

The numerical evidence generally and rounding

227. Having started to set out each side's case I will mention a problem inherent in that and in grappling with the cases. Both via the valuation experts and in their submissions both sides presented the court with a blizzard of figures. The summaries in this judgment represent a small fraction of the numbers presented. There was a somewhat larger blizzard from Unwired Planet than from Huawei but the difference was not significant enough to make a difference. A frequent problem is in keeping track of the bases on which numbers are presented so as to try and make sure one is comparing like with like. In practice, for example, it is impossible to ensure that on every occasion two rival figures are both based on the state of the Ericsson portfolio (pre- or post-MSA etc.), and multimode weighted or not, as well as many other more subtle factors.
228. From now on I intend to put most weight on figures derived from the post-MSA post-Lenovo portfolio. The effect of the differences between the three versions of the Ericsson portfolio is smaller than the effect of other uncertainties inherent in the various exercises. While I have aimed to be consistent, striving for perfect consistency with the numbers in this case is not productive.
229. In the discussion below the terms HWLTER and UPLTER refer to the parties' rival values for the relative strength ratio R between Unwired Planet and Ericsson for 4G/LTE multimode. HWLTER is [...] and UPLTER is [...].
230. I will mention rounding briefly. Obviously 0.36 and 0.37 both differ from 0.40 and can all be rounded appropriately to 0.4. It is not mathematically correct to say that 0.36 can be rounded to 0.40. Nor is it mathematically accurate to say that 0.36 is less than 0.4. However the assessment is not a purely mathematical one and the inherent uncertainties in the evidence are much greater than the difference between 0.36 and 0.40. So I will try (a) to state numbers in the evidence in the form they appear, but also (b) to use two significant figures in giving my reasons but (c) not to get too hung up on it all. This will involve heresies like "0.36% can be rounded to 0.40%".
231. Related to this is the point that many of the numbers written in the comparable licences are obviously round numbers (such as a royalty in dollars of 1\$ for 2G, 2\$ for 3G and 4\$ for 4G). It is not wrong to unpack these into rates expressed as percentages like 0.36%, 0.72% and 1.44% but one needs to take care not to assume from numbers like 0.72% that the parties negotiating that licence were really choosing 0.72% as opposed to (say) 0.70% or even 0.50%. They were probably thinking in terms of whole numbers of dollars and that was all.

(ii) The parties' rival submissions on royalty rates

232. To arrive at an equivalent benchmark rate on Huawei's case one needs to know that the UK uplift applied by Huawei is 48.51% based on [...]. Stripping out this uplift from Huawei's October 2016 proposals and rounding to two significant figures comes to:
- i) for 4G/LTE: infrastructure 0.041%; mobile devices 0.040%;
 - ii) for 3G/UMTS: infrastructure 0.031%; mobile devices 0.031%;

- iii) for 2G/GSM single mode: infrastructure 0.030%; mobile devices 0.030%.
233. Mobile devices and handsets are the same thing. Infrastructure refers to RAN infrastructure. In argument the parties focussed on the rates for 4G/LTE multimode handsets and I will do the same. To recap, Unwired Planet's case is that the FRAND rate for its global SEP portfolio for 4G/LTE is 0.13% whereas for 2G/GSM and 3G/UMTS the rate is 0.065%.
234. Of course a rate of 0.13% is just over triple 0.040% but all the same these numbers demonstrate that the parties are not now so far apart as some of the rhetoric at trial might have led one to believe. At the start the rival benchmark rates differed by an order of magnitude (0.2% for 4G/LTE from Unwired Planet and 0.022% for Huawei (based on the 0.034% UK offer and stripping out a 48.51% uplift). Nevertheless the difference is still substantial when one bears in mind that as a royalty it is to be applied to very large revenues.

Huawei's case on rates

235. Huawei's opening case was encapsulated by the following chart (best seen in colour) which was figure 4 of Mr Lasinski's 3rd report and was presented in Huawei's written opening submissions:

[chart redacted]

236. The dashed grey and red solid lines are Unwired Planet's proposals (the October 2016 rates are the same as in July). The directly comparable Unwired Planet-Samsung 2016 rate is shown as a green block, three comparable Ericsson licences are shown as blue blocks and the top-down aggregate royalty burden rate is yellow. It is marked "Patent Analysis" or "Huawei Patent Analysis".
237. The three Ericsson licences Huawei contend are most probative are *[J]* licence, the *[K]* licence, and the *[L]* licence. The last one is treated as a 2G/3G licence.
238. The rates for 4G/LTE in the chart are derived in the following way. From the *[J licence]* one starts with Mr Lasinski's preferred rate of [...] as representative of *[a]* royalty rate for 4G, [...]. Then a relative strength ratio R of [...] is applied to produce an effective Unwired Planet rate of [...]. Note that the [...] was taken as R based on the portfolio post-MSA, before Lenovo and using multimode weightings but that figure had been corrected in chief to [...], see a letter from Powell Gilbert dated 18th November 2016 which also explained the change made no difference, as indeed it does not. Mathematically the number ends up as [...] as the effective rate for Unwired Planet, which is still rounded to [...]. Using the HWLTER of [...] makes no difference either. Of course using the UPLTER of [...] produces a rate of [...].
239. Unwired Planet do not deny that the *[J]* licence is one relevant comparable but contend it should be seen as one of many. In addition, Unwired Planet point out that the Ericsson rate E used by Mr Lasinski is based on [...]
240. The 2016 Unwired Planet-Samsung licence involves [...] and, like the *[J]* licence, it has other complications too. One complication it does not have is scaling by strength ratio since it is an Unwired Planet licence not an Ericsson licence. Mr Lasinski's

evidence is that making many allowances in Unwired Planet's favour to increase the effective rate [...]. This, say Huawei, indicates that [...] for Unwired Planet is generous.

241. Unwired Planet do not agree with this. First they say that the Unwired Planet-Samsung licence is not a useful comparable at all because it must be seen in a wider context of a developing relationship between PanOptis and Samsung. Second, they say that in truth the rates in this licence are pitifully small, much smaller than those derived by Mr Lasinski, which is said to be a reflection of the first point.
242. The [K] licence has [...]. [the rate is...] for 4G multimode handsets. Therefore using a HWLTER of [...] (as for [...]) produces an effective Unwired Planet rate of [...].
243. The key terms of the [K] licence, at least the royalty rates, were decided in an arbitration rather than being negotiated between the parties. Unwired Planet say this completely undermines the utility of this licence as a comparable. Huawei do not agree.
244. Huawei's top down case on aggregate royalty burden derives a 4G benchmark handset rate of 0.028%. This was based on starting from a total burden T of 8% (based on a figure stated publicly by Ericsson as the maximum aggregate royalty range) and taking the appropriate share of the whole industry S as 0.36% for multimode. (I wondered if 0.30% should have been used for handsets but nothing turns on the difference.)
245. So for 4G/LTE Huawei contend the two Ericsson comparable licences have [...] and based on Huawei's case for the strength ratio ($R = [...]$) that gives a rate for Unwired Planet of [...]. Huawei contend that the 2016 Unwired Planet-Samsung rate is lower at [...] and so is the top down case at 0.028% but all this goes to show is that [...] is generous to Unwired Planet.
246. There is an issue on "hard-edged" non-discrimination arising from the 2016 Unwired Planet-Samsung licence. If it is accepted then Huawei contend the rates applied to them should be same ([...]for 4G) as the rates in that licence. I will treat this as a distinct issue.

Unwired Planet's case on rates

247. Unwired Planet's opening case cannot be encapsulated with a single chart in quite the same way as Huawei's largely because Mr Bezant produced so many charts. The charts are best seen in colour. This is one from Bezant 6, Appendix 2 (U/10/p1):

2G/3G/4G multi-mode royalty rates based on the comparables that Mr Bezant considers to be most relevant, based on UP's Updated MNP and adjusted for the 80/20 Rule

[chart redacted]

248. The blue "offer line" is 0.13%. The various bars are rates derived from different sources. Although the key contemplates one source was one way lump sum rates, in fact there are none in this chart. The ARR comes from the MSA and [...] refers to a

rate from the Lenovo licence with an adjustment. All the other bars come from Ericsson licences. For each Ericsson licence the bar is an example of ExR in which the value E is different. There are more bars than licences because Mr Bezant has derived multiple rates from the same licence in various cases.

249. Unwired Planet argue that no individual comparable, particularly the ones singled out by Huawei, can bear the weight Huawei place on it. Unwired Planet also argue that this chart indicates the existence of a wide spread of rates in practice.
250. The key thing about some of the Ericsson licences that Unwired Planet rely on in addition to the licences relied on by Huawei is that in them Ericsson is [...]
251. [...]
252. [...]
253. [...]
254. [...]
255. The 2011 Ericsson-RIM licence [...]
256. That is sufficient to understand how Unwired Planet put their case. There is no need at this stage to address the other Ericsson licences in the chart. The further evidence Unwired Planet rely on can be put into four groups: the ARR from the MSA, publicly stated rates, the 2014 Unwired Planet-Lenovo licence, and licences from other licensors.
257. The term of the MSA which Unwired Planet rely on as a comparable is the ARR, which is [...]. Huawei make the point that this is self-serving given that Ericsson benefit from royalties paid to Unwired Planet. As a tool for assessing a benchmark FRAND rate today the ARR has no value.
258. The public statements about rates are addressed below. In terms of top down aggregate royalties generally, Unwired Planet contend that while it may be useful as a cross-check in certain circumstances, it is based on a false premise that manufacturers in fact pay everyone who owns any portion of the relevant pool whereas in practice they do not. Nevertheless they also point out that using their case for their share S of the Relevant SEPs (say 1.25%) and applying it to a total aggregate royalty burden T of 8% or 10% produces rates close to their preferred rate.
259. Turning to the 2014 Unwired Planet-Lenovo licence, on its face it contains a lump sum licence payment of [...] and running royalties creditable against that lump sum of [...] per product in defined “Major Markets” (the MM rate) and [...] per product in other territory (the OT rate). In percentage terms [...] compares favourably with the 0.2% demanded by Unwired Planet in 2014 and maintained until July 2016. Huawei contend that to rely on the stated rates is to ignore the true economics of this agreement. Huawei also point out that [...].
260. The licences from other licensors which Unwired Planet addressed, at least at the start of the trial (see opening p103), are licences from Qualcomm (to Huawei (two) and Samsung), licences from InterDigital (again to Huawei and Samsung) and two

licences in which Samsung were licensee (from [...] and Nokia). To the extent they are significant they can be addressed in context.

A striking correlation – aggregate royalty

261. In closing I pointed out to the parties that there seemed to be a broad equivalence about their rival cases at least in one respect. It can be seen in the implied aggregate royalty rate. Huawei contend the benchmark multimode 4G/LTE handset Unwired Planet rate should be 0.040% and Huawei contend that Unwired Planet's share S of multimode LTE handset patents overall is 0.30%. Conversely Unwired Planet contend the final royalty rate should be 0.13% and contend their share S overall is 1.25%. The ratios of these two pairs of figures are close and the similarity can be expressed in terms of the implied total aggregate royalty burden T. On Huawei's figures the implied total aggregate royalty burden T would be 13.3% while for Unwired Planet it would be 10.4%.
262. Huawei resisted this characterisation of the arguments. Their top down approach starts from a value of T of 8% and works the other way to a royalty rate of 0.028% to support, as generous, a conclusion that the royalty should be 0.040%.
263. This has caused me to address the question of whether the total aggregate royalty approach is better used as a top down method or as a cross-check. To apply a top down approach one needs to decide on the total royalty burden T as a starting point. The evidence from which Huawei submit an inference should be drawn is evidence of statements by patent owners about what they say the aggregate royalty burden for a given standard should be.
264. A variety of statements about the total aggregate royalty and statements about individual companies are in evidence. The most significant for 4G/LTE are the following. Some are undated but they are most probably all from the same era 2008-2010:
- i) An Ericsson press release in April 2008 referred to a public statement by “wireless industry leaders” (Ericsson, Alcatel-Lucent, NEC Corporation, NextWave Wireless, Nokia, Nokia Siemens Networks and Sony Ericsson) that they had “agreed a mutual commitment to a framework for licensing IPR” relating to LTE and supported the idea that a reasonable maximum aggregate royalty level for essential IPR in handsets is a “single-digit percentage of the sales price”.
 - ii) Another Ericsson press release in 2008 states that they expect to hold a relative patent strength of 20-25% of all standard essential IPR for LTE and that Ericsson believes the market will drive all players to act in accordance with these principles and to a reasonable maximum aggregate royalty level of 6-8% for handsets. Ericsson's fair royalty rate for LTE is therefore expected to be around 1.5% for handsets.
 - iii) A Huawei press release in 2009 states that Huawei “anticipates and supports a low single-digit percentage of sales prices as a reasonable maximum aggregate royalty rate applicable to end-user devices”. Huawei believe they will hold

15-20% of all essential patents relating to LTE standards therefore a royalty rate with some flexibility, but not to exceed 1.5%, is expected.

