Neutral Citation Number: **[2008] EWHC 329 (Pat)**

Case No: HC 2006 C 02034

IN THE HIGH COURT OF JUSTICE
CHANCERY DIVISION
PATENTS COURT

Royal Courts of Justice
Strand, London, WC2A 2LL

Date: 03/03/2008

Before :

THE HON. MR JUSTICE FLOYD

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Between :

QUALCOMM INCORPORATED **(a Delaware Corporation)**	**Claimant**
- and -	
NOKIA CORPORATION **(a Finnish Company)**	**Defendant**

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Mr Antony Watson QC, Mr Guy Burkill QC and Mr Thomas Hinchliffe (instructed by **Lovells**) for the **Claimant**
Mr Michael Silverleaf QC and Mr Adrian Speck (instructed by **Bird & Bird**) for the **Defendant**

Hearing dates: 26th – 30th November; 3-4, 6-7, 10-11, 13-14 and 17-18 December 2007
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Approved Judgment

I direct that pursuant to CPR PD 39A para 6.1 no official shorthand note shall be taken of this
Judgment and that copies of this version as handed down may be treated as authentic.

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THE HON. MR JUSTICE FLOYD

The Hon. Mr Justice Floyd:

Introduction

1.   This is an action for infringement of two patents. Although the claims are not
so limited, both patents are really about cellular mobile telephones of the kind
we carry in our pockets.   The first, European Patent (UK) No. 0,629,324
("324" or "the 324 Patent"), relates to an apparatus for controlling the way in
which the mobile telephone reduces power consumption by monitoring a
channel for incoming messages intermittently. The second, European Patent
(UK) No. 0,695,482 ("482" or "the 482 Patent"), relates to a method and
device for the correction and limitation of the transmitted power of a mobile
telephone. Both the patents are in the name of Qualcomm Incorporated, a US
company and the claimant in the action. Qualcomm promoted the introduction
in some countries of a multiple access terrestrial telephone system known as
"CDMA", of which more later.

2.   The defendant is Nokia Corporation, a Finnish company which is well known
as a manufacturer of mobile telephone handsets. It is accused of contributory
infringement of 324, and infringement of 482, by selling those handsets. Nokia
denies infringement of both patents, contends that they are both invalid and
counterclaims to revoke them. There are also issues about whether the patents
are "essential" to the operation of the relevant standards. In relation to the 324
Patent, Qualcomm seeks a declaration that it is essential, and it is agreed by
Nokia that if the patent is valid and infringed, then it is essential. On the other
hand, Nokia seeks a declaration that 482 is essential if it is infringed, whilst
Qualcomm says that it is not essential.

3.   This is the trial of the technical issues relating to infringement, validity and
essentiality. By an Order dated 11th October 2006, Kitchin J. limited the
present trial to those issues. He ordered

> "[f]or the avoidance of any doubt, all other issues, including
> issues relating to the meaning or effect of the declarations of
> essentiality   made   by   Qualcomm   to   the   European
> Telecommunications Standards Institute in respect of the
> patents in issue, together with all issues relating to relief (if
> any) are reserved and shall not form part of the first trial and no
> interim injunctive relief shall be sought or ordered until issues
> concerning such relief have been determined".

Law - Approach to construction

4.   As is often the case, many of the issues which divide the parties to this action
are issues of construction of the relevant patent claims. The correct approach
to the construction of a patent specification and its claims is now well settled.
The task for the court is to determine what the person skilled in the art would
have understood the patentee to have been using the language of the claim to
mean: see *Kirin Amgen v TKT* [2005] RPC 9 [30]-[35].   In that case the list of
principles to be found in the judgment of Jacob LJ in *Technip France SA's
Patent* [2004] RPC 46 was approved subject to minor modifications. Pumfrey

J in *Halliburton v Smith* [2006] RPC 2; [2005] EWHC 1623 at [68] to [69] listed those modified principles, and added some observations of his own. I will not re-write, far less attempt to paraphrase them here. I will endeavour to apply them.

5. One observation of Pumfrey J's is important here. The addressee of the specification is the person skilled in the art, equipped with the common general knowledge, no more and no less. The addressee does not have access to documents which are not part of the common general knowledge. This may seem trite, but there was a sustained attempt by Nokia in cross examination to make use of Qualcomm's confidential internal documents (disclosed as relevant to other issues) on the issue of construction. This is wrong, and counterproductive. It is easy to explain why this is so. It is wrong because, if the effect of such an internal document were to force an interpretation different from that which would be arrived at without it, the patent would mean different things to different people. In particular, it would mean different things in the course of the grant procedure (where there is no disclosure) and in litigation (at least when there is chance disclosure on other issues). It is wrong because the process of construction is designed to elicit objectively what the patentee's intention is, not to inquire into his subjective intention. It is counterproductive because (like file wrappers) it leads to lengthy and irrelevant satellite arguments as to the meaning and effect of other documents, which not everybody has access to or can be bothered to read.

6. No doubt the purpose of deploying such documents is that it is thought that the court, once it has seen what the subjective intention of the patentee was, will be reluctant to hold that the skilled person would have understood that he meant something different. For my part I can say that there is no such reluctance. If anything, it alerts the tribunal to the fact that, without the document, there may be something to be said for the alternative construction. The same goes for file wrappers, which I noticed had been prepared into court bundles, but were not deployed.

7. It is often said that a patent specification should be construed without reference to the infringement. Yet one cannot sensibly identify the point of construction without understanding what it is about the alleged infringement which is said to take it outside the claims. Pumfrey LJ (sitting at first instance) identified the necessary process in *Nokia v Interdigital Technology* Corporation [2007] EWHC 3077 (Pat) (unreported 21st December 2007), when he said (in another case about mobile telephone standards):

> "Although one construes a claim 'as if the defendant had never been born', in any complex case it is essential to see where the shoe pinches so that one can concentrate on the important points. It is important nevertheless that the opportunity thus presented to construe the document with one eye on the infringement must be rejected, as far as possible. So when the claim calls for A, and the standard requires B, the right question is not whether A means B, or covers B, or might with hindsight be said to be another example of the genus of which B is also a member, but whether in the context of the

specification the skilled man would appreciate that A in the claim encompassed B."

8.   Jacob LJ was not saying anything different in *Technip France SA's Patent* (2004) RPC 46,

> "Although it has often been said that the question of construction does not depend on the alleged infringement ("as if we had to construe it before the Defendant was born" *per* Lord Esher MR in *Nobel v Anderson* (1894) 11 RPC 519 at 523), questions of construction seldom arise in the abstract. That is why in most sensible discussions of the meaning of language run on the general lines 'does it mean this, or that, or the other?' rather than the open-ended 'what does it mean'?"

9.   It is for the court and not the witnesses to come to conclusions about what the claim means. Subject to the well known exception about technical terms with a special meaning, the construction of a patent is a question of law. So an expert report which seeks to parse the language of the claim, and opine that a particular ordinary English word can only in his opinion have a particular meaning is not admissible, or helpful. Both sides in the present case are guilty of adducing evidence of this kind.

10.   What is both admissible and helpful expert evidence is something rather different: evidence about the technical inter-relationship between rival claim meanings and the teaching of the specification. The expert is well able to assist the Court about the impact of different assumptions about the correct legal construction of the claim. It may be that it is only on one construction of the claim that general technical statements made in the body of the patent about what the invention achieves will hold good. It is perfectly legitimate for an expert to point that out, and to give a technical explanation of why, if the rival construction is adopted, the claim would extend to embodiments which would not achieve the patent's technical objective.

11.   None of the above requires the expert to go through the claim and give his definition (wide or narrow) of every word or phrase in it. The written evidence in the present case suffered from this excess. Some of the cross examination did as well. It sometimes takes longer to intervene and stop it than it does to let it happen. It should not start.

The witnesses

12.   In the course of the trial I heard from a number of fact witnesses and four expert witnesses (one per side per patent). Other fact witnesses were relied upon by Nokia but not cross examined by Qualcomm. I set out my assessment of the witnesses I saw and heard here.

13.   Qualcomm's witnesses of fact were:

i)   Mr **Children.** He was an entirely fair witness, who was called to deal with the likelihood of implementation of PCCCH.

ii)   Dr **Tiedemann**, one of the inventors of the 324 Patent, who was called to deal with issues of prior publication of documents. He was criticised by Nokia for the fact that, as it turned out, he did not have as much knowledge of and responsibility for the relevant events as one would have understood from reading his witness statements. He was also criticised for what Mr Michael Silverleaf QC, who appeared for Nokia with Mr Adrian Speck, described as "toeing the party line". There is some substance in the first point, but I am satisfied that this was in no sense deliberate, and the point does not affect the weight I should attach to the evidence he was able to give. I reject the second point, if by that it is suggested that Dr Tiedemann was not honestly trying to assist the court. He remained calm, and I thought objective, during a very lengthy and sometimes hostile cross examination.

iii)   Mr **Knapp** is Qualcomm's Senior Vice President, Marketing. He was a member of one of the CDMA committees in the early 1990s. He was an entirely fair witness, but one whose recollection of the relevant events was understandably hazy.

iv)   Mr **Salmasi** was cross examined by video link. As an engineer, he initiated and led the development of CDMA at Qualcomm, which he had joined in 1988. Mr Silverleaf says he was only willing to speculate when the answer would assist Qualcomm and not otherwise. I think there was something in this. However Mr Salmasi's evidence was evidence of fact, and the events in question were many years ago. I do not think that he was trying to be misleading in giving his evidence about what occurred. He did so to the best of his recollection.

14.   Nokia's only fact witness to be cross examined was Mr **Altschul**, who was Legal General Counsel of the CTIA from September 1990 to the present. He was called by Nokia to give evidence about prior publication. Mr Altschul gave a statement both to Nokia's solicitors and to Qualcomm's. In the end he was called by Nokia. He had created a somewhat unfortunate impression before he entered the witness box. This was caused by the fact that the statements he had given to the two parties were somewhat difficult to reconcile. The reconciliation only came in his third statement. I found that in his oral evidence he was doing his best to help the Court as to the CTIA policy about confidential documents, insofar as it had a fully articulated one.

15.   Nokia also relied on witness statements of Richard Vary, Reijo Lyytinen, Allan Frederiksen, Kim Jensen, Michael Roche, Arto Kanagas and Alan Whitehead, which were not challenged by Qualcomm.

16.   **Professor Raymond Steele** was called by Qualcomm as its expert witness in relation to the 324 Patent. Though he is now retired, Professor Steele was Professor of Communications in the Department of Computer Science, University of Southampton from 1983 to 1999. In 1986 he founded Multiple Access Communications Limited. In the course of his career he became a Fellow of the Royal Academy of Engineering, a Fellow of the IEE, a Fellow of the IEEE, a Member of the IEEE Avant Garde, and was awarded a number of prizes for research papers. These professional awards arose mainly from

his work on telecommunications, and in particularly from mobile radio communications. He is the author of a book, 'Mobile Radio Communications', published in 1992, and written in the period immediately before the date of the patent in suit. At its time this was quite an advanced textbook. From 1979 to 1983 Professor Steele worked on wireless communications at the well known AT&T Bell Laboratories in the USA; from 1983 to 1999 his research group at Southampton studied a wide range of topics relating to wireless communications, from radio propagation to systems such as GSM and IS-95. He also participated in UK Government committees dealing with wireless, particularly the one dealing with the then forthcoming pan-European system that became GSM.

17.   Professor Steele's background undoubtedly qualified him well to give evidence on the issues arising on the 324 Patent. I have to say, however, that he adopted a somewhat combative and argumentative approach to his evidence. To a degree, this was clearly an aspect of his character which came through clearly during his time in the witness box. But, whatever the reasons for it, it did seem to me that he was on occasions losing the objectivity which his position as an expert in this case required. On a number of occasions I felt he was rather more interested in the process of jousting with counsel, and scoring what he thought were points for his side, than in answering the technical questions put to him.

18.   **Professor Alfons Eizenhöfer** was called by Nokia to give evidence on 324. Since 1992 Professor Eizenhöfer has been a Professor at the University of Applied Science in Nürnberg lecturing in the fields of mobile communications (GSM, UMTS) and data communication networks (TCP/IP, LAN, Internet). He has been involved in the field of telecommunications engineering since obtaining his diploma degree in communications engineering from the University Kaiserslautern 1977, and his PhD in analogue transmission systems, in 1980. From 1980 to 1991 he worked in industry at Philips Kommunikationsindustrie in Nürnberg, working on a number of projects including the development of digital switching, analogue mobile radio and pre-GSM trial systems before being appointed head of the mobile system engineering group in 1986. In that rôle he oversaw the specification and development of the Philips GSM system and participated and contributed to various GSM work groups.

19.   Professor Eizenhöfer was a most impressive witness and gave his evidence in a measured and disinterested way. He accepted fair points that were put to him, and made it clear where his own opinions lay.

20.   **Dr Charles Wheatley** was called by Qualcomm as its expert in relation to the 482 Patent. Dr Wheatley is presently an independent consultant having obtained his Ph.D in Electrical Engineering from the University of California, Los Angeles in 1972. Having worked as an engineer in various electronics companies, he joined Qualcomm in 1987, where he occupied positions from Senior Engineer to Senior Vice President, until his retirement earlier this year.

21.   In total Dr Wheatley has worked for over 50 years in the fields of radio communications and navigation. He is a named inventor of three of the prior

art patent citations in relation to 482, of the Gilhousen '109 patent which is cross-referenced in the 482 Patent, in the Wheatley PCT citation and in another citation called Soliman, of which he is a co-author. He was also involved at Qualcomm with the technical development of CDMA at around the time when the invention the subject of the 482 Patent was made.

22. It was suggested by Mr Silverleaf that Dr Wheatley's close involvement with Qualcomm, with the cited prior art and the invention inhibited him in performing his functions as an independent witness in two ways. Firstly it was said that he found it difficult to draw only on the documents themselves, as opposed to his own experiences within Qualcomm at the time. Secondly it was said he has, through his consultancy position at Qualcomm and his interest in the company, a financial interest in the outcome of the case.

23. I should say that I found Dr Wheatley to be a scrupulously fair and extremely knowledgeable witness. I have no hesitation in rejecting Mr Silverleaf's second criticism. However I do accept that there were times when Dr Wheatley's historical involvement with the prior art and the invention may have been an obstacle for him in assessing what a document conveyed to a skilled outsider, and to a limited extent I therefore accept Mr Silverleaf's first criticism. Although Dr Wheatley made clear in his first expert report that he had been told that he must guard against this danger, it was always going to be difficult for him to do so. The author of a document will almost always be inclined to explain what he meant and be reluctant to accept that the skilled reader would have understood something different.

24. Nokia called **Dr Christoph Grauel** as its expert on the 482 Patent. Since 2005 Dr Grauel has been a partner in the firm of Hillebrand & Partners, Consulting Engineers. He has been involved in the field of telecommunications engineering since 1974 when he obtained a Dipl.-Ing. in Communications Technologies, at Braunschweig Technical University, Germany. From 1979 to 1996 he worked at Philips Mobile Radio Department in Nürnberg, Germany, initially as a Systems Engineer working on the air interface, as R&D Team Leader for C-Net radio telephones and GSM Base Transceiver Stations and then as Technical Manager for GSM BTS with total R&D responsibility for 3 GSM BTS generations. Subsequently, when Philips Mobile was acquired by Lucent Technologies he held a number of posts concerned with base station development and overall system architecture.

25. Dr Grauel was a highly knowledgeable expert witness. Mr Burkill QC, who argued the case for Qualcomm on the 482 Patent, made it clear that he did not question Dr Grauel's integrity, but suggested that Dr Grauel's evidence tended at times towards advocacy on the part of his client. He also suggested that Dr Grauel had a tendency, when faced with a choice which the skilled person might have made, always to lean in the direction taken by the patent. It is correct that at times Dr Grauel's responses to simple questions tended to be long and on occasions indirect, but I am in no doubt that he was doing his best to assist me on technical matters. I reject the suggestion that he was putting the interests of his clients ahead of the interests of technical accuracy. Whether Dr Grauel's evidence as to the likely behaviour of the skilled team withstands analysis is a matter which I will have to consider in its place.

Technical Background

26. Mobile telephony is a complex area of technology. The standards documents are so extensive that the experts agreed that it is unlikely that any one person would be capable of knowing, let alone understanding, all the detail. The concepts involved are not always easy to grasp, or once grasped, easy to hold onto. Fortunately, to understand the technical issues in this case it is not necessary to know or understand the whole field.

27. In addition to the expert evidence in the case, I have been greatly assisted by a Primer, which was largely agreed by the experts, subject to some points of emphasis. I have also had the considerable benefit of the assistance of Dr Gareth Griffiths, a Senior Patent Examiner at the UK Intellectual Property Office (formerly the Patent Office), as a scientific adviser. Dr Griffiths has had considerable experience of dealing with patents in this technical field. He has assisted me with the technical understanding of the evidence in the case, although he has played no rôle in any question of construction, law or decision making. I have had regard to the guidance as to the rôle of a scientific adviser in a case such as this which is to be found in the judgment of Jacob LJ in *Halliburton Energy Services Limited v Smith International (North Sea) Limited* [2006] EWCA Civ 1599.

28. I will nevertheless have to set out the technical background relevant to the patents in suit to the extent that it is necessary for an understanding of this judgment. In what follows it will be apparent that I have borrowed heavily from the Primer and the expert reports. There is some general technical background relevant to the disputes on these patents. Not everything is relevant to both patents.

Mobile telephone networks

29. A mobile telephone system consists of a fixed infrastructure, the network, and a number of mobile telephones which communicate with the network by radio. The network is connected at one or more points to the fixed (land-line) telephone system and also to other mobile telephone systems (for example, owned by different network operators). The network is responsible for distributing telephone calls throughout the geographical area which it serves, either from telephones on the fixed telephone network to mobile telephones (and vice versa) or from mobile telephones to mobile telephones. The mobile network incorporates base stations. Calls can be connected to a given base station from any other point in the network. The final leg of the connection to and from an individual mobile telephone is then made by a radio link with the base station.

30. In a fixed (land-line) telephone system each subscriber will generally be connected to a local exchange by a dedicated line. It would be theoretically possible for each mobile telephone within the area of a base station to be given its own dedicated radio link to the base station on which to make and receive calls. However, this is not possible in practice because it would be wasteful of radio bandwidth.

31.   The radio links used for carrying voice (or data) between users of a mobile telephone system are generally referred to as traffic channels. In order to conserve bandwidth, the traffic channels available for communication between a base station and mobile telephones within its area must be shared. The small proportion of the mobile telephones within a base station's cell at any one time which are actually engaged in calls are each assigned one of the available radio links only for the duration of the call. When a call is terminated, the radio link previously employed for that call is freed for use by another mobile telephone. The network must therefore provide mechanisms for assigning radio links to mobile telephones on a call-by-call basis. This is effected by control channels.

32.   A telephone conversation involves the communication of voice information in two directions at once. In the case of a fixed land-line telephone network, the link from the local exchange to the subscriber's telephone is a pair of wires and can carry voice signals in two directions. A radio link can only carry information in one direction – from transmitter to receiver. Each telephone call therefore requires two radio links – one from base station to mobile telephone (called the downlink or forward link) and one from mobile telephone to base station (called the uplink or reverse link).
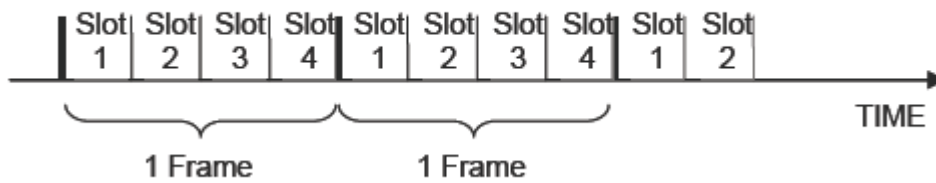
Multiple Access methods

33.   As discussed above, it is necessary to have available a number of individual radio links which can be assigned (in duplex pairs) to particular mobile telephones for the duration of a telephone call. There are three ways in which the frequency spectrum available for a mobile telephone system may be divided up into individual radio channels. These are referred to as "multiple access methods". They are abbreviated to FDMA, TDMA and CDMA.

FDMA

34.   FDMA stands for Frequency Division Multiple Access. In this system the available frequency spectrum is divided into a number of individual frequency channels, having regard to the required bandwidth of each channel. This system was used for the analogue AMPS and TACS systems in the US and UK respectively.

TDMA

35.   TDMA stands for Time Division Multiple Access. It is a way of providing more than one radio link on a single frequency channel. The transmitter in the base station transmits substantially continuously, but the transmission is divided in time into repeating groups of time slots called frames. This is illustrated below:

Four time slots per frame are illustrated, but the number varies from one system to another. In GSM, there are 8 time slots per frame.

36.   Each time-slot in the frame forms a radio link. Voice (or other information) for one mobile telephone can be transmitted on every repeating Slot 1. Another mobile telephone can use every repeating Slot 2 and so on. Obviously, a given repeating time slot does not provide a continuous radio channel. The *effect* of a continuous channel can be achieved, however, by "squeezing up" the voice data required to be transmitted in the period of one frame so that it fits within one slot. This can be done by storing the voice data for one channel in memory during the period of one frame and then reading it out of the memory, in the example at 4 times the normal rate during the time interval of the appropriate slot. This technique is most suited to digital data.

37.   At the receiver of a mobile telephone, after demodulation, the data in the relevant time slot for the channel assigned to that mobile telephone must be extracted from the datastream. This can be done by the reverse of the method illustrated above – reading the data from every fourth time slot into a memory and reading out at one quarter of the rate at which it was received.

38.   The above description relates to a downlink TDMA (strictly TDM) channel. The same principle can be applied to the uplink. However, in that case, each time-slot is transmitted by a different mobile telephone which may well be at a different distance from the base station. This has importance in relation to the 482 Patent.

CDMA

39.   CDMA stands for Code Division Multiple Access. It is, like TDMA, another method of effectively providing more than one radio channel on a single frequency channel. In essence, the data transmitted on each CDMA channel is combined with a unique code which identifies the channel and allows the data from all the users to be separated from other channels.

40.   CDMA uses a set of code words. Each code word is made up of a number of bits called chips. One of the codewords is used for encoding each data channel of each user. Each '1' bit of the data in that channel is encoded by replacing it with the chips in the codeword and each '0' bit is encoded by replacing it with the inverse of the chips in the codeword. The bit rate of the data stream is therefore increased by a factor equal to the length of the

codeword.   The bandwidth required to transmit the data is correspondingly increased.   For this reason the codes are also known as spreading codes and the encoding process (at the transmitter) is referred to as spreading.

41.   If a number of data streams are encoded using codewords and transmitted on the same frequency channel, the individual data streams can be decoded or extracted from the combined transmitted signal by use of the corresponding codeword.

42.   Each mobile station is allocated one of the codewords which acts as a signature for that mobile station.

Battery consumption

43.   From the beginning of the mobile telephone, a problem which beset designers was battery power consumption.   Early mobile phones were referred to as "bricks" as they required large batteries to provide the transmit power necessary to reach their base station.   Even with advances in technology, such as more efficient battery technology, no designer would approach the design of a cellular network without having battery power saving in mind. The smaller the battery and the longer it lasted, the more mobile the mobile became.

44.   A mobile telephone consumes power even when not transmitting and receiving messages, i.e. when in "idle" mode.   This is because, even in idle mode, it has to be switched on and listening to the appropriate paging channel in order to learn whether the base station has a message for it.   If it is listening all the time, it will be consuming power all the time.   Most of the time there will be no message for it, and it will be wasting power.

Physical and logical channels

45.   The use of time division multiplexing to carry multiple channels over a single wire or radio carrier was well known.   Thus conventional telephone land lines in Europe carried 24 time division multiplexed channels on a single wire. These can be regarded as 24 separate (or logical) channels.

46.   Similarly, an RF (radio) carrier can transmit on its carrier frequency a structure of repeating time slots, arranged into frames.   Each slot in the frame can be regarded as a separate (or logical) channel.   TDMA is an example.

47.   Physical channels can be used as the underlying foundation on which to build logical channels.   To take a simple example, the first time slot, S1, of a repeating frame of 8 time slots could be identified for carrying a particular type of information.   That time slot can be picked out, and considered as a stream of S1 time slots.   That stream is a logical channel.   Logical channels can be "mapped" onto physical channels in a variety of ways.   The concept of a "logical channel" is a very useful one for analysing time division multiplexed signal structures.   For many purposes, one can think of data being transmitted on a logical channel as if it is passing continuously through an entirely distinct "pipe" from the transmitter to the receiver.   In fact, that data is

transmitted via the same physical communication channel – a modulated frequency channel – as all other data on other "logical channels". The data on a given logical channel is simply transmitted at different times in the time division multiplexed structure to the data in other logical channels. The use of the "logical channel" concept simplifies design and analysis of a system because it hides the complexity of the underlying timing.

Relevant Standards

48. A number of mobile telephony standards are relevant to this dispute for different reasons. It is sufficient at this stage to identify them. I can come to the relevant technical features at the appropriate point.

49. **GSM** originally stood for Groupe Spéciale Mobile. It was in use as the European digital terrestrial telephony standard at the priority date of both patents. It is relevant as prior art to the 324 Patent. GSM was originally developed as a radio communication system to make conventional wireless telephone calls. It is based on a circuit switched network. With the development of digital networks in telephone systems, it became possible to route information from one point to another by packet switching. In packet switching the information is split up into packets which are individually transmitted over the network. Each packet contains a header which has address information giving its ultimate destination. Packet switching for sending and receiving data was incorporated into the GSM system by the **GPRS** standards. **GPRS** stands for General Packet Radio Service.

50. **IS-95** was a draft standard at the priority date of the 482 Patent. It is a dual mode standard incorporating both FDMA (AMPS) and CDMA multiple access systems.

51. First generation earlier standards such as **AMPS** and **TACS** are of peripheral relevance.

The 324 Patent

52. The 324 Patent is entitled "Apparatus and method for reducing power consumption in a mobile communications receiver". It claims priority from a United States application filed on 5th March 1992. Its application date is 4th March 1993.

53. Only claim 1 is truly in issue. It is accepted by Qualcomm that if claim 1 is invalid then no other existing claim will save the Patent. Qualcomm indicated in its opening skeleton that if it lost on certain issues of construction it would wish to apply to amend to make the construction clear – I shall have to return to that question below.

