Neutral Citation Number: [2013] EWHC 468 (Pat)

Case No: HC11C02180

IN THE HIGH COURT OF JUSTICE
CHANCERY DIVISION
PATENTS COURT

Royal Courts of Justice
Rolls Building London EC4A1NL

Date: 07/03/2013

Before :

THE HON MR JUSTICE FLOYD

- -

Between :

SAMSUNG ELECTRONICS CO. LIMITED	**Claimant**
- and -	
(1) APPLE RETAIL UK LIMITED	
(2) APPLE SALES INTERNATIONAL	**Defendants**

- -
- -

Mark Vanhegan QC and **Brian Nicholson** (instructed by **Bristows**) for the **Claimant**
Simon Thorley QC, Guy Burkill QC and **Jeremy Heald** (instructed by **Freshfields Bruckhaus Deringer LLP**) for the **Defendants**

Hearing dates: 10-12, 14 and 17 December 2012

- -

Judgment on the 404 Patent

Mr Justice Floyd :

Introduction

1. In this action and counterclaim, the claimant Samsung Electronics Co. Limited ("Samsung") alleges infringement of three patents by the defendants Apple Retail UK Limited and Apple Sales International Limited (together "Apple"). The alleged infringements include certain Apple 3G(HSUPA)-enabled devices, including the iPhone 4, iPhone 4S and the iPad2 3G. The trial of the action fell into two quite distinct parts, the first part concerned with two of the patents and the second part with the third patent. There was virtually no overlap between the patents concerned in the first part and that involved in the second. I deal with the first two patents in a separate judgment: [2013] EWHC 467 (Pat). This judgment deals with the third patent only. That patent is European Patent UK No. 1,714,404 ("404"). Apple denies infringement and counterclaims for revocation.

2. The respective cases on this patent were advanced by Mr Mark Vanhegan QC and Mr Brian Nicholson for Samsung and by Mr Simon Thorley QC, Mr Guy Burkill QC and Mr Jeremy Heald for Apple.

The 404 patent and the issues

3. The 404 patent is entitled "*Apparatus and method for allocating OVSF codes and I/Q channels for reducing peak to average power ratio for transmitting data via enhanced uplink dedicated channels in WCDMA systems*". I will explain the technical terms used in the title in the next section of the judgment. For present purposes it is enough to say that the invention is broadly concerned with the structuring of individual data streams which are transmitted simultaneously on the same frequency range from a mobile device to a base station.

4. On its face, the patent claims priority from no less than 10 priority documents. However Samsung do not rely on any claim to priority earlier than the fourth priority document. The question of entitlement to priority is important because Samsung accept that the patent is invalid if the date of the fourth priority document, 17 June 2004, is not kept.

5. Samsung have proposed an amendment to the claims. There is a small remaining issue about the allowability of the amendments. Samsung invited me to consider only the proposed amended claim. The amendment is therefore proposed unconditionally.

6. Samsung's case of infringement is based on its allegation that the claimed invention was incorporated into the 3GPP UMTS telecommunications standard and that all Apple's accused devices comply with that standard. Apple did not challenge Samsung's technical evidence on infringement. In its opening skeleton Apple merely reserved their position on infringement, in case Samsung should adopt a construction of the claims which they had not anticipated. In the event, no issue on infringement emerged at the trial.

7. Apple allege that the claims are obvious over a prior proposal by Ericsson. In addition they allege that the claims cannot credibly deliver the advantage ascribed to them in the specification, an attack which they describe as "*Agrevo* obviousness"

after the EPO case of that name. Alternatively, Apple contend that the claims are invalid for insufficiency on a similar basis. There is also an added matter attack, which largely follows the priority issue.

Technical background

8. The general architecture of a mobile communications system has been described in a number of judgments. The following aspects need to be explained further here. I acknowledge the assistance of both sides' expert reports in preparing this section of my judgment.

The history of the relevant standards

9. In order to understand the issues which arise for decision in this case, it is necessary to recite some of the history of the development of the relevant telecommunications standards. That is because the invention is concerned in part with the way in which one allocates channels defined in earlier standards and versions of the standards. These channels are referred to as "legacy channels".

10. Cellular radio telephone communications systems have developed through a number of generations, from the original analogue (1G) systems, via the GSM system (2G) to the 3GPP UMTS (3G) system.

11. GSM is the most widely deployed cellular system in the world. It uses a channel structure based on splitting the radio spectrum into frequency slots and time slots. The base station receives signals from different mobile handsets in these different frequency and time slots (see below), and can accordingly extract the signals from different mobile handsets for onward distribution through the network.

12. UMTS is another widely deployed cellular system. It stands for Universal Mobile Telecommunication System. UMTS uses a channel structure which is not based on splitting the radio spectrum into frequency and time slots for different users. The different signals are differentiated using a system known as code division multiple access (CDMA). This system involves the use of codes to differentiate signals. On the uplink, i.e. from the mobile to the base station[1], each mobile applies a code to the signal. The receiver in the base station uses the same code to extract the signal. The same occurs in the opposite direction on the downlink. Even though all of the signals on a given cell are transmitted using the same frequency range, the individual signals can be extracted at either end using the different codes to distinguish them. Thus, the acronym WCDMA used in the title of the 404 patent stands for Wideband Code Division *Multiple Access*.

13. The 2G and 3G standards were not immutable, but would be updated by Releases which add improvements to the basic system mandated by the standard. As new, enhanced functionality is added to mobile phones, it is essential that new phones are able to continue to obtain services based on the old or "unenhanced" service. Thus the mobile will be able to obtain both the enhanced service from base stations which have been updated and so called legacy services from base stations which have not.

---

[1] UMTS calls the mobile a UE (user equipment) and the base station a Node B, but I will use the terms mobile and base station for clarity

Equally base stations which have been updated will need to be able to offer the legacy service to older mobiles which do not have the enhanced functionality. Allowing for legacy services to continue operation in this way is called backward compatibility.

14. 3G was originally standardised by a document entitled "Release 99" in 2000. In contrast to the predominantly voice-based 2G system, 3G offered multiple services such as video and data in addition to voice. In particular, 3G offered a packet data service.

15. In September 2002, 3GPP Release 5 was published. This added an additional, enhanced data service on the downlink (from base station to mobile) known as the High Speed Downlink Packet Access ("HSDPA"). Release 5 did not make any alteration to packet access on the uplink because, at that date, it was thought that the main user activity, such as browsing the internet or downloading material, would result in higher demand on the downlink rather than the uplink. This assumption turned out to be misplaced.

16. The subsequently appreciated need for improved capacity on the uplink was met by one of the more important upgrades to the 3G UMTS system. This upgrade related to the provision of the High Speed Uplink Packet Access system ("HSUPA"). HSUPA was an enhancement to the way in which data (as opposed to voice) is transmitted on the uplink between the mobile and the base station. HSUPA was under development at the date I have to consider in May/June 2004. It is this enhanced uplink data service which gives rise to the need for enhanced uplink dedicated transport channels (EUDCH) which are the subject of the patent.

17. With rare exceptions, later releases of the standards have preserved all the features of earlier releases, whilst adding new features in a backward compatible manner.

Channelization

18. Channelization refers to the ability to send multiple data streams simultaneously over a single physical radio link. For example, a user may hold a voice conversation while at the same time receiving e-mail, or surfing the Internet. The process of combining data streams in this way is known as multiplexing. Common approaches to multiplexing are:

    i) Frequency multiplexing: separate channels are sent on separate frequencies. When one tunes a dial on a radio, one is changing the frequency so as to receive a different channel.

    ii) Time multiplexing: separate channels are sent at different times. In this system the channel is divided into different time slots. Individual time slots are allocated to different streams of data. The receiver knows to look in particular time slots to find the data for that channel.

    iii) I/Q multiplexing: separate channels are sent on the independent "In-Phase" and "Quadrature" branches.

    iv) Code Multiplexing: separate channels are sent using different spreading codes.

19. Frequency and time division multiplexing are mentioned by way of background only. I/Q multiplexing and code multiplexing are central to the 404 patent, and require further explanation.

I/Q multiplexing

20. In I/Q multiplexing, or I/Q channelization, two waveforms are superimposed onto the same radio link by phase-shifting one of those signals by 90° with respect to the other in the transmitter. These two waveforms are referred to as the I (in-phase) component and the Q (quadrature) component of the radio signal. In I/Q channelization, the I and Q waveforms are used to carry separate data channels.

21. The two waveforms can be visualised as two completely independent waveforms bearing digital information simultaneously multiplexed onto a single radio signal at a given carrier frequency.

22. This technique works because the introduction of the 90° phase-shift to the signal on the Q branch in the transmitter means that the two input waveforms I and Q become "orthogonal" to each other. It is this orthogonality which allows them to be individually extracted in the receiver by applying orthogonal versions of the carrier wave.

Code multiplexing

23. UMTS uses "orthogonal spreading codes" which allow a receiver which is receiving many different signals simultaneously to extract a desired signal by applying the same "spreading code" as was applied prior to transmission.