- iv) In 2009 Alcatel-Lucent said it expects to license its LTE SEPs for handsets at a discounted royalty of no greater than 2%.
 - v) In an undated press release Nokia stated that it believes it will have 20-30% of all LTE standards-essential IPR and that it expects its single-mode and multi-mode LTE rates to be in a range of 1.5% and 2.0% of the sales price of an end-user device, respectively.
 - vi) In an undated press release Nokia Siemens Networks believes it will hold approximately 10 to 15% of all LTE standards-essential patents and that it anticipates its LTE royalty rate for end-use terminal devices will be in the region of 0.8% of the selling price.
 - vii) In a December 2008 press release Qualcomm states that it does not agree with cumulative royalty caps or proportional allocations of such royalty caps.
 - viii) In an undated press release Motorola states that it expects that its essential royalty rate for LTE systems and equipment (e.g. infrastructure and subscriber handsets) will be approximately 2.25%.
265. For 4G/LTE Huawei contend that the total royalty burden T should be 8% based on the first three statements (the two from Ericsson in 2008 and the one from Huawei). For 3G Huawei rely on a further statement by Ericsson, Nokia, Siemens and NTT DoCoMo that they had, as the owners of “the clear majority” of SEPs for W-CDMA reached a “mutual understanding” to license “...at rates that are proportional to the number of essential patents owned by each company”, which would “...enable the cumulative royalty rate for W-CDMA to be at a modest single digit level”, meaning 5% or less.
266. Huawei point out that the April and July 2008 statements by Ericsson were regarded as so important that they were formally scheduled as encumbrances on the [...] patent portfolio when it was transferred to Unwired Planet and also point out that Mr Robbins accepted that Ericsson’s statements about aggregate royalty were obligations Unwired Planet was obliged not to violate.
267. Huawei submit that the court should attach particular weight to early declarations by major patent owners who were predicting what their ownership would be and what the total stack should be. Huawei refer to the evidence of Prof Neven on this (paragraph 14 of his 2nd report) however the Professor’s evidence does not align completely with the submission. Prof Neven recognised a top down royalty stack approach as one way of implementing an *ex ante* benchmark. He contemplates various ways of arriving at a total stack (which I call T) including using comparable agreements. Prof Neven then expresses the view that early declarations by patent owners about what the total royalty stack should look like are highly relevant because they determine potential users’ expectations and hence their decision to choose among the alternative technologies. He goes on to recognise that for a stack determined *ex ante* (i.e. before adoption of the standard by implementers) one needs a method for sharing out the stack *ex post*. A virtue of a total stack method is that in such a system

there is no incentive for patent holders to divest their patents *ex post* to achieve a higher return since the total stack remains fixed.

268. Prof Neven's explanation is compelling as long as one is confident what the total stack should be in the first place and provided some means for enforcing it against all parties exists. However the main conceptual difficulty I have with the using a total stack in a top down approach as opposed to using it as a cross-check is in the selection of the total royalty burden T to start with.
269. In my judgment the statements set out above have little value in arriving at a benchmark rate today for a number of reasons. The claims are obviously self-serving. The statements about aggregate royalties in particular are statements about other people's money on the footing that the person making the statement says at the same time that the cake is quite small but they are entitled to a large piece of it. As an illustration, if one assumes Alcatel's 2% royalty claim means they claim at least 20% of the Relevant SEPs (because in April 2008 Alcatel put their name to a "single digit percentage aggregate" and 2% is 20% of 10% (10% being just higher than the highest single digit percentage)) then the total shares of Relevant SEPs just mentioned in these statements add up to about 100% without including other major industry players such as Motorola, Qualcomm, and Samsung. The figures in Huawei's own claim are not closely internally consistent either. A low single digit percentage aggregate sounds like a figure of no more than 5% but to produce that with a 15-20% share of Relevant SEPs represents a royalty of 0.75%-1%. To produce a royalty close to the 1.5% limit referred to requires an aggregate of 7.5%-10%.
270. Furthermore, putting weight in these statements do not take into account what implementers and SEP holders have actually been content to agree in the intervening years. Compared to public statements, comparable licences are concrete data points, albeit their interpretation can be uncertain and the factors derived from them even more so. One could use comparable licences to try and derive a figure for the total royalty burden T but to achieve that requires one to have done all the same work which is needed to apply comparables directly anyway, so back calculating T will not add anything.
271. Moreover the combination of Huawei's submissions on rates and Huawei's submissions on what Unwired Planet's share of the Relevant SEPs is, shows that in truth Huawei's case does not support an aggregate royalty burden of 8%. It supports a higher total burden than that.
272. Where Huawei undoubtedly have a point is that the cross-check shows that if Huawei's case on Unwired Planet's share S of SEPs overall (0.30%) is right, the benchmark rate claimed by Unwired Planet of 0.13% cannot be supported. It would imply a total burden T of 43%. That is far too much. Conversely if Unwired Planet are right about their share S of SEPs overall (1.25%), a benchmark of 0.040% implies a total burden of 3.2%. That is much less than Huawei themselves are prepared to countenance in these proceedings.

(iii) The MNPA and HPA techniques

273. I will now address each party's patent counting techniques (the MNPA and HPA), explain the criticisms which are made and then address them. Rather than focus on

one technique completely and then the other, the two methods need to be explained and evaluated side by side so that the assessments of each can be understood in context.

The MNPA technique

274. The MNPA was devised by Unwired Planet as a technique to use in licensing negotiations. It is applied to 4G/LTE and in the original method consisted of the following steps:

- (1) Identifying all declarations using a list of declared SEPs from the ETSI IPR database as of 12 March 2014.
- (2) Defining LTE and then limiting the declarations to LTE-specific declarations.
- (3) Grouping patents into families and removing duplication.
- (4) Filtering down to “Live” families. This removes patents and applications that have been abandoned or expired and filters out families which do not have a pending or issued US or EP patent.
- (5) Separating out what Unwired Planet called “Core” LTE. Here the word core connoted importance. It is not drawing the distinction drawn elsewhere between different kinds of infrastructure (RAN and Core network). Core in this sense is identified using a simple pre-2009 cut off. Any patent with a priority date after 31st December 2008 was non-Core.
- (6) Separating out handset families from infrastructure only families. If a patent has a handset claim it is in the handset family even if it also has infrastructure claims. The resulting sets were called “Handset Candidate Families” and “Infrastructure Only Candidate Families”.
- (7) Applying essentiality filters, which in the original MNPA involved three percentages:
 - a. 28% to represent over-declaration (i.e. on the basis of published studies by Fairfield/ Goodman and Myers (mentioned below) which indicate that only 28% of declared SEPs are truly essential);
 - b. 90% to take account of patents which are essential to options in the standard;
 - c. 80% to take account of patents essential to features in the standard which are not deployed.

275. The Revised MNPA was produced in 2016 in response to points made in the litigation. It differed from the original MNPA in two major respects. At step (2) the way the standards are identified was changed in such a way as to incorporate more standards. At step (7) a different approach entirely is taken to what Unwired Planet call applying essentiality filters. In the Revised MNPA, instead of the three percentages at step (7), a figure derived by Dr Cooper was used based on a detailed analysis he carried out on a sample of Samsung SEPs. The figure used is 16.6%.

276. The numbers produced by the original MNPA are the following:

Step	Original MNPA			
1 – 3	5915			
4 Live LTE families	4941			
5 Core LTE	Core 3280		Non-Core 1661	
6 Handset	2071		1049	
7 Apply 28%	Essential 580		Non-essential 1491	
7(b) Apply 90%	Mandatory 522	Options 58		
7 (c) Apply 80%	Deployed 418	Non-deployed 104		
Final TOTALS:	“True LTE handset families” 418	Residue 2702		

277. On this basis a starting list of 5915 patents is reduced to 418 Relevant SEPs for the LTE standard and for handsets and a residue of 2702 other patents relevant to handsets which were declared as essential.

278. The numbers produced by the Revised MNPA (in Mr Bezant’s appendices to his third report) are as follows

Step	Revised MNPA		
1 – 3	6619		
4 Live LTE families	5296		
5 Core LTE	Core 3377		Non-Core 1919
6 Handset	2128		1209
7 Apply 16.6%	355	Core non-true LTE handset 1773	
Final TOTALS:	Core True LTE handset 355	Residue 2983	

279. On this basis a starting list of 6619 patents is reduced to 355 Relevant SEPs for handsets and a residue of 2983 other patents relevant to handsets which were declared as essential. Note that the number of Relevant SEPs (355) is not exactly 16.6% of 2128. That number would be 353. The difference is explained in a footnote to Mr Bezant’s third report. I am satisfied 355 is the appropriate number to use.

280. Both the Original and Revised MNPA produce numbers for the industry as a whole. The way Unwired Planet derive figures for individual companies (apart from Unwired Planet itself) is by identifying the patents at step 6 by company and then applying the relevant fractions to those totals. This gives figures for individual companies.
281. The 80/20 approach seeks to attribute some value to the other handset patents in the residue. It does so in a mathematically simple way by attributing 80% of the royalty to a company's Relevant SEPs in these tables and 20% of the royalty to a company's figure for the residue.

The MNPA and infrastructure

282. Unwired Planet use the same MNPA approach to derive a total number of Relevant SEPs for infrastructure (by which they mean the air interface and eNode Bs rather than core network). The original produces a total of 3280 which Unwired Planet confusingly call the "Core LTE" (see step 5 of the Original MNPA table above). From this 2071 were identified as having handset claims (see step 6) which leaves 1209 families as infrastructure only ($3280 = 1209 + 2071$). From the 1209 Unwired Planet estimate most will be core network (i.e. not air interface or eNode Bs) and only 15% will be relevant infrastructure. 15% of 1209 is 181. To this 181 has to be added the share of the handset families which also includes relevant infrastructure. That is 1337 giving a total of 1518. That figure is treated in the same way as the handset figure at step 7 to produce 306 as the number of Relevant SEPs for infrastructure. As I understand it when Unwired Planet revised their approach to counting patents they did not revisit the numbers for infrastructure but simply reduced the infrastructure offer in the same proportion as the handset offer.

Unwired Planet's approach to 2G and 3G

283. The way Unwired Planet deal with 2G and 3G is simpler than the MNPA technique. They start with a figure for the total pool of Relevant SEP families for 2G or 3G based on a published report. For 2G Unwired Planet use the report "*Analysis of Patents Declared as Essential to GSM as of June 6, 2007*" by Goodman and Myers of Fairfield Resources International published on 31st December 2008. For 3G Unwired Planet use a similar paper published by the same group on 6th January 2009 entitled "*Review of Patents Declared Essential to WCDMA Through December, 2008*". In these papers the authors report the outcome of detailed reviews by a team of experienced engineers of the patents declared essential to wireless standards with a view to determining how many are actually essential.
284. The figure from the Fairfield report for the total number of truly essential 2G patent families is 158 while the Fairfield report for 3G reports the equivalent number as 529. Unwired Planet then subtract from these totals a number for the patent families which solely relate to infrastructure. That produces a total for handsets which is 102 for 2G and 324 for 3G.
285. For infrastructure Unwired Planet used the figures from the reports, identified patents relating to infrastructure both alone and with handsets in the same way as for the approach to infrastructure with the MNPA and came up with figures for the total Relevant SEPs for 2G and 3G. Those numbers are 85 for 2G and 274 for 3G.

