UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

CRADLEPOINT, INC., DELL INC., HONEYWELL INTERNATIONAL, INC., SIERRA WIRELESS, INC., TCL COMMUNICATION TECHNOLOGY HOLDINGS LIMITED, TCT MOBILE INTERNATIONAL LIMITED, TCT MOBILE, INC., TCT MOBILE (US) INC., TCT MOBILE (US) HOLDINGS INC., THALES DIS AIS DEUTSCHLAND GMBH, ZTE CORPORATION, AND ZTE (USA) INC.
Petitioners,

v.

3G LICENSING S.A.,
Patent Owner.

Inter Partes Review No.: IPR2021-00640

Patent No. 8,600,383

DECLARATION OF CRAIG BISHOP

TABLE OF CONTENTS

Page

I. INTRODUCTION 1

II. QUALIFICATIONS 2

III. PUBLIC AVAILABILITY OF 3GPP TECHNICAL SPECIFICATIONS AND OTHER DOCUMENTS TO POSITAS 7

A. Prominence and Purpose of 3GPP 8

B. 3GPP Document Policies and Practices 12

C. 3GPP Structure and Standards Development Process 13

D. 3GPP Documents 16

i. TDocs 17

ii. Technical Specifications 20

E. The 3GPP Online File Repository 25

IV. EXHIBIT 1005 ("TS45.008") 27

V. EXHIBIT 1006 ("TS25.304") 29

VI. EXHIBIT 1007 ("TS25.331") 32

VII. EXHIBIT 1009 ("TS43.022") 35

VIII. EXHIBIT 1017 38

IX. EXHIBIT 1018 40

X. EXHIBIT 1019 43

IX. CONCLUSION 46

X. DECLARATION 48

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 2 of 304

I. INTRODUCTION

I, Craig Bishop, declare as follows:

1. I have been retained as an independent expert witness on behalf of Petitioners related to Inter Partes Review ("IPR") of U.S. Patent No. 8,600,383 ("the '383 patent").

2. I am being compensated for my work in this matter at my accustomed hourly rate. I am also being reimbursed for reasonable and customary expenses associated with my work and testimony in this investigation. My compensation is not contingent on the results of my study, the substance of my opinions, or the outcome of this matter.

3. In the preparation of this declaration I have reviewed Exhibits 1005, 1006, 1007, 1009, 1017, 1018, and 1019, each of which is a type of material that experts in my field would reasonably rely upon when forming their opinions.

4. In forming the opinions expressed within this declaration, I have considered:

1) Exhibits 1005, 1006, 1007, 1009, 1017, 1018, and 1019; and

2) My own academic background, knowledge, and professional experiences in the field of wireless communications and 3rd Generation Partnership Project (3GPP) standards-development, as described below.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 3 of 304

5. Although I have attempted to organize the information presented in this declaration into helpful sections and/or divisions, my opinions are supported by the information in the declaration in its entirety.

II. QUALIFICATIONS

6. My complete qualifications and professional experience are described in my *curriculum vitae*, a copy of which has been attached as Appendix 1. The following is a summary of my relevant qualifications and professional experience.

7. I earned my Bachelor of Electronic Engineering degree with Honors from Polytechnic of Central London in 1989. In 2005, I earned my MSC in Computer Science with Distinction from the University of Kent.

8. After graduating with my first degree, I worked as an operations engineer at the British Broadcasting Corporation (BBC) for 4 years, then as a civil servant at the UK Radiocommunications Agency until 1996, during which time I became involved in telecommunications standardization in the European Telecommunication Standards Institute ("ETSI"), working in particular in Technical Committee Radio Equipment and Systems (TC RES2) concerned with the standardization of Private Mobile Radio (PMR). From 1994 through 1996, I acted as Rapporteur for voice and data related PMR standards ETS 300 113, ETS 300 219 and ETS 300 390. I participated as the only TC RES2 delegate on behalf of the UK Radiocommunications Agency, generating proposals in support of UK

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 4 of 304

administration and business requirements, downloading and reviewing other meeting input documents, and proposing changes as necessary to ensure input documents and the resulting specifications were in line with said requirements.

9. In 1996, I joined Samsung Electronic Research Institute as a Senior Standards Engineer where I worked for 16 years, eventually becoming Director of Standards and Industry Affairs in 2011. My work at Samsung mainly focused on the standardization of Global System for Mobile Communications (GSM)/ General Packet Radio Service (GPRS), Universal Mobile Telecommunications System (UMTS), and Long-Term Evolution (LTE)/ Evolved Packet System (EPS) systems. Initially, I participated in ETSI Special Mobile Group (SMG) committees SMG1, SMG2, SMG4, SMG5, and SMG9, and relevant UMTS related sub-committees working on the air interface radio access network protocols, service, and terminal aspects of UMTS and GSM/GPRS until 1999. I was specifically involved in the ETSI SMG2 meetings leading up to selection of Wideband Code Division Multiple Access (WCDMA) as the radio access technology for the Frequency Division Duplex (FDD) mode of UMTS.

10. Beginning in 1998, I worked as a Principal Standards Engineer on the 3rd Generation Partnership Project (3GPP) on UMTS. I have been involved with 3GPP since its inception. I attended the inaugural 3GPP Technical Specification Group (TSG) meetings held in December 1998, and I began attending Working

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 5 of 304

Group (WG) meetings in 1999. Specifically, I regularly attended Radio Access Network (RAN) WG1, Services & System Aspects (SA) WG1, Terminals (T) WG2, but also other Working Groups and TSG plenary meetings covering similar technical aspects as in my previous work in ETSI. As examples, RAN WG1 was, and is, a Working Group responsible for the specification of the physical layer of the latest wireless cellular standards, and RAN WG2 was, and is, a Working Group responsible for signaling protocol layers 2 and 3 residing just above the physical layer. As part of this work, I would prepare meeting contributions in support of Samsung's research and development activities. Also, by way of preparation for each meeting, I would download all contributions and review those of interest to Samsung, and where necessary, prepare additional input to the meeting based on said review.

11. Beginning in 2000, I acted as project manager and then as system engineering manager at Samsung, providing technical requirements for the team working on Samsung's UMTS modem development. This involved scrutiny of ongoing standardization work, particularly in RAN WG1, RAN WG2, and TSG Core Network (CN) WG1, from which I would download, and assess the impact of, contributions on Samsung's development projects, ensuring that Samsung's development team was kept informed about the latest developments as layers 2 and 3 of the UMTS standard were stabilized.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 6 of 304

12. During this period, in addition to authoring and presenting technical contributions for the 3GPP standard, and producing technical requirements for the radio modem, I acted as Rapporteur for 3GPP Technical Reports covering User Equipment ("UE") capability requirements (3GPP TR 21.904) from 1999–2000, and the Evolution of the 3GPP System (3GPP TR 21.902) in 2003 (the first Study Item to consider the 3GPP system beyond UMTS towards LTE/EPS).

13. In 2005, I became Head of Advanced Technologies, Standards and Regulation (ATSR) at Samsung. In addition to my managerial duties which included responsibility for standards, research, and regulatory engineers including three standards engineers who were regularly attending 3GPP RAN WG2 and Core Network and Terminals (CT) WG1 Working Groups, I personally continued to work on 3GPP standardization issues. From 2005 until 2008, I regularly attended and participated in SA WG2 meetings, mainly focusing on IP Multimedia Subsystem (IMS) including voice over IMS but also looking at wider Evolved Packet System (EPS) related issues. From 2008 until 2011, I regularly attended and participated in SA WG1 meetings. I also attended SA plenary meetings from 2008 until I left Samsung in 2013. As well as generating contributions in support of Samsung's research and development as preparation for each meeting, I would download and review documents from other 3GPP members, identifying those of interest to Samsung and, where necessary, preparing additional contributions on

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 7 of 304

behalf of Samsung. The work required a sound working knowledge of the broader 3GPP system to ensure effective management of the ATSR team, effective participation in meeting discussions, expert assessment of third-party standards contributions, and provision of implementation guidance to Samsung developers.

14. From 2006 until the time I stopped attending SA WG1 meetings in 2011, I authored and presented over 100 contributions to SA WG2 and SA WG1 meetings at 3GPP and appeared as an author/co-author on 18 patent applications related to User Equipment operation in the IMS and the 3GPP Core Network.

15. In 2011, I became Director of Standards and Industry Affairs at Samsung, and in November of that year I was elected to the Board of ETSI on which I served for a term of 3 years until November 2014. In this position I gained further perspective on the organisation, management, and activities of ETSI and its Technical Committees.

16. Since leaving Samsung in January 2013, I have become a member of ETSI, and as part of various projects undertaken, I have continued to regularly access the ETSI and 3GPP document servers, and to keep abreast of ETSI and 3GPP document handling and publication practices.

17. Through my extensive work in ETSI and on 3GPP standardization issues over the years, I have become very familiar with ETSI and 3GPP practices for when and how revisions to the technical standards and other standards-related

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 8 of 304

contributions are made publicly available, including in the 1999-2011 timeframe when I was attending or monitoring various 3GPP Working Groups including RAN WG2. Also, in the 1998-1999 timeframe as explained above in ¶ 9, I participated in ETSI Special Mobile Group (SMG) committees SMG1, SMG2, SMG4, SMG5, and SMG9, and relevant UMTS related sub-committees working on the air interface radio access network protocols, service, and terminal aspects of UMTS and GSM/GPRS.

18. For purposes of my analysis in this declaration, I have been informed that a person of ordinary skill in the art ("POSITA") in the field of the '383 patent in approximately August 2004 would have had a bachelor's degree in electrical engineering or a similar discipline, with at least 3 years of relevant industry or research experience (or additional education). This description of a POSITA is consistent with my experience with 3GPP and ETSI. I was a POSITA in August 2004 based on my education and experience, which are described above and in my attached CV.

III. PUBLIC AVAILABILITY OF 3GPP TECHNICAL SPECIFICATIONS AND OTHER DOCUMENTS TO POSITAS

19. Based on my years of experience working in various capacities in 3GPP and on 3GPP standards issues, I am familiar with the regular business practices of the 3rd Generation Partnership Project (3GPP) relating to technical

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 9 of 304

documents including specifications, draft standards and proposals, and standards-related technical contributions—including the business practices through which 3GPP makes these documents public.

A. Prominence and Purpose of 3GPP

20. 3GPP was inaugurated in December 1998 to produce Technical Specifications and Technical Reports for the Universal Mobile Telecommunications System (UMTS), a 3G Mobile System based on evolved GSM core networks and a new radio access network known as UTRA (UMTS Terrestrial Radio Access). Appendix 9 at 2–3 (3GPP Partnership Project Description); Appendix 10 at 4; Appendix 15 at 15. At that time, various standards organizations agreed to cooperate to produce a "complete set of globally applicable Technical Specifications" that would then be transposed into standards by the relevant standardization bodies (also known as organizational partners). Appendix 9 at 3, 5 (3GPP Partnership Project Description). 3GPP "attracted a very strong commitment from organisations and companies around the world, reflecting the truly global nature of the project." Appendix 15 at 17.

21. 3GPP is a global initiative partnership made up of organizational partners, market representation partners, and individual members. Appendix 18 at 7 (3GPP Working Procedures, 1999); Appendix 16 at 13; Appendix 9 at 10. Today, 3GPP unites seven telecommunications standard development

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 10 of 304

organizations ("Organizational Partners") from around the world: the Association of Radio Industries and Businesses (ARIB) and the Telecommunication Technology Committee (TTC) from Japan, the China Communications Standards Association (CCSA) from China, the Telecommunications Standards Development Society, India (TSDSI) from India, the Telecommunications Technology Association (TTA) from Korea, the European Telecommunications Standards Institute (ETSI), and the Alliance for Telecommunications Industry Solutions (ATIS) from the United States.[1] These Organizational Partners are regional standards organizations that have the authority to define, publish, and set standards for their respective regions. Appendix 9 at 12. 3GPP also includes "Market Representation Partners" that represent various industry perspectives and offer market advice. Appendix 18 at 7–8 (3GPP Working Procedures, 1999, "Market Representation Partnership"); Appendix 16 at 13 ("The market representation partners are industry associations that promote deployment of specific technologies); Appendix 9 at 14; Appendix 15 at 15. Additionally, 3GPP includes individual member companies ("Individual Members") that participate in 3GPP through their membership in a 3GPP Organizational Partner. Appendix 18 at 8 (3GPP Working Procedures, 1999, "Individual Membership"); Appendix 17 at 5

[1] The specific organizational partners that make up 3GPP have changed over time.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 11 of 304

(textbook including a chart showing 3GPP organization at the time of publication); Appendix 15 at 15. As an example of how prominent 3GPP was in the industry, by January 2000, there were 284 companies participating as Individual Members. Appendix 15 at 18; Appendix 16 at 14 (textbook noting there were 297 Individual members by 2006). Indeed, even in the 1999 timeframe, just after the inception of 3GPP, at least dozens of companies were already members of 3GPP. In fact, 350 delegates attended the first 3GPP Technical Meeting in December 1998. Appendix 15 at 6.

22. As noted in paragraph 20, a primary goal of 3GPP is to provide an environment to produce technical specifications and technical reports that define and standardize technologies covering cellular telecommunications networks, including User Equipment or Mobile Device (UE) technologies, Radio Access Network (RAN) technologies, Core Network (CN) technologies, and service and system capabilities—including work on codecs, security, and quality of service. The specifications also provide hooks for interworking with non-3GPP networks including but not limited to Wi-Fi networks.

23. Given the prominence of 3GPP in the wireless communication industry, beginning in 1999 and continuing through today, interested POSITAs were tracking the developments of the latest 3GPP specifications and reports to ensure timely development of products and services by their companies that were

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 12 of 304

consistent with the standards being developed. In other words, it is my opinion that a POSITA would be familiar with 3GPP and the specification-related documents produced as part of the 3GPP process in order to properly perform his or her job. Without access to and knowledge of the 3GPP documentation, including for example the substantive contents of 3GPP technical specifications, an engineer could not develop products that were interoperable with the worldwide 3G (and later 4G) standards. Because 3GPP documents were an important aspect of a POSITA's professional experience, textbooks and articles about cellular communications commonly directed readers to the 3GPP website for information regarding standards development. Appendix 15 at 23 (directing readers to the 3GPP website at the conclusion of the chapter on the success of 3GPP in the standards development process). As a POSITA myself, I would regularly visit the 3GPP website for the latest developments in 3G standards setting and refer colleagues involved in the development of 3G devices to the 3GPP website as a valuable reference.

24. My personal experience at Samsung confirms 3GPP's prominence in the wireless industry. For example, engineers and managers at Samsung who were responsible for developing 3G modem software (and who were not attending 3GPP meetings or involved with 3GPP in any direct way) would regularly ask me to which version of a given 3GPP specification they should be developing their

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 13 of 304

products. A significant part of my role at Samsung was to ensure that Samsung's development engineers were made aware of changes and proposals made in the 3GPP development process that would likely impact their work—and to discuss the implications of those changes or proposals with them. Such communication became so regular that around 2003 we began holding regular feedback sessions between those of us involved with 3GPP and the development engineers who were not involved with 3GPP work. I also maintained an internal company database that tracked changes that had been approved by 3GPP, to help the various development groups at Samsung stay informed as to changes that would impact their development work. The database contained summaries of changes introduced (and by whom), a brief assessment on the potential impact of the change, and the time and date information, including from which version the change was introduced. The database also included links to relevant 3GPP documents so that engineers could access the documents directly. In short, the technical work of 3GPP was at the forefront of development at Samsung, even for engineers who were not directly involved with creating or contributing to the 3GPP process.

B. 3GPP Document Policies and Practices

25. 3GPP's policy was to make 3GPP documents available to the public, including to interested POSITAs. The free availability of 3GPP documents to any interested member of the public was widely recognized in the industry. As an

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 14 of 304

example of the prominence of 3GPP and its place in the wireless standards industry, I note that textbooks directed readers to the 3GPP website for information about relevant standards. For example, one textbook made clear that "[t]he latest specifications can be obtained from 3GPP." Appendix 17 at 6.

26. Because the purpose of 3GPP was worldwide adoption of a common standard, no restrictions on distribution or discussion were placed on 3GPP documents. For example, I personally recall sharing some documents with a colleague who was not involved in the 3GPP process and, the internal company database I created at Samsung, discussed in paragraph 24, included links to 3GPP documents so that others (including individuals not involved with 3GPP) could access those documents directly.

C. 3GPP Structure and Standards Development Process

27. Within 3GPP, responsibility for producing specifications was delegated to the Technical Specification Groups (TSGs). Appendix 18 at 11 (3GPP Working Procedures, 1999, "TSG tasks"). At its inception, 3GPP was divided into four Technical Specification Groups (TSGs), each covering a particular category of technology. Appendix 9 at 31 (3GPP Partnership Project Description); Appendix 17 at 5-6 (textbook listing four TSGs and noting the subsequent addition of a fifth TSG); Appendix 15 at 16, 25, 39. Each TSG is further divided into a number of Working Groups (WGs). Appendix 16 at 14; Appendix 17 at 5; *see also* Appendix

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 15 of 304

18 at 21 (3GPP Working Procedures, 1999, defining "Working Group"). Two of the TSGs from 1999 are still in existence in 2021: TSG Radio Access Networks (RAN) and TSG Service & Systems Aspects (SA). The activities of two other TSGs, TSG Core Networks (CN) and TSG Terminals (T), were amalgamated under Core Network and Terminals (CT) following the closure of TSG T in 2005, with responsibility for terminal test specifications being moved to a RAN working group (RAN WG5). The fifth TSG, GSM EDGE Radio Access Networks (GERAN), was responsible for evolution of the GSM radio technology from 2000 until that TSG closed in 2016 and its work was transferred to a RAN working group (RAN WG6) which was itself closed in July 2020.

28. The TSGs held quarterly plenary meetings[2] where members' contributions, draft specifications/reports, and other documents that had been agreed upon by the Working Groups were presented for discussion and approval. Appendix 18 at 18 (3GPP Working Procedures, "Deliverable types," stating that Technical Specifications and Technical Reports are "drawn up by the TSGs" and are approved by TSGs). Once a Technical Specification was, or Change Requests creating a new version of a Technical Specification were, formally approved by

[2] Except in 1999 when 5 meetings were held.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 16 of 304

TSG plenary, the latest version of said Technical Specification would be created by the Mobile Competence Centre (MCC[3]) and uploaded to the file server. Appendix 14 at 8 (#4.15). In that way, the conclusion of 3GPP TSG plenary meetings serves as notice that new versions of specifications incorporating Change Requests approved by the TSG meeting will shortly be made available on the public 3GPP server.

29. As part of the standards development process, delegates could submit contributions on behalf of the Individual Members. Members had an incentive to stay updated on 3GPP developments because those members usually wanted to contribute to the standard and make suggestions as to what technology and/or features should (or should not) be included. Delegates also attended 3GPP meetings to keep their employers abreast of developments related to the standards that would ultimately apply to those members and the products those members (e.g., companies) produce. 3GPP members around the world—and the interested POSITAs employed by them—would have been motivated to stay up to date regarding 3GPP developments to ensure their products, networks, and research programmes remained consistent with and relevant to the specifications being

[3] Part of the ETSI secretariat supporting 3GPP activities.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 17 of 304

developed. In light of this need to follow the standards development process, delegates often distributed 3GPP-related documents far beyond the attendees at 3GPP meetings. This was certainly my experience at Samsung, as I described in paragraphs 24-26.

30. Although attendance at 3GPP meetings was generally limited to 3GPP members, the public, including interested POSITAs, would have been made aware of Working Group meeting dates and times on 3GPP's website. For example, POSITAs would have been aware of the meeting information pages for each TSG Working Group. Appendix 16 at 26 (textbook providing, as an example, a URL to the meeting information page for TSG RAN WG1 and including a screenshot of that web page).

D. 3GPP Documents

31. The technical specifications and reports developed by 3GPP were, and are, driven by the technical contributions of 3GPP members. As part of that development process, various types of documents were produced. As relevant to this case, the 3GPP process involved the consideration of temporary[4] documents

[4] The term "temporary" is used to designate documents that are submitted to and dealt with by 3GPP TSGs and WGs in the process of elaborating the standards, but

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 18 of 304

("TDocs," also referred to as "technical contributions," or "member contributions"), resulting in the production of technical specifications.

i. TDocs

32. Prior to each Working Group meeting, members of the Working Group could prepare TDocs to identify, discuss, and/or propose a new feature or change(s) to an existing feature or to identify a technical issue for discussion. According to the 3GPP FAQs, "[a]ny bona fide representative of any 3GPP Individual Member . . . can present a technical contribution - for example, a Change Request - to any 3GPP TSG or WG meeting." Appendix 11 at 7. This has been the practice since 1999 when I began attending 3GPP Working Group meetings.

33. POSITAs would have known that TDocs could be a helpful source of technical information regarding the 3GPP specifications. Appendix 16 at 24 (textbook explaining that "[o]ne way to find a more detailed description of the specific methodology or parameter in the specification is to go through the

---

do not constitute permanent 3GPP deliverables such as Technical Specifications and Reports. Temporary documents are permanently archived by and freely available from 3GPP once they have been submitted.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 19 of 304

contribution papers (called technical [sic] documents, or tdocs) that 3GPP uploads on their meeting website").

34. Each TDoc was assigned a TDoc number, according to a standard format set by 3GPP.[5] As described in the 3GPP Working Procedures from 1999, the numbering system followed the format: Gxmnnzzz.ext. Appendix 18 at 15–16. Within that format, "Gx" referred to the relevant TSG. Appendix 18 at 15. For example, "R" was used for TSG RAN. Appendix 18 at 15. Likewise, "m" referred to the relevant Working Group. Appendix 18 at 15. A document for RAN WG1 would therefore begin with "R1," and a document for the TSG RAN plenary would use the letter "P" instead of a number. Appendix 18 at 15. The two digits "nn" represented the year (e.g., 99), and the digits "zzz" represented the unique document number. Appendix 18 at 15–16; Appendix 16 at 25 (a book explaining the TDoc naming convention). This document number was used as the TDoc's filename. Appendix 18 at 15. Documents could be compressed to ".zip" files, such that a document titled, for example, "R1-99357" would be contained in the file "R1-99357.zip." This general naming convention has been in use since at least

[5] Some documents other than technical contributions (such as meeting reports) were also assigned TDoc numbers, for ease of reference.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 20 of 304

1999 with only minor variations[6]. Appendix 18 at 15–16 (3GPP Working Procedures, 1999).

35. Each TDoc would include in its header the meeting at which the contributor intended the TDoc to be discussed. Most TDocs were uploaded to the 3GPP website for public viewing prior to the relevant Working Group meeting listed on the TDoc, although some TDocs were uploaded during or after the meeting. Appendix 11 at 9. Specifically, "TDoc numbers start to be allocated some weeks before a 3GPP meeting, and the authors then create [the TDocs] and they or the group's secretary uploads them to the public file server as soon as possible." Appendix 11 at 9. The documents were uploaded to the public file repository in an area allocated to the particular Working Group. Appendix 7 (RAN WG2 Homepage with link to WG2's "Documents Area"). Immediately upon upload, any member of the public could download and access the TDocs and other documents offered for discussion. "No password is needed to access any information on the 3GPP Web site, all information is openly published." Appendix 11 at 8. The

[6] E.g. due to the number of TDocs handled by 3GPP Working Groups, the number of "z" digits was increased to four from the beginning of 2000, and in some Working Groups starting from 2016 to five.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 21 of 304

process discussed in this paragraph has been the practice since I began attending Working Group meetings in 1999.

ii. Technical Specifications

36. As I noted in paragraphs 20 and 22, a primary purpose of 3GPP is to prepare, approve, and maintain globally applicable Technical Specifications and Technical Reports. Appendix 18 at 6 (3GPP Working Procedures, "Purpose"). A "Technical Specification," as defined by 3GPP, is "[a] 3GPP output document containing normative provisions approved by a Technical Specification Group." Appendix 18 at 21. 3GPP would (and still does) periodically freeze a complete set of standards (referred to as a "Release" [7]), and each set would include many new specifications. Appendix 16 at 14. 3GPP would also make publicly available draft specifications that would usually be included as part of the next Release. Appendix 16 at 14.

---

[7] As denominated by the major version field (see paragraph 41). E.g. v4.x.x versions are part of release 4, v8.x.x versions are part of release 8. The exception to the matching major version field number and the release number is v3.x.x versions, which are part of Release 99 (rather than release 3, to be consistent with the GSM release designation).

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 22 of 304

37. It was widely known that Technical Specifications (and Technical Reports) were publicly available on 3GPP's website. It was also well known that the latest version of a given specification that was under change control would be made available following each TSG Plenary meeting responsible for that specification, and that TSG Plenary meetings usually occur four times per year. Appendix 14 at 8 (#4.15).

38. Technical specifications, and revisions of technical specifications, could be easily accessed from the 3GPP website. In 2002, the "Specifications" page was available directly from the 3GPP website's home page. Appendix 19. The 3G specifications page provided direct links to the specifications area in the 3GPP website's file repository. Appendix 8 at 1. In the 2002-2004 timeframe, the specifications page listed the specifications grouped by the date of the approval of the latest versions reflecting the TSG plenary meeting date. Appendix 8 at 1

39. Additionally, the 3GPP specifications followed a clear numbering scheme to help the public, including interested POSITAs, identify the subject matter of each specification. Appendix 13 at 1. As described on the 3GPP Numbering Scheme webpage, all 3G and GSM specifications had a specification

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 23 of 304

number of 4 or 5 digits,[8] where the first two digits defined the series. Appendix 13 at 1. The Numbering Scheme webpage included a table showing the subject matter corresponding to each series. Appendix 13 at 1. For example, the "25 series" of specifications focused on radio aspects, while the "22 series" focused on service aspects. Appendix 13 at 1. I note that the five specifications referenced in this Declaration are "25" series and focus on radio aspects. An interested POSITA could also narrow down the relevant specifications based on whether the specification applied to only 3G or to both GSM and 3G. (GSM only specifications were transferred from ETSI to 3GPP in July 2000.) For a specification in the 21–35 series, this could be determined based on the third digit of the specification number, where a "0" would indicate that the specification applied to both systems. Appendix 13 at 1. Specifications outside the 21–35 series prior to 2007[9] applied only to GSM systems. Appendix 13 at 1.

---

[8] Four-digit specification numbers were used for GSM specifications transferred from ETSI, *i.e.*, pre-3GPP Rel-4.

[9] Series 36, 37, and 38 specifications now cover other radio access technologies including LTE and 5G.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 24 of 304

40. The specifications were stored on the 3GPP website's file repository as zipped files, where the filenames followed the structure: SM[-P[-Q]]-V.zip. This format corresponded to the numbering scheme discussed in paragraph 39. "S" represented the series number; "M" represented the mantissa (the part after the series number); "P" represented an optional part number; "Q" represented an optional sub-part number; and "V" represented the version number (without the separating dots). Appendix 13 at 1.

41. The Working Groups would create incremental versions of the standards[10] (*e.g.*, V0.6.6, V1.0.0, V1.1.0, etc.). These versions were made available on the 3GPP website's file repository which is accessible from the 3GPP specifications page. The version numbering scheme for Technical Specifications and Technical Reports was standardized by 3GPP. Appendix 20 at 1-2. The version number included three fields—the major version field, the technical version field, and the editorial version field. Appendix 20 at 1. The major version

[10] This was prior to the versions receiving formal approval by the relevant Technical Specification Group upon being deemed sufficiently complete. After that, they are placed under change control, and each subsequent version is based on Change Requests approved by the relevant Technical Specification Group.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 25 of 304

field reflects the stage of the specification, with "0" representing an immature draft and a value of "3" or greater representing a specification that has been approved by the relevant TSG and thus had been moved to change control. Appendix 20 at 1. The technical version field begins at zero and is incremented every time a technical change is made to the specification (either as part of the drafting process or as part of an approved change request). Appendix 20 at 1. The editorial version field begins at zero and is incremented each time a non-technical change is made to the specification (*e.g.*, to fix a typo or formatting issue). Appendix 20 at 1.

42. One of the documents on which I opine in this Declaration is a version of the technical specification with the following label: "V5.3.0." Consistent with the 3GPP version numbering scheme, the specification has a major version field value of "5" which means it represents a specification approved by the applicable TSG, as part of 3GPP Release 5. The second digit, "3" means that a third technical change[11] had been approved for the corresponding technical specification since that specification's initial approval. And the third digit, "0" means that no non-technical changes had been made to the technical specification since the latest version had been approved by RAN plenary.

43. I understand that the alleged invention in the '383 patent relates to

[11] Or set of technical changes.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 26 of 304

cellular telecommunications, and more particularly to a method and apparatus for transitioning between different radio access technologies (RATs), such as the Global System for Mobile Communications (GSM) and Universal Mobile Telecommunications System (UMTS). Any POSITA interested in GSM and UMTS would necessarily be monitoring 3GPP's activities in this area and could be already participating as a full or associate member or observer in the standard development process or would have at least known that information regarding the proposed revisions to the technical specifications under discussion were available through 3GPP.

E. The 3GPP Online File Repository

44. 3GPP makes TDocs, draft and approved technical specifications, technical reports, and other materials freely available to interested POSITAs (and to any interested member of the public) through the public file repository on the 3GPP website. Interested POSITAs would have been well aware of 3GPP and of the 3GPP website in 1999.

45. As described in paragraphs 25-26, 3GPP documents were accessible to any member of the public through the 3GPP website. Any interested individual, including interested POSITAs could download documents from the 3GPP website's file repository without providing any login credentials or other exclusive access criteria.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 27 of 304

46. An interested POSITA could access the 3GPP file repository through the web address www.3gpp.org/ftp. Appendix 2. Regardless of how an individual initially accessed the public files, the indexed navigation of the files follows a clear pattern—the top two levels of indexing within the file repository are based wholly on subject matter, as reflected by the division of subject matter. Appendix 2. As shown in the archived page in Appendix 2, the 3GPP file repository organized "Specs" (commonly understood as shorthand for "Technical Specifications").

47. 3GPP's public file repository provides a reliable mechanism for identifying the date a document was uploaded to the website. When a document is uploaded, the file server automatically assigns the document a time stamp, an accurate and automatically computer-generated electronic record of when the document was uploaded, as part of the regular business practices of 3GPP. *"[T]he time stamp of the Zip file can be relied upon to indicate when the upload occurred*." Appendix 11, at 9 (3GPP FAQs (added emphasis)). This has always been the practice regarding uploading documents to the file repository, and my personal experience further confirms that the time stamps have always been a reliable way to indicate when a file was uploaded to the 3GPP website. In my experience, whilst the servers used for 3GPP file repository have been updated since 1999 and responsibility for the GSM standard has moved from ETSI to 3GPP in 2000, the original upload date for files including specifications has always been

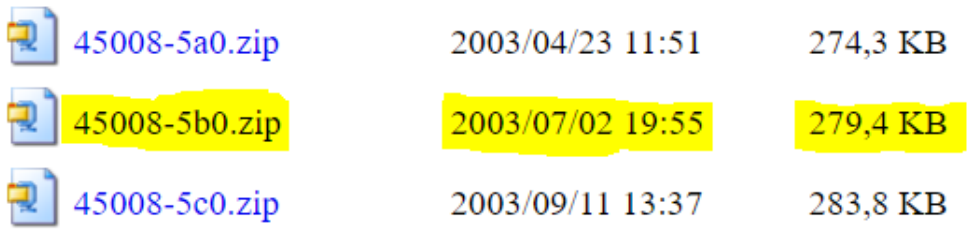
Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 28 of 304

preserved, providing a true and accurate indication of their earliest availability for download.

IV. EXHIBIT 1005 ("TS45.008")

48. 3GPP TS 45.008 v5.11.0 ("TS45.008") (Ex. 1005) is a Technical Specification titled "3rd Generation Partnership Project; Technical Specification Group GSM/EDGE Radio Access Network; Radio subsystem link control (Release 5)." Ex. 1005 at 1. The specification indicates that it was produced by 3GPP in June 2003. Ex. 1005 at 1. To obtain this document, I directed a web browser to the URL: https://www.3gpp.org/ftp/Specs/archive/45_series/45.008. Appendix 3 at 1. I selected the link for "45008-5b0.zip" and downloaded a zip file of the same name. Appendix 3 at 1. The zip file contained a Microsoft Word document, titled "45008-5b0.doc." A true and correct copy of the Word document within the zip file (45008-5b0.doc), in PDF form, is provided as Ex. 1005.

49. TS45.008 was available to download from 3GPP's public file on July 2, 2003, as evidenced by the upload date corresponding to that file:



Appendix 3, at 1 (annotated).

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 29 of 304

50. As I described above in paragraphs 36-41 and 44-47, *supra*, technical specifications could be readily obtained through the 3GPP website. Interested POSITAs would have been well aware of 3GPP and of the 3GPP website, and they would have known that 3GPP documents were available to the public. ¶¶ 23–26, *supra*. As specifically explained in paragraph 38, *supra*, the specifications area of the 3GPP file repository could be accessed from the 3GPP website's specifications page (which, in turn, was directly accessible from the 3GPP Home Page through the "Specifications" link). Additionally, the Specifications page provided a direct link to versions of technical specifications grouped according to their approval date.38, *supra*. As described in paragraphs 38-41, *supra*, an interested POSITA could then narrow the relevant specifications of interest based on the subject matter covered by each Working Group, as well as the specification numbering scheme.

51. With that knowledge, to download TS45.008, an interested POSITA could have navigated to the specifications area of the file repository via the direct link on the specifications page. Appendix 8 at 1. As described in paragraph 40, *supra*, that navigation structure was simple, as it was based on the filename structure. Thus, an interested POSITA would have been capable of navigating to relevant 3GPP specifications on the 3GPP website using reasonable diligence.

52. As I described in paragraphs 49-51, *supra*, the upload time stamp indicates that 45008-5b0.zip was uploaded to 3GPP's publicly available website on

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 30 of 304

July 2, 2003, and that any member of the public could have downloaded the zip file, extracted the Word document enclosed, and viewed the contents of the Word document without restriction on July 2, 2003, and anytime thereafter. As I described in paragraph 47, *supra*, based on my personal knowledge and experience, this time stamp accurately reflects the date the document was uploaded to the 3GPP public file repository, and I have no reason to believe this particular time stamp is inaccurate. I have determined that TS45.008 (Ex. 1005) was available for any member of the public to download from the 3GPP website as of July 2, 2003. Further, as described in paragraphs 25-26, *supra*, 3GPP documents were freely available and were not burdened by any confidentiality requirements or restrictions on further dissemination.

53. It is my opinion, therefore, that by July 2, 2003, an interested POSITA using reasonable diligence could have located TS45.008 on the 3GPP website, downloaded the reference without providing any credentials, and disseminated the reference to others without restriction.

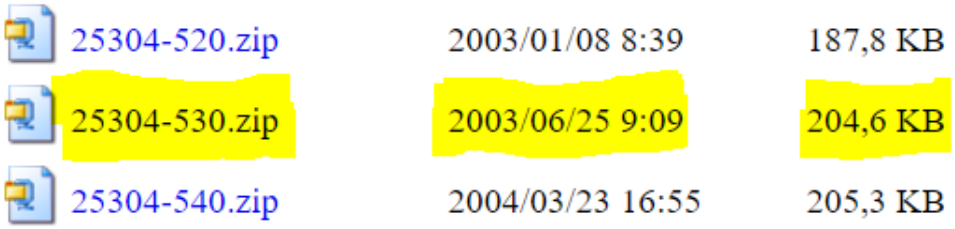
V. EXHIBIT 1006 ("TS25.304")

54. 3GPP TS 25.304 V5.3.0 ("TS25.304") (Ex. 1006) is a Technical Specification titled "3rd Generation Partnership Project; Technical Specification Group Radio Access Network; User Equipment (UE) procedures in idle mode and procedures for cell reselection in connected mode (Release 5)." Ex. 1006 at 1. The

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 31 of 304

specification indicates that it was produced by 3GPP in June 2003. Ex. 1006 at 1. To obtain this document, I directed a web browser to the URL: https://www.3gpp.org/ftp/Specs/archive/25_series/25.304. Appendix 5, at 1. I selected the link for "25304-530.zip" and downloaded a zip file of the same name. Appendix 5 at 1. The zip file contained a Microsoft Word document, titled "25304-530.doc." A true and correct copy of the Word document within the zip file (25304-530.doc), in PDF form, is provided as Ex. 1006.

55. TS25.304 was available to download from 3GPP's public file on June 25, 2003, as evidenced by the upload date corresponding to that file:



Appendix 5, at 1 (annotated).

56. As I described above in paragraphs 36-41 and 44-47, *supra*, draft technical specifications could be readily obtained through the 3GPP website. Interested POSITAs would have been well aware of 3GPP and of the 3GPP website, and they would have known that 3GPP documents were available to the public. ¶¶ 23–26, *supra*. As specifically explained in paragraph 38, *supra*, the specifications area of the 3GPP file repository could be accessed from the 3GPP

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 32 of 304

website's specifications page (which, in turn, was directly accessible from the 3GPP Home Page through the "Specifications" link). Additionally, the specifications page provided a direct link to versions of technical specifications grouped according to their approval date.¶ 38, *supra*. As described in paragraphs 38-41, *supra*, an interested POSITA could then narrow the relevant specifications of interest based on the subject matter covered by each Working Group, as well as the specification numbering scheme.

57. With that knowledge, to download TS25.304, an interested POSITA could have navigated to the specifications area of the file repository via the direct link on the specifications page. Appendix 8 at 1. As described in paragraph 40, that navigation structure was simple, as it was based on the filename structure. Thus, an interested POSITA would have been capable of navigating to relevant 3GPP specifications on the 3GPP website using reasonable diligence.

58. As I described in paragraphs 55-57, *supra*, the upload time stamp indicates that 25304-530.zip was uploaded to 3GPP's publicly available website on June 25, 2003, and that any member of the public could have downloaded the zip file, extracted the Word document enclosed, and viewed the contents of the Word document without restriction on June 25, 2003, and anytime thereafter. As I described in paragraph 47, *supra*, based on my personal knowledge and experience, this time stamp accurately reflects the date the document was uploaded

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 33 of 304

to the 3GPP public file repository, and I have no reason to believe this particular time stamp is inaccurate. I have determined that TS25.304 (Ex. 1006) was available for any member of the public to download from the 3GPP website as of June 25, 2003. Further, as described in paragraphs 25-26, *supra*, 3GPP documents were freely available and were not burdened by any confidentiality requirements or restrictions on further dissemination.

59. It is my opinion, therefore, that by June 25, 2003, an interested POSITA using reasonable diligence could have located TS25.304 on the 3GPP website, downloaded the reference without providing any credentials, and disseminated the reference to others without restriction.

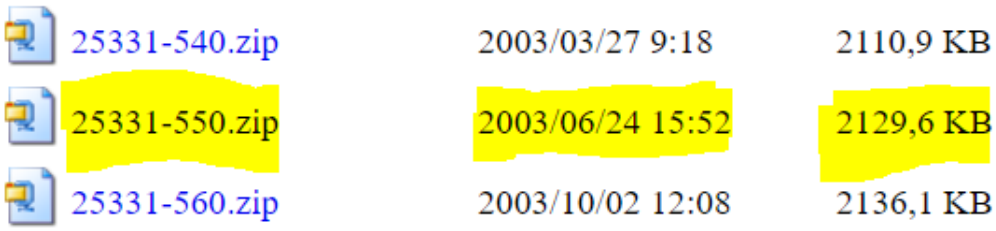
VI. EXHIBIT 1007 ("TS25.331")

60. 3GPP TS 25.331 V5.5.0 ("TS25.331") (Ex. 1007) is a Technical Specification. Ex. 1007 at 1. The specification indicates that it was produced by 3GPP in June 2003. Ex. 1007 at 1. To obtain this document, I directed a web browser to the URL: https://www.3gpp.org/ftp/Specs/archive/25_series/25.331. Appendix 4, at 1. I selected the link for "25331-550.zip" and downloaded a zip file of the same name. Appendix 4 at 1. The zip file contained a Microsoft Word document, titled "25331-550.doc." A true and correct copy of the Word document within the zip file (25331-550.doc), in PDF form, is provided as Ex. 1007.

61. TS25.331 was available to download from 3GPP's public file on June

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 34 of 304

24, 2003, as evidenced by the upload date corresponding to that file:



Appendix 4, at 1 (annotated).

62. As I described above in paragraphs 36-41 and 44-47, *supra*, draft technical specifications could be readily obtained through the 3GPP website. Interested POSITAs would have been well aware of 3GPP and of the 3GPP website, and they would have known that 3GPP documents were available to the public. ¶¶ 23–26, *supra*. As specifically explained in paragraph 38, *supra*, the specifications area of the 3GPP file repository could be accessed from the 3GPP website's specifications page (which, in turn, was directly accessible from the 3GPP Home Page through the "Specifications" link). Additionally, the specifications page provided a direct link to versions of technical specifications grouped according to their approval date. ¶ 38, *supra*. As described in paragraphs 38-41, *supra*, an interested POSITA could then narrow the relevant specifications of interest based on the subject matter covered by each Working Group, as well as the specification numbering scheme.

63. With that knowledge, to download TS25.331, an interested POSITA

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 35 of 304

could have navigated to the specifications area of the file repository via the direct link on the specifications page. Appendix 8 at 1. As described in paragraph 40, that navigation structure was simple, as it was based on the filename structure. Thus, an interested POSITA would have been capable of navigating to relevant 3GPP specifications on the 3GPP website using reasonable diligence.

64. As I described in paragraphs 61-63, *supra*, the upload time stamp indicates that 25331-550.zip was uploaded to 3GPP's publicly available website on June 24, 2003, and that any member of the public could have downloaded the zip file, extracted the Word document enclosed, and viewed the contents of the Word document without restriction on June 24, 2003, and anytime thereafter. As I described in paragraph 47, *supra*, based on my personal knowledge and experience, this time stamp accurately reflects the date the document was uploaded to the 3GPP public file repository, and I have no reason to believe this particular time stamp is inaccurate. I have determined that TS25.331 (Ex. 1007) was available for any member of the public to download from the 3GPP website as of June 24, 2003. Further, as described in paragraphs 25-26, *supra*, 3GPP documents were freely available and were not burdened by any confidentiality requirements or restrictions on further dissemination.

65. It is my opinion, therefore, that by June 24, 2003, an interested POSITA using reasonable diligence could have located TS25.331 on the 3GPP

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 36 of 304

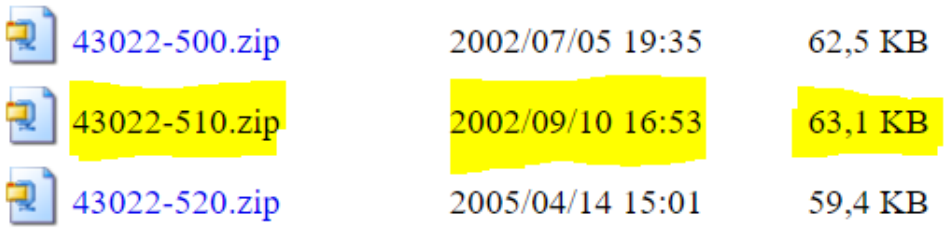
website, downloaded the reference without providing any credentials, and disseminated the reference to others without restriction.

VII. EXHIBIT 1009 ("TS43.022")

66. 3GPP TS 43.022 V5.1.0 ("TS43.022") (Ex. 1009) is a Technical Specification titled "3rd Generation Partnership Project; Technical Specification Group GSM/EDGE Radio Access Network; Functions related to Mobile Station (MS) in idle mode and group receive mode (Release 5)." Ex. 1009 at 1. The specification indicates that it was produced by 3GPP in August 2002. Ex. 1009 at 1. To obtain this document, I directed a web browser to the URL: https://www.3gpp.org/ftp/Specs/archive/43_series/43.022. Appendix 6, at 1. I selected the link for "43.022-510.zip" and downloaded a zip file of the same name. The zip file contained a Microsoft Word document titled "43.022-510.doc." A true and correct copy of the Word document within the zip file (43.022-510.doc), printed to PDF form, is provided as Ex. 1009.

67. TS43.022 was available to download from 3GPP's public file on September 10, 2002, as evidenced by the upload date corresponding to that file:

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 37 of 304



Appendix 6, at 1 (annotated).

68. As I described above in paragraphs 36-41 and 44-47, *supra*, technical specifications could be readily obtained through the 3GPP website. Interested POSITAs would have been well aware of 3GPP and of the 3GPP website, and they would have known that 3GPP documents were available to the public. ¶¶ 23–26, *supra*. As specifically explained in paragraph 38, *supra*, the specifications area of the 3GPP file repository could be accessed from the 3GPP website's specifications home page (which, in turn, was directly accessible from the 3GPP Home Page through the "specifications" link). Additionally, the specifications page provided a direct link to versions of technical specifications grouped according to their approval date. ¶ 38, *supra*. As described in paragraphs 38-41, *supra*, an interested POSITA could then narrow the relevant specifications of interest based on the subject matter covered by each Working Group, as well as the specification numbering scheme.

69. With that knowledge, to download TS43.022, an interested POSITA could have navigated to the specifications area of the file repository via the direct

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 38 of 304

link on the specifications page. Appendix 8 at 1. As described in paragraph 40, that navigation structure was simple, as it was based on the filename structure. Thus, an interested POSITA would have been capable of navigating to relevant 3GPP specifications on the 3GPP website using reasonable diligence.

70. As I described in paragraphs 67-69, *supra*, the upload time stamp indicates that 43.022-510.zip was uploaded to 3GPP's publicly available website on September 10, 2002, and that any member of the public could have downloaded the zip file, extracted the Word document enclosed, and viewed the contents of the Word document without restriction on September 10, 2002, and anytime thereafter. As I described in paragraph 47, *supra*, based on my personal knowledge and experience, this time stamp accurately reflects the date the document was uploaded to the 3GPP public file repository, and I have no reason to believe this particular time stamp is inaccurate. I have determined that TS43.022 (Ex. 1009) was available for any member of the public to download from the 3GPP website as of September 10, 2002. Further, as described in paragraphs 25-26, *supra*, 3GPP documents were freely available and were not burdened by any confidentiality requirements or restrictions on further dissemination.

71. It is my opinion, therefore, that by September 10, 2002, an interested POSITA using reasonable diligence could have located TS43.022 on the 3GPP website, downloaded the reference without providing any credentials, and

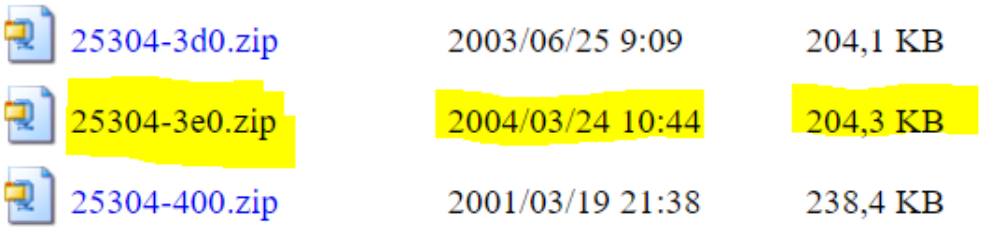
Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 39 of 304

disseminated the reference to others without restriction.

VIII. EXHIBIT 1017

72. 3GPP TS 25.304 V3.14.0 (Ex. 1017) is a Technical Specification titled "3rd Generation Partnership Project; Technical Specification Group Radio Access Network; User Equipment (UE) procedures in idle mode and procedures for cell reselection in connected mode (Release 1999)." Ex. 1017 at 1. The specification indicates that it was produced by 3GPP in March 2004. Ex. 1017 at 1. To obtain this document, I directed a web browser to the URL: https://www.3gpp.org/ftp/Specs/archive/25_series/25.304. Appendix 5, at 1. I selected the link for "25304-3e0.zip" and downloaded a zip file of the same name. Appendix 5 at 1. The zip file contained a Microsoft Word document, titled "25304-3e0.doc." A true and correct copy of the Word document within the zip file (25304-3e0.doc), in PDF form, is provided as Ex. 1017.

73. Ex. 1017 was available to download from 3GPP's public file on March 24, 2004, as evidenced by the upload date corresponding to that file:



Appendix 5, at 1 (annotated).

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 40 of 304

74. As I described above in paragraphs 36-41 and 44-47, *supra*, draft technical specifications could be readily obtained through the 3GPP website. Interested POSITAs would have been well aware of 3GPP and of the 3GPP website, and they would have known that 3GPP documents were available to the public. ¶¶ 23–26, *supra*. As specifically explained in paragraph 38, *supra*, the specifications area of the 3GPP file repository could be accessed from the 3GPP website's specifications page (which, in turn, was directly accessible from the 3GPP Home Page through the "Specifications" link). Additionally, the specifications page provided a direct link to versions of technical specifications grouped according to their approval date. ¶ 38, *supra*. As described in paragraphs 38-41, *supra*, an interested POSITA could then narrow the relevant specifications of interest based on the subject matter covered by each Working Group, as well as the specification numbering scheme.

75. With that knowledge, to download Ex. 1017, an interested POSITA could have navigated to the specifications area of the file repository via the direct link on the specifications page. Appendix 8 at 1. As described in paragraph 40, that navigation structure was simple, as it was based on the filename structure. Thus, an interested POSITA would have been capable of navigating to relevant 3GPP specifications on the 3GPP website using reasonable diligence.

76. As I described in paragraphs 73-75, *supra*, the upload time stamp

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 41 of 304

indicates that 25304-3e0.zip was uploaded to 3GPP's publicly available website on March 24, 2004, and that any member of the public could have downloaded the zip file, extracted the Word document enclosed, and viewed the contents of the Word document without restriction on March 24, 2004, and anytime thereafter. As I described in paragraph 47, *supra*, based on my personal knowledge and experience, this time stamp accurately reflects the date the document was uploaded to the 3GPP public file repository, and I have no reason to believe this particular time stamp is inaccurate. I have determined that Ex. 1017 was available for any member of the public to download from the 3GPP website as of March 24, 2004. Further, as described in paragraphs 25-26, *supra*, 3GPP documents were freely available and were not burdened by any confidentiality requirements or restrictions on further dissemination.

77. It is my opinion, therefore, that by March 24, 2004, an interested POSITA using reasonable diligence could have located Ex. 1017 on the 3GPP website, downloaded the reference without providing any credentials, and disseminated the reference to others without restriction.

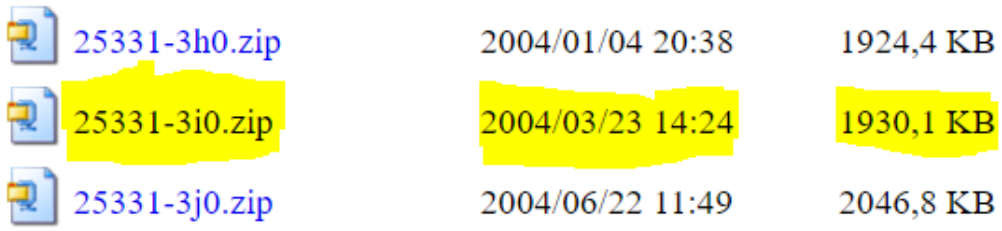
IX. EXHIBIT 1018

78. 3GPP TS 25.331 V3.18.0 (Ex. 1018) is a Technical Specification titled "3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Radio Resource Control (RRC) protocol specification (Release

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 42 of 304

1999).” Ex. 1018 at 1. The specification indicates that it was produced by 3GPP in March 2004. Ex. 1018 at 1. To obtain this document, I directed a web browser to the URL: https://www.3gpp.org/ftp/Specs/archive/25_series/25.331. Appendix 4, at 1. I selected the link for “25331-3i0.zip” and downloaded a zip file of the same name. Appendix 4 at 1. The zip file contained a Microsoft Word document, titled “25331-3i0.doc.” A true and correct copy of the Word document within the zip file (25331-3i0.doc), in PDF form, is provided as Ex. 1018.

79. Ex. 1018 was available to download from 3GPP’s public file on March 23, 2004, as evidenced by the upload date corresponding to that file:



Appendix 4, at 1 (annotated).

80. As I described above in paragraphs 36-41 and 44-47, *supra*, draft technical specifications could be readily obtained through the 3GPP website. Interested POSITAs would have been well aware of 3GPP and of the 3GPP website, and they would have known that 3GPP documents were available to the public. ¶¶ 23–26, *supra*. As specifically explained in paragraph 38, *supra*, the specifications area of the 3GPP file repository could be accessed from the 3GPP

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 43 of 304

website's specifications page (which, in turn, was directly accessible from the 3GPP Home Page through the "Specifications" link). Additionally, the specifications page provided a direct link to versions of technical specifications grouped according to their approval date. ¶ 38, *supra*. As described in paragraphs 38-41, *supra*, an interested POSITA could then narrow the relevant specifications of interest based on the subject matter covered by each Working Group, as well as the specification numbering scheme.

81. With that knowledge, to download Ex. 1018, an interested POSITA could have navigated to the specifications area of the file repository via the direct link on the specifications page. Appendix 8 at 1. As described in paragraph 40, that navigation structure was simple, as it was based on the filename structure. Thus, an interested POSITA would have been capable of navigating to relevant 3GPP specifications on the 3GPP website using reasonable diligence.

82. As I described in paragraphs 79-81, *supra*, the upload time stamp indicates that 25331-3i0.zip was uploaded to 3GPP's publicly available website on March 23, 2004, and that any member of the public could have downloaded the zip file, extracted the Word document enclosed, and viewed the contents of the Word document without restriction on March 23, 2004, and anytime thereafter. As I described in paragraph 47, *supra*, based on my personal knowledge and experience, this time stamp accurately reflects the date the document was uploaded

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 44 of 304

to the 3GPP public file repository, and I have no reason to believe this particular time stamp is inaccurate. I have determined that Ex. 1018 was available for any member of the public to download from the 3GPP website as of March 23, 2004. Further, as described in paragraphs 25-26, *supra*, 3GPP documents were freely available and were not burdened by any confidentiality requirements or restrictions on further dissemination.

83. It is my opinion, therefore, that by March 23, 2004, an interested POSITA using reasonable diligence could have located Ex. 1018 on the 3GPP website, downloaded the reference without providing any credentials, and disseminated the reference to others without restriction.

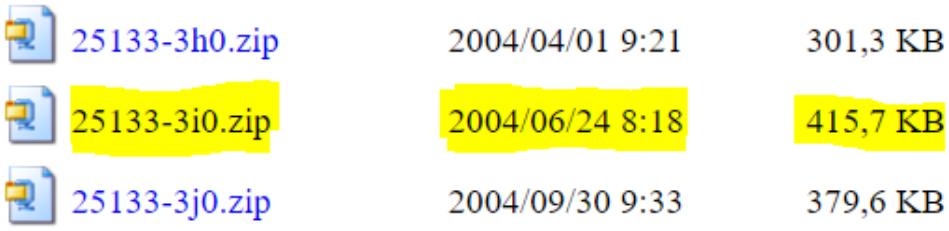
X. EXHIBIT 1019

84. 3GPP TS 25.133 V3.18.0 (Ex. 1019) is a Technical Specification titled "3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Requirements for support of radio resource management (FDD) (Release 1999)." Ex. 1019 at 1. The specification indicates that it was produced by 3GPP in June 2004. Ex. 1019 at 1. To obtain this document, I directed a web browser to the URL: https://www.3gpp.org/ftp/Specs/archive/25_series/25.133. Appendix 12, at 1. I selected the link for "25133-3i0.zip" and downloaded a zip file of the same name. Appendix 12 at 1. The zip file contained a Microsoft Word document, titled "25133-3i0.doc." A true and correct copy of the Word document

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 45 of 304

within the zip file (25133-3i0.doc), in PDF form, is provided as Ex. 1019.

85. Ex. 1019 was available to download from 3GPP's public file on June 24, 2004, as evidenced by the upload date corresponding to that file:



25133-3h0.zip	2004/04/01 9:21	301,3 KB
25133-3i0.zip	2004/06/24 8:18	415,7 KB
25133-3j0.zip	2004/09/30 9:33	379,6 KB

Appendix 12, at 1 (annotated).

86. As I described above in paragraphs 36-41 and 44-47, *supra*, draft technical specifications could be readily obtained through the 3GPP website. Interested POSITAs would have been well aware of 3GPP and of the 3GPP website, and they would have known that 3GPP documents were available to the public. ¶¶ 23–26, *supra*. As specifically explained in paragraph 38, *supra*, the specifications area of the 3GPP file repository could be accessed from the 3GPP website's specifications page (which, in turn, was directly accessible from the 3GPP Home Page through the "Specifications" link). Additionally, the specifications page provided a direct link to versions of technical specifications grouped according to their approval date. ¶ 38, *supra*. As described in paragraphs 38-41, *supra*, an interested POSITA could then narrow the relevant specifications of interest based on the subject matter covered by each Working Group, as well as

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 46 of 304

the specification numbering scheme.

87. With that knowledge, to download Ex. 1019, an interested POSITA could have navigated to the specifications area of the file repository via the direct link on the specifications page. Appendix 8 at 1. As described in paragraph 40, that navigation structure was simple, as it was based on the filename structure. Thus, an interested POSITA would have been capable of navigating to relevant 3GPP specifications on the 3GPP website using reasonable diligence.

88. As I described in paragraphs 85-87, *supra*, the upload time stamp indicates that 25133-3i0.zip was uploaded to 3GPP's publicly available website on June 24, 2004, and that any member of the public could have downloaded the zip file, extracted the Word document enclosed, and viewed the contents of the Word document without restriction on June 24, 2004, and anytime thereafter. As I described in paragraph 47, *supra*, based on my personal knowledge and experience, this time stamp accurately reflects the date the document was uploaded to the 3GPP public file repository, and I have no reason to believe this particular time stamp is inaccurate. I have determined that Ex. 1019 was available for any member of the public to download from the 3GPP website as of June 24, 2004. Further, as described in paragraphs 25-26, *supra*, 3GPP documents were freely available and were not burdened by any confidentiality requirements or restrictions on further dissemination.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 47 of 304

89. It is my opinion, therefore, that by June 24, 2004, an interested POSITA using reasonable diligence could have located Ex. 1019 on the 3GPP website, downloaded the reference without providing any credentials, and disseminated the reference to others without restriction.

IX. CONCLUSION

90. In sum, the upload date of July 2, 2003, supports my opinion that TS45.008 (Ex. 1005) was publicly available on July 2, 2003. Additionally, the upload date on the 3GPP file repository supports my opinion that an interested POSITA exercising reasonable diligence could have located and downloaded this reference as of July 2, 2003, from the 3GPP website.

91. Further, the upload date of June 25, 2003, supports my opinion that TS25.304 (Ex. 1006) was publicly available on June 25, 2003. Additionally, the upload date on the 3GPP file repository supports my opinion that an interested POSITA exercising reasonable diligence could have located and downloaded this reference as of June 25, 2003, from the 3GPP website.

92. Further, the upload date of June 24, 2003, supports my opinion that TS25.331 (Ex. 1007) was publicly available on June 24, 2003. Additionally, the upload date on the 3GPP file repository supports my opinion that an interested POSITA exercising reasonable diligence could have located and downloaded this reference as of June 24, 2003, from the 3GPP website.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 48 of 304

93. Further, the upload date of September 10, 2002, supports my opinion that TS43.022 (Ex. 1009) was publicly available on September 10, 2002. Additionally, the upload date on the 3GPP file repository supports my opinion that an interested POSITA exercising reasonable diligence could have located and downloaded this reference as of September 10, 2002, from the 3GPP website.

94. Further, the upload date of March 24, 2004, supports my opinion that Ex. 1017 was publicly available on March 24, 2004. Additionally, the upload date on the 3GPP file repository supports my opinion that an interested POSITA exercising reasonable diligence could have located and downloaded this reference as of March 24, 2004, from the 3GPP website.

95. Further, the upload date of March 23, 2004, supports my opinion that Ex. 1018 was publicly available on March 23, 2004. Additionally, the upload date on the 3GPP file repository supports my opinion that an interested POSITA exercising reasonable diligence could have located and downloaded this reference as of March 23, 2004, from the 3GPP website.

96. Further, the upload date of June 24, 2004, supports my opinion that Ex. 1019 was publicly available on June 24, 2004. Additionally, the upload date on the 3GPP file repository supports my opinion that an interested POSITA exercising reasonable diligence could have located and downloaded this reference as of June 24, 2004, from the 3GPP website.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 49 of 304

X. DECLARATION

Pursuant to Section 1746 of Title 28 of United States Code, I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct and that the foregoing is based upon personal knowledge and information and is believed to be true.

Executed on March 25, 2021.

By: 

Craig Bishop

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 50 of 304

Appendix 1

Curriculum Vitae – January 2021

Name: Craig Bishop

Contact Tel No.: +44 (0)7984 564949 (mobile)

Email: craig@bishopcom.co.uk

Current job title: Independent Consulting Engineer, CEO

Address: 32 Nightingale Road, Faversham, Kent, ME13 8RF

Key Skills and Experience

- 31 years Telecoms, Radio and Broadcast experience
- 24 years experience in 2G/3G/4G telecoms standardisation and mobile handset development
- Extensive knowledge of 3GPP and ETSI specifications and procedures including ETSI role from regulatory perspective (harmonised standards, mandates, spectrum, etc)
- Sound understanding of 3GPP systems, including Radio Access Interfaces and Networks, Access Stratum protocols, Core Networks, Non-Access Stratum protocols, and IMS
- Depositions, reports, and declarations as expert witness in cases on 3GPP technologies and on 3GPP & ETSI practices and procedures.
- Intellectual property analysis including prior art search and evaluation of patent essentiality
- Application of data analytics and machine learning techniques to standards and IP data
- Programming in Java, Python, C, Octave (Matlab)

Career History

Bishop Communications Ltd. 01/13 –

Independent Telecommuncations Standards and Intellectual Property Consultant

Full ETSI member

Activities have included:

- Provision of expertise for EC funded ETSI Specialist Task Force (STF489) to produce implementation guidelines for Total Conversation for emergency services. Project delivered on time / budget and well received. Ouput published March 2016 as ETSI TR 103 201.
- Provision of expertise for ETSI Specialist Task Force (STF555) assessing the impact on existing standards of communications involving IoT devices in all types of emergency situations. Project delivered on time / budget and well received. Ouput published July 2019 as ETSI TR 103 582.
- Provision of expert support for IPR litigation from standards landscape analysis / background technical reports to expert testimony reports / declarations and depositions.
- Intellectual property analysis assessing strengths and weaknesses of patents and patent portfolios, conducting searches for prior art, evaluating patent essentiality, and acquring relevant documentation.
- Provision of standards consultancy services for Samsung Electronics in ETSI including membership of the ETSI Board until November 2014

Technologies covered in patent related work include: 3GPP GSM, UMTS, LTE radio interface technologies (Phy, MAC, RLC, RRC), 3GPP access and core networks (GPRS/UMTS & EPC NAS), IMS. Organisations covered include 3GPP & ETSI.

Clients served during last 8 years include: Addy Hart LLP, Alston & Bird LLP, Banner Witcoff LLP, DLA Piper LLP, European Telecommunications Standards Institute (ETSI), Fish & Richardson P.C., Gibson Dunn LLP, Haynes and Boone LLP, Hillebrand-CE GmbH (work for third party clients as Consulting Engineer for Hillebrand-CE), Kilpatrick Townsend & Stockton, Kirkland & Ellis LLP, Morgan, Lewis & Bokius LLP, MckoolSmith LLP, Paul Hastings LLP, Perkins Coie LLP, Powell Gilbert LLP, Sidley

Petitioners' Ex. 1016

Exhibit 2004
IPR2023-00919
Page 52 of 304

Austin LLP, Samsung Electronics Research & Development Institute UK (SRUK), Williams & Connolly LLP, WilmerHale LLP.

Expert testimony through deposition:

- *Huawei Technologies Co. Ltd. vs. T-Mobile US, Inc., et al.*, Case Nos. 2:16-cv-0052-JRG-RSP, 2:16-cv-0055-JRG-RSP, 2:16-cv-0056-JRG-RSP, and 2:16-cv-0057-JRG-RSP (E.D. Tex.). On behalf of T-Mobile US Inc.
- *T-Mobile US, Inc., et al.* v. *Huawei Technologies Co. Ltd.*, IPR Nos. IPR2017-00696 and IPR2017-00697 (PTAB). On behalf of T-Mobile US Inc.
- *LG Electronics, Inc., v. Koninklijke KPN N.V.*, IPR Nos. Case IPR2018-00558 (PTAB). On behalf of LG Electronics, Inc.

Expert testimony in court:

- *Between IPCom GmbH and Vodafone, e al.,* Claim No. HP-2018-000030 Claim No. HP-2018-000031, High Court of Justice, Business & Property Courts of England and Wales, Intellectual Property List (ChD), Patents Court. Retained by Vodafone.

A list of reports and declarations submitted but not deposed for can be provided on request.

Samsung Electronics Research Institute (SERI) 12/96 – 01/13

Director Standards and Industry Affairs 03/11 – 01/13

Mission and Tasks as for previous role plus:

- Proactive member of ETSI Board following election as Board member in November 2011
- Worked with Samsung internal and external legal counsel in response to EC investigation into Samsung suspected abuse of Standards Essential Patents.
- Deposed by Apple as fact witness in ITC investigation 337-TA-794.

