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Case Nos: HC 08C02525 and HC 08C03143

IN THE HIGH COURT OF JUSTICE
CHANCERY DIVISION
PATENTS COURT

Royal Courts of Justice
Strand, London, WC2A 2LL

Date: 18/01/2010

Before :

THE HON MR JUSTICE FLOYD

- -

Between :

NOKIA GMBH	**Claimant**
- and -	
IPCOM GMBH & CO. KG	**Defendant**
and between:	
IPCOM GMBH & CO. KG	**Claimant**
- and -	
(1) NOKIA UK LIMITED (2) NOKIA OYJ (NOKIA CORPORATION)	**Defendants**

Richard Meade QC and **James Abrahams** (instructed by **Bird & Bird LLP**) for **Nokia GmbH, Nokia UK Limited and Nokia Oyj**

Daniel Alexander QC and **Brian Nicholson** (instructed by **Bristows**) for **IPCom GmbH & Co. KG.**

Hearing dates: November 19-20, 23-27, 30 and December 1-3.

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Judgment

Mr Justice Floyd :

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Introduction

1. These proceedings concern two patents in the name of IPCom GmbH and Co KG ("IPCom"). IPCom sues Nokia UK Limited and Nokia Oyj (Nokia Corporation) for infringement of both patents. The proceedings are part of a larger battle between the parties. Licensing and infringement litigation commenced in Germany between a Nokia company and IPCom when licensing negotiations between the companies broke down. There is no need to distinguish between the various Nokia companies involved in these proceedings. I will refer to them collectively as "Nokia".

2. Part of Nokia's response to the German action was to commence revocation actions in this country against some 15 IPCom patents. IPCom has countered with infringement proceedings here as well. This is the judgment following a trial of the issues of infringement, validity and "essentiality" only of these two patents. The hearing was treated as a conventional infringement action, with IPCom opening the case and calling its evidence first, although the evidence of both sides on the first patent was called before the evidence of both sides on the second. Further trials relating to infringement and validity of other patents are planned over the course of this year. They will be followed by a trial of licensing issues at a date yet further in the future.

3. The two patents relate to cellular mobile phone technology. Broadly speaking, the first of the patents, European Patent (UK) No. 540 808 ("808"), is concerned with the way in which the mobile phone synchronises itself with the transmissions it receives from the base station. The second of the patents, European Patent (UK) No. 1 186 189 ("189"), is concerned with management of the right of the mobile phone to connect to the network.

4. Nokia manufacture a large range of mobile phones. IPCom's original allegation of infringement was a fairly comprehensive one, but at an earlier case management hearing I gave directions to enable the issues to come to trial based on a representative phone or phones. IPCom alleges that the Nokia 6300 phone infringes the 808 patent and that the Nokia N96 phone infringes 189. Nokia say that both the patents are invalid.

5. Mr Daniel Alexander QC and Mr Brian Nicholson appeared for IPCom. Mr Richard Meade QC and Mr James Abrahams appeared for Nokia.

Expert Witnesses

6. Each side called one expert on each patent. Although Nokia served some factual evidence to establish publication of certain matters, no factual witnesses, in the end, needed to be called.

7. Nokia called Professor Eizenhöfer (808) and Dr Cooper (189). IPCom called Mr Gould (808) and Professor Darwazeh (189).

8. Professor Dr Alfons Eizenhöfer is a Professor at the University of Applied Science in Nürnberg, carrying out research and lecturing in mobile communications and data communication networks. Prior to that, he worked in industry at Philips Kommunikationsindustrie in Nürnberg on projects including development of pre-GSM trial systems, and also contributed to various GSM work groups.

9. I have previously described Professor Eizenhöfer as an impressive witness (*Qualcomm v Nokia* [2008] EWHC 229 at [18]), but I endeavoured to approach his evidence in this case with an open mind. Mr Alexander submitted that I should qualify my conclusion in *Qualcomm* by saying that, in this case, he came over as an experienced expert witness making things sound a bit harder when the issue was insufficiency and a bit easier when the issue was obviousness. He also submitted that he was more heavily involved in standardisation than would be appropriate for the notional average skilled person, and that, as a patentee on a number of telecoms patents, he must be regarded as more inventive than such a person.

10. I think that to some extent Professor Eizenhöfer's written evidence may have overstated the case on insufficiency a little: but in cross examination he was ready to accept where this was so. It is right to point out that he is probably marginally more skilled than the notional addressee in terms of the standards and possibly generally. I have taken that into account in assessing his evidence, which is all Mr Alexander invited me to do.

11. Dr David Cooper is, and has been since 2006, a partner of Hillebrand and Partners (who specialise, among other things, in providing evidence for patent cases and with which Professor Eizenhöfer has also been connected). He has previously worked at a number of firms in the mobile telecommunications field, including NEC.

12. Mr Alexander submitted that Dr Cooper had become a "Nokia man". He had been doing nothing but work on Nokia patent cases for the last two years. He submitted that he had worked too closely with Nokia's lawyers in the preparation of his report, allowing them, for example, to prepare claim charts. One of the claim charts prepared in relation to a publication no longer relied on by Nokia, NTT, had proceeded on a highly tendentious, to say the least, interpretation of the document. He said that Dr Cooper's evidence could not be regarded as his evidence alone insofar as it dealt with the disclosure of the prior art. He referred me to the decision of the United States District Court for the Northern District of California in *Intermedics v Ventritex* 139 FRD 384 (N. D.Cal 1991), a case in which the Court was being asked to make an order for disclosure of communications between lawyers and expert witness, for the proposition that the court is entitled to know who it is who is giving the evidence.

13. I think it is fair to say that Dr Cooper's evidence did on occasion seek to squeeze out of the disclosure of the prior art rather more than was there. The NTT evidence is the main example. I do not think that the conclusion he reached about that document was a fair one, and I am inclined to think it was arrived at either through suggestion by lawyers, or by Dr Cooper becoming too much of a lawyer himself – it does not matter which. Moreover he clung rather unattractively to the position he had adopted, rather than recognise it was wrong. I should bear that incident in mind when assessing his evidence. But I am very far from being satisfied that I should discount his evidence altogether. Indeed, Mr Alexander did not invite me to do this. On at least one issue he invited me to prefer Dr Cooper's evidence to that of his own expert which was, on

that point, adverse to IPCom. Dr Cooper brought a great deal of relevant experience into the witness box, and I did find his evidence helpful overall.

14. Mr Peter Gould is currently the Consulting Services Director of Multiple Access Communications Limited, a mobile telephony consulting and product development company. At the priority date of the Synchronisation Patent he was engaged in the development of a quadrature amplitude modulation (QAM) system, including the synchronisation aspects. He is also the co-author of a book with the enticing title 'GSM, cdmaOne and 3G Systems' (Wiley 2006).

15. Mr Meade pointed out that Mr Gould cannot be said to have been immersed in the field at the priority date. He only took his degree in 1991, and the only experience of GSM he could point to was that a background paper on GSM (the paper by Hodges referred to in the 808 patent) had formed part of his course notes. He had no practical experience with GSM either then or subsequently.

16. Mr Gould was quick to recognise the limitations to which Mr Meade drew attention. Nevertheless, I thought that Mr Gould gave his evidence extremely fairly within those limitations. He demonstrated more than once in the witness box that he held an open mind on the issues under discussion, making concessions where appropriate to do so. Occasionally I felt he was not in a much better position than me to form the assessment, but this was the exception. He has obviously acquired a deep theoretical understanding of the subject since the priority date.

17. Professor Izzat Darwazeh is Professor of Communications Engineering at University College London. Prior to this he was at UMIST. He has extensive experience of the telecommunications industry, including having worked for Nokia. He impressed me as a highly intelligent and fair witness. Mr Meade castigated him for disputing that certain matters were common general knowledge in his report. This was unfair. The distinction between matters which are simply widely known and common general knowledge is not such an obvious distinction to a layperson. In any event he made his position clear in his oral evidence.

Technical Background

18. An unusually large amount of background is needed in order to approach the issues which arise in this case. It will be familiar to many who have experience of mobile telephone patent litigation. For that reason and in order to prevent the body of this judgment from becoming unreadable by reason of its length, I have relegated this material to a Technical Appendix. I am satisfied that the contents of the Technical Appendix would form part of the common general knowledge of the skilled team.

The 808 Patent

19. 808 is entitled "Synchronisation method for mobile telephone of GSM standard with beginning, normal and end synchronisation". It has a priority date of 2nd November 1991. It is common ground that the title would have been more consistent with the specification if it had ended "with initial, normal and lock-on synchronisation".

20. The disclosure of 808 is extremely sparse. The original German text (ignoring the claims) is concentrated into only 30 paragraphs spread over only 5 columns. The

drawings, many of which are inaccurate or trite, do not take the disclosure much further. The first claim, on the other hand, occupies almost all of a sixth column. With so little guidance from the specification, and with such a lengthy claim, it is hardly surprising that almost every expression in the claim was the subject of dispute. To describe the document as a recipe for protracted litigation would not, I am afraid, be unfair.

The 808 patent – disclosure

21. The specification starts (page 1 lines 4-9 of the translation) by saying that in the GSM system a relatively large amount of effort is required for synchronisation. After a cross reference to an article by Hodges, it states that the object of the invention is to specify a synchronisation method which satisfies all the relevant requirements with as little technical complexity as possible, an object which it claims is achieved by a method according to claim 1. This is said to be linked to the advantage that synchronisation can be achieved with high precision and relatively little effort. The description continues at page 1 lines 23 to 27 with a point (repeated later in relation to the specific embodiment at page 2 lines 24 to 27):

> "The method is particularly advantageous if the synchronisation is based on evaluation of the continuous phase angles which are in each case calculated from the individual I and Q value pairs. This allows the synchronous state to be reached very quickly."

22. IPCom's case is that these passages simply refer to the fact that GMSK is based on continuous phase angles, and does not exclude the possibility of maintaining operation with I and Q, at least so far as claim 1 is concerned. IPCom is correct, and the general statements about the invention are simply the obviously desirable goals: minimum complexity and high precision with little effort. There is nothing specific about how these goals are to be achieved, or about what caused the prior GSM system, if it did, to fail to achieve them.

23. Apart from the global statement of advantage and the point about using phase angles calculated from I and Q, the introduction does not focus on any particular aspect of the synchronisation. This leaves the reader without much of an idea about what the patentee considered to be the inventive concept. The specification then moves (at page 1 line 29) straight into the description of a specific embodiment. At page 2 line 16 it is pointed out that, in the context of GSM:

> "A distinction is drawn between three types of synchronization for the required synchronization of the mobile radio telephones.
>
> (1) Initial synchronization,
>
> (2) Normal operation synchronization,
>
> (3) Lock on synchronization during normal operation."

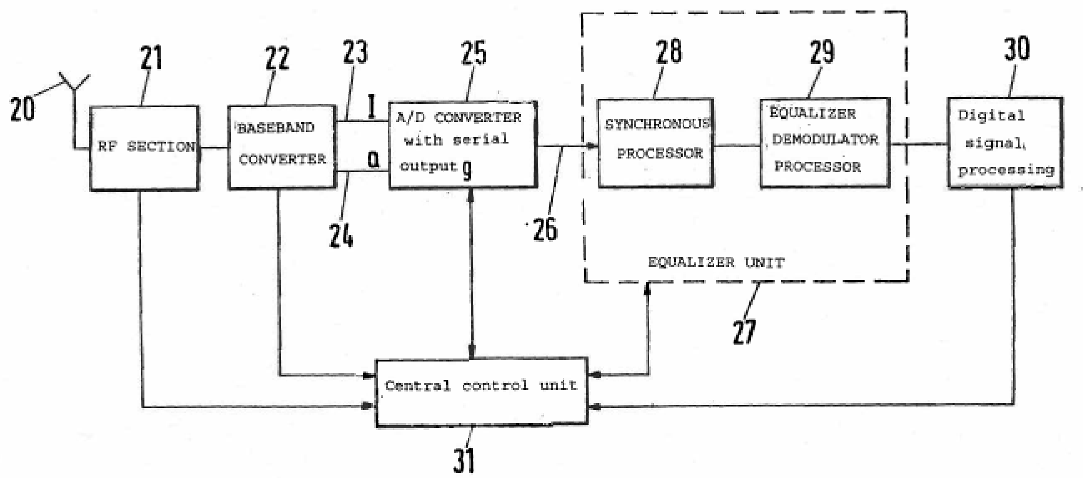
24. Before it turns to any aspect of any of these synchronisation stages, the specification launches into a description of some very general matters:

i) a summary of GMSK (page 2 lines 27 to 32);

ii) a TDMA frame, rather misleadingly described (page 2 lines 33 to 35) by reference to figure 1 by omitting various parts of the frequency correction and synchronisation bursts,

iii) "the basic design of the reception path of a mobile radio telephone" described from page 2 line 36 to page 3 line 32, by reference to figure 2. This is reproduced below. Of especial note is the dotted line 27 labelled "equalizer unit". This surrounds something called the "synchronous processor" 28 (which it is common ground is a misnomer – the skilled person would understand it is the processor in which some aspect of synchronisation takes place) and the "equalizer demodulator processor" 29. A connection is indicated between the "central control unit" and the "equalizer unit", although it is not specific as to precisely where, within that, it goes.

Fig.2



iv) The specification again emphasises (now for the third time at page 3 line 24 to 26) that all processing subsequent to the analogue to digital converter is based on the processing of phase angles calculated from the I and Q components.

25. The specification then goes on to discuss the three types of synchronisation: initial, normal and lock-on.

Disclosure about initial synchronisation

26. The disclosure about initial synchronisation extends from page 3 line 33 to page 6 line 11. This is said to comprise four steps:

> "(1. 1) coarse frequency synchronization,
>
> (1. 2) coarse frame synchronization,
>
> (1. 3) fine frequency synchronization,
>
> (1.4) fine frame synchronization."

27. Each of these steps is then described in some more detail. Step (1.1), coarse frequency synchronisation, which is required to be "burst-independent", is the subject of an insufficiency attack. I will return to the disclosure relating to this step in its context. I should simply note at this stage that the specification makes it clear that one does not always have to perform the coarse frequency step, a fact which has a bearing on one of the many arguments on construction. There is no disclosure of any practical step which is taken to determine whether the coarse frequency step should be undertaken. The specification only states:

> "If the accuracy of the carrier frequencies is adequate, it is possible to dispense with the burst – independent coarse frequency determination; the synchronization steps described in 1.2, 1.3 and 1.4 are then sufficient for the initial synchronization."

28. Whilst step 1.1. is therefore, at least to some degree optional, steps 1.2 to 1.4 are all accepted to be old or obvious in the light of the GSM Recommendations. I will pick up relevant parts of the disclosure on these when dealing with construction, as Nokia have non-infringement points based upon them.

Disclosure about normal synchronisation

29. Normal operation synchronisation is said to take place in two steps:

> "2.1 frame synchronization with fine synchronization
>
> 2.2 data signal pre-processing
>
> Error-free decoding is ensured by continuously monitoring and maintaining frame and frequency synchronism by evaluating the training sequence within the normal burst 14 (Figure 1). In this case, the frame offset is determined first of all. The determined value (clock offset) is a parameter required to mark the pattern sequence within the data set with bit accuracy. This is a precondition for the subsequent correct correlation calculation to determine the present frequency offset.
>
> <u>Data preprocessing (2.2)</u>
>
> A frequency correction value determined from the present frequency measurements by the central control unit 31 is supplied to the synchronous processor 28. This results in the data being preprocessed, as a result of which the decoder certainty is improved, since the equalizer is supplied with the present data with the frequency already corrected. Data signal preprocessing allows the limitation of error-free decoding for frequency offsets of more than 200 Hz, which could be caused by the Doppler effect and the oscillator, to be completely eliminated."

30. It is common ground that the headline of step 2.1 should read "frame synchronization with fine *frequency* synchronization". It is also common ground that the skilled reader would realise that the term "correlation" is inappropriate terminology for the calculation of the frequency offset in step 2.1. The important point about the disclosure of step 2.1 is that the patentee is telling the reader to use the training sequence within the normal burst for this purpose. This is the subject of claim 9.

31. The text I have set out above (read in conjunction with the block diagram of the receiver of figure 2) is the totality of the description in the patent about data pre-processing, step 2.2. Nevertheless the reader learns that the pre-processing is concerned with errors that arise because of the Doppler effect and because of the oscillator. The skilled person would understand that these are both long and short term effects.

Disclosure about lock-on synchronisation

32. Lock-on synchronisation is said to mean "synchronization of a mobile radio telephone to surrounding adjacent cells during normal operation" and occurs in two steps:

> "3.1 coarse frame synchronization
>
> 3.2 fine frame synchronization with fine frequency synchronization"

33. As to the detail, one finds this at page 7 line 35:

> "..during normal operation, coarse frame synchronization (frequency burst start) and fine frame synchronization together with fine frequency synchronization are carried out as a background process for lock-on synchronization…"

34. The specification explains that the algorithms for this purpose correspond in principle to those in the earlier steps. At page 7 lines 26 to 32 the specification explains with less than model clarity:

> "… the synchronization parameters required for going beyond the cell boundary (frame and frequency offset) for the surrounding adjacent cells are determined as a background process during normal operation – lock-on synchronization (process with a relatively low priority). The control unit 31 thus ensures that a connection is maintained when going beyond a cell boundary."

