UNITED STATES DISTRICT COURT
CENTRAL DISTRICT OF CALIFORNIA

TCL COMMUNICATION TECHNOLOGY HOLDINGS, LTD., *et al.*,

Plaintiffs/Counterclaim-Defendants,

v.

TELEFONAKTIEBOLAGET LM ERICSSON, *et al.*,

Defendants/Counterclaim-Plaintiffs,

ERICSSON INC., *et al.*,

Plaintiffs/Counterclaim-Defendants,

TCL COMMUNICATION TECHNOLOGY HOLDINGS, LTD., *et al.*,

Defendants/Counterclaim-Plaintiffs.

CASE NO: SACV 14-341 JVS(DFMx)
Consolidated with
CASE NO: CV 15-2370 JVS(DFMx)

Memorandum of Findings of Fact and Conclusions of Law

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This case focuses on the licensing of patents in the telecommunications field affecting 2G, 3G, and 4G[1] cellular technologies. As discussed below, TCL Communication Technology Holdings, Ltd., TCT Mobile Limited, and TCT Mobile (US) Inc. (collectively "TCL") manufacture and distribute cell phones on a world-wide scale. Telefonaktiebolaget LM Ericsson and Ericsson Inc. (collectively "Ericsson") hold an extensive portfolio of telecommunications patents. TCL seeks to license Ericsson's patents, but the parties cannot agree on terms.

There is a critical overlay to this dispute. Standards organizations have evolved with the development of technology. The adoption of standards facilitates the overall development of technology and provides a common base which allows many manufacturers' devices to perform reliably and interchangeably in a given telecommunications environment. The relevant standards organization here is the European Telecommunications Standards Institute, or "ETSI." The acceptance of a patent holder's patent into a standard is of great value to the patent holder, and enhances the monopoly which the patent holder has by virtue of his patent. The accepted patents are referred to as standard essential patents, or "SEPs." Anyone who wishes to manufacture in accordance with the standard must secure a license from the patent holder. However, in exchange for acceptance of a patent as part of a standard, the patent holder must agree to license that technology on fair reasonable and non discriminatory terms, or "FRAND" terms.

The task of the Court here is three fold.[2] The Court must determine whether Ericsson met its FRAND obligation, and then whether Ericsson's final offers before litigation, Offer A and Offer B, satisfy FRAND. If they are not, the Court must determine what terms are material to a FRAND license, and then supply the

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[1]Unless otherwise specified, 2G refers to GSM, GPRS, and EDGE, 3G refers to W-CDMA, and 4G refers to LTE and LTE advanced standards.

[2]TCL's complaint contained a cause of action for breach of contract, here the ETSI third party obligation. (Docket No. 31, Second Amended Complaint, First Cause of Action.) However, the Court granted summary judgment on that claim in light of TCL's discovery defaults with regard to damages. (Docket No. 1061.)

FRAND terms.[3] (Docket No. 1055 at 3-5.) The Court is presented with two principal schemes for determining the proper royalty rate. TCL advocates a "top-down" approach which begins with an aggregate royalty for all patents encompassed in a standard, then determines a firm's portion of that aggregate. Ericsson turns to existing licenses which it has negotiated to determine the appropriate rates. Ericsson also offers an "*ex ante*," or ex-Standard, approach which seeks to measure in absolute terms the value which Ericsson's patents add to a product.[4]

The Court discusses the procedural and factual background of the dispute, considers the ETSI overlay, and then turns to the parties' competing royalty approaches.

At the end of the day, the Court reaches the following conclusions:

- Ericsson negotiated in good faith and its conduct during the course of negotiations did not violate its FRAND obligation.

- It is unnecessary for the Court to determine whether the failure to arrive at an agreed FRAND rate violated Ericsson's FRAND obligation. Regardless of the answer to that question, the Court is required to assess whether FRAND rates have been offered in light of the declaratory relief which both sides seek.

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[3]The claims here are framed by the following pleadings in Case No. SACV14-341: TCL's Second Amended Complaint (Docket No. 31), Ericsson's Answer, Defenses and Counterclaims (Docket No. 59), and TCL's Reply (Docket No. 66), as well as the following pleadings in Case No. CV 15-2370: Ericsson's First Amended Complaint (Docket No. 17), TCL's Answer, Affirmative Defenses, and Counterclaims (Docket No. 22), and Ericsson's Amended Answer and Affirmative Defenses to TCL's Counterclaims (Docket No. 52). However, the only claims tried were the parties' respective claims for breach of contract and declaratory relief regarding Ericsson's compliance with its FRAND obligation and declaratory relief for determination of FRAND rates. The parties' respective claims regarding infringement, invalidity, and other substantive patent defenses were previously stayed. (See Docket No. 1448-1, p. 3.)

[4]The royalty rates determined by the Court will also form the basis for the calculation of a release payment from TCL to Ericsson to compensate for TCL's prior unlicensed use of Ericsson's patents.

• Ericsson's Offer A and Offer B are not FRAND rates, and thus the Court proceeds to determine FRAND rates, and does so.

Pursuant to Federal Rule of Civil Procedure 52(a), the following constitute the Court's Findings of Fact and Conclusions of Law.[5]

PART I: BACKGROUND[6]

I. The Parties' License Dispute and Litigation.

A. The Parties' Negotiations and the Foreign Litigation.

On March 6, 2007, two TCL affiliates–T&A Mobile Phones Limited (later renamed TCL Mobile Ltd.) and TCL Mobile Communication (HK) Company Limited–entered into 2G licenses with Ericsson with seven-year terms. (Exs. 64, 65; Brismark Decl. ¶ 76; Guo Decl. ¶¶ 19-20.)

Although there were some prior discussions, it was not until 2011 that TCL and Ericsson began to negotiate a 3G license in earnest. (Alfalahi Depo., Jan. 12, 2016, pp. 206:20-207:6; Ex. 102 at 14-15.) TCL did not sell a meaningful volume of 3G phones until that year. (TT Feb. 28, 2017, p. 103:11-15; Ex. 142.)

In 2012, while the parties were still negotiating, Ericsson initiated a series of foreign litigations against TCL for alleged infringement of Ericsson's SEPs.

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[5]Although the court has labeled its final section as Conclusions of Law and so by implication the remainder are Findings of Fact, these labels are only applied to aid in understanding the opinion. See Tri–Tron Int'l v. A.A. Velto, 525 F.2d 432, 435–36 (9th Cir.1975) ("We look at a finding or a conclusion in its true light, regardless of the label that the district court may have placed on it.... [T]he findings are sufficient if they permit a clear understanding of the basis for the decision of the trial court, irrespective of their mere form or arrangement") (citations omitted); In re Bubble Up Delaware, Inc., 684 F.2d 1259, 1262 (9th Cir.1982) ("The fact that a court labels determinations 'Findings of Fact' does not make them so if they are in reality conclusions of law.").

[6]The parties have filed extensive evidentiary objections, some of which the Court ruled on during the trial. (E.g., Docket Nos. 1378, 1494, 1497, 1507, 1571, 1627, 1635, 1638.) Where evidence is cited, the Court overrules all objections. With regard to the balance of the objections, the Court does not rely on those matters and the objections are moot.

Between October 2012 and late 2014, Ericsson filed at least 11 lawsuits against TCL and/or its affiliates in 6 different jurisdictions— France, the U.K., Brazil, Russia, Argentina, and Germany. (Docket No. 279-1, pp. 6-9; Brismark Decl. ¶ 78; Guo Rebuttal Decl. ¶ 59.)

TCL continued to negotiate with Ericsson. In 2013, the parties began negotiating a license covering Ericsson's 4G patents. (Ex. 102 at 19-20.) That year TCL started selling 4G phones, and Ericsson offered 4G rates to TCL for the first time. (Id.; Ex. 142.) But there was no offer or counteroffer exchanged that TCL considered to be on FRAND terms. (TT Feb. 15, 2017, pp. 17:7-19:9.)

The rates Ericsson offered evolved over the course of the parties' negotiations. For example, Ericsson's first 4G offer on March 25, 2013 was a running royalty rate of 3% for 4G handsets and tablets, with a $3 floor and $8 cap (on top of a $10 million release payment). (Ex. 102 at 19-20.) Less than two months later, Ericsson reduced the cap for 4G devices to $7. (Id. at 21-23.) About a month after that, Ericsson dropped the floor to $2.50 per 4G device. (Id. at 24-25.) After TCL filed this lawsuit, Ericsson made another offer on April 23, 2014, reducing the 4G rate to 2% and eliminating the floor and cap for any sales exceeding $3 billion U.S. (plus lump sum payments of $30 million per year for 5 years and a release payment). (Id. at 27-29; Docket No. 138, Ex. A at 9-10, ¶ 7.1.) On February 11, 2015, Ericsson made another offer, reducing the 4G rate to 1.5%, with a $2 floor and a $4.50 cap (plus a release payment but no lump sum payments). (Ex. 102 at 29; Docket No. 138, Ex. B, pp. 8-9, ¶ 6.1.)

Ericsson's 3G offers show a similar drop during the negotiations. Ericsson's first offer on July 25, 2011 was a 2% running royalty rate with a $2 floor and $6 cap. (Ex. 102 at 14-15.) By the time Ericsson proposed Option B on February 11, 2015, Ericsson had reduced the running royalty rate to 1.2% with no floor or cap. (Docket No. 138, Ex. B, p. 8, ¶ 6.1.)

