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Case No: A3/2020/2075

IN THE COURT OF APPEAL (CIVIL DIVISION)
ON APPEAL FROM THE BUSINESS AND PROPERTY COURTS OF ENGLAND AND WALES, INTELLECTUAL PROPERTY LIST (ChD), PATENTS COURT
Mr Justice Birss
[2020] EWHC 2746 (Pat)

Royal Courts of Justice
Strand, London, WC2A 2LL

Date: 10 November 2021

Before :

LORD JUSTICE NEWEY
LORD JUSTICE ARNOLD
and
LORD JUSTICE WARBY

- -

Between :

(1) OPTIS CELLULAR TECHNLOGY LLC **(2) OPTIS WIRELESS TECHNOLOGY LIMITED** **(3) UNWIRED PLANET INTERNATIONAL LIMITED**	**Claimants/ Respondents**
- and -	
(1) APPLE RETAIL UK LIMITED **(2) APPLE DISTRIBUTION INTERNATIONAL LIMITED** **(3) APPLE INC**	**Defendants/ Appellants**

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Guy Burkill QC and Brian Nicholson QC (instructed by **Wilmer Cutler Pickering Hale and Dorr LLP**) for the **Appellants**
Mark Chacksfield QC, Thomas Jones and Henry Edwards (instructed by **EIP Europe LLP and Osborne Clarke LLP**) for the **Respondents**

Hearing dates : 20-21 October 2021

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Approved Judgment

Covid-19 Protocol: This judgment was handed down remotely by circulation to the parties' representatives by email, release to BAILII and publication on the Courts and Tribunals Judiciary website. The date and time for hand-down is deemed to be at 10:30am on 10 November 2021

Lord Justice Arnold:

Introduction

1. The Claimants ("Optis") are members of a group of companies which owns a portfolio of patents that have been declared to be essential to one or more telecommunications standards. Among those patents is European Patent (UK) No 1 230 818 entitled "Method for improving handovers between mobile communications systems" ("the Patent"), which was originally obtained by Ericsson. The Patent has a priority date of 17 November 1999 and expired on 20 October 2020. By an order dated 23 November 2020 Birss J (as he then was) declared, for the reasons given in his judgment dated 16 October 2020 ([2020] EWHC 2746 (Pat)), that the Patent was valid, was essential to certain releases of the 2G standard 3GPP TS 45.008 and had been infringed by the Defendants ("Apple") through dealings in iPhones and iPads with compatible cellular capabilities. Apple now appeal against that order with permission granted by the judge, contending that the Patent is invalid and in any event was not essential and thus has not been infringed.

2. This case forms part of a larger battle between Optis and Apple, but that has no bearing on the issues that arise on the appeal. It may also be noted that the Patent was previously litigated in *Unwired Planet International Ltd v Huawei Technologies Co Ltd*, and in those proceedings the judge had also held that it was valid and essential for the reasons given in a judgment dated 22 March 2016 ([2016] EWHC 576 (Pat)). As the judge observed in the judgment under appeal at [4], it was necessary for him to consider the matter afresh not merely because Apple are not bound by the earlier decision, but also because the issues, arguments and evidence are somewhat different.

3. The invention described and claimed in the Patent relates to handover between different Radio Access Technologies (RATs) such as GSM (2G) and UMTS (3G). It is important to note at the outset that, although the specific embodiment described in the Patent concerns handover from GSM to UMTS, the claims are not limited to that scenario. This is illustrated by the fact that the alleged infringements encompass handover from GSM to LTE (4G). The judge nevertheless found it convenient when discussing the Patent and its claims frequently to refer to the exemplary situation. I shall follow his example. As the judge noted, however, it must constantly be borne in mind that the claims extend much further.

The skilled person

4. As the judge found at [26]-[29], the Patent is directed to an engineer with a number of years' practical experience of mobile telecommunications in general, and measurement reporting and handover technologies in particular. The skilled person would be well aware of the standardisation work on the new UMTS standard which was being developed by 3GPP, but had not yet been finalised, in November 1999, but not immersed in the detail of it.

Common general knowledge

5. The judge set out the skilled person's common general knowledge at [5]-[10], [12]-[13] and [30]-[48]. The findings that remain relevant for the purposes of the appeal are as

follows (I have interpolated two additional headings and some expansions of abbreviations):

"[*RATs*]

> 7. GSM is an FDMA [Frequency Division Multiple Access]/TDMA [Time Division Multiple Access] system. When a phone call is in progress the phone transmits digital signals to the base station at a particular frequency which has been allocated to it and in one of eight time slots at that frequency. Each time slot is 577 microseconds long. The uplink signals from each phone in a cell are on a different combination of frequency and time slot. From the point of view of the receiver, all the radio signal energy at that frequency at a particular time is signal from just one phone. Everything else in that time and frequency is noise. The downlink from the base station to the phones works the same way.
>
> …
>
> 10. Unlike GSM, UMTS uses radio access technology called wideband CDMA (Code Division Multiple Access). All the phones in a cell transmit in the same broad frequency band at the same time. What distinguishes one signal from another is a scrambling code. Each transmitter has a different code. The codes are orthogonal which means that (in theory) they can all be uniquely distinguished from one another. From the point of view of the receiver, the radio signal energy in a frequency band at all times is made up of all the transmitters 'talking' at once. If the receiver wants to 'listen' to a particular transmitter it uses the right code to pull out from that overall radio energy the signal sent by that transmitter. Everything else, including all the other transmitters, is effectively noise. The base stations in UMTS (called Node Bs) also broadcast something called the CPICH. This is a 'pilot' channel which allows phones to find the signals from that base station using the primary scrambling code for the cell.
>
> …
>
> *Handover*
>
> 12. In a cellular telecommunications network handover is crucial in order to maintain connections (phone calls or data). The quality of the channel between the phone and the base station in one cell may start to deteriorate but there may be another cell available which can provide a better connection. The phone is handed over from one base station to another. This can happen seamlessly in the middle of the phone call or data connection so that the user does not notice. It may need to happen very quickly. There are different kinds of handover. One sort is known as network

controlled mobile assisted handover. The decision to handover is made by the network not the phone, but the phones assist the process by using their radio receivers to make measurements of neighbouring cells and then reporting these results to the network so that the network can make a decision. Another sort of handover can be controlled by the phone itself.

13. When the GSM system began, the only handovers contemplated within its standard were GSM to GSM, in other words intra-RAT handovers. These included handovers between different frequency bands within GSM. Nevertheless given the variety of RATs which were in existence in the 1990s, the general idea of inter-RAT handover was well known. Focussing in particular on GSM and UMTS, by the priority date it was clear that so called dual mode phones would be available which were capable of working in GSM or UMTS and there would be a need for inter-RAT handovers in which a phone could be handed over from a GSM cell to a UMTS cell and vice versa.

…

[*GSM*]

31. RATs have a land side, which refers to the fixed part of the network, as distinct from the air side, i.e. the phone. The phone is mobile. The land side communicates with the phone over the air interface. The land side of GSM consisted of essentially three kinds of boxes: the MSC [Mobile Switching Centre], the BSC [Base Station Controller] and the BTS [Base Transceiver Station]. The BTS is the base station. It is often depicted as an aerial. Each cell has a BTS. The BSCs control a number of BTSs and an MSC in turn sits above a number of BSCs forming a hierarchy. ….

32. When measurements are made in GSM for handover purposes the phone can measure the received signal level of a cell such as a neighbour. This is called RXLEV. RXLEV is a measure of power and its units are dBm [decibel-milliwatts]. The quality of the received signal can be represented by a value called RXQUAL. RXQUAL is a kind of signal to noise ratio. As a ratio its units are dB [decibels]. Generally a phone can measure RXLEV for both the serving cell to which it is connected and neighbour cells while it only measures or reports RXQUAL for the serving cell.

33. In GSM there are two available control channels on the uplink, SACCH and FACCH. These letters stand for Slow Associated Control Channel and Fast Associated Control Channel. The SACCH worked as follows. Together the eight time slots of 577 µsec each form one single frame of about 4.6 msec. A multiframe amounts to 26 frames and takes up about 120 msecs.

In the normal case 24 of those 26 frames in a multiframe are used to carry traffic channels. The 26th frame is empty for various reasons. The 13th frame is used to send control data. One SACCH message requires four bursts, in other words four of these 13th frames. So to send one SACCH message takes about half a second (4 x 120 msecs = 480 msecs).

34. The FACCH works in a different way. Traffic channel frames are used to send FACCH messages. That means those traffic frames cannot be used to send data such as voice data. The traffic frames are said to be 'stolen'. A FACCH message needs four frames worth of data sent over five successive frames. So it is much faster than the SACCH. Moreover, owing to the error correction methods which are used it is possible to steal a small number of traffic data bits without sacrificing connection quality at all. However for various reasons the error correction may not be able to compensate for a FACCH message, in which case using the FACCH frequently may degrade connection quality.

35. So using the SACCH to send messages does not 'steal' from the voice or data traffic, whereas using the FACCH may well do, especially if it is used repeatedly or if conditions are poor.