The claims in issue

35. The claims follow the various steps described for each of the three aspects of synchronisation very closely. I set out the relevant ones below:

> <u>Claim 1</u>
>
> "Synchronization method for mobile radio telephones in a cellular, digital mobile radio telephone network, which

comprises a plurality of fixed stations and mobile radio telephones and operates with the GSM method, characterized in that, in the mobile radio telephone,

(1) initial synchronization which is used to set up a connection between a mobile radio telephone and a fixed station,

(2) normal operation synchronization, and

(3) lock-on synchronization, that is to say synchronization of a mobile radio telephone to an adjacent cell during normal operation, are carried out in a manner

in which the initial synchronization is split into the following steps:

(1.1) coarse frequency synchronization at least if the accuracy of the carrier frequencies is not adequate, in which case the coarse frequency synchronization operates independently of bursts and determines whether the frequency of the determined carrier is within a tolerance band,

(1.2) coarse frame synchronization by approximate detection of the start of a frame with the aid of the identification of the start of a frequency correction burst

(1.3) fine frequency synchronization by phase differencing with regard to a frequency correction burst

(1.4) fine frame synchronization, that is to say bit-accuracy frame synchronization,

the normal operation synchronization is split into the following steps:

(2.1) frame synchronization with fine frequency synchronization,

(2.2) frequency-correcting data signal preprocessing using a frequency correction value which is determined from up-to-date frequency measurements

and the lock-on synchronization comprises

(3.1) coarse frame synchronization and

> (3.2) fine frame synchronization with fine frequency synchronization."
>
> Claim 9
>
> "Synchronization method according to one of Claims 1 to 6, characterized in that the normal operation synchronization is carried out by identifying and evaluating the training sequence within the normal burst"
>
> Claim 11
>
> "Synchronization method according to one of Claims 1 to 10, characterized in that the lock-on synchronization is carried out to surrounding adjacent cells during normal operation by means of coarse frame synchronization and in that, after this, fine frame synchronization is carried out with fine frequency synchronization by identifying and evaluating the synchronization burst."

The skilled addressee and common general knowledge

36. I deal with both patents here. The 808 and 189 patents are both addressed to an engineer or team of engineers who are concerned with developing mobile phones for use in the GSM system, and in particular the functionality required to cause the mobile phone to synchronize to the network.

37. It is clear that the skilled addressee for the purposes of considering the objection of insufficiency must have the same level of skill as the skilled addressee for the purposes of considering the objection of obviousness. I think the specification in the 808 case assumes a very high level of skill in its reader, as it leaves almost all implementation details for the reader to work out for himself. That is an assumption which was borne out by the evidence. Those working on the GSM project and its implementation were engineers of the highest calibre.

38. There is no dispute that the skilled addressee would have available the latest GSM recommendations. These are very extensive documents, and no skilled team could be expected to have or keep even a tiny fraction of their contents in its collective head. But the skilled team would know where to find information relevant to the task in hand in the various recommendations.

39. The skilled person would understand the technical concepts described in the Technical Appendix.

Construction

Approach to construction

40. 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 (as he then was) in *Halliburton v Smith* [2006] RPC 2; [2005] EWHC 1623 at [68] to [69] listed those modified principles.

41. Where a patentee has used general language in a claim, but has described the invention by reference to a specific embodiment, it is not normally legitimate to write limitations into the claim corresponding to details of the specific embodiment, if the patentee has chosen not to do so. The specific embodiments are merely examples of what is claimed as the invention, and are often expressly, although superfluously, stated not to be "limiting". There is no general principle which requires the court to assume that the patentee intended to claim the most sophisticated embodiment of the invention. The skilled person understands that, in the claim, the patentee is stating the limits of the monopoly which it claims, not seeking to describe every detail of the manifold ways in which the invention may be put into effect.

An entire scheme?

42. Nokia contends that claim 1 of 808 defines an entire scheme for synchronisation. In other words, the claim does not allow steps which are not specified to be interposed between the prescribed steps for each stage of synchronisation. They draw attention to the fact that, in describing the stages of initial and normal synchronisation, the claim states that the stage is "split into" a number of steps, rather than saying that the stage "comprises" those steps. "Comprise" is patent attorney's code for saying that the claim allows for other things; "split into" suggests they are part of a whole into which nothing else is admitted.

43. Nokia also submit that the whole tenor of the specification suggests that it is contemplating a complete scheme. They draw attention to the advantages advanced by the specification which I have summarised above. IPCom contends that other techniques can be used.

44. In my judgment the claim would not be read as excluding other steps. I think it unlikely that the skilled reader would attach much importance to the patentee's use of "split into" as opposed to "comprise". For example the claim says that lock-on synchronisation "comprises" the two steps, but I cannot accept that a distinction would have been intended. Further, the advantages attained are those which *may be* attained by the use of the invention, but there is nothing to suggest that other steps may not be used. It would be odd, to say the least, if infringement could be avoided by the use of some additional step.

order of steps

45. Nokia contends that the claim requires that the steps be performed in the order specified in the claim, in the sense that no step should begin until the end of the previous one. They rely, again, on the use of the word "split", this time as indicating that the steps are separated in time. IPCom submits that there is nothing to suggest that the claim should be read with that degree of strictness. I accept IPCom's

submission on this. The claim simply requires each of the steps to be performed, but is not concerned with precisely when they start and finish.

"operates with the GSM method"

46. The method must be one "for mobile[s] in a … network" which (i.e. which network) "operates with the GSM method". The issue of construction arises because infringement of 808 is only alleged when the Nokia phone is operating in EDGE (Enhanced Data rates for GSM Evolution) mode, which, whatever else it is, is not GSM as it stood at the date of the patent.

47. The skilled person would clearly understand that the claim was not limited to GSM frozen in time. GSM could and probably would develop. But the skilled person would also understand that some aspects of the way in which the network operates are assumed in the 808 patent. Examples are the presence of training sequences in the normal and synchronisation bursts. Another example is that it is assumed that the network uses a modulation system for which it is possible to create a tolerance band of the kind used for coarse frequency synchronisation. GMSK meets this description. But if GSM were so fundamentally altered that it did not use a modulation system which could be treated in that way, I think the skilled person would regard it as being outside the meaning of GSM for the purposes of the patent. I will consider the extent to which EDGE meets that requirement under "infringement" below.

optional coarse frequency synchronisation: 1.1

48. The coarse frequency synchronisation step forming part of initial synchronisation is expressly stated to be required:

> "at least if the accuracy of the carrier frequencies is not adequate".

49. In context, "adequate" must mean "adequate to perform the next step".

50. IPCom contends that this feature means that the claim can be considered as notionally split into two parts: one part where the accuracy of the carrier frequencies is accurate enough and another part where it is not. Only in the latter case is the coarse frequency step a required claim integer. So if you have a local oscillator whose frequency is "adequate", then, although you may nevertheless do coarse frequency synchronisation if you wish, the claim does not require it. The step is therefore truly optional, and need only be performed for insufficiently accurate oscillators.

51. Nokia contends that the claim includes an implicit requirement which arises in all cases, namely that a check is performed by the mobile to determine whether coarse frequency synchronisation is necessary. They say that this is necessary, because an oscillator which is good enough at the time that the phone is built may not always be so. Frequency varies with ambient temperature and with age of the device. So a reader of the specification would understand that it was not enough to ensure that the oscillator was adequate at the design and manufacture stage. If the mobile is to operate the claimed method, it must have the ability to carry out coarse frequency synchronisation whenever the carrier frequency becomes insufficiently accurate. To

put it another way, Nokia contend that there must be implied into the claim a logical branch which asks whether the carrier frequency is within some acceptable band.

52. I was not referred to any authority on the implication of claim features. In the absence of authority I would hold, by analogy with the principles applied to the interpretation of contracts, that a term should not be implied into a patent claim unless it is necessary to do so. Thus for example it may be necessary to imply a feature to make technical sense of the claim.

53. I do not think that Nokia's implied test for adequacy is necessary to make technical sense of the claim, or otherwise a necessary implication. The option to include such a test was available to the draftsman, but results in a significant limitation of the claim. I see no reason why the draftsman should be presumed to have wanted to build in a test of this kind when the claim makes technical sense without it.

"start of a frequency correction burst" (1.2)

54. In the claim, the requirement is for:

> "approximate detection of the start of a frame with the aid of the identification of the start of a frequency correction burst".

55. The specification states that in relation to step 1.2:

> "In the next synchronization step, coarse frame determination … it is necessary to detect the approximate start of a frame. The frequency correction burst is used for this purpose."

56. The issue here is whether, literally, the start of the frequency correction burst has to be identified. Nokia submit that the words mean what they say. They suggest a reason: a method which satisfactorily identified the start of the burst would not have to continue reading to the end of the burst. This would satisfy the stated objective of obtaining synchronisation quickly.

57. IPCom submits that it is enough if the method inherently identifies the start of the frequency correction burst: it does not matter if the method is not specifically directed at finding it. The purpose of identifying the start of the frequency correction burst is to identify the start of the *frame*. So IPCom submits that, read purposively, the claim means "take the frequency correction burst to locate the start of the frame"

58. I prefer IPCom's submissions on this point. Once one has identified any point in the frequency correction burst, one has inherent knowledge of every point in it. It is a burst of regular and invariant length.

"phase differencing": 1.3

59. Fine frequency synchronisation must be done by "phase differencing with regard to a frequency correction burst".

60. The patent explains at page 5 lines 21 to 27 that

> "The frequency determination algorithm determines the present phase value from the I,Q sample value pair and forms the difference from the reference phase value calculated in parallel with it. Minimising the phase difference values by use of linear regression provides a measure that is proportional to the frequency offset."

61. The purpose of this step is to match the oscillator in the mobile to the oscillator frequency of the base station to within 0.1 ppm.

62. Nokia submit that this requires the use of phase angles. Processing I and Q values, even though these have the angle information included within them, is not enough. They rely on the various passages in the specification which appear to lay emphasis on using angles calculated from I and Q. They say that given the use of GMSK, every method of calculating the frequency offset must use the phase at some point. So, if phase differencing is not given this limited meaning, then the limitation has no effect at all.

63. IPCom submits that the passage on page 1 which I have quoted above relates to an advantage of dependent claims. Claim 2 calls for the evaluation of "continuous phase angles … calculated from the individual I and Q value pairs". This cannot therefore be a limitation of claim 1.

64. I have no doubt that IPCom is right about this. Claim 1 is intended to be more general. It includes a method in which the I and Q values are used, rather than being converted into angles.

"with" in step 2.1

65. Step 2.1 requires:

> "frame synchronization *with* fine frequency synchronization"

66. IPCom contends that this claim feature requires the use of the same burst (not simply the same type of burst) for both frame and frequency synchronisation. This requirement does not exclude averaging: but a common burst must be used for frame and frequency.

67. The specification describes this step at page 6 lines 24 to 30. It explains that frame and frequency synchronisation are obtained by evaluating the normal burst. The frame offset is determined first of all. This is said to be a precondition for the subsequent calculation to determine the present frequency offset. Thus, while the specification provides a basis for using the same type of burst (the normal burst) for the two operations, nothing is said about using the very same burst.

68. I am wholly unable to extract from the word "with" the technical significance which IPCom attaches to it. No doubt it is sensible, if one is using the same type of burst, to use the very same burst for both timing and frequency. But I see no reason why the skilled person would assume that the patentee wanted to *exclude* the use of adjacent bursts for example. Indeed there is nothing in claim 1 to indicate that even the same type of burst is required.

"frequency-correcting data pre-processing using a frequency correction value which is determined from up-to-date frequency measurements" (2.2)

69. I have set out the disclosure on this feature above. The disclosure is explained by reference to figure 2 which I have also reproduced. There are two separate disputes about this feature.

70. The first dispute concerns the meaning of "up-to-date frequency measurements". The specific embodiment speaks of "present" frequency measurements, and the equaliser being supplied with "present data with the frequency already corrected". I have no doubt that the two terms would be understood to have the same meaning. In fact, they are translations of the same German word "aktuelle".

71. IPCom submits that the requirement for "up-to-date" frequency measurements requires burst-wise correction and excludes the use of an average value based on the measurement of several bursts.

72. Nokia submit that the requirement should not be read so rigidly. It would be understood by the skilled person to mean "sufficiently close to the transmission time of the data to produce a useful correction".

73. I accept Nokia's submission on this issue. There is nothing to support IPCom's rigid view in the specification. The skilled person would understand that averaging was a sensible thing to do. Using an average value of several measurements for the purposes of adjusting the oscillator was accepted to be essential. I consider that it would require a clear technical explanation in the patent to indicate that the frequency measurement<u>s</u> (note the plural used in the specification and claims) taken for pre-processing should not be averaged. The terms "up-to-date" and "present" are simply not adequate for this purpose.

74. Secondly, IPCom submits that the data pre-processing must cause the frequency correction to be applied before the equaliser. They point to the fact that this is where the correction is applied in figure 2 and is so described in the specification. Nokia submit that the requirement for pre-processing allows the correction to be applied anywhere before the decoder, by which they mean the place where binary values are finally ascribed to the data.

75. I prefer Nokia's construction for the following reasons:

    i) IPCom's construction is simply an attempt to use the specific embodiment to limit the claim. This is not legitimate. The only restrictions imposed by the claim are that the frequency correction is properly regarded as pre-processing and that it uses up to date information.

    ii) The term "equaliser" does not itself have a clear meaning, as the experts agreed. So even if it were legitimate to read "before the equaliser" into claim 1, there would still be a question about what the term "equaliser" meant.

    iii) The skilled person would have no reason to think that the patentee was at all concerned about precisely where the correction was applied. Indeed this seems to be left deliberately vague in figure 2.

"lock-on synchronization" (3) and "frequency synchronization" (3.2)

76. I have set out the disclosure about lock-on above. The major dispute is whether the claim requires the local oscillator to be tuned to the new frequency, or whether it is enough to determine and store the necessary offsets, without adjusting the local oscillator.

77. Nokia submits that, consistently with the meaning of synchronisation in the other stages, the synchronisation for lock-on requires the local oscillator to be tuned to the new frequency. They say that this is supported by the cross reference to the algorithms used in those earlier synchronisation steps. They also rely on the fact that when the specification is referring to the intermediate step of determining the necessary offsets, it makes this clear. Nokia also submitted that it was perfectly rational to assume that the patentee wished to restrict itself to tuning the oscillator, as this would be a more secure means of reading the BSIC from the neighbouring base station.

78. IPCom submits that all that is required for lock-on synchronisation is that the mobile determines and stores the frame and frequency offsets as a background process in preparation for a smooth handover.

79. Whilst it is unusual for the same term to carry a different meaning at different points in the same claim, it is not impossible for this to occur. In the present case the different stages of synchronisation have a different purpose, and the specification and claims provide a different context. The passage which states that the frame and frequency synchronization "are carried out as a background process for lock-on synchronization" is important in this respect.

80. The specification does its best to make this point obscure, and it is tempting to visit the consequences on the patentee. But, on balance, I think the skilled person would realise from the purpose and context of lock-on synchronisation that to require the oscillator to be tuned while it remains on the serving cell is unnecessary, and might add complexity. Accordingly, the skilled person would understand that the claim did not require the oscillator to be tuned.

Validity of the 808 Patent

Insufficiency- law

81. A patent will be invalid if "the specification of the patent does not disclose the invention clearly enough and completely enough for it to be performed by a person skilled in the art": section 72(1)(c) of the Act.

82. What amounts to sufficient instruction? In *Mentor Corporation v Hollister Inc* [1993] RPC 7 at 13, the Court of Appeal (Lloyd, Stuart-Smith, Scott LJJ) said they could find "no vestige of error" in a statement of Aldous J. in the same case in the following terms:

> "The section requires the skilled man to be able to perform the invention, but does not lay down the limits as to the time and energy that the skilled man must spend seeking to perform the

> invention before it is insufficient. Clearly there must be a limit. The subsection, by using the words, clearly enough and completely enough, contemplates that patent specifications need not set out every detail necessary for performance, but can leave the skilled man to use his skill to perform the invention. In so doing he must seek success. He should not be required to carry out any prolonged research, enquiry or experiment. He may need to carry out the ordinary methods of trial and error, which involve no inventive step and generally are necessary in applying the particular discovery to produce a practical result. In each case it is a question of fact, depending on the nature of the invention, as to whether the steps needed to perform the invention are ordinary steps of trial and error which a skilled man would realise would be necessary and normal in order to produce a practical result."

83. The specification must enable the performance of the invention across the entire scope of the claim see *Biogen v Medeva* [1997] RPC 1. This principle is important in the present case, because Mr Alexander advanced an argument along the following lines: if the skilled person found that the coarse frequency step (1.1) did not work, then there would in practice be no difficulty, because, at the relevant date, it would have been possible to obtain an oscillator of sufficient accuracy to avoid the need for coarse frequency synchronisation at all.

84. I have no hesitation in rejecting that argument. It is not permissible in law expressly to claim product features or process steps which are not enabled. In the present case step 1.1 forms a distinct part of the monopoly claimed. The claim can be thought of as split notionally into two parts: one where the coarse frequency step is not needed and the other where it is. If the part where coarse frequency synchronisation is needed is not enabled, the claim will be insufficient.

Insufficiency - facts

85. Nokia attacks the coarse frequency synchronisation step 1.1 as being insufficiently taught by the specification. The Grounds of Invalidity are as follows:

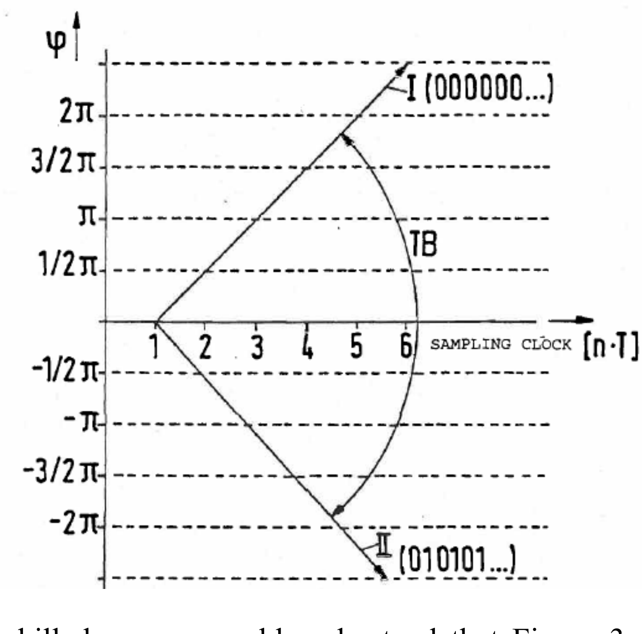
> "The description of step 1.1 (coarse frequency synchronisation) does not identify sufficiently or at all: (i) how it is determined whether or not the frequency of the determined carrier is within or outside a tolerance band; (ii) how an initial estimate of the frequency is derived; (iii) how the results of (i) or (ii) are used to synchronise the receiver sufficiently to carry out the subsequent steps claimed; (iv) how the tolerance band is varied if the band is constrained for any given datastream, including how such a constraint of the band is identified or determined and how such a varied tolerance band is used to synchronise the receiver sufficiently to carry out the subsequent steps claimed; (v) how phase unwrapping can be implemented for large frequency offsets in the presence of interference and noise or at the boundaries between bursts."

