

9 Patents Declared to the Korean Telecommunications Association as Essential to WCDMA Standards

Prior to the current study, we also examined 2838 patents and applications listed on the Korean Telecommunications Association (TTA) web site http://www.tta.or.kr/Home2003/committee/Ipr_PromiseList.jsp. Although the lists of declared patents and applications are primarily in Korean (a planned upgrade to English was not complete), we were able to identify 74 patent families with at least one issued US or EP (or both) patent that we had not previously reviewed for essentiality to WCDMA. These were all declared either by Samsung or LG. Where there were both US and EP patents in the family, we selected the EP patent for review. Where there were two or more patents in the same jurisdiction, we selected the most recently issued for our initial review. If, however, that patent was judged not essential, we then reviewed the remaining patents in that jurisdiction for their essentiality.

A total of 79 families, 43 US and 36 EP, were reviewed. 22 out of the 74 families (30%) were judged to have an essential patent. Of these, 15 are assigned to LG and 7 to Samsung. These results are included in the foregoing tables and charts as “Total Patents”.

The patents we reviewed were, as in our previous studies, assigned to one of eleven technology categories, listed in Appendix A. Only seven categories were found, with 22 of the 79 patents categorized as Layer2 and 16 categorized as channel coding. Ten of the 22 patents judged as essential – almost half - were in Layer2.

10 Discussion of our Results

10.1 Evolution of Technology Categories of Declared Patents

In Fairfield’s latest study, 20% of the patents claimed technology in more than one category. In this report, we refer to only one category per patent, the one that we identified as most prominent in the patent claims. Although the patents covered 15 technology categories, Table 1 and the pie chart in Figure 1 show that the distribution across categories is very uneven.

The study is dominated by patents in the Network category (115 families, 31%). The next two categories - Layer 2 and Radio Resources Management - together account for another 115 families, also 31%. Seven categories account for the next 116 families (also 31%). The remaining 24 families are distributed among 5 categories. In view of the increased importance of network categories, we have provided an expanded explanation of their definitions, as follows:

Layer 2

Certain cellular communications signals share the same channel with one another. Layer 2 protocols, especially media access control (MAC), establish rules for granting access to one signal at a time while the other signals wait their turn. Other

Layer 2 protocols deal with signals that have not been received correctly. The receiver instructs the transmitter to send additional information that will enable it to detect the original signals correctly. Error detection and retransmission are together referred to as ARQ (automatic repeat request, an old telegraphy term). Patents in the 2009 study disclose increasingly sophisticated and efficient ARQ techniques, many of them referred to as “hybrid ARQ” or incremental redundancy. Another term is “Layer 1 ARQ” reflecting the fact that error detection and retransmission are combined with forward error correction (FEC).

Location

In order to set up communication with a mobile phone, the network has to know which base station the phone is in contact with. To make this possible, an inactive phone sometimes sends a registration message to the network. When the network has to set up communication, it pages the phone at base stations near the one that received the latest registration message. The patents also disclose technology for determining the geographical coordinates of a phone (or other wireless device)⁴⁶. Several patents in the Location category of the 2009 study are concerned with location determination, either finding the geographical coordinates of mobile devices or communicating this information within a cellular network or between a cellular network and independent service providers.

Network

Techniques for coordinating the operations of elements of a cellular telephone system’s infrastructure, including base stations, switching centers, routers, and databases. This category also includes patents covering network management procedures for maintaining the long term health of a network and insuring that it meets quality objectives. The telephone industry sometimes refers to OA&M: operations, administration, and maintenance. Examples include fault location and provisioning (deciding where and when to replace old equipment or add new equipment to a growing network). In the 2009 Fairfield study, patents in the Network category address interaction between cellular networks and Wireless Local Area Networks. Other Network patents define procedures and protocols for delivering new services to mobile devices. Two examples are multimedia broadcast/multicast services (MBMS) and location dependent services.