36. In GSM the SACCH is used to send regular measurement reports from the phone to the BSS. The normal measurement report provides the RXLEV and RXQUAL for the serving cell and the RXLEV of the 6 neighbouring cells. The 6 cells to report are the ones with the highest RXLEV. This normal measurement report takes up one whole SACCH message. Therefore if nothing else was sent on the SACCH, the phone could send two normal measurement reports per second. However the standard permits some other messages to be sent on the SACCH too. An example of another message is an SMS text message. In GSM SMS messages are sent on the SACCH. …

37. The rule is that a normal measurement report may be sent in every SACCH message and must be sent in every other SACCH message. So if, for example there was no other message to be sent, then every SACCH message would be a normal measurement report. The SACCH is never empty. The reason for this is because the regular measurement reports are used by the network to build up a picture of how conditions around the phone are changing over time. This helps make handover decisions. Nevertheless if another message such as an SMS message needed to be sent, then that other message could only use up to half the capacity of the SACCH. The SACCH would still send normal measurement reports every half a second, but every other SACCH message could be used to send the SMS (which might only need one SACCH message or might require more). This way some capacity on the SACCH was available.

But that availability was at the expense of sending some measurement reports.

…

39. … At the relevant time two separate frequency bands, GSM 900 and DCS 1800, were established in GSM. Dual mode handsets capable of operating on either band became available, and handover between the different bands had to be catered for. The GSM standard at the time had special provisions relating to multiband handsets. The network could require multiband reporting to take place using a parameter called MULTIBAND_REPORTING. One setting meant that the phone would report the six strongest neighbouring cells irrespective of the band they were in. Picking these cells would require the phone to compare the RXLEV measurements from the various GSM cells in the two bands.

UMTS

40. … the skilled person knew in November 1999 that the structure of the land side of the UMTS network was also going to consist of essentially three kinds of boxes: the MSC, the RNC and the Node B.

41. The Node B is the radio transceiver. The RNCs control a number of Node Bs and an MSC in turn sits above a number of RNCs forming a hierarchy. The UMTS network is sometimes called UTRAN. UMTS works in two ways, FDD [Frequency Division Duplex] and TDD [Time Division Duplex]. …

42. In UMTS measurements can be made of the strength and quality of a received signal. The value RSCP is a measure of signal strength for the cell. The letters stand for Received Signal Code Power. The reason this measure is concerned with code power is because UMTS is a CDMA system and what distinguishes each cell from its neighbour is the code (i.e. the scrambling code). Strictly the value is CPICH RSCP, i.e. RSCP after despreading on the pilot channel. The units of RSCP are dBm.

43. In UMTS signal quality can be expressed as the ratio Ec/Io (strictly E_c/I_0). This is the ratio of code energy to interference. Another measure is the ratio between code energy and noise power spectral density, written as Ec/No. These two are not the same but for the purposes of this case they can be treated interchangeably. Both quantities represent a measure of signal to noise ratio and hence quality. Strictly Ec refers to energy per chip. A chip can be thought of as a single bit of a given scrambling code. The units in which Ec/Io and Ec/No are expressed are dB.

44. As of the priority date, candidates for signal characteristics to be measured and reported by the mobile for inter-frequency handover in UMTS were identified in [a] list [which] identified five candidate characteristics including RSCP and Ec/Io. The list made clear that while one of them would be mandatory, it had not been decided which one. … Moreover the range over which the individual measurement had to be expressed was undecided and so also was the mapping and format in which that information would be conveyed in UMTS.

Message design, mappings and formats

45. Part of the task of a skilled person would be to design messages to be sent over the air interface. Techniques to do this were part of the common general knowledge. One aspect is the mapping and formatting of information.

46. In GSM … RXLEV … is encoded or 'mapped' into a 6 bit format in the standard GSM measurement report. A 6 bit binary number provides 64 integer values expressed in decimal numbers as 0-63. The scheme works as follows. The received power level for a cell can be expressed as a value in watts. A value in watts can also be expressed in dBm. dBm is a logarithmic scale which allows a range of powers which differ by several orders of magnitude to be expressed in a convenient way. For example -90 dBm is 10^{-12} watts or 1 picowatt and -30 dBm is 10^{-6} watts or 1 microwatt, a power level six orders of magnitude greater. In GSM the default encoding scheme is that values less than -110 dBm are all mapped to zero in the 6 bit format. Values within the range -110 to -48 dBm are mapped to the integers 1 to 62 in 1dBm increments. Values greater than -48 dBm are all mapped to the integer 63. It will be seen that there are 62 steps of 1 dBm each between -110 and -48. So if the phone measures a received power level for a GSM cell of 56 picowatts (which is 5.6×10^{-11} watts), expressed in dBm that is -72.5 dBm. That value would be encoded in the 6 bit format as 100110 (or 38). The GSM scheme has further aspects (such as a SCALE parameter) but that is not relevant. Note that this encoding is not arbitrary because, within the range a higher encoded value will represent a higher power and the steps are the same size in dBm (although not the same size in watts). That is commonly done and for good reason but it is not a necessary part of encoding. An encoding scheme could be entirely arbitrary provided both the sender and the receiver know what the rules are. The term RXLEV sometimes means the measured value and sometimes means the encoded integer. Usually there is no problem with this and the skilled person understands, but nevertheless they are two distinct entities. …

47. There is no reason why the encoding of one value in one communications protocol (say RXLEV in GSM measurement

> reports) has to correspond to the encoding of a different value in a different protocol (say RSCP in UMTS measurement reports). At this stage the point is simply that encoding formats can differ. …
>
> 48. Moreover, … encoding or mapping does not have any necessary connection with the comparability of two pieces of information. …"

The Patent

6. As is often the case with mobile phone patents, the specification of the Patent is quite short, but densely written. Comprehension is not assisted by a couple of discrepancies between the text and the figures. Perhaps as a result of these factors, there is a substantial dispute between the parties as to the disclosure of the Patent.

7. Under the heading "Background of the invention", the specification begins at [0001] by stating that the invention relates, in particular, to a method for improving the performance of handovers between different mobile communication systems. At [0002] the specification notes that UMTS is being developed as a successor to GSM, and that when it is introduced there will be a need for handovers between GSM and UMTS networks. At [0003] the specification states that a "basic problem" with respect to such handovers is determining how to transport UMTS measurement information from a mobile station (MS) to the GSM BSC. GSM is said to provide "no spare signalling capacity" on the uplink (i.e. on the SACCH), and hence the transport of UMTS measurement information from an MS to the GSM BSC will have to be performed at the expense of other information. At [0004] the specification notes that a proposed solution is to send the UMTS measurement information on the FACCH, but due to stealing this would "severely reduce" the quality of the speech information being conveyed. It then states that "the present invention successfully resolves this pressing handover problem and other related problems".

8. Under the heading "Summary of the invention", the specification states at [0005]:

> "In accordance with a preferred embodiment of the present invention, a method for conveying measurement information from a mobile terminal in a first communication system to a second communication system is provided, whereby the measurement information related to the first communication system is conveyed to the second communication system on a control channel which can function in a non-stealing mode. For example, in accordance with the preferred embodiment, UMTS measurement information can be conveyed from an MS to a GSM BSC, in a GSM message on a Slow Associated Control Channel (SACCH)."

As can be seen, this statement is directed to the preferred embodiment of the invention.

9. This section of the specification goes on to list three "important technical advantage[s]" of the invention at [0006]-[0008]: (i) "measurement information can be conveyed effectively between different mobile communication systems without sacrificing the

quality of speech information being conveyed"; (ii) "handovers between different types of mobile communication systems can be effectively performed"; and (iii) "coverage for a UMTS network can be expanded using GSM network coverage".

10. Under the heading "Detailed description of the drawings", the specification describes what is said repeatedly to be a "preferred embodiment" of the invention by reference to Figures 1 and 2. Although described as a single embodiment, it is important to note that it comprises two alternatives, only the second of which is covered by the claims. The parties disagree as to the extent to which these two alternatives differ from each other.

11. At [0011] the specification repeats almost word-for-word the contents of [0005]-[0007].

12. At [0012]-[0014] the specification describes in high level terms by reference to Figure 1 a GSM network with an adjacent cell of a UMTS network.

13. It is explained in [0012] that, in the GSM network, the BTS "can receive [signal strength and transmission quality] measurement reports from each one of a plurality of mobile terminals". The BTS conveys the "measurement report information" to the BSC, which can "evaluate incoming measurement information and make handover decisions".

14. It is then explained in [0013] that:

> "A mobile terminal (MS 22) operating in a GSM cell … is capable of making UMTS measurements related to the UMTS cell … and conveying them (in measurement reports) to the GSM BSC in the measurement reports on the SACCH for handover decisions. Notably, the UMTS measurement information being reported is different from the typical GSM measurement information being reported."

15. The difference between the UMTS measurement information and the GSM measurement information is further explained in [0014], which also identifies a consequence of this difference:

> "For example, a typical GSM MS continuously measures and reports (on the UL) signal strength (dBm) and quality (Bit Error Rate or BER) of its own cell, and signal strength of the Broadcast Control Channel (BCCH) carriers of the neighboring cells. On the other hand, instead of measuring signal strength in a UMTS cell, a UMTS MS measures and reports (on the UL) the Code Energy-to-Interference Ratio (E_c/I_0) or Received Signal Code Power (RSCP in dBm) of the UMTS cell. Consequently, in order for an MS (e.g. 22) to convey UMTS measurement information to a GSM BSC (e.g., for handover purposes), the UMTS measurement information is preferably converted to an appropriate GSM measurement format."