At a meeting in February 2014, Ericsson made the license offer to TCL that would later form the basis for Option A. (Brismark Decl. ¶79; TT Feb. 14, 2017, p. 169:13-18.) TCL's George Guo followed up with an email stating that "[w]e just had an internal discussion on your proposal, it looks promising. We will form a team quickly to start the detail negotiation." (Ex. 137 at 2; TT Feb. 14, 2017, pp. 169:19-170:8.) However, TCL filed this lawsuit before the process could proceed

further. (TT Feb. 14, 2017, p. 170:9-15.)

At that time, the parties had already engaged in more than six years of negotiations: Ericsson had made over a dozen offers to TCL and multiple concessions in the process. (Brismark Decl. ¶¶ 78, 82; see also Exs. 1471, 1477, 1481, 1483, 1485, 1487, 1491, 1494, 1497.) In addition, when the parties' negotiations failed, TCL and Ericsson agreed to engage in a binding court adjudication of terms for a worldwide portfolio license. (Guo Rebuttal Decl. ¶ 60; Brismark Decl. ¶¶ 76-82.)

B. The Filing of This Lawsuit and Subsequent Anti-Suit Injunction.

In March 2014, the 2G licenses between TCL and Ericsson were set to expire. (Exs. 64, 65.) On March 5, 2014, TCL initiated this action. (SACV 14-341,[7] Docket Nos. 1, 31; Guo Rebuttal Decl. ¶ 60.) Among other things, TCL sought a declaration that Ericsson had failed to offer FRAND terms and conditions, as well as a determination of the FRAND rates to which TCL is entitled. (Docket No. 31, p. 41, ¶¶ A, D, G.) Ericsson asserted counterclaims. (Docket No. 59.)

On June 3, 2014, Ericsson filed what was essentially a mirror-image action against TCL in the Eastern District of Texas. (C.D. Cal., Case No. 2:15-cv-02370-JVS-DFM (as transferred), Docket No. 1.) In that case, Ericsson sought a declaration that it had complied with its FRAND obligation. (Id. ¶¶ 53-59.) In the alternative, Ericsson asked the Court to "declare what steps would be required to achieve such compliance." (Id. p. 18, ¶ G.) Ericsson also sought a "compulsory forward royalty" in lieu of an injunction. (Id. ¶ I.) TCL asserted counter-claims. (Id., Docket No. 22, pp. 12-54.) On April 2, 2015, the Texas action was transferred to this Court. (Id., Docket No. 104.) On June 29, 2015, the transferred action was consolidated with TCL's lawsuit. (Docket No. 279-1, p. 16.)

On May 7, 2015, TCL filed a motion to enjoin Ericsson "from further prosecuting any actions alleging infringement of its 2G, 3G, and 4G patents until the FRAND issues are resolved here." (Docket No. 195, pp. 12-13.) On June 29, 2015, the Court granted TCL's motion and enjoined the foreign litigation.

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[7]Unless otherwise noted, docket number reference as to Case No. SACV 14-341 JVS DFM.

(Docket No. 279-1, pp. 5-11.) In the Court's view, a stay of the foreign litigation would allow the parties to concentrate on the overriding FRAND issues. Moreover, during the course of this litigation, TCL agreed to be bound by the Court's determination of FRAND terms and conditions for a worldwide portfolio license, including a release payment for TCL's past unlicensed sales. This effectively mooted Ericsson's pending patent infringement claims against TCL in this Court and other courts around the world.

C. Ericsson's FRAND Contentions.

On February 24, 2015, the Court ordered Ericsson to file its "FRAND contentions," i.e., what Ericsson contended would constitute FRAND terms for a license to its SEPs. (Docket No. 120.) Ericsson's FRAND contentions contained two offers: "Option A" and "Option B." (Docket No. 138, 205 (as amended in March and May 2015).) Options A and B are based on Ericsson's April 23, 2014 and February 11, 2015 offers, respectively. (Brismark Decl. ¶ 84.)

Both Options A and B, if accepted, would grant TCL a forward license to Ericsson's 2G, 3G, and 4G SEP portfolios, with coverage for TCL's global sales of 2G, 3G, and 4G standard-compliant end user terminals,[8] external modems, and personal computers (as those product categories are defined in the offers). (Exs. 458, 459.) Both offers specify a release payment intended to compensate Ericsson for TCL's unlicensed use of Ericsson's SEPs in the past. (Exs. 458, 459.)

Under Option A, for mobile phones, TCL would make an annual payment of $30 million for its first $3 billion in sales, with percentage running royalties for additional sales. (Brismark Decl. ¶¶ 89, 90.) The running royalty rates are 0.8% of the net selling price for phones with 2G GSM/GPRS, 1.1% for phones with 2G EDGE, 1.5% for 3G devices, and 2.0% for 4G devices, with a 50% discount for sales in China. (Brismark Decl. ¶¶ 89, 90.) For the first $3 billion in sales, TCL would pay an effective percentage rate of 1.0%. However, lower or higher sales volumes would produce a higher effective rate.

[8]End user terminals are defined in Options A and B to include handsets (feature phones and smartphones) and tablets. (Ex. 458 at 2; Ex. 459 at 2.) In this Order, the Court uses the terms "end user terminal," "handset," "cell phone," and "device" interchangeably.

Option A also includes running royalty rates for external modems and personal computers. For external modems, the non-China per-unit rates are 1.5% of the net selling price for 2G or 3G with a $0.40 floor, $3 for 4G if the net selling price is $60 or more, and $1 for 4G if the net selling price is under $60 (the China rates are half as much). (Brismark Decl. ¶ 89.) For personal computers, the non-China per-unit rates are $0.50 for 2G GPRS, $0.75 for 2G EDGE, $2.25 for 3G single mode, $2.75 for 3G multi-mode, and $3.5 for 4G (the China rates are half as much). (Id.)

Under Option B, for mobile phones, TCL would pay percentage running royalty rates as follows: 0.8% of the net selling price for 2G GSM/GPRS, 1.0% for 2G EDGE, 1.2% for 3G, and 1.5% for 4G with a $2.00 floor and a $4.50 cap. (Brismark Decl. ¶ 96.) For external modems, TCL would pay $0.75 per unit for 2G or 3G, and 1.5% of the net selling price for 4G with a $2.00 floor. (Id.) For personal computers, the rates are the same as the non-China rates in Option A. (Id.)

Ericsson's Option A and Option B offers also contained a variety of other license terms. TCL subsequently agreed that certain terms—those regarding Non-Exclusivity, Licensed TCL Products, and the License Period—were undisputed and could be adopted into a final judgment. (Docket No. 935- 2, pp. 15-16.) The Court later adopted these concessions. (Docket No. 1055, p. 9.)

On March 22, 2016, well into this litigation, Ericsson offered TCL a license based on a pure dollar-per-unit rate structure. (Exs. 213-14; TT March 1, 2017, (Sealed Vol. 1) p. 18:13-23.) This was the first time in the lengthy negotiations that Ericsson had offered a per unit royalty. Ericsson later filed a motion to supplement its FRAND contentions with its March 22, 2016 offer as "Option C." (Docket No. 694.) The Court denied Ericsson's motion because Ericsson had not been not diligent and the late change would prejudice TCL. (Docket No. 760, pp. 5, 6.)

D. The Trial.

Following the Court's ruling that TCL failed to provide evidence of damages because of its discovery defaults, the Court ruled that TCL's remaining claims were equitable and the trial would be before the Court. (Docket No. 1448-1

at 2.) The Court held a 10-day bench trial starting on February 14, 2017. Following the Court's standard procedure for bench trials, the parties submitted their direct examinations as by declarations. The Court heard live testimony from twenty-four witnesses and received additional written direct testimony from three experts in foreign law. Closing arguments occurred on May 18, 2017. Prior to closing arguments the parties prepared proposed Findings of Fact ("FOF") and Conclusions of Law ("COL") which the Court cites to for each party's contentions. (Docket No. 1650 (Ericsson's proposed FOF and COL); Docket No. 1651 (TCL's proposed FOF and COL).)

II. ETSI and the FRAND Obligation.

ETSI is a not-for-profit association under French law. (Fauvarque-Cosson Decl. ¶¶ 14, 18; Stoffel-Munck Rebuttal Decl. ¶ 11.) The parties do not dispute that this case is governed by the ETSI Directives, and that the ETSI Directives are governed by the laws of France. (Fauvarque-Cosson Decl. ¶¶ 14, 18; Stoffel-Munck Rebuttal Decl. ¶ 11; ETSI IPR Policy § 6, Ex. 223 at 6[9].) Similarly, ETSI's Intellectual Property Rights ("IPR") licensing declarations state that "[t]he construction, validity and performance of this IPR information statement and licensing declaration shall be governed by the laws of France." (ETSI IPR Policy Annex A, Ex. 223 at 9.) Thus, the FRAND commitment must be interpreted, and its performance evaluated, pursuant to French law. Fauvarque-Cosson Decl. ¶18; Apple, Inc. v. Motorola Mobility, Inc., 886 F. Supp. 2d 1061, 1081-1082 (W.D. Wis. 2012).

ETSI's acceptance of a patent holder's patent as an SEP forms a contract which includes the patent holder's obligation to license. Under French law, TCL is entitled to enforce this contract through the doctrine of *stipulation pour autrui,* or stipulation on behalf of a third party. (Fauvarque-Cosson, ¶¶19-22.) The doctrine is akin to the concept of a third-party beneficiary at common law. ETSI is the promisee, the owner of a SEP who submits the IPR licensing declaration is the promisor, and the third-party beneficiaries are prospective licensees who benefit from the stipulation. Id.; Apple, Inc., 886 F. Supp. 2d at 1085.

