1. The Importance and Contribution Analysis.

The importance analysis began by identifying the sections of the 2G, 3G, or 4G standards cited in Ericsson's claim chart. (Kakaes Decl. ¶ 116.) Key claim limitations of Ericsson's patents were then determined by considering what the patent described as the heart of the invention, or by reviewing the arguments and amendments the applicant used to overcome prior art, and/or the reasons identified by the patent office as the patentable subject matter. (Id. ¶ 117.) Once these key claim limitations were identified, the corresponding features of the standards cited in Ericsson's claim charts were identified. (Id. ¶ 118.)

The overall value of the key features to the standard were then analyzed by considering the following factors: (a) a prior technical solution (if any) that was in the standard prior to the adoption of the key feature, and if so, the incremental improvement (or technical value) of the key feature over the prior technical solution; (b) the incremental improvement of the key feature over other well-known prior art, including technology identified in the background section of the patent, or prior related standards; (c) the impact of removing the key feature from the standard in terms of performance degradation and implementation cost; (d) whether the accused technology is optional to the standard; and (e) how widely the accused technology/key accused feature is deployed in major markets. (Id. ¶¶ 119-120.)

For the contribution analysis, Dr. Kakaes identified alternatives to Ericsson's SEPs through a variety of ways, including: (1) written contributions submitted to ETSI or a 3GPP working group (e.g., TDocs and Change Requests); (2) prior art technical solutions identified in the patent at issue (e.g., applicant-admitted prior art); (3) prior art references cited during patent prosecution; (4) any technical solutions that were known in the art as evidenced by patent and non-patent literature; and (5) any other technical solutions that would have been known to a person of ordinary skill in the art and that could have served as alternatives. (Kakaes Decl. ¶ 122.)

Overall, 146 family/standard pairs that were given an Essentiality Rank of 1 or 2 were also given Contribution and Importance Rankings. (Kakaes Decl. ¶ 294, Figure 55.) Only 13 of the 146 family/standard pairs received both importance

and contribution scores of 1 or 2, while 58 family/standard pairs received an importance score of 3 and a contribution score of 4. (Id.)

2. Dr. Leonard's Use of the Importance and Contribution Analysis to Create a Value-Share.

Dr. Leonard attempted to adjust Ericsson's royalty rate based on the strength of its patent portfolio as compared to other SEP owners. The logic behind this is that if Ericsson's patents are above average in value, it should receive a higher royalty share, while if its patents provide less than average value for SEPs, it should receive a lower royalty rate. (Leonard Decl. ¶ 96.) Phrased another way, Ericsson's share of the total aggregate royalty depends on where its patents fall in the value distribution of all SEPs. (Id. ¶ 97.)

Dr. Leonard attempted to do this by applying a principle from an academic paper that shows that across numerous industries most patents are worth very little, and that the top 10% of patents are worth 65% of the value of patents in the industry, the next 10% make up 14.6%, and eventually the bottom 50% of patents make up 4.8% of the value in the industry. (Id. ¶ 100). Dr. Leonard treated all patents that received an importance score of 1 or 2 and a contribution score of 1 or 2 as top 10% patents. (Id. ¶ 105.) Using the 10%/65% ratio above, this led to Ericsson owning 3.1% of the U.S. 4G patent value share, 4.0% of the U.S. 3G patent value share, and 6.7% of the U.S. 2G value share. (Id. ¶ 108, Table 6.)

As a cross-check on his results, Dr. Leonard confirmed his results using a forward citation analysis, which attempted to determine the strength of patents by examining how often they are cited in future patent applications. (Leonard Decl. ¶¶ 102, 109-117, Table 7.) The economic logic behind using forward citations as an indicator of patent value is that a patent that is more important and valuable would be expected to generate a greater number of future innovations that then cite back to the patent in question. (Id. ¶ 102) Dr. Leonard argued that the positive relationship between forward citations and patent value has been confirmed by some empirical economics research. (Leonard Decl. ¶ 102; e.g., Ex. 1104 at 1-20.) The results of the forward citation analysis demonstrate that Ericsson owns a 4.0% value share of U.S. 4G patents, a 5.7% value share of U.S. 3G patents, and an 8.1% value share of 2G patents. (Leonard Decl. ¶ 116, Table 7.)

3. Flaws with the Importance and Contribution Analysis.

There are three flaws with TCL's importance and contribution analysis.

First, TCL uses the importance and contribution analysis to weight Ericsson's portfolio according to its relative value, but it never applies that analysis to the rest of the SEPs in the standard. (Leonard Decl. ¶ 108.) This means that TCL's "value share" is a ratio with inconsistent units, and it is unclear what it actually represents. Because TCL only analyzed the importance and contribution of Ericsson's SEPs, there is nothing to compare its rankings against to determine the strength of Ericsson's portfolio.

Second, in determining contribution scores TCL ignored important legal and factual issues that determine how an SEP's contribution affects its value. In identifying alternatives to each SEP, Dr. Kakaes caused what Ericsson characterized as a "ripple effect." This is because Dr. Kakaes did not analyze whether his alternatives are mutually inconsistent with each other, would perform worse than the standard, would even create a viable, functional standard, or require other patents owned by Ericsson (thus defeating the point of the analysis).[26]

TCL's contribution scores are also legally flawed because Dr. Kakaes did not examine who owned his proposed alternatives. An SEP's contribution is only relevant to its value because, prior to the adoption of the standard, patents with viable alternatives have less value than patents without viable alternatives due to competition. Broadcom Corp. v. Qualcomm Inc., 501 F.3d 297, 314 (3d Cir. 2007) ("Although a patent confers a lawful monopoly over the claimed invention, its value is limited when alternative technologies exist."). The degree to which alternatives will lower the value of a patent will depend on the quality of the alternatives, and who owns the alternatives. TCL's 1-4 rankings do not reflect who owns the proposed alternative patents. How much proposed alternatives will

[26] However, Ericsson's critiques would be stronger had Dr. Parkvall gone through more of Dr. Kakaes's alternatives and shown that they were inferior, impossible, or infringing. Dr. Parkvall instead testified that he did not go through most of Dr. Kakaes's alternatives because he "found his methodology such flawed and not a good one, I didn't see the point in wasting time trying to check each of his gradings." (TT Mar. 1, 2017, pp. 77:25-78:2.)

affect the value of a patent depends on a number of variables, including whether the alternative is unpatented, expired, part of the previous standard, owned by another company that lets manufacturers use it for free or at a low rate, an entity that aggressively protects its intellectual property, or by the company itself. See In re Innovatio IP Ventures, LLC Patent Litig., No. 11 C 9308, 2013 WL 5593609, at *20 (N.D. Ill. Oct. 3, 2013) (finding that the price of an SEP will be driven down more by an alternative in the public domain than an alternative owned by a competitor).

Third, Dr. Leonard assumed that any patent which received a contribution score of 1 or 2 was in the top 10% of patents in the standard that provided 65% of the value in the standard, while a patent that received contribution score of 3 or 4 was in the bottom 90% of patents that provided 35% of the value of the standard. (Leonard Decl. ¶ 107, Table 5.) As it turned out, the importance scores had no impact on Dr. Leonard's estimate of their value.[27] The critical distinction between a contribution score of 2 or 3 was whether its contribution was moderate, or marginal. (Kakaes Decl. ¶ 121.) Neither Dr. Kakaes nor Dr. Jayant provided a meaningful explanation on the difference between a moderate or marginal improvement, and it is not clear that this score can be used for determining whether a patent a top 10% or bottom 90% SEP. (TT Feb. 17, 2017, p. 142:16-24.) Dr. Leonard drew his top 10%:65% ratio from a paper by Dr. Jonathan Putnam, who found that across various industries the top 10% of patents contained 65% of the value in the industry. (Leonard Decl. ¶¶ 100-101; Ex. 319.) The Court is not persuaded Putnam's findings are applicable to telecommunications SEPs. Dr. Leonard also did not explain why a different skew was appropriate here compared to Innovatio, where he testified based on a different paper that the top 10% of Wi-Fi SEPs provided 84% of the value. Innovatio, 2013 WL 5593609, at *43.

Similarly, the Court is not persuaded by Dr. Leonard's forward citation analysis, which he used as a check on the importance and contribution analysis. (Leonard Decl. ¶ 102.) Its results generally contradicted the importance and contribution analysis done by Dr. Kakaes, and the Court is not convinced on this record that it provides a meaningful way to value SEPs. (Kennedy Rebuttal Decl. ¶¶ 215-221.) It does not appear that any other court or company has used a

[27]Because the importance scores were ultimately irrelevant, the Court need not discuss the validity of TCL's attempt to quantify the importance of Ericsson's SEPs.

forward citation analysis for such a task, and it is unclear whether companies would have the same incentives to cite to potential prior art, particularly in the context of multiple standards. In addition, while ignoring self-citations reduces the risk of gaming the system, it would also appear to ignore the possibility that one patent owner would naturally cite to itself because it is has been the leader in developing a particular technical area.

Because the Court has found fatal flaws with certain steps in TCL's top down approach, it does not accept Dr. Leonard's final numbers. However, the Court does find some value in the technical analysis, particularly to show that Ericsson's patent portfolio is certainly not as strong or essential as it has claimed. The Court uses this finding in part to assist it in determining the final FRAND rate.

D. Adjusting for Ericsson's Weaker Portfolio outside of the United States.

Generally speaking, Ericsson's portfolio is weaker outside the U.S. (Leonard Decl. ¶¶ 132-134.) If Ericsson does not patent the same technology in other regions, then that technology remains in the public domain in those jurisdictions. (Id. ¶ 132.) A fair and reasonable royalty must be proportionally related to an SEP owner's geographic patent portfolio strength, and ignoring disparities in geographic patent portfolio strength ignores the fundamental relationship between FRAND and domestic patent law. (ETSI IPR Policy § 15.7, Ex. 223 at 7.) This is because FRAND does not permit an SEP owner to charge a royalty for an IPR it does not own, and unpatented inventions are essentially in the public domain. (Leonard Decl. ¶ 132.) Nevertheless, the Court assumes that FRAND permits companies to agree to a global rate between themselves and structure their contracts accordingly, so long as such an agreement would not violate the patent law of each country where the products are sold. Many of the licenses presented to the Court during the course of the litigation reflect the fact that as a matter of commercial reality, firms regularly adopt a single world-wide rate.

It would be very easy to construct a FRAND rate using any of the approaches presented in this case without examining where an SEP owner actually has enforceable patents. In a top down approach, one would simply calculate the

number of SEPs owned by Ericsson, divided by the total number of SEPs, and then multiply that by the total aggregate royalty. Indeed, TCL began its top down model in such a way. It is not until Dr. Leonard generated U.S.-specific numbers that TCL began to tie its FRAND royalty to patents filed in a particular country. (Leonard Decl. ¶ 94, Table 4.) However, to look at patent families in the abstract without regard to where actual patents are enforceable would result in a subsidy to consumers in countries where the SEP owner has more enforceable patents from consumers that are not legally obligated to pay such a royalty. In essence, a global patent rate that does not account for differences in national patent strength provides the SEP owner a royalty based on features that are unpatented in many jurisdictions. See Ericsson v. D-Link, 773 F.3d at 1232 (requiring patent royalties to apportion the value of the patent feature apart from the unpatented features of the standard).

There is one important caveat to this general rule: patents can also be enforced where the product is manufactured. (Leonard Decl. ¶ 134.) This means that the SEP owner's patent portfolio strength in the country where the products are made effectively sets a global floor for the manufacturer's FRAND rate. Because TCL manufactures its products in China, the strength of Ericsson's SEP portfolio in China will therefore determine the lowest FRAND rate for any product TCL sells globally. (Id.)