The HPA technique

286. The HPA was carried out by a team including Dr Kakaes and consultants at Thomson Reuters in India. The consultants at Thomson Reuters (the “Evaluators”) have technical expertise. The HPA consisted of the following steps:

- (1) “Identification and De-duplication”: a list of declared essential patents and patent applications was created using the ETSI database and also making reference to the Korean Telecommunications Technology Association database. The list was de-duplicated.
- (2) “Family members not expressly declared to ETSI”: Since the ETSI IPR Policy a declaration applies to a patent family as a whole, additional family members not expressly declared to ETSI were identified. This was done using the public INPADOC database.
- (3) “Grouping families in five categories”: the patents and applications were collected into families. The families were collected into five groups. Only group 1 was selected for further analysis. The five groups were:
 - Group 1 – at least one issued and non-expired patent and an English or Chinese language member;
 - Group 2 – at least one issued and non-expired patent but no English or Chinese language member;
 - Group 3 – only expired members
 - Group 4 – no issued patents (“issued” means granted)
 - Group 5 – family information not available on INPADOC
- (4) “Grouping families into standards”: the families were classified into three classes: LTE/4G, UMTS/3G, GSM/2G by reference to the standards to which they were declared on the ETSI website. The families were also classified as relevant either to RAN (which in this study includes handsets) or core network (“CN”). This was also based on the standards to which they were declared.
- (5) “Essentiality analysis of Group 1 families”: The Evaluators reviewed the essentiality of a patent in each Group 1 family. The review took about 30 minutes per family. The patent and relevant standard were selected in accordance with given rules. The claims of the patent were compared to the relevant standard specification to determine if the standard required all the elements of the claims. If the Evaluator determines that the specification does not provide a clear reason to rule out the patent as being essential, then the family is deemed essential. If the family provides a clear reason to rule out the patent being essential, the family is deemed not essential. The given rules are:
 - a. Patents in the family are reviewed in the following order until a patent is deemed essential or the categories are exhausted. If multiple patents are in the categories then the earliest is looked at first. The categories are:

- i. US issued patent
 - ii. EP issued patent
 - iii. Any other English language issued patent
 - iv. Chinese issued patent
 - v. English-language expired patent or subsequently English language application (where there is no English language or Chinese language issued non-expired member but there are members from other jurisdictions that are issued and not expired).
- b. For each family both representative handset and infrastructure claims are identified.
- c. If the family is declared to more than one of LTE/4G, UMTS/3G, and GSM/2G then the family analysis is continued until a patent or application is found essential to each of these three standards or the categories are exhausted.

287. Once these five steps were completed one could derive numbers representing Unwired Planet’s “deemed” essential patents identified this way. They are the basis for Huawei’s case on how many Relevant SEPs are held by Unwired Planet. One could also derive numbers for the industry as a whole and for other companies such as Ericsson and Huawei. They are the basis for the figures set out above. There are various different ways of deriving these figures but there is no need to get into that detail.

288. The totals produced by the HPA are the following:

Step	HPA					
1 Extraction and de-duplication	109,662					
2 non-ETSI family members	141,666 patents processed into 18,938 families					
3 Grouping	1 11,384		2 545	3 3,035	4 2,899	5 1,075
4 Standards	LTE 7,077	UMTS 5,158	GSM 1525			
5 Essentiality:	2535	1639	629			
RAN	1585	937	312			
Total UE	1862	1154	362			

Total UE (UE means user equipment, i.e. handsets).

289. These are the numbers presented in Huawei’s FRAND Statement of Case. They differ slightly from the numbers used in the figures set out in this judgment above for

the denominators because adjustments were made during the proceedings but the changes are small and do not alter the substance.

Summary of the criticisms of the rival methods

290. Huawei level a sustained attack on Unwired Planet's MNPA both internally (i.e. relating to the method itself) and externally (i.e. the way the method was created and by comparing the results of the MNPA to other evidence). Huawei's major internal criticisms are: step (2) (the limitation to certain standards), step (4) (the US/EP filter), step (5) (the pre-2009 cut off), step (6) (handset filter), step (7) (the essentiality % filters).
291. Huawei's external attacks on the MNPA characterise it as "patently unreliable and self-serving". They submit that in cross-examination Mr Saru accepted that it was never designed for the purposes for which it has been pressed into service in this trial. They submit the results it produces are counterintuitive and contrary to both Unwired Planet's own fact evidence and the available third party studies. They contend that the relevant experts for Unwired Planet, Dr Cooper and Mr Bezant, were both keen to emphasise that they had no hand in its creation and that "neither sought with any conviction to defend its results".
292. In summary Huawei contended that the evidence points clearly to Unwired Planet having around 6% of Ericsson's portfolio (the strength ratio). They also submitted that the MNPA was the only method which came close to giving Unwired Planet a 1.5% plus share of the industry's Relevant SEPs and that all the other methods gave figures of less than 0.5%; and that the figures differ by "a long way".
293. Unwired Planet mounted a significant attack on the HPA and its status in these proceedings. In its FRAND Statement of Case (para 132) Huawei had presented the HPA as something which was undertaken given the flaws in Unwired Planet's methodology. However during the trial it emerged that this was not true, as Huawei now accept. The HPA was in fact carried out for the arbitration between Ericsson and Huawei which led to the 2016 Ericsson-Huawei licence and in which Dr Kakaes and Mr Lasinski were both witnesses. Unwired Planet also submitted that the HPA depends on an extremely cursory 30 minute analysis and contains an inbuilt presumption of essentiality. Unwired Planet ties this in to the arbitration point because, they submit, what also emerged was that in the arbitration the HPA was no more than a filter to identify patents that Dr Kakaes should look at properly. They argued that for Huawei to put the HPA forward as the actual assessment of analysis was regrettably misleading.
294. As an outcome, Unwired Planet maintain that a strength ratio of 10.50% for LTE multimode between Unwired Planet and Ericsson is not inconsistent with the evidence nor is a percentage of about 1.5% for Unwired Planet's share of all the Relevant SEPs. They maintain Huawei's figures are too low.
295. Some of the criticisms made relate to the utility of these methods for unpacking. I will not address them because I am not satisfied that the differences between the counting techniques make enough of a difference to unpacking to be worth it.

The external criticisms of the MNPA

296. I have no doubt that the exercise of devising the original MNPA involved a degree of self-interest on the part of Unwired Planet. The idea that it was devised in an entirely objective fashion is fanciful and if Mr Saru's evidence was intended to persuade me that it was, then it did not succeed. That said I also reject the idea that the whole thing was a cynical exercise designed purely to attempt to justify Unwired Planet's pre-ordained licensing policy. Unwired Planet knew they needed to come up with some method of assessing the value of their patent portfolio by reference to the industry as a whole. The original MNPA was devised with that in mind but as an exercise, its utility depends on its objective characteristics which are addressed below. If it is objectively reasonable then the fact it was devised with a degree of self-service does not justify rejecting it as relevant evidence.
297. Huawei are correct that the MNPA was not devised to compare Unwired Planet's portfolio with other companies' individual portfolios but the fact that Unwired Planet now seeks to use it in this way too does not matter. What matters in that respect are detailed issues.
298. Huawei are right to criticise Unwired Planet for suggesting (or aiming to leave one with the impression) that Dr Cooper was responsible for the MNPA or parts of it as a method. Aside from his work on the sample from the HPA, he was not. Neither was Mr Bezant. On the other hand, apart from specifics dealt with later such as the 10%/20% optional/mandatory point I do not recognise the suggestion that somehow Dr Cooper or Mr Bezant thought the MNPA was so flawed that they were "keen" to emphasise they had no hand in its creation or that, overall, they did not seek to defend its results "with any conviction".
299. The more significant external criticism made by Huawei is that it produces results which are counterintuitive and contrary to other, reliable, evidence. The highpoint of this is the comparison of what Huawei call "implied essentiality rates". These rates represent the application of the MNPA to a particular company's patents. For reasons explained below I will not use the label "implied essentiality rate". I will call these rates the "MNPA Relevant SEP ratio" for a given company. Huawei produce a table for all the patent families in the original 6619 pool used by the Revised MNPA. [...]. The figures are derived for the whole industry but it is only necessary to mention the MNPA Relevant SEP ratios for Samsung (6.72%), Qualcomm (7.41%), Huawei (3.24%) and Nokia (8.07%). Using the same approach, the MNPA Relevant SEP ratio for Unwired Planet is 12.00%. That is different from the ratios for Unwired Planet's portfolio deployed by Unwired Planet in argument because the 12% comes from applying the MNPA to both the numerator and the denominator (the numbers are 3/25).
300. Huawei submit that this shows that the MNPA assesses Unwired Planet's portfolio as being far stronger than the portfolios such as Ericsson (of which Huawei contend the Unwired Planet portfolio was intended to be a representative cross-section), Nokia (which Huawei point out Mr Saru explained was "careful in declaring") and Qualcomm (which Mr Bezant said in his report had a "strong portfolio"). Huawei argue that these differences are systematic, very substantial and irreconcilable with the fact evidence or indeed any reasonable experience of the industry.
301. In argument for comparison with the MNPA Relevant SEP ratios for third parties Huawei used a ratio for Unwired Planet which would be produced using Unwired

Planet's preferred numerator (the ratio is 24%) but I do not accept that is a fair test. It is the same point which I will address in another context below about whether it is fair to use a different method for deriving the numerator and the denominator. However Huawei's submission still has force since 12% is much higher than the ratios for Ericsson, Nokia, Qualcomm and Samsung (and indeed is higher than any company with at least 100 patents in the MNPA starting pool (see U1/6/4)).

302. Mr Bezant's view was that this could be explained as an artefact of Unwired Planet's small portfolio size. There is something in this. One would expect that as portfolios get smaller the relative effect on the ratios of small changes in absolute numbers will increase. That is borne out by Huawei's analysis as a whole. All the MNPA Relevant SEP ratios over 10.00% are in the smaller portfolios (below 100 in size). The same point can be made another way – if the numerator for Unwired Planet had ended up at 2 instead of 3 the MNPA Relevant SEP ratio would have been 8.00% [...] rather than 12.00%. So I accept that one cannot place much weight on the fact that a company with a small portfolio like Unwired Planet has an MNPA Relevant SEP ratio which is larger than the company from whom their patents were selected.
303. Nevertheless this still does not mean Huawei do not have a real point. They do. These numbers expose a fallacy in the way Unwired Planet present the results of the MNPA both in argument and in evidence. Huawei's name for this ratio ("essentiality rate") was reasonable because Unwired Planet use similar language to describe the same thing. Unwired Planet have presented the number produced by the MNPA which is used as a denominator as if it represents the number of "truly essential LTE patents" or words to that effect. Unwired Planet's FRAND Statement of Case calls this number the "True LTE handset pool". These descriptions are wrong and misleading. The MNPA includes rates for the essentiality rate (28% in the original method and 16.6% in the revised) but it also has other features. The justification for the cut offs in the method apart from the essentiality rate, such as the pre-2009 cut-off, is not essentiality. It is an attempt to differentiate between the value to a licensee of two different categories of patents even though both may be truly ESSENTIAL within the meaning of the ETSI IPR policy. That is a key conceptual difference between the MNPA and the HPA. The reason different companies have different MNPA Relevant SEP ratios is not because their implied essentiality rates differ, it is because of the kinds of patents they have relative to things like the particular LTE standards to which they are declared, the priority date, and the presence of handset claims, differ. So the low rate for Huawei relative to Samsung and Ericsson is explicable by the combined effect of steps (4) and (5) whereby families with no EP/US member and the pre-2009 cut off has more impact on Huawei than Samsung or Ericsson, which in turn is consistent with the phenomenon that Chinese companies have increased their patent filings outside China only in recent years.
304. In my judgment the external criticisms do not undermine the utility of the revised MNPA as such but they have exposed the need to be clear about what the results mean. In that sense Huawei are right that the difference between companies is systematic. Whether it is reconcilable depends on the legitimacy of the other filters and turns the focus onto the internal criticisms.

The internal criticisms of the MNPA

Step (2)

305. The first point is about step (2). The MNPA does not look at all patents declared to LTE in general, rather the MNPA takes a defined list of particular standards and deals with patents declared to those. Unwired Planet started with a list of 49 standards from a licensing pool called VIA known as the VIA 49. The VIA pool includes industry giants AT&T and NTTDoCoMo. Mr Saru was cross-examined about the decision to use it. While I agree the choice had an element of being self-serving, I was not persuaded it was an unreasonable choice to make. The list had been made by a third party. Later in the proceedings following criticism Unwired Planet used a much longer list of standards but this did not make a major difference to the end result in the light of the other filters which were used. By the closing there was less to this issue than at earlier stages in the litigation. It is not in dispute that there is no generally accepted view of what constituted a correct list of LTE standards. Part of Unwired Planet's rationale for doing something along these lines was to focus on the parts of LTE which they thought licensees would be interested in. That was not unreasonable. I reject the point on step (2). The other criticisms are lesser points in any event nor do they make enough of a difference to matter.