86. The disclosure of the 808 patent about coarse frequency synchronisation is as follows.

> "Coarse frequency determination is carried out independently of bursts and, once a carrier frequency has been found, can thus be used by the radio-frequency reception section 21 to make an initial estimate of the frequency. The result provides information on whether the frequency of the determined carrier is within or outside a tolerance band TB, see Figure 3. The maximum tolerance band is governed by the absolute phase profile, resulting from a permanent binary sequence I of the logic value 0 on the one hand and from an alternating binary sequence II of the logic values 0 and 1 within a fixed measurement time. The tolerance band is variable, as a result of which the accuracy of the frequency estimate increases if the band is constrained for any given data stream; see Figure 3. If the accuracy of the carrier frequencies is adequate, it is possible to dispense with the burst – independent coarse frequency determination; the synchronization steps described in 1.2, 1.3 and 1.4 are then sufficient for the initial synchronization."

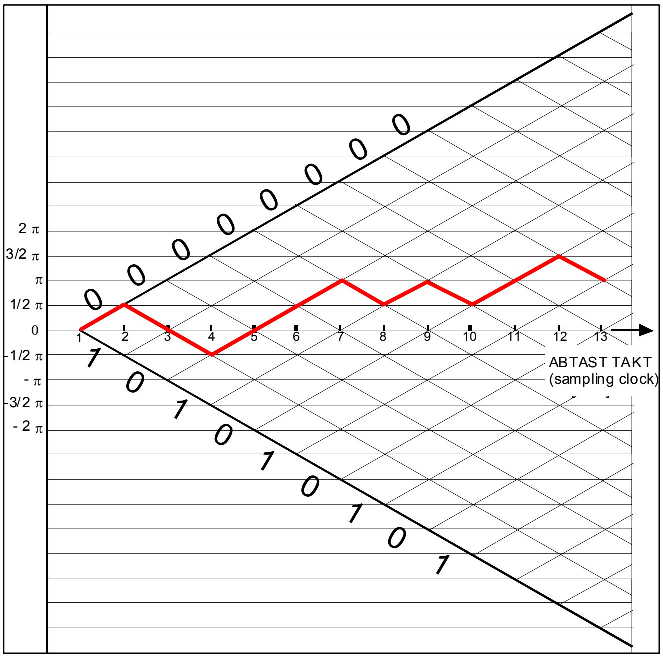
87. Figure 3 looks like this:

Fig.3

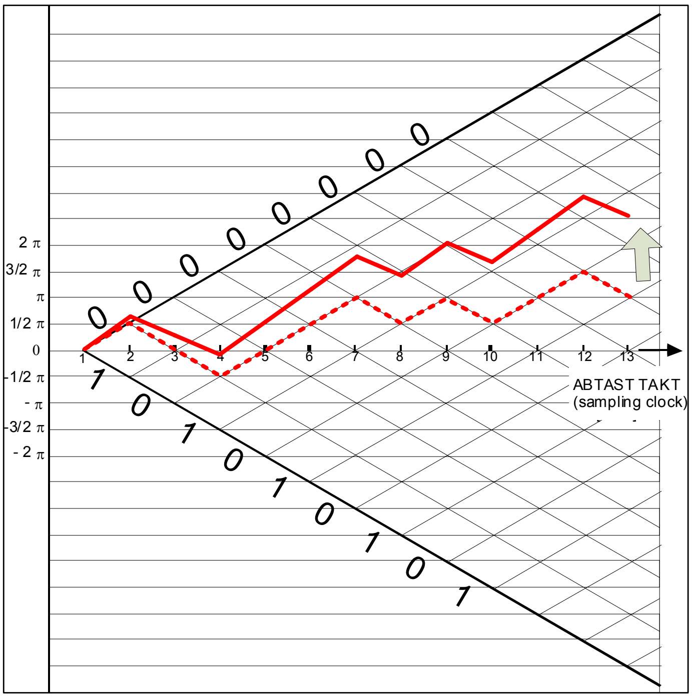


88. The skilled person would understand that Figure 3 measures the continuous phase angle against time. If the local oscillator were perfectly synchronised, the phase measurement could not move outside the tolerance band marked TB on the graph. This is because the maximum phase change per unit time in GMSK is +/- π/2 or 90°.

89. The phase actually measured should therefore follow a path within the limits of the tolerance band. Professor Eizenhöfer showed how a sequence of data bits 1,0,1,1,1,1,0,0,1,1,1,0 would appear represented by a red line on such a phase trellis:

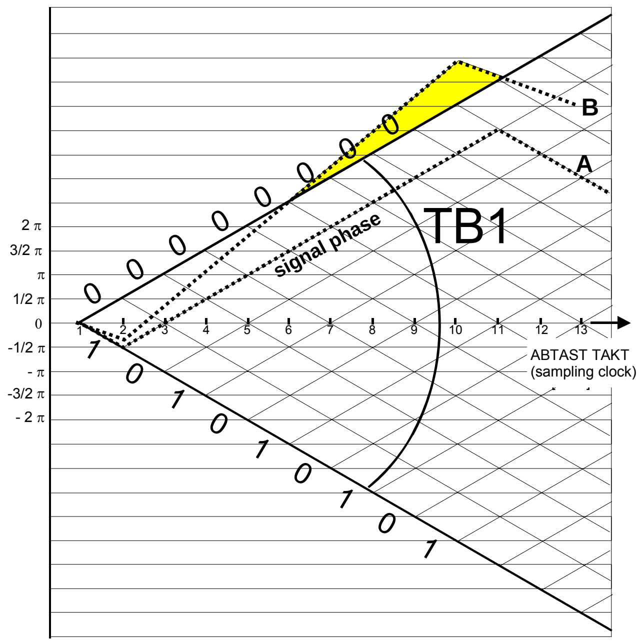


90. Where there is a frequency offset between the local oscillator and the carrier frequency, the phase will precess by an amount at each unit of time. The overall effect is to cause the phase trace to be offset by an increasing amount. This is represented by Professor Eizenhöfer as follows:



.

91. The phase trajectory may stray outside the tolerance band. The skilled person would have in mind something like Professor Eizenhöfer's third diagram below as representing this case.



92. The line marked B has strayed outside the tolerance band. This, as Mr Meade described it, acts as an alarm to the system that the phase of its oscillator requires to be retuned.

93. Thus far no difficulties arise. The parties are agreed that the skilled team would be able to devise a system in which the tolerance band was used to determine whether the phase was too high or too low. The difficulty comes when one considers what the skilled person is supposed to do next. If the "true" phase trajectory were one which followed the lower limit of the tolerance band, a phase trajectory which just failed to cross the upper limit could be wrong by as much as 135kHz and not be detected. That analysis, of course takes the most extreme case. It is reasonable to assume that data in reality would tend to be closer to the horizontal axis. But even then the frequency error could be as much as half of that amount, or 67.25 kHz.

94. In order to have the ability to move straight on to step 1.2, the evidence established that one would need a frequency error of less than 40kHz. But the tolerance band method could not, without modification, reliably detect errors of this magnitude.

95. The second problem is that where an error is detected, the method gives no idea of the magnitude of the error.

96. The third problem is that caused by phase unwrapping. If the error exceeds 135 kHz, then the phase change per bit will exceed 180^o and it becomes very difficult to obtain the continuous phase angles.

97. IPCom's main answer to these problems was provided by Mr Gould in his oral evidence in chief. He said that it would be possible by the use of a scanning technique, to scan for the frequency correction burst.

> "In Mr. Meade's opening I think he implied that there was common ground in terms of I accepted that you needed a frequency error of less than or equal to 40 kHz in order to perform a frequency correction burst search. That is not my

> opinion. My opinion is that if you can devise a scheme to find a frequency correction burst with this 30 or 40 kHz window, it is a trivial exercise to simply -- if you know your error on your frequency correction burst is potentially larger, it is a trivial exercise to simply tune the oscillator by a small amount and search over a larger window. The penalty you pay in that respect is obviously time. If you can find it first go, then obviously you will do it more quickly. But if you need to tune around, then you pay a time penalty. It is almost like if you take a digital radio, you push the button for Radio 4 and you go straight there. If you have got an old analogue one, you would tune around where you expected Radio 4 to be and if you got to Radio 1 or Radio 3 you would have known that you had missed it. So I do not accept this 40 kHz limitation on step 1.2."

98. Professor Eizenhöfer did not really quarrel with this technical proposition. Moreover he recognised that bringing the frequency within the tolerance band produced some benefit, even if it did not enable recognition of the frequency correction burst in one go.

99. Mr Meade summarised his submissions about scanning as follows:

i) if some further step dependent on bursts were necessary to allow the mobile to read the frequency correction burst, then coarse frequency synchronisation (which has to be independent of bursts) had not been achieved;

ii) there is no teaching of scanning in the patent, and scanning would not be common general knowledge

iii) the addition of such a further step is contrary to the whole teaching of the 808 patent that synchronisation is achieved quickly and with relatively little effort; indeed on Nokia's view of construction it is outside the claim altogether;

iv) the fact that some further step is necessary is tantamount to an admission that it was not possible to achieve coarse frequency synchronisation.

100. Mr Meade also reminded me that I need to look at insufficiency in the round. Other routes suggested by IPCom, such as constraining the tolerance band to a lower figure, also presented difficulties which were not adequately resolved by the Patent.

101. In the end I was not persuaded that these difficulties with the coarse frequency step rendered the patent insufficient. The coarse frequency step, even if it can only constrain the frequency to within the tolerance band shown in figure 3, does provide some benefit. The next step, coarse frame synchronisation, involves evaluation of the frequency correction burst. If it were not possible to find the FCB with the exercise of ordinary skill on the basis of the teaching of the patent, then there would be insuperable difficulties with sufficiency. But I accept Mr Gould's evidence that it would be trivial (and part of the skilled person's common general knowledge) to find the FCB using a simple scanning technique provided that the frequency error is kept within the tolerance band. So it does not matter that the step is not described in the

patent. Whether this is regarded as part of coarse frame synchronisation, or a separate intervening step does not seem to me to make any difference.

102. Nokia had a further point based on 8PSK. If a device which uses 8PSK is within the claims then, they submit, the evidence establishes that coarse frequency synchronisation will not work. For it to work it is necessary to assume that the phase difference per symbol cannot exceed 180^{o}. So if the claims are wide enough to include EDGE, they are insufficient.

103. Professor Eizenhöfer's evidence in his first report was as follows:

> "There is nothing to tell the skilled reader how to use a tolerance band when the phase changes per bit period could be as large as 337.5°. I do not see how this method could even begin to work in such a system. I cannot conceive what sort of tolerance band would be used for such a system, or how to begin to address the other issues that I have discussed above."

104. Mr Gould appeared to agree in his written reply evidence:

> "I agree with Professor Eizenhöfer … that Figure 3 of the Synchronisation Patent is based on the assumption that the modulation scheme is GMSK. EDGE uses two modulation schemes: GMSK and 8PSK. The tolerance bands shown in Figure 3 of the Synchronisation Patent do not apply to 8PSK. From the time of the deployment of EDGE, the skilled person would rely on a sufficiently accurate oscillator which, as Professor Eizenhöfer has indicated, had been widely available for some time."

105. This evidence of Mr Gould appeared to accept that the method would not work for 8PSK. However, in cross examination, Mr Gould, said that in using the patented method for 8PSK the skilled person would just assume that the phase changes were +/- 180 degrees, even though this would not be the case in fact.

106. On balance I think that the evidence shows that if a system is based exclusively on 8PSK it could not be made to work in the patented method. But to the extent that a system makes any use of GMSK or any modulation scheme in which the tolerance band is meaningful, the step has a value. As I consider that the claims are limited to such systems, the 8PSK point does not affect the validity of the claims.

Obviousness - law

107. It is convenient to address the question of obviousness by using the structured approach explained by the Court of Appeal in *Pozzoli v BDMO* [2007] EWCA Civ 588; [2007] FSR 37. This involves the following steps:

> "(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) Ask whether, when 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?"

In *Conor v Angiotech* [2007] UKHL 49; [2008] RPC 28 at [42] Lord Hoffmann approved the following statement by Kitchin J in *Generics (UK) Ltd v H Lundbeck A/S* [2007] RPC 32 at [72]:

> "The question of obviousness must be considered on the facts of each case. The court must consider the weight to be attached to any particular factor in the light of all the relevant circumstances. These may include such matters as the motive to find a solution to the problem the patent addresses, the number and extent of the possible avenues of research, the effort involved in pursuing them and the expectation of success."

108. These principles were not in dispute. Nokia say that this is an unusual patent specification, in that the claim divides the invention into three separate compartments: initial, normal and lock-on synchronisation. They submit that this does not amount to a true combination: it is merely a juxtaposition of three methods which do not interact with one another, except to the extent that they are all required to be used in the same overarching method. I accept that submission on the facts of this case. IPCom made no real attempt to dispute it. In such a case it is legitimate to look at the separate parts and determine whether they were inventive. In *SABAF SpA v. MFI Furniture Centres Ltd* [2005] RPC 209 at [17] the House of Lords re-affirmed the statement of Lord Tomlin in *British Celanese Ltd v. Courtaulds Ltd* (1935) 52 RPC 171 at page 193:

> "a mere placing side by side of old integers so that each performs its own proper function independently of any of the others is not a patentable combination, but that where the old integers when placed together have some working inter-relation producing a new or improved result then there is patentable subject-matter in the idea of a working interrelation brought about by the collocation of the integers."

109. IPCom also reminded me of an aspect of the law of obviousness, given the heavy reliance which Nokia place on the common general knowledge. They reminded me about the points I made in *ratiopharm v Sandoz* [2008] EWHC 3070, [2009] RPC 11 at [155] – [159]. In summary the task for the court is:

i) The starting point for the attack must be established as common general knowledge;

ii) It is important to be precise about what it is that is said to be common general knowledge;

iii) It is important in the context of (i) and (ii) to remember that knowledge known to some only is not common general knowledge;

iv) Care needs to be taken to make sure the whole picture presented by the common general knowledge is presented;

v) The common general knowledge does not include matter which does not inform the skilled person's approach from the outset.

110. I have identified the skilled person and the common general knowledge above. The inventive concept of claim 1 is the collection of suggestions for the three types of synchronisation dealt with in the claim, as I have construed them. It is not possible to be more precise than that. Similarly with the subsidiary claims relied on.

The prior art

111. Nokia rely for their obviousness attacks on the following GSM Recommendations:

i) GSM 05.01 version 3.3.2: *Physical Layer on the Radio Path: General Description;*

ii) GSM 05.02 version 3.4.1: *Multiplexing and Multiple Access on the Radio Path;*

iii) GSM 05.08 version 3.1.0: *Radio Sub-System Link Control*;

iv) GSM 05.10 version 3.4.0: *Radio Sub-System Synchronisation*.

112. Nokia say that, at the very least, the relevant parts of these documents for the task in hand would form part of the common general knowledge of the skilled person.

113. Nokia also rely on the following:

i) European Patent Application No 0 454 266 entitled "*Receiver comprising a circuit for estimating frequency offset*" ("Baier");

ii) An article by D'Avella and others in IEEE Journal on Selected Areas in Communications, January 1989, entitled "An Adaptive MLSE Receiver for TDMA Digital Mobile Radio" ("D'Avella").

114. It is convenient to consider first the disclosure of the GSM recommendations and then see how far the skilled team would be carried if it was seeking to implement GSM with its common general knowledge.

The GSM recommendations

GSM 05.01

115. GSM 05.01 lays down many of the basic parameters of the radio path for GSM. At paragraph 5.2 it explains about time slots and bursts:

> "The time slot is a time interval of [approximately] 576.9 µs … and its physical content is called a burst. Four different types of bursts exist in the system. ...
>
> - normal burst (NB): this burst is used to carry information on traffic and control channels, except for RACH…
>
> -frequency correction burst (FB): this burst is used for frequency synchronization of the mobile….
>
> -synchronization burst (SB): this burst is used for time synchronization of the mobile. It contains a long training sequence and carries the information of the TDMA frame number (FN) and base station identity code (BSIC ...

116. GSM 05.01 cross-refers to other Recommendations, for example 05.10 for synchronisation aspects and 05.08 for re-selection of another base station.

GSM 05.02

117. GSM 05.02 explains that the Frequency correction channel (FCCH) carries information for frequency correction of the mobile station and that the synchronisation channel (SCH) carries information for frame synchronisation of the mobile and identification of a transceiver station. It also contains a more detailed definition of the contents of the bursts. In particular, at 5.2.3 there is a detailed definition of the normal burst, including the definition of its training sequence.

GSM 05.08

118. GSM 05.08 contains amongst other things, requirements for handover. Thus paragraph 7.2 is headed "Identification of adjacent BSs for handover measurements". It explains that it is necessary for the mobile to synchronise to and demodulate adjacent BCCH carriers and identify the Base Station identification Code (BSIC). The mobile is required to demodulate the SCH on the BCCH carrier of each adjacent cell and decode the BSIC as often as possible, and at a minimum once every 10 seconds.

119. GSM 05.08 also cross refers to other standards, including 05.10 for synchronisation.

GSM 05.10

120. This is the recommendation concerned with synchronisation. It explains in paragraph 1 that the Recommendation defines the requirements for synchronisation, but does not define the synchronisation algorithms to be used in the BS and MS. These are left to the manufacturer to specify.