54. The specification opens by saying that the invention :

> "relates to mobile communications systems such as cellular telephone systems and, more specifically, to a system for

reducing power in a mobile or portable transceiver of such a system"

55.   The specification explains at [0002] that in such systems the mobile station is only sporadically active, but to ensure that it receives sporadically transmitted messages, it must monitor a channel continuously. At [0004], it says:

> "A system that reduces power consumption by periodically monitoring the channel for incoming messages during idle periods would be highly desirable. These problems and deficiencies are clearly felt in the art and are solved by the present invention in the manner described below"

56.   After citing two prior published specifications concerning pagers, at least the first of which has a receiver which turns on briefly during an assigned time slot to save power, the specification explains at [0007] that:

> "..both the cited documents do not disclose any information feedback provided by the respective pagers to the transmitter elements to change the transmission timing of messages"

57.   Thus, at this point, the feature which is said to distinguish the invention from the prior proposals is not the power saving itself, but the use of a signal from the receiver to the base station which affects the transmission timing.
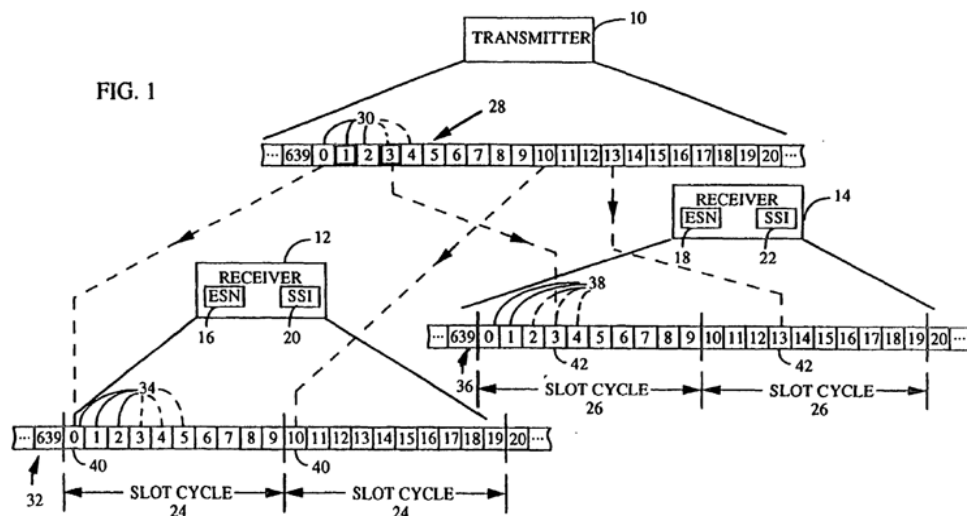
58.   The invention is summarised in [0009] to [0016]. The passage describes a transmitter and receiver communicating over a channel. The receiver has active states for receiving messages from the transmitter and inactive states during which it saves power, and during which the transmitter does not send any messages to it. The transmitter sends one or more messages to the receiver during each occurrence of the active state of the receiver. The channel is divided into "a continuous stream of slots". The receiver is said to have a slot cycle. One slot of the slot cycle is the assigned slot of the receiver, during which it wakes up. It goes back to sleep for the rest of the cycle. Steps need to be taken to align the timing of the transmitter and receiver, so that the transmitter transmits during the assigned slot. It is suggested that this synchronisation may be achieved using a separate pilot channel.

59.   At [0015] one finds this:

> "All receivers in a system need not have the same slot cycle. Furthermore, the slot cycle of a receiver may change during operation. For example the receiver may select a new slot cycle and send a message to the transmitter notifying it of the new slot cycle. Although either the receiver or the transmitter may change the slot cycle of the receiver, both must have the slot cycle information."

60.   The preferred embodiment is described principally by reference to Figure 1 which is reproduced below. The transmitter (10) is shown as transmitting to two mobiles, (12) and (14) a stream of timed slots 0-639 (so 640 in total).

Each mobile selects a Slot Cycle Index (curiously identified as "SSI" rather than "SCI" in Figure 1). The processor in the mobile may select an SSI using an algorithm, or it may use a predetermined value (see [0021] at lines 57-58). The receivers in Figure 1 have chosen "1" for the slot cycle index from a range of indices from 1-7. If the value "0" is chosen, the invention is said to be bypassed, because this will cause the receiver to monitor the channel continuously. The slot cycle is transmitted to the base station during registration of the mobile with the base station, so that the base station is able to access the mobile.
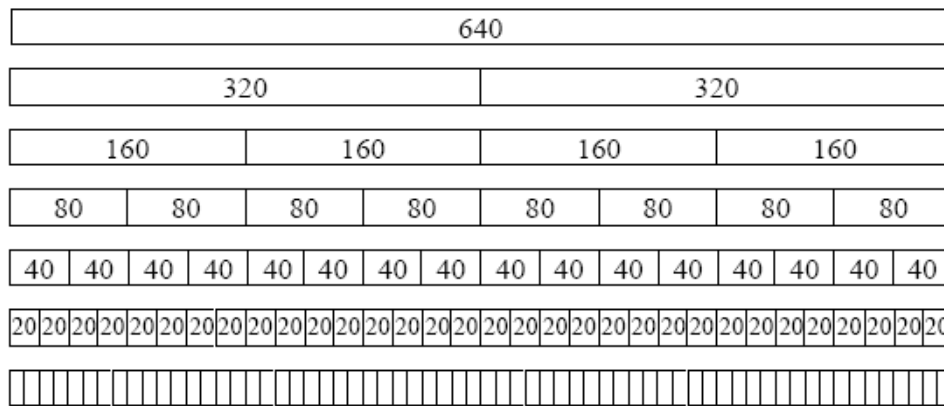

FIG. 1

61.   The length of the slot cycle is calculated from the formula:

$$\text{Slot cycle} = 5 \times 2^{SSI}.$$

Thus, when the SSI has the value 1, as in the figure, the slot cycle will be 10^1. The slot cycles are represented by the numerals (24) and (26) for the two telephones. The range of slot cycles produced is therefore (ignoring SSI=0, the bypass value) from 10 to 640 slots. As explained at [0022], if each slot is equal in length and of 200 milliseconds duration, the duration of the slot cycle will be between 2 and 128 seconds, depending on the choice of SSI. These time periods represent the length of time that it may take to cause the phone to wake up. This indicates that, in this embodiment, what is envisaged is that the slots are of precisely equal length and "contiguous" in time.

62.   The available slot cycles form a nesting set of frames. Professor Eizenhöfer illustrated this as follows:

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[1]   When the slot cycle index is zero, the algorithm returns a value of 5; however the system is designed to treat this value as "bypass" or "listen continuously" as already indicated.

63.   The patent explains an advantage of the nested slot cycles at [0029]. When the mobile sends a message changing the slot cycle, the base station is required to acknowledge that message. If no acknowledgment is received, then the mobile will default to an SSI of 1. This means that whatever slot cycle the base station is on, the mobile will hear messages from the base station (because it will listen every 10 slots, and this will always coincide with the slot cycle being used by the base station, which can be every 10, 20, 40, 80, 160, 320 or 640 slots). The Patent notes that in fact all the mobile has to do is pick a slot cycle less than the transmitter.

64.   Each receiver is thus allocated an assigned slot in the cycle to listen for its paging information. In Figure 1, receiver (12) is allocated the first slot in each slot cycle, whereas receiver (14) is allocated the fourth slot. An appropriate algorithm allows the information to be spread evenly over the network[2].

65.   In use, therefore, the mobile will listen for messages during its assigned slot in the slot cycle. If there is no message for it in that slot, it will power down and not wake up again until the assigned slot in the next slot cycle, between 2 and 128 seconds later, depending on the value of the SSI.

66.   At [0032] the patentee says:

> "Although at least one message must be transmitted in each assigned slot, the maximum number of messages that may be transmitted in a slot is limited only by the transmission rate and slot length".

At [0043] it is explained that the message may contain a MORE_PAGES field. This indicates to the receiver whether an additional message will be received following the current message. A zero indicates no more messages and it is said that:

> "If the receiver decodes a zero in the MORE_PAGES field, it may then immediately enter the inactive state <u>without waiting until the end of the current slot</u>." (emphasis supplied)

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[2]   The experts agree that there is an error in the explanation of this allocation process, but nothing turns on this.

67.   It is clear therefore that the patentee indicates a purpose for sending a message in every assigned slot: it will tell the receiver that it can switch off before the end of the slot. In a long slot cycle this may enable further power savings to be made. This has a bearing on one of the questions of construction of the claim.

The skilled addressee

68.   There is no dispute that the skilled addressee in the present case is a team of engineers concerned with the design of a mobile telephone system. The team would be made up of at least the following types of engineer:

    i)   a system engineer responsible for the overall design and architecture of the system;

    ii)   an engineer particularly skilled in RF matters, i.e. modulation techniques, the design of radio transmission systems and antennae;

    iii)   an engineer familiar with telephony signalling and switching;

    iv)   an engineer skilled in signal processing and coding;

    v)   an engineer specialising in microprocessors and their programming; and

    vi)   an engineer skilled in digital electronics and digital signal processing.

69.   The overall system architect would typically be an engineer with a number of years experience in the industry on similar projects after qualifying in electronic or communication engineering. All the engineers working on such a project would be qualified at least to degree level in an appropriate discipline, some to doctorate level. All would have some years of experience in the field.

The claim in issue

70.   I set out claim 1 below. I have ignored the reference numerals in the claim and added feature letters for clarity. I have underlined the main phrases in dispute, and put the word "for" in bold for reasons which appear subsequently:

> "An apparatus **for** <u>communicating at periodic intervals,</u> comprising a base station and at least one remote station,
>
> (a) said base station comprising:
>
>   (i) a message generator **for** providing message information;
>
>   (ii) <u>a transmitter message timing generator</u> **for** <u>generating a stream of periodic slots with a number of said slots forming a slot cycle</u> corresponding to said at least one remote station;

(iii) and said <u>slot cycle</u> <u>being determined based on an index number</u> provided from said at least one remote station, at least one of said slots being an assigned slot;

(iv) a message transmitter **for** transmitting said message information <u>on a message channel</u> <u>only during each said assigned slot</u>;

(b) said at least one remote station, each disposed at a location remote from said base station and corresponding to one of said assigned slots, each said remote station comprising:

(i) a receiver message timing generator **for** providing an indication of said assigned slot corresponding to said remote station; and

(ii) a message receiver **for** monitoring said message channel only during said assigned slot corresponding to said remote station; and

(iii) a message extractor **for** recovering said message information from said assigned slot.

Issues of construction

Apparatus cf method

71.   It is worth starting with something easy. The claim is to a complete system: an apparatus comprising a base station and a mobile. It is therefore not a claim to a method. Thus one must seek to give meaning to the apparatus features of the claim, and come in due course to see whether they are present in the apparatus alleged to infringe, or in the prior art.

"for"

72.   A particular feature of this claim, which is a very common one, is that the various elements of the apparatus, in themselves simply items of hardware, are described by reference to their function: **for** doing this, that or the other. Normally, in a patent claim, where a device is required to be "for" a particular function, one reads it as being "suitable for" that function, and no more. That requirement may draw in physical requirements which are essential to performing that function. If there are no such specific physical requirements associated with that function, the device will still infringe when not performing that function, and even if the intended function of the device is something entirely different. If one wants a claim to a device when actually performing a particular function, one can spell that out in the claim, or claim it

in method terms: see *Coflexip v Stolt Comex* [2001] IP & T 1332 at [24] to [27][3].

73.   Nevertheless, one has to be very cautious of any principle of construction which is said to codify the meaning of particular words. Perhaps more importantly in this particular case, it is important not to take the meaning of "suitable for" too far. Mr Antony Watson QC, who argued the case on the 324 Patent for Qualcomm with Mr Thomas Hinchliffe, started from the premise that an apparatus did not cease to infringe merely because it was switched off. So an apparatus for toasting bread infringes whether connected to the mains or not. He says this is just one example, and there is a general principle that an apparatus is still suitable for performing a particular function if it can be readily modified so as to perform that function. Mr Silverleaf accepts that a claim will be infringed if all that is required is to supply power. But he contends that modifications to the apparatus are not what is contemplated by "suitable for".

74.   I think Mr Silverleaf is right. Supplying power to a toaster does not change the apparatus: it simply puts into use the apparatus which is there already. The question in each case is whether the apparatus, as it stands, is suitable for use in that way. If the apparatus has to undergo physical modification before it can be used, then *prima facie* it is not suitable for use and does not infringe.

Relevance of TDMA and GSM/GPRS

75.   The issues of construction are not easy to identify without at least some idea of the context in the alleged infringement in which they arise. They arise partly out of the fact that the alleged infringement uses TDMA, and partly out of the fact that the particular implementation of TDMA in GSM/GPRS introduces further complexity which may have a bearing on the issues of infringement.

76.   As already noted, the information which an individual mobile receives in a TDMA system is already time-divided. In TDMA the mobile can already go to sleep in between its respective slots: that is built into the multiple access system itself. The disclosure in the Patent is based on, or to be more precise, starts from, a system where there is no such time division of message information for a mobile. Hence the references in the specification to the need, prior to the invention, for the mobile to listen continuously. There is no such need in TDMA systems, such as GSM.

77.   However it is one thing to say that the inventors started from a system where there was no time division, and quite another to say that they would only wish to claim their invention by reference to a system which, but for the invention, would involve continuous listening. Professor Eizenhöfer, in his first expert report (paragraph 35), said:

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[3]   Mr Blanco White's textbook "Patents for Inventions" had a whole paragraph headed simply "For": see the 1974 edition at page 2-213. He said then that the word in apparatus claims gives rise to considerable difficulty: it still does.

> "I do not think that the patentee had in mind a TDMA system already using time multiplexed control channels and periodic monitoring as the sort of system which required the improvement of the alleged invention."

78. I agree that it may be legitimate to draw this inference from the disclosure of the Patent, in the narrow sense that one would conclude that the patentee did not have TDMA systems at the forefront of his mind. However, the proposition does not in my judgment advance Nokia's case. It is frequently the fact that an invention may arise from a particular starting point where a need exists, or is felt particularly acutely. Nevertheless, once the invention has been made, it can be seen to apply to situations where the need is felt less acutely. One does not conclude, as a result of considering the patentee's starting point, that the monopoly he is about to claim will necessarily be restricted by reference to those particular antecedents. It all depends on what he has claimed.

79. The disclosure of the invention in 324 is not, on its face, directed to any specific form of multiple access system. Historically we know that Qualcomm were the proponents of CDMA, and there is no doubt that one can pick up clues in the specification to suggest that the specific embodiment was derived in fact from an application of the invention to a CDMA system. Thus the prior art referred to in [0002] is CDMA prior art, as the titles of the specifications recited show. The "pilot channel" mentioned as an example in [0012] is a channel characteristic of CDMA. The somewhat unclear cross reference in [0012] might be read back to the CDMA prior art in [0002], although the phrase "the above referenced US Patent and co-pending application" only seems apt to refer to the art referred to in [0005] and [0006], which is not CDMA.

80. All that is a very long way indeed from suggesting that the skilled reader would read from the specification an intention on the part of the patentee to restrict the invention to any particular form of multiple access.

81. In the end, Mr Silverleaf reluctantly accepted that it was possible to read the claim onto some TDMA systems. He was in my judgment right to accept this. If, in such a system, message information for all mobiles is contained in a particular slot in a real-time frame, then it would be entirely possible to apply the invention as claimed to that system. The real issue between the parties cannot be decided by asking "does the claim cover TDMA at all?" The differences between the parties lie at a lower level of generality, namely whether the claims are apt to cover the particular implementation of TDMA which is the subject of the allegation of infringement. In GSM/GPRS the assigned slots are not at regular intervals in real time. They are to be found on a logical channel called PPCH, made up of time slots which are irregular (in real time), and do not even occur at regular intervals in the PPCH logical channel. The first question which falls for decision is the type of periodicity in the assigned slots which the claim is calling for.

82. There are further issues as to

i) whether the requirement "slot cycle being determined based on an index number" means that the base station has no rôle in setting the length of the slot cycle. If the base station is allowed a rôle, is there some limit to how much it can interfere before the slot cycle is no longer "determined based on an index number"? In GSM/GPRS the mobile tells the base station how many times it wishes to be paged in the available number of paging slots; the latter number is determined by the base station. Thus both base station and mobile will always be involved.

ii) whether the requirement for an "index number" to be sent by the mobile means or implies that there must be a plurality of different slot cycles from which the mobile can choose; or is it enough if the mobile can choose between a slot cycle and no intermittent reception at all?

iii) whether the requirement that a message be sent "only in each assigned slot" means that a message must be sent, even when the base station has no message for a mobile: i.e. a "nothing for you" message; and what is to be read into the requirement that it be only in that slot.

Construction: periodicity

83. Claim 1 is in two main parts: part (a) to the base station and part (b) to the mobile. The base station generates messages "for providing message information" transmitted on a "message channel". The patent is not specific as to the limits of "message information", but it clearly includes messages for alerting the mobile to the presence of an incoming call or data message, or those for updating system parameters. The experts were agreed that it was not intended to include the voice traffic itself, and I see no reason to disagree.

84. The base station also generates a stream of timing slots. The slots are "periodic". A number of the slots form a slot cycle, determined based on an index number sent by the remote. At least one of the slots is "an assigned slot". The message transmitter transmits message information "only during each assigned slot."

85. The mobile station has corresponding features. It has its own timing generator, a receiver for monitoring the message channel "only during said assigned slot", and the necessary means for extracting the message from the slot.

86. Nokia's primary submission is that the claim results in a system in which the slots, which are of equal length and contiguous in time, combine to make slot cycles of equal length. The mobile will then listen to its own assigned slot at points in time separated by regular recurring intervals in real time. Nokia says this is the approach taken in the Patent.

87. Qualcomm's submission is more complex. It says that the assigned slot may, in the idealised case, be composed of regularly appearing slots in the basic slot structure. But it may also be selected from irregularly appearing slots. It arrives at this proposition by considering a *logical* message channel. What

matters, says Qualcomm, is whether it is possible to identify a message channel with assigned slots; it does not matter if the slots which make up the channel are contiguous in time, or how regularly they were originally distributed. What matters is that the slots are predictable and pre-arranged.

88.   Qualcomm says that the skilled reader would understand that the thrust of the invention is not the underlying slot structure, but the fact that it is the mobile and not the base station which determines the length of the slot cycle. Why should it matter for that purpose whether one uses regular assigned slots, when all that matters is that the base station and the mobile are in agreement as to the slots on which they respectively transmit and listen?

89.   In my judgment, logical channels were a sufficiently well established part of the structure of mobile telephone networks (and of the common general knowledge) to make it legitimate to look to the logical channels built into the structure to see if the invention is being used there. Once the relevant channel has been identified it is necessary to be able to identify a slot cycle, and the assigned slot within it. The skilled team would not regard real-time periodicity as being built into this claim.

90.   The claim says that <u>a number</u> of the slots form a slot cycle. In the specific embodiment the number of slots in each cycle remains the same, at least until the mobile decides to change it. In the alleged infringement the slot cycle is arrived at by dividing up the available number of paging slots (as determined by the base station), so adjacent cycles may have slightly different numbers of slots. I do not think the skilled reader would regard minor variants in periodicity as outside the language of the claim. However it would not be right to say, as Qualcomm does, that the only thing that matters is that the slots are predictable and pre-arranged: there must be something that can be recognised as a slot cycle, even if the number of slots is not precisely constant.

Construction: "slot cycle determined based on an index number provided from said at least one remote station"

91.   There are two issues raised by this phrase above. One is whether the phrase precludes the base station from having any rôle in the setting of the slot cycle. The second is whether the phrase requires there to be more than one possible value of slot cycle which can be chosen by the mobile. The former question is relevant to infringement, the latter to validity.

92.   In relation to the first issue, Qualcomm contends that the phrase has a broad meaning: it means that the slot cycle is calculated using the index number provided by the mobile. It also contends that the phrase does not prevent the base station from having an influence over the slot cycle, provided that the index number from the mobile has one too. The base station may, for example, refuse to apply a particular short slot cycle on the grounds of network overloading.

93.   Nokia contends that the phrase means that the slot cycle is fixed by the mobile and cannot be overridden by the base station. It accepts that the "index" does

not have to be the slot cycle itself: the slot cycle may be calculated, or looked up, from it.

94. Here I prefer Qualcomm's submission. First, the specification says at [0015] that the base station may change the slot cycle. Mr Silverleaf submitted that this is just a carry-over from the pre-amended form of the claim, which was unspecific as to which component of the system set the slot cycle: it was only by amendment that the requirement for the slot cycle to be determined based on an index number sent by the mobile was introduced. I do not agree. The skilled person would understand from his common general knowledge that complete control cannot be handed over to the mobile: so the claim must extend sufficiently far for the base station to be able to overrule an initial slot cycle selection by the mobile. Once one approaches the claim with that understanding, there is nothing to indicate what particular additional rôle, if any, the base station plays: the only positive requirement is that the mobile must participate in the calculation of the slot cycle, by sending the index number.

95. The second aspect of the dispute on this phrase (the one that is relevant to validity) is whether it requires, as Qualcomm contends, that there is more than one possible slot cycle which the base station might adopt on receipt of the index number. Qualcomm says that there must be a menu, consisting of at least two possible slot cycles, from which the base station can select, before a system falls within the claim. A system which merely allows one level of discontinuous reception on a channel, so-called DRX on/off[4], is not, on Qualcomm's construction, within the claim.

96. Nokia contends that there is nothing in the phrase which requires anything more than one slot cycle, and that DRX on/off is included.

97. I do not think the words can bear the construction which Qualcomm seeks to give them. The fact that the mobile sends an index number does not mean that the base station is required to maintain a menu of more than one length of slot cycle. For example, in the specific embodiment, if the SSI is set at a value of 1, the base station will determine a slot cycle of 10 based upon that number; if the number sent is zero the mobile will listen continuously. This is DRX on/off. I cannot see any reason why the particular case where the index number may be 1 or zero would be taken to be excluded. That is particularly so when one considers that the key distinguishing feature of the invention identified in paragraph [0007] is that the mobile feeds back a slot cycle message at all.

Contingent amendment

98. As I mentioned above, in anticipation of the possibility that I might conclude that the claim did not require a plurality of different slot cycles, Qualcomm put forward an amendment to the claim in its opening skeleton argument at the

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[4] DRX is an industry expression for discontinuous reception. I have avoided extensive use of it in this judgment because it gives rise to a dispute all of its own as to what it means. As the acronym is not used in the Patent, I have preferred not to use it, except in this particular context.

trial. The amendment was originally offered on the basis that it made express the construction being advanced. Thus Qualcomm's opening skeleton said this:

> "It is submitted that if there is any doubt about construction an amendment as follows (shown in bold) would make the point on construction clear and would also be a permissible amendment as not adding matter or extending protection
>
> (iii) and said slot cycle being determined based on an index number provided from said at least one remote station, at least one of said slots being an assigned slot **and wherein the said slot cycle is capable of being changed to a plurality of different slot cycles based on different index numbers provided by the said at least one remote station .....**
>
> Qualcomm's position is that such an amendment is unnecessary, but it is one they would wish to make if necessary to preserve validity. For this reason they are giving notice of the possibility of such an amendment in advance of trial."

99. When put forward in this way Nokia did not object strongly to Qualcomm's proposal that the Court consider the validity of such a proposed amended claim in these proceedings. By the time of his reply speech, Mr Watson was submitting

> "The point of the amendment is to make it explicit that the base station can change the slot cycle to a plurality of cycles different from the first slot cycle. In other words the base station must be capable of transmitting at least **three** different cycles in response to three different index numbers."

100. I had certainly not understood Qualcomm to be putting forward an amendment which required the base station to be able to offer three different slot cycles. Had that been made express in Qualcomm's original skeleton, I would have been more sympathetic to the suggestion that it was far too late for such an amendment to come in.

101. It is also unfortunate that this late amendment should give rise to a further dispute about construction of its own. My first task is to say what I think it means. Mr Watson contends that if one slot cycle is capable of being changed to a plurality of different slot cycles, then there must be three in total. Mr Silverleaf replies that is only if you read "different" as different from the first: if you read it as different from each other then you can get away with only two.

102. In my judgment Mr Silverleaf's construction is correct. Mr Watson's construction is far too pedantic. The amended claim still covers the case where the base station can only offer two slot cycles. There is absolutely nothing in the specification to suggest that there is anything special about three: and three slot cycles are nowhere mentioned.

103.   If Mr Watson were right, the amendment would raise serious questions as to allowability. The amended claim would amount to a disclosure of three slot cycles, a disclosure which is not immediately obvious to me anywhere in the unamended specification. But that question would arise at a further hearing on allowability of the amendment, and is not before me now.

Construction: "only during each assigned slot"

104.   There are two questions raised by this phrase: one raised by the word "each" and one by the word "only".   They are

   i)   whether the requirement that a message be sent "<u>only during each assigned slot</u>" requires that a message be sent, even when the base station has no message for a mobile: i.e. a "nothing for you" message;

   ii)   how strictly the requirement that a message be sent "only" in the assigned slot is to be read.

105.   This is really a method feature, because the transmitter is only required to be "for" so transmitting. The corresponding method claim, claim 7, includes a step of transmitting on a channel "at least one message per slot cycle".

106.   Clearly in my judgment the meaning of the functional requirement is that the transmitter transmits a message for the mobile in each and every assigned slot. The specification at [0032] provides a good enough reason so to construe the term, and the passages at page 2 line 47 (which relates to the invention generally) and page 5 line 33 (which relates to the specific embodiment) lay emphasis on this aspect. Even though the experts were not agreed as to the relative importance of requiring such a message except in the case of a long slot cycle, it is clear to me that the phrase means a message in every slot.

107.   The second question concerns the word "only". Message information is to be transmitted "only during each assigned slot". However the specification indicates that where the MORE_PAGES message is sent, the message may overlap into the next slot, i.e. a slot other than its assigned slot: see [0043]. I think that the requirement must therefore be read in the sense that message information for the mobile is, subject to the MORE_PAGES possibility, only during the assigned slot.