Head of Advanced Technologies Standards & Regulation 09/05 - 03/11

Mission: To help position Samsung and SERI at the forefront of mobile telecommunication developments through participation in and leadership of mobile communications standards and European regulatory affairs

Key tasks:

- Developed standards and research strategy and coordinated activites with head office, acting as official Samsung contact for the European Telecommunications Standars Institute.
- Programme managed standardisation and regulation projects covering 3GPP (RAN2, CT1, SA2, SA1, SA, RAN, CT), OMA, and mobile Broadcast strategies and technologies (DVB Forum), European Framework projects (FP7), Spectrum Management (CEPT, ETSI EM, TFES, BRAN, …) and European Regulatory affairs (Digital Europe, relations with European Commission, …). - Grew department from 3 to 12 persons to cater for these activities.
- Participated and actively contributed to 3GPP SA1 (11/08 – 11/11), SA2 (10/05 – 08/11) , SA and ETSI TC SCP groups on issues including IMS / CS Interworking (VCC / SRVCC, VoLTE, T-ADS, ICS), Local IP Access & Selected IP Traffic Offload (LIPA-SIPTO), MOSAP, M2M/MTC, Embedded / 4FF UICC.
- Drafted and filed communication technology related patents related to 3GPP SA2 and CT1 technologies – 18 filed, mainly IMS and 3GPP NAS related
- Supported Samsung IP team with analysis of Samsung and 3rd party communication technology related patents and claim charts including GSM/GPRS, UTRAN, NAS, and IMS patents
- Chaired SERI Patent Committee from 2007-2009 - SERI achieved patent targets for first time in 2007 and did so in every year following

Standards consultant – part time 09/04 – 09/05

(Whilst studying fulltime for MSC)

During this time, I conducted a review of the wireless communication technolgies and the associated standards space, with a particular emphasis on 802.16a, as well as 3G and 802.11 evolutions. I was also involved in analysis of 3rd party patents and claim charts on request from Samsung IP team.

Technology Manager System Engineering group 06/03 – 09/04

Mission: To establish a System Engineering group within SERI to support development of SERI's dual mode GSM/UMTS radio modem platform.

Key Tasks:

- Defined and implemented System Engineering group strategy including recruitment and line management of the group which grew from 3 to 10 engineers during this period.
- Developed detailed system requirements for SERI's dual mode 2G/3G radio modem platform(s) including production of background documentation describing system wide behaviour
- Defined system test programme for platform, including example test cases using off the shelf test equipment. This project outsourced (under my supervision) to a third party company for completion.
- Provided continued support to development engineers in terms of understanding specification and system requirements, particularly with respect to Access Stratum and Non Access Stratum specifications and protocols.
- Instigated and managed studies investigating optimised system architecture for future Samsung mobile platforms.
- Analysed Samsung and 3rd party 3GPP technology related patents and claim charts on request by Samsung IP team and reported on their value and standards essentiality.

Technology Manager Standards & System Group 04/02 – 06/03

Mission: To provide Standards support to SERI development teams and Samsung's global standardisation activities.

Key Tasks:

- Devised and implemented revised strategy to improve the focus of activities and provide improved support for software developers from a system perspective.
- Attended 3GPP TSG SA plenary and occasional SA WG1 meetings - acted as rapporteur for 3GPP Evolution technical report 3GPP TR 21.902.
- Analysed 3rd party GSM/GPRS technology related patents and claim charts on request by Samsung IP team and reported on their value and standards essentiality.
- Line managed 3 engineers, ensuring that the group provided expert support for SERI SW and HW developers in terms of standards interpretation and system requirements, particularly with respect to the Radio Access Network.

Project Manager 04/00 – 04/02

Mission: To establish and manage development of a dual mode GSM/UMTS modem platform.

Key tasks:

- Defined and managed work relating to core technology development for Samsung's 3G handsets.
- Determined major technical architecture and parameters for the platform producing high level system requirements specification and project development plan.

- As a technical authority on UMTS, supported the project in terms of requirements specification and interpretation (L1, MAC/RLC, RRC, and NAS specifications), and contributed towards the training of UMTS project team members.
- Acting in a consultative capacity, interfaced with other departments in Samsung and with external customers/suppliers on issues relating to 2G and 3G technologies
- Responsible for the overall planning, work allocation and co-ordination of engineers for the project, as well as being involved in recruitment – during this period the number of engineers working on the project increased from 10 to over 40.
- Instigated, defined and managed a feasibility study involving HW and SW engineers, as essential preparation for the development of a dual mode GSM/UMTS radio modem platform.

Senior/Principal Standards Engineer 12/96 – 04/00

Mission: To support Samsung standards and development activities in ETSI and 3GPP.

Key Tasks:

- Gathered and disseminated information throughout Samsung concerning latest specifications and trends in telecommunications, providing advice to Senior Management on future strategies for telecommunications development.
- Acted as sole Samsung representative in ETSI TC SMG2 from December 1996 and during the selection phase for the UMTS Radio Acces Technology providing training for Samsung engineers on elaborated technologies
- Participated in 3GPP TSG RAN WG1 (UTRA Physical Layer), and RAN WG2 (L2/3) contributing specifically in areas related to FEC, Common Packet Channel, and Transmit Diversity
- In 3GPP TSG T WG2 I initiated and acted as rapporteur for the UE capabilities work item. I also acted as liaison officer between TSG T WG2, TSG RAN WG1 and TSG SA WG1 (Service Aspects) on issues of common interest
- Acted as main spokesperson for and advisor on Samsung strategic activities in, 3GPP TSG RAN from 3GPP's creation until April 2000
- Acted in a consultative capacity advising the company on technical, commercial and regulatory issues relating to 3rd generation telecommunications development and implementation.
- Developed and promoted programme to co-ordinate standards activities throughout Samsung. – Samsung Global Standards Strategy Group established in September 1998.
- Attended ETSI TCs, SMG1, SMG4, SMG5, SMG7, SMG9 and SMG11 as required by Samsung to keep abreast of developments prior to establishment of 3GPP

Radiocommunications Agency 06/93 -11/96

HPTO Spectrum Engineer

- Responsible for the management of spectrum for use by PMR and Wireless LAN technologies.
- Defined and instigated development of an improved assignment methodology for Private Mobile Radio (PMR) channels, promoting increased quality and spectrum efficiency.
- Managed research projects involving the assessment and selection of bids from external companies, submitted under competitive tender.
- Represented the Agency in the National and International fora associated with the use of Land Mobile Radio, acting as rapporteur for PMR voice and data standards in ETSI Sub-Technical-Committee RES02, and as chairman of a sub-working group under ITU WP8A drafting the recommendation for use of the radio spectrum by Radio LANs.
- Involved in CEPT Spectrum Engineering Project Teams, dealing with spectrum for Narrow band PMR technology and co-ordination between that technology and T-DAB transmissions in Band III.

- Dispensed technical advice both within the Agency and to external customers, on national and international PMR standards, assessing requests for additional frequencies, and providing technical justification for assignments and wider spectrum policy

BBC Radio 11/89 – 05/93

Radio Operations Engineer

- Worked on projects requiring the design, development, maintenance and testing of equipment for use within the broadcasting chain.
- Responsible for acceptance testing of new studios for Radio 5, and in particular redesign of outside source circuits for the main sports continuity studio.
- Involved in acceptance testing for NICAM transmission routers. Designed and implemented modifications to synchronise transmission feeds, resulting in seamless switching between routers.

Education

1. MSC in Computer Science from the University of Kent

   Awarded (with distinction): 07/2006

   Dissertation title: Roles Variables and Program Analysis – Received prize for outstanding achievement

2. B.Eng. (Hons) in Electronic Engineering from the Polytechnic of Central London

   Awarded: 07/1989

3. In house and external technical and management training including: Learning Tree courses on System Analysis and Design, User Requirements, UML, and Project Management.
4. On-line courses from: Cousera, Udemy, and Zenva courses covering Machine Learning, Python, Data Science, and Natural Language Processing

Appendix 2

http://www.3gpp.org/ftp/ Go MAY AUG OCT
433 captures
7 Apr 2000 - 18 Jan 2021
1999 2000 2001
About this capture

www.3gpp.org - /ftp/

[To Parent Directory]

```
   7/18/00  4:06 PM       <dir> Information
   5/25/00  2:42 PM       <dir> Op
   5/25/00  2:43 PM       <dir> PCG
   7/31/00 11:31 AM       <dir> Specs
    4/3/00  3:30 PM       <dir> TSG_CN
    8/9/00  2:03 PM       <dir> TSG_GERAN
   2/28/99  4:58 PM       <dir> TSG_RAN
   6/13/00  5:20 PM       <dir> TSG_SA
    1/8/99 10:07 AM       <dir> TSG_T
   1/31/00  4:44 PM       <dir> WORKSHOP
```

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 58 of 304

Appendix 3

www.3gpp.org / ftp / Specs / archive / 45_series / 45.008

sort by name/desc	sort by date/desc	sort by size/desc
45008-400.zip	2000/10/10 14:04	207,8 KB
45008-401.zip	2000/10/24 11:19	208,1 KB
45008-410.zip	2000/11/24 8:22	197,9 KB
45008-411.zip	2000/11/30 9:42	210,7 KB
45008-420.zip	2001/02/15 14:31	216,8 KB
45008-430.zip	2001/04/20 14:58	222,2 KB
45008-440.zip	2001/06/17 16:09	224,7 KB
45008-450.zip	2001/09/23 6:23	225,5 KB
45008-460.zip	2001/12/30 15:20	228,5 KB
45008-470.zip	2002/02/14 19:31	230,8 KB
45008-480.zip	2002/04/30 20:37	232,6 KB
45008-490.zip	2002/07/08 11:48	236,7 KB
45008-4a0.zip	2003/04/22 20:27	247 KB
45008-4b0.zip	2003/07/02 19:42	255 KB
45008-4c0.zip	2003/09/11 10:22	256,5 KB
45008-4d0.zip	2003/12/05 9:43	223,4 KB
45008-4e0.zip	2004/07/01 15:02	264,1 KB
45008-4f0.zip	2004/09/09 22:56	274,7 KB
45008-4g0.zip	2004/11/19 19:01	280,3 KB
45008-4h0.zip	2005/11/23 17:16	281,6 KB
45008-4i0.zip	2009/03/20 10:34	263,1 KB
45008-4j0.zip	2013/09/19 15:10	264,2 KB
45008-510.zip	2001/04/20 15:01	220,2 KB
45008-520.zip	2001/06/18 8:53	222,7 KB
45008-530.zip	2001/09/23 6:25	243 KB
45008-540.zip	2001/12/30 21:12	246 KB
45008-550.zip	2002/02/14 19:46	248,5 KB
45008-560.zip	2002/05/01 16:45	252,9 KB

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 60 of 304

sort by name/desc	sort by date/desc	sort by size/desc
45008-570.zip	2002/07/08 14:37	255,3 KB
45008-580.zip	2002/09/10 16:54	258,7 KB
45008-590.zip	2003/02/21 8:55	268,8 KB
45008-5a0.zip	2003/04/23 11:51	274,3 KB
45008-5b0.zip	2003/07/02 19:55	279,4 KB
45008-5c0.zip	2003/09/11 13:37	283,8 KB
45008-5d0.zip	2003/12/05 9:44	247 KB
45008-5e0.zip	2004/02/12 16:29	290,2 KB
45008-5f0.zip	2004/04/29 18:16	280,9 KB
45008-5g0.zip	2004/07/01 15:02	300,6 KB
45008-5h0.zip	2004/09/09 23:19	299,1 KB
45008-5i0.zip	2004/11/19 21:18	298,8 KB
45008-5j0.zip	2005/06/30 17:41	312,7 KB
45008-5k0.zip	2005/09/14 11:45	295,7 KB
45008-5l0.zip	2005/11/23 17:16	314 KB
45008-5m0.zip	2006/05/07 0:49	300,1 KB
45008-5n0.zip	2009/03/20 10:34	297 KB
45008-5o0.zip	2013/09/19 15:10	295,3 KB
45008-600.zip	2003/01/03 8:53	269,1 KB
45008-610.zip	2003/02/21 8:56	270,7 KB
45008-620.zip	2003/04/23 12:55	275,8 KB
45008-630.zip	2003/07/02 20:18	283,4 KB
45008-640.zip	2003/09/11 14:41	286 KB
45008-650.zip	2003/12/05 9:44	251,9 KB
45008-660.zip	2004/02/12 17:04	293,6 KB
45008-670.zip	2004/05/06 14:12	274,1 KB
45008-680.zip	2004/07/01 15:02	289 KB
45008-690.zip	2004/09/09 23:48	293,5 KB
45008-6a0.zip	2004/11/22 15:00	289,7 KB
45008-6b0.zip	2005/02/03 15:24	310,7 KB
45008-6c0.zip	2005/04/19 14:26	310,7 KB
45008-6d0.zip	2005/06/30 17:53	310,9 KB

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 61 of 304

sort by name/desc	sort by date/desc	sort by size/desc
45008-6e0.zip	2005/09/14 11:53	311,4 KB
45008-6f0.zip	2005/11/23 17:16	313 KB
45008-6g0.zip	2006/05/07 0:49	297,6 KB
45008-6h0.zip	2006/07/07 9:30	298,3 KB
45008-6i0.zip	2006/09/15 19:17	297,7 KB
45008-6j0.zip	2007/02/24 22:25	291,3 KB
45008-6k0.zip	2008/03/20 12:06	293,2 KB
45008-6l0.zip	2009/03/20 10:34	293,7 KB
45008-6m0.zip	2013/09/19 15:55	299,9 KB
45008-700.zip	2005/09/14 12:28	293,9 KB
45008-710.zip	2005/11/23 17:16	314,1 KB
45008-720.zip	2006/01/25 19:27	315,4 KB
45008-730.zip	2006/05/07 0:48	305,6 KB
45008-740.zip	2006/07/07 14:10	307,8 KB
45008-750.zip	2006/09/15 20:05	309,5 KB
45008-751.zip	2006/10/04 8:53	313,8 KB
45008-760.zip	2006/11/26 15:18	310,4 KB
45008-770.zip	2007/02/25 0:26	307,1 KB
45008-780.zip	2007/05/30 5:56	303,4 KB
45008-790.zip	2007/09/25 8:39	306,7 KB
45008-7a0.zip	2007/12/19 13:51	317,1 KB
45008-7b0.zip	2008/03/20 12:06	316,6 KB
45008-7c0.zip	2008/09/09 0:40	323,5 KB
45008-7d0.zip	2008/11/27 19:09	324,8 KB
45008-7e0.zip	2009/03/20 10:34	325,5 KB
45008-7f0.zip	2009/06/12 7:32	326 KB
45008-7g0.zip	2009/09/15 17:09	326,5 KB
45008-7h0.zip	2010/06/04 9:22	334,7 KB
45008-7i0.zip	2010/09/14 17:21	328,5 KB
45008-7j0.zip	2010/12/21 13:58	335,8 KB
45008-7k0.zip	2011/04/01 10:52	329,3 KB
45008-7l0.zip	2013/09/19 15:10	349,2 KB

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 62 of 304

sort by name/desc	sort by date/desc	sort by size/desc
45008-800.zip	2008/09/09 2:04	336 KB
45008-810.zip	2008/12/02 9:34	377,9 KB
45008-820.zip	2009/03/20 10:34	379,5 KB
45008-830.zip	2009/06/12 7:32	381,9 KB
45008-840.zip	2009/09/23 18:18	382,6 KB
45008-850.zip	2009/12/08 19:43	391,9 KB
45008-860.zip	2010/03/17 18:13	391,9 KB
45008-870.zip	2010/06/04 9:56	389,1 KB
45008-880.zip	2010/09/14 17:42	390,6 KB
45008-890.zip	2010/12/06 17:19	390,2 KB
45008-8a0.zip	2011/04/01 10:52	393,4 KB
45008-8b0.zip	2011/06/17 14:31	394,3 KB
45008-8c0.zip	2011/09/30 13:43	404,9 KB
45008-8d0.zip	2011/12/07 22:45	396,9 KB
45008-8e0.zip	2012/03/06 17:32	416,5 KB
45008-8f0.zip	2013/03/06 18:50	391,8 KB
45008-8g0.zip	2013/09/19 15:10	416,6 KB
45008-900.zip	2009/09/23 18:20	385 KB
45008-910.zip	2009/12/03 15:37	388,1 KB
45008-920.zip	2010/03/15 19:27	393,1 KB
45008-930.zip	2010/06/07 18:05	417,7 KB
45008-940.zip	2010/09/14 18:26	408,2 KB
45008-950.zip	2010/12/21 13:59	417,6 KB
45008-960.zip	2011/04/01 10:52	410,5 KB
45008-970.zip	2011/06/17 14:31	420,8 KB
45008-980.zip	2011/09/30 13:43	421,9 KB
45008-990.zip	2011/12/08 11:52	423,6 KB
45008-9a0.zip	2012/03/06 17:48	418,2 KB
45008-9b0.zip	2013/03/06 19:04	442,6 KB
45008-9c0.zip	2013/09/19 15:10	443,9 KB
45008-a00.zip	2011/04/01 10:52	414 KB
45008-a10.zip	2011/06/17 14:31	422,1 KB

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 63 of 304

sort by name/desc	sort by date/desc	sort by size/desc
45008-a20.zip	2011/09/30 13:43	423 KB
45008-a30.zip	2011/12/08 18:24	424,9 KB
45008-a40.zip	2012/03/06 18:00	420,9 KB
45008-a50.zip	2012/06/03 13:20	418,9 KB
45008-a60.zip	2013/03/06 19:27	430 KB
45008-a70.zip	2013/09/19 15:10	446,1 KB
45008-b00.zip	2012/03/06 18:07	420,9 KB
45008-b10.zip	2012/06/03 13:34	446,6 KB
45008-b20.zip	2012/09/05 11:06	420,6 KB
45008-b30.zip	2013/03/06 19:34	422,3 KB
45008-b40.zip	2013/05/23 15:06	422,4 KB
45008-b50.zip	2013/09/19 15:10	423,1 KB
45008-b60.zip	2014/03/04 16:56	347,3 KB
45008-b70.zip	2018/04/03 8:35	353,5 KB
45008-c00.zip	2013/05/23 15:15	448,4 KB
45008-c10.zip	2013/09/19 15:10	433,5 KB
45008-c20.zip	2013/11/28 15:43	425 KB
45008-c30.zip	2014/03/05 9:52	352 KB
45008-c40.zip	2014/12/02 17:51	349,7 KB
45008-c50.zip	2017/09/25 16:39	353,1 KB
45008-c60.zip	2018/04/03 8:45	356,3 KB
45008-d00.zip	2015/12/03 17:33	357,3 KB
45008-d10.zip	2016/03/17 12:12	370,1 KB
45008-d20.zip	2016/06/21 14:18	378,6 KB
45008-d30.zip	2016/09/30 10:08	377,6 KB
45008-d40.zip	2016/12/23 0:59	378,4 KB
45008-d50.zip	2017/03/20 17:50	378,5 KB
45008-d60.zip	2017/09/25 16:25	381,9 KB
45008-d70.zip	2018/04/03 8:46	379,3 KB
45008-d80.zip	2018/09/21 18:35	371,6 KB
45008-d90.zip	2019/03/29 16:23	368,3 KB
45008-da0.zip	2019/06/19 13:25	368,5 KB

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 64 of 304

sort by name/desc	sort by date/desc	sort by size/desc
45008-db0.zip	2019/10/04 20:16	378,2 KB
45008-dc0.zip	2020/04/02 20:38	385,9 KB
45008-e00.zip	2017/03/20 17:52	378,7 KB
45008-e10.zip	2017/06/23 19:30	383,4 KB
45008-e20.zip	2017/09/25 16:26	381 KB
45008-e30.zip	2018/04/03 8:47	380,6 KB
45008-e40.zip	2018/06/23 10:39	380,4 KB
45008-e50.zip	2018/09/21 18:36	373,5 KB
45008-e60.zip	2018/12/21 10:44	374,7 KB
45008-e70.zip	2019/03/29 16:24	370,2 KB
45008-e80.zip	2019/06/19 13:25	369,7 KB
45008-e90.zip	2019/10/04 20:16	384,9 KB
45008-ea0.zip	2020/04/02 20:37	389,5 KB
45008-f00.zip	2018/06/25 18:45	381,4 KB
45008-f10.zip	2018/09/21 18:36	375,4 KB
45008-f20.zip	2018/12/21 10:45	376,4 KB
45008-f30.zip	2019/03/29 16:25	371,5 KB
45008-f40.zip	2019/06/19 13:26	371,5 KB
45008-f50.zip	2019/10/04 20:17	382,7 KB
45008-f60.zip	2020/04/02 20:36	391 KB
45008-g00.zip	2020/04/02 20:35	391,2 KB

177 items.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 65 of 304

Appendix 4

www.3gpp.org / ftp / Specs / archive / 25_series / 25.331

sort by name/desc	sort by date/desc	sort by size/desc
25331-100.zip	1999/05/05 11:56	165,9 KB
25331-110.zip	1999/06/28 6:41	197,6 KB
25331-300.zip	1999/10/18 15:36	850,9 KB
25331-310.zip	2000/01/14 20:07	962,7 KB
25331-320.zip	2000/04/06 9:02	1111,5 KB
25331-330.zip	2000/06/30 15:04	1186,6 KB
25331-340.zip	2000/10/06 6:49	1446,4 KB
25331-341.zip	2000/10/06 7:00	1426,9 KB
25331-350.zip	2000/12/21 8:50	1492,6 KB
25331-360.zip	2001/03/22 18:01	1486,9 KB
25331-370.zip	2001/06/20 16:31	1569,5 KB
25331-380.zip	2001/09/27 4:13	1680,2 KB
25331-390.zip	2001/12/19 3:05	1698,4 KB
25331-3a0.zip	2002/03/25 9:11	1761,5 KB
25331-3b0.zip	2002/06/12 21:10	1769,8 KB
25331-3c0.zip	2002/09/17 20:42	1795,3 KB
25331-3d0.zip	2003/01/09 13:35	1826,9 KB
25331-3e0.zip	2003/03/25 9:19	1913,5 KB
25331-3f0.zip	2003/06/19 13:18	1915,6 KB
25331-3g0.zip	2003/10/02 12:06	1923,3 KB
25331-3h0.zip	2004/01/04 20:38	1924,4 KB
25331-3i0.zip	2004/03/23 14:24	1930,1 KB
25331-3j0.zip	2004/06/22 11:49	2046,8 KB
25331-3k0.zip	2004/09/23 8:23	2184,6 KB
25331-3l0.zip	2004/12/20 16:57	2029,6 KB
25331-400.zip	2001/04/04 5:41	1551,3 KB
25331-410.zip	2001/06/27 8:50	1630 KB
25331-420.zip	2001/10/08 7:36	1701,4 KB

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 67 of 304

sort by name/desc	sort by date/desc	sort by size/desc
25331-421.zip	2001/10/16 9:10	1740,1 KB
25331-430.zip	2002/01/18 15:00	1783,9 KB
25331-440.zip	2002/03/25 9:11	1845 KB
25331-450.zip	2002/06/20 14:57	1842 KB
25331-460.zip	2002/09/19 19:38	1764,1 KB
25331-470.zip	2002/09/23 7:21	1890,7 KB
25331-480.zip	2003/01/29 18:11	1909,8 KB
25331-490.zip	2003/03/25 17:40	2008 KB
25331-4a0.zip	2003/06/23 14:23	2017 KB
25331-4b0.zip	2003/10/02 12:07	2021,1 KB
25331-4c0.zip	2004/01/12 8:54	2029,5 KB
25331-4d0.zip	2004/03/23 14:57	2040 KB
25331-4e0.zip	2004/06/28 12:20	2186 KB
25331-4f0.zip	2004/09/23 9:51	2159,2 KB
25331-4g0.zip	2004/12/20 16:58	2151,4 KB
25331-4h0.zip	2005/03/24 12:29	2308,5 KB
25331-4i0.zip	2007/12/21 14:28	2098,1 KB
25331-4j0.zip	2008/06/17 7:18	2237,3 KB
25331-4k0.zip	2008/12/17 9:40	2146,3 KB
25331-4l0.zip	2011/12/22 18:31	2203 KB
25331-500.zip	2002/04/04 6:59	1862,9 KB
25331-510.zip	2002/06/21 8:23	1890,5 KB
25331-520.zip	2002/10/01 9:20	1924,4 KB
25331-530.zip	2003/02/02 21:38	2005,7 KB
25331-540.zip	2003/03/27 9:18	2110,9 KB
25331-550.zip	2003/06/24 15:52	2129,6 KB
25331-560.zip	2003/10/02 12:08	2136,1 KB
25331-570.zip	2004/01/12 8:55	2077,8 KB
25331-571.zip	2004/01/20 10:03	2081,1 KB
25331-580.zip	2004/03/26 20:02	2100,2 KB
25331-590.zip	2004/07/01 13:43	2480,8 KB
25331-5a0.zip	2004/09/24 14:11	2329,8 KB

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 68 of 304

sort by name/desc	sort by date/desc	sort by size/desc
25331-5b0.zip	2004/12/20 16:59	2343,7 KB
25331-5c0.zip	2005/03/24 13:08	2281,2 KB
25331-5c1.zip	2005/03/30 8:11	2339,6 KB
25331-5d0.zip	2005/06/27 16:33	2484,2 KB
25331-5e0.zip	2005/10/12 17:56	2313,9 KB
25331-5f0.zip	2005/12/20 12:22	2453,4 KB
25331-5g0.zip	2006/04/03 15:34	2454,3 KB
25331-5h0.zip	2006/06/22 19:53	2427,6 KB
25331-5i0.zip	2006/10/20 8:54	2436,6 KB
25331-5j0.zip	2006/12/21 13:27	2220,1 KB
25331-5k0.zip	2007/10/23 14:28	2223,7 KB
25331-5l0.zip	2007/12/21 14:29	2223,6 KB
25331-5m0.zip	2008/06/17 7:18	2251,8 KB
25331-5m1.zip	2008/08/05 7:59	2117,6 KB
25331-5n0.zip	2008/12/17 9:40	2228,1 KB
25331-5o0.zip	2009/06/18 6:13	2253,9 KB
25331-5p0.zip	2011/12/22 18:32	2277 KB
25331-600.zip	2004/01/12 14:22	2076,5 KB
25331-601.zip	2004/01/20 10:03	2081,8 KB
25331-610.zip	2004/03/29 8:42	2106,2 KB
25331-620.zip	2004/07/02 7:59	2322,7 KB
25331-630.zip	2004/09/27 13:10	2337 KB
25331-640.zip	2004/12/20 17:00	2474,3 KB
25331-650.zip	2005/03/28 12:37	2537 KB
25331-660.zip	2005/06/29 12:47	2739,6 KB
25331-670.zip	2005/10/12 18:01	2631,4 KB
25331-680.zip	2005/12/21 10:41	2537,7 KB
25331-690.zip	2006/04/03 14:17	2601,8 KB
25331-6a0.zip	2006/06/22 20:00	2897 KB
25331-6b0.zip	2006/10/19 15:01	2679,3 KB
25331-6c0.zip	2006/12/21 13:27	2803,2 KB
25331-6d0.zip	2007/03/28 14:45	2777,2 KB

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 69 of 304

sort by name/desc	sort by date/desc	sort by size/desc
25331-6e0.zip	2007/07/24 14:18	2783 KB
25331-6f0.zip	2007/10/23 14:28	2576,1 KB
25331-6g0.zip	2008/01/03 13:26	2793,6 KB
25331-6h0.zip	2008/04/03 7:24	2577,6 KB
25331-6i0.zip	2008/06/25 11:18	2803,3 KB
25331-6i1.zip	2008/08/05 7:59	2298,1 KB
25331-6j0.zip	2008/09/19 11:55	2373,1 KB
25331-6k0.zip	2008/12/17 9:41	2563,3 KB
25331-6l0.zip	2009/03/16 7:56	2632,1 KB
25331-6m0.zip	2009/06/18 9:05	2573,7 KB
25331-6n0.zip	2009/09/28 9:29	2593,4 KB
25331-6o0.zip	2010/01/09 16:36	2620,3 KB
25331-6p0.zip	2010/04/20 9:03	2620,9 KB
25331-6q0.zip	2011/12/22 18:34	2632,7 KB
25331-700.zip	2006/04/07 15:11	2873,4 KB
25331-710.zip	2006/06/23 13:18	2903,6 KB
25331-720.zip	2006/10/19 15:41	2720,9 KB
25331-730.zip	2006/12/21 13:27	2855,8 KB
25331-740.zip	2007/04/06 19:30	2737,8 KB
25331-750.zip	2007/07/31 12:59	2920,3 KB
25331-760.zip	2007/10/23 14:28	2939,6 KB
25331-770.zip	2008/01/03 13:26	2934,6 KB
25331-780.zip	2008/03/28 9:58	3014,1 KB
25331-790.zip	2008/07/10 13:30	3032,1 KB
25331-791.zip	2008/08/04 13:11	2850,2 KB
25331-7a0.zip	2008/09/19 11:55	2912,1 KB
25331-7b0.zip	2009/01/05 8:52	3017,3 KB
25331-7c0.zip	2009/04/03 13:53	2751,3 KB
25331-7c1.zip	2009/04/06 11:30	2927,1 KB
25331-7d0.zip	2009/06/24 8:51	3310,4 KB
25331-7e0.zip	2009/09/29 7:09	3039,9 KB
25331-7f0.zip	2010/01/18 9:29	2962,7 KB

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 70 of 304

sort by name/desc	sort by date/desc	sort by size/desc
25331-7g0.zip	2010/04/21 7:57	3038,6 KB
25331-7h0.zip	2010/06/17 15:27	3046,5 KB
25331-7i0.zip	2010/10/06 0:31	3039,7 KB
25331-7j0.zip	2011/03/28 12:30	3121,6 KB
25331-7k0.zip	2011/06/27 2:37	3035,9 KB
25331-7l0.zip	2011/12/22 18:36	3166,9 KB
25331-7m0.zip	2012/03/15 21:23	2997,9 KB
25331-7n0.zip	2013/01/02 0:19	2999,2 KB
25331-7o0.zip	2013/12/29 12:30	3000,5 KB
25331-7p0.zip	2014/07/02 10:33	2374,6 KB
25331-800.zip	2007/10/23 14:28	3192,5 KB
25331-810.zip	2008/01/28 9:33	3189,8 KB
25331-820.zip	2008/04/20 9:58	3023,2 KB
25331-830.zip	2008/07/10 14:18	3070 KB
25331-831.zip	2008/08/04 12:52	2766,3 KB
25331-840.zip	2008/09/22 14:04	3024 KB
25331-850.zip	2009/01/05 8:52	3200 KB
25331-860.zip	2009/03/19 19:19	2822,7 KB
25331-870.zip	2009/06/24 8:51	3192,3 KB
25331-880.zip	2009/09/29 7:09	3354 KB
25331-890.zip	2010/04/12 13:21	3080,7 KB
25331-8a0.zip	2010/04/06 14:03	3495,2 KB
25331-8b0.zip	2010/06/17 16:41	3465 KB
25331-8c0.zip	2010/10/06 0:32	3461 KB
25331-8d0.zip	2011/01/06 11:38	3472,2 KB
25331-8e0.zip	2011/03/28 12:40	3555,8 KB
25331-8f0.zip	2011/06/29 22:58	3465,5 KB
25331-8g0.zip	2011/10/06 13:47	3468,9 KB
25331-8h0.zip	2011/12/22 16:55	3481,8 KB
25331-8i0.zip	2012/03/15 21:29	3746,1 KB
25331-8j0.zip	2012/06/26 21:29	3848,2 KB
25331-8k0.zip	2012/09/21 0:50	3473,1 KB

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 71 of 304

sort by name/desc	sort by date/desc	sort by size/desc
25331-8l0.zip	2013/01/02 0:21	3491 KB
25331-8m0.zip	2013/03/16 12:46	3776,3 KB
25331-8n0.zip	2013/06/29 18:27	3772,3 KB
25331-8o0.zip	2013/12/29 12:31	3775,8 KB
25331-8p0.zip	2014/07/02 10:33	2583,6 KB
25331-900.zip	2009/09/29 16:38	3096,1 KB
25331-910.zip	2010/01/18 9:30	3330,6 KB
25331-920.zip	2010/04/28 14:56	3781,1 KB
25331-921.zip	2010/04/29 7:02	3686,2 KB
25331-930.zip	2010/06/17 19:27	3396,8 KB
25331-940.zip	2010/10/06 0:32	3407,1 KB
25331-950.zip	2011/01/06 12:02	3476,7 KB
25331-960.zip	2011/03/28 14:01	3512,7 KB
25331-970.zip	2011/07/01 10:10	3710,2 KB
25331-980.zip	2011/10/03 8:14	3826,9 KB
25331-990.zip	2011/12/22 16:57	3829,6 KB
25331-9a0.zip	2012/03/15 21:40	4072,2 KB
25331-9b0.zip	2012/10/25 18:52	4118,4 KB
25331-9c0.zip	2012/10/25 19:19	3908,2 KB
25331-9d0.zip	2013/01/02 0:24	3954,6 KB
25331-9e0.zip	2013/03/16 12:39	4159 KB
25331-9f0.zip	2013/07/03 11:49	4159,9 KB
25331-9g0.zip	2013/09/14 18:18	4152,8 KB
25331-9h0.zip	2014/01/06 11:37	3906,3 KB
25331-9i0.zip	2014/07/02 10:33	2692 KB
25331-9j0.zip	2014/09/16 10:59	2699,5 KB
25331-a00.zip	2010/06/17 20:31	3401,3 KB
25331-a10.zip	2010/10/01 9:53	3465 KB
25331-a20.zip	2011/01/06 16:59	3797,7 KB
25331-a30.zip	2011/04/01 10:55	3578,5 KB
25331-a31.zip	2011/04/11 12:03	3588,6 KB
25331-a40.zip	2012/10/25 19:30	3567,8 KB

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 72 of 304

sort by name/desc	sort by date/desc	sort by size/desc
25331-a50.zip	2012/10/25 19:46	3584,6 KB
25331-a60.zip	2012/10/25 19:44	3623 KB
25331-a70.zip	2012/10/25 19:49	3579,3 KB
25331-a80.zip	2012/10/25 19:52	3601,3 KB
25331-a90.zip	2012/10/25 20:54	3628 KB
25331-aa0.zip	2013/01/02 0:25	3622,4 KB
25331-ab0.zip	2013/03/19 13:15	3831,8 KB
25331-ac0.zip	2013/06/29 19:06	3840,7 KB
25331-ad0.zip	2013/09/15 22:08	3838,5 KB
25331-ae0.zip	2014/01/07 17:54	3650 KB
25331-af0.zip	2014/03/18 13:26	3817,9 KB
25331-ag0.zip	2014/07/07 14:55	2863,1 KB
25331-ah0.zip	2014/09/18 7:39	2863 KB
25331-ai0.zip	2014/12/19 11:16	2853,3 KB
25331-aj0.zip	2015/03/23 10:11	2855,7 KB
25331-ak0.zip	2016/07/03 16:25	2880,8 KB
25331-b00.zip	2012/01/03 14:52	3629,4 KB
25331-b10.zip	2012/03/16 8:39	3617 KB
25331-b20.zip	2012/07/10 8:00	3716,9 KB
25331-b30.zip	2012/09/25 13:44	3862,7 KB
25331-b40.zip	2012/12/21 20:19	4147,3 KB
25331-b50.zip	2013/03/16 22:17	4012,1 KB
25331-b60.zip	2013/07/03 16:35	4122,9 KB
25331-b70.zip	2013/09/18 17:16	4174,2 KB
25331-b80.zip	2014/01/06 11:35	4143,2 KB
25331-b90.zip	2014/03/20 13:16	4179,6 KB
25331-ba0.zip	2014/07/07 14:55	3048,2 KB
25331-bb0.zip	2014/09/18 7:39	3056,5 KB
25331-bc0.zip	2014/12/19 16:13	3050,1 KB
25331-bd0.zip	2015/03/23 10:11	3088,9 KB
25331-be0.zip	2015/06/30 22:20	3054,7 KB
25331-bf0.zip	2015/12/17 7:00	3055,1 KB

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 73 of 304

sort by name/desc	sort by date/desc	sort by size/desc
25331-bg0.zip	2016/03/31 20:46	3085,5 KB
25331-bh0.zip	2016/07/03 16:26	3088,6 KB
25331-bi0.zip	2018/01/17 10:33	3048,4 KB
25331-c00.zip	2014/01/06 11:32	4206,5 KB
25331-c10.zip	2014/03/20 13:16	4208,1 KB
25331-c20.zip	2014/07/07 14:55	3112,2 KB
25331-c30.zip	2014/09/22 9:39	3196,3 KB
25331-c40.zip	2014/12/22 23:08	3228,8 KB
25331-c50.zip	2015/03/25 15:58	3224,1 KB
25331-c50_README.txt	2015/04/08 9:19	1,5 KB
25331-c60.zip	2015/06/30 22:46	3280,9 KB
25331-c70.zip	2015/09/17 17:40	3227 KB
25331-c80.zip	2015/12/21 10:09	3270,7 KB
25331-c90.zip	2016/03/31 20:48	3237,6 KB
25331-ca0.zip	2016/07/03 16:27	3241,2 KB
25331-cb0.zip	2016/10/05 8:16	3242 KB
25331-cc0.zip	2016/12/30 0:32	3278,6 KB
25331-cd0.zip	2017/03/21 10:26	3194,9 KB
25331-ce0.zip	2017/09/26 12:57	3141 KB
25331-cf0.zip	2018/01/17 9:34	3166,1 KB
25331-d00.zip	2015/09/24 8:09	3234,6 KB
25331-d10.zip	2016/01/06 10:42	3285 KB
25331-d20.zip	2016/03/31 20:51	3263,1 KB
25331-d30.zip	2016/07/07 9:23	3303,3 KB
25331-d40.zip	2016/10/05 13:45	3304,8 KB
25331-d50.zip	2016/12/30 0:34	3324,9 KB
25331-d60.zip	2017/03/21 10:26	3219,8 KB
25331-d70.zip	2017/09/26 15:39	3158,2 KB
25331-d80.zip	2018/01/17 9:32	3194,8 KB
25331-e00.zip	2016/10/05 13:46	3354,7 KB
25331-e10.zip	2016/12/30 0:51	3323 KB
25331-e20.zip	2017/03/21 10:27	3273,4 KB

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 74 of 304

sort by name/desc	sort by date/desc	sort by size/desc
25331-e30.zip	2017/06/23 23:21	3291 KB
25331-e40.zip	2017/09/26 16:11	3225 KB
25331-e50.zip	2018/01/17 9:29	3256,1 KB
25331-f00.zip	2017/09/26 17:01	3233,7 KB
25331-f10.zip	2018/01/15 13:13	3279,4 KB
25331-f20.zip	2018/04/03 8:14	3236 KB
25331-f30.zip	2018/06/23 9:59	3259 KB
25331-f40.zip	2018/09/21 18:27	3280,5 KB
25331-g00.zip	2020/04/02 20:02	3436,3 KB
25331-g10.zip	2020/10/09 15:37	3479,5 KB
25331d310.zip	1999/12/29 9:48	1021,5 KB
25331vIntermediate.zip	1999/11/19 8:57	845,7 KB
25331_readme.txt	2014/10/07 15:23	1 KB

265 items.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 75 of 304

Appendix 5

www.3gpp.org / ftp / Specs / archive / 25_series / 25.304

	sort by name/desc	sort by date/desc	sort by size/desc
	25304-100.zip	1999/05/05 11:56	143,4 KB
	25304-120.zip	1999/06/28 7:28	244,1 KB
	25304-300.zip	1999/10/19 9:44	220,9 KB
	25304-310.zip	1999/12/22 10:58	360,3 KB
	25304-320.zip	2000/03/31 9:41	289,1 KB
	25304-330.zip	2000/06/30 15:04	331,6 KB
	25304-340.zip	2000/10/16 12:48	234,4 KB
	25304-350.zip	2000/12/11 7:03	236,5 KB
	25304-360.zip	2001/03/27 7:17	238,6 KB
	25304-370.zip	2001/06/19 8:22	176,4 KB
	25304-380.zip	2001/09/25 2:00	178,2 KB
	25304-390.zip	2001/12/12 14:26	178,4 KB
	25304-3a0.zip	2002/03/19 9:53	177,8 KB
	25304-3b0.zip	2002/06/10 14:05	179,2 KB
	25304-3c0.zip	2003/01/08 8:39	187 KB
	25304-3d0.zip	2003/06/25 9:09	204,1 KB
	25304-3e0.zip	2004/03/24 10:44	204,3 KB
	25304-400.zip	2001/03/19 21:38	238,4 KB
	25304-410.zip	2001/06/19 8:25	176,5 KB
	25304-420.zip	2001/09/25 2:02	178,2 KB
	25304-430.zip	2001/12/17 2:24	177,6 KB
	25304-440.zip	2002/03/19 9:54	177,9 KB
	25304-450.zip	2002/06/10 14:05	179,6 KB
	25304-460.zip	2003/01/08 8:39	187,4 KB
	25304-470.zip	2003/06/25 9:10	204,3 KB
	25304-480.zip	2004/03/24 10:43	204,8 KB
	25304-500.zip	2002/03/19 9:54	178,2 KB
	25304-510.zip	2002/06/10 14:05	179,5 KB

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 77 of 304

sort by name/desc	sort by date/desc	sort by size/desc
25304-520.zip	2003/01/08 8:39	187,8 KB
25304-530.zip	2003/06/25 9:09	204,6 KB
25304-540.zip	2004/03/23 16:55	205,3 KB
25304-550.zip	2004/06/16 12:58	186,3 KB
25304-560.zip	2004/09/20 10:40	189 KB
25304-570.zip	2004/12/21 12:51	189,6 KB
25304-580.zip	2005/03/28 13:24	191,9 KB
25304-590.zip	2005/10/13 12:54	192,7 KB
25304-600.zip	2004/01/12 8:37	204,6 KB
25304-610.zip	2004/03/23 16:55	205,1 KB
25304-620.zip	2004/06/16 12:58	188 KB
25304-630.zip	2004/09/20 10:40	187,3 KB
25304-640.zip	2004/12/21 12:51	198,1 KB
25304-650.zip	2005/03/28 13:24	138,3 KB
25304-660.zip	2005/06/27 12:58	135,4 KB
25304-670.zip	2005/10/13 12:55	136,4 KB
25304-680.zip	2005/12/22 9:50	142,8 KB
25304-690.zip	2006/04/06 8:02	143,5 KB
25304-6a0.zip	2008/03/20 15:42	136,7 KB
25304-700.zip	2006/04/06 8:02	143,7 KB
25304-710.zip	2006/12/21 13:22	145,3 KB
25304-720.zip	2007/07/17 11:17	145,5 KB
25304-730.zip	2007/10/24 9:51	146,6 KB
25304-740.zip	2008/01/04 9:39	147,3 KB
25304-750.zip	2008/03/20 15:42	141,6 KB
25304-760.zip	2008/06/17 7:18	142,4 KB
25304-770.zip	2008/09/18 10:02	140,8 KB
25304-780.zip	2009/09/25 9:40	143,6 KB
25304-800.zip	2008/01/07 16:56	146,2 KB
25304-810.zip	2008/03/20 15:42	142,8 KB
25304-820.zip	2008/06/17 7:18	144,2 KB
25304-830.zip	2008/09/18 10:02	154,7 KB

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 78 of 304

sort by name/desc	sort by date/desc	sort by size/desc
25304-840.zip	2009/01/05 8:52	264,3 KB
25304-850.zip	2009/03/19 15:36	304 KB
25304-860.zip	2009/06/18 6:13	306,9 KB
25304-870.zip	2009/09/25 9:41	210,8 KB
25304-880.zip	2009/12/28 12:10	217,5 KB
25304-890.zip	2010/04/27 19:33	213,3 KB
25304-8a0.zip	2010/06/17 3:13	213,6 KB
25304-8b0.zip	2010/10/05 21:51	214 KB
25304-8c0.zip	2011/06/24 9:15	191,7 KB
25304-900.zip	2009/12/28 12:10	218,3 KB
25304-910.zip	2010/04/27 19:33	207,2 KB
25304-920.zip	2010/06/17 3:14	215,4 KB
25304-930.zip	2010/10/05 21:51	219,7 KB
25304-940.zip	2011/03/22 18:59	219,9 KB
25304-950.zip	2011/06/24 9:16	196,7 KB
25304-960.zip	2011/09/28 12:12	197,4 KB
25304-970.zip	2011/12/20 11:49	198,4 KB
25304-980.zip	2012/09/25 14:33	199,1 KB
25304-a00.zip	2011/03/28 17:02	220,5 KB
25304-a10.zip	2011/06/24 9:18	198,8 KB
25304-a20.zip	2011/09/28 12:12	200,3 KB
25304-a30.zip	2011/12/20 11:53	200,9 KB
25304-a40.zip	2012/03/13 20:18	201 KB
25304-a50.zip	2012/06/25 23:40	201,3 KB
25304-a60.zip	2012/09/25 14:44	201,6 KB
25304-a70.zip	2012/12/27 17:28	201,9 KB
25304-b00.zip	2012/09/25 21:27	200,9 KB
25304-b10.zip	2013/01/02 0:13	204,4 KB
25304-b20.zip	2013/03/14 21:20	204,8 KB
25304-b30.zip	2013/06/29 15:42	205,7 KB
25304-b40.zip	2013/09/13 14:22	205,1 KB
25304-b50.zip	2014/01/02 13:24	206,4 KB

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 79 of 304

sort by name/desc	sort by date/desc	sort by size/desc
25304-c00.zip	2014/01/02 13:25	207,1 KB
25304-c10.zip	2014/03/17 9:29	201,7 KB
25304-c20.zip	2014/07/04 8:23	182,8 KB
25304-c30.zip	2014/09/25 15:00	188,1 KB
25304-c40.zip	2015/01/05 14:15	188,4 KB
25304-c50.zip	2015/03/18 15:43	188,2 KB
25304-c60.zip	2015/06/30 22:41	188,8 KB
25304-c70.zip	2015/12/17 7:00	188,9 KB
25304-d00.zip	2016/01/08 9:27	189,8 KB
25304-e00.zip	2017/03/23 14:16	192,4 KB
25304-f00.zip	2018/06/27 9:07	242 KB
25304-g00.zip	2020/07/18 20:36	242,8 KB

104 items.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 80 of 304

Appendix 6

www.3gpp.org / ftp / Specs / archive / 43_series / 43.022

	sort by name/desc	sort by date/desc	sort by size/desc
	43022-400.zip	2000/10/10 13:06	58,7 KB
	43022-401.zip	2000/10/24 11:18	59 KB
	43022-410.zip	2000/11/21 12:37	56,6 KB
	43022-411.zip	2000/11/30 9:41	59,2 KB
	43022-420.zip	2001/02/06 17:05	60,7 KB
	43022-430.zip	2001/06/14 10:57	61,1 KB
	43022-440.zip	2002/07/05 19:31	61,9 KB
	43022-450.zip	2002/09/10 16:53	62,7 KB
	43022-460.zip	2005/04/14 14:53	59,4 KB
	43022-500.zip	2002/07/05 19:35	62,5 KB
	43022-510.zip	2002/09/10 16:53	63,1 KB
	43022-520.zip	2005/04/14 15:01	59,4 KB
	43022-600.zip	2003/01/03 8:50	72,4 KB
	43022-610.zip	2004/12/02 14:29	74,7 KB
	43022-620.zip	2005/02/01 14:54	71,1 KB
	43022-630.zip	2005/04/14 15:07	72 KB
	43022-700.zip	2005/04/14 15:13	72,3 KB
	43022-710.zip	2005/06/29 13:06	72,3 KB
	43022-720.zip	2006/09/15 17:09	73,2 KB
	43022-800.zip	2007/09/25 8:39	72,7 KB
	43022-810.zip	2008/06/16 12:36	73,1 KB
	43022-820.zip	2010/04/06 12:26	83,7 KB
	43022-830.zip	2010/09/13 18:59	83,3 KB
	43022-900.zip	2009/12/09 14:58	73,6 KB
	43022-910.zip	2010/04/06 12:27	83,6 KB
	43022-920.zip	2010/09/13 19:02	83,2 KB
	43022-a00.zip	2011/04/01 10:53	84 KB
	43022-b00.zip	2012/09/18 13:42	83,4 KB

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 82 of 304

sort by name/desc	sort by date/desc	sort by size/desc
43022-c00.zip	2014/09/18 13:04	82,8 KB
43022-d00.zip	2015/12/03 16:44	83,5 KB
43022-d10.zip	2016/06/21 12:35	84,3 KB
43022-d20.zip	2016/09/30 9:19	84,4 KB
43022-e00.zip	2017/03/20 18:05	84,6 KB
43022-f00.zip	2018/06/28 8:41	84,7 KB
43022-g00.zip	2020/07/19 19:06	87,1 KB

35 items.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 83 of 304

Appendix 7

http://www.3gpp.org/TB/RAN/RAN2/RAN2.htm Go NOV DEC MAY
119 captures 24 2000 2001 2002
24 Dec 2001 - 13 Oct 2008 About this capture

TSG RAN WG2 (Radio layer 2 and Radio layer 3 RR)

Overview:

TSG RAN WG2 is in charge of the Radio Interface architecture and protocols (MAC, RLC, PDCP), the specification of the Radio Resource Control protocol, the strategies of Radio Resource Management and the services provided by the physical layer to the upper layers.

Useful links and information			
Terms of Reference	Next meeting	Meeting calendar	Email exploder lists
Work items	Specifications	Documents area	Contact RAN2 @

List of officials			
Position	**Name / Telephone**	**Company / Partner**	**Elected on**
Chairman	Denis FAUCONNIER +33 1 39 44 52 87	Nortel Networks	2001-02-19
Vice-Chairman	Francesco Grilli	Qualcomm Europe	2001-02-19
Secretary	Hans VAN DER VEEN +33 4 92 94 42 61	3GPP Support	n/a

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 85 of 304

Appendix 8

http://www.3gpp.org/specs/specs.htm Go APR JUN AUG
544 captures 03
8 Jun 2002 - 21 Aug 2020 2002 2003 2004
About this capture

3GPP Specifications Home Page

Spec download | Titles and spec numbers | Current version | Releases | Numbering scheme | Change Requests
Published specifications | Historical information | Work plan | TSG Working methods | Drafting rules | Delegates corner | ASN.1

Quick link to the specifications file server area (http) for those who know where they are going!

To find a particular spec quickly, go here and click on the links in the spec-series in the table.

The term "***3GPP specification***" covers all **GSM** (including **GPRS** and **EDGE**) and **3G** specifications. The following terms are also used to describe networks using the 3G specifications: **UTRAN**, **W-CDMA**, **UMTS** (in Europe) and **FOMA** (in Japan). Revised versions of many of these specifications are produced up to four times a year following the quarterly TSG plenary meetings. See the table below which gives links to lists of specifications arising from each plenary TSG meeting since the freezing of Release 1999. The month of the meeting and the meeting number are shown in each case.

Following each TSG SA plenary meeting, a complete set of specifications is produced. This set includes not only the new specifications generated at that meeting, but also the latest versions of each specification that was not changed at that meeting. i.e. each directory holds a complete set of specifications. Each set has an associated **status list** as detailed in the table below. Each set (and corresponding status list) includes the specs arising from the TSG GERAN meetings held since the preceding SA meeting. (GERAN meets asynchronously from the other TSGs.)

The **Status List** (ZIPped RTF format) summarizes the current version number for every release of every 3GPP specification following each TSG plenary meeting. Also listed for each specifications are:

- the 3GPP working group and rapporteur responsible for the specification
- the Project Manager in MCC (Mobile Competence Centre) responsible for the specification
- the meeting at which it was, or is expected to be, "frozen" (i.e. the point after which only corrections are allowed)

Full details of the Specifications, their history and current status can be found in the 3GPP Specifications Status database.

year-month	remark	status list	specs directory	TSG CN	TSG RAN	TSG T	TSG SA	TSG GERAN
2003-04			ftp://ftp.3gpp.org/specs/2003-04-geran-mtg-14-delta					14th meeting
2003-02		StatusList	ftp://ftp.3gpp.org/specs/2003-03/	19th meeting	19th meeting	19th meeting	19th meeting	
2003-02			ftp://ftp.3gpp.org/specs/2003-02-geran-mtg-13-delta					13th meeting
2002-11 2002-12		StatusList	ftp://ftp.3gpp.org/specs/2002-12/	18th meeting	18th meeting	18th meeting	18th meeting	12th meeting
2002-09		StatusList	ftp://ftp.3gpp.org/specs/2002-09/	17th meeting	17th meeting	17th meeting	17th meeting	11th meeting
2002-06			ftp://ftp.3gpp.org/specs/2002-06-geran-mtg-10-delta/					10th meeting
2002-06	Rel-5 features content functionally frozen (remainder)	StatusList	ftp://ftp.3gpp.org/specs/2002-06/	16th meeting	16th meeting	16th meeting	16th meeting	
2002-04			ftp://ftp.3gpp.org/specs/2002-04-geran-mtg-09-delta/					9th meeting
2002-03	Rel-5 features content functionally frozen (part)	StatusList	ftp://ftp.3gpp.org/specs/2002-03/	15th meeting	15th meeting	15th meeting	15th meeting	
2002-02								8th meeting
2001-12		StatusList	ftp://ftp.3gpp.org/specs/2001-12/	14th meeting	14th meeting	14th meeting	14th meeting	
2001-11								7th meeting
2001-09		StatusList	ftp://ftp.3gpp.org/specs/2001-09/	13th meeting	13th meeting	13th meeting	13th meeting	

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 87 of 304

http://www.3gpp.org/specs/specs.htm Go APR JUN AUG
544 captures 03
8 Jun 2002 - 21 Aug 2020 2002 2003 2004
About this capture

2001-06								4th meeting
2001-03	Rel-4 features content functionally frozen	StatusList	ftp://ftp.3gpp.org/specs/2001-03/	11th meeting	11th meeting	11th meeting	11th meeting	
2001-01								3rd meeting
2000-12		StatusList	ftp://ftp.3gpp.org/specs/2000-12/	10th meeting	10th meeting	10th meeting	10th meeting	
2000-11								2nd meeting
2000-09		StatusList	ftp://ftp.3gpp.org/specs/2000-09/	9th meeting	9th meeting	9th meeting	9th meeting	1st meeting
2000-06		StatusList	ftp://ftp.3gpp.org/specs/2000-06/	8th meeting	8th meeting	8th meeting	8th meeting	
2000-03				7th meeting	7th meeting	7th meeting	7th meeting	
1999-12	R99 features content functionally frozen			6th meeting	6th meeting	6th meeting	6th meeting	

If you plan to download a large number of specifications and are using MS Explorer 4.0 or earlier, it may be worthwhile acquiring an FTP client software tool such as:

- Ipswitch WS_FTP Pro® : This general purpose file transfer program simplifies the process of downloading large numbers of files from an FTP site.
- FTPSync®: This tool allow the user to specify a directory on their local disk and synchronize it with a directory on an FTP site.

Latest version

The **latest versions** of the specifications can always be found here:
ftp://ftp.3gpp.org/specs/latest/.

Particular version

All older versions of specifications (where available) are stored in the archive subdirectory. All versions of all releases of a given specification are placed directly under the name of the specification.
ftp://ftp.3gpp.org/specs/archive/

Title or subject

If you only know the **title** or the subject, but not the specification number, the best place to start looking is the complete list of all 3GPP specification numbers and titles. A high level description of each *series* (of specification e.g. the 25.- series) is available in on the page called "Releases and the numbering scheme for 3G specifications". Once you have identified possible specification numbers, go the "Latest Version" directory mentioned above.

Specs related to a particular working group

Each 3GPP TSG Working Group has a home page, which lists the specifications under their responsibility. Follow the links from here....

Official versions published by recognized Standards Development Organizations

The 3GPP Technical Specifications (and Technical Reports) which are publicly available from this site have, in themselves, no legal standing. They only become "official" when transposed into corresponding publications of the Partner Organizations. If you are looking for the **official versions**, see the official publications page.

Further information:

- **Work plan.** The 3GPP Work plan describes the new functionality currently being elaborated in the TSG working groups. It also indicates the expected timescales for their finalization.
- **Numbering scheme.** What is the system for numbering specifications? Which specifications contain information on .....? Find out here.
- **Releases (and phases, stages).** An introduction to the 3GPP mechanism for specifications releases can be found here.
- **Historical information.** If you need to look for old / superseded specifications or change requests, start here.
- **TSG working methods.** The procedures for creating, enhancing and maintaining specifications are described in TR 21.900. A presentation outlining the release and change request process can be found here.
- **3GPP Drafting rules.** The rules for drafting specifications are described in TR 21.801.
- **Change Requests (CRs).** The change request mechanism is used when a correction or new functionality is required for an existing specification. Here you can find all information related to change requests. If you like pretty charts, look here.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 88 of 304

http://www.3gpp.org/specs/specs.htm Go APR JUN AUG
544 captures 03
8 Jun 2002 - 21 Aug 2020 2002 2003 2004
About this capture

2003-03-25 - table entry for TSGs#19 added
2003-02-24 - table entry for GERAN#13 added
2003-01-13 - link to CR trends page added.
2002-12-15 - TSGs#18 (GERAN#12) line added; quick link to specs file at top of page added.
2002-10-18 - reference to 3GPP Specifications Status database added.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 89 of 304

Appendix 9

- 2- Partnership Project Description
- 3- Preamble
- 4- 3GPP Overview
- 5- Definition of 3GPP
- 6- Scope and objectives (1)
- 7- Scope and objectives (2)
- 8- Characteristics of 3GPP (1)
- 9- Characteristics of 3GPP (2)
- 10- Partnership and Membership
- 11- Organizational Partners (1)
- 12- Organizational Partners (2)
- 13- Market Representation Partners (1)
- 14- Market Representation Partners (2)
- 15- Individual Members (1)
- 16- Individual Members (2)
- 17- Individual Members (3)
- 18- Observership
- 19- Documentation for 3GPP
- 20- The Partnership Project Agreement (1)
- 21- The Partnership Project Agreement (2)
- 22- The Partnership Project Agreement (3)
- 23- Ownership of the Partnership Project results
- 24- Contributions to ITU
- 25- Submission of 3GPP results to ITU
- 26- Regulators/Governments
- 27- National/Regional regulatory requirements
- 28- Resource requirements for establishing 3GPP
- 29- Overview showing external interfaces
- 30- Internal structure of 3GPP
- 31- Internal structure of 3GPP
- 32- Work areas to be covered by the Radio Access Network TSG
- 33- Work areas to be covered by the Core Network TSG
- 34- Work areas to be covered by the Terminal TSG
- 35- Work areas to be covered by the System Aspects TSG
- 36- Primary responsibilities of PCGs and TSGs (1)
- 37- Primary responsibilities of PCGs and TSGs (2)
- 38- Primary responsibilities of PCGs and TSGs (3)
- 39- Primary responsibilities of PCGs and TSGs (4)
- 40- Primary responsibilities of PCGs and TSGs (5)
- 41- Participation rights in PCG and TSGs
- 42- Principles for decision making within 3GPP
- 43- Principles for voting within TSGs
- 44- Working language for 3GPP
- 45- Relationship with other groups
- 46- Intellectual Property Rights (1)
- 47- Intellectual Property Rights (2)

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 91 of 304

THIRD GENERATION PARTNERSHIP PROJECT (3GPP)

During the meeting held in Copenhagen, 2 - 4 December 1998 ARIB, ETSI, T1, TTA and TTC agreed this Partnership Project Description.

Petitioners' Ex. 1016

Exhibit 2004

IPR2023-00919

Page 92 of 304

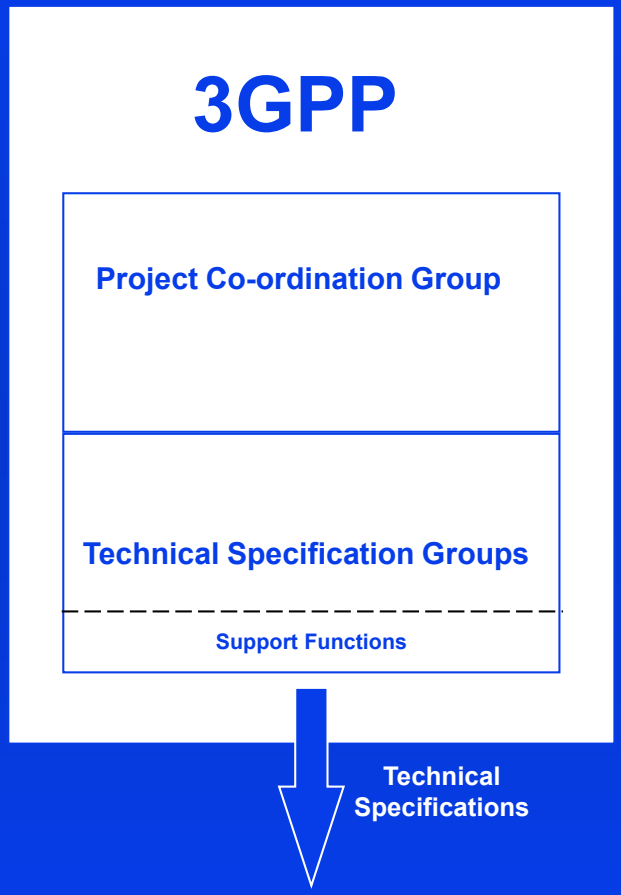
Standards organizations and other related bodies have agreed to co-operate for the production of a complete set of globally applicable Technical Specifications for a 3rd Generation Mobile System based on the evolved GSM core networks and the radio access technologies supported by 3GPP partners (i.e., UTRA both FDD and TDD modes).

The Project is entitled the “Third Generation Partnership Project” and may be known by the acronym “3GPP”.

3GPP has been established for the preparation and maintenance of the above mentioned Technical Specifications, and is not a legal entity.

Petitioners' Ex. 1016

Exhibit 2004
IPR2023-00919
Page 93 of 304



Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 94 of 304

3GPP will provide globally applicable Technical Specifications for a 3rd Generation Mobile System based on the evolved GSM core network, and the Universal Terrestrial Radio Access (UTRA), to be transposed by relevant standardization bodies (Organizational Partners) into appropriate deliverables (e.g., standards).

Petitioners' Ex. 1016

Exhibit 2004

IPR2023-00919

Page 95 of 304

The Technical Specifications will be developed in view of global roaming and circulation of terminals.

The 3rd Generation Mobile System and its capabilities will be developed in a phased approach. Initially, 3GPP will elaborate, approve and maintain the necessary set of Technical Specifications for the first phase of a 3rd Generation Mobile System including:

- UTRAN (including UTRA; W-CDMA in Frequency Division Duplex (FDD) mode and TD-CDMA in Time Division Duplex (TDD) mode)
- 3GPP Core Network (Third Generation networking capabilities evolved from GSM . These capabilities include mobility management and global roaming.)
- Terminals for access to the above (including specifications for a UIM)
- System and service aspects

Petitioners' Ex. 1016

Exhibit 2004

IPR2023-00919

Page 96 of 304

The set of global specifications for the first phase of the 3GPP core network and the specifications for the GSM core network should be common to the largest extent possible and should not be needlessly different.

The results of the 3GPP work will form the basis of member contributions to the ITU in accordance with existing procedures.

3GPP will take account of emerging ITU recommendations on interworking between IMT-2000 family members.

In the framework of agreed relationships, 3GPP will elaborate Technical Specifications that will form the basis of standards, or parts of standards, of the Organizational Partners.