Under French law, a contract must be interpreted unless its terms are "clear

[9]For the ease of readers, when the Court cites to the ETSI IPR Policy or ETSI Guide on IPRs it will cite to both the documents' internal section numbering and the trial exhibit number.

and precise." (Stoffel-Munck Rebuttal Decl. ¶ 12.) Although many contract interpretation rules exist, none are mandatory. (Id.) The main objective is to determine the common intent of the parties. (Id. ¶ 13.) If that cannot be discovered, the inquiry focuses on the understanding of a reasonable person. (Id.) It is common to use extrinsic materials, including negotiation documents, in following these rules. (Id. ¶ 12.) Contracts should also be interpreted such that they are internally consistent, and in a manner that complies with the law. (Id. ¶¶ 20, 21.)

For this case, the two relevant parts of the ETSI Directives are the ETSI IPR Policy (Ex. 223) and the ETSI Guide on IPRs (Ex. 224). The actual form signed by each SEP-holder is ETSI's IPR Licensing Declaration Form, which is part of the ETSI IPR Policy. (ETSI IPR Policy, Annex A, Ex. 223 at 9-10.) The FRAND commitment is found at § 6.1 of the ETSI IPR Policy and states:

> When an ESSENTIAL IPR relating to a particular STANDARD or TECHNICAL SPECIFICATION is brought to the attention of ETSI, the Director-General of ETSI shall immediately request the owner to give within three months an irrevocable undertaking in writing that it is prepared to grant irrevocable licences on fair, reasonable and non-discriminatory ("FRAND") terms and conditions under such IPR to at least the following extent:
>
> - MANUFACTURE, including the right to make or have made customized components and sub-systems to the licensee's own design for use in MANUFACTURE;
> - sell, lease, or otherwise dispose of EQUIPMENT so MANUFACTURED;
> - repair, use, or operate EQUIPMENT; and
> - use METHODS.
>
> The above undertaking may be made subject to the condition that those who seek licences agree to reciprocate.

(ETSI IPR Policy § 6.1, Ex. 223 at 1-2 (emphasis added).) The capitalized terms are all defined in the ETSI IPR Policy's Definitions section. (Id. § 15, Ex. 223 at 6-8.) The Court will discuss ETSI's definition of essential below.

ETSI's definition of IPR is "any intellectual property right conferred by statute law including applications therefor other than trademarks. For the avoidance of doubt rights relating to get-up, confidential information, trade secrets or the like are excluded from the definition of IPR." (ETSI IPR Policy § 15.7, Ex. 223 at 7.) As is clear from this definition, ETSI does not grant rights to IPR, and the FRAND obligation is not a supra-national patent. Instead, the FRAND undertaking is to be expressly interpreted as an encumbrance on the IPR, where applicable under the laws of the jurisdiction. (Id. § 6.1bis, Ex. 223 at 2.)

A. The Mechanics of ETSI.

Under ETSI's IPR Policy, patent owners must disclose a patent which is or may become, essential to a standard. (Bekkers Decl. ¶ 37.) When ETSI becomes aware of a patent that is, or may become, essential to a standard, it asks the owner to declare that it is "prepared to grant irrevocable licences on fair, reasonable and non-discriminatory ('FRAND') terms and conditions . . . ."[10] (Id. ¶ 38, quoting ETSI IPR Policy § 6.1, Ex. 223 at 1-2.) If a patent owner refuses to commit to license on FRAND terms and conditions, ETSI will attempt to design around the patent, and if that is impossible, then work will cease. (Bekkers Decl. ¶¶ 39-40, citing ETSI IPR Policy §§ 8.1.1, 8.1.2, Ex. 223 at 3.) According to ETSI, "in the absence of an agreement between the parties involved, the national courts of law have the sole authority to resolve IPR disputes." (Bekkers Decl. ¶ 41, quoting ETSI Guide on IPRs § 4.3, Ex. 224 at 15.)

In formulating its IPR Policy ETSI was concerned, among other things, with addressing the problem of "hold up." (Bekkers Decl. ¶¶ 31, 46-50; Kennedy Rebuttal Decl. ¶ 259.) Hold up occurs when a patent holder seeks to extract more for the use of his patent than the value which his patent adds to a standard. ETSI's precursor noted an IPR policy was necessary because "a standard may bestow a

[10]ETSI's process does not assess whether declared patents actually are essential. This leads to a substantial over-declaration of patents. As discussed below in Part 2, Section IV.B.2, this is an issue where an SEP holder's share of an aggregate royalty is based in whole or in part on patent counting.

'windfall' monopoly position for an individual supplier." (Bekkers Decl. ¶ 31, quoting Ex. 1069 at 1.) Similarly, in 1993 the ETSI Chairman of Technical Assembly explained that an IPR Policy was needed because of the investment lock-in created by a standard. If a firm takes a license and incorporates that technology in its product, it cannot easily take an alternative path in developing and marketing its product. This lock-in "tilts the negotiating balance in favour of the IPR owner," such that "the term 'fair and reasonable' for royalty becomes whatever anyone cares to demand," increasing the risk that "[s]mall enterprises get pushed out of the market." (Bekkers Decl. ¶ 52, quoting Ex. 1027 at 3.)

ETSI was also concerned with price discrimination among potential licensees. (Bekkers Decl. ¶¶ 46-50, 57-60; Bekkers Rebuttal Decl. ¶¶ 20-28; TT, 2/16/17, pp. 24:24-32:5.) For example, ETSI's predecessor noted that absent uniform IPR commitments, "there will be a serious risk of distortion of market forces against [small and medium-sized enterprises] and in favour of large multinationals." (Bekkers Decl. ¶ 47, quoting Ex. 1584 at 14.)

The ETSI IPR Policy forbids discrimination based on nationality or ETSI membership, but the policy is not so limited. (Bekkers Rebuttal Decl. ¶ 21; ETSI IPR Policy § 6.1, Ex. 223 at 1.) ETSI organic documents specifically note the concern with protecting small and medium-sized enterprises. (Ex. 1584 at 14; Ex. 5289 at 4, 6.) They also demonstrate that ETSI sought to extend the same protections against discriminatory terms and conditions for ETSI members to non-members. (Ex. 5289 at 5.)

Yet the precise contours of the FRAND obligation were never crystalized in a definitive formulation. Over time, there have been several efforts within ETSI to further define the meaning and application of the FRAND obligation. (Bekkers Rebuttal Decl. ¶¶ 7-12; Ex. 238 at 8-9, 19-22, 67; Ex. 239 at 2-6; Ex. 240 at 1-2; Ex. 241 at 2; Ex. 242 at 2-4.) During these efforts, two camps emerged among ETSI's members: They disagreed on whether to further define FRAND in the ETSI IPR Policy, and if so, how. (Bekkers Rebuttal Decl. ¶¶ 7-12; see also Ex. 240 at 2.)

The first camp has sought a more specific policy that would provide information that implementers of the standards believe would prove useful by removing ambiguities (e.g., by defining specific practices as non-FRAND, and

identifying a common royalty base). (Bekkers Rebuttal Decl. ¶ 10.) The second camp sought to preserve the policy's status quo, such that aggrieved implementers (or patent owners) can go to the courts or submit to arbitration in order to resolve IPR disputes. (Id. ¶ 11.) This camp took the view that there is "no sense in such attempts [to define exemplary non-FRAND practices] as each case is different and the decision on FRAND conditions is, finally, a matter for the courts of law." (Id. quoting Ex. 238 at 9.) Ultimately, the efforts within ETSI to further define FRAND were unsuccessful because the two competing camps could not find sufficient common ground to pass any reforms. (Bekkers Rebuttal Decl. ¶ 12.)

The inconclusive history of ETSI's development of FRAND presents the Court with difficulties in applying the concept. ETSI's IPR Special Committee has explained that "[t]he absence of an agreement on a more detailed definition of FRAND or on compensation elements under the FRAND commitment does not imply their inexistence." (Ex. 4622 at 6 (October 2012 report).) Early ETSI documents also show that ETSI did not want to "tilt[] the negotiating balance in favour of the IPR owner" by defining FRAND so broadly as to mean "whatever anyone cares to demand." (Ex. 1027 at 3.) The lack of consensus within ETSI about further defining the FRAND obligation has left the resolution of FRAND-related disputes to the national courts. (Bekkers Rebuttal Decl. ¶ 18; see also Ex. 241 at 2.)

There is at least some guidance in ETSI's consideration and ultimate rejection of the "most favored nations (or here licensee) concept." The 1993 version of ETSI's IPR Policy contained a "most-favored licensee" provision. (Ex. 1583 at 46.) This provision concerned the re-opening and re-negotiation of existing licenses that would require a licensor to:

> promptly notify a licensee of any licence granted by it to a third party for the same IPRs under comparable circumstances giving rise to terms and conditions that are clearly more favourable, in their entirety, than those granted to the licensee and allowing the licensee to require replacement of the terms and conditions of its licence, in their entirety, either with those of the third party licence, or with such other terms and conditions as the parties may agree."

(Id.)