108.   The more difficult question (for both points) is how one tells if the transmitter is "for" sending message information in this way, when it is not programmed to send anything specific to a mobile except when it has positive information to send. Consistently with the approach I have adopted to the word "for" above, I would hold that the transmitter has this feature if it is capable without modification of sending a message to a specific mobile only in every assigned slot.

Validity of 324

Law – novelty

109.   A patent will be invalid for lack of novelty if the invention claimed in it is not new in the light of the state of the art at its correct priority date. The state of the art is everything made available to the public by written or oral description or by use or in any other way (see s. 2(2) 1977 Act).

110.   In *Synthon BV v SmithKline Beecham plc* [2005] UKHL 59 Lord Hoffmann explained the dual requirement for the objection of lack of novelty to succeed: disclosure and enablement.   Only disclosure is of importance to the issues in this case. Lord Hoffmann said this at paragraph 20:

"20.   The concept of what I have called disclosure has been explained in two judgments of unquestionable authority. The first is Lord Westbury LC in *Hill[s] v Evans* (1862) 31 LJ(NS) 457, 463:

> "I apprehend the principle is correctly thus expressed: the antecedent statement must be such that a person of ordinary knowledge of the subject would at once perceive, understand and be able practically to apply the discovery without the necessity of making further experiments and gaining further information before the invention can be made useful. If something remains to be ascertained which is necessary for the useful application of the discovery, that affords sufficient room for another valid patent."

The second authoritative passage is in the judgment of the Court of Appeal (Sachs, Buckley and Orr LJJ) in *General Tire and Rubber Co v Firestone Tyre and Rubber Co Ltd* [1972] RPC 457, 485-486:

> "To determine whether a patentee's claim has been anticipated by an earlier publication it is necessary to compare the earlier publication with the patentee's claim…If the earlier publication…discloses the same device as the device which the patentee by his claim…asserts that he has invented, the patentee's claim has been anticipated, but not otherwise. …

> When the prior inventor's publication and the patentee's claim have respectively been construed by the court in the light of all properly admissible evidence as to technical matters, the meaning of words and expressions used in the art and so forth, the question whether the patentee's claim is new…falls to be decided as a question of fact. If the prior inventor's publication contains a clear description of, or clear instructions to do or make, something that would infringe the patentee's claim if carried out after the grant of the patentee's patent, the patentee's claim will have been shown to lack the necessary novelty…The prior inventor, however, and the patentee may have approached the same device from different starting points and may for this reason, or it may be for other reasons, have so described their devices that it cannot be immediately discerned from a reading of the language which they have respectively used that they

have discovered in truth the same device; but if carrying out the directions contained in the prior inventor's publication will inevitably result in something being made or done which, if the patentee's claim were valid, would constitute an infringement of the patentee's claim, this circumstance demonstrates that the patentee's claim has in fact been anticipated.

If, on the other hand, the prior publication contains a direction which is capable of being carried out in a manner which would infringe the patentee's claim, but would be at least as likely to be carried out in a way which would not do so, the patentee's claim will not have been anticipated, although it may fail on the ground of obviousness. To anticipate the patentee's claim the prior publication must contain clear and unmistakeable directions to do what the patentee claims to have invented…A signpost, however clear, upon the road to the patentee's invention will not suffice. The prior inventor must be clearly shown to have planted his flag at the precise destination before the patentee."

If I may summarise the effect of these two well-known statements, the matter relied upon as prior art must disclose subject-matter which, if performed, would necessarily result in an infringement of the patent."

111. The matter relied upon must have been made available to the public. There is no room for dispute as to the law to be applied to this issue. It is sufficient to make a document available to the public if it is communicated to a single person who is free in law and equity to make use of it for himself. If the communication is encumbered with an obligation of confidence, expressed or implied, the communication has no invalidating effect.

112. Nokia submitted that, where a document is effectively circulated to every person having an interest in it, it should be treated as made available to the public, even if individual recipients were supplied the document in confidence. I cannot accept that submission. The effect of the submission is to put a gloss on the words of the Convention: to read it as if it said "made available to the interested public". The submission is contrary to the decision of the Technical Board of Appeal of the EPO in *Decision T 482/89* (OJ EPO 1992 646 at paragraphs 2.1-2.8) relying on German law to the same effect.

113. The burden of proving that matter was made available to the public lies with the party asserting it, i.e. Nokia. Mr Silverleaf tried to unload the burden onto Qualcomm to prove the contrary by submitting that once distribution of a document had been proved, the burden shifted. That cannot be right as a general proposition. If what is proved is distribution through a channel which would normally be expected to make the document available to the public, then the burden will shift, at least temporarily. But if what is proved is distribution through an unconventional channel, particularly one where precautions to maintain confidentiality of some kind were taken, the burden

will remain with the party seeking to establish that the document was made available to the public.

Law – Inventive Step

114.   A patent will be invalid for lack of inventive step if the invention claimed in it was obvious to a person skilled in the art having regard to the state of the art at the priority date.

115.   The familiar structured approach first articulated by the Court of Appeal in *Windsurfing v Tabur Marine* [1985] RPC 59 (CA) has recently been explained and restated in the judgment of Jacob LJ in *Pozzoli v BDMO SA*, [2007] EWCA Civ 588; [2007] FSR 37 at [23].

> "In the result I would restate the *Windsurfing* questions thus:
>
> (1) (a) Identify the notional "person skilled in the art"
>
>   (b) Identify the relevant common general knowledge of that person;
>
> (2) Identify the inventive concept of the claim in question or if that cannot readily be done, construe it;
>
> (3) Identify what, if any, differences exist between the matter cited as forming part of the "state of the art" and the inventive concept of the claim or the claim as construed;
>
> (4) Viewed without any knowledge of the alleged invention as claimed, do those differences constitute steps which would have been obvious to the person skilled in the art or do they require any degree of invention?

116.   The approach assists the fact-finding tribunal, but is not a substitute for the statutory question: "is it obvious"? In applying it, as elsewhere, hindsight is impermissible. It has to be remembered that the skilled person is not in a position to perform his own *Pozzoli* analysis. It is particularly important to remember that the first three stages are merely those which the court needs to go through in order to equip itself with the tools to answer the statutory question, which is the fourth one. The first three steps involve knowledge of the invention, which must then be forgotten for the purposes of step 4. What one is seeking to establish is whether the claim extends to methods or objects which are, absent knowledge of the invention and absent inventive capacity, obvious.

117.   The primary evidence on the question of obviousness is that of the expert: see Nicholls VC in *Molnlycke v. Procter & Gamble* [1994] RPC 49 at 112. The usefulness (or otherwise) of the expert evidence is not so much the assertion (obvious/inventive) which the expert expresses, but the explanations and

reasons he gives for them: see Jacob LJ in *Rockwater v. Technip* [2004] RPC 46 at [6] to [15].

Lack of Novelty over Qualcomm's own publications

118.   Nokia alleges that Qualcomm itself prior published the invention the subject of the 324 Patent in two ways before the earliest claimed priority date. The documents in question are

    i)   A document entitled 'Cellular System CDMA-Analog Dual Mode Mobile Station Base Station Compatibility Standard', also known as the "Common Air Interface Standard" ('the **CAI**'), and

    ii)   An abbreviated version of that document submitted to the Cellular Telecom Industry Association (CTIA), referred to hereinafter as "the **CTIA paper**".

119.   Nokia also alleges that a third document, a draft US standard called TR45, produced by a committee of the TIA, was published between the earliest claimed priority date and the date of the application for the patent.

120.   Qualcomm accepted before trial that the technical content of these documents is such that a finding of fact that any of them was made available to the public before the priority date to which 324 is entitled will result in a finding of lack of novelty. Orders for summary judgment were accordingly entered to the effect that, if any of these documents was so published, the patents are invalid. It follows that, subject to the question of priority date in the case of TR45, the issue resolves itself into a question of primary fact: were the documents made available to the public?

CAI

121.   There were a number of revisions of the original CAI document which was first produced in July 1990. Revisions up to Revision X1 dated 5th March 1992 (the earliest priority date) bore the legend

> "All data and information contained in or disclosed in this document is confidential and proprietary information of QUALCOMM, Inc and all rights therein are expressly reserved. By accepting this material, the recipient agrees that this material and the information contained therein is held in confidence and on trust and will not be used, copied, reproduced in whole or in part, nor its contents revealed in any manner to others without the express written consent of QUALCOMM Incorporated."

122.   Qualcomm says, and I accept, that a number of other precautions were taken with the CAI document to prevent it becoming public knowledge. Firstly, each copy carried the following in black capitals in a black box:

<div align="center">

QUALCOMM PROPRIETARY

REPRODUCTION PROHIBITED

</div>

123. Secondly, copies of the CAI were circulated to selected companies for the purpose of developing and testing CDMA technology. Copies so circulated not only carried the above confidentiality notice but, also

   i)   were disclosed under express non-disclosure agreements;

   ii)   Qualcomm kept a list of those external parties who had received a copy of the CAI;

   iii)   copies of the CAI were numbered;

   iv)   the letters enclosing copies of the CAI emphasised the confidentiality of the document;

   v)   letters sending out change sets (updates of parts of a version between revisions) referred to the facts that numbered copies of the CAI had been sent out;

   vi)   when a new revision of the CAI was circulated under an NDA, the recipients were instructed to destroy the old version.

124. On 5 March 1992, Qualcomm made its proposed standard available to the public by submitting revision X1 to the TIA on that date. Thereafter, later versions simply carried the marking "QUALCOMM copyright". Further, letters were sent to those persons who had received the CAI under terms of confidence informing them that the document was no longer confidential.

125. Dr Tiedemann said, and I accept, that the reason that X1 and subsequent revisions did not include this wording was that it ceased to be confidential once the document had been submitted to the Telecommunications Industry Association ("TIA") on 5th March 1992. Once the CAI had been submitted to the TIA, Qualcomm sent letters to recipients of earlier versions informing them that the contents of the document were no longer to be regarded as confidential.

126. Nokia accepts that initially Qualcomm treated the CAI document as confidential. However Nokia submitted that as time went on the importance to Qualcomm of having the document accepted as a standard outweighed its interest in maintaining confidentiality and, as a result, copies of the document were circulated to companies not having pre-existing NDAs. Absent an NDA, says Nokia, the recipient of the CAI was free to do with it as he wished.

127. In my judgment, Nokia has not established on the balance of probabilities that a copy of the CAI was sent to any recipient who was free in law and equity to use it. The markings on the document itself were adequate to create an obligation of confidence on the recipient, even absent a prior NDA. Moreover I was not persuaded on the evidence that any company had received a copy without an NDA being in place.

CTIA paper

128. The CTIA paper is called "An Overview of the Application of Code Division Multiple Access to Digital Cellular Systems and Personal Communications Networks".

129. In October or November 1990 a CTIA Subcommittee was set up with the objective of reporting its findings on Qualcomm's CDMA technology to the CTIA Board of Directors. The CTIA Paper was a document provided by Qualcomm to that Committee. It was submitted on about 11th January 1991.

130. By 17th January 1991 Qualcomm had supplied the CDMA sub-committee with a comprehensive overview of the technology.

131. On March 6th 1991 the CTIA held an open forum attended by Qualcomm. In advance of the meeting Gerry Flynn wrote to Mr Salmasi of Qualcomm informing him that this meeting was open. A set of slides was prepared for use at the meeting, which it is accepted do not disclose the invention of the 324 Patent.

132. Following the forum the CTIA sub-committee held meetings with Qualcomm, including a visit to Qualcomm in San Diego California where CDMA field trials were in progress. None of this was "open".

133. Later in 1991 the CTIA issued a press release confirming that they were monitoring field trials of CDMA by Qualcomm.

134. In January 1992 the Board of CTIA proposed to arrange open forums at which proposals for wide band spread spectrum (i.e CDMA) telephony would be considered. This was to be done by a Wideband Spread Spectrum Committee, with some overlap of personnel with the original CDMA sub-committee. In contrast to the position with the original CDMA sub-committee, where the majority of the dealings between Qualcomm and the committee were confidential, the Wideband Committee's proceedings were all open. The first open forum of the Wideband Committee did not occur until after the priority date.

135. The front page of the CTIA paper bears the following legend:

   "Restriction on Use of Data. All data and information contained in or disclosed in this document are proprietary information of QUALCOMM, Inc. and all rights therein are expressly reserved."

136. Three witnesses gave evidence as to the CTIA's policy in relation to a document of this nature: Mr Altschul, Mr Knapp and Mr Salmasi.

137. Mr Altschul's evidence was contained in three witness statements, two given to Nokia's solicitors and one to Qualcomm's. Although his evidence emerged in a somewhat piecemeal fashion, the effect of it was that information would be kept within the confines of the CTIA until a defining moment when the Board of CTIA decided that it would become public. He was not able to point

to any moment in time when the material submitted to the original CDMA sub-committee became public. Moreover Mr Altschul made clear that these rules were not written down, but were "*more in his mind than perhaps anywhere else in the organisation's governance structure*".

138.   Mr Knapp, who was a member of the Wideband Committee, was clear that, so far as he personally was concerned, he would have not have felt able to share a document with these markings with anyone outside the committee.

139.   Mr Salmasi was told by Gerry Flynn, the chairman of the CDMA sub-committee, that the CTIA paper would be kept within the committee for the purposes of evaluating the technology.

140.   Nokia says that the CTIA paper has already been edited down so as to exclude sensitive confidential information. Nokia relies heavily on the March 1991 open forum. Nokia argues that those who attended the meeting would be free to ask questions based on the CTIA paper, thereby unquestionably placing the subject matter of the question in the public domain. How, in those circumstances could a person in possession of the paper believe the contents to be held subject to an obligation of confidence?

141.   An important passage of Mr Salmasi's cross examination went like this

> Q. So you knew that by submitting the paper to the CTIA, it would become available to all CTIA members potentially and that they would be free to discuss its contents with others. That is why you took out the sensitive bits.
> A. That was partially the reason because obviously we did not want this document to be leaked out to the public in its entirety. At the same time, Mr. Flynn and others had given us some notion of how CTIA members would treat this document; and so our assumption was that this document was only being disseminated to the members of that investigation committee.
> Q. Qualcomm has not suggested that it sought any kind of undertaking from the CTIA not to disclose your submission to it. You knew that the CTIA would be free to make what use it wanted of this document, did you not?
> A. The CTIA could have decided what to do with this document, except for the fact that Mr. Flynn had told us that as a member of this sub-committee he was basically sharing documents with the members strictly for the purposes of evaluating the CDMA technology.
> Q. So you are saying that Mr. Flynn's understanding of what could be done with this document is indicative of what the CTIA felt able to do.
> A. Not necessarily. I am not suggesting that Mr. Flynn was speaking for CTIA, but my understanding was that the document was being shared by the members of this investigation sub-committee for the purposes of evaluating this technology and then it would have been submitted in some form or shape to the executive committee of the CTIA. That was the general understanding at the time.

142.   It is clear that, in contrast to the CAI, Qualcomm made no special efforts to keep the contents of the CTIA paper confidential. Mr Salmasi so accepted. Qualcomm had more serious matters to contend with at the time.

143.   Nokia also relies on correspondence which shows that in February 1992 Mr Flynn suggested sending the CTIA paper to a journalist. It was not established that the CTIA paper was so sent. Nevertheless, says Nokia, the incident shows that Mr Flynn considered it perfectly acceptable to send the CTIA paper to a journalist, a proposal inconsistent with any attempt to maintain the document as confidential.

144.   It is important to recall that the pleaded allegation is the disclosure of the paper to the CTIA. The CTIA did not enter into any express undertaking as to confidentiality. I have to deduce from all the surrounding circumstances (including the purpose of supplying the document to the CTIA, what was said by Mr Flynn, the March 1991 open meeting, the manner in which it was treated and proposed to be treated by the CTIA) whether there was any implied obligation of confidentiality on the CTIA. Mr Altschul's evidence about what he thought the CTIA could do is important but not conclusive.

145.   In the end I have concluded that the effect of the evidence is not sufficient to establish that the document was made available to the public.   The document was supplied to the CTIA for a limited purpose, namely for it to evaluate CDMA technology. It was only in that limited context that it was free to make use of the document. It is undoubtedly the case that the contemplated process of evaluation of the technology carried with it the risk that the information in the CTIA paper might have been further disclosed, so as to make it available to the public.   But, in my judgment, it was not established that further disclosure ever happened. The provision of the document to the CTIA did not itself make the document available to the public.

TR45

146.   It is common ground that TR45 was made available to the public after the earliest priority date and before the second date. It is not alleged that it was published earlier.

147.   The attack on priority date follows the grounds of the insufficiency and added matter attacks, which I deal with later. On the approach I have taken to construction of the claim, it will be seen that those attacks have failed. It follows that TR45 was not made available to the public before the priority date of the claim.

148.   If I had accepted Qualcomm's construction of claim 1, one of the added matter attacks would have succeeded and the claim would not have been entitled to priority. In those circumstances the claim would have been anticipated by TR45.

Conclusions on Qualcomm Prior Publication

149.   It follows that none of Qualcomm's prior publications invalidates claim 1 as I have construed it.

Cognito

150.   I take this document next because, as Mr Silverleaf recognises, it represents Nokia's strongest attack from the non-Qualcomm prior art.
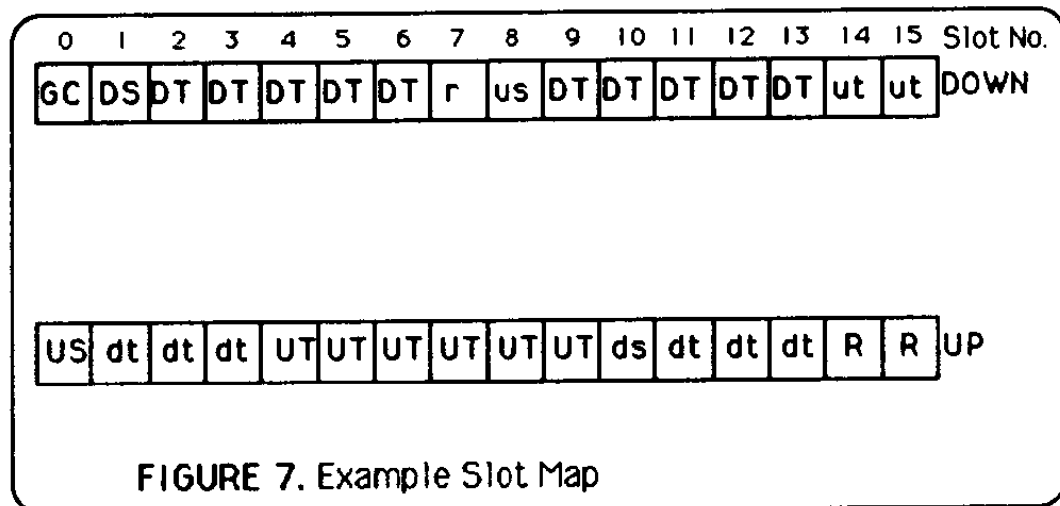
Cognito Disclosure

151.   Cognito is described in a paper by Haine and I shall refer to it by the former name. It is entitled "A New Radio Access Protocol and Network Architecture for Mobile Packet Data". It was published in 1991 as part of the proceedings of the 41st IEEE Vehicular Technology Conference "Gateway to the Future – Technology in Motion". Nokia also pleaded the relevant user guide, but I was not taken to any part of it: accordingly I take no notice of it here.

152.   Cognito is a data only system. The terminals are portable wireless data terminals which operate without mains power supply. The flow of data is two-way.

153.   Cognito explains that the signal is TDMA with a series of slots, with 16 slots comprising a frame. In operation, a mobile registers with a base station. This includes providing a choice of power saving mode as part of 'other control information'.

154.   Figure 7 of Cognito shows how the time slots are arranged.

FIGURE 7. Example Slot Map

155.   The time slots are numbered from zero. Slot 1 is the paging slot in which the mobile must look to see if data for it is included (by recognising a number – its Mobile Group Label or MGL). This slot is called Down Setup. In the standard

mode in Cognito, the mobile only need listen in 1 out of 16 slots, the paging channel.

156. GC in Slot 0 of each frame is the general control channel broadcast by the base station. The mobile listens to it on registration: Cognito is not specific as to what intervals the mobile will pay attention to this channel thereafter. Professor Eizenhöfer suggested that it was not milliseconds: perhaps every five minutes.

157. Cognito explains that there is a further feature called VLDC (Very Low Duty Cycle) Mode which enables the mobile to power up its receiver and monitor during only one slot in several frames (instead of one per frame of 16 slots).

158. As section 3.7 of the paper explains

> The Cognito radio protocol described above has been specifically designed to allow portable terminal units to achieve low power consumption and therefore long battery life. Most of the energy in a battery pack goes in powering the receiver as it listens for any packets addressed to the unit by the network. Because the mobile is alerted that there is a packet by a down setup message, which is transmitted in a specific slot in each frame, the mobile only has to power up to receive this slot and decode it, and can then switch of until the next frame. This feature on its own permits a significant power saving compared to a conventional portable which must remain switched on all the time to receive messages.

> A further feature is built into the system called VLDC MODE. A mobile may register telling the network it is in this mode and the network will inform the mobile of the current length of the a "multiframe", which is simply a sequence of frames and in which frame of the multiframe the mobile should listen to receive down–setup messages. The mobile then switches off except for one slot every multiframe, and therefore its power consumption can be decreased even further. The trade-off made is that packets sent to the mobile will be delayed.

> As an example, the Cognito Messenger has an option for battery saving which the user can select or disable, which will result in the mobile going into VLDC mode. The user can then decide whether he wants long battery life or faster response.

159. The system operated upon what is referred to as a 'multiframe' – that is a sequence of a number of frames. The mobile registers and tells the network it is in VLDC mode. As the length of the multiframe (i.e. how many frames) may not be fixed for all base stations for all time, when this occurs the base station tells the mobile the length of the multiframe. The mobile then switches off except for one slot every multiframe and power consumption is decreased accordingly.

Cognito - novelty

160.   Nokia contends that Cognito is a complete anticipation. It is common ground that the critical issue on anticipation is whether the slot cycle in Cognito is determined based on an index number sent by the mobile. If it is, then there is lack of novelty.

161.   When the user wishes the mobile to change from its normal mode (listening to the DS slot in the frame) to VLDC mode in which it listens once every multiframe, it sends a signal to the base station to request the longer slot cycle. A corresponding signal will be sent when the user wishes to revert to the normal mode.

162.   In my judgment, those facts are sufficient to anticipate the claim prior to the proposed amendment. It is enough that a signal is sent when the user selects VLDC mode. The longer slot cycle is then "determined based on an index number" sent by the mobile, as I have construed that phrase.

163.   The proposed amended claim requires the base station to be in a position to provide more than one slot cycle. Here it is necessary to consider whether Cognito's normal and VLDC mode constitute two such slot cycles, so that the system is within the claim.

164.   Qualcomm says that Cognito's normal mode, even though it allows the mobile to save power by listening only once every 16 slots, is not the relevant channel to consider, as it carries message information outside the relevant DS slot, such as the information carried on the general control channel, GC. Thus, on this channel, message information is not transmitted "only" during each assigned slot. Once this is appreciated, one appreciates also that the mobile is listening "continuously" to DS, in the sense that it listens to every DS slot. The logical channel formed by picking out all the DS slots is therefore the relevant channel to consider. The only intermittent channel mode, and the only slot cycle, is therefore in VLDC.

165.   Mr Watson relied heavily on this interchange with Professor Eizenhöfer:

> Q. And the receiver is also listening to slot 0, is it not?
>
> A. The receiver is listening to 0 I would say every now and then. If the receiver enters a new cell, he has to get this broadcast channel and the broadcast channel does not change every millisecond or so, but maybe once a day, maybe once a year. So, let us say, every five minutes, yes, the receiver would listen to 0 as well.

166.   I do not think this helps Qualcomm. For long periods the transmitter will be behaving exactly as required by the claim. The message transmitter is plainly therefore suitable for transmitting message information only during the assigned slot. I am conscious that there must be "clear and unmistakable directions", but the fact that the transmitter will not always operate in this way is no barrier to such a finding, because all that is required is functional capability, and that is inevitably present. The claim would be anticipated, as I have construed it, even if allowed to be amended.

167.   If the amendment were to be construed as suggested by Mr Watson, as requiring at least three different slot cycles (a construction of his amendment which I have rejected) there would be no anticipation.

Cognito – inventive step

168.   On the view which I have come to, obviousness over Cognito does not arise. However, it may be helpful if I consider the issue of obviousness on the basis that the differences argued by Qualcomm between Cognito and the claimed invention did exist.   Those differences are the availability in the base station of at least one more slot cycle which the mobile can choose to have on an exclusive message channel.

169.   Before coming to the primary evidence on the issue, I should deal with two general matters relied upon by Qualcomm on the issue of obviousness on this patent:

   i)   the relative lack of interest at the priority date in data and data-only mobiles, and

   ii)   the existence of a "base-station-centric" mindset which would be reluctant to devolve power to the mobile.

170.   Qualcomm prays these matters in aid as part of the common general knowledge of the addressee, in a manner similar to that applied by the Court of Appeal in *Dyson v Hoover*: [2002] RPC 22 see especially per Sedley LJ at [84] – [88].

171.   The first general point is relevant because the value of variable length slot cycles really only arises in the context of data: for voice calls it is not acceptable to build in longer periods of delay before the call is connected. In the case of data, a longer cycle is acceptable: users will not mind if a message takes much longer than a few seconds to get through. Moreover systems such as GSM do not distinguish between voice and data when they wake the mobile up, so the shorter paging cycle demanded by the voice call is dominant. Hence the motivation to apply different slot cycles could only arise in the context of data, and would be felt most clearly in the case of a data only device.

172.   There was some evidence to suggest that those concerned with designing portable equipment to meet the GSM standard were mainly concerned with voice.   The standard did not cover "data only" mobile devices.   It also provided the SMS service, but the SMS service in GSM was not implemented until 1994.

173.   Thus, GSM was designed primarily with speech transmission in mind, the provision for data transmission being secondary because it was not seen as immediately important commercially.

174.   Nevertheless, by early 1992, the Cognito network had been launched and provided specialised portable data communication. The Mobitex network was

a narrowband packet switched data network launched by Eritel (a subsidiary of Ericsson) in the mid 1980's.