Petitioners' Ex. 1016

Exhibit 2004

IPR2023-00919

Page 97 of 304

3GPP is characterized by the following attributes:

- Minimum production time for Technical Specifications from conception to approval
- Fast, electronic based approval process
- Maximum use of modern (electronic) working methods
- Minimum number of hierarchical levels with decision making taking place at the lowest appropriate levels

Petitioners' Ex. 1016

Exhibit 2004
IPR2023-00919
Page 98 of 304

- A Project Co-ordination function and a Technical Specification function
- Task oriented, ensuring that on completion of the tasks the future of the project is re-evaluated
- Cost effective use of financial/human resources provided by Partner Organizations (if required)

Petitioners' Ex. 1016

Exhibit 2004

IPR2023-00919

Page 99 of 304

3GPP comprises of:

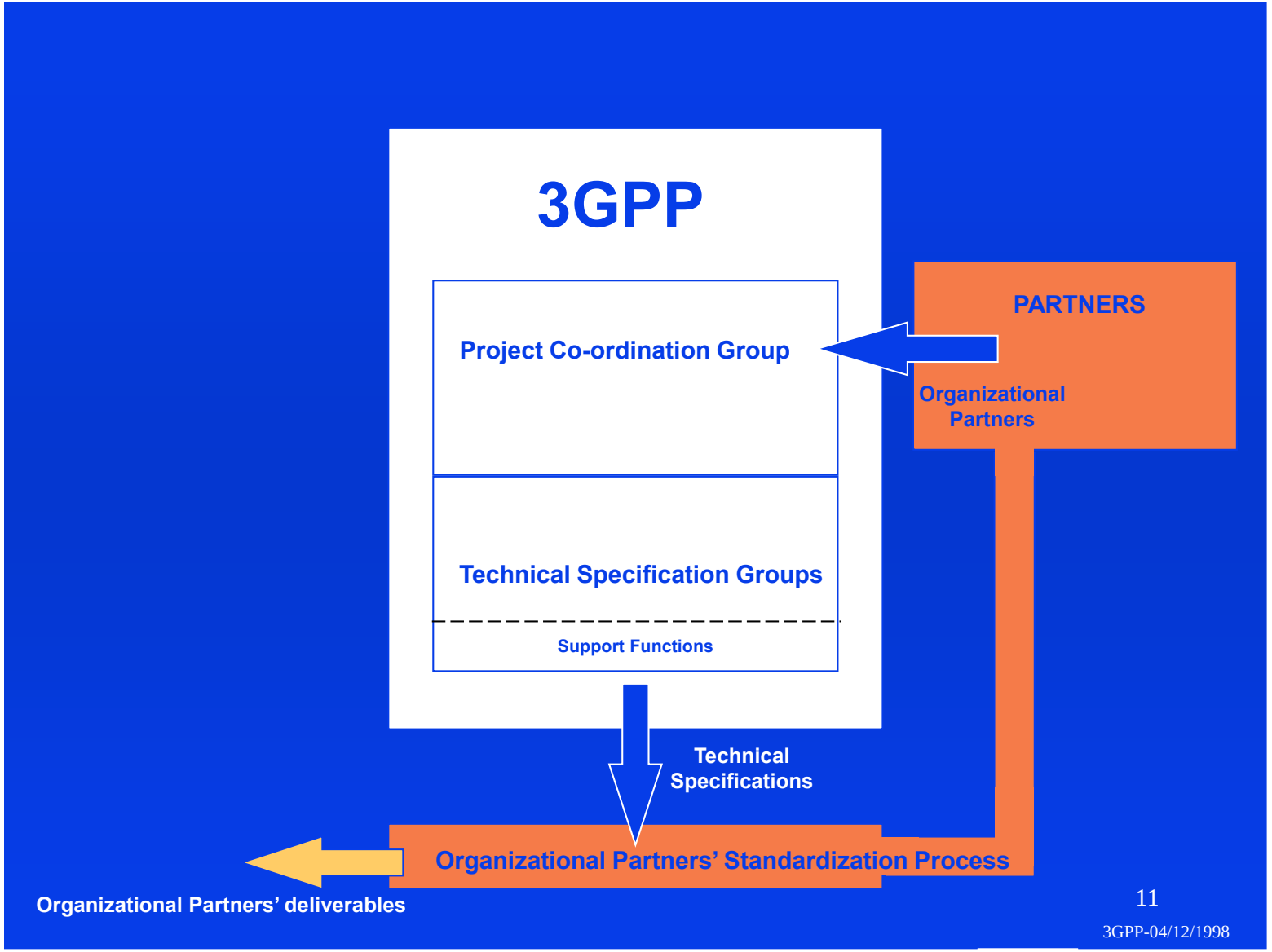
- Partners:
  - Organizational Partners
    - 3GPP is open to all standards organizations irrespective of the geographical location.
  - Market Representation Partners
- Individual Members

Petitioners' Ex. 1016

Exhibit 2004

IPR2023-00919

Page 100 of 304



Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 101 of 304

An Organizational Partner is:

An open standards organization with a national, regional or other officially recognized status (in their country or region)

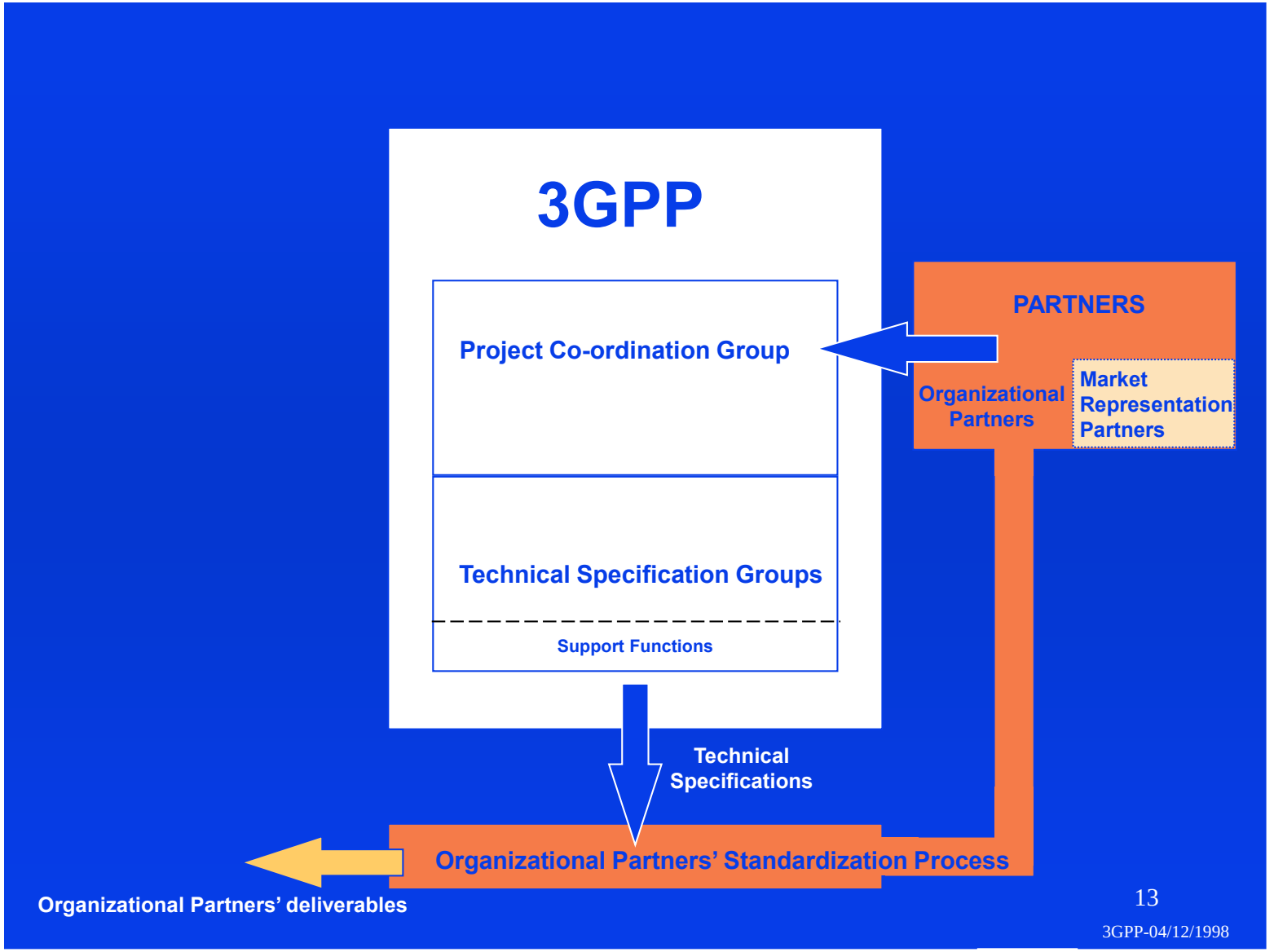
that:

- **has the capability and authority to define, publish and set standards nationally or regionally and**
- **has signed (or whose sponsor has signed) the Partnership Project Agreement**

Organizational Partners will meet as approriate and make decisions by consensus.

Petitioners' Ex. 1016

Exhibit 2004
IPR2023-00919
Page 102 of 304



Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 103 of 304

Standardization should meet market needs.

In order to identify market requirements, the high competence of Market Representation Partners should be used.

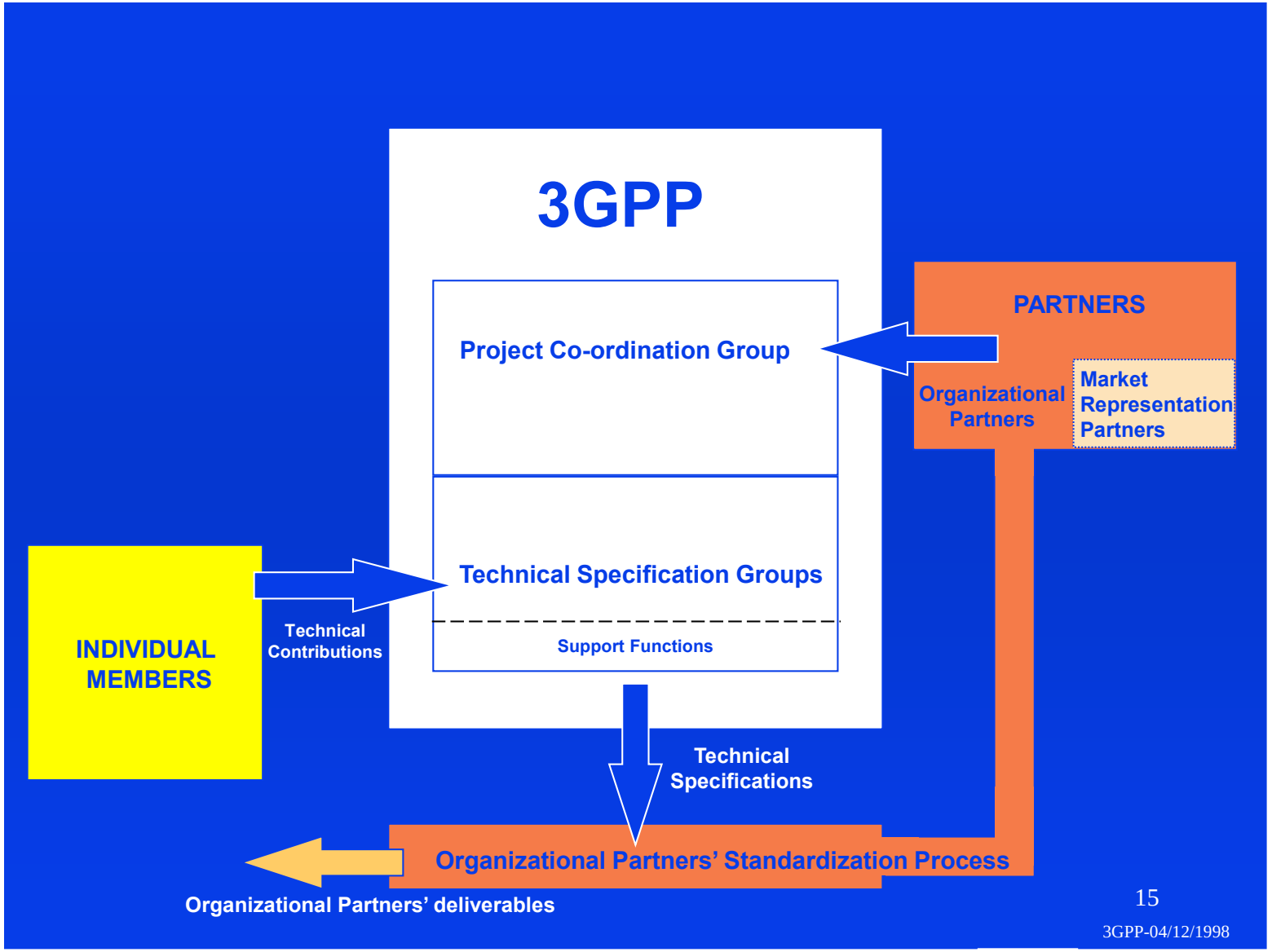
A Market Representation Partner is an organization invited to participate by the Organizational Partners to offer market advice to 3GPP and to bring into 3GPP a consensus view of market requirements (e.g. services, features and functionality) falling within the 3GPP scope.

A Market Representation Partner:

- does not have the capability and authority to define, publish and set standards nationally or regionally
- has signed (or whose sponsor has signed) the Partnership Project Agreement
- has committed itself to the 3GPP scope

Petitioners' Ex. 1016

Exhibit 2004
IPR2023-00919
Page 104 of 304



Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 105 of 304

Membership in an Organizational Partner is a pre-requisite for Individual Membership in 3GPP.

Individual Membership is open to legal entities committed to support 3GPP and to:

- contribute technically or otherwise to one or more of the Technical Specification Groups within the 3GPP scope
- use the 3GPP results to the extent feasible

Individual Membership in 3GPP will be terminated by dissolution, abolition, resignation or expulsion from the related Organizational Partner.

Petitioners' Ex. 1016

Exhibit 2004

IPR2023-00919

Page 106 of 304

All entities registered as members of an Organizational Partner and eligible for participation in the technical work of that Partner, can become Individual Members of 3GPP. Individual members shall apply to their Organizational Partner to participate in 3GPP.

Individual Members act in the 3GPP in their own right; they carry the full responsibility for their contributions.

Individual Membership applicants residing in a country/area without an Organizational Partner can apply for membership in an Organizational Partner according to the rules of each Partner. (e.g. ETSI Associate Membership is available)

Petitioners' Ex. 1016

Exhibit 2004
IPR2023-00919
Page 107 of 304

In order to ensure globally applicable Technical Specifications, the status of "Observer" may be granted by the Organizational Partners to an entity which has the qualifications to become a future Organizational Partner. The status of "Observer" includes obligations to:

- identify as early as possible any regulatory requirements that may lead to options within Technical Specifications
- make their IPR policy available for consideration
- contribute to the common objective of the 3GPP and avoid duplication of work related to the 3GPP

The participation rights of an Observer will be decided on a case by case basis.

Petitioners' Ex. 1016

Exhibit 2004
IPR2023-00919
Page 108 of 304

The following 3 documents describe 3GPP:

- The Partnership Project Agreement
- The Partnership Project Description (this present document)
- The Partnership Project Working Procedures

Petitioners' Ex. 1016

Exhibit 2004

IPR2023-00919

Page 109 of 304

The Partnership Project Agreement is a concise legal document signed by participating Partners (or their sponsor).

It contains the minimum legal text necessary for 3GPP to function correctly.

The Partnership Project Agreement refers to the Partnership Project Description and the Partnership Project Working Procedures.

Petitioners' Ex. 1016

Exhibit 2004
IPR2023-00919
Page 110 of 304

The Partnership Project Agreement includes obligations on Organizational Partners to commit themselves to the 3GPP scope:

- to encourage their members to contribute to the common set of Technical Specifications and to avoid duplication of work
- to convert / transpose / adopt all relevant Technical Specifications resulting from 3GPP into their own relevant deliverables through their normal processes
- to identify as early as possible, any national / regional regulatory requirements that may lead to options within the Technical Specifications
- to make their IPR Policy available for consideration

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 111 of 304

The Partnership Project Agreement includes obligations on Market Representation Partners to identify market and service requirement of 3GPP and to contribute to:

- the promotion of 3GPP
- the definition of 3GPP System and Service scenarios

The Market Representation Partners should also encourage their members to contribute to the common objectives of 3GPP and to avoid duplication of work.

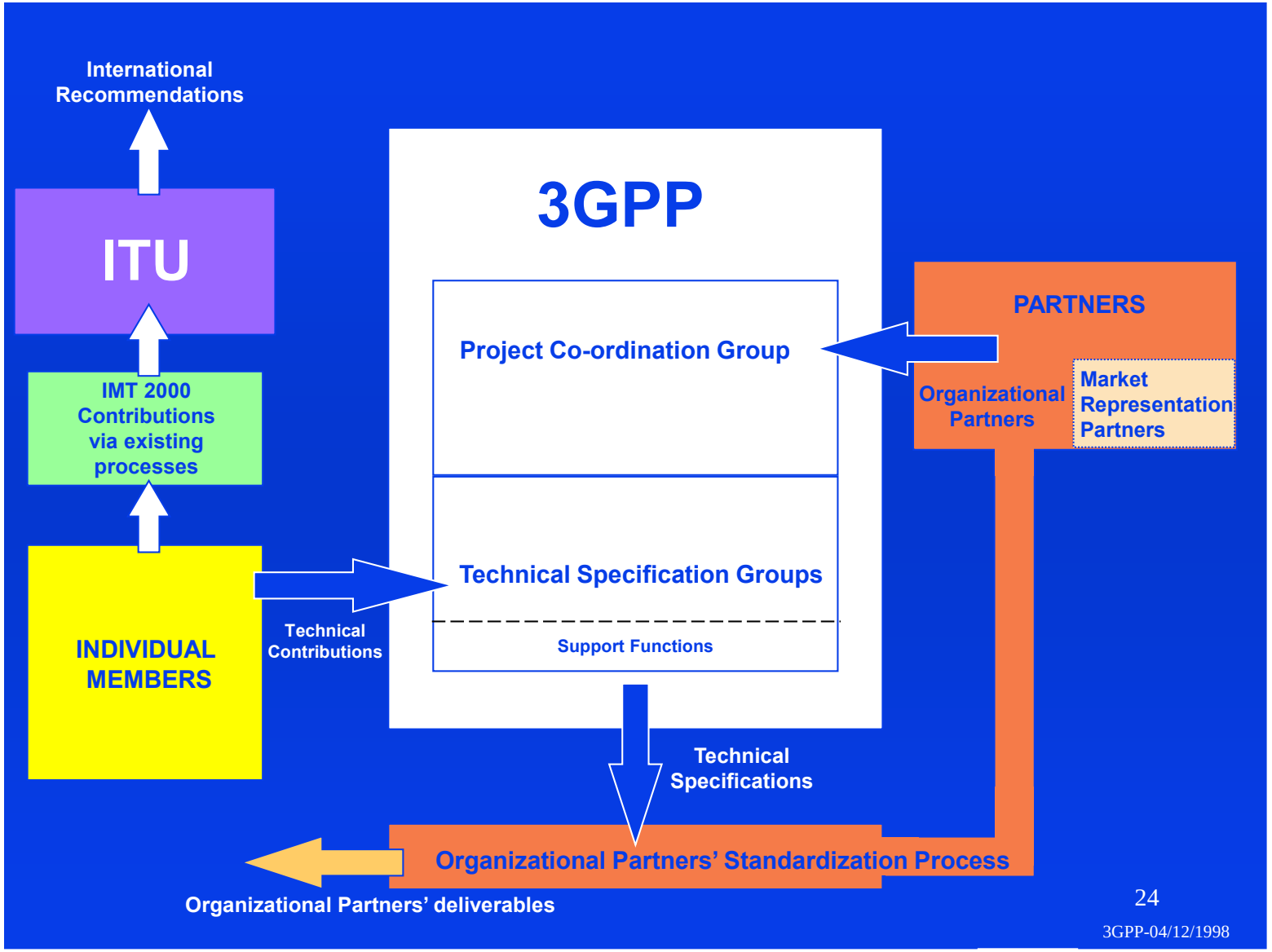
Petitioners' Ex. 1016

Exhibit 2004
IPR2023-00919
Page 112 of 304

The Organizational Partners of 3GPP will have joint ownership (including copyright) of the Technical Specifications.

Petitioners' Ex. 1016

Exhibit 2004
IPR2023-00919
Page 113 of 304



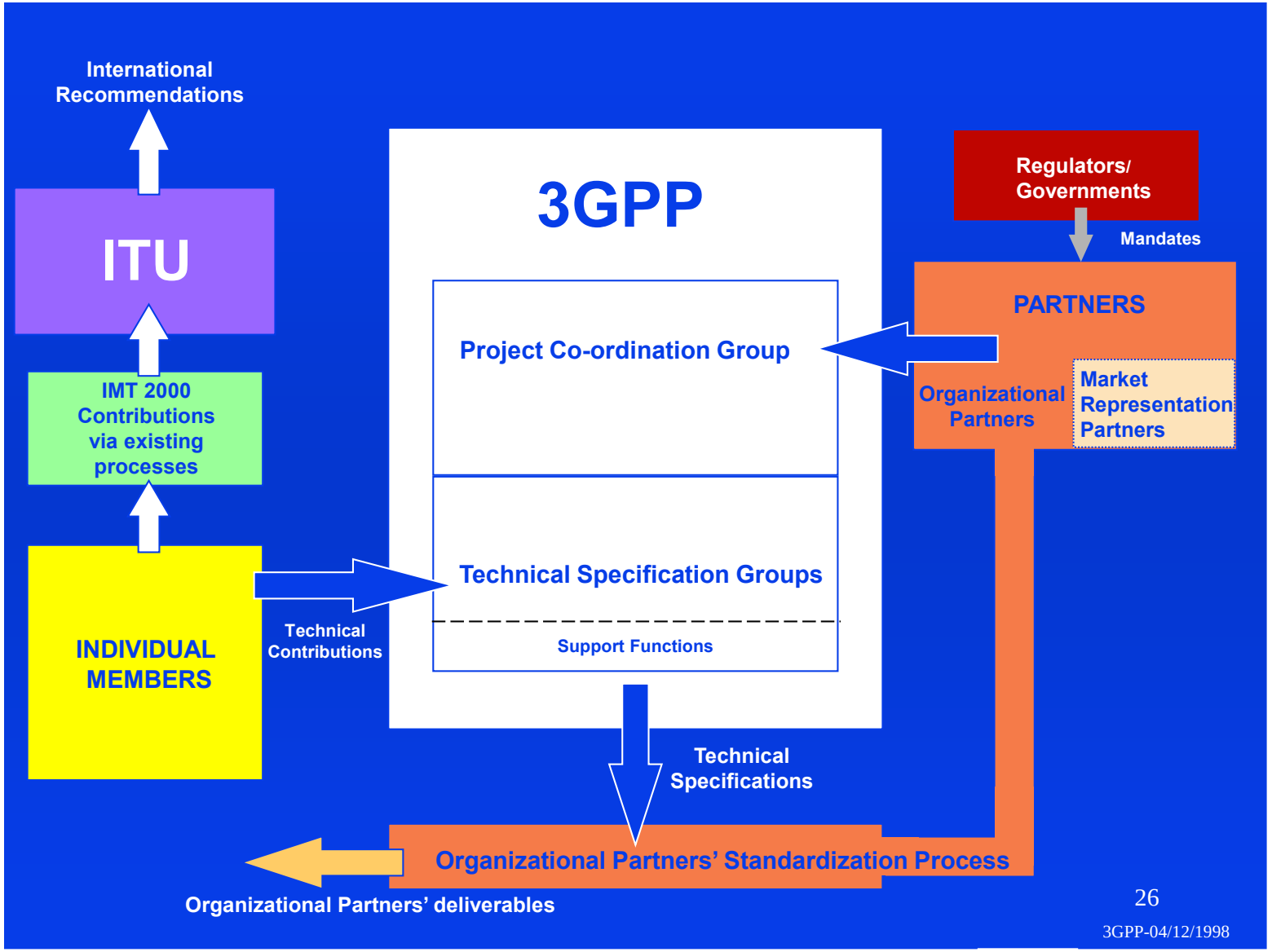
Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 114 of 304

3GPP will not contribute directly to the ITU.

Formal contributions to ITU Study Groups are made by ITU members following existing national/regional processes.

Petitioners' Ex. 1016

Exhibit 2004
IPR2023-00919
Page 115 of 304



Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 116 of 304

Variations imposed by national / regional regulatory requirements will be included in the Technical Specifications as defined by the Technical Specification Groups.

Petitioners' Ex. 1016

Exhibit 2004
IPR2023-00919
Page 117 of 304

ETSI will absorb the initial cost of establishing the 3GPP, if required.

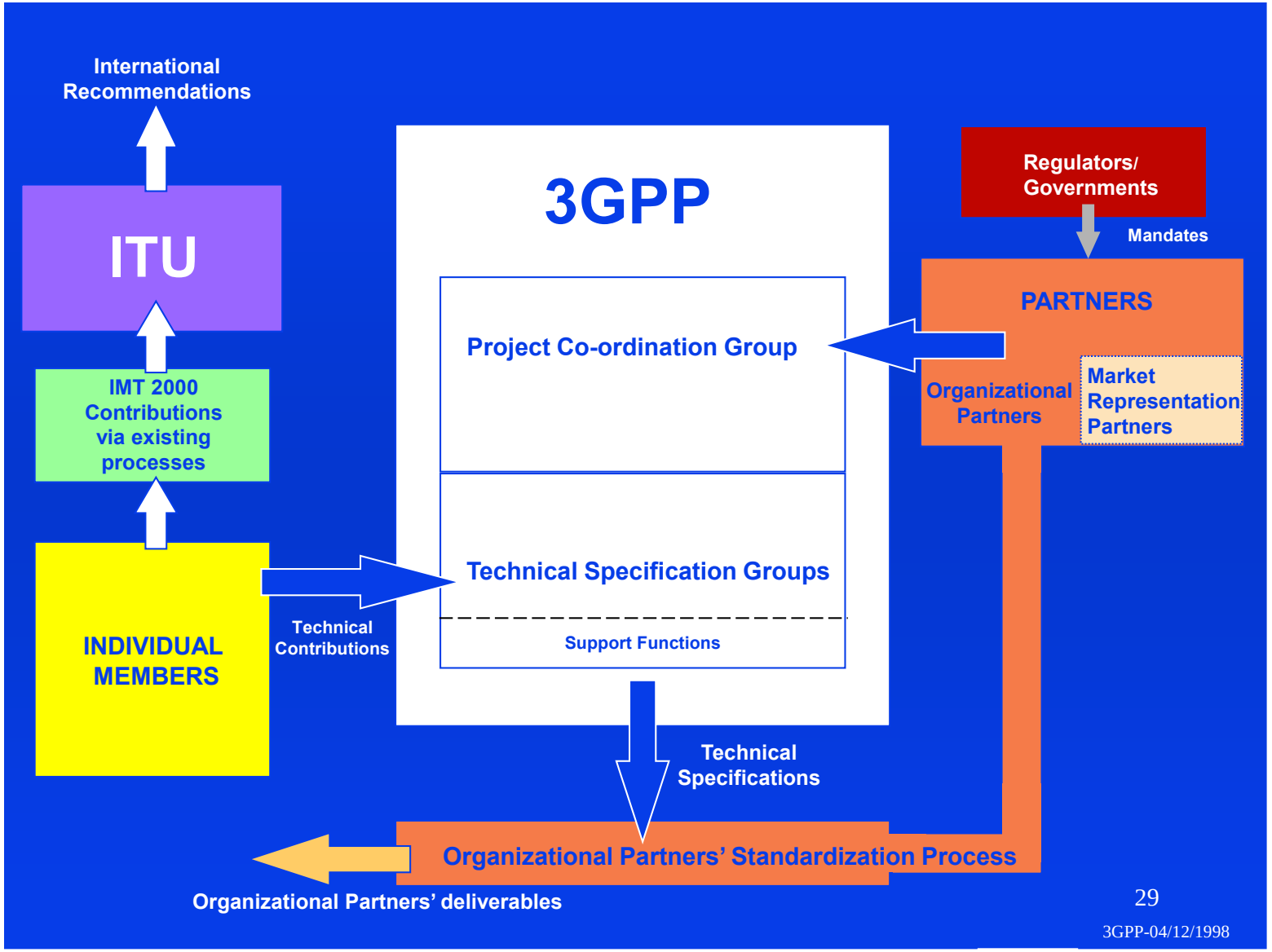
Thereafter, the costs will be shared by the Organizational Partners. There will be no direct 3GPP membership fee for Individual Members.

Partners and Individual Members may provide support functions to the extent that they are able (eg hosting of meetings and provision of Secretariat support).

The longer term financial requirements are for further study.

Petitioners' Ex. 1016

Exhibit 2004
IPR2023-00919
Page 118 of 304



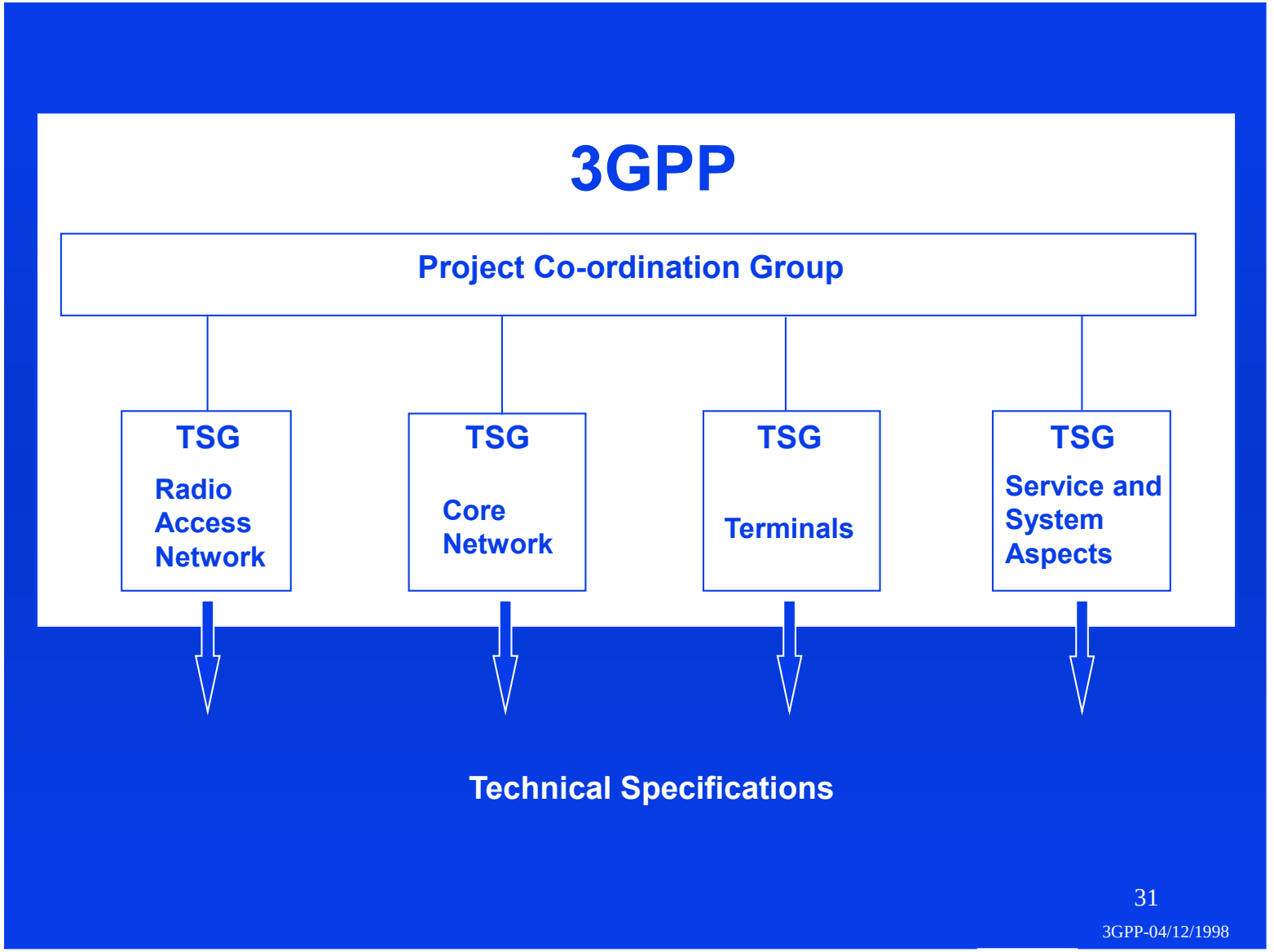
Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 119 of 304

3GPP consists of a Project Co-ordination Group (PCG) and Technical Specification Groups (TSGs).

To assist in the co-ordination of the technical activities, the TSGs are encouraged to meet at the same time and place, as and when appropriate (e.g. twice per year).

Petitioners' Ex. 1016

Exhibit 2004
IPR2023-00919
Page 120 of 304



Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 121 of 304

- Radio Layer 1 specification
- Radio Layer 2 specification
- Radio Layer 3 RR specification
- Iub specification
- Iur Interface
- Iu Interface
- UTRAN O&M requirements
- Base station radio performance specification
- Conformance test specification for testing of radio aspects of base stations
- Specifications for radio performance aspects from the system point of view

Petitioners' Ex. 1016

Exhibit 2004
IPR2023-00919
Page 122 of 304

- Mobility management, call connection control signalling between the user equipment and the core network
- Core network signalling between the core network nodes. the signalling supports functionality such as user location information, subscription information and control of network services
- Definition of interworking functions between the core network and external networks
- Packet related questions such as mapping of QoS (e.g. transparency for IP domain applications, general for bearer types, special for optimized applications such as Voice over IP)
- Core network aspects of the Iu interface
- Core network O&M requiremnents

Petitioners' Ex. 1016

Exhibit 2004
IPR2023-00919
Page 123 of 304

- Service capability protocols
- Messaging
- Services end-to-end interworking
- USIM to Mobile Terminal interface
- Model/framework for terminal interfaces and services (application) execution
- Conformance test specifications of terminals, including radio aspects

Petitioners' Ex. 1016

Exhibit 2004
IPR2023-00919
Page 124 of 304

- **Service capabilities**
  - Definition of services and feature requirements
  - Development of service capabilities and a service architecture for cellular, fixed (and cordless) applications
- **Stage one and two descriptions for:**
  - Charging and accounting
  - Network Management
  - Security Aspects
- **Architecture**
  - Definition, evolution, and maintenance of overall architecture, including assignment of functions to particular sub-systems and identification of key information flows
  - In co-operation with other TSGs, define required services, service capabilities and bearer capabilities offered by the different sub-systems
- **Codec aspects**
  - Principles for definition of end-to-end transmission
  - Definition, evolution and maintenance of relevant specifications
- **Project co-ordination**
  - High level co-ordination of the work performed in other TSGs and monitoring of progress

Petitioners' Ex. 1016

Exhibit 2004
IPR2023-00919
Page 125 of 304

The primary responsibilities of PCG, TSGs and Organizational Partners are given in the following tables:

	Function	Org Partners collectively	PCG	TSGs
1	Approval of new Partners for 3GPP	X		
2	Approval of Organizational Partner funding requirements and contributions	X		
3	Allocation of human and financial resources provided by Partners to PCG	X		
4	Allocation of resources to TSGs		X	
5	Allocation of resources within TSGs			X

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 126 of 304

	Function	Org Partners collectively	PCG	TSGs
6	Allocation of voluntary human and financial resources by Market Representation Partners and Individual Members		X	X
7	Handling of appeals from Individual Members on procedural matters	2nd step	1st step	
8	Handling of appeals from Individual Members on technical matters		2nd step	1st step
9	Determine overall time frame and manage overall work progress		X	

Petitioners' Ex. 1016

Exhibit 2004

IPR2023-00919

Page 127 of 304

	Function	Org Partner collectively	PCG	TSGs
10	Detailed time frame and manage detailed work progress			X
11	Approval of Technical Specifications			X
12	Proposal and approval of work items within the agreed scope and terms of reference			X
13	Final adoption of work items within the agreed scope and terms of reference		X	
14	Management of work items			X

Petitioners' Ex. 1016

Exhibit 2004

IPR2023-00919

Page 128 of 304

	Function	Org Partners collectively	PCG	TSGs
15	Technical Co-ordination (System Aspects TSG will play a role here)			X
16	Appointment of Org Partners meeting Chairman (provided by host on a rotational basis)	X		
17	Appointment of PCG Chairman (for one year term)		X	
18	Election of TSG Chairman and Vice Chairmen			X
19	Creation of TSGs and approval of their terms of reference	X		

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 129 of 304

	Function	Org Partners collectively	PCG	TSGs
20	Creation of TSG working groups and approval of their terms of reference			X
21	Election of TSG Working Group Chairmen and Vice Chairmen			X
22	Confirmation of individual member participation rights	X		
23	Approval of 3GPP scope and terms of reference	X		
24	Maintain Partnership Project Agreement, Project Description and Working Procedures (consensus agreement by all Partners)	X		

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 130 of 304

The following have a right to participate in the PCG:

- Representatives of participating Organizational Partners
- Representatives of participating Market Representation Partners
- Chairman and Vice Chairmen of the TSGs, as ex-officio members

The following have a right to participate in the TSGs :

- Representatives of members of participating Organizational Partners (i.e. Individual Members)
- Representatives of participating Organizational and Market Representation Partners

Petitioners' Ex. 1016

Exhibit 2004
IPR2023-00919
Page 131 of 304

Decision making within PCGs

- By consensus amongst the Organizational Partners
- By vote amongst the Organizational Partners in unavoidable cases

Decision making within TSGs

- By consensus amongst the Individual Members
- By vote amongst the Individual Members in unavoidable cases

The Organizational Partners will conduct a fairness review of the decision making process six months after 3GPP start-up, taking into account all concerns raised

(Note: voting will not be permitted on National/Regional regulatory requirements)

Petitioners' Ex. 1016

Exhibit 2004
IPR2023-00919
Page 132 of 304

The following principles will be applied for voting within the TSGs

- One “Individual company Member”, one vote
- Organizational Partners to interpret “ Individual company Member” according to its own rules of membership
- The PCG will maintain a register of eligible voters for the TSGs
- Each Individual Member may carry the proxy for up to five other Individual Members

Petitioners' Ex. 1016

Exhibit 2004
IPR2023-00919
Page 133 of 304

The working language for 3GPP shall be English

- **Meetings of the PCG and TSGs shall be conducted in English**
- **3GPP Technical Specifications shall be prepared in English**

Petitioners' Ex. 1016

Exhibit 2004
IPR2023-00919
Page 134 of 304

3GPP will establish and maintain good relationships with groups working on standards for other IMT-2000 family members.

Petitioners' Ex. 1016

Exhibit 2004

IPR2023-00919

Page 135 of 304

The Individual Members of 3GPP are bound by the IPR Policies of their respective Organizational Partner.

Individual Members are encouraged to declare at the earliest opportunity, any IPRs which they may have and believe to be essential, or potentially essential, to any work ongoing within 3GPP.

After comparing their respective IPR policies, ARIB, ETSI, T1, TTA and TTC have agreed that their IPR policies share common principles are quite similar and have agreed on the following additional principles to maximize the success of 3GPP.

Petitioners' Ex. 1016

Exhibit 2004
IPR2023-00919
Page 136 of 304

(i) To encourage their respective members' declaration of willingness to grant licences on fair, reasonable terms and conditions on a non-discriminatory basis, and consistent with the respective Organizational Partners' IPR policies.

(ii) To encourage their respective members who may have IPR which they believe to be essential, or potentially essential, and are unwilling to license such IPR, that early indication of such unwillingness be provided to their respective Organizational Partners.

(iii) To understand that essential IPRs mean essential IPRs relative to any or all parts of the content of the 3GPP technical specifications.

(iv) A mechanism for exchanging information associated with the patent statement among the Organizational Partners will be introduced so that such information may be used when adopting relevant standards in each Partner Organization.

Petitioners' Ex. 1016

Exhibit 2004
IPR2023-00919
Page 137 of 304

Appendix 10

About 3GPP Home

The 3rd Generation Partnership Project (3GPP) unites [Seven] telecommunications standard development organizations (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC), known as "Organizational Partners" and provides their members with a stable environment to produce the Reports and Specifications that define 3GPP technologies.

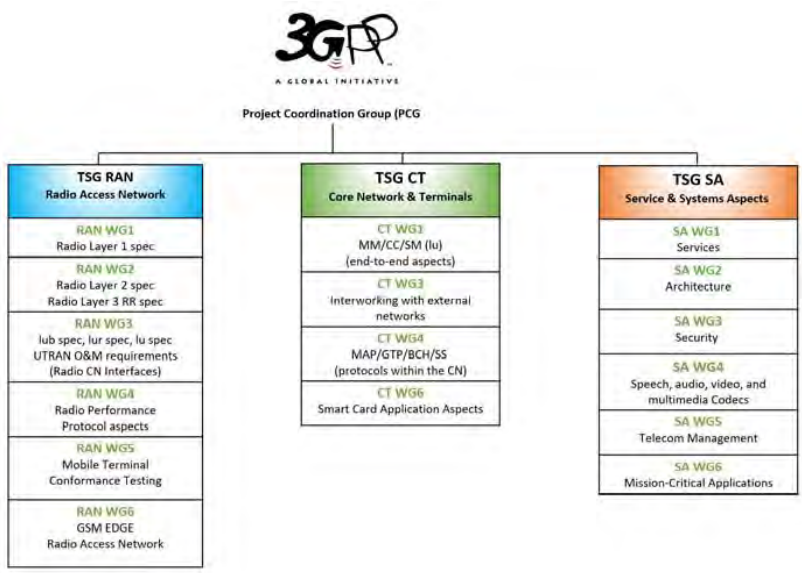
The project covers cellular telecommunications technologies, including radio access, core network and service capabilities, which provide a complete system description for mobile telecommunications.

The 3GPP specifications also provide hooks for non-radio access to the core network,and for interworking with non-3GPP networks.

3GPP specifications and studies are contribution-driven, by member companies, in Working Groups and at the Technical Specification Group level.

The three Technical Specification Groups (TSG) in 3GPP are;

Radio Access Networks (RAN),
Services & Systems Aspects (SA),
Core Network & Terminals (CT)



The Working Groups, within the TSGs, meet regularly and come together for their quarterly TSG Plenary meeting, where their work is presented for information, discussion and approval.

The last meeting of the week of TSG Plenary meetings (see example below) is TSG SA, which also has responsibility for the overall coordination of the technical work and for the monitoring of its progress.

Search

3GPP Website: Search for...

Search and download specs, docs, CRs and more from the 3GPP FTP Server:

ADVANCED FTP SEARCH

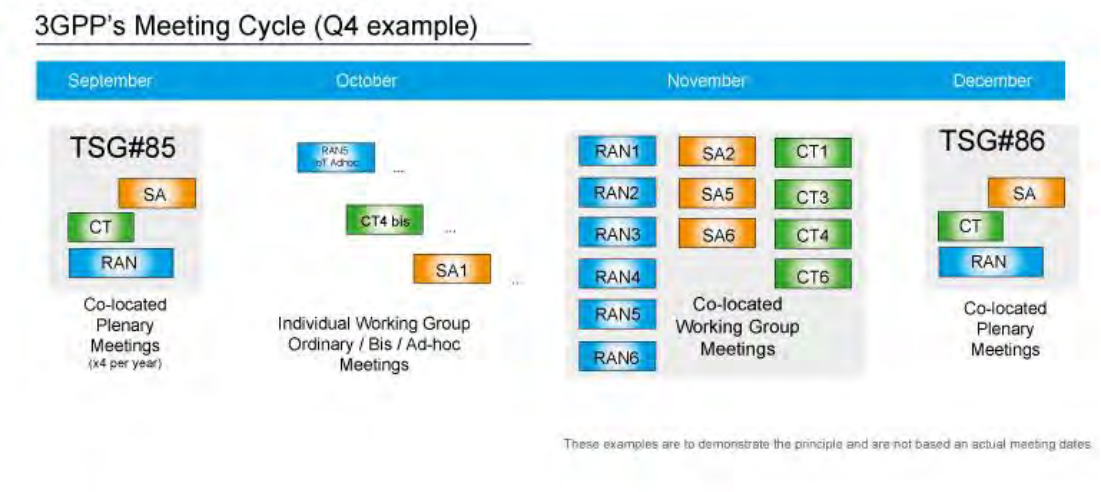
More News:

- Adjustments to Rel-16 & Rel-17 Timelines
- Changing 3GPP to help the verticals
- 3GPP working on-line 1H 2020
- 5G for Industry 4.0
- Recorded 3GPP webinars and interviews (no registration needed)

News Feeds

3GPP tweets

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 139 of 304



The 3GPP technologies from these groups are constantly evolving through Generations of commercial cellular / mobile systems (see table below). With LTE, LTE-Advanced, LTE Advanced Pro and 5G work - 3GPP has become the focal point for the vast majority of mobile systems beyond 3G.

Although these Generations have become an adequate descriptor for the type of network under discussion, real progress on 3GPP standards is measured by the milestones achieved in particular Releases. New features are 'functionality frozen' and are ready for implementation when a Release is completed. 3GPP works on a number of Releases in parallel, starting future work well in advance of the completion of the current Release. Although this adds some complexity to the work of the groups, such a way of working ensures that progress is continuous & stable.

Backward Compatibility

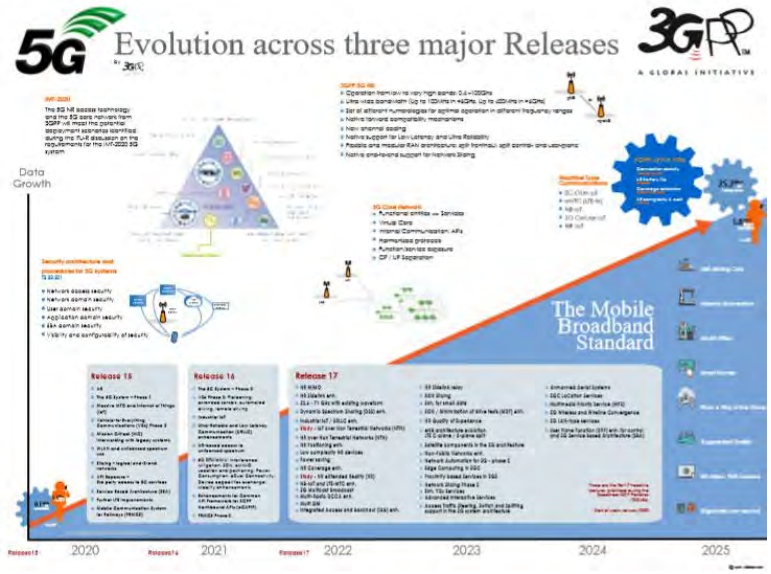
The major focus for all 3GPP Releases is to make the system backwards and forwards compatible where possible, to ensure that the operation of user equipment is uninterrupted. A good example of this principle was the priority placed on backward compatibility between LTE and LTE-Advanced, so that an LTE-A terminal can work in an LTE cell and an LTE terminal works in the LTE-A cell.

For 5G, many operators are starting with dual connectivity between LTE and 5G NR equipment - using the 'Non-Standalone' work completed early in Release 15. In the process of completing the early drop of 5G NR care has been taken to build 'forward compatibility' in to Non-Standalone NR equipment, to ensure that it will be fit for use on Standalone 5G NR systems.

Generations of Mobile Systems

Generation	Major Systems Milestones
1G	Analogue technology, from the 1980s onwards. Various technologies were deployed, Nationally or Regionally, including: NMT (Nordic Mobile Telephone), AMPS (Advanced Mobile Phone System), TACS (Total Access Communications System), A-Netz to E-Netz, Radiocom 2000, RTMI (Radio Telefono Mobile Integrato), JTACS (Japan Total Access Communications System) and TZ-80n (Source:wikipedia)
2G	First digital systems, deployed in the 1990s introducing voice, SMS and data services. The Primary 2G technologies are: GSM/GPRS & EDGE, CDMAOne, PDC, iDEN, IS-136 or D-AMPS.
3G	The 3G system from 3GPP is based on evolved Global System for Mobile communication (GSM) core networks and the radio access technologies that they support. This has allowed for the maintenance and development of GSM, with the evolution of General Packet Radio Service (GPRS) and Enhanced Data rates for GSM Evolution (EDGE), as well as further developments with the Universal Mobile Telecommunications System (UMTS) and High Speed Packet data Access (HSPA). 3G brought a global vision to the evolution of mobile networks, with the creation of the ITU's family of IMT-2000 systems which included EDGE, CDMA2000 1X/EVDO and UMTS-HSPA+ radio access technologies.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 140 of 304

Generation	Major Systems Milestones
3G/4G	LTE and LTE-Advanced have crossed the “generational boundary” offering the next generation(s) of capabilities. With their capacity for high speed data, significant spectral efficiencies and adoption of advanced radio techniques, their emergence has been the basis for all new mobile systems from Release 8 onwards. It should be noted that LTE-Advanced (From Release 10) is 3GPP's ITU-R IMT-Advanced radio interface. LTE-Advanced is the first true 4G technology to be specified by 3GPP. LTE-Advanced Pro is the name that helps the industry describe what has been achieved with the completion of Release 13. LTE Pro is set to be used by other sectors, beyond telecoms, including Critical Communications (blue light services & other Mission Critical systems), the machine-to-machine or Internet of Things (IoT) sector, Transport (Rail, ITS, etc), Education and many other areas. LTE-Advanced Pro is 3GPP's stepping stone to 5G systems.
5G	5G brings another major technology step, with the creation of a 'New Radio' (NR). Unlike with 4G, where 3GPP hesitated to join the generational march onwards beyond 3G, we have embraced the alignment of the industry on NR and on LTE-Advanced Pro to provide 5G – from 3GPP Release 15 onwards. 

Radio Access Milestones

3GPP Technical Specification Group RAN, like other TSGs, ensures that systems based on 3GPP specifications are capable of rapid development and deployment with the provision of global roaming of equipment.

Each progressive 3GPP radio access technology aims to reduce complexity and avoid fragmentation of technologies on offer.

Core Network Evolution

GSM networks used circuit-switch telephony initially, with packet-switching added with GPRS. In the UMTS architecture, this dual-domain concept was kept on the core network side. Some network elements were evolved, but the concept remained very similar.

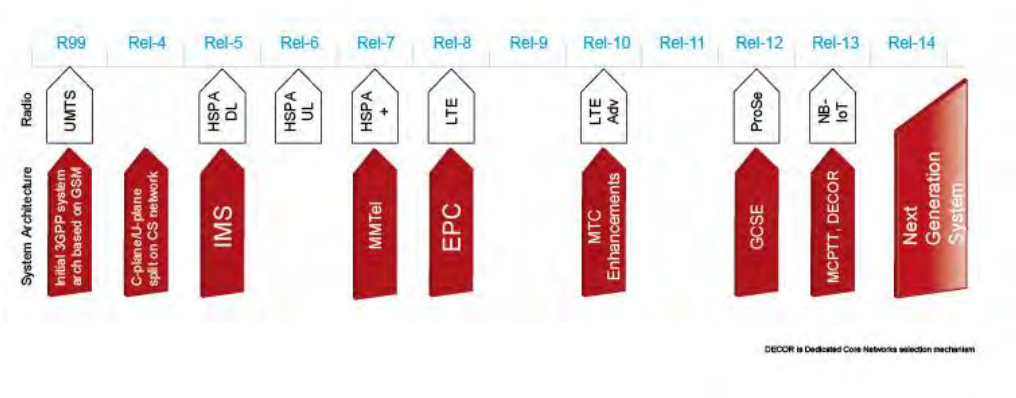
When considering the evolution of the 3G system towards LTE, the 3GPP community decided to use IP (Internet Protocol) as the key protocol to transport all services. It was therefore agreed that the Evolved Packet Core (EPC) would not have a circuit-switched domain but that the EPC should be an evolution of the packet-switched architecture used in GPRS/UMTS.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 141 of 304

This decision had consequences on the architecture itself but also on the way that the services were provided. Traditional use of circuits to carry voice and short messages needed to be replaced by IP-based solutions in the long term... *Read more on the EPC at*



http://www.3gpp.org/The-Evolved-Packet-Core



For details of the contents of each Release, see the appropriate 'Release Description' document (or see direct link at bottom of this page).

Details of all 3GPP Work Items are in the 3GPP Work Plan, which provides details of the cooperation between all of the 3GPP groups on "Features", defined as 'new or substantially enhanced functionality which represents added value to the existing 3GPP system'.

3GPP Scope

The original scope of 3GPP (1998) was to produce Technical Specifications and Technical Reports for a 3G Mobile System based on evolved GSM core networks and the radio access technologies that they support (i.e., Universal Terrestrial Radio Access (UTRA) both Frequency Division Duplex (FDD) and Time Division Duplex (TDD) modes).

The scope was subsequently amended to include the maintenance and development of the Global System for Mobile communication (GSM) Technical Specifications and Technical Reports including evolved radio access technologies (e.g. General Packet Radio Service (GPRS) and Enhanced Data rates for GSM Evolution (EDGE)).

3GPP was created in December 1998 by the signing of the "The 3rd Generation Partnership **Project Agreement**". The latest **3GPP Scope and Objectives document** has evolved from this original Agreement.

The discussions that led to the signing of the 3GPP Agreement were recorded in a series of slides called the **"Partnership Project Description"** that describes the basic principles and ideas on which the project is based. The Partnership Project Description has not been maintained since its first creation but the principles of operation of the project still remain valid.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 142 of 304

ABOUT RELEASES

Release 17
Release 16
Release 15
Release 14
Release 13
Release 12
Release 11
Release 10
Release 9
Release 8
Release 7
Release 6
Release 5
Release 4
Release 1999

FULL MEETING CALENDAR

Face to face meetings have been suspended for the time being.
The calendar of replacement e-meetings is online at
https://portal.3gpp.org/

BROWSE KEYWORDS & TECH.

Common API Framework (CAPIF)
Carrier Aggregation Explained
Coordinated Vulnerability Disclosure (CVD)
The Evolved Packet Core
GPRS & EDGE
HSPA
LTE-Advanced
LTE
UAS - UAV
UMTS
V2X
W-CDMA
...more keywords

©3GPP 2020

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 143 of 304

Appendix 11

3GPP FAQs

3GPP FAQs

Questions about 3GPP Membership
Questions about 3GPP email exploder lists
Questions about Legal Matters
Questions about 3GPP Specifications
Questions about Technical Specification Group/Working Group
Questions about Documents and TSG/WG Meetings
Questions about Work Items and Deliverables
Miscellaneous
Technical topics

Questions about 3GPP Membership

Who can become an Individual Member of 3GPP and how much does it cost?
Who may participate in 3GPP meetings?
Who shall fill in the 3GPP Individual Member Application form?
What shall I do if a 3GPP company or official contact details change?
What are the different membership categories?
Who may become an observer?
Who may become a Guest Member and do guests have to pay any fees?
Who can apply for market representative Partnership?
Can an ETSI Observer become an Individual Member of 3GPP?
Can an ETSI Applicant apply for 3GPP Membership?
Can an ETSI Member apply for 3GPP Guest status?

Questions about 3GPP email exploder lists

Are there discussion archives for the 3GPP exploder lists?
How do I subscribe to the 3GPP exploder lists?

Questions about Legal Matters

What is the 3GPP IPR Policy?
What is the 3GPP policy on licensing?
Who owns the Technical Specifications and the Technical Reports approved by 3GPP?
Are meeting contributions to ETSI TC SMG publically available?
Is permission needed to use the 3GPP logo in marketing collaterals or on a web site?
Can I use computer code included with a 3GPP TS to implement a product?

Questions about 3GPP Specifications

How do I create the next Release version of a TS or TR?
Where can the rules, protocols or software needed to develop applications for UMTS be found?
What is the correlation between Stage 1, Stage 2 and Stage 3?
Are the 3GPP specifications produced only in word?
Which group works with specifications covering the use of the GSM codec (either in C or Java based)?
Where can I find documents produced by the GSM MoU Group / GSM Association?
Where would I find a document (e.g. UMTS 30.03 version 3.1.0) which does not appear on the status list?
Where are all the Change Requests (CRs) located?
Where are all the current ETSI SMG specs located?
Which group works on Physical Layer aspects of UMTS/LTE?
Where can I find the list of Abstract syntax notation (ASN.1) object identifiers?

Search

3GPP Website: Search for...

Search and download specs, docs, CRs and more from the 3GPP FTP Server:

ADVANCED FTP SEARCH

More News:

- Adjustments to Rel-16 & Rel-17 Timelines
- Changing 3GPP to help the verticals
- 3GPP working on-line 1H 2020
- 5G for Industry 4.0
- Recorded 3GPP webinars and interviews (no registration needed)

News Feeds

3GPP tweets

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 145 of 304

Where can I find the 3GPP Confidentiality and Integrity algorithms?
What is a Release - how does specification version numbering work?
Where can I find information on the current status of 3GPP specifications?
What is the system for numbering specifications?
What is the meaning of the text at the foot of the TS/TR cover page?

Questions about Technical Specification Group/Working Group

Who are the TSG/WG Officials and Support team and where can I find their contact details?
Where can I find the Terms of Reference for my TSG/WG?
May I become an Official?
Where are my TSG/WGs documents stored?

Questions about Documents and TSG/WG Meetings

How do I register for a meeting?
Who can submit a change proposal on any 3GPP specifications to 3GPP?
If a change proposal is submitted how long does it take for it to get approved?
How to get a user name and password for "Reserve a Document Number"?
How do I obtain a document number for my contribution?
Where can I download documents for an upcoming meeting?
Where can I find a temporary document template?

Questions about Work Items and Deliverables

What is my role when my TSG/WGs has to approve a deliverable?
What are the different types of deliverables?
Can I write an 3GPP Document myself?
Do I and my company have to support my TSG/WGs Work Items?

Miscellaneous

Do I need a password and user name to access the 3GPP Web site ?
Can you give me information about which companies manufacture particular types of equipment. (...)
How can I determine when a meeting contribution document (TDoc) became publicly available?
Is it possible to determine the date and time of publication of a particular version of a 3GPP specification?

Technical topics

What formalities do I have to go through to get type approval for terminal equipment in Europe? Is there a single point of contact? What standards does my equipment need to conform to in order that I can place it on the market?
Where can I find a list of technical terms and abbreviations used in 3GPP documents?
What is the difference between a SIM and a USIM? What is a UICC?
I have transferred a video file from my phone to my PC. Where can I find a player for 3gp files?
Where can I find the specification of the SIM Lock feature?

Who can become an Individual Member of 3GPP and how much does it cost?

Individual Members are by definition members of the Organizational Partners of 3GPP. This means that members of standardization bodies such as ETSI, ARIB, TTA, TTC, ATIS and CCSA have a right to take part in 3GPP. If your company becomes an ETSI member, please be informed that for participation in 3GPP you need to pay 3 units of contribution as a minimum except SMEs, Users, Universities, Public Research Bodies who should pay 2 units (instead of 1).

ETSI Members' and associate members' fees are calculated by class. The class is derived from the member company's annual ECRT band (Electronics Communications Related Turnover) – see ECRT definition.
Each class corresponds to a number of units. This number determines the contribution payable.

Example: If your organization declares an annual ECRT of up to 135€ million, you would need to pay 2 Units of Contribution (corresponding to 9380€ per year) plus an additional UoC for participation in 3GPP of 3380€ (see fees table). Members joining ETSI during the 2nd half of the year benefit from a 50% rebate on the membership fee of the current year. In this case, you would pay 12760€ minus 50% = 6380€ for yyyy.

Who may participate in 3GPP meetings?

To attend a 3GPP meeting, you must be a 3GPP Individual Member (i.e., you must be a Member of one of the Organizational Partners involved in the project; ARIB, CCSA, ETSI, ATIS, TTA , TTC or TSDSI). A non-member company should seek membership with one of the above partners to be eligible to contribute and participate at 3GPP Meetings.

Who shall fill in the 3GPP Individual Member Application form?

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 146 of 304

The person legally responsible for the requesting company shall fill in the form.

What shall I do if a 3GPP company or official contact details change?

All changes of correspondence should be notified to ETSI Membership and 3GPPMembership.
In case of change of official contact an ETSI Online (EOL) account will be created for the new contact.
Please note that as official contact person you can view and modify your personal and organization's contact details via the "Manage my membership" web interface.

What are the different membership categories?

The different membership categories of 3GPP are described in Article 4 of the 3GPP Working Procedures.

Who may become an observer?

The status of Observer may be granted by the Organizational Partners to an entity which has the qualifications to become a future Partner (see also 3GPP Working Procedures Article 10)

Who may become a 3GPP Guest Member and do guests have to pay any fees?

The 3GPP Guest status is for potential Individual Members who may be granted permission to participate in 3GPP for a maximum period of 6 months. Guest status is granted on a case-by-case basis by the Organizational Partners (see also 3GPP Working Procedures Article 10). If you like to apply for a Guest status, please complete the on-line 3GPP Application form.

No membership fees are requested for Guest applications. The Guest status is a one time only membership which is used to enable a company to decide whether or not they wish to become a full member (by joining one of the Partners).

Who can apply for market representative Partnership?

Organisation who have the ability to offer market advice to 3GPP and to bring into 3GPP a consensus view of market requirements (e.g., services, features and functionality) falling within the 3GPP scope (see also 3GPP Working Procedures, Article 7).

Can an ETSI Observer become an Individual Member of 3GPP?

An ETSI Observer cannot become an Individual Member of 3GPP. An ETSI Observer may "observe" all activities, but their participation is limited to the ETSI General Assembly only. Therefore, ETSI Observers have no participation rights in 3GPP. ETSI Observers have access to ETSI documentation and of course to 3GPP documentation since that is openly published on the web.

3GPP does have it's own category called "Observer" but that is entirely different and is used for potential Partners.

Can an ETSI Applicant apply for 3GPP Membership?

YES, an ETSI Applicant means that your request to become an ETSI Member will be addressed (and normally approved) at the next General Assembly and that the company has specified they want to participate in 3GPP activities. See also above regarding 3GPP fees.

Can an ETSI Member apply for 3GPP Guest status?

Yes, any ETSI Member can apply for a 3GPP Guest status by filling in the on-line 3GPP Application form.

Are there discussion archives for the 3GPP exploder lists?

Yes! To see the complete list please have a look here: Home page of listserv and scroll down until you find the list you are interested in. For example, the archives for the main RAN email list.

How do I subscribe to the 3GPP exploder lists?

All 3GPP email exploder lists can be found at list.3gpp.org. In order to subscribe to any of the lists, scroll down until you find the list you are interested in, then click on the link and on the right side of the page you will find Subscribe or Unsubscribe. Click on the link and follow the simple instructions. Delegates who already have an ETSI username and password should use the list management application on the ETSI site.

What is the 3GPP IPR Policy?

The 3GPP Organizational Partners have agreed that their IPR policies should be respected and that their respective members should be encouraged to declare "their willingness to grant licenses on fair, reasonable terms and conditions

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 147 of 304

and on non discriminatory basis" (Article 3.1 of the Third Generation Partnership Project). For more information, look here >>>

The above-mentioned principles are further reflected in Article 55 of the 3GPP Working Procedures which request that each Individual Members should declare "at the earliest opportunity, any IPR which they believe to be essential, or potentially essential, to any work ongoing within 3GPP".

What is the 3GPP policy on licensing?

Some aspects of 3GPP systems are covered by essential Intellectual Property Rights (IPR) - that is, patented technologies without which equipment cannot be implemented. The IPR vests in - i.e. the patents are held by - individual companies, and not by 3GPP itself or any of its Organizational Partners (OPs). All Individual Members of 3GPP abide by the IPR policies of the OP to which they belong; all such policies are broadly similar see also "What is the 3GPP IPR Policy", and require IPR holders to make licences available to all third parties, whether or not they are 3GPP Individual Members, under fair, reasonable and non-discriminatory (FRAND) terms.

Neither 3GPP nor its component OPs offer an IPR search service. It is the responsibility of each manufacturer / system implementor to seek and obtain its own licenses from the individual IPR holders. For more information, and a guide to the IPRs declared to each 3GPP OP, look here>>>

Who owns the Technical Specifications and the Technical Reports approved by 3GPP?

According to the Article 3.2.2 of the Third Generation Partnership Project Agreement, the 3GPP Organizational Partners jointly own copyright on the Technical Specifications and the Technical Reports approved by 3GPP.

Are meeting contributions to ETSI TC SMG publically available?

ETSI TC SMG meeting documents can be found on the ETSI docbox file server. Access is limited to bona fide representatives of ETSI member organizations. These, together with early versions of the GSM specifications, have been gathered together into a set of DVDs "A Technical History of GSM" available to ETSI members via the ETSI WEB store.

The GSM standardization work was transferred from CEPT to ETSI in 1991. TC SMG was closed at meeting #32 and TC MSG created to continue the work. Like almost all ETSI Technical Committees, participation in TC SMG and its working groups was open to all ETSI member organizations. That is, any bona fide representative of an ETSI member was free to participate. Exceptionally, other individuals could participate by express invitation of the chairman. Each meeting report contains a list of participants with their corporate affiliations.

Until the late 1990s, all meeting documents were circulated in paper form. Electronic files started to take over from paper in around 1997. Meeting documents ("TDocs") were distributed by post (later, by fax) in batches prior to the meeting, to those persons registered as regular participants in SMG or the appropriate working group, and many more documents were produced during the course of the meeting itself. Although a provision existed (and still exists) in the context of the IPR Policy for contributors to place restrictions on the distribution of TDocs via a formal notification at the time the document was provided, this was seldom if ever invoked. In the absence of such a condition, all TDocs were free of any restriction on subsequent distribution. Thus no restriction has ever been placed on how meeting participants dispose of the documents subsequent to their distribution before, during, or after the meeting. There were no non-disclosure agreements.

ETSI maintains a paper archive of the SMG TDocs, and bona fide representatives of current ETSI members can, by appointment, make an accompanied search of the archives. This facility extends to members which may not have been members at the time the document was originally produced.

TC-approved versions of ETSI “deliverables” (see ETSI Directives for formal definition of this term) would have been transferred by the support officer of the committee to the secretariat team responsible for publishing ETSI deliverables. That team would have made cosmetic (non-technical) modifications to the draft deliverables before issuing them. Depending on the type of “deliverable”, those documents would have been issued via National Standards Organizations (NSOs) either for immediate publication, or first via either a one-step or two-step national public enquiry and vote process prior to final publication by ETSI. In ETSI parlance, “publication” of a deliverable is the final step in the development cycle of a technical standard, and has a precise meaning. That meaning is not “making publically available”, since draft deliverables released for public enquiry or for vote are "publically available" but not yet "published".

