403	200	
	Security	Access security			621	260
		Authentication			1359	681
		Key management			683	316
		Privacy			670	207
	Topologies	Pre-organized, hierarchical	Cellular		1000	784
			WLAN		768	339
		Self-organized, ad hoc			924	251
	User comms	Billing			509	584
		Location-based			1421	596
		M2M			261	329
Messaging				789	457	
Multimedia broadcast				1294	724	
NFC, RFID				428	77	

## Mobile Equipment - Competitive Landscape (1)

Competitive Comparison (1)			Cisco	ZTE	Huawei	Ericsson	Nokia	Nokia + Alcatel-Lucent	
Data processing	Billing		712	577	1162	1091	1907	2966	
	Character recognition		223	277	748	195	933	1147	
	Digital cards		100	385	376	112	515	614	
	Info retrieval		1936	1860	4651	1725	3261	4947	
	Interactive TV, VOD		790	393	727	459	990	1343	
	Navigation devices		28	52	98	69	376	426	
	Network security	Authentication		1005	375	937	881	1174	1669
		DRM		193	93	334	242	328	430
		Monitoring		927	627	1605	805	1025	1581
		Service discovery		1591	553	1729	1547	1898	2901
	Program control unit	Config mgmt		880	194	607	299	200	493
		GUI		118	302	497	153	528	605
Signalling, control or architecture			1586	504	1346	1129	998	1615	
	Stored programs		1229	2107	4992	1633	1281	2322	
Data transmission	Data switching	LAN, WAN	3972	2511	5590	3860	3234	6600	
		Metering	199	558	1210	742	428	1098	
		Multicasting	854	858	1638	1029	933	1730	
		Store-and-forward	2649	1014	3363	5452	6109	10550	
	Digital protocol	Alternate routing	334	178	567	433	237	462	
		Config mgmt	329	227	558	250	176	364	
		Connection setup	60	205	457	562	687	810	
		Flow control	636	582	1408	1803	1349	2107	
		Info retrieval	552	470	1116	720	924	1380	
		Special services	247	384	556	598	911	1351	
		by Application	404	55	383	817	941	1470	
	by Terminal	665	593	1179	1018	720	1213		
	w/ Subscriber data	372	663	1036	1435	1625	2187		
	Network app protocols	Location-based	148	54	190	309	485	669	
		Service discovery	211	185	410	450	471	657	
		Session mgmt	409	244	553	729	660	1022	
		WAP	51	91	150	459	911	1069	
	Packet data	Web-based	343	233	673	515	447	706	
		Header parsing	477	118	573	507	347	552	
		Layered protocols	441	93	439	1060	1263	1761	
		TCP/IP, UDP	417	170	496	654	513	840	
	Real time protocols	Control	IP multimedia	92	369	836	1778	746	1255
			SIP	233	210	490	936	718	1124
		Session control	496	626	1159	1586	778	1408	
		QoS	357	192	620	861	418	818	
	Routing	Alternate routing	560	207	639	446	133	439	
		Fault recovery	682	263	747	581	123	496	
		Interdomain routing, e.g. hierarchical routing	590	126	415	240	71	301	
		MPLS	685	198	865	422	86	483	
		Topology update	1027	243	903	583	133	456	
Traffic regulation	Admission control	560	316	1006	888	442	982		
	Flow control	706	137	711	997	469	1156		
	by Priority, QoS	189	55	239	770	474	769		
	in Wireless networks	66	1095	2538	1988	1134	1807		
Transmission path	Path division	36	948	2038	1589	817	1136		
	Sub-channels	16	673	1796	1442	540	817		
Others	Aerials	108	560	1480	1510	868	1793		
	Coders, decoders	250	357	1305	1383	1209	1980		
	Speakers, mics, stereo	105	208	558	236	802	876		
	Speech synthesis	190	398	1876	1457	1422	1839		
	Waveguides	15	89	358	643	167	665		

## Mobile Equipment - Competitive Landscape (2)

Competitive Comparison (2)			Cisco	ZTE	Huawei	Ericsson	Nokia	Nokia + Alcatel-Lucent
Signal transmission	EM transmission		506	1714	3486	1509	391	3782
	Gain control		51	107	318	859	405	710
	Hand-off		212	667	1457	2375	1700	2739
	Network security		548	373	1019	844	1021	1740
	Power saving		287	1032	2133	4210	2083	3523
Substation equipment	TDM Time division multiplexer		1300	1127	2104	2172	1314	3243
	Frequency, direction characteristics		51	116	206	60	379	398
	Power supply		513	750	1613	586	897	1218
	Receivers		242	637	1655	3080	1938	2873
	Spread spectrum		86	487	830	2102	912	1571
	Substation extension		208	1945	1655	1317	3235	3971
	TPC Transmission power control		168	432	1575	1871	866	1573
	Telephone sets		26	589	623	503	1659	1760
	Terminals		216	1792	3362	3129	2228	3129
	Switches, relays	Selecting general	LAN, internet	70	10	72	243	146
		Memory	32	5	15	209	100	311
Selecting multiplex		Optical	106	627	1236	455	109	873
		Time-division	138	58	193	1078	691	1860
TV, broadcast	Selecting wired		157	442	772	1530	994	2400
	3D TV		34	66	241	102	383	467
	Audio synthesis		27	20	145	90	123	155
	Broadcast apps		196	332	308	246	813	1165
	Coding, decoding		523	330	1577	1108	1413	1704
	Digital interface arrangements		419	291	533	257	708	889
	Image analysis		197	125	461	178	592	715
	Image transmission		83	136	273	263	490	597
	Real time		933	947	1524	1161	1073	1774
	TV HW / SW		2729	3027	3913	2185	3540	5151
Telephonic comms	Exchanges		1445	1884	3294	3581	3166	6826
	Metering		311	1202	2063	1973	2111	3614
	Monitoring		104	283	552	501	551	823
	Multiplex systems		142	18	156	288	238	535
	Real time		979	1419	2527	2710	2636	4887
	Security		227	429	620	788	925	1361
Wireless networks	Monitoring	Optimization	160	1125	1666	1516	806	1341
		Reports	68	1090	1706	1679	890	1224
		Testing	118	737	1096	1100	450	721
	Network devices	Access points	302	1319	3229	2194	908	1888
		Gateways	167	456	832	728	333	588
		Terminals	216	1792	3362	3129	2228	3129
	Resource mgmt	Broadcast services	68	390	570	400	427	742
		Resource allocation	121	660	2440	2159	799	1281
		Defined plan	44	537	2250	1292	639	975
	Security	Info exchange between nodes	22	264	974	956	403	600
		Downlink	191	462	649	594	621	881
		Uplink	381	1228	1509	1274	1359	2040
		Access security	143	458	698	637	683	999
	Topologies	Key management	120	392	427	605	670	877
		Privacy	119	600	1004	1494	1000	1780
	User comms	Pre-organized, hierarchical	453	634	1638	674	768	1107
		Cellular	313	241	488	671	924	1175
		WLAN	113	586	829	710	509	1093
		Self-organized, ad hoc	298	649	968	1127	1421	2017
		Billing	43	668	779	928	261	590
Location-based		53	1291	1303	644	789	1244	
M2M		159	1443	1642	1217	1294	2018	
Messaging	46	136	392	171	428	505		
Multimedia broadcast								
NFC, RFID								

## Contact Us

Do get in touch with us with your specific needs related to intelligence and decision support on all matters related to technology and its business impact. We will figure the best way to address your needs with an appropriate combination of our technology and reports. We offer a range of tailored solutions and flexible engagement models.



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