24. In the transmitter, the input data signal is multiplied by another signal representing a "spreading code" to generate the signal to be transmitted. To extract a desired signal from the overall radio traffic in a receiver, the receiver must be able to i) recover the bits from the wanted signal and ii) cancel out all other signals to avoid interference with the wanted signal. In practice the transmitted signal will arrive at the receiver distorted by noise picked up over the air interface or within the apparatus itself. However the receiver recovers the original data signal by multiplying the received signal distorted by noise with the same spreading code used in the transmitter; this is called de-spreading.

25. The use of the appropriate code in the receiver also has the effect of cancelling out all other unwanted signals. The technique works because the codes selected for transmitting the various signals are orthogonal to each other.

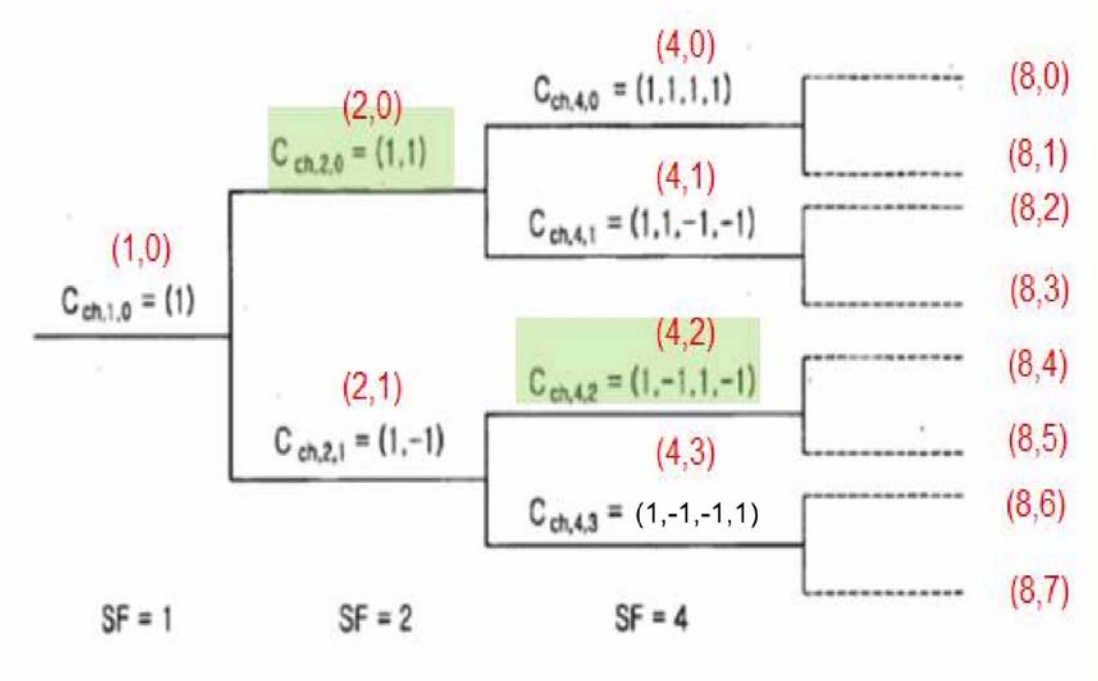
Spreading factors

26. The spreading codes are patterns of "1s" and "-1s" which, in this context, are known as "chips". The bit period of the data signal must be an integer multiple of the chip duration. The signal representing the spreading code is repeated each bit period. A spreading code which uses 4 chips per bit period, is said to have a "spreading factor" of 4. A higher spreading factor means that the maximum data rate on the coded signal will be lower. Low spreading factors, on the other hand, lead to higher data rates.

OVSF codes

27. Orthogonal Variable Spreading Factor, or OVSF codes form a particular family of orthogonal spreading codes. These codes are advantageous as they maintain the desirable orthogonality property, but allow the spreading factor (i.e. the number of chips) to be varied between the different channels spread by the family of codes. This is advantageous as it allows different data rates on the different spread channels, which enables more flexible and efficient use of the radio spectrum.

28. The "code tree" illustrated below illustrates how OVSF codes can be generated. It will be seen that a single code sequence with SF=1 (i.e. one chip) gives rise to 2 "descendants" with SF=2, and these in turn give rise to descendants with higher spreading factors. 4 levels are shown (spreading factors 1, 2, 4 and 8). Higher spreading factors, SF=16 and beyond can be provided.



29. It will be seen that there is a special nomenclature adopted for the codes and branches, such as $C_{ch,4,3.}$ The first figure, 4, is the spreading factor and the second is the number of the channel. Later one will see branches identified as (I,4,3) or (Q,4,3) which identifies whether the branch is on I or Q as well as giving the spreading factor and channel number information. This example shows only one branch (I or Q) of the I/Q channelization.

30. There are three rules about orthogonality:

i) Codes with the same spreading factor (i.e. at the same level of the code tree) will be orthogonal to each other (i.e. $C_{ch2,\ 0}$ is orthogonal to $C_{ch2,1}$).

ii) Codes on different branches are orthogonal to each other - for example, those in the bottom half of the tree (i.e. $C_{ch2,1}$, $C_{ch4,2}$ and $C_{ch4,3}$) are orthogonal to any of the codes in the top half of the tree (i.e. $C_{ch2,0}$, $C_{ch4,0}$ and $C_{ch4,1}$).

iii) Codes are *not* orthogonal to any of their descendants or ascendants (i.e. none of the codes on the top half of the tree are orthogonal to $C_{ch2,0}$).

31. An example of a channel allocation would be as follows. Suppose channel $C_{ch2,0}$ is allocated on the top branch. This prevents the use of $C_{ch(1,0)}$, $C_{ch(4,0)}$, $C_{ch(4,1)}$ and $C_{ch(8,0)}$ to $C_{ch(8,3)}$ according to rule (iii) above. However it allows a second channel to be allocated on the bottom branch, according to rule (ii) above. A second channel, for example $C_{ch(4,2)}$ can therefore be allocated on the bottom branch. This second channel additionally prevents the use of $C_{ch(2,1)}$, $C_{ch(8,4)}$, and $C_{ch(8,5)}$ according to rule (iii) above. If an additional channel was needed, the remaining available codes would be, applying the rules above $C_{ch(4,3)}$, $C_{ch(8,6)}$ or $C_{ch(8,7)}$.

Peak to average power ratio (PAPR)

32. The Peak to Average Power Ratio (PAPR) is the ratio of a signal's peak transmission power to its average transmission power. PAPR is important in electronic communications since it is easier to build an efficient transmitter which works over a limited range of output powers than to build one which needs to work over a wide range of output powers.

33. The transmission power of an electronic signal is proportional to the square of its instantaneous amplitude. PAPR is therefore sensitive to variations in amplitude. Increased PAPR is undesirable for a number of reasons. It may increase the levels of distortion of the transmitted signals and increase the amount of power leaking over into adjacent channels.

34. A large number of factors were known to affect PAPR. These included the number of simultaneously transmitted channels, the relative transmission power of the channels, the distribution of channels as between I and Q branches, the spreading codes uses, the relative gain factors, the modulation scheme and so on.

35. Balancing channels between the I and Q branches was recognised to be a good first step in seeking to minimise the increase in PAPR. The analogy of two stacks of Lego bricks was used in the evidence. One would try and keep the stacks equal. In practice, once one takes into account gain and other factors, not all the channels can be treated as equivalent. The Lego bricks are thus not all the same height, so equality in numerical terms may not give the balancing required.

36. In practice, engineers use computer simulations to determine the best combinations of channel allocation and OVSF codes, using assumptions about relative power and gain factors.

UMTS legacy uplink channels

37. UMTS Release 5 defined a number of existing uplink channels concerned with the operation of UMTS, including the DPCCH (Dedicated Physical Control Channel), DPDCH (Dedicated Physical Data Channel), and HS-DPCCH (High Speed - Dedicated Physical Control Channel). Data channels are those which carry actual data, whereas control channels carry control information about the channel, and not the data itself. It is necessary to explain the channel allocation rules for these channels.

DPDCH - the legacy data channel

38. The DPDCH is the original uplink *data* channel in UMTS, carrying traffic such as voice calls or data. The standard at that time allowed multiple DPDCHs, labelled $DPDCH_1$ to $DPDCH_{6,}$ using different channelization codes. The number of DPDCHs used would reflect the instantaneous data rate. If the data payload during a particular frame could be accommodated using one DPDCH, then only $DPDCH_1$ would be transmitted. If the data payload required two DPDCHs, then $DPDCH_1$ and $DPDCH_2$ would be transmitted, and so on.

39. The code and I/Q branch mapping was specified as follows. If there was only one DPDCH, that channel would be allocated to the I branch, on (SF_{DPDCH}, $SF_{DPDCH}/4$), (i.e. (4,1) if a spreading factor of 4 is used, or a descendant of (4,1) if spreading factor more than 4 is used). Following the convention I have already described, this I/Q mapping and code allocation can be written as (I, SF_{DPDCH}, $SF_{DPDCH}/4$).