175.   This is a point which I have to bear in mind in assessing obviousness. It is a more telling point in relation to prior art which starts from voice mobiles. The obviousness argument from those starting points requires the skilled team in some cases to consider building a data-only unit based on the same principles, when those starting points are primarily concerned with voice. In relation to Cognito, which is a data network, whilst it is a point which I do not dismiss, the point is of much diminished weight.

176.   The second general point, that designers had a base-station-centric approach, arises because it is said that allowing the mobile a menu of options from which it could choose was anathema to the system designer.

177.   Professor Steele, supported by Dr Tiedemann, said this in his reply report:

> In paragraphs 702 – 708 Prof Eizenhöfer deals with what he calls the "general obviousness" of claim 1. As I explained in my first report, I simply do not agree the position in early 1992 was as simple or straightforward as Prof Eizenhöfer suggests. The concept of DRX as a battery saving tool was well known. However, the way it was implemented was with the base station dictating the slot cycle to the mobile stations. The mindset for DRX was that the base station was in control.

> The reasons for this were as follows. First, the mobile was technically inferior to the base station because the base station was not power limited. It had a much more powerful signal processing capacity than the mobile and also knew what was going on in the network and therefore the radio resources it could bring to bear in any situation. Second, the networks were owned by companies, like Vodafone, Cellnet, etc, who fundamentally wanted the network to have all the control, both technically over the mobiles and commercially over their customers. So, mobiles could assist the base stations, but never control them. Third, because of the previous two points, it would not have occurred to the skilled man to have the mobiles have the capability to decide what they wanted. The base stations decided what was to be done, and the user was obliged to charge their batteries as frequently as required. Of course the operators did not want the user to charge their batteries more frequently than was necessary, but they looked to the manufacturers of phones to increase the time between battery charges. Accordingly, the manufacturers sought improvements in battery technology, chip design, and so on. The operators, obtaining more users, had to decrease the size of their cells and that had a profound improvement on battery life because the mobiles were not having to transmit large distances to their base station. Finally, the prevailing atmosphere in 1992 was that <u>all</u> decisions were made by the network in cellular systems.

178.   I have no doubt that considerations such as these were current in 1992, and that some of them are entitled to some weight in the appropriate context. For

example, the first point might have weight depending on what additional processing capability the mobile was expected to undertake; the second might have weight if the only way in which a particular technical advance could be implemented was to incorporate it within an existing commercial network. However, I have to approach obviousness from the perspective of an overall network design. I therefore think that it would be wrong to do so on the basis of a pervasive mindset against allowing a mobile to make certain selections, provided always that this was technically obvious in the light of the prior art.

179.   So far as the *Pozzoli* analysis is concerned, I have identified the skilled addressee above.   The relevant common general knowledge would include knowledge of the existence of the various standards, but not every team would know all the details of each standard.   I have also identified the inventive concept to the extent necessary, by construing the claim.   In the course of dealing with anticipation I have identified the differences which might exist, should a higher court come to a contrary conclusion on anticipation.   I turn to consider the evidence of obviousness.

180.   Professor Eizenhöfer's report did not address the specific question which arises on obviousness, because he was proceeding on the basis of a construction of the claim which resulted in anticipation. His cross examination explored the question of why Cognito did not suggest the use of more than one (or two depending on whether you count normal mode).

> Q. Yes. And it did not occur, as far as we can tell, to the designers of Cognito to go away from the standard concept of everything being sorted out by the base station to give the mobile the ability to demand and get a variety of DRX cycles.
>
> A. I do not know whether it came to their mind or not. They did not do it and it is not proposed in the paper. We have to be aware that if we implement that on such a TDMA channel, it really gets complicated. It gets as complicated as in GPRS and so if the long cycle is the same for all mobiles, then it is very easy to implement and straightforward. They obviously did not see the reason why they should choose, well, OK, either I have good power or I want short calls setup for speech calls and I can delay calls setup for, let us say, e-mails. Though two are good enough, which is OK, but I think extending it to 8 is certainly not a big issue.
>
> Q. It is not a big issue once you have got the idea. The difficulty that my Lord will have to deal with is, of course now we have seen the patent, it is very easy to see, well, Cognito could have taken that further step and converted the give me VLDC into give me five levels of VLDC.
>
> A. Yes.
>
> Q. But they did not do it.
>
> A. No, they did not do it because they have not seen a reason why it is technically necessary. Maybe they said, OK, two is good enough. I could imagine, I do not know. I have not been working with Cognito.

Q. And it is very difficult, once one knows of the idea, just to say would that have occurred in 1992 reading Cognito to suddenly change for the first time and give the ability to determine DRX cycles to the mobile. That is quite a shift.

A. I think it is not really. I think one would not need Cognito for this idea. This idea comes immediately if you have the power problem. If you have different types of terminals, I think it is not so much as the thought, OK, I let the user choose whether I want this or that. But you have different application. If you want to build pagers with very tiny small battery and you want to build other equipment, then you come to the idea to apply different paging cycles, I would say.

181.   So Professor Eizenhöfer did not really advance any reason why anyone should want the same Cognito mobile data terminal to allow the user to select a further level of power saving, and could see reasons related to technical complexity of the network why implementation would be difficult. He thought that the idea of having such a further level would occur to anyone once they designed a system with different types of terminals, with different levels of power.

182.   Professor Steele approached Cognito from the point of view that it was the base station which set the only slot cycle where there was discontinuous reception. He saw no reason why the reader would see any advantage in allowing further levels of power saving. He asserted repeatedly that he did not think it would have been obvious to go beyond what was specifically taught by Cognito. When pressed as to his reasons in cross examination, he too thought that it would add complexity to the network if mobiles (whether the same mobile, or different groups) were allowed to select a slot cycle from a selection.

183.   Nokia submits that once one has the idea from Cognito that a mobile is given the ability to dictate the choice between two different levels of battery saving, one involving listening every 16 slots, and the other an integer multiple of 16 slots, there is nothing in adding the option of further levels of power saving, either in that mobile, or by giving groups of mobiles of different descriptions their own different paging intervals.

184.   Qualcomm submits that the skilled person would not have had this idea from Cognito. Qualcomm relies on the absence of any hint in Cognito to take the step, the absence of any motivation to take the step, and the perceived network complexity by the addition of further slot cycles chosen by the base station.

185.   On balance I prefer Qualcomm's submissions. There was really no incentive for the skilled team to turn their minds to developing the Cognito system in this way. The idea arises only when one has the idea of adapting Cognito to accommodate a variety of different mobiles. I am not satisfied that the skilled team would have had that idea at all. Whilst I can see the logical attraction of

the way in which Nokia put their case, in the end I have come to the conclusion that it involves hindsight, and should be rejected.

186.   Accordingly, if Cognito does not fall within the claim as granted or as proposed to be amended on its proper construction, because it requires a further level of power saving, then the claim would not be obvious.

Nippon Telegraph - disclosure

187.   Japanese Patent Specification No JP 3-15437 granted to Nippon Telegraph and Telephone Corporation ("Nippon Telegraph") and published on 2nd July 1991 describes a system in which mobile stations are grouped into different classes. The document recognises that as between in-car mobile phones and hand held ones, the importance of battery power saving is different. In the case of the former there is a substantial reservoir of power in the car battery, whilst in the case of the latter there is not. Accordingly, the document suggests treating the two types differently as regards the extent to which they listen when idle. The car phones are referred to as "ungrouped"; the hand held portables as "grouped". As can be seen most clearly in Figure 2, reproduced below, the in-car mobile stations listen continuously, whilst the mobiles operate DRX and listen only in defined slots.
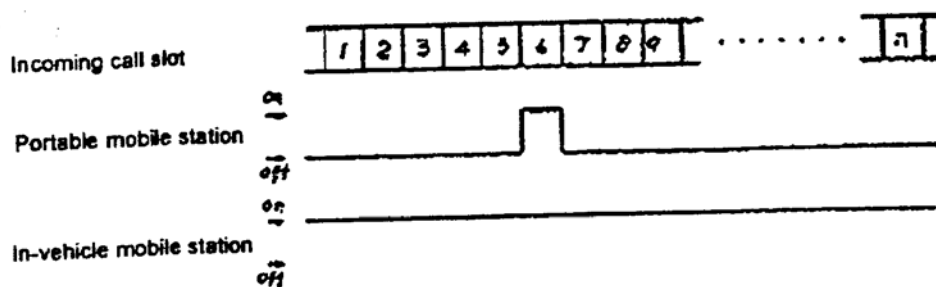

Figure 2

188.   The base station in Nippon Telegraph determines whether a particular mobile station is grouped or ungrouped as follows:

> In making the selection, the buffer selector uses the grouped/ungrouped type information for the mobile stations obtained by the mobile station type and group analyser 2 and – in the case of grouped mobile stations – the information for the group to which the mobile station belongs. The type/group analyser 2 is able to obtain the type/group information for the mobile station by reading the type/group information for that mobile station that is stored in the home memory location.

189.   Accordingly, the base station stores in its memory information as to the type of mobile station to which each mobile station belongs. When a call arrives for a particular mobile station, the base station is able to look up the type of mobile station for which the call is intended and transmit accordingly.

190.   A somewhat opaque passage on page 6 of Nippon Telegraph reads as follows

"There is however, also the approach in which portable mobile stations are divided into N groups and receive only the incoming call slots for their own group and in-vehicle mobile stations receive only a plural portion of the incoming call slots rather than them all. If for example, multiple control channels are provided due to an increase in the number of subscribers such that there are 3 channels containing incoming call slots, as in Figure 3, portable mobile stations in Group I will receive slots #i shown in Figure 3. In the case of in-vehicle mobile stations, some will receive all of the incoming slots #1, #4, …#22 in Channel 1, while others will receive all of the incoming call slots #2, #5, …#23 in Channel 2. In this way, in-vehicle mobile stations and portable mobile stations can be differentiated by grouping."

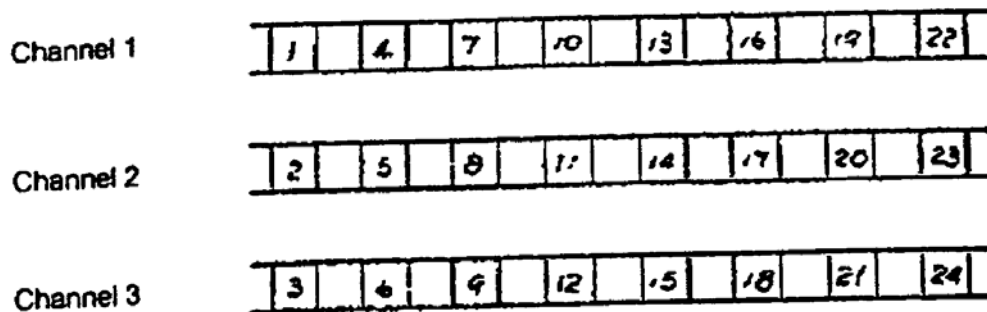191.   Figure 3 looks like this:

Channel 1 | 1 | 4 | 7 | 10 | 13 | 16 | 19 | 22 |

Channel 2 | 2 | 5 | 8 | 11 | 14 | 17 | 20 | 23 |

Channel 3 | 3 | 6 | 9 | 12 | 15 | 18 | 21 | 24 |

Figure 3

192.   It is common ground that Nippon Telegraph does not disclose that a given mobile station has any capacity to change the slot cycle it is to receive. The case for anticipation is based on the fact that, by identifying to the base station the class of mobile station to which it belongs, the mobile determines the slot cycle which the base station transmits. Nippon Telegraph certainly discloses that much.

193.   Quite what Figure 3 and the passage on page 6 which I have set out above are trying to show was the subject of some debate at trial.

194.   Professor Eizenhöfer suggested in his expert report that Figure 3 was disclosing a version in which the in-vehicle mobiles listened to alternate paging slots. It was suggested to Professor Steele that what Figure 3 was showing was the in-vehicle mobiles having a short paging interval and switching on and off. He did not agree, and wondered why an in-vehicle mobile would be required to switch on and off in that way when it has not the same power saving requirements as a portable. In my judgment Nippon Telegraph does not contain clear directions to adopt two different paging intervals

Nippon Telegraph –novelty

195.   The critical question on lack of novelty of the granted claim over Nippon Telegraph is whether the slot cycle is determined based on an index number sent by the grouped mobiles. In order to obtain the intermittent reception mode, grouped mobiles identify themselves to the base station by sending a signal. Based on the receipt of that signal, the base station determines that the mobile is a grouped and not an ungrouped mobile, and allocates the longer paging cycle. In my judgment that is adequate to anticipate claim 1 of the granted patent.

196.   The disclosure of Nippon Telegraph is not adequate to anticipate claim 1 as proposed to be amended, either as I have construed it or as Qualcomm construe it. There is no clear and unambiguous disclosure of a second slot cycle.

Nippon – inventive step

197.   In his first expert report Professor Eizenhöfer suggested that it would be an obvious step from Nippon Telegraph to design the system so that when an in-vehicle mobile was removed from the car, it sent a signal to the base station to indicate that it wanted the longer, grouped, slot cycle. I am not sure this really takes Nokia far enough, because it is still necessary to take the further step of allocating a different paging cycle to the formerly in-vehicle mobiles and the grouped ones. In any case it emerged in cross-examination that this thought was based on some very specific knowledge of GSM, which was not established to be common general knowledge.

198.   What was put to Professor Steele was something more general:

> Q. Let me put to you this. If you read Nippon with its reference to vehicular mobiles and portable mobiles, you can immediately see that what it is teaching could be applied to different classes of portable mobiles just as easily.
>
> A. I suppose so, but, yes, you would have to think a bit about how to do that, wouldn't you?
>
> Q. It would be exactly ----
>
> A. On the grouping, is it not moving into the patent? Is that what you are trying to say? It has different slot cycles now.
>
> Q. What I am trying to say you can apply the same ungrouped distinction to different classes of hand portables as you can ----
>
> A. You are being inventive, you see. This thing, the vehicle will only listen to all those slots, and he probably would not turn off because he has no battery power problem.
>
> Q. I appreciate that, professor. I would find it easier if you would just listen to the question and answer it.

A. I know what you are saying and I agree with you. I haven't disagreed with you.

Q. In that case, I can stop.

199. I do not think that Professor Steele was agreeing that it was obvious to apply the teaching of Nippon to arrive at a system with two different slot cycles. If the claim were to be amended, it would not be obvious over Nippon Telegraph.

NEC - disclosure

200. NEC is another Japanese patent, No 3-206741 published a few months later than Nippon Telegraph on 10th September 1991.

201. The key figure is Figure 1:

Figure 1

202. NEC discloses a system in which certain mobile stations have a mode of operation in which the receive interval is longer than set for normal operation. This is achieved by having two different standby states: "Intermittent waiting A", and "Intermittent waiting B". When the mobile is switched on it goes into state A. If no calls are received for 5 minutes it goes into state B and so

informs the base station. In state B the device switches on once every 30 seconds (transitioning between states 4 and 5 in Figure 1). If an incoming call is received the device shifts into state 6, reverting to state 2 (intermittent waiting A) when the call clears.

203. The system is based on the idea that if a call is received, there is an increased likelihood of another call being received within the next 5 minutes.

204. There is a dispute between the parties as to what state A entails. Professor Steele's initial view was that state A was not discontinuous reception. However in cross examination he accepted that a reasonable view of the document was that it was teaching intermittent reception in state A. I think this falls slightly short of clear and unmistakable directions. So there is no anticipation by NEC.

NEC – inventive step

205. Qualcomm accepts that an obvious implementation of NEC would be one in which both intermittent states involve intermittent reception on different slot cycles. Qualcomm argues, however, that although the mobile indicates to the base station that it is going into state B, what determines the slot cycle is in fact elapsed time, not the sending of a signal. I think this is a trivial distinction: Professor Steele accepted how it worked:

> Q. And the mobile selects between them depending on how long it has been inactive. After five minutes, it sends a signal saying it is going to the other one. Is that right?
>
> A. It does.
>
> Q. To do that, the signal it sends is a parameter to the base station saying it is switching from state A to state B.
>
> A. It does.

206. It follows that the claims as granted and as proposed to be amended (as I have construed them) do not involve an inventive step over NEC.

207. If the amended claim were to be construed as contended for by Qualcomm, a further intermittent state would be necessary. Mr Silverleaf put this to Professor Steele

> Q. The whole point of this is to save battery power, is it not?
>
> A. It is.
>
> Q. So the less often you page, the more battery power you save.
>
> A. Indeed.
>
> Q. What this teaches is that you should reduce the frequency of paging when there are few calls.

A. Yes.

Q. It therefore teaches you that the fewer calls there are, the less frequently you want to page.

A. Yes.

Q. Therefore it is obvious that you could add a longer paging interval when there are even less calls.

A. That is true in pure logical way, but I do not think you would necessarily find that obvious on this patent. Actually, I think he would go in and muddle around with waiting B. That is what he would do.

208. I do not think it would be obvious to add yet further intermittent waiting states to the system in NEC. I think the most one can say on the evidence that it was obvious to do would be to vary the waiting time in intermittent B. The evidence suggested that 30 seconds was too long to expect a caller to wait to be connected. Implementing NEC, one would come to a conclusion as to the longest time one could expect a caller to wait and would set that as the waiting time. The step to more than two waiting times may not seem much, but the evidence does not really explain why anyone would want to set up such a system.

209. Accordingly the claim involves an inventive step if I am wrong as to the correct construction of the proposed amendment, and it requires more than two slot cycles.

Obviousness over GSM

210. Nokia allege that the invention of the 324 Patent was also obvious over the GSM standard. In GSM, provision was made for multiple slot cycles, but in that system it was the base station that decided the paging interval, not the mobile.

211. Nokia's case is that if one were to design a data-only mobile to work with GSM, it would be technically obvious to design it so that the mobile could select from a range of power saving options, each with a different slot cycle. The fact that it did not happen was for commercial rather than technical reasons.

212. I can deal shortly with this argument. I think, on the evidence, it is expecting too much of the skilled person to say that in 1992 he would have conceived on the basis of GSM alone, of the combination of the idea of a data-only mobile, of the idea of multiple power saving modes, and of the idea of allowing a mobile (or different groups of mobiles) to select between them.

Insufficiency

213. The relevant principles are well settled: see *Biogen v Medeva* [1995] RPC 1 at [46]-[54]; *Kirin Amgen v TKT* [2004] UKHL 46; [2005] RPC 9 at [110]-[112]; *Mentor v Hollister* [1993] RPC 7. The scope of the claims must not exceed the

territory in which it can be said that infringer would be making use of the patentee's contribution to the art; and making use of that contribution must not involve undue effort beyond what is taught by the specification.

214. Paragraph 2A of the Grounds of Invalidity against the 324 Patent contains allegations of insufficiency, as follows:

"(a) The claims of the 324 Patent do not equiparate with the inventive contribution of the Patent (if any) if and insofar as they

i)   extend to the use of a fixed slot cycle, where remote stations cannot change the period at all. For example, the patent highlights at paragraph [0007] that it differs from the prior art in providing for the remote stations to change the timing. But the claims are not limited to this contribution (if it is one).

ii)   extend to a system where every slot is an assigned slot, which for example (i) the description of the patent expressly states at paragraph [0021] is outside the scope of the invention of the 324 Patent and (ii) would not address the problem with which the patent is concerned or produce the benefit that is promises (longer battery life).

iii)   extend to TDMA systems which were inherently already slotted in nature, so the problem identified and addressed in the 324 Patent, that of *continuous* monitoring, did not apply to this technology anyway. The patent is directed to a CDMA system and a problem that occurs in CDMA.

iv)   extend to discontinuous reception in which messages are *only* transmitted in some assigned slots: a message need not be transmitted in every such slot. The description discloses only a discontinuous reception system in which messages are transmitted to each receiver in every assigned slot.

v)   extend to determination of the slot cycle using an index number provided by the remote station other than by the precise method disclosed in the specification as explained in paragraph 2B below.

(b)   if the patent extends to any method of arranging discontinuous reception other than one where the slots are strictly periodic in time, then the patent provides no teaching or guidance as to how to achieve such a discontinuous reception arrangement.

215. The group of pleas of insufficiency in paragraph 2(A)(a) are aimed at the scope of the claims. Paragraph 2(A)(b) is directed to the absence of any teaching of anything other than strict periodicity.

216. I can deal with these objections fairly shortly, as the issues which I have already decided are adequate to deal with the action insofar as it relates to this Patent.

217. Paragraph 2(A)(a)(i). This objection is directed at the fact that Nokia's phones cannot themselves change the slot cycle. But it is clear from the patent that the slot cycle may be hard wired into the phone: see [0021]. The passage at [0007] applies equally to a phone which returns a fixed index number, chosen in the factory by the manufacturer and hard-wired into the phone and to a phone which has a switch which allows the user to select the index to be fed back to the network.

218. Paragraph 2(A)(a)(ii). A system in which every slot is an assigned slot (and there is no provision for slotted paging) is not within the claim when read purposively. I do not see how anyone can read paragraph [0021], which says that if the phone listens continuously the invention is bypassed, and come to the conclusion that such an arrangement is within the claim. The condition on which the plea is based is not therefore satisfied.

219. Paragraph 2(A)(a)(iii). I have dealt with this when dealing with construction. The idea of allowing the mobile to send an index number to determine the slot cycle applies to TDMA as well as CDMA.

220. Paragraph 2(A)(a)(iv). I have held that the functionality required is that the transmitter sends only during each assigned slot. Provided the apparatus has that functionality, it does not seem to me to matter whether it is always used. The apparatus claim cannot be insufficient on that basis.

221. Paragraph 2(A)(a)(v). This is simply an allegation that the claim is wider than the specific embodiment. The skilled reader would understand that the teaching of the specification could be applied more broadly than the "precise" method in the description.

222. Paragraph 2(A)(b) This is the only example of an attack on the adequacy of the teaching of the Patent. This is the sort of insufficiency which one would expect to be supported by evidence. It did not feature in Professor Eizenhöfer's expert report on behalf of Nokia however. It also did not feature in Nokia's opening skeleton, although it was not at that stage formally abandoned. Professor Steele did give some evidence about it on which he was not cross examined. In my view the objection is not established.

223. The objections of insufficiency fail.

Added Matter

224. It is an objection to the validity of a patent that "the matter disclosed in the specification of the patent extends beyond that disclosed in the application for the patent as filed."

225. In *Bonzel v. Intervention (No. 3)* [1991] RPC 553 at 574 Aldous J. stated:

"The decision as to whether there was an extension of disclosure must be made on a comparison of the two documents (application as filed, patent as granted) read through the eyes of a skilled addressee. The task of the Court is threefold:

(a) to ascertain through the eyes of a skilled addressee what is disclosed, both explicitly and implicitly in the application;

(b) to do the same in respect of the patent as granted;

(c) to compare the two disclosures and decide whether any subject matter relevant to the invention has been added whether by deletion or addition. The comparison is strict in the sense that subject matter will be added unless such matter is clearly and unambiguously disclosed in the application either explicitly or implicitly."

226. Sometimes there can be added matter by taking a narrow concept, stripping it from its context and broadening it out: see Pumfrey J in *Palmaz's Patents* [1999] RPC 47 at 70-71, especially at page 71 lines 1-9, cited with approval by Jacob LJ in *Vector v Glatt* [2007] EWCA Civ 805: see in particular Jacob LJ at paras 2-9. This type of added matter is called "intermediate generalisation".

227. The grounds of invalidity in this case contained two allegations of added matter. I set them out here:

   i)   The disclosure of the application for the patent as filed discloses the remote station determining the slot cycle by provision of a number used to calculate the slot cycle using a specific formula: 5×2^n. This provides a set of nested slot cycle lengths, with each of the larger slot cycles comprising an integral number of the smaller slot cycles. There is no teaching in the application as filed of any other manner of determining the length of slot cycles involving the use of an index number, nor any teaching that the use of an index number as such is advantageous. Claim 1 of the patent as granted contains a generalisation between a mere requirement that the remote station set the slot cycle and the requirement that it does so using the method of the embodiment described. This intermediate generalisation is introduced by use of the term index number which is broader than the specific method disclosed in the application as filed and, accordingly, adds matter to its disclosure.

   ii) The disclosure of the Patent extends to arrangements with more than one assigned slot per slot cycle (as the Claimant alleges in paragraph 71 of its reply statement of case on the '324 Patent). The disclosure of the application for the patent does not extend to this subject matter.

Particulars (i).

228. The first objection complains of an intermediate generalisation by the use in the granted claim of the term "index number" divorced of its original context of a number generated by the slot cycle formula of the specific embodiment.

229. It is correct that the term "index number" is not used in the application before one gets to the specific embodiment, where it is used in intimate connection with the slot cycle equation 5×2^{SSI}. Before one gets there however, one finds this passage at page 3 lines 17-22 of the application (reproduced in [0015] in the Patent):

> All receivers in the system need not have the same slot cycle. Furthermore, the slot cycle of a receiver may change during operation. For example, the receiver may select a new slot cycle and send a message to the transmitter notifying it of the new slot cycle. Although either the receiver or transmitter may change the slot cycle of the receiver, both must have the slot cycle information."

230. So there is a broad disclosure in the application of the idea of the mobile sending a message to the base station indicating the slot cycle it wants. The specific embodiment is an illustration of that broadly disclosed idea.

231. The approach I have taken to construction of the term "index number" does not allow it to carry any implication of menus of available slot cycle, or how those slot cycles relate to each other. It is just a message from the mobile to the base station indicative of a given slot cycle, exactly as described in the passage I have quoted from the application.

232. On the approach I have taken to construction of the unamended claim, no added matter objection arises.

233. On Qualcomm's approach to construction of "index number", I think there would be added matter. The specific "index number" in the application is one that delivers a nested range of slot cycles, which reduces the overall complexity of the system and brings with it advantages in the event of non-response. There is no disclosure in the application of a system in which the mobile can select from a plurality of unrelated slot cycles, but the unamended claim on Qualcomm's construction would disclose exactly that.

Particulars (ii)

234. I don't think there is anything in this second added matter point. Whilst at one stage Qualcomm did allege that the claim was intended to imply that more than one assigned slot per slot cycle was intended, that suggestion was correctly withdrawn.

Priority Date

235. The attack on priority fails for the same reasons as the insufficiency and added matter attacks. As I have already said when dealing with TR45, if I had adopted Qualcomm's construction of claim 1, there would have been added matter in claim 1 of the granted patent. The case was argued on the basis that priority date depended on the allegations of insufficiency and added matter. In those circumstances, had I adopted Qualcomm's construction, the priority date of the claim would have been the date of the application.