It is instructive to compare the technology categories in the 2009 Fairfield study with those reported by Fairfield in 2006, covering two earlier studies of patents declared essential to 3G cellular technology standardized by 3GPP. Those studies included 1428 patent families with patents declared essential to 3GPP standards prior to January 1, 2006. In that study the network category was fifth most prominent with only 107 families (7.5% of the total). The largest category was Radio Resources Management with 237 patents (17% of the total).

⁴⁶ This is particularly important in making a “911” emergency call.

The high proportion of Network patents in the 2009 study is due to the fact that one of the main goals of 3GPP standards creation in recent years has been to bring cellular networks in line with the Internet. The Network patents can be divided into a few subcategories. In common with most of the Network patents in the earlier Fairfield studies, some of the patents in the 2009 study describe protocols for communication between various elements of the Core Network. Another set of patents addresses interaction between cellular networks and Wireless Local Area Networks. With WiFi modems standard in practically all portable computers and features of many cellular smartphones, there are many advantages of linking WiFi systems with cellular networks.

Other Network patents define procedures and protocols for delivering new services to mobile devices. Two examples are multimedia broadcast/multicast services (MBMS) and location dependent services. We have assigned the category “Location” to most of the patents that deal with location dependent services. Originally, the Location category dealt with procedures used to track the locations of mobile devices in order to deliver incoming phone calls and other types of information such as short messages. Registration and paging procedures are at the heart of “location management” in cellular networks. Many patents in the Location category of the 2009 study have to do with location determination, either finding the geographical coordinates of mobile devices or communicating this information within a cellular network or between a cellular network and independent service providers. Some of this communication requires authorization by subscribers or service providers, and thus intersects the “Security” category.

The Network category in the 2009 Study also includes patents that relate to charging subscribers for services. Originally, charging for services was the proprietary concern of cellular operating companies. With the possibility of obtaining services from other networks and in the interest of giving consumers more control of the cost of the services they obtain, patents in the 2009 study describe network elements referred to as “charging centers”, communications between charging centers and other network elements, and methods of notifying subscribers of charges for services they might purchase.

Another departure from the earlier Fairfield studies is the higher proportion of patents in the “Layer 2” category: 16% in 2009 compared with 7% in the earlier studies. Layer 2 technologies include Media Access Control and error detection and retransmission. Engineers refer to retransmission procedures as ARQ (originally a telegraphy acronym for “automatic repeat request”). Newer cellular systems have incorporated increasingly sophisticated and efficient ARQ techniques, many of them referred to as “hybrid ARQ” or incremental redundancy. Another term is “Layer 1 ARQ” reflecting the fact that error detection and retransmission is combined with forward error correction (FEC). FEC technologies in the earlier studies have had their own category: “Channel Coding”.

On the other hand, the percentage of patents in the radio signals category is much lower in the 2009 study (4%) than it was in the earlier Fairfield studies (13%). This change reflects the fact that the earliest emphasis in 3GPP was standardization of the WCDMA technologies at the heart of the 3G radio access network. By the end of 2005, these

technologies were well established and subsequently there were relatively few new patents declared essential to them.

All in all the distribution of patents across technology categories in the 2009 Fairfield study reflect the main thrusts of technology creation in the present decade. The nature of the patents suggests that it might be fruitful to reformulate the technical categories in future studies, perhaps subdividing some of the original categories such as Network and Location and consolidating others (Radio Signals, Channel Coding).