Step (4)

306. The point on step (4) is that the patents chosen were restricted only to families containing a US or EP member. This was justified by Mr Saru on the basis that serious industry players would seek patents in Europe and the USA as major markets if they thought the patents were essential. Huawei disputed this, submitting that Dr Kakaes was obviously right not to agree in cross-examination that other markets such as China are not valuable and important. Huawei pointed out that the MNPA excluded around 709 patents for having no US or EP member.
307. Dr Kakaes was correct in cross-examination, all the same the evidence was clear that the licensing rates in the US and Europe are higher than elsewhere. Both the MNPA and HPA have a step like step (4) because it is a sensible thing to do. The difference is that the HPA includes a family if it has a Chinese member even if there is no US or EP. One can understand why that might be done given that Huawei is Chinese and also given the evidence that many Chinese companies will only file in China for many applications. Based on Mr Cheng's evidence I would expect Huawei today to file SEPs internationally once the first application was made in China, given their importance. In the end I am not satisfied that this difference between the MNPA and the HPA makes any material difference to the issues I have to decide. A serious player in the telecommunications market, including a major Chinese company, would likely file SEPs in the US and/or Europe. A method which included Chinese patents when the family had no US or EP member at this stage would present a more complete picture of the landscape but the differences overall are modest. In my judgment no significant systematic error is introduced by not doing so. The nature of Huawei's portfolio means that it will have an effect on that portfolio but I am not satisfied this matters. If the differences between unpacking methods mattered, this would be important, but they do not.

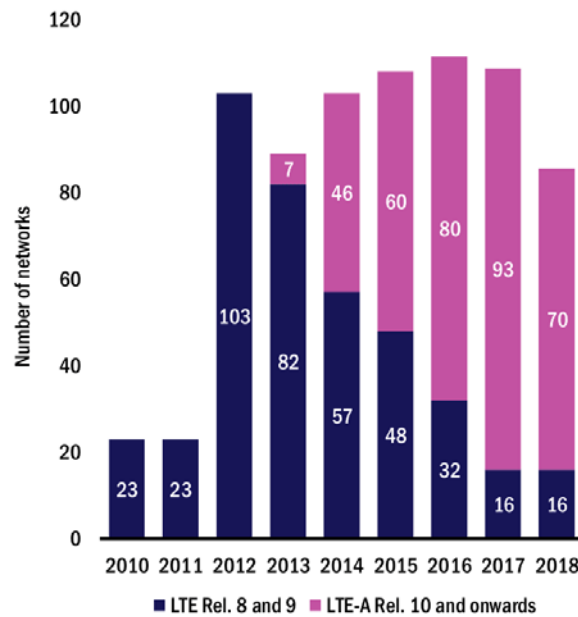
Step (5)

308. The debate about step (5) of the MNPA is important. At this step Unwired Planet select only patents with a pre-2009 priority date to take forward. Unwired Planet's rationale is that there is an inevitable time-lag between the priority date of a patent,

the invention making its way into a frozen release of a standard and then that standard being implemented. Unwired Planet say the fundamentals of LTE as a system were determined in LTE Release 8 and that was fixed at the end of 2008. So only patents with pre-2009 priority can be part of it. A later dated patent could not be valid and essential to this “core” system. Huawei point out that this step excludes well over 1,500 LTE families from the pool and argue it is completely unjustified.

309. Unwired Planet do have a point in that LTE Release 8 was the first and fundamental release of LTE however Huawei contend that this approach gives no value for later releases and is flawed.
310. The relevant releases after LTE Release 8 are Releases 9, 10 and 11. The term “LTE-A” for LTE-Advanced sometimes appears. It can be taken as the same as releases after and including Release 10 of LTE. Release 10 was released in 2011 and enables downloads and uploads ten times faster than Release 8. In the UK the network operator EE began implementing LTE-A in 2013. The implementation was across the whole network. On the evidence I find that the really important aspect of the releases after release 8 is a feature called carrier aggregation. It is clearly significant, particularly relating to infrastructure and to network operators.
311. Mr Saru explained that the cut-off was justified in a licensing context because technology in later releases was not as critical to LTE as implemented in the products on the market at the time (by which he meant 2013/14 but the point is general, that there is a lag). In his oral evidence Mr Saru distinguished between what technology has been released in a standard and what drives the market. Huawei pointed out that Mr Saru accepted that this filter had been chosen by Unwired Planet knowing that it would have a relatively minimal effect on the Unwired Planet portfolio. Unwired Planet sought to mitigate this on the basis that Mr Saru’s view was that it was simply a reflection of the fact that Unwired Planet had deliberately selected good patents which would be strong from a licensing perspective. However I do not accept that that would justify the step even if it is really what Unwired Planet thought.
312. Mr Yang gave evidence on this for Huawei. He said that in technical terms Releases 9 to 11 involve significant developments many of which have been deployed, while in commercial terms Releases 9 to 11 are highly valuable to Huawei. Unwired Planet submitted Mr Yang was a fact witness but gave opinion evidence. So he did but Mr Yang was a good witness, generally qualified to discuss the topics he covered, and was simply seeking to explain his companies’ point of view.
313. Mr Yang supported his evidence with material extracted from three papers said to show the widespread deployment of LTE-A networks over time. (There is a point that figures for networks, i.e. infrastructure, will not directly relate to handsets and that Mr Yang was more a network man than a handset man. I will take that into account). The papers had been produced by the lawyers and Mr Yang did not know much about the origin of the papers themselves or the groups which produced them. A graph from one of the three papers which Mr Yang relied on is this:

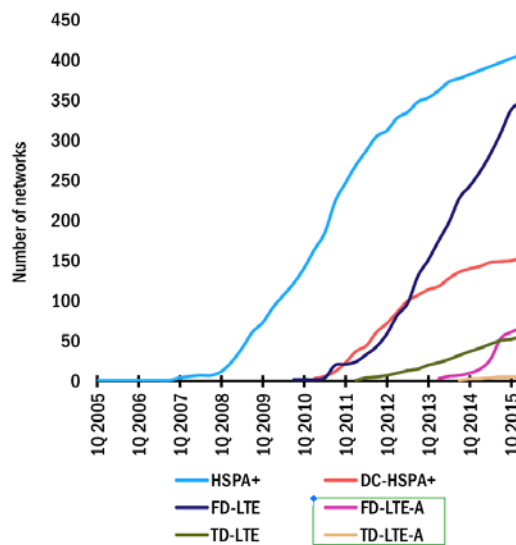
Figure 3: Incremental FD-LTE networks launched by technology, worldwide, 2010–2018



From an August 2015 paper by consultants Analysys Mason.

314. As it states, this is a graph of incremental deployments of LTE-A Release 10 networks as compared to incremental deployments of Release 8 and 9 networks. In the same paper is another graph as follows:

Figure 1: 3G and 4G network deployments by technology, worldwide, 1Q 2005–2Q 2015



315. These two graphs are best understood in colour. To be precise the second graph distinguishes between the two LTE duplex modes: FDD – which is used e.g. in the UK and TDD – which is mostly just in China. In any event Unwired Planet say this second graph shows the very slow projected adoption of LTE-A.

316. Taking Mr Yang’s evidence as a whole I find the position is as follows. In general different features are adopted by the industry at different rates. Carrier aggregation has been adopted much faster in Asia than in Europe. At a technical level features

commercially deployable in later releases may well have their technical roots in Release 8 (e.g. Voice over LTE).

317. Dr Kakaes' view about the pre-2009 filter was that it unreasonably excluded things which by 2013/14 were being frozen into the standards and implemented. Nevertheless he also accepted that there are features in standards which are not commercially implemented, for a range of reasons, and implementers commonly will decline to license patents relating to features they do not implement. Unwired Planet submitted that Dr Kakaes accepted that if it was possible to take account of these commercial realities then it was better to do so, and he accepted that the HPA did not try to do this at all. The latter submission is correct. The former submission does not precisely reflect what Dr Kakaes said in the cross-examination relied on but taking his evidence as a whole, a fair reflection of Dr Kakaes' position was that it was reasonable to take account of the reality that there are features in standards which are not implemented.
318. Dr Cooper supported the existence of a time lag in terms of implementation of features and explained that features in Release 8, in contrast to later releases, were required to be used if one is implementing LTE, whereas it would be up to implementers to what extent they would implement features in a later release. However he also made clear that he "did not necessarily accept that simply post Release 8 developments should be dismissed since they can and often do add 'value'". That supports Huawei. There was a point about early R&D investments being higher risk and deserving higher reward but it was nebulous and I do not accept it.
319. There is more to these arguments than this summary but I have dealt with the major points. In my judgment LTE Release 8 does represent the fundamental technology on which LTE is based and FRAND licence negotiators would take that into account in assessing the value of patents. Later Releases of LTE are still based on the fundamentals of what is in that first working Release. Taking a cut-off of patents with a pre-2009 priority date is a FRAND approach to licensing Release 8.
320. On the other hand once later releases exist and are licensed, a method which gives no value at all for the technology in later releases is flawed and does not reflect FRAND. The impact of this problem changes as time goes on. It is an inherent difficulty arising from the fact that standards develop over time.
321. For LTE, assessed as at 2014, I find that the absence of value for post-2009 patents is not significant (either in Europe or anywhere else). However assessed today (2016/2017) the absence is significant given the way LTE-A has been implemented over time. For LTE some value has to be given in assessing the FRAND value of a portfolio for patents essential to later releases (and which therefore may have been excluded by a pre-2009 cut off). On the other hand, a method which gives equal value to any patent essential to anything in Releases 9 to 11 will inevitably overstate that value. Release 8 is still the fundamental technology in LTE and while carrier aggregation is important in the later releases, other aspects are not.
322. There are a limited number of ways in which one can deal with this. Unless one is going to make a list of Releases 9 to 11 features and identify each patent relevant to that feature, which would be impractical, the only alternatives are broad brush. One can include all patents knowing that this overstates the value of post-2009 patents,

which is the HPA method, or exclude them all knowing this understates the same value, which is the MNPA. The 80:20 approach by Unwired Planet is an attempt to mitigate this problem, among others, because it gives some value for patents put to one side by the pre-2009 cut-off. In that sense the intention behind the 80:20 approach is sensible but I am concerned that it is so crude as to be arbitrary.

Step (6)

323. The points on step (6), the handset and infrastructure filter, were mostly concerned with unpacking and Huawei's portfolio. There is no need to engage with that. Unwired Planet's detailed approach to handsets and infrastructure involves an assumption that 15% of the families with no handset claim are RAN rather than core network. Having listened to Dr Kakaes' oral evidence on this I find that Unwired Planet's approach was reasonable. The MNPA figure for handsets will be a lower bound but I doubt it is all that far from the true figure.

Step (7)

324. The next step is step (7), the essentiality filter. Here the Revised and the Original MNPAs differ. In the Original MNPA three fractions are used. The first is the 28% essentiality ratio. This was used to deal with over-declaration. There is no question that over-declaration is a major problem. The question is - how big? 28% was derived from studies reported in papers by Fairfield/Goodman & Myers on 2G and 3G. Dr Kakaes criticised this because there were also similar studies from the same group (Fairfield) and other groups for 4G which gave higher essentiality ratios. Mr Saru thought 28% was likely to be a ceiling and a lower percentage might be more accurate. Two 4G papers were put to Mr Saru (from Cyber Creative and FRI) in which essentiality rates of 50% or more are given.
325. In an annex to Huawei's opening skeleton is a summary of third party essentiality studies on 4G. There are four: iRunway at 8.2%, Fairfield at 50% and two Cyber Creative studies at 53.8% and 56.0%. Huawei submitted the iRunway study was not representative.
326. However as Unwired Planet point out, Huawei's own HPA produces a lower overall essentiality ratio than the 50%+ rates from Cyber Creative and Fairfield. Dr Kakaes reported overall essentiality ratios for 4G of 35.8% and 34.1% from the HPA on slightly different bases (the differences do not matter). In his third report Dr Kakaes set out a table for sixteen individual companies' 4G essentiality ratios derived from the HPA. They range from 18.6% for Google's patents (338 declared, 63 deemed essential by the HPA) to 82.3% for Sharp's patents (79 declared, 65 deemed essential by the HPA). Most of the companies in the table (13) have ratios within 22%-50%. The portfolios range from 64 to 771 declared and 14 to 228 deemed. The ratio for Huawei is 43.5% and the ratio for Samsung is 23.5%.
327. In cross-examination Dr Kakaes did not accept it was reasonable to use a 2G/3G study for the purposes of considering a 4G rate although he accepted that there was no technical reason why essentiality ratios for 2G, 3G and 4G should differ and indeed had made that point in his third report. Unusually for Dr Kakaes, who was a good witness, on this particular point he had lost some objectivity.