ETSI's members ultimately approved an ETSI IPR Policy that did not require such re-opening and re-negotiation of prior licenses. (Bekkers Decl. ¶¶ 59- 60.) In particular, the 1994 version of the IPR Policy did not include the "most-favored licensee" provision quoted above. (Id.) However, the obligation of the patent owner to license its patents on non- discriminatory terms and conditions remained essentially unchanged between the 1993 and 1994 versions of the ETSI IPR policy, and continues in effect today. (Bekkers Decl. ¶¶ 56, 60; TT, Feb. 16, 2017, pp. 22:22-24:23.)

Neither the history of ETSI's policy development nor the meager case law development of the FRAND concept provides the Court definitive guidance in assessing whether Ericsson's offers have been non-discriminatory. As TCL suggests, the Court must turn to law, logic, and economics. (TCL FOF,¶ 81.)

PART 2: TCL'S TOP DOWN ANALYSIS

Before turning to the royalty setting analyses advanced by the parties' experts, the Court makes one central observation as the fact finder in this case. The search for precision and absolute certainty is a doomed undertaking. See Apple Inc. v. Motorola, Inc., 757 F.3d 1286, 1315 (Fed. Cir. 2014). The complexity of the analyses and the number of variable components inevitably lead to criticism. Indeed, there are facial limitations in the analyses themselves.[11] The Court's effort has been to determine whether each expert's work has a reasonable level reliability and convincing force that allows the Court to make a judgment whether to accept the ultimate conclusions advanced.

To establish the appropriate FRAND rate in this case, TCL advances a so-called "top down" approach. A top down model aims to value a portfolio of SEPs by determining a fair and reasonable total aggregate royalty for all patents that are essential to a standard. It then apportions that royalty to the SEP owners based on the relative value of their portfolio against the value of all patents essential to the standard. (Leonard Decl. ¶ 40.) In simplest terms, TCL's top down approach computes a fraction of the aggregate royalty where the numerator is the value of the SEPs owned by Ericsson for that standard, and the denominator is the total

[11]For example, Dr. Leonard only used United States patents in his survey of SEPs. And Dr. Kakaes looked only to English language patents in his work.

value of all SEPs in that standard.

The appeal of a top down approach is that it prevents royalty stacking. Stacking occurs when each individual SEP holder demands a royalty which when totaled exceeds the value of all the SEPs in a standard. Because the top down methods starts with the maximum aggregate royalty burden and works down to a fair and reasonable rate, it avoid the possibility that licensees will be force to pay an unreasonable amount in total. If the total aggregate royalty is properly based upon the total value of the patents in the standard, it can also prevent hold-up because it prevents SEP owners from charging a premium for the value added by standardization.

The top down approach used by TCL directly examined the essentiality, importance, and contribution of Ericsson's patents for each standard and provided a method to account for the value of expired and acquired patents, as well as regional differences in Ericsson's patent portfolio. A top down method, however, cannot address discrimination as the Court interprets the term, and is not necessarily a substitute for a market-based approach that considers comparable licenses.

Significantly, Ericsson did not present its own top down model.

I. Summary of TCL's Top Down Approach.

TCL presented its top down analysis in nine steps.

Step 1: Dr. Gregory K. Leonard selected a maximum aggregate royalty of 6% of the price of a 4G handset, and 5% of the price for a 2G/3G handset. (Leonard Decl. ¶ 73.)

Step 2: Dr. Zhi Ding, Dr. Apostolos Kakaes, and teams at Concur IP and Ernst & Young India determined the total number of SEPs for each standard as of September 15, 2015. (Kakaes Decl. ¶ 31.) This became the denominator for calculating Ericsson's proportional share of each standard. The remainder of the analysis focused on determining the appropriate numerator and modifiers to apply.

Step 3: Dr. Kakaes and Dr. Nikil Jayant ranked all of Ericsson's 192 claim

charted patent families on a scale of 1-3 for essentiality.

Step 4: Dr. Kakaes and Dr. Jayant then evaluated the importance and contribution of each patent family they found essential.

Step 5: Dr. Leonard then applied certain adjustments to arrive at royalty rates. He adjusted the numerator based on the importance and contribution rankings from Dr. Kakaes and Dr. Jayant to reflect the relatively low value of Ericsson's patents.

Step 6: Dr. Leonard then confirmed his view on the value of Ericsson's patents with a forward-citation analysis, which attempts to determine the value of U.S. patents based on the frequency with which they are cited in later patent applications. (Leonard Decl. ¶¶ 109–117.)

Step 7: Dr. Leonard then adjusted for changes in Ericsson's portfolio due to acquisitions and expirations. (Id. ¶¶ 120–131.)

Step 8: Dr. Leonard then accounted for Ericsson's weaker patent portfolio in some countries, by determining its patent portfolio strength in each region relative to Ericsson's strongest patent portfolio, which is for the United States. (Id. ¶¶ 132–134.)

Step 9: Dr. Leonard then used TCL's sales data to weight the royalty by region and blended the regional royalties together to create a single global royalty rate for each standard. (Id. ¶¶ 67, 139, 142.) He determined that a fair and reasonable royalty for Ericsson's 4G SEPs was .16%, and for 2G/3G was .21%. (Id. ¶ 11, Table 1.)

II. Summary of Court's Conclusions

As explained below, the Court rejects TCL's analysis presented in steps 4-6, and 9 on factual and/or legal grounds. This ultimately meant that the Court did not accept Dr. Leonard's final results. However, the Court uses the data it did accept to construct a number of rates based on different assumptions and approaches. The Court adopts a simple patent counting system which treats every patent as possessing identical value, and then applies the numbers that it found reliable from

the analyses provided by TCL's experts. The formula for Ericsson's royalty rate is its proportional share of the total aggregate royalty. This can be expressed as:

$$\begin{aligned} &\textit{Total Aggregate Royalty} \\ &\quad \times \textit{Ericsson's Proportional Share of the Total Aggregate Royalty} \\ &\quad = \textit{Ericsson's Royalty Rate} \end{aligned}$$

Ericsson's proportional share can be further broken down as:

$$\textit{Proportional Share} = \frac{\textit{Number of unexpired SEPs owned by Licensor}}{\textit{Total Number of SEPs in the Standard}}$$

Throughout this section, the Court refers to the number of unexpired SEPs owned by Ericsson as the numerator, and the total number of SEPs as the denominator. As explained below, because Ericsson's SEP portfolio is weaker in some countries than others, the Court also had to apply a regional strength ratio. The full top down formula used by the Court can be expressed as:

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

III. Summary of Experts and their Qualifications

TCL's top down approach primarily relies on the testimony of three experts, Dr. Kakaes, Dr. Ding, and Dr. Leonard.

Dr. Kakaes is a consultant at Cosmos Communications Consulting Corporation. (Kakaes Decl. ¶ 1.) He holds a B.S. and M.S. in Applied Mathematics and Electrical Engineering from the University of Colorado. (Id.) In 1988, he was awarded a Ph.D. in Electrical Engineering from the Polytechnic Institute of New York. (Id.) From 1987 to 1994, he worked in the Department of Electrical Engineering at George Washington University, Washington D.C., where he developed and taught George Washington University's first course on mobile communications (Id. ¶ 2.) As part of his consulting work, he provides advice on telecommunications patents, their features, and their technical development. (Id.)

He has also served as an expert witness in a number of cases involving SEPs. (Id. ¶ 4.)

Dr. Ding has been a Professor in the Department of Electrical and Computer Engineering at the University of California, Davis, since July 2000. (Ding Decl. ¶ 1.) He holds a Ph.D. in Electrical Engineering from Cornell University, and a Masters of Applied Science from the University of Toronto. (Id. ¶ 2.) He has published over 160 peer-review research articles on communications and signals, as well as an introductory textbook to communications systems. (Id.) Since 2007, he has engaged in extensive work as an expert in litigation involving cellular and Wi-Fi SEPs. (Id. ¶ 10.)

Dr. Leonard is an economist and partner at Edgeworth Economics. (Leonard Decl. ¶ 2.) He received his bachelors degree in Applied Mathematics-Economics from Brown University, and a Ph.D. in Economics from the Massachusetts Institute of Technology. (Id.) He currently serves as a senior editor of the Antitrust Law Journal. (Id. ¶ 4.) He has published over sixty papers in scholarly and professional journals, many of them addressing econometrics, intellectual property, and FRAND royalty rates. (Id. ¶ 3.) He has also served as an expert witness in a substantial number of cases over the past for years. (Id. ¶ 6.)

Even though the Court did not accept each expert's opinions in their entirety, the Court found the experts well qualified in their fields of endeavor.

IV. The Components of TCL's Top Down Analysis.

The Court reviews TCL's steps in more detail, including Ericsson's criticisms.

A. Setting the Total Aggregate Royalty Burden.

Ericsson has long argued that a fair and reasonable royalty rate for a SEP license can be determined using a top down approach, or what the Court calls a simple patent counting system. This is significant apart from the specific aggregate burdens Ericsson has advanced. In 2008 for example, Ericsson stated on its website that its licenses complied with the "prevalent industry interpretation

of FRAND, i.e. the basis is a reasonable maximum aggregate royalty rate to which each patent holder is entitled a proportion according to its relative share of all standard essential IPR." (Ex. 1152 at 1.) Ericsson has repeatedly affirmed its policy of calculating rates based off of a total aggregate royalty burden in its interrogatory responses, depositions, and during trial. (E.g., Ex. 131 at 26, 34; TT, Feb. 28, 2017, p. 14:1-19; Brismark Depo., Dec. 18, 2015, pp. 65:9-21.)