16. The last sentence indicates that it is preferable to convert the UMTS measurement information to a GSM measurement format so that the information can be reported by the mobile to the network. The skilled reader would understand that the reason for this

is that it enables the UMTS measurement information to be included in what the specification refers to later as "a GSM measurement report" (see [0016] quoted in paragraph 23 below) and "the standard GSM measurement result message" (see box 106 in Figure 2 reproduced beneath paragraph 18 below), which contains space to report measurements for six cells.

17. The paragraph concludes:

> "As such, in accordance with the preferred embodiment of the present invention, an exemplary method that can be used by an MS for converting UMTS measurement information to a GSM measurement information format is described below with respect to FIGURE 2."

This statement focusses on the use of the method described below for converting UMTS measurement information to a GSM format.

18. Figure 2 is reproduced below.

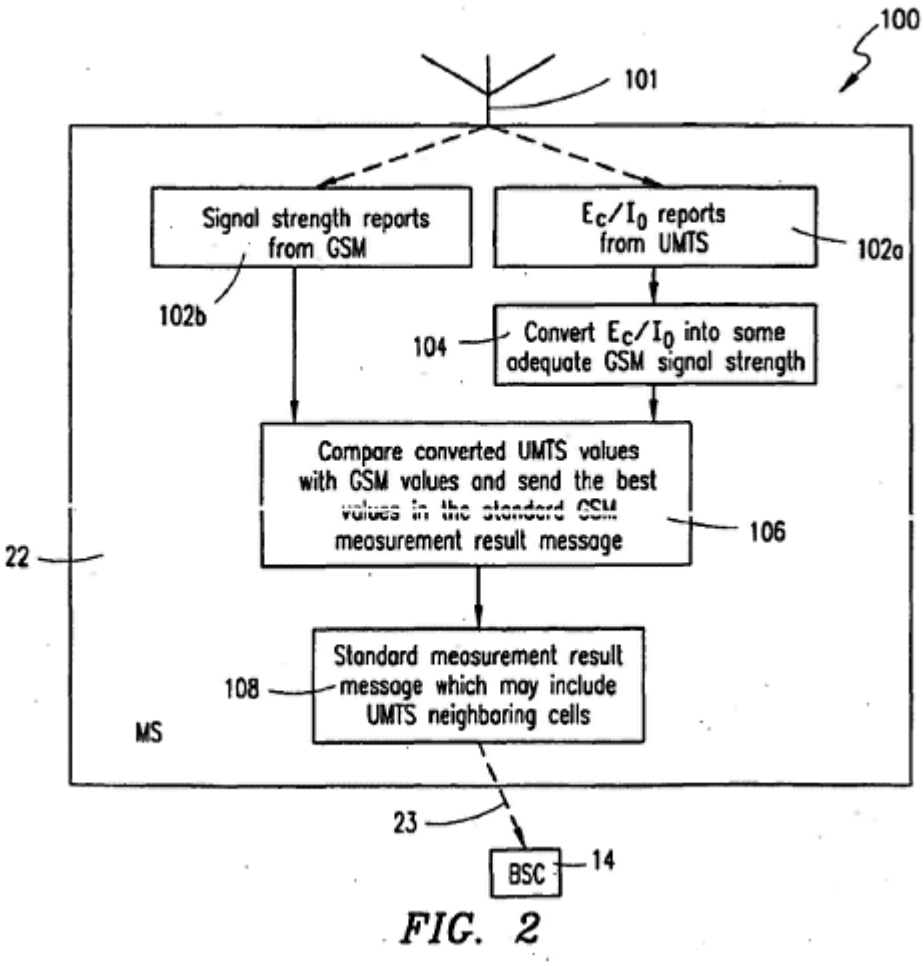

FIG. 2

19. As explained in [0009] and [0015], Figure 2 is a (schematic) flow diagram of "an exemplary conversion method 100" that can be used to implement the preferred embodiment. This method consists of four steps.

20. The first is step 102, which consists of two operations 102a and 102b carried out in parallel. This is described in [0015] as follows:

> "... at step 102a of the method, the MS 22 retrieves from local memory, E_c/I_0 or RSCP information … measured and stored for reporting to a GSM BSC (14). At step 102b, the MS 22 (e.g., a dual-mode MS) can also retrieve from local memory, signal strength information (dBm) measured and stored for reporting to a GSM BSC."

Although it is not explicitly stated in this passage, it is clear from the preceding discussion that the "E_c/I_0 or RSCP information" is UMTS measurement information while the "signal strength information" is GSM measurement information. This is confirmed by the text in boxes 102a and 102b (although the text in box 102a only refers to E_c/I_0, and not to RSCP, no doubt for brevity).

21. The second step is 104. This is described in [0015] as follows:

> "At step 104, the MS 22 converts the retrieved UMTS E_c/I_0 or RSCP measurement information to appropriate GSM signal strength information, which can be used by the GSM BSC 14 for making handover decisions. For example, the UMTS RSCP measurement information retrieved by the MS 22 can be converted to appropriate GSM signal strength measurement information (RXLEV) by using the following equation:
>
> RXLEV = RSCP + OFFSET(RSCP), (1)
>
> where RXLEV represents GSM signal strength measurements [e.g., -110,-47] in dBm, RSCP represents UMTS signal strength measurements in dBm, and OFFSET represents offset values that can be constant or variable with RSCP."

22. This passage begins by speaking about the conversion of UMTS measurement information to GSM signal strength information. It goes on to give an example of how this can be done using an offset which may be constant or variable. It is clear that, in this example, the RSCP values are converted into RXLEV values using the equation. The judge rejected at [65] a contention by Apple that the skilled reader would conclude that the conversion had to be done by some mathematical operation. Apple did not renew that contention on the appeal. It should be noted, however, that there is no express reference to format.

23. The third step is 106. As foreshadowed above, there are two alternatives for this. Since the specification describes the second alternative after describing the fourth step, 108, I shall adopt the same course. The first alternative is described in [0016] as follows:

> "At step 106, the MS 22 compares the converted UMTS signal strength values (derived from step 104) with the set of stored GSM signal strength values (derived from step 102b). The MS 22 then retrieves a predetermined number (e.g., 6, or the maximum number of neighboring cells included in a GSM

> measurement report) of the 'best' measurement values from step 106 to be reported in a measurement report to the GSM BSC 14."

24. If this description is compared with the text in box 106 in Figure 2, it can be seen that there is a small discrepancy: in [0016] the word "best" appears in inverted commas, whereas in box 106 it does not. This appears to be a straightforward typographical error in the box. As the judge explained at [68]:

> "The skilled reader would understand the writer to be [putting 'best' in inverted commas] to indicate that best is being used in a figurative sense alluding to their suitability for handover, while not pretending that necessarily one is really better than another because real handover decisions are more complicated than that and take in other factors such as loading."

25. It can be seen from the passage quoted in paragraph 23 above that step 106 consists of comparing the converted UMTS values derived from step 104 with the GSM values from step 102b. It is then said that the mobile retrieves (i.e. selects), say, six of the "best" values to be reported in a GSM measurement report. It is ambiguous as to whether the selection of these values is part of step 106 or a separate, unnumbered, step, but this does not matter. For convenience I will treat step 106 as consisting of both comparison and selection.

26. Again, there is no express reference to format. It is clear, however, that the result of this step is that what box 106 calls "the standard GSM measurement result message" which is sent to the GSM BSC may contain a mixture of GSM and UMTS cells amongst the six reported, depending on the comparison.

27. The fourth step is 108. This is described in [0016] as follows:

> "At step 108, for this exemplary embodiment, the MS 22 sends a GSM-type measurement report for receipt at the BSC 14 (via BTS 16) on the GSM SACCH over the radio air interface 23. The GSM-type measurement report can include signal strength information about UMTS neighboring cells."

28. There is a discrepancy between this passage and Figure 2, since Figure 2 shows the sending of the report in box 106 rather than in box 108, and box 108 just shows what is sent. In my judgment the skilled reader would rely upon what is said in [0016] and conclude that this is another mistake in Figure 2. Again, there is no express reference to format.

29. The specification then describes the second alternative at step 106 in [0016] as follows:

> "Alternatively, at step 106, instead of comparing the converted UMTS measurement values with GSM measurement values, the MS can convert each stored UMTS measurement value to an appropriate GSM signal strength value, and select each converted UMTS measurement value that exceeds a predetermined signal strength threshold value, for reporting to the GSM BSC 14."

30. A number of points should be noted about this passage. First, although it is not expressly stated, it is clear that the converted UMTS values are again derived from step 104. Secondly, this is the only reference in the specification (as opposed to the claims) to a threshold value. Thirdly, there is no statement as to the source of the threshold value: it could be e.g. hard-wired in the mobile or sent dynamically by the network. Fourthly, in this alternative, step 106 clearly consists of both comparison with the threshold and selection. Fifthly, it is evident that the result will be a variable number of UMTS values, depending on how many values exceed the threshold. Sixthly, once again there is no express reference to format. Seventhly, there is no express description of precisely how the selected values are reported to the GSM BSC.