Infringement

236.   Infringement is alleged under section 60(2) of the Patents Act 1977, so called "contributory infringement". It is said that the sale of Nokia phones for use in the GSM/GPRS network will lead to a combination of base station and receiver falling within the claims.

237.   There are two rather unusual aspects to this part of the case. The first is that it is common ground the network as it currently exists does not operate as described by the functional requirements of the claim. What is said is that the combination represented by a Nokia phone and the existing network meets the requirement of the claim because it is suitable for implementing those functional requirements, even if those functions are not in fact implemented in the current network. It is said that the standard provides for a common control channel for packet data called PCCCH, which when implemented, would mean that there would be an infringing combination of phone and network. There was a factual dispute, which has effectively fallen away, about whether PCCCH was likely to be implemented in the GSM/GPRS network, and the impact this has on the knowledge requirement under the infringement sections relied on.

238.   The second unusual aspect is that it is said by Nokia that the allegation of infringement is so complicated to understand that, even if I conclude that the GSM/GPRS network when combined with a Nokia phone falls within the claim, I should hold that this is not "obvious to a reasonable person in the circumstances", and that there is therefore no contributory infringement.

239.   These points make it necessary to consider with some care the proper approach to section 60(2) infringement.

Section 60(2)

240.   Section 60(2) provides:

> (2) Subject to the following provisions of this section, a person (other than the proprietor of the patent) also infringes a patent for an invention if while the patent is in force and without the consent of the proprietor, he supplies or offers to supply in the United Kingdom a person other than a licensee or other person entitled to work the invention with any of the means, relating to an essential element of the invention, <u>for putting the invention into effect</u> when he <u>knows, or it is obvious to a reasonable person in the circumstances</u>, that those means are <u>suitable for putting</u>, <u>and are intended to put</u>, the invention into effect in the United Kingdom.

241.   It is clear, first of all, that infringement takes place at the moment of the supply, or offer to supply, of the essential means. It follows that the time at which the knowledge requirement of the section is to be fulfilled is the instant of supply or offer as well.

242.   There is a double requirement so far as the means are concerned: they are to be both suitable for putting and intended to put the invention into effect. The legislature might have stopped at "suitable for putting", but it did not. Merely supplying something which the supplier knows can be used for infringement is not enough. What the second requirement adds is that the supplier must know (actually or constructively) that the means supplied are intended to be so used.

243.   Clearly there can (and in fact almost always will) be a gap in time between the supply of the essential means and the putting of the invention into effect. If A supplied B with essential means knowing that the means were suitable for incorporating into an infringing apparatus and knowing that three months later B plans to incorporate them into an infringing system, then A knows that the means are suitable for putting and are intended to put the invention into effect. It does not matter if B subsequently changes his mind: infringement has already occurred. It is more difficult to decide the right answer where A knows that there is a chance, maybe only a small chance, that B will infringe. A may still gain some advantage from the invention from selling the means in those circumstances.

244.   Mr Silverleaf submitted that A does not infringe unless it is more likely than not in the circumstances known to him that B will infringe. Otherwise A does not know that the means are intended to put the invention into effect. Mr Watson did not demur and as we shall see, in the end recoiled from putting his case based on knowledge or foresight of what would occur. It is therefore not necessary for me to decide the question: it is preferable that it should await a case where the point arises directly.

245.   I do, however, reject Nokia's "too complicated for us to know we infringe" point. It does not seem to me that the sub-section is at all concerned with how difficult it is, on the facts known to the alleged infringer, to determine that he infringes. The sub-section is concerned and concerned only with whether he knows sufficient facts about what is to be done with the means supplied. If facts material to the allegation that the means are to be put to infringing use are hidden from him, then he will not infringe. But if the facts are known or obvious to him in the circumstances, their complexity does not afford a defence. Otherwise, complicated inventions are less well protected than simple ones, which would not be a rational policy.

Infringement by GSM/GPRS with PCCCH implemented

246.   The Nokia mobile phones complained of are described in the Product Description relating to the 324 Patent.

247.   A GSM/GPRS system, although designed for packet switching, is still capable of carrying normal mobile telephone calls on a circuit switched basis. For the purpose of carrying packet data, the system incorporates a number of packet data channels identified PDCH. A helpful diagram was included by Mr Watson in his skeleton argument, and was used in the course of cross examination of both expert witnesses. It is reproduced as Appendix 1.

248.   PDCH is shown as Level 1. The network operator can nominate channels within a cell for use as PDCHs dynamically, according to the changing demand for different types of traffic in the cell.

249.   In GSM, mobile phones in idle mode monitor the paging channel only during predefined intervals of time and can save power between those intervals. In GSM/GPRS, when operating in packet mode, the system was modified to allow the mobile station to influence how often it is required to monitor the paging channel by providing a value for the parameter SPLIT_PG_CYCLE_CODE. The Nokia mobile phones are hard wired to supply the value 7 for SPLIT_PG_CYCLE_CODE in these circumstances. Of course Nokia could have chosen another value and obtained another slot cycle.

250.   The PCCCH in GSM/GPRS is a group of control channels, consisting of the Packet Access Grant Channel (PAGCH, downlink only), the Packet Paging Channel (PPCH, downlink only), the Packet Notification Channel (PNCH, downlink only) and the Packet Random Access Channel (PRACH, uplink only). Usually a Packet Broadcast Control Channel (PBCCH, downlink only) is allocated on the same physical channel. These are all "logical channels".

251.   Message information is transmitted in GSM/GPRS using the logical PCCCH channel. The PCCCH channel is mapped onto the PDCH. The PDCH channel is transmitted in every 8th slot, in the basic stream of slots on a particular frequency transmitted by the base station (Level 1 in the figure above). 52 GSM frames form a multiframe for this purpose. Each slot 8 in every frame of the multiframe is used to transmit PDCH. The PDCH carries one or more of the logical channels, amongst them the PCCCH.

252.   Level 2 in the figure shows that most of the slots from the underlying stream of slots are taken in groups of 4 which make up radio blocks – blocks of data which are interleaved before transmission. These blocks are numbered Block 0 to Block 11. The blocks are allocated by the network for use by the Packet Broadcast Control Channel (PBCCH), the Packet Access Grant Channel (PAGCH), the Packet Notification Channel (PNCH) and the Packet Paging Channel (PPCH). If a network operator decided that there would be one PBCCH block in a multiframe, it goes in block B0. A number of blocks are then allocated to functions other than paging, for example to Access Grant, Packet Notification or packet data transmission. Once this allocation has been made, the remaining blocks are available for paging. The blocks (after Block 0) must be allocated in the order: B6, B3, B9, B1, B7, B4, B10, B2, B8, B5, B11.

253.   Thus a variety of different patterns of blocks carrying message information can be encountered in a cell transmitting PCCCH. Level 3 in the figure shows the division of the radio blocks into three sub-channels.

254.   Level 3 in the Figure also shows how 64 of the 52-frame multiframes as described above make up a superframe. Each of those multiframes will contain a number of paging blocks, depending upon the network configuration. Each multiframe will also contain a number of PBCCH and PAGCH blocks, PTCCH slots and idle slots. 64 multiframes will contain a

relatively large number of paging blocks, between 64 and 704. The actual number, M, is 12 (the total number of blocks) less the number allocated for PBCCH and PAGCH, multiplied by 64. In the example in the Figure it will be 5x64, i.e. 320.

255. The parameter SPLIT_PG_CYCLE_CODE (for the Nokia mobile phones always 7) indicates how many times the mobile should monitor the paging channel during the 64 multiframes.

256. Level 4 shows the 320 paging blocks from the superframe. The first paging block will be assigned randomly between 0 and (M-1) using a hashing algorithm based on the mobile phone's IMSI. This is to ensure that the paging slots for different phones are randomly distributed over the 64 multiframes. The algorithm then seeks to place the remaining 6 paging blocks fairly evenly throughout the M paging blocks. In general, this cannot be achieved with accuracy, because M will not always be divisible by 7 without a remainder.

257. In the example in the Figure the paging blocks for an individual phone are placed at 24, 69, 115, 161, 206, 252 and 298, i.e they are spaced 45 or 46 blocks apart.

258. Of course the numbering of the paging blocks does not correspond to real time. A difference of paging block number of 1 may shift the timing of transmission by more than one block, because the paging blocks are generally not adjacent to each other in the multiframe.

259. Although the average time between paging blocks which the mobile phone must monitor is determined by SPLIT_PG_CYCLE, this does not determine the <u>number</u> of paging blocks or slots from one paging block in the paging group to the next. This depends also on how many paging blocks are available in the cell. As explained above, the approximate number of paging blocks between one paging block and the next depends on SPLIT_PG_CYCLE and on M, which is determined by the base station and can vary from cell to cell and time to time. Even though the value of SPLIT_PG_CYCLE for a Nokia phone is always 7, this will result in different numbers of paging blocks between paging blocks in the group depending on the parameters set by the base station. Then, the number of blocks or slots between paging blocks in the group will depend on the arrangement of paging blocks in the multiframe, explained above, which is again determined by the base station.

Infringement – periodicity

260. On the view which I have taken as to the construction of claim 1, it is legitimate to look at Level 4 as the message channel, even though this is only a logical channel and is not constructed from slots which would be regular or contiguous in time. The crucial question is whether the fact that the GSM/GPRS paging intervals are, in this example and most others slightly irregular (45, 46 etc), takes the system outside the claim. In my judgment this difference is not sufficient to avoid infringement. The difference is an artefact of allowing the base station some control over the paging interval, something

which the claim does not exclude. The skilled person would regard the difference introduced in this way as immaterial.

261.   I also do not consider that the other non-infringement points raised by Nokia are good ones. They are dealt with by the construction I have adopted. The slot cycle is determined by the index number sent by the mobile, even though the base station has an influence. The fact that the base station may not send a message in every slot does not matter, as the base station is clearly capable of sending such a message, so the apparatus claim is infringed.

Section 60(2)

262.   Up to now I have assumed that PCCCH is implemented. But at the date of the infringement it had not been. The evidence in my judgment did not establish that, at the date of the supply of the Nokia phones, Nokia knew or that it was obvious to it in the circumstances that PCCCH would be implemented. In fact Nokia has recently withdrawn support for PCCCH in their base stations, although others have not done so. So if section 60(2) infringement were to be based on the evidence of what was known to Nokia or obvious to it in the circumstances, the allegation would fail.

263.   Recognising the difficulty that he faced on this evidence, Mr Watson put his case on contributory infringement in this way. He said that the apparatus created by the supply of the Nokia phone into the **existing** (non PCCCH) system was an infringement, because it was suitable for implementing slotted paging using PCCCH. So by supplying the Nokia phones, Nokia is providing an essential means when it knows that those means are suitable for putting and intended to put the invention (i.e. the existing system) into effect. In this way he neatly bypasses the effect of the evidence as to the likelihood of PCCCH being implemented. The argument depends upon showing that the existing system is an infringement, because it is "for" PCCCH.

264.   GSM/GPRS has three Network Modes of Operation, NMOs 1, 2 and 3. In the current system, NMO 2, it is not possible to implement PCCCH. In practical terms, to implement PCCCH it would be necessary to implement NMO1. This would involve adding a new interface, the Gs interface, to allow the mobile switching centre to communicate with the serving GPRS support node.

265.   Once these implementations were in place, to turn on PCCCH within an individual cell would require three commands to be sent one after the other to the base station via the OMC interface. The Nokia manual describes how this could be done.

266.   For completeness, there is a third mode of operation, NMO3. This is a sub-optimal system which does not make use of the Gs interface. As a result, the scheduling of the PCH and PPCH will periodically clash, with the result that the mobile would have to choose which channel to monitor, resulting in lost messages. Mr Children accepted that this was not a serious option.

267.   Nokia submits that the fact that one would have to introduce a new interface into the system in order to implement PCCCH means that the existing

combination of phone and network cannot be regarded as an apparatus within the claim. It says that the relevant feature -"the slot cycle being determined based on an index number provided from [a] remote station" - is one which must be found in the existing system, not in a modified system.

268.   Qualcomm submits that the need to provide the Gs interface is irrelevant. The Gs interface is only the means by which signalling information is provided to the claimed apparatus: it is not part of the claimed apparatus itself. It points out that the alleged infringing apparatus is the mobile, the Base Transceiver Stations (BTS) and the Base Station Controllers (BSC). The Gs interface lies outside this. The feature relied on by Nokia is, says Qualcomm, just another functional feature which will be satisfied if connections are made to the claimed apparatus (mobile, BTS, BSC) to make it fulfil that function. If PCCCH is enabled, the phones, the BTS and BSC will respond automatically and send the index number which is hard wired into their circuits, and thus set their slot cycle.

269.   I have come to the conclusion that Qualcomm is right on this issue. It is true that the existing system is not one which is in fact operating so that the slot cycle is determined based on an index number provided from a remote station, or implements slotted paging at all. But the combination of mobile, BTS and BSC are set up to operate in that way. As soon as the PCCCH channel, for which the standard makes provision, is enabled (by means external to that combination), the combination will function as required by the claim. The relevant apparatus (mobile, BTS and BSC) has not changed. All that has changed is the manner in which the apparatus is being used. That is not enough to avoid infringement.

Overall conclusion on 324

270.   To avoid repeating it when I get there, my overall conclusions on 324 are stated at the end of this judgment.

The 482 Patent

271.   The 482 Patent is entitled "Method and apparatus for correction and limitation of transmitter power on the reverse link of a mobile radio telephone system". It claims priority from a United States application filed on 28th February 1994. There is no challenge to the priority date of this patent. There is no allegation of anticipation. There are issues of obviousness, added matter, insufficiency, infringement and essentiality.

272.   Before coming to the Patent itself I am afraid that it is necessary in this already long judgment to tackle some more technical background specific to 482.

482 Technical background

Open and Closed Loop power control

273.   When a mobile telephone transmits a radio signal, the power which is received from it at the base station will be a function of the distance between the mobile telephone and the base station. Radio waves lose power (attenuate) rapidly with distance. In order to be heard at the base station from a remote part of the cell, the mobile will have to transmit at a higher power than would be necessary for it to be heard if it were adjacent to the base station. If the mobile has a fixed power output, and one sufficient to be heard at the remote location, it will be too loud when it is close to the base station.

274.   Excessive transmission power is undesirable from a number of points of view. It is wasteful of battery resources. It will also give rise to interference with other signals. Some means of controlling the transmission power is therefore needed.

275.   One method is for the mobile to monitor the received power on the down link. In this method the assumption is made that the received signal, having travelled between the base station and the mobile, will have been subject to the same degree of attenuation as the transmitted signal will experience on the uplink. If the transmit power from the base station was T_B and the received power at the mobile was R_M, then the attenuation loss is T_B-R_M. The mobile will know T_B (because it is fixed) and will measure R_M. It will therefore know that to achieve a given receive power at the base station, R_B, it will have to transmit at a power which is greater than R_B by T_B-R_M, the loss due to attenuation.

276.   The above method is called "**open loop**" power control. The accuracy of open loop power control is dependent on the validity of the assumption that the loss on the down link will be the same as on the up link. The assumption is not always valid. It will be noted in addition that there will be an inverse relation between the power received by and the power transmitted by the mobile. The louder the base station sounds to the mobile, the softer it will transmit back to the base station, and vice versa.

277.   Another method which can be used is for the base station to measure the incoming power from a given mobile, to compare it with a desired power, and to send to the mobile a feedback signal ("turn it up by x dB" or "turn it down by ydB" or "transmit power zdB")). This is generally called closed loop power control. It does not rely on any assumptions as to the equivalence of the attenuation on the down and up links. However it requires an additional signal to be sent by the base station to the telephone.

278.   By the priority date it was certainly known to combine the open and closed methods of power control in the same system. It was specified in the IS-95 standard for CDMA, for example.
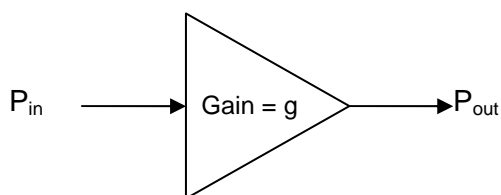
Power and Decibels

279.   The decibel (dB) is a logarithmic unit of measurement that expresses power relative to a specified or implied reference level. Its logarithmic nature allows very large or very small ratios to be represented by a convenient number. Because it is essentially a ratio, it is a dimensionless unit.
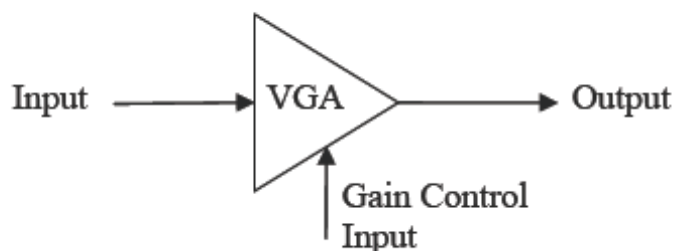
280. A decibel is one tenth of a bel (B). The unit was originally devised by engineers of the Bell Telephone Laboratory to quantify the reduction in audio level over a 1 mile length of standard telephone cable, and was named in honour of the laboratory's founder Alexander Graham Bell. In many situations, however, the bel proved inconveniently large, so the decibel has become more common.

281. The definitions of the decibel and bel use base-10 logarithms. The mathematics of exponents ($10^x \times 10^y = 10^{x+y}$) means that the overall decibel gain of a multi-component system (such as consecutive amplifiers) can be calculated simply by summing the decibel gains of the individual components, rather than needing to multiply amplification factors. Thus if a first amplifier has a gain of x dB and a second amplifier has a gain of y dB, then the two in series will have a total gain of (x+y) dB.

Variable Gain amplifiers

282. In radio circuitry an amplifier is a device for increasing the strength of a signal by an amount called the gain.

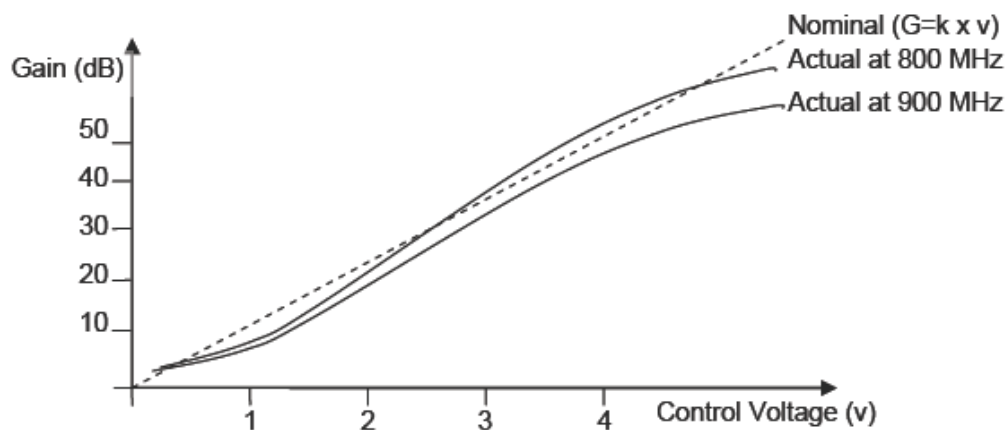283. An amplifier is conventionally depicted as shown below:

284. In an ideal amplifier the output power P_{out} is equal to the input power P_{in} times the gain, g. An amplifier is said to be "<u>linear</u>" if the output of the amplifier is equal to the input multiplied by a constant (possibly plus another constant, an offset value). The graph of P_{out} against P_{in} is a straight line. In practice amplifiers deviate from true linearity. This may occur both outside and inside their operating ranges.

285. A variable gain amplifier is an amplifier whose gain is adjustable. Variable gain amplifiers (VGAs), as depicted below, essentially have a signal input, a signal output and a gain control input.

286.   As with any amplifier, the ratio of the output voltage to the input voltage of a VGA is termed the gain of the amplifier. The distinguishing feature of a VGA, as its name implies, is that the gain of the amplifier can be varied in use as part of the amplifier's function in a circuit.

287.   The gain of a VGA is varied by varying the control signal applied to the gain control input. Typically, the relationship between the control input and the resulting gain is intended to be of the form:

Gain (in dB) = k x control voltage (in volts)

288.   In this equation, k is intended to be a constant factor. In practice, due to circuit design or component limitations, it may not be constant over the entire operating range of voltages. It may also vary with frequency. Thus, the relationship between the control input voltage and the resulting gain in practice might be illustrated as is shown below:
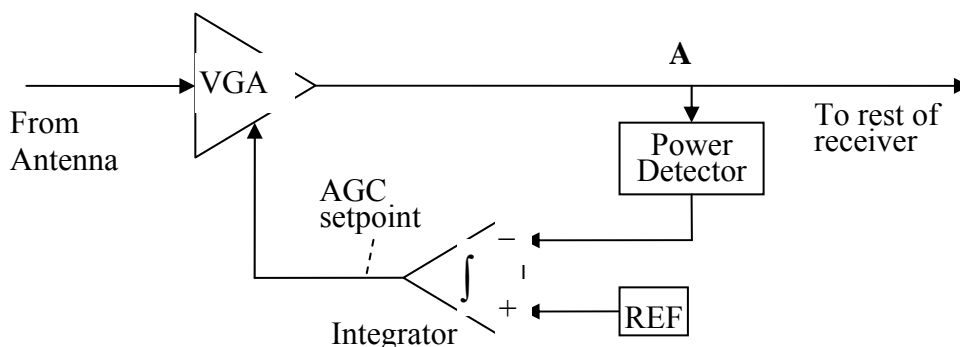

289.   Further, the graphs shown above in this figure may differ according to the working temperature of the VGA and they may differ from one example to another of a particular design or model of amplifier, due to production variations and component tolerances.

290.   The control voltage response of the amplifier shown in solid lines above can be described as non-linear. The amplifier gain does not actually follow a straight line relationship to the control voltage as intended by the above equation.

291.   The linearity or non-linearity of the gain vs control voltage characteristic of the VGA must be distinguished from another type of non-linearity frequently referred to in connection with any amplifier - non linearity of the output voltage vs the input voltage.

292.   The non-linear response of a VGA to its control input referred to above may be the best that can be achieved in practice. It is however possible to alter the value of the control signal in such a way that it corrects for the non-linearity. For example, assume that a VGA is designed to produce a gain of 10dB per

volt of the control signal. Measurement shows that a control signal of 1 volt actually produces a gain of 12dB, whereas 0.8 volts produces a gain of 10dB. If a control signal of 1 volt is always corrected to a value of 0.8 volts, then the VGA will produce the actual gain value required by the circuit producing the control signal.

293.   It is necessary to carry out this correction operation throughout the working range of the VGA. A correction circuit is required which takes in values of the control signal produced by whatever circuitry is specifying the gain of the amplifier, and outputs a corrected value which, when applied to the VGA, will produce the specified gain.

294.   The above considers only the non-linearity of the VGA gain control characteristic with the value of gain specified.   The same approach can take account of variations with frequency also.

Automatic Gain Control (AGC)

295.   Automatic gain control (AGC) circuits can be used to adjust the strength of the received signal for later processing of the signal. The purpose of an AGC circuit is to produce a near constant output from a receiver amplifier or amplifier chain whatever the size of the input signal. This is particularly important in radio receivers, where the received signal strength may vary by many orders of magnitude, but the circuitry for processing the received signal may only operate effectively over a small range of input voltages. To achieve this, the gain of the amplifier must be able to vary in order to increase when the input signal is small and decrease when the signal is large.

296.   AGC circuits may operate purely on analogue signals or, in a digital receiver, they may be partly analogue and partly digital.   This does not alter the basic principle of operation. A typical AGC circuit may be illustrated functionally as follows:
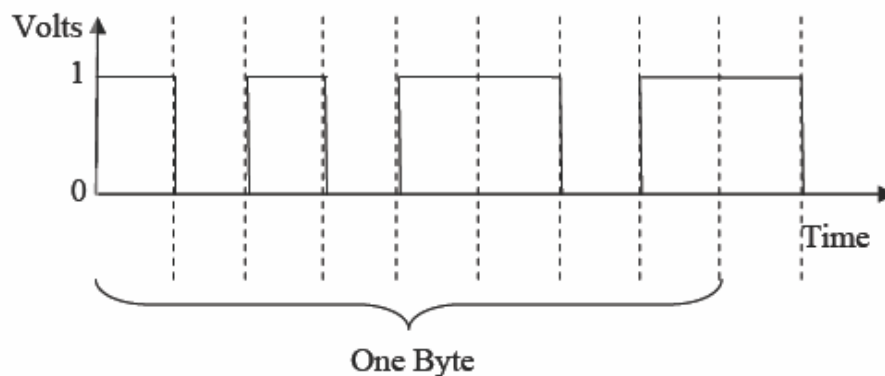

297.   The signal from the antenna of the receiver is amplified by a variable gain amplifier (marked VGA above). The Power Detector produces a measurement of the power of the incoming signal at point 'A' in the circuit, i.e. after amplification.   The amplified signal then continues on to the remainder of the

receiver circuitry. It is the signal at point A which the AGC circuit seeks to keep at a constant power.

298. The circuit needs to know what power level is required at point 'A'. This is provided by a reference value, shown as 'REF' in the diagram.

299. The measured power at point A is subtracted from the 'REF' value at the input to the integrator. The result is an error value representing the departure of the measured power from the required power. If the measured power is too high, the error value will be negative. If the measured power is too low, the error value will be positive.

300. Successive error values are integrated by the integrator to produce what will be referred to here as an AGC setpoint. Suppose, first, that a signal of a constant power is being received from the antenna and the AGC setpoint results in the gain of the VGA being set to a value which produces the desired output at point A. In other words, the AGC is doing its job. The error value at the input to the integrator will be zero.

301. If the strength of the signal received at the antenna then falls (for example the receiver moves further from the transmitter), the error value at the input of the integrator will go positive. The result of the integration will be that this positive value is added to the previous setpoint (thus increasing the gain of the VGA) until the measured power again equals the 'REF' value. If the signal received at the antenna increases, then the error value goes negative, and the integrator subtracts the error value from the previous setpoint until the measured power again equals the desired value set by 'REF'. The circuit operates as a control loop where any error between the measured power and the 'REF' value produces a change in the control signal to the VGA which reduces that error to zero.