Historically, Ericsson has advanced specific targets for an appropriate total aggregate royalty burden. TCL has not advanced a methodology to independently determine a fair and reasonable total aggregate royalty. Instead, TCL pegs the total aggregate royalty to statements made by Ericsson and other SEP owners before each standard was adopted. These statements are important because (1) they were made prior to, or around, the time the respective standards were being set, such that they reflect the *ex ante* expectations of what a reasonable aggregate royalty burden should be before the standard was adopted and manufacturers are locked-in; and (2) they were made at a time when Ericsson was both a licensor and licensee with respect to SEPs that read on handsets, and thus Ericson had an incentive to strike a reasonable balance. (Leonard Decl. ¶¶ 77, 78.) These statements were thus intended to provide insight and incentives to encourage other companies to invest in the standard. (Brismark Rebuttal Decl. ¶ 12.)

Ericsson contends that any method for determining a FRAND rate that starts with the total aggregate royalty should be excluded because it does not account for subsequent releases of the standard that include additional valuable features. (Ericsson FOF, ¶ 258.) The only feature added to any standard after Ericsson's initial estimates of an appropriate total aggregate royalty is carrier aggregation for 4G. (Id.) However, Ericsson knew that 4G would continue to advance just as every standard before it continued to advance. Carrier aggregation itself was a part of 3G, and given its participation in 3GPP Ericsson certainly should have anticipated that carrier aggregation, along with other valuable features, would be added to 4G. (Kakaes Decl. ¶ 389 (describing 4G carrier aggregation as "a simple extension of well-known techniques, plus a bit of common sense.").) Adding features to a standard does not undermine TCL's reliance on statements Ericsson made to induce the market to adopt Ericsson's preferred standards. The Court does not believe that Ericsson's shift from advocating a top down approach to preferring a comparable license analysis was caused by or at all related to subsequent additions to the standard. The Court would have certainly considered

applying a higher total aggregate royalty than the one initially announced by Ericsson if Ericsson had provided evidence that showed the value of subsequent additions to each standard. However, without any such evidence the Court cannot simply assume that additions to the 3G or 4G standards make Ericsson's own top down methodology unreliable. Finally, Ericsson has patents for later additions to each standard which are included in the numerator of a top down calculation. Thus, Ericsson does receive credit in its proportional share for later additions to the each standard.

The Court now discusses the press releases where Ericsson and other companies publicly announced total aggregate royalty rates for each standard.

1. 2G/3G.

Beginning in at least 2002, Ericsson endorsed the concept of an aggregate maximum royalty. In a joint press release with other companies in the industry, Ericsson told the market:

> Industry leaders NTT DoCoMo, Ericsson, Nokia and Siemens today reached a mutual understanding to introduce licensing arrangements whereby essential patents for W-CDMA are licensed at rates that are proportional to the number of essential patents owned by each company. The intention is to set a benchmark for all patent holders of the W-CDMA technology to achieve fair and reasonable royalty rates.
>
> The companies together own the clear majority of the essential Intellectual Property Rights (IPR) relevant to the W-CDMA standard selected already by about 110 operators worldwide. This arrangement would enable the cumulative royalty rate for W-CDMA to be at a modest single digit level.

(Ex. 333 at 1; emphasis added.) In the same press release, Nokia endorsed a 5% figure and NTT DoCoMo advocated for "keeping cumulative royalty rate below 5%." (Ex. 333 at 2.) Equally important is the fact that these companies advocated a licensing system based on a proportional number of SEPs owned by each company which treated each patent equally. In other words, none of the

adjustments made by Dr. Leonard were reflected in the industry pronouncements at the time.

Ericsson did not dispute the press release or its intentions, but instead sought to put it in context. (Brismark Rebuttal Decl. ¶¶ 15–16.) In 2001, NTT DoCoMo introduced the first 3G handset, which retailed for $560, or $800 with a video camera, and in 2003 Ericsson (through its joint venture with Sony) released its first 3G phone which was priced at $835. (Ex. 5397; Brismark Rebuttal Decl. ¶ 16.) Ericsson executive Lars Gustav Brismark stated that "These are the 3G mobile phone prices that we had in mind when we made the public statements found in the 2002 press release . . . ." (Brismark Rebuttal Decl. ¶ 16.) A 5% total aggregate royalty applied to phone prices of $560, $800, and $835 would provide a royalty of roughly $28, $40, and $42, respectively. It is not clear whether Brismark had the foundation for these observations, given that he was on the engineering side of the business and was a project manager for W-CDMA radio access networks at the time. (Brismark Decl. ¶ 5.) Regardless, the Court is unconvinced by his attempt disavow Ericsson's commitment to calculate royalties based on a proportional share of a total aggregate royalty capped at a modest single digit. These statements were about the overall rate for the industry, and Ericsson has provided no evidence that shows they were conditional on specific returns for itself. More telling is the fact that three of the documents Ericsson annexed to its 2014 sale of SEPs to Interdigital were: the ETSI IPR Policy, its 2002 press release, and the 2008 press release discussed below. (Ex. 1150 at 128, 135, 136.) Ericsson has not produced any evidence that shows that these public statements were conditioned on a particular set of prices or return to Ericsson.

The Court finds that on this record 5% is an appropriate number to use for the total aggregate royalty for 2G[12] and 3G. While outside groups not a part of this press release may have expected higher rates, Ericsson advocated and expected a rate close to 5%. Ericsson may feel that such a rate for its 3G SEPs would undercompensate it now, but it has not shown that its desire for a higher rate today

[12]TCL creates a blended 2G/3G rate, which necessarily means that its 2G-only devices would be subject to the same 5% total aggregate royalty, although it provides no similar statements from Ericsson regarding 2G. However, Ericsson does not dispute that if 5% is an appropriate total aggregate royalty figure for 3G, it is also an appropriate total aggregate royalty for 2G. The Court therefore accepts that 5% is appropriate total aggregate royalty for both standards.

is fair, reasonable, or sufficient to ignore the commitment it made that successfully induced manufacturers to adopt the 3G W-CDMA standard.

2. 4G/LTE.

In April 2008, Ericsson again stated its commitment to a total aggregate royalty approach. In a posting on its website, Ericsson advised:

> . . . Ericsson expects to hold a relative patent strength of 20-25% of all standard essential [4G] IPR. Ericsson believes the market will drive all players to act in accordance with these principles and to a reasonable maximum aggregate royalty level of 6-8% for handsets. Ericsson's fair royalty rate for LTE is therefore expected to be around 1.5% for handsets.

(Ex. 1152 at 1.) Ericsson also issued a joint press release with Alcatel-Lucent, NEC, NextWave Wireless, Nokia, Nokia Siemens Networks, and Sony Ericsson that announced:

> Specifically, the companies support that a reasonable maximum aggregate royalty level for LTE essential IPR in handsets is a single-digit percentage of the sales price. . . . The parties believe the market will drive the LTE licensing regime to be in accordance with these principles and aggregate royalty levels.
>
> This framework balances the prevailing business conditions relevant for the successful widespread adoption of the LTE standard, which continues its progress toward definitive adoption by the industry in the applicable standards forums and organizations.

(Ex. 1146 at 1.) The press release also invited "all interested parties to join this initiative which is intended to stimulate early adoption of mobile broadband technology across the communications and consumer electronic industries." (Id.) Brismark confirmed at his deposition and at trial that Ericsson had repeated its commitment to a "single-digit aggregate royalty burden for LTE" during its 2015 arbitration with Huawei. (TT Feb. 28, 2017, pp. 24:22-25:9; Brismark Depo. Dec. 18, 2015, p. 66:4-18.) Ericsson also confirmed its commitment to a single-digit

royalty for LTE in its interrogatory responses to TCL in this case. (Ex. 131, p. 26:8-10 ("Ericsson's position is that the total accumulated royalties for 4G standard essential patents should be in the single digits, and Ericsson has been consistent in this position over time.").

Ericsson admits making these statements, but argued that: (1) they were intended to be a prediction or hope for where the market would eventually drive royalty rates, (2) these statements were made against the backdrop of much higher industry estimates of the total aggregate royalty burden, and (3) they were made in the context of higher average selling prices for 4G phones which Ericsson did not expect to drop so low. (Ericsson FOF, ¶¶ 246, 249.)