40. If there was more than one DPDCH: the DPDCHs are allocated sequentially to (I,4,1), (Q,4,1), (I,4,3), (Q,4,3), (I,4,2), (Q,4,2) as required.

41. To avoid becoming blinded with acronyms I shall, wherever possible, refer to the DPDCHs as "legacy data channels".

DPCCH - the legacy control channel

42. The DPCCH is the uplink *control* channel which carries control information between the mobile and the base station relating to the legacy data channels. Regardless of the number of legacy data channels being transmitted, this channel is always mapped to the Q branch and is always allocated the OVSF code (256, 0).

43. Again, to avoid the acronym problem, I will call this channel the "legacy control channel".

HS-DPCCH - the high speed legacy control channel

44. Although HSDPA was a downlink data connection, HS-DPCCH (the high speed legacy control channel) was an uplink channel introduced to relay control information about the HSDPA connection back to the base station. This channel is only transmitted when HSDPA is in use and data is being sent to the mobile. The I/Q branch and code allocation depends on the number of legacy data channels being transmitted, according to the following rules.

    i) If there is an even number of legacy data channels, the high speed legacy control channel is allocated to (I,256,1).

    ii) If there is one legacy data channel, the high speed legacy control channel is allocated to (Q,256,64).

    iii) If there are three or five legacy data channels the high speed legacy control channel is allocated to (Q,256,32).

45. The diagram below, taken from the 3GPP standard version 6.0.0, depicts the channels referred to above. The top half of the diagram shows the I branch, the bottom half

shows the Q branch. The legacy data channels are allocated alternately to I and Q according to the above rules. The legacy control channel is always on Q, and the high speed legacy control channel is on I or Q depending on whether the total number of legacy data channels is odd or even.

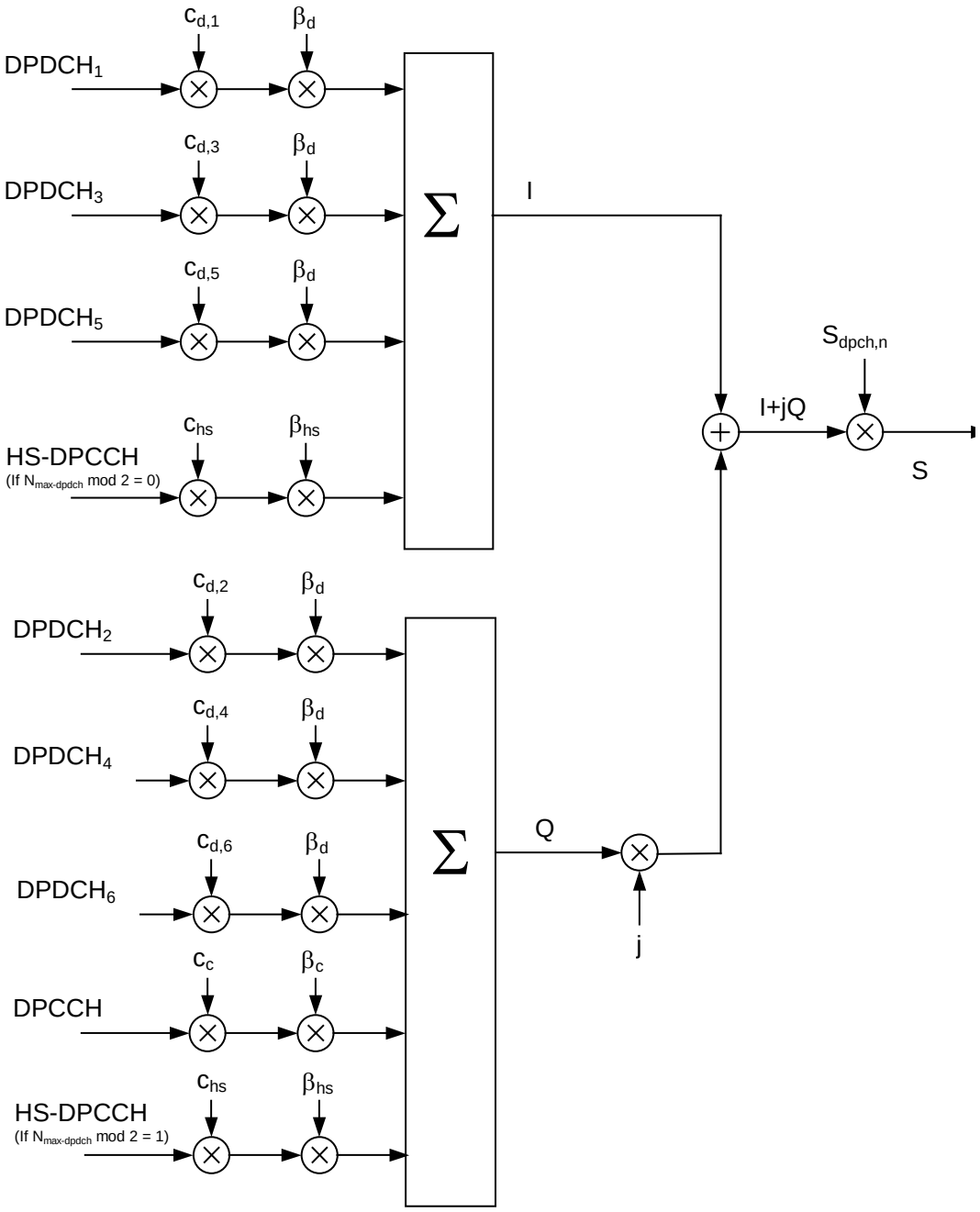


Figure 1: Spreading for uplink DPCCH, DPDCHs and HS-DPCCH

46. If one looks at the top line of the figure, the first legacy data channel is first multiplied by the appropriate spreading factor, designated c. There is then a further multiplication by a gain factor, designated β. The figure shows that as further legacy data channels are added, they are alternately assigned to the I and Q channels until the maximum of 6 legacy data channels is reached. The legacy control channel is always

on Q. The high speed legacy control channel switches from I to Q in dependence on whether the number of legacy data channels is odd or even: that is what the algebra underneath HS-DPCCH means.

The enhanced uplink data channel

47. As I have already mentioned, at the priority date, 3GPP had decided that an enhanced uplink data channel (EUDCH) was to be introduced into UMTS to deliver faster and more efficient uplink data transmission. I shall call this the enhanced data channel. However 3GPP had not reached a decision on how the enhanced data channel was to be implemented within the UMTS system, and in particular how the new channels would be added alongside the various legacy channels that already formed part of UMTS.

The skilled addressee

48. There was no relevant dispute about the identity of the skilled addressee in the case of the 404 patent. It is addressed to an electronic or communications engineer working in the wireless communications sector and engaged in network resource allocation. Such a person would have a degree in electronics or electrical engineering, and some years of post-graduate work experience in that field.

The witnesses on 404

49. Each side called one expert witness in relation to 404. Samsung called Dr David Cooper and Apple called Dr Mohammad Shikh-Bahaei.

50. Dr Cooper is an independent engineering consultant. Since 2008 a significant part of his work has been for Hillebrand Consultant Engineering, a firm of consulting engineers specialising in mobile telecommunications. He has been involved in the field of telecommunications since 1987 when he joined Coherent Research (a communication and engineering consultancy) as a Software Manager, and where he commenced work on his PhD (ultimately awarded in 2001) by studying on a part-time basis. Prior to joining Coherent, in 1978 he obtained a degree in Mathematics from Imperial College, University of London. Thereafter and until 1987 he was employed by several companies, including NEC Technologies and Panasonic. While at NEC Dr Cooper represented the company within both ETSI and 3GPP in the development of both the GSM and UMTS Standards. In 1998 he was appointed vice-Chairman of the 3GPP standards committee SA1, which was responsible for the definition of UMTS services. While at Panasonic, he became the Standards and IPR Manager for Panasonic. Dr Cooper was a most impressive expert witness: he was scrupulously fair.

51. Dr Shikh-Bahaei is currently (since 2010) a Senior Lecturer at the Institute of Telecommunications (formerly the Centre for Telecommunications Research) at King's College London. Dr Shikh-Bahaei has been involved in research in the areas of wireless communications and mobile systems since 1995. He graduated with a BSc degree in Electrical Engineering from Tehran University in Iran in 1992. He completed a MSc in Electrical Engineering at the Sharif University of Technology in Iran in 1994. Thereafter he embarked on his PhD in wireless communications at KCL, submitting a thesis in the area of CDMA technology. He has also worked as a

consulting engineer on projects involving cell planning and advanced signal processing for wireless communication systems. He obtained his PhD in 2000. From December 1999 to November 2000 he worked on a project regarding the capacity evaluation of, and resource allocation for, WCDMA systems. In 2003 he received funding from Nokia for two research projects in relation to new technologies for HSDPA and HSUPA. These projects resulted in the publication of papers on new resource allocation schemes for WCDMA. His teaching responsibilities have included the subject of resource allocation for CDMA.