There are two countervailing considerations for the Court in accounting for regional disparities in an SEP owner's patent portfolio: (1) the regional disparities have to be supported by evidence in the record, and (2) final rate(s) should avoid complications that disproportionately increase the complexity and difficulty in understanding and enforcing any final judgment. Courts would be faced with an insurmountable task if they have to resolve disputes involving the technical nuances of patent law in dozens of jurisdictions, where as here the parties have requested a global adjudication, especially if the sum of all of those disputes is relatively trivial. Where geographic disparities are relatively insubstantial or unsupported by the evidence, the Court disregards them in favor of a more understandable, administrable, and enforceable royalty structure.[28]

[28] For these reasons, the Court finds it unnecessary to create a separate rate for TCL's definition of the Asia-Pacific region, which excludes China. The entire region is less than 2% of TCL's total sales, and it's patent strength in that region is sufficiently close to China's for all standards that accounting for it separately would likely have less impact than a rounding error. (Ex. 1122.)

Dr. Leonard accounted for geographic disparities by determining how many SEPs Ericsson owns in the United States in order to make regional adjustments and create a global blended rate that is based on TCL's sales in each region. (Leonard Decl. ¶¶ 94, 132-34.) He first determined Ericsson's value share of SEPs in the United States. (Id. ¶ 94.) He then determined the country in each of TCL's sales regions where Ericsson has the strongest patent portfolio by value share, which he applied to the entire region. (Id. ¶ 133.) He then expressed that region's value share as a percentage of Ericsson's U.S. value share (with China as a floor). Blending the regional value shares and TCL's actual and projected sales for the course of the license to account for differences in selling prices, Dr. Leonard eventually created a single global rate. (Id. ¶¶ 138-39.) This process was designed to ensure that TCL's total royalty payments would reflect the regional variations in Ericsson's patent portfolio. However, because Ericsson's portfolio is stronger in the U.S. than the rest of the world, a global blended still means that TCL's sales throughout the world paying a higher rate to subsidize its sales in the United States.

Aside from the United States, the only other region where Ericsson has a stronger patent portfolio than China is Europe, and only for 2G and 3G. For the reasons described above, instead of trying to project future sales and use a weighted blended average to create a global rate, the Court instead adopts three sets rates for TCL's sales in: 2G, 3G, and 4G in United States; for 2G and 3G sales in Europe; and for 2G, 3G, and 4G sales in the rest of the world ("ROW"). Ericsson's European value share is 72.2% and 87.9% of its United States portfolio's value share for 2G and 3G respectively. (Ex. 1122.) For ROW, Ericsson's value share relative to its U.S. portfolio is 54.9% for 2G, 74.8% for 3G, and 69.8% for 4G. (Id.) The Court would have preferred to have the regional patent strength presented by country and not region to avoid lumping together the patent regimes of different countries, but Dr. Leonard presents his conclusions only by region. (Ex. 1122.) However, because of Ericsson's strength in China, the only relevant regional calculation of Dr. Leonard's is for Europe. The Court is much less concerned about using a single regional rate for Europe because many if not most of Ericsson's patents in Europe are European Patents. Microsoft Corp. v. Motorola, Inc., 696 F.3d 872, 878 n.3 (9th Cir. 2012) (noting that while European Patents are not a transnational patent, they are equivalent to a national patent in each designated state that is a signatory to the European Patent Convention).

The Court understands that these ratios are based on Dr. Leonard's value shares, which incorporate the importance and contribution analysis which the Court rejected above. However, this is not a significant problem because the regional numbers stated above are a ratio of one value share to another. This means that the ratios are only impacted by the importance and contribution analysis to the degree that Ericsson has disproportionately registered its less valuable patents (in Dr. Leonard's approach) in Europe and China compared to the United States. There is no reason to believe this is true, and if the importance and contribution analysis has any bearing on the value of patents (which the Court agrees it does, just not enough to apply it to the entire top down analysis), Ericsson would have a strong incentive to register those patents in foreign countries more frequently than others. For this reason, the Court is comfortable applying Dr. Leonard's regional adjusted portfolio strength ratios.

V. Calculating a Fair and Reasonable Royalty Rate.

The basic formula to calculate a top down royalty rate using a simple patent count is:

$$Ericsson's\ Royalty\ Rate = Total\ Aggregate\ Royalty \times \left(\frac{Number\ of\ unexpired\ SEPs\ owned\ by\ Licensor}{Total\ Number\ of\ SEPs\ in\ the\ Standard}\right) \times Regional\ Strength\ Ratio$$

Filling in the numbers the Court has adopted above provides the following results:
2G:

USA: $5\% \times \left(\frac{12}{365}\right) \times 100\% = 0.16402\%$ of ASP

Europe: $5\% \times \left(\frac{12}{365}\right) \times 72.20\% = 0.11842\%$ of ASP

ROW: $5\% \times \left(\frac{12}{365}\right) \times 54.90\% = 0.090049\%$ of ASP

The 2G and 3G figures which the Court calculates compare to Dr. Leonard's final conclusion that a proper 2G/3G world wide blended rate is .21%. (Leonard Decl. ¶ 143.)

3G:

$$5\% \times \left(\frac{[19.65\ or\ 24.65]}{953}\right) \times [100\%\ for\ USA, 87.90\%\ for\ Europe, 74.80\%\ ROW]$$

Using TCL's patent number:

USA: $5\% \times \left(\frac{19.65}{953}\right) \times 100\% = 0.10309\%$ of ASP

Europe: $5\% \times \left(\frac{19.65}{953}\right) \times 87.90\% = 0.090618\%$ of ASP

ROW: $5\% \times \left(\frac{19.65}{953}\right) \times 74.81\% = 0.07711\%$ of ASP

Using Ericsson's patent number:

USA: $5\% \times \left(\frac{24.65}{953}\right) \times 100\% = 0.12932\%$ of ASP

Europe: $5\% \times \left(\frac{24.65}{953}\right) \times 87.90\% = 0.11367\%$ of ASP

ROW: $5\% \times \left(\frac{24.65}{953}\right) \times 74.81\% = 0.09673\%$ of ASP

For 4G there are 4 different combinations, using a 6% up to a 10% total aggregate royalty, and using just the number of patents TCL concedes are essential, or up to the total number that Ericsson disputes are also essential:

$$[6\% \text{ or } 10\%] \times \left(\frac{[69.88 \text{ or } 111.51]}{1481}\right) \times [100\% \text{ for USA}, 69.80\% \text{ for ROW}]$$

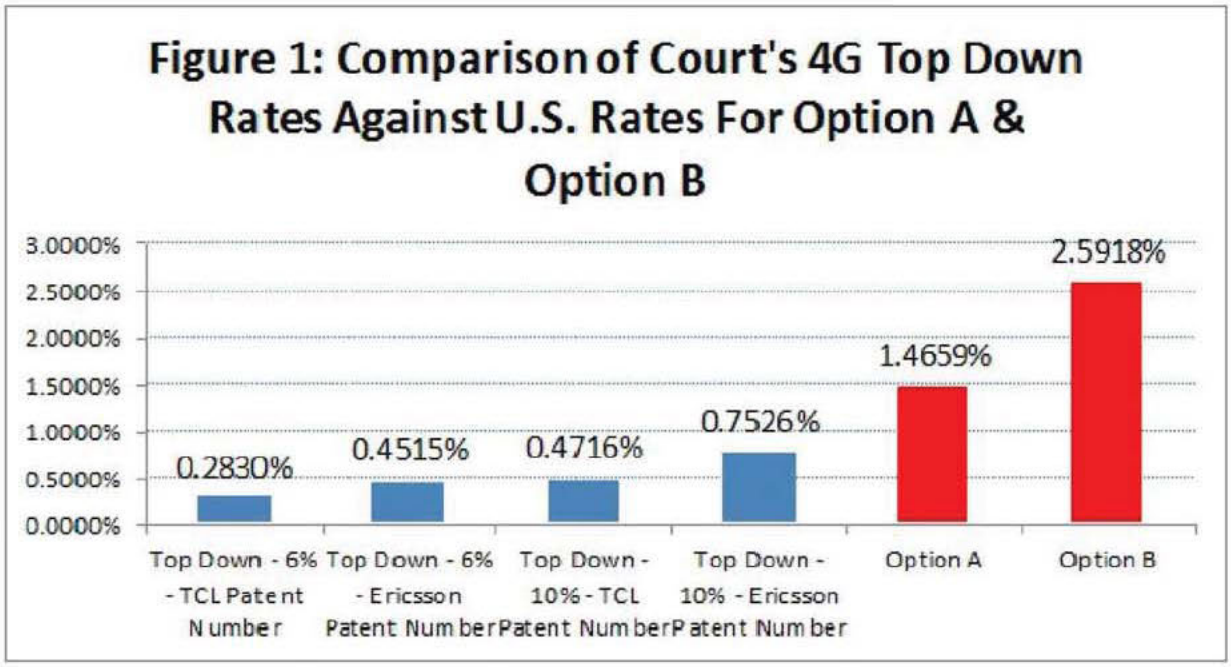
That formula returns the following results:

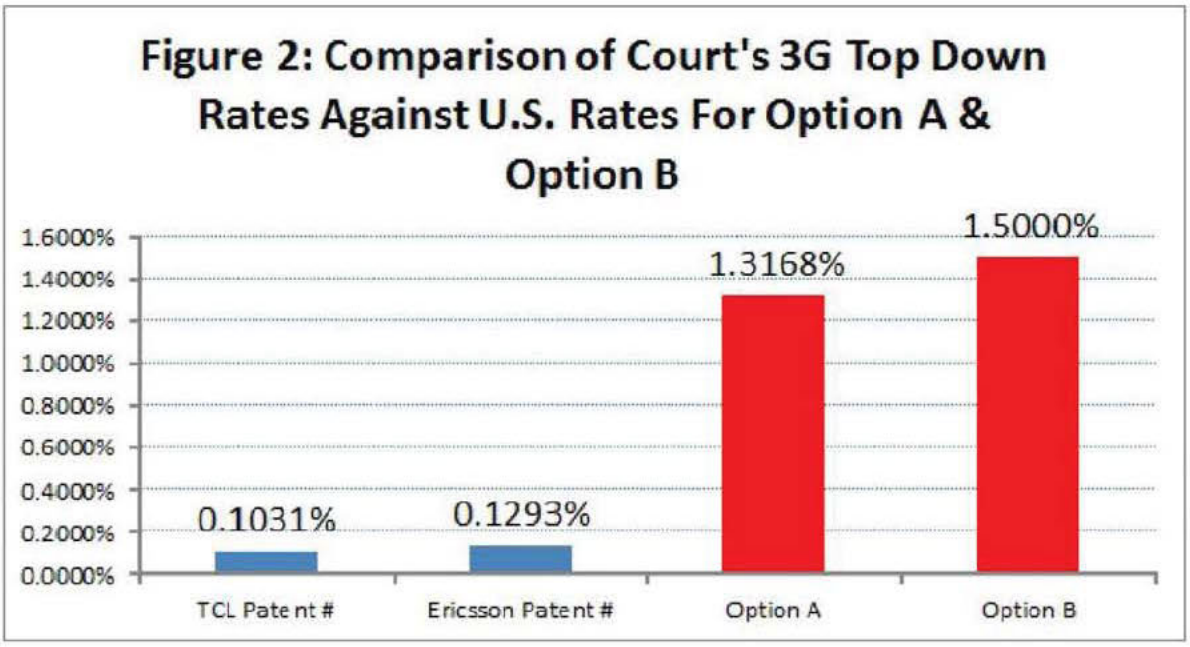
USA	6%	10%
69.88 Ericsson SEPs	0.28297	0.471611
111.51 Ericsson SEPs	0.45145	0.752576
Rest of World	6%	10%
69.88 Ericsson SEPs	0.19751	0.32918