121. Paragraph 2 says the following:

> "The BS sends signals on the BCCH to enable the MS to synchronise itself to the BS and if necessary correct its frequency standard to be in line with that of the BS. The signals sent by the BS for these purposes are
>
> (a) Frequency correction bursts
>
> (b) Synchronisation bursts"

122. Paragraph 5 requires the base station to use a single frequency source of absolute accuracy better than 0.05 ppm. Paragraph 6 sets out the requirements for MS synchronisation. It lays down the requirements for the MS to be allowed to transmit. The first two of these are:

> "6.1 The MS carrier frequency shall be accurate to within 0.1 ppm, or accurate to within 0.l ppm compared to signals received from the BS (these signals will have an apparent frequency error due to BS frequency error and Doppler shift). In the latter case the signals from the BS must be averaged over sufficient time that errors due to noise or interference are allowed for within the above 0.1 ppm figure. The MS shall use the same frequency source for both RF frequency generation and clocking the timebase.
>
> 6.2 The MS shall keep its internal timebase in line with that of signals received from the BS. If the MS determines that the timing difference exceeds 2µs, it shall adjust its timebase in steps of 1/4 bit period . This adjustment shall be performed at intervals of not less than 1 second and not greater than 2 seconds until the timing difference is less than 1/2 bit periods."

123. The Recommendation also requires the mobile to be ready to transmit within 120 ms of being given the handover command. A note at the end of this section provides that the MS shall keep the timings of the neighbour BS's that it is monitoring to an accuracy of +/- 1 bit periods.

Obviousness in the light of GSM

124. The obviousness attack is launched on the basis that the skilled team would combine at least the above extracts from the Recommendations if it was designing a synchronisation scheme for GSM. Mr Gould performed a pointless exercise in his evidence in chief of looking at each recommendation in isolation. But it emerged that this is something he was asked to do by the lawyers, and he readily accepted that in reality all these documents would be looked at together.

125. It also became apparent that anyone in the position of the skilled person, designing the synchronisation aspects of the GSM mobile phone, would either have the relevant aspects of the Recommendations in his or her head or rapidly acquire knowledge of them. They are fundamental to the task which the skilled person is taken to be undertaking, and would inform that task from the outset.

126. It is inherent in GSM that the MS will have to perform initial, normal and lock-on synchronisation of some kind, and it is convenient, and entirely legitimate, to consider these steps separately.

(1) Initial synchronisation

127. With the exception of the coarse frequency synchronisation step (1.1), it is common ground that, in implementing the GSM Recommendations, it would be obvious for the skilled person to adopt the initial synchronisation steps 1.2, 1.3 and 1.4. Given that step 1.1 is optional, there is no need to discuss these steps further for present purposes. There was no suggestion that, at the priority date, there would be any difficulty in obtaining an oscillator of sufficient accuracy.

(2) Normal synchronisation

128. The skilled team working on implementing the GSM Recommendations would first have achieved initial synchronisation. The GSM Recommendations require frequency synchronisation to within 0.1 ppm, which must amount to fine synchronisation. The question is how the skilled person would set about maintaining this fine synchronisation.

129. One method would be to revert to the synchronisation burst and frequency correction bursts. This is plainly obvious in the light of GSM: they are the bursts that are clearly recommended, at least for initial synchronisation. No doubt it is for this reason that IPCom also relies on claim 9, which requires use of the normal burst for both. This, IPCom submits, is not something which comes from the GSM Recommendations at all. The skilled team would think they should use the synchronisation and frequency correction bursts for both initial and normal synchronisation. IPCom's point is that, although the normal burst has a training sequence, that training sequence is intended for generating the channel impulse response. Its use for obtaining a frequency or timing offset is not obvious.

130. It is necessary therefore to have careful regard to the evidence on this topic as it forms an important part of IPCom's response to the obviousness attack.

Fine frame synchronisation

131. Professor Eizenhöfer saw it this way in his first report:

> "…. at least in connected mode, it would have been obvious in 1991 to use the Normal Bursts for maintaining synchronization. Normal burst traffic channels are being processed anyway to provide the voice connection. The timing of such Normal Bursts is being ascertained for the purposes of data detection from the training sequence and can be used for timebase adjustment also."

132. Mr Gould accepted the logic of this in cross-examination:

> "Q. Obviously decoding either the normal burst or the synchronisation burst requires maintaining timing

synchronisation and frequency synchronisation between the base station and the mobile phone.

A. In the broad sense, yes. I mean, there are degrees in the case of each of those synchronisation areas, but in the broad sense you would need to be both frequency and time synchronised.

Q. And by what common general knowledge means in 1991 did you envisage, for example, the ordinary skilled person getting adequate timing synchronisation between base station and the mobile for decoding normal bursts?

A. By using the channel estimate -- sorry, the training sequence to generate a channel estimate and known time when the training sequence passes through the channel.

Q. Right. We agree with you on that.

133. Professor Eizenhöfer was cross examined on this topic. The points put to him were:

i) the tool which was provided by GSM for obtaining the fine timing synchronisation was the synchronisation burst;

ii) the synchronisation burst has a longer training sequence, and it would be perceived by the skilled person as specially suited for obtaining fine frame synchronisation;

iii) there was adequate time for the mobile to use the synchronisation burst during the idle periods when it was not decoding the normal bursts;

iv) the skilled team would see no reason to obtain timing more frequently, or to obtain frame timing from every normal burst;

v) no documents describe the normal burst being used for frame synchronisation.

134. Professor Eizenhöfer maintained his position that it was obvious for the skilled person to maintain fine frame synchronisation using the normal burst. He considered that the skilled team would view the synchronisation burst as a compendious and accurate source of timing for obtaining all the information on timing required for initial synchronisation, which would require far more information than simply fine frame synchronisation. He considered that the skilled team could not fail to notice that, as the mobile was receiving and processing normal bursts with training sequences for the purpose of obtaining the channel impulse response for decoding purposes, these training sequences could also be used for maintaining fine frame synchronisation. Although the longer training sequence in the synchronisation burst would be more accurate, the normal burst was received more frequently. Though possible, it would have involved more work to check the synchronisation burst in the idle periods when the mobile would have other things to do.

135. It is correct that there is no clear reference in the literature to the use of the normal burst for fine frame synchronisation (as opposed to obtaining bit synchronisation

which is the identification of the received samples with the individual bits making up the transmitted burst within a timeslot). Professor Eizenhöfer clearly considered that it was too trivial a matter to call for mention.

136. This is a matter on which I have to be guided by the available evidence. I am satisfied by that evidence that it was obvious to use the normal burst for the purposes of maintaining fine frame synchronisation during normal operation. The forensic points made by IPCom found no support with the experts. As a practical matter it was entirely natural to use the normal burst for maintaining fine frame synchronisation during normal operation.

Fine frequency synchronisation

137. Professor Eizenhöfer's written evidence was that obtaining fine frequency synchronisation from the training sequence of the normal burst was also obvious. This case was put to Mr Gould in cross-examination:

> Q. By what method, using common general knowledge in 1991, did you think that the ordinary skilled person would get and maintain sufficient frequency synchronisation to decode the normal burst?
>
> A. I think there may be a number of techniques that could have been used. I think the convention or at least perhaps the techniques that had been used in the past on earlier systems would have been along the phase lock loop variety whereby you manipulate the signal in some way to produce spurs at particular known frequencies and then lock to those, potentially in the digital domain. So that would be one approach. You might call that a sort of frequency-centric approach. The other way to do it would be to look at the phase of the signal and use that as some guide as to what the frequency offset would be.
>
> Q. You regard both of those techniques as being common general knowledge. Can you just explain to what extent, if at all, those are done using the training sequence in the normal burst?
>
> A. I think the first one does not rely on a training sequence. The idea is that you can generate those spikes from general data. The second technique, it could use the known training sequence bits or it could manipulate the data in such a way that it could use the entire burst.
>
> Q. I see, but in any case you accept that it would have been included in the common general knowledge in 1991 to get and maintain frequency synchronisation using either the whole of the normal burst or the training sequence within it
>
> A. Yes."

138. Later he answered as follows:

> "Q. Let me put it to you this way. You accept obviously that normal bursts are being received and processed anyway.
>
> A. Yes.
>
> Q. You have agreed with me that the training sequence inside the normal burst is absolutely perfect for getting timing.
>
> A. Yes.
>
> Q. And is it not therefore the case that using the normal burst for normal synchronisation -- sorry, excuse me, for what the patent calls normal synchronisation -- is an extremely obvious way to go even if there are other options?
>
> A. Because of my kind of ambivalence on the subject, I probably would not use the word extremely.
>
> MR. JUSTICE FLOYD: Subject to that?
>
> A. I am willing to accept it is obvious. I do not really have a strong view one way or the other. I do not really want to have a big argument if it is obvious."

139. I conclude that it was also obvious to use the normal burst for maintaining fine frequency synchronisation during normal operation.

Using the same burst

140. Mr Gould also accepted that it was obvious to use the same burst for both frame and frequency synchronisation, once one had decided to use the normal burst for both. He answered as follows:

> "Q. Step away from the '808 patent all together for the moment. Put yourself in the position of the ordinary skilled person in 1991 armed only with their common general knowledge, no knowledge of the '808 patent at all, working on the issue of normal operation synchronisation. Assume with me for the moment that they have decided, do not worry about why for the moment, to use the normal burst type, both for fine frame and fine frequency synchronisation. I think it follows from your previous answers that they would definitely use the same burst in the sense that you have described it. "
>
> A. Yes, I think it would make sense to do that.
>
> Q. It would be positively odd to take a timing offset and then wait a few normal bursts ----
>
> A. I agree."

Data pre-processing

141. Because it forms a topic of its own and because it may involve consideration of the other citations, I deal with data pre-processing separately below.

(3) Lock-on synchronisation

142. There is no dispute that coarse frame synchronisation is required and obvious. Neighbour cells will not be in frame synchronisation, so the mobile's current information will not be sufficient to monitor anything from the neighbouring cell.

143. Fine frame synchronisation is also obvious, as Mr Gould accepted.

144. The real issue on this aspect of the claim is whether the skilled team would go further and effect fine frequency synchronisation, by determining and storing the frequency offset of the neighbouring cell for use in possible future handover.

145. Nokia contends that the additional step of obtaining the frequency offset is obvious in the light of common general knowledge. They also say it is obvious in the light of Baier (a point which I deal with below).

146. The factual background to the issue is not really in dispute. I set it out below.

i) When handover actually takes place, there is, as the skilled team would appreciate, only a limited time available to effect synchronisation: some four frames. Professor Eizenhöfer thought this "very tight", whilst Mr Gould said there was "no time to hang around".

ii) Base stations have very accurate oscillators which are designed to be in synchronism to 0.05 ppm. One view might be that it was not therefore necessary to obtain fine frequency synchronisation. Nevertheless the tolerances on two base stations, when added to the tolerance at the mobile, can add up to a maximum possible difference of 0.2 ppm.

iii) The mobile has to visit the neighbouring base station anyway as required by GSM to obtain the timing and the BSIC. There would be adequate time to obtain the frequency information as well within the available window.

147. Mr Gould accepted that the idea of storing the frequency offset in advance might occur to the skilled person if he thought that the window on handover was too tight. Professor Eizenhöfer thought that storing the offsets was an attractive and obvious thing to do, because he did think that the window would be very tight. He accepted that some people might not do it if they thought they could manage it in the handover window.

148. In my judgment the step of storing the frequency offset was a plainly obvious one. I think the skilled team would perceive the window available on handover as being tight, and would understand that it was prudent to prepare by storing the frequency offset at the same time as the timing offset is obtained.

149. A related point concerns claim 11, which requires that the synchronisation burst be used for both frequency and timing synchronisation during lock-on. I was satisfied

that this again must be an obvious choice. The mobile is required to read the synchronisation burst in order to obtain amongst other things the BSIC. Given that, it was obvious to use that burst for frequency as well. The point is analogous to the use of the normal burst for frequency and timing synchronisation when in normal mode.

Conclusion thus far

150. I have dealt with the differences between the GSM Recommendations and the inventive concepts of claims 1, 9 and 11 with the exception of data pre-processing. Subject to data pre-processing, which I have yet to deal with, I have held that everything in these claims, with that exception, would be obvious to the skilled person seeking to implement the recommendations.

151. There is nothing in GSM about data pre-processing. Nokia contend that it is obvious in the light of common general knowledge, Baier and D'Avella and it is legitimate to combine the net result of what is obvious in the light of GSM with data pre-processing from any of these sources.

Data pre-processing

Data pre-processing over common general knowledge alone

152. This heading encompasses two questions: (a) what was the common general knowledge of the skilled team about data-pre-processing and (b) what if anything was it obvious to do in the light of that in a GSM system?

153. Nokia contended that it was common general knowledge (a) that a frequency offset in the datastream was a bad thing, and (b) that where such a frequency offset was present there were common general knowledge ways of correcting it, such as mixing. In this respect they were supported by Professor Eizenhöfer. However Professor Eizenhöfer accepted in his report that whether this additional step would be undertaken would depend upon the capabilities of the remainder of the receiver design (and in particular the equalizer). This would be a design choice, almost certainly based on simulation results.

154. Mr Gould accepted that it was common general knowledge that a frequency offset in the data stream is deleterious. In a situation where the skilled person had a receiver which did not have adequate tolerance to deal with the frequency offset without help it would be obvious to fix the frequency offset prior to the equaliser.

155. I think it was established that the common general knowledge of the skilled person would include the fact that if there was a data offset in incoming data which was outside the tolerance of the receiver, then it was possible to take steps to correct the offset prior to the equaliser. Whether to do so in any individual instance was a design choice.

156. Mr Gould's position in relation to the obviousness of implementing data pre-processing in GSM was extremely tentative. The following extract from his cross-examination illustrates his position, which was largely the non-technical one that data pre-processing would not be discussed at GSM conferences if it was such an obvious thing to do:

"Q. So when the skilled person cracks down to the task of actually designing the routines and the components that he or she is going to use for the equaliser and decoder, and so on and so forth, he or she is not going to be able to avoid noticing that the offset is present in the data.

A. Yes.

Q. In those circumstances, he or she will have to consider whether that is going to cause a problem.

A. Yes.

Q. And if it is going to cause a problem, he or she is going to want to fix it.

A. In some way, yes.

Q. That can be done by a number of routine means ----

A. Yes.

Q. ---- including taking the offset out of the data.

A. I do not know if there is some implication in your word routine" there.

Q. "Obvious".

A. OK, that is what I am having difficulty agreeing to, just because, you know, the sorts of things people have been talking about in these conferences suggest that perhaps the obvious way of doing it was to design an adaptive equaliser that can actually tolerate a bigger frequency offset. This idea of correcting it before it goes into the equaliser, so it is clearly being talked about at these learned conferences, that is what I have difficulty with.

Q. Mr. Gould, can I ask you a broader question?

A. Yes.

Q. This seems to us, and it is Nokia's case, that this is a very trivial bit of engineering.

A. Yes. As I say, I have a really open mind on this. I am prepared to be convinced, but you are not convincing me. That is where I stand."

157. Professor Eizenhöfer's position was supported by four publications discussed in the evidence: Baier, D'Avella, Okanoue and Buné. It was not asserted that the publications themselves formed part of the common general knowledge, or that the

detailed methods proposed would be either. They are consistent with, and provide some modest support for the proposition that those involved with developing receivers for use in GSM were both aware of the problem of a frequency error in the data and of the need in some circumstances to correct it by some means.

158. Mr Gould's forensic point about the nature of the conferences at which these papers were delivered was not really an answer to Professor Eizenhöfer's technical evidence of obviousness. In any case the conference papers to which he referred were not about the broad idea of pre-processing: they were about more specific details. I accept that one obvious way of attempting to deal with the problem is to seek out a more tolerant receiver. But the skilled person would also know that the data could be corrected by pre-processing as in 808 and would know how to do so. In doing so the skilled team would use up to date information with averaging.

159. It follows that data signal pre-processing as claimed is an obvious step to take in the light of common general knowledge

Data pre-processing and Baier

160. Baier was published on 30th October 1991, three days before the priority date of the 808 patent. Baier was an inventor at Philips in Eindhoven. His patent application was published in German but references below are to the English translation. He starts at page 3 lines 3 to 13 by explaining why he needs to calculate frequency offsets at all:

> "With baseband conversion of signals transmitted with a carrier frequency, signals received in the receiver are converted to the baseband frequency after they have been converted as appropriate to one or more intermediate frequencies, for example, by means of a quadrature mixer. Tolerances and drift of the transmitter frequency and of the mixing frequencies in the receiver may lead to a frequency offset in the baseband signal, so that the transmission performance is affected in a negative fashion. In addition, Doppler effects in radio transmission systems comprising mobile transceiving arrangements make a relatively rapidly varying frequency offset possible, which is additively superimposed on the afore-mentioned frequency offset which varies only very slowly.
>
> In order to avoid or restrict a negative effect on the transmission performance, which effect is caused by a frequency offset in the receiver, it is necessary to continuously estimate the frequency offset and keep this offset as small as possible by means of an automatic mixing frequency control, or equalize this offset by means of various analog or digital signal processing measures, for example a frequency correction in the digitized baseband signal."

161. At page 4 lines 19-20 of the translation, Baier points out the advantages of averaging for his purposes:

> "In order to obtain statistically rather reliable estimates of the frequency offset, it is advantageous to form a mean value of a plurality of calculations of the frequency offset."

162. Baier explains at page 5 lines 14-16 one way of using the offsets:

> "The estimates produced for the frequency offset in [the] above way are pre-eminently suitable for controlling the oscillators used for the baseband conversion, so as to adjust the frequency offset by accordingly varying the oscillators."