302. The integration function is required in the control loop because the instantaneous difference between REF and the measured value will not work. If the error value is zero the voltage at the control input of the VGA will be zero. That would provide zero gain and the measured power would drop to nothing. If the signal received at the antenna increases or decreases in power, the error value will go negative or positive, but the error signal does not represent the gain required to achieve the desired measured power: it indicates whether the gain should be higher or lower than it was before. The output of an integrator is a constant value so long as the input does not change, and increases or decreases from that value if the input goes positive or negative respectively, which is the control function required for the AGC circuit.

303. A characteristic of the above circuit is that its operation does not depend upon the response of the VGA to the control signal being linear. As long as the gain of the VGA increases with increase in the voltage applied to the control input, and vice versa, the effect of the control loop is to force the error signal to zero i.e. monotony is sufficient. The circuit increases or decreases the AGC setpoint value until the gain provides a measured power value equal to the reference value.

Digital and analogue signals and circuits

304.   An analogue signal from, say, the microphone of a mobile telephone can be represented by a voltage varying continuously with time. Such an analogue signal can be transferred over a radio link by using a process known as modulation to impose the information in the voice signal on a radio frequency signal. This was the method adopted in early mobile telephone systems which are generally referred to as analogue systems.

305.   However, it is also possible to convert the analogue voice signal to a digital signal prior to modulation. This is the approach taken in more modern mobile telephone systems which are therefore referred to as digital systems.

306.   The use of digital voice signals offers a number of advantages, although they initially have a greater bandwidth than the corresponding analogue signal.

307.   A digital signal consists of a sequence of numbers or values expressed in binary form. In digital systems, each '1' can be represented by, say, a voltage of 1 volt on a wire and each '0' bit by a voltage of 0 volts. Thus a wire carrying a digital signal would have a voltage varying with time as shown below:

308.   An analogue signal is converted to a digital signal by methods which were well known. There are essentially two steps in the process. The first is sampling. Sampling is a process in which the magnitude or voltage of the analogue voice signal is measured at fixed intervals of time. The second step is quantisation. Quantisation is the conversion of the measured sample voltages to digital values. In digital telephony, each sample is represented by one byte, so the maximum value is 255.

309.   The earliest mobile telephone systems, such as AMPS and TACS, were analogue systems and are generally referred to as 1st Generation Systems. Systems developed from about 1985 onwards were generally digital systems.

Analogue to Digital and Digital to Analogue Conversion

310.   An analogue-to-digital converter (abbreviated ADC, A/D or A to D) is an electronic circuit that converts continuous signals (e.g. an input analogue voltage) to discrete digital numbers. The digital output will typically be a value in binary.

311.   The reverse operation is performed by a digital-to-analogue converter (DAC). The DAC converts finite-precision numbers (usually binary numbers) into a physical quality, usually an electrical voltage.

Calibration

312.   Many circuits, analogue and digital, require calibration in order to ensure that they perform in accordance with their design criteria. Individual components vary slightly in performance from the design specification and adjustments need to be made to fine tune the performance of production items.   In traditional analogue circuitry, calibration was usually performed by providing appropriate variable resistors or 'trimmers' which could be manually adjusted as part of the production process. Circuits are often calibrated by measuring their response to a known signal and entering an appropriate adjustment factor (to bring the response into line with specification) into a look-up table stored in an associated memory. In operation the adjustment factor is read from the look-up table and applied to the signal processing carried out by the circuit so that the performance of all examples of the circuit is the same.
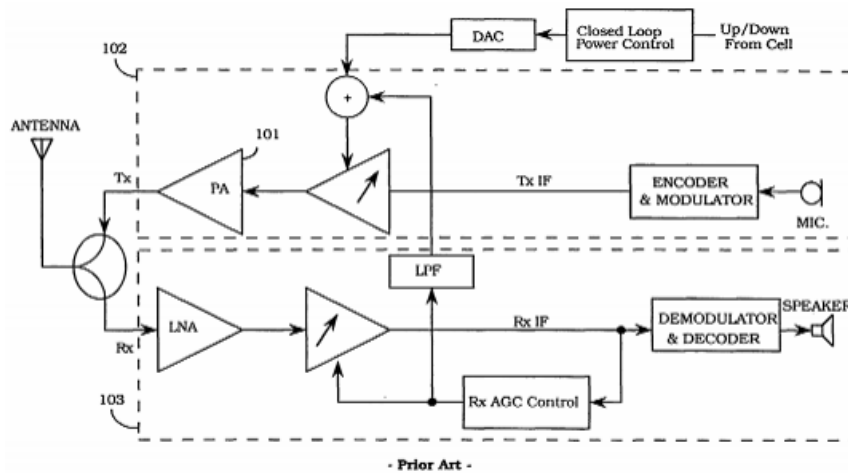
Look-up tables

313.   The use of look-up tables of various kinds is a widely used technique in electronic circuits for various purposes. A look-up table is simply a set of stored data, which may be in a Read Only Memory (ROM) or other memory storage device. In the case where a circuit uses a microprocessor or computer, it may just be held in a part of the permanent memory of the computer.

314.   Look-up tables are used when a frequent need arises to convert certain values (the input values) measured or produced by a circuit to some other value or values (the output values). The output values may represent the result of some calculation performed on the input values, the look-up table avoiding the need to provide circuitry or software to calculate the result every time it is needed. In using a look-up table, the input value or values are used to form an address or addresses to the memory in which the look-up table is stored. The output values are then read from the data stored in that or those addresses.

The disclosure of 482

315.   The 482 Patent starts by explaining that users of cellular network systems need to ensure that they comply with regulations as to the level of radiated emissions both inside and outside of the channels they have been assigned. So power output levels need to be limited. If the output level is close to the regulated maximum, then the control over it must be accurate unless a big safety margin is allowed for. The need for accurate control over the

transmitted power is the background to the power <u>correction</u> aspect of the claims; the regulatory limit is the background to the power <u>limitation</u> aspect introduced by certain subsidiary claims.

316.   At [0006] the Patent introduces, as Figure 1, what is said to be a "typical prior cellular radiotelephone". Figure 1 is reproduced below:

- Prior Art -

317.   The circuit shows the use of a combination of open and closed loop power control being used in a mobile. The incoming signal from the antenna on the left of the diagram is passed via a low noise amplifier (marked "LNA") in the lower dotted rectangle into an automatic gain control circuit. The resultant signal then passes on to the rest of the circuitry of the receive side of the phone, labelled "Demodulator and decoder", and to a speaker. The automatic gain control loop goes through the box marked "Rx AGC Control". The control signal output from this box, apart from being fed back into the variable gain amplifier, is also taken off (vertically in the diagram) via a low pass filter (marked "LPF") to a summer (marked as "+" in a circle). In the summer, it is combined with the output from the closed loop power control signal (marked as being received from the "cell", i.e. the base station) before being used to influence the output of the variable gain amplifier in the transmit part of the circuit. That variable gain transmit amplifier receives, through encoding and modulating circuitry, the transmit signal from the microphone. The output of the transmit VGA is passed through a further power amplifier (marked 101) to the antenna for transmission.

318.   The AGC Control box in the receive part of the circuit measures the level of the signal leaving the variable gain amplifier. According to whether this is above or below the desired level, the circuitry alters the gain of the VGA using the control signal which it outputs.

319.   I have explained the principles of open-loop power control above. If the mobile receives a loud signal from the base station, that indicates that it does not need to transmit at high power, and vice versa. There are a number of places where the receive power could be measured for the purposes of open loop power control. However, the unamplified signal may often be too small to measure; and the output from the VGA is intended to be constant, and thus

does not provide an accurate measure. On the other hand, the output from the AGC control provides a useful measure of the received power for the purposes of open loop power control. If the received signal is weak, the amplification required will be high and so will the AGC control voltage. If the received signal is strong, the amplification required will be low and the control voltage low as well. This is exactly the sort of signal you want for open loop: low when the base station is heard loudly (and so you want to transmit quietly); high when the base station is heard softly (and you want to transmit loudly).

320. Having referred to this circuit the specification goes on to acknowledge (at column 2 lines 14-46) the disclosure of US Patent No. 5,056,109 ("Gilhousen 109"). In short, the specification acknowledges that Gilhousen 109 discloses the combination of open and closed loop power control. Having so acknowledged Gilhousen 109, the specification continues:

> "Therefore, the linear and non-linear errors produced in both the receiver (103) and transmitter (102) RF sections can cause unacceptable power control performance. Also both the FDMA and CDMA based radios must operate on different channels whilst maintaining acceptable output power levels. Variation in output power level and input power detection versus frequency can cause an unacceptable amount of error in the amount of return link transmitted energy."
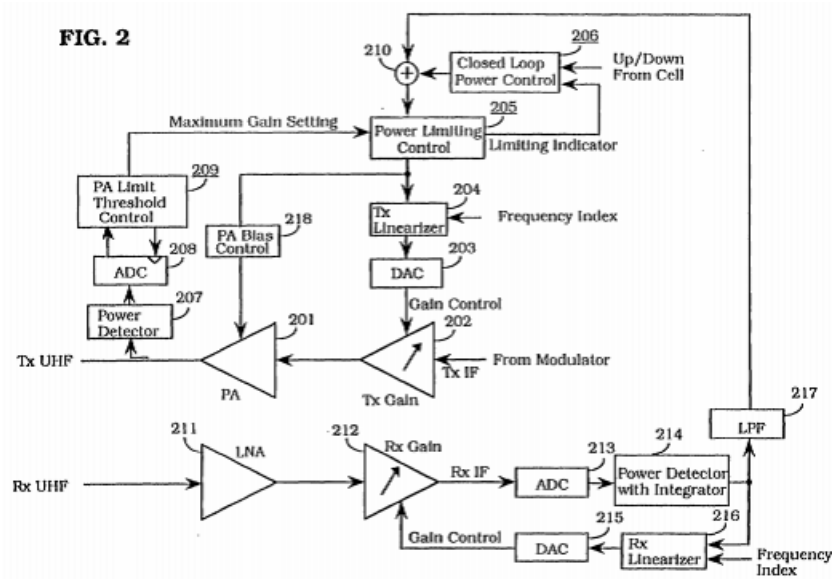
321. The above issues are said in the patent to present significant problems to the designer of both FDMA and CDMA based radiotelephones and to create a need for an effective, cost efficient means of correcting these problems.

322. The invention is summarised in [0011] in the following way:

> "The process of the present invention enables a radiotelephone to operate in a linear fashion over a wide dynamic range while maintaining acceptable transmit output power levels inside and outside of the return link bandwidth. In a preferred embodiment, the forward and return link power are measured by power detectors and input to an analog to digital converter accessible by both control hardware and/or software. The closed loop power control setting is also monitored. The radiotelephone uses the detected power levels and closed loop power control settings to index a set of correction tables that indicate the reverse link transmitter power error and desired power amplifier biasing for the particular operating point. The radiotelephone also determines if the transmitter is operating above a maximum setpoint. The transmit gain and power amplifier biasing of the radiotelephone are adjusted to correct the undesired error and maintain the desired output power."

323. Thus it will be seen that the two objectives of correction and limitation of power mentioned in the title of the specification are reflected in the summary.

324.   Figure 2 is an overall block diagram of the preferred embodiment. It looks like this:

FIG. 2

325.   In this embodiment the received signal (bottom left) is again passed through a low noise amplifier (211) into a receive AGC circuit (212,213,214,216,215). The analogue output from the VGA (212) is passed to an analogue to digital converter. The digital signal so produced is fed to a power detector and integrator (214).

326.   In addition to being fed around the VGA, the signal which emerges from (214), the AGC set point, is used as a measure of the received power and sent to summer (210) where it is added, as before, to the closed loop power control signal received from the base station. The output of the summer (210) is fed via a transmit lineariser (204) and a digital to analogue converter (203) to provide the *control* signal for the transmit amplifier chain (202) and (201).

327.   In the top left of the drawing is shown a transmit power detector which operates with element (208), (209) and (205) to provide the power *limitation* part of the circuit.
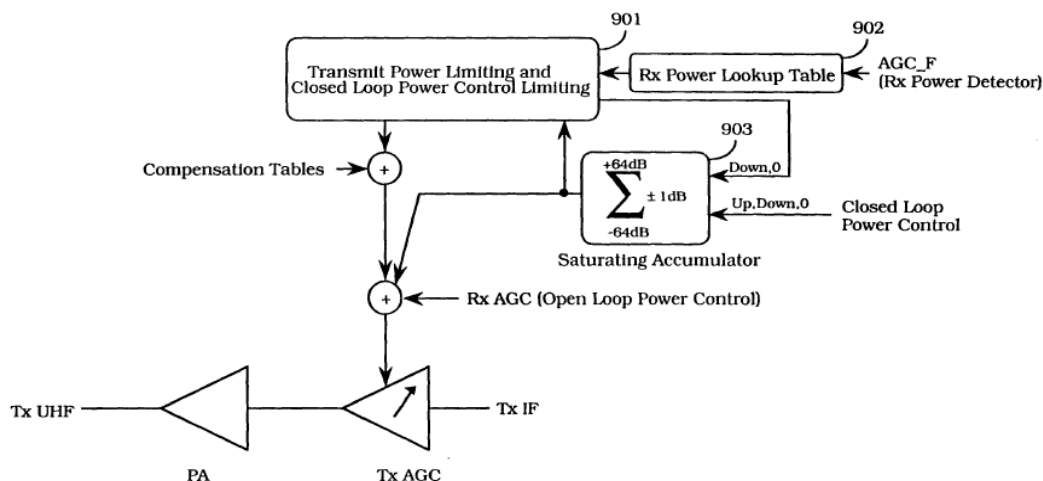
328.   Because, as I have explained, a power detector and integrator would be part of a typical AGC circuit, the principal changes from the prior art Figure 1 introduced in Figure 2 are the following:

    i)   A lineariser is introduced in the receive amplifier at 214;

    ii)   Another lineariser is introduced in the transmit amplifier at 204;

    iii)   The circuitry is now part analogue and part digital, so ADCs and DACs are introduced where the transitions occur;

    iv)   The linearisers have a frequency index as an input.

329.   Figure 2 also shows the power limiting function. It shows that the mobile's transmit power is measured by a power detector at the transmit VGA output. An alternative embodiment is described at [0046] as follows:

> **[0046]** In still another embodiment, illustrated in FIG. 9, a power limiting control system is employed that is based only on a measure of receive power, as determined by the Rx power lookup table (902), and the closed loop power control setting as opposed to actual output power. The transmit power limiting and closed loop power control limiting function (901) can be implemented with either the preferred embodiment using the saturating accumulator (903) or one of the alternate embodiments. However, only the receive power and closed loop power control setting are used to estimate transmit output power.

330.   Paragraph [0046] is the only description of Figure 9. Figure 9 has a number of deficiencies. It is reproduced below.

FIG. 9

331.   There are two inputs identified as AGC_F [Rx Power Detector] and Rx AGC [Open Loop Power Control] respectively. They are not explained. There is no explanation of why one needs two inputs both of which are indicative of input power. Moreover if AGC_F is the calibrated AGC set point, it seems strange that it should be input to a Rx Power Look Up Table, as it will not be necessary to adjust its value.   Much was made of these and other inconsistencies in the drawing.

332.   It is, of course, unfortunate that the understanding of Figure 9 is encumbered by these inconsistencies. Nokia, however, makes an extreme submission.   It submits that the effect of the inconsistencies is so severe that a skilled person would ignore paragraph [0046] and Figure 9 altogether. Qualcomm submit that, whatever the inconsistencies in Figure 9, paragraph [0046] teaches the

skilled reader that the patentee is contemplating an alternative to direct measurement of transmit power.

333. Notwithstanding the inconsistencies, paragraph [0046] is, to me, a clear disclosure of the use of a measure of received power and the closed loop power control signal (instead of measured transmitted power) in the power limitation circuitry in the Patent.

The Claims

334. The claims really in issue are numbers 1, 2, 9 and 11. Qualcomm relies on a number of subsidiary claims as being independently valid, but not infringed: I deal with those separately. I set asserted claims out below:

Claim 1

A radio having a transmit power calibration capability for use in a radio communications system, the radio communications system comprising at least one base station that transmits signals including power control commands to the radio, the radio transmitting and receiving signals having a plurality of frequencies, each having a frequency index,

(a) the radio transmitting signals through a variable gain transmit amplifier (202; 608; 704; 807) having a control input and receiving signals through a variable gain receive amplifier (212) having a control input,

(b) the radio comprising: a receive power detector (214), coupled to the variable gain receive amplifier (212), for generating a receive power value from a received signal having a receive frequency;

(c) a receive integrator, coupled to the receive power detector, (214), for generating an open loop power control signal in response to the receive power value;

(d) a receiver linearizer (216), coupled to the receive integrator and to the variable gain receive amplifier (212), for generating a receive calibration value in response to the open loop power control signal and a receive frequency index corresponding to the receive frequency, the receive calibration value being coupled to the variable gain receive amplifier (212) control input and adjusting the gain of the variable gain receive amplifier (212);

(e) a closed loop transmit power control circuit (206; 603-605; 702; 802-804; 903), coupled to said variable gain transmit amplifier (202; 608; 704; 807), for generating a closed loop transmit power control signal in response to power control commands sent by the at least one base station;

(f) a combiner (210; 703; 807), coupled to said variable gain transmit amplifier (202; 608; 704; 807) control input, for generating a transmit power adjust signal in response to the closed loop transmit power control signal and the open loop power control signal, the transmit power adjust signal being for adjusting the gain of the variable gain transmit amplifier (202; 608; 704; 807); and

(g) a transmit linearizer (204) for generating a transmit calibration value in response to the transmit power adjust signal for a transmitted signal having a

transmit frequency and a transmit frequency index corresponding to the transmit frequency, the transmit calibration value being coupled to the variable gain transmit amplifier (202; 608; 704; 807) control input and adjusting the gain of the variable gain transmit amplifier (202; 608; 704; 807).

Claim 2

The radio of Claim 1, comprising

(a) a maximum gain setting;

(b) means (301; 601; 701) for comparing a transmit power value to the maximum gain setting; and

(c) means (203; 603) for adjusting the gain of the variable gain transmit amplifier (202; 606) in response to the maximum gain setting if the transmit power value is greater than or equal to the maximum gain setting, and for adjusting the gain of the variable gain transmit amplifier (202; 606) in response to the transmit power value if the transmit power value is less than the maximum gain setting.

Claim 9

(a) A method for correcting transmit power of a radio having a plurality of predetermined calibration values, a reference voltage signal, and a variable gain receive amplifier (212), said radio transmitting and receiving on a plurality of frequencies, each frequency having a frequency index, the method comprising the steps of;

(b)(i)   determining a receive power value in response to a first signal received from at least one base station, said first signal having a first frequency of the plurality of frequencies and an associated first frequency index:

(ii) generating an open loop receive power control signal in response to the receive power value and the reference voltage signal;

(iii) selecting a first predetermined calibration value in response to the open loop receive power control signal and the first frequency index;

(iv) adjusting the variable gain receive amplifier (212) in response to the first predetermined calibration value;

(c)(i)   transmitting a second signal via a transmit amplifier having a second gain and a second frequency of the plurality of frequencies, the second frequency having a second frequency index;

(ii) determining a transmit power value for the second signal;

(iii) selecting a second calibration value in response to the open loop receive power control signal, the second frequency index, and the transmit power value; and

(iv) adjusting the second gain in response to the second calibration value.

Claim 11

The method of Claim 9 or Claim 10,

(a) wherein said radio operates in a radio communications system, the radio communications system comprising at least one base station that transmits signals including power control commands to the radio,

(b) the radio comprising a variable gain transmit amplifier (202) and a maximum gain setting,

(c) the method comprising, for limiting transmit power of said radio operating in said radio communications system, the steps of:

(d) determining a gain adjust signal in response to power control commands sent by the at least one base station;

(e) combining the open loop receive power control signal and the gain adjust signal to produce a summation signal;

(f) comparing the summation signal to the maximum gain setting; and

(g) adjusting the variable gain transmit amplifier (202) in response to the maximum gain setting if the summation signal is greater than or equal to the maximum gain setting, and adjusting the variable gain transmit amplifier (202) in response to the summation signal if the summation signal is less than the maximum gain setting.

Issues of construction

335. This time, it is worth noting that the apparatus claims are to "a radio….. for use in a radio communications system, the radio communications system comprising at least one base station etc….". The claim, unlike 324, is not to the combination of telephone and network. It is a claim to a radio suitable for use in such a network. The distinction is important, because one does not escape from the claim if the network for which the phone is in fact intended does not have the features in question. One only escapes if the phone is not suitable for use in such a network if it should happen to encounter one.

336. There is a general question as to whether the claims are limited to a digital implementation of the linearisers. Qualcomm suggest that this is to be derived from the fact that some claims refer to a frequency <u>index</u>. This is a somewhat Delphic way of incorporating a requirement for a digital implementation into the claims. In my view the claims are not limited specifically to digital implementations. Nevertheless, I shall assume this in favour of Qualcomm and consider the issue of obviousness on the basis that they are so limited.

"a variable gain transmit amplifier" and " a variable gain receive amplifier"

337. Qualcomm submits that the requirement that the gain of the amplifiers be variable is in contradistinction to a fixed gain amplifier.

338. Nokia submits that whether or not an amplifier can be regarded as a VGA within the claim depends on whether its "granularity" permits it to deliver the required power control accuracy in combination with the lineariser (Opening

Skeleton 4.1.91). This "granularity" point permeated other aspects of Nokia's submissions on construction as well.

339.   I prefer Qualcomm's construction on this point. Firstly, the claim must be wide enough to include amplifiers which can only deliver gain in discrete steps. Given that the look-up tables in the patent can only output discrete values, this must obviously be so. I cannot see any basis in the language of the claim for introducing a limitation about the granularity of the steps. The gain does not cease to be "variable" just because, if the granularity is too great it will affect the performance of the apparatus.

"a receive integrator, coupled to the receive power detector for generating an open loop power control signal in response to the receive power value and a receive linearizer coupled to the receive integrator and to the variable gain amplifier for generating a receive calibration value.."

340.   Nokia submits that the requirement for

   i)   an integrator requires integration with respect to a reference value (i.e. the desired output value), and an output

   ii)   a lineariser is for a device which ensures a linear relationship between control voltage (in this case the open loop power control) and the resulting gain.

341.   Qualcomm submit that the requirement for the integrator is for something which performs integration, and for a lineariser is for something which produces a calibration of the absolute power versus gain.

342.   So far as the integrator is concerned, it is clear to me that it must perform the function of integration: nothing else is specified by the claim. It clearly must have an input and an output.

343.   I am unable to read anything into the fact that the lineariser produces a calibration value beyond what is stated either. Without further qualification, it seems to me that the feature requires that the lineariser produce an adjusted value which ensures that the response is linear.

344.   The real issue between the parties is as to whether some limitation must be read into these terms having regard to the purpose which they serve in the invention. In its final written submissions Nokia says this:

> "Their purpose [i.e integrator and receive lineariser] is to generate an AGC setpoint of higher accuracy than would otherwise be the case so as to improve the accuracy of the open loop power control system. … The integrator must, as implemented in the circuit, perform the function of integrating the received power with respect to the desired reference value. And the resultant AGC setpoint must be more accurate as a result of linearization than it would otherwise have been. A circuit which does not meet these objectives cannot be within the claim."

345.   I am unable to read a requirement that these objectives be met into the claim. The objective of a lineariser is to make the response linear, or at least more linear than it would otherwise be. That is not to say that it will always be easy to determine whether an element is making a response more linear. I have to deal with that when I come to infringement.

"a closed loop power control circuit... for generating a closed loop power control signal in response to power control commands sent by the... base station"

346.   This feature is important, because in GSM/GPRS the network does not implement closed loop power control. The power control commands issued by the base station are not based on input power measured there. There is no closed loop in the normal sense.

347.   Qualcomm accepts that in the system context, "closed loop" would normally require a complete loop between the mobile and the base station. However, it submits that in the context of the mobile, as opposed to a whole system, the expression "closed loop" has a wider meaning: any power control commands sent by the base station will do, as the mobile has no knowledge of how the power control signals were generated. To a mobile one power control signal is very much like another. Qualcomm draws attention to the fact that the incoming commands at the telephone are described as "power control commands", not "closed loop power control commands", and the circuit is only required to be "for" generating a closed loop power control signal, not actually to generate such a signal.

348.   Nokia submits that the terms "closed loop power control circuit" and closed loop power control signal" must have some physical meaning. So they submitted, in the end, that it was a dedicated closed-loop circuit – one which can only do closed-loop power control.

349.   In my judgment a "closed loop power control circuit" is a circuit which is suitable for dealing with closed loop power control commands, namely commands which are transmitted by the base station and are based on the received signal strength at the base station. The circuit must be capable of responding to such commands, and must generate an internal signal (the closed loop power control signal) in response to them.   So I reject Qualcomm's submission to the extent that it argues that "closed loop" in the claim has anything other than its usual meaning. I also reject Nokia's submission that the claim requires a dedicated circuit. There is nothing in the claim to require a dedicated closed-loop power control circuit. If the circuits in the phone will deal with, and process, closed-loop power commands, then this feature of the relevant circuit is present.

Construction of Claim 2

"transmit power value"

350.   Although other terms were the subject of dispute, the main issue of construction on claim 2 is the phrase "transmit power value". Does it mean, and mean only, the measured power, or can it be an estimate?

351.   A very large amount of time was spent debating this issue at the trial, with the witnesses and in oral argument. It seems to me that once the skilled reader has been given the information in [46] that the power limiting control system can be based only on a measure of received power and the closed loop power control setting as opposed to actual output power, the suggestion that "transmit power value" should mean only measured output power becomes a difficult one. Moreover there is a contrast with claim 3, which requires a power detector for generating the transmit power value, clearly therefore requiring a measurement of transmitted power. In my judgement the "transmit power value" may be an estimate of or proxy for transmit power as well as a direct measurement.

"maximum gain setting"

352.   Nokia contends that maximum gain setting must be a fixed value hard-wired into the phone or input during manufacture. Qualcomm contends that it is simply a value stored in the circuit. It need not be hard wired or permanently fixed.

353.   In Figure 5 of the 482 Patent the maximum gain signal is generated internally. I see no reason why the skilled reader would read in the limitations suggested by Nokia.