328. Dr Cooper addressed the papers which reported essentiality ratios. He thought they all had problems and weaknesses and he thought the 4G Fairfield paper produced a ratio which was too high. In his opinion there was no reason to think the essentiality ratio for 4G was likely to be different from 2G and 3G. He thought 28% for 4G was generous and this was a view formed before he had conducted a review of Huawei's and Samsung's portfolios. He thought the true essentiality ratio was likely to be between 10% and 20%.
329. In my judgment adopting 28% as an overall essentiality ratio for 4G cannot be criticised. It was reasonable both when Unwired Planet adopted it in 2013/14 and later on.
330. A further point which relates to this but is convenient to address now is Dr Kakaes' opinion that using a different method to assess the numerator and the denominator in the strength ratios is not appropriate. It will be recalled that Unwired Planet do this whereas Huawei do not. Although superficially it might appear to be a sound criticism, in my judgment it is not a valid point in these proceedings. Of course in general one usually seeks to compare like with like. Therefore it is meaningful to present a ratio for Unwired Planet against another company or the pool as a whole based entirely on figures provided by the same technique – as in the HPA. This is particularly so when the technique does involve some consideration of each patent rather than figures applied across the board as in the MNPA. However it is also meaningful when one wants to make a comparison between an identified collection of patents and the pool overall to do what Unwired Planet did and analyse the identified collection individually while applying a broader brush technique like the MNPA to the wider pool, since after all it is entirely impractical to analyse the whole pool with that same rigour. Moreover this is all the more legitimate when the identified portfolio is small, since an average is less likely to be accurate when applied to a small pool than a large one.
331. The other two percentages used by Unwired Planet (10% optional and 20% mandatory non-deployed) were criticised as arbitrary. The problem is not with the concept that there are optional features to which SEPs are essential and mandatory features in a standard which are not deployed. I have no doubt both exist (as Dr Cooper explained), albeit it is also true that some strictly optional parts of LTE are really important (e.g. MIMO as Dr Kakaes explained). The problem is justifying deductions of this magnitude. Combined together these two fractions reduce the denominator by over a quarter and therefore correspondingly could increase Unwired Planet's royalty rate by a third ($1/100 = 1\%$, $1/75 = 1.33\%$). And in my judgment the problem is made much worse given the pre-2009 cut off and a limit on the number of standards considered at step (2). Dr Kakaes was right that there was no reliable empirical basis for either fraction. Mr Saru's attempt to justify them in his oral evidence referred to his experience in a vague way and to informal calls to old friends. That was hopeless.
332. In my judgment the 10% and 20% fractions cannot be supported alongside the pre-2009 cut-off at step (5) and the limit on standards at step (2). Combining the fractions with steps (2) and (5) is not FRAND.
333. The Revised MNPA was devised with the criticisms of the original MNPA in mind. At step (7) the Revised MNPA uses a single fraction of 16.6% derived by Dr Cooper.

It arose as follows. Dr Cooper was asked to review the findings of a sample of the patents which the HPA deemed to be essential to an LTE handset that had a pre-2009 priority date. Dr Cooper randomly selected a sample of patents of a size that would allow him to draw conclusions with at least 90% confidence about the pool from which the sample was drawn. This resulted in Dr Cooper reviewing 38 Samsung and 30 Huawei patents and he spent 5-6 hours per patent family. He concluded that the essentiality rate of the Samsung patents (excluding optional features) was at most 16.6% and then revised that further to 15.9%. For the Huawei patents he concluded that the essentiality rate (excluding optional features) was at most 9.4%. Unwired Planet used that 16.6% figure at step (7) of the revised MNPA.

334. Unwired Planet point out that in his second statement Dr Kakaes was not surprised that having spent 5-6 hours per patent family, Dr Cooper had found a number of patents not essential which the HPA had deemed to be essential. They point out that Dr Kakaes went on to agree with Dr Cooper about a substantial number of the patents in his study. The major criticism made by Dr Kakaes was about the sampling process. I will deal with that after the other points.
335. The detailed points were these. First, there were patents excluded based on Dr Cooper's definition of LTE. However I am satisfied that at best this would make little difference to the end result. At best the point changes the result for two patents. The impact of that can be seen from the fact that changing the result for one patent moves the answer from 15.9% to 16.6%. The point does not undermine Dr Cooper's position as a witness. Second, there are patents which Dr Cooper found were not essential because they were not implemented (optional). As Dr Kakaes explained that was not part of his approach. If Unwired Planet had then tried to use the crude fractions for options applied in the Original MNPA as well there would be more to this point. I find Dr Cooper was justified in doing this although one needs to keep in mind that excluded this way are LTE TDD, which is used in China, MIMO and carrier aggregation. Third, there were cases in which Dr Cooper and Dr Kakaes maintained their disagreement about particular patents. I am not asked to resolve technical disagreements at the level of individual patents. Based on my assessment of both experts, I am sure the disagreement represents cases in which reasonable people can differ.
336. A question was whether it was right to use a rate for Samsung as in effect an industry average. Huawei submitted there was no empirical evidence that a rate for Samsung was representative of the industry as a whole. The choice was Unwired Planet's rather than Dr Cooper's. He explained that he would not expect the rates for different companies to be identical but he could not see an *a priori* reason why there should be big variations between companies. In my judgment the evidence, as best it is, is that the rates for different companies can differ considerably (see the table above from the HPA) but there is no systematic reason why one company's rate should be different from another. In my judgment using a rate for Samsung as representative of the industry is not illegitimate given that Samsung is a major player. I doubt Samsung has an essentiality rate which is significantly below average. There are significant uncertainties in all these exercises and this is another but it does not render the technique meaningless. Choosing to use the number derived by Dr Cooper for Samsung rather than Huawei was the conservative choice.

337. Huawei also submitted that it was inappropriate to use a figure derived from the HPA in the MNPA. This was for three reasons. First because the filters in the MNPA produce a different starting pool of patents from that in the HPA. Second because the different approach to LTE means many Samsung families found essential in the HPA would not have made it through the filters in the MNPA but were then chalked up as inessential. Third because the way of identifying a family as a handset family differs. In substance these are either another way of putting the detailed points I have already considered or they relate to the major sampling issue which comes next.
338. For Dr Kakaes the key problem with Dr Cooper's approach was that while a random sample had been taken from the pool which was sampled, the pool which was sampled was skewed. This was in two respects: first the pool from which the sample was taken consisted of the patents deemed essential (and held by Huawei or Samsung); and second the pool was actually only a subset of that because it was also limited to patents which met certain MNPA filters such as the pre-2009 cut-off. I have already dealt with the second point above but that does not address the first point. As to this, Dr Kakaes acknowledged that there will inevitably be errors in the evaluation process in the HPA but he said those errors would point in both directions, i.e. essential patents could be deemed not essential as well as not essential patents deemed essential. Therefore sampling only from the pool deemed to be essential was skewed. To do something like this sort of sampling appropriately, a random sample should have been selected from the pool as a whole, before evaluation. For Dr Kakaes this undermined the exercise entirely. Dr Cooper had sampled from what Dr Kakaes called a very, very, very biased universe.
339. The strength of Dr Kakaes' view about this point came across in his oral evidence. However to resolve this issue I need to address the most important aspect of Unwired Planet's attack on the HPA. That is because Unwired Planet's answer depends on its case that the essentiality evaluation in the HPA was a coarse filter designed to screen out non-essential patents and had a tendency built into it in favour of increasing the number of patents in the pool deemed to be essential. Huawei disagrees.
340. Without resolving this argument about the HPA I cannot complete my consideration of the Revised MNPA. In order to decide issues as much as possible in their proper context I will therefore suspend consideration of the Revised MNPA, this being the last major issue, and turn to the HPA. Once I have dealt with the HPA I will consider the implications of those decisions on this aspect of the Revised MNPA and reach my conclusions on both the Original and Revised MNPA.

The criticisms of the HPA

341. The HPA was run as an exercise as part of the Ericsson – Huawei arbitration. That is not in dispute. The way the HPA was presented by Huawei in these proceedings in the FRAND Statement of Case was wrong and should not have happened. Huawei cannot simply blame Ericsson for demanding secrecy about the arbitration. Huawei have an excellent UK legal team and the matter could have been raised with the court (or even conceivably with another judge although I cannot see that that would have been necessary). What has happened is that the truth about how the HPA was devised and the reasons for it were not presented properly from the outset. Although more came out at trial I am not satisfied the full picture has been presented to the court.

342. Huawei maintained in closing that:

“The exercise was overseen by Dr Kakaes and a team of engineers from Thomson Reuters. The evaluators were not informed of the identity of the ultimate client (i.e. Huawei) or of the opposing party in the dispute for which the analysis was originally prepared (i.e. Ericsson), so as to preserve neutrality.”

343. I accept that the engineers who undertook the evaluation exercise at step (5) of the HPA did not know that the client was Huawei when they carried out their work. That is a virtue and in that sense the exercise was neutral. However it was clear from Dr Kakaes’ answers in his oral evidence that Huawei’s US lawyers, Sidley Austin LLP, were involved at various stages in the decision making and possibly drafting of documents and I am not satisfied that the HPA can be regarded as something set up independently of Huawei’s interests. It is not possible to say. However just like the MNPA, what matters most is the objective reasonableness of the steps, not the motives of the devisers.

344. Unwired Planet take a number of points about the HPA but in my judgment none of them matter except one, which is the submission that the evaluation step (5) was in fact no more than a coarse filter to identify patents that Dr Kakaes should look at properly later and has a tendency built into it in favour of increasing the number of patents in the pool deemed to be essential. The other points taken by Unwired Planet (about the initial dataset and technology categories) are similar to the points I have rejected which Huawei took against the MNPA. If the coarse filter point succeeds Unwired Planet do not need to place further emphasis on the other issues and if it fails, they are not significant enough to undermine the HPA outright. Just as they do for the MNPA, the extra points serve to emphasise the inherent uncertainties in the exercise.

345. The evaluation exercise which was carried out was a huge undertaking. Even then the average time per family was ½ hr. In a much smaller exercise on a small subset of patents which Dr Cooper conducted he spent 5-6 hours per family. He was not wasting time. Unwired Planet detected that in cross-examination Dr Kakaes tried to resile from the onerous nature of the task. I do not believe that is what he was doing. He was simply emphasising that in parts some of the elements of the task may not be that difficult. In his reports Dr Kakaes had emphasised that the analysis was not a rigorous and thorough assessment of essentiality of all declared SEP families in the relevant group, since carrying that out was not plausible without employing vast resources. The exercise was based on what he called a “relatively quick assessment”. In my judgment, given the number of families to deal with, and the inherent complexities of the patents, standards and the task itself, it would not be possible to make a definitive assessment of essentiality for the number of patents in issue in the time available. I do not believe Dr Kakaes suggested otherwise.

346. In his written fact evidence Dr Kakaes addressed the Essentiality Review Protocol. In paragraph 31 of his first witness statement Dr Kakaes described the evaluation as follows:

“31. Accordingly, the second stage of the study was to analyse the 11,384 Group 1 patent families to seek to determine

whether or not a patent that was declared essential to ETSI is, in fact, “essential”. Conclusively confirming actual essentiality is a complicated and involved legal and technical task. In this document, I use the term “is essential” (and similar terms) to mean that, after evaluation, we have determined that there is a reasonable basis for treating a patent as essential. In each such instance, we reviewed the patent specification and claims and did not identify an apparent reason to exclude the patent from being essential. Thus, a more precise interpretation of this phrase is that such a patent has passed a screen to exclude non-essential patents.”

347. Unwired Planet say this shows that patents were deemed essential as long as there was a reasonable basis to treat it as such and only excluded if an apparent reason to exclude it had not been identified. The method was in Dr Kakaes’ words a screen to exclude non-essential patents. On its face this description accords with Unwired Planet’s submissions.
348. In paragraph 41 of the same statement Dr Kakaes explained that if the standard being considered required all the elements of one of the claims being considered, then the patent family was deemed essential. Expressed that way there is no tendency either way but in a footnote to this paragraph Dr Kakaes then said: “To be more precise, the reviewers determined that the declared standard specification(s) did not provide a clear reason to rule out the patent as being essential.” Unwired Planet say this reflects the same tendency they contend can be seen in paragraph 31.
349. Unwired Planet also pointed to the protocol document exhibited by Dr Kakaes which provided that the evaluators in which the word “substantially” appeared in a context which expanded the scope of what would pass as essential. The text is:
- “Compare the selected claims with the declared standard specifications and determine whether the standard specifications substantially require all the elements of the claim.”
- (my emphasis)
350. These points were all put to Dr Kakaes in cross-examination. He did not accept Unwired Planet’s characterisation of the effect of these passages. One suggestion he made in cross-examination and repeated in re-examination was that the explanation related to a detail of ETSI IPR Policy which is involved in considering whether it is not possible on technical grounds to do otherwise. I accept Dr Kakaes’ evidence that this detail of the IPR Policy, which would involve proving a negative, did not form part of the assessment of essentiality but I do not accept that it is what passages in the written evidence were talking about.
351. I accept Dr Kakaes’ testimony that he checked numerous entries and found errors going both ways, including patents the evaluators should have placed in the deemed essential collection but had not done so, perhaps because they read the claims too narrowly or missed additional standards. I also accept that he spent hundreds of hours checking results and answering queries from the evaluators. This supports Huawei’s

submission that the aim of the HPA was to apply a consistent approach to all the patents considered. I am sure a consistent approach was applied. The debate is to properly characterise what the approach was.