On the first point, the Court does not interpret Ericsson's statements merely as a prediction of the market. Ericsson is a major player in the telecommunications industry, and a joint press release with other major companies is fundamentally different than, for example, a prediction by an academic in a journal. The statements were current endorsements of a conceptual approach that sought to have LTE adopted as the 4G standard instead of two competing standards, UMB and WiMAX. (Brismark Decl. ¶¶ 38-39.) At the time of Ericsson's press release, WiMAX had a substantial head start because two U.S. carriers had already launched WiMAX networks, while LTE would not be commercially launched for another eighteen months. (Id. ¶ 41.) The joint press release was designed to entice manufacturers to invest in LTE over WiMAX and UMB by promising them that Ericsson and others would use this approach with these expected LTE royalty rates. Ericsson was willing to do this it was invested heavily in LTE, but had not invested at all in WiMAX or UMB.[13] (Id. ¶ 38; Ex. 4366 at 30.) If LTE were not adopted as the 4G standard, Ericsson's investments would have been wasted, and instead it would be forced to pay other companies in order to build its own infrastructure equipment. Ericsson was ultimately

[13]This reason also requires the Court to find that the announced rates are implicitly for multi-mode devices. A 4G multi-mode device, for example, can use 4G, 3G, or 2G networks. (Parkvall Decl. ¶ 22.) Backwards compatibility is especially important when a standard is first adopted so that carriers and consumers can continue using existing products and gradually transition to newer standards. If the rates Ericsson and others announced in their press release were for single-mode devices, it would undermine an important advantage of LTE over WiMAX, and would create obvious stacking issues if these companies actually expected to add the 4G total aggregate royalty to the 3G total aggregate royalty and multiple 2G total aggregate royalties. (Brismark Decl. ¶ 39.)

successful: Qualcomm announced in November 2008 that it was abandoning UMB, and by late 2011 WiMAX was being phased out. (Id. ¶ 40-41.) Now both standards are essentially obsolete. (Id. ¶ 41.) Ericsson's statements were thus not a hope or prediction, but a pledge to the market that if the market adopted Ericsson's championed standard, the total aggregate royalties would be calculated as described above. Brismark also clarified in response to a question from the Court that Ericsson believed the market would drive the royalty to 6-8% in particular, and that Ericsson thought, and still thinks, that a single digit percentage royalty is a reasonable royalty rate. (TT Feb. 28, 2017, p. 113:1-9.) This leaves the Court with the view that before the adoption of the 4G standard, Ericsson thought a total aggregate royalty for 4G would be as low as 6% (if not lower), but certainly not higher than 10%.

Ericsson also cites to various studies and papers that estimated a much higher 4G total aggregate royalty rate. The Court discounts these. These include three surveys by an industry consortium called Next Generation Mobile Networks Alliance that combined anonymous industry surveys to produce total royalties of 33%, 37.3%, and 28.8%, respectively. (Ex. 1172 at 7; Ex. 1173 at 8, Ex. 1155 at 6.) Ericsson also points out that the publicly declared rates in 2010 from just nine SEP owners totaled 14.8% of the handset selling price. (Ex. 1063 at 3.) However, these figures were volunteered by individual companies, virtually all of whom had yet to convince anyone to pay anything close to these rates because the first connection between an 4G device and a 4G network only occurred in October 2009. (Brismark Decl. ¶ 29.) The Court would actually expect that the rates companies publicly declared in 2008-2010 to be artificially high because each company knows that the figure it announces will naturally turn into the ceiling for what it can demand from future licensees. In addition, no one was checking whether the individual rates that companies announced were fair, reasonable, or based on anything other than a desire to maximize royalty revenue. (E.g., Ex. 1063 at 3.) Simply totaling individually announced rates plays into the trap of stacking, a vice which standardization seeks to avoid. The total aggregate royalty announced in the joint press release is more accurate and reasonable because those firms faced a countervailing pressure to keep the aggregate estimate low enough to encourage investment and adoption of LTE over the alternatives, they know that they will be asked to pay the same rates as licensees, and because if LTE was not adopted then their investments in it become obsolete.

Ericsson also suggested that its statements in 2008 cannot be used in this case because it did not anticipate the decline in the price of phones. (Ericsson FOF, ¶¶ 248-48.) Ericsson is correct that 4G phone prices have fallen since 2008, but Ericsson certainly expected that to happen. In 2008 the average price of a 3G smartphone was $430, and Ericsson anticipated that 4G phones would initially be priced at over $500. (Brismark Rebuttal Decl. ¶ 17.) This was initially true, and when 4G smartphones debuted in 2011-2012, the average retail price was $630. (Id.) Sony Ericsson's phone, the Sony Xperia V was priced around $750. (Id.) By 2015, however, nearly half of all smartphones sold for less than $150. (Kennedy Rebuttal Decl. ¶¶ 176, 178.) Ericsson's argument that in 2008 it did not anticipate phone prices would drop is not credible in the face of Brismark's own testimony that starting in 2005-2007 Ericsson had just seen the prices of low-end 3G phones drop more quickly than expected. (Compare Ericsson FF, ¶ 248 with TT Feb. 28, 2017, p. 81:7-22.) This drop in prices was even borne out by the prices of Ericsson's own phones. Ericsson's first 3G phone retailed for $835 in 2003, while its first 4G smartphone debuted nine years later already showed a decline in prices and cost $750. (Brismark Rebuttal Decl. ¶¶ 16–17.)

It is also unclear why the drop in the price of phones matters, because Ericsson's public statements were never conditioned on a particular dollar-per-unit return. If Ericsson had wanted that, it certainly could have proposed that, such an idea would not have been shocking to the industry because in that same press release in 2008 Ericsson announced a royalty in dollar per unit terms for notebook computers. (Ex. 1146 at 1.) Moreover, while Ericsson earned less royalty revenue because prices dropped, Ericsson also earned substantially more revenue as 4G technology became cheaper and spread around the world. IDC estimates that in 2008 global phone sales were $245 billion, while in 2015 global phone sales were $438 billion. (Ex. 1000.)

The Court therefore finds some merit in applying a top down approach starting with a total aggregate royalty. While this approach is not perfect, it has merit because: (1) it relies on statements that Ericsson and other SEP owners made to induce people to adopt and invest in each standard when the risk of hold-up was low; (2) these statements were made before the standard was adopted, providing the SEP owners with incentive to be reasonable with their overall expectations and greatly reducing the risk of hold-up and royalty stacking; (3) Ericsson was a licensor and licensee, giving it stronger incentive to be fair and reasonable with its

own estimate; (4) Ericsson still stands by this methodology, (TT Feb. 28, 2017, p. 113:1-9); and (5) it at least provides the ceiling for a FRAND rate, because increasing the royalty rate after the standard has been adopted, without showing that the increase is due to additions to the standard, is the definition of hold-up. Use of an aggregate figure in fact hews to the principle of setting rates to reflect Ericsson's own estimate of the total value the licensed technology contributed to the product.

The Court applies the 5% figure to 2G/3G, and applies both 6% and 10% to 4G.

B. Ericsson's Proportional Share of Standard-Essential Patents.

With a total aggregate royalty in place, the next question to resolve is Ericsson's proportional share. This is a ratio calculation taking the number of Ericsson's SEPs (the numerator) over the total number of SEPs for the standard in question (the denominator). (Leonard Decl. ¶¶ 39-42, 94-95, Table 4.) To determine essentiality the Court relied on ETSI's definition of essential:

> "ESSENTIAL" as applied to IPR means that it is not possible on technical (but not commercial) grounds, taking into account normal technical practice and the state of the art generally available at the time of standardization, to make, sell, lease, otherwise dispose of, repair, use or operate EQUIPMENT or METHODS which comply with a STANDARD without infringing that IPR. For the avoidance of doubt in exceptional cases where a STANDARD can only be implemented by technical solutions, all of which are infringements of IPRs, all such IPRs shall be considered ESSENTIAL.

(ETSI IPR Policy § 15.6, Ex. 223 at 7.)

The only dispute that arose concerning ETSI's definition of essential was whether the informative annex was part of the 3G standard. Ericsson argued that ETSI's definition of standard includes "any standard adopted by ETSI including options therein . . . ." (Id. § 15.11.) This means that the optional parts of the standard are still a standard, and thus patents that cover the optional parts of the standard are essential. However, informative annexes "shall not contain

provisions to which it is necessary to conform in order to be able to claim compliance with the ETSI deliverable." (Ex. 404 at 12.) Based on this definition, TCL argued that patents covering optional parts of the standard cannot be essential. The Court agrees with TCL that patents for inventions solely in the informative annex, while part of a standard, are not standard-essential patents. To hold otherwise would rewrite ETSI's definition of informative annex. This is further confirmed by the definition of normative annex directly above the definition of informative annex, which states that provisions in the normative annexes are necessary to conform in order to be able to claim compliance with the standard. (Ex. 404 at 12.)[14]

The Court first determines how many SEPs are in each standard (the denominator), and then determines how many SEPs are owned by Ericsson (the numerator).

1. Determining the Number of Industry-Wide SEPS: The Denominator.

To estimate the total number of industry-wide patent families related to user equipment ("UE") (such as handsets) that are essential to the 2G, 3G, and 4G standards, Dr. Kakaes, Dr. Ding, and teams of engineers from Concur IP, and Ernst & Young India conducted an extensive industry-wide essentiality study. (Ding Decl. ¶¶ 35-87; Kakaes Decl. ¶¶ 28-42.)

First, the team from Ernst & Young India, supervised by Dr. Kakaes, conducted a census of all IPR declarations submitted to ETSI as of September 2015 for the 2G, 3G, and/or 4G standards.[15] (Kakaes Decl. ¶¶ 29-30, 315.) As of September 15, 2015, there were over 153,000 patents and/or patent applications

[14]The Court therefore finds that Ericsson's P08333 family and corresponding U.S. Pat. No. 5,991,330 ("'330 patent") are not essential to the 3G standard. Ericsson makes additional arguments for why the '330 patent is essential to the 3G standard, (Cason Rebuttal ¶¶ 24-28), but since Ericsson cannot identify a required part of the standard covered by this patent, the Court has no basis to find this patent essential.