163. This is simply the idea of using the offsets to adjust the oscillator. However, Baier goes on to explain another embodiment of his invention

> "Another advantageous embodiment of the invention is the use of estimates in an arrangement for frequency offset correction. This arrangement for frequency correction is inserted between the analog-to-digital converter and the channel estimators or before a baseband signal processor and multiplies the complex signal I + jQ, obtained after baseband conversion by means of sampling and analog-to-digital conversion, by a suitably sampled and digitized copy of a correction signal g = exp(j2π-df(i)•t) recovered from the frequency offset df. When an arrangement for correcting the frequency position is used, the oscillators need not be adjusted."

164. What is being described here is data pre-processing. IPCom's answer to this is that what is being described implicitly involves averaging (as that is what is taught for the oscillator) and so was not pre-processing with up to date frequency measurements as required by 808.

165. Nokia expressly disclaimed any argument based on modifying Baier. Their case is only that it would not involve invention to apply Baier in the context of developing a GSM scheme. There was no dispute that it was obvious to use Baier, whatever it taught, in the context of a GSM development. The document itself would make it clear to the appropriately informed reader that it was concerned with GSM, as Mr Gould accepted. Accordingly the dispute about obviousness of the 808 pre-processing step resolves itself neatly into an issue about construction. On the construction which I have adopted, which does not exclude averaging, Baier discloses the step and no modification is needed.

166. It is fair that I should add that Professor Eizenhöfer did not contend that the IPCom form of data pre-processing would be obvious. So if I am wrong on construction, then data pre-processing would not be obvious.

167. As a footnote I would add that Nokia contended that Baier also contained a broad hint about how to do lock-on synchronisation, which I have not found it necessary to rely on. Nevertheless, I have no doubt that the skilled person would perceive its application to lock-on synchronisation:

> "When an arrangement for correcting the frequency position is used, the oscillators need not be adjusted. This is especially advantageous when a receiver alternately receives signals with different receive frequencies. In such a case the frequency offset may be separately determined and stored for each receive frequency."

Data pre-processing and D'Avella

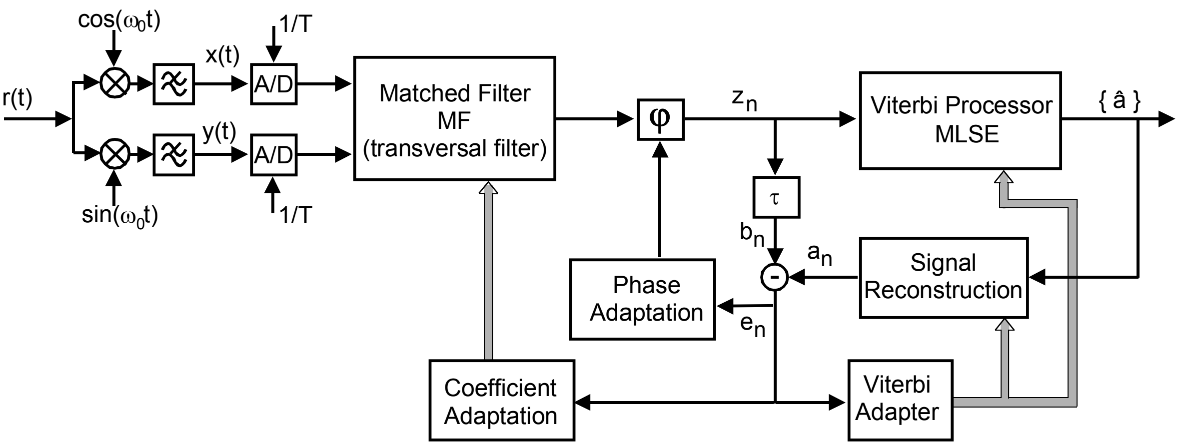
168. Nokia had another case of obviousness based on D'Avella. In the light of the conclusions I have reached thus far and the length of this judgment, I will deal with D'Avella shortly.

169. D'Avella is a paper by a group of scientists from the Italian company Italtel. It proposes the use of a matched filter and a Viterbi processor to deal with multipath propagation effects.

170. Amongst a number of other things, D'Avella discloses a feedback path which is designed to deal with frequency offsets between the reference oscillator and the received carrier. At page 124 under 'Tracking Mode' one finds this:

> "In practice, there are two independent adaptation functions: a tracking of the CIR variations and a tracking of the phase variations."

171. This second feedback loop in D'Avella introduces a phase shifting function φ after the matched filter and before the Viterbi processor. This results in the following arrangement as shown in Professor Eizenhöfer's figure:



172. Nokia contends, and I accept, that it would be obvious to incorporate D'Avella's idea for this second feedback loop into a GSM receiver. IPCom's answer to this obviousness case is that it contends that there is no data preprocessing in D'Avella because the "processing" is applied inside and not before the equaliser.

173. The case of obviousness of preprocessing over D'Avella turns on whether data preprocessing in 808 is limited in the way for which IPCom contend. I have rejected

IPCom's case that the claim excludes a phase offset being applied within the equaliser.

174. It follows that I consider that data pre-processing as claimed in 808 is obvious over D'Avella.

Overall conclusion on obviousness

175. I conclude that the skilled team developing a system of synchronisation for use in GSM would arrive without invention at a method within claims 1, 9 and 11 of 808. I come to this conclusion on the basis of common general knowledge alone, and on the basis of Baier or D'Avella and common general knowledge.

Infringement – claim 1

176. Most of the points which Nokia rely on to take the 6300 outside the claims of 808 turn on the correct construction of the claims.

"*operates with the GSM method"*

177. The allegation of infringement is made against the 6300 when operating in EDGE mode. As I have explained in the Technical Appendix, EDGE uses both GMSK and 8PSK modulation depending on channel conditions. In order to succeed on this point Nokia would need to establish that the proper construction of the claim meant that the system must operate *exclusively* with a system which uses a GMSK modulation system, or at least a system where it can be assumed that the phase change per symbol period did not exceed $+/-90^{o}$. I have rejected such an extreme interpretation. A system which was exclusively based on 8PSK would not infringe. But to the extent that EDGE continues to use GMSK at least part of the time, it is still a GSM method.

"coarse frequency synchronisation" (1.1)

178. It is common ground that the 6300 does not use coarse frequency synchronisation. It does not need to as the accuracy of its local oscillator is sufficient for it to move straight to coarse frame synchronisation. But as the feature is optional, this has no bearing on infringement of claim 1 as I have construed it.

179. I have rejected Nokia's alternative implied test feature. If that were a correct construction then I consider that the 6300 would not infringe: it has no facility to do coarse frequency synchronisation if the accuracy of its local oscillator turned out to be inadequate.

"start of a frequency correction burst" (1.2)

180. It is common ground that the 6300 uses the frequency correction burst to detect the start of a frame. On the construction which I have adopted, that is enough for infringement.

"fine frequency synchronisation by phase differencing with regard to a frequency correction burst" (1.3)

181. Nokia take two points here. The first is whether the 6300 satisfies the definition of fine frequency synchronisation (i.e. to within 0.1 ppm) by using the frequency correction burst. They contend that to reach that accuracy the 6300 carries out further operations using other bursts.

182. This is an aspect of the "entire scheme" approach to construction which I have rejected. It follows that it is not an answer to infringement. Nokia had other points like this (e.g. in relation to step 1.4), but they all fail for the same reason.

183. The second point relates to phase differencing. In the 6300, the processing of the received samples all takes place using the I and Q values. But as I have rejected a construction of claim 1 (as opposed to claim 2) which limits the method to phase angles as opposed to I and Q, this is no answer to infringement.

order of steps 1.2 and 1.3

184. Nokia submit that because steps 1.2 and 1.3 overlap in the 6300, there is no infringement. Again, on the construction which I have adopted, this does not matter.

fine frame with fine frequency in lock on (3.2)

185. Nokia's case on construction of this integer was, it will be recalled, that the mobile had to tune its oscillator during lock-on synchronisation. So the point on this part of the claim turns only on construction. As I have rejected Nokia's construction, it is no answer to infringement. The same point arises on claim 11 and meets the same fate.

Infringement -claim 9

186. Claim 9 requires the normal operation synchronisation to be carried out by "*identifying and evaluating the training sequence within the normal burst*".

187. The details of the functioning of the 6300 on this point are confidential. I have therefore put details of the evidence in relation to the issue in a First Confidential Appendix, which forms a confidential part of this judgment.

188. The issue is again one of construction: is it enough if some use is made of the training sequence of the normal burst in normal synchronisation, even if it is only used for timing and not used for frequency synchronisation? The specification only makes specific reference to the use of the training sequence in relation to fine frame synchronisation, so on balance I prefer the wider construction. It follows that the 6300 does not escape on this ground either.

Conclusion on infringement

189. If it were valid, on the construction which I have applied to the claims, the 6300 would infringe claims 1, 9 and 11.

Essentiality

190. On the view which I have taken on construction, 808 is not essential to the GSM standard. There is no suggestion, for example, that it is not technically possible to

operate the standard without data pre-processing. There was in the end no dispute about this.

The 189 patent

191. 189 has a priority date of 8th March 1999. It describes and claims a method and apparatus for the access control or management of a telecommunications channel.

192. Nokia denies infringement of the 189 patent and contends that it lacks novelty or is obvious in the light of the GSM/GPRS recommendations, an Ericsson patent application ("Ericsson") and common general knowledge.

193. The mobile phone in issue is Nokia's N96. Nokia also seeks, by means of a late application for a declaration, a finding of non-infringement in respect of a modified design "The New Device", described in a confidential product description. Both sides wanted this issue decided at the trial, despite its late introduction.

Additional technical background for 189

Contention on a shared channel

194. Where the uplink from a mobile station is a shared random access channel, there is a danger of collision between users' signals, allowing stronger signals through and preventing weaker ones. This competition is called "contention". It can be tackled in numerous ways. One set of ways in which the problem is tackled is by restricting access to the channel.

The "lottery"

195. One well known way of restricting access to the channel involved a form of lottery. "Lottery" is not a term of art, but is a convenient term to provide an analogy for what is done. Each mobile station generates for itself a random number and compares it with a value sent by the network. A "win" can be defined as generating a random number greater than or equal to the transmitted value. So, for example, the possible transmitted numbers could be 1 to 10, and the random numbers could be 1 to 9. If the base station transmits a 10, no mobile will get onto the channel, but if it transmits a lower number than 10 an increasing proportion of mobiles can get on. At busy times the access can be throttled back to prevent collision. At very low usage times the transmitted value could be 1, and all mobiles would get access.

196. Although it was in dispute, I was satisfied that the lottery idea had become common general knowledge by the priority date of 189. But in the end I do not think it mattered much for the arguments whether it was or was not.

Access classes

197. Systems in which certain classes of user (user classes or access classes) could be restricted from access were also well known. For example class barring, under which a mobile of a particular class would be barred from access absolutely, was a feature of the GSM/GPRS system. Again, to the extent that it matters, this was common general knowledge as well.

Transmission capacity

198. Bandwidth is a scarce resource in any mobile telephone system. Designers of such systems would try to arrange matters so as to minimise the amount of data that had to be sent routinely. One common general knowledge way of limiting the amount of data to be sent is the use of single bit flags, which alert the mobile to the fact that data is coming. This allows the network only to send the data when the flag is set.

The 189 patent - disclosure

199. Control of access to a radio channel was a well known problem, and one which is expressly recognised in the 189 specification. So, at page 7 lines 22 to 36, the specification points out that where the message from a mobile station collides with another message on the random access channel, the message is not received properly in the base station and the base station is unable to acknowledge its receipt. The mobile station accordingly tries again, leading to a danger that the random access channel will become overloaded.

200. It is fair to say that the draftsman of the 189 Patent has adopted a somewhat unusual approach to composing the introductory and general passages of the specification, and one which is not well suited to understanding the precise bounds of the inventive contribution. After a reference to three prior art documents, and in the place where one would normally expect to find the consistory clauses, the specification has a section entitled "Advantages of the invention". Instead of stating what the invention consists of by reference to the features of the independent claims, the draftsman has attempted to formulate each of the claims as if it were itself an advantage. So the first paragraph says:

> "By contrast, the inventive method and the inventive subscriber station having the features of the independent claims have the advantage that access authorisation data for the least one subscriber station are transmitted with the information signals, that, upon receipt of the access authorisation data in an evaluation unit in the at least one subscriber station, a check is carried out to determine whether the access authorisation data comprise an access threshold value, the access threshold value being compared with a random number or with a pseudo-random number, and that the access right for a telecommunications channel is assigned to the at least one subscriber station on the basis of the comparison result."

201. Thus far the specification has simply described as "an advantage" the characterising features of independent claim 1. Although this is not itself objectionable, it does not make it clear what aspect of what follows is advantageous, or as compared with what prior method. However, the same paragraph continues to explain what the invention "allows":

> "This allows the access authorization for this telecommunications channel to be randomly distributed for one or more subscriber stations. This access control uses a minimum of transmission capacity for transmitting the

> information signals, since it is effected merely by transmitting the access threshold value."

202. What is promised, therefore, is random distribution of access based on random numbers generated within the mobile being compared with a transmitted access threshold value, and a saving of transmission capacity. It is not made clear what this saving is to be compared with, although it is conceivable that the comparison is made with the "access probabilities" which it is necessary to transmit in the Motorola proposal discussed in the prior art section and with which the invention is contrasted.

203. Subsequent paragraphs adopt the same procedure for claims 2, 3, 4, 5 and 10. The claim 2 paragraph reads as follows:

> "A particular advantage is that the evaluation unit in the at least one subscriber station checks whether the access authorisation data comprise access authorisation information with access class information for at least one prescribed user class, with, in this case and on the assumption that the at least one subscriber station is associated with the at least one prescribed user class, access to at least one telecommunications channel being granted to the at least one subscriber station on the basis of the access class information for this user class."

204. Thus far, again, the specification has set out the characterising features of claim 2 as "an advantage". Again it is not made clear with any precision what it is about these features which delivers an advantage, or what the claimed features are being compared with. The specification continues, again, to explain what this permits:

> "This permits subscriber stations of a prescribed user class to be authorized to use the telecommunications channel even if the random distribution by means of access threshold value would not authorize them to access this telecommunications channel. Thus, by way of example, subscriber stations for emergency services, such as the police or the fire brigade, can be associated with such a prescribed user class and can then access the telecommunications channel with priority irrespective of the random distribution by corresponding access threshold value information."

205. This ability to allow access irrespective of access threshold value is a theme which appears elsewhere in the specification. However it is dangerous at this stage to read too much into this statement of advantage. As we shall see, in one of the embodiments described, it is possible for the same mobile, on the basis of the same access authorisation data, to have a second attempt at access (via the lottery method) if it is refused access on the basis of user class. But in another of the embodiments (which is accepted to be within claim 2) that is not possible. A given transmission from the base station will include either access class or threshold information, not both, and so no second attempt is possible.

206. A similar exercise is conducted for the features of claims 3, 4, 5, and 10. The specification then moves directly to the specific embodiments. This section

commences with a general description of a telecommunications network and a subscriber station by reference to figure 1 and figure 2, which are in commonplace form.

207. At page 7 lines 38 onwards, after the passage to which I have already referred concerning the problem of collision on the random access channel, the specification moves on to explain that it is possible to restrict access to the random access channel by the individual mobile stations by, for example, only allowing particular user classes access on a temporary or permanent basis. User classes may be any number of individual users including in particular a separate user class for each mobile station. At page 8 line 26 onwards it is explained that the network operator uses information signals transmitted from the base station to inform the individual mobile stations of which rights have been assigned to them. The information is sent on a broadcast channel so that the same information is sent to all mobile stations at the same time in order to notify the mobile stations of their assigned access rights to the random access channel.

208. The specification also explains from page 9 line 34 onwards that a random scatter for the access authorisation to the random access channel can be achieved by sending an access threshold value S on the broadcast channel. The access threshold value is supplied to an evaluation unit. The evaluation unit draws a random number R which it generates itself. The evaluation unit then checks whether R is greater than or equal to S. If so then access to the random access channel is allowed. In this way access to the random access channel can be prevented for some or a proportion of the mobiles. This is a description of the approach to granting access rights to a random access channel which I have referred to as "the lottery".

209. The specification then goes on to describe a first exemplary embodiment with reference to figures 3a and 3b. Because there is a considerable dispute as to the interpretation of this part of the specification it is necessary that I set out my understanding of it in some detail.

210. Figures 3a and 3b look like this:

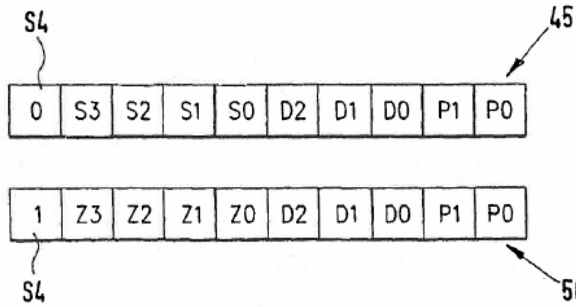


Fig. 3a

Fig. 3b

211. These figures represent alternative bit patterns which are transmitted by the network to the mobile stations on a broadcast channel. The first bit in each pattern is an evaluation bit S4. In figure 3a, S4 is 0. In figure 3b, S4 is 1. When S4 is 0, the following four bits, S3, S2, S1, and S0, are access threshold values. These four bits can be used to transmit 16 different access threshold values to the mobile stations (16

is the number of options that four binary bits gives you). Of course the same access threshold value will be sent to all the mobile stations. The access threshold value can be set to a greater or lesser value so as to throttle back access to the network.

212. In figure 3b the evaluation bit S4 is set to 1. In this case the second, third, fourth and fifth bits are not defined as access threshold value bits but rather as access class bits: see page 13 line 33 and following. Each of the access class bits Z3, Z2, Z1 and Z0 represents a particular user class. The arrangement is such that if the access class bit has a value zero, then all the mobile stations in the associated user class can access the random access channel. If the access class bit is set to 1, then none of the mobile stations in that user class can access the channel.

213. At page 16 lines 10 to 13, the specification explains in summary that the S4 bit determines whether the second to fifth bits are interpreted in line with the first bit pattern (figure 3a) or in line with the second bit pattern (figure 3b).