111.51 Ericsson SEPs	0.31517	0.52529

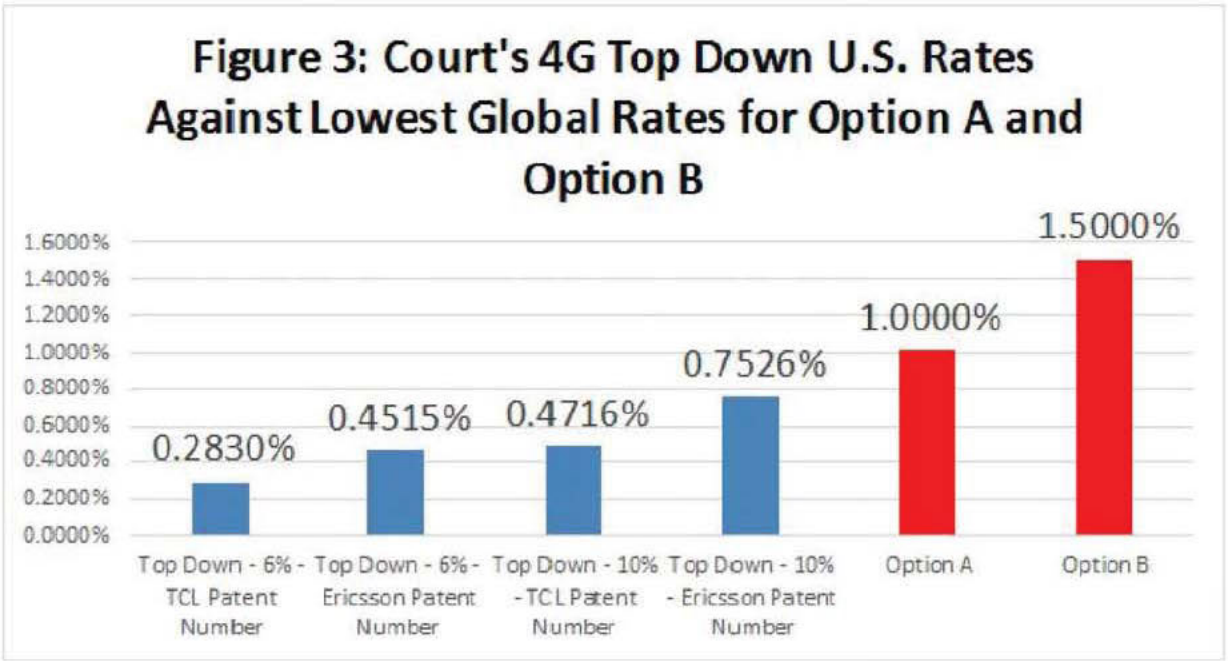
The 4G rates which the Court calculates compare to Dr. Leonard's final conclusion that a proper 4G world-wide blended rate is .16%. (Leonard Decl. ¶ 139.)

The charts below compare the U.S. 3G and 4G rates from the Court's top down analysis compared to the U.S. rates implied by Option A and Option B. The Court explains its conversion of unpacked rates to U.S. rates in Part 4, Section VI, below.





Even if one assumed the lowest possible rates under Option A (TCL sells exactly $3 billion entirely 4G sales) and under Option B (TCL's ASPs are above the cap), there is a substantial disparity in rates.



While the Court has some reservations about the top down analysis, there is no basis to reconcile the results of the top down analysis with Option A or Option B. Even if the Court assumed that every patent that Ericsson presented at trial was essential, applied a 10% total aggregate royalty, and ignored when patents expired, the 4G U.S. royalty rate would still only be .843%. Option A and Option B are therefore not fair or reasonable offers the the top down measure.

As discussed below (Part 4, Section VI), the Court use these numbers in conjunction with its analysis of comparable numbers to create its overall FRAND rate.

PART 3: ERICSSON'S EX STANDARD APPROACH

Ericsson presented the work of David Kennedy as a means of testing whether Ericsson's Options A and B are fair and reasonable. (Kennedy Decl. ¶¶ 225-29.) The ex-Standard approach is designed to estimate the value of SEPs independent of any value arising from incorporation of SEPs into a standard. (Id. ¶ 29.) The premise is that if the royalties sought by Options A and B are less than the ex-Standard value of the licensed technology, the analysis indicates that the royalties are fair and reasonable. (Id.)

The Court found the analysis flawed at multiple steps and rejects the conclusions.

Kennedy worked with Ericsson's technical expert, Dr. Parkvall, to perform three steps: (a) isolate and identify the specific contributions of 4G SEPs to the cellular standards by comparison to the next best available non-infringing alternative, (b) estimate the economic value of the technical contribution of all 4G SEPs over the next best available non-infringing alternative; and (c) apportion Ericsson's share of that economic value. (Id. ¶¶ 30, 230.)

Dr. Parkvall performed what he refers to as a "technology by technology" analysis. He began by subdividing Ericsson's SEPs into ten technology sub-areas. (Parkvall Decl. ¶¶ 55-69.) He then considered the Ericsson SEPs within each sub-area and identified the next best non-infringing way to implement the technology in the 2G, 3G, or 4G standard without using Ericsson's SEPs. (Parkvall Decl. ¶¶ 57, 70; Kennedy Decl. ¶¶ 231-32.) At that point, Dr. Parkvall identified the

benefits that each sub-area conferred on the 4G standard over and above the next best non-infringing alternative. (Parkvall Decl. ¶¶ 75, 93, 113, 145, 161, 184, 214-15.) Dr. Parkvall calculated a value for certain of these benefits, including improved battery life, faster data speeds/throughput, fewer connection delays/less latency, better uplink peak-to-average ratios, increased spectral efficiency, and coverage improvements. (Id.; TT Feb. 28, 2017, p. 131:11-24.) For other benefits, including decreased interference, increased service quality, increased network coverage, cheaper handset components, increased voice quality, and increased security, Dr. Parkvall did not calculate a precise value, but simply testified to the fact that they confer value on a handset. (Parkvall Decl. ¶ 215.)

Kennedy measured the dollar value that two of these benefits—improved battery life and faster data speeds—confer on a 4G device as compared to the alternative identified by Dr. Parkvall. (Kennedy Decl. ¶¶ 235-42, 248-57.) For the other two benefits—less latency and improved system capacity/network performance—Kennedy analyzed the value they confer on a 4G device, without calculating a specific monetary value. (Id. ¶¶ 258-72.)

To assign a dollar value to the improved battery life benefit, Kennedy relied on Dr. Parkvall's testimony that 4G "sleep mode" technology provides a 53% improvement in battery life over the next best non-infringing alternative. (Id. ¶¶ 236-37; Parkvall Decl. ¶ 184.) He also relied on the results of a survey by of 306 American smartphone users that was conducted International Planning and Research ("IP&R") in 2012. (Kennedy Decl. ¶¶ 239-41.) However, Dr. Parkvall conceded that many companies other than Ericsson were involved in creating Sleep Mode Solutions. (TT, Mar. 11, 2017,(Sealed Vol. 3) pp. 8:19-11:13.) Neither Dr. Parkvall nor Kennedy determined Ericsson's proportional share of Sleep Mode Solutions patents, or the number of accepted technical contributions that relate to Sleep Mode Solutions submitted by Ericsson or any other companies. (Id .; see also Kakaes Rebuttal Decl., ¶¶ 284-85, Figures 49-52 (finding Ericsson's share of Sleep Mode Solutions patents is just 2.3%, not 14.6%).)

Using these two inputs, Kennedy arrived at a dollar value of $15.90. (Kennedy Decl. ¶¶ 241-42, Figure 57.) Because other companies have contributed technology to the 4G standard that works in tandem with Ericsson's 4G Essential Patents, he apportioned out Ericsson's share of the $15.90 using the Signals approved contribution counting data. (Id. ¶ 238) This led him to conclude

that Ericsson's share of the value conferred on a 4G handset by improved battery life is $2.32 per handset. (Id. ¶ 242.)

To assign a dollar value to the faster data speed benefit, Kennedy relied on Dr. Parkvall's testimony that Ericsson's 4G Essential Patents improve data rates through multiple technology clusters. (Id. ¶ 249; e.g., Parkvall Decl. ¶ 146) (testifying that a system without Ericsson technology would not achieve 4G system throughput or bitrates).) For his dollar figures, he relied on a 2012 survey by IP&R, as well as a 2013 survey of more than 30,000 consumers in 26 countries by Accenture. (Kennedy Decl. ¶¶ 248-54.) Using these surveys, he arrived at a dollar value of $26.24 to $33.00 per handset. (Id. ¶¶ 251-54, Figures 59, 60.) After apportioning Ericsson's share based on contribution counts determined by Signals (Id. ¶¶ 252, 254), he concluded that Ericsson's share of the value conferred on a 4G handset by faster data speeds is $3.83 to $4.82 per handset. (Id. ¶¶ 252, 254, Figures 59, 60.)

Taken together, Kennedy estimated that just two of the benefits of Ericsson's 4G Essential Patents confer $6.15 to $7.14 of value on a 4G handset . The Court finds that Kennedy's result are highly suggestive of royalty stacking; i.e, valuing individual components of a standard in manner that accedes the aggregate value of the standard. Kennedy concedes these figures have never been the basis for any of Ericsson's licensing proposals, and no Ericsson licensee has ever paid anywhere close to $6.15 per phone for a license to Ericsson's 4G patents. (TT, Feb. 28, 2017, p. 133:13-23.)

While the Court has doubts about the ex-Standard method as implemented here, Ericsson is correct that TCL did not challenge Kennedy's ex-Standard methodology, but rather challenged the inputs to his calculations: Dr. Parkvall's technical analysis, the surveys by International Planning and Research and Accenture, and the use of contribution counting. (Kakaes Rebuttal Decl. ¶¶ 15-40, 285-85; Simonson Rebuttal Decl. ¶¶ 30-49.) The Court found TCL's criticisms of Ericsson's ex-Standard analysis persuasive.

Kennedy's apportionments are flawed because they relied on contribution counting, and because he apportioned based off of what percentage of the standard as a whole Ericsson owned, not the specific technologies he identified. (Kennedy Decl. ¶¶ 242, 252.) The Court identifies many of the problems with contribution

counting above (see Part 4, Section IV.B.3 below). While Kennedy did use Dr. Ding's patent counting results as an alternative, this still gave Ericsson credit regardless of how many patents it actually owned that were related to that technology. This is particularly confusing because Dr. Parkvall actually identified how many SEPs Ericsson owned for each technical area, but Kennedy did not use this information to determine. (E.g., Parkvall Decl. ¶ 134, 154, 178.) Ericsson is only entitled to 14.6% of the value longer battery life or faster connections if it can show that it owns 14.6% of the patents that cover those inventions. Kennedy did not attempt to show that Ericsson is responsible for 14.6% of the specific features he valued.

In addition, Dr. Itamar Simonson testified that the surveys used by Kennedy were irrelevant and biased. (Simonson Rebuttal Decl. ¶¶ 11, 33-37, 47-49.) The Court found Dr. Simonson's testimony credible. Kennedy has no experience in survey work, and the basis for his reliance on the surveys is questionable. By contrast, Dr. Simonson is exceptionally well credentialed in survey work. (Ex. 2387.) Kennedy conceded that Dr. Simonson is more qualified to address matters related to the study of consumer behavior and survey design. (TT, Feb. 28, 2017, p. 145:3-7.)