31. The description concludes at [0017] as follows:

> "Using the above-described method (100) in accordance with the preferred embodiment of the present invention, the UMTS measurement information from the MS 22 can be converted to a GSM measurement format and sent to the GSM BSC 14 on the SACCH for use in making handover decisions. Consequently, since the SACCH does not operate in a stealing mode, the quality of the speech and on-line data being conveyed between the MS 22 and the GSM network 10 will not be diminished due to the use of speech frames for measurement signalling."

32. As the judge explained at [73]:

> "The skilled person would understand that this result in paragraph [0017] happens for two reasons. First, by converting the UMTS measurements into a GSM measurement format, the reporting can be carried out using the existing GSM measurement report. UMTS and GSM measurements have the same format and so they can replace one another in the existing report. The best cells from a pool of GSM and UMTS cells can be sent in the report. That report message is sent on the SACCH and so the reporting of UMTS measurements can take place on the SACCH and as a result does not steal from speech. Second, by converting the UMTS measurements into what is described as 'appropriate GSM signal strength information' (para [0015] ln49) and 'some adequate GSM signal strength' (box 102a of Fig 2) the UMTS values can be compared against GSM values. This comparison can be carried out in the BSC when making handover decisions (para [0015] ln49) and can be done in the phone in order to work out which UMTS cells to include in the standard GSM measurement report instead of GSM cells."

33. As mentioned above, there is a dispute between the parties as to the extent of the difference between the two alternatives referred to in [0016]. Optis contend that the only difference between the two alternatives is with respect to the comparison in step 106. Apple contend that the differences extend beyond that, and in particular that there is no teaching that in the second alternative the converted UMTS values are sent in a GSM standard measurement result message (step 108).

34. The judge held that Optis were correct. He gave four reasons. It is sufficient to quote the first three:

> "78. First, one must read the document as a whole. Overall in the specification conversion is described as one exercise albeit it has two aspects – comparability and format. The reader would not think the conversion in the context of the second alternative was different from the conversion in the first alternative. Also, looking at the document overall, the second alternative is presented as an alternative at step 106 in conversion method 100. It is not stated to be an alternative to paragraph [0017]. As written paragraph [0017] applies to both alternatives. The same goes for earlier paragraphs [0014] and [0015]. The language referring to preferred embodiments does not justify excluding either alternative from these other parts of the disclosure.
>
> 79. Second, it is true that the second alternative refers to selecting 'each' converted UMTS value which exceeds the threshold for reporting, but that would not be understood by the skilled person as a statement that an unlimited number of UMTS values should be sent. The skilled person would know that there ought to be a limit on the number sent and would see that these words were not being used to mean that the idea of using the standard GSM message was being abandoned. Far from it. The skilled person was familiar with message design and would understand, based on their common general knowledge, that there were various ways of carrying this out. That could include e.g. providing that up to six UMTS measurements would be reported with the remainder being used by GSM measurements, or providing some form of partitioning of the available space (e.g. 3 for UMTS and 3 for GSM) or some other approach again.
>
> 80. Third, it is also true that the sentence at the end of paragraph [0016] in which the second alternative is contained does not mention a standard GSM report but the skilled person would not think that that meant a completely different approach was being proposed. The reader would not think that using the standard GSM report was mandatory, but nor would they think the second alternative excluded any such thing."

35. Notwithstanding the submissions of Apple to the contrary, in my judgment this reasoning is compelling. In particular, I do not accept the submission that the last sentence quoted contradicts the preceding reasoning. As Apple themselves point out, [0016] is describing a preferred embodiment. For the reasons explained by the judge, the skilled reader would understand the second alternative in the preferred embodiment to employ the standard GSM measurement report. It is true that, as the judge recognised, the claims do not require this, which is a point I shall have to return to when considering the correct construction of the claims, but that does not contradict the judge's analysis of the preferred embodiment.

36. The judge drew the following conclusion as to the disclosure of the Patent:

> "82. It follows from this conclusion that it is fair to say that what the patent discloses is the idea that when the phone does the comparison it may be done using real GSM measurements (first embodiment) or a GSM threshold (second embodiment). Although not stated in the patent expressly for the second embodiment, the reader would understand that both embodiments could result in a measurement report containing both UMTS and GSM cells. If (say) only three converted UMTS measurements passed the threshold test and were to be reported in a standard GSM message report with room for six cells, the phone could report the three best GSM cells in the available spaces.
>
> 83. [Counsel for Optis], as he did in the previous case, described this as the invention enabling the phone to 'flexibly and intelligently' allocate the limited signalling capacity available on the SACCH such that it was likely that the most useful cells are reported. This is correct to the extent that starting with a standard GSM measurement report which can include six cells, this does not enable more cells to be reported but it does allow the phone to select from the pool of both GSM and UMTS cells, choose the six 'best', and flexibly allocate space to those six. It is flexible in the sense that next time a report is sent, a different mix of UMTS and GSM cells may be sent. Whether it is right to call it intelligent does not matter."

37. As the judge noted elsewhere in his judgment, in particular at [100], claim 1 is not limited to use of the SACCH, although it does of course cover use of the SACCH. Subject to that minor qualification, I agree with this assessment.

The claims

38. Claim 1 of the Patent is as follows (broken down into integers):

> "[a] A method for conveying measurement information from a terminal in a first communication system to a second communication system, characterised by the steps of:
>
> [b] converting a plurality of downlink measurement values associated with said first communication system to a plurality of downlink measurement values for said second communication system;
>
> [c] comparing said converted plurality of downlink measurement values with at least one threshold measurement value; and
>
> [d] if at least one of said converted plurality of downlink measurement values exceeds a predetermined threshold measurement value, sending said at least one of said converted plurality of downlink measurement values on a control channel to a control node in said second communication system."

39. Claim 2 requires the first communication system to be "a" UMTS. Claim 3, which is dependent on claim 1, requires the second communication system to be "a" GSM. Claim 8, which is again dependent on claim 1, requires the control channel in feature [d] to be "a" SACCH. As the judge noted, the use of the indefinite article in these claims is a little odd, but nothing turns on this. There are also parallel product claims.

Construction of claim 1

40. There is a dispute between the parties as to the correct construction of claim 1. This turns on the meaning of the word "converting" in integer [b] read in context. It is common ground that this means converting to ensure *comparability* of the measured values with the threshold value. Optis contend that it also means converting the *format* of the measurement values, whereas Apple dispute this. Somewhat unusually, therefore, the alleged infringers are arguing for a wider construction of the claim than the patentees.

41. For the purpose of resolving this dispute the judge treated the claim as if it were limited to UMTS and GSM because, as he explained, this makes it easier to articulate the analysis than if one has to refer to first and second communication systems. As noted above, however, it must be borne in mind that the claims extend more widely.

42. The judge expressed his conclusion as follows:

> "93. In my judgment the skilled reader would understand the patent as a whole to refer to conversion as a process with both aspects. Its purpose is to render the UMTS measurement in a form both (i) comparable with a GSM measurement and (ii) expressed in a GSM measurement format. The former makes it useful for handover decisions and the latter helps send it on the SACCH in a non-stealing mode. The reader of the patent would not think the conversion referred to had taken place if only one of these two things was achieved.
>
> 94. The reader would understand the term conversion as it is used in the claim to have the same meaning as in the rest of the specification. This is not to read a gloss from the specification into the claim, it is to interpret the claim in its proper context."

43. It is clear from what the judge said in [82] (quoted in paragraph 36 above) and in [91]-[92] that, when the judge said in [93] "comparable with a GSM measurement", he meant comparable with either an actual GSM measurement (in the first alternative of the preferred embodiment) or a GSM measurement threshold value (in the second alternative and in the claim).

44. The judge explained the requirement of comparability in more detail as follows:

> "103. To make UMTS measurements comparable with GSM measurements as required by the patent as part of conversion, what is required is that the UMTS value be expressed as if it was a GSM measured value, even though it is not, and thereby allow

> ranking of the cells from both GSM and UMTS on a common scale.
>
> 104. As the exemplary equation in the specification shows, one way of doing this could be to add an offset to the UMTS value to make it comparable. However that is not the only way. As the skilled person would understand, information from different sources can also be made comparable by a process of encoding and mapping to an appropriate scale. The temperature example relied on by [counsel for Optis] illustrates the point."

45. Although this passage refers to comparison of the converted UMTS measurements with "GSM measurements", it is again clear that the judge meant either actual GSM measurements or a GSM measurement threshold value.

46. Later in the judgment the judge used the phrase "direct comparability" to epitomise this aspect of the conversion required by the claim. This is a helpful way of expressing the requirement, and I will adopt it.