[15]The patent census involved extracting the declarations of essentiality from the ETSI database. (Kakaes Decl. ¶ 318.) There were 1800 declarations submitted to ETSI, representing 119,850 patents and applications. (Id.) ETSI rules also specify that the FRAND commitment applies to all members of that patent family, unless a specific exclusion has been made. (ETSI IPR Policy § 6.2, Ex. 223 at 2.) Based on International Patent Documentation Center data, this added an additional 34,030 patents to the census. (Kakaes ¶ 319.)

declared essential to the 2G, 3G, and 4G standards. (Id. ¶ 31.) Dr. Kakaes and Dr. Ding then supervised Concur IP in the industry-wide essentiality study. (Ding Decl. ¶¶ 59-60; TT Feb. 17, 2017, p. 73:2-10.)

Dr. Kakaes then excluded patent families that either had only expired patents, or were not published in English. (Kakaes Decl. ¶ 31.) Dr. Kakaes did not provide an explanation for excluding expired patent families. For reasons discussed in the next section, this was an error. Nonetheless, it is an error which favors Ericsson, and it may have been necessary to conduct a feasible study. Dr. Kakaes also excluded patent families that did not have an English language patent. (Id.) He explained that he did this because there were relatively few non-English patents, and including them would not have made a significant difference because the vast majority of families contained at least one English-language patent. (TT Feb. 17, 2017, pp. 69:24-70:3.) This exclusion is corroborated by Ericsson itself, because despite being a Swedish company, it has more patents in the United States than any other jurisdiction. (E.g., Ex. 1122.) The Court is satisfied that the subset actually examined was a reasonable surrogate for the whole.

There were 11,469 patent families with at least one patent that is still active (i.e., non-expired) and was published in English. (Kakaes Decl. ¶ 31.) After excluding patent families that did not have any patents with claims directed to user equipment, there were 7,106 patent families remaining. (Id. ¶¶ 31-32.) These 7,106 patent families were divided into 2G, 3G, and 4G depending on which standard they were declared essential to, and then sorted by patent holder for the 15 largest patent holders. (Id. ¶ 34.) Concur IP then analyzed the essentiality of a random sample of one-third of the patents in each standard, per patent holder, which totaled 2,600 patent families because some patents are essential to multiple standards. (TT Feb. 17, 2017, p. 72:3-20.) Dr. Ding sampled and checked 442 (or 17%) of Concur IP's essentiality determinations for accuracy. (Ding Decl. ¶¶ 64, 68.) When Dr. Ding was in agreement with Concur IP, he recorded the determination as accurate. (Id.) When he identified a discrepancy, he and Concur IP reexamined the claims and if Concur IP's original essentiality determination was changed, Dr. Ding recorded the original determination as inaccurate, and noted the direction of the error.[16] (Id. ¶¶ 64-68.) The overall error rate for Concur IP was only 9.5%. (Id. ¶ 69.) The error rate regarding whether patents were

[16]Given the somewhat subjective nature of these determinations, "disagreements" is probably a more accurate label than "error."

essential went in both directions, and thus the small number of errors largely balanced each other out over the course of the study. (Id. ¶¶ 69-71.) Specifically, out of the 442 patent families that Dr. Ding reviewed, 36 out of 305 patent families (or 11.8%) were changed from non-essential to essential, and 6 out of 137 patent families (or 4.4%) were changed from essential to non-essential. (Id. ¶¶ 70-71.)

From these adjusted totals, Dr. Ding then calculated the total number of essential patent families in each standard. For 2G, the total estimated number of essential patent families is 446. (Id. ¶ 77.) For 3G, the total estimated number of essential patent families is 1,166. (Id. ¶ 81.) For 4G, the total estimated number of essential patent families is 1,796. (Id. ¶ 85.)

However, TCL does not actually use the total number of SEPs per standard created by Dr. Ding because that would create a global rate and make it impossible to account for geographic disparities in Ericsson's patent portfolio. (Leonard Decl. ¶ 94.) Dr. Leonard therefore took Dr. Ding's world-wide results and determined how many total SEPs are registered in the United States for each standard. This actually causes the total number of SEPs to decrease slightly for each standard. (Id. Table 4.) Dr. Leonard calculated that there are 413 essential 2G families, 1,076 3G families, and 1,673 4G families.[17]

[17]Dr. Kakaes and Dr. Jayant also conducted an essentiality analysis on Ericsson's patents to determine the appropriate numerator (see Part 2 Section IV.B.2 below). This led to 55 patent families that were analyzed both by Dr. Kakaes and Dr. Jayant for the numerator, and Concur IP for the denominator. This therefore provides a useful cross-check on Concur IP's results. Of the 55 patent families that were analyzed twice, everyone reached the same conclusion on 41 of them, meaning they initially agreed roughly 75% of the time. (Kakaes Decl. ¶ 345.) Of those 14 families where they disagreed, Dr. Kakaes provides an explanation for 4 of the disagreements that are unrelated to the substance of Concur IP's analysis. (Id. ¶¶ 346–48.) One of them was explained because Ericsson's claim chart is broader than the declaration it submitted to ETSI, one was because of an inconsistency related to ETSI's database, and two errors were because Dr. Kakaes examined the file history, which showed that the patents were not essential. (Id.) Of the remaining ten disagreements, seven occurred when Dr. Kakaes or Dr. Jayant found the patent essential and Concur IP did not, and three where Concur IP found the patent essential and Dr. Kakaes or Dr. Jayant did not. (Id. ¶ 349.) This provides an error rate for Concur of 7/51 (13.7%) in favor of non-essentiality, and 3/51(5.8%) in favor of essentiality. These results are remarkably similar to Dr. Ding's, who checked 442 of Concur IP's assessments and found error results of 11.8% and 4.4% respectively. (Ding Decl. ¶¶ 64, 68.)

Ericsson made numerous challenges to the process that produced these numbers, although it proposes no alternative numbers. Ericsson challenged the results of this process because: (1) Concur IP team spent an average of 20 minutes and charged only $100 per patent, (2) they did not read the entire patent specifications, (3) the individuals in the Concur IP team lacked the qualifications to perform this work, and (4) Concur IP team knew whom they were working for and against. These criticisms led to Ericsson's ultimate conclusion that patent counting studies are highly subjective and inherently unreliable. The Court disagrees.

Ericsson argued that based on the total billing from Concur IP they must have spent on average about 20 minutes per patent, and charged $100, and this is plainly insufficient. By way of contrast, Via Licensing for example charges $10,000 to determine whether a single patent is essential before accepting the patent into a patent pool.[18] (Mallinson Decl. ¶¶ 91-92.) The Court is not persuaded that the tasks for which Concur IP charged are comparable to the task performed by Via Licensing. Patent pools ask customers to pay for each specific patent in the pool, so the greater the certainty in their process and the stronger the patents the more they can charge and convince customers and patent owners to join. (Mallinson Decl. ¶ 92.) Conversely, if prospective licensees discovered that a patent pool included non-essential patents it would undermine the patent pool's entire business model. Patent pools therefore require substantially greater certainty than is necessary or reasonable for counting the number of SEPs in a standard. While charging on average only $100 per patent family may be cheap, this process is only intended to provide a workable size of the relevant universe and has no need to be as precise as a licensing pool must be. The Court does not think that the internal procedures used by either patent pools or Ericsson to determine the essentiality of their own patents are fair bench marks for assessing quality of the analysis done by Concur IP. While they are similar tasks, they require very different levels of certainty because the results are being used in very different ways.[19]

[18]A patent pool is a vehicle for collecting and licensing a group of patents held by multiple owners. The business of a patent pool is to license rather than practice the patents.

[19]In addition, Concur IP conducted a similar study for another company, which allowed them to work much more quickly than if they were doing this for the first time. (TT Feb. 17, 2017, pp. 99:21-100:10.)

The Court is also not persuaded that the individuals on the Concur IP team lacked the qualifications to perform this work. At trial, Ericsson attempted to show that the members of the Concur IP team lacked the qualifications to perform this study because their industry experience was in consulting work, which Ericsson argued was insufficient to show they were persons of ordinary skill in the art. (Ericsson FOF, ¶ 265; TT Feb. 17, 2017, pp. 83:15-85:8.) However, nothing that Ericsson elicited on the stand from Dr. Kakaes convinced the Court that the Concur IP team lacked the qualifications or experience to complete their assigned task. In a similar vein, while it would have been better had the team not known who the parties were in this case, there is no requirement that an essentiality study be conducted in a blind manner, and the same concern applies with equal force to every expert in every case.

Ericsson's arguments regarding the patent specifications are more salient. Dr. Kakaes testified that the Concur IP team read the patent claims, but they did not read the entire patent specification. (TT Feb. 17, 2017, p. 100:20-21.) This means that they may not have noticed if a patent contained a means plus functions claim, likely would not have noticed if a patent used its own lexicography, and would not have read any specification disclaimer or the file history. (Id. pp. 100:20-110:15.) As discussed above, Dr. Kakaes found that the file history showed that the patent family was not essential for one 2G patent family (P07288 2G) and one 4G patent family (P10867 4G) out of the 55 overlapping patent families that were also examined by Concur IP. The Court therefore adjusts the total number of patents in each standard to account for Concur IP finding too many patents to be essential because it ignored file histories, as described below. (Kakaes Decl. ¶ 344, Table 16.) While Ericsson's concerns regarding means plus function claims, lexicography, and specification disclaimers could be substantial, they could also be entirely trivial. The Court declines to speculate on how often they would impact the essentiality determination.[20]

[20] The Court also notes an inherent tension in Ericsson's position on essentiality. It criticizes Concur IP for finding too many patent family essential because they ignored things such as the file history, but Ericsson itself initially claimed that it owned 235 essential patent families (Kakaes Decl. ¶ 95) and at trial only argued that it owned 179 essential patent families. The Court gives little weight to Ericsson's criticisms when it appears to have made the same error despite spending 50–80 hours assembling claim charts and employing an extensive review process involving multiple patent attorneys. (McLeroy Decl. ¶ 10.)