214. The description of what is described as a second exemplary embodiment begins at page 16 line 15. The specification says:

> "In a second exemplary embodiment, in figure 3c, a third bit pattern … having a bit length of 13 bits is transmitted from the base station … to the mobile stations … with the information signals. The third bit pattern … does not have an evaluation bit S4 and therefore comprises both the access threshold value bits S3, S2, S1, S0 and the access class bits Z3, Z2, Z1, Z0. In addition the third bit pattern … and also the first bit pattern … and the second bit pattern … comprise the telecommunications service bits D2, D1, D0 and the priority bits P1, P0."

215. Figure 3c looks like this:

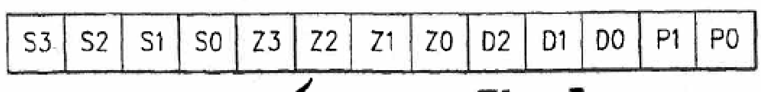


Fig. 3c

216. Herein lies the major source of contention between the parties. Does the second embodiment, as Nokia contend, involve the base station sending all three bit patterns? Or does the second embodiment, as IPCom contends, simply involve the transmission of the 13 bit pattern? The dispute is about whether there is a freestanding embodiment which does not involve the sending of the S4 bit, a bit which tells you about whether an access threshold value is being sent. This is an important plank for IPCom's contention that the invention does not necessarily involve a check for the presence of an access threshold value and can cover an arrangement where an access threshold value is always sent.

217. I think both sides were trying to extract too much from the question of precisely what overall system the second embodiment was intended to describe. The real purpose of the second exemplary embodiment is to introduce the 13 bit pattern. In my judgement the skilled reader of the specification would appreciate that access to the random access channel could be controlled by the base station by sending the 13 bit pattern

alone. All the information necessary to do an access threshold test and an access class test are present in the 13 bit pattern. The skilled person would also appreciate that access to the network could be controlled in a system in which the base station was capable of sending all three bit patterns. The skilled person would expect that the patentee was seeking to protect a method which involved 10 bit alone, 13 bit alone, or combinations.

218. Nokia make a number of highly semantic points on this passage. For example they lay stress on the fact that the 13 bit pattern is called a "third" bit pattern: but that does not mean that it is a third pattern which always has to be present in the second embodiment. Rather, I think it means that it is the third bit pattern to be mentioned, which it is. They also draw attention to the words "in addition" in the third sentence: but in context these words are simply referring to the additional inclusion of the D and P bits, additional information which it is not necessary to explain here. The patentee is not saying that the third bit pattern is necessarily present in addition to the first and the second. Likewise, Nokia referred to the words "and also" in the third sentence, but this is a flimsy foundation indeed for saying that the first and second bit patterns are required to be present. As IPCom pointed out, the corresponding German text uses the words "wie auch" which do not convey the meaning for which Nokia contend in any event.

219. The specification then goes on (page 16 lines 26 and following) to repeat the point that mobile stations belonging to a favoured user class are able to access the random access channel irrespective of the access threshold value S. In other words, using this bit arrangement, and on the basis of the same transmission, a mobile station can be given access without the need to participate in the lottery at all. Similarly, as the specification goes on to explain, mobile stations which are refused access on the basis of class need to enter the lottery where they will get a second chance. Whilst this is a clear description of a method in which a second chance is allowed, one has to remember that this passage is to be found in a description of the specific embodiments, and in only one of them at that.

220. The specification makes an important contrast between the first and second embodiments at page 17 lines 16 to 24.

> "In contrast to the first exemplary embodiment, the second exemplary embodiment allows access to the RACH … not only by mobile stations which can access the RACH … on account of their association with a user class, but also by such mobile stations as draw a random or pseudo-random number R of greater than or equal to the access threshold value S ....

221. In the context, this paragraph is saying that the same mobile station ("such mobile stations") has two routes to access based on the same access information. It is also saying that that functionality is **not** possessed by the 10 bit embodiment of figures 3a and 3b. In those figures, all mobiles in the network are either allocated access by access threshold value or by access class. No one mobile will have two routes to access at any one time. This is important when one comes to construction. As it is common ground that I should approach construction on the basis that both embodiments are within both claims 1 and 2, the ability to gain access irrespective of

the access threshold value cannot be regarded as a necessary attribute of the features of either claim.

222. The specification then goes on to describe, by reference to figures 4a, 4b and 4c a flowchart for the way in which the evaluation unit in the mobile works. I first set out figure 4a substantially as annotated in the expert report of Dr Cooper:

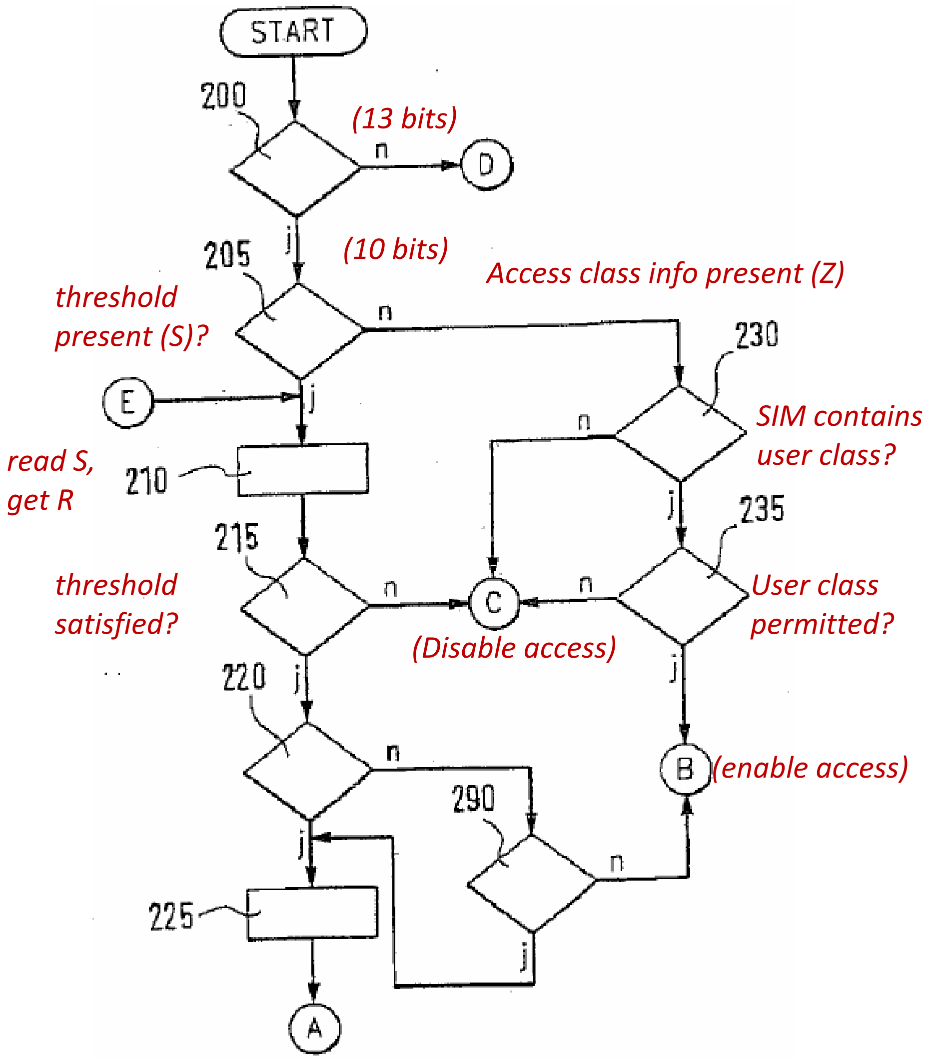


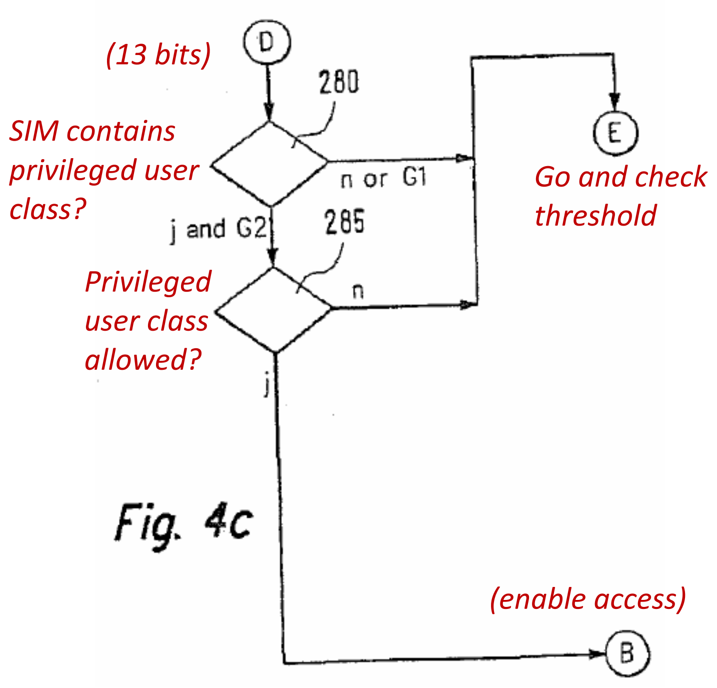
Fig. 4a

223. The evaluation unit is capable of evaluating both types of bit pattern, that is to say the 10 bit pattern and the 13 bit pattern. Nokia say this supports their view of the structure of the specification. To a degree it does, as it is undoubtedly the sort of evaluation unit one would need if one were arranging a network to receive both the 10 bit and 13 bit embodiments. But I do not think that alters the fact that the skilled person would appreciate that the 13 bit embodiment could be used on its own in a simpler evaluation unit, just as he would appreciate that the 10 bit embodiment could be so used on its own.

224. The first check which the unit performs is to determine which of the two lengths of bit pattern is being transmitted. The flowchart then divides at box 200 to provide appropriate processing for the different bit patterns.

225. For the 10 bit pattern, the first step is to evaluate the S4 bit to ascertain whether the four bits which follow are access threshold value bits or access class bits. There is a further branch at box 205 to accommodate each of these two possibilities, and the logic follows the appropriate course thereafter.

226. For the 13 bit pattern the evaluation unit knows that it will be receiving both access threshold information and access class information. This is shown in Figure 4c:



227. So the unit checks the four access class bits (at box 285) to check whether the user class ascertained for the mobile is authorised for access. If so, access is granted subject to some further hurdles. If not, there is a second branch which leads back to the processing of threshold value at box 210 in Figure 4a. The processing of the 10 and 13 bit patterns is therefore intertwined to this extent, but again the skilled person would appreciate that this is not inevitably the case. An adapted evaluation unit just for 10 or just for 13 bits would be envisaged.

The claims and their interpretation

228. It is with this background that the reader arrives at the claims. I set claims 1 and 2 out below with the reference numerals removed.

> 1. Method for allocating access rights for at least one telecommunications channel, which may be in shared use by a plurality of subscriber stations, in a telecommunications network to at least one subscriber station in the telecommunications network, where information signals are transmitted to the at least one subscriber station,

> characterized in that access authorization data for at least one subscriber station are transmitted with the information signals,
>
> in that, upon receipt of the access authorization data in an evaluation unit in the at least one subscriber station, **a check** is carried out to determine whether the access authorization data comprise an access threshold value (S), the access threshold value being compared with a random number or with a pseudorandom number (R),
>
> and in that the access right for a telecommunications channel is assigned to the at least one subscriber station on the basis of the comparison result.
>
> 2. Method according to Claim 1,
>
> characterized in that the evaluation unit in the at least one subscriber station checks whether the access authorization data comprise access authorization information with access class information for at least one prescribed user class
>
> with, in this case and on the assumption that the at least one subscriber station is associated with the at least one prescribed user class, access to at least one telecommunications channel being granted to the at least one subscriber station on the basis of the access class information for this user class.

229. The principal dispute on construction is concerned with the nature of the check called for by claim 1. I have emboldened the place where it occurs in that claim. Mr Alexander QC characterises the dispute about construction as follows:

> "The dispute is whether the check in claim 1 means:
>
> (a) Establish whether or not the access authorisation data sent by the network contain or do not contain an access threshold value (a check for presence – Nokia's position); or
>
> (b) Use the set of access authorisation data sent by the network to all users to check which route to access should be used by the specific subscriber station in question (a check for relevance for access)."

230. Mr Meade QC did not quarrel with the way in which Nokia's position is characterised. In outline he submitted that

i) Nokia's construction was more consistent with the language of the claims;

ii) Provided that one understood the 13 bit pattern as being an addition to the two 10 bit patterns, then all the embodiments will carry out a check for presence of an access threshold value;

iii) Unless the 10 bit embodiment was included in all the claims, it was difficult to understand how the advantage of improved transmission capacity was obtained by the invention.

231. Mr Alexander QC submitted

i) The patent is about an individual subscriber station being able to determine the appropriate access management procedure from the same information sent to all subscribers. This is achieved by a check which determines whether the data comprises an access value for access management of that subscriber station.

ii) Nokia's approach is inconsistent with the second embodiment (on the footing that the skilled person would appreciate it was a freestanding embodiment). There the access threshold information is always sent, and so a check of the Nokia variety would have no purpose.

iii) Moreover, on Nokia's approach the patent would effectively be for sending a flag to tell the mobile whether access threshold information is present, an idea which both sides contend to be entirely trivial.

iv) IPCom's construction was consistent with that arrived at by the Mannheim District Court in its decision dated 27th February 2009 in a case brought by IPCom against High Tech Computer Corporation and HTC Europe Limited. Nokia's construction was not. In that case Judges Voss, Gredner-Stelgleider and Schmidt, having considered the disclosure of the 189 patent, said:

> "the content check according to [this claim feature] does not consist of a "presence check" that is, it does not ask if an access threshold is contained in the transmitted access authorisation data, but rather that the check described in the patent document serves to determine whether the received access authorisation data should make access for a specific mobile station to the telecommunications channel dependent on the comparison of a random number within an access threshold value, hence part of the access authorisation data should be given relevance to the access threshold value for the specific mobile station.

232. In my judgment Nokia's construction does not properly encapsulate what is required by the check in claim 1. The check is not in substance a check whether the access threshold information is being transmitted. That, of itself, is of no interest to the mobile station.

233. In my judgment the check which is required by claim 1 is a check as to whether the mobile station is to use part of the access information to perform the access threshold evaluation. This occurs in the first embodiment when the mobile checks the S4 bit, telling the mobile that the answer to the question is "yes" if the S4 bit is set to 0 and "no" if it is set to 1. It also occurs in the second embodiment when the mobile looks at the Z bits in box 285. If a Z bit for the user class in which that mobile is included is set to 1, then the answer to the question is "yes" and it will use the access threshold information to do the lottery. If the same Z bit is set to 0, then it will not (in fact it will obtain access based on its class).

234. I believe that this construction best accords with the patent specification when it is construed as a whole.

i) Firstly I think the skilled person, as I have said, would not expect a method which uses the 13 bit pattern alone to be outside the claims, which it would be on Nokia's construction. Although the skilled person would see that the patentee had contemplated a "combined" system, as shown in the flow charts, that person would also understand that the 10 bit pattern and 13 bit pattern could be used on their own.

ii) Secondly it is, as always, important to have in mind the patentee's purpose. What underlies the invention is an allegedly novel method of allocating access rights under the control of the network. A method which merely checks for the presence of the access threshold value does not get anywhere near achieving this.

iii) Thirdly, as to using a minimum of the transmission capacity, neither construction fits very well with the passage at page 2 lines 31 to 35. Nokia say that the saving is of the three bit difference between the 13 and 10 bit patterns. But I do not think this can be right. Firstly, the comparison is more likely to be with something which has gone before, such as Motorola than with something which follows. Secondly, those 3 bits of transmission capacity will be spared some of the time, but not while the system is using the 13 bit embodiment. The sentence is in any case a slightly odd one, as it explains the reason for the saving as "it is effected merely by transmitting the access threshold value". This is not correct, as it is necessary to send the S4 bit as well.

235. It is correct that Nokia's construction is not consistent with the Mannheim Court decision. Nokia submit that the Mannheim Court fell into error in its understanding of the inter-relationship of the embodiments of the invention. I do not think it did so.

236. On the other hand, the construction contended for by IPCom omits all reference to access threshold at all. This is too general. As I have said, in my judgment, claim 1 requires a check of the received access authorisation data to determine whether that mobile should do an access threshold evaluation. That construction is consistent with that of the Mannheim court.

237. The check in claim 2 should be construed in the same way. The evaluation unit must perform a check of the access authorisation data to determine whether it should grant access on the basis of class. I was for a time attracted to the argument that, by the time one gets to claim 2, one necessarily has a composite method in which access can be granted on the basis of class irrespective of the lottery i.e. one in which a permitted class would bypass the lottery altogether, whilst those in refused classes would still do the lottery. I believe that to be wrong. Firstly, the claim is scrupulous not to say anything at all about how the two checks, and the resultant access routes interact. There are simply two checks. There is no indication that the class test is only performed for those mobiles which have failed the lottery, or that the lottery is only performed on those mobiles which have failed on class. Such an interpretation would in any event exclude the 10 bit embodiment. Secondly, I wondered whether the fact that the claim says that access is "granted" on the basis of access class could be

construed to mean that access could not be obstructed by the lottery. But it is clear from elsewhere in the specification that mobiles which pass on access class may be subjected to further tests which they can fail. So "grant" would be understood to mean "pass the test" not "have unrestricted access past other tests".

The prior art

GPRS: disclosure

238. Nokia relies on GSM recommendation GSM 04.60 which is part of the description of the General Packet Radio Service: GPRS. That specification must be read in the light of GSM 04.08 which concerns access to the random access channel in GSM generally. That combination is legitimate because GPRS is an add-on to GSM.