47. The temperature example referred to by the judge is shown in the following table:

°C Encoding			°F Encoding			°F Encoding & Conversion		
0	< -20		0	< -16		0	< -4	
1	-20	-19.1	1	-16	-13.1	1	-4	-2.3
2	-19	-18.1	2	-13	-10.1	2	-2.2	-0.5
3	-18	-17.1	3	-10	-7.1	3	-0.4	1.3
4	-17	-16.1	4	-7	-4.1	4	1.4	3.1
5	-16	-15.1	5	-4	-1.1	5	3.2	4.9
6	-15	-14.1	6	-1	1.9	6	5	6.7
7	-14	-13.1	7	2	4.9	7	6.8	8.5
8	-13	-12.1	8	5	7.9	8	8.6	10.3
9	-12	-11.1	9	8	10.9	9	10.4	12.1
10	-11	-10.1	10	11	13.9	10	12.2	13.9
11	-10	-9.1	11	14	16.9	11	14	15.7
12	-9	-8.1	12	17	19.9	12	15.8	17.5
13	-8	-7.1	13	20	22.9	13	17.6	19.3
14	-7	-6.1	14	23	25.9	14	19.4	21.1
15	-6	-5.1	15	26	28.9	15	21.2	22.9
16	-5	-4.1	16	29	31.9	16	23	24.7
17	-4	-3.1	17	32	34.9	17	24.8	26.5
18	-3	-2.1	18	35	37.9	18	26.6	28.3
19	-2	-1.1	19	38	40.9	19	28.4	30.1
20	-1	-0.1	20	41	43.9	20	30.2	31.9
21	≥ 0		21	≥ 44		21	≥ 32	

48. The left-hand columns encode temperature measurements in ºC on a decimal scale of 0 – 21. The central columns encode temperature measurements in ºF on a decimal scale of 0 – 21. Although the format of the encoded ºF measurements is the same as the format of the encoded ºC measurements, there is no comparability between the two. For example -19ºC (encoded 2) is not equivalent to -13ºF (encoded 2). In the right-hand columns ºF is encoded on a decimal scale which has both the same format as, and comparability with, the encoded ºC measurements. For example, -19ºC (encoded 2) is equivalent to -2.2ºF (encoded 2). Thus one can compare a ºF measurement encoded in accordance with the left-hand columns with a ºC measurement encoded in accordance with the right-hand columns by comparing their encoded values, the higher being hotter. The analogy with the scenario described in the Patent is not perfect, not least because the same fundamental physical property (heat) underlies each set of columns in the table, whereas in the Patent slightly different physical properties are being

measured in the GSM and UMTS measurements, as the judge explained at [32] and [42], but nevertheless it is a helpful illustration.

49. Apple challenge the judge's construction of claim 1. Although it makes no difference to the issues of essentiality and infringement, Apple rely upon their wider construction of the claim in support of their case that the Patent is invalid.

50. There is no dispute as to the applicable principles, which are well settled. It is therefore unnecessary to set them out at length. The principle upon which Apple particularly rely was expressed by Floyd J in *Nokia GmbH v IPCom GmbH & Co KG* [2009] EWHC 3482 (Pat) at [41] as follows:

> "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."

51. Apple point out that the claim expressly requires a comparison to be made between the converted measurement values and the threshold measurement value in order to determine whether the converted values exceed the threshold value. It is therefore implicit that the converted values must be directly comparable with the threshold value, otherwise this comparison would not be meaningful. By contrast, there is no mention of format in the claim. Apple argue that this is not implicit in the claim, and that the judge fell into the error of importing a feature of the preferred embodiment into his interpretation of the claim.

52. Apple emphasise the breadth of the claim, which has been generalised out from the second alternative of the preferred embodiment. Not only is the claim not limited to GSM and UMTS (or indeed any specific RATs), but as noted above it covers the use of any control channel (including the FACCH) to send converted values which exceed the threshold. Moreover, the claim only requires the converted values from the first system (UMTS) to be sent to the network in the second system (GSM): it does not require values from the second system (GSM) also to be sent. Furthermore, the claim is not limited to the use of any particular report, as the judge recognised when discussing Apple's obviousness case over an item of prior art referred to as "Tdoc 1145" at [194]:

> "The document describes a UMTS measurement report which would be triggered to be sent if a UMTS measurement exceeds a threshold. The proposal in the document would be understood to be that it is sent on the FACCH – but that is no distinction over

> claim 1. Moreover the report is not a standard GSM measurement report – it is a special UMTS measurement report – but that is no distinction over claim 1 either."

53. These points are all well made, but nevertheless it remains necessary to consider the meaning of the words of integer [b] of the claim read in the context firstly of the claim as a whole and secondly of the specification.

54. Integer [b] requires that "measurement values" associated with the first system (UMTS) are converted to "measurement values" for the second system (GSM). Apple contend that the word "value" means just a magnitude. As the judge noted, however, the specification refers in [0015] to converting "UMTS … measurement *information*" to "GSM signal strength *information*" and in [0016] to comparing "converted UMTS signal strength *values*" with "GSM signal strength *values*". Thus "information" and "values" are used interchangeably. Furthermore, the specification refers in [0014] and [0017] to converting "UMTS measurement information" to "a GSM measurement information format" and "a GSM measurement format". Yet further, in the first alternative of the preferred embodiment the conversion at step 104 must be a conversion for both comparability and formatting since there is no other conversion before the converted values are sent in the GSM report at step 108, yet the specification refers at [0016] to comparing "the converted UMT signal strength values" with the GSM values. Accordingly, as the judge held at [98]:

> "… there is no reason based on the specification for the reader to attribute any particular significance to the use of the term 'value' as a way of drawing a distinction between the measurement information and the format in which it is expressed. The term is apt to refer to both. This is similar to the way RXLEV can mean the measurement or the formatted number. They are both values for RXLEV, as the skilled person understands."

55. Furthermore, the purpose of the conversion is not merely to enable the comparison to be made. It is also to enable the converted values to be sent on a control channel to the network in the second system (GSM). As I have already accepted, Apple are correct to stress that the claim is not limited to use of the SACCH or to use of the standard GSM measurement report, and does not even require GSM measurement information to be sent to the network. Even so, I agree with the judge that the skilled reader interpreting the claim in context would understand that the conversion "to … measurement values *for* said second system" (my emphasis) required by integer [b] was both a conversion to ensure direct comparability with the threshold value in integer [c] and a conversion into a format used by the second system (GSM) in order to send the converted values to the network in the second system in integer [d].

56. I therefore conclude that the judge's construction of claim 1 was correct.

Validity

57. Although Apple challenged the validity of the Patent on a number of grounds at first instance, on appeal Apple confined their challenge to a single ground. This is that the Patent is "*AgrEvo* obvious", although the use of that label is a slightly inaccurate way

of characterising their case. Case T 939/92 *AGREVO/Triazole sulphonamides* [1996] EPOR 171 is a decision of the Technical Board of Appeal of the European Patent Office that, in order to be patentable, a selection of chemical compounds must not be arbitrary, but must be justified by a hitherto unknown technical effect which is caused by those structural features which distinguish the claimed compounds from other compounds and hence is present across the breadth of the claim. The present case is not concerned with an alleged arbitrary selection, but rather an alleged arbitrary limitation in the claim.

58. There is no dispute as to the applicable principle, which was succinctly stated by the judge at [207] as follows:

> "The principle is not that a claim which contains an arbitrary feature is invalid. Merely having an arbitrary feature in a claim is not a ground of invalidity. The point of ***Agrevo*** obviousness is that if a claim is found to contain an arbitrary limitation in it, then that limitation cannot assist the patentee in defending an obviousness case. The claim still does have to be obvious over something in the state of the art – perhaps common general knowledge or some cited prior art."

59. Apple's starting point for this part of their appeal is the judge's finding at [210]:

> "… if conversion was an arbitrary feature [of claim 1] then I agree with Apple that the claim would be ***Agrevo*** obvious. That would be because, stripped of the conversion feature, claim 1 would cover a process in the context of inter-RAT handover from GSM to UMTS in which the phone measures a UMTS value like RSCP, compares it against a threshold and sends that UMTS measurement to the GSM network on a control channel if measurement exceeds the threshold. Whether the report itself was triggered by exceeding the threshold or whether passing the threshold led to the measurement being included in a report which was to be sent anyway does not matter. The claim covers both. The claim also covers a report on any control channel and does not require the use of any particular report. That process, couched at that level of generality, would be obvious to the skilled person at the priority date."

60. The judge did not explicitly state the basis on which he reached this conclusion, but as I read his judgment it was on the basis that, on the stated premises, the method would be obvious over common general knowledge, although it appears that the conclusion would also follow from Tdoc 1145. The basis for the finding does not matter, however, since it is not challenged by Optis.

61. The judge rejected Apple's case for the reason he gave at [211]:

> "… this ***Agrevo*** obviousness objection fails because conversion is not arbitrary. At the risk of repetition, conversion has the result that the converted values have the two beneficial properties referred to above. … These beneficial properties are shared by everything within the claim. In a case in which the

> beneficial properties exist across the full width of the claim, there is no reason based on ***Agrevo*** or anything else why the inventors should have limited their claim to particular instances of the taking advantage of those benefits."

62. The beneficial properties referred to here are those which the judge had previously discussed in [157]:

> "The conversion means that measurements from the first communications system are made comparable with those in the second system, and it means that measurements from the first communications system can be conveyed in the second system in the same format as measurements in that second system. These two aspects of conversion mean that the converted values have beneficial properties and so the method itself has benefits. There are two benefits. The first arises because the conversion means that the values are directly comparable between the two systems. This makes them useful for making handover decisions. It also allows a comparison to be made, between the two systems, to decide which measurements to report. The second benefit means that the values can be treated alike where format matters, such as by filling up space in a measurement report. This shows why conversion is a crucial aspect of the inventive concept."

63. Apple contend that the judge was wrong to conclude that conversion was not arbitrary. Apple's first point is that this conclusion was premised upon the judge's construction of claim 1 as requiring both conversion to ensure comparability and conversion of format, whereas Apple dispute that it requires conversion of format. Since I have concluded that the judge was correct, this point falls away.