If the confidentiality conditions described above had been imposed on a TDoc by its authors, if the text of that TDoc was in due course incorporated into an ETSI "deliverable", then those conditions are regarded as annulled from the date on which the deliverable is published.

Collections of TDocs / meeting reports have from time to time been made available to ETSI members in CD or DVD form, look here >>>

Is permission needed to use the 3GPP logo in marketing collaterals or on a web site?

ETSI (European Telecommunications Standards Institute) is the sole owner of the following acronyms:

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 148 of 304

ETSI,
DECT,
UMTS,
3GPP and
TIPHON,

as well as the ETSI, TIPHON, 3GPP and LTE logos. ETSI Members are authorized to use these Trade Marks in accordance with Collective Letter 1943. Authorization is needed to use the above mentioned acronyms and logos.

For further information contact the ETSI Legal Team or see http://www.3gpp.org/about-3gpp/legal-matters/logo-use.

Can I use computer code included with a 3GPP TS to implement a product?

Yes, but read this clause carefully. Some 3GPP Technical Specifications include computer code such as ASN.1 or XML (protocols), ANSI-C language (codecs), ...; and some include test vectors (codecs) for verifying implementations. These are published to allow users of these TSs to implement real-world products. No permission is required from 3GPP or its Organizational Partners (OPs) to use this code in the design of products - e.g. to compile the C to implement a codec in machine code.

Nevertheless, there may be essential IPR involved with such a design, and implementers are obliged to seek licences from IPR owners to use that technology. See also What is the 3GPP policy on licensing?

Moreover, the copyright of all 3GPP TSs and TRs vests jointly by all the 3GPP OPs. Other than for in-house copies for the purpose of further development of the 3GPP standard or for product design purposes, etc. you may not reproduce any part of a 3GPP TS or TR without seeking permission from 3GPP (e.g. from the ETSI Legal Team): use the procedure described on the legal area of this site. This means that you must not provide verbatim copies of source code (or lightly modified copies) without seeking permission from 3GPP.

Finally, you are reminded that 3GPP TSs and TRs have no legal status, and you should not design products directly to them. See the advice notice on the cover page of every 3GPP TS and TR. Instead, use the technically identical publication of one of the OPs.

How do I create the next Release version of a TS or TR?

There are three ways of upgrading a Release X spec to Release X+1:

1. Write a CR to the latest Release X version to incorporate technical changes to satisfy a Release X+1 work item, and on the cover sheet showing the WI code for that work item and the Release code for Release X+1. If the CR is approved at TSG level, this will automatically create the first instance of the next Release of the spec.
2. Make a specific request to the TSG to upgrade the latest version of the spec from Release X to Release X+1. This might be needed if the functionalities of the two Releases diverge, though backwards-incompatibility is to be avoided if possible.
3. Do nothing. If a spec has survived unchanged throughout the period during which Release X+1 was developed, when Release X+1 is frozen, all such specs will automatically be upgraded from Release X to Release X+1 without technical change.

Where can the rules, protocols or software needed to develop applications for UMTS be found?

A good place to start is on the 3GPP website, and particularly the specifications list.

What is the correlation between Stage 1, Stage 2 and Stage 3?

A three-stage methodology as defined in ITU T Recommendation I.130 is applied in 3GPP according TR 21.900 clause 4.1:

Stage 1 is an overall service description from the user's standpoint.
Stage 2 is an overall description of the organization of the network functions to map service requirements into network capabilities.
Stage 3 is the definition of switching and signalling capabilities needed to support services defined in stage 1.

Are the 3GPP specifications produced only in word?

The 3GPP specs are published as ETSI deliverables, and these are available in PDF form http://www.etsi.org/standards-search. But you can download a free Word viewer (i.e. read only) from the Microsoft web site. PDF is inherently secure (more so than html, in fact), and because WordViewer is very simple (it can not handle macros, for example), it is pretty safe too. ETSI has no plans at present to publish specifications in plain text or in html.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 149 of 304

Which group works with specifications covering the use of the GSM codec (either in C or Java based)?

The SMG STC SMG11 and 3GPP SA4 specifications, available from http://www.3gpp.org, respectively deal with this. It gives you a list of specifications via the status list (look for the GSM specs in the MS-Access database at : http://www.3gpp.org/ftp/Information/Databases/Spec_Status/)

and you can then download the specs you need. If you do not have an ETSI EOL account, you can download the ETSI equivalent standards from http://www.etsi.org/standards-search.

Where can I find documents produced by the GSM MoU Group / GSM Association?

These documents are not available via 3GPP or its Organizational Partners. You must address this question to the GSM Association.

Where would I find a document (e.g. UMTS 30.03 version 3.1.0) which does not appear on the 3GPP Status List?

Look at http://www.3gpp.org/DynaReport/3003U.htm. It is a document stemming from the initial TC-SMG studies on UMTS, not a product of 3GPP. It was, in fact, published as an ETSI deliverable, TR 101 112, and this may be downloaded via http://www.etsi.org/standards-search.

Where are all the Change Requests (CRs) located?

The CR database can be downloaded under: http://www.3gpp.org/ftp/Information/Databases/Change_Request/

Or you select the specification under:
http://www.3gpp.org/specifications/79-specification-numbering

The information is classed by series so it is very easy to locate the particular specification which interests you. After selecting a series and a specification you will find a line "Change Requests for this spec: click here." which provides a web list of the CRs for this specification.

If, for example, you are looking for CRs on GSM 08.18 then you would use this link:
http://www.3gpp.org/ftp/Specs/html-info/0818-CRs.htm
http://www.3gpp.org/DynaReport/0818http://www.3gpp.org/ftp/Specs/html-info/0818-CRs.htm
-CRs.htm

Where are all the current ETSI SMG specs located?

All the ETSI SMG specs are located here archives for the GSM documentation. An ETSI On-Line account is needed to access these documents. You can apply for an ETSI online account.
In general, the cross-referencing between GSM and ETSI deliverables, and between 3GPP and ETSI deliverables may be found at http://webapp.etsi.org/key/queryform.asp

Which group works on Physical Layer aspects of UMTS/LTE?

The radio aspects are standardised in TSG-RAN. The technical work is done in the 5 Working Groups of RAN (WG1 radio layer 1, WG2 radio layer 2/3, WG3 interfaces, WG4 RF measurements, WG5 Mobile Terminal Conformance Testing).
So Physical Layer aspects are addressed by TSG RAN WG1. Their UMTS specifications are numbered 25.2xx and their LTE specifications are numbered 36.2xx.
The temporary documents (meeting documents etc.) of WG1 are stored on ftp://ftp.3gpp.org/TSG_RAN/WG1_RL1.

Where can I find the list of Abstract syntax notation (ASN.1) object identifiers?

The expandable list of object identifiers is available here >>>. To see the formal definition of the object identifiers, see the document cited on the right. The tree is not necessarily complete; further extensions may be included in the referenced document. For more information look here >>>.

Where can I find the 3GPP Confidentiality and Integrity algorithms?

The 3GPP Confidentiality and Integrity algorithms F8 & F9 (KASUMI) have been developed through the collaborative efforts of the 3GPP Organizational Partners. For more information and in order to download the algorithms look here >>>.

What is a Release - how does specification version numbering work?

To meet new market requirements, 3GPP specifications are continually being enhanced with new features. In order to provide developers with a stable platform for implementation while at the same time allowing the addition of new

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 150 of 304

features, the 3GPP uses a system of parallel "releases". For more information look here >>>.

Where can I find information on the current status of 3GPP specifications?

New versions of many 3GPP specifications are made available shortly after the 3GPP TSG plenary meetings which take place four times a year (March, June, September and December). In order to identify what the current version is or and how to find information about older versions of specifications look here >>>.

What is the system for numbering specifications?

All 3G and GSM specifications have a 3GPP specification number consisting of 4 or 5 digits. (e.g., 09.02 or 29.002). For a more complete description and examples look here >>>.

Who are the TSG/WG Officials and Support team and where can I find their contact details?

Each TSG/WG has a Chairman, up to two Vice-Chairmen (three Vice-Chairmen) in the case of TSGs and a secretary who is a member of the support team. From the 3GPP structural organization page, click on the TSG or WG of interest to reach its home page. From there, click on the "officials" entry in the table.

Where can I find the Terms of Reference for my TSG/WG?

The current Terms of Reference for each TSG/WG appear on the web pages of each TSG/WG.

May I become an Official?

The TSG Chairman and Vice Chairmen are elected by the Technical Specification Group from amongst the Individual Member representatives. Each TSG can elect a maximum of two Vice Chairmen. Once elected, these candidates are proposed to the PCG for appointment.
The Working Group Chairman and Vice Chairmen are elected by the Working Group from amongst the Individual Member representatives. Each Working Group can elect a maximum of two Vice Chairmen.
A candidate for TSG or Working Group election shall provide a letter of support from his Organization and nominations may be made up to the point when an election takes place.
The TSG Chairman and Vice-Chairmen shall be appointed by the PCG on the proposal of the TSG.
The Chairman and the Vice-Chairmen shall be appointed for a two year term of office. The Chairman and Vice-Chairmen may be appointed for one further consecutive term. If, at the end of a Chairman or Vice Chairmans second term, no other candidates are available, the Chairman or Vice Chairmen may be appointed for a further term.
Chairman and Vice Chairmen should not be from the same region, Organizational Partner, or from the same group of companies, unless no other candidate is available.
Successive Chairmen should not be from the same Organizational Partner, the same region or from the same group of companies, unless no other candidate is available

How do I register for a meeting?

To register to any 3GPP TSG/WG meeting, please go to the Meetings tab on the 3GPP Ultimate portal (3GU) at https://portal.3gpp.org/, log in with your EOL credentials, and click "Not registered" in the Registration column of the meeting in question. When registration is complete, you will receive a confirmation email. Keep this email, it contains important information, without which you will not be able to confirm your presence!

Once you are at the meeting you have to "Check-in" to confirm your presence at the meeting itself. To check in, open the registration confirmation email and click on the check-in URL. This will take you to a page on the local meeting server (not the Internet). After you have checked in, your token will be sent to the main 3GPP server, and the web-based participants list will now show "yes" in the Participated column. Obviously you must be physically present at the meeting venue to be able to reach the local server.

Who can submit a change proposal on any 3GPP specifications to 3GPP?

Any bona fide representative of any 3GPP Individual Member (see list via the first sentence at http://www.3gpp.org/membership) can present a technical contribution - for example, a Change Request - to any 3GPP TSG or WG meeting.

If a change proposal is submitted how long does it take for it to get approved?

The usual procedure is that the responsible Working Group will examine a CR and agree it (or revise it until such time as it be agreeable - or not!). Having been agreed at WG level, it is packaged with related CRs and sent to the TSG plenary, where it will be discussed if necessary and then - if appropriate - formally approved. Within a matter a few weeks at most, a new version of the Specification is produced, which includes the contents of the TSG-approved CR.

TSGs meet every three months, and WGs meet at least once between each TSG meeting (sometimes two or occasionally even more times). Thus from inception of a CR to its approval is normally a matter of a few weeks,

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 151 of 304

depending on the point in the meeting schedule of the WG and TSG concerned.

How to get a user name and password for "Reserve a Document Number"?

You need to request an EOL account via: http://webapp.etsi.org/createaccount/form.asp (username and password will then be sent to you by separate email).

How do I obtain a document number for my contribution?

Delegates wishing to make contributions must first obtain a document number either from the secretary or automatically via an on-line application "Automatic Document Numbering (ADN)" which is used by some groups.

You need a user name and password to "Reserve a Document Number" (see above).

Where can I download documents for an upcoming meeting?

Each TSG/WG has a specific area allocated on the 3GPP ftp server. For example TSG SA look here ftp://ftp.3gpp.org/tsg_sa/TSG_SA/. It is advisable for delegates attending a meeting to download the documents available prior to the meeting from the ftp server and onto their personal computers.

Where can I find a temporary document template?

The document template is made available by each TSG/WG in the meeting respective folder on the ftp server (see above).

What is my role when my TSG/WGs has to approve a deliverable?

Approval of Technical Specifications and Technical reports by a TSG shall normally be by consensus. Where consensus cannot be achieved in the TSG a vote may be taken.
When Technical Specifications and Technical Reports become sufficiently stable, they shall be put under change control of the relevant TSG. The further elaboration of these Technical Specifications and Technical Reports shall be achieved by Change Requests (CRs) to be approved by the TSG.

What are the different types of deliverables?

3GPP shall prepare, approve and maintain documents known as Technical Specifications and Technical Reports. Such documents shall be drawn up by the TSGs and shall, following approval at that level, be submitted to the participating Organizational Partners to be submitted to their respective standardization processes.

Can I write an 3GPP Document myself?

Why not?! If you wish to propose a deliverable then bring it to the attention of your chairman and the other members of the TSG/WG in order to discuss the subject.
Each proposed new Work Item shall be supported by at least four Individual Members, and their names shall be recorded in the Work Item definition prepared for the TSG approval. One or more persons shall be named as Rapporteur for the proposed Work Item, and the Rapporteur shall act as the prime contact point on technical matters and for information on progress throughout the drafting phases. The supporting Individual Members are expected to contribute to and progress the new work item throughout the drafting phases.
In addition to the above, TSGs shall approve new Work Items, giving all essential parameters. The proposal shall be entered into the 3GPP work programme, clearly marked as a new entry, for which a unique reference identity shall be allocated.

Do I and my company have to support my TSG/WGs Work Items?

Neither you or your company is obliged to support the work items of your TSG/WG, however it is normal that if you and your company are supporting members of a Work Item that you be in agreement with their work and will normally support the production of the related deliverable.

Do I need a password and user name to access the 3GPP Web site ?

No password is needed to access any information on the 3GPP Web site, all information is openly published.

Can you give me information about which companies manufacture particular types of equipment. Or about what services are available on particular networks?

No. The 3GPP Support Team must remain neutral and must not show bias to any of its Individual Members. Such information may be available from the Global Mobile Suppliers Association (www.gsacom.com) where you will find a statistics area which could be of help.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 152 of 304

How can I determine when a meeting contribution document (TDoc) became publicly available?

TDoc numbers start to be allocated some weeks before a 3GPP meeting; the authors then create them and they or the group's secretary uploads them to the public file server as soon as possible. Some may have been distributed to the group's members in draft form for review, using the email exploder, in advance of the final version becoming available, and for some groups, it is normal to distribute even the final TDoc via the exploder, from where the secretary picks it up and copies it to the public server.

Most Groups have a deadline for their meetings by which TDocs should have been uploaded. Contributions uploaded after this point are are considered to be "late" and will be addressed during the meeting only at the Chairman's discretion, depending on the time available. Typically, at the start of a meeting, most TDocs for which numbers have been reserved are available. However, during the meeting, it is normal for further TDoc numbers to be reserved and uploaded. Typically, the final number of TDocs can be double the number reserved at the start of the meeting. Such TDocs are not subject to the "late" rules described above because they are generally produced as a result of discussions during the meeting itself.

TDoc numbers are allocated sequentially, from lowest to highest.

This distribution on the group's email exploder is important, because once that happens, the document is effectively in the public domain, since membership of the exploder is open to all and is (almost) unpoliced.

As noted above, during the meeting, further TDocs are created, mostly revisions of ones available before the meeting, but usually some brand new ones too – for example, outgoing liaison statements. These are uploaded to the *meeting* server, but may or may not be uploaded to the *public* server during the meeting. (Since 2014, for most meetings, meeting server contents have been mirrored to a folder on the public server, but these copies are deleted after the end of the meeting.)

Soon after the end of the meeting – at worst within a few days – the TDocs created during the meeting are uploaded by the secretary to the public server. Occasionally, some matters from the meeting cannot be resolved until maybe one week later, and these might result in some very late TDocs which are produced well after the end of the meeting, and thus uploaded onto the public server correspondingly late.

When the secretary copies from the meeting server (or from his own PC) to the public server, he may opt to only copy the missing files (i.e. the new ones), which is the best approach; or he may decide to overwrite everything and thus do a complete refresh of the files on the public server, which will now get an upload date/time-stamp of the new upload. This latter approach is now deprecated but has sometimes happened; you can detect this most easily when a meeting shows the same date/time-stamp for all or nearly all TDoc files, and this date/time-stamp is after the end of the meeting.

In cases such as this, one has to descend to greater subterfuge to narrow down the likely "public availability" moment. The zip file for a TDoc typically contains a Word file which has its own date/time-stamp, which puts an absolute limit on the earliest moment that the TDoc could have become available in that form.

Searching the group's email exploder archive (http://list.etsi.org/scripts/wa.exe?INDEX) on or about the suspected production date gleaned from the file date/time-stamp may well reveal the message in which the TDoc was *first* distributed, or perhaps the message by which the group's secretary announced that it was available on the server. Note however that this technique does not reveal any earlier versions of the TDoc which might have been circulated, either as draft versions of the identified TDoc or as other Tdocs which were ultimately revised into the actual TDoc of interest. In order to identify this latter case, it is necessary to refer to the official secretary's report of the meeting, where the train of revisions will be evident.

Some final considerations:

> Some FTP tools will retain the original timestamp of a file when copying it to (or from) a server, whilst others will use the current time for the new copy.
> The observed timestamp of a file depends on the time zone and the daylight saving time setting in force. Thus the apparent upload time of a given file may vary when viewed in summer compared to when viewed in winter.

Is it possible to determine the date and time of publication of a particular version of a 3GPP Spec?

During the drafting phase (versions lower than 3.0.0), 3GPP TSs and TRs ("Specs") are under the control of their authors ("rapporteurs") and are handled like normal meeting contributions (see above). Revised versions incorporating text agreed by the responsible working group are often made available by the rapporteur via the group's email exploder shortly after the end of the meeting at which such text was discussed. Consultation of the exploder archives can reveal this. Alternatively, a revised draft may be sent directly to the 3GPP Support Team, and it will be uploaded to the public file server (specs archive directory) shortly afterwards. Again, the time stamp of the Zip file can be relied upon to indicate when the upload occurred.

After formal approval by the TSG (versions 3.0.0 or greater), Specs are edited only by the Support Team. The first approved version is based upon the draft version formally approved by the TSG, and thereafter versions are

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 153 of 304

generated whenever Change Requests are approved by the TSG. These versions are made available shortly after the TSG meeting at which such approval occurred. The date (year and month) shown at the top of the Spec's cover page indicates either the date of (the last day of) the meeting, or the month in which the new version was prepared. However a more precise indication of the date of availability can be obtained from the Spec's web page (via the table at http://www.3gpp.org/specifications/) where a precise date is shown in the "available" column.

More information on the procedures relating to Spec handing can be found in 3GPP TR 21.900.

Note that, in accordance with the statement at the foot of the cover page of all 3GPP Specs, 3GPP does not "publish" its Specs per se. Formal publication is the responsibility of the individual Standards Development Organizations which comprise the Organizational Partners of 3GPP. For further information, see http://www.3gpp.org/specifications/63-official-publications.

What formalities do I have to go through to get type approval for terminal equipment in Europe? Is there a single point of contact? What standards does my equipment need to conform to in order that I can place it on the market?

The legal requirements for the marketing of electrical products in Europe are governed by various EU Directives, depending on the nature of the equipment. Conformity with any of these Directives can be demonstrated by the use of Harmonized Standards, whose title has been cited in the Official Journal of the European Union. The lists of relevant standards can be found on the Commission web site which can be accessed via http://www.newapproach.org/Directives/DirectiveList.asp.

General electrical equipment is covered by the EMC Directive & Low Voltage Directives, see http://ec.europa.eu/enterprise/sectors/electrical/documents/index_en.htm.
The harmonized standards are listed at http://ec.europa.eu/enterprise/policies/european-standards/harmonised-standards/index_en.htm
More general information on procedures to declare conformity and how equipment should be marked are contained on the web sites related to the two Directives.

Radio Equipment and Telecommunications Terminal Equipment is covered by the Radio and Telecommunications Terminal Equipment Directive, see http://ec.europa.eu/enterprise/policies/european-standards/harmonised-standards/rtte/index_en.htm, which also includes a link to the one-stop procedure for "placing on the market" (http://ec.europa.eu/enterprise/sectors/rtte/documents/guidance/one-stop-procedure_en.htm).

Further information on EU harmonized standards relevant to telecommunications can be found on the ETSI site at http://www.etsi.org/standards/looking-for-an-etsi-standard/list-of-harmonized-standards, and the published standards themselves can be downloaded via http://pda.etsi.org/pda/queryform.asp.

Where can I find a list of technical terms and abbreviations used in 3GPP documents?

Individual terms are defined in each 3GPP Technical Specification and Technical Report. A compendium of terms and abbreviations can be found in 3GPP TR 21.905. ETSI maintains a list of all terms and abbreviations defined in its publications in "TEDDI".

What is the difference between a SIM and a USIM? What is a UICC?

The Universal Integrated Circuit Card (UICC) is the removable card bearing a silicon chip which holds 3GPP system subscriber information. The UICC is a general purpose card having both non-volatile memory and a general-purpose processor. Thus while it is used, in a 3GPP terminal, to hold (U)SIM information / applications, it is can also be used for other purposes, possibly unrelated to telecommunications. A common use of UICCs is in the well-known credit card format, and there is no reason why a single card could not hold (U)SIM functionality in addition to electronic purse / credit card functionality, or indeed any other application / data.

The Subscriber Identity Module (SIM) is the collection of functions which personalize a 3GPP terminal. The SIM contains static information about the services subscribed to, the phone number, the identity of the home network, a list of preferred roaming networks, and so on. The SIM also contains storage capacity for the subscriber's contacts' phone numbers. The term "SIM" is often misused for "UICC". The SIM concept was created during the early development of the GSM standards, and second-generation (based on GERAN) terminals up to and including Release 4 use SIM functionality.

For third generation systems (based on UTRAN), more complex functionality was called for, and the SIM evolved into the USIM or Universal Subscriber Identity Module. Release 99 3rd generations onwards use USIMs rather than SIMs. From Release 5 onwards, both second and third generation terminals use USIMs (though to maintain backwards compatibility with older networks and terminals, later Release 2nd generation USIMs are likely to implement Rel-4 SIM functionality in addition to Rel-5 or later USIM functionality).

For further information on the 3GPP Release system, see the Release page.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 154 of 304

I have transferred a video file from my phone to my PC. Where can I find a player for 3gp files?

The 3gp file format is defined in 3GPP TS 26.244 and in 3GPP TS 26.412. However, 3GPP has not defined a specific decoder. Your phone manufacturer may have supplied a player (check the CD-ROM which came with your phone) or look on its web site. Alternatively, search the Internet: a number of commercial players exist, and trial versions of some may be downloaded without charge.

Where can I find the specification of the SIM Lock feature?

In clause 8 of 3GPP TS 22.022.

What is the meaning of the text at the foot of the TS/TR cover page?

> The present document has been developed within the 3rd Generation Partnership Project (3GPP TM) and may be further elaborated for the purposes of 3GPP..
> The present document has not been subject to any approval process by the 3GPPOrganizational Partners and shall not be implemented.
> This Specification is provided for future development work within 3GPPonly. The Organizational Partners accept no liability for any use of this Specification.
> Specifications and Reports for implementation of the 3GPP TM system should be obtained via the 3GPP Organizational Partners' Publications Offices.

3GPP is not a legally incorporated body, and its technical work is conducted under the auspices of its Organizational Partners, each of which transposes relevant 3GPP specifications as its own publications. Thus the "raw" 3GPP TSs and TRs have no legal status per se. Under an agreement with the ITU at the time 3GPP was created, the ITU would not publish the output of 3GPP but would make reference to the publications of the participating Organizational Partners from its Recommendations; this state of affairs accounts for the text found on the cover of each 3GPP TS and TR. More information can be found here.

Revision histoory:

2020-02-21: Minor improvements to the answer to FAQ "How can I determine when a meeting contribution document (TDoc) became publicly available?" (JMM)
2018-01-04: Clarifications to the answer to faq M12. (JMM)
2016-11-16: Correction of minor typo. (JMM)

ABOUT RELEASES

Release 17
Release 16
Release 15
Release 14
Release 13
Release 12
Release 11
Release 10
Release 9
Release 8
Release 7
Release 6
Release 5
Release 4
Release 1999

FULL MEETING CALENDAR

Face to face meetings have been suspended for the time being.
The calendar of replacement e-meetings is online at
https://portal.3gpp.org/

BROWSE KEYWORDS & TECH.

Common API Framework (CAPIF)
Carrier Aggregation Explained
Coordinated Vulnerability Disclosure (CVD)
The Evolved Packet Core
GPRS & EDGE
HSPA
LTE-Advanced
LTE
UAS - UAV
UMTS
V2X
W-CDMA
...more keywords

©3GPP 2020

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 155 of 304

Appendix 12

www.3gpp.org / ftp / Specs / archive / 25_series / 25.133

sort by name/desc	sort by date/desc	sort by size/desc
25133-300.zip	1999/12/21 8:29	132,3 KB
25133-310.zip	2000/04/06 13:21	183,9 KB
25133-320.zip	2000/07/06 12:25	208,8 KB
25133-330.zip	2000/10/18 10:01	245,8 KB
25133-340.zip	2001/01/09 17:01	196,4 KB
25133-350.zip	2001/04/05 12:17	226,2 KB
25133-360.zip	2001/06/28 8:14	243,1 KB
25133-370.zip	2001/10/02 10:38	281,9 KB
25133-380.zip	2002/01/17 15:10	294,5 KB
25133-390.zip	2002/03/19 13:06	306,6 KB
25133-3a0.zip	2002/07/03 15:31	319,3 KB
25133-3b0.zip	2002/10/02 14:26	322,5 KB
25133-3c0.zip	2003/01/10 15:08	333,3 KB
25133-3d0.zip	2003/04/04 7:49	337,9 KB
25133-3e0.zip	2003/07/01 13:54	343,6 KB
25133-3f0.zip	2003/10/10 12:27	290,8 KB
25133-3g0.zip	2004/01/22 18:04	300 KB
25133-3h0.zip	2004/04/01 9:21	301,3 KB
25133-3i0.zip	2004/06/24 8:18	415,7 KB
25133-3j0.zip	2004/09/30 9:33	379,6 KB
25133-3k0.zip	2005/04/01 14:29	383,7 KB
25133-3l0.zip	2005/06/24 16:50	412,2 KB
25133-3m0.zip	2005/10/14 12:49	222,3 KB
25133-400.zip	2001/04/08 11:39	233,9 KB
25133-410.zip	2001/06/28 8:15	244,4 KB
25133-420.zip	2001/10/10 8:08	293,4 KB
25133-430.zip	2002/01/17 15:06	306,1 KB
25133-440.zip	2002/03/29 16:43	315,4 KB

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 157 of 304

sort by name/desc	sort by date/desc	sort by size/desc
25133-450.zip	2002/07/03 15:31	335,8 KB
25133-460.zip	2002/10/02 14:26	348,2 KB
25133-470.zip	2003/01/10 15:08	361,9 KB
25133-480.zip	2003/04/04 7:49	364,7 KB
25133-490.zip	2003/07/01 14:40	368,9 KB
25133-4a0.zip	2003/10/10 12:27	306,4 KB
25133-4b0.zip	2004/01/22 18:04	314,8 KB
25133-4c0.zip	2004/04/01 9:21	315,7 KB
25133-4d0.zip	2004/09/30 9:33	399,2 KB
25133-4e0.zip	2005/04/01 14:29	405,8 KB
25133-4f0.zip	2005/06/24 15:45	394,4 KB
25133-4g0.zip	2005/10/14 12:49	435,4 KB
25133-4h0.zip	2006/03/31 8:42	218,3 KB
25133-500.zip	2001/10/10 8:09	297,5 KB
25133-510.zip	2002/01/17 15:09	319,3 KB
25133-520.zip	2002/03/29 16:43	327,7 KB
25133-530.zip	2002/07/03 15:31	341,5 KB
25133-540.zip	2002/10/02 14:26	361,9 KB
25133-550.zip	2003/01/10 15:09	376,7 KB
25133-560.zip	2003/04/04 7:49	381 KB
25133-570.zip	2003/07/02 7:58	386 KB
25133-580.zip	2003/10/10 12:27	325 KB
25133-590.zip	2004/01/22 18:04	330,4 KB
25133-5a0.zip	2004/04/01 9:21	340,8 KB
25133-5b0.zip	2004/06/24 8:18	436,1 KB
25133-5c0.zip	2004/09/30 9:33	435,5 KB
25133-5d0.zip	2005/01/06 10:24	475,7 KB
25133-5e0.zip	2005/04/01 14:30	461,1 KB
25133-5f0.zip	2005/06/29 13:39	440,2 KB
25133-5g0.zip	2005/10/14 12:49	406 KB
25133-5h0.zip	2005/12/22 8:38	439,2 KB
25133-5i0.zip	2007/09/13 15:02	210 KB

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 158 of 304

sort by name/desc	sort by date/desc	sort by size/desc
25133-600.zip	2003/01/10 15:09	377 KB
25133-610.zip	2003/04/04 7:49	386,4 KB
25133-620.zip	2003/07/01 14:41	391 KB
25133-630.zip	2003/10/10 12:28	327,2 KB
25133-640.zip	2004/01/22 18:04	334,9 KB
25133-650.zip	2004/04/01 9:21	347,1 KB
25133-660.zip	2004/06/24 8:18	479,7 KB
25133-670.zip	2004/09/30 9:33	445,9 KB
25133-680.zip	2005/01/06 16:38	451 KB
25133-690.zip	2005/04/01 14:30	493,5 KB
25133-6a0.zip	2005/06/29 13:39	466,7 KB
25133-6b0.zip	2005/10/14 12:49	472,7 KB
25133-6c0.zip	2005/12/22 8:39	452,3 KB
25133-6d0.zip	2006/03/31 8:43	529,4 KB
25133-6e0.zip	2006/06/23 13:31	547,4 KB
25133-6f0.zip	2006/10/04 12:46	440,4 KB
25133-6g0.zip	2006/12/01 15:17	427 KB
25133-6h0.zip	2007/03/22 13:15	467,2 KB
25133-6i0.zip	2007/06/12 12:18	426,5 KB
25133-6j0.zip	2007/09/13 15:02	444 KB
25133-6k0.zip	2007/12/20 8:28	484,9 KB
25133-6l0.zip	2008/03/20 14:19	434,6 KB
25133-6m0.zip	2008/05/29 16:05	439,9 KB
25133-6n0.zip	2008/09/15 15:16	437 KB
25133-6o0.zip	2009/03/17 10:20	477,9 KB
25133-700.zip	2005/06/29 13:39	467,2 KB
25133-710.zip	2005/10/14 12:49	474,2 KB
25133-720.zip	2005/12/22 8:39	505,8 KB
25133-730.zip	2006/03/31 8:50	504,5 KB
25133-740.zip	2006/06/23 13:31	518,7 KB
25133-750.zip	2006/10/04 12:53	485,6 KB
25133-760.zip	2006/12/01 15:17	445,6 KB

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 159 of 304

sort by name/desc	sort by date/desc	sort by size/desc
25133-770.zip	2007/03/22 13:15	485,2 KB
25133-771.zip	2007/03/29 9:52	455,8 KB
25133-780.zip	2007/06/12 12:18	487,2 KB
25133-790.zip	2007/09/13 15:01	447,5 KB
25133-7a0.zip	2007/12/20 8:28	494,8 KB
25133-7b0.zip	2008/03/20 14:19	451,2 KB
25133-7c0.zip	2008/05/29 16:05	460,2 KB
25133-7d0.zip	2008/09/15 15:16	461,9 KB
25133-7e0.zip	2009/03/17 10:20	451,3 KB
25133-7f0.zip	2009/09/30 8:43	491,9 KB
25133-800.zip	2007/09/13 15:01	442,8 KB
25133-810.zip	2007/12/20 8:28	483,7 KB
25133-820.zip	2008/03/20 14:19	488,4 KB
25133-830.zip	2008/05/29 16:05	459,6 KB
25133-840.zip	2008/09/15 15:16	478,8 KB
25133-850.zip	2008/12/17 16:26	480,9 KB
25133-860.zip	2009/03/17 10:20	548,2 KB
25133-870.zip	2009/06/18 7:54	554,9 KB
25133-880.zip	2009/09/30 8:43	629,4 KB
25133-890.zip	2009/12/28 22:49	586,9 KB
25133-8a0.zip	2010/04/02 19:31	567,4 KB
25133-8b0.zip	2010/06/21 13:31	571,3 KB
25133-8c0.zip	2011/01/06 4:31	588,6 KB
25133-8d0.zip	2011/04/12 4:26	585,9 KB
25133-8e0.zip	2011/06/20 1:15	581,1 KB
25133-8f0.zip	2011/10/03 1:51	638,7 KB
25133-8g0.zip	2012/07/06 21:25	638,8 KB
25133-8h0.zip	2012/09/24 0:09	639,9 KB
25133-8i0.zip	2013/01/07 18:56	638,4 KB
25133-8j0.zip	2013/03/22 15:49	600,5 KB
25133-8k0.zip	2013/07/08 8:29	594,7 KB
25133-900.zip	2009/06/18 7:54	599,1 KB

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 160 of 304

sort by name/desc	sort by date/desc	sort by size/desc
25133-910.zip	2009/09/30 8:43	581,8 KB
25133-920.zip	2009/12/28 22:49	670 KB
25133-930.zip	2010/04/02 19:31	663,8 KB
25133-940.zip	2010/06/21 13:31	663,9 KB
25133-950.zip	2010/09/29 23:26	667,8 KB
25133-960.zip	2011/01/06 4:31	627,9 KB
25133-970.zip	2011/04/12 4:27	629,4 KB
25133-980.zip	2011/06/20 1:15	684,9 KB
25133-990.zip	2011/10/03 1:51	688,2 KB
25133-9a0.zip	2012/01/05 22:47	689,5 KB
25133-9b0.zip	2012/03/18 19:36	633,1 KB
25133-9c0.zip	2012/07/06 21:25	690,1 KB
25133-9d0.zip	2012/09/24 0:09	690 KB
25133-9e0.zip	2013/01/07 18:56	681,3 KB
25133-9f0.zip	2013/03/22 15:50	688,7 KB
25133-9g0.zip	2013/07/05 19:33	679,4 KB
25133-9h0.zip	2014/01/06 16:41	668,8 KB
25133-a00.zip	2011/01/06 4:31	678,4 KB
25133-a10.zip	2011/04/12 4:27	631,4 KB
25133-a20.zip	2011/06/20 1:16	697,7 KB
25133-a30.zip	2011/10/03 1:51	701,7 KB
25133-a40.zip	2012/01/05 22:47	724,7 KB
25133-a50.zip	2012/03/18 19:36	667,8 KB
25133-a60.zip	2012/07/06 21:26	671,1 KB
25133-a70.zip	2012/09/24 0:09	732 KB
25133-a80.zip	2013/01/07 18:56	736,3 KB
25133-a90.zip	2013/03/22 15:50	705,1 KB
25133-aa0.zip	2013/07/05 19:33	739,1 KB
25133-ab0.zip	2014/01/06 16:41	665,1 KB
25133-b00.zip	2012/03/18 19:36	675,5 KB
25133-b10.zip	2012/07/06 21:26	738 KB
25133-b20.zip	2012/09/28 17:55	737,9 KB

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 161 of 304

sort by name/desc	sort by date/desc	sort by size/desc
25133-b30.zip	2013/01/07 18:56	750,7 KB
25133-b40.zip	2013/03/22 15:50	772,7 KB
25133-b50.zip	2013/07/05 19:33	779,3 KB
25133-b60.zip	2013/09/27 3:26	870,7 KB
25133-b70.zip	2014/01/06 16:41	829,6 KB
25133-b80.zip	2014/03/27 0:49	658,3 KB
25133-b90.zip	2014/07/03 21:50	662,8 KB
25133-ba0.zip	2015/03/28 0:13	661,3 KB
25133-c00.zip	2013/07/05 19:33	790,2 KB
25133-c10.zip	2013/09/27 3:26	869,8 KB
25133-c20.zip	2014/01/06 16:42	820,3 KB
25133-c30.zip	2014/03/27 0:49	664,7 KB
25133-c40.zip	2014/07/03 21:50	668,6 KB
25133-c50.zip	2014/10/02 6:30	672 KB
25133-c60.zip	2015/01/06 14:51	694,3 KB
25133-c70.zip	2015/03/28 0:13	697,9 KB
25133-c80.zip	2015/07/03 8:54	762,4 KB
25133-c90.zip	2016/03/24 18:12	761,1 KB
25133-d00.zip	2016/01/07 16:40	767,2 KB
25133-d10.zip	2016/03/25 2:12	775,8 KB
25133-d20.zip	2018/04/06 12:08	802,1 KB
25133-e00.zip	2016/07/01 18:31	787,9 KB
25133-e10.zip	2017/01/12 16:10	766,7 KB
25133-e20.zip	2018/04/06 12:01	797,1 KB
25133-f00.zip	2017/09/28 21:11	803 KB
25133-f10.zip	2018/01/17 13:40	805,5 KB
25133-f20.zip	2018/04/06 11:39	793,3 KB
25133-g00.zip	2019/01/15 14:21	782,9 KB

184 items.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 162 of 304

Appendix 13

http://www.3gpp.org/specs/numbering.htm Go JAN FEB AUG
421 captures 11
11 Feb 2002 - 22 Nov 2019 2001 2002 2003
About this capture

3GPP Specifications - Numbering scheme

Spec download | Titles and spec numbers | Current version | Releases | Numbering scheme | Change Requests
Published specifications | Historical information | Work plan | TSG Working methods | Drafting rules | Delegates corner | ASN.1

All 3G and GSM specifications have a 3GPP specification number consisting of 4 or 5 digits. (e.g. 09.02 or 29.002). The first two digits define the series as listed in the table below. They are followed by **2** further digits for the 01 to 13 series or **3** further digits for the 21 to 52 series.

The full title, specification number and latest version number for every specification can be found in the status list and more information about terms such R99 and Rel-4 can be found on the Releases and phases page.

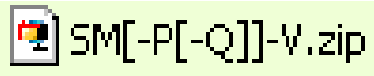
A specification in the 21 to 35 series may apply either to 3G only or to GSM and 3G. This can be determined by the third digit, where a "0" indicates that it applies to both systems. For example, 29.002 applies to 3G and GSM systems whereas 25.101 and 25.201 apply only to 3G. All other series apply only to GSM systems.

Subject of specification series	3G/GSM R99 and later	GSM only (Rel-4 and later)	GSM only (before Rel-4)
Requirements	21 series	41 series	01 series
Service aspects	22 series	42 series	02 series
Technical realization	23 series	43 series	03 series
Signalling protocols (user equipment to network)	24 series	44 series	04 series
Radio aspects	25 series	45 series	05 series
CODECs	26 series	46 series	06 series
Data	27 series	47 series	07 series
Signalling protocols (RSS-CN)	28 series	48 series	08 series
Signalling protocols (intra-fixed-network)	29 series	49 series	09 series
Programme management	30 series	50 series	10 series
User Identity Module (SIM / USIM)	31 series	51 series	11 series
O&M	32 series	52 series	12 series
Access requirements and test specifications		13 series (1)	13 series (1)
Security aspects	33 series	(2)	(2)
Test specifications	34 series	(2)	11 series
Security algorithms	35 series	(2)	(2)

Note (1): The 13 series GSM specifications relate to European-Union-specific regulatory standards. On the closure of ETSI TC SMG, responsibility for these specifications was transferred to ETSI TC MSG, (Mobile Specification Group) and they do not appear on the 3GPP file server.

Note (2): The specification of these aspects were spread throughout several series.

The 3GPP Specifications are stored on the file server as zipped MS-Word files. The filenames have the following structure:



where the character fields have the following significance ...

S = series number - 2 characters (see the table above)
M = mantissa (the part of the spec number after the series number) - 2 or 3 characters (see above)
P = optional part number - 1 or 2 digits if present
Q = optional sub-part number - 1 or 2 digits if present
V = version number, without separating dots - 3 digits

So for example:
21900-320.zip is 3GPP TR 21.900 version 3.2.0
0408-6g0.zip is 3GPP TS 04.08 version 6.16.0

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 164 of 304

http://www.3gpp.org/specs/numbering.htm Go JAN FEB AUG
421 captures 11
11 Feb 2002 - 22 Nov 2019 2001 2002 2003
About this capture

Related Information. Further information about the Specification numbering scheme, 3GPP releases, phases, file naming conventions, and other related information can be found in 3GPP TR 21.900 "*Technical Specification Group working methods*". See the download page to find the latest version of TS 21.900.

last updated 31 January 2002

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 165 of 304

Appendix 14

http://www.3gpp.org/faq/faq_2005_2.htm Go NOV DEC FEB
137 captures
25 Dec 2005 - 2 Jun 2017
2004 2005 2007
About this capture

3GPP Frequently Asked Questions

1. Membership | **2. Mailing Lists** | **3. Legal Matters** | **4. Specifications** | **5. Technical Specification Group/Working Group** | | **6. Documents and Meetings** | **7. Miscellaneous**

1. Membership

1.1 Who can become an Individual Member of 3GPP and how much does it cost? **Answer>>>**

1.1.1 How do I become a member of 3GPP? **Answer>>>**

1.2 Who may participate in 3GPP meetings? **Answer>>>**

1.3 Who should fill in the 3GPP membership application form? **Answer>>>**

1.4 What should I do if the details of a 3GPP member company or official contact change? **Answer>>>**

1.5 What are the different membership categories? **Answer>>>**

1.6 Who may become a 3GPP Observer? **Answer>>>**

1.7 Who may become a Guest Member and do guests have to pay any fees? **Answer>>>**

1.8 Who can apply for Market Representative Partnership? **Answer>>>**

1.9 Can an ETSI Observer become an Individual Member of 3GPP? **Answer>>>**

1.10 Can ETSI Applicant apply for 3GPP Membership? **Answer>>>**

1.11 My company is already an ETSI Member, what do I have to do to join 3GPP and do I have to pay any fees? **Answer>>>**

back to top

2. 3GPP email exploder lists

2.1 Are there discussion archives for the 3GPP exploder lists? **Answer>>>**

2.2 How do I subscribe to the 3GPP exploder lists? **Answer>>>**

back to top

3. Legal matters

3.1 What is the 3GPP IPR Policy? **Answer>>>**

3.2 What is the 3GPP policy on licensing? **Answer>>>**

3.3 What is the 3G Patent Platform? **Answer>>>**

3.4 Is it true that a number 3GPP members are looking at setting up a patents cooperative, with the aim of reducing the royalties they pay each other for the use of patented technology in third-generation mobile systems? **Answer>>>**

3.5 Who owns the Technical Specifications and the Technical Reports approved by 3GPP? **Answer>>>**

3.6 Does a company implementing a product based on the 3GPP specifications have to pay any royalties to the 3GPP organization? **Answer>>>**

3.7 Is permission needed to use the 3GPP logo in marketing collaterals or on a web site ? **Answer>>>**

3.8 Can I use computer code included with a 3GPP TS to implement a product ? **Answer>>>**

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 167 of 304

http://www.3gpp.org/faq/faq_2005_2.htm Go NOV DEC FEB
137 captures 25
25 Dec 2005 - 2 Jun 2017 2004 2005 2007
About this capture

4.1 Where can the rules, protocols or software needed to develop applications for UMTS be found? **Answer>>>**

4.2 What is the correlation between Stage 1, Stage 2 (GSM 3.90 and GSM 02.90) and Phase 1, Phase 2? **Answer>>>**

4.3 Is there any simple guide to the different CAMEL specifications? **Answer>>>**

4.4 Where are the specifications which identify the Vcc voltages for the SIM interface? **Answer>>>**

4.5 Are the 3GPP specifications produced only in word? **Answer>>>**

4.6 Which group works with specifications covering the use of the GSM codec (either in C or Java based)? **Answer>>>**

4.7 Does the ETSI GSM standard document collection also include GSM standard documents produced by the GSM Association and exactly what kind of GSM standards does ETSI produce? **Answer>>>**

4.8 Where would I find a document (e.g. UMTS 30.03 version 3.1.0) which does not appear on the 3GPP Status list? **Answer>>>**

4.9 Where are all the Change Requests (CRs) located? **Answer>>>**

4.10 Where are all the current ETSI SMG specs located? **Answer>>>**

4.11 Which group works on the W-CDMA and the Physical Layer of W-CDMA? **Answer>>>**

4.12 Where can I find the list of Abstract syntax notation (ASN.1) object identifiers? **Answer>>>**

4.13 Where can I find the 3GPP Confidentiality and Integrity algorithms? **Answer>>>**

4.14 What is a Release - how does specification version numbering work? **Answer>>>**

4.15 Where can I find information on the current status of 3GPP specifications? **Answer>>>**

4.16 What is the system for numbering specifications? Which specifications contain information on specific topics? **Answer>>>**

back to top

5. Technical Specification Group/Working Group

5.1 Who are the TSG/WG Officials and Support team and Where can I find their contact details? **Answer>>>**

5.2 Where can I find the Terms of Reference for my TSG/WG? **Answer>>>**

5.3 When did the Officials begin their Term of Office? **Answer>>>**

5.4 May I become an Official? **Answer>>>**

5.5 Where are my TSG/WGs documents stored? **Answer>>>**

5.6 Is the ETSI Secretariat responsible for the management of the Application Provider Codes for 3GPP ? **Answer>>>**

back to top

6. Documents and Meetings

6.1 How do I register for a meeting? **Answer>>>**

6.2 How do I submit a contribution for a meeting? **Answer>>>**

6.3 How do I obtain a document number for my contribution? **Answer>>>**

6.4 Where can I download documents for an upcoming meeting? **Answer>>>**

6.5 Where can I find a temporary document template? **Answer>>>**

6.6 What happens if I am unable to attend a meeting? **Answer>>>**

Work Items and Deliverables

6.7 What is my role when my TSG/WGs has to approve a deliverable? **Answer>>>**

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 168 of 304

http://www.3gpp.org/faq/faq_2005_2.htm Go NOV DEC FEB
137 captures 25
25 Dec 2005 - 2 Jun 2017 2004 2005 2007
About this capture

6.10 Do I and my company have to support my TSG/WGs Work Items? **Answer>>>**

back to top

7. Miscellaneous

7.1 How do I resolve the problem with the corrupt file warning in MSWord. Note that this only applies to MSWord2000? **Answer>>>**

7.2 Do I need a password and user name to access the 3GPP Web site ? **Answer>>>**

7.3 Can you give me information about which companies manufacture particular types of equipment. Or about what services are available on particular networks? **Answer>>>**

7.4 Can you give me information about which companies manufacture particular types of equipment. Or about what services are available on particular networks?

back to top

ANSWERS

1. Membership

1.1 Who can become an Individual Member of 3GPP and how much does it cost ?

Individual Members are by definition members of the Organizational Partners of 3GPP. This means that members of standardization bodies such as ETSI, ARIB, TTA, TTC, T1 and CCSA have a right to take part in 3GPP. There are no fees payable directly to 3GPP. However, the funds required for the running of 3GPP are collected from the Organizational Partners and you may be required to contribute in some way through that route.

If you are not a member of one of the above Standardization bodies then you can find links to these bodies from the 3GPP home page.

If you require further guidance on how to participate in 3GPP activities you should contact the Mobile Competence Centre.

back to top

1.2 Who may participate in 3GPP meetings ?

To attend a 3GPP meeting, you must be a 3GPP Individual Member (i.e. you must be a Member of one of the Organizational Partners involved in the project; ARIB, CCSA, ETSI, T1, TTA or TTC. A non-member company should seek membership with one of the above partners to be eligible to contribute and participate at 3GPP Meetings.

1.3 Who shall fill in the 3GPP Individual Member Application form ?

The person legally responsible for the requesting company shall fill in the form.

1.4 What shall I do if a 3GPP company or official contact details change?

All changes of correspondence should be notified to 3GPPContact@etsi.org

1.5 Different membership categories ?

The different membership categories of 3GPP are described in Section B of the 3GPP Working Procedures.

1.6 Who may become an observer ?

1.7 Who may become a Guest Member and do guests have to pay any fees ?

The Guest Status is for potential Individual Members who may be granted permission to participate in 3GPP for a maximum period of 6 months. Guest status is granted on a case-by-case basis by the Organizational Partners (see also Working Procedures Article 10). If you like to apply for a Guest status, please send an email to 3GPPContact@etsi.org

No membership fees are requested for Guest applications.

back to top

1.8 Who can apply for market representative Partnership?

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 169 of 304

http://www.3gpp.org/faq/faq_2005_2.htm Go NOV DEC FEB
137 captures 25
25 Dec 2005 - 2 Jun 2017 2004 2005 2007
About this capture

3GPP does have it's own category called "Observer" but that is entirely different and is used for potential Partners.

1.10 Can an ETSI Applicant apply for 3GPP Membership ?

YES, an Applicant means that your request to become an ETSI Member will be approved at the next General Assembly. You can participate in 3GPP as soon as the ETSI application has been processed and you are flagged as a Candidate Member (i.e. there is no need to wait until the next GA).

1.11 My company is already an ETSI Member, what do I have to do to join 3PP and do I have to pay any fees ?

As an ETSI member your company is eligible for a 3GPP Individual Membership and you will be able to attend any of the 3GPP Meetings. Please fill in the on-line 3GPP Application form and your company will be then listed on the 3GPP Website (add link to the form)

There are currently no additional costs involved for participation in 3GPP (the membership fees for ETSI covers the cost of 3GPP participation).

back to top

2. 3GPP email exploder lists

2.1 Are there discussion archives for the 3GPP exploder lists ?

The home page of listserv is at: http://list.3gpp.org/scripts/wa.exe

Then, just follow the links to the archives. For example, the archives for the main RAN email list can be found at:

http://list.3gpp.org/archives/3gpp_tsg_ran.html

2.2 How do I subscribe to the 3GPP exploder lists ?

follow the instructions found on this page: http://www.3gpp.org/Discussion_Lists/mailing.htm

back to top

3. Legal Matters

3.1 What is the 3GPP IPR Policy ?

The 3GPP Organizational Partners have agreed that their IPR policies should be respected and that their respective members should be encouraged to declare "their willingness to grant licenses on fair reasonable terms and conditions and on non discriminatory basis" (Article 3.1 of the Third Generation Partnership Project). For more information Look Here >>>

The above-mentioned principles are further reflected in Article 55 of the 3GPP Technical Working Procedures which request that each Individual Members should declare "at the earliest opportunity, any IPR which they believe to be essential, or potentially essential, to any work ongoing within 3GPP".

back to top

3.2 What is the 3GPP policy on licensing ?

Some aspects of 3GPP systems are covered by essential Intellectual Property Rights (IPR) - that is, patented technologies without which equipment cannot be implemented. The IPR vests in - i.e. the patents are held by - individual companies, and not by 3GPP itself or any of its Organizational Partners (OPs). All Individual Members of 3GPP abide by the IPR policies of the OP to which they belong; all such policies are broadly similar (see FAQ 3.1), and require IPR holders to make licences available to all third parties, whether or not they are 3GPP Individual Members, under fair, reasonable and non-discriminatory (FRAND) terms.

Neither 3GPP nor its component OPs offer an IPR search service. It is the responsibility of each manufacturer / system implementor to seek and obtain its own licences from the individual IPR holders.

For more information, and a guide to the IPRs declared to each 3GPP OP, look here >>>

(Answer drafted 2005-09-12 by JMM.)

back to top

3.3 What is the 3G Patent Platform ?

On the fringe of standardization activities some telecom companies have set up a voluntary arrangement for the licensing of essential patents required to meet the standards published for 3G systems has emerged.

Please find a historical recap of the creation of the 3G Patent Platform. Thank you to note that Phase 3 has not started yet.

1. Discussions started in the UMTS IPR working Group (1998).

2. The UMTS IPR working group operated within the UIAP (UMTS Intellectual Property Association) to define the functions of the 3G Patent Platform.

The 3G Patent Platform will provide services for:

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 170 of 304

http://www.3gpp.org/faq/faq_2005_2.htm Go NOV DEC FEB
137 captures 25
25 Dec 2005 - 2 Jun 2017 2004 2005 2007
About this capture

3. Implementation of the 3G Patent Platform scheme.

The 3G Patent Platform will operate within a new profit service company governed by the members (essential patent holders and licensees). As of today this NEW CO is not operational since it is waiting for the approval of the US/EC/Japanese competition law authorities in order to launch the above-described activities.

More information is to be found at http://www.3gpatents.com/

back to top

3.4 Is it true that a number 3GPP members are looking at setting up a patents cooperative, with the aim of reducing the royalties they pay each other for the use of patented technology in third-generation mobile systems ?

- Discussion started in the UMTS IPR working Group (1998),
- Creation of the UIAP (UMTS Intellectual Property Association) which has performed the function of the definition the 3G Patent Platform scheme (Evaluation of a patent, certification of essentiality, licensing arrangements, etc.) and which is the legal owner of the 3G Patent Platform Specification.
- Implementation of the scheme:

As of today NEW CO (implementing the 3G Patent Platform) has not be incorporated and the Patent Platform scheme is not operational as it is awaiting for the approval of the US/EC competition law authorities.

ETSI follows the development of the 3G Patent Platform but, as a neutral standard body, cannot take an active participation in this market initiative.

3.5 Who owns the Technical Specifications and the Technical Reports approved by 3GPP ?

According to the Article 3.2.2 of the Third Generation Partnership Project Agreement, the 3GPP Organizational Partners jointly own copyright on the Technical Specifications and the Technical Reports approved by 3GPP.

3.6 Does a company implementing a product based on the 3GPP specifications have to pay any royalties to the 3GPP organization ?

The Third Generation Partnership Project is not a legal entity but a Partnership Project between different standardization organizations in the field of telecommunications.

back to top

3.7 Is permission needed to use the 3GPP logo in marketing collaterals or on a web site ?

ETSI (European Telecommunications Standards Institute) is the sole owner of the following acronyms:

- ETSI,
- DECT,
- UMTS,
- 3GPP and
- TIPHON,

as well as the ETSI, TIPHON and 3GPP logos. ETSI Members shall use these Trade Marks in accordance with Collective Letter 1943. Authorization is needed to use the above mentioned acronyms and logos.

For further information please contact : 3GPP Legal

back to top

3.8 Can I use computer code included with a 3GPP TS to implement a product ?

Yes. Some 3GPP Technical Specifications include computer code such as ASN.1 or XML (protocols), C language (codecs), ...; and some include test patterns (codecs) for verifying implementations. These are published to allow users of these TSs to implement real-world products. No permission is required from 3GPP or its Organizational Partners (OPs) to use this code in the design of products - e.g. to compile the C to implement a codec in machine code.

Nevertheless, there may be essential IPR involved with such a design, and implementors are obliged to seek licences to use that technology. See FAQ 3.2.

Moreover, the copyright of all 3GPP TSs and TRs vests jointly by all the 3GPP OPs. Other than for in-house copies for the purpose of further development of the 3GPP standard or for product design purposes, etc. you may not reproduce any part of a 3GPP TS or TR without seeking permission: use the form available here. This means that you must not provide verbatim copies of *source* code (or lightly modified copies) without seeking permission from 3GPP.

Finally, you are reminded that 3GPP TSs and TRs have no legal status, and you should not design products directly to them. See the advice notice on the cover page of every 3GPP TS and TR. Instead, use the technically identical publication of one of the OPs.

(Answer drafted 2005-09-12 by JMM.)

back to top

4. Specifications

4.1 Where can the rules, protocols or software needed to develop applications for UMTS be found ?

A good place to start is on the 3GPP website http://www.3gpp.org, and particularly the specifications list at http://www.3gpp.org/specs/specs.htm.

Look at the titles of the specs for those which are appropriate. Perhaps 21.111, 31.102 and 31.111 might be relevant.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 171 of 304

http://www.3gpp.org/faq/faq_2005_2.htm Go NOV DEC FEB
137 captures 25
25 Dec 2005 - 2 Jun 2017 2004 2005 2007
About this capture

back to top

4.3 Is there any simple guide to the different CAMEL specifications ?

Unfortunately there is no single document acting as a guide to the CAMEL standards. Initial plans were published in ETSI ETR 244 in 1995, though this is so old as to be more or less useless now. GSM 10.78 is the CAMEL project plan, and this is probably the best thing. This may have been available as a temp doc to SMG meeting no. 25, but is still only in draft form, and has never been made publicly available.

In the SS7 arena,

GSM 02.78 / UMTS 22.078 is the Stage 1 (requirements) document.

GSM 03.78 / UMTS 23.078 is the Stage 2 (functions, conceptual data flow)

GSM 09.78 / UMTS 29.078 is the Stage 3 (protocol) - CAMEL Application Part (CAP)

CAP has been released in several phases:

Release 1996 = Phase 1

Release 1997 = Phase 2

Release 1998 = Phase 2

Release 1999 = Phase 3 (GSM and UMTS common spec)

For UMTS, 21.978 is a feasibility study on CAMEL control of Voice over IP.

In the Intelligent Network area, CAMEL is an extension of Core INAP, under the control of ETSI SPAN3 (formerly SPS3) - ignore for simplicity the Stage 1 and Stage 2 specifications, which were under ETSI SPAN6 (formerly NA6). Core INAP was released in sevaral phases:

CS1 = ETS 300 374 series,

CS2 = EN 301 140 series,

CS3 = EN 301 931 series.

It had originally been intended to split CS3 into two releases, and also to produce a CS4. These plans now seem to be on hold. Tthe ETSI phasing of the various Capability Sets was not strictly aligned with the ITU-T "equivalents", and this was a source of some confusion. For further information on SPAN please contact : spansupport@etsi.org Very recently, SPAN has been reorganised, and SPAN3's work is now to be found within SPAN12.

IN CAMEL phase 1 is an enhancement of Core INAP CS1. The protocol is defined in the ETSI EN 301 152 series, which is a "delta" to ETS 300 374, and assumes a CAP according to GSM 09.78 v5.5.x (Phase 2+, Release 1996). IN CS3 includes CAMEL aspects (which were ignored for IN CS2).

back to top

4.4 Where are the specifications which identify the Vcc voltages for the SIM interface ?

3V and 1.8 V SIMs for GSM are specified in GSM 11.12 (phase 2) and GSM 11.18 (release 98) respectively.
However, in 3GPP we have developed a new specification (3G TS 31.101) which combines the physical/electrical/logical aspects of GSM 11.11, GSM 11.12 and GSM 11.18 into a single specification. The electrical and physical aspects have not really been changed compared to the GSM specification mentioned above (the logical and security aspects have been enhanced). It is recommended that you use this new specification as the basis for any new work.

back to top

4.5 Are the 3GPP specifications produced only in word ?

The 3GPP specs are published as ETSI deliverables, and these are available in PDF from http://www.etsi.org/key. But you can download a free Word viewer (ie read only) from the Microsoft web site. PDF is inherently secure (more so than html, in fact), and because WordViewer is very simple (it can not handle macros, for example), it is pretty safe too.

ETSI has no plans at present to publish specifications in plain text or in html.

back to top

4.6 Which group works with specifications covering the use of the GSM codec (either in C or Java based) ?

The SMG11 and 3GPP SA4 specifications available from http://www.3gpp.org respectively deal with this. It gives you a list of specifications via the status list (look for the GSM specs in the MS-Access database at :
and you can then download the specs you need. If you do not have an ETSI EOL account, you can download the ETSI equivalent standards from http://www.etsi.org/key .

back to top

4.7 Does the ETSI GSM standard document collection also include GSM standard documents produced by the GSM Association and exactly what kind of GSM standards does ETSI produce ?

The GSM specifications were originally started in committee GSM of CEPT. There (as "CEPT Recommendations") they were allocated a reference number of the form nn.nn, for example GSM 06.12. Even after transfer to ETSI about ten years ago, the GSM community (in Technical Committee SMG) continue to use these spec identifiers.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 172 of 304

http://www.3gpp.org/faq/faq_2005_2.htm Go NOV DEC FEB
137 captures 25
25 Dec 2005 - 2 Jun 2017 2004 2005 2007
About this capture

version release

3.x.x	Phase 1
4.x.x	Phase 2
5.x.x	Phase 2+, R96
6.x.x	Phase 2+, R97
7.x.x	Phase 2+, R98
8.x.x	Phase 2+, R99

There will (probably) not be a Release 2000, since the work has been subsumed by the third generation specifications under 3GPP.

All (nearly) the specs of all releases are published as ETSI deliverables, and most have undergone several revisions in each release. In order to match a GSM spec number and version with the corresponding ETSI deliverable, you should go to http://www.etsi.org/key/ .

back to top

4.8 Where would I find a document (e.g. UMTS 30.03 version 3.1.0) which does not appear on the 3GPP Status List?

Look at http://docbox.etsi.org/tech-org/smg/Document/smg/specs/UMTS/3003_320.zip but, an ETSI server account is needed to access this. It is a document stemming from the initial TC-SMG studies on UMTS, not a product of 3GPP. It was, in fact, published as an ETSI deliverable, TR 101 112, and this may be downloaded via http://pda.etsi.org/pda.

In general, the cross-referencing between GSM and ETSI deliverables, and between 3GPP and ETSI deliverables may be found at http://www.etsi.org/key

back to top

4.9 Where are all the Change Requests (CRs) located ?

The information on CRs is available via the 3GPP website at this address:

http://www.3gpp.org/ftp/Specs/html-info/

The information is classed by series so it is very easy to locate the particular specification which interests you.

If, for example, you are looking for CRs on GSM 08.18 then you would use this link:

http://www.3gpp.org/ftp/Specs/html-info/0818-CRs.htm

back to top

4.10 Where are all the current ETSI SMG specs located ?

The latest GSM status database located at

http://docbox.etsi.org/zarchive/smg/.

An ETSI account is needed to access this directory.

back to top

4.11 Which group works on the W-CDMA and the Physical Layer of W-CDMA ?

The radio aspects are standardised in TSG-RAN. The technical work is done in the 4 Working Groups of RAN (WG1 radio layer 1, WG2 radio layer 2/3, WG3 interfaces, WG4 RF measurements). I'd say you are interested in TSG-RAN WG1 then. Their specifications are numbered 25.2xx.
The temporary documents (meeting documents etc.) of WG1 are stored on ftp://ftp.3gpp.org/TSG_RAN/WG1_RL1 and the latest specifications (December 99) are or will be provided on ftp://ftp.3gpp.org/Specs/December_99/25_series.

back to top

4.12 Where can I find the list of Abstract syntax notation (ASN.1) object identifiers?

The expandable list of object identifiers is available here >>>. To see the formal definition of the object identifiers, see the document cited on the right. The tree is not necessarily complete; further extensions may be included in the referenced document. For more information look here >>>

back to top

4.13 Where can I find the 3GPP Confidentiality and Integrity algorithms?

The 3GPP Confidentiality and Integrity algorithms F8 & F9 (KASUMI) have been developed through the collaborative efforts of the 3GPP Organizational Partners. For more information and in order to download the algorithms look here >>>

back to top

4.14 What is a Release - how does specification version numbering work?

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 173 of 304

http://www.3gpp.org/faq/faq_2005_2.htm Go NOV DEC FEB
137 captures 25
25 Dec 2005 - 2 Jun 2017 2004 2005 2007
About this capture

4.15 Where can I find information on the current status of 3GPP specifications?

New versions of many 3GPP specifications are made available shortly after the 3GPP TSG plenary meetings which take place four times a year (March, June, September and December). In order to identify what the current version is or and how to find information about older versions of specifications look here >>>.

back to top

4.16 What is the system for numbering specifications? Which specifications contain information on specific topics ?

All 3G and GSM specifications have a 3GPP specification number consisting of 4 or 5 digits. (e.g. 09.02 or 29.002). For a more complete description and examples look here >>>

back to top

5. Technical Specification Group/Working Group

5.1 Who are the TSG/WG Officials and Support team and Where can I find their contact details?

Each TSG/WG has a Chairman, up to two Vice-Chairmen, a secretary and a member of the support team (officials).

Who are the other members of the TSG/WG?

Active participant lists are maintained by the TSGs. Any member attending a meeting will be added to the TSG/WG active participants list, and may be removed after not attending 3 or more consecutive meetings (see Article 35 of 3GPP Working Procedures).

back to top

5.2 Where can I find the Terms of Reference for my TSG/WG?

The current Terms of Reference for each TSG/WG appear on the web pages of each TSG/WG.

back to top

5.3 When did the Officials begin their Term of Office?

The four Technical Specification Groups (TSGs) have elected their 3GPP TSG officials at the Fort Lauderdale (FL) meeting in March.

The meeting reports for each TSG/WG will indicate the election/re-election/resignation of an official. A complete list of TSG/WG officials is available on the 3GPP web site.

back to top

5.4 May I become an Official?

The TSG Chairman and Vice Chairmen are elected by the Technical Specification Group from amongst the Individual Member representatives. Each TSG can elect a maximum of two Vice Chairmen. Once elected, these candidates are proposed to the PCG for appointment.

The Working Group Chairman and Vice Chairmen are elected by the Working Group from amongst the Individual Member representatives. Each Working Group can elect a maximum of two Vice Chairmen.