352. Unwired Planet also put to Dr Kakaes something he said about Dr Cooper's detailed analysis of the sample deemed essential by the HPA. Dr Kakaes had said he was not surprised that Dr Cooper's more detailed studies had found that a number of patents deemed essential in the HPA were not in fact essential. That lack of surprise supports Unwired Planet's point but when asked about it Dr Kakaes said he just meant that he was not surprised Dr Cooper had reached different views. I do not accept that explanation. The point was not simply that Dr Cooper had reached different views, the point was that for patents deemed essential, Dr Cooper had found quite a number of them not to be.
353. Some of Dr Kakaes' answers on this topic were rather difficult to follow. I think a partial explanation for this was that in all his evidence about the HPA as a methodology, particularly before the point at which the arbitration point emerged fully but also afterwards, in the back of his mind Dr Kakaes was worried about the arbitration and about what he thought he was and was not allowed to say. This did not help but even taking that into account I am left with one characterisation of the HPA in Dr Kakaes' written evidence and a different one in his cross-examination and re-examination.
354. Weighing up the evidence I prefer to place weight on Dr Kakaes' written evidence. It was clearly written taking care to present a balanced explanation of the exercise and its limitations. It is also inherently credible that an exercise of this scale, which could only ever be a "relatively quick assessment", would err on the side of placing a patent family in the deemed essential collection unless there was a sufficient basis not to. There is nothing wrong with that provided it is understood that that is what is happening. It is a sensible way of proceeding. Dr Kakaes felt a personal ownership of the HPA and I think in the cross-examination he regarded the questions on this topic as implying that the HPA was flawed. Therefore he sought to defend it.
355. I find that it is accurate to describe the evaluation step in the HPA as a step which errs on the side of including a patent in the deemed essential pool.
356. I turn to consider the significance of Unwired Planet's case about the HPA's role in the arbitration. The submission is that in truth the HPA was designed to be just a coarse filter to identify patents that Dr Kakaes should then look at properly, or in other words a screen to exclude clearly non-essential patents. If that is right then it enhances Unwired Planet's case on the nature of the evaluation step.
357. In cross-examination it was put to Dr Kakaes that Huawei needed to make the process of assessing essentiality manageable by curtailing how long a single family was to be considered. Dr Kakaes did not agree and wanted to explain why but to give a complete answer required him to explain how the results of the HPA were used. At this point it emerged that he felt unable to give a full answer because of non-disclosure obligations he felt he owed Ericsson as a result of the arbitration. Once in private and reassured that he could speak freely Dr Kakaes explained that the HPA, which he called the "study" was "just to figure out what the landscape is". The study had two steps, the census (i.e. steps (1) to (4) as described in this judgment) and the

essentiality study (step (5)). The information was passed on to Mr Lasinski but Dr Kakaes said his (Mr Lasinski's) usage of it was minimal. What Dr Kakaes also did was analyse a subset of patents that were deemed essential in the HPA. They were patents held by the parties to the arbitration - Ericsson and Huawei. He said "I looked in detail, and in the subset of Ericsson essential patents, and identified their importance and so on." and added "a big part of what happened next is this question of importance of Huawei and Ericsson patents". Finally, there was the following exchange:

60:13 MR SPECK: So that's why you couldn't take an
14 industry average?
15 A. No, no. The -- the usage of the -- of the study
16 that we've been talking about, the study referring to the
17 census and essentiality, was very limited because -- and the
18 reason for doing that, at least one of the reasons, was to
19 flesh out what's Ericsson and what's Huawei, without ever
20 telling the team in India who the players are.
21 MR JUSTICE BIRSS: I see.
22 A. So the players were ignorant. They said: here is
23 the census. Here is the essentiality results for all the
24 companies. And then we looked at the Ericsson universe and
25 the Huawei universe, to do further study and analysis, which
61: 1 is -- as my Lord observed -- irrelevant.

358. Unwired Planet say this proves their point. Huawei do not agree. In closing counsel for Huawei placed emphasis on the word "importance" in these passages and submitted that the further detailed study which Dr Kakaes was talking about was not a study of essentiality, it was a study of "importance". That is a term he had used elsewhere in his report as relating to the value of an invention, i.e. the importance to the standard of the technology covered by the patent. In other words it is accepted (plainly rightly) that Dr Kakaes here was explaining that there was further detailed study and analysis of patents placed into the deemed essential pool by the HPA, but Huawei argues that the nature of that further study was about importance and so does not support the idea that the HPA was a coarse filter on essentiality on the footing that patents could always be weeded out later on more careful consideration of that aspect.
359. I readily accept that although it was not apparent at the time he was speaking, Dr Kakaes was using the word "importance" there in the same sense as elsewhere in his report. But I am not persuaded that this takes one as far as Huawei seek to go. First of all, if it matters, Dr Kakaes did not say in these passages that "importance" was the only thing considered in the further study. Secondly, "importance" is concerned with evaluating the importance of the patent's technology to the standard and therefore cannot help but traverse the same ground as essentiality. The idea of undertaking a further study of importance without noticing whether a patent is essential is unreal.
360. The HPA was devised for and used in the arbitration and regrettably the court has not been presented with a full picture of the HPA. I find that what we call the HPA was devised not simply as a scheme to produce an end result in itself, but as a form of filter or screen to produce a pool for further study. That is consistent with all of what I know now. On that basis there is nothing surprising about the idea that the evaluation would err on the side of essentiality since there was going to be a further

detailed study which involved considering the patented technology and the standard. Given that, there was no harm in including more patents in the deemed pool than would turn out to be essential on detailed study. What one would seek to minimise was missing patents from the deemed pool which might be essential. Unwired Planet's characterisation of the nature of the evaluation step in the HPA is correct.

The HPA – conclusions

361. The task the HPA performs is an inherently difficult one. The answers can only ever be approximate. In the HPA the essentiality evaluation step is and was intended to be a coarse filter to screen out non-essential patents and to err on the side of including a patent in the deemed essential pool. This does not mean the method is flawed or unreliable. I am satisfied that the HPA has applied a consistent yardstick and produces meaningful results. It is a reasonable attempt to deal with over-declaration and derive information about how many essential patents there really are. When comparing large numbers on a like with like basis, the tendency built into the evaluation step matters much less. However as an absolute value, the numbers from the HPA over-estimate the true number of essential patents. In other words, if a number derived from the HPA is used as the denominator in a fraction in which the numerator is a number derived by considering the patents in more detail, the result will understate the significance of Unwired Planet's patents. Furthermore for smaller pools the coarse nature of the filter is likely to matter more and produce a greater uncertainty in the numbers.
362. Huawei derive the HWLTER of [...] using the HPA on its own and so they can fairly submit it is the result of applying the HPA consistently. However that number is based on a numerator which gives the same number of Relevant SEPs in Unwired Planet's portfolio as Dr Cooper's more careful analysis. I find that Dr Cooper's analysis is likely to be closer to the true figure. Compared with this, raw figures from the HPA tend to be overestimates. The impact of that will apply to the denominator. I find the true strength ratio R should be somewhat higher than [*the HWLTER*].

The implications of the decisions on the HPA for the MNPA

363. I can now return to the Revised MNPA. To recap the point is that Dr Cooper performed a more detailed study of a sample of patents belonging to Huawei and Samsung which were in the deemed essential pool of the HPA. Huawei submitted I should place no weight on Dr Cooper's assessment because by sampling only from the deemed essential pool, the exercise was badly skewed. Unwired Planet's answer was that the nature of the evaluation step in the HPA meant it was reasonable to focus on patents which passed the filter and assume that those patents which were discarded as not passing the filter would not have been found essential by Dr Cooper. I have accepted that this step of the HPA does increase the pool of essential patents and errs on the side of putting a patent in the deemed pool. Accordingly, one would not expect there to be as many patents in the discard pool which would in fact turn out to be essential after a detailed 5-6 hour analysis, as there would be patents in the deemed essential pool which turn out not to be essential. There will be errors going both ways, as the evidence established, but the inherent tendency built into the evaluation exercise means that it is reasonable to expect many fewer patents in the discard pool as having been wrongly rejected, than there are patents in the deemed essential pool which turn out not to be essential. So while selecting only from the deemed essential

pool will inevitably skew the result a bit, I am not satisfied that the skewing will be anything other than small. It is a point to keep in mind when placing weight on the result but it is not strong enough to justify rejecting the approach.

364. Obviously more effort would lead to more statistical rigour, but the effort of evaluating the number of patents Dr Cooper's exercise did with 5-6 hours per patent family is already considerable. Even within the limits of the enormous sums spent in costs by the parties in these proceedings, there is force in Unwired Planet's point that the approach taken kept the exercise proportionate.
365. In my judgment Dr Cooper's study was a reasonable effort to assess the essentiality rates of Samsung and Huawei.

The MNPA –overall conclusions

366. Having now been through all the points in detail I will stand back and consider the MNPA as a whole. Broadly the HPA and MNPA are aimed at the same difficult task. The MNPA has flaws but, apart from one aspect of the Original MNPA, overall in my judgment the Original MNPA was and the Revised MNPA is a reasonable attempt to derive information which allows one to assess the strength of a portfolio of patents declared essential to LTE as against the industry as a whole, from the point of view of what licensees would be interested in. There are two critical caveats.
367. First, as with the HPA, one needs to take care with the results because the error bars are wide. However the results of the MNPA are not meaningless and do not systematically favour Unwired Planet, as long as one does not think the results are the true essentiality rates. The MNPA has a tendency to understate the value of patents in China because of step (2) but for a global benchmark the MNPA has utility.
368. Second, with the MNPA, something like the 80:20 approach is necessary. Unwired Planet's description of the final number as the "True LTE handset pool" is wrong. To use the Revised MNPA fairly demands the incorporation of some step which gives some value for the patents which fall outside the so called "True LTE handset pool". That is a serious weakness.
369. Huawei pointed out correctly that when the 80:20 approach was applied in the Original MNPA it was applied differently, not to calculate a number representing Unwired Planet's patent share but rather to apply to the imputed royalty stack. That is true but this way of putting Unwired Planet's case was advanced at the trial and it is right to consider it.
370. Whether another ratio apart from 80:20 is a better reflection of the different value of patents in the two pools is not something addressed in the evidence. A majority of the residue patents will not be essential at all but a good number will be essential to options and later developments of significance to LTE (e.g. carrier aggregation, TDD and later MIMO patents). In terms of individual patents, given the different sizes of the two LTE pools using Unwired Planet's figures, 80:20 makes an individual patent in the Relevant SEPs pool about 34 times more valuable than residue. I think that is much too high. That may be because the pool of Relevant SEPs is too small relative to the residue pool or because the 80:20 ratio is too generous to Unwired Planet or some combination of the two.

371. The focus of the debate on the MNPA has been on 4G handsets but the weaknesses exposed in it also apply to the numbers Unwired Planet contend for in relation to infrastructure on 4G. The points made do not apply to the same extent to Unwired Planet's case on 2G and 3G.

(iv) Findings about the strength of Unwired Planet's portfolio

372. The strength of Unwired Planet's portfolio for multimode 4G handset licensing is represented by two numbers: S (the share of the total Relevant SEPs) and R (the ratio of Unwired Planet to Ericsson). For 4G multimode handsets Unwired Planet's number for S is 1.25% and for R is [...] (the UPLTER). These are based on the MNPA and 80:20 approach. Given my findings the true values are lower than this. Correspondingly Huawei's number for S is 0.30% and for R is [...] (the HWLTER). These are based on the HPA. Given my findings the true values are higher than this.

373. A further aspect to keep in mind is that these numbers are supposed to reflect various ratios of numbers of patents in different categories to one another and they are linked in complicated ways. A simple illustration that the differences between the parties are not simply in the magnitudes of S and R is that Unwired Planet's R is about 8 times bigger than its S whereas Huawei's R is about 20 times bigger than its S. I do not mean to say that that relationship means anything in particular, the point is a reflection of underlying differences.

374. I am satisfied that both methods produce the wrong answer. The problem is whether there is a better way to arrive at the right answer than doing my best to choose values for S and R somewhere between the parties' extremes.