64. This is not the end of Apple's case, since Apple contend that conversion is an arbitrary feature even if it does involve format. The basis for this contention is similar to the basis for Apple's contention that conversion to ensure comparability is arbitrary, and so I shall turn next to that.

65. Apple argue that conversion to ensure comparability is an arbitrary feature because the claim does not require any comparison of values between RATs to be made in the mobile. Unconverted values can be reported, and the network can itself make whatever conversions and comparisons are needed to take the handover decision. Thus, although the unclaimed first alternative in the preferred embodiment solves the problem identified in the specification at [0003] and has the advantages identified at [0005]-[0008] and [0011], the invention claimed in claim 1 does not, or at least does not across the full width of the claim.

66. In support of this argument Apple rely upon what the judge said in the context of rejecting their obviousness case over an item of prior art referred to as "Losh" at [174] (emphasis added):

> "As Losh says, and the skilled person would think as a matter of common general knowledge anyway, one could have the

> handover decision made by the phone or by the network. A critical problem with Apple's obviousness case here is that the idea of comparing values in Losh is disclosed only as something for the purpose of making handover decisions. To the skilled person it would be obvious to do that in the phone if the phone was making handover decisions, but in that case there would be no reason to send any UMTS measurement values in a report to the GSM network. That line of thinking does not take the skilled person to a system within claim 1. On the other hand if the skilled person was not considering handover decisions in the phone, they would be considering network directed, mobile assisted, handover. Indeed that is the more attractive option for the skilled person. In that case it would be obvious (from common general knowledge anyway but also based on Losh) to send UMTS measurement information to the network. However the reference to comparison in Losh would not be understood to have any relevance to that. *There is no reason to make any conversion in the phone – for the purpose of comparability*. I am not persuaded that the fact that the RXLEV comparisons both in band and between GSM bands which are made for normal reporting of handover in GSM itself, which are common general knowledge, would make it obvious over Losh to start making comparisons between different RATs in the phone for the purpose of reporting. It is only hindsight to see the reference to comparisons in Losh which would be understood in one context, and seek to turn that into a hint to make inter-RAT measurement comparisons in the phone for a different purpose."

67. Apple argue that (i) the sentence I have italicised amounts to a recognition by the judge that a conversion requirement in the mobile is pointless in a situation where the network makes handover decisions and (ii) the claims do not require any comparison to be made in the mobile. Accordingly, Apple contend, conversion is an arbitrary feature.

68. I do not accept this argument for the following reasons. First, Apple's reliance upon the sentence in [174] is misplaced. What the judge was saying was that Losh did not give the skilled reader any reason to make any conversion in the mobile to ensure comparability. He was not saying that it was a pointless thing to do. Secondly, the judge made a clear finding at [157] as to the technical benefits of conversion. That finding has not been directly challenged by Apple otherwise than on the basis that it is contradicted by [174], but for the reason I have just given I do not accept that. Thirdly, Apple are wrong to say that the claim does not require any comparison to be made in the mobile. The claim requires a comparison to be made with the threshold value. Although the judge referred in [157] to allowing "a comparison to be made, between the two systems, to decide which measurements to report", it is clear from the context that the judge was not intending to refer to a comparison of the kind exemplified by the first alternative of the preferred embodiment, but rather to a comparison with a threshold value as required by the claim and exemplified by the second alternative. It is true that the claim contains no limitation as to the source of the threshold value, but the fact that the measurements are converted before the comparison makes it clear that the threshold is one set by reference to the second system (GSM). Fourthly, it follows

that Apple are wrong to say that conversion in the mobile is pointless where the network makes handover decisions: conversion has the two benefits identified by the judge. Finally, those benefits are shared by everything within the claim, as the judge held.

69. Accordingly, I consider that the judge was correct to conclude that claim 1 is not invalid on this ground.

Essentiality and infringement

70. As noted above, Apple's appeal against the judge's findings of essentiality and infringement is independent of their challenge to the judge's construction of claim 1.

71. The judge had to consider two versions of the standard, and in the case of the second version two different methods of reporting measurements of UMTS cells, making a total of three cases. He found that the Patent was essential in all three cases. On the appeal it is common ground that it is only necessary for this Court to consider the first case, which concerns enhanced measurement reporting in TS 45.008 release 5, version 5.22.0 dated April 2006.

72. It is worth noting that, at trial, Optis contended that the standard implemented the claimed method with respect to both signal strength and signal quality, but ultimately abandoned the latter contention even though it had succeeded in *Unwired Planet v Huawei*. The contention was abandoned because the evidence showed that the UMTS signal quality measurements reported to GSM in the standard were identical in both value and format to the native UMTS values, and therefore there was no conversion.

73. There is no dispute as to what the standard requires. This was explained by the judge as follows:

> "111. The standard addresses the process of handover, including handover between GSM and other RATs. Section 3 of the April 2006 version contains an overview of the handover process. This explains (3.1) that measurements will be made by phones and reported to the BSS for assessment. The BSS will also measure the uplink performance for the phone being served and assess signal level interference on its idle traffic channels. Handover strategy (3.4) will be based on reported measurement results and various parameters set for each cell. An example of a basic algorithm is given in the standard. It is an example because the actual algorithms are not standardised. Section 8 of the standard deals with radio link measurements to be used in the handover process. Section 8.1 deals with signal level. Sections 8.1.2 – 8.1.4 deal with GSM and section 8.1.5 deals with other RATs. The relevant other RAT is UTRAN FDD.
>
> 112. In GSM the RMS received signal level is measured. In GSM the signal level is RXLEV. Section 8.2 deals with signal quality. In GSM received signal quality is RXQUAL. Section 8.4 deals with measurement reporting. There are two types of measurement reports – 'normal' and 'enhanced'. Section 9 Table 2 sets out the control parameters used in handover.

113. The standard requires that the phone measures both signal level and signal quality on the serving cell and signal level on neighbouring GSM cells.

114. In the context of a potential handover from GSM to UMTS, the serving cell will be a GSM cell and so the phone will be measuring RXLEV and RXQUAL on the GSM serving cell. The neighbouring cells may be GSM or UMTS cells. In the case of neighbouring GSM cells, the phone will be measuring RXLEV and, in the case of neighbouring UMTS FDD cells, the phone will measure RSCP and Ec/No.

115. The encoding of measured RXLEV values into the 6 bit format is set out in paragraph 8.1.4.

116. The two kinds of measurement reports, normal and enhanced are sent on the SACCH. The structure of normal and enhanced reports is quite different. As mentioned above, in addition to reporting measurements from the serving cell, the 'normal' report provides the RXLEV values for the six neighbouring GSM cells with the highest RXLEV. The enhanced measurement report is organised very differently. There is a neighbour cell list which places the neighbouring cells in order. … The important things are, first, that the enhanced report is based on a list of neighbouring cells which both the phone and the BSS know. That means there is no need to send cell identifiers because the placing of data in the report acts as a key to indicate which cell the reported value relates to. The other important thing is that in the enhanced report measurement values are reported in a 6 bit format. That applies whether the values are RXLEV from a GSM cell or whatever measurements are being reported from a UMTS cell.

117. For the relevant kind of UMTS (UTRAN FDD) the standard requires the measurement of RSCP and Ec/No for the neighbour cells. Although two values are measured only one is reported. Which one is to be reported is set by a parameter called FDD_REP_QUANT. The standard states (8.1.5) that the measured value which is to be reported 'shall replace RXLEV in the measurement reports'. So in the 6 bit fields for RXLEV described above, if a cell being reported is a UMTS cell the 6 bits will be used to report a value of RSCP or Ec/No as the case may be.

118. There is no need now to [consider] Ec/No [i.e. signal quality]. The case turns on RSCP [i.e. signal strength].

119. In relation to RSCP there are a number of points to note. The encoding is similar to but not the same as the encoding of RXLEV. The increments are the same (1dBm). For RXLEV (without SCALE) the integer zero represents less than -110 dBm

whereas for RSCP it represents less than -115 dBm. So in a sense one scale is offset by 5dBm relative to the other. For RXLEV the integer 63 represents greater than -48 dBm whereas for RSCP measurements > -53 dBm is mapped to 63.

120. Enhanced measurement reporting in accordance with the April 2006 standard is dealt with in section 8.4.8. With enhanced measurement reporting, the phone is not limited to sending back measurement information for six neighbouring cells, but may send back information for a greater number of cells. In order to populate the enhanced measurement report, the various cells have to be ranked in order of reporting priority. That is done as follows:

i) Priority level 1: the relevant GSM cells with the highest reported value (RXLEV) are reported. The phone is told how many such cells may be reported, the maximum number is 3.

ii) Priority level 2: the cells to be reported work in the same way as priority level 1 but for cells in other GSM frequency bands.

iii) Priority level 3: the number of best valid cells whose reported values equal or exceed a pre-defined threshold in each supported other RAT, again up to a maximum of 3 per additional RAT. Where the other RAT is UTRAN FDD, then the non-reported value has to be equal or greater than a distinct pre-defined threshold. This second threshold can be disabled by being set to zero. For each RAT the cells with the highest reported values are reported.

iv) Priority level 4: the remaining valid GSM cells and valid cells of other RATs are reported as long as the cells pass the relevant threshold for that RAT. Within this level, the reporting priority for UTRAN FDD cells is based upon RSCP even if Ec/No is reported and the non-reported value has to be equal or greater than the pre-defined threshold.