52. Dr Shikh-Bahaei was a rather more argumentative witness than Dr Cooper, although clearly extremely well versed in the relevant technology. In the course of his evidence he sought to advance an interpretation of the principal prior art citation in the case (Ericsson) which had not been advanced before in his expert evidence or otherwise featured in Apple's case. This led to a lengthy passage of cross-examination in which Samsung sought to demonstrate, by reference to a companion publication (X6) that the alternative interpretation advanced by Dr Shikh-Bahaei was not correct. In the end nothing of substance turned on this, as Apple did not seek to rely on the alternative interpretation. As Mr Thorley recognised, it would not have been right to do so as it had not been put to Dr Cooper.

53. Mr Vanhegan QC attached great significance to this incident as affecting the credibility of Dr Shikh-Bahaei. I did not think it did so. It reflected the impression which I had of Dr Shikh-Bahaei overall, which is that he had a fertile mind and relished an argument.

54. In the end however, considerations such as these do not really assist me to decide this case. The scope of disagreement between the experts on questions of technical fact and even opinion was, in the end a very narrow one.

Common general knowledge

55. Everything I have set out in the section of this judgment on the technical background would be part of the common general knowledge of the skilled team.

The disclosure of the 404 patent

56. The patent commences by saying that the invention relates to an apparatus and method for minimizing an increase in Peak to Average Power Ratio (PAPR) of a transmission signal during data transmission through an Enhanced Uplink Dedicated transport Channel (the enhanced data channel). It claims to provide an optimal OVSF code and I/Q channel allocation apparatus and method for uplink physical channels for the enhanced data channel.

57. The patent recognises at [0012] that the addition of the new enhanced data channels onto the uplink will generally lead to an increase in PAPR. At [0013] and [0014] the patentee explains that the increase in PAPR may cause the mobile to perform a "power back-off". However this will result in a weaker signal at the base station and a consequently increased error rate. Alternatively one could send the new channel on a time division basis, but this is said to lead to increased implementation complexity.

58. At [0023] the patent explains that an increase in uplink PAPR depends on the number of physical channels simultaneously transmitted on the uplink, the power ratio between physical channels, an OVSF code used for each physical channel and the I/Q channel allocation.

59. The patent therefore seeks to optimise the system so as to reduce the extent to which PAPR is increased when the new channels are introduced. It is expressed in this way at [0030]:

> "[0030] It is further another aspect of the present invention to provide an apparatus and method for allocating I/Q channels and OVSF codes for E-DPDCHs and an E-DPCCH to minimize an increase in PAPR according to presence/absence of an HS-DPCCH and the number of codes for DPDCHs."

E-DPDCH and E-DPCCH are the new enhanced data and control channels respectively.

60. The disclosure of the patent is very consistent in explaining that it is both the OVSF code and the I/Q channel allocation which minimise the increase in PAPR: see for example [0035], [0037], [0040], [0042], [0043].

61. The patent recognises the importance of backward compatibility. At [0039] it explains that the method maintains the existing Release 5 for the legacy data and control channels. At [0040] it refers in addition to the high speed legacy control channel.

62. Apart from the broad statements about objectives, the specification has not thus far told the skilled reader much about what the inventive method and apparatus are. In reality the skilled person would by now, I think, have had a glance at the claims. He or she would have seen that a prominent feature of the claims was the allocation of the enhanced data channel first to I and then to Q (or vice versa) depends on whether HSDPA is set (or not set). Both experts appear to have approached the specification in this way.

63. The specification now goes on to describe ten methods in which the increase in PAPR is said to be mitigated. Not all of these methods fall within the scope of the claims. In fact only embodiments 2 and 7 were said by Samsung to be embodiments of the invention. Attention at the trial focussed only on embodiment 7 at [0170] - [0181]. I believe that the skilled person, having approached the specification in the way I have indicated, would also eventually find his or her way to, and focus on embodiment 7.

64. Embodiment 7 explains that it is a method of allocating I/Q channels and OVSF codes for the enhanced control channel and enhanced data channels, which is based on the maximum number of "transmittable" legacy data channels and the transmission/non-transmission of the high speed legacy control channel. This dependency on the transmission/non transmission of the high speed legacy control channel would, at least, strike a chord with claim 1.

65. "A basic rule" of the method is:

i) Enhanced control channel rule: if the maximum number of transmittable legacy data channels is 2 or 4 and the high speed legacy control channel is allocated (I,256,1), the enhanced control channel uses (Q, $SF_{E\text{-}DPCCH}$, $SF_{E\text{-}DPCCH/8}$). In other cases it uses (I, $SF_{E\text{-}DPCCH}$,1);

ii) Enhanced data channel rule: when several legacy data channels are transmitted, the legacy data channels use OVSF codes in order of (I,4,1), (Q,4,1), (I,4,3), (Q,4,3), (I,4,2) and (Q,4,2) according to a data rate. I call this series of codes the "6 code set". The enhanced data channels use the remaining codes except the codes set for legacy data channel transmission.

66. The seventh embodiment then goes on to deal with a number of instances. These are:

i) High speed legacy control channel is not set up;

ii) High speed legacy control channel set up and a maximum of 1 legacy data channel transmittable;

iii) High speed legacy control channel set up and a maximum of 2,3,4 and 5 legacy data channels transmittable.

67. In the first case, where the high speed legacy control channel is <u>not</u> set up, the enhanced control channel will always have code (I,$SF_{E\text{-}DPCCH}$,1). A table sets out the application of the rule for the enhanced data channel according to the number of transmittable legacy data channels:

i) If there are no legacy data channels transmittable, all 6 codes from the 6 code set are available for the enhanced data channels. So a first enhanced data channel could be allocated (I,4,1) and subsequent enhanced data channels will be allocated the remaining 5 codes in the order (Q,4,1), (I,4,3), (Q,4,3), (I,4,2) and (Q,4,2).

ii) If there is one legacy data channel transmittable, that channel will be allocated (I,4,1). The remaining codes in the 6 code set will be sequentially available to five enhanced data channels.

iii) If there are five transmittable legacy data channels, only one enhanced data channel is transmittable.

68. In the second case, where HSDPA is set up, and a maximum of one legacy data channel is transmittable, the high speed legacy control channel is allocated (Q,256,64). This is the position which it would take in Release 5. That allocation has an effect on the other codes which form the 6 code set which can be deployed. (Q,4,1) is not orthogonal to the code allocated to the high speed legacy control channel. The specification recognises that there is now one less code available for the legacy and enhanced data channels. In these circumstances, when allocating the data channels to the now reduced set, the single legacy data channel will go on (I,4,1) and the four enhanced data channels will go on (I,4,3), (Q,4,3), (I,4,2) and (Q,4,2).

69. Given Samsung's proposal to amend, it is worth noting the effect of the setting/not setting HSDPA in the case of a single legacy data channel. As noted above, because

of the need for the high speed legacy control channel when HSDPA is set, the first enhanced data channel will move from I to Q depending on whether HSDPA is or is not set. In both cases the second enhanced data channel will be allocated to the opposite I/Q branch.

The claims of 404

70. Claims 1 and 3 of the 404 patent are relevant. I set them out below showing Samsung's proposed amendment in italics:

> Claim 1
>
> "(a) A method for transmitting enhanced packet data in a mobile communication system, [*when a maximum of one dedicated physical data channel (DPDCH) is transmittable*] the method comprising the steps of:
>
> (b) generating a first enhanced dedicated physical data channel (E-DPDCH) through an in-phase (I) channel and a second E-DPDCH through a quadrature-phase (Q) channel if high speed downlink packet access (HSDPA) is set,
>
> (c) and generating the first E-DPDCH through the Q channel and the second E-DPDCH through the I channel if HSDPA is not set;
>
> (d) generating an enhanced dedicated physical control channel (E-DPCCH) using the I channel; and
>
> (e) summing up the E-DPDCHs and the E-DPCCH before transmission."
>
> Claim 3
>
> "The method of claim 1, wherein if one dedicated physical data channel (DPDCH) is set up, a high speed-downlink physical channel (HS-DPCCH) is allocated to an OVSF code (256, 64) on the Q channel."

Issues of construction

71. There was no dispute about the correct approach to construction of a patent specification. I set it out in the 726/675 judgment and I have applied it here.

"a first" and "a second" enhanced data channel

72. An issue which emerged in the evidence but which had largely evaporated by the beginning of the trial was whether these first and second enhanced data channels indicated an order of allocation or were merely arbitrary identifiers for the purposes of the claim. In my judgment the words are used so as to indicate, as between I and Q where the first and second enhanced data channels go. No other meaning really makes sense.