A candidate for TSG or Working Group election shall provide a letter of support from his Organization and nominations may be made up to the point when an election takes place.

The TSG Chairman and Vice-Chairmen shall be appointed by the PCG on the proposal of the TSG.

The Chairman and the Vice-Chairmen shall be appointed for a two year term of office. The Chairman and Vice-Chairmen may be appointed for one further consecutive term. If, at the end of a Chairman or Vice Chairmans second term, no other candidates are available, the Chairman or Vice Chairmen may be appointed for a further term.

Chairman and Vice Chairmen should not be from the same region, Organizational Partner, or from the same group of companies, unless no other candidate is available.

Successive Chairmen should not be from the same Organizational Partner, the same region or from the same group of companies, unless no other candidate is available

back to top

5.5 Where are my TSG/WGs documents stored?

Each TSG/WG has a specific area allocated on the 3GPP ftp server.

back to top

5.6 Is the ETSI Secretariat responsible for the management of the Application Provider Codes for 3GPP ?

The ETSI secretariat does not actually allocate these number - unique number are obtained by the coding scheme that is defined in 31.110. Application identifiers for consist of two parts - a RID and a PIX.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 174 of 304

http://www.3gpp.org/faq/faq_2005_2.htm Go NOV DEC FEB
137 captures 25
25 Dec 2005 - 2 Jun 2017 2004 2005 2007
About this capture

- 3G USIM, and
- 3G USIM toolkit

Each of these requires the use of the "Card issuer code" as defined in ITU-T recommendation E.118 [3]. This is a unique code given to each card issuer (for example, each GSM operator in the world has requested a card issuer code). So, any 3G operator that does not have a 2G system that uses SIMs will have to apply to the ITU-T in accordance with the procedures in E.118.

back to top

6. Documents and TSG/WG Meetings

6.1 How do I register for a meeting?

If you are a TSG/WG member you will receive information about forthcoming meetings via the e-mail exploder. This will indicate the path on the ftp server where the invitation and related documents may be found. You may also consult the Meetings area on the 3GPP Web where the latest invitations of each TSG/WG are stored together with the calendar of meetings.

back to top

6.2 How do I submit a contribution for a meeting?

Each meeting invitation will contain details of how to register contributions for that meeting and who to send your contributions to.

6.3 How do I obtain a document number for my contribution?

Each meeting invitation will contain details of how to register contributions for that meeting and who to send your contributions to.

6.4 Where can I download documents for an upcoming meeting?

Each meeting invitation will contain details of where the documents are stored for the meeting. It is advisable for delegates attending a meeting to download the documents available prior to the meeting from the ftp server and onto their personal computers.

back to top

6.5 Where can I find a temporary document template?

The document template is made available by each TSG/WG in the meeting respective folder on the ftp server.

6.6 What happens if I am unable to attend a meeting?

You should contact your chairman and the meeting host indicating when you will be absent.

Work Items and Deliverables

6.7 What is my role when my TSG/WGs has to approve a deliverable?

Approval of Technical Specifications and Technical reports by a TSG shall normally be by consensus.

Where consensus cannot be achieved in the TSG a vote may be taken.

When Technical Specifications and Technical Reports become sufficiently stable, they shall be put under change control of the relevant TSG. The further elaboration of these Technical Specifications and Technical Reports shall be achieved by Change Requests (CRs) to be approved by the TSG.

back to top

6.8 What are the different types of deliverables?

3GPP shall prepare, approve and maintain documents known as Technical Specifications and Technical Reports. Such documents shall be drawn up by the TSGs and shall, following approval at that level, be submitted to the participating Organizational Partners to be submitted to their respective standardization processes.

6.9 Can I write an 3GPP Document myself?

Why not?! If you wish to propose a deliverable then bring it to the attention of your chairman and the other members of the TSG/WG in order to discuss the subject.

Each proposed new Work Item shall be supported by at least four Individual Members, and their names shall be recorded in the Work Item definition prepared for the TSG approval. One or more persons shall be named as Rapporteur for the proposed Work Item, and the Rapporteur shall act as the prime contact point on technical matters and for information on progress throughout the drafting phases.The supporting Individual Members are expected to contribute to and progress the new work item throughout the drafting phases.

In addition to the above, TSGs shall approve new Work Items, giving all essential parameters. The proposal shall be entered into the 3GPP work programme, clearly marked as a new entry, for which a unique reference identity shall be allocated.

6.10 Do I and my company have to support my TSG/WGs Work Items?

Neither you or your company is obliged to support the work items of your TSG/WG, however it is normal that if you and your company are supporting members of a Work Item that you be in agreement with their work and will normally support the production of the related deliverable.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 175 of 304

http://www.3gpp.org/faq/faq_2005_2.htm Go NOV DEC FEB
137 captures 25
25 Dec 2005 - 2 Jun 2017 2004 2005 2007
About this capture

7.1 How do I resolve the problem with the corrupt file warning in MSWord. Note that this only applies to MSWord2000?

Problem:
When opening a document in Word 2000, the following error message appears: This document may be corrupt. To preserve the contents: Choose Select All from the Edit menu, then choose Copy from the Edit menu. Create a new document, then choose Paste from the Edit menu.

Cause:
This may be related to something called list templates. A list template is created for every numbering or bulleting scheme defined in the document. Apparently, a minor change in a scheme, or even switching a list from numbered to bulleted creates a new template. In an arcane way, tables are also related to list templates. The template count increases automatically, but cannot be decreased by the user. When more than 1500 templates are defined in the list, the document becomes corrupt. There are more reasons why a document is corrupt, so the fix proposed will not solve the problem 100% of the times.

Resolution:

- To solve the problem, you need to have MS Office 2000 Service Release 1/1a installed . To check this, in Word on the "Help" menu point to "About Microsoft Word". The first line in the window shows you the MSWord version you have. You should get something like: "Microsoft Word 2000 (9.0.3821 SR-1)". If you don't get SR-1 (or SR-1a) at the end, you need to install the Service Release. Contact your IT department or follow this link: http://support.microsoft.com/support/kb/articles/Q245/0/25.ASP
- You have to introduce a new entry in the Windows registry. You can do this simply by clicking twice in the file "word_bug_fix.reg" attached. Note that modifying the Windows Registry incorrectly can cause serious problems; this fix simply introduces a new entry in a MSWord part of the registry, but if you don't feel confident, contact your IT department or check the Microsoft link below.
- Open MSWord normally. The fix proposed will open the corrupted files without warning and delete the unused list templates, so its count goes under 1500. The user will not notice anything, but this implies that the document is modified. When closing, MSWord will ask the user if he wants to save the changes, even if apparently no change has been made.

This bug is confirmed by Microsoft and it is listed in its Support Web Site. Follow this link to get the complete report:

http://support.microsoft.com/support/kb/articles/q241/5/81.asp

7.2 Where is the information regarding the Core Network located ?

Unfortunately, there is no one document that describes the Core Network, as it is an area of work far too involved to be contained in one specification.
For a general overview document of Network Architecture TS 23.002 may be downloaded from our FTP server. ftp://ftp.3gpp.org/Specs/October_99/23_series.
For more general organizational information, have a look at the 3GPP web site which shows the individual areas of 3GPP and in particular Core Network.
http://www.3gpp.org/TSG/CN.htm.

7.3 Do I need a password and user name to access the 3GPP Web site ?

No password is needed to access any information on the 3GPP Web site, all information is openly published.

7.4 Can you give me information about which companies manufacture particular types of equipment. Or about what services are available on particular networks?

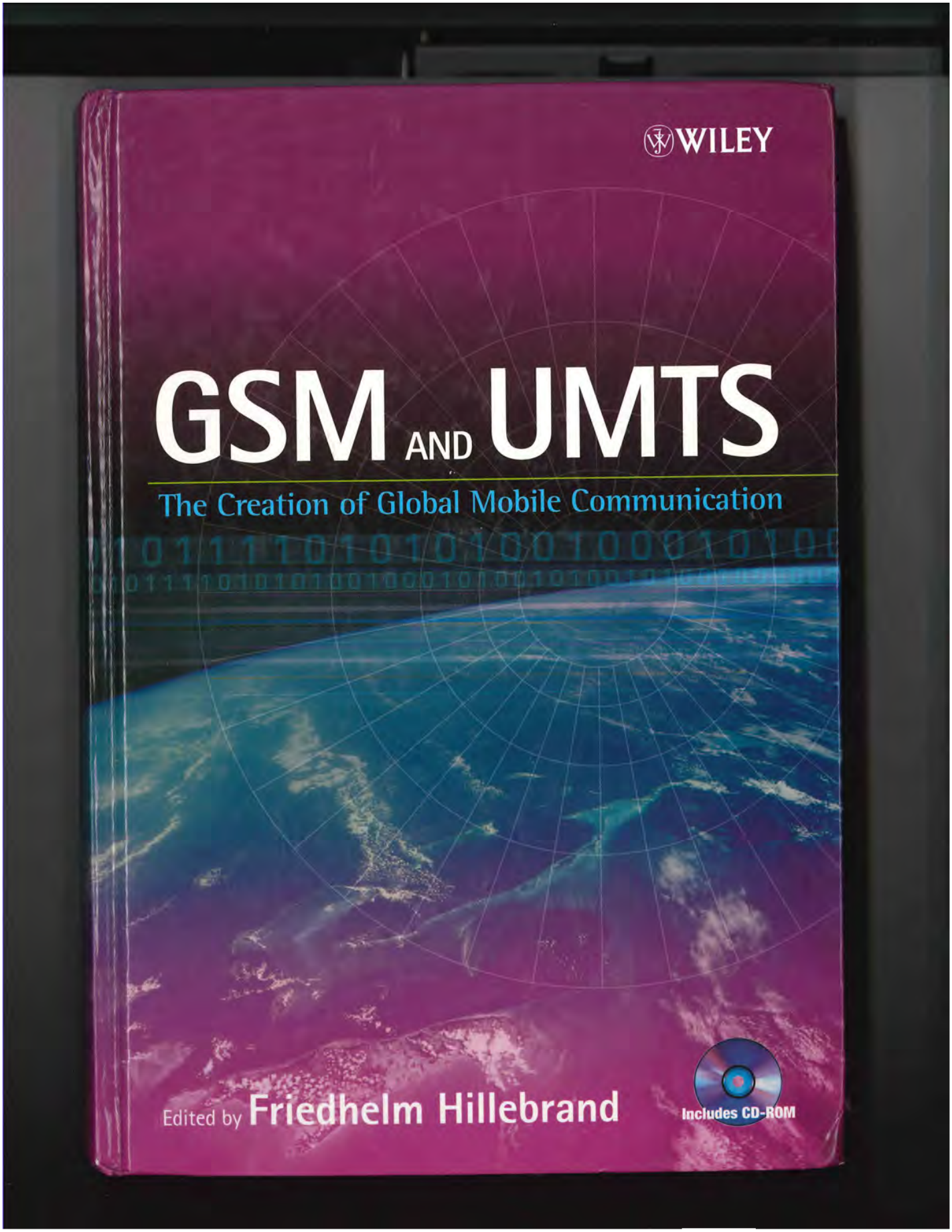
No. The 3GPP Support Team must remain neutral and must not show bias to any of its Individual Members. Such information may be available from the Global Mobile Suppliers Association (www.gsacom.com) where you will find a statistics area which could be of help.

back to top

Last updated:
2005-09-12
2005-08-22

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 176 of 304

Appendix 15



Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 178 of 304

GSM and UMTS

The Creation of Global Mobile Communication

Edited by

Friedhelm Hillebrand
Consulting Engineer, Germany

With contributions from 37 key players involved in the work for GSM and UMTS



JOHN WILEY & SONS, LTD

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 179 of 304

Copyright © 2002 by John Wiley & Sons, Ltd
Baffins Lane, Chichester,
West Sussex, PO19 1UD, England
National 01243 779777
International (+44) 1243 779777

e-mail (for orders and customer service enquiries): cs-books@wiley.co.uk
Visit our Home Page on http://www.wiley.co.uk or http://www.wiley.com

Reprinted January 2002.

All Rights Reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, scanning or otherwise, except under the terms of the Copyright Designs and Patents Act 1988 or under the terms of a licence issued by the Copyright Licensing Agency, 90 Tottenham Court Road, London, W1P 9HE, UK, without the permission in writing of the Publisher, with the exception of any material supplied specifically for the purpose of being entered and executed on a computer system, for exclusive use by the purchaser of the publication.

Neither the author(s) nor John Wiley & Sons Ltd accept any responsibility or liability for loss or damage occasioned to any person or property through using the material, instructions, methods or ideas contained herein, or acting or refraining from acting as a result of such use. The author(s) and Publisher expressly disclaim all implied warranties, including merchantability of fitness for any particular purpose. There will be no duty on the authors or Publisher to correct any errors or defects in the software.

Designations used by companies to distinguish their products are often claimed as trademarks. In all instances where John Wiley & Sons is aware of a claim, the product names appear in initial capital or capital letters. Readers, however, should contact the appropriate companies for more complete information regarding trademarks and registration.

Other Wiley Editorial Offices

John Wiley & Sons, Inc., 605 Third Avenue,
New York, NY 10158-0012, USA

WILEY-VCH Verlag GmbH
Pappelallee 3, D-69469 Weinheim, Germany

John Wiley & Sons Australia Ltd, 33 Park Road, Milton,
Queensland 4064, Australia

John Wiley & Sons (Canada) Ltd, 22 Worcester Road
Rexdale, Ontario, M9W 1L1, Canada

John Wiley & Sons (Asia) Pte Ltd, 2 Clementi Loop #02-01,
Jin Xing Distripark, Singapore 129809

Library of Congress Cataloging-in-Publication Data

GSM and UMTS : the creation of global mobile communications / [edited by] Friedhelm Hillebrand.
p. cm.
Includes bibliographical references and index.
ISBN 0-470-84322-5
1. Global system for mobile communications. I. Hillebrand, Friedhelm.
TK5103.483 .G7496 2001
384.5'35–dc21

2001045565

British Library Cataloguing in Publication Data

A catalogue record for this book is available from the British Library

ISBN 0470 84322 5

Typeset in Times by Deerpark Publishing Services Ltd, Shannon, Ireland.
Printed and bound in Great Britain by T. J. International Ltd, Padstow, Cornwall.

This book is printed on acid-free paper responsibly manufactured from sustainable forestry, in which at least two trees are planted for each one used for paper production.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 180 of 304

This common concept would be based on UMTS service innovation, UTRA and the GSM core network evolution. This result had been prepared and enabled by a network of interested companies active at the global level.

8.2.6.2 The Efficient Global Open Organisation of the UMTS and GSM Specification Work in the Third Generation Partnership Project (3GPP)

8.2.6.2.1 Problem Situation

The implementation of the agreement on the UMTS cornerstones within the existing organisations would have been unmanageable. Three committees in different continents would have worked on the UMTS radio specifications (SMG2, T1P1.5 radio sub-working group, ARIB), several other committees would have worked on network aspects (SMG12 and SMG3, T1P1.5 network sub-working group, TTC). The situation in other key areas like services, SIM, O&M would have been comparably difficult. There would have been no overall decision-making body for conflict resolution. Therefore, the global strategic agreement on the UMTS cornerstones called for a new more efficient global organisational solution, in order to lead the agreement on the cornerstones to a complete and consistent UMTS system specification available in time for the market.

8.2.6.2.2 Proposal to Initiate a Partnership Project for GSM and UMTS

In order to secure the integrity of GSM and UMTS, the cohesion between GSM and UMTS, the ongoing cross-fertilisation between UMTS and GSM and an efficient specification work, I proposed in the fourth quarter of 1997 to create an ETSI Partnership Project for UMTS and GSM to several network operators and manufacturers. This would provide a single lean working structure and would be open to all committed parties world-wide. This Partnership Project model had been developed in the ETSI reform in 1996, but had never been used.

This Partnership Project for GSM and UMTS was proposed by several GSM network operators at SMG#24 in December 1997.[119] The document "Future Organisation for GSM and UMTS Standardisation", source T-Mobil, Mannesmann Mobilfunk, E-Plus Mobilfunk, aimed at a smooth and efficient standardisation process for the evolution of GSM and towards UMTS. The GSM community is now a global community of operators and manufacturers but has experienced difficulties in opening up for a wider participation in ETSI/SMG. Organisations from outside Europe still cannot become full ETSI members. Even voting rights for associate members in Technical Bodies were not endorsed by ETSI's General Assembly in November 1997. Present working methods with ANSI T1P1 on common GSM specifications are proven as a best possible solution for co-operation with other standard bodies, but they are very complex. This situation calls for a closer and more efficient overall co-operation. The GSM MoU Association and especially the Asian Pacific Interest Group (APIG) of GSM MoU have expressed their desire to participate fully in GSM work and in third generation standardisation and to ensure roaming with Japan.

For these reasons, these three companies proposed the establishment of SMG as the joint working structure among the interested bodies to produce GSM and UMTS standards for GSM (as an ETSI partnership project) and for the other interested bodies, avoiding parallel work and overhead co-ordination; current budget allocations for ETSI/SMG to be considered

[119] SMG P-97-1062 submitted by T-Mobil, Mannesmann and Eplus.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 181 of 304

as an asset for this possible joint working structure; the SMG chairman to carry out an exploratory mission in this sense."[120]

8.2.6.2.3 Endorsement of the Partnership Project by Technical Committee SMG and Mandate for Exploratory Missions

After an intensive discussion and some revisions of the document it was approved by SMG#24 in December 1997.[121] This included a mandate for exploratory missions to Japan and the US. This mission mandate was endorsed by the chairman of the ETSI General Assembly and Board as well as the ETSI director general in a meeting on 13 January 1997 in Sophia Antipolis.

I gave a first progress report to SMG#24bis in January 1999.[122] Then I led – as mandated by SMG – an exploratory mission to Japan on 3–11 February 1998. We found a strong interest in such an intensified co-operation[123]. The following summary was agreed in the meeting on 5-6 February 1998 between ETSI SMG, UMTS Forum, GSMA, ARIB, TTC and ANSI T1P1:

> "1. There is interest to create common specifications for IMT -2000 in the areas of terminals, radio access networks and core networks
> 2. It was recognised that the development of these standards in parallel organisations would be slow and could lead to unnecessary differences
> 3. It was agreed that the best way to proceed would be to further explore the creation of a common working structure (a "Project") to produce common specifications.
> 4. Such a Project, built on agreed common interests, would need appropriate recognition by as well as relationship / membership to the standardisation bodies.
> 5. A procedure for a transition phase into the full implementation of the Project would need to be worked out."[124]

This was the basic agreement for the creation of the Third Generation Partnership Project.

8.2.6.2.4 Lead Taken by the ETSI Board

Creation of the UMTS Globalisation Group

Due to the fundamental importance the creation of such a Partnership Project had for ETSI, the ETSI Board created the UMTS Globalisation Group with a strong SMG participation who undertook the negotiations for the implementation (see Chapter 9, Section 1). This group was chaired by Karl Heinz Rosenbrock, the ETSI director general.

The interest of the GSM and UMTS community was especially actively supported by three members of the ETSI Board in the UMTS Globalisation Group and in ETSI Board meetings: Wolf Haas of Mannesmann Mobilfunk, Kari Lang of Nokia and Tom Lindström of Ericsson. Their contribution was decisive for the ultimate success, the creation of 3GPP.

Great help for the ultimate resolution came also from the UMTS Forum and the chairman

[120] Extract from the SMG#24 Meeting Report (CD ROM folder B1), Section 3.3
[121] SMG P-97-1154.
[122] SMG P-98-0009.
[123] Report on the Japan mission in SMG P-98-0112.
[124] This summary is contained in SMG P-98-0112 as appendix B13. It was also presented to SMG and the ETSI Board in February 1998.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 182 of 304

Thomas Beijer. His diplomacy, bridge building ability and the ability not to give up strategic targets was an indispensable key to the ultimate success.

SMG was represented in the UMTS Globalisation Group by Gunnar Sandegren (SMG vice chairman), Francois Grassot (ECTEL TMS chairman) and me as SMG chairman.

Factions in the UMTS Globalisation Group

There was a very strong polarisation between three factions in the UMTS Globalisation Group. They were not officially organised. Therefore, I will name and describe them briefly:

"*Greater ETSI faction*": they wanted an even stronger and greater role for ETSI in the future in UMTS. They feared a big loss, if SMG the greatest producer of deliverables in ETSI were to "emigrate" to the Partnership Project. They tried to bring non-European partners into ETSI. But after the decision of the ETSI General Assembly to grant these parties only associate membership without voting rights, this was not attractive to the non-Europeans. In the UMTS Globalisation Group they tried in the beginning to block the Partnership Project and later to minimise the scope of work to be transferred to the Partnership Project.

"*Fixed-mobile convergence faction*": this community came from a fixed network background. They hoped to reach fixed-mobile convergence by bringing the relatively independent GSM/UMTS work into an organisation which would be created by melting the existing fixed network committees with SMG under the leadership of the fixed side. Their UMTS vision was dominated by fixed-mobile convergence as a high priority. They lacked in their groups dealing with the fixed network evolution towards third generation a sufficient support and momentum. They wanted to keep GSM and UMTS in ETSI in order to reach their targets and to exploit the SMG momentum and know-how. They tried in the beginning to block the creation of the Partnership Project. Later they tried to limit the scope of the transferred work as much as possible.

"*GSM-UMTS faction*": due to the global acceptance of GSM and the UMTS cornerstones they needed an efficient globally open work structure which dealt with all system aspects. Their prime concern was the progress of their GSM-based UMTS vision. This was complemented with work on the "mobile-fixed convergence". They saw that the number of mobile users would very soon be much bigger than the number of fixed users. They wanted to transfer all GSM and UMTS work into the Partnership Project.

The Decision of the ETSI General Assembly Which Freed the Way for 3GPP

Due to the strong polarisation in ETSI a decision of the General Assembly on principles was needed in September 1998. During this General Assembly I was charged with negotiating a compromise, which was acceptable to the whole ETSI membership. The compromise proposal foresaw:

- to create 3GPP for an initial phase of UMTS;
- to keep GSM in ETSI; and
- to create the ETSI Project UMTS for long-term UMTS aspects.

This proposal was endorsed with a very high majority. It cleared the way to the 3GPP agreement signed in December 1998.

The Success of 3GPP

The first 3GPP Technical Meeting in December 1998 attracted 350 delegates and the level

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 183 of 304

of participation and contributions remained high. 3GPP produced a common set of Technical Specifications for UMTS based on service innovation, UTRA and the GSM core network evolution. The work was started in December 1998. The Technical Specifications of UMTS Release 99 were completed in December 1999. Some smaller issues were resolved by March 2000. For this purpose all pure UMTS work was transferred from SMG to 3GPP during the first quarter of 1999. The responsibility for the common GSM and UMTS specifications was transferred in the third quarter of 1999. 3GPP was supported by a large number of SMG contributors and SMG leaders. The full-time program managers of the SMG technical support were made available to 3GPP. All proven SMG working methods were made available to 3GPP.

In autumn 1999 ANSI T1P1 and TIA with UWCC proposed the transfer of the remaining GSM work (mainly EDGE, SIM and mobile station testing) to 3GPP in order to ensure the cohesion between the classic GSM and UMTS. The ETSI Board endorsed this proposal based on a review and recommendation of SMG. A Board ad-hoc group was installed with SMG representation. The negotiations between the partners led to an acceptance in principle in May 2000. Therefore, the remaining GSM activities were transferred to 3GPP in mid-2000. ETSI Project UMTS attracted 30–50 delegates and did not have the momentum to produce UMTS specifications. It was closed in 2000.

So finally the SMG vision of 3GPP was realised. The creation of 3GPP ensures the integrity of GSM and UMTS, the cohesion between GSM and UMTS and the cross-fertilisation of GSM and UMTS. 3GPP allows all interested and committed organisations, e.g. regulators, network operators and manufacturers world-wide to participate in the work with equal rights.

8.2.7 Complementary Work to 3GPP in ETSI

8.2.7.1 The Transposition of 3GPP Documents in ETSI Documents

After the creation of 3GPP the question arose, how to "transpose" the 3GPP documents into ETSI documents and whether there is a need for additional documents. 3GPP elaborates and approves common Technical Specifications and Technical Reports, which should be transposed into ETSI documents. I developed the following concept, which was endorsed by SMG and the ETSI Board.[125]

3GPP is acknowledged by the ETSI internal rules as an ETSI Technical Body. Therefore Technical Specifications and Reports approved by 3GPP are to be recognised directly as ETSI Technical Specifications and Reports without another "ETSI internal approval". They can be published directly by the ETSI Secretariat.

Besides Technical Specifications and Reports there are in ETSI European Standards (ENs). They are approved by an ETSI Technical Body and then in a second step by the whole ETSI membership with the assistance of the National Standardisation Organisations.

A broad demand survey[126] regarding the demand for ENs in autumn 1999 showed that a demand for ENs exists for the purposes of the R&TTE-Directive only (access of terminals to the market). All other demand can be covered by Technical Specifications.

These ENs should be elaborated and approved by a "pure" European Committee (

[125] P-99-751.
[126] P-99-736.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 184 of 304

Technical Committee SMG). In this process 3GPP results should be referred to as much as possible.

8.2.7.2 The Elaboration of European UMTS/IMT-2000 Harmonised Standards for Terminals Pursuant to the R&TTE Directive

In order to avoid barriers to international trade the European Commission requested ETSI in a letter in December 1999 to produce European harmonised standards pursuant to the R&TTE Directive, which "would typically describe emission masks ensuring proper coexistence of the different members of the IMT-2000 family and that it would be aligned with similar standards outside the Community".

I was charged by SMG with forming a small delegation and to talk to the different parties involved to explore a way forward. A strategic framework and several technical documents were elaborated and endorsed by SMG. The principles were endorsed by the ETSI Board. A joint ERM/SMG Task Force was formed in May 2000 to do the technical work.

The strategic framework document developed by me and endorsed by Technical Committee SMG[127] identifies the regulatory requirements and contains the following key targets for the standardisation work:

- ETSI needs to produce harmonised standards for all IMT-2000 systems.
- The work can reference ITU, 3GPP2 and TIA specifications directly. There is no need to transpose these into ETSI documents.
- The harmonised standards will be produced by a joint ERM/SMG Task Force and EP DECT.
- The first release of the harmonised standard needs to be completed ideally in October 2000.

8.2.7.3 Technical Committee MSG, the New Body for ENs

The work, which remains in ETSI, is the elaboration and approval of ENs needed for regulatory purposes. For this task I proposed to create a new body Technical Committee MSG (Mobile Standards Group) and its terms of reference. This was endorsed by SMG[128] and approved by the ETSI Board. It started in June 2000.

8.2.7.3.1 EP SCP (ETSI Project Smart Card Platform)

The generic smart-card work and the work on common lower layer functions for smart-cards of all 3G systems was transferred to EP SCP which was created in March 2000.

8.2.8 Conclusions

During the period from April 1996 to February 1999 ETSI Technical Committee SMG created a UMTS strategy consensus on a vision which was based on services' innovation, GSM evolution and Internet orientation. All basic concepts for the UMTS standard were

[127] SMG P-00-194.
[128] SMG P-00-183.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 185 of 304

elaborated and agreed. Very difficult decisions like the UTRA decision were taken. On this basis a set of reports and raw specifications were produced. The creation of a globally open efficient new working structure, the 3GPP, was initiated and brought to life. All UMTS and GSM work was transferred to 3GPP. The necessary changes in ETSI were initiated. Then the Technical Committee SMG was closed at the end of July 2000 since its mission was fulfilled.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 186 of 304

Chapter 9: The Third Generation Partnership Project (3GPP)

Section 1: The Creation of 3GPP

Karl Heinz Rosenbrock[1]

Having read the title, it should not surprise you that this section deals with the creation of the Partnership Project for the standardisation of a Third Generation Mobile Communications System (3GPP).

Why, you may ask, in a history book about the GSM and UMTS development, do I want to talk about the establishment of a partnership project? Isn't it the most natural thing to do? This is, of course, a stance an insider can take today – after nearly 30 months of 3GPP's creation and the smooth and successful running of this project.

As this section will eventually show, it took quite some time, filled with tough and even passionate discussions, before the goal was achieved. Approaching this idea from a rather philosophical point of view, one should not be too surprised about the big efforts needed, because already the old Greek ancestors knew that "prior to being successful the Gods will demand some sweat"...[2]

This section starts with some general considerations leading the European Telecommunications Standards Institute (ETSI) membership towards a global approach in standardisation and then deals with the establishment of an ad hoc group of the ETSI Board (UGG = UMTS Globalisation Group) to address the matter of global standardisation in this context and the related meetings and discussions. Afterwards, the 3GPP will be described in a rather general manner, highlighting how it works, who the stakeholders are and dealing with the results achieved so far. The section is rounded up with the relationship towards the International Telecommunication Union (ITU) and other initiatives as well as a few concluding remarks.

9.1.1 First Approaches to Globalisation

The re-engineering process ETSI, the "Excellent" Telecommunications Standards Institute in Europe, undertook in the years 1995/1996 – only 7 years after its creation – resulted in among others a kind of mission statement for the Institute: "Making international standards happen first in Europe".

[1] The views expressed in this section are those of the author and do not necessarily reflect the views of his affiliation company.

[2] One of my cruel translations of a German idiom "Vor den Erfolg haben die Götter den Schweiß gesetzt"...

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 187 of 304

Classical examples of ETSI success stories that witness this slogan are among others: the Global System for Mobile Communication (GSM); Digital Enhanced Cordless Telecommunications (DECT); Digital Audio Broadcasting (DAB); Digital Video Broadcasting (DVB); Terrestrial Trunked Radio (TETRA), just to name a few of them.

In positioning ETSI in the standardisation landscape, it became clear that the trends and changes towards globalisation, convergence and new value chains would lead to the creation of a huge volume of standards making space. Furthermore, it was not tenable for ETSI to try to fill the entire space. Choices had to be made. In addition, the investigations revealed that collaboration by means of appropriate partnerships could be a promising formula.

ETSI consciously withstood the temptation to become a global standards body. But it has always undertaken great efforts to ensure that all of its products, i.e. deliverables, such as European Norms (ENs), ETSI Standards (ESs), ETSI Technical Specifications (TSs), etc. satisfy real market needs and have the potential to become global standards. The ITU remains ETSI's global partner of choice. But the fast moving markets were expected to require ETSI to supplement this with various international partnerships on a case-by-case basis.

The high level task force that undertook the ETSI review in 1995/1996 advised the Institute that it had to sustain its core competence of making high quality standards for large and complex telecommunications systems. But, if neat demarcation lines are going to cease to exist, then ETSI must inevitably move more into the IT, audio-visual and other fields. It should do this in good partnerships, where other Standards Developing Organisations (SDOs) or appropriate fora and consortia are willing to co-operate with ETSI. Retrenchment by ETSI was not considered to be in Europe's interest.

Other results of interest here, of ETSI's re-engineering process after 7 years of existence were:

- to reduce the hierarchical structure in the Technical Organisation to a minimum;
- to delegate power (of approval, etc.) to the Technical Bodies where the main work is being done;
- to focus on semi-autonomous projects;
- to aim at proper project management;
- to allow the creation of ETSI Partnerships Projects (EPPs);
- to streamline and rationalise the ETSI Working Procedures;
- to improve the use of electronic tools for further rationalisation and innovation;
- to use audio and video conferencing;
- to broadcast inter-active meetings;
- to increase standards promotion activities;
- to facilitate and to promote direct electronic access to ETSI documents and deliverables free of charge.

Regarding ETSI's external relations the advice given was: that ETSI should add to its strength through partnerships in complementing areas, ceding some sovereignty on a case by case basis to achieve common purposes.

ETSI should continue its dialogue (in GSC/RAST) with its major regional/national counterparts, with the objective of strengthening arrangements for effective co-operation and be prepared to enter into bilateral co-operation on a case-by-case basis.

With this short excerpt of some basic results stemming from the ETSI re-engineering

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 188 of 304

process undertaken in the middle of the 1990s, we have the fertile soil, i.e. the driving forces, motivations, basic elements needed in order to establish a partnership project.

The tremendous success story of GSM may have even led some ETSI members to believe that it would have been the most natural choice to repeat this with the third generation mobile communication system within ETSI, too. But for insiders it became clear that such a success could not be guaranteed another time.

After having dealt with the ETSI internal change in orientation from Europe-centric to international and global, let's have a short look at the first attempts at getting into closer contact with our partners. Let's start with our American friends.

In Sections 5.3 and 5.4 the standardisation work on PCS 1900 in ANSI T1P1 as well as the new co-operation between ANSI T1P1 and ETSI Technical Committee SMG are described.

The relationship between ANSI T1P1 and ETSI TC SMG started in 1996/1997. Both Technical Committees were working on independent sets of Technical Specifications, i.e. GSM 1900 in the US and GSM 900/1800 in Europe, etc. Parallel working with different speeds includes the risk of differences that may result in incompatibilities. In order to avoid these difficulties both SDOs agreed to merge the two independent sets of specifications into a common one and to further develop it commonly using a co-ordinated approach, i.e. each work item and the results were approved in both committees and incorporated into the common specifications.

Despite the fact that the co-operation between T1P1 and SMG was excellent, it suffered a little from the fact that the double approval process and the difficult co-ordination process at several levels, e.g. first in T1P1 and then within SMG, were not very efficient and too time consuming. One of the lessons learnt from this exercise was: Why don't we really co-operate, i.e. work together, from the very beginning – then avoiding any type of "approval ping-pong"? This was another good reason to consider what and how to improve the standardisation work for the third generation…

Now let's have a look at the relationships with our friends from Asia.

In the People's Republic of China, network operators had implemented large GSM networks based on existing ETSI standards. In order to avoid divergence, Chinese authorities (RITT) joined ETSI as an associate member and participated fully in the work of ETSI TC SMG since 1997. Thus, it was possible to fully integrate the Chinese requirements into the standardisation process within TC SMG in order to secure the integrity of GSM between China and the "rest of the world".

In the meantime – with the Universal Terrestrial Radio Access (UTRA) decision in January 1998 – contacts with Japanese ARIB/TTC colleagues had been established within ETSI TC SMG. These contacts had started in spring 1997, 1 year earlier

Discussions on the Technical Committee working level at the end of 1997 and the beginning of 1998 between ETSI, ARIB/TTC, and T1P1[3] led to the hope that the creation of a common UMTS concept applicable in all territories – and thus de facto globally – was possible. Such a concept could be based on UMTS service innovation, UTRA and the GSM core network evolution.

In other words, there was from the beginning a lot of goodwill available from all sides to undertake something in common. But how to do it? It became clear that to perform the UMTS standardisation within the three (or more) existing organisations would have been easily unmanageable. Three committees in different continents could have developed the

[3] More information is in Chapter 8, Section 8.2.6.2.3

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 189 of 304

UMTS radio specifications whilst several other committees would have worked on network aspects. The situation in other key areas, such as services, Subscriber Identification Module (SIM), and Operation and Maintenance would have been equally difficult. Furthermore, there would have been no overall decision-making body for the resolution of possible conflicts. All these difficulties sketched out here simply called for a new and much more effective global organisational solution.

As the friends from ARIB were quite interested in developing a common radio interface whose key parameters had been agreed in Japan and in the UTRA radio interface decision in January 1997, a delegation from the ETSI TC SMG undertook an exploratory mission to Japan on 5 and 6 February 1998 in order to find out whether or not a kind of co-operation with them would be possible. Further information is given in Chapter 8, Section 8.2.6.2.3.

These informal contacts on the working level revealed that there was a good resonance on the Japanese side. In an association like ETSI, there is not only the working level, there are other levels as well, e.g. the General Assembly (GA), the highest ETSI authority, and the Board, a body with some 25 clearly identified powers delegated by the GA. In 1997/1998 the first ETSI Board could have looked back at about 18 months of existence and had, of course, to play its role... Without acting like a "donkey who eats up the grass that has grown over (above) an old and nasty story,[4] one has to admit that the communication/co-operation between the ETSI Board and the ETSI TC SMG suffered a little bit from irritations, misunderstandings, mal-perceptions, etc. In other words, it was far from optimum at that time... Nevertheless, there was a role to play from a more political strategic point of view. And now the question was what to do in order to make something useful happen?

What do you do, when you do not exactly know how to proceed? You create a committee. At least the politicians are supposed to do so. Well, within ETSI it was the Board that – after an interesting extraordinary meeting at the Frankfurt Airport on 27 February 1998 – decided to create an ETSI UMTS Globalisation Group (UGG), i.e. not a committee but an ad-hoc group, but what is the difference? The next section will tell you more.

Coming back to the extraordinary ETSI Board meeting on 27 February 1998, to simply mention "it was an interesting one" is, of course, correct, but an understatement. We had already quite an emotional ETSI Board#11 meeting dealing, with among other items, the question of how to standardise UMTS in the most useful manner. As no consensus could be achieved, a specially convened Board meeting was required.

At the beginning, a recall of the ETSI Board#11 results concerning the third generation mobile standardisation was made. In addition, reports from ETSI TC SMG were given, especially about their exploratory contacts with potential partners.

Regarding the ETSI strategy and policy for the standardisation of a third generation mobile communications system, there were quite differing opinions and fears expressed. The two extreme positions were something like:

- create a new and independent 3G forum; and
- keep all 3G standardisation within ETSI.

With all shades of compromise in between – among others why not use an ETSI Partnership Project (EPP)? By the way, at that time it was not very clear what an EPP was. There existed a general description in the ETSI Rules of Procedure, but it dated from 1995/1996 and covered some basic characteristics only, allowing for a great variety of different implementations.

[4] Wenn endlich Gras über eine (traurige) Angelegenheit gewachsen ist, kommt ein Esel, der das Gras wieder

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 190 of 304

tions... Thus, asking three people about their interpretations, one could well be confronted with four descriptions...

The result of this heated discussion was the idea to create a kind of starter group, UGG. And the Board agreed that the group should consider the requirements for the globalisation of GSM-based UMTS and make recommendations as to how this may be achieved.

9.1.2 The ETSI UMTS Globalisation Group

The UMTS Globalisation Group (UGG) was an ad-hoc group established by the ETSI Board from where it got its first draft Terms of Reference. They have been refined since based on the experience gained in the meantime.

9.1.2.1 Terms of Reference of UGG

In the following you will find the UGG Terms of Reference as revised during the first UGG meeting and approved by correspondence by the ETSI Board.

9.1.2.1.1 Objectives of the Group

The objective of this Group was to consider the actions, which are required to enable UTRA and "GSM-based" UMTS specifications to be prepared and promoted in a manner, which makes them attractive to global partners such that they will be implemented world-wide.

To achieve this objective the Group should:

- provide strategic management of those activities which fall within the scope of this Group;
- investigate the development of relationships with external partners and identify their expectations for UMTS;
- propose an organisational structure which meets the expectations of the Institute and external partners, taking into account the recommendations of the ETSI GA ad-hoc Group on fixed/mobile convergence (after their approval by the ETSI GA);
- consider what transition arrangements are necessary to move towards a new organisational structure;
- propose a mechanism, which enables all active partners to take part in the approval of related specifications.

In their work the Group may need to take into account the following factors:

1. Management characteristics (*How do stakeholders define and approve strategic direction? How is the "work-programme" defined and approved to carry out the strategic objectives?*)
2. Business model (*How are "regional" priorities, based on their business model, defined such that the standards are truly global?*)
3. Financial model (*How are "overhead" costs assigned?*)
4. Operating principles (*How is actual standardisation work carried out? How are the standards approved in different regions/countries?*)
5. Maintenance work (*How are improvements, maintenance of standards performed?*)
6. European fall-back (*What is the fall-back solution for Europe if there are disagreements at*

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 191 of 304

- unanimously requested the ETSI Board (through its UMTS Globalisation Group) to complete the negotiations with potential partners and to oversee the creation of the Partnership Project;
- unanimously requested the ETSI Board to agree and maintain on behalf of ETSI the final versions of the Partnership Project Description, the Partnership Project Working Procedures, and the Partnership Project Agreement;
- unanimously authorised the director-general to sign the Partnership Project Agreement.

9.1.2.4.14 Happy End in Copenhagen

It was in Copenhagen where the last 3GPP preparatory meeting with all six OPs took place on 2–4 December 1998.

Here, the final fine-tuning of the 3GPP documentation was achieved. In addition, the 3GPP agreement[8] was signed (in a nice framework provided by the host, TeleDenmark) by the following OPs: ARIB, ETSI, T1, TTA, and TTC.

Unfortunately, the partners from CWTS (China) were not authorised to sign the 3GPP agreement yet. Furthermore, owing to the fact that the UMTS Forum was unable to participate in Copenhagen, they were prevented from co-signing the 3GPP agreement as a first Market Representative Partner (MRP).

During that Copenhagen meeting, another discussion ensued about the role the MRPs should play. Finally, it was concluded that the high competence of MRPs should be used in order to identify market requirements, thus enabling 3GPP standardisation to meet the needs of the market. An MRP is an organisation invited by the OPs to participate in 3GPP with the objective of offering market advice to 3GPP and to bring into 3GPP a consensus view of market requirements.

9.1.3 What is 3GPP?

The 3GPP is a global standardisation initiative created in December 1998. Its task was to develop a complete set of globally applicable Technical Specifications for a third generation (3G) mobile telecommunications system based on the evolved GSM core network and an innovative radio interface known as UTRA. The Project is based on a concept devised by ETSI aimed at facilitating better co-operation between regional standards organisations, fora and other industry groupings. 3GPP is a collaborative activity between officially recognised SDOs, with the participation of other industry groups and individual members.

Partnership in 3GPP is open to all national, regional or other SDOs, irrespective of their geographical location – within the project the participating SDOs are referred to as OPs. The OPs may invite MRPs to participate: these may be any organisation from anywhere in the world that can offer market advice to 3GPP and bring a consensus view of market requirements that fall within the project's scope. Individual membership is open to companies and organisations within the communications industry that are active members of one of the OPs. The truly global nature and the breadth of the market interest in the task of specifying this 3G system is evident from the identity of the 3GPP partners (see further in sub-paragraph 9.1.3.2) and all agree that 3GPP is proving a highly successful initiative.

[8] The 3GPP Agreement and the 3GPP Project Description can be found on the attached CD-ROM in E

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 192 of 304

The 3GPP has no legal status. Ownership (including copyright) of the specifications and reports it produces is shared between the partners. The 3GPP process includes a conversion (transposition) of the project's output into official standards and reports by one or more of the OPs.

The specifications being prepared by 3GPP are evolved in part from the enormously successful GSM standard, which is currently (February 2001) serving over 400 million subscribers in more than 140 countries. Building on this massive installed base, the system being specified by 3GPP will be an attractive upgrade path for existing operators and users. It also has an assured compatibility with GSM – good news for both operators and users who are unable, or unwilling, to upgrade to 3G.

Paramount among the 3GPP specifications is the definition of UTRA, the innovative radio access technology that is the key to the new system's high data rates and dramatically improved performance. UTRA is spectrum-efficient and supports FDD and TDD modes. This interface has been accepted by ITU as a member of the IMT-2000 family – or more correctly, as *two* family members: IMT-DS, the FDD mode; and IMT-TC, the TDD mode. IMT-2000 family membership requires the ability for users to roam globally and seamlessly, which implies interoperability with other family members: 3GPP thus co-operates closely with the 3GPP2 project which is specifying another family member, a 3G CDMA system based on an evolution of the ANSI-41 architecture.

9.1.3.1 How Does 3GPP Work?

3GPP has been designed to minimise delays and inefficiencies. As a result, it has a "flat" organisational structure and a large degree of distributed autonomy. Overall project planning and co-ordination is the responsibility of the PCG, with input primarily from the OPs, guided by the MRPs. It is mainly at this level that regulatory requirements, provided by the telecommunications administrations and governments around the world, are taken into account.

The development of the specifications is performed by TSGs and their subordinate working groups. Here, the main participation is by technical experts from the individual members of the OPs. Individual members in their capacity as ITU members are also responsible for carrying the results of the 3GPP work to the ITU.

At the time of the creation, 3GPP had structured around four principal aspects of the 3G system being defined as TSGs:

- TSG CN: core network
- TSG RAN: radio access network
- TSG SA: services and systems aspects
- TSG T: terminals

Each TSG is authorised to develop and approve specifications and reports within its scope, and TSG SA also has a role of co-ordinating the work of the TSGs at a more detailed level than the PCG. The result is a process that is able to rapidly produce and approve specifications and reports in response to the needs of the market, although it is important to note that the deliverables do not have a formal status until they have been transposed by one or more of the OPs.

The formal status is necessary for regulatory and other purposes in the various regions, and all the OPs have committed themselves to complete this process rapidly. Each OP will apply

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 193 of 304

its own procedures, appropriate to their respective regions. As the official European SDO within 3GPP, ETSI recognises the 3GPP output as ETSI Technical Specifications and ETSI Technical Reports without a need for any further endorsement within the Institute. This means that the 3GPP documents are published – within a matter of a few weeks – as identical text directly as ETSI deliverables. In addition, ETSI is transposing, i.e. adapting, a few of the initial 3GPP specifications into ENs for specific European regulatory requirements. This is happening in parallel with the publication of the initial Technical Specifications and will not impede the implementation of 3G in Europe.

9.1.3.1.1 Electronic Working

3GPP has taken a leading role in changing the traditional ways of standards making. A very heavy dependence is now placed on electronic working, both outside and within meetings, advancing a trend that started in ETSI a year or two ago. This means that paper copies of draft documents have been almost entirely eliminated, saving time and expense, and making a significant contribution to the environment.

Given that 3GPP has participants from all over the world, the use of the Internet, e-mail exploders and other such facilities have proved invaluable for distributing and sharing information, working drafts and so on. Delegates to meetings had already become used to downloading working documents from the Internet and having updates to the documents distributed in meetings on CD-ROM. But in recent months, in meetings around the world participants have experienced the benefits of a local area network (LAN) solution as the latest step in improving working methods. ETSI's headquarters premises already have LANs in all its meeting rooms, but most other venues currently rely on temporary LANs (wired or radio), using equipment and support kindly donated by individual members.

Such facilities permit delegates to access all the meeting documents electronically from their laptop computers. As a result, the huge burden of producing paper copies (as many as 10 000 pages per delegate for some meetings) can be eliminated. Delegates can access new documents as soon as they are available, rather than having to wait for paper copies to be made or for the documents to be distributed by other means, such as diskette or CD-ROM.

9.1.3.1.2 Project Support

For administrative and support purposes the 3GPP Partners have established a Mobile Competence Centre (MCC) which is hosted by ETSI at its premises in Sophia Antipolis, Southern France. The MCC was created in March 1999 to provide support not only to the 3GPP but also to ETSI's own studies in mobile technologies. A full description of MCC including the financing is given in Chapter 15, Section 3.

9.1.3.2 Who are the Stakeholders in 3GPP?

3GPP has attracted a very strong commitment from organisations and companies around the world, reflecting the truly global nature of the project. There are currently six OPs (in alphabetical order):

- The Association of Radio Industries and Businesses (ARIB), Japan

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 194 of 304

- The China Wireless Telecommunication Standards Organisation (CWTS)
- The European Telecommunications Standards Institute (ETSI)
- Committee T1, US
- The Telecommunications Technology Association (TTA), Korea
- The Telecommunication Technology Committee (TTC), Japan

ARIB, ETSI, T1, TTA and TTC can be considered as founding OPs of 3GPP who signed the agreement in Copenhagen on 4 December 1998. CWTS signed the 3GPP agreement during the OP meeting #1 in Seoul on 8 June 1999.

In addition to the six OPs mentioned above, there are now seven MRPs (in chronological order of joining 3GPP):

- The UMTS Forum (December 1998 at Antibes/Juan les Pins)
- The Global Mobile Suppliers Association (GSA) (February 1999 at Cannes)
- The GSM Association (OP meeting #1 in Seoul)
- The Universal Wireless Communications Consortium (UWCC) (September 1999 at Geneva)
- The IPv6 Forum (OP meeting #2 at Sophia Antipolis)
- The Multimedia Wireless Internet Forum (MWIF) (during OP meeting #3 in Beijing)
- The 3G.IP Focus Group (during OP meeting #3 in Beijing)

In addition, by January 2000 3GPP had 284 companies participating as individual members, and the numbers continue to grow; their affiliation with the OPs is as follows:

ETSI (Europe) 173 companies	(61%)
T1 (US) 22 companies	(8%)
ARIB (Japan) 37 companies	(13%)
TTC (Japan) 18 companies	(6%)
TTA (Korea) 25 companies	(9%)
CWTS (China) nine companies	(3%)

The brackets at the end indicate the percentage of individual OP members active in 3GPP. From this, one can deduce that the representation from the three continents involved in 3GPP is as follows:

Asia	89 (31%)
Europe	173 (61%)
North America	22 (8%)

9.1.3.2.1 Leadership positions

During the first meeting of the 3GPP PCG and the OPs in Fort Lauderdale, US in March 1999, a lot of effort was undertaken in order to establish a good regional balance regarding the leadership positions within 3GPP. Fortunately, that goal was achieved as can be seen in the following:

PCG for the first 2 years: chairman from Europe, vice-chairmen from Asia (ARIB) and North America.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 195 of 304

From 2001 on there will be an annual rotation. For 2001 the PCG chairman comes from Asia (ARIB).

Regarding the four TSGs: CN, RAN, SA&T, with one chairman and two vice-chairmen each, we can register the following situation as of the end of the year 2000:

- Europe has five (of 12) leadership positions;
- North America has four (of 12) leadership positions;
- Asia has three (of 12) leadership positions.

9.1.3.3 3GPP Meetings

Regarding the meetings within 3GPP, we have to distinguish basically between three different levels:

- PCG/OP meetings;
- TSG meetings; and
- WG meetings underneath the TSG level.

PCG/OP meetings are not that frequent. Until April 2001, the following meetings took place:

PCG#1	1–4 March 1999 in Fort Lauderdale, US
PCG#2	6–7 July 1999 at Sophia Antipolis, France
PCG#3	19–20 January 2000 at Sophia Antipolis, France
PCG#4	17 July 2000 in Beijing, China
PCG#5	14 November 2000 in San Francisco, US
PCG#6	10 April 2001 at Sophia Antipolis, France

The composition of PCG, the project co-ordination group, is as follows:

Six OPs with a maximum five delegates each;
Seven MRPs with a maximum of three delegates each;
Five TSGs with one chairman and two vice-chairmen each;
Two observers with one delegate each;
ITU-T and -R with three delegates as special observers,
One secretary, Mr Adrian Scrase.

Thus – ignoring any guests – the PCG may encompass up to about 70 delegates. This high amount of delegates within PCG – although most of the delegations do not send the maximum number of delegates allowed – does not correspond anymore to the "light structure" originally intended.

Decisions within PCG are taken by consensus among the OPs. In "unavoidable cases" a vote may be taken.

Most of the OP meetings were organised in connection with the PCG meetings as follows:

OP#1	27–28 May 1999 in Seoul, Korea
OP#2	18 January 2000 at Sophia Antipolis, France
OP#3	18–19 July 2000 in Beijing, China
OP#4	15 November 2000 in San Francisco, US
OP#5	11 April 2001 at Sophia Antipolis, France

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 196 of 304

The OP meetings are composed of delegations stemming from the participating OPs. They are normally chaired by a representative of the hosting OP. The delegation number is not fixed, but as most OP meetings are joined with a PCG meeting, the delegations from the OPs do not differ very much from PCG meetings with the difference that the TSG chairmen and vice-chairmen are now part of the OP delegations. Up to now the MRPs have been invited to participate as guests within the OP meetings.

There is a 3GPP Funding and Finance Group, chaired by Mr Phil Davidson, active and reporting to the OP meetings providing appropriate advice.

The TSGs meet quarterly in parallel (CN, RAN, T) and in sequence with SA. The TSGs have met 11 times since the creation of 3GPP.

TSG#1	Sophia Antipolis (December 1998), France
TSG#2	Fort Lauderdale (March 1999), US
TSG#3	Yokohama (April 1999), Japan
TSG#4	Miami (June 1999), US
TSG#5	Kyongju (October 1999), South Korea
TSG#6	Nice (December 1999), France
TSG#7	Madrid (March 00), Spain
TSG#8	Düsseldorf (June 00), Germany
TSG#9	Hawaii (September 00), US
TSG#10	Bangkok (December 00), Thailand
TSG#11	Palm Springs (March 01), US

At those TSG meetings between 400 and 600 delegates can be expected. During the recent ones we have been closer to 600 – quite a challenge from the logistics point of view!

The working groups belonging to the TSGs may even meet more frequently. Therefore, it does not make much sense to refer to them here in more detail. But it should be clearly pointed out that the bulk of the 3GPP work is being done there…

9.1.3.4 What Progress has been Made in 3GPP?

In little over 1 year, the project had already produced the first series of more than 300 specifications and reports in what is called Release 99. The specifications in Release 99 include those that define UTRA, the radio interface, and these have been submitted by the 3GPP OPs to the ITU-R for reference in its IMT.RSPC Recommendation, which forms the compendium of 3G terrestrial radio interfaces.

In addition to UTRA, this initial release of specifications includes the definition of around 50 services including multimedia messaging, plus architectural aspects, other features and enhancements. Release 99 has enabled industry to proceed with the development of the system, which, as noted earlier, is planned to come into service in Japan in 2001, with progressive launches around the world thereafter. These incredibly short timescales have necessitated an extremely efficient, and yet open, specification process. The fact that around 100 vital specifications have been produced so quickly confirms both the commitment of all concerned and the effectiveness of the 3GPP process.

The Project's specification activities will continue as it develops Release No. 4 (scheduled for March 2001) and beyond, providing more enhancements and features including an "all-IP" based network, specification of a UTRA repeater, further refinements of radio access

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 197 of 304

modes, seamless service provisioning, enhancements to security, emergency calls, languages and alphabets, optimisation of power, spectrum and quality of service, and numerous other aspects. The task also entails an updating of the Release 99 specifications as needed (the technology is still evolving), for which a mechanism for handling quarterly updates has been established.

9.1.4 What is the Relationship Between 3GPP and ITU?

The 3GPP has been recognised by the ITU as one of the sources of technical specifications for the IMT-2000 family. There is thus a clear understanding between the two parties, which includes that 3GPP results will be submitted to the ITU where appropriate. However, because of the Project's status it does not contribute directly to the ITU. Formal contributions to ITU Study Groups, based on 3GPP Technical Specifications and Technical Reports, are made by individual members or OPs who are also members of the ITU.

The ITU entrusts the work of developing the standards needed for 3G systems to groups such as 3GPP, 3GPP2, UWCC and ETSI. For its part, the ITU is focusing on the interfaces between IMT-2000 family members to ensure seamless operation for users. A large number of 3GPP specifications, notably those for UTRA, have been accepted by the ITU as an essential component of its IMT.RSPC Recommendation, and 3GPP will continue to contribute to this process as the ITU updates and enhances the Recommendation.

In order to improve the exchange of information with the two sectors of the ITU, ITU-R and ITU-T, 3GPP agreed during its recent PCG/OP meetings in San Francisco to provide a special observer status for the ITU within the PCG of 3GPP.

9.1.5 What is the Relationship Between 3GPP and Other Initiatives?

The technologies that form the terrestrial component of IMT-2000 are being developed in several different communities: 3GPP is producing the specifications for the UTRA FDD (W-CDMA) mode and the UTRA TDD modes (high and low chip rates, the low chip rate mode

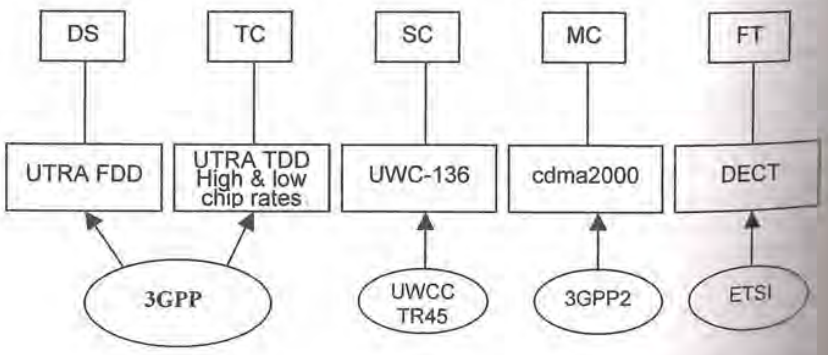


Figure 9.1.1 The five IMT-2000 terrestrial interfaces agreed by ITU-R

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 198 of 304

being TD-SCDMA, proposed by CWTS. A similar group, 3GPP2, is preparing the cdma2000 specifications, UWC-136 TDMA specifications are being developed principally by UWCC, and DECT specifications are defined by a set of ETSI standards (Figure 9.1.1).

Since the UWCC and ETSI are both partners in 3GPP (as an MRP and OP respectively), there is direct liaison between the Project and these two sources of specifications for other IMT-2000 family members.

When 3GPP and 3GPP2 were created it was felt that the interests of each group were sufficiently different to require them to remain separate but here again many of the OPs and MRPs are common to both groups, so there are natural channels for information exchange. Particular instances of formal co-operation between the groups were the two joint 3GPP-3GPP2 workshops held in 1999 to address the "Hooks and Extensions" issue aimed at ensuring interworking between the respective technologies.

In addition to all this, the 3GPP TSGs and their working groups are encouraged to liase directly with relevant technical bodies within the Project as well as among the Partners.

9.1.6 Conclusions

The attentive reader, and let's assume that you are one, may still be astonished to learn what big efforts have been necessary in order to establish 3GPP.

In the meantime, i.e. in the course of year 2000 nearly the whole work of the former ETSI TC SMG has been incorporated into 3GPP, to a large extent within the new TSG GERAN.

Well, our Japanese friends were not happy about this shift because they feared that it could result in delays in the 3G introduction in their country. They accepted this because a separate TSG for the GSM work was created.

Trying to recall the heated discussions within ETSI about the scope of 3GPP from 1998, one has to admit that such a move would have been violently rejected by a lot of ETSI members, maybe even by the majority. Using a philosophic approach, one can, of course, state that time helps healing (even wounds).

Today, i.e. February 2001, we can conclude from ETSI's point of view that all standardisation work related to further evolution of the second generation mobile system, i.e. GSM, and to UMTS is being done well within 3GPP. Thus, the objective to avoid parallel work within ETSI TBs and 3GPP has been fully achieved.

The ability of organisations and individuals around the world to co-operate and make available a full set of stable, agreed 3GPP specifications in 1 year is a remarkable achievement, one that is unprecedented in the world of standardisation. 3GPP meetings have taken place in many parts of the world, emphasising the strong commitment of the SDOs from China, Europe, Japan, Korea and the US. The MRPs have also lent very strong support to the work. Thanks to this widespread and determined commitment it has been possible to meet the very aggressive targets for 3G.

But Release 99 was only the first step – the workload has continued to intensify this year, as the initial specifications are refined and many new ones added, opening the path to full, seamless, global 3G services, changing forever the way that people communicate.

In the meantime, 3GPP has changed the designation of the releases and dropped to mention the year in order to avoid irritations and wrong expectations. Release 99 was first established in December 1999 and got its maturity in the course of year 2000. In 2000, more than 5700 change requests were implemented. The next big event will be Release #4 as a result of the

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 199 of 304

series of TSG meetings scheduled for March 2001 in Palm Springs, US. This will obviously result in a further stabilisation and extension of the UMTS specifications.

3GPP is running very well. The individual members from the six OPs seem to be very satisfied with this arrangement – and the production line is in full swing.

Without exaggeration, one can give 3GPP the attribute of a success story. One may quote again here Mr Ed Roney who even addressed the 3GPP concept – prior to its realisation – as a "paradigm shift".

As the results of the GSM and UMTS related standardisation work represent a great part of ETSI's deliverables, it might be justified to note here that during the year 2000, ETSI published more than seven new deliverables each working day (Monday through Friday), i.e. one deliverable per hour!

Further information may be found on the 3GPP website at http://www.3gpp.org.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 200 of 304

ile Communication

uis will obviously

seem to be very

. One may quote
realisation – as a

ent a great part of
year 2000, ETSI
through Friday),

gpp.org.

Chapter 9: The Third Generation Partnership Project (3GPP)

Section 2: UMTS in 3GPP (December 1998–May 2001)

Niels Peter Skov Andersen[1]

9.2.1 A Change of Environment

In the period 1982 until end of 1998 the work on the GSM standard, and in the later part of the period on UMTS, had been performed in the same environment, starting under CEPT and later transferred into ETSI. The Technical Committee GSM, during this period renamed to SMG, and its working groups (Sub Technical Committees) had continuously existed and evolved. The same was the case for the working methods and procedures used within the work. Over time with the success of the GSM system more and more interested parties became involved in the work including parties from outside the original CEPT area. However, this was all a relatively slow evolution and no major revolutions in the organisation or the working methods occurred in this period.

After all these years of continuity in the work the discussions around the creation of 3GPP and the decision to establish 3GPP for the initial phase of UMTS[2] naturally created some uncertainty amongst the members of SMG. Especially the resulting split of the GSM standardisation, with the responsibility for the GSM core network transferred to 3GPP, but the responsibility for the GSM radio access Network maintenance remained in ETSI in SMG. This caused some concern amongst many delegates. Also the internal structure for the technical work within 3GPP was different from the well-known structure in SMG. SMG was based on a technical plenary with a number of working groups (SMG1, SMG2, ..., SMG12) performing the detailed technical work. The SMG plenary was the approving authority for the results of the work performed by the working groups. Also the plenary was the group responsible for approval of all new work items and the content of the releases. The structure for the work in 3GPP, as agreed by the partners, was quite different. The project

[1] The views expressed in this section are those of the author and do not necessarily reflect the views of his affiliation [illegible].

[2] The term UMTS is throughout this section used to keep consistency of terminology with the other chapters and sections. The term UMTS do not appear in the in 3GPP agreement, which defines the system as a third generation mobile system based on an evolved GSM core network and UTRAN (including UTRAN (FDD and TDD modes)).

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 201 of 304

was organised with four equal Technical Specification Groups (TSGs), who had complete autonomy for their area of responsibility, i.e. they were responsible for approval of new work items and final approval of deliverables. The four technical groups originally defined were:

TSG CN	Responsible for the core network development
TSG-RAN	Responsible for the radio access network based on UTRAN (FDD and TDD modes)
TSG-SA	Responsible for services and system aspects
TST-T	Responsible for Terminal and UIM

In addition to the technical groups the 3GPP organisation has a Project Coordination Group (PCG). However, the role of this PCG cannot be compared to the role the SMG plenary played. The SMG plenary was an open technical group with the approving authority in all technical questions including approval of new work items. The 3GPP PCG is a closed group with a defined membership consisting of a limited number representative of each of the partners (SDOs, MRPs) and the leadership (chairman and two vice-chairmen) of each TSG. Thus as a closed group the role of the PCG becomes more like a board overlooking the overall well being of the project.

This structure made many long-term SMG delegates concerned about how the overall coordination of the project could be ensured. This new structure was not introduced to overcome known deficits of the SMG organisation, but in my opinion, by political considerations to ensure than no single individual, individual member, organisational partner could obtain a controlling position in the project.

9.2.2 The First Two TSG Meetings

The inauguration meeting of the 3GPP TSGs was held in December 1998 in Sophia Antipolis, France. In the process of creation of 3GPP this was the first time that the 3GPPs real work force – the technical experts – met. The main objectives for this first meeting was to get the work started. One of the elements of the meeting was a presentation from the different partners on the status of their work on the third generation mobile system, the work, which they now were in the process of handing over to 3GPP.

Listening to the presentations and the discussions during the breaks it was very obvious that the background for standardization amongst the delegates was quite different. As an example, I remember that during the coffee break just after I, as chairman of ETSI SMG2, had presented the status of the UMTS radio work in ETSI, and had ended my presentation by stating that the UMTS radio work would only be on the agenda of one more meeting of ETSI SMG2. This was in order to complete the documentation to be handed over to 3GPP and then the work on UMTS radio in ETSI would cease, a small group of non-ETSI delegates came to me and asked "if all work on UMTS radio in ETSI ceases, how do the Europeans then coordinate their views on 3GPP?" Coming from the ETSI SMG background this was a completely unexpected question, as the working procedures for 3GPP were very similar to those of ETSI, it was clear to me that the contributions to 3GPP in general should come from the individual members – the companies, regulators etc. – in their own name and not as regional contributions. I explained this, but I also understood that for delegates with a background in international standardization from, e.g. ITU this was the normal way of thinking. During the

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 202 of 304

first meeting a lot of small explanations similar to this were given over a cup of coffee and already by the second meeting there was a far better common understanding on how the work in the groups was intended to be performed.

Even though the partners, already before the first meeting of the TSGs, had made the principle decision of having four TSGs and had elaborated draft terms of references for the groups, the definition of the area of responsibility for the TSGs and refinement of the terms of references was a key item on the agenda. Each of the TSGs adjusted their terms of references and with some subsequent adjustments at the second meeting, the terms of reference for the TSGs have until now (March 2001) stayed the same except for few minor adjustments.