121. For each of the four priority levels used in enhanced reporting, two additional rules apply:

i) if there are spaces unfilled within each priority level, those spaces are to be left over for the lower-prioritised cells; and

ii) if there is not enough space in the report for all valid cells, then the cells that shall be reported are those with

> the highest sum of the reported value and the parameter XXX_REPORTING_OFFSET.
>
> 122. Thus within priority levels 1 to 3, the phone selects cells within each RAT or band entirely independently of the measurement values obtained from other RATs or bands. The selection is done from a specific pool of cells (either GSM serving band; GSM non-serving band(s) or UMTS). Thresholds are applied to the reported values. Only values above the appropriate threshold are reported. Within the levels the ranking is in order of reported value.
>
> 123. At priority level 4 the pool of potential candidate cells is mixed as between GSM and UMTS (and other GSM bands and other RATs). In order to choose which cells to report at priority level 4 the encoded measured values are compared with each other. So the 6 bit integer encoded RXLEV value for a GSM cell is compared to the 6 bit integer encoded RSCP value for a UMTS cell. The higher integer gets a higher priority. The comparison can be affected by offsets, which can be set separately for each kind of cell. At that priority level only candidates that meet the RAT-specific entry requirements can enter the pool – i.e. for UMTS the second threshold can be applied. Even if Ec/No is the value which is going to be reported, in order to assess priority it is the encoded RSCP value which is used in the comparison with other candidates."

74. It should be explained that, when the judge says in [122] that "[t]hresholds are applied to the reported values" and "[o]nly values above the appropriate threshold are reported", the thresholds are RAT- and band-specific.

75. Optis' case is that the method specified in the standard with respect to priority level 3 falls within the claims. Apple dispute this. It is common ground that the priority level 3 method involves comparing UMTS values with a threshold value and reporting those that exceed the threshold. Apple do not suggest that the fact that the threshold is a UMTS-specific threshold rather than a GSM-specific threshold in itself prevents the method from falling within the claims, but Apple dispute that the UMTS values which are compared with the threshold and reported are *converted* values.

76. Thus, as the judge noted at [126], the issue on essentiality is whether the priority level 3 method involves "converting" a plurality of downlink measurement values associated with UMTS to a plurality of downlink measurement values for GSM (feature [b]) and sending those converted values to the GSM network (feature [d]) given the judge's construction of "converting" as having two aspects, namely formatting and direct comparability.

77. The judge first considered conversion of format at [127]-[130], and concluded that this requirement was satisfied because RSCP values which were encoded in a 7 bit format in UMTS were converted into the 6 bit format used by GSM for RXLEV. Although Apple do not challenge this conclusion, it is necessary to explain the basis for it in order that the issue with respect to direct comparability can be understood.

78. The judge reproduced a useful table set out by Apple's expert witness Paul Simmons in his second report which shows how GSM RXLEV measurements are encoded into a 6 bit format in the GSM standard, how UMTS RSCP measurements are encoded into a 7 bit format in the UMTS standard and how UMTS RSCP measurements are encoded into a 6 bit format for use in GSM, with the binary codes represented in each case by their decimal equivalents:

A B C D

	RXLEV (dBm)			RSCP (dBm)			UMTS RSCP Mappings		
0	< -110			< -115			< -115		
1	-110	to	-109	-115	to	-114	-115	to	-114
2	-109	to	-108	-114	to	-113	-114	to	-113
3	-108	to	-107	-113	to	-112	-113	to	-112
4	-107	to	-106	-112	to	-111	-112	to	-111
...	...			...			...		
44	-67	to	-66	-72	to	-71	-72	to	-71
45	-66	to	-65	-71	to	-70	-71	to	-70
46	-65	to	-64	-70	to	-69	-70	to	-69
47	-64	to	-63	-69	to	-68	-69	to	-68
48	-63	to	-62	-68	to	-67	-68	to	-67
49	-62	to	-61	-67	to	-66	-67	to	-66
...	...			...			...		
59	-52	to	-51	-57	to	-56	-57	to	-56
60	-51	to	-50	-56	to	-55	-56	to	-55
61	-50	to	-49	-55	to	-54	-55	to	-54
62	-49	to	-48	-54	to	-53	-54	to	-53
63	> -48			> -53			-53	to	-52
64							-52	to	-51
65							-51	to	-50
66							...		
...							-24	to	-23
89							-25	to	-24
90							-26	to	-25
91							> -25		

79. As the judge explained:

> "128. The first column A is the integer value in decimal of the binary encoding. A 6 bit number in decimal can be from zero to 63. That is how RXLEV and RSCP are encoded in the GSM standard as shown in the next two sections of the table, B and C. A 7 bit number could code for zero up to 127. In the UMTS standard RSCP uses a 7 bit format and codes up to the integer value 91. This is shown in section D.
>
> 129. Moving from the UMTS to GSM way of encoding RSCP, involves losing the 7th bit. In order to do that in GSM all measurements above -53 dBm are encoded as 63, whereas in UMTS integer 63 means -53 to -52 dBm and integers above 63 encode measurements up to more than -25 dBm."

80. As Apple point out, it can be seen that 63 out of 64 of the RSCP encoded values reported to GSM (section C) are identical to the native RSCP encoded values used in UMTS (section D). The sole difference is that the set of RSCP encoded values reported to GSM

has been truncated because only 6 bits are available for the encoding. This is achieved by encoding all measurements above -53 dBm as the binary equivalent of 63.

81. Optis do not suggest that the fact that the format of the RSCP values is converted from 7 bits to 6 bits in the manner described above is sufficient to demonstrate that the RSCP values are also directly comparable with the threshold value.

82. The judge went on to consider comparability at [131]-[141]. As he explained, Optis rely on what happens at priority level 4 as proving that the RSCP values reported at priority level 3 are directly comparable, even though Optis do not contend that priority level 4 itself falls within the claims because no threshold is used there. Apple dispute this.

83. There is no dispute that priority level 4 involves a comparison between UMTS RSCP values and GSM RXLEV values. As the judge explained, the dispute concerns the role of the offsets mentioned by the judge in [123] which are applied by the parameter XXX_REPORTING_OFFSET referred to by the judge in [121(ii)]. The standard states in paragraph 8.4.8.1 (page 45):

> "if there is not enough space in the report for all valid cells, the cells shall be reported that has the highest sum of the reported value (RXLEV or as defined in subclause 8.1.5) and the parameter XXX_REPORTING_OFFSET for respective radio access technology/mode. Note that this parameter shall not affect the actual reported value. …"

As the judge explained in [117], paragraph 8.1.5 says that RSCP converted to 6 bit format is used.

84. Thus offsets are applied to the GSM RXLEV and UMTS RSCP values before the comparison is made at priority level 4 to select cells for reporting. The parameter XXX_REPORTING_OFFSET is a value set by the network: the "XXX" indicates the RAT/mode, and the offsets may therefore have different values for the different RATs. Importantly, as the standard states, this does not affect the actual reported values.

85. The judge explained Optis' case as follows:

> "133. … its case was that the comparison between encoded integers representing values from different RATs at priority level 4 demonstrates that the RSCP measured value has been rendered directly comparable with the encoded RXLEV value by converting the UMTS measured value into a measurement value for the GSM system. The priority assessment at level 4 works by ranking UMTS and GSM cells on the same numerical scale (the scale from 0 to 63 shown above) and choosing the highest ranked values to report, with a further ability to introduce prioritisation via offsets. So, it is submitted, priority level 4 proves that the encoding of RSCP in the GSM standard, in the form in which it is reported to the GSM network, satisfies all the requirements for the conversion required by claim 1.

> 134. For example consider priority level 4 and assume first that the offsets are set at zero. Assume also that there are two candidate cells each of which has its reported value above the relevant threshold: a GSM cell with RXLEV of -64.5 dBm and a UMTS cell with RSCP of -70.5 dBm. The encoding in the standard renders these measured values into integer 46 for the GSM cell and 45 for the UMTS cell. At priority level 4 these numbers are directly compared and the GSM cell is given a higher priority. If there is only one more space in the enhanced report then the GSM cell will be reported with its value and not the UMTS cell.
>
> 135. Optis contends that priority level 4 is a scheme for reporting the best cells chosen by directly comparing converted measurement values. Thus the claimed conversion has been undertaken, and the overall method infringes the claim because it creates, uses and reports converted UMTS values."

86. As the judge explained, Apple contended that Optis' case was wrong because it ignored the offsets:

> "136. … Apple agrees that in order to meaningfully compare the two values it is necessary for some conversion to take place, but contends that the necessary conversion is provided by the offsets, which are controlled by the network. Note that it is the values without the offsets which are reported. So Apple argues that while it is true that the values are converted in the phone for the purposes of direct comparison, using the offsets, nevertheless there is no reporting of the converted values because the values reported are the ones without the offsets which had been applied. Apple also submits that the fact that, when both offsets are zero (or equal to one another) a valid comparison can be made, is true as far as it goes, but is not meaningful. Rather it is like a stopped clock which still happens to be right twice a day."

Thus Apple contended that it was the application of the offsets which converted the UMTS and GSM values so as to enable a meaningful comparison to be made between them in priority level 4.