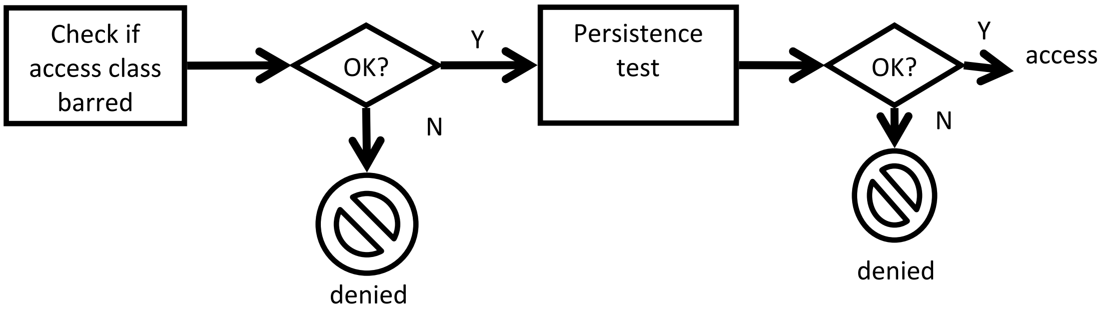
239. The way in which GPRS operates is not in dispute. It is a service which allows transmission by packet switching, enabling "packets" of data to be sent discontinuously. To access the network the MS transmits a "PACKET CHANNEL REQUEST" message on the PRACH, the packet random access channel. The network transmits a dynamic persistence value P(i) on a broadcast channel. The probability of transmitting during an access attempt is controlled by comparing P(i) with a random value R to see whether P(i) is less than or equal to R. R is a number between 0 and 15.

240. The dynamic persistence level is contained in an information element called PERSISTENCE_LEVEL. This is an optional information element which is preceded by one bit of meta-data indicating its presence or absence. If PERSISTENCE_LEVEL is not supplied by the network the mobile uses a default value of 0. The MS must therefore check to see whether PERSISTENCE_LEVEL is present by examining the one bit of meta-data.

241. An MS may belong to one of a number of access classes. The network also transmits other access control data including an information element ACC_CONTR_CLASS. This information element inhibits certain access classes from accessing the network regardless of other persistence parameters, including thresholds.

242. In GPRS the mobile station first checks ACC_CONTR_CLASS to determine whether or not an access class is allowed to access the RACH. If the bit for an access class has a value of 1 then access is barred for that class. If the bit has a value of 0 then access is not barred, i.e. access is determined on the basis of the persistence test.

243. If the network sends a P(i) value then that value is used for the persistence test. If it does not send a P(i) value then a value of 0 is used by the MS and access will always be granted in the persistence test because 0 will always be less than or equal to the random value R (which cannot be less than 0). This is illustrated below:-



Lack of novelty over GPRS

Claim 1

244. There is no dispute that the majority of the features of claim 1 are disclosed by the GSM/GPRS recommendations. Although there is no specific mention in the recommendations of an evaluation unit, IPCom did not suggest that this was anything other than implicit. There is no dispute that the persistence test is an access threshold test. The point on lack of novelty of claim 1 over GPRS is a simple one. Does GPRS perform the necessary check?

245. Nokia advanced their main lack of novelty case on the basis of their construction that the check required by claim 1 was simply a check for the presence of the access threshold data. On that construction, which I have rejected, the claim would have been anticipated. They maintained, nevertheless, that the claim was invalid for lack of novelty on IPCom's construction as well.

246. I have formed the view that GPRS does perform the claimed check as to whether to do an access threshold test. The critical test takes place in the first diamond shaped decision box in the last figure above. That box checks part of the access authorisation data. If the access class bit for the user class in question is set so that access is permitted, then the mobile is directed to perform an access threshold test. Accordingly it is a check whether to perform the test.

247. I am unable to see any relevant distinction between this test and the test performed in box 285 in the 189 specification. That box is contended by IPCom to be the relevant check for the purposes of the patent. The check of the class access bits in that box determines whether an access threshold test is to be performed. It is true that in the two cases the alternative routes are different. In the GPRS case the alternative result is that access is *barred* on the basis of class, and in the 189 case the alternative result is that access is *granted* on the basis of class. But claim 1 does not get anywhere near this level of particularity. The check merely asks whether an access threshold test is to be performed: and that check is done in both GPRS and 189.

248. In my judgment claim 1 lacks novelty over GPRS.

Claim 2

249. Claim 2 is a method according to claim 1. In addition, it calls for a check based on access class.

250. On Nokia's construction of this claim the access class check would be one which checked only for the presence of access class information. No such check is carried out in GPRS. On that construction, claim 2 does not lack novelty.

251. On the construction of claim 2 which I have arrived at there is no relevant distinction over GPRS. The evaluation unit in GPRS has to check the access class information, ACC_CONTR_CLASS to see whether the mobile is associated with a barred or an allowed access class, and access is barred or enabled accordingly.

252. It follows that claim 2 is also anticipated by GPRS.

Other claims

253. Although claim 11 is an independent claim to a subscriber station, IPCom did not suggest that it, or any other dependent claim could be valid if claims 1 and 2 were anticipated.

Lack of inventive step over GPRS

254. I have dealt with the skilled addressee and the common general knowledge above. If Nokia had been correct on construction they would have burdened themselves with a difference between GPRS and the inventive concept of claim 2, that is to say a presence check for the access class information. Unlike the access threshold value which is optional, access class information is always sent, and hence there is no check for its presence.

255. Professor Darwazeh was happy to accept in cross-examination that (absent the restriction of the GSM recommendation which requires it always to be sent) it was technically obvious to make access class information optional and provide a flag to indicate whether it was present or not.

256. Dr Cooper was not so enthusiastic about the notion. He answered thus in cross-examination:

> "Q. What I want to suggest to you is if you were reading the GPRS standard in 1999, it would not at all be obvious to make that optional when hundreds of researchers had been saying over an extended period you always send it.
>
> A. It would not be an obviously beneficial step to take."

257. In re-examination he said it was "certainly an obvious thing to consider, and doing it would have been entirely uninventive": but "in that particular message" it was not done because the data was needed.

258. On balance, the evidence did establish that this step was technically obvious. Although the matter is ultimately one for the court, I see no reason to disregard Professor Darwazeh's very clear evidence. Dr Cooper's temporary concession was adequately explained in re-examination.

259. Quite apart from this, I think the absence of invention was quite powerfully demonstrated by the fact that Professor Darwazeh was unable to identify any

functionality that was achieved by the 10 bit embodiment of the 189 patent which was not available in GPRS. Thus in GPRS it is possible to set all the access class bits to allow access and control access by access threshold value by sending a value of P(i). Equally in GPRS it is possible to control access by access class, and "fix" the lottery by not sending P(i) or sending a value of 0, so that mobiles get access independently of the lottery, albeit at different times. Exactly the same is true of the 10 bit embodiment. When the S4 bit is set to 0 the network controls access on the basis of threshold value; when it is set to 1 the network controls access on the basis of access class. That is all the 10 bit embodiment can do: and GPRS can do it as well. In fact GPRS can do more, because it can make those that pass on access class do the lottery as well.

Ericsson: disclosure

260. Nokia pleaded and adduced evidence on a whole raft of additional citations, but in the end pursued only Ericsson "for reasons of procedural economy".

261. Ericsson is PCT Application No WO 98/37668. The specification is entitled Multiple Access Communication Network with dynamic access control". It is generally concerned with access to a reverse channel or uplink in a communications system. At page 2 line 4 onwards the specification says:

> "This immediately highlights that the access to the reverse channel by the subscribers must be carefully managed due to the risk of multiple devices attempting to use the channel at the same instant, which results in collisions and a waste of the available bandwidth"

262. Ultimately, as can be seen from the claims, Ericsson proposes a dynamic access control method based on generating a control parameter based on whether packets sent to the base station were received without error.

263. Ericsson is a very long document. Nokia do not suggest that the overall error analysis method of Ericsson has anything to do with the invention of 189. They focus on two aspects only of it. The first they call the "lottery with (dis)favoured users aspect" and the second they call "the contention/reservation aspect". This latter aspect was raised very late in the day by means of a sixth expert report of Dr Cooper, dated the 24th November, which was the fifth day of the trial. Mr Alexander complained about this, but he did not formally oppose the introduction of Dr Cooper's statement. It follows that I have to deal with it, whilst bearing in mind that IPCom have had little time to consider it.

The (dis)/favoured users aspect

264. The first aspect appears in a section headed "Detailed Description of the Dynamic Access Control Procedures of the Present Invention". This starts with a description of a lottery based approach to access. At page 36 lines 22-25 one finds this suggestion for adding to a dynamic access method:

> "In addition, specific subscriber devices 26 could be favoured or disfavoured by providing them a non-random selection of the value for comparison to the broadcast value."

265. Professor Darwazeh read this passage as indicating that the mobile station is provided at manufacture (or on its SIM card) with a non-random value, thus distinguishing this arrangement from the one claimed in 189, where the information is sent by the network. I think he is right. I think Nokia are trying to press too much out of this disclosure. In that respect this document is a worse starting point than GPRS.

266. Although Dr Cooper gave written evidence that he thought that this passage disclosed the relevant claim feature, I think he was striving a little too manfully to see it in a single sentence in Ericsson. Mr Alexander submitted, and I agree, that this was an example of what Pumfrey J described in *Hewlett Packard GmbH v Waters Corp* [2002] IP&T 5 at [32]:

> "Mr Wyand submitted that it is the task of the court to determine what Saito clearly and distinctly taught the skilled person at the priority date, not what can be read out of Saito by the application of hermeneutical stress. This admirable phrase concisely describes the process of squeezing a document to extract every last drop of meaning. The submission is correct: to anticipate, a document must contain a clear description of, or clear and unmistakable directions to do or make, something within the claim: see *General Tire v Firestone* [1972] RPC 457. When considering obviousness, on the other hand, ambiguities in the disclosure of the document may be obviously capable of resolution in a particular way without the exercise of ingenuity: but it is not legitimate to try to resolve obscurity by an exercise in imaginative reconstruction to ascertain what it was that the patentee [of the prior art] must have been trying to describe."

the contention/reservation aspect

267. In an earlier passage Ericsson teaches a combination of a "reservation" mode and a "contention" mode. Nokia rely in particular on a passage at page 15 lines 10-19:

> "The present invention consists of a forward channel data stream (broadcast by the base station) that is delineated into forward channel blocks (the data contained in each block is ordinarily protected against channel impairments and errors by an error detecting and correcting FEC code). The block boundaries are identified by the inclusion of a forward channel synchronisation word within each block. Furthermore, embedded in each block is a Reservation/contention flag and a Reservation Identifier. The Reservation/contention flag is used to indicate to the population of subscriber devices that the reverse channel is available for contention access or whether it has been allocated to a specific device for a reservation transmission."

268. This teaching would disclose to the skilled person that any given mobile receiving a block of control information on the forward channel would

- check the reservation/contention flag

- if reservation is indicated, check whether that mobile is the one with the reservation

- if contention is indicated use a contention method

269. One of the possible contention methods in Ericsson is the lottery. The mobile's processing of the reservation/contention flag is explained in Ericsson at page 42 line 25 to page 47 line 22 by reference to Figure 22:

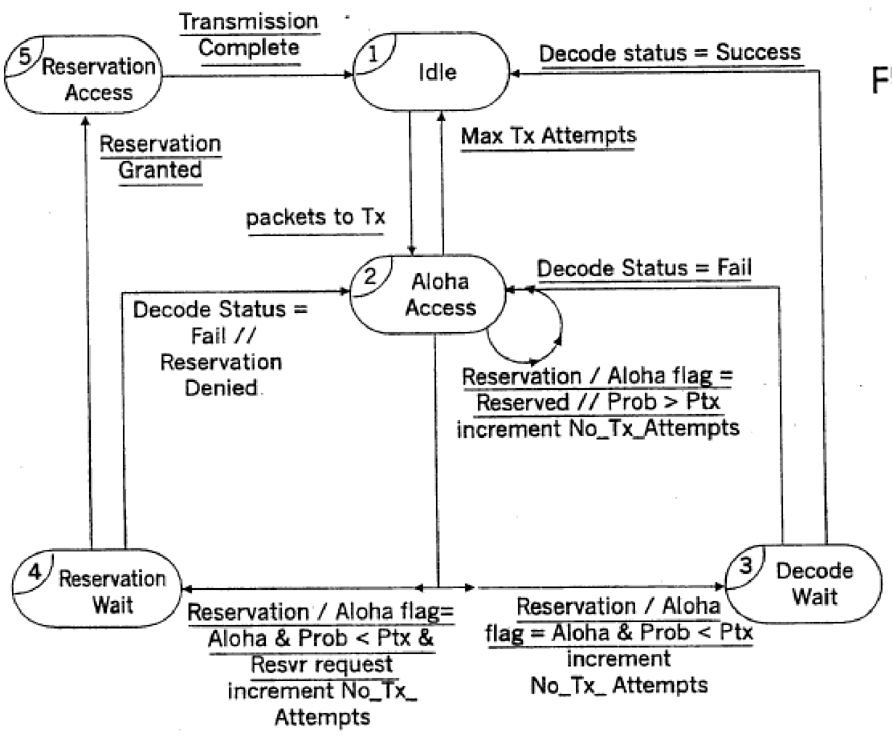


FIG. 22

270. The subscriber station decides on the basis of the data which it has to transmit whether the data will be transmitted in a random access slot or in a dedicated reserved slot. The flag identified by Nokia indicates what type of slot is next on the physical channel. Nokia focuses on the Reservation Wait state (labelled 4 in Figure 22), where the mobile waits to determine whether it will be given a reserved access or go back into contention.

Lack of novelty/obviousness over Ericsson

271. I deal first with the (dis)/favoured users aspect. Nokia appreciated that it was necessary for its anticipation case for the network to send the non-random value. Their case is therefore at best one of obviousness. Although Professor Darwazeh was cross examined about a system in which the network sent the non-random value, so that, in effect, the network was sending both the question and the answer, he thought that this would be rather a strange system. I do not think that Nokia have established

that to modify Ericsson in the way proposed would have occurred to the skilled person in 1999 without knowledge of the patent.

272. As to the reservation/contention aspect, Nokia contends that this anticipates claims 1 and 2. They accept that the "access class" in this case can only be a single mobile: the one that has requested and is granted a reservation: but they draw attention to the express teaching in 189 that the class can be a class of one mobile.

273. IPCom advanced a number of answers to this case:

i) The system discussed in Ericsson is about access to two different channels, as compared to 189 which is about access to a single random access channel which may be in shared use;

ii) Ericsson does not have "prescribed user classes" in the sense in which that phrase is used in the 189 patent, even taking on board the point about a user class being a class of one mobile;

iii) Ericsson does not perform a check within the meaning of the claim;

274. Nokia say that the first point adopts too narrow a construction of claim 1 which only calls for a "method for allocating access rights for at least one telecommunications channel", and later on refers only to the access right being assigned to "a telecommunications channel", so that the scope of the claim would extend to entirely separate physical channels. Although the 189 specification talks about a single random access channel, the notion of what is a "channel" in the 189 patent is nowhere defined. The skilled person is told by Ericsson that everything happens on the "reverse channel". I see no reason why this is not an adequate channel for the purposes of the claims of 189. Furthermore it is a channel which may be in shared use.

275. As to the second point, Mr Alexander emphasised that the class must be a "prescribed" user class: whether a user class is prescribed is not a question of the number of members alone. He submits that it is unrealistic to regard a mobile which puts itself forward for a reservation as belonging to a prescribed user class. Nokia's answer is to say that once the mobile has made such a reservation request which is granted by the network, then it becomes a prescribed user class of one mobile.

276. On the second point I prefer Nokia's submission. There is nothing in 189 which limits the point at which the check has to be performed to the beginning of any request for access. I cannot fault Nokia's analysis that the relevant checks are performed when the mobile is in state 4 in Figure 22.

277. As to the third point, IPCom submitted in its closing skeletons, firstly that the flag indicated no more than the availability of the relevant logical channel: it did not determine any route to access. I do not think this is correct. Examining the flag tells the mobile whether to go back to contention, or whether it has a reserved slot. Secondly IPCom submitted that the access authorisation data which the mobile must check in 189 must be access authorisation data generally broadcast to a number of stations – not individual data for assigning an individual transmission right. IPCom are correct that the data must be transmitted to all mobile stations: it is. The fact that

it only authorises access to the mobile that has requested reservation seems to me to be simply another way of putting the point about classes.

278. It follows that claims 1, 2 and 11 are anticipated (or rendered obvious) by Ericsson. I add the words in parentheses because the relevant part of the description does not mandate the lottery as the contention method, but the lottery is plainly an obvious choice and is disclosed in Ericsson. No other claim was said to be independently valid in this circumstance.

Obviousness over common general knowledge alone

279. In the light of my findings thus far it is not necessary for me to decide Nokia's further attack based on common general knowledge alone. It seems to me that it does not add anything of significance to its attack based on GPRS.

Infringement by the Nokia N96

280. The functioning of Nokia's N96 mobile phone is based on the UMTS Standard.

281. A value called the "dynamic persistence level" is sent by the base station to all mobiles. The dynamic persistence value is always sent by the base station. The mobile takes the dynamic persistence value and applies a scaling factor to yield a persistence value P_i. P_i is then compared with a random number generated in the mobile and if successful is allowed to attempt access to the random access channel.

282. Nokia's first non-infringement point is that it is common ground that no check is performed to determine the presence of the dynamic persistence level, or anything equivalent to it. The parameter is always sent. This argument is founded on Nokia's construction of the claim which I have rejected. It follows that I also reject their point on non-infringement.

283. UMTS provides for Access Classes which may be individually barred or allowed access. Every N96 is assigned to an Access Class which is fixed in its SIM. UMTS also provides for Access **Service** Classes. The network also broadcasts a matrix which maps the individual Access Classes to an Access Service Class, for example to prioritise groups of users. The matrix can be changed by the network.

284. The highest priority Access Service Class is Access Service Class 0. Access Service Class 0 is given a fixed persistence value of 1 which has the effect that the members of that Access Service Class will always be allowed to attempt access.