The Court finds that Dr. Simonson's criticisms of the survey work here are valid.

First, the IP&R survey suffered from many defects which make it unreliable as a basis for measuring the value of any Ericsson patented technology. (Simonson Rebuttal Decl. ¶¶ 33-46.) For example, IP&R focused on one feature at a time instead of presenting the bundle of phone features consumers evaluate in reality, and also singled out certain features. (Id. ¶¶ 39-44.) Research shows that singling out features without simultaneously considering other features tends to greatly overstate the importance of the focal feature, as compared to its impact in actual purchase decisions. (Id., ¶¶ 24-26, 28, 33-46.) Also, research shows that asking survey respondents direct questions about their willingness to pay for individual features and feature differences has been shown to be unreliable and susceptible to various influences. (Id. ¶ 26, 38, 43.)

Second, the survey from Accenture apparently focused on the value and interest in various mobile network services, not necessarily handset features. (Id.

¶ 48; Ex. 4845, pp. 2.) Otherwise, no information was provided by Ericsson showing the survey methodology, or the specific questions asked. (Simonson Rebuttal Decl. ¶ 47.) This prevents a proper assessment of the reliability of the survey (although, as noted above, any attempt to gauge feature value by asking questions about willingness to pay for specific features is unreliable). (Id.; see also id. ¶¶ 24-26, 28, 38.)

In the end, the Court found that the ex-Standard approach lacked fundamental credibility. If one takes a step back and credits Kennedy's work at face value, it is simply not logical that two features could have a value in excess of Ericsson's entire portfolio. Either there is something radically wrong in Ericsson's portfolio valuation, or Kennedy's work is not reliable. The Court draws the latter conclusion.

PART 4: COMPARABLE LICENSE ANALYSIS AND FRAND DETERMINATION

The second component of the FRAND obligation is to offer a rate which is non-discriminatory. The parties agree that like, or close to, like rates must be offered to firms which are similarly situated. (TCL COL, ¶ 34; Ericsson COL, ¶ 17.) The parties point to different clusters of firms for the comparison. TCL contends that the relevant licensees are Apple, Samsung, Huawei, LG, and HTC. (TCL COL, ¶¶ 36 *et seq.*) Ericsson focuses on firms in the middle and lower end of the market: LG, HTC, CoolPad, Kaarbon, and ZTE. (Ericsson FOF, ¶ 317.) The Court identifies the relevant firms, and then analyzes their rates to test Option A and Option B for discrimination.

I. Summary of the Comparable License Analysis.

The Court begins this section with an explanation of how it determined firms comparable to TCL for non-discrimination purposes, and then identifies the six firms that it finds are similarly situated to TCL: Apple, Samsung, LG, HTC, Huawei, and ZTE. The Court then explains the formula used to "unpack" a license. Unpacking is used to derive a one-way royalty rate so that licenses can be compared on a common basis. Here, unpacking requires the Court to account for cross-licenses, lump sum payments, pass-through rights, and other issues. The Court explains why it chose not to use dollar-per-unit rates and instead calculates

its unpacked results as percentage royalties without caps or floors. The Court then explains how it determined appropriate discount rates, revenue of each licensee, and the appropriate portfolio strength ratio, or PSR. The Court then analyzes the licenses from the six comparable firms and compares them to the results of Ericsson's Option A and Option B. The Court then explains why it rejected Ericsson's proposed requirement of competitive harm, and finally the Court provides its conclusions from the comparable license analysis.

II. Summary of the Experts and their Qualifications.

A. Unpacking.

Dr. Matthew Lynde conducted the unpacking analysis for TCL, and David Kennedy conducted the unpacking analysis for Ericsson. Dr. Lynde is an economist at Cornerstone Research, an economic and financial consulting firm. (Lynde Decl. ¶ 1.) He holds a bachelors and Ph.D. in economics from the University of California, Berkeley. (Id. ¶ 2.) His consulting work specializes in the economic and financial analyses of complex business and regulatory matters, and he has analyzed thousands of license agreements. (Id. ¶¶ 8-9.) He has testified extensively as an expert witness on the economic issues related to intellectual property and antitrust law. (Id. ¶ 8.) Kennedy is the Managing Director of the consulting firm Berkeley Research Group, LLC. (Kennedy Decl. ¶ 42.) He specializes in patent valuation, patent licensing, and patent sales, and has participated in or analyzed more than 150 patent-related transactions. (Id.) He holds a B.S. in Business Administration with a major in accounting from the University of Georgia, and has been a licensed Certified Public Accountant in Georgia since 1987. (Id. ¶ 50.)

B. Similarly Situated Firms.

To determine which firms are similarly situated to TCL, Ericsson relied on Dr. David Teece, while TCL relied on Dr. Janusz Ordover. Dr. Teece is a professor of Global Business at the Haas School of Business at the University of California, Berkeley, and received his Ph.D. in economics from the University of Pennsylvania. (Teece Decl. ¶ 2.) He co-founded and co-edits Industrial and Corporate Change, an academic journal that focuses on issues related to technological change, and has published hundreds of books and articles in the

fields of industrial organization, technology management, and public policy. (Id. ¶¶ 2-3.) He has testified as an expert witness over 100 times, including in a number of RAND, FRAND, and antitrust trials. (Id. ¶¶ 6-8.) Dr. Ordover is a Emeritus Professor of Economics at New York University, and former Deputy Assistant Attorney General for Economics in the Antitrust Division of the U.S. Department of Justice. (Ordover Decl. ¶ 1.) He received his Ph.D. from New York University, and has written extensively on topics such as antitrust, the licensing of intellectual property, and the FRAND commitment. (Id. ¶ 2; Ex. 451.)

C. Valuation of LG Patents.

To estimate the value of certain patents that LG transferred to Ericsson as part of their license agreement, Ericsson relied on Michael Pellegrino, and TCL relied on Dr. Andrew Wolfe. Pellegrino is the president of Pellegrino and Associates, LLC, a boutique intellectual property valuation firm. (Pellegrino Decl. ¶ 15.) His firm has conducted hundreds of intellectual property valuations, and he wrote the first and second editions of BVR's Guide to Intellectual Property Valuation. (Id. ¶ 16.) He received a bachelor's degree in computer science from the Indiana Institute of Technology, and a Master's degree in business administration from Ball State University. (Id. ¶ 21.) Dr. Wolfe earned his B.S.E.E. in Electrical Engineering and Computer Science from The Johns Hopkins University, an M.S. in Electrical and Computer Engineering from Carnegie Melon, and a Ph.D. in Computer Engineering from Carnegie Melon. (Wolfe Decl. ¶ 2.) He has published more than 50 articles on computer architecture and computer systems, and has testified extensively on patent issues. (Id. ¶ 11; Ex. 1600.) He works as a consultant on intellectual property issues for Wolfe Consulting, and teaches graduate courses on computer organizations and architecture at the University of Santa Clara. (Ex. 1600.)

The Court found that all of the experts were well-credentialed.

III. Determining The Relevant Firms.

The Court concludes that for purposes of license comparisons the analysis should include all firms reasonably well-established in the world market. This implies a necessarily wide spectrum, and correctly so for several reasons. First, ETSI contemplates facilitating competition in the market, particularly from

emerging firms. Second, excluding from the analysis the largest firms in the market would have the effect of insulating them, and further contributing to their dominant positions, by imposing a barrier in the form of higher rates for those not at the top end of the market. (See TT Mar. 1, 2017, pp. 171:22-173:25.) By the same token, TCL overstates the nature of the concern for small and medium sized firm.[29] Third, permitting Ericsson to define similarly situated very narrowly by picking and choosing criteria with no relation to its SEPs or the FRAND commitment would effectively allow Ericsson to read the non-discrimination prong out of the FRAND commitment.

In defining similarly situated firms, there is a similar thread among all experts in that they look to firms using the same technology and at a similar level in the value chain. (Ordover Decl. ¶ 61; TT Mar. 1, 2017, p. 104 (Teece); id., p. 6-7 (Kennedy).)

The Court finds that the concept of strategic groups advocated by Dr. Teece takes too narrow a focus. Under his approach, discrimination between firms in different strategic groups would never run afoul of FRAND, absent an adverse effect on standards development. (TT Mar.1, 2017, pp. 170-76.) The Court finds that competition for purposes of FRAND is not limited to Dr. Teece's definition of head-to-head competition. On the other hand, Dr. Ordover's view that TCL is similarly situated with every other firm that uses the same technology is too broad and would impose the same rate on large global firms and local niche manufacturers. (TT Feb. 15, 2017, pp. 74-75.)

The Court also believes that similarly situated should be broadly interpreted because the mobile phone market has been extremely dynamic over the last decade. In 2007, the six largest companies ranked by U.S. market share were, in order, Motorola, Samsung, LG, Nokia, Blackberry, and Apple. (Teece Decl. ¶ 163, Figure 16.) Within a decade Motorola, Nokia, Blackberry, and even Ericsson's own handset division would be shuttered or divested, events which Brismark acknowledged no industry observer would have ever predicted. (Brismark Decl. ¶ 61.) TCL itself first entered the U.S. market in 2011, and within six years was the fourth largest manufacturer in the U.S. by market share. (Cistulli Decl. ¶ 3.) The volatility of the handset market over last decade requires the Court

[29]ETSI was concerned about the availability of arbitration to small firms in deterring discrimination. (Ex. 5289 at 4, 6.) However, an arbitration scheme was never adopted.

to exercise a broad view of who will be similarly situated to TCL over the course of the five-year license which the Court adopts.

The parties agreed that Huawei, LG, HTC, and ZTE[30] are similarly situated to TCL. (TCL COL, ¶ 36; Lynde Decl. ¶ 84; Ericsson FOF, ¶¶ 308, 310.) The Court agrees that these firms are similarly situated to TCL because they meet the Court's criteria for well-established global firms. TCL argued that in addition, at least Apple and Samsung are also similarly situated to TCL. (TCL COL, ¶¶ 34-35.) Ericsson disagreed and argued that Coolpad and Karbonn, not Apple and Samsung, are similarly situated to TCL. (Ericsson FOF, ¶ 310.) The Court therefore needs to determine whether Apple, Samsung, Coolpad, and Karbonn are also similarly situated to TCL.

For the reasons set forth below, the Court finds that six firm meet the Court's criteria: Apple, Samsung, Huawei, LG, HTC, and ZTE. The Court appreciates Ericsson's position that certain firms should be excluded from the analysis because their licenses post-date Option A and Option B, but for the moment the Court focuses on similarity.

A. Factors Relevant to Finding Firms Similarly Situated.

In determining which firms are similarly situated to TCL, the Court's task is to identify other reasonably well-established firms in the global market. Certain factors obviously matter, such as the geographic scope of the firm, the licenses required by the firm, and a reasonable sales volume. These factors suggest that even among similarly situated firms, there may be degrees of similarity which may affect the weight that each unpacked rate has on the Court's conclusions. The Court does not believe that factors such as the firm's overall financial success or risk, brand recognition, the operating system of their devices, or the existence of retail stores have any bearing on whether Ericsson's royalty rates for its SEPs are discriminatory.

B. Local Kings are not Similarly Situated to TCL.

[30] TCL appears to have dropped ZTE from its list of similarly situated firms, presumably because Dr. Lynde could not unpack rates from its licenses. However, whether a firm is similarly situated to TCL is a separate question from whether the firm's effective rate can be calculated, and what that rate means for non-discrimination under the FRAND commitment.