375. I thought initially that a virtue of what one might call the Revised MNPA + 80:20 approach, based as it is on percentages such as the 16.6% at step (7), would be that the method itself was more readily adjustable than the HPA. For instance one could for example decide as a matter of judgment that 16.6% ought to be 28% (the figure used in the Original MNPA). However the complexity of the 80:20 adjustment, layered on top of the multimode adjustment and, if one is considering R, also taking into account figures for Ericsson too, makes the Revised MNPA + 80:20 approach impossible to adjust in a credible manner. The only way it can be adjusted would be so broad brush that it would be mere pretence to suggest it was more meaningful than doing my best to just choose values for S and R somewhere between the parties' extremes.

376. The problem posed by the HPA is different. At its heart is the evaluation of the team of evaluators which is not adjustable at all. Nevertheless the way in which the key numbers are produced using the HPA as a method is simpler and more transparent than the Revised MNPA + 80:20 approach. I have concluded that the right way to reach a conclusion is to apply adjustments to the figures derived from the HPA. The basis for the adjustments is my qualitative evaluation of the evidence as a whole, primarily Dr Kakaes and Dr Cooper, and including the indications given by the Revised MNPA + 80:20 approach. Since this is the approach I will take to 4G, I will take the same approach to 2G and 3G.

377. The significant overstatement in the HPA is the number produced for the total pool of Relevant SEPs. The number for 4G handsets is 1812 and is much too high. The corresponding number in the Revised MNPA is 355 but that number is much too low

if it is to represent all Relevant SEPs. I think both values are out by about a factor of two. Half of 1812 is 906 while twice 355 is 710. Splitting the difference takes one to 800. Standing back, about 800 is fair and in my judgment an appropriate figure for the pool of 4G/LTE patents. Applying that as the denominator in a fraction to determine the share S which Unwired Planet's patents represent from the pool gives $6/800 = 0.75\%$. I appreciate that Unwired Planet's 2G and 3G denominators derive from the Fairfield/Goodman and Myers reports but it is reasonable to apply the approach I am taking consistently and make an adjustment in the same proportion to the numbers for the total pool of 4G infrastructure and for 2G and 3G patents. The proportion will be 44% ($=800/1812$). I will include a multimode figure for handsets but not infrastructure.

378. This all produces the following tables:

Unwired Planet Share S for handsets				
	UP patents	HPA denominator	Adjusted denominator	S
2G	2	350	154	1.30%
3G	1	1089	479	0.21%
4G	6	1812	800	0.75%
Multimode				
2G/3G				0.57%
2G/3G/4G				0.70%

Unwired Planet Share S for infrastructure				
	UP patents	HPA denominator	Adjusted denominator	S
2G	1	305	134	0.75%
3G	2	886	390	0.51%
4G	7	1554	684	1.02%

379. Turning to the ratio R between Unwired Planet and Ericsson and taking the numerators as a given, the critical numbers are the numbers of relevant Ericsson patents. For this exercise I will not try to distinguish between handsets and infrastructure but just use Unwired Planet's handset numerators. It is simpler and fair. For 4G the Ericsson number given by the HPA is [...]. Here another adjustment has to be made but in my judgment a smaller proportionate adjustment is needed here than the previous one. Unwired Planet's equivalent for the number of Relevant SEPs held by Ericsson is 34. Unwired Planet's denominator here ([...]) produces a figure for R for 4G alone of [...] which I find is an odd result even bearing in mind the small sample sizes. Doing my best I think the right proportion is two thirds. Applying the same proportionate adjustment to 2G and 3G produces the following table:

Unwired Planet:Ericsson ratio R				
	UP patents	HPA: Ericsson patents	Adjusted Ericsson patents	R
2G	2	[...]	[...]	[...]
3G	1	[...]	[...]	[...]
4G	6	[...]	[...]	[...]
Multimode				

2G/3G				[...]
2G/3G/4G				[...]

380. All of these numbers are close enough to $[Z\%]$ so as not to be out of line with the number of patents transferred to Unwired Planet from Ericsson's portfolio. The small sample sizes involved mean that reasonable deviations from $[Z\%]$ are unsurprising.

381. So for 4G multimode handsets I have concluded that Unwired Planet's share S of the total pool is 0.70% while Unwired Planet's ratio to Ericsson R is 7.69%. In principle these numbers ought to be linked by Ericsson's share of Relevant SEPs but the uncertainties mean that perfect consistency is not realistic and I will not strive to find it.

(v) The comparables in this case

382. Having considered how the Unwired Planet patents stand as compared to the industry and to Ericsson, the next step is to evaluate the various comparable licences in evidence. The Unwired Planet licences may also allow me to arrive at a rate directly. The bulk of the licences are Ericsson licences and the ultimate objective with those is to arrive at a figure for the value E in order to do the sum $E \times R$.

(a) 2014 Unwired Planet - Lenovo

383. The 2014 Unwired Planet-Lenovo was introduced in the section on Unwired Planet's case on rates above. The major debate about this licence is whether any weight should be placed on the running royalty rates on the face of the licence. Mr Lasinski said they were cosmetic. The rates are expressed in cents per product but making sensible assumptions they compare favourably to a royalty rate of 0.2%. The point is that the licence contains two lump sums adding up to \$100 million. On the face of the agreement [...] is defined as a prepayment of royalty while the [...] balance is attributed to the sale to Lenovo by Unwired Planet of certain patents. On its own terms therefore no further running royalties will be due until the [...] is exhausted. Huawei contend that Lenovo wanted to attribute the whole \$100 million to royalty pre-payment but accepted the [...] split because they thought they were safe that [...] would not be exhausted during the term (5 years plus an additional possible 2 years). Other factors which bear on this are these: [...] Also there is a dispute about the attribution of the [...] licence element.

384. A factor which does not have much significance is the difference between the higher MM rate [...] and the lower [...] OT rate applied elsewhere [...]. Within the limits of the uncertainties in this exercise these two come to a similar percentage rate when the difference in product prices in these two markets is taken into account.

385. The oral evidence about the Lenovo licence was given by Mr Robbins, who had been personally involved in the negotiations on the Unwired Planet side. There are also some Unwired Planet documents. The import of the evidence is fairly clear. I find that both Lenovo and Unwired Planet thought it was highly unlikely that the prepayment would be exhausted. (Mr Robbins in cross-examination said "certainly unlikely".) [...]. Nevertheless it does not follow from this that Lenovo did not care what the running rate was. That is for three main reasons. First, it was not inconceivable that Lenovo's sales would be large enough over the term to exhaust the

royalty. It was possible that they would be that large if Lenovo enjoyed a very high rate of growth, comparable to that of Samsung. The running royalty will determine the rate at which the lump sum is used up. [...] For these reasons I find that the running rate was the product of genuine negotiation. The [...] and, of course, the lump sum pre-payment itself, meant that Lenovo's interests were protected to a high degree in any case but I find that Lenovo still had an interest in negotiating a lower rate. Their interest was modest compared to the negotiation of the lump sums and other terms, but it was tangible.

386. The allocation of the lump sums between the patent purchase and the licence as it appears on the face of the documents is not reliable. Mr Bezant and Mr Lasinski were agreed about that. As I understand the case presented by each side, neither party seeks to unpack a lump sum notionally attributable to the licence in order to generate a comparable royalty rate nor does either party seek to use a sum attributed to the value of the patents sold to generate useful evidence for the value of Unwired Planet's patents. Therefore it is not necessary to reach a view about what the proper attribution would be. If I had to do so I would find the large majority of the value should be attributed to the patent purchase.
387. Focussing on the licence itself, it is a licence for SEPs and implementation patents but as drafted there is no information to allow one to make an attribution between these two.
388. In his Sixth report Mr Bezant plotted what the comparable Lenovo rate might look like if one assumes [...]. To do this also involved taking Huawei's sales profile as a royalty base. This is not a reliable comparable at all. I will not place weight on it.
389. I conclude that the Lenovo licence is not a useful comparable from the point of view of setting a FRAND rate today given the other evidence now available. However its utility depends on the other evidence available and so, from the point of view of Unwired Planet in 2014, who were not privy to the terms of any licences to which they were not a party, it may bear more weight. I will address that in context if necessary.

(b) Unwired Planet-Samsung 2016

390. As part of a settlement of these proceedings and after PanOptis acquired Unwired Planet, the Unwired Planet-Samsung licence was entered into on 28th July 2016. Huawei contend it is in principle the best comparable in the case while Unwired Planet contend it is a poor comparable.
391. As Huawei put it, they rely on the licence for both the FR and ND elements of FRAND. At this stage I will focus on the weight and significance to be attached to this licence as evidence of the fair and reasonable value of the Unwired Planet portfolio in 2016. Hard edged non-discrimination will be dealt with later.
392. Under the licence Samsung paid Unwired Planet US [...] and assigned a portfolio of 20 patent families in return for a worldwide licence under Unwired Planet's SEP and non-SEP portfolio until [...] together with a release of any past damages. Before one decides how much weight to place on any royalty rate information derived from the licence, Unwired Planet contend that this licence cannot be seen in isolation and needs

to be considered in the context of a wider arrangement between PanOptis and Samsung and the distressed financial position Unwired Planet was in when acquired by PanOptis. This depends on Mr Ware's evidence. Huawei's case is that the facts of what went on are now sufficiently clear to show that the wider factors make no material difference. Unwired Planet disagree and contend that the two issues of rate and context interact directly because any royalty rate derived from this licence is truly much lower than the rates which Huawei put at the forefront of their argument on this licence and that this is a reflection of context.

393. So in order to derive a royalty rate from this one needs [...], ascribe a value to the Samsung patents assigned to Unwired Planet, take into account the value of the non-SEPs and work out a way of assigning value as between 2G, 3G and 4G. The way Mr Lasinski assigned value between 2G/3G and 4G is not in dispute.
394. Mr Lasinski derived a range of possible rates and presented them in two tables, one for [...] and the other assuming [...]. The provisions [...] in the licence are complicated but do not need to be explained. Each table then shows the implied royalty rate depending on the value attributed to the assigned patents – from [...], and the percentage of royalty attributable to SEPs rather than non-SEPs from 25% to 100%. As the value of the assigned patents rises the royalty goes up because in effect Samsung have given more value for the licence. Also as the percentage rises the rate rises too, because it is a rate for the SEPs rather than the non-SEPs. The 4G rates range from [...]. The 2G/3G rates vary accordingly from [...] on the same basis.
395. Mr Lasinski made a point relating to the similarity of rates implied by the [K] licence and the [J] licence. Similarly in figure 4 of his third report which is set out above Mr Lasinski plotted rates derived from the Unwired Planet-Samsung 2016 licence on the chart together with rates from those two Ericsson licences and two other data points. Unwired Planet criticised this and submitted its effect was to make the rates derived from the [...] licence look closer to the other three Ericsson licences than they really are. That is because the rates used were the highest rates Mr Lasinski derived from the Unwired Planet-Samsung 2016 licence and while the difference is still a factor of [...], if more realistic rates were used for the Unwired Planet-Samsung 2016 licence it would be shown to be an outlier. Mr Lasinski did not accept that was why he had chosen to plot those rates in Figure 4 and since the idea that Mr Lasinski was setting out to mislead was not put squarely to him in this context, it would not be fair to him to make a finding on that.
396. However, objectively speaking, by including only the highest rates from Mr Lasinski's tables for the Unwired Planet-Samsung 2016, Figure 4 is capable of misleading. The assumptions on which the highest rates are based are [...]. However, Mr Lasinski accepted [...] and accepted he had used a much lower SEP percentage (about 30%) when performing a similar calculation on the Lenovo licence. His explanation that this was because he did not regard Lenovo as a good comparable does not justify this difference. On the assigned value Mr Lasinski took Mr Ware's acceptance of [...] despite having earlier expressed the view [...] and despite generally not accepting Mr Ware's evidence. On that Unwired Planet submitted Mr Lasinski was being inconsistent and selective. There is some force in that but given Mr Ware's evidence I will use the [...] figure. Mr Ware said they included some SEPs which PanOptis considered to be essential to LTE, and some implementation

patents which PanOptis considered related to popular features of the best-selling handsets.