Issue on amendment

73. Proposed amended claim 1 introduces a limitation into claim 1 and the claims dependent from it to:

> "when a maximum of one dedicated physical data channel (DPDCH) is transmittable".

74. Samsung propose to allow claim 3 to remain in place which reads in part:

> "The method of claim 1, wherein if one dedicated physical data channel (DPDCH) is set up …"

75. Apple say this gives rise to ambiguity. If a maximum of one legacy data channel is transmittable (claim 1), it follows that one legacy physical channel is set up. However, the word "if" gives rise to a suggestion that this might not be so. I think the right course would be to delete these words from claim 3, as Samsung have offered to do. However, for reasons which will appear, the point will not arise.

Entitlement to priority

The law

76. I set out the approach which the law takes to entitlement to priority in the 726/675 judgment, and I have applied it here.

The disclosure of the fourth priority document for 404

77. The fourth priority document is Korean national patent application 2004045127 filed on 17 June 2004. It is necessary to review its disclosure without knowledge of the contents of the patent, and to see what it discloses clearly and unambiguously.

78. The document is concerned in general with the addition of the new enhanced data channels in WCDMA systems, and how to do so whilst minimising the increase in PAPR. Thus, the title of the fourth priority document is "*Apparatus and Method for allocating OVSF codes and I/Q channels for reducing peak to average power ratio in transmitting data via enhanced up-link dedicated channels in WCDMA systems*", and the abstract of the disclosure reads as follows:

> "The present invention supposes a situation in which an Enhanced Uplink Dedicated transport Channel (EUDCH) is used in a Wideband Code Division Multiple Access (WCDMA) system. In a user equipment (UE), when EUDCH channels for high speed data transmission are additionally transmitted, a Peak-to-Average Power Ratio (PAPR) of an uplink transport signal increases. The increase in PAPR depends upon Orthogonal Variable Spreading Factor (OVSF) codes allocated to the corresponding physical channels and in-phase/quadrature-phase (I/Q) channels. Therefore, the present invention proposes an apparatus and method for allocating optimum OVSF codes and I/Q channels to EUDCH-related

> physical channels in order to minimize an increase in PAPR due to EUDCH."

79. The title and the abstract are just the first two of a large number of references in the fourth priority document which stress that the invention is concerned with both code and I/Q channel allocation. Thus the object of the invention at page 2 line 25 of the English translation is stated as follows:

> "The present invention relates generally to an asynchronous Wideband Code Division Multiple Access (WCDMA) communication system, and in particular, to an apparatus and method for minimizing an increase in Peak-to-Average Power Ratio (PAPR) of a transmission signal during data transmission through an Enhanced Uplink Dedicated transport Channel (EUDCH).
>
> That is, *the present invention relates to an optimal Orthogonal Variable Spreading Factor (OVSF) code and in-phase/quadrature-phase (I/Q) channel allocation apparatus and method* for uplink physical channels for EUDCH service." (emphasis supplied)

80. Much of the introductory portion of the fourth priority document is devoted to reminding the reader of features of the channel structure of the existing UMTS system. At page 5 line 11 onwards the document turns to the problems associated with adding more physical channels, such as the enhanced data channels. It explains that:

> "It is general that the PAPR increases higher as the number of simultaneously transmitted physical channels increases higher."

81. Having pointed to the adverse effects associated with increasing PAPR, the document considers and dismisses the alternative of transmitting the new channels on a time division basis.

82. At page 7 line 16 the specification reminds the reader that:

> " … an increase in uplink PAPR depends on the number of physical channels simultaneously transmitted in the uplink, a power ratio between physical channels, an OVSF code used for each physical channel, and I/Q channel allocation for each physical channel."

83. Before the Summary of the Invention, one reads the following statement of what the authors consider to be necessary:

> "Accordingly, OVSF code and I/Q channel allocation capable of reducing the PAPR increase while maintaining orthogonality with the existing DPCCH, DPDCH, and HS-DPCCH in a mobile communication system supporting an EUDCH is necessary. That is, an OVSF code and I/Q channel allocation

> method optimized for E-DPCCH and E-DPDCH according to supporting the EUDCH is necessary."

84. In conformity with what is said to be necessary, the object of the invention is set forth in the following terms:

> "It is, therefore, an object of the present invention to provide a UE's transmission apparatus and method for efficiently transmitting packet data through an enhanced uplink in a mobile communication system.
>
> It is another object of the present invention to provide an OVSF code and I/Q channel allocation apparatus and method for minimizing an increase in PAPR of an uplink transmission signal in a mobile communication system supporting an uplink.
>
> It is further another object of the present invention to provide an apparatus and method for allocating I/Q channels and OVSF codes for EDPDCHs and an E-DPCCH to minimize an increase in PAPR according to presence/absence of an HS-DPCCH and the number of codes for DPDCHs."

85. Accordingly the objects are clearly stated in terms of allocating both OVSF codes and I/Q channel. Likewise, at page 9 lines 3 to 9, the authors say that the invention proposes OVSF code and I/Q channel allocation for minimising an increase in PAPR in a WCDMA system supporting uplink.

86. The document goes on to describe two methods. The first method is:

> "a method of allocating OVSF codes and I/Q channels … to maintain backward compatibility with the existing Rel-99 and Rel-5 WCDMA standards."

87. The second method is:

> "method not maintaining compatibility with the existing WCDMA system is considered. This is the case where backward compatibility with the HS-DPCCH is partially lost while compatibility with the existing DPDCH and DPCCH is maintained."

88. At page 9 line 34 to page 10 line 6 the reader is reminded that in the existing system I/Q channel and OVSF code allocation for the high speed control channel depends on the number of simultaneously transmittable (legacy) data channels. It proposes retention of this rule despite the presence of enhanced data channels to be allocated. It also points out in somewhat opaque terms, that only a single enhanced control channel will be required.

89. The document then goes on to describe two embodiments of the first method (that which aims at backward compatibility). The first embodiment is said to transmit only

one legacy data channel, whilst the second is said to transmit one or more such channels.

90. The third embodiment is an example of the second method which is said to be a case of ignoring compatibility with the high speed control channel.

91. The skilled reader would, even at this stage, appreciate that the document was not putting forward a single approach to the problem of adding the enhanced data service, but a variety of different ones. Whilst the main focus of attention at the trial was on Method B of the second embodiment, one part of the disclosure in relation to the first embodiment was relied on by Apple. This is the discussion of Figure 5 which one finds at page 19 lines 7 to 26. The text explains that three cases are considered, the first which uses the invention and the second and third "where different OVSF codes or different I/Q channels are allocated". The PAPR which is measured is said to be obtained through computer simulation, using certain values of scrambling code and the channel gain factor β. Figure 5 demonstrates that changing one OVSF code results in an increase in PAPR, although to a lesser extent than moving the enhanced control channel from I to Q.

92. Method B of the second embodiment is described from pages 30 to 32. Whilst the skilled reader would not know this, its technical disclosure is very similar to that of the seventh embodiment of the patent. Simply to avoid repetition, I will not repeat here what I have said already in the context of the patent.

The subject matter of claim 1

93. As Samsung do not invite me to consider the granted claims, it is right to consider the subject matter of claim 1 as proposed to be amended. As such it is in essence a method in which, when a maximum of one legacy data channel is transmittable, comprises generating a first enhanced data channel on I and a second on Q when the high speed legacy channel is set, and reversing that order to Q then I, when it is not set. The method also requires the enhanced control channel to be on I.

Apple's challenge to the priority of the claims of 404 as granted

94. Apple accept that if one focuses on the single case within Method B of embodiment 2 where the maximum number of legacy data channels is one, the fourth priority document discloses a method which falls within the scope of amended claim 1. They contend that the claims are nevertheless not entitled to priority from method B of embodiment 2. Firstly, Method B teaches an entire scheme and one cannot extract the single case. Secondly, the specific single case within Method B is a scheme for allocating I/Q channels and OVSF codes together and not I/Q channels alone.

Is the subject matter of claim 1 derivable directly and unambiguously from the disclosure of the priority document?

95. The skilled person would appreciate that Method B of embodiment 2 contains both general and more specific disclosures. At the general level, he or she would appreciate that the patentee is proposing a scheme in which channel and code allocation is in accordance with its "basic rule". This is a complete scheme which

takes account of both the maximum number of transmittable legacy data channels and also whether or not the high speed legacy channel is set or not set.

96. Samsung make no attempt to suggest that the invention of claim 1 is the same invention as this general disclosure of Method B. Any such attempt would be hopeless, as the invention of claim 1 does not use the maximum number of transmittable legacy data channels as a determinant of anything. In claim 1 that maximum number is fixed. Both the elements of the "basic rule" assume that more than one legacy data channel is transmittable. There are other reasons as well, but what I have said is sufficient.

97. The skilled person would however recognise that the general teaching of Method B is specifically applied to the case where the maximum number of transmittable legacy data channels is 1. This case is illustrated by the first line of Table 21 (where HSDPA is not set) and the text bridging pages 31 and 32 (where HSDPA is set). The critical question for priority is whether this specific example amounts to a disclosure of the invention of claim 1.