Ultimately the Court finds that the flaws are not enough to justify rejecting TCL's experts' calculation of the total number of SEPs entirely. However, the Court does find it appropriate to make certain adjustments to TCL's calculation of the overall number of SEPs. The only cross-check on the total presented by Dr. Ding and Concur IP occurred when they examined the same patents as Dr. Kakaes and Dr. Jayant. Excluding 2 families where the disagreement was not caused by the substantive analysis, Concur IP disagreed with Dr. Kakaes on the essentiality of 12 of the 53 overlapping patent families. (Id. ¶ 349.) These 53 patent families represent 6 2G family/standards pairs, 16 for 3G, and 35 for 4G.[21] (Id. ¶ 344, Table 16.) There were three 4G families that Concur IP said were essential that Dr. Kakaes said were not essential. Giving Ericsson the benefit of the doubt for every dispute between Concur IP and Dr. Kakaes, Concur over-declared 4G patents to be essential four out of thirty-five times, or 11.4%. The Court uses this figure for adjusting the total number of SEPs in each standard downwards. While the Court makes the adjustment because it is warranted, shrinking the denominators favors Ericsson in determining its share of the overall royalty burden.

TCL's final step in calculating the total number of patents in each standard is to calculate the U.S.-specific number of total SEPs. This is necessary in order to adjust the rate to account for differences in Ericsson's patent strength in each country, which requires a numerator and denominator stated in terms of U.S. patents. Because the essentiality analysis examined one-third of the total declared patents, Dr. Leonard multiplied the number of U.S. patents that were analyzed by three to determine the total number of U.S. SEPs in each standard. (Leonard Decl. ¶ 94, Table 4 n.3.) Dr. Ding calculated that globally there were 446 2G SEPs, 1116 3G SEPs, and 1796 4G SEPs. (Ding Decl. ¶¶ 77, 81, 85.) Dr. Leonard then calculated that there were 413 2G SEPs, 1076 3G SEPs, and 1673 4G SEPs. (Leonard Decl. ¶ 94, Table 4.) Applying the reduction for over-declaring patents to be essential in order to give Ericsson the benefit of the doubt leads the Court to adopt the following totals for the number of SEPs in each standard: 365 for 2G, 953 for 3G, and 1481 for 4G.

2. Determining the Total Number of SEPs Owned by Ericsson: The Numerator.

[21] The numbers do not total 53 because some patents cover multiple standards.

Ericsson identified 235 patent families it contends are essential to the 2G, 3G, and 4G standards, although Ericsson only provided claim charts to support its contentions for 192 of the families. (Kakaes Decl. ¶¶ 95-96.) Because Ericsson contended certain families are essential to multiple standards, there were a total of 219 patent family/standard pairs that had corresponding claim charts. (Id. ¶ 97.) Ericsson's patents were each evaluated by either Dr. Kakaes or Dr. Jayant to determine if they were truly essential. (Id. ¶ 20.) Dr. Kakaes conceded that many of Ericsson's patents were essential to a standard, but also testified that many were not essential. (Id. ¶ 22.) Ericsson provided testimony from its experts that disputed some of the findings of non-essentiality by Dr. Kakaes and Dr. Jayant. (Cason Rebuttal Decl. ¶¶ 13, 15-188; Sågfors Rebuttal Decl. ¶¶ 20, 23-295; Chen Rebuttal Decl. ¶¶ 14-15, 18-81; Bruhn Rebuttal Decl. ¶¶ 46, 49-69.)

As described below, the Court chose to apply the top down formula twice, using TCL's conceded number of SEPs, and using Ericsson's disputed number of SEPs. This more accurately reflects the reality faced by parties in a licensing negotiation who each have different views how many SEPs the licensor owns. The Court also adopts Dr. Leonard's conclusions regarding the impact of patents that will become essential during the course of the license, but the Court made its own calculations to account for the expiration of Ericsson's SEPs during the license. (Leonard Decl. ¶¶ 126-131.)

a. TCL's Essentiality Analysis.

Dr. Kakaes analyzed 180 out of the 192 patent families Ericsson alleged cover the 2G, 3G, and/or 4G standards. (Kakaes Decl. ¶¶ 1-6, 20, 96.) Dr. Jayant, an expert in speech coding, analyzed the remaining 12 out of the 192 patent families that Ericsson alleged cover portions of the 2G and/or 3G standards related to speech communications and primarily adaptive multi-rate (AMR) speech coding. (Jayant Decl. ¶¶ 1-13, 15.) Much of the analysis Dr. Kakaes and Dr. Jayant presented to Ericsson was not new because other licensees had taken the same positions during their negotiations with Ericsson. (Exs. 1289, 1689, 1715, 1717, 1718, 1729.)

The essentiality analysis performed by Dr. Kakaes and Dr. Jayant was conducted using ETSI's definition of essential described above. (Kakaes Decl. ¶¶ 105-106; Jayant Decl. ¶ 60.) When conducting the essentiality analysis, Dr.

Kakaes and Dr. Jayant ranked the patents on a scale of 1 to 3, where a 1 meant they did not see any evidence precluding a finding that the claim is essential under ETSI's IPR Policy, a 2 meant that under a proper claim construction the claim is not essential, and a 3 meant the claim is not essential under any reasonable claim construction. (Kakaes Decl. ¶ 113; Jayant Decl. ¶¶ 67-68.) For some patent families, Ericsson produced multiple claim charts for claims within the patent family. (Kakaes Decl. ¶ 100.) For those families, the entire patent family was given the rank associated with the highest ranked claim. (Id.)

For 2G, Dr. Kakaes and Dr. Jayant gave 29 out of 41 of the patent families an Essentiality Rank of 1, one of the patent families an Essentiality Rank of 2, and 11 of the patent families an Essentiality Rank of 3. (Kakaes Decl. ¶ 172.) For 3G, they gave 33 out of 51 of the patent families an Essentiality Rank of 1, two of the patent families an Essentiality Rank of 2, and 16 of the patent families an Essentiality Rank of 3. (Id. ¶ 173.) For 4G, Dr. Kakaes gave 74 out of 127 of the patent families an Essentiality Rank of 1, seven of the patent families an Essentiality Rank of 2, and 46 of the patent families an Essentiality Rank of 3. (Id. ¶ 174.) Thus, Dr. Kakaes concludes that Ericsson owns 29 patent families that are essential to 2G, 33 patent families that are essential to 3G, and 74 patent families that are essential to 4G. (Id. ¶¶ 172-174.) The Court refers to these as TCL's patent numbers.

At trial, Ericsson provided testimony from four of its employees who argued TCL's experts were wrong and additional Ericsson patents were essential to the standards. (Cason Rebuttal Decl. ¶¶ 13, 15-188 (arguing for the essentiality of 27 patents); Sågfors Rebuttal Decl. ¶¶ 20, 23-295 (arguing for the essentiality of 23 patents); Chen Rebuttal Decl. ¶¶ 14-15, 18-81 (arguing for the essentiality of 11 patents); Bruhn Rebuttal Decl. ¶¶ 46, 49-69 (arguing for the essentiality of 2 patents).) These 63 disputed patents represent 2 patent families that are essential to 2G, 14 patent families that are essential to 3G, and 51 patent families that are essential to 4G.[22] The Court refers to these as Ericsson's patent numbers.

b. Accounting for SEPs added to Each Standard.

Ericsson's proportional share will change as new patents are added to each standard because the denominator will grow, and some of those will belong to

[22]The numbers do not total 63 because some patents cover more than one standard.

Ericsson. To account for patents added to each standard Dr. Leonard created a model to determine the number of SEPs that will be added to each standard, and from that determined how many Ericsson SEPs will be added to each standard. (Leonard Decl. ¶¶ 127-131.) Dr. Leonard's model calculated the net result of these two changes, along with patents that expire, and then provided the net result of all three as a change in Ericsson's "value share," which is Ericsson's proportional share weighted by TCL's importance and contribution analysis discussed below. (Leonard Decl. ¶¶ 92, 126-31.) However, Dr. Leonard did not provide his calculations on the individual inputs or identify what specific sources he used in a meaningful way, although Ericsson also did not raise this point during the trial. (See Ex. 1119 n.2.) As a matter of general industry practice, licenses covering SEPs typically also cover patents issued or acquired during the term of the license. (Leonard Decl. ¶ 120.)

Dr. Leonard's model ultimately showed that newly issued patents will not significantly affect Ericsson's proportional share because Ericsson can only obtain additional patents when the standard also grows. (Leonard Decl. ¶ 130.) The Court is skeptical that his model is the best way to estimate the growth of the 4G standard, but ultimately the Court agrees that newly issued patents will not make a significant difference to Ericsson's overall proportional share. Even assuming new patents will be added to each standard during the license, there is no evidence that Ericsson will be more successful in obtaining SEPs in the next five years than it has been in the past.[23] The best case scenario for Ericsson is that it will acquire future SEPs at the same rate as it has in the past. Thus, Ericsson's newly acquired SEPs will be offset by SEPs being added to the standard. Therefore the Court accounts for the effect of new patents added to the