Construction of claim 9

354.   In contrast to the apparatus claim 1 and 2 which require linearisers, claim 9 calls for calibration values. All the references to calibration in the specification relate to the use of calibration values to populate linearisation tables. There is no disclosure of the use of calibration values other than as part of the linearisation function.

355.   Nokia contends that, in context, the reader would interpret the called-for calibration values as those which give rise to the linearisation function. It would be strange if anything wider was intended, when linearisation is at the heart of the patentee's solution.

356.   Qualcomm points out that there are passages where calibration/correction is referred to independently of linearisation: for example [11].

357.   I do not think it is legitimate to gloss the plain meaning of calibration in the way Nokia suggests. Whilst linearisation is plainly the type of calibration with which the patent is concerned, claim 9 is not so limited.

Validity

358.   The principal attack against this patent was obviousness.

Skilled addressee

359.   Subject to one point there was substantial agreement that the skilled team for this patent would be of a similar nature to that for 324. The reservation was that, in the case of this patent, and in contrast to 324, the addressee is concerned with designing a radio to fit in with an existing network which is already in place. So the need for the full scale system architect is removed. Dr Grauel's view, which I accept, was that he

> "would need then, this system expert only if there is a question which I do not understand."

Common General Knowledge

360.   Any team of engineers setting about the task of designing a CDMA phone in 1994 would be aware of the existence of the IS-95 standard. Although he would not carry every detail of it about in his head, he would look to the standard for the performance requirements which would have to be built into the phone. The IS-95 standard is not of course concerned with implementation.

361.   It is common ground that the behaviour of AGC loops and the function of an integrator within the AGC loop were part of the common general knowledge.

362.   Nokia submitted that Figure 1, and indeed the common features of Figure 1 and 2, would be part of the common general knowledge. This, I think, was putting it too high; but I think that any team setting about designing a CDMA phone in 1994 for compliance with the IS-95 standard would have known the following:

  i)   That the phone would have to accommodate the combined use of open and closed loop power control: IS-95 says so.

  ii)   The transmitter power is therefore required to be controlled by a combination of open and closed loop.

  iii)   The open loop gain control signal would have to be taken from some value in the circuit representative of the received signal strength.

  iv)   The closed loop gain control signal would have to be obtained ultimately from the base station and combined with the open loop.

363.   There was an issue on the evidence as to whether the use of linearisers and calibration tables was common general knowledge. The issue is crucially important, not least because Nokia is running an attack based on obviousness in the light of the IS-95 standard which is, as one might expect, silent as to implementation details of this kind. If linearisers and calibration tables were

not common general knowledge, then it is hard to see that attack getting off the ground.

364.   In a dispute of this nature I was reminded by Mr Burkill that it is important how one characterises the issue. Qualcomm does not seriously dispute that digital look-up tables were part of the common general knowledge, but they argue that that fact alone does not mean that the skilled person would turn to digital lookup tables for the purposes of pre-compensating gain inputs to VGAs in AGC loops.

365.   In his second report at paragraph 4.8, Dr Wheatley said:

"I accept that the use of look-up tables would be known, including the use of such tables in order to pre-distort a signal in order to compensate for distortion in an amplifier. If somebody had asked that this be done in order to produce a linear relationship then this would be straightforward. Some of the prior art in this case uses that approach."

366.   In paragraph 26 of his report Dr Grauel said:

"In my view linearizers, look-up tables ("LUTs") and the implementation of linearizers by the use of LUTs were well known and common general knowledge at the priority date of the 482 patent."

367.   In cross-examination Dr Grauel was asked if he was aware of usage of linearisers in mobile phones at that time.   His reply was that he was aware of their use wherever you needed them, for example whenever they had a non-linear relationship which they wanted to make linear or wanted to correct to some degree, he used lookup tables. He did not identify any actual use in a mobile phone.

368.   Dr. Grauel was of course working in Philips on the base station side. His view that these techniques would be used on the telephone side in the context of non-linear relationships was not supported by any textbook

369.   Dr Wheatley accepted in cross examination that it was common for telephones on the market at the priority date to be built and calibrated on production lines using digital look up tables. It was a common activity.

370.   It seems to me on this evidence that the use of look up tables to make a response linear when it would otherwise not be was part of the common general knowledge. I think it would be going too far to say that linearisation of transmit and receive VGAs in mobile telephones was part of the common general knowledge.   Whether the skilled team would think of using linearisation in that context is a matter which I consider under the heading of obviousness.

371.   By 1994 a digital implementation of a mobile telephone circuit would certainly be considered. It is common ground that the skilled team would include those skilled in digital techniques. One thing did emerge very clearly,

however. By 1994 a team considering a mobile telephone for mass production would consider a digital implementation to be essential.

The inventive concept

372. The inventive concept of claims 1 and 2 as I have construed them is the radio circuit claimed; that of claims 9 and 11 corresponding power correction and limitation methods. It is perhaps dangerous to try and extract the essence of these claims. I approach this issue on the basis that the invention claimed is a digital implementation, as Qualcomm contends.

Obviousness over IS-95

373. IS-95 was an interim standard entitled "Mobile Station – Base Station Compatibility Standard for Dual-Mode Wideband Spread Spectrum Cellular System" issued in 1993 by the TIA (Telecommunications Industry Association). The "dual-mode" refers to the fact that it was for both the existing AMPS system (which was FDMA) and CDMA.

374. Section 6 relates to CDMA. In CDMA mode, a combination of open loop and closed loop is required. There are tolerances on the determination of the open loop value and on the response to the closed loop value. There are some equations defining requirements for speed of response, of the order of milliseconds for open loop and 500 μs for closed loop. There are limits also on maximum output power.

375. It is common ground that either digital or analogue circuits may be used to meet the requirements.

376. The difference between IS-95 and the inventive concept is in essence the use of a digital implementation, and the use of linearisers (including correcting for frequency) in the circuit claimed. For claims 2 and 11 power limitation is required as well.

377. Nokia's case of obviousness over this standard is a simple one. It says that in the course of designing a mass produced phone for use in accordance with the standard, the skilled team would be driven towards using a digital implementation in order to use digital calibration. Nokia says that in any event a digital implementation with look up tables would be considered as a well known option for correction of non-linear components.

378. Dr Wheatley fairly acknowledged that there would be a need to correct for non-linearities to the extent they prevented one from meeting the specification:

> Q. It would be obvious, would it not, Dr. Wheatley, that to build the circuit we have just discussed, which is the circuit required to meet the requirements of the IS-95 standard, that it would be necessary to calibrate the received power and transmitted power values in order to obtain the appropriate accuracies.

A. We would certainly have to read input power, find out what it is, estimate it, calibrate it over the range somehow from that computed transmit power.

Q. And you would have to have frequency calibration to deal with the requirements to cover those frequency bands?

A. There is no relaxation of the spec across frequency.

Q. No. And temperature compensation as necessary to meet the temperature demands?

A. Right, but back on the frequency, if the frequency compliments are really good, then you will not need to compensate. You would meet this requirement.

Q. But would you need to compensate as necessary to meet that requirement.

A. Yes, you would.

Q. Finally, in a digital implementation in early 1994, an obvious way to meet those calibration requirements would be to use lookup tables to linearize the performance of the circuit.

A. It would certainly be a candidate.

379. Qualcomm answers this case in a number of ways. Firstly, it says that the case is too general. The claim requires the receive lineariser to be within the receive AGC loop, rather than connected to a separate power measurement device. It also requires a combiner as opposed to separate transmit VGAs. Qualcomm argues that the evidence of Dr Grauel was tainted with hindsight when he said that all these choices would be those made by the skilled person, without mentioning the other possibilities.

380. Qualcomm also relied on what Mr Burkill describes as the history of the way the invention was made. He summarised it in this way in his final speech, pieced together from the evidence and from the cross examination of Dr Wheatley:

- CDMA had not previously been commercialised in a cellular system. Spread spectrum (CDM, non-cellular and by satellite) had been known in the military for its anti-jamming and low detection properties but CDMA was not generally accepted as viable.

- In 1988 the CTIA expressed a need for a new all-digital mobile radio system with goals including a tenfold increase in capacity over AMPS.

- Others put forward a TDMA proposal which could meet most goals except the capacity one. However Qualcomm came to believe that CDMA could meet the 10x capacity and the other goals.

- Qualcomm's first demonstration systems in November 1989 (just after the 109 patent application was filed) were "brassboard" prototypes. The radio

modules were built by Dr Wheatley, by eviscerating some existing carphones and replacing most of the FM circuitry with CDMA circuitry.

- These units were all analogue, as shown in the 109 patent fig.5, and did not have any compensation for gain non-linearities or maximum power limitation.

- A draft standard proposal was prepared and circulated under NDA terms.

- The draft standard went through revisions and emerged as interim standard IS-95 in July 1993. Meanwhile scepticism raged.

- There followed the Wheatley patents cited as prior art. These retained an analogue approach to the AGC loop. Matched amplifiers for the open loop function were proposed.

- Internally, Qualcomm tried combining the two transmit amplifiers into one. As Dr Wheatley explained at 1136, the design team overruled him, but the consequence was:

  > All right, this is the result of the design team working on
  > this and I was overruled. They said, no, it would be simpler
  > to combine. I said, yes, it will functionally work and this
  > is exactly the design that they could not put into production
  > because they could not make it repeat.

- The next design in evidence is the one at S4/380 (conf), of June 1993. This retains the analogue AGC. The AGC setpoint is taken as an analogue signal outside the RF subsystem and is then A/D converted. A number of lookup tables are then consulted, the closed loop signal is also combined, and the result is used to control the transmit amplifier.

- Finally, the invention of the patent in suit was made. This now linearises two different signals separately, one in the receiver, and one in the transmitter. In the receiver the AGC is converted to digital, and a digital lookup table is used to linearise the VGA within the Rx AGC loop.

381. Mr Burkill also relied on some cross-examination of Dr Grauel, where he accepted that the "error budget" of a design process gave rise to a variety of choices at every stage. Further, at each stage of the design process there had to be investigation in order to see whether what the team thinks might be beneficial is actually going to work.

382. Mr Burkill also relied on difficulties recorded by Nokia itself. In the course of the development of IS-95, Nokia provided comments on the draft (Bundle F2/5). In particular it stated:

> "3. Power control
>
> The accuracy of the power control (both open and closed loop), as specified today in the CAI, is extremely difficult to achieve in all the

practical environmental conditions. It is not known what is the impact to the overall capacity and functioning of the system, if these requirements are made less stringent".

and:

"1. Open Loop Power Estimate accuracy

The accuracy of the open loop power estimate is determined by the following: ...

These numbers add up to +/- 14 dB. The CAI Standard (V1.1) requires +/- 6dB, which will be very difficult to meet. It might be possible to get +/- 8 to 10dB, but that will increase cost and production time."

After reviewing closed loop requirements:

"The conclusion is that the CAI specification is impossible to meet"

383. The final specification for estimated open loop power was for +/- 9dB rather than +/- 6dB (see IS-95 p.6-6 second full paragraph).

384. I conclude that there was a strong motivation to see whether the standard could be met for CDMA. There would have been uncertainty as to the outcome. The non-linear response of the amplifiers would have been seen as an obstacle to achieving adequate control and digital look up tables to linearise the response would have been an obvious way of correcting for this.

385. I do not think the patchwork "history" Mr Burkill relies on is really inconsistent with that. First of all, it is not really satisfactory to piece together a history of this sort from odd bits of evidence in this way. If the inventor's history is to be relied on as a secondary indication of non-obviousness, then it should be set out in a comprehensible way in the evidence, in a way that the opposing party knows what case it has to meet. Secondly, such history as has been put together strikes me as no more than routine development work. The rivalry between CDMA and TDMA does not seem to me to matter: there was a clear and strong incentive to pursue CDMA once it is identified as part of a draft standard. As to what Nokia said about the standard, it cannot be said that this would be a disincentive to seeing how close to the accuracy requirement one would come, given the strong motivation to succeed that existed. In fact the evidence showed that there was no real difficulty: the "lion in the path" would not deter, far less defeat, the average skilled team.

386. Very similar considerations apply to a point about whether digital would be fast enough. I was not sure what was meant by this, given that the patent does not claim any particular speed or teach any technique which makes anything go faster. The evidence simply did not support the suggestion that the skilled team would not even try

387. Mr Burkill's most telling point was that there was no need to take the measure of received signal power from the AGC loop. He produced a series of designs

(X21) which adopted alternative strategies. I accept that alternatives were possible, but it does not seem to me that there was invention involved in taking the decision to use the AGC setpoint as the measure of received signal strength. It is at least one obvious place to derive it from, and would be preferred by the skilled team over employing an entirely separate detector circuit for this purpose. There is no suggestion that there is any particular benefit to be derived from using that signal. Dr Grauel's evidence was really fatal to this:

> A. But as it turns out, Qualcomm in the end has chosen the one which is really the most obvious one, starting from the point that you would be done if you have directly a linear amplifier and receive and transmit direction. If that is not linear enough, you go and linearize it. I think that is the simplest way. I think if I spend one day, I could add another 10 permutations of things to that, but this does not take away the one which has finally been chosen. It is the simplest and most straightforward one, based on the fact, and I think that seems to be the clue for all that, if you come to the decision that you do things digital as much as you can, and I think that is what figure 2 is about, it is really a straightforward approach.

388.   In my judgment claims 1 and 9 were obvious implementations of the IS-95 standard.

389.   Claims 2 and 11 add power limitation. As I have indicated, power limitation was a requirement of the IS-95 standard. It is true, as Mr Burkill points out, that the standard does not give any explanation of how to implement power limitation, and that this would require a further step over and above those required to arrive at claim 1. However, the claims in question here simply require that if the power to be transmitted exceeds some maximum, it is to be capped. If not, the power which has been calculated as the correct power to send can be transmitted. This seems to be merely to be stating the obvious. The implementation taught by the patent is an entirely straightforward implementation of the requirement; the claims cover all implementations.

390.   The fact that I have held that the claims can extend to an estimated or proxy value of transmitted power does not affect this conclusion: the claims are wide enough to cover the measured transmit power, and are invalid for that reason. It follows that all the claims relied upon are invalid over the IS-95 standard and common general knowledge.

Obviousness over Wheatley documents

391.   There are three so called Wheatley documents, so called because Dr Wheatley was the, or an, inventor :

   i)   PCT Application WO No 93/07702 published 15th April 1993 ("Wheatley PCT"),

   ii)   United States Patent No 5,099,204 published May 24th 1992 ("Wheatley 204"), and

iii)   United States Patent No 5.107,225 published April 21 1992 ("Wheatley 225").

392.   Wheatley PCT is concerned with power control in CDMA systems.   It explains (page 3_{11-22}) that in terrestrial mobile communications the distance which exists between the mobile and the base station varies, and the propagation loss characteristic varies inversely with the distance according to a fourth power law.

393.   Where the system uses different frequency bands for forward and reverse links, the mobile can no longer assume that the loss on one is equal to the loss on the other and compensate by using the appropriate transmitter power. Accordingly Wheatley PCT suggests (page 4_{30}-page 5_8) using "a basic technique" for overcoming the power control problems associated with this situation, namely that disclosed in Gilhousen 109, the document referred to at [0008] in the 482 Patent.   In other words Wheatley PCT suggests using a combination of open and closed power control.

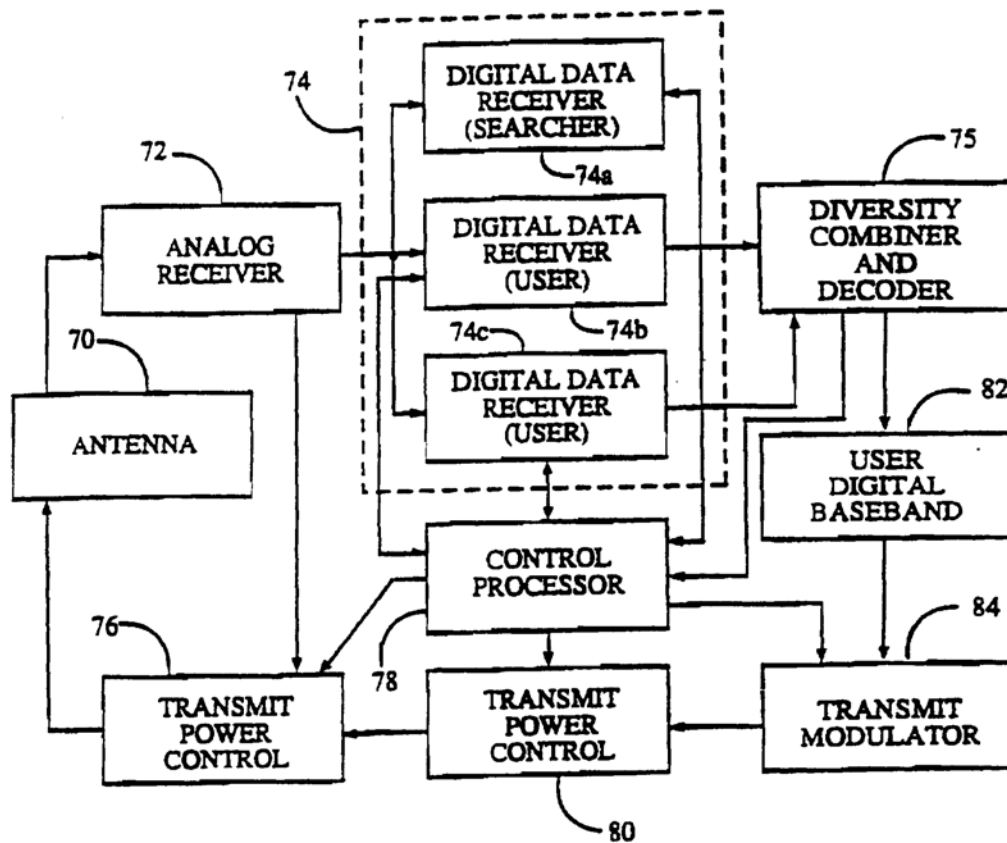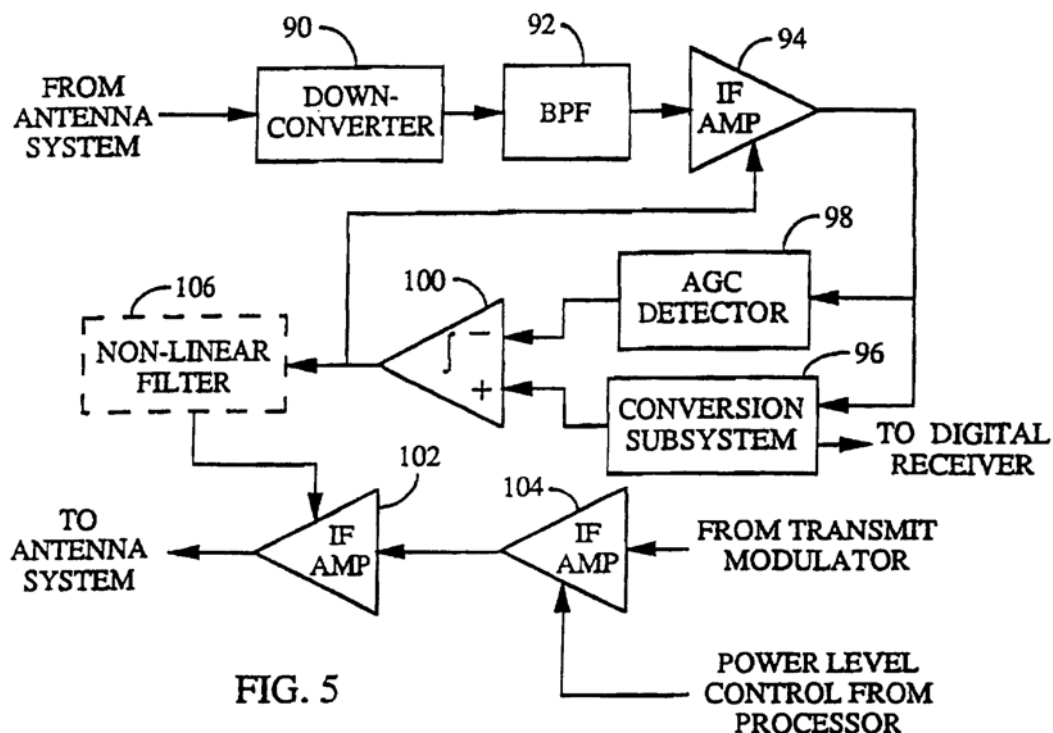394.   Figure 4 of Wheatley PCT is reproduced below:

FIG. 4

395.   The signal from the antenna 70 is fed via the receiver directly to transmit power control unit 76. This is the open loop part of the circuit which makes

direct use of the received power to control the power output. The receiver also feeds a signal to the data receivers 74 which extract the closed loop power control signal and feed it to a control processor 78 and a transmit power control unit 80. There are thus two separate units for controlling transmit power, 76 and 80. Wheatley PCT points out at page 25_{16} that

> "Although illustrated as two separate units for controlling the transmit power, the power level could be adjusted by a single variable gain amplifier with two input control signals combined before being applied to the variable gain amplifier."

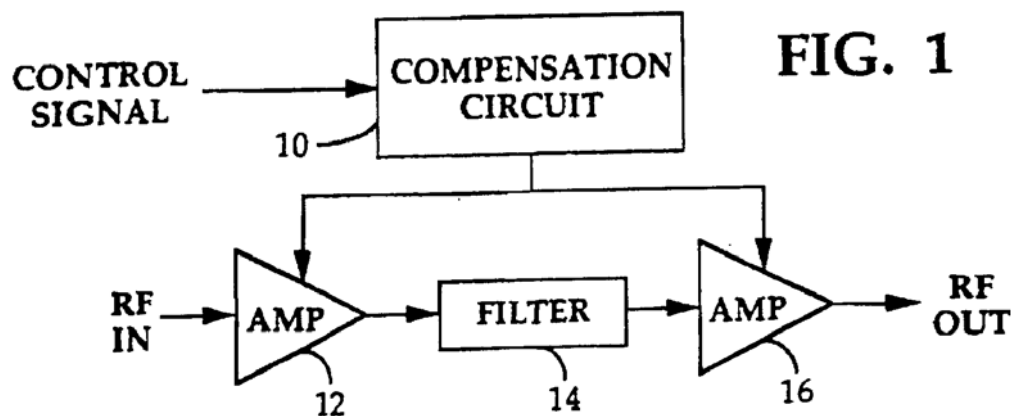396.   Figure 5 illustrates the circuitry of Figure 4 in more detail.

FIG. 5

397.   Amplifiers 94 and 102 form part of the open loop control, whereas amplifier 104 is in the closed loop part of the circuit. At page 27 Wheatley PCT explains that the use of the same gain control signal for both amplifiers 94 and 102 allows the transmitter power to track the received signal power. At page 28 line 7 Wheatley explains that

> "In a preferred embodiment, amplifiers 94 and 102 are each configured as series coupled dual FET transistors with a surface acoustic wave bandpass disposed there between. In order to correct for inherent non-linearities of the transistors so as to provide linear gain operation over an extended dynamic range, a gain compensation circuit is used to modify the gain control signal as input to the transistors. Further details on the specific implementation of the circuitry are provided in [Wheatley 204]. Further details on an implementation of the feedback loop comprised of amplifier 94, AGC detector circuit 98 and

comparator 100 which provide the gain control are provided in [Wheatley 225]."

398. Qualcomm points out that in relation to Figure 4 of Wheatley PCT, there is an express suggestion of combining the open and closed loop power control signals, but no lineariser. In Figure 5 there is a suggestion of the use of linearisers (the gain control circuits), but no express suggestion of combining of the signals: the open and closed loop are fed to separate amplifiers.

399. Wheatley 204, as advertised by Wheatley PCT, discloses the details of the open loop circuitry compensation circuit.

400. The circuit is analogue and does not compensate for frequency. Nevertheless it explains that the amplifier circuit can be given an extended range of gain control in dB which is a linear function of the AGC signal. The uncompensated circuit has a range of about 60dB where the response is linear; the compensated circuit has a range of about 85 dB where the gain is linear.

401. Wheatley 225 adds detail of the AGC loop. Again it is an analogue circuit and makes the suggestion that digital AGC circuits are relatively slow.

402. The parties were divided as to whether the skilled person would take the teaching in Wheatley PCT about combining the signals as applicable to Figure 5 as well. Qualcomm argues that the passage on page 27, which is describing Figure 5, teaches that the <u>same</u> gain control signal should be used for amplifiers 94 and 102, and explains that this allows the transmitter power to "track" the received signal power. The earlier passage on page 25, which teaches combining the control signals into a single variable gain amplifier would thus be thought to have no application to the Figure 5 embodiment.

403. Dr Wheatley's view was that this passage taught that the amplifiers concerned with the open loop signal were matched so that any non-linearities in each cancel out. This error cancellation would be lost if the signals to the transmit amplifier were to be combined: the two amplifiers would no longer see the same control signal.

404. I think Dr Wheatley is reading too much into the passage on page 27, probably based on his own knowledge of what Qualcomm were trying to do. The term "tracking" is a loose one. The specification is merely drawing attention to the

fact that, as the two amplifiers see the same gain control signal, they will track each other. The passage is not concerned with cancellation of non-linearities. The way in which Wheatley PCT deals with non-linearities in the amplifiers is by the compensation circuits, described in more detail by reference to Wheatley 204. I cannot accept that in the Figure 5 embodiment the skilled reader would understand that the option of combining the signals was being excluded.

405.   In my judgment the Wheatley trio disclose an analogue equivalent of the power control features of Figure 2 of the 482 Patent. The differences between the disclosure of this trio of patents and the inventive concept are that Wheatley implementation is entirely analogue, and there is no separate calibration operation for frequency.

406.   Mr Burkill relied heavily on the passages in Wheatley 225 which decry digital implementations. He put these points to Dr Grauel, whose view was that such passages would simply trigger discussion about whether a digital or analogue implementation would be suitable in any individual case. It would all depend on the assumptions one made about the digital implementation. Dr Wheatley's cross examination about analogue implementations went like this:

> Q . You could alternatively implement a digital AGC to perform this task, and with sufficient resolution I think you have agreed it would be fast enough even for CDMA .
>
> A . It would be accurate enough . It might not be fast enough . You still have to do the conversion and you have to convert a lot of bits .
>
> Q . And I think you have agreed that a designer would consider both digital and analogue options and choose that which he thought was more suitable for his particular application with all the trade offs taken into account .
>
> A . I think anyone would continue to do that.