98. Apple submitted that the skilled person would not see the I/Q channel allocation as independent of the OVSF codes. The invention was presented as a method for allocating both, not one or the other.

99. Samsung's case is that the skilled person would see in the specific example a teaching about I/Q allocation, independent of the OVSF codes. From the common general knowledge, he or she would know that it was possible then to proceed to optimise both OVSF codes and gain factors.

100. In his closing submissions Mr Vanhegan QC submitted:

i) That features could be lifted out of specific embodiments if they were not technically interrelated in such a way that one could not take one without the other. He described this as the two features having a synergistic effect.

ii) That the two features in question here - I/Q channel allocation and OVSF codes - could only be regarded as technically interrelated in this sense if the skilled person would have understood the patentee to be promising a fully optimised system;

iii) That the evidence showed that a system which does not take into account gain factors could not be said to be a fully optimised system;

iv) Thus, the skilled person would appreciate that the specific example was not an optimised system, and that the I/Q channel allocation would be of value independently of the OVSF codes.

101. I am unable to accept these submissions, apart from the third, which I accept. The first submission states the test too generously to Samsung. As Jacob LJ said in the passage from *Unilin* which I have cited in the judgment on the 726 and 675 patents, the question is whether the invention disclosed in the priority document is a combination, or whether individual features will be seen to be independent. The second and fourth submissions are also in my judgment incorrect. The priority document is putting

forward the various schemes as ways of minimising PAPR. The fact that the skilled person would know or suspect that he might be able to do better once he had experimented further does not alter the nature of the disclosure. The distinction between what is disclosed and what the skilled person might do in reliance on it is important here.

102. Both the general disclosure of the fourth priority document and the disclosure within Method B of embodiment 2 make it clear that the patentee is proposing a scheme which allocates both I/Q channel and OVSF codes with a view to minimising the increase in PAPR. It is difficult to conceive of what the patentee could have done further to emphasise that it was the combination of allocations which he was putting forward as his invention. There is simply no disclosure of an apparatus or method which merely allocates the I/Q channels. This is not merely a question of form. The skilled person would know (and insofar as he did not, Figure 5 would have told him) that choice of OVSF codes can affect PAPR. He would have no idea what the effect of departing from the specified OVSF codes would be on the ability of the proposed scheme to minimise the increase in PAPR. He would not see the OVSF codes as independent from the I/Q allocation.

103. Accordingly, I would hold on this ground, and for the reasons I have given, that the proposed amended claim is not entitled to priority.

Infringement

104. Samsung's case of infringement is based on the fact that the accused Apple devices are said to be compliant with the UMTS standard. Apple advance no independent case of non-infringement. The evidence of Dr Cooper satisfies me that amended claims 1 and 3 of 404 read directly onto the UMTS standard.

Validity

105. Samsung accept that, because of intervening prior art between the claimed priority date and the filing date of 404, the patent is invalid for lack of novelty if it is not entitled to priority. As I have concluded that the relevant claims are not entitled to priority, the patent is invalid. However, in case the matter goes further, I should consider the remaining validity attacks on the 404 patent on the assumption that it is, contrary to my finding, entitled to the date of the fourth priority document.

Obviousness

106. Apple contended that the 404 patent is obvious over one prior art citation, namely Ericsson's submission to the relevant working group for the UMTS project (Proposal R1 – 040562) entitled "*Enhanced Uplink – Physical Channel Structure"* ("Ericsson").

Law

107. There was no dispute about the approach to obviousness. I set it out in the 726/675 judgment and have applied it here.

108. Apple also advanced an obviousness case against 404 based on the decision of the Technical Board of Appeal in *Agrevo* Case T0939/92. That decision was summarised

by Lord Hoffmann in the course of his judgment in *Conor v Angiotech* [2008] UKHL 49; [2008] RPC 28, in the following way:

> "There is also a line of authority in the EPO in which claims to broad classes of chemical compounds alleged to have some common technical effect have been rejected under article 56 (obviousness) when there was nothing to show that they would all have that technical effect. The leading case is *AGREVO, Case No T 0939/92*, which was a product claim for a class of chemical compounds alleged to be useful as herbicides. But there was nothing in the description to justify the assertion that all the compounds in the class would have herbicidal properties. The Board of Appeal decided that the claims were not insufficient (the skilled man would have been able to make all the compounds claimed) but failed for lack of an inventive step because there was nothing inventive in simply making the compounds. The invention, if any, would lie in the discovery that they were herbicides. The Board of Appeal said (at paragraph 2.5.4):
>
> > "…[A] technical effect which justifies the selection of the claimed compounds must be one which can be fairly assumed to be produced by substantially all the selected compounds..."
>
> "

109. The case is best understood in the context of the EPO's problem and solution approach to obviousness. This approach involves identifying a technical effect delivered by the claim. The focus of the enquiry on obviousness is then centred on whether it would be obvious to the skilled person, on the basis of the prior art, how to achieve that technical effect. If the compounds are not all herbicides, but include some which are just further examples of compounds of a known class, it is not justified to pose the obviousness question in terms of herbicidal effect. The question becomes the more mundane one of whether it would be obvious to produce similar compounds to those in the prior art. The Board held that, posed in this way, the compounds were obvious.

110. I have identified the person skilled in the art and the common general knowledge above.

The inventive concept

111. The inventive concept is represented by claim 1 as proposed to be amended. It consists in a method of sending enhanced packet data when there is a maximum of one legacy data channel, in which, when HSDPA is set, the enhanced data channels go to I then Q, and when HSDPA is not set they go to Q then I. It also requires the enhanced control channel to be on I. Claim 3 requires, in addition, the high speed legacy control channel to be on (Q,256,64).

112. It is important to be clear that this is all the inventive concept is. As Laddie J pointed out in *Brugger v MedicAid* [1996] RPC 635 at 656:

> "It is not legitimate to define the inventive step as something narrower than the scope of the relevant claims. In particular it is not legitimate to identify a narrow sub-group of embodiments falling within the claims and which have certain technical advantages and then to define the inventive step in terms which apply to that sub group but not the rest of the claim."

113. Mr Vanhegan sought to attach more significance to the claimed concept. He submitted that the method and apparatus claimed in the patent ensures that the number of simultaneously transmitted physical channels on the I and the Q branch is minimised not only when the maximum configured capacity is utilised but also during all possible patterns of use. He submitted that the evidence established that this technical advantage was delivered across the entire spectrum of the claim.

114. In support of these submissions, Samsung produced a number of tables. The first set, originally appearing in Samsung's opening skeleton, deals with allocation of channels, and shows balancing once the enhanced channels are fully allocated. It deals with all the cases of maximum number of legacy data channels. In fact only the first line of each table is the subject of the amended claims, which are limited to a maximum number of one transmittable legacy data channel (DPDCH). Moreover it should be noted, even in relation to the first line of the table, that the claim does not specify the position of the single transmittable legacy data channel or that of the legacy control channel.

a. HSDPA not in use:

	Legacy	Enhanced	DPCCH	E-DPCCH	Num I	Num Q
Max 1 DPDCH	I	Q,I,Q,I,Q	Q	I	4	4
Max 2 DPDCH	I,Q	I,Q,I,Q	Q	I	4	4
Max 3 DPDCH	I,Q,I	Q,I,Q	Q	I	4	4
Max 4 DPDCH	I,Q,I,Q	I,Q	Q	I	4	4
Max 5 DPDCH	I,Q,I,Q,I	Q	Q	I	4	4

b. HSDPA in use:

	Legacy	Enhanced	DPCCH	HS-DPCCH	E-DPCCH	Num I	Num Q
Max 1 DPDCH	I	I,Q,I,Q	Q	Q	I	4	4
Max 2 DPDCH	I,Q	I,Q,I,Q	Q	I	Q	4	5
Max 3 DPDCH	I,Q,I	Q,I,Q	Q	Q	I	4	5
Max 4 DPDCH	I,Q,I,Q	I,Q	Q	I	Q	4	5
Max 5 DPDCH	I,Q,I,Q,I	Q	Q	Q	I	4	5

115. The second set of tables (X5), which I reproduce below, is based on the channels being fully set up, but in decreasing demand because the amount of data is not sufficient to "fill" all the channels:

HSDPA not in use:

Legacy	Enhanced	DPCCH	E-DPCCH	Num I	Num Q
I	Q,I,Q,I,Q	Q	I	**4**	**4**
I	Q,I,Q,I	Q	I	**4**	**3**
I	Q,I,Q	Q	I	**3**	**3**
I	Q,I	Q	I	**3**	**2**
I	Q	Q	I	**2**	**2**
I	-	Q	I	**2**	**1**
-	Q,I,Q,I,Q	Q	I	**3**	**4**
-	Q,I,Q,I	Q	I	**3**	**3**
-	Q,I,Q	Q	I	**2**	**3**
-	Q,I	Q	I	**2**	**2**
-	Q	Q	I	**1**	**2**

-	-	Q	I	**1**	**1**

HSDPA in use:

Legacy	Enhanced	DPCCH	E-DPCCH	HS-DPCCH	Num I	Num Q
I	I,Q,I,Q	Q	I	Q	**4**	**4**
I	I,Q,I	Q	I	Q	**4**	**3**
I	I,Q	Q	I	Q	**3**	**3**
I	I	Q	I	Q	**3**	**2**
I	-	Q	I	Q	**2**	**2**
-	I,Q,I,Q	Q	I	Q	**3**	**4**
-	I,Q,I	Q	I	Q	**3**	**3**
-	I,Q	Q	I	Q	**2**	**3**
-	I	Q	I	Q	**2**	**2**
-	-	Q	I	Q	**1**	**2**

116. The shaded areas on the X5 tables are supposed to represent the claimed method. However, as Apple point out, the claims extend to cases where there are more than two enhanced data channels (i.e.) the non-shaded portions, and in those cases there is no restriction placed on the I/Q branch allocation for the enhanced data channels, contrary to what is suggested by the tables. Moreover, as before, the claims do not specify that the legacy data and control channels are where they are placed in the tables.