285. The N96 therefore checks whether the Access Class is mapped to a non-zero Access Service Class, in which case the access threshold value will be used for a persistence test and access will be assigned on the basis of the comparison result.

286. Nokia contend that this check in the N96 does not satisfy claim 1. Firstly they say that the check is not "shall I do the lottery or something else?" The N96 always does the lottery, even for ASC 0. It is just that in that case the result of the lottery is a foregone conclusion. I reject that submission. A lottery with a foregone conclusion is hardly a lottery. The N96 performs both types of check required by the claims.

287. Nokia's final non-infringement point concerned the precise mathematics of what is compared with what in the access threshold test. They say that IPCom cannot rely on the dynamic persistence value as the access threshold, as that is not compared with the random number: it is processed first. Similarly they cannot rely on P_i because that is not transmitted by the network. There was nothing in this point. If correct it would mean that the claim could be avoided by functionally equivalent systems just because of some processing in the phone. The skilled person would understand that the comparison in question is not to be read as literally as Nokia contend.

288. On the construction which I have adopted, and had the 189 patent been valid, the N96 would have infringed.

Infringement – the New Device

289. The PPD for the New Device is confidential. For the reasons I give in the Second Confidential Appendix, the New Device would also have infringed on the construction which I have adopted, if the patent had been valid

Essentiality

290. The description of the N96 is effectively taken from the UMTS standard. The patent thus reads on to the standard, and is essential to the operation of the standard.

Overall Conclusions

291. The 808 Patent is invalid for obviousness over the GSM recommendations, and also over both Baier and D'Avella when combined with common general knowledge. Had it been valid it would have been infringed by the 6300. 808 is not essential to the GSM standard.

292. The 189 patent is invalid. Had it been valid it would have been infringed by both the N96 and the New Device. 189 is essential to the operation of UMTS.

TECHNICAL APPENDIX

Mobile telephone networks generally: Cellular Networks, Handover

293. Cellular telephone networks are so called because they use a network of tessellated radio coverage cells to provide contiguous coverage over a large area. Each cell has a transmitter/receiver station, called a base station or BTS, which transmits signals to and receives signals from the mobile phones (called MS) within its cell. At any one time the mobile talks (transmits and receives traffic) to a particular BTS.

294. Mobile phones, as the name suggests, can move from one cell to another. When they do so the network must arrange for the MS to decamp from one BTS to another. This is called handover. It must be done without interrupting any calls in progress. The MS is however required to read certain information from neighbouring cells in preparation for possible handover. One such item of information is the Base Station Identification Code or BSIC of the neighbouring cell.

The GSM radio interface and channels

295. GSM as an international standard is a remarkable example of international technical co-operation. An article by M R L Hodges in the British Telecom Journal in January 1990 reported that commitment to the GSM system had been given by 18 European countries.

296. There are two main interfaces involved in GSM: the MS-BTS interface and the BTS-switching centre interface. This action is concerned only with the former. The GSM Recommendations give certain necessary conditions to ensure inter-operability, without over-specifying the manner in which these specifications are implemented. Accordingly much implementation detail – filling in the gaps - is left to the manufacturers of equipment for use on the network.

297. The GSM system is required to operate over a frequency band around 900MHz. This band is divided into a number of radio channels with a 200kHz spacing between them. Each of the radio channels is divided into timeslots of approximately 577 microseconds duration. 8 consecutive timeslots is called a frame.

298. The data structures for the MS-BTS radio interface are constructed as a series of layers, built one upon another. For present purposes it is sufficient to know that there are two main types of channel within GSM: traffic channels and control channels. Traffic channels are those which convey speech and data, control channels are those which carry signalling and synchronisation data.

299. One type of control channel is the broadcast channel: this is used to convey information to all MS in the network. Of these, GSM defines

- Frequency correction channel (FCCH) for mobile station frequency correction
- Synchronisation channel (SCH) for frame synchronisation of the mobile station and identification of the base station

- Broadcast control channel (BCCH) which broadcasts general information on an individual basis, such as cell selection information.

300. There are also common control channels (CCCH). These are used during establishment of a connection between the MS and the BTS before a dedicated control channel has been allocated to the MS. They include an uplink only random access channel called the RACH used for access attempts. This channel is relevant to the 189 patent.

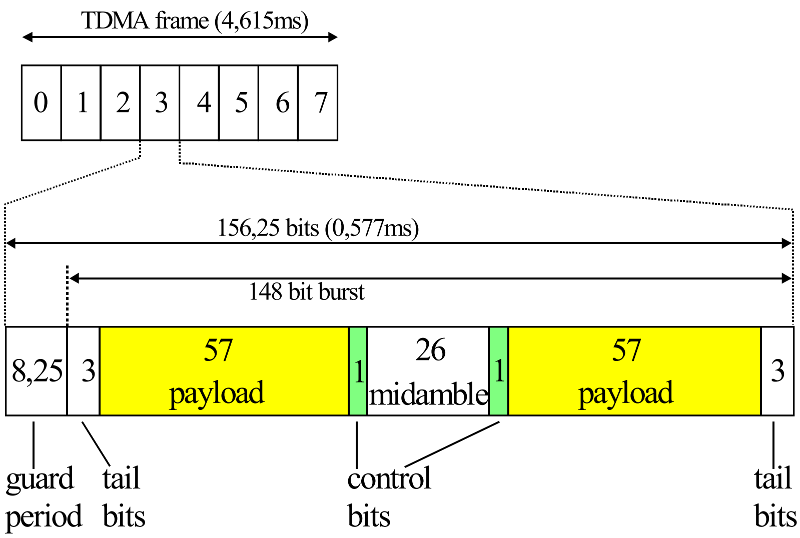
Burst types and structures

301. The timeslot of approximately 577 microseconds corresponds to 156.25 bit durations. The extent of this timeslot is called a burst.

302. Five types of burst are defined by GSM of which three are relevant here:

Normal bursts

303. The normal burst consists of two stretches of encrypted data on either side of a training sequence of 26 bits. The training sequence was provided for RF channel equalisation (see below). At the extreme ends of the burst are short start and stop tail bits and a guard period between bursts. They are constructed as in the figure below, which also shows how they fit to a GSM frame:



Frequency correction burst

304. The frequency correction burst has the same guard period and start and stop periods as the normal burst, but instead of the two strings of encrypted data and a training sequence, the remaining bits form a fixed sequence of zeros. This burst is used for frequency synchronisation of the MS. Because of the string of zeros it is highly recognisable: it was described during the trial as "a shark's fin in a sea of noise". It is well shown as the most prominent feature in this figure from an article by Frank & Koch:

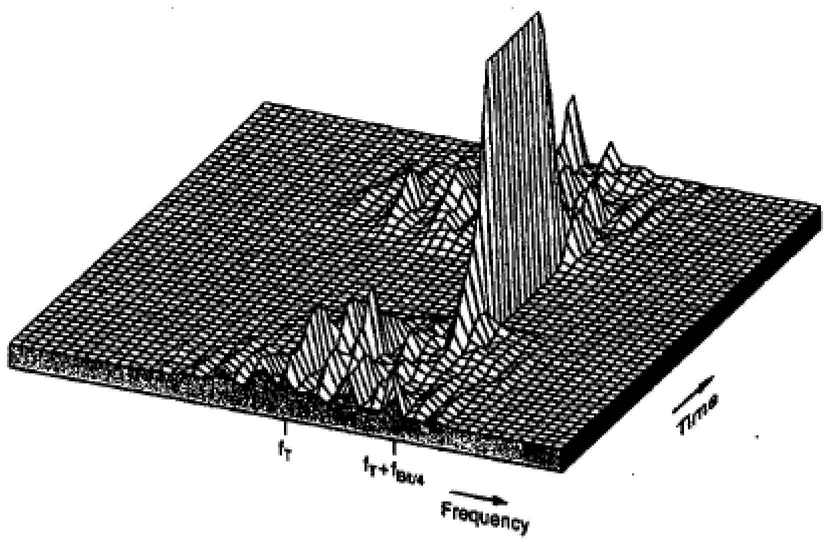


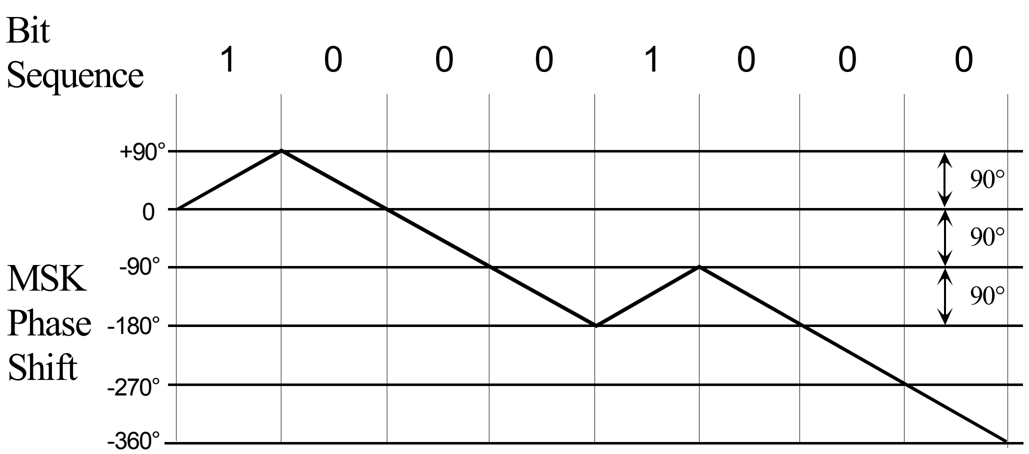
Fig. 7 Short-term spectra of a transmit signal with FCB

Synchronisation burst

305. This burst also has the same guard period and start and stop bits, but has an extended training sequence of 64 bits (extended compared to the 26 bits of the normal burst), and consequently only has room for two shorter data strings of 39 bits each.

Modulation of the carrier wave, MSK, GMSK, 8PSK and inter-symbol interference

306. The carrier wave is modulated so that it carries the data to be transmitted. Minimum shift keying (MSK) is a method of encoding data onto the carrier wave which uses the relative phase of the signal to carry the relevant data. MSK uses positive or negative phase difference of +/- 90^{o} between adjacent bits to indicate whether a zero or a one is intended. Some idea of how it works can be obtained from the following figure, which shows the impact of a bit sequence on the relative phase:



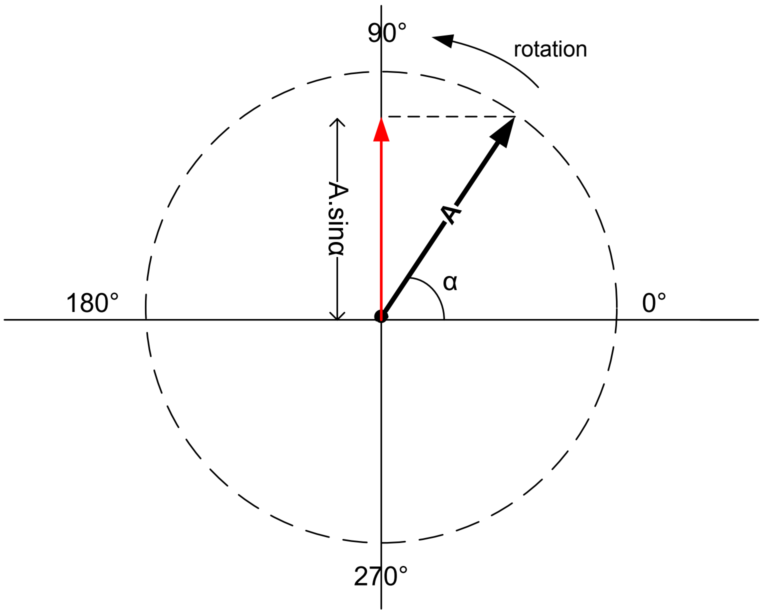
307. A problem created by MSK is that it necessarily involves a series of fairly sharp phase changes which are demanding on bandwidth. To eliminate this, the modulating signal is pre-filtered so as to produce a smoother phase profile. This system is called Gaussian Minimum Shift Keying or GMSK. Although the use of the Gaussian filter in

GMSK reduces the transmitted bandwidth, it also has the effect of introducing inter-symbol interference in the modulated carrier. The *maximum* phase shift per bit is still +/-90°.

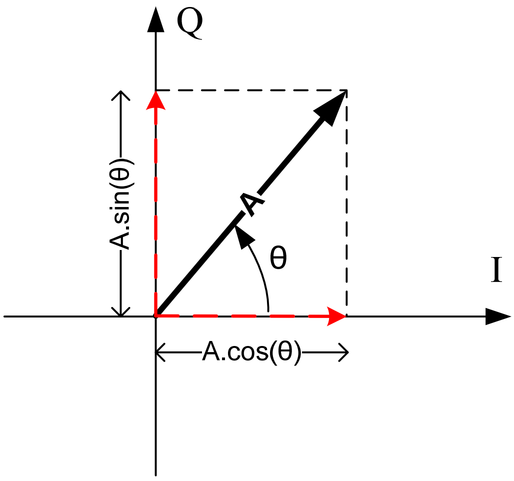
308. In phase shift keying (PSK), each bit (0 or 1) causes the phase to have a defined value. The principle can be extended to systems where the phase can have 8 different values (8PSK). Data transmitted using 8PSK is grouped into three-bit symbols, thus achieving higher data transmission rates. However, the downside is that 8PSK is more susceptible to noise during propagation. For present purposes the most important point about 8PSK is that it cannot be assumed that the phase change per bit is only +/-90°.

In-phase and quadrature signal components

309. The carrier wave can be thought of as a sine wave. It has a frequency and an amplitude. An alternative representation is the polar one, in which a radius rotates about the origin. Each 360° rotation represents a cycle. The number of rotations per second is the frequency. The length of the radius is the amplitude:



310. Just as with the wave representation, the phase of a signal with respect to a reference can be designated by an angle alone. Moreover all the information in the sine wave, including the amplitude, can be recorded in the so called I and Q components. The I component is the projection of the subject signal which is in phase with the reference signal, and the Q component is the projection which is at right angles:



311. The phase angle obtainable from the I and Q values will always lie in the range 0 to 360°. This can give rise to ambiguity, a waveform which has lagged 60° behind the reference carrier at a particular time is indistinguishable from one that has lagged by 60° + 360°. The phase angles are said to "wrap-around" at 360°.

312. There are circumstances where it is of interest to know how the phase of a signal is changing over a relatively long period. This can be done by "unwrapping" the phase angles to form continuous (rather than discontinuous) phase angles. An algorithm can be written to "unwrap" the measured phase angles to obtain the continuous phase angles. This can only be done if one has some knowledge about what phase changes are possible.

Propagation of the carrier wave

313. The radio frequency environment is characterised by multipath propagation. A radio signal path between the BTS and the MS may be direct, or may be reflected off buildings. This results in different path lengths. Accordingly the MS receives several different versions of the signal, which it has to unscramble.

314. Another effect which the mobile station has to deal with is the Doppler effect. The Doppler effect is caused by relative motion between transmitter and receiver. If the transmitter is moving towards the receiver, the received frequency at the receiver will be higher: if away from the receiver then the perceived frequency will be lower. It is the Doppler effect which causes the police siren to appear to change pitch as it goes past a fixed point.

315. One means of unscrambling the signal is to treat the path between the BTS and the MS as a kind of filter. Then, if one examines the effect of the "filter" on a known signal one can estimate the nature of the filter, and apply the reverse of the filter to get a true signal. In GSM the known signal which is used for this purpose is the training sequence within the normal or synchronisation burst.

316. The training sequence in a GSM burst is designed so that it produces a unit impulse at the output of the correlator when it matches the training sequence stored by the receiver. The received signal, which is an overlay of several signals due to the multipath propagation, is correlated repeatedly with the stored training sequence; each

time the received signal is shifted along by just one bit. As the two signals are shifted against each other a unit impulse will be seen for each propagation path. The sequence of correlation results for the successively shifted positions of the received signal samples is the channel impulse response (CIR) for the received signal. The process of calculating the CIR from the received signal is called channel estimation.

Equalisers

317. An equaliser is incorporated in the receiver to remove errors in the received signal caused by the radio channel so that the transmitted data in the received signal can be decoded and read by the receiver. The CIR calculated during channel estimation is used by the equalizer to estimate the transmitted information that is most likely to have resulted in the received signal.

Requirements for time and frequency synchronization

318. I set out the GSM requirements for frequency and time (frame) synchronisation when dealing with the GSM recommendations relied on by Nokia for their obviousness attack.

319. Frequency synchronisation is required in order to extract the baseband from the incoming signal. For this purpose the mobile requires a locally generated frequency, which is derived from its local oscillator. If the locally generated frequency is not synchronised with the received carrier frequency, the baseband signal will contain an offset which will interfere with the proper decoding of the signal.

320. Oscillators in mobile phones are cheaper and less stable than the oscillators used to generate the transmitted signals in the base station. Base station oscillators are highly stable.

321. Timing synchronisation is needed between the frame structures of the base station and the mobile stations. The mobile must be able to identify time slot 0 in the frame structure.

Development of GSM

322. The GSM system was designed originally to carry speech and low speed data. To increase the data rate the General Packet Radio Service (GPRS) was added.

323. "Enhanced Data rates for GSM Evolution" or EDGE was developed as an alternative GSM radio technique for increasing the user data rate. Standardisation work on EDGE started in the late 1990s.

324. EDGE introduced 8PSK as a modulation method in order to increase the data transmission rate per radio timeslot compared with GMSK. However it continued to use both GMSK and 8PSK modulation. The modulation scheme chosen for any burst depends on the quality of the radio link: the higher order 8PSK modulation scheme is chosen when the quality of the radio link is good, and the system reverts to the lower order GMSK modulation scheme when the quality of the radio link is poor. EDGE employs a form of 8PSK with a continuous additional phase rotation of $3\pi/8$ radians (or 67.5°) per bit period.

325. The additional rotation of 67.5° in EDGE 8PSK means that the phase change between two bit periods can be up to 337.5°. It is not limited to +/- 90° as in MSK or GMSK.