407.   For reasons I have already given when considering the obviousness of the invention in the light of IS-95, I consider that the step of seeking to implement this disclosure digitally was an obvious one. I accept Dr Grauel's view that the weight to be attached to what is said about digital implementation in Wheatley 225 would depend on what one was trying to do. In the context of producing a mobile phone for mass production, it seems to me that one is forced to consider a digital implementation, notwithstanding Wheatley's preference for analogue.

408.   Such a step would immediately throw up the question of how to implement Wheatley's compensation for non-linear response of the amplifiers in a digital way.

409.   I have absolutely no doubt that in these circumstances the skilled team would implement Wheatley's compensation in the form of digital look up tables. To include tables to compensate for the effect of frequency would be an obvious extension of that.

410. It follows that claims 1 and 9 are, in my judgment, obvious in the light of the Wheatley trio.

411. Claims 2 and 11 are also obvious. I can see nothing, and the evidence suggested nothing, which would make the step of including a power limitation feature into the Wheatley disclosure anything but an obvious one to take.

Soliman IEEE Paper

412. This is another document of which Dr Wheatley is a co-author. It is entitled "CDMA reverse Link Power Control" . Figure 5 of Soliman looks like this:
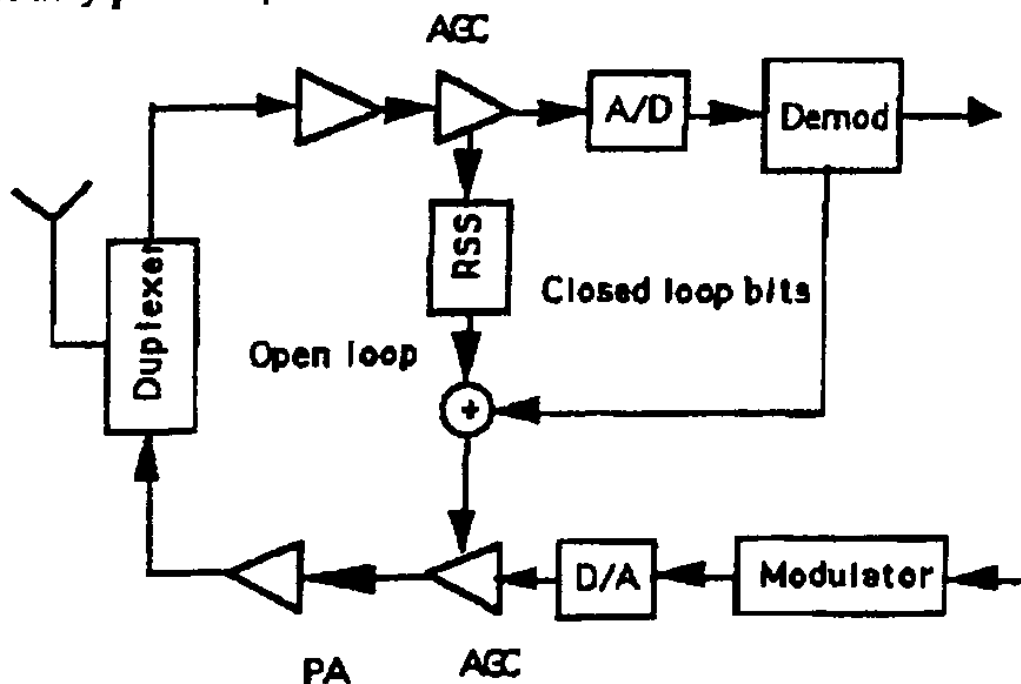
Figure 1 Mobile block diagram

413. There is clearly a combiner of the open and closed loop power control, indicated by the + symbol in the middle of the diagram. The output of the amplifier at the top of the diagram is used as a Received Signal Strength Indication (RSSI) and thus the open loop power control signal. The document gives the expected performance of the circuit. There is, however, no suggestion of a lineariser.

414. Nokia's case on this document is that it gives an idealised circuit, which when implemented in a practical situation would lead to a circuit within the claims. Qualcomm's case is that it gives no implementation details, and the claimed circuit can only be arrived at with hindsight.

415. Although Dr Wheatley's evidence drew attention to a number of deficiencies in the implementation details given by the Soliman paper, they were not in the main deficiencies which were supplied by the 482 disclosure. In cross examination he said this:

Q.   You see, in paragraph 16.7 you say "The 482 Patent shows you
to build a real system and address all the issues of non-ideal elements.
The Soliman paper does nothing to suggest such a solution." What you
mean is that the patent tells to you use linearisers.

A. Correct.

416.   He was pressed on how the team would go about a practical implementation:

Q.   Right. So the engineer knows that in the real world with real
components he will counter non-linearity, misbehaviour of the
circuitry, errors over required dynamic range, temperature range,
frequency and so on, variation between components, and he is going to
have to build his circuit so it deals with all that so that it behaves like
this circuit. That is what he would expect to do, is it not?

A.   Agreed, but there is nothing to say a priori that some step in that
process that he chose is not going to not work. He is going to have to
pick another process.

Q.   Right. We have already discussed at great length that if he were to
engage in a digital implementation of this circuit, which you accept is
something which would be considered ----

A.   It would be considered.

Q. ---- it would be straightforward and well known to adopt a set   of
calibration tables to calibrate the amplifiers in this circuit so they have
the ideal characteristics.

A.   All right. On the surface -- I think that would be an obvious first step,
but it would not be obvious if that was going to meet the time
requirements as exemplified by these figures here. Not right off.

Q.   There is nothing in the '482 patent about that, is there?

A.   There is nothing too much in the patent that explicitly shows how you
can do it.

417.   Dr Wheatley's point was that you would not know *a priori* that the circuit
would perform up to the time specification in the Soliman article. I do not
think that helps Qualcomm. The concession that the skilled team would take
the "obvious first step" is one that was unavoidable in my judgment. Once it
is conceded that the team would start off down the road and see what results
are obtained, a finding of obviousness becomes inevitable, as it is not
suggested that the team would in fact meet any obstacle on the way.

418.   Dr Grauel was of the view that to take the Soliman diagram forward into a
digital implementation involved merely straightforward design development.
He would of course check to see that a linear VGA on both sides was

necessary: if routine analysis showed that it was, you would "go make it linear".

419.   Taking the evidence of the two experts together, it follows that claims 1 and 9 are, in my judgment, obvious in the light of the Soliman article as well.

420.   Claims 2 and 11 are also obvious. I can see nothing, and the evidence suggested nothing which would make the step of including a power limitation feature into Soliman anything but an obvious one to take.

Obviousness over Novatel, Fujitsu and Nokia Vaisonen

421.   I take these three citations together. They were not placed anywhere near the forefront of Nokia's arguments, and the evidence in relation to them was not as extensive. They were cited, as I understood it, mainly because they disclose the use in mobile telephone circuitry, of digital look up tables, presumably against the eventuality that I held that digital look up tables were not an expedient for which the skilled team would immediately reach when faced with a problem of non-linear response over a dynamic range. However the disclosure of these documents was much further away from the claimed circuitry and method than any of IS-95, Wheatley and Soliman. Because of this I was not persuaded that the skilled team would be likely to have gone from the disclosure of any of these documents to something within the claims.

422.   Mr Burkill made a forensic point about what Nokia saw as inventive in its own patent. Broad points about what companies applied for patents for are not really entitled to much weight. It is different if there is some specific factual matter made clear by the patent application, inconsistent with the case being advanced: as was the case in *Unilever v Chefaro* [1994] RPC 567 at 586.

Added Matter

423.   There are four separate allegations of added matter introduced between the application for the patent and the patent as granted. They are pleaded at very great length in the Grounds of Invalidity.

Particulars (1): Measured Power

424.   The first allegation of added matter asserts that

> "it was an essential feature of all the claims of the application directed to the use of calibration tables that the transmitted power be measured and the transmit calibration value be selected in response to that measured power value as well as the desired gain of the transmit VGA and a frequency index."

425.   Moreover it is said that

> The "summary of invention" starting on page 2 line 31 of the application required measurement of both forward and return link (transmitted) power and use of those power levels to index a set of correction tables.

426.   Finally, so far as the application is concerned, it is said that all the embodiments described in it (with the exception of Figure 9) involved the measurement of transmitted power and selection of the transmit calibration value in response to the measured transmitted power value as well as the desired gain and a frequency index. So far as Figure 9 is concerned, it is said that it should be regarded as a separate invention, and the manner in which it worked was not comprehensible.

427.   Accordingly, Nokia submitted that the application on its true construction did not disclose any apparatus or method in which transmit calibration values are selected in response to desired gain and a frequency index without reference to measured transmitter power or an estimate of transmitter power.

428.   The burden of the remainder of the pleaded objection is that, in the course of prosecution the claims were amended so as to use the term "transmit power value" (at least on Qualcomm's construction) in a manner which suggests it is wider in meaning than a measured power value. For example contrasting granted claims 2 and 3, the requirement for a power detector in claim 3 and not in claim 2 suggests that "transmit power value" in claim 2 could be something other than measured power.

429.   Qualcomm submitted that the premise of the argument is incorrect, and the application as filed was not restricted to the use of measured power. They rely on claim 1 of the application as filed, a wide method claim which includes the step of "determining a transmit power value of the second signal". This is not limited to measured power. Moreover they rely on the fact that the description by reference to Figure 9 is present in the application as an embodiment of the invention.

430.   In my judgment there was no added matter between the application as filed and the granted patent. Both documents contemplated an embodiment where measured power was not used. The summary of the Invention in the application would not be read in isolation: the skilled reader would understand when he came to the description of Figure 9 and the claims that he could not safely assume that the invention in its widest aspect would be limited to measured power. No different understanding would be conveyed by the granted patent.

Particulars (2): AGC Setpoint

431.   The objection starts by asserting that, in the application, and in particular the first embodiment thereof, the receiver AGC setpoint was employed as an open loop power control signal which was used to address both the receiver and transmitter calibration tables. It was an essential feature of claims 1-4 that the receiver AGC setpoint was used to address both the receive and transmit calibration tables. No other way of generating an open loop power control signal and of addressing the calibration tables was described or suggested.

432.   In the course of prosecution claims 1-4 were amended to substitute the words "an open loop power control signal" or "an open loop receive power control signal" for the words "automatic gain control setpoint". Nokia says that,

insofar as those words are construed in claims 1, 2, 9 and 11 to mean something wider than the AGC setpoint, so that "any "open loop power control signal" will do", matter has been added.

433.   Qualcomm argues that feature (f) in claim 1 effectively defines where the open loop power control comes from, namely something generated by the receive integrator. Moreover the application at page 4 line 23 says "The power detector performs the integration, thus generating an AGC setpoint." The claims in the granted patent do not disclose anything beyond what was disclosed in the application. It is not Qualcomm's case that "any open loop signal will do".

434.   In my judgment there is nothing added by the use of the term "open loop power control" in the granted claims. The skilled reader would understand in both cases that the signal used to address the receiver and transmitter calibration tables would be that generated by the receive integrator, albeit that it might pass through other processing (e.g. Low Pass Filter (217)) before doing so.

Particulars (3): open loop only

435.   The foundation for this objection is that the main text of the application

> "described only the use of a combination of open loop and closed loop transmit power control. The application stated at page 2 line 17: "Closed loop and open loop power control together determine the return link transmit energy … ." The use of open and closed loop power control settings to index the correction tables was part of the summary of the invention beginning at page 2 line 31 of the application. All embodiments described used a combination of closed and open loop power control."

436.   However, the pleading recognises that claims 1-4 of the application extended to the use of open loop power control alone. Those claims required, as essential features, transmit calibration, power limitation by reference to measured transmitted power as set out in Particulars (1) above and the use of the receiver AGC setpoint as set out in Particulars (2).

437.   The pleading continues:

> "If, as the Claimant contends, claim 9 now covers a method using open loop power control alone which does not require a measurement of transmitted power to be used in setting transmitter gain and does not require the receiver AGC setpoint to be used in addressing the transmit calibration table, this is a generalisation of the matter disclosed in the application which is not supported by the application as filed and constitutes added matter."

438.   In my judgment, once it is recognised that the broadest claim of the application did not include a requirement for closed loop power control, the broadest claim did not include a requirement for measured power and there

has been no change in the disclosure so far as the use of the receiver AGC setpoint is concerned, there can be no additional disclosure in claim 9.

Particulars (4): Figure 9

439. The complaint here is that :

    i)   Figure 9 and its description in the specification can only be understood with reference to the claims which correspond to that embodiment.

    ii)   Figure 9 when read in conjunction with claim 12 of the application would lead the reader to conclude that the parameter AGC_F appearing in figure 9 was the power value of the received signal identified in claim 12.

    iii)   Figure 9 when read in conjunction with claim 17 of the 482 Patent leads the reader to conclude that AGC_F is the transmit power value or some other value different from the power value of the received signal identified in claim 12 of the application.

    iv)   These two parameters are not the same and the new meaning of AGC_F constitutes added matter.

440. I think this is too sophisticated an argument. The disclosure of Figure 9 has not changed between the application and the granted patent. It would be surprising if it had.

Conclusion on added matter

441. The 482 Patent is not invalid on the ground of added matter.

Insufficiency

442. There are no less than 5 allegations of insufficiency, to which I must now turn.

443. Paragraph 5 of the Grounds of Invalidity raises an insufficiency squeeze with obviousness. It is predicated on the basis that the obviousness attack has failed, which it has not. There was in any case no challenge to Dr Wheatley's evidence directed to the point. The objection therefore fails.

444. Paragraph 7 of the Grounds of Invalidity raised four further objections. These are *Biogen* type objections introduced in the following way:

> "The specification of the 482 Patent does not disclose the invention clearly enough or completely enough for it to be performed by a person skilled in the art. Nokia relies hereunder upon the fact that upon a true construction of the specification the alleged invention now claimed extends beyond what is disclosed in the specification and is not supported by or fairly based upon that disclosure and extends to apparatus and methods which owe nothing to the alleged invention disclosed."

Particulars (1): Maximum Power

445.   Nokia say that if claims 2 and 11 on their proper construction should be limited to a fixed hard-coded or input maximum power value within the mobile, consistently with the overall purpose of limiting transmission power to prevent distortion. If they extend to a comparison of calculated output power of a mobile with a parameter calculated from parameters transmitted by the base station, then the claims extend to arrangements which have nothing to do with preventing distortion. Furthermore, the claims extend to arrangements where the problem of over-driving the transmitter does not arise, such as a case where the transmitter is limited to a number of pre-defined levels, none of which exceed the regulatory limit.

446.   This is an attempted squeeze on construction for the purposes of non-infringement. I have rejected the narrow construction put forward by Nokia, that the maximum gain setting can mean only a hard wired fixed value, but I do not think that the result is that the claim is rendered insufficient or unsupported by the description. Regulatory limits on transmitted power may change, or vary from cell to cell or region to region. The invention is of equal applicability in such circumstances.

Particulars (2): Claim 11 and closed loop power control

447.   This is an attack on claim 11. The basis of this allegation is that closed loop power control in the patent means the sending by the base station of power adjustment commands to the mobile station which were based on measurements at the base station of the power of the signal received from the mobile station and which continually adjust the power of the mobile station. Nothing else is described. If, as contended by Qualcomm, the terms "power control commands" and "gain adjust signal" in claim 11 extend to anything other than closed loop power control commands and a closed loop gain adjust signal as defined above, then claim 11 is insufficient

448.   This is the flip side of the construction argument about closed loop. It is true that claim 11 claims the power control command and gain adjust signal in general terms, but I believe the skilled addressee would see from the specification that the idea of responding to a power control command from the base station was not restricted to closed loop power control commands, i.e. to ones which had been calculated based on a measurement of received signal strength at the base station. I do not think the scope of this claim gives rise to any insufficiency.

Particulars (3): Claim 1 and closed loop power control

449.   This objection covers similar ground to the previous one. The essence of the allegation is as follows:

1.   Claim 1 requires that the radio the subject thereof contains "a closed loop power control circuit". The Claimant alleges that this requirement is satisfied by the presence in Nokia phones of software which computes the value of P_{CH} in accordance with the equation:

$$P_{CH} = \min(\Gamma_0 - \Gamma_{CH} - \alpha*(C + 48), P_{MAX})$$

in which Γ_{CH} is a closed loop power control parameter.

2. However, Γ_{CH} is not so used in the GPRS system as implemented in the UK and, indeed, throughout Europe and elsewhere. On the contrary the value of Γ_{CH} used in the GPRS system is fixed in any particular cell. Accordingly, there is no use of closed loop power control in the GPRS system.

3. If, as the Claimant contends, claim 1 nevertheless covers Nokia phones because they contain the software set out above, then the claims cover phones which do not use an essential feature of the invention, namely a combination of open and closed loop power control to regulate the transmit power of a mobile phone.

4. Such a claim covers methods of operation which owe nothing to the teaching of the 482 Patent or any principle which it discloses. It is accordingly of excessive breadth and insufficient.

450.   Nokia's skeleton argument developed the argument thus:

> "… the claim is not properly based on the alleged invention disclosed. The alleged invention, so far as claim 1 is concerned, is a particular method of controlling the power of a mobile transmitter in which a combination of open and closed loop power control is employed. There is no entitlement to an apparatus claim to the phone alone, unless it can be properly limited to the alleged invention. In this case, on Qualcomm's contentions, it is not. The method of power control used is not determined by the phone. The claim, according to Qualcomm, covers phones which will never make any use of the alleged inventive method of power control. It covers phones which will be used purely to implement a power control method which owes nothing to the alleged invention. Claim 1 is not properly limited to the alleged invention and the specification is 'Biogen' insufficient."

451.   It seems to me that there are a number of premises in this argument which are incorrect. Firstly, the invention of claim 1 is not a method at all. It is an apparatus with a particular capability. It is inherent in claims of that kind that the apparatus will not always be performing the method of which it is capable. Secondly, and in consequence, it cannot be right to say that in those circumstances there can be no entitlement on principle to a claim for apparatus. Depending on the circumstances, it may be appropriate to have a monopoly to all apparatuses which have the capability. Thirdly, the suggestion that the claim in this case is too broad because it covers phones which will never make use of closed loop power control ignores the fact that the phones are capable of making such use, and is in any case no more than an example of the inevitable consequence of having claims in this form. Fourthly, there is far more to this claim than the combined used of open and closed loop power control. It is further limited by features of internal circuitry, such as the requirement for linearisers, which are part of the

inventive concept of the claim. I cannot see why in those circumstances it is inappropriate to claim the circuitry even when not being used in a network which operates open and closed loop power control.

Particulars (4): Claim 9 and calibration

452.   It is said that claim 9 and 11 are insufficient on the following basis:

> The references to "calibration" in the description relate to the use of calibration to populate the linearization tables. There is no disclosure of the use of calibration or calibration values other than as part of the linearizer function.

> If, as contended by Qualcomm, claim 9 covers calibration of a kind which does not result in linearization of the actual gain of the VGA versus the control signal input to the linearizer, then claim 9 and its dependent claims are not fairly based on or supported by the description and those claims are insufficient as aforesaid.

453.   I have held that claim 9 is not limited to linearisation. It does seem to me that there is substance in this final allegation of insufficiency. Claim 9 is quite out of step with the apparatus claims and the disclosure as a whole because it extends to methods involving some unspecified type of calibration of the amplifiers. So extended, it seems to me that it must cover methods which owe nothing to the central idea of the patent, and have nothing to do with the problem it solved.

Validity of other claims

454.   Qualcomm identifies a number of other claims as independently valid. They are claims 7, 12, 14, 15 and 16. They are not alleged to be infringed by Nokia, and it was not suggested by Nokia that they have any present commercial interest in them. Some written evidence was directed to these claims, but no case of obviousness of those claims was put to Dr Wheatley. In those circumstances it seems to me that those claims must stand.

Infringement

455.   The claims alleged to be infringed are claims 1 and 2 (direct infringement of product claims) and claims 9 and 11 (indirect infringement under section 60(1)(b) or 60(2) of method claims).

456.   It is not possible to discuss certain of the issues of infringement which arise in this case without making reference to Nokia's Confidential PPD for the 482 Patent. Parts of my judgment on these issues are therefore contained in a Confidential Schedule.

The Nokia Circuit

457.   Almost all of the debate between the parties as to infringement can be determined by reference to Figure 1 of Nokia's Confidential PPD. It is

attached to this judgment as a Confidential Appendix. A description of the Nokia Circuit is in Confidential Schedule at paragraphs 1-15.

The infringement issues

458.   Nokia's non-infringement points can be summarised as follows:

(a)   Nokia's circuits do not have a variable gain receive or transmit amplifier.

(b)   Nokia phones do not use the receive AGC setpoint as an open loop power control signal. The open loop power control signal is created separately from the AGC setpoint.

(c)   Nokia phones have no receive integrator.

(d)   Nokia phones do not have a receive lineariser coupled to the receive VGA. The alleged lineariser does not linearise.

(e)   GPRS has no closed loop power control at all. It has a parameter which is capable of being used to implement closed loop power control (Γ_{CH}) but it is not so implemented in any network anywhere.

(f)   Because of the way the GPRS power control scheme is organised it is not possible for a mobile phone to have a closed loop power control circuit (i.e. functionality dedicated to providing closed loop power control) as required by the claims. GPRS has a general algorithm with a number of parameters which any mobile phone must implement. Whether or not closed loop power control is provided is determined by the network and how it is set up.

(g)   For claims 2 and 11 there is no maximum gain setting in Nokia phones. The parameter PMAX, a network set parameter which requires phones not to transmit at a power higher than the network permits, does not satisfy the requirement of a maximum gain setting.

(h)   For claims 9 and 11, in the Nokia phones a calibration value is not selected from a transmit calibration table in response to actual (measured) power.

Infringement: variable gain amplifiers

459.   See paragraph 16 of the Confidential schedule.

Infringement: source of open loop power control signal not "AGC setpoint"

460.   See paragraph 17 of the Confidential schedule.

Infringement: receive integrator

461.   See paragraphs 18-27 of the Confidential schedule.

Infringement: receive lineariser

462.   See paragraphs 28-36 of the Confidential schedule.

Infringement: closed loop

463.   For this issue one can turn to the standard, because it is common ground that Nokia's phones are standard compliant.

464.   Paragraph 10.2.1 of the relevant standard (TS 45.008) requires that the mobile phone's output power P_{CH} is determined according to the following equation:

$$P_{CH} = \min(\Gamma_0 - \Gamma_{CH} - \alpha * (C + 48), PMAX)$$

465. Γ_{CH} is defined as follows:

> "Γ_{CH} is an MS and channel specific power control parameter, sent to the MS in an RLC control message."

466.   The standard explains how the equation works for closed loop:

> "B.2 Closed loop control
>
> A pure closed loop is achieved by setting $\alpha = 0$. The output power will then be:
>
> $$P = \Gamma_0 - \Gamma_{CH}$$
>
> In this case, Γ_{CH} is the actual power level (relative to Γ_0) commanded by network. It can be based on the received signal level measured at the BTS. Power control commands can be sent when required in order to achieve the target received signal level."

467. Γ_{CH} may take a value between 0 and 62, in 2dB steps. α may take a value between 0 and 1, in 0.1 increments. The mobile <u>must</u> respond to any valid values of Γ_{CH} and/or α sent by the base station, for whatever reason.

468.   Qualcomm's case is that Nokia's phones must be suitable for receiving and processing Γ_{CH}. Γ_{CH} is a closed loop power control command, and the circuit that processes it is a closed loop power control circuit.

469.   Nokia says that it cannot be infringing any claim requiring closed loop power control, because closed loop power control has not been implemented by any network operator. However, Nokia does not dispute that its circuits will respond to and process closed loop power control commands if such commands were sent out by the network.

470.   In my judgment Nokia's point cannot be any answer to infringement of claims 1 and 2, the product claims, as I have construed them. All that is required is the circuitry to deal with closed loop commands: such circuits are required by the standard.

471.   The issue does not arise on claim 9, which does not require external commands. I was not persuaded that there was contributory infringement of claim 11 by offering the Nokia phone when there was no evidence of the transmission of closed loop power control.

Infringement – maximum gain setting

472.   This issue turns on construction. It goes to claims 2 and 11. For the reasons I have given there, the Nokia phones have a maximum gain setting in the sense meant in the patent.

Infringement – transmit power value

473.   This issue also turns on construction. Measured power is not a requirement of the claims.

Conclusion on infringement

474.   Had the patent been valid, Qualcomm would have established infringement of claims 1, 2 and 9.

482 Essentiality

475.   As I have held the patent invalid, the question of essentiality is moot. However, in case the matter goes further I should state my conclusions and reasons shortly.

476.   Essential is defined in the ETSI IPR Policy document as follows

> 6   "**ESSENTIAL**" as applied to IPR means that it is not possible on technical (but not commercial) grounds, taking into account normal technical practice and the state of the art generally available at the time of standardization, to make, sell, lease, otherwise dispose of, repair, use or operate EQUIPMENT or METHODS which comply with a STANDARD without infringing that IPR. For the avoidance of doubt in exceptional cases where a STANDARD can only be implemented by technical solutions, all of which are infringements of IPRs, all such IPRs shall be considered ESSENTIAL.

477.   482 claims a specific circuit for and method of using a combination of open and closed loop power control commands. Whilst the standard requires the phone to be capable of using both types of power control, it is silent on how to implement its requirements. For example it does not specify calibration, far less how calibration is to be achieved. The evidence also established (see for example document X21) that there were other ways of achieving this objective. I was not satisfied that these were not technically possible.

478.   Accordingly the 482 Patent would not, if valid, be technically essential.

Overall conclusions

479.   324 is invalid as granted for lack of novelty over Cognito and Nippon Telegraph and obviousness over NEC. It would remain invalid as proposed to be amended, as I have construed the amendment, for lack of novelty over

Cognito and obviousness over NEC. 324 would, if valid, be infringed by GSM/GPRS in combination with the Nokia phones.

480. Claims 1, 2, 9 and 11 of the 482 Patent are invalid for lack of inventive step over IS-95, the Wheatley trio and Soliman, and claims 9 and 11 for insufficiency. Had it been valid the Nokia phones would have infringed claims 1, 2 and 9. Had it been valid I would not have held it to be essential to the standard.