397. There are major uncertainties deriving implied rates from this licence but the figures used in Mr Lasinski's figure 4 are too high. [...]. On these assumptions the 4G rate ranges from [...] and the 2G/3G rate ranges from [...]. These are all far lower than the other rates in Figure 4 and relied on by Huawei as best comparables. It supports Unwired Planet's case that the Unwired Planet-Samsung 2016 licence is an outlier and that Unwired Planet are right that Mr Lasinski's purported generosity to Unwired Planet in his calculations is a wolf in sheep's clothing.
398. Mr Bezant's view of this licence was that there were a number of factors which significantly reduced its reliability for the purposes of assessing FRAND offers in 2016. He addressed the implied aggregate royalty burden produced by using Mr Lasinski's figures for this licence combined with the HPA and also with the MNPA. While I can see Mr Bezant's point, it does not add anything to the analysis because it is just another way of explaining that the rates are low.
399. In principle, it is obvious that one would expect a licence granted under the same portfolio, to one of the parties in the proceedings, would be an excellent comparable. Huawei pointed out that in ***British Phonographic Society v MCPS*** [2008] EMLR 5, the Copyright Tribunal held that a settlement by a co-defendant can be an "outstanding" comparator. There is no doubt it can be, the question is whether it is. Before turning to the context in which the licence was entered into, having now analysed the licence itself, it can be said that the terms on their face raise a question mark over this licence as evidence of the fair and reasonable value of the Unwired Planet portfolio in 2016. Even taking into account the uncertainties, the rates are significantly lower than the rates Huawei contend for in these proceedings and are significantly lower than the rate implied by the [...] licence, which is an important comparable on any view.
400. Unwired Planet's version of the context relevant to understanding this licence is the following. PanOptis is a licensing company. It has an existing relationship with Ericsson. It had considered buying the Unwired Planet portfolio in 2014 but did not. In March 2015 PanOptis offered \$75 million for the portfolio but Unwired Planet wanted \$100 million and no deal was done. From about July 2014 PanOptis started having commercial discussions with Samsung. They included the possibility of Samsung taking a licence under other PanOptis telecoms patent portfolios and by the summer of 2015 they included the possibility of a wider strategic partnership. In July 2015 Unwired Planet approached PanOptis again, this time about purchasing the licensing companies themselves. In September 2015 PanOptis offered to buy Unwired Planet for \$35 million. [...]
401. Mr Ware's evidence was that the reason that PanOptis were interested in this deal was because it would be "solving a problem for Samsung that would significantly assist the development of the wider strategic relationship we were in the process of negotiating and that could ultimately be of enormous commercial value to us". He also said that without this the acquisition of the Unwired Planet portfolio in late 2015 did not fit with his strategic vision.

402. [...], Ericsson also approached PanOptis encouraging it to purchase Unwired Planet. Ericsson was keen for PanOptis to purchase the portfolio as it considered PanOptis to be a safe pair of hands. The fact that Ericsson wanted PanOptis to purchase the portfolio was an additional reason why PanOptis were interested in doing the deal because it would strengthen PanOptis' existing strategic partnership with Ericsson. Ericsson also indicated that it would be prepared to waive the revenue sharing arrangements, which would allow PanOptis to license the Unwired Planet portfolio as it saw fit and which would avoid Ericsson needing to be part of any litigation with prospective licensees.
403. There were various negotiations and by March 2016 PanOptis dropped its offer price from \$50 million to \$40 million due to Unwired Planet's worsening financial position.
404. Mr Ware said that PanOptis was able to purchase Unwired Planet for a price which did not represent the value of Unwired Planet's patents. In his view that was because Unwired Planet was on the verge of insolvency. It had told shareholders that it would run out of cash reserves in July 2016 and was desperate to get out of the licensing business, to a significant degree as a result of the difficulties Unwired Planet had encountered in trying to license the portfolio and the cost of litigation. Unwired Planet characterise this as a fire sale. [...].
405. Once PanOptis had purchased Unwired Planet it approached Samsung and the licence was concluded in very short order. Under that licence Samsung agreed to pay [...] in cash and transfer the patents mentioned already for which I have used a value of [...]. Mr Ware emphasised what he called other considerable benefits that PanOptis gained from concluding the licence with Samsung in addition to the cash and transferred patents. These were: the fact that it [...], the fact that it [...] and strengthening the foundations for a far wider commercial relationship with Samsung in the future.
406. Huawei do not agree with the way the transaction is characterised by Unwired Planet. They say in response:
- i) PanOptis had been attempting to buy Unwired Planet well before Samsung even came into the picture and clearly had enough money to do so at all material times.
 - ii) In March 2015, having done extensive due diligence, and knowing Unwired Planet was embroiled in major litigation in numerous jurisdictions, PanOptis offered \$75 million to purchase the portfolio because they had concluded it was a good fit.
 - iii) When the September 2015 offer was made all Mr Ware had was a strong feeling that Samsung would take a licence [...] but he accepted in cross-examination that PanOptis was "*flying a bit blind*" and "*taking a risk*".
 - iv) In terms of its wherewithal, PanOptis has 60-70 shareholders including pension funds, hedge funds, and Yale University. In terms of cash available to buy Unwired Planet, on 19 December 2015, Ericsson extended a convertible loan of \$100 million to PanOptis and in December 2015, PanOptis received a further \$160 million of licensing revenue. PanOptis was certainly not in any state of distress when it committed to buy Unwired Planet in April 2016.

- v) There was no commitment of any kind by Samsung, at any stage, to take a licence [...]. It was simply a feeling acquired by Mr Ware in meetings conducted “*over a very long dinner and drinks*” with no written records at which it was conveyed to him that he would be doing a “*great favour to Samsung*”.
 - vi) When Samsung ultimately did take a licence it paid [...], since in addition to the [...] Samsung transferred patents which Mr Ware accepted were worth [...].
407. Huawei submit that the suggestion that PanOptis accepted a [...] price from Samsung because of the [...] element to the acquisition does not sit with the facts of the case. Whether or not Unwired Planet was in financial distress is irrelevant. The licence was granted months after the purchase by PanOptis, who were certainly not in any financial distress. The benefits to PanOptis which are relied on were simply ordinary commercial aspirations and no more. Mr Ware accepted that discussions with Samsung on other PanOptis portfolios had pre-dated anything to do with Unwired Planet and accepted that the first time any written link between the licence and other PanOptis licences was recorded was in his witness statement. He likewise accepted that there was no link between [...] and the acquisition nor was there any suggestion of a link with [...]. Huawei contend that Mr Ware accepted that these areas were simply aspects in which he hoped his relationship with Samsung would develop and more business would be done. Huawei submit that no link between the licence and any of these other issues was ever made or suggested to Samsung and none of the other alleged “benefits” was an actual additional cost to Samsung in any event.
408. I have set out the parties’ rival cases on this licence at length because it plays an important role in this case. If it is sound evidence of the value of the Unwired Planet portfolio then that would reduce the fair, reasonable and generally non-discriminatory royalty rate. My findings on the context in which the 2016 Unwired Planet-Samsung licence arose are as follows. By the time it was purchased Unwired Planet was in serious financial trouble. The only licence Unwired Planet had been able to agree was with Lenovo and Unwired Planet was engaged in very expensive multinational patent litigation in an effort to establish its rights. By late 2015 – early 2016 Unwired Planet was close to insolvency. I accept Mr Ware’s evidence about what happened. The price PanOptis paid for Unwired Planet was lower than the market value of the patent portfolio because of the serious financial difficulties Unwired Planet were in at the time. As regards his discussions with Samsung, the picture Mr Ware painted of the reality of high level negotiations with that major multinational organisation was convincing and credible. PanOptis had the ability and the means to buy Unwired Planet in any event but I find that the key reason why PanOptis did buy Unwired Planet when they did and for the price they paid was in order to build trust with Samsung and because Samsung were prepared to take a licence under the portfolio in a deal in which the cash component [...]. The purchase was being “de-risked”, as Mr Ware put it. The long term benefits to PanOptis which would derive from this were regarded by PanOptis as important and are in fact potentially very valuable. The arrangements did not give PanOptis a contractually enforceable right to the benefits derived from building trust with Samsung but that does not mean it was not well worth doing.

409. These findings about the context of the licence together with the findings about low rates in the licence itself support one another. I conclude that the licence does not represent useful evidence of the market value of the Unwired Planet patent portfolio.

(c) Ericsson-Huawei 2016

410. [...]

411. The issue to resolve concerning the Ericsson-Huawei 2016 licence is the significance of the fact that *[certain]* terms were the product of an arbitration. I can deal with this shortly because I believe the answer is clear. Terms which were settled by an arbitrator are not evidence of what willing, reasonable business people would agree in a negotiation. In that sense a royalty in the licence is not probative of the market value of the portfolio under licence at all. Decisions of other courts may have persuasive value but that will largely depend on the reasoning that court has given to reach its conclusion. An arbitral award is at least capable of having a similar persuasive value, but reasoning supporting the terms in this licence is not available. I know that the arbitrators *[made findings about the effective royalty rate to be paid ...]* and I also know that this is not far above the [...] rate from the [...] licence [...]. It is [...]. Dr Kakaes and Mr Lasinski were witnesses in the arbitration and they have given some very brief evidence about what the arbitrators did or did not rely on. Mr Lasinski said that the arbitrators [...]. I am not prepared to place weight on this evidence in relation to the value of Ericsson's portfolio. There is no good evidence of what the terms of the [...] or [...] licences are. Moreover without seeing the reasoning of the arbitrators one cannot see how they arrive at the conclusion they did.

412. Huawei submitted the licence was relevant because it was a rate someone (Huawei) was paying. So they are, but since [...], the fact they are doing so is not evidence of the value of the portfolio.

413. [...] Without sight of the arbitrators' reasons I cannot accept that submission.

(d) Ericsson-Samsung 2014

414. [...]

415. [...]

416. [...]

417. Mr Lasinski referred to a witness statement of Mr Kim of Samsung. Mr Kim was going to attend trial but following the settlement he did not. In the relevant paragraph Mr Kim said that Samsung had agreed [...]. Relying on this Mr Lasinski did not take account of the [...]. Unwired Planet criticised Mr Lasinski for this but I do not see the force in that criticism since Mr Lasinski's report makes his approach transparent so that the court can understand the basis on which he approached it.

418. Unwired Planet contended that little weight should be placed on Mr Kim's evidence because (i) he did not in the end attend trial, (ii) [...], (iii) as with Lenovo, there are good reasons why Samsung would not want a licence to contain rates they thought were unreasonably high since those rates could be used in later negotiations or in

approached the determination of FRAND rates using the same techniques as have been addressed in this case.

(vii) *What is the benchmark FRAND rate for Unwired Planet?*

475. The outcome of considering the comparables is that I have benchmark rates for Ericsson of 0.80% for 4G and 0.67% for 2G and 3G and no other reliable comparables. Given the previous conclusion for the strength ratio R of Unwired Planet to Ericsson for 4G multimode handsets as 7.69%, that indicates a benchmark royalty rate for Unwired Planet for a 4G multimode handset in 2016 is 0.062%.
476. Applying the total royalty burden as a cross-check produces the following. A benchmark royalty rate for Unwired Planet for a 4G multimode handset of 0.062% coupled with a figure of 0.70% for Unwired Planet's share S of the Relevant SEPs for 4G multimode handsets produces a total royalty burden T of 8.8%. That is lower than the aggregate implied by either party's case (Huawei's 13% and Unwired Planet's 10.4%). It is higher than the specific numbers mentioned by patent holders in 2008 but not so far as to be out of line. I conclude that the cross-check supports a benchmark royalty of 0.062% for 4G multimode handsets. It is the appropriate rate.
477. The figure for 4G infrastructure will be 0.072% using $R = 8.95\%$ for 4G infrastructure ($0.072\% = 0.80\% \times 8.95\%$). The cross-check T comes to 7.0% (using S for 4G infrastructure of 1.02%) which is appropriate.
478. The 4G figures as well as the corresponding figures for 2G and 3G are in this table:

Unwired Planet benchmark FRAND rates					
<i>Handsets (3G and 4G are multimode)</i>					
	Ericsson rate	Strength ratio	Benchmark rate	Share	Implied total burden
	E	R	ExR	S	T
2G	0.67%	9.52%	0.064%	1.30%	4.9%
2G/3G	0.67%	4.76%	0.032%	0.57%	5.6%
2G/3G/4G	0.80%	7.69%	0.062%	0.70%	8.8%
<i>Infrastructure (not multimode)</i>					
	Ericsson rate	Strength ratio	Benchmark rate	Share	Implied total burden
	E	R	ExR	S	T
2G	0.67%	9.52%	0.064%	0.75%	8.5%
3G	0.67%	2.38%	0.016%	0.51%	3.1%
4G	0.80%	8.95%	0.072%	1.02%	7.0%

479. The total royalty burden T implied by each of these rates falls within an appropriate range. The value of T for 3G multimode handsets at 5.6% is not far out of line with the judgment of the internationally respected IP High Court of Japan. The 3.1% value for 3G infrastructure is somewhat lower than 5% but not far away.