In this case geographic scope is the most important factor in determining which firms are similarly situated to TCL. The Court heard testimony breaking down major firms into two types, global firms, and "local kings." (Guo Decl. ¶ 7.) As the Court uses the term, a local king is a company that sells most or all of its devices in a single country, often the same country where it is headquartered and manufactures the devices.

Local kings are not similarly situated to global firms for two reasons. First, their sales largely occur in one country, while a single country will generally account for a relatively small percentage of the global firm's sales. Because the global firm will be dealing with different marketplaces, different regulatory environments, and consumers with different tastes and preferences, a global firm is unlikely to be similarly situated to a local king. Second, local kings receive a different license from Ericsson. A local king only needs license to Ericsson's SEPs in one jurisdiction, and Ericsson is bound to limit its offer to a rate that reflects the SEP strength of its portfolio in that jurisdiction. However, for global firms, Ericsson asserted that it provides a license at a global blended rate which averages out the higher rates Ericsson could charge in some countries with the lower rates it could charge in countries with weaker or non-existent patent protections.[31] (Brismark Decl. ¶ 55.) Thus, a license between Ericsson and a local king does not reflect the rate that a global firm like TCL would have to pay.

Ericsson argued that Karbonn and Coolpad are similarly situated to TCL, but Karbonn and Coolpad are both local kings. (Ericsson FOF, ¶ 327; Guo Rebuttal Decl. ¶¶ 49-53.) Karbonn sells handsets almost exclusively in India, while less than 3% of TCL's sales occurred in India. (Teece Decl. ¶ 80; Guo Rebuttal Decl. ¶ 53; Ex. 1122.) It is unclear what percentage of Coolpad's sales are made inside China, but both sides agreed it was "most." (Guo Rebuttal Decl. ¶ 51; Teece Decl. ¶ 127.) Coolpad's sales outside of China are so small that Kennedy assumed that all of its sales were in China when he unpacked its license with Ericsson. (Kennedy Decl. ¶ 204.) Coolpad's 2014 annual report shows that roughly 93% of its total revenue in 2014 came from customers in China, and

[31]The Court is skeptical that Ericsson actually averages different levels of patent protection to create a global blended rate for global firms. First, there is no evidence that Ericsson actually does this in its business cases. Second, Ericsson's preferred metric for determining its portfolio strength is contribution counting. Contribution counts, discussed more below, are a single number independent of geography or intellectual property rights, and thus cannot be used to reflect or average geographic distinctions in patent portfolios.

virtually all revenue was from the sale of mobile phones and phone accessories. (Ex. 2389 at 82-83.) This stands in stark contract to TCL, where over 90% of its sales occur outside its home country of China. (Guo Rebuttal Decl. ¶ 11.) Based on this evidence, Karbonn and Coolpad are not similarly situated to TCL.

C. Apple and Samsung Are Similarly Situated to TCL

TCL is a one of the largest cell phone companies in the world, and sells a wide range of products around the world. TCL sells mobile devices in every continent, with South America taking the largest share at 26.4% of TCL's devices sold in 2015. (Guo Decl. ¶ 25, Figure 3.) TCL will require at least a multi-modal 4G license for Ericsson's SEPs, as well as 3G[32] and 2G licenses. In 2015 it was the seventh largest mobile phone seller by volume. (PDX 237[33].) For reference, in 2015 Huawei was ranked fourth by volume, LG was ranked sixth, ZTE was ranked ninth, and HTC did not reach the top ten. (Id.)

In 2015 Apple was the second largest seller of mobile phones in the world. (PDX 237.) Its devices cater to the high end of the market, but Apple also sells older and refurbished models at much lower price points to capitalize on customers at the lower segments of the market. (Brismark Decl. ¶ 75; Guo Rebuttal Decl. ¶ 33.) Apple sells its devices globally, manufactures them in China, and they are all multi-modal 4G devices. While Apple's phones have similar specifications to some of TCL's flagship products, both parties agree that Apple's products command much higher selling prices because of the incredible value of its brand. (Ericsson FOF, ¶ 18; Cistulli Decl. ¶ 72.) Ericsson agreed the premium that consumers pay for Apple products (and Samsung products, discussed below) is largely a function of brand value and other intangibles unrelated to the value added by Ericsson's SEPs. (Brismark Decl. ¶ 73.)

In 2015 Samsung was the largest seller of mobile phones by volume. (PDX 237.) Samsung also sells its phones globally. Similar to HTC, Samsung's products cater the mid to high end of the market. Samsung's products are similar

[32]It is clear that at least some, of TCL's devices would have pass-through rights to Ericsson's 3G SEPs because of a separate license agreement between Qualcomm and Ericsson, but the parties do not address the details of these devices or how that may affect the overall license.
[33]While PDX 237 is not in evidence, the Court found it to be an accurate summary of IDC data. (Ex. 1273.) The Court cites to other PDXs as accurate summaries of the evidence.

to Apple's because both companies sell their high-end products at a premium because of brand value, but that brand value has nothing to do with the value provided by Ericsson's SEPs. Samsung, like TCL, sells feature phones and smartphones, and requires licenses for multi-mode 4G, as well as 3G and 2G. (E.g., Guo Rebuttal Decl. ¶¶ 17-18.)

The Court cannot identify any dispositive reason why Apple and Samsung are not similarly situated to TCL with regard to Ericsson's SEPs. All three firms are all global firms, Ericsson has asked all three to pay a global blended rate for a multi-modal 4G license, they all create phones of similar technical specifications, and they all have substantial sales volume. Although Apple does not require 2G or 3G licenses, Samsung does, and Ericsson does not suggest that Apple's lack of 2G or 3G products justifies TCL paying a higher 4G rate than Apple. Apple and Samsung do sell many more devices than TCL, but the Court views sales volume only as a filter to separate out niche and small firms from the reasonably well-established global firms. Sales volume alone does not justify giving lower rates to otherwise similar firms. Ericsson identifies many other criteria in its attempt to show Apple and Samsung are not similarly situated, but exclusive applications, retail stores, brand recognition, and a proprietary operating system are irrelevant to determining a non-discriminatory rate for Ericsson's SEPs. Ericsson would clearly prefer that Apple and Samsung be considered *sui generis*, but the prohibition on discrimination would mean very little if the largest, most profitable firms could always be a category unto themselves simply because they were the largest and most profitable firms.

IV. Determining the Rates for Assessing the Presence of Discrimination.

The experts devoted substantial effort to analyzing the relevant licenses, an exercise made more complex in some cases by the presence of cross-licenses and lump sum payments. However, their license unpackings provided a common basis to compare the economic deal offered each licensee. One surprising result is that the experts' conclusions for each firm largely agreed and were rarely widely disparate.

There are certain terms which the parties used to describe various licensing arrangements which will make the analysis clearer. A cross-license or two-way license is in effect a reciprocal license: the licensee grants Ericsson the right to use

its infrastructure SEPs in exchange for a smaller payment. A licensee's cash payment takes the form of a lump sum or running royalties. A lump sum is a fixed payment or series of fixed payments regardless of how many units the licensee sells. A running royalty means that the licensee pays a royalty for each qualifying unit, usually either as a percentage of the unit's net selling price, or on a dollar-per-unit basis. If the running royalty is calculated as a percentage of the net selling price, in some cases Ericsson's royalty would be subject to a cap and a floor. For example, if the contract specified a 1% royalty, with a floor of $2 and cap of $4, then for a $300 device Ericsson would receive $3, for a $150 device it receive be $2 (because of the floor), and for a $500 device it would receive $4 (because of the cap).

A. The Unpacking Formula.

Some Ericsson licenses expressly state a clear one-way per unit royalty rate that the licensee must pay Ericsson for its SEPs. (E.g., Ex. 1277 at 18 (Huawei license).) However, the licenses with Apple, Samsung, HTC, LG, and ZTE all involve either lump sum payments, or meaningful cross-licenses. A license agreement with a lump sum payment or cross-license must be unpacked to arrive at a one-way rate. Unpacking a license involves evaluating all of its terms and other consideration so that the Court can calculate the effective one-way rate that each licensee pays Ericsson for its handset SEPs. (Lynde Decl. ¶ 86.)

Both sides generally agree on the formula to use to unpack cross-licenses. (TCL FOF, ¶ 185; Ericsson FOF, ¶ 150.) The unpacking formula starts with the basic premise:

$$\textit{Value of a license} = \textit{Licensor One-way Rate} \times \textit{Licensee Revenues}$$

Thus, if a licensor's one-way rate was 10%, and the licensee made $500 selling products that required a license, the value to the licensee, or what it would have to pay, would be $50. In the case of a cross-license, both sides receive value from the license provided by the other party, and the party which receives less value will have to give cash or other consideration to make up the difference. This cash difference is called a net balancing payment. Using Ericsson as an example, this formula is expressed as:

$$Net\ Balancing\ Payment\ =$$
$$[Ericsson\ One\text{-}way\ Rate \times Licensee\ Revenues]$$
$$-[Licensee\ One\text{-}Way\ Rate \times Ericsson\ Revenues]$$

This equation has two unknown variables: Ericsson's rate for its SEPs and the Licensee's rate for its SEPs.[34] In order to make this equation solvable, both sides used a PSR to state a licensee's one-way rate as a ratio of Ericsson's one-way rate. (Kennedy Decl. ¶ 111; Lynde Decl. ¶ 93.) The PSR is:

$$Portfolio\ Strength\ Ratio\ ("PSR") = \frac{Ericsson\ One\text{-}way\ Rate}{Licensee\ One\text{-}Way\ Rate}$$

The PSR assumes that each party's one way license rate reflects the relative strength of its patent portfolio. (Lynde Decl. ¶ 93.) Using a PSR, the unpacking formula can be stated as:

$$Ericsson\ One\text{-}way\ Rate = \frac{Net\ Balancing\ Payment}{Licensee\ Revenues - \frac{Ericsson\ Revenues}{PSR}}$$

(Kennedy Decl. ¶ 112; Lynde Decl. ¶ 95.) Importantly, the net balancing payments and revenues must be stated in dollars of the same year, which generally requires determining the net present value of past and future payments and revenue. (Ericsson FOF, ¶ 152.) In addition, because the unpacking formula calculates a royalty rate, it can only be used for one standard at a time. This is not a problem for the revenue inputs or the PSR, which can be determined individually for each standard, but it is a problem if the licensee paid Ericsson a single lump sum that covers multiple standards. This will be addressed in the apportionment section below.

In unpacking the license agreements, the experts are not required to follow the assumptions Ericsson made in its business cases. Ericsson created a business case after signing each license agreement to memorialize some of its projections and assumptions, and to act as a "memo to the file." (Brismark Decl. ¶¶ 60-61.)

[34]Until late 2011 Ericsson through its joint venture with Sony produced cell phones and thus required a cross-license for those handsets. (Brismark Decl. ¶ 11.) After Ericsson divested its mobile phone business in February 2012, it now requires a cross-license only for its infrastructure equipment. (Kennedy Decl. ¶ 117.) With the exception of Samsung and ZTE, all of the other comparable licensees only required a license for Ericsson's handset SEPs.

Ericsson did not use the business cases before the Court in its actual negotiations, and they represent nothing more than after-the-fact attempts to model certain projections. (Id.) Ericsson's business cases do not reflect how much licensees are actually paying over the course of the license. Most importantly, experts are free to provide their own expertise and analysis based on experience and industry practice. (Kennedy Rebuttal Decl. ¶¶ 116-17.)