117. Claim 1 says nothing about the allocation as between I and Q of the legacy data channel. It does not even mention the legacy control channel. It does not require backward compatibility. It does not specify the channel allocation as between I and Q of any except the first two enhanced data channels. It cannot be said that, as a whole, claim 1 balances the number of channels on I and Q.

118. The tables were accepted by Dr Shikh-Bahaei as fairly representing the allocation and actual use of I and Q. He accepted that the method balanced the number of channels as far as it was possible to do so, and that this was a beneficial result. However, whilst this case is encompassed by the claims, it is plain that the claims extend to embodiments which have no such technical benefit. It is therefore wrong to approach obviousness from the point of view of the advantages of the sub-group of embodiments on which Samsung wish to focus attention.

Disclosure of Ericsson

119. Ericsson is a two-page document submitted to the TSG-RAN Working Group meeting in Montreal on May 10-14, 2004. It is specifically directed to a proposal for the physical channel structure of the enhanced data uplink. The Introduction states that:

> "Apart from the obvious requirement of being able to support the features introduced for the [enhanced data uplink], the physical channel structure chosen should avoid unnecessary

> complexity, be conceptually simple and allow for implementation with minimal impact on already existing hardware solutions."

120. Section 2 of the document discusses the options - time or code based -for multiplexing of the legacy and enhanced data channels. It concludes, having considered the advantages and disadvantages that a code-multiplexed structure is "*recommended for the (enhanced data uplink)*".

121. Under the heading "Spreading", Ericsson recommends that:

> "Spreading … should be performed using the same channelization codes … as in [Release 5] to ensure backwards compatibility and good [PAPR] properties."

122. For backward compatibility it is recommended that the legacy control channel and the high speed legacy control channel code mapping should be identical to Release 5. So far as data channels are concerned, Ericsson says the following:

> "Furthermore, the DPDCHs that, according to the TFCS configured, may carry [legacy data] traffic should reside on the same channelization codes as in [Release 5]. The remaining DPDCHs, carrying [enhanced data] traffic only, could in principle be using any non-occupied channelization code. However, unless there is a significant benefit in [PAPR] reduction by using a different allocation strategy, it is recommended to maintain the [Release 5] structure also for these DPDCHs."

123. This passage uses the term "DPDCHs" to cover both legacy data channels and enhanced data channels. It distinguishes between them on the basis of the type of traffic which they carry.

124. The document continues by saying that the enhanced control channel "*is allocated a suitable code resulting in good [PAPR] properties*", but does not identify a specific code.

125. The proposed structure is summarised as follows:

i) [the legacy control channel] is mapped on the same channelization code as in [Release 5] to ensure backwards compatibility.

ii) [the high speed legacy control channel] is mapped on the same channelization codes as in [Release 5]. The channelization code used depends on the maximum number of DPDCHs configured for the combinations of [legacy data channel] and [enhanced data channel] data rates in the [Transport Format Combination Set].

iii) Each DPDCH can be used either for [legacy data] or [enhanced data] traffic, but not simultaneously.

iv) The DPDCH(s) that, according to the [Transport Format Combination Set] configured, may carry [legacy data] traffic should reside on the same channelization codes as in [Release 5] to ensure backwards compatibility.

v) The DPDCH(s) that, according to the [Transport Format Combination Set] configured, will carry [enhanced data] traffic only could be allocated in the same way as DPDCHs in [Release 5] unless there is a significant benefit in PAR from a different choice of code mappings.

vi) Additional control signaling (sic) required is carried on the [enhanced control channel]. The code selection, spreading factor and selection of I or Q branch is [for further study]. The code mapping should either be fixed, as is the case for the DPCCH, or related to the [Transport Format Combination Set], as is the case for the [high speed legacy control channel].

vii) The allowed β settings for DPDCHs carrying the [enhanced data] are [for further study].

viii) Scrambling codes and modulation schemes are identical to [Release 5].

126. The teaching of Ericsson at (ii) above that the code used for the high speed legacy control channel depends on the maximum number of DPDCHs was the subject of some dispute. In cross examination, Apple's expert Dr Shikh-Bahaei thought the term "*a bit vague*". According to Dr Shikh-Bahaei, the document could either be teaching that the total number of data channels (legacy plus enhanced) should be counted or that only legacy data channels are counted. This interpretation had not emerged clearly from Dr Shikh-Bahaei expert reports. Moreover, as Dr Shikh-Bahaei was cross-examined after Dr Cooper had given evidence, this alternative interpretation was not put to Dr Cooper. In these circumstances Mr Thorley recognised that he could not rely positively on Dr Shikh-Bahaei alternative (legacy plus enhanced) interpretation. In any event I reject the alternative interpretation put forward by Dr Shikh-Bahaei. I think the bullet points make clear that legacy and enhanced data channels are being treated on the same footing.

Differences between Ericsson and the inventive concept

127. There are a number of differences between the disclosure of Ericsson and the inventive concept. Firstly, Ericsson does not deal specifically with the case where only one legacy data channel is transmitted (the feature introduced by Samsung's amendment). Secondly, Ericsson does not deal with the I/Q allocation for the first two enhanced data channels, or teach that the allocation is dependent on whether HSDPA is set or not. Thirdly Ericsson does not teach that the enhanced control channel should be on I. It merely says that it should be fixed, or vary as did the high speed legacy control channel.

Obvious over Ericsson?

128. Apple's argument of obviousness considers a skilled team implementing a channel allocation strategy for the enhanced data uplink, based on Ericsson. The argument for obviousness over Ericsson runs as follows:

i) First, one considers the case where a maximum of one transmittable legacy data channel is to be transmitted together with at least two enhanced data channels. This is an obvious scenario to consider. It results in feature (a) of the claim being satisfied, and the enhanced data channels being considered in features (b) and (c) being present;

ii) The enhanced control channel. Although this was not mandated by Ericsson, the skilled person would consider providing an enhanced control channel as a separate physical channel, code multiplexed.

iii) One of the options taught by Ericsson if there is to be an enhanced control channel of this kind is that its mapping is fixed (as in the case of the high speed legacy control channel). It would be sensible to allocate the enhanced control channel to I, given that, at least when HSDPA is set, there were two control channels allocated to Q (the legacy control channel and the high speed legacy control channel).

iv) If HSDPA is not set, the first and second enhanced data channels are the second and third data channels (speaking cumulatively), because there is already one legacy data channel. Using the Release 5 approach the legacy data channel will be on I and the first and second enhanced data channels will be on Q and I respectively. This is in accordance with feature (c) of the claim

v) If HSDPA is set the high speed legacy control channel must be allocated. It would be allocated its legacy position on Q. There would thus be two control channels on Q and one control channel on I. The first legacy data channel would be allocated to I, meaning that there were two channels on I and two on Q.

vi) Ericsson would still teach that the first enhanced data channel would go to Q and the second to I. However the skilled person would try reversing the I/Q order in order to see whether he got better PAPR. In so doing he would try putting the first enhanced data channel on I, in accordance with feature (b) of the claim.

129. Mr Thorley took Dr Cooper through this series of steps in the course of his cross examination. Dr Cooper initially accepted that putting the enhanced control channel on I looked like a sensible suggestion, given the presence, when HSDPA is set, of the two legacy control channels on Q. There then followed this passage:

> Q. So you now have to allocate the two enhanced data channels.
>
> A. I think Ericsson are proposing to do this the other way round in fact. They are proposing to allocate the physical channels on which the data is being transmitted, using the legacy method. So definitely you have DPDCH on I; you have an enhanced data channel on Q; you have another enhanced data channel on I; and then the question is, where is it most optimal to put your enhanced control channel, and is it worth

> doing something special, depending on -- is it worth putting it in a position that is dependent on this configuration.
>
> Q. Even if you did it that way round, Dr. Cooper, you are still going to end up with it on the I channel to balance things, are you not?
>
> A. I would imagine -- let us see. Yes, on the face of it, it looks like it.
>
> Q. You are going to have three on each. So whichever way round you go about it, you are going to end up with the enhanced code channel going on the -- sorry, I ----
>
> A. The enhanced control channel going on -- I mean, that is a reasonable heuristic when one could perform simulations to ensure that the heuristic you are proposing is correct. It sounds reasonable.