In order to get the detailed work started and not loose the momentum, which had existed in the SDOs before the creation of 3GPP, it was a very important task at the first meeting of the TSGs to get the detailed work within the TSGs organised so technical work could commence and progress in the period up to the second meetings of the TSGs in March 1999 in Fort Lauderdale. This part of the programme for the first meetings of the TSGs went well, and by the end of the meeting each of the TSGs had established between three and five working groups, outlined their area of responsibility and appointed convenors for the groups. With the establishment of the working groups the detailed technical work was ready to start, and already by the second meeting of the TSGs significant progress was reported.

By the second meeting of the TSGs, which took place in Fort Lauderdale, the complete atmosphere had changed from the general uncertainty and procedural questions to a far more technical focus, even though a few items of a management and organisational nature still needed to be sorted out. In addition, at this second meeting the leadership (chairman and vice-chairmen) for the individual TSGs was elected for the next 2-year period.

As indicated, one of the main differences with the 3GPP organisation compared to the organisation of SMG was the lack of a superior technical group with an open plenary with responsibility for the technical coordination, final decision making, conflict resolution and the project management including adaptation of work items, etc. Already the original description for the role of TSG SA, which was elaborated by partners together with the 3GPP agreement in Copenhagen in early December 1998, contained a paragraph on giving TSG SA the role of "High level co-ordination of the work performed in other TSGs and monitoring of progress". This role was subsequently reflected in the terms of references for TSG SA agreed at the first meeting of TSG SA (TSG SA#01). At the second meeting of TSG SA the TSG SA convenor Mr Fred Harrison, BT, provide a proposal[3] for how the TSG SA could fulfil its project coordination role. The key principles of the proposal were:

- To establish a project management function to create and maintain a cross TSG project programme including status of technical specification and reports.
- To establish close co-operation with TSG CN; TSG RAN and TSG T. Requiring the chairman or vice-chairman of each TSG to attend the TSG-SA meetings and bring new work items, issues and progress information to the attention of TSG-SA.

At the meeting another proposal[4] was received from a group of companies[5] who suggested that a TSG plenary be created, i.e. a fifth TSG with plenary function similar to that of ETSI

[3] SP-99050: proposals for managing the TSG project co-ordination role.
[4] SP-99068: TSG plenary.
[5] AT&T, BT, FRANCE TELECOM, NTT DOCOMO, TIM, TMOBIL.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 203 of 304

SMG. The argument for this proposal was that a TSG plenary would help to ensure overall project coordination and elaboration of a consistent and complete set of UMTS specifications.

After long discussions a compromise not requiring changes to the TSG structure was found and agreed. This comprise[6] was based on the following principles for the TSG SA's project coordination role:

- At least while performing its project co-ordination role, the TSG SA will not meet at the same time as other TSGs.
- At least one representative of TSGs RAN, CN and T and their working groups will attend each TSG SA meeting, to report on the activities of their respective TSG. They shall be responsible for bringing new work items, issues and progress statements on work such as specifications and existing work items from their respective TSGs to the attention of TSG SA.
- The TSG SA plenary will also include reports from its own working groups and facilitate information exchange between those working groups and the other TSGs.
- The TSG SA shall have arbitration responsibility to resolve disputes between TSGs.

As can be seen from the principles, the independence and the rights of the other TSGs was not touched by the compromise. Each TSG maintained its right to approve work items and deliverables, etc. As a result of the way forward on the TSG SA management role, the TSG meetings in Fort Lauderdale were the last meetings where all four TSGs met in parallel. At the subsequent TSG meetings in Shin-Yokohama in Japan at the end of April TSG CN, TSG RAN and TSG T met in parallel followed by TSG SA and the chairmen of TSG CN; TSG RAN and TSG T provided to TSG SA a status report on the work and progress in their respective TSGs. The TSG SA meetings starting from the third meeting in Shin-Yokohama then had a three part structure. A part related to TSG SA internal matters where the different TSG SA working groups report the progress of their work and submit their contributions for approval, this part is similar to the work in the other TSGs. A second part related to the technical coordination with the other TSGs and a third part dealt with general project management issues such as working methods, document handling, etc.

By the end of the second TSG meetings most of the "beginners" difficulties had been resolved, the interaction between the TSGs defined and TSG SA was ready to take on-board its role in the coordination role. Also the second TSG meetings showed that the detailed work in the working groups had got a good start, the work handed over from the partners was well received and progressing well. All in all, the definition and establishment phase of the technical work in 3GPP had been completed successfully and the transfer of work from the partners to 3GPP had been performed without causing any major disruption in the ongoing technical work.

9.2.3 The First Release – Release 99

After the two first two meetings of the TSGs where especially TSG SA had used time to organise the work, the third meetings were into their routine and could fully concentrate on the technical specification work.

The work in 3GPP followed the same basic methodology as was used for the GSM work in ETSI. The specifications generally are based on a three stage approach, with a

[6] SP-99087: proposals for managing the TSG project co-ordination role.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 204 of 304

description containing the functional requirements, stage 2 containing the overall functional description and architecture for a given functionality and stage 3 being the detailed technical specification down to the bit level. Working with this methodology the idea is of course that the stage 1 description is first completed or nearly completed so the requirements are clear. The next step is then to complete the stage 2 description and thereby define the overall architecture and functional split for the technical realisation of the functionality. When stage 2 is complete or close to completion the third step the stage 3 specifications containing the detailed technical specification is complete.

However, it was not possible for 3GPP to do this work serially, because of the very short timescale for completion of the first set of specifications in December 1999 only 1 year from 3GPP's creation in December 1998. Thus the work on stage 1, 2 and 3 specifications had to a large degree to be performed in parallel. Doing so TSG SA WG2, which is responsible for system architecture, quickly became a bottleneck in the process, as it was difficult, especially for TSG CN (core network) to draft the detailed specification before the architectural decisions were made. This problem peaked at the fourth TSG SA meeting in June 1999, when going through the status report from TSG SA WG2, where it became clear to the full membership that an extraordinary effort was needed to ensure that the architectural work was speeded up.

Standardisation by committee is not a traditional project, where the project leader can reallocate resources to the most urgent task. In standardisation the important task is to ensure that all the participants know and understand where additional effort is most urgently needed, so the volunteer work effort is pointed in the right direction. The recognition of the need for an extraordinary effort in TSG SA WG2 helped to speed up the architectural work and minimise the problem of TSG SA WG2 being a bottleneck. The initial delay of course made the work schedule even tougher for the groups responsible for the detailed stage 3 specifications.

As you can imagine it is not possible here to go into the details of the work, which led to the first set of specification from 3GPP in December 1999. In the following I will therefore only provide a few of examples of items, which required resolution by TSG SA.

For UMTS a new ciphering and authentication mechanism providing a higher degree of security has been developed. The SIM card (for UMTS USIM) is involved in the authentication process and calculates the necessary keys for the authentication and ciphering. Thus new SIM cards are required, or to be technically correct, cards with the USIM application are required. In the following I will use the short term USIM to indicate the card supporting the new security algorithms and SIM for the old cards supporting the GSM level of security. At the third meeting of the TSGs there was the question of whether the UMTS networks should only support USIM and thus always provide the highest possible degree of security or whether it should be possible to access a UMTS network with terminals with a SIM only. On one hand a number of delegates believed that it was preferable only to allow the usage of USIMs in the UMTS terminals, this on the other hand was questioned by operators that could foresee a slower roll-out of UMTS, e.g. due to the expected licensing time. For them a requirement for usage of USIM only in the UMTS terminals would leave them with two alternatives; either to issue USIMs even though they did not yet have a UMTS network, or be in a situation where their customers could not roam to, e.g. Japan and Korea with no GSM networks but only UMTS networks. This lead to a long discussion where it could have been tempting to perform a quick vote; however, to keep the good spirit of cooperation and

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 205 of 304

consensus based work I as 3GPP TSG SA chairman considered voting as an emergency solution if everything else failed. As almost always the attempt to find a solution for which consensus could be obtained succeeded. The comprise was found based on the following elements:[7]

- Support access to UMTS access networks while using cards equipped with either the SIM, the USIM functionality or both; and
- Allow a serving UMTS operator the option to block access to the UMTS access network when a card equipped only with a SIM functionality is used.

As usual when compromises of this type were obtained it was the assumption of the meeting that the companies/members who required the capability should do the work to specify the signalling and other mechanisms required.

At the fourth TSG meetings the very rare situation of one of the other TSGs raising an issue to TSG SA for resolution occurred. TSG CN had completed the feasibility study of the Gateway Location Register (GLR). TSG CN had then decided not to start specification work for the GLR. However, as some members of TSG CN had expressed strong interest in the GLR, it had been proposed to let the interested parties elaborate the specifications required for the GLR outside TSG CN and submit the result to TSG CN. This decision had caused some problems and the TSG CN raised the question to TSG SA of how to proceed, e.g. should a vote be taken. I as chairman of TSG SA indicated to the meeting that votes were to be seen as an emergency solution when everything else has failed. First, an attempt should be made to find a solution for which consensus can be obtained. For this explicit case it seemed clear that the resistance to start work on the GLR was coming from operators not seeing the need for a GLR and fearing that the introduction would impact existing networks and other networks without a GLR. On the other hand especially operators with no GSM legacy network showed a strong interest in the GLRs as a way to reduce the amount of international signalling caused by roamers moving around in very densely populated areas. Taking into account the strong interest and the concerns expressed, it was found, that there would be no problem, if a GLR could be done in such a way, that it had no impact on an existing HLR[8] (pre-3G), if a subscriber belonging to a HLR roamed onto a network utilising a GLR. Similarly the support of the GLR in one network should not impact networks not utilising the GLR. Based on this analysis, TSG SA recommended that TSG CN adopt a work item on GLR requiring a GLR to be fully compatible with old and new non-GLR networks. As hopefully can be seen from this example it is and has been a key priority in 3GPP to as far as possible base decisions on consensus as it also was the case for the GSM development in ETSI.

Another type of problem, which every now and then needs resolution at TSG level is the specific national or regional requirement often caused by the local regulation. Requirements that often can cause problems in relation to roaming. One example of this is the emergency call where TSG SA at meeting number 5 received a proposal[9] for national variation of terminals to cater for the differences in emergency call requirements. When GSM was introduced one unique number for initiating emergency calls had been defined (112), that ensured that a roaming user would always be able to perform a emergency call within

[7] SP-99208.
[8] HLR = home location register.
[9] SP-99481.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 206 of 304

knowing a any specific local situation. When GSM entered into new parts of the world this function had been improved by letting the local operator store a number on the SIM card which should be considered as the emergency call number, and thus, e.g. and American user could use 911 wherever he brought his mobile. However, there are other differences in the handling of emergency calls other than just the number to dial. The GSM solution only allows routing of emergency calls to one central emergency centre and does not differentiate the type of service needed such as ambulance, fire brigade or police. However, some operators had a regulatory requirement to route directly emergency calls to the relevant service and thus needed different numbers per service. Therefore, they had suggested having a national variation of terminals. After some discussion in TSG SA the proposal was rejected. The main reasons for this was that it was seen as essential to avoid local variations of terminals and secondly a solution based on local variation of terminals would not solve the problem of subscribers roaming from other parts of the world with terminals without the specific local variation. Anyhow, the rejection of the proposal did not mean that the problem was ignored; on the contrary the relevant working groups were tasked to find a generic solution, which would satisfy the local regulations without causing problems with roaming or requiring variation in terminals.

That the previous examples from the elaboration of 3GPP Release 99 all come from the TSG SA does not mean that this type of problem does not appear in the other TSGs. As also can be imagined, the specification of a complete new radio access network in TSG RAN in the timeframe of 1 year was one of the most demanding tasks during the elaboration of the first set of specifications from 3GPP (Release 99).

As mentioned earlier, when 3GPP started in December 1998 a target date of December 1999 was set for the first set of specifications. So the sixth meetings of the TSGs in Nice, France in December 1999 were the meetings where the status for the first year of 3GPP was to be made. In order to get a full overview of the status of the work and the degree of completion, the process for documenting the remaining open issues had been agreed amongst the chairs and vice-chairs of all of the TSGs.

The principle for this was relatively simple and building on the assumption and desire that a set of specifications should be completed and frozen at the sixth meetings of the TSGs. The term frozen meant that there should be no functional changes or additions made to the set of specifications, but only strictly necessary corrections of errors or omissions which if uncorrected risk making the system malfunction. The idea behind the principle was that at the next meetings of the TSGs all proposed changes to the specifications, which could not be justified as an essential correction should be rejected, unless an exception for that specific item had been given in December 1999. In order to document these exceptions all working groups and TSGs had prepared and forwarded to TSG SA sheets describing the non-completed functionality for which they wished to have granted an exception from the general rule of no functional changes. In addition to the description of the functionality, the sheet also indicated the consequences if this functionality was completely removed from Release 99.

TSG SA collected the status reports from the different groups and created a relatively large table[10] where on one side was the different functionalities and on the other side the different groups and in the table an indication if a group had requested an exception for completion of the functionality. After having created this table based on the status reports, TSG SA went through the table on a per functionality basis and evaluated the expected completion date and

[10] SP-99639

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 207 of 304

the necessity of the function in Release 99. In order to maximise the stability of the set of specifications, especially in the case where several groups had items open for the same functionality, specifications were scrutinised in detail and in several cases the functionality was completely removed from 3GPP Release 99. This review led to the removal of functionalities such as Enhanced Cell Broadcast, Tandem Free Operation for AMR, Support of Localised Service Area and a reduction in the location service functionality in Release 99.

At the end of the December 1999 TSG SA meeting approximately 80 exceptions from the rule of no functional changes were granted. At the following meeting of the TSGs in Madrid in March 2000 the status and the list of open items was once again reviewed and the number of open items was reduced from 80 to approximately 30. At the TSG meetings in June 2000 the remaining open items were completed and since then only necessary corrections could be made. However, it is to be understood, that when such a substantial set of specifications for the 3GPP Release 99 have been elaborated in the time frame of approximately 1 year, it is unavoidable that there are some ambiguities and errors in the specifications. It is a very important task to have these errors corrected in the specification as soon as they are discovered, as this is the only way to avoid small differences in implementation due to different solutions to errors. Differences which if not avoided could lead to problems of interoperability, etc. Also it should be noted that there will continuously be errors discovered in the specifications which need to be corrected, at least until every detail has been implemented and made operational in the field.

9.2.4 Introduction of Project Management

As indicated, one of the main differences with the 3GPP organisation compared to the organisation of SMG was the lack of a superior technical group with an open plenary with responsibility for the technical coordination, final decision making, conflict resolution and the project management including adaptation of work items, etc. Instead the different TSGs approved work items and technical work on their own. Even though they reported the status of their work to TSG SA there was no simple way to for linking a given functionality with the work being performed in the different TSGs. This was clearly a problem during the elaboration of Release 99, as it was difficult for the delegates to get an overview of which functionalities were on the critical path for completion. To get an overview actually required that key experts from the different areas sit together and fit the different parts of the puzzle. It therefore, required quite some effort in and outside the TSG meetings of December 1999 to provide an overview, which allowed the meetings to make conscious decisions.

As this potential problem was clear to me from the start of the project, I had, already at the second meeting of the TSGs in March 1999, had discussions with the chairmen of TSG SA WG1 and TSG SA WG2 on introducing a model for the project co-ordination which would follow the work from the initial requirements to completion. This model was then introduced for initial discussion to the leadership (chairmen and vice-chairmen) of the other TSGs at the third meeting of the TSGs. During the rest of 1999 additional background work was done in order to prepare for the introduction of the model for project co-ordination. At the December 1999 TSG SA the model was presented to TSG SA for approval and became the model for the organization of the work for the following releases and the basis for the overall project plan.

The model was based on the introduction of the Feature, Building Block and Work Task concept, and categorization and linkage of the work items. The model was thought of as a

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 208 of 304

reference model for structuring the work. It was not the intention to rigorously enforce the usage of the model on all ongoing work, but merely to use the model as a common reference model across the TSGs and to structure future work. The model took its origin from the typical flow for creation of a new feature or service and can briefly be described as follows.

TSG SA is through TSG SA WG1 responsible for defining the features and services required in the 3GPP specifications. TSG SA WG1 is responsible for producing the stage 1 descriptions (requirement) for the relevant features and passing them on to TSG SA WG2. TSG SA WG1 can also forward their considerations on possible architecture and implementation to TSG SA WG2, but is not responsible for this part of the work.

TSG SA WG2 should then define the architecture for the features and the system, and then divide the features into building blocks based on the architectural decisions made in TSG SA WG2. TSG SA WG2 will then forward the building blocks to the relevant TSGs for the detailed work. These proposals will be reviewed and discussed in an interactive way together with TSGs/WGs, until a common understanding of the required work is reached. During the detailed work of the TSGs and their working groups, TSG SA WG2 is kept informed about the progress.

The TSGs and their WGs treat the building block as one or several dedicated Work Tasks (WTs). The typical output of a given WT would be new specification(s), updated specification(s), technical report(s) or the conclusion that the necessary support is already provided in the existing specifications.

A part of TSG SA WG2's role is in co-operation with the TSGs and their WGs to identify if synergy can be obtained by using some of the building blocks or extended building blocks for more than one feature. Part of TSG SA WG2's task is to verify, that all required work for a full system specification of the features relevant take place within 3GPP without overlap between groups. In order for TSG SA WG2 to be successful, this has to be done in co-operation with other TSGs/WGs.

About the project scheduling: TSG SA WG1 sets a target, TSG SA WG2 performs a first technical review and comments on the target. TSG SA WG2 indicates some target for time schedule together with allocation of the defined building blocks. The TSGs and their WGs comment back on these targets. TSG SA WG2 tries if necessary to align the new target between the involved parties. TSG SA WG1 and TSG SA are kept informed of the overall schedule.

It was also in the model, it was identified as a task for TSG SA, TSG SA WG1 and TSG SA WG2 to ensure early involvement of TSG SA WG3 (working group responsible for security) to ensure that the potential security requirements, service requirements and the architectural requirements are aligned and communicated to the TSGs and their WGs.

In order for TSG T and its subgroups to plan and perform its horizontal tasks on conformance testing and mobile station capabilities, it was foreseen to invite TSG T to evaluate the potential impact of a new feature. Also work on the horizontal tasks is required to be included in the overall work plan.

With the acceptance of the modeling of the work based on the work breakdown into features, building blocks and work tasks, the next step was to map the work onto the model, create the corresponding work items for the features and building blocks and establish a first version of an overall project plan for 3GPP. In order to kick-start this process a number of Inter Group Coordination groups were establish within TSG SA WG2. The purpose of these groups was to try to establish a first version of a project plan for a given area. To ensure

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 209 of 304

the correctness of the information rapporteurs and representatives from the different working groups were invited to either participate or provide status and planning information, which then was used to establish a "traditional" project plan. Also the groups identified and informed the relevant groups if, e.g. building blocks or WTs were missing.

After the establishment of stable versions of the project plan covering ongoing activities for all of the TSGs and their working groups. The responsibility for maintenance of the project plan, was shifted so each TSG was made responsible for keeping updated the parts of the work plan, which correspond to their work. The practical maintenance of the project plan was then transferred to the MCC, the team of technical experts functioning as technical secretaries for the groups and responsible for implementation of the decisions of the meetings. The MCC corresponds to the Permanent Nucleus later known as PT12 during the elaboration of GSM.

Today the project plan is just another well functioning and convenient tool, which allows delegates and their organizations a quick overview of the status of the ongoing activities. However, this is only possible because the different groups and the MCC make a significant effort in keeping the plan up to date.

In the August 2000 TSG SA held an ad-hoc release planning, which recommended entirely controlling the 3GPP work program via the work plan, and doing this independent of releases. This recommendation, which later was confirmed by TSG SA further proposed that approved work items introduced into the plan are given calendar target dates and not particular release target dates. These "calendar" work item target dates will need to monitored and adjusted as work and knowledge about the work items progress. For this purpose reasonable milestones shall be defined. The work plan calendar should then also indicate planned future release dates with reasonable frequency to allow for stability, e.g. approximately every 12 months. depending on whether there would be enough completed work to justify the issue of a release.

The content of each release could then be easily deduced from the work plan, i.e. those items scheduled for completion by the closing day for the release being included in that particular release, a 3GPP road map. The definition of the content of a release could then be based upon the work plan, with a review of the release content starting approximately 6–9 months before the initial predicted closing date of the release. Work items not completed at the chosen closing time of the release are not included in that particular release. Maintaining the closing date of a release is a priority. Only when it is identified that no substantial new features would be available at the target date, is shifting the date considered to be an option.

In addition, independently of the actual release date, upon completion of a particular work item, the work item is frozen, denying any further functional change on the completed work item, permitting only essential technical corrections. This helps stabilize the specifications and the availability of the draft new release versions of the specifications can assist companies wanting to start developing the new features.

In all, the definition and establishment of an overall project plan was successful and has provided a high degree of visibility of 3GPP's activities. Especially, when the second set of specifications from 3GPP (Release 4) was completed in March 2001. The advantage of having the project plan to identify the completed features showed a major advantage and helped simplify the work compared to when Release 99 was completed. Also the process has changed from a release centric approach to a project plan approach with individual planning for each function or feature. To mark this change the naming of the releases was decoupled from the calendar and changed to refer to the version number on the specification and the

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 210 of 304

what would in the old philosophy have been called Release 2000 is called Release 4, which then is to be followed by Release 5, etc.

9.2.5 Technical Work in 3GPP Following the First Release

About the first release of specification from 3GPP, one can in short describe the system specified as a core network evolution where the circuit switched domain provides circuit oriented services based on nodal MSCs (an evolution of GSM). Similarly the packet switched domain provides IP-connectivity between the mobiles and IP-networks based on an evolved GSM GPRS core network. In contrast to this the radio access network is a complete revolution with a brand new radio access technology. From this background it was not a major surprise that the most significant changes to come in the next releases are focused on the core network side.

Already when the work after Release 99 was discussed for the first time at the fourth meeting of the TSGs in Miami, this trend was clear. It was at this meeting that 3GPP accepted the idea of specifying an all IP based architecture option, i.e. an architectural option not requiring the traditional nodal MSC. The work on an all IP based architectural option started with a short feasibility study to identify the implications and to plan the time-scales. However, this work progressed so fast and in parallel with the time critical task of completing Release 99 that several organization, especially those amongst the smaller operators had problems following the work. Also the architectural analysis progressed much faster than the work on requirements. Therefore, in order to bring everybody level again, it was, at the TSG meetings in December 1999, decided to hold a workshop on the subject of the "All IP" option. This workshop took place in Nice, France in February 2000.

The "All IP" workshop in February 2000 was organized as a two part event, the first part where members were invited to present their vision for the "All IP" work, being about operational scenarios, technical visions, etc. The second part of the workshop was used to draw up the general trends from the presentations and thereby identify the goals by going "All IP", the requirements for the solutions and the way forward.

From the discussions it was clear that the key motivator for moving toward the "All IP" option was to establish a flexible service creation environment, allowing for quick service/application creation with well defined APIs allowing for third party applications and thus allowing gain from Internet as well as intranet services. Further, the development should provide for real time applications including multimedia services, this to allow the operators to market new and interesting services allowing the creation of additional revenue streams. Further, the introduction of IP based architecture was seen as providing the option for independence of access type and thus allowing seamless services across different access networks. Also the independence of access type could allow savings through the common development of services for several access types. Clearly one of the key motivators for the operators' interest in an IP based architecture was the expectation of cost reduction due to the possibility of leveraging the IP technology cost factor and the expected gains from the better scalability compared to nodal switched based networks.

From the discussions at the workshop it was also clear that a hybrid circuit switched and packet switched network would exist for a long time. It was also clear that the changes towards the IP based architecture should not be done at any price. Especially, the need for an open multi-vendor environment with at least the same quality and security levels as the

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 211 of 304

"state of the art" mobile networks at the time of introduction. Another requirement identified due to the co-existence of the circuit switched and packet switched domains was the requirement for service transparency across domains. Finally, an important and far from trivial requirement to fulfill, was the need to respect spectrum efficiency. It was noted at the workshop, that the IP header was actually larger than a standard 20 ms speech frame in the cellular system, which on its own clearly made the spectrum efficiency requirement a challenge. During 2000 the need for being economical with spectrum was clearly illustrated by the prices paid at the 3G spectrum auctions, with payments of approximately US$35 billion in the UK and approximately US$50 billion in Germany for the licenses to install and operate 3G networks.

At the workshop in February 2000, there were different opinions about what would be a reasonable and realistic timescale for the specification of the IP based architecture option. Some of the large operators indicated that they felt that a target date of December 2000 was too aggressive and not realistic, whilst other large operators indicated that they believed it could be completed by December 2000 and wanted to keep a target date of December 2000. Even though it was never said, one of the reasons for the aggressive timescale was clearly to ensure that the focus especially from the manufacturers was kept on this development, and not risk unnecessary delays, due to a time schedule, which people might regard as relaxed.

Even though the initial time schedule kept a target date of December 2000, in the further work the size of the task quickly became clear and some more realism appeared in the definition of targets in terms of content and completion dates. With respect to this it should not be forgotten that in difference to when working on the creation of the first release (Release 99), 3GPP now had a major task to perform in parallel to all new developments, that was the maintenance and error correction of Release 99. As mentioned earlier the first years of maintenance of a brand new standard are very time consuming, and thus it was very ambitious to plan for a next release already 1 year after the first. Even though the GSM work in ETSI used an annual release schedule, one should not forget that it took more than 3 years from the stable specification for GSM phase 1 before it was followed by the second set of specification for GSM phase 2.

Anyhow the second release (Release 4) was planned for and completed in March 2001, this without the result of the ongoing IP based work, which is the target for the next release (Release 5) expected approximately 1 year later than Release 4. Thus Release 4 does not contain significant revolutionary news, but instead it contains a number of smaller features and functionalities, which can be seen as an important complement to Release 99.

The work on the IP based architecture for Release 5 is focusing on the introduction of an IP multimedia subsystem, the part of the IP based network providing the capabilities for multimedia services. This choice has been made in order to ensure that the first results of the "All IP" work do not only provide for alternative methods of providing already existing and well known services, but also allow the operators to create new innovative services and new revenue streams which can justify the investment in the IP based architecture. The service drivers for Release 5 have evolved to be compatible with Release 99 and Release 4, with the addition of IP based multimedia services, including efficient support for voice over IP over the radio for the multimedia services. In Release 5 it is foreseen that the circuit switched domain is retained and provides 100% backward compatibility for the circuit switched services. Similarly the existing packet service domain is kept and the IP multi-subsystem

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 212 of 304

is added and provides new IP multimedia services that complement the already existing services.

In the longer term, the IP multimedia subsystem might evolve to the extent to where it can provide all services previously provided by the CS-domain, and thus the specification will need to support all the commercial interesting services from today's circuit switched domain in the packet switched domain in the IP based architecture.

9.2.6 The Transfer of the Remaining GSM Activities into 3GPP

As described earlier, the original terms of reference for 3GPP covered a third generation mobile system based on an evolved GSM core network and UTRAN (including UTRAN (FDD and TDD modes)) and not covering the GSM/EDGE Radio Access Network (GERAN) part. This work together with a few other GSM only items remained in ETSI under the responsibility of SMG. This resulting split of the GSM standardization caused concern when 3GPP was created. However, time showed that it was possible to co-ordinate the work between 3GPP and SMG. For most areas, except for the GERAN specific work, co-locating the meetings of the SMG working groups with their corresponding 3GPP groups enabled the co-ordination. However, it was also clear that there was no longer one single forum with an overall responsibility for GSM as a system. This overall co-ordination was to some degree made during the TSG meetings, in the corridors and in the meetings by delegates, who ensured that the service, architectural and core network decisions would be compatible with the GERAN. However, this way of working reduced transparency of the background for arguments and decisions, both for those interested in the further development of GSM as a system and for those not interested in the GSM legacy.

In September 1999, Committee T1 sent a liaison to its 3GPP Organizational Partners requesting that the terms of reference of 3GPP be expanded to include evolved GSM radio access; that all evolutionary work of GSM should be transferred to 3GPP. The reasoning provided was that for the foreseeable future, the GSM/EDGE radio access would co-exist with the 3G radio access and there would be a clear benefit for all parties in ensuring co-ordination between the further GSM/EDGE development and the work related to the UTRAN access. Also the liaison statement indicated that by including the remaining GSM/EDGE radio work in 3GPP the overall number of meetings, liaison statements, etc. could be reduced and thus the efficiency increased.

At the 3GPP PCG meeting in January 2000, the responses from the other partners was tabled and discussed. ETSI indicated that they could support the proposal from T1 and suggested that the transfer should be effective from June 2000. ARIB indicated that 3GPP activities were based on common interest, meaning that each participating SDO and individual member needs to commit to the 3GPP objective and scope. ARIB continued that unfortunately, ARIB had no requirements to produce standards of GSM radio access including EGPRS in Japan. In conclusion ARIB could not support the request of ARIB individual members to take part in the study related to GSM radio access in 3GPP. Also the response from ARIB indicated concerns regarding potential impact on the timescales for the UMTS work as well as concern regarding financing of the project if not all parties had equal benefit of the work performed. TTA's response was very similar to that of ARIB additionally commenting that the existing process was functioning well.

At the PCG meeting CWTS indicated that they could support a transfer of the GSM radio

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 213 of 304

work into 3GPP. After some short discussions it was agreed to form an "Ad-Hoc Group on Movement of Work into 3GPP" to assess the impacts and appropriate program structure to support the transfer of appropriate ETSI/SMG and T1 programs related to the GSM/EDGE radio access into a 3GPP. It was agreed that the work should be based on the following key assumptions:

- Any proposed new 3GPP work items should have no negative impact on current Release 99/Release 4 schedules, resources and funding.
- Only those parties within 3GPP interested in contributing to 3GPP developments in the area of GSM/EDGE radio access will be required to resource and fund this specific activity.

The ad-hoc group, which was lead by a member of the T1 delegation to 3GPP, meet three times in order to elaborate on a detailed report covering the concerns, potential advantages and disadvantages of the transfer, and the proposal for how the transfer could be performed, in terms of organization, funding, timing, etc. At the final meeting of the ad-hoc group in late March 2000 in Tokyo the report of the ad-hoc group was completed and contained the following proposals:

- A new TSG should be created – TSG GERAN – into which essentially all current SMG2 work would be moved.
- The work of SMG7 would be moved into the proposed TSG GERAN.
- The generic operations and maintenance work of SMG 6 would be transferred to 3GPP TSG SA WG5, while radio-specific GERAN work in SMG 6 would be transferred into the proposed TSG GERAN.
- The work of SMG9 that is specific to GSM and 3GPP systems would be transferred into 3GPP T3.
- The other ETSI SMG groups already have direct SMG-3GPP correlation, and the corresponding groups are already meeting in parallel or at least in close collaboration. Therefore this proposal recommends the formal transfer of this work.

This proposal from the ad-hoc group was accepted by all the partners in 3GPP at the PCG and OP meetings in July 2000 in Beijing. At these meetings also the corresponding modifications to the 3GPP working procedures, project description, and partnership agreement was approved. At this meeting, terms of references for TSG GERAN was approved and I was appointed convenor for TSG GERAN with the task of convening the first meetings of TSG GERAN.

TSG GERAN held its first meeting in Seattle at the end of August 2000 on the days originally planned for the meeting of ETSI SMG2, which held its last meeting in late May 2000. With the transfer of the remaining GSM work from ETSI to 3GPP, the first part of the GSM era in standardization had finished and the forming of 3GPP completed.

The transfer of the GSM/EDGE radio activities to 3GPP went without any major problems and without causing any delays to ongoing GSM/EDGE or UMTS activities. The work in TSG GERAN is now focusing on upgrading the GSM/EDGE radio access network to support the Iu interface as defined for UMTS, as well as supporting the IP multimedia subsystem. This is in order to allow full independence for the core network from the type of radio access network used, being either UTRAN or GERAN. This of course only as long as the required

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 214 of 304

service from the radio access network is within the physical limitations of the radio access network in question.

As a part of the decision of transferring the remaining GSM activities into 3GPP it was agreed to perform an organizational review in a 6 month time frame after the transfer. This review was performed during early 2001 and at the PCG meeting in April 2001 it was as a result of this review concluded, that there was no need for changes to the 3GPP organizations. It was further noted that the current organization of 3GPP had been able to evolve and handle the changes and challenges appearing.

In all, 3GPP is now a mature organization able to continue the good work and the co-operative spirit, which was always the trademark of the GSM/SMG group.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 215 of 304

Annex 2: Organisation Evolution of the Technical Groups

Section 3: 3GPP

Adrian Scrase[1]

A2.3.1 December 1998 to Mid-1999

During the preparatory talks that led to the creation of 3GPP, many discussions took place to find the optimum organizational structure. The ETSI TC SMG model had worked well for many years and it was very tempting to adopt a similar structure and just widen the sphere of participation. However, some voices called for a more radical approach in order to streamline the structure and to reduce the time taken for specifications production. As a result of these discussions, the following key principles were established on which 3GPP was structured:

- Minimum number of hierarchical levels;
- Large degree of distributed autonomy;
- Clear separation of technical activities from political and administrative activities.

When 3GPP was created, four Technical Specification Groups (TSGs) were formed to undertake the preparation of technical specifications. The four TSGs were as follows:

- TSG CN – core network
- TSG RAN – radio access network
- TSG SA – services and system aspects
- TSG T – terminals

Each of the TSGs was authorized to develop and approve specifications and reports within its terms of reference. This represented a departure from the more traditional approach where a single entity (i.e. a plenary) within a project has the authority to approve a project's output. It was believed that by distributing the approval authority, the time taken to produce specifications would be reduced since this effectively removes one level of hierarchy from the approval procedure. However, it was apparent from the outset that distributing the approval of specifications would lead to a greater requirement for technical co-ordination and thus TSG SA was tasked to perform a co-ordination role across all TSGs. This co-ordination role

[1] The views expressed in this section are those of the author and do not necessarily reflect the views of his affiliation entity.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 216 of 304

has been aided by the collocation of the TSG meetings and by concerted efforts from the industrial members within 3GPP.

On the creation of 3GPP, a large amount of the work previously undertaken by ETSI TC SMG was transferred to the four TSGs. It was important for all involved to track the transfer of work carefully and meticulous care was taken to map the work from its old home in SMG to its new home in the 3GPP TSGs. This mapping information was made openly available on the 3GPP and ETSI websites to ensure that the telecommunications community could, as a whole, follow the work. This transfer of work was a form of "soft handover", with groups existing in parallel within SMG and within 3GPP for a period of time and items of work being transferred at the most appropriate point. The complete transfer of work was achieved within a period of 6 months.

The scope of 3GPP had been a subject of much debate and at the time of creation the scope covered the 3G system incorporating the UTRA radio access technology. This implied that not all of the work that existed within ETSI TC SMG was to be transferred to 3GPP. There remained a lot of work to be done for the evolving GSM radio interface (i.e. GPRS and EDGE) and this work would remain within SMG for the time being. In addition, the generic work relating to IC cards did not belong in 3GPP either and this too remained within ETSI TC SMG. SMG also retained the responsibility for European issues relating to both 2G and 3G, particularly for regulatory matters, and was also responsible for the transposition of 3GPP specifications into ETSI deliverables.

3GPP had no responsibility for the long-term evolution of the 3G system nor any responsibility for the fixed access component of UMTS. An ETSI project was therefore created (EP UMTS) to take care of these aspects.

A2.3.2 Mid-1999 to Mid-2000

3GPP was an entirely new concept and the first few months of operation were, in effect, experimental. However, in a very short time the project proved to be successful, and the industrial members gained confidence in the new method of working. The preparation of the first release of specifications proceeded at an alarming speed with more than 300 specifications being completed within the first year of operation. At the same time, the development of GPRS and EDGE continued within the ETSI TC SMG environment with active participation from North America. It was not long before serious consideration was to be given to the transfer of all remaining work and the closure of ETSI TC SMG.

An ad-hoc group was created within 3GPP in January 2000 to give full consideration to the widening of the 3GPP scope, particularly to include GPRS and EDGE. It was clear that not all 3GPP partners had a commercial interest in GPRS and EDGE and assurances were required that the ongoing UTRA based activities would not be unduly delayed by such a change in the 3GPP scope. By July 2000 the necessary agreements had been obtained by each 3GPP partner and the scope of 3GPP was formally changed to include the development and maintenance of GSM specifications, including the GSM evolved radio access technologies (such as the General Packet Radio Service (GPRS) and Enhanced Data Rates for GSM Evolution (EDGE)). This was achieved by the creation of a new TSG called TSG GERAN – GSM/EDGE Radio Access Network.

The scope of 3GPP was also modified to make clear that the responsibility for the long-

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 217 of 304

term evolution of the 3G system was vested there. This enabled the ETSI group EP UMTS to be closed, thus focusing efforts firmly within 3GPP.

With the transfer of GSM into 3GPP it was a natural progression for ETSI TC SMG to be closed. However, ETSI still had the important task of transposing the 3GPP results into ETSI deliverables and the preparation of harmonised standards required to meet European regulations. This activity was not expected to be particularly onerous but it was nevertheless of high important for the European industry. To accommodate this work, the ETSI TC Mobile Standards Group (TC MSG) was created.

The only remaining activity to be accommodated was the generic activity pertaining to IC cards. ETSI had earned a high reputation for this work and since it was not specific to mobile telecommunications systems it was not appropriate for this to be placed within 3GPP. This led to the creation of an ETSI project later to be called Smart Card Platform (EP SCP).

A2.3.3 Mid-2000 Onwards

By mid-2000 the focus of attention was now clearly on 3GPP where all UTRA based and GSM radio based activities were now taking place within five TSGs. The European regulatory interests were being taken care of by ETSI TC MSG, and the generic IC card activities by EP SCP. (The former TC SMG and EP UMTS had been closed by this time).

Within Europe, interest had been shown by the railway community to adapt the GSM system and to use it as the basis for a European railway telecommunications system. This work had progressed well within the former ETSI TC SMG with much of the work having been completed before its closure. The systems were now close to deployment and it was desirable to have a permanent home for these activities. This led to the creation of a new ETSI Project called Railway Telecommunications (EP RT).

By late 2000, 3GPP had grown used to having five TSGs and had gained some experience of operating with its expanded scope. Part of the agreement reached for the expansion of the scope was that a review should be held after 6 months of operation to ensure that the best organizational structure had been found. At the time of writing that review had just begun.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 218 of 304

A3.3 List of the Chairpersons in T1P1 and JTC[2]

Group	Name	Terms of Office Start	Terms of Office End
T1P1			
T1P1 chairs	Mel Woinsky	February 1994	February 1998
	Asok Chatterjee	February 1998	Expires February 2002
T1P1 vice-chairs	Mel Woinsky	February 1991	February 1994
	Jim Papadouplis	February 1994	February 1996
	Stephen Hayes	February 1996	June 1996
	Asok Chatterjee	June 1996	February 1998
	Mark Younge	February 1998	Expires February 2002
T1P1 working groups			
T1P1.4 chair	Ed Ehrlich	April 1995	July 1996
T1P1.5 chair	Ed Ehrlich	February 1996	February 2000
T1P1.5 vice-chair	Quent Cassen	February 1996	February 1998
	Don Zelmer	February 1998	February 2000
JTC			
Co-chairs	Gary Jones	February 1993	July 1996
	Charles Cook	February 1993	April 1995
	Ed Ehrlich	April 1995	July 1996

A3.4 Officials of 3GPP[3]

TSG/WG	Position	Name	Start date	End date
CN	Convenor	Stephen Hayes	1998-12-07	1999-03-03
	Chairman	Dettner Harald	1999-03-03	2000-03-15
	Chairman	Stephen Hayes	2000-03-15	
CN 1	Convenor	Hannu Hietalahti	1998-12-07	1999-03-22
	Chairman	Hannu Hietalahti	1999-03-22	
CN 2	Convenor	Masami Yabasaki	1998-12-07	1999-03-01
	Chairman	Ian David Chalmer Park	1998-12-07	2000-03-17
	Convenor	Keiijo Palviainen	2000-03-17	2000-05-26
	Chairman	Keiijo Palviainen	2000-05-26	
CN 3	Joint Convenors	Oscar Lopez-Torres and Norbert Klehn	1998-12-07	1999-03-15
	Chairman	Norbert Klehn	1999-03-15	
CN 4	Convenor	Yun Chao Hu	2000-05-26	
	Chairman	Yun Chao Hu	1999-11-04	2000-03-17

[2] Editor: Don Zelmer
[3] Editor: Adrian Scrase

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 219 of 304

TSG/WG	Position	Name	Start date	End date
CN 5	Convenor	Lucas Klostermann	2000-03-17	2000-05-25
	Chairman	Lucas Klostermann	2000-05-26	
CN ITU-T	Chairman	Masami Yabusaki	2000-03-17	
GERAN	Convenor	Niels Peter Skov Andersen	2000-07-31	2001-04-02
	Chairman	Niels Peter Skov Andersen	2001-04-02	
GERAN 1	Convenor	Niels Peter Skov Andersen	2000-08-28	2001-04-03
	Chairman	Niels Peter Skov Andersen	2001-04-03	
GERAN 2	Convenor	Jean-Francois Minet	2000-09-04	2000-11-10
	Chairman	Bruno Landais	2000-11-10	
GERAN 3	Convenor	Ake Busin	2000-08-28	2000-11-06
	Chairman	Ake Busin	2000-11-06	
GERAN 4	Convenor	Jean Marc Recouvreux	2000-08-28	2000-11-22
	Chairman	Jean-Marc Recouvreux	2000-11-23	
RAN	Convenor	Akio Sasaki	1998-12-07	1999-03-01
	Chairman	Yukitsuna Furuya	1999-03-01	2001-03-13
	Chairman	Francois Courau	2001-03-13	
RAN 1	Convenor	Yukitsuna Furuya	1998-12-07	1999-02-22
	Chairman	Antti Toskala	1999-02-22	
RAN 2	Convenor	Denis Fauconnier	1998-12-07	1999-03-08
	Chairman	Denis Fauconnier	1999-03-09	
RAN 3	Convenor	Per Willars	1998-12-07	1999-04-26
	Chairman	Per Willars	1999-04-26	2001-02-26
	Chairman	Martin Israelsson	2001-02-26	
RAN 4	Convenor	Howard Benn	1998-12-07	1999-02-15
	Chairman	Howard Benn	1999-02-15	
SA	Convenor	Fred Harrison	1998-12-07	1999-03-01
	Chairman	Niels Peter Skov Andersen	1999-03-01	
SA 1	Convenor	Alan Cox	1998-12-07	1999-03-10
	Chairman	Alan Cox	1999-03-10	2001-02-08
	Chairman	Kevin Holley	2001-02-08	
SA 2	Convenor	Yukio Hiramatsu	1998-12-07	1999-03-01
	Chairman	Teuvo Jarvela	1999-03-01	2001-02-26
	Chairman	Mikko Puuskari	2001-02-26	
SA 3	Convenor	Michael Walker	1998-12-07	1999-03-27
	Chairman	Michael Walker	1999-03-27	
SA 4	Convenor	Kari Järvinen	1998-12-07	1999-03-01
	Chairman	Alain Ohana	1999-03-01	2000-06-28
	Chairman	Kari Järvinen	2000-06-28	
SA 5	Convenor	Inaki Cabrera	1998-12-07	1999-03-01
	Chairman	Albert Yuhan	1999-03-01	
T	Convenor	Sang Keun Park	1998-12-07	1999-03-01
	Chairman	Sang Keun Park	1999-03-01	

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 220 of 304

TSG/WG	Position	Name	Start date	End date
T 1	Convenor	Remi Thomas	1998-12-07	1999-03-01
	Chairman	Bjarke Nielsen	1999-03-01	
T 2	Convenor	Kevin Holley	1998-12-07	1999-03-01
	Chairman	Kevin Holley	1999-03-01	
T 3	Convenor	Klaus Vedder	1998-12-07	1999-03-01
	Chairman	Klaus Vedder	1999-03-01	
PCG	Chairman	Karl Heinz Rosenbrock	1999-03-04	2000-12-31
	Chairman	Akio Sasaki	2001-01-01	

A3.5 List of the Chairpersons in the GSM MoU Group/Association and GSM Association[4]

Name	Start date	End Date
Armin Silberhorn	September 1987	March 1988
Philippe Dupuis	March 1988	September 1988
Renzo Failli	September 1988	March 1989
Ted Beddoes	March 1989	September 1989
Gunnar Fremin	September 1989	March 1990
Dick Hoefsloot	March 1990	September 1990
Petter Bliksrud	September 1990	March 1991
Miguel Menchen	March 1991	September 1991
Arne Foxman	September 1991	March 1992
Kari Marttinen	March 1992	March 1993
George Schmitt	March 1993	March 1994
Bruno Massiet du Biest	March 1994	March 1995
Mike Short	March 1995	March 1996
Gretel Holcomb Hoffman	March 1996	March 1997
Adriana Nugter	March 1997	April 1998
Richard Midgett	May 1998	April 1999
Michael Stocks	May 1999	April 2000
Jim Healy	May 2000	April 2001
Scott Fox	May 2001	April 2002

[4] Editor: Friedhelm Hillebrand.

Anne

3G
3GPP

3GPP2

ACTS

AMPS

AMR
ANSI
ARIB
CAMEL
CDMA

CEPT
CN
CR
CWTS
DCS1800

DECT
Doc
EDGE
EGPRS
ETSI
FPLMTS

GERAN
GHz
GPRS
GSM

GSM#1, 2, 3,
GSM1, 2, 3, e
GSM400, 900

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 221 of 304

Appendix 16

Hyung G. Myung and David J. Goodman

Single Carrier FDMA

A New Air Interface for Long Term Evolution



Wiley Series on Wireless Communications and Mobile Computing

WILEY

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 223 of 304

SINGLE CARRIER FDMA

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 224 of 304

Wiley Series on Wireless Communications and Mobile Computing

Series Editors: Dr Xuemin (Sherman) Shen, *University of Waterloo, Canada*
Dr Yi Pan, *Georgia State University, USA*

The 'Wiley Series on Wireless Communications and Mobile Computing' is a series of comprehensive, practical and timely books on wireless communication and network systems. The series focuses on topics ranging from wireless communication and coding theory to wireless applications and pervasive computing. The books offer engineers and other technical professional, researchers, educators, and advanced students in these fields invaluable insight into the latest developments and cutting-edge research.

Other titles in this series

Mišić and Mišić: *Wireless Personal Area Networks: Performance, Interconnections and Security with IEEE 802.15.4*, January 2008 987-0-470-51847-2

Takagi and Walke: *Spectrum Requirement Planning in Wireless Communications: Model and Methodology for IMT-Advanced*, April 2008 987-0-470-98647-9

Pérez-Fontán and Mariño Espiñeira: *Modeling the Wireless Propagation Channel: A Simulation Approach with MATLAB®*, August 2008 987-0-470-72785-0

Ippolito: *Satellite Communications Systems Engineering: Atmospheric Effects, Satellite Link Design and System Performance*, September 2008 978-0-470-72527-6

Lin and Sou: *Charging for Mobile All-IP Telecommunications*, September 2008 987-0-470-77565-3

Hart, Tao, Zhou: *IEEE 802.16j Multi-hop Relay*, March 2009 978-0-470-99399-6

Qian, Muller, Chen: *Security in Wireless Networks and Systems*, May 2009 978-0-470-51212-8

Wang, Kondi, Luthra, Ci: *4G Wireless Video Communications*, May 2009 978-0-470-77307-9

Shen, Cai, Mark: *Multimedia for Wireless Internet — Modeling and Analysis*, May 2009 978-0-470-77065-8

Stojmenovic: *Wireless Sensor and Actuator Networks: Algorithms and Protocols for Scalable Coordination and Data Communication*, August 2009 978-0-470-17082-3

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 225 of 304

SINGLE CARRIER FDMA

A NEW AIR INTERFACE FOR LONG TERM EVOLUTION

Hyung G. Myung

Qualcomm/Flarion Technologies, USA

David J. Goodman

Polytechnic University, USA

WILEY

A John Wiley and Sons, Ltd, Publication

Petitioners' Ex. 1016

Exhibit 2004
IPR2023-00919
Page 226 of 304

This edition first published 2008.
© 2008 John Wiley & Sons, Ltd.

Registered office
John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex, PO19 8SQ, United Kingdom

For details of our global editorial offices, for customer services and for information about how to apply for permission to reuse the copyright material in this book please see our website at www.wiley.com.

The right of the author to be identified as the author of this work has been asserted in accordance with the Copyright, Designs and Patents Act 1988.

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, except as permitted by the UK Copyright, Designs and Patents Act 1988, without the prior permission of the publisher.

Wiley also publishes its books in a variety of electronic formats. Some content that appears in print may not be available in electronic books.

Designations used by companies to distinguish their products are often claimed as trademarks. All brand names and product names used in this book are trade names, service marks, trademarks or registered trademarks of their respective owners. The publisher is not associated with any product or vendor mentioned in this book. This publication is designed to provide accurate and authoritative information in regard to the subject matter covered. It is sold on the understanding that the publisher is not engaged in rendering professional services. If professional advice or other expert assistance is required, the services of a competent professional should be sought.

Library of Congress Cataloging-in-Publication Data

Myung, Hyung G.
Single carrier FDMA : a new air interface for long term evolution / Hyung G. Myung, David J. Goodman.
p. cm.
Includes bibliographical references and index.
ISBN 978-0-470-72449-1 (cloth)
1. Wireless communication systems. 2. Mobile communication systems. I. Goodman, David J., 1939– II. Title.
TK5103.2.H983 2008
621.384–dc22

2008027441

A catalogue record for this book is available from the British Library.

ISBN 978-0-470-72449-1 (HB)

Typeset in 11/13pt Times by Aptara Inc., New Delhi, India.
Printed in Singapore by Markono Print Media Pte Ltd

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 227 of 304

Contents

Preface		**ix**
1	**Introduction**	**1**
1.1	Generations	1
1.2	Standards	3
1.3	Cellular Standards Organizations 3GPP and 3GPP2	3
1.4	IEEE Standards	6
1.5	Advanced Mobile Wireless Systems Based on FDMA	6
	1.5.1 IEEE 802.16e-Based Mobile WiMAX	6
	1.5.2 3GPP2 Ultra Mobile Broadband	8
	1.5.3 3GPP Long Term Evolution	8
	1.5.4 Summary and Comparison of Mobile WiMAX, LTE and UMB	10
1.6	Figures of Merit	11
1.7	Frequency Division Technology in Broadband Wireless Systems	12
	References	13
2	**Channel Characteristics and Frequency Multiplexing**	**15**
2.1	Introduction	15
2.2	Radio Channel Characteristics	15
	2.2.1 Physics of Radio Transmission	16
	2.2.2 Effects of Extraneous Signals	21
	2.2.3 Transmitting and Receiving Equipment	23
	2.2.4 Radio Propagation Models	24
2.3	Orthogonal Frequency Division Multiplexing	25
	2.3.1 Signal Processing	26
	2.3.2 Advantages and Weaknesses	29

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 228 of 304

2.4 Single Carrier Modulation with Frequency Domain Equalization 30
2.4.1 Frequency Domain Equalization 30
2.4.2 Comparison with OFDM 32
2.5 Summary 34
References 35

3 Single Carrier FDMA **37**
3.1 Introduction 37
3.2 SC-FDMA Signal Processing 38
3.3 Subcarrier Mapping 42
3.4 Time Domain Representation of SC-FDMA Signals 44
3.4.1 Time Domain Symbols of IFDMA 45
3.4.2 Time Domain Symbols of LFDMA 47
3.4.3 Time Domain Symbols of DFDMA 48
3.4.4 Comparison of Subcarrier Mapping Schemes 48
3.5 SC-FDMA and Orthogonal Frequency Division Multiple Access 50
3.6 SC-FDMA and CDMA with Frequency Domain Equalization 53
3.7 Single Carrier Code-Frequency Division Multiple Access (SC-CFDMA) 55
3.8 Summary 57
References 59

4 SC-FDMA in 3GPP Long Term Evolution **61**
4.1 Introduction 61
4.1.1 3GPP Technical Specifications 61
4.1.2 Contents of the Physical Layer Technical Specifications 62
4.2 Protocol Layers and Channels 63
4.3 Uplink Time and Frequency Structure 67
4.3.1 Frames and Slots 67
4.3.2 Resource Blocks 69
4.4 Basic Uplink Physical Channel Processing 71
4.5 Reference (Pilot) Signal Structure 76
4.6 Summary 77
References 78
4.7 Appendix – List of 3GPP LTE Standards 78

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 229 of 304

5 Channel Dependent Scheduling 83
5.1 Introduction 83
5.2 SC-FDMA Performance Measures 88
5.3 Scheduling Algorithms 91
5.4 Channel Models used in Scheduling Studies 93
5.5 Channel-Dependent Scheduling Simulation Studies 95
5.5.1 Schedules Based on Perfect Channel State Information 96
5.5.2 Schedules Based on Delayed Channel State Information 101
5.5.3 Discussion of Scheduling Studies 103
5.6 Summary 105
References 105

6 MIMO SC-FDMA 107
6.1 Introduction 107
6.2 Spatial Diversity and Spatial Multiplexing in MIMO Systems 108
6.3 MIMO Channel 109
6.4 SC-FDMA Transmit Eigen-Beamforming with Unitary Precoding 111
6.4.1 Impact of Imperfect Feedback: Precoder Quantization/Averaging 113
6.4.2 Impact of Imperfect Feedback: Feedback Delay 115
6.5 SC-FDMA Spatial Diversity 117
6.6 Summary 117
References 120

7 Peak Power Characteristics of a SC-FDMA Signal 123
7.1 Introduction 123
7.2 Peak Power Characteristics of a Single Carrier Signal 124
7.3 PAPR of Single Antenna Transmission Signals 128
7.4 PAPR of Multiple Antenna Transmission Signals 132
7.5 Peak Power Reduction by Symbol Amplitude Clipping 136
7.6 Summary 141
References 142

8 Simulation of a SC-FDMA System Using MATLAB® 143
8.1 Introduction 143
8.2 Link Level Simulation of SC/FDE 143
8.3 Link Level Simulation of SC-FDMA 146
8.4 Peak-to-Average Power Ratio Simulation of SC-FDMA 149

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 230 of 304

8.5 Summary 150
References 150
Appendix – Simulation Codes 151
MATLAB® Simulation Codes for SC/FDE 151
MATLAB® Simulation Codes for SC-FDMA (Link Level) 155
MATLAB® Simulation Codes for SC-FDMA and OFDMA (PAPR) 159

Appendix A: Derivation of Time Domain Symbols of Localized FDMA and Distributed FDMA **165**
A.1 Time Domain Symbols of LFDMA 165
A.2 Time Domain Symbols of DFDMA 167

Appendix B: Derivations of the Upper Bounds in Chapter 7 **171**
B.1 Derivation of Equations (7.9) and (7.10) in Chapter 7 171
B.2 Derivations of Equations (7.13) and (7.14) in Chapter 7 172

Appendix C: Deciphering the 3GPP LTE Specifications **175**

Appendix D: Abbreviations **179**

Index **183**

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 231 of 304

1

Introduction

In less than three decades, the status of cellular telephones has moved from laboratory breadboard via curious luxury item to the world's most pervasive consumer electronics product. Cellular phones have incorporated an ever-growing array of other products including pagers, cameras, camcorders, music players, game machines, organizers, and web browsers. Even though wired telephony is 100 years older and the beneficiary of "universal service" policies in developed countries, the number of cellular phones has exceeded wired phones for a few years and the difference keeps growing. For hundreds of millions of people in developing countries, cellular communications is the only form of telephony they have experienced.

First conceived as a marriage of mature telephony and mature radio communications, cellular communications is now widely recognized as its own technical area and a driver of innovation in a wide range of technical fields including – in addition to telephony and radio – computing, electronics, cryptography, and signal processing.

1.1 Generations

The subject of this book, Single Carrier Frequency Division Multiple Access (SC-FDMA), is a novel method of radio transmission under consideration for deployment in future cellular systems. The development of SC-FDMA represents one step in the rapid evolution of cellular technology. Although technical progress is continuous and commercial systems frequently adopt new improvements, certain major advances mark the transition from one generation of technology to another. First generation systems, introduced in the early 1980s, were characterized by analog

Single Carrier FDMA: A New Air Interface for Long Term Evolution Hyung G. Myung and David J. Goodman
© 2008 John Wiley & Sons, Ltd

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 232 of 304

speech transmission. Second generation technology, deployed in the 1990s, transmits speech in digital format. Equally important, second generation systems introduced advanced security and networking technologies that make it possible for a subscriber to initiate and receive phone calls throughout the world.

Even before the earliest second generation systems arrived on the market, the cellular community turned its attention to third generation (3G) technology with the focus on higher bit rates, greater spectrum efficiency, and information services in addition to voice telephony. In 1985, the International Telecommunication Union (ITU) initiated studies of Future Public Land Telecommunication Systems [1]. Fifteen years later, under the heading IMT-2000 (International Mobile Telecommunications-2000), the ITU issued a set of recommendations, endorsing five technologies as the basis of 3G mobile communications systems. In 2008, cellular operating companies are deploying two of these technologies, referred to as WCDMA (wideband code division multiple access) and CDMA2000, where and when they are justified by commercial considerations. Meanwhile, the industry is looking beyond 3G and considering SC-FDMA as a leading candidate for the "long term evolution" (LTE) of radio transmissions from cellular phones to base stations. It is anticipated that LTE technology will be deployed commercially around 2010 [2].

With respect to radio technology, successive cellular generations have migrated to signals transmitted in wider and wider radio frequency bands. The radio signals of first generation systems occupied bandwidths of 25 and 30 kHz, using a variety of incompatible frequency modulation formats. Although some second generation systems occupied equally narrow bands, the two that are most widely deployed, GSM and CDMA, occupy bandwidths of 200 kHz and 1.25 MHz, respectively. The third generation WCDMA system transmits signals in a 5 MHz band. This is the approximate bandwidth of the version of CDMA2000 referred as 3X-RTT (radio transmission technology at three times the bandwidth of the second generation CDMA system). The version of CDMA2000 with a large commercial market is 1X-RTT. Its signals occupy the same 1.25 MHz bandwidth as second generation CDMA, and in fact it represents a graceful upgrade of the original CDMA technology. For this reason, some observers refer to 1X-RTT as a 2.5G technology [3]. Planners anticipate even wider signal bands for the long term evolution of cellular systems. Orthogonal Frequency Division Multiplexing (OFDM) and SC-FDMA are attractive technologies for the 20 MHz signal bands under consideration for the next generation of cellular systems.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 233 of 304

1.2 Standards

The technologies employed in cellular systems are defined formally in documents referred to as "compatibility specifications". A compatibility specification is one type of technical standard. Its purpose is to ensure that two different network elements interact properly. In the context of cellular communications, the two most obvious examples of interacting equipment types are cellular phones and base stations. As readers of this book are aware, standards organizations define a large number of other network elements necessary for the operation of today's complex cellular networks.

In addition to cellular phones and base stations, the most familiar cellular network elements are mobile switching centers, home location registers, and visitor location registers. In referring to standards documents, it is helpful to keep in mind that the network elements defined in the documents are "functional" elements, rather than discrete pieces of equipment. Thus, two different network elements, such as a visitor location register and a mobile switching center, can appear in the same equipment and the functions of a single network element (such as a base transceiver station) can be distributed among dispersed devices.

Figure 1.1 shows the network elements and interfaces in one 3G system [4]. The network elements (referred to in the standards as "entities") are contained in four major groups enclosed by dotted boxes. The core network (CN) is at the top of the figure. Below the core network is the radio access network with three sets of elements; a Base Station System (BSS) exchanges radio signals with mobile stations (MS) to deliver circuit switched services, and a corresponding Radio Network System (RNS) exchanges radio signals with mobile stations to deliver packet switched services. This book focuses on the radio signals traveling across the air interfaces. The Um interface applies to circuit switched services carrying signals between mobile stations and Base Transceiver Stations (BTS). Uu applies to packet switched services carrying signals between a mobile station and a base station system.

1.3 Cellular Standards Organizations 3GPP and 3GPP2

Two Third Generation Partnership Projects publish 3GPP cellular standards. The original Partnership Project, 3GPP, is concerned with descendents of the Global System for Mobile (GSM). The 3G technologies standardized by 3GPP are often referred to collectively as WCDMA (wideband code division multiple access). 3GPP uses two other acronyms

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 234 of 304

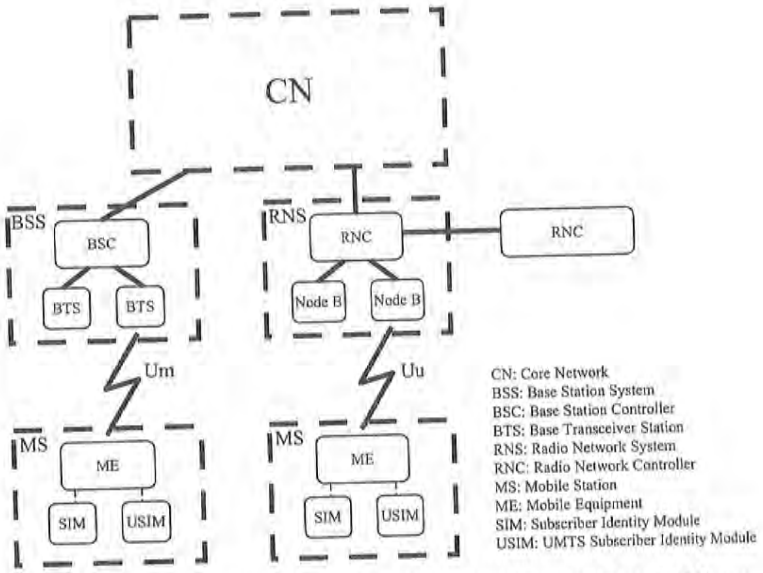


Figure 1.1 Basic configuration of a public land mobile network (PLMN) supporting circuit switched (CS) and packet switched (PS) services and interfaces [4]. *Source:* ETSI (European Telecommunications Standards Institute) © 2007. 3GPP™ TSs and TRs are the property of ARIB, ATIS, CCSA, ETSI, TTA and TTC who jointly own the copyright in them. They are subject to further modifications and are therefore provided to you "as is" for information purposes only. Further use is strictly prohibited.

to describe its specifications: UMTS (Universal Mobile Telecommunications System) applies to the entire cellular network contained in hundreds of 3GPP specifications; and UTRAN (Universal Terrestrial Radio Access Network) refers to the collection of network elements, and their interfaces, used for transmission between mobile terminals and the network infrastructure. The other project, 3GPP2, is concerned with advanced versions of the original CDMA cellular system. The technologies standardized by 3GPP2 are often referred to collectively as CDMA2000.

The Partnership Projects consist of "organizational partners", "market representation partners", and "individual members". The organizational partners are the regional and national standards organizations, listed in Table 1.1, based in North America, Europe, and Asia. The market representation partners are industry associations that promote deployment of specific technologies. The individual members are companies associated with one

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 235 of 304

Table 1.1 Organizational members of the Partnership Projects

Organizational member	Nationality	Affiliation
Association of Radio Industries and Businesses	Japan	3GPP and 3GPP2
Alliance for Telecommunication Industry Solutions	United States	3GPP
China Communications Standards Association	China	3GPP and 3GPP2
European Telecommunication Standards Institute	Europe	3GPP
Telecommunications Industry Association	North America	3GPP2
Telecommunications Technology Association	Korea	3GPP and 3GPP2
Telecommunication Technology Committee	Japan	3GPP and 3GPP2

or more of the organizational partners. In October 2006 there were 297 individual members of 3GPP and 82 individual members of 3GPP2.

The technologies embodied in WCDMA and CDMA2000 appear in hundreds of technical specifications covering all aspects of a cellular network. In both Partnership Projects, responsibility for producing the specifications is delegated to Technical Specification Groups (TSG), each covering one category of technologies. In 3GPP, the TSGs are further subdivided into Work Groups (WG). The publication policies of the two Partnership Projects are different. 3GPP periodically "freezes" a complete set of standards, including many new specifications. Each set is referred to as a "Release". Each Release is complete in that it incorporates all unchanged sections of previous standards that are still in effect as well as any new and changed sections. 3GPP also publishes preliminary specifications that will form part of a future Release. By contrast, each TSG in 3GPP2 publishes a new or updated specification whenever the specification obtains necessary approvals.

Release 5 of WCDMA was frozen in 2002, Release 6 in 2005, and Release 7 in 2007 [5]. In 2008, LTE specifications are being finalized as Release 8. Two of the innovations in Release 5 are High Speed Downlink Packet Access (HSDPA) and the IP Multimedia Subsystem (IMS). In Release 6, the innovations are High Speed Uplink Packet Access (HSUPA), the Multimedia Broadcast/Multicast Service (MBMS), and Wireless LAN/cellular interaction, and in Release 7, Multiple Input

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 236 of 304

Multiple Output (MIMO) and higher order modulation. Release 8 deliberations focus on the Long Term Evolution (LTE) of WCDMA. In the Radio Access Network (RAN), the LTE goals are data rates "up to 100 Mbps in full mobility wide area deployments and up to 1 Gbps in low mobility, local area deployments" [6]. For best effort packet communication, the long term spectral efficiency targets are 5–10 b/s/Hz in a single (isolated) cell; and up to 2–3 b/s/Hz in a multi-cellular case [6]. In this context, SC-FDMA is under consideration for transmission from mobile stations to a Base Station Subsystem or a Radio Network System.