TCL's expert Dr. Lynde appears to have generally tried to follow Ericsson's methodology reflected in its business case or testimony. However, Ericsson's expert Kennedy appears to have sometimes followed Ericsson's business case, sometimes followed Dr. Lynde, and sometimes made his own assumptions. (Kennedy Decl. ¶ 115.) Sound methodology should preclude the experts from cherry-picking facts from the business cases or each other's reports they choose to accept; rather, they must provide a factual basis for their opinions. The Court is very cognizant of just how easy it is to pick particular assumptions or approaches in order to manipulate the unpacking analysis to arrive at a preferred rate for each license.[35] The more that the unpacking analysis can be manipulated, the less it represents what the parties actually agreed to do, and therefore the less useful it is to the Court.

Because the purpose of unpacking comparable licenses is to establish comparable rates, the licenses should all be unpacked in a similar manner. If a particular license is treated differently, the explanation for why needs to be in the record. It is not sufficient to simply say that Ericsson did it that way in its business case because: (1) Ericsson's decisions in its business case are not binding on this Court; (2) as explained above, Ericsson created these business cases after-the-fact to explain the license; and (3) the business cases themselves are just Ericsson's projections and at best reflect only Ericsson's view of the license, not the licensee's view, or what the licensee actually ended up paying.

The Court will now address four common issues that arose in how to apply the unpacking formula.

1. Treatment of Released Sales.

[35]For example, with the Samsung license, keeping all of the inputs exactly the same and changing only the discount rates and 3G/4G apportionment factor to those used by the experts in other unpackings, Samsung's one-way effective 4G rate can range from [redacted].

In a typical license, the licensee will buy his peace for past unlicensed sales with a one-time payment, or a release payment. Released sales are those that were unlicensed at the time they were made, but then retroactively covered by a subsequent license agreement. (Kennedy Decl. ¶ 26.) In the case of a cross-license where Ericsson's own infrastructure sales were not licensed under the licensee's infrastructure SEPs, Ericsson would also receive the benefit of a release of liability for its own past unlicensed sales.

Dr. Lynde initially treated released sales as separate from prospective sales, and thus treated any initial lump sum payment made by the licensee as separate from the prospective rate, unless he had evidence that Ericsson allocated some of the initial lump sum payment towards prospective sales. (E.g., Lynde Decl. ¶ 106.) Sensing that this may be problematic, Dr. Lynde later unpacked the Apple and Samsung licenses to include the release payments. (Lynde Rebuttal Decl. ¶¶ 78-80.) Because Dr. Lynde had already unpacked the HTC license with the release payment and did not unpack the ZTE licenses, the only license he did not unpack with the release payment was the LG license.

Kennedy generally incorporated the release period into his analysis. However, with the LG license he only included the released sales from the years in Ericsson's business case, and therefore excluded released sales from years not included in Ericsson's business case. (Kennedy Decl. ¶ 116.)

The license agreements themselves do not spell out any basis to allocate lump sum payments between past and future sales. Although Ericsson's actual release of a licensee from past liability is often triggered by the payment of an initial lump sum, the Court interprets this as a timing issue, and not that the parties agreed to pay different rates for past and future sales, or that they agreed that the initial lump sum would exclusively and entirely cover all released sales. (E.g., Ex. 5331 at 13, 15.) Following Dr. Lynde's approach would invite SEP-holders to manipulate their internal discussions and opinions towards whatever their goals are for the next FRAND dispute. This is particularly true where, as here, Dr. Lynde's decisions are based entirely on after-the-fact statements made by Brismark. (E.g., Lynde Decl. ¶ 105, citing Brismark Depo., May 18, 2016, p.183:3-15.)

The Court generally views released sales as part and parcel of the forward-looking terms of the license agreements. The Court decides this based on a pragmatic view of the negotiations between sophisticated parties. When Ericsson and Apple negotiated their license agreement, they both knew that there were unlicensed sales, and they had even engaged in substantial litigation across the globe over that very issue. (Brismark Decl. ¶ 108.) To then exclude released sales and the initial lump sum payment ignores the reality that, particularly for lump sum deals, the released sales are being paid for as part of the same transaction. The Court is therefore skeptical of any unpacking which ignores released sales and an initial lump sum payment for the purposes of determining a FRAND rate. The Court believes that parties to these license agreements generally care much more about the total amount they have to pay and the total value they receive, rather than whether a payment is labeled as a release from past liability or for the future license. Brismark himself seemed to generally share that view: when he was asked at his deposition how Ericsson divided the lump sum payments from Apple into released and prospective sales he responded, "We haven't done that because it's a one-time payment and it's for past and for future." (Brismark Depo., May 18, 2016, p. 185:1-11.) In addition, it is very likely that a licensee may choose to pay a larger lump sum in exchange for lower rates, a lower cap, a lower floor, or a lower percentage or dollar-per-unit running royalties. Ignoring these possibilities ignores the substantial flexibility that FRAND leaves parties with to structure their licenses in a friendly and bilateral manner. (ETSI Guide on IPR § 4.3, Ex. 224 at 7.)

It is certainly possible that parties could specifically agree to different royalty rates for released and prospective sales, but that is not the case for any of the licenses the Court unpacked.[36] The Court agrees with Kennedy that released sales should generally be included in unpacking each license. The Court will therefore treat released sales and release payments the same as projected sales and prospective payments and calculate a single rate over the course of the combined license and release period.

2. Apportioning Lump Sum Payments Between Multiple Standards.

[36]Ericsson's license with ZTE in 2011 for 2G/3G actually did state different percentage running royalty rates for released and prospective sales. (Ex. 1197 at 8.) However, this license was superseded by an amended license in 2015 and was not unpacked by either expert. (Ex. 1200.)

In order to determine the licensee's one-way effective royalty rate for each standard, the Court must determine exactly how much the licensee paid Ericsson for each standard. All of the comparable licenses except Huawei's contain a lump sum component. A lump sum payment creates a challenge for unpacking a license that covers multiple standards (e.g., 2G, 3G, 4G) because the effective royalty rate for each standard needs to be unpacked separately, even though the licensee paid a single lump sum net balancing payment that covers multiple standards. In some cases, the license agreement also covers things beyond handset SEPs, such as external modems, personal computers, implementation patents. The experts therefore had to determine how much the licensee paid for handset SEPs, and then apportion the net balancing payment across the licensed standards so that they could apply the unpacking formula for each standard.[37] However, each apportionment will affect each later standard, and the more assumptions the experts made, the more the license reflects the expert's decisions rather than the parties' agreed upon royalties rates.

Dr. Lynde generally unpacked the licenses he examined twice, once for 4G, and then again for a blended 2G/3G rate. (Lynde Decl. ¶ 21.) Dr. Lynde apportioned the net balancing payments based on the licensee's proportion of revenue for each standard. (Id. ¶ 96.) Kennedy generally unpacked lump sum licenses four times, for 4G, 3G, 2G EDGE, and 2G GSM/GPRS. (Kennedy Decl. ¶ 133.) Kennedy claimed that he apportioned the balancing payments according to Ericsson's own assumptions regarding the breakdown of revenue between the various standards by units. (Kennedy Decl. ¶¶ 129-133.) It is unclear, however, that Ericsson made those assumptions, or that it applied them to the lump sum

[37]The Court has previously ruled that implementation patents will not be covered by this FRAND adjudication because they are not SEPs. (Docket No. 1055 at 7.) TCL also did not show that Ericsson's cross-licenses to implementation patents had any net value that would require adjusting the licensees' net balancing payments in either direction.

However, licenses to Ericsson's SEPs for external modems and personal computers certainly do have value, and are a material term of this FRAND dispute. Ericsson's licenses with HTC and Samsung cover the licensees' sale of personal computers with cellular connectivity. (Ex. 1275 at 6 (HTC); Ex. 1276 at 4 (Samsung).) Ericsson's licenses with Apple and LG cover both personal computers and external modems with cellular connectivity. (Ex. 5331 at 2 (Apple); Ex. 199 at 2, 4 (LG).) Because both experts applied the entire balancing payment to handsets, the unpackings treated the licensees as paying 0% for external modems and personal computers in exchange for a higher royalty rate on handsets. The Court will treat TCL the same way.

payments. Kennedy actually appears to use estimates about the types of units in each projection to decide for himself how to apportion the lump sum payments between standards. (See Lynde Rebuttal Decl. ¶¶ 70-72.) It becomes particularly problematic when Kennedy apportioned between 3G, 2G EDGE, and 2G GSM/GPRS, because each additional unpacking relies on the previous apportionment assumptions such that any error compounds throughout the remaining calculations. This leads to some questionable results. For example, Kennedy concluded that Samsung agreed to pay virtually the same rate for 2G EDGE as it did for a multi-modal 4G license that included 2G functionality, and that Samsung actually paid more for 2G GSM/GPRS than for multi-modal 3G license that included 2G GSM/GPRS. (Kennedy Decl. ¶ 173.) The Court has trouble believing that Ericsson asked Samsung for less money the more its patents were used. Kennedy has not cited sufficient evidence to convince the Court that his apportionments regarding 2G have any basis in the license agreements or how the parties interpreted them.[38] Therefore, Kennedy's apportionments of net balancing payments between the 2G standards, and between 2G and 3G are not credible. Kennedy and Dr. Lynde do not disagree substantially over the 4G apportionment ratios for the projections that they both unpacked. Accordingly, the Court generally adopts Dr. Lynde's methodology for apportioning the net balancing payments between standards. (Lynde Decl. ¶¶ 96, 99; Lynde Rebuttal ¶¶ 70-73.)

3. Dollar-per-unit Rates, Caps, and Floors.

While Ericsson has in the past entered into some licenses dollar-per-unit rates or licenses with caps and floors, the Court declines to adopt a dollar-per-unit approach in determining FRAND rates here.

[38]This is also true because Kennedy never calculated a 2G PSR. Both experts cited to each other when they justifed why they used a 3G PSR to unpack a combined 2G/3G rate. (Lynde Decl. ¶ 93 n.3; Kennedy Decl. ¶ 131.) However, Dr. Lynde at least explained that it is because 2G patents are less important and more likely to have expired, and he created a blended 2G/3G rate and does not try to unpack each 2G standard. (Lynde Decl. ¶ 93 n.3.) Kennedy explained that the method he used to determine PSRs (contribution counting, discussed below in the PSR section) does not exists for 2G. Thus, rather than introduce inconsistencies from using a new metric, he just used the same 3G PSR. (Kennedy Decl. ¶ 131.) A 3G PSR cannot be used to calculate rates for 2G GSM/GPRS or 2G EDGE. The only comparable licensee that sells 2G products is Samsung, so in unpacking the Samsung license the Court chose to apportion out the 2G net balancing payment and calculate just 3G and 4G rates.

First, use of dollar-per-unit royalties is at odds with industry practices generally and specifically Ericsson's own past licencing practices, a point which Ericsson expert Kennedy acknowledged at trial. (TT Mar. 1, 2017, pp. 8-9.) For example, in Ericson's business cases for Samsung, LG, and HTC, Ericsson used running royalties, as did the actual licenses for Coolpad, Karbonn, Doro, Sharp, Huawei, ZTE, and LG. (TT (Sealed) Mar. 1, 2017, pp. 5-7, 10.)

Second, a percentage-based royalty better aligns the incentives of the SEP-holder and the licensee than a dollar-per-unit royalty. This furthers ETSI's express policy objectives of both rewarding SEP-holders and making their intellectual property available to the public. (ETSI IPR Policy § 3, Ex. 223 at 1.)