87. The judge disagreed with Apple for reasons he expressed as follows:

> "137. Optis argued that this is wrong. The offsets used at priority level 4 are there to allow the network to bias the results. However they are not what makes the values directly comparable. The fact the values can be compared in this stage at all, using offsets which are constants to adjust or bias the comparison, shows that the encoding schemes for the reported values of RXLEV and RSCP as mandated by the GSM standard are directly comparable and therefore shows that RSCP has been converted appropriately.

> 138. In my judgment Optis's approach to this is the right one. I was not persuaded by Mr Simmons' approach to this. The fact that the patent does give, as an example, an equation in which a constant offset is added to the RSCP to make it comparable to RXLEV does not mean that the existence of a method which allows constant offsets to be used for prioritisation between RATs (or frequency bands) proves that the values before those offsets were added were not comparable. They may or may not have been. Moreover using a constant offset is clearly not the only way of converting measurements in such a way as to make them comparable. Another way expressly disclosed is to use an offset which varies as a function of RSCP and another way, which does not involve offsets at all (or not really) is mapping measurements to appropriate integers. That is how it is done in this case. Further, the contention that the fact offsets are added in level 4 proves that before the offsets were added the numbers were not comparable simply does not follow as a matter of logic. Moreover, as Optis pointed out, part of the same offsetting process involves applying offsets to RXLEV measurements from different frequency bands of GSM. Those RXLEV measurements plainly were directly comparable, prior to the application of the offsets."

88. For the purposes of their appeal, Apple do not go so far as to contend that the judge should have found that the application of the offsets made the UMTS and GSM values directly comparable, and for that reason should have positively found that the standard did not fall within the claim. Rather, they contend that the judge should have concluded that Optis had failed to establish that the standard involved conversion of the UMTS values to ensure direct comparability.

89. Apple submit that in [138] the judge both contradicts himself and impermissibly puts the burden on Apple to prove non-infringement:

    i) On the one hand, the judge states that "the existence of a method which allows constant offsets to be used for prioritisation between RATs" does not prove that "the values before those offsets were added were not comparable". On the other hand, the judge accepts that the values before the offsets were added "may or may not have been" comparable. Apple agree with the latter statement, and submit that it must follow that the existence of a method which allows constant offsets to be used for prioritisation between RATs does not prove that the values before those offsets were added *were* comparable.

    ii) Apple agree that the Patent discloses in [0015] that the offset may be variable rather than constant (see paragraphs 21-22 above). They point out the offsets in the standard are variable in that they are set by the network, as the judge correctly found later in the judgment. They submit that this does not demonstrate that the values are comparable before the offsets are added either: as the judge says, they may or may not have been.

    iii) Apple accept that direct comparability can be achieved by mapping, as the temperature example discussed in paragraph 48 above illustrates, but submit that

there is no evidence that the mapping of the UMTS values in the standard does this. Rather, it simply converts the format of the UMTS values from 7 bits to 6 bits.

iv) The judge goes on to say that "the contention that the fact offsets are added in level 4 proves that before the offsets were added the numbers were not comparable simply does not follow as a matter of logic", but Apple submit that it is equally true to say that it does not prove that the numbers *were* comparable. As the judge himself says, they may or may not have been; and it was for Optis to prove that they were comparable.

v) As for RXLEV measurements from different frequency bands of GSM, Apple agree that these are directly comparable without offsets, but say that that is precisely because they are both GSM RXLEV values and neither is a UMTS RSCP measurement requiring conversion. Again, Apple submit that this does not show that the UMTS and GSM values can be directly compared without offsets.

90. The judge went on at [140]:

> "Another point is that the issue is about the effect of the scheme itself. I think that is the point of Apple's analogy with the clock. I agree that the schemes by which the values are encoded need to make the values comparable or not, as a whole. Comparability does not exist if it is only present when offsets are set to certain values. But to be fair, Optis's line of argument about starting by assuming the offset is zero is not meant to be that the values are only comparable with offsets set at zero."

91. Apple agree with the judge's statement that "[c]omparability does not exist if it is only present when the offsets are set to certain values", and in particular zero. They point out, however, that the judge gives no reason in this paragraph for concluding that comparability exists regardless of the values of the offsets.

92. The judge expressed his conclusion at [141] as follows:

> "I find as a fact that the encoding of the RSCP measurements from the UMTS RAT into the 6 bit integer values provided for in the GSM standard produces a set of values which are directly comparable to a set of RXLEV values in GSM. That is why they are comparable whatever values are selected for the offsets. The offsets allow the operator to adjust what the result would be in a given case but they are not what makes the encoding schemes themselves comparable in the first place."

93. Optis relied upon the judge's statement that this is a finding of fact, and submitted that it was a finding which was open to him on the expert evidence. As Apple point out, however, the conclusion depends on the correctness of the prior reasoning in [138] and [140]. Otherwise, it simply amounts to a statement that the values are directly comparable because they are comparable. Not only is that circular, but also it is contrary to the premise of the Patent, which is that UMTS values are not comparable with GSM

values unless they are converted to ensure comparability. As discussed above, it is not enough simply to convert the format of the UMTS values into a GSM format, nor do Optis contend that it is. What is required is that they be put on a common scale, as the judge held at [103].

94. Optis had no real answer to Apple's criticisms of the judge's reasoning in [138] and [140]. Indeed, counsel for Optis accepted the point made in sub-paragraph 89(iv) above. I am therefore driven to conclude that the judge fell into error. Given that offsets are applied to the values in priority level 4, it cannot be concluded that the UMTS values were directly comparable with the GSM values prior to the application of those offsets. At best, from Optis' point of view, they may or they may not have been.

95. Optis attempted to meet this difficulty by advancing three arguments, none of which was founded upon the judge's reasoning and none of which was the subject of a respondent's notice. The first argument relied upon evidence that one of the functions of the offsets was (as the judge put it in [138]) to allow prioritisation between different RATs or (as the judge put it in [137]) to bias the results. Optis argued that it could be inferred from this that the values prior to the application of the offsets were comparable. I do not accept this argument. The judge did not find that this was the *only* function of the offsets, nor did the evidence establish that. It follows that the necessary inference cannot be drawn. Moreover, even if the inference could be drawn, it would not suffice to demonstrate that the values were directly comparable, i.e. had been put on a common scale. At best, it would support a conclusion that it was possible to make a rough-and-ready comparison between the UMTS and GSM values. But the judge did not construe the claim as only requiring a rough-and-ready comparison to be made, and such a construction would render it uncertain. To put it another way, mere comparability is not enough to satisfy the claims as construed by the judge: what is required is conversion to ensure direct comparability by putting the values on a common scale.

96. The second argument relied upon the fact that, as the judge noted at [119] and as can be seen from Mr Simmons' table reproduced under paragraph 78 above, there is a constant 5 dBm difference between the RSCP values in section C and the RXLEV values in section B. Optis argued that this showed that the two were directly comparable. Again, I do not accept this argument. It is essentially a repetition of the argument set out by judge at [134] in which it is assumed that the offsets are set to zero. As the judge correctly held in [140], however, the values are not comparable if they are only comparable when the offsets are set to zero: they need to be comparable whatever the value of the offsets. As the judge explained at [143], the standard requires the offset parameters to be sent in every relevant message, and thus the default value is essentially irrelevant.

97. It should be explained at this point that, although the judge correctly recorded Apple as making a comparison with a stopped clock which happens to be right twice a day, in this Court Apple pointed out that it cannot be assumed that the values are comparable even when the offsets are zero. There is no evidence that the constant 5 dBm difference means that the values can be directly compared in the manner postulated in the example set out in [134]. Moreover, this is inherently improbable given that RXLEV and RSCP measure slightly different physical properties as noted in paragraph 48 above.

98. The third argument relied upon the fact that it is common ground that the UMTS and GSM values which are actually reported in priority level 4, i.e. the values prior to

application of the offsets, are used by the network for making handover decisions. Optis argued that it may be inferred from this that they are sufficiently comparable with each other to enable at least a rough-and-ready comparison to be made between them. I do not accept this argument either. The judge made no finding as to what the network does with the reported values, nor does this appear to have been explored in the evidence. It cannot be assumed that a comparison is made between the reported values given that a comparison has already been made using the offsets. Thus there is no basis for the inference which Optis seek to draw. Furthermore, as noted above, the judge's construction requires that it be possible to rank the cells from UMTS and GSM, and cells from UMTS and the threshold value, on a common scale, and not merely as enabling a rough-and-ready comparison to be made.

99. I therefore conclude that Optis have failed to demonstrate that the standard involves conversion of the UMTS values in order to ensure direct comparability with the threshold value used in priority level 3. Indeed, it appears to me that Apple were probably correct to contend at trial that it is the application of the offsets that makes the values comparable in priority level 4, but it is not necessary to reach a conclusion on this point given that Apple do not pursue it in this Court.

100. It follows that the Patent is not essential to the standards in issue, and therefore Apple have not infringed the Patent.

Conclusion

101. For the reasons given above, I would dismiss the appeal against the judge's conclusion that the Patent is valid, but allow the appeal against his conclusion that it is essential and has been infringed by Apple.

Lord Justice Warby:

102. I agree.

Lord Justice Newey:

103. I also agree.