1.4 IEEE Standards

In addition to the two cellular Partnership Projects, the Institute of Electrical and Electronic Engineers (IEEE) has published standards used throughout the world in products with a mass market. Within the IEEE LAN/MAN standards committee (Project 802), there are several working groups responsible for wireless communications technologies. The one with the greatest influence to date is IEEE 802.11, responsible for the "WiFi" family of wireless local area networks. Two of the networks conforming to the specifications IEEE 802.11a and IEEE 802.11g employ OFDM technology for transmission at bit rates up to 54 Mb/s [7,8]. The other working group standardizing OFDM technology is IEEE 802.16, responsible for wireless metropolitan area networks. Among the standards produced by this working group, IEEE802.16e, referred to as "WiMAX" and described in the next section, most closely resembles technology under consideration by 3GPP for cellular long term evolution.

1.5 Advanced Mobile Wireless Systems Based on FDMA

Three standards organizations, IEEE, 3GPP, and 3GPP2, have work in progress on advanced mobile broadband systems using frequency division transmission technology. The following subsections describe key properties of Mobile WiMAX (developed by the IEEE), Ultra Mobile Broadband (developed by 3GPP2), and 3GPP Long Term Evolution (LTE). SC-FDMA, the subject of this book, is a component of LTE.

1.5.1 IEEE 802.16e-Based Mobile WiMAX

Following in the footsteps of the highly successful IEEE 802.11 family of wireless local area network (WLAN) standards, the IEEE 802.16 Working Group on Broadband Wireless Access (BWA) began its work of

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 237 of 304

Table 1.2 Evolution of the IEEE 802.16 standard

Standards	Publication date	Highlights
802.16	Apr. 2002	Line-of-sight fixed operation in 10 to 66 GHz band.
802.16a	Apr. 2003	Air interface support for 2 to 11 GHz band.
802.16-2004 (802.16d)	Oct. 2004	Minor improvements and fixes to 802.16a.
802.16e	Feb. 2006	Support for vehicular mobility and asymmetrical link.
802.16m	In progress	Higher peak data rate, reduced latency, and efficient security mechanism.

developing the IEEE 802.16 wireless metropolitan area network (WMAN) standards in July 1999. Initially, IEEE 802.16 primarily focused on a point-to-multipoint topology with a cellular deployment of base stations, each tied into core networks and in contact with fixed wireless subscriber stations.

Since the first publication of the standard in 2002, the IEEE 802.16 standard has evolved through various amendments and IEEE 802.16e, published in February 2006, specifies physical and medium access control layers for both fixed and mobile operations [9]. Currently, 802.16m is being developed for the next generation system. Table 1.2 summarizes the IEEE 802.16 evolution.

Mobile WiMAX is an IEEE 802.11e-based technology maintained by the WiMAX Forum [10], which is an organization of more than 400 operators and communications component/equipment companies. Its charter is to promote and certify the compatibility and interoperability of broadband wireless access equipment that conforms to the IEEE 802.16 specifications. The WiMAX Forum Network Working Group (NWG) develops the higher-level networking specifications for Mobile WiMAX systems beyond what is defined in the IEEE 802.16 specifications, which address the air interface only.

Key features of the 802.16e-based Mobile WiMAX are:

- Up to 63 Mb/s for downlink and up to 28 Mb/s for uplink per sector throughput in a 10 MHz band.
- End-to-end IP-based Quality of Service (QoS).

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 238 of 304

- Scalable OFDMA and spectrum scalability.
- Robust security: Extensible Authentication Protocol (EAP)-based authentication, AES-CCM-based authenticated encryption, and CMAC/HMAC-based control message protection schemes.
- Optimized handoff scheme and low latency.
- Adaptive modulation and coding (AMC).
- Hybrid automatic repeat request (HARQ) and fast channel feedback.
- Smart antenna technologies: beamforming, space-time coding, and spatial multiplexing.
- Multicast and broadcast service (MBS).

1.5.2 3GPP2 Ultra Mobile Broadband

3GPP2 developed Ultra Mobile Broadband (UMB) based on the frameworks of CDMA2000 1xEV-DO revision C [11], IEEE 802.20 [12], and Qualcomm Flarion Technologies' FLASH-OFDM [13]. The UMB standard was published in April 2007 by the 3GPP2 and the UMB system is expected to be commercially available in early 2009.

The key features of UMB include [11]:

- OFDMA-based air interface.
- Multiple Input Multiple Output (MIMO) and Space Division Multiple Access (SDMA).
- Improved interference management techniques.
- Up to 280 Mb/s peak data rate on forward link and up to 68 Mb/s peak data rate on reverse link.
- An average of 16.8 msec (32-byte, round trip time) end-to-end network latency.
- Up to 500 simultaneous VoIP users (10 MHz FDD allocations).
- Scalable IP-based flat or hierarchical architecture.
- Flexible spectrum allocations: scalable, noncontiguous, and dynamic channel (bandwidth) allocations and support for bandwidth allocations of 1.25 MHz, 5 MHz, 10 MHz, and 20 MHz.
- Low power consumption and improved battery life.

1.5.3 3GPP Long Term Evolution

3GPP's work on the evolution of the 3G mobile system started with the Radio Access Network (RAN) Evolution workshop in November 2004

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 239 of 304

[14]. Operators, manufacturers, and research institutes presented more than 40 contributions with views and proposals on the evolution of the Universal Terrestrial Radio Access Network (UTRAN), which is the foundation for UMTS/WCDMA systems. They identified a set of high level requirements at the workshop: reduced cost per bit, increased service provisioning, flexibility of the use of existing and new frequency bands, simplified architecture and open interfaces, and reasonable terminal power consumption. With the conclusions of this workshop and with broad support from 3GPP members, a feasibility study on the Universal Terrestrial Radio Access (UTRA) and UTRAN Long Term Evolution started in December 2004. The objective was to develop a framework for the evolution of the 3GPP radio access technology towards a high-data-rate, low-latency, and packet-optimized radio access technology. The study focused on means to support flexible transmission bandwidth of up to 20 MHz, introduction of new transmission schemes, advanced multi-antenna technologies, signaling optimization, identification of the optimum UTRAN network architecture, and functional split between radio access network nodes.

The first part of the study resulted in an agreement on the requirements for the Evolved UTRAN (E-UTRAN). Key aspects of the requirements are as follows [15]:

- Up to 100 Mb/s within a 20 MHz downlink spectrum allocation (5 b/s/Hz) and 50 Mb/s (2.5 b/s/Hz) within a 20 MHz uplink spectrum allocation.
- Control-plane capacity: at least 200 users per cell should be supported in the active state for spectrum allocations up to 5 MHz.
- User-plane latency: less than 5 msec in an unloaded condition (i.e., single user with single data stream) for small IP packet.
- Mobility: E-UTRAN should be optimized for low mobile speeds 0–15 km/h. Higher mobile speeds between 15 and 120 km/h should be supported with high performance. Connections shall be maintained at speeds 120–350 km/h (or even up to 500 km/h depending on the frequency band).
- Coverage: throughput, spectrum efficiency, and mobility targets should be met for 5 km cells and with a slight degradation for 30 km cells. Cells ranging up to 100 km should not be precluded.
- Enhanced multimedia broadcast multicast service (E-MBMS).
- Spectrum flexibility: E-UTRA shall operate in spectrum allocations of different sizes including 1.25 MHz, 1.6 MHz, 2.5 MHz, 5 MHz, 10 MHz, 15 MHz, and 20 MHz in both uplink and downlink.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 240 of 304

- Architecture and migration: packet-based single E-UTRAN architecture with provision to support systems supporting real-time and conversational class traffic and support for an end-to-end QoS.
- Radio Resource Management: enhanced support for end-to-end QoS, efficient support for transmission of higher layers, and support of load sharing and policy management across different radio access technologies.

The wide set of options initially identified by the early LTE work was narrowed down in December 2005 to a working assumption that the downlink would use Orthogonal Frequency Division Multiplex (OFDM) and the uplink would use Single Carrier Frequency Division Multiple Access (SC-FDMA). Supported data modulation schemes are QPSK, 16QAM, and 64QAM. The use of Multiple Input Multiple Output (MIMO) technology with up to four antennas at the mobile side and four antennas at the base station was agreed. Re-using the expertise from the UTRAN, they agreed to the same channel coding type as UTRAN (turbo codes), and to a transmission time interval (TTI) of 1 msec to reduce signaling overhead and to improve efficiency [16,17].

The study item phase ended in September 2006 and the LTE specification is due to be published in 2008.

1.5.4 Summary and Comparison of Mobile WiMAX, LTE and UMB

In summary, the upcoming systems beyond 3G overviewed in the previous sections have the following features in common:

- Up to 20 MHz transmission bandwidth.
- Multi-carrier air interface for robustness against frequency-selective fading and for increased spectral efficiency: OFDM/OFDMA and its variant forms are the basic modulation and multiple access schemes.
- Advanced multi-antenna techniques: various MIMO techniques are integrated to the system to increase spectral efficiency and to make the link more reliable.
- Fast time-frequency resource scheduling.
- Flat all-IP network architecture: reduced network overhead by eliminating network layers.
- Multicast and broadcast multimedia service.

Table 1.3 compares the air interfaces of the three beyond-3G systems.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 241 of 304

Table 1.3 Summary and comparison of Mobile WiMAX, LTE and UMB

	Mobile WiMAX	3GPP LTE	3GPP2 UMB
Channel bandwidth	5, 7, 8.75, and 10 MHz	1.4, 3, 5, 10, 15, and 20 MHz	1.25, 2.5, 5, 10, and 20 MHz
DL multiplex	OFDM	OFDM	OFDM
UL multiple access	OFDMA	SC-FDMA	OFDMA and CDMA
Duplexing	TDD	FDD and TDD	FDD and TDD
Subcarrier mapping	Localized and distributed	Localized	Localized and distributed
Subcarrier hopping	Yes	Yes	Yes
Data modulation	QPSK, 16-QAM, and 64-QAM	QPSK, 16-QAM, and 64-QAM	QPSK, 8-PSK, 16-QAM, and 64-QAM
Subcarrier spacing	10.94 kHz	15 kHz	9.6 kHz
FFT size (5 MHz bandwidth)	512	512	512
Channel coding	Convolutional coding and convolutional turbo coding: block turbo coding and LDPC coding optional	Convolutional coding and turbo coding	Convolutional coding, turbo coding, and LDPC coding
MIMO	Beamforming, space-time coding, and spatial multiplexing	Multi-layer precoded spatial multiplexing, space-time/ frequency block coding, switched transmit diversity, and cyclic delay diversity	Multi-layer precoded spatial multiplexing, space-time transmit diversity, spatial division multiple access, and beamforming

1.6 Figures of Merit

Standards organizations, in principle, provide a venue for interested parties to establish the technologies that provide the best tradeoff among a variety of performance objectives. In practice, the aim for excellence is modulated by the need for industry participants to advance the interests of

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 242 of 304

their employers. In balancing these conflicting interests, the organizations measure possible solutions with respect to several figures of merit. The figures of merit most relevant to the systems covered in this book are spectral efficiency, throughput, delay, and power consumption in mobile portable devices.

SC-FDMA, which utilizes single carrier modulation, DFT-precoded orthogonal frequency multiplexing, and frequency domain equalization, is a technique that has similar performance and essentially the same overall complexity as OFDMA. One prominent advantage over OFDMA is that the SC-FDMA signal has better peak power characteristics because of its inherent single carrier structure. SC-FDMA has drawn great attention as an attractive alternative to OFDMA, especially in the uplink communications where better peak power characteristics greatly benefit the mobile terminal in terms of transmit power efficiency and manufacturing cost. SC-FDMA has been adopted for the uplink multiple access scheme in 3GPP LTE.

A major purpose of this book is to show how the details of an SC-FDMA transmission scheme influence the tradeoffs among these figures of merit.

1.7 Frequency Division Technology in Broadband Wireless Systems

Frequency division was a mature radio technology, and therefore the earliest cellular systems used it to separate different analog speech transmissions: frequency division multiplexing in the forward (downlink) direction and frequency division multiple access in the reverse (uplink) direction. Second generation systems use either code division technology or a hybrid of time division and frequency division to convey speech and other signals in digital form. Although the two 3G systems are based on code division technologies, all of the advanced broadband systems are reverting to frequency division. As explained in Chapter 2, frequency division technology is well-suited to transmission through mobile radio channels subject to frequency-selective fading due to multipath propagation. Orthogonal frequency division techniques, which effectively transmit a high-speed data signal as a composite of a large number of low-speed signals, each occupying a narrow frequency band, have been employed in digital audio and digital television broadcasting, wireless metropolitan area networks, and wireless local area networks. The same reasons that make them effective in those environments, also make frequency division techniques attractive for the long term evolution of cellular networks. In establishing standards for LTE, 3GPP recognized that OFDMA places significant implementation

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 243 of 304

burdens on mobile terminals. From the point of view of implementation, SC-FDMA can be viewed as a modification of OFDMA with extended battery life in mobile terminals due to low peak power characteristics.

Chapter 2 describes the propagation characteristics of broadband mobile radio signals that make frequency division techniques attractive for high-speed data transmission. It also provides a summary of the main characteristics of OFDM and OFDMA, the predecessors of SC-FDMA. Finally, before presenting details of SC-FDMA in the remainder of this book, Chapter 2 describes in general terms single carrier high-speed data transmission with frequency domain equalization.

References

[1] International Telecommunication Union, "About Mobile Technology and IMT-2000," http://www.itu.int/osg/spu/imt-2000/technology.html.

[2] Toskala, A., Holma, H., Pajukoski, K., *et al.*, "UTRAN Long Term Evolution in 3GPP," *Proc. International Symposium on Personal, Indoor and Mobile Radio Communications (PIMRC) '06*, Helsinki, Finland, Sep. 2006.

[3] Smith, C. and Collins, D., *3G Wireless Networks*, McGraw Hill, 2002, pp. 201–213.

[4] 3rd Generation Partnership Project, *3GPP TS 23.002 – Technical Specification Group Services and Systems Aspects; Network Architecture (Release 8)*, June 2007, Section 5.1.

[5] Holma, H. and Toskala, A., *WCDMA for UMTS – HSPA Evolution and LTE*, John Wiley & Sons, Ltd, 4th edition, 2007, p. 5.

[6] 3rd Generation Partnership Project, *3GPP TR 21.902 – Technical Specification Group Services and System Aspects; Evolution of 3GPP system; (Release 7)*, June 2007.

[7] Institute of Electrical and Electronics Engineers, *IEEE Std 802.11a – Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications; High-Speed Physical Layer in the 5 GHz Band*, 1999.

[8] Institute of Electrical and Electronics Engineers, *IEEE Std 802.11g – Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications*, 2003.

[9] Balachandran, K., Calin, D., Cheng, F-C., *et al.*, "Design and Analysis of an IEEE 802.16e-based OFDMA Communication System," *Bell Labs Tech. Jour.*, vol. **11**, no. 4, Mar. 2007, pp. 53–73.

[10] WiMAX Forum, "Mobile WiMAX - Part I: A Technical Overview and Performance Evaluation," http://www.wimaxforum.org/technology/downloads/Mobile_WiMAX_Part1_Overview_and_Performance.pdf, Aug. 2006.

[11] Das, S., Li, S., Monogioudis, P., *et al.*, "EV-DO Revision C: Evolution of the cdma2000 Data Optimized System to Higher Spectral Efficiencies and Enhanced Services," *Bell Labs Tech. Jour.*, vol. **11**, no. 4, Mar. 2007, pp. 5–24.

[12] Institute of Electrical and Electronics Engineers, *IEEE 802.20 Mobile Broadband Wireless Access (MBWA)*, 2008, http://www.ieee802.org/20/.

[13] Laroia, R., Uppala, S., and Li, J., "Designing a Mobile Broadband Wireless Access Network," *IEEE Sig. Proc. Mag.*, vol. **21**, no. 5, Sep. 2004, pp. 20–28.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 244 of 304

[14] 3rd Generation Partnership Project, "UTRA-UTRAN Long Term Evolution (LTE) and 3GPP System Architecture Evolution (SAE)," http://www.3gpp.org/Highlights/LTE/LTE.htm.

[15] 3rd Generation Partnership Project, *3GPP TR 25.913 – Technical Specification Group Radio Access Network; Requirements for Evolved UTRA and Evolved UTRAN (Release 7)*, Mar. 2006.

[16] Ekström, H., Furuskär, A., Karlsson, J., *et al.*, "Technical Solutions for the 3G Long-Term Evolution," *IEEE Commun. Mag.*, vol. **44**, no. 3, Mar. 2006, pp. 38–45.

[17] Bachl, R., Gunreben, P., Das, S., *et al.*, "The Long Term Evolution towards a New 3GPP Air Interface Standard," *Bell Labs Tech. Jour.*, vol. **11**, no. 4, Mar. 2007, pp. 25–51.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 245 of 304

Appendix C

Deciphering the 3GPP LTE Specifications

Unless you are really familiar with the LTE standardization process, it is rather difficult to understand how things actually work just by reading through the specifications. Since a technical specification is merely a description of a guideline for interoperability, it does not necessarily explain any rationale or background information for choice of the specific methodologies or parameters.

One way to find a more detailed description of the specific methodology or parameter in the specification is to go through the contribution papers (called technical documents, or tdocs) that 3GPP uploads on their meeting website. 3GPP has different work groups working on different aspects of the radio interface and network architecture. The Technical Specification Group Radio Access Networks (TSG RAN) is where all the radio air interface specifications are handled and it has five working groups (WG) as described in Table C.1.

Table C.2 highlights the LTE specifications and their corresponding working groups.

Most of the physical layer and MAC layer components are discussed in RAN1 meetings and the meeting information is at http://www.3gpp.org/ftp/Specs/html-info/Meetings-R1.htm. Figure C.1 is a screenshot of the website.

If you go to this site, there is a column called "First & Last tdoc" (tdoc = technical document) as shown in Figure C.1. This is the paper number that identifies each contribution paper. If you click on the link, it directs you to the ftp site where you can access all the tdocs of the particular meeting.

© 2008 John Wiley & Sons, Ltd

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 246 of 304

Table C.1 TSG RAN work groups

RAN WG1 (RAN1)	Layer 1 (Physical layer) specification
RAN WG2 (RAN2)	Layer 2 (MAC, RLC) and layer 3 specification
RAN WG3 (RAN3)	Overall UTRAN architecture.
RAN WG4 (RAN4)	Radio performance and protocol aspects
RAN WG5 (RAN5)	Mobile terminal conformance testing

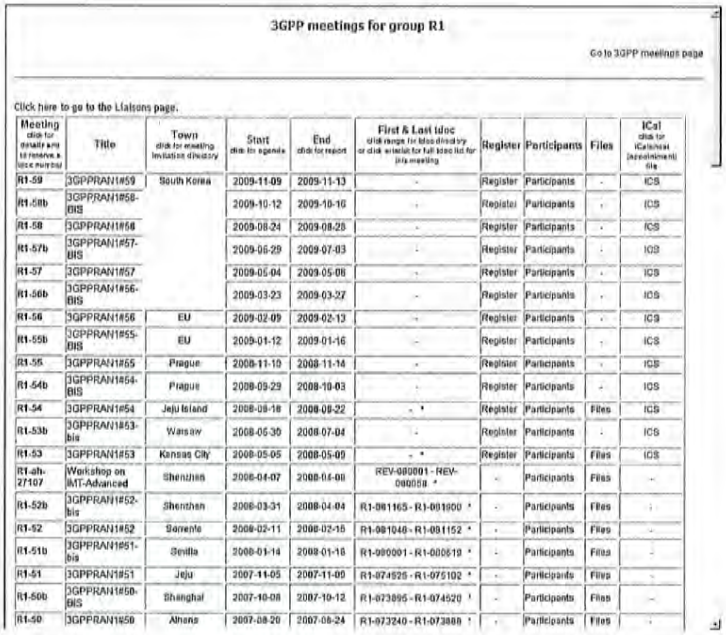
Since the tdocs are uploaded in zip files without any title (only the tdoc numbers are specified in the file name), you would have to look at the excel spreadsheet of the tdoc list (provided at the bottom of the list) to know which is which. Tdoc numbers are in the form of R*x*-*yyzzzz* where *x* is the RAN work group number, *yy* is the year of the meeting, and *zzzz* is the cumulative number assigned to the document. For example, R1-081165 refers to the document 1165 of RAN1 meeting in the year 2008.

It may be daunting to go through each tdoc list spreadsheet for each meeting because the list is usually very long list (300 $\sim$ 400) and not organized by subject. What you can do is first read the meeting summary report that summarizes the discussions and decisions from the meeting by subject. You can find the meeting report by following "Files" link and then "Report" link. From the meeting report, you can find out about the decisions made and the relevant tdocs. Once you know the tdoc number, you can locate the link from the "First & last tdoc" column and access it from there.

Table C.2 LTE specifications and their corresponding working groups

Document number	Working group
36.1xx	RAN4
36.2xx	RAN1
36.3xx	RAN2
36.4xx	RAN3
36.5xx	RAN5
36.8xx	RAN4
36.902	RAN3
36.913	RAN
36.938	RAN4
36.942	RAN4
36.956	RAN4

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 247 of 304



3GPP meetings for group R1

Go to 3GPP meetings page

Click here to go to the Liaisons page.

Meeting click for details and to reserve a face meeting	Title	Town click for meeting invitation directory	Start click for agenda	End click for report	First & Last tdoc click range for tdoc directory or click arrow(s) for full tdoc list for this meeting	Register	Participants	Files	ICal click for iCalendar (appointment) file
R1-59	3GPPRAN1#59	South Korea	2009-11-09	2009-11-13	-	Register	Participants	-	ICS
R1-58b	3GPPRAN1#58-BIS		2009-10-12	2009-10-16	-	Register	Participants	-	ICS
R1-58	3GPPRAN1#58		2009-08-24	2009-08-28	-	Register	Participants	-	ICS
R1-57b	3GPPRAN1#57-BIS		2009-06-29	2009-07-03	-	Register	Participants	-	ICS
R1-57	3GPPRAN1#57		2009-05-04	2009-05-08	-	Register	Participants	-	ICS
R1-56b	3GPPRAN1#56-BIS		2009-03-23	2009-03-27	-	Register	Participants	-	ICS
R1-56	3GPPRAN1#56	EU	2009-02-09	2009-02-13	-	Register	Participants	-	ICS
R1-55b	3GPPRAN1#55-BIS	EU	2009-01-12	2009-01-16	-	Register	Participants	-	ICS
R1-55	3GPPRAN1#55	Prague	2008-11-10	2008-11-14	-	Register	Participants	-	ICS
R1-54b	3GPPRAN1#54-BIS	Prague	2008-09-29	2008-10-03	-	Register	Participants	-	ICS
R1-54	3GPPRAN1#54	Jeju Island	2008-08-18	2008-08-22	- *	Register	Participants	Files	ICS
R1-53b	3GPPRAN1#53-bis	Warsaw	2008-06-30	2008-07-04	-	Register	Participants	-	ICS
R1-53	3GPPRAN1#53	Kansas City	2008-05-05	2008-05-09	- *	Register	Participants	Files	ICS
R1-ah-27107	Workshop on IMT-Advanced	Shenzhen	2008-04-07	2008-04-08	REV-080001 - REV-080058 *	-	Participants	Files	-
R1-52b	3GPPRAN1#52-bis	Shenzhen	2008-03-31	2008-04-04	R1-081165 - R1-081900 *	-	Participants	Files	-
R1-52	3GPPRAN1#52	Sorrento	2008-02-11	2008-02-15	R1-081048 - R1-081152 *	-	Participants	Files	-
R1-51b	3GPPRAN1#51-bis	Sevilla	2008-01-14	2008-01-18	R1-080001 - R1-080619 *	-	Participants	Files	-
R1-51	3GPPRAN1#51	Jeju	2007-11-05	2007-11-09	R1-074525 - R1-075102 *	-	Participants	Files	-
R1-50b	3GPPRAN1#50-BIS	Shanghai	2007-10-08	2007-10-12	R1-073895 - R1-074520 *	-	Participants	Files	-
R1-50	3GPPRAN1#50	Athens	2007-08-20	2007-08-24	R1-073240 - R1-073888 *	-	Participants	Files	-

Figure C.1 Screenshot of the 3GPP RAN1 meeting information website at http://www.3gpp.org/ftp/Specs/html-info/Meetings-R1.htm

For example, the channel coding scheme specified in TS 36.212 uses quadratic permutation polynomial (QPP) interleaver. Let's say we want to find more details of the QPP interleaver. By searching through the meeting reports, we can find that there was a decision to adopt the QPP interleaver in RAN1 meeting #47b. The document that proposes this method is R1-070483 and other related documents are listed as well in the meeting report. By looking at the listed documents, we can understand more about the QPP interleaver that is new in LTE channel coding.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 248 of 304

Wiley Series on
Wireless Communications
and Mobile Computing



Single Carrier FDMA

A New Air Interface for Long Term Evolution

Hyung G. Myung, *Qualcomm/Flarion Technologies, USA*
David J. Goodman, *Polytechnic University, USA*

Single Carrier Frequency Division Multiple Access (SC-FDMA) is a novel method of radio transmission under consideration for deployment in future cellular systems; specifically, in 3rd Generation Partnership Project Long Term Evolution (3GPP LTE) systems. SC-FDMA has drawn great attention from the communications industry as an attractive alternative to Orthogonal Frequency Division Multiple Access (OFDMA).

Single Carrier FDMA places SC-FDMA in the wider context of wireless communications, providing the reader with an in-depth tutorial on SC-FDMA technology. The book introduces the reader to this new multiple access technique that utilizes single carrier modulation along with orthogonal frequency multiplexing and frequency domain equalization, plus its applications in communications settings. It considers the similarities with and differences from orthogonal frequency division modulation, multiplexing, and multiple access used extensively in cellular, broadcasting, and digital subscriber loop applications. Particular reference is made to the peak power characteristics of an SC-FDMA signal as an added advantage over OFDMA.

Key features:

- **Provides an extensive overview of the principles of SC-FDMA and its relation to other transmission techniques.**
- **Explains how the details of a specific implementation influence the tradeoffs among various figures of merit.**
- **Describes in detail the configuration of the SC-FDMA uplink transmission scheme published by 3GPP.**
- **Features link level simulation of an uplink SC-FDMA system using MATLAB®.**

This is an essential text for industry engineers who are researching and developing 3GPP LTE systems. It is suitable for engineers designing wireless network equipment, handsets, data cards, modules, chipsets, and test equipment as well as those involved in designing LTE infrastructure. It would also be of interest to academics, graduate students, and industry researchers involved in advanced wireless communications, as well as business analysts who follow the cellular market.

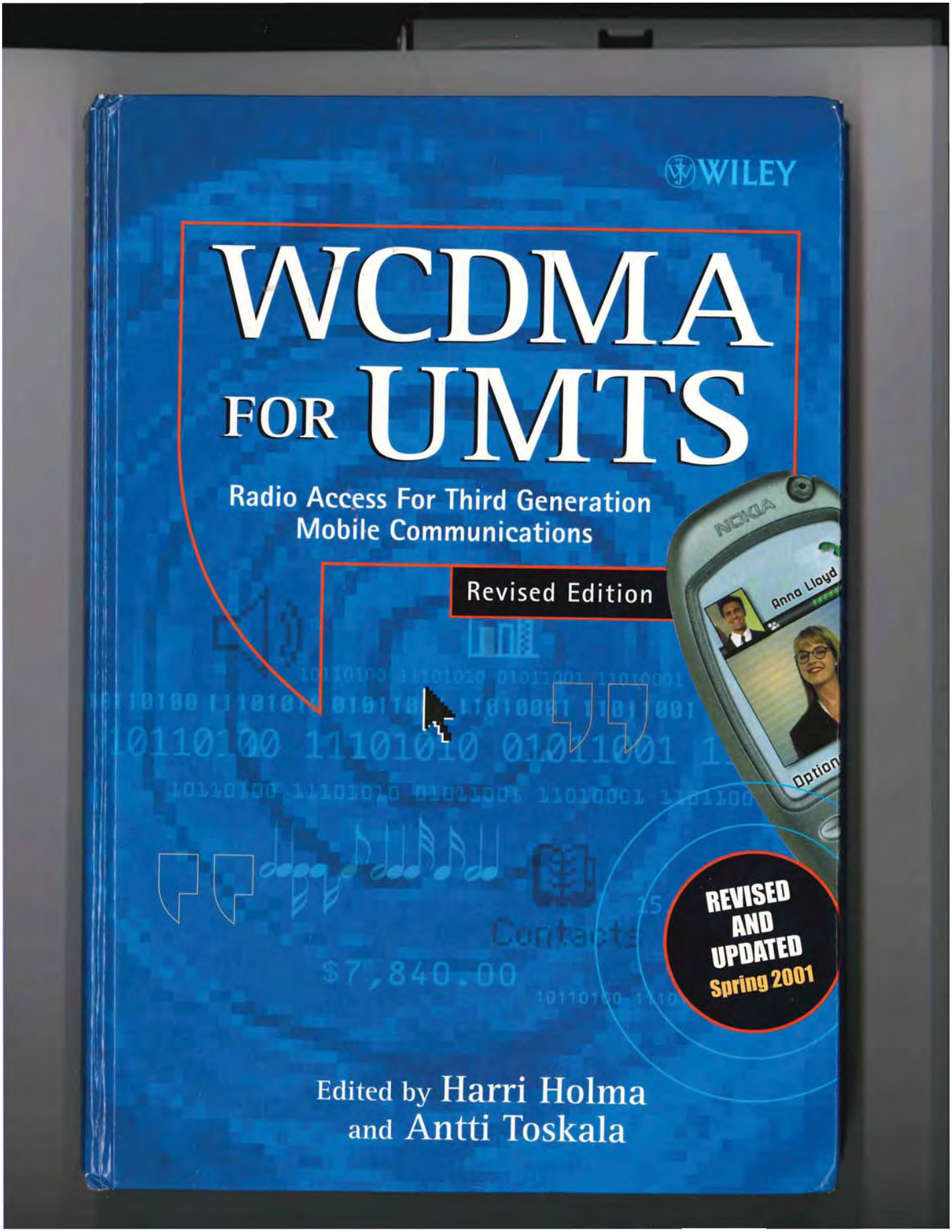
Cover design by Dan Jubb

WILEY
wiley.com

ISBN 978-0-470-72449-1

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 249 of 304

Appendix 17



Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 251 of 304

WCDMA FOR UMTS

Radio Access For Third Generation Mobile Communications

Revised edition

Edited by
Harri Holma and Antti Toskala
Both of Nokia, Finland

JOHN WILEY & SONS, LTD
Chichester • New York • Weinheim • Brisbane • Singapore • Toronto

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 252 of 304

Copyright © 2001 by John Wiley & Sons, Ltd,
Baffins Lane, Chichester,
West Sussex, PO19 1UD, England

National 01243 779777
International (+44) 1243 779777

e-mail (for orders and customer service enquiries): cs-books@wiley.co.uk

Visit our Home Page on http://www.wiley.co.uk or http://www.wiley.com

All Rights Reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, scanning or otherwise, except under the terms of the Copyright Designs and Patents Act 1988 or under the terms of a licence issued by the Copyright Licensing Agency, 90 Tottenham Court Road, London, W1P 9HE, UK, without the permission in writing of the Publisher, with the exception of any material supplied specifically for the purpose of being entered and executed on a computer system, for exclusive use by the purchaser of the publication.

Neither the author(s) nor John Wiley & sons Ltd accept any responsibility or liability for loss or damage occasioned to any person or property through using the material, instructions, methods or ideas contained herein, or acting or refraining from acting as a result of such use. The author(s) and Publisher expressly disclaim all implied warranties, including merchantability of fitness for any particular purpose. There will be no duty on the author(s) or Publisher to correct any errors or defects in the software.

Designations used by companies to distinguish their products are often claimed as trademarks. In all instances where John Wiley & Sons is aware of a claim, the product names appear in initial capital or capital letters. Readers, however, should contact the appropriate companies for more complete information regarding trademarks and registration.

Other Wiley Editorial Offices

John Wiley & Sons, Inc., 605 Third Avenue,
New York, NY 10158-0012, USA

WILEY-VCH Verlag GmbH
Pappelallee 3, D-69469 Weinheim, Germany

John Wiley & Sons Australia, 33 Park Road, Milton,
Queensland 4064, Australia

John Wiley & Sons (Asia) Pte Ltd, 2 Clementi Loop #02-01,
Jin Xing Distripark, Singapore 129809

John Wiley & Sons (Canada) Ltd, 22 Worcester Road
Rexdale, Ontario, M9W 1L1, Canada

British Library Cataloguing in Publication Data

A catalogue record for this book is available from the British Library

ISBN 0 471 48687 6

Typeset by Laser Words, Madras, India
Printed and bound in Great Britain by Antony Rowe Ltd, Chippenham, Wiltshire.
This book is printed on acid-free paper responsibly manufactured from sustainable forestry,
in which at least two trees are planted for each one used for paper production.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 253 of 304

4.5.3 *cdma2000*

The cdma2000 air interface proposal to ITU is the result of work in TR45.5 on the evolution of IS-95 towards the third generation. The cdma2000 proposal is based partly on IS-95 principles with respect to synchronous network operation, common pilot channels, and so on, but it is a wideband version with three times the bandwidth of IS-95. The ITU proposal contains further bandwidth options as well as the multi-carrier option for downlink. The cdma2000 proposal has a high degree of commonality with the Global CDMA 1 ITU proposal from TTA, Korea.

The cdma2000 multi-carrier option is covered in more detail in Chapter 13, as being currently standardised by 3GPP2.

4.5.4 *TR46.1*

The WIMS W-CDMA was not based on work derived from an existing second generation technology but was a new third generation technology proposal with no direct link to any second generation standardisation. It was based on the constant processing gain principle with a high number of multicodes in use, thus showing some fundamental differences but also a level of commonality with WCDMA technology in other forums.

4.5.5 *WP-CDMA*

WP-CDMA (Wideband Packet CDMA) resulted from the convergence between W-CDMA N/A of T1P1 and WIMS W-CDMA of TR46.1 in the US. The main features of the WIMS W-CDMA proposal were merged with the principles of W-CDMA N/A. The merged proposal was submitted to the ITU-R IMT-2000 process towards the end of 1998, and to the 3GPP process at the beginning of 1999. Its the most characteristic feature, compared with the other WCDMA-based proposals, was a common packet mode channel operation for the uplink direction, but there were also a few smaller differences.

4.6 Creation of 3GPP

As similar technologies were being standardised in several regions around the world, it became evident that achieving identical specifications to ensure equipment compatibility globally would be very difficult with work going on in parallel. Also, having to discuss similar issues in several places was naturally a waste of resources for the participating companies. Therefore initiatives were made to create a single forum for WCDMA standardisation for a common WCDMA specification.

The standardisation organisations involved in the creation of the 3rd Generation Partnership Project (3GPP) [9] were ARIB (Japan), ETSI (Europe), TTA (Korea), TTC (Japan) and T1P1 (USA) as shown in Figure 4.2. The partners agreed on joint efforts for the standardisation of UTRA, now standing for Universal Terrestrial Radio Access, as distinct from UTRA (UMTS Terrestrial Radio Access) from ETSI, also submitted to 3GPP. Companies such as manufacturers and operators are members of 3GPP through the respective standardisation organisation to which they belong.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 254 of 304

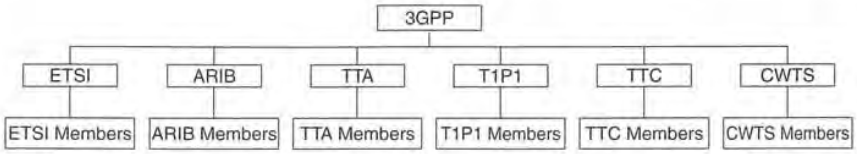


Figure 4.2. 3GPP organisational partners

Later during 1999, CWTS (the China Wireless Telecommunication Standard Group) also joined 3GPP and contributed technology from TD/SCDMA, a TDD-based CDMA third generation technology already submitted to ITU-R earlier.

3GPP also includes market representation partners: GSM Association, UMTS Forum, Global Mobile Suppliers Association, IPv6 Forum and Universal Wireless Communications Consortium (UWCC). In [9] there are up-to-date links to all participating organisations.

The work was initiated formally at the end of 1998 and the detailed technical work was started in early 1999, with the aim of having the first version of the common specification, called Release-99, ready by the end of 1999.

Within 3GPP, four different technical specification groups (TSG) were set up as follows:

- Radio Access Network TSG
- Core Network TSG
- Service and System Aspects TSG
- Terminals TSG

Within these groups the one most relevant to the WCDMA technology is the Radio Access Network TSG (RAN TSG), which has been divided into four different working groups as illustrated in Figure 4.3.

The RAN TSG will produce Release-99 of the UTRA air interface specification. The work done within the 3GPP RAN TSG working groups has been the basis of the technical description of the UTRA air interface covered in this book. Without such a global initiative, this book would have been forced to focus on a single regional specification, though with many similarities to those of other regions. Thus the references throughout this book are to the specification volumes from 3GPP.

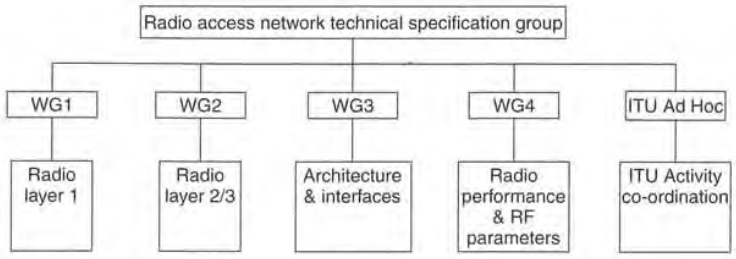


Figure 4.3. 3GPP RAN TSG working groups

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 255 of 304

During the first half of 1999 the inputs from the various participating organisations were merged in a single standard, leaving the rest of the year to finalise the detailed parameters for the first full release, Release-99, of UTRA from 3GPP. The member organisations have undertaken individually to produce standard publications based on the 3GPP specification. Thus, for example, the Release-99 UMTS specifications from ETSI are identical to the Release-99 specifications produced by 3GPP. The latest specifications can be obtained from 3GPP [9].

During 2000, further work on GSM evolution was moved from ETSI and other forums to 3GPP, including work on GPRS and EDGE. A new TSG, TSG GERAN was set up for this purpose.

4.7 Creation of 3GPP2

Work done in TR45.5 and TTA was merged to form 3GPP2, focused on the development of cdma2000 Direct-Sequence (DS) and Multi-Carrier (MC) mode for the cdma2000 third generation component. This activity has been running in parallel with the 3GPP project, with participation from ARIB, TTC and CWTS as member organisations. Recently the main concentration has been on the MC mode work, due to decisions resulting from the global harmonisation efforts.

4.8 Harmonisation Phase

During the spring of 1999 several operators and manufacturers held series of meetings to seek further harmonisation and convergence between the CDMA-based third generation solutions, WCDMA and cdma2000. For the 3GPP framework the ETSI, ARIB, TTA and T1P1 concepts had already been merged to a single specification, while cdma2000 was still on its own in TR45.5. As a result of several meetings and telephone conferences, the manufacturers and operators agreed to adopt a harmonised global third generation CDMA standard consisting of three modes: Multi-Carrier (MC), Direct Spread (DS) and Time Division Duplex (TDD). The MC mode was based on the cdma2000 multi-carrier option, the DS mode on WCDMA (UTRA FDD), and the TDD mode on UTRA TDD. The agreement was to phase in a modular approach in which both core networks could be used with all air interface alternatives, as described in Figure 1.4 in Chapter 1.

The main technical impacts of these harmonisation activities were the change of UTRA FDD and TDD mode chip rate from 4.096 Mcps to 3.84 Mcps and the inclusion of a common pilot for UTRA FDD. The work in 3GPP2 focused on the MC mode, and the DS mode from cdma2000 was abandoned. The result is that globally there is only one Direct Spread (DS) wideband CDMA standard, WCDMA.

4.9 IMT2000 Process in ITU

In the ITU, recommendations have been developed for third generation mobile communications systems, the ITU terminology being called IMT-2000 [10], formerly FPLMTS. In the ITU-R, ITU-R TG8/1 has worked on the radio-dependent aspects, while the radio-independent aspects have been covered in ITU-T SG11.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 256 of 304

roc. IEEE Int. Conf. on
Helsinki, Finland, 1–4

AMES Multiple Access
, April 1998, pp. 16–24.
Multiple Access Mode
'onf. on Personal Indoor
1–4 September 1997,

:AMES Multiple Access
door and Mobile Radio
, pp. 42–46.
s for the UMTS Terres-
'S 21.01 version 3.0.1,

:edures for the Choice of
rt, UMTS 30.03 version

errestrial Radio Access
TS 30.06 version 3.0.0,

adio Interface for Third

ations Approved in ITU

5

Radio Access Network Architecture

Fabio Longoni and Atte Länsisalmi

5.1 System Architecture

This chapter gives a wide overview of the UMTS system architecture, including an introduction to the logical network elements and the interfaces. The UMTS system utilises the same well-known architecture that has been used by all main second generation systems and even by some first generation systems. The reference list contains the related 3GPP specifications.

The UMTS system consists of a number of logical network elements that each has a defined functionality. In the standards, network elements are defined at the logical level, but this quite often results in a similar physical implementation, especially since there are a number of open interfaces (for an interface to be 'open', the requirement is that it has been defined to such a detailed level that the equipment at the endpoints can be from two different manufacturers). The network elements can be grouped based on similar functionality, or based on which sub-network they belong to.

Functionally the network elements are grouped into the Radio Access Network (RAN, UMTS Terrestrial RAN = UTRAN) that handles all radio-related functionality, and the Core Network, which is responsible for switching and routing calls and data connections to external networks. To complete the system, the User Equipment (UE) that interfaces with the user and the radio interface is defined. The high-level system architecture is shown in Figure 5.1.

From a specification and standardisation point of view, both UE and UTRAN consist of completely new protocols, the design of which is based on the needs of the new WCDMA radio technology. On the contrary, the definition of CN is adopted from GSM. This gives the system with new radio technology a global base of known and rugged CN technology that accelerates and facilitates its introduction, and enables such competitive advantages as global roaming.

WCDMA for UMTS, edited by Harri Holma and Antti Toskala
© 2001 John Wiley & Sons, Ltd

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 257 of 304

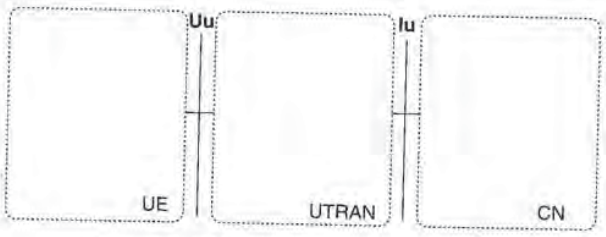


Figure 5.1. UMTS high-level system architecture

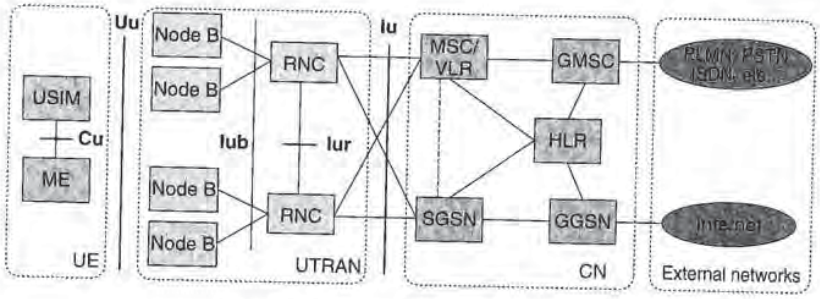


Figure 5.2. Network elements in a PLMN

Another way to group UMTS network elements is to divide them into sub-networks. The UMTS system is modular in the sense that it is possible to have several network elements of the same type. In principle, the minimum requirement for a fully featured and operational network is to have at least one logical network element of each type (note that some features and consequently some network elements are optional). The possibility of having several entities of the same type allows the division of the UMTS system into sub-networks that are operational either on their own or together with other sub-networks, and that are distinguished from each other with unique identities. Such a sub-network is called a UMTS PLMN (Public Land Mobile Network). Typically one PLMN is operated by a single operator, and is connected to other PLMNs as well as to other types of networks, such as ISDN, PSTN, the Internet, and so on. Figure 5.2 shows elements in a PLMN and, in order to illustrate the connections, also external networks.

The UTRAN architecture is presented in Section 5.2. A short introduction to all the elements is given below.

The UE consists of two parts:

- The Mobile Equipment (ME) is the radio terminal used for radio communication over the Uu interface.
- The UMTS Subscriber Identity Module (USIM) is a smartcard that holds the subscriber identity, performs authentication algorithms, and stores authentication and encryption keys and some subscription information that is needed at the terminal.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 258 of 304



m into sub-networks.
have several network
r a fully featured and
f each type (note that
al). The possibility of
MTS system into sub-
her sub-networks, and
ub-network is called a
is operated by a single
s of networks, such as
a PLMN and, in order

ntroduction to all the

o communication over

at holds the subscriber
ication and encryption
minal.

UTRAN also consists of two distinct elements:

- The Node B converts the data flow between the Iub and Uu interfaces. It also participates in radio resource management. (*Note that the term 'Node B' from the corresponding 3GPP specifications is used throughout Chapter 5. The more generic term 'Base Station' used elsewhere in this book means exactly the same thing.*)
- The Radio Network Controller (RNC) owns and controls the radio resources in its domain (the Node Bs connected to it). RNC is the service access point for all services UTRAN provides the CN, for example management of connections to the UE.

The main elements of the GSM CN (there are other entities not shown in Figure 5.2, such as those used to provide IN services) are as follows:

- HLR (Home Location Register) is a database located in the user's home system that stores the master copy of the user's service profile. The service profile consists of, for example, information on allowed services, forbidden roaming areas, and Supplementary Service information such as status of call forwarding and the call forwarding number. It is created when a new user subscribes to the system, and remains stored as long as the subscription is active. For the purpose of routing incoming transactions to the UE (e.g. calls or short messages), the HLR also stores the UE location on the level of MSC/VLR and/or SGSN, i.e. on the level of serving system.
- MSC/VLR (Mobile Services Switching Centre/Visitor Location Register) is the switch (MSC) and database (VLR) that serves the UE in its current location for Circuit Switched (CS) services. The MSC function is used to switch the CS transactions, and the VLR function holds a copy of the visiting user's service profile, as well as more precise information on the UE's location within the serving system. The part of the network that is accessed via the MSC/VLR is often referred to as the CS domain.
- GMSC (Gateway MSC) is the switch at the point where UMTS PLMN is connected to external CS networks. All incoming and outgoing CS connections go through GMSC.
- SGSN (Serving GPRS (General Packet Radio Service) Support Node) functionality is similar to that of MSC/VLR but is typically used for Packet Switched (PS) services. The part of the network that is accessed via the SGSN is often referred to as the PS domain.
- GGSN (Gateway GPRS Support Node) functionality is close to that of GMSC but is in relation to PS services.

The external networks can be divided into two groups:

- CS networks. These provide circuit-switched connections, like the existing telephony service. ISDN and PSTN are examples of CS networks.
- PS networks. These provide connections for packet data services. The Internet is one example of a PS network.

The UMTS standards are structured so that internal functionality of the network elements is not specified in detail. Instead, the interfaces between the logical network elements have been defined. The following main open interfaces are specified:

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 259 of 304

- Cu Interface. This is the electrical interface between the USIM smartcard and the ME. The interface follows a standard format for smartcards.
- Uu Interface. This is the WCDMA radio interface, which is the subject of the main part of this book. The Uu is the interface through which the UE accesses the fixed part of the system, and is therefore probably the most important open interface in UMTS. There are likely to be many more UE manufacturers than manufacturers of fixed network elements.
- Iu Interface. This connects UTRAN to the CN and is introduced in detail in Section 5.4. Similarly to the corresponding interfaces in GSM, A (Circuit Switched) and Gb (Packet Switched), the open Iu interface gives UMTS operators the possibility of acquiring UTRAN and CN from different manufacturers. The enabled competition in this area has been one of the success factors of GSM.
- Iur Interface. The open Iur interface allows soft handover between RNCs from different manufacturers, and therefore complements the open Iu interface. Iur is described in more detail in Section 5.5.1.
- Iub Interface. The Iub connects a Node B and an RNC. UMTS is the first commercial mobile telephony system where the Controller-Base Station interface is standardised as a fully open interface. Like the other open interfaces, open Iub is expected to further motivate competition between manufacturers in this area. It is likely that new manufacturers concentrating exclusively on Node Bs will enter the market.

5.2 UTRAN Architecture

UTRAN architecture is highlighted in Figure 5.3.

UTRAN consists of one or more Radio Network Sub-systems (RNS). An RNS is a sub-network within UTRAN and consists of one Radio Network Controller (RNC) and one or more Node Bs. RNCs may be connected to each other via an Iur interface. RNCs and Node Bs are connected with an Iub Interface.

Before entering into a brief description of the UTRAN network elements (in this section) and a more extensive description of UTRAN interfaces (in the following sections), we present the main characteristics of UTRAN that have also been the main requirements for

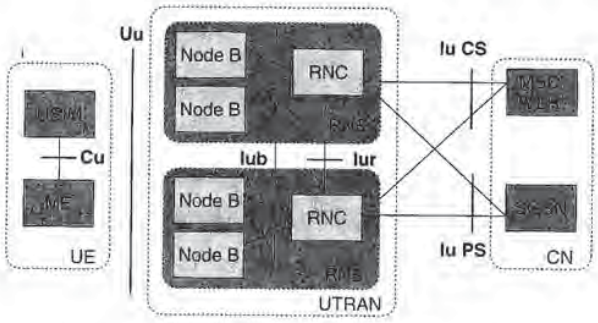


Figure 5.3. UTRAN architecture

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 260 of 304

martcard and the ME.

ıbject of the main part
es the fixed part of the
:e in UMTS. There are
xed network elements.

ı detail in Section 5.4.
tched) and Gb (Packet
ossibility of acquiring
etition in this area has

ı RNCs from different
ır is described in more

s the first commercial
ıce is standardised as a
pected to further moti-
ıat new manufacturers

JS). An RNS is a sub-
ller (RNC) and one or
rface. RNCs and Node

ments (in this section)
llowing sections), we
main requirements for



the design of the UTRAN architecture, functions and protocols. These can be summarised in the following points:

- *Support of UTRA* and all the related functionality. In particular, the major impact on the design of UTRAN has been the requirement to support *soft handover* (one terminal connected to the network via two or more active cells) and the WCDMA-specific *Radio Resource Management* algorithms.
- Maximisation of the *commonalities in the handling of packet- switched and circuit-switched data*, with a unique air interface protocol stack and with the use of the same interface for the connection from UTRAN to both the PS and CS domains of the core network.
- Maximisation of the *commonalities with GSM*, when possible.
- Use of the *ATM transport* as the main transport mechanism in UTRAN.

5.2.1 *The Radio Network Controller*

The RNC (Radio Network Controller) is the network element responsible for the control of the radio resources of UTRAN. It interfaces the CN (normally to one MSC and one SGSN) and also terminates the RRC (Radio Resource Control) protocol that defines the messages and procedures between the mobile and UTRAN. It logically corresponds to the GSM BSC.

5.2.1.1 Logical Role of the RNC

The RNC controlling one Node B (i.e. terminating the Iub interface towards the Node B) is indicated as the *Controlling RNC* (CRNC) of the Node B. The Controlling RNC is responsible for the load and congestion control of its own cells, and also executes the admission control and code allocation for new radio links to be established in those cells.

In case one mobile–UTRAN connection uses resources from more than one RNS (see Figure 5.4), the RNCs involved have two separate logical roles (*with respect to this mobile–UTRAN connection*):

- *Serving RNC*. The SRNC for one mobile is the RNC that terminates both the Iu link for the transport of user data and the corresponding RANAP signalling to/from the

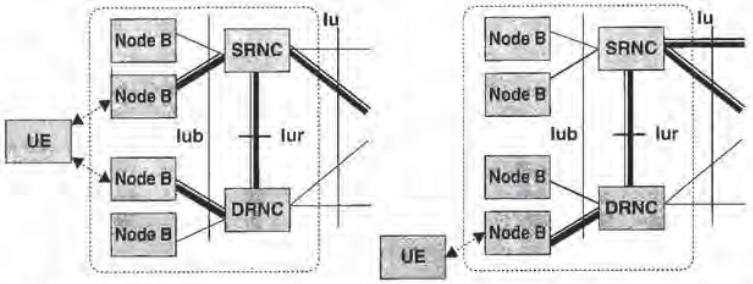


Figure 5.4. Logical role of the RNC for one UE UTRAN connection. The left-hand scenario shows one UE in inter-RNC soft handover (combining is performed in the SRNC). The right-hand scenario represents one UE using resources from one Node B only, controlled by the DRNC

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 261 of 304

core network (this connection is referred to as the RANAP connection). The SRNC also terminates the Radio Resource Control Signalling, that is the signalling protocol between the UE and UTRAN. It performs the L2 processing of the data to/from the radio interface. Basic Radio Resource Management operations, such as the mapping of Radio Access Bearer parameters into air interface transport channel parameters, the handover decision, and outer loop power control, are executed in the SRNC. The SRNC may also (but not always) be the CRNC of some Node B used by the mobile for connection with UTRAN. One UE connected to UTRAN has one and only one SRNC.

- *Drift RNC.* The DRNC is any RNC, other than the SRNC, that controls cells used by the mobile. If needed, the DRNC may perform macrodiversity combining and splitting. The DRNC does not perform L2 processing of the user plane data, but routes the data transparently between the Iub and Iur interfaces, except when the UE is using a common or shared transport channel. One UE may have zero, one or more DRNCs.

Note that one physical RNC normally contains all the CRNC, SRNC and DRNC functionality.

5.2.2 *The Node B (Base Station)*

The main function of the Node B is to perform the air interface L1 processing (channel coding and interleaving, rate adaptation, spreading, etc.). It also performs some basic Radio Resource Management operation as the inner loop power control. It logically corresponds to the GSM Base Station. The enigmatic term 'Node B' was initially adopted as a temporary term during the standardisation process, but then never changed.

The logical model of the Node B is described in Section 5.5.2.

5.3 General Protocol Model for UTRAN Terrestrial Interfaces

5.3.1 *General*

Protocol structures in UTRAN terrestrial interfaces are designed according to the same general protocol model. This model is shown in Figure 5.5. The structure is based on the principle that the layers and planes are logically independent of each other, and if needed, parts of the protocol structure may be changed in the future while other parts remain intact.

5.3.2 *Horizontal Layers*

The protocol structure consists of two main layers, the Radio Network Layer and the Transport Network Layer. All UTRAN-related issues are visible only in the Radio Network Layer, and the Transport Network Layer represents standard transport technology that is selected to be used for UTRAN but without any UTRAN-specific changes.

5.3.3 *Vertical Planes*

5.3.3.1 Control Plane

The Control Plane is used for all UMTS-specific control signalling. It includes the Application Protocol (i.e. RANAP in Iu, RNSAP in Iur and NBAP in Iub), and the Signalling Bearer for transporting the Application Protocol messages.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 262 of 304

nnection). The SRNC
the signalling protocol
data to/from the radio
the mapping of Radio
rameters, the handover
. The SRNC may also
ile for connection with
RNC.

controls cells used by
ombining and splitting.
ata, but routes the data
UE is using a common
e DRNCs.

nd DRNC functionality.

1 processing (channel
orms some basic Radio
ogically corresponds to
adopted as a temporary

Interfaces

according to the same
ructure is based on the
h other, and if needed,
ther parts remain intact.

rk Layer and the Trans-
e Radio Network Layer,
hnology that is selected

. It includes the Appli-
lub), and the Signalling

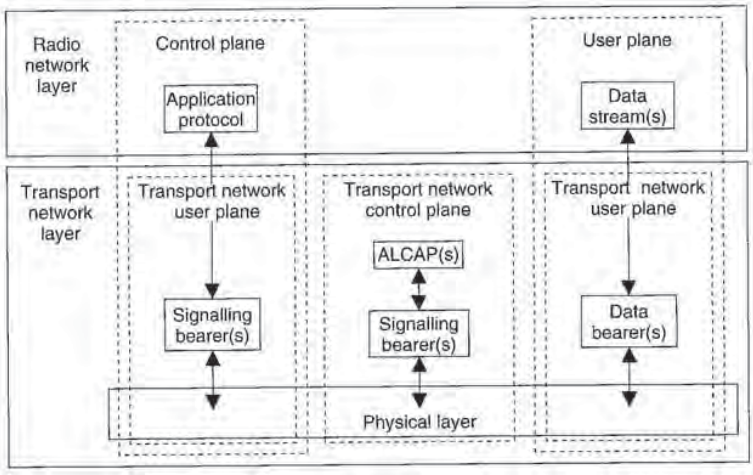


Figure 5.5. General protocol model for UTRAN terrestrial interfaces

The Application Protocol is used, among other things, for setting up bearers to the UE (i.e. the Radio Access Bearer in Iu and subsequently the Radio Link in Iur and Iub). In the three-plane structure the bearer parameters in the Application Protocol are not directly tied to the User Plane technology, but rather are general bearer parameters.

The Signalling Bearer for the Application Protocol may or may not be of the same type as the Signalling Bearer for the ALCAP. It is always set up by O&M actions.

5.3.3.2 User Plane

All information sent and received by the user, such as the coded voice in a voice call or the packets in an Internet connection, are transported via the User Plane. The User Plane includes the Data Stream(s), and the Data Bearer(s) for the Data Stream(s). Each Data Stream is characterised by one or more frame protocols specified for that interface.

5.3.3.3 Transport Network Control Plane

The Transport Network Control Plane is used for all control signalling within the Transport Layer. It does not include any Radio Network Layer information. It includes the ALCAP protocol that is needed to set up the transport bearers (Data Bearer) for the User Plane. It also includes the Signalling Bearer needed for the ALCAP.

The Transport Network Control Plane is a plane that acts between the Control Plane and the User Plane. The introduction of the Transport Network Control Plane makes it possible for the Application Protocol in the Radio Network Control Plane to be completely independent of the technology selected for the Data Bearer in the User Plane.

When the Transport Network Control Plane is used, the transport bearers for the Data Bearer in the User Plane are set up in the following fashion. First there is a signalling transaction by the Application Protocol in the Control Plane, which triggers the setup of the Data Bearer by the ALCAP protocol that is specific for the User Plane technology.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 263 of 304

The independence of the Control Plane and the User Plane assumes that an ALCAP signalling transaction takes place. It should be noted that ALCAP might not be used for all types of Data Bearers. If there is no ALCAP signalling transaction, the Transport Network Control Plane is not needed at all. This is the case when preconfigured Data Bearers are used. It should also be noted that the ALCAP protocol(s) in the Transport Network Control Plane is/are not used for setting up the Signalling Bearer for the Application Protocol or for the ALCAP during real-time operation.

The Signalling Bearer for the ALCAP may or may not be of the same type as that for the Application Protocol. The UMTS specifications assume that the Signalling Bearer for ALCAP is always set up by O&M actions, and do not specify this in detail.

5.3.3.4 Transport Network User Plane

The Data Bearer(s) in the User Plane, and the Signalling Bearer(s) for the Application Protocol, also belong to the Transport Network User Plane. As described in the previous section, the Data Bearers in the Transport Network User Plane are directly controlled by the Transport Network Control Plane during real-time operation, but the control actions required for setting up the Signalling Bearer(s) for the Application Protocol are considered O&M actions.

5.4 Iu, the UTRAN–CN Interface

The Iu interface connects UTRAN to CN. Iu is an open interface that divides the system into radio-specific UTRAN and CN which handles switching, routing and service control. As can be seen from Figure 5.3, the Iu can have two different instances, which are Iu CS (Iu Circuit Switched) for connecting UTRAN to Circuit Switched (CS) CN, and Iu PS (Iu Packet Switched) for connecting UTRAN to Packet Switched (PS) CN. The original design goal in the standardisation was to develop only one Iu interface, but then it was realised that fully optimised User Plane transport for CS and PS services can only be achieved if different transport technologies are allowed. Consequently, the Transport Network Control Plane is different. One of the main design guidelines has still been that the Control Plane should be the same for Iu CS and Iu PS, and the differences are minor.

5.4.1 Protocol Structure for Iu CS

The Iu CS overall protocol structure is depicted in Figure 5.6. The three planes in the Iu interface share a common ATM (Asynchronous Transfer Mode) transport which is used for all planes. The physical layer is the interface to the physical medium: optical fibre, radio link or copper cable. The physical layer implementation can be selected from a variety of standard off-the-shelf transmission technologies, such as SONET, STM1, or E1.

5.4.1.1 Iu CS Control Plane Protocol Stack

The Control Plane protocol stack consists of RANAP, on top of Broad Band (BB) SS7 (Signalling System #7) protocols. The applicable layers are the Signalling Connection Control Part (SCCP), the Message Transfer Part (MTP3-b) and SAAL-NNI (Signalling ATM Adaptation Layer for Network to Network Interfaces). SAAL-NNI is further divided into Service Specific Co-ordination Function (SSCF), Service Specific Connection Oriented Protocol

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 264 of 304

mes that an ALCAP
ght not be used for all
ne Transport Network
ired Data Bearers are
port Network Control
cation Protocol or for

same type as that for
Signalling Bearer for
detail.

) for the Application
cribed in the previous
directly controlled by
at the control actions
otocol are considered

iat divides the system
g and service control.
ices, which are Iu CS
'S) CN, and Iu PS (Iu
N. The original design
it then it was realised
n only be achieved if
port Network Control
that the Control Plane
or.

three planes in the Iu
port which is used for
m: optical fibre, radio
cted from a variety of
'M1, or E1.

Broad Band (BB) SS7
ng Connection Control
Signalling ATM Adap-
er divided into Service
ion Oriented Protocol

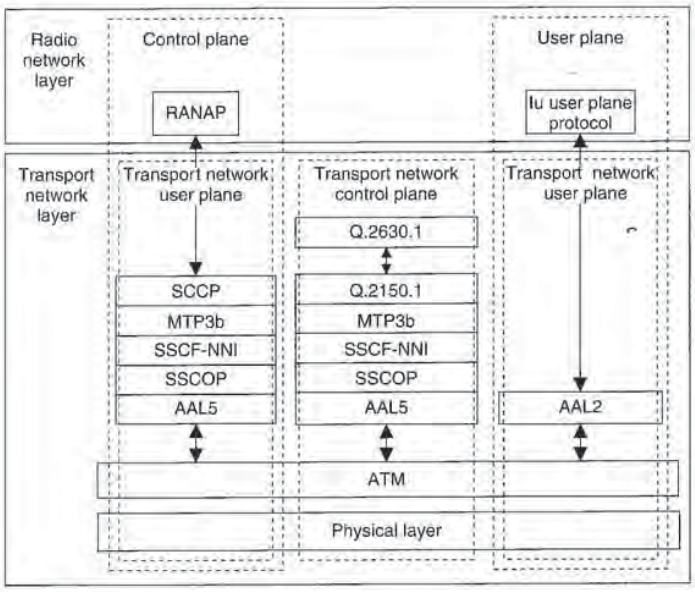


Figure 5.6. Iu CS protocol structure

(SSCOP) and ATM Adaptation Layer 5 (AAL) layers. SSCF and SSCOP layers are specifically designed for signalling transport in ATM networks, and take care of such functions as signalling connection management. AAL5 is used for segmenting the data to ATM cells.

5.4.1.2 Iu CS Transport Network Control Plane Protocol Stack

The Transport Network Control Plane protocol stack consists of the Signalling Protocol for setting up AAL2 connections (Q.2630.1 and adaptation layer Q.2150.1), on top of BB SS7 protocols. The applicable BB SS7 are those described above without the SCCP layer.

5.4.1.3 Iu CS User Plane Protocol Stack

A dedicated AAL2 connection is reserved for each individual CS service. The Iu User Plane Protocol residing directly on top of AAL2 is described in more detail in Section 5.4.4.

5.4.2 Protocol Structure for Iu PS

The Iu PS protocol structure is depicted in Figure 5.7. Again, a common ATM transport is applied for both User and Control Plane. Also the physical layer is as specified for Iu CS.