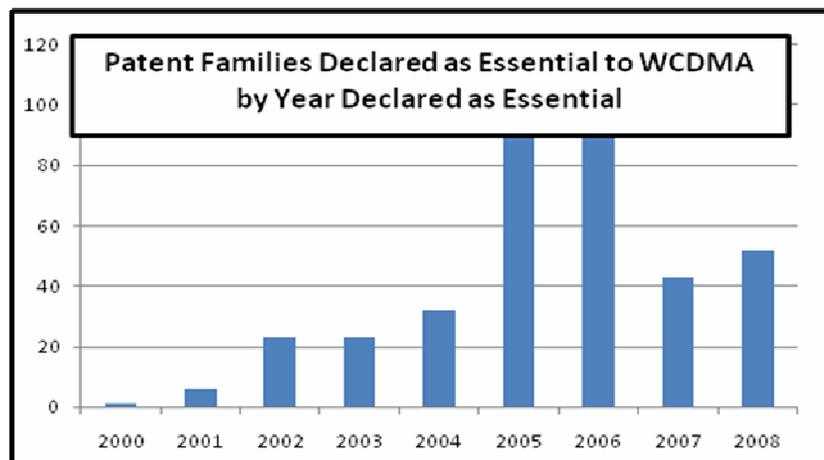
10.2 Evolution of Ownership of Essential Patents

Qualcomm, Ericsson, Nokia, Huawei and Samsung now dominate the rank of owners of declared essential patents, with two thirds of the total. In contrast, in our 2006 study Qualcomm, Ericsson and Nokia alone owned more than 60% of the patents we studied; Samsung had less than 3% and Huawei had none. Nokia and Ericsson and, to a lesser extent, Qualcomm continue to maintain a high rate of declarations in our latest study, but Huawei is a standout, with all of their declarations coming in the year 2000 and later; Samsung's large increase in declarations stems from their declarations to the Korean TTA.

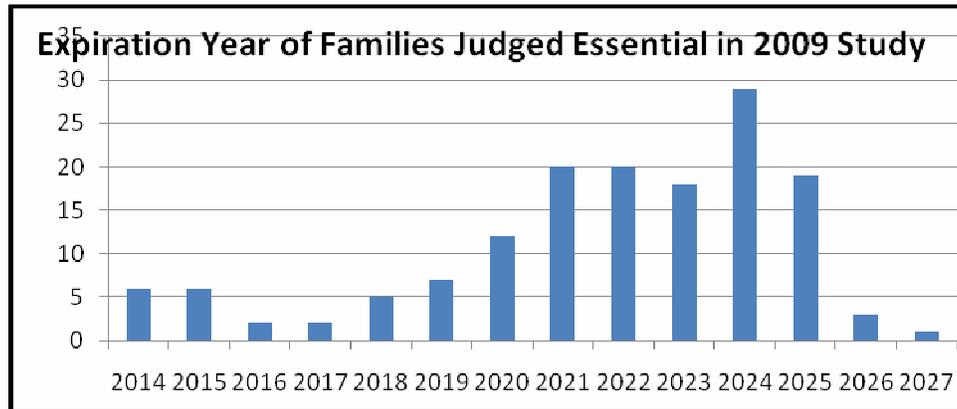
The four largest owners of declared patents also own the lion's share of patents our experts judged essential, 65% - very close to their share of total patents. However, this percentage is skewed by the Huawei and (new) Nokia declarations, almost 50% of which our experts judged as essential. Consequently, the percentage of patents found essential in our extension study was about 38%. In spite of this high percentage, the total sum of patents judged essential by our experts is still only 27%.

Our current results also indicate a number of new players in the essential patent field, particularly Apple (8) and Research in Motion (5). This probably reflects the new focus in wireless technology on interworking with the Internet and Smartphones.

Since this study is a continuation of our previous studies, it is no surprise that virtually all of the patents we reviewed in his study were declared after 2000.



We also see that the great majority of the patents judged essential do not expire until 2021 or later, indicating that they were filed after the year 2001. This is not surprising, since patents filed earlier than that would likely have issued in time to be reviewed in one of our earlier studies.



We have no indisputable argument as to why our experts judged so many patents to be essential in the current review. The team is substantially the same as previously so it is not likely that we have suddenly engaged a group of “easy graders”. Since such a high proportion of the newly reviewed patents are Chinese patents, however, it is possible to argue that the “easy graders” were the Chinese examiners, who overlooked prior art that might have precluded US or EP examiners from allowing the claims. This assertion might be checked in time as the patent families with an allowed CN patent are reviewed by US and EP patent offices.