Third, in this case, Ericsson itself has repeatedly reaffirmed that royalties should be a percentage running royalty. Option A and Option B were both largely stated handset royalties as a running percentage royalties, and in its interrogatories Ericsson confirmed that its royalty rate should be calculated as a percentage of the handset price. (Ex. 131 at 15-18.)

Finally, there is no support in the record that a package of SEPs has a fixed, determinable value which would justify a fixed dollar-per-unit rate or a percentage rate as modified by floors or caps. Brismark explained that Ericsson seeks to apply a floor to its license agreements so that it can obtain a certain minimum amount of revenue for itself. (TT Feb. 28, 2017, pp. 50:23-51:2.) However, as noted above, the Court rejects Kennedy's ex-Standard analysis. In addition, on the stand Brismark explained that its existing caps and floors are solely the product of negotiations, not any sort of analysis of whether they are fair or reasonable. (TT Feb. 28, 2017, pp. 116:13-117:17.)

To be sure, in the course of private negotiations, parties may enter into a variety of licensing schemes that reflect each party's unique assessment of the risk of a particular arrangement. However, the Court prefers to conduct its FRAND analysis on principles of general application which do not require the Court to discern the peculiarities of those risk assessments.

For these reasons, the Court will unpack these licenses as Ericsson has, a percentage of the net selling price of the licensed devices without a cap or floor.

B. The Inputs to the Unpacking Formula.

As explained above, unpacking a cross-license requires four inputs to determine Ericsson's one-way rates, the PSR, and the present value of: the net balancing payments, Ericsson's revenues , and the licensee's revenues. However, many of the disputes over these inputs are caused by the parties' use of different discount rates, different revenue projections, and different PSRs. The Court will address each of these inputs in turn.

1. Determining the Appropriate Discount Rate.

In order to unpack and evaluate a license the monetary terms of the unpacking formula (net balancing payments, licensee's revenue, and Ericsson's revenue) must be expressed in comparable units. This means that a discount must be applied to future payments so that they can be expressed in present value terms.[39]

In its business cases, Ericsson would sometimes use a discount rate to indicate the size of the risk associated with each licensee. (Lynde Rebuttal Decl. ¶ 74.) When Ericsson specified a discount rate in its business cases, it was usually 10% or 12%. Dr. Lynde generally adopted the discount rate Ericsson used in its business case to unpack the entire license. (Lynde Decl. ¶ 99.) On the other hand, Kennedy applied a number of different discount rates depending on the type of payment and licensee. (Kennedy Decl. ¶ 120.) He adjusted past sales at the Treasury Bill rate, future revenue and running royalties at 10% or 12%, and lump sums payments at the prime rate (slightly higher than the Treasury Bill rate). (Id.)

For example, in unpacking the Samsung license, Kennedy used a 12% discount rate for Samsung's revenue, but only a 10% discount rate for Ericsson's revenue. (Id. ¶ 171.) He also used a 10% for ZTE's future 3G sales and Ericsson's sales, but a 12% discount rate for ZTE's future 4G sales. (Id. ¶ 157.)

[39]It appears that the parties have unpacked all payments to the beginning of each license. If the Court declared the final rate as a running dollar-per-unit royalty, it would then have to go an additional step and determine how to implement that over the five-year license by either having the nominal rate increase to keep Ericsson's return constant in present dollars, or keeping the nominal rate the same and having TCL pay a higher effective rate in the first half the license to balance out the second half. Because the Court states its ultimate rates as a running percentage royalty, it need not worry about how the time value of money will affect these rates.

However, Kennedy did not explain why Samsung's projected revenue should be treated differently than ZTE's, or why Ericsson's revenue should be treated differently depending on which license is being analyzed. In order to avoid obvious cherry-picking problems and create comparable rates, and because there is no basis in the record to do otherwise, the Court will apply a uniform 10% discount rate to all revenue projections of both Ericsson and its licensees.

Kennedy also applied much lower discount rates to future fixed payments, usually around 3%. (Kennedy Rebuttal Decl. ¶ 110.) He did so because future fixed payments are much more certain and valuable, and thus the risk is better measured by applying the company's cost of debt. (Kennedy Decl. ¶ 120.) This leads to him discounting future fixed payments from anywhere between 1.7% and 3.8%. (Id. ¶¶ 190, 157.) The Court agrees that future fixed payments are more valuable than percentage payments because they are certain. However, the Court does not believe that the revenue projections for Samsung should be discounted at a rate more than four times higher than its lump sum payments, particularly when Ericsson used the same discount rate for both. (Id. ¶ 171 (applying a 2.9% discount rate for fixed payments, and 12% for future revenues).) The Court will apply a 5% discount rate to future fixed payments.

The revenue from a licensee and/or Ericsson's released sales must also be adjusted so that it can be stated in dollars of the same year as the projected sales. Because the licensee (or Ericsson, in the case of a cross-license) sold the product before paying for the license, the licensee effectively received an interest-free loan from the SEP-holder. Revenue from released sales must therefore be adjusted upward. The Court will adopt Kennedy's discount rate of using the Treasury Bill rate of 0.56% for released revenue. (Kennedy Decl. ¶ 120.)

To summarize, the Court adopts a 10% discount rate for all revenue projections, a 5% discount rate for future fixed payments, and a 0.56% adjustment for all past revenue. The Court also uses the mid-year convention for calculating discounted values, treating all the licenses that start in December or January as starting on January 1, and the LG license as starting on June 30, or halfway through the year. Finally, the Court treats all lump sum payments made in the first quarter of each year as if they occurred on January 1 of that year.

2. Estimating Revenue

In order to unpack a lump sum or cross-license there must be some estimate of the amount of money that a licensee has earned from its sales of products compliant with each standard. The experts used two sources for revenue information: Ericsson's internal projections in its businesses cases and data from International Data Corporation ("IDC"), a third-party market analyst. IDC data is based on actual handset sales,[40] which makes it much more reliable, but more limited because only data through 2015 was available, and IDC does not report infrastructure revenue. (Lynde Decl. ¶ 101.) Dr. Lynde and Kennedy both unpacked the comparable licenses with business case data. Where Ericsson made multiple projections in a business case, the experts either agreed on which one to apply, or they unpacked the license using multiple business case projections. Dr. Lynde also unpacked the Samsung, LG, and HTC licenses based on IDC data through 2015. Although Kennedy did not unpack any licenses with IDC, for the reasons discussed below the Court believes that independent third-party data serves as a valuable check on a party's internal and unvalidated projections.

First, IDC data is heavily relied on by experts for both sides, as well as the representatives for both Ericsson and TCL. Dr. Kakaes, Dr. Lynde, Cistuli, Dr. Guo, Brismark, Dr. Teece, Kennedy, and Pellegrino all used IDC data.

Second, in many cases, Ericsson's business cases dramatically underestimated the licensee's revenue when compared to IDC data. For example, Ericsson's business case for HTC projected that from 2014-2015 HTC would earn around [redacted] in 4G revenue off of [redacted] 4G units. IDC reported that during that period HTC actually earned over $11 billion on 28.5 million units. Similarly, Ericsson projected that from 2013-2015 LG would earn [redacted] in 4G revenue off of [redacted] 4G units. IDC reported that during that period LG actually earned over $29 billion in 4G revenue on 75 million 4G units. Ericsson's high projection estimated that from 2011 through 2015 Samsung would earn [redacted]

[40]It is unclear whether the revenue projections in Ericsson's business cases for Apple, Samsung, HTC and LG are based on the licensee's wholesale or retail sales. These were all lump sum deals, so Ericsson would not necessarily have had a business reason to prefer one over the other. Brismark stated only that its business cases "endeavor to use the most reliable sales data available at the time, either from market analysts or from the licensee." (Brismark Decl. ¶ 61.) To the extent that the business case data is wholesale data, it would tend to produce higher rates than IDC data. The Court keeps this problem in mind in ultimately setting a FRAND rate, and uses business case projections as the lower limit of the licensee's revenue, and IDC data as the upper limit.

[redacted] in 4G revenue off of [redacted] 4G units. IDC reported that Samsung actually earned $248 billion in 4G revenue off of 472 million units. Discrepancies of this magnitude are not attributable to rounding errors or using different discount rates, and they always occur in the direction that favors Ericsson.[41] IDC's business model relies on providing accurate data.

Third, IDC data reflects actual sales, not the projections of one party to the license. Ericsson's business cases could, at best, only reflect the rate Ericsson thought the licensee would pay over the course of the license and release period. However, the non-discrimination prong of FRAND does not incorporate an SEP-holder's projections; it applies to the actual terms and conditions. (ETSI IPR Policy, § 6.1, Ex. 223.) When Ericsson accepted the certainty that came with lump sum payments, it also accepted the risks and consequences of the licensee outperforming its projections. Excluding third-party data would allow Ericsson to take the benefits that come with lump sum deals (including Kennedy's lower discount rate for lump sum payments, which increases Ericsson's effective royalty rate) but none of the risk.

The one challenge posed by using IDC data in this case was that it was only available through 2015. In order to unpack a license with IDC data, the net balancing payment therefore had to be apportioned between the years covered by IDC data, and the remaining years of the license. The Court chose to apportion the net balancing payment proportionally based on the number of years of the license and release covered by IDC data. For example, Ericsson's license with HTC licensed HTC's sales in 2015 and 2016, and provided a release of liability for HTC's unlicensed sales in 2014. IDC data covers HTC's sales up through 2015, so the Court apportioned 2/3 of the total net balancing payment to the period covered by IDC data.

3. Using the Appropriate PSR

As noted above, the Portfolio Strength Ratio, or PSR, is the strength of Ericsson's SEP portfolio relative to the licensee's SEP portfolio, on a standard-by-standard basis. (Lynde Decl. ¶ 91.) Although both experts agreed on how to use a PSR and what it represents, they used numbers derived from very different

[41]This is so because licensee revenue is in the denominator of the unpacking equation; thus lower licensee revenue means a higher effective royalty rate.

sources. TCL used PSRs derived from Dr. Ding's patent counting study of how many essential patents each company owned. (Id.) Ericsson instead calculated its PSRs based on contribution counting, which is an estimate of how many ideas it contributed to the development of the 3G and 4G standards. (Mallinson Decl. ¶ 65-66.) Ericsson's use of contribution counting actually creates results more favorable to TCL, while TCL's results actually created results more favorable to Ericsson. The Court first addresses issues common to both PSR approaches, and then addresses TCL's use of patent counting and Ericsson's use of contribution counting.

Whether a PSR is calculated through patent counting or contribution counting, it still contains two basic assumptions. The first is that an SEP portfolio's strength is directly proportional to its size. The second is that each patent or contribution is treated equally, regardless of individual value of the invention, or whether it is for a handset, infrastructure device, or both. Both assumptions are also shared by the top down analysis discussed above. In the top down approach treating each patent equally was an express feature of the methodology advocated by Ericsson and others. However, it is less clear that assumption is valid in the context of negotiations between sophisticated parties.

Dr. Lynde and Dr. Ding calculated PSRs for TCL based off of patent counts. Based on Dr. Ding's patent census, Dr. Lynde calculated how many SEPs are owned by each licensee. (Lynde Decl. ¶ 91.) The PSRs are the number of SEPs owned by Ericsson that the licensee needs, divided by the number of SEPs owned by the licensee that Ericsson needs. Because Ericsson no longer makes handsets, the denominator of the PSR is the number of infrastructure SEPs owned by the licensee. (Id. ¶ 94; Ex. 1239.) Patent counting, while not perfect, does reflect the number of SEPs that are owned by each company. In addition, patent counts will reflect changes to a company's portfolio from purchases, expirations, and transfers of SEPs.