5.4.2.1 Iu PS Control Plane Protocol Stack

The Control Plane protocol stack again consists of RANAP, and the same BB SS7-based signalling bearer as described in Section 5.4.1.1. Also as an alternative, an IP-based signalling bearer is specified. The SCCP layer is also used commonly for both. The IP-based signalling bearer consists of M3UA (SS7 MTP3—User Adaptation Layer), SCTP (Simple

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 265 of 304

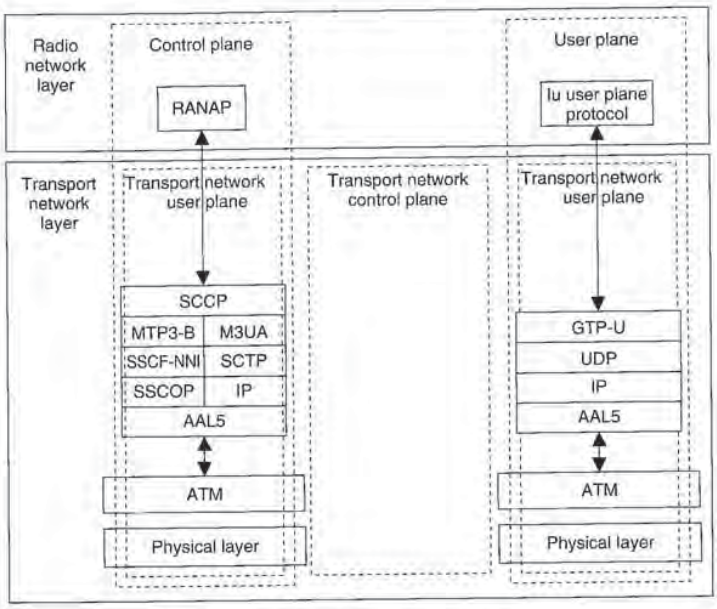


Figure 5.7. Iu PS protocol structure

Control Transmission Protocol), IP (Internet Protocol), and AAL5 which is common to both alternatives. The SCTP layer is specifically designed for signalling transport in the Internet. Specific adaptation layers are specified for different kinds of signalling protocols, such as M3UA for SS7-based signalling.

5.4.2.2 Iu PS Transport Network Control Plane Protocol Stack

The Transport Network Control Plane is not applied to Iu PS. The setting up of the GTP tunnel requires only an identifier for the tunnel, and the IP addresses for both directions, and these are already included in the RANAP RAB Assignment messages. The same information elements that are used in Iu CS for addressing and identifying the AAL2 signalling are used for the User Plane data in Iu CS.

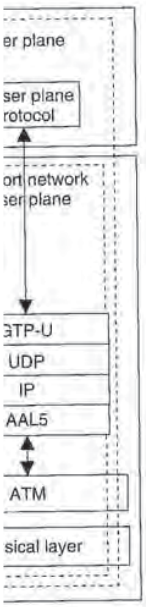
5.4.2.3 Iu PS User Plane Protocol Stack

In the Iu PS User Plane, multiple packet data flows are multiplexed on one or several AAL5 PVCs. The GTP-U (User Plane part of the GPRS Tunnelling Protocol) is the multiplexing layer that provides identities for individual packet data flow. Each flow uses UDP connectionless transport and IP addressing.

5.4.3 RANAP Protocol

RANAP is the signalling protocol in Iu that contains all the control information specified for the Radio Network Layer. The functionality of RANAP is implemented by various RANAP Elementary Procedures. Each RANAP function may require the execution of one

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 266 of 304



hich is common to both
ansport in the Internet.
ling protocols, such as

setting up of the GTP
for both directions, and
. The same information
AL2 signalling are used

xed on one or several
Protocol) is the multi-
v. Each flow uses UDP

l information specified
nplemented by various
re the execution of one

or more EPs. Each EP consists of either just the request message (class 2 EP), the request and response message pair (class 1 EP), or one request message and one or more response messages (class 3 EP). The following RANAP functions are defined:

- Relocation. This function handles both SRNS Relocation and Hard Handover, including intersystem case to/from GSM:
  - SRNS Relocation: the serving RNS functionality is relocated from one RNS to another without changing the radio resources and without interrupting the user data flow. The prerequisite for SRNS relocation is that all Radio Links are already in the same DRNC that is the target for the relocation.
  - Inter RNS Hard Handover: used to relocate the serving RNS functionality from one RNS to another and to change the radio resources correspondingly by a hard handover in the Uu interface. The prerequisite for Hard Handover is that the UE is at the border of the source and target cells.
- RAB (Radio Access Bearer) Management. This function combines all RAB handling:
  - RAB Setup, including the possibility for queuing the setup,
  - modification of the characteristics of an existing RAB,
  - clearing an existing RAB, including the RAN-initiated case.
- Iu Release. Releases all resources (Signalling link and U-Plane) from a given instance of Iu related to the specified UE. Also includes the RAN-initiated case.
- Reporting Unsuccessfully Transmitted Data. This function allows the CN to update its charging records with information from UTRAN if part of the data sent was not successfully sent to the UE.
- Common ID management. In this function the permanent identification of the UE is sent from the CN to UTRAN to allow paging coordination from possibly two different CN domains.
- Paging. This is used by CN to page an idle UE for a UE terminating service request, such as a voice call. A paging message is sent from the CN to UTRAN with the UE common identification (permanent Id) and the paging area. UTRAN will either use an existing signalling connection, if one exists, to send the page to the UE or broadcast the paging in the requested area.
- Management of tracing. The CN may, for operation and maintenance purposes, request UTRAN to start recording all activity related to a specific UE–UTRAN connection.
- UE–CN signalling transfer. This functionality provides transparent transfer of UE–CN signalling messages that are not interpreted by UTRAN in three cases:
  - Transfer of the first UE message from UTRAN to UE: this may be, for example, a response to paging, a request of a UE-originated call, or just registration to a new area. It also initiates the signalling connection for the Iu.
  - Direct Transfer: used for carrying all consecutive signalling messages over the Iu signalling connection in both the uplink and downlink directions.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 267 of 304

  - CN Information Broadcast: allows the CN to set system information to be broadcast repetitively to all users in a specified area.
- Security Mode Control. This is used to set the ciphering or integrity checking on or off. When ciphering is on, the signalling and user data connections in the radio interface are encrypted with a secret key algorithm. When integrity checking is on, an integrity checksum, further secured with a secret key, is added to some or all of the Radio Interface signalling messages. This ensures that the communication partner has not changed, and the content of the information has not been altered.
- Management of overload. This is used to control the load over the Iu interface against overload due, for example, to processor overload at the CN or UTRAN. A simple mechanism is applied that allows stepwise reduction of the load and its stepwise resumption, triggered by a timer.
- Reset. This is used to reset the CN or the UTRAN side of the Iu interface in error situations. One end of the Iu may indicate to the other end that it is recovering from a restart, and the other end can remove all previously established connections.
- Location Reporting. This functionality allows the CN to receive information on the location of a given UE. It includes two elementary procedures, one for controlling the location reporting in the RNC and the other to send the actual report to the CN.

5.4.4 Iu User Plane Protocol

The Iu User Plane protocol is in the Radio Network Layer of the Iu User Plane. It has been defined so that it would be, as much as possible, independent of the CN domain that it is used for. The purpose of the User Plane protocol is to carry user data related to RABs over the Iu interface. Each RAB has its own instance of the protocol. The protocol performs either a fully transparent operation, or framing for the user data segments and some basic control signalling to be used for initialisation and online control. Based on these cases, the protocol has two modes:

- Transparent Mode. In this mode of operation the protocol does not perform any framing or control. It is applied for RABs that do not require such features but that assume fully transparent operation.
- Support Mode for predefined SDU sizes. In this mode the User Plane performs framing of the user data into segments of predefined size. The SDU sizes typically correspond to AMR (Adaptive Multirate Codec) speech frames, or to the frame sizes derived from the data rate of a CS data call. Also, control procedures for initialisation and rate control are defined, and a functionality is specified for indicating the quality of the frame based, for example, on CRC from the radio interface.

5.5 UTRAN Internal Interfaces

5.5.1 RNC–RNC Interface (Iur Interface) and the RNSAP Signalling

The protocol stack of the RNC to RNC interface (Iur interface) is shown in Figure 5.8.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 268 of 304

nation to be broadcast

ty checking on or off.
in the radio interface
ing is on, an integrity
of the Radio Interface
has not changed, and

ıe Iu interface against
RAN. A simple mech-
; stepwise resumption,

: Iu interface in error
t is recovering from a
:onnections.

ve information on the
ɔne for controlling the
port to the CN.

User Plane. It has been
: CN domain that it is
ı related to RABs over
The protocol performs
;ments and some basic
sed on these cases, the

ɔt perform any framing
:s but that assume fully

Plane performs framing
typically correspond to
: sizes derived from the
sation and rate control
lity of the frame based,

gnalling
:hown in Figure 5.8.

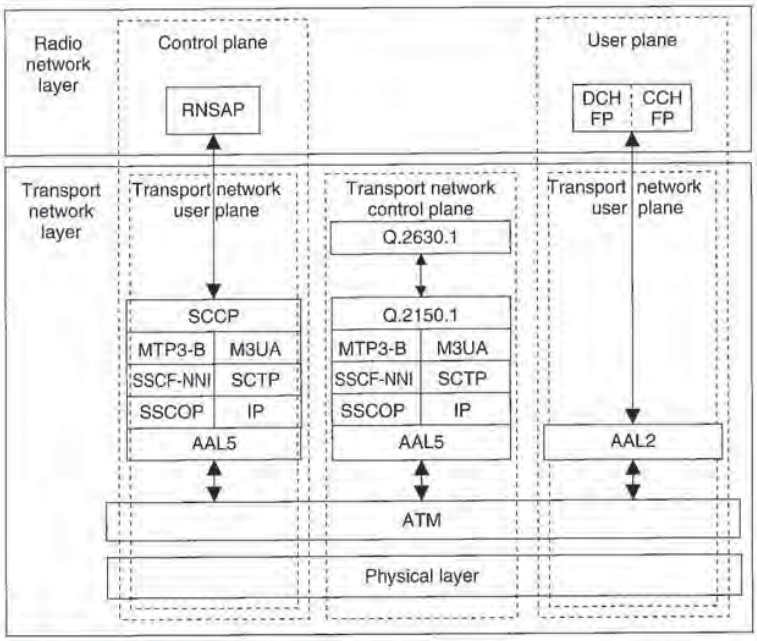


Figure 5.8. Protocol stack of the Iur interface. As for the Iu interface, two options are possible for the transport of the RNSAP signalling: the SS7 stack (SCCP and MTP3b) and the new SCTP/IP based transport. Two User Plane protocols are defined (DCH: dedicated channel; CCH: common channel)

Although this interface was initially designed in order to support the inter-RNC soft handover (shown on the left-hand side of Figure 5.4), more features were added during the development of the standard and now the Iur interface provides four distinct functions:

1. Support of Basic Inter-RNC Mobility
2. Support of Dedicated Channel Traffic
3. Support of Common Channel Traffic
4. Support of Global Resource Management

For this reason the Iur signalling protocol itself (RNSAP, *Radio Network System Application Part*) is divided into four different *modules* (to be intended as groups of procedures). In general, it is possible to implement only part of the four Iur functions between two Radio Network Controllers, according to the operator's need.

5.5.1.1 Iur1: Support of the Basic Inter-RNC Mobility

This functionality requires the *basic* module of RNSAP signalling as described in [25.423]. This first brick for the construction of the Iur interfaces provides by itself the functionality needed for the mobility of the user between the two RNCs, but does not support the exchange of any user data traffic. If this module is not implemented, the Iur interface as such does

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 269 of 304

not exist, and the only way for a user connected to UTRAN via the RNS1 to utilise a cell in RNS2 is to disconnect itself temporarily from UTRAN (release the RRC connection).

The functions offered by the Iur basic module include:

- *Support of SRNC relocation*
- *Support of inter-RNC cell and UTRAN registration area update*
- *Support of inter-RNC packet paging*
- *Reporting of protocol errors*

Since this functionality does not involve user data traffic across Iur, the User Plane and the Transport Network Control Plane protocols are not needed.

5.5.1.2 Iur2: Support of Dedicated Channel Traffic

This functionality requires the *Dedicated Channel* module of RNSAP signalling and allows the dedicated channel traffic between two RNCs. Even if the initial need for this functionality is to support the inter-RNC soft handover state, it also allows the anchoring of the SRNC for all the time the user is utilising dedicated channels (dedicated resources in the Node B), commonly for as long as the user has an active connection to the circuit-switched domain.

This functionality requires also the User Plane *Frame Protocol* for the dedicated channel, plus the Transport Network Control Plane protocol (*Q.2630.1*) used for the setup of the transport connections (AAL2 connections). Each dedicated channel is conveyed over one transport connection, except the coordinated DCH used to obtain unequal error protection in the air interface.

The *Frame Protocol* for dedicated channels, in short DCH FP [25.427], defines the structure of the *data frames* carrying the user data and the *control frames* used to exchange measurements and control information. For this reason, the Frame Protocol specifies also simple messages and procedures. The user data frames are normally routed transparently through the DRNC; thus the Iur frame protocol is used also in Iub and referred to as Iur/Iub DCH FP.

The functions offered by the Iur DCH module are:

- *Establishment, modification and release of the dedicated channel in the DRNC due to hard and soft handover in the dedicated channel state*
- *Setup and release of dedicated transport connections across the Iur interface*
- *Transfer of DCH Transport Blocks between SRNC and DRNC*
- *Management of the radio links in the DRNS, via dedicated measurement report procedures and power setting procedures*

5.5.1.3 Iur3: Support of Common Channel Traffic

This functionality allows the handling of common and shared channel data streams across the Iur interface. It requires the Common Transport Channel module of the RNSAP protocol and the Iur Common Transport Channel Frame Protocol (in short, CCH FP). The Q.2630.1

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 270 of 304

RNS1 to utilise a cell
e RRC connection).

ur, the User Plane and

P signalling and allows
ed for this functionality
nchoring of the SRNC
ources in the Node B),
rcuit-switched domain.
the dedicated channel,
d for the setup of the
is conveyed over one
nequal error protection

P [25.427], defines the
ames used to exchange
Protocol specifies also
ly routed transparently
id referred to as Iur/Iub

el in the DRNC due to
e Iur interface
urement report proce-

inel data streams across
of the RNSAP protocol
CH FP). The Q.2630.1

signalling protocol of the Transport Network Control Plane is also needed if signalled AAL2 connections are used.

If this functionality is not implemented, every inter-RNC cell update always triggers an SRNC relocation, i.e. the serving RNC is always the RNC controlling the cell used for common or shared channel transport.

The identification of the benefits of this feature caused a long debate in the relevant standardisation body. On the one hand, this feature allows the implementation of the total anchor RNC concept, avoiding the complex SRNC relocation procedure (via the CN); on the other hand, it requires the splitting of the Medium Access Control layer functionality into two network elements, generating inefficiency in the utilisation of the resources and complexity in the Iur interface. The debate could not reach an agreement, thus the feature is supported by the standard but is not essential for the operation of the system.

The functions offered by the Iur common transport channel module are:

- *Setup and release of the transport connection across the Iur for common channel data streams*
- *Splitting of the MAC layer between the SRNC (MAC-d) and the DRNC (MAC-c and MAC-sh). The scheduling for DL data transmission is performed in the DRNC*
- *Flow control between the MAC-d and MAC-c/MAC-sh*

5.5.1.4 Iur4: Support of Global Resource Management

This functionality provides signalling to support enhanced radio resource and O&M features across the Iur interface. It is implemented via the *global module* of the RNSAP protocol, and does not require any User Plane protocol, since there is no transmission of user data across the Iur interface. The function is considered optional. This function is not present in the Release'99 UTRAN specification, but it is foreseen to be introduced in subsequent releases for the support of advanced positioning methods and Iur optimisation purposes.

The functions offered by the Iur global resource module are:

- *Transfer of cell measurements between two RNCs*
- *Transfer of Node B timing information between two RNCs*

5.5.2 *RNC–Node B Interface and the NBAP Signalling*

The protocol stack of the RNC–Node B interface (Iub interface) is shown, with the typical triple plane notation, in Figure 5.9.

In order to understand the structure of the interface, it is necessary to briefly introduce the logical model of the Node B, depicted in Figure 5.10. This consists of a common control port (a common signalling link) and a set of traffic termination points, each controlled by a dedicated control port (dedicated signalling link). One traffic termination point controls a number of mobiles having dedicated resources in the Node B, and the corresponding traffic is conveyed through dedicated data ports. Common data ports outside the traffic termination points are used to convey RACH, FACH and PCH traffic.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 271 of 304

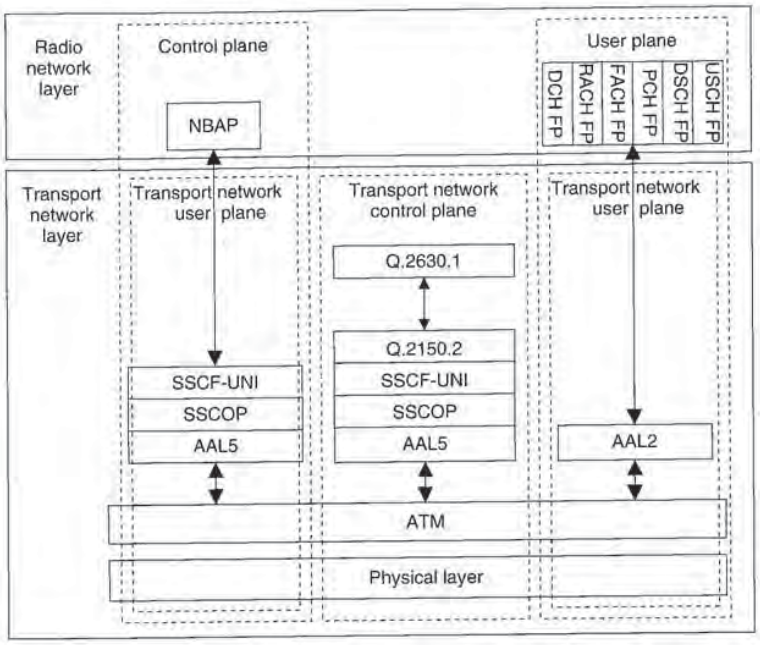


Figure 5.9. Protocol stack of the Iub interface. This is similar to the Iur interface protocol, the main difference being that in the Radio Network and Transport Network Control Planes the SS7 stack is replaced by the simpler SAAL-UNI as signalling bearer. Note also that the SCTP/IP option is not present here

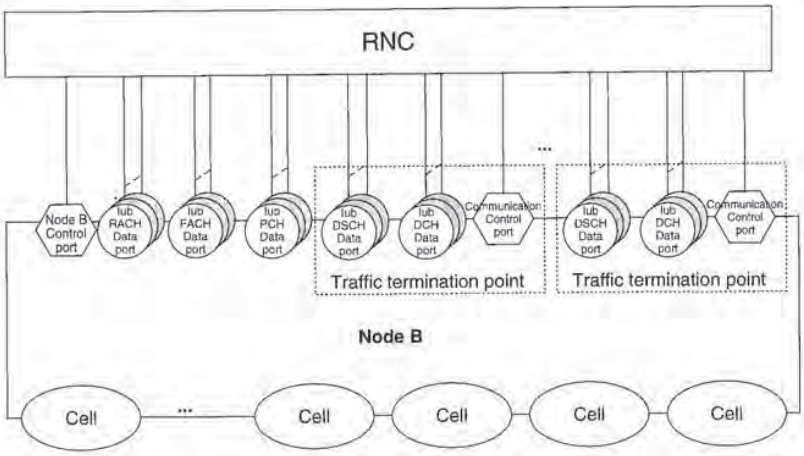
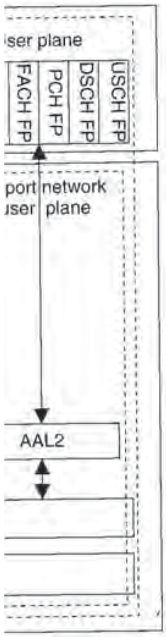
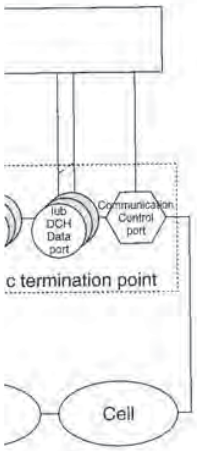


Figure 5.10. Logical model of the Node B for FDD

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 272 of 304



erface protocol, the main
I Planes the SS7 stack is
ie SCTP/IP option is not



D

Note that there is no relation between the traffic termination point and the cells, i.e. one traffic termination point can control more than one cell, and one cell can be controlled by more than one traffic termination point.

The Iub interface signalling (NBAP, *Node B Application Part*) is divided into two essential components: the common NBAP, that defines the signalling procedures across the common signalling link, and the dedicated NBAP, used in the dedicated signalling link.

The User Plane Iub frame protocols define the structures of the frames and the basic in-band control procedures for every type of transport channel (i.e. for every type of data port of the model). The Q.2630.1 signalling is used for the dynamic management of the AAL2 connections used in the User Plane.

5.5.2.1 Common NBAP and the Logical O&M

The common NBAP (C-NBAP) procedures are used for the signalling that is not related to one specific UE context already existing in the Node B. In particular, the C-NBAP defines all the procedures for the logical O&M (Operation and Maintenance) of the Node B, such as configuration and fault management.

The main functions of the Common NBAP are:

- *Setup of the first RL of one UE, and selection of the traffic termination point*
- *Cell configuration*
- *Handling of the RACH/FACH and PCH channels*
- *Initialisation and reporting of Cell or Node B specific measurement*
- *Fault management*

5.5.2.2 Dedicated NBAP

When the RNC requests the first radio link for one UE via the C-NBAP *Radio Link Setup* procedure, the Node B assigns a traffic termination point for the handling of this UE context, and every subsequent signalling related to this mobile is exchanged with dedicated NBAP (D-NBAP) procedures across the dedicated control port of the given Traffic Termination Point.

The main functions of the Dedicated NBAP are:

- *Addition, release and reconfiguration of radio links for one UE context*
- *Handling of dedicated and shared channels*
- *Handling of softer combining*
- *Initialisation and reporting of radio link specific measurement*
- *Radio link fault management*

References

[1] 3GPP Technical Specification 25.401 UTRAN Overall Description.
[2] 3GPP Technical Specification 25.410 UTRAN Iu Interface: General Aspects and Principles.
[3] 3GPP Technical Specification 25.411 UTRAN Iu Interface: Layer 1.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 273 of 304

[4] 3GPP Technical Specification 25.412 UTRAN Iu Interface: Signalling Transport.
[5] 3GPP Technical Specification 25.413 UTRAN Iu Interface: RANAP Signalling.
[6] 3GPP Technical Specification 25.414 UTRAN Iu Interface: Data transport and Transport Signalling.
[7] 3GPP Technical Specification 25.415 UTRAN Iu Interface: CN-RAN User Plane Protocol.
[8] 3GPP Technical Specification 25.420 UTRAN Iur Interface: General Aspects and Principles.
[9] 3GPP Technical Specification 25.421 UTRAN Iur Interface: Layer 1.
[10] 3GPP Technical Specification 25.422 UTRAN Iur Interface: Signalling Transport.
[11] 3GPP Technical Specification 25.423 UTRAN Iur Interface: RNSAP Signalling.
[12] 3GPP Technical Specification 25.424 UTRAN Iur Interface: Data Transport and Transport Signalling for CCH Data Streams.
[13] 3GPP Technical Specification 25.425 UTRAN Iur Interface: User Plane Protocols for CCH Data Streams.
[14] 3GPP Technical Specification 25.426 UTRAN Iur and Iub Interface Data Transport and Transport Signalling for DCH Data Streams.
[15] 3GPP Technical Specification 25.427 UTRAN Iur and Iub Interface User Plane Protocols for DCH Data Streams.
[16] 3GPP Technical Specification 25.430 UTRAN Iub Interface: General Aspects and Principles.
[17] 3GPP Technical Specification 25.431 UTRAN Iub Interface: Layer 1.
[18] 3GPP Technical Specification 25.432 UTRAN Iub Interface: Signalling Transport.
[19] 3GPP Technical Specification 25.433 UTRAN Iub Interface: NBAP Signalling.
[20] 3GPP Technical Specification 25.434 UTRAN Iub Interface: Data Transport and Transport Signalling for CCH Data Streams.
[21] 3GPP Technical Specification 25.435 UTRAN Iub Interface: User Plane Protocols for CCH Data Streams.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 274 of 304

Appendix 18

Third Generation Partnership Project

3GPP

Working Procedures

7 July 1999

Petitioners' Ex. 1016

Exhibit 2004
IPR2023-00919
Page 276 of 304

Foreword

These Working Procedures of the Third Generation Partnership Project (3GPP) are effective from 7 July 1999.

An electronic version of these Partnership Project Working Procedures is available from the following address:

http://www.3gpp.org

Petitioners' Ex. 1016

Exhibit 2004
IPR2023-00919
Page 277 of 304

Contents

Foreword 2
SECTION A: GENERAL 6
Article 1: Description 6
Article 2: Purpose 6
Article 3: Scope and objectives 6
SECTION B: PARTICIPATION 7
Article 4: Categories 7
Article 5: Partnership 7
Article 6: Organizational Partnership 7
Article 7: Market Representation Partnership 7
Article 8: Individual Membership 8
Article 9: Termination of Individual Membership 8
Article 10: Observership 8
SECTION C: STRUCTURE 8
Article 11: Structure of 3GPP 8
SECTION D: PARTNERS' COLLECTIVE RESPONSIBILITIES 9
Article 12: Organizational Partners' Collective Responsisbilities 9
Article 13: Collective responsibilities of all Partners 9
SECTION E: PROJECT CO-ORDINATION GROUP (PCG) 9
Article 14: PCG tasks 9
Article 15: PCG participation 10
Article 16: PCG appointment of Chairman and Vice Chairman 10
Article 17: PCG Chairman Responsibilities 10
Article 18: PCG meetings 11
Article 19: PCG decision making 11
SECTION F: TECHNICAL SPECIFICATION GROUPS 11
Article 20: TSG tasks 11
Article 21: TSG participation 12
Article 22: TSG and WG election of Chairman and Vice Chairman 12
Article 23: TSG Chairman responsibilities 12
Article 24: TSG and WG Chairman and Vice Chairmen dismissal 13
Article 25: TSG and WG decision making 13
Article 26: TSG and WG voting during a meeting 13
Article 27: TSG or WG voting by correspondence 14
Article 28: TSG or WG voting for the election of TSG or WG Chairman and Vice-Chairman 14

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 278 of 304

Article 29: TSG or WG Chairman's decision appeal process 14
Article 30: TSG and WG meetings 14
Article 31: TSG and WG meeting invitation 14
Article 32: TSG and WG meeting agenda 15
Article 33: TSG and WG meeting registration 15
Article 34: TSG and WG meeting document and file naming 15
Article 35: TSG and WG Participant and Membership List 16
Article 36: TSG Sub Working Groups 16
SECTION G: WORK PROGRAMME AND TECHNICAL CO-ORDINATION 16
Article 37: Work Programme 16
Article 38: Work Items 16
Article 39: Work Item creation 17
Article 40: Work Item adoption by PCG 17
Article 41: Work Item stopping 17
Article 42: Technical co-ordination 17
SECTION H: DELIVERABLES 18
Article 43: Deliverable types 18
Article 44: Approval process 18
Article 45: Drafting rules 18
Article 46: Copyright and ownership 18
Article 47: Conversion by Organizational Partners 18
SECTION I: REPORTING 18
Article 48: Chairman's reporting obligations 18
Article 49: Changes to structure and officials 19
Article 50: Calendar of meetings 19
SECTION J: EXTERNAL RELATIONS 19
Article 51: Relationship with the ITU 19
Article 52: Relations with other groups 19
SECTION K: MISCELLANEOUS 19
Article 53: Resources 19
Article 54: Support Team 19
Article 55: Intellectual Property Rights (IPR) Policy 20
Article 56: Working language 20
Article 57: Duration 20
Article 58: Review of activities 20
Article 59: Dissolution, winding up 20
Article 60: Amendments to 3GPP Working Procedures 20

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 279 of 304

Annex A: Definitions 21
Annex B: Abbreviations 22
Annex C: Individual member application form 23
Annex D: External Liaison Approval Process……

Petitioners' Ex. 1016

Exhibit 2004
IPR2023-00919
Page 280 of 304

SECTION A: GENERAL

Article 1: Description

The Partnership Project is not a legal entity but is a collaborative activity between the following recognized Standards Development Organizations:

ARIB (Japan)

CWTS (China)

ETSI (Europe)

T1 (US)

TTA (Korea)

TTC (Japan)

The Partnership Project is entitled the "THIRD GENERATION PARTNERSHIP PROJECT" and may be known by the

Article 2: Purpose

The purpose of 3GPP is to prepare, approve and maintain globally applicable Technical Specifications and Technical Reports for a 3rd Generation Mobile System based on the evolved GSM core network, and the Universal Terrestrial Radio Access (UTRA), to be transposed by the Organizational Partners into appropriate deliverables (e.g., standards).

Article 3: Scope and objectives

The 3rd Generation Mobile System and its capabilities shall be developed in a phased approach. Initially, 3GPP shall prepare, approve and maintain the necessary set of Technical Specifications and Technical Reports for the first phase of a 3rd Generation Mobile System including:

- UTRAN (including UTRA; W-CDMA in Frequency Division Duplex (FDD) mode and TD-CDMA in Time Division Duplex (TDD) mode);
- 3GPP Core Network (Third Generation networking capabilities evolved from GSM . These capabilities include mobility management and global roaming);
- Terminals for access to the above (including specifications for a UIM);
- Service and system aspects.

The Technical Specifications and Technical Reports shall be developed in view of global roaming and circulation of terminals.

The set of 3GPP Technical Specifications and Technical Reports for the first phase of the 3GPP core network and the specifications for the GSM core network should be common to the greatest extent possible and should not be unnecessarily different.

The results of the 3GPP work may form the basis of member contributions to the ITU in accordance with existing procedures.

3GPP shall take account of emerging ITU recommendations on interworking between IMT-2000 family members.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 281 of 304

In the framework of agreed relationships, 3GPP shall prepare Technical Specifications and Technical Reports that are intended to form the basis of standards, or parts of standards, of the Organizational Partners.

SECTION B: PARTICIPATION

Article 4: Categories

Participation in 3GPP shall be classified into one of the following categories:

- Partners;
- Individual Members.
- Observers and Guests

Article 5: Partnership

Partners in 3GPP shall be classified into one of the following two categories:

- Organizational Partners;
- Market Representation Partners.

Article 6: Organizational Partnership

Organizational Partnership is open to any Standards Organization, irrespective of its geographical location, which has:

- a national, regional or other officially recognized status and the capability and authority to define, publish and set standards within the 3GPP scope, in that nation or region;
- an Intellectual Property Rights (IPR) Policy which is compatible with those of the Organizational Partners;
- committed itself to all or part of the 3GPP scope;
- signed the Partnership Project Agreement.

Standards Organizations may apply to become an Organizational Partner by writing to any of the existing Organizational Partners.

Article 7: Market Representation Partnership

The Organizational Partners may invite Market Representation Partners to take part in 3GPP.

An invitation for Market Representation Partnership is open to any organization, irrespective of its geographical location, which:

- has the ability to offer market advice to 3GPP and to bring into 3GPP a consensus view of market requirements (e.g. services, features and functionality) falling within the 3GPP scope;
- does not have the capability and authority to define, publish and set standards within the 3GPP scope, nationally or regionally;
- has committed itself to all or part of the 3GPP scope;
- has signed the Partnership Project Agreement.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 282 of 304

Organizations may apply to become Market Representation Partners by writing to any of the existing Partners.

Article 8: Individual Membership

Membership in an Organizational Partner is a pre-requisite for Individual Membership of 3GPP. All entities registered as members of an Organizational Partner and eligible for participation in the technical work of that Organizational Partner, can become Individual Members of 3GPP if they are committed to support 3GPP and:

- to contribute technically or otherwise to one or more of the Technical Specification Groups within the 3GPP scope;
- to use the 3GPP results to the extent feasible.

An Individual Member has the right to participate in the work of 3GPP by attending meetings of the Technical Specification Groups and subtending groups.

Applications for Individual Membership of a Technical Specification Group shall be made in writing to the relevant Organizational Partner using the form given at **Annex C**.

Individual Members act in 3GPP in their own right and carry the full responsibility for their contributions.

Article 9: Termination of Individual Membership

Individual Membership of 3GPP may be terminated by dissolution, abolition, resignation or expulsion from the related Organizational Partner.

Article 10: Observership and Guests

The status of Observer may be granted by the Organizational Partners to an entity which has the qualifications to become a future Partner.

An Observer may send a single representative to an Organizational Partners or PCG meeting. An Observer may also have representatives at TSG meetings. Representatives of Observers may participate in discussions, receive and contribute documents but may not take part in decision making or hold any leadership positions.

Additional participation rights of an Observer shall be decided by the Organizational Partners on a case-by-case basis.

The status of Guest may be granted for a limited period , by the Organizational Partners to an entity which has the qualifications to become a future Individual Member. The limited period shall be decided by the Organizational Partners on a case-by-case basis.

A Guest may have representatives at TSG and subtending group meetings. Representatives may participate in discussions, receive and contribute documents but may not take part in decision making or hold any leadership positions.

SECTION C: STRUCTURE

Article 11: Structure of 3GPP

3GPP shall consists of a Project Co-ordination Group (PCG) and Technical Specification Groups (TSGs). The Technical Specification Groups may establish Working Groups if required.

The Organizational Partners may decide to call a meeting of the full 3GPP membership if required.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 283 of 304

SECTION D: PARTNERS' COLLECTIVE RESPONSIBILITIES

Article 12: Organizational Partners' Collective Responsisbilities

The Organizational Partners shall determine the general policy and strategy of 3GPP.

In addition the Organizational Partners shall perform the following tasks:

- approval and maintenance of the 3GPP scope;
- maintenance the Partnership Project Description
- taking decisions on the creation or cessation of Technical Specification Groups, and approving their scope and terms of reference;
- approval of Organizational Partner funding requirements;
- allocation of human and financial resources provided by the Organizational Partners to the Project Co-ordination Group;
- acting as a body of appeal on procedural matters referred to them.

Article 13: Collective responsibilities of all Partners

Organizational Partners and Market Representation Partners shall perform the following tasks:

- maintenance of the Partnership Project Agreement
- approval of applications for 3GPP partnership;
- taking decisions relating to the dissolution of 3GPP.

SECTION E: PROJECT CO-ORDINATION GROUP (PCG)

Article 14: PCG tasks

The PCG shall perform the following tasks:

- appointment of PCG Chairman and Vice Chairmen;
- allocation of human and financial resources provided by Organizational Partners to TSGs;
- allocation of voluntary human and financial resources provided by Market Representation Partners and Individual Members;
- management of the 3GPP Support Team;
- handling of appeals from Individual Members on procedural matters referred to them;
- propose and approve modifications to the Partnership Project Working Procedures
- handling of appeals from Individual Members on technical matters referred to them;

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 284 of 304

- determination of the overall time frame and manage overall work progress;
- final adoption of new and stopped work items proposed by the TSGs within the agreed 3GPP scope and objectives;
- when a work item is outside the scope of the 3GPP, and where a common global solution is desired, recommend how to achieve a global solution;
- appointment or dismissal of TSG Chairmen and Vice-Chairmen, as proposed by TSGs based on election results. (The proposed candidate shall be appointed unless there are extraordinary reasons that prevent such an appointment, e.g., severe company or geographical imbalance within 3GPP. In such cases the TSG shall be requested to elect an alternative candidate. The decision not to appoint a candidate shall be made by consensus.);
- authorizing requests from the TSGs for approval to liaise with external organizations, and maintain a list of approved requests
- maintenance of the register of Individual Members eligible to participate in 3GPP;
- maintenance of the register of IPR declarations relevant to 3GPP, received by the Organizational Partners;

The PCG may decide to call a meeting of the full 3GPP membership if required.

Article 15: PCG participation

The following shall have a right to participate in the PCG:

- Three representatives of each Organizational Partner;
- Three representatives of each Market Representation Partner;
- The Chairmen and Vice Chairmen of the TSGs as ex-officio members.
- One representative of each Observer

.

Article 16: PCG appointment of Chairman and Vice Chairman

The PCG shall appoint their Chairman and Vice Chairmen from amongst the Organizational Partner representatives.

The Chairman and Vice Chairmen shall be appointed for a one year term of office.

The Chairman and Vice Chairmen shall normally serve one term of office. If no other candidates are available, the Chairman or Vice Chairmen may be appointed for a further term.

Successive Chairmen and Vice Chairmen should not be from the same Organizational Partner, the same region or from the same group of companies, unless no other candidate is available.

Article 17: PCG Chairman Responsibilities

The PCG Chairman is responsible for the overall management of the co-ordination work within 3GPP.

The Chairman has the overall responsibility to ensure that the Partnership Project Agreement, Partnership Project Description and Partnership Project Working Procedures are followed.

The Chairman may nominate officials to assist in the work.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 285 of 304

The Chairman may be assisted by the Support Team.

The Chairman may delegate tasks to the Vice Chairmen.

In performing his tasks, the Chairman and Vice Chairmen shall maintain strict impartiality and act in the interest of the 3GPP.

Article 18: PCG meetings

A meeting of the PCG shall be held at least twice per year.

At least thirty days before the due date, a calling notice, draft agenda and supporting documents shall be issued.

Article 19: PCG decision making

In any meeting of the PCG, the quorum required for decision making shall be 50% of the total number of Organizational Partners. Proxies shall not be permitted.

The PCG shall endeavour to reach consensus on all issues. The views and opinions of the Market Representation Partners and the Chairmen and Vice Chairmen of the TSGs shall be taken into account during the consensus building process. If consensus cannot be achieved, the Chairman can decide to take a vote. The vote may exceptionally be performed by a secret ballot if decided by the PCG.

Each Organizational Partner shall have one vote. A proposal shall be deemed to be approved if 71% of the votes cast are in favour. Abstentions or failure to submit a vote shall not be included in determining the number of votes cast.

SECTION F: TECHNICAL SPECIFICATION GROUPS

Article 20: TSG tasks

The TSGs shall prepare, approve and maintain the 3GPP Technical Specifications and Technical Reports.

The TSGs shall also perform the following tasks:

- Propose to the PCG for appointment TSG Chairman and Vice Chairmen based on election results;
- Creation of TSG Working Groups and approval of their terms of reference;
- When a new Working Group is created, the appointment of TSG Working Group Convenor ;
- Allocation of resources within the TSG;
- Allocation of voluntary human and financial resources provided by Market Representation Partners and Individual Members;
- Handling of appeals from Individual Members on technical matters;
- Preparation of a detailed time frame and management of detailed work progress;
- Management of work items;
- Technical Co-ordination;
- Proposal and approval of work items within the agreed scope and terms of reference of the TSG.
- Where a work item is outside the scope of the 3GPP, but a common global solution is desired, recommend an approach to the PCG;

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 286 of 304

- Assignment of work to Partners. (Specification development may be accomplished using various methods, including the assignment of work to Partners.)
- Maintenance of the list of Individual Members eligible to vote within the TSG (Voting Members).

Article 21: TSG participation

The following shall have a right to participate in the TSGs:

- Representatives of members of participating Organizational Partners (i.e. Individual Members);
- Representatives of Organizational Partners
- Representatives of Market Representation Partners.
- Representatives of Observers and Guests

Article 22: TSG and WG election of Chairman and Vice Chairman

The TSG Chairman and Vice Chairmen, to be proposed to the PCG for appointment, shall be elected by the Technical Specification Group from amongst the Individual Member representatives. Each TSG shall elect a maximum of two Vice Chairmen.

The Working Group Chairman and Vice Chairmen shall be elected by the Working Group from amongst the Individual Member representatives. Each Working Group shall elect a maximum of two Vice Chairmen.

A candidate for TSG or Working Group election shall provide a letter of support from his Organization and nominations may be made up to the point when an election takes place.

The TSG Chairman and Vice-Chairmen shall be appointed by the PCG on the proposal of the TSG.

The Chairman and the Vice-Chairmen shall be appointed for a two year term of office. The Chairman and Vice-Chairmen may be appointed for one further consecutive term. If no other candidates are available, the Chairman or Vice Chairmen may be appointed for a further term.

Chairman and Vice Chairmen should not be from the same region, Organizational Partner, or from the same group of companies, unless no other candidate is available.

Successive Chairmen should not be from the same Organizational Partner, the same region or from the same group of companies, unless no other candidate is a vailable

When a new TSG is established, the Organizational Partners shall appoint a convenor for the first two TSG meetings. The initial election for TSG Chairman and Vice Chairmen shall take place at the second TSG meeting.

When a new TSG Working Group is established, the TSG shall appoint a Convenor for the first two Working Group meetings. The initial election for Working Group Chairman and Vice Chairmen shall take place at the second Working Group meeting.

Article 23: TSG Chairman responsibilities

The TSG Chairman is responsible for the overall management of the technical work within the TSG and its Working Groups. The Chairman has an overall responsibility to ensure that the activities of the TSG follow the Partnership Project Working Procedures.

The Chairman may nominate officials to assist in the work.

The Chairman may delegate tasks to the Vice Chairmen.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 287 of 304

The Chairman may be assisted by the Support Team.

Recognizing the need to balance the requirement of rapid specification development with the limited resources of participants, the Chairman should encourage a minimum number of meetings, especially parallel meetings, and maximize the use of electronic means to advance the work.

In performing TSG tasks, the Chairman shall maintain strict impartiality and act in the interest of 3GPP.

Article 24: TSG and WG Chairman and Vice Chairmen dismissal

A secret ballot shall be taken for the proposal to dismiss a TSG or WG Chairman or Vice-Chairman because of a failure to effectively perform their duties, if requested by 30% of the TSG or WG membership list. 71% of the votes cast are required to recommend dismissal.

The PCG shall dismiss a Chairman or Vice Chairman on the proposal of the TSG.

Article 25: TSG and WG decision making

TSGs and WGs shall endeavour to reach consensus on all issues, including decisions on Technical Specifications and Technical Reports. If consensus cannot be achieved, the Chairman can decide to take a vote. The vote may exceptionally be performed by a secret ballot if decided by the TSG or WG. A vote may be conducted during a TSG or WG meeting or by correspondence.

A proposal shall be deemed to be approved if 71% of the votes cast are in favour. Abstentions or failure to submit a vote shall not be included in determining the number of votes cast.

It is the responsibility of the Chairman to ensure that questions to be voted upon are phrased in a positive yes/no manner, with 71% required to approve the question. Questions should not be phrased as the TSG shall not do something. Examples of appropriate questions are; Shall the TSG approve the Specification and send it to the SDOs? Shall the liaison be approved? Shall the new WI be approved? Shall the existing WI be stopped? If the issue is to choose option A or B, the question should be split into two questions, with the Chairman selecting the order. First, shall the TSG take option A as the way forward? If this question fails the second question is, shall the TSG take option B as the way forward?

Contributions on which decisions will be based should be made available in good time before each meeting. TSGs may establish informal guidelines for dealing with late contributions.

Article 26: TSG and WG voting during a meeting

The following procedures apply for voting during a TSG or WG meeting:

- before voting, a clear definition of the issues shall be provided by the Chairman;
- Voting Members shall only be entitled to one vote;
- if an Voting Member has more than one representative present, only one representative may vote;
- each Voting Member may only cast the vote once;
- each Voting Member may carry proxy votes for up to five other Voting Members. All proxy votes shall be accompanied by a letter of authority from the authorising Voting Member. Proxies will not be taken into account when determining the quorum;
- the quorum required for voting during a TSG or WG meeting shall be 30% of the total number of Voting Member companies on the TSG or WG membership list;
- the result of the vote shall be recorded in the meeting report.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 288 of 304

Article 27: TSG or WG voting by correspondence

The following procedures apply for voting by correspondence:

- before voting, a clear definition of the issues shall be provided by the Chairman and disseminated to all on the TSG or WG membership list;
- Voting Members shall only be entitled to one vote;
- each Voting Member may only cast the vote once within the voting period;
- the voting period shall be 30 days;
- there are no quorum requirements;
- The result of the vote should be disseminated to everybody on the TSG or WG active participants list.

Article 28: TSG or WG voting for the election of TSG or WG Chairman and Vice-Chairman

In the case where there is more than one candidate for TSG or WG Chairman or Vice-Chairman, a secret ballot shall be used. For interpreting the result of the secret ballot the following procedure shall apply:

When, in the first ballot, no candidate has obtained 71% of the votes cast, a second ballot shall be held. In the second ballot, in cases where there are only two candidates, the candidate obtaining the higher number of votes is elected. In cases where there are more than two candidates, if none of them has obtained 71% of the votes, a third and final ballot shall be held among the two candidates who have obtained the highest number of votes in the second ballot. The candidate obtaining the higher number of votes in the third ballot is then elected.

The TSG or WG Chairman shall be responsible for the voting process and shall ensure that confidentiality is maintained.

Article 29: TSG or WG Chairman's decision appeal process

An Individual Member of 3GPP who opposes a Chairman’s ruling on a vote taken within a TSG or WG may submit its case to the PCG for decision. In such cases the Individual Member shall also inform the relevant TSG or WG Chairman.

When a TSG or WG Chairman has made a ruling, his decision shall be taken as the basis for future operations, unless or until overturned by the PCG.

Article 30: TSG and WG meetings

TSGs and WGs shall meet as necessary to complete their work within the prescribed timeframe. TSGs should endeavour to hold their meetings at the same time and place to assist in the overall co-ordination of the work.

Meeting locations should reflect the geographical diversity of the TSG and WG participants.

Article 31: TSG and WG meeting invitation

The invitation to a TSG or WG meeting and the necessary logistical information shall be disseminated at least 21 days before the meeting to all on the TSG or WG membership list.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 289 of 304

Article 32: TSG and WG meeting agenda

The draft agenda for a TSG or WG meeting shall be disseminated by the responsible Chairman to all on the TSG or WG membership list at least 21 days before a meeting. The draft agenda should indicate subject matters where voting may be required.

Article 33: TSG and WG meeting registration

Every attendee shall register on arrival at each TSG or WG meeting. Each attendee who represents an Individual Member shall declare the precise name of that Individual Member. An attendee may only register to represent one Individual Member. This information shall be used for the preparation of voting forms.

Article 34: TSG and WG meeting document and file naming

Documents for a TSG or WG meeting shall follow a consistent numbering system as shown in the following example:

3GPP/TSGx.m#y(nn)-zzz

This numbering system has four logical elements:

1) **3GPP**: to indicate that it is a 3GPP document;
2) **/TSGx**: the name of the TSG;

   where x : **R** (Radio Access Network)

   N (Core Network)

   S (Service and System Aspects)

   T (Terminals)
3) **m** Working Group identity (if required)
4) **#y**: TSG or WG meeting number
5) **(nn)**: to indicate the year, e.g. (99);
6) **zzz**: unique number of the document or its status, etc.

Electronic document files shall follow an 8+3 naming convention as follows:

Gxmnnzzz.ext

This numbering system has four logical elements:

1) **/Gx**: the name of the ***TSG*** Group;

   where **x** : **R** (Radio Access Network)

   N (Core Network)

   S (Service and System Aspects)

   T (Terminals)
2) **m** Working Group identity (if required)
3) **nn**: to indicate the year, e.g. (98);

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 290 of 304

4) **zzz**: unique number of the document or its status, etc.

5) .**ext**: file type extension e.g. pdf, rtf

No provision is made for the use of revision numbers. Documents which are a revision of a previous version should indicate the document number of that previous version.

Article 35: TSG and WG Participant and Membership List

Each TSG shall maintain a list of active participants and voting members. To qualify for either list it is necessary to attend TSG or WG meetings. Individuals who fail to attend three consecutive meetings of a TSG or WG without justification shall be removed from the active participants list. A member or company (or agency) which is not represented at three consecutive meetings of the TSG or WG without justification shall be removed from the voting members list. In either case, those removed shall be re-instated after attending one meeting. The right to vote is reinstated at the next meeting attended.

The active participants list shall be used for document distribution. The voting member list shall be used to establish quorum and for determining those eligible to take part in a vote.

Voting members shall designate a Principal and Alternate individual for document distribution and voting. Either of these individuals may designate a replacement in writing to represent them. This is not considered a proxy if the person designated registers as representing the same Individual Member.

Any group that wants to call an electronic meeting (audio, video, document distribution by posting or e-mail, etc) may do so, although this works best with smaller groups. Therefore, all electronic meetings are allowed and count towards attendance. However, if a meeting is designated as face-to-face, provision of bridge and speakerphone capabilities for those requesting it would be at the discretion of the host. Also, in this case for those only participating by speakerphone they would not be counted toward quorum, attendance or allowed to vote (TSG, WG).

Article 36: TSG Sub Working Groups

A Working Group may establish a Sub Working Group (SWG) with defined Terms of Reference. The Working Group shall appoint a SWG Chairman. The SWG shall work by consensus. The meeting notice requirements for a SWG meeting are the same as for TSGs and WGs.

SECTION G: WORK PROGRAMME AND TECHNICAL CO-ORDINATION

Article 37: Work Programme

The 3GPP Work Programme shall consist of Work Items defined by the TSGs.

Article 38: Work Items

A 3GPP Work Item is a specification task defined in terms of the following principle parameters:

- title;
- intended output (ie Technical Specifications or Technical Reports);
- impact on other Technical Specifications and Technical Reports;

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 291 of 304

- technical scope, including the field of application of the intended output;
- impact on other 3GPP Work Items;
- the schedule of tasks to be performed;
- the identities of the supporting Individual Members;
- the identity of the Work Item Rapporteurs.

Article 39: Work Item creation

Each proposed new Work Item shall be supported by at least four Individual Members, and their names shall be recorded in the Work Item definition prepared for the TSG approval. One or more persons shall be named as Rapporteur for the proposed Work Item, and the Rapporteur shall act as the prime contact point on technical matters and for information on progress throughout the drafting phases.The supporting Individual Members are expected to contribute to and progress the new work item throughout the drafting phases.

In addition to the above, TSGs shall approve new Work Items, giving all essential parameters. The proposal shall be entered into the 3GPP work programme, clearly marked as a new entry, for which a unique reference identity shall be allocated.

Article 40: Work Item adoption by PCG

The 3GPP work programme shall be made available to all Individual Members. A new Work Item shall remain flagged as "new" until the end of the month following the month during which the 3GPP work item was entered into the 3GPP work programme. A new Work Item shall be adopted by the PCG unless a substantial objection is received from an Individual Member or Partner during this period. At the end of the period, the "new" flag shall be removed (even if there is an objection) and it is the responsibility of any objecting Individual Member or Partner to discuss their objections with the TSG Chairman. If it is not possible to resolve the objection, it is the responsibility of the Individual Member or Partner to raise the issue with the PCG.

The TSGs shall ensure that the 3GPP Work Item details are maintained at regular intervals.

Article 41: Work Item stopping

Prior to completion of the intended 3GPP output, the responsible TSG may conclude that a Work Item is no longer required. Any Work Item shall automatically be considered by a TSG for stopping, if no progress has been achieved in a given period of time, typically one year. In such cases, the Work Item shall be flagged as "stopped" in the Work Programme. The proposal to stop a Work Item shall be fully justified.

The Work Programme shall be updated accordingly, and shall show the Work Item as "stopped" until the end of the month following the month during which the Work Item was initially flagged.

The Work Item will be stopped by the PCG unless substantial objection is received from an Individual Member during this period. It is the responsibility of any objecting Individual Member to discuss their objections with the TSG Chairman. If it is not possible to resolve the objection, it is the responsibility of the Individual Member to raise the issue with the PCG.

Article 42: Technical co-ordination

The PCG shall be responsible for determining the overall time frame and for managing the overall work progress. The System Aspects TSG shall have a particular responsibility for the technical co-ordination of work being undertaken within 3GPP, and for overall system architecture and system integrity. Problems encountered in performing this technical co-ordination role shall be reported immediately to the PCG.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 292 of 304

SECTION H: DELIVERABLES

Article 43: Deliverable types

3GPP shall prepare, approve and maintain documents known as Technical Specifications and Technical Reports. Such documents shall be drawn up by the TSGs and shall, following approval at that level, be submitted to the participating Organizational Partners to be submitted to their respective standardization processes.

Article 44: Approval process

Approval of Technical Specifications and Technical reports by a TSG shall normally be by consensus.

Where consensus cannot be achieved in the TSG a vote may be taken.

When Technical Specifications and Technical Reports become sufficiently stable, they shall be put under change control of the relevant TSG. The further elaboration of these Technical Specifications and Technical Reports shall be achieved by change requests to be approved by the TSG.

Article 45: Drafting rules

The Technical Specifications and Technical Reports drafted by the TSGs shall follow the 3GPP drafting rules, using document processing facilities, format, languages and notations agreed by the Organizational Partners, and on a medium suited for electronic document handling and publishing.

Article 46: Copyright and ownership

The Organizational Partners will have joint ownership (including copyright) of the Technical Specifications and Technical Reports produced by 3GPP.

Article 47: Conversion by Organizational Partners

Organizational Partners shall use their best endeavours to convert the Technical Specifications and Technical Reports approved by the Partnership Project into national/regional deliverables in a timely manner through their normal processes.

The Organizational Partners are urged not to change the technical parts of the Technical Specifications and Technical Reports; they may add non-technical parts required by their own deliverable schemes and they may add descriptions of options selected.

Organizational Partners should ensure that all un-resolved comments raised during their public enquiry and approval phases are delivered to the appropriate TSG.

SECTION I: REPORTING

Article 48: Chairman’s reporting obligations

A report shall be prepared by the Chairman following all PCG and TSG meetings.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 293 of 304

Article 49: Changes to structure and officials

The Chairman of each TSG shall inform the PCG of all organizational changes concerning Working Groups and their officials. An up to date record of the 3GPP structure shall be maintained.

Article 50: Calendar of meetings

The PCG and TSGs shall maintain an up to date calendar of the dates and venues for future meetings.

SECTION J: EXTERNAL RELATIONS

Article 51: Relationship with the ITU

3GPP results should be submitted to the ITU as appropriate.

3GPP will not contribute directly to the ITU. Formal contributions to ITU Study Groups shall be made by Individual Members who are also members of the ITU. 3GPP Technical Specifications and Technical Reports may be taken as the technical content of such contributions.

Article 52: Relations with other groups

TSGs and WGs are encouraged to liaise directly with the relevant technical bodies within the 3GPP and Partners as appropriate.

A liaison statement shall clearly communicate what is expected from the receiver, i.e., which parts are for information, which questions are expected to be clarified and by whom (especially if there are multiple receivers), and also when an answer is needed, e.g., when is the next meeting of the group sending the liaison statement.

The PCG shall maintain a list, based on proposals received from the TSGs, of external organizations with whom the TSGs and subtending WGs are authorised to liaise directly. External liaisons can not be approved by SWGs or Ad Hoc groups.

The external liaison approval process is described in Annex D.

SECTION K: MISCELLANEOUS

Article 53: Resources

The resources for the operation of 3GPP shall be managed by the Organizational Partners. The resources are allocated to the TSGs by the PCG.

Article 54: Support Team

The Partners shall provide logistical support to, and assist in the operation of, 3GPP. The support shall be in the form of a Support Team which shall operate under the overall management of the PCG and the day to day management of TSGs.

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 294 of 304

Article 55: Intellectual Property Rights (IPR) Policy

Individual Members shall be bound by the IPR Policy of their respective Organizational Partner.

Individual Members should declare at the earliest opportunity, any IPRs which they believe to be essential, or potentially essential, to any work ongoing within 3GPP.

Organizational Partners should encourage their respective members to grant licences on fair, reasonable terms and conditions and on a non-discriminatory basis.

The PCG shall maintain a register of IPR declarations relevant to 3GPP, received by the Organizational Partners.

Article 56: Working language

The working language for 3GPP shall be English.

Meetings of the PCG and TSGs shall be conducted in English.

3GPP Technical Specifications and Technical Reports shall be prepared in English (as defined by the Shorter Oxford English Dictionary).

Article 57: Duration

3GPP shall be task oriented and on completion of the tasks the future of 3GPP shall be re-considered. The continuation of 3GPP shall therefore be confirmed by the Organizational Partners on an annual basis.

Article 58: Review of activities

An evaluation of the activities of 3GPP should be made by the Organizational Partners at regular intervals.

Article 59: Dissolution, winding up

In the event of a voluntary dissolution of 3GPP, the Partners shall determine the terms of liquidation by consensus. All issues shall be documented and distributed at least 30 days prior to decisions being made.

Article 60: Amendments to 3GPP Working Procedures

These Partnership Project Working Procedures may only be amended by decision taken by the PCG.

Petitioners' Ex. 1016

Exhibit 2004
IPR2023-00919
Page 295 of 304

Annex A: Definitions

Attendee:	An individual taking part in a TSG/WG meeting physically or by electronic means, if not designated as a face-to-face meeting.
Consensus:	General agreement, characterized by the absence of sustained opposition to substantial issues by any important part of the concerned interest and by a process that involves seeking to take into account the views of all parties concerned and to reconcile any conflicting arguments. (Note: consensus need not imply unanimity).
Conversion:	The transformation of a 3GPP output document into an Organizational Partners deliverable following the Organizational Partners' recognized processes.
Drafting Rules:	A document approved by the Organizational Partners providing rules for the drafting of 3GPP Technical Specifications and Technical Reports.
Election:	The voting process used to identify an individual from a number of individuals.
Guest:	An entity fulfilling the criteria to become a future Individual Member, which has been granted temporary participation rights in the 3GPP
Individual Member:	A member of an Organizational Partner having participation rights within that Organizational Partner and which has registered to take part in 3GPP.
Market Representation Partner:	An Partner invited by the Organizational Partners to participate in 3GPP to offer advice and to bring into 3GPP a consensus view of market requirements.
Observer:	An Organization fulfilling the criteria to become a future Partner which has been granted temporary participation rights in the 3GPPOrganizational Partner: A recognized Standards Organization which has been accepted as a Partner in 3GPP.
Partner:	An Organizational Partner or a Market Representation Partner of 3GPP.
Partnership Project Agreement:	The document signed by 3GPP Partners defining their rights and obligations.
Partnership Project Description:	A document which describes the overall structure and operation of 3GPP.
Sub Working Group	A subordinate body of a Working Group.
Support Team:	A number of persons dedicated to support 3GPP.
Technical Report:	A 3GPP output document containing mainly informative elements approved by a Technical Specification Group.
Technical Specification:	A 3GPP output document containing normative provisions approved by a Technical Specification Group.
Voting Member	An Individual Member who has voting rights within a TSG/WG.
Work Item:	The documented record of a specific technical activity of 3GPP.
Work Programme:	The documented record of the all technical activities of 3GPP.
Working Group:	A subordinate body of a Technical Specification Group.

Petitioners' Ex. 1016

Exhibit 2004
IPR2023-00919
Page 296 of 304

Annex B: Abbreviations

3GPP	Third Generation Partnership Project
ARIB	Association of Radio Industries and Businesses
CDMA	Code Division Multiple Access
CWTS	China Wireless Telecommunications Standards Group
ETSI	European Telecommunications Standards Institute
FDD	Frequency Division Duplex
GSM	Global System for Mobile Communication
IMT-2000	International Mobile Telecommunication
ITU	International Telecommunication Union
PCG	Project Co-ordination Group
SWG	Sub Working Group
T1	Standards Committee T1
TDD	Time Division Duplex
TSG	Technical Specification Group
TTA	Telecommunications Technology Association
TTC	Telecommunication Technology Committee
UIM	User Identity Module
UTRA	Universal Terrestrial Radio Access
UTRAN	Universal Terrestrial Radio Access Network
W-CDMA	Wideband CDMA
WG	Working Group

Petitioners' Ex. 1016

Exhibit 2004
IPR2023-00919
Page 297 of 304

Annex C: Individual member application form

APPLICATION FORM
for INDIVIDUAL MEMBERSHIP
of the THIRD GENERATION PARTNERSHIP PROJECT
Please complete this form and return it to your Organizational Partner

COMPANY NAME .....

Please indicate below which ORGANIZATIONAL PARTNER you are a member of

ARIB	
CWTS	
ETSI	
T1	
TTA	
TTC	

Please indicate below which Technical Specification Groups you wish to participate in:

Radio Access Network	
Core Network	
Terminals	
Service and System Aspects	

Signed by (Authorized Representative)	
Print name	
Position	
Date	
Telephone	
Fax	
Email	
Company Web site URL	

Contact persons family name	
Contact persons given name	
Job title	
Mailing address	
Telephone	
Fax	
Email	

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 298 of 304

ANNEX D: EXTERNAL LIAISON APPROVAL PROCESS

The following process shall be used in order for a TSG to gain approval to liaise with an external organization;

- TSG Chairman, or Vice-Chairman at the Chairmans direction, shall send a request to the PCG Secretary containing the following information:

  (a) Name of Organization

  (b) Contact information (including URL)

  (c) Purpose of the liaison request (brief description)

  (d) Urgency of decision-minimum 3 days (e.g. 3 days, 5 days, 2 weeks)

- PCG Secretary shall send request to the PCG exploder list giving deadline for negative comments
- Request shall be considered approved unless negative comments received
- PCG Secretary will inform PCG members and update the web page accordingly
- A TSG or any subtending Working Group may send individual liaisons to any external organization on that TSGs approved list without further PCG approval, except if the statement is considered "sensitive" by the TSG Chairman, in which case PCG clearance is needed.
- It is not necessary to have all external liaisons copied to the PCG and/or TSG SA. The liaison originating TSG should decide, at its own discretion, who should be copied. External liaisons that may have management implications such as schedules, organization, process, procedures, and policy shall be copied to the PCG, or approved by the PCG if "sensitive".

Petitioners' Ex. 1016

Exhibit 2004
IPR2023-00919
Page 299 of 304

Appendix 19

http://www.3gpp.org/ Go JUN AUG SEP
3,499 captures 02
25 Jan 1999 - 2 Mar 2021 2001 2002 2003
About this capture

About 3GPP
Project Management
Technical Bodies
Project Support
Specifications
Membership of 3GPP
Delegates Corner
Meetings
Contact 3GPP
Email Lists
FAQ



Shaping the future of mobile communication standards

News & info

- **Kari Jarvinen re-elected Chairman of SA WG4**
- Elections to be held in CN WG1/ T WG3
- 3GPP IETF Dependencies and Priorities
- New test tools promise global 3G roaming
- GSM calls even more secure thanks to new A5/3 algorithm
- Revised 3GPP Working Procedures agreed by PCG#8 now available
- Manufacturers - want to label your equipment with the 3GPP logo?

Last update: 2nd August 2002

Legal notice

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 301 of 304

Appendix 20

http://www.3gpp.org/specs/version-numbering.htm Go OCT NOV JAN
83 captures
27 Nov 2005 - 12 Sep 2008
2004 2005 2007
About this capture

3GPP Specifications - Version numbering scheme

Spec download | Titles and spec numbers | Current version | Releases | Numbering scheme | Change Requests
Published specifications | Historical information | Work plan | TSG Working methods | Drafting rules | Delegates corner | ASN.1

As 3GPP Technical Specifications and Technical Reports evolve from the early drafting stages, though progressively more stable versions, to being brought under change control, so the version number of the document changes. The rules for maintaining the version number are contained in clause 4.4 of 3GPP TR 21.900, but are briefly summarized here.

The "version" is comprised of three fields:

- major
- technical
- editorial

and each has a numeric value, starting with zero. The fields are separated with dots, and the version number shows major, technical and editorial fields respectively from left to right. Thus a spec whose major field is 4, whose technical field is 7 and whose editorial field is 1 would be shown as **version 4.7.1**.

The **major version field** reflects the stage of the spec:

- 0 = immature draft
- 1 = draft which is at least 50% complete and has been presented / will shortly be presented to the responsible TSG for *information*
- 2 = draft which is at least 80% complete and has been presented / will shortly be presented to the responsible TSG for *approval*
- 3 or greater = spec which has been approved by the responsible TSG and is under change control.

Once under change control, the major field indicates the Release to which the spec applies. Thus it is quite normal for a Release 7 specification to go, on TSG approval, from version 2.0.0 directly to version 7.0.0. There will be no versions 3.0.0, 4.0.0 etc between.

The **technical version field** is incremented each time a technical change is made to the spec as a result of the drafting process (major version <= 2) or as a result of the incorporation of one or more approved Change Requests (major version > 2).

The **editorial version** field is incremented each time a non-technical change is made to the spec, for example to correct trivial typographical errors. Note that any change which could conceivably have an effect on the interpretation of the *technical* provisions of a spec cannot be considered as *editorial*. (Thus changing the greater-than symbol > into the less-than symbol <, although only the result of a mistyped character, is *not* considered editorial, since it makes a profound difference to the interpretation of the technical provisions of the document.) Exceptionally, the editorial version is used to show the replacement of a new version of a spec within the period (normally three working weeks) immediately following the end of a TSG meeting prior to the "all specs available" deadline, even though the modification might be more than purely editorial. Such circumstances cover, for example, the late availability of C code or TTCN associated with a spec. The document's change history annex will always explain the nature of any such change.

The version number, consisting of the three numeric fields, is reflected in the filename of the TS or TR concerned. Each field is represented by a single character, and the mapping between version field value and the character representing that value in the filename is as shown in the table below:

version field value	filename character
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 303 of 304

http://www.3gpp.org/specs/version-numbering.htm Go OCT NOV JAN
83 captures 27
27 Nov 2005 - 12 Sep 2008 2004 2005 2007
About this capture

14	e
15	f
16	g
17	h
18	i
19	jh
20	k
21	l
22	m
23	n
24	o
25	p
26	q
27	r
28	s
29	t
30	u
31	v
32	w
33	x
34	y
35	z
36 onwards	for further study

last updated:
2005-07-21: original

Petitioners' Ex. 1016
Exhibit 2004
IPR2023-00919
Page 304 of 304