It is interesting to speculate on the possibility that inventors have been paying attention to our publications and presentations, and are now more careful (with their attorneys) to actively pursue patents which, if issued are more likely to be essential. Another more positive explanation for the high hit rate in our current study may lie in the nature of Release 7 of the standards, and in the skewed distribution of technology categories of the declared patents. That is, Release 7 is more focused on interworking with the Internet and Smartphones and Internet protocols in general, and this is an area where the prior art has been less dense and the opportunities for covering an essential standard are broader.

A simple explanation for the relatively “high” percentage of E/E* patents in the 2009 study, however, can be seen from Table 7, the percentage of families declared essential which were judged essential by our experts. We found about 33% of the families declared essential in the 2006 review were declared by Qualcomm, but only 11% of these were actually judged essential. This clearly skewed the earlier results, while in 2009 only 10% of the declared families were declared by Qualcomm.

At this point in our research, we believe that the evolution of fourth generation wireless technologies, LTE (“Long Term Evolution”) and Wi-Max, have reached the point at

which it is appropriate to investigate the role that essential patents may play in this further evolution of wireless technology.

10.3 Significance of the 2009 results

Wireless technology and standards have been evolving at a fast pace over the past decade and a half, and the patents that may read on the standard have been following and often leading this evolution. For the most part the technology leaders have continued to lead in obtaining patents which our experts judged to be essential, although companies with challenges in the marketplace such as Motorola now lag. In contrast, Huawei, an emerging industry leader, has emerged as a patenting leader, now overshadowing Japanese companies. Samsung, too, is now an important patentee and will likely be more so as more of its applications issue⁴⁷.

The technology emphasis of the patents reported in this study is now highly focused on the network aspects of the system, while many of the elements that were necessary in order to install and operate early systems are now receiving less attention both from the standards committees and from inventors. It will be interesting to see if this trend carries over to the new fourth generation systems, LTE and Wi-Max.

It continues to be clear that participating in most aspects of wireless communications requires either licenses to a growing number of patents, or comparable protection (e.g., by supplying to a licensee) from infringement allegations.

10.4 Limitations of this Research

The evaluations performed by the experts in this study are *preliminary technical* assessments. By contrast, determining the scope of a patent and its commercial value can consume several days of effort by lawyers and engineers and weeks or months of adjudication by judges and juries. Therefore we suggest that the data be regarded as a valid statistical evaluation of the ownership and technology covered by patents that are essential to implementing the WCDMA standards. Our methodology, which includes reviews of different patents by different experts as well as a significant number of reviews of the same patents by different experts, embodies controls across the large number of patents reviewed which assure the reliability of the analysis on an aggregate basis. It may also be necessary to judge the *validity* of the patent claims judged to be technically essential. Even though some of these claims are extremely broad, the experts did *not* assess their validity.

We also note that WCDMA networks adopt protocols standardized for GSM telephone communications and GPRS packet data communications. It follows that patents essential to GSM and GPRS can also be essential to WCDMA⁴⁸. Patents that were declared to

⁴⁷ In the current study we did not revisit the TTA declarations to see if any of the previously unissued applications now have issued US or EP counterparts.

⁴⁸ For example, the speech-related standards for GSM and WCDMA are very similar; in some cases, identical.

ETSI as essential to these standards were not included in the results reported here unless they were also declared as essential to the 3G standards (UMTS, 3GPP and AMR).

We draw the attention of readers to several other limitations to our study. With regard to patent ownership, we are aware that it is not unusual for a company to acquire the rights to patents invented by outsiders. As a consequence our data are not precise indicators of who owns declared and essential intellectual property. The actual ownership distribution would take into account agreements that transfer patent rights from the company identified on the patent to another company.