Ericsson calculated its PSRs based on standards contribution counting.[42] (Kennedy Decl. ¶ 122.) A contribution is a technical submission of an idea to a 3GPP working group. (Mallinson Decl. ¶ 65.) A contribution is then "approved" by the working group when it is included in the 3GPP technical specifications,

[42]This is a different concept than TCL's importance and contribution analysis discussed in the Top Down section. (See ___, supra.)

which are ultimately provided to ETSI. (Id.) Ericsson used standard contribution counts calculated by Signals Research Group, who conducted a study paid for by Ericsson to update Ericsson's own report on its contribution counts. (Mallinson Decl. ¶ 68.) Ericsson developed this methodology because it was concerned that there were alternative studies showing that it owned a low proportional share of 4G SEPs. (TT Feb. 28, 2017, p. 34:7-23.) Ericsson argued that because companies that participate in the standardization process often seek patent protection for their approved standard contributions, contribution counting can serve as a good proxy for the strength of their SEP portfolios. (Ericsson FOF, ¶ 162.) The Court disagrees.

Standards contribution counting counts contributions, not patents. Contributions can be made for ideas that are unpatented, unpatentable, patented by someone else, or split into multiple contributions. (TT Feb. 28, 2017, pp. 37-38; Bekkers Decl. ¶¶ 76-86.) Brismark testified that Ericsson has never actually done any analysis to determine whether its own contribution counts correlate to its SEPs. (TT Feb. 28, 2017, p. 38.) Ericsson's internal documents show that it has inflated its contribution counts by "hijacking" the contributions of other companies as well as requiring its subsidiaries to vote for Ericsson's proposals. (Ex. 1076 at 1;Bekkers Decl. ¶¶ 99-100.) TCL raised many additional flaws with standards contribution counting at trial that the Court notes here. (TCL FOF, ¶¶ 127-129; Bekkers Decl. ¶¶ 80, 90.)

The two major flaws with contribution counting are the absence of any evidence that it corresponds to actual intellectual property rights, and its inability to account for transferred or expired patents. (Bekkers Decl. ¶¶ 82-83; Mallinson Decl. ¶ 6.) For example, if Ericsson sold off a substantial portion of its SEP portfolio, Ericsson would still claim the exact same royalty as before it sold its SEPs based on an unchanged standards contribution count. Thus, contribution counting does not reflect the roughly two hundred U.S. patents that Ericsson has divested over the last decade. (E.g., Ex. 1126.) Contribution counting also permits Ericsson to demand royalties well beyond the expiration of the corresponding patents, if those contributions were actually tied to patents at all. These are incorrect results. While contribution counting may have its uses, it cannot be used to determine a FRAND rate for a patent portfolio, or unpack a cross-license. Except for the LG license (discussed below), the Court will adopt Dr. Lynde's PSRs for unpacking each license.

C. Unpacking the Comparable Licenses.

1. The Apple License.

Apple is a U.S.-based consumer electronics company and the second largest smartphone vendor by volume. (Brismark Decl. ¶ 103.) In 2008 Apple and Ericsson signed an agreement to license Ericsson's 2G and 3G SEPs. (Ex. 257.) That license expired on January 14, 2015. (Id. at 3.) After the expiration of that license, the parties engaged in extensive litigation in 2015 which resulted in a new global cross-license in December 2015, that will expire in January, 2022. (Ex; 5331; Brismark Decl. ¶ 104.) The 2015 license settled a total of 51 litigations between Ericsson and Apple around the world.

Under the 2015 license, Apple agreed to make a one-time payment of [redacted] (Ex. 5331 at 15.) Ericsson also received a cross-license to Apple's infrastructure SEPs, as well as a release of any past unlicensed sales. (Id. at 10, 13.)

Ericsson's business case for its license with Apple contains three sets of projections. (Ex. 4946.) Both experts unpacked the license according to Ericsson's mid projections. (Lynde Decl. ¶ 110; Kennedy Decl. ¶ 188.) Dr. Lynde does not unpack this license with IDC data because IDC data was only available through 2015, and the license was signed on December 19, 2015. (Lynde Decl. ¶ 113.) Although this license does give Apple the option of paying a running royalty instead of a lump sum, neither expert believes that Apple's sales are ever likely to drop low enough for Apple to make that choice. (Kennedy Decl. ¶ 189.)

The primary dispute between the experts concerns how to resolve two issues related to released sales. The first issue was how to treat Apple's 4G sales from 2012-2014, for which Apple paid Ericsson the 2008 license's [redacted] for 2G and 3G SEPs, but [redacted] for 4G functionality. The second issue was how to treat released sales in 2015. Both of these issues are relevant to the unpacking analysis because they affect the determination of Apple revenue figures and the allocation of the net balancing payments.

Based on his understanding of Brismark's deposition testimony, Dr. Lynde believed that Ericsson internally allocated Apple's initial lump sum payment such that Apple paid [redacted] for all released sales from 2012-2015. (Lynde Decl. ¶ 106.) He credited Apple with already having paid [redacted] for the sales from 2012-2014, and therefore deducted [redacted] for each 4G sale from 2012-2014, and [redacted] from each 4G sale in 2015 from the net balancing payment. (Id.) However, at trial it was clear that this understanding of Brismark's deposition testimony was incorrect, and that Brismark meant the [redacted] figure to be illustrative, not what Ericsson actually calculated Apple to have paid per 4G unit. (TT Feb. 16, 2017, p. 57:24-59:24; Brismark Depo., May 18, 2016, p. 184:10-20.) The Court therefore cannot accept Dr. Lynde's assumption that Apple paid [redacted] for released 4G sales from 2012-2015.

Kennedy instead adopted an assumption made by Brismark that Apple would pay the same rate for future sales and past sales, less the [redacted] per unit that it already paid for sales from 2012-2014. (Kennedy Decl. ¶ 193.) Kennedy assigned all of the net balancing payments to 2015-2022 sales, and calculated that Apple will pay [redacted] for each 4G unit. (Id.) Because Apple already paid [redacted] per unit for 2G and 3G functionality for its phones from 2012-2014, Kennedy assumed that Apple owed no additional royalties from those phones. (Id.) In essence, he found that Ericsson asked for a royalty of [redacted] for its 4G SEPs from Apple from 2012-2014 when it signed its 2015 license with Apple. Ericsson estimated that Apple sold [redacted] LTE devices during this period. (Ex. 4946.) Ericsson's business case also shows that Ericsson factored in the foregone LTE royalties as part of the release for this license. (Id.) Given the extensive litigation that occurred in 2015 between Apple and Ericsson, and Ericsson's own estimates that it was owed hundreds of millions of dollars in royalties for these units, the Court does not accept Kennedy's conclusion that Ericsson simply dropped its claims for 4G devices sold by Apple from 2012-2014. Instead, the Court finds that Apple paid for 4G functionality on its devices from 2012-2014 as part of its lump sum payments.

Neither expert provided a satisfactory method to unpack Apple's released sales. Dr. Lynde created a disjointed payment schedule based on an incorrect assumption, while Kennedy assumed that Ericsson gave up hundreds of millions of dollars. The simplest way for the Court to treat Apple's released sales where it paid for 2G and 3G but not 4G SEPs, without having to determine the marginal

value that 4G functionality added to a 2G/3G device, is simply to treat Apple's [redacted] per unit payments from 2012-2014 as a down payment on the 4G functionality that it would license from Ericsson in December 2015. This means adding the present value (adjusted to 2016 dollars) of those down payments to Apple's net balancing payments, and adding the revenue from those released sales to Apple's revenue.

The parties also disagreed on how to calculate the non-cash value Apple's cross-license provided to Ericsson, if any. Dr. Lynde calculated that, based on its business case, Ericsson would earn a little over [redacted] in 4G infrastructure sales from 2012-2021, while Kennedy conservatively treats the Apple license as providing no additional value. (Ex. 2457; Kennedy Decl. ¶ 191.) However, the difference between their figures is very small given the order of magnitude difference in revenue between Apple and Ericsson. The Court will adopt Kennedy's approach in order to avoid the uncertainty added from Ericsson's revenue estimates or using a PSR. Because Apple almost exclusively sells multi-mode 4G devices, the net balancing payment does not need to be apportioned between standards. Apple's one-way effective rate is therefore just its net balancing payment divided by its 4G revenue.

Apple Revenue: From 2012-2014 Apple earned $227,376,433,685 in 4G revenue according to IDC data. (Ex. 1000.) Using Ericsson's projections in its business case, from 2015-2021 Apple will earn [redacted] in 4G revenue. (Ex. 4946.) Apple will therefore earn [redacted] in 4G revenue from 2012-2021 that is licensed under the 2015 agreement.

Net Balancing Payments: Apple's net balancing payments to Ericsson contain two parts, the amount represented by Apple's down payment of [redacted] per device from 2012-2014, and the total amount of cash Apple must pay Ericsson under the 2015 license agreement. Based on IDC numbers, Apple produced 312,409,549 4G units from 2012-2014. At [redacted] a unit, in 2016 dollars this was [redacted]. Apple also paid [redacted] in cash from 2016 through 2021, which is [redacted] in 2016 dollars. These numbers add up to a total net balancing payment of [redacted].

Conclusion: Dr. Lynde calculated that Apple pays a royalty rate of [redacted], while Kennedy calculated that Apple pays a royalty rate of [redacted]. Based on the

above numbers, the Court calculates that Apple pays an effective 4G royalty rate of [redacted].

2. The Samsung License.

In January 2014, Ericsson and Samsung executed a global patent cross-license. (Ex. 1276.) The license included a release for the companies' past unlicensed sales going back until 2011, as well as future sales until [redacted]. (Id. at §§ 8, 13; Kennedy Decl. ¶ 163.) The license covers SEPs for 2G, 3G, and 4G, but excludes CDMA. (Lynde Decl. ¶ 119; Ex. 5316 at 6.) The license confers substantial grant back value on Ericsson, and settled extensive litigation between Ericsson and Samsung. (Brismark Decl. ¶¶ 121-22.) Under the license, Samsung agreed to make a one-time payment of [redacted], and annual royalty payments of either a [redacted] lump sum or per unit royalties of [redacted] per unit (2G), [redacted] per unit (3G) and [redacted] per unit (4G). (Ex. 1276 at 9-11.) Samsung also committed to purchase a [redacted] of thin modems from Ericsson. (Id. at 11; Ex. 4024.)

Part of the consideration Ericsson received in its 2014 license agreement with Samsung was a commitment from Samsung to [redacted] (Brismark Decl. ¶ 123; Ex. 4024.) Both experts attributed a value of [redacted] to this commitment. Kennedy did this because Dr. Lynde did (Kennedy Decl. ¶ 170), and Dr. Lynde only included it to be conservative because [redacted] (Lynde Decl. ¶ 117.) Dr. Lynde stated that he was not aware of any support provided by Ericsson for a [redacted]. (Id.) However, the Court cannot accept a conclusion merely because [redacted]; the conclusion must be supported by the record. The only evidence regarding the actual number of [redacted] from Brismark, who stated that Samsung [redacted] (Brismark Depo., May 18, 2016, pp. 130:14-132:4. [redacted], but Ericsson closed its modem division 7 months after signing the Samsung license. (Brismark Decl. ¶ 123.) Given the short period of time Ericsson would have had to provide thin modems, and absence of any evidence regarding how many were actually sold, the Court has no basis for attributing any value to the thin modem commitment.