130. The cross-examination returned to the topic of the order of allocation of the first and second enhanced data channels as follows:

> Q. Now, so far as the allocation of the first and second enhanced data channel[s] is concerned, as a matter of preference, which one is going to go to the Q channel and which one is going to go to the I channel?
>
> A. Can I just clarify first? You are assuming that the legacy channel is continuously transmitting.
>
> Q. Yes.
>
> A. There are no gaps in the legacy channel.
>
> Q. Yes, that is the basis on which we are proceeding.
>
> A. In that case Ericsson instructs the skilled person that it is going to go Q-I.
>
> Q. It is going to go first to Q and then to I?
>
> A. Yes.
>
> Q. And would I be right that for PAPR purposes you would not know whether that was the best or not?
>
> A. You would have a reasonable assumption that that might be a good approach because of its similarity with Release 99.
>
> Q. Would you do a simulation to check that it was?

> A. You would always do simulations to optimise and verify, yes.
>
> Q. And in this case ----
>
> A. And to know what your performance is.
>
> Q. Yes, and in this case you would try the E-DPDCHs on swapping them round to see whether you have got a better balance with the first one on I and the second one on Q?
>
> A. The E-DPDCHs I think you are actually -- Ericsson is definitely saying use the I/Q branch mapping rule -- the balancing rule that is compatible with Release 5, that has been optimised with Release 5. I do not think that is something that you would change. What you might change, because you do not need to worry about compatibility, is the position of the enhanced uplink control channel.
>
> Q. You do not have to worry, do you, about the enhanced channels for compatibility, because there were not any before?
>
> A. That is quite correct, but I think what Ericsson is teaching you is that you are allocating in the same order -- you are just doing what was done in Release 5.
>
> Q. Yes. But where I was crossing swords with you is the suggestion that you were allocating them because of some compatibility considerations.
>
> A. The compatibility consideration is that you have got exactly the -- this is attractive in the sense that you are using exactly the same mechanism, the same order and (potentially possibly) the same software as you have already used in your Release 5 implementation. But that is not to say that other possibilities would not be investigated by the skilled team.
>
> Q. Yes. You would start off with that as your, so to speak, preferred bet, but you would not have it set in stone. You would ring the changes for the purposes of simulation to satisfy yourself that you had got it right.
>
> A. And indeed this document invites you to. It actually says start with the codes that have been used already, but if there is a PAPR benefit, do consider using other codes.

131. Accordingly Dr Cooper's evidence was that the starting position, whether HSDPA was or was not set, was that the enhanced data channels would be allocated to Q then I. One would investigate other possible allocations to see if a PAPR advantage could be obtained.

132. Dr Shikh-Bahaei's evidence in his first report dealt first with the case where HSDPA is not set. If backwards compatibility was to be maintained, the first legacy data channel would be mapped to I in accordance with Release 5. The legacy control channel would be in its legacy position on Q. Following the Release 5 approach, the first enhanced data channel will be allocated to Q. The enhanced control channel would be allocated to I (opposite the first enhanced data channel). The second enhanced data channel would be allocated to I, opposite to the first. Dr Shikh-Bahaei describes the first and second enhanced data channels as "effectively the second [data channel]" and "effectively the third [data channel]". This is in accordance with Ericsson's teaching that one allocates the legacy and enhanced data channels according to the cumulative total of data channels.

I	**Q**
First legacy data	Legacy control
Enhanced control	First enhanced data
Second enhanced data	

133. In cross-examination Dr Shikh-Bahaei backed up this approach by saying that placing the enhanced control on I would be favoured because of balancing. By this he meant that at the stage of placing the first enhanced data and the enhanced control channels, and applying Release 5, the first enhanced data would go to Q because it is "effectively the second" data channel, and the control channel would go to I to balance things out.

134. Dr Shikh-Bahaei then turned to the case where HSDPA is set. If backwards compatibility is to be maintained the high speed legacy control channel is to be mapped to Q, as would the legacy control channel. The first legacy data channel would again be mapped to I in accordance with Release 5. Introducing the first enhanced data channel would require the enhanced control channel as well. This would make the total number of channels 5. His evidence was that the skilled person would try both options of allocating the first enhanced data channel to I or to Q and compare them in terms of overall PAPR using simulations and other analysis. By this I understood him to mean that the 5 channels would be allocated according to the following table:

I	Q
First legacy data	High speed legacy control
First enhanced data/enhanced control?	Legacy control
	First enhanced data/enhanced control?

135. Once a choice had been made for the first enhanced data channel, the second enhanced data channel would be allocated to the opposite branch. The skilled person would then confirm the resulting PAPRs for the different combinations.

136. Dr Shikh-Bahaei added that the study which he had outlined would indicate the optimal channel allocation for the enhanced control channel. However he goes on to point out that the skilled person would be aware that the legacy control channel was always present on Q, which would suggest to the skilled person that the enhanced control channel should be on I. This would put the first enhanced data channel on Q.

137. Samsung placed belated reliance on the contents of the Ericsson companion paper, X6, which was put to Dr Shikh-Bahaei in cross-examination, but had formed no part of their case before. The point made was that Ericsson themselves did not adopt a scheme falling within claim 1, or indeed balance the channels. I did not find this opportunistic reliance on X6 of any value. As the Lego analogy shows, much depends on the gain factors. Once it is accepted that the claimed method is not optimised, it is difficult to see why adoption of an alternative strategy should be treated as an indication of non-obviousness.

138. Viewing the evidence as a whole, I was persuaded that Apple had made good their case of obviousness over Ericsson. Ericsson's approach, if applied strictly, does not result in the reversal of the order of allocation of the first two enhanced data channels depending on whether HSDPA is, or is not, set. In order to arrive at the claim, one has to depart from a strict application of its teaching. Nevertheless both experts considered that the skilled person would take Ericsson as a starting point and look at the limited number of different allocation possibilities. In doing so he would, in my judgment, inevitably arrive at the claimed combination.

139. Samsung contended that it was never established that the skilled person would finally adopt the claimed configuration: at most it was established that the skilled person would try it. That is correct, and would normally be a serious objection to a finding of obviousness. But in the unusual circumstances of this case one has to bear in mind that neither side was contending that the claimed combination produced an optimum

result. It is therefore not an answer for Samsung to say that the skilled person would try the claimed combination and move on from it.

Agrevo

140. Apple's alternative case of obviousness is based on *Agrevo*. I will deal with this very briefly in the light of my conclusions to date.

141. As explained in their opening skeleton, Apple's case was that there was no teaching in the specification that the arrangements falling within claim 1 solve the problem posed in the specification, namely the provision of an EUDCH system which minimises any increase in PAPR.

142. Samsung does not really quarrel with the proposition that the claimed solution does not completely solve the problem identified in the specification of achieving the minimum increase in PAPR. Rather they contend that the method and apparatus claimed in the patent ensures that the number of simultaneously transmitted physical channels on the I and the Q branch is minimised not only when the maximum configured capacity is utilised but also during all possible patterns of use. They contend that the evidence established that this technical effect or advantage was delivered across the entire spectrum of the claim.

143. I have already dealt with the basis on which Samsung makes the submissions in the last paragraph, when dealing with the inventive concept. In my judgment those submissions are flawed because they focus on a sub-group of the claimed invention, rather than the claim as a whole.

144. A recurring theme in Samsung's submissions was that the claimed combination must be of value because, as the finding of infringement shows, it was adopted by UMTS. However, the factual circumstances surrounding the incorporation of the claimed combination into the patent and the UMTS standard respectively were not addressed in evidence. As Apple pointed out, it was not even established which came first. The way in which the claimed combination had to be severed from surrounding aspects of the scheme appearing in the priority documents is certainly not supportive of any suggestion that Samsung had it clearly in mind before it was adopted by the standard.

145. In my judgment Apple are correct that the claim is to a class of configurations which do not have any common technical benefit. It is obvious on the *Agrevo* basis as well.

Insufficiency and added matter

146. Although allegations of insufficiency and added matter were pleaded, these closely followed the attacks based on obviousness and loss of priority. Nothing is to be gained by revisiting the evidence under these headings.

Conclusions

147. My overall conclusions are that the 404 patent as proposed to be amended is invalid both because it has lost priority and is accordingly rendered invalid by intervening prior art (on the basis of Samsung's concession) and because it is, in any event,

obvious. If it had survived these attacks, it would have been infringed by Apple's accused, HSUPA enabled devices.