It is also important to address the status of the essentiality data. In practice, the value of a patent depends on several *legal* and *commercial* factors. By contrast, the evaluations performed by the panel in this study are *preliminary technical* assessments, based on an average of one hour of analysis per patent. Determining the scope of a patent and its commercial value, if any, requires several days of effort by lawyers and engineers, and sometimes weeks or months of adjudication by judges and juries⁴⁹. In addition to the relationship of a patent to practical equipment and services, it is also necessary to consider patent *validity*. It is common for a company to assert that a competitor's patents are invalid and therefore unenforceable, either due to flaws in the patent itself or due to the fact that the claimed technology already existed when the inventor filed the patent application.

Another factor is the dynamic nature of both standards and intellectual property. By necessity, the standards cover existing proven technology, while patent applications describe novel techniques. Many of the patents were declared to be essential to technical specifications that were under consideration but not yet published when the patent applications were submitted. FRI took great pains to identify declared patent applications which subsequently issued within our window. Both 3GPP and 3GPP2 continue to refine and enhance the standards. They regularly publish new and revised Technical Specifications, so that some of the patents that were judged not essential to specifications published before 2004 may be essential to present-day specifications or specifications to be published in the future. The increase in the number of patents our experts found to be essential in the current study is one indication of the evolution in both the standards and in the ability of inventors to tune their inventions and patents to the evolving standards.

⁴⁹ Spending many hours or days reviewing each one of almost 2000 patent families is neither necessary nor realistic. Some of our expert reviewers have been engaged in this exercise for five or more years and all are intimately familiar with the standards. Since many of the patents are clearly not essential, we therefore believe there has been ample time to study the more complex patents. We do not believe that the results of our study would be changed substantively had our time budget been increased.

Appendix A: Technology Category Definitions

Antenna

Most of the antenna patents apply to base stations and or terminals with more than one antenna. The patents specify how to coordinate transmissions from multiple antennas and how to combine signals received on multiple antennas.

Call management

Procedures for establishing, maintaining, and breaking connections between devices in a phone call or a data session.

Channel coding

Wireless communications systems are vulnerable to transmission errors (the transmitter sends “one”, the receiver detects “zero”). Channel codes add redundancy (extra ones and zeros) so that the correct transmission can be detected by the receiver even if some of the ones and zeros have been reversed.

Circuits

Electronic circuits for realizing functions specified in the standards.

Data

Techniques for communicating digital data (as distinct from voices or pictures). Many of the patents in this category apply generally to data transmission techniques, not necessarily cellular (even though they may have been devised as part of 3G cellular development and included in 3G standards).

Facsimile

Communicating standard telephone fax signals in a 3G network.

Handover

Transferring a communication from one antenna in the fixed part of the radio access network to another.

Layer 2

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Radio signals

These patents cover the signals transmitted between terminals and base station. Many of them relate to CDMA codes (sequences of ones and zeros used to transmit each unit of information). Others present modulation techniques that transform the ones and zeros into radio signals to be transmitted at specified frequencies.

Radio resources

Efficiently managing transmitter power levels and bandwidth occupancy of the signals that share the same radio spectrum.

⁵⁰ This is particularly important in making a “911” emergency call.

Security

Encryption of information to prevent eavesdropping. Authentication to ensure that only authorized users have access to networks.

Source coding

Compression techniques for representing speech and pictures as a sequence of numbers.

Synchronization

Base stations and terminals transmit sequences of ones and zeros, divided into data units, each containing a prescribed number of ones and zeros. Synchronization techniques enable a receiver to determine the beginning and end of each data unit within a continuous binary data stream.

TDMA

Time division multiple access. Signals sent to and from different terminals are transmitted at different times.

Terminal

Patents covering technologies located entirely or predominantly in subscriber equipment. Some of these patents cover SIM (subscriber identity modules). Others cover over the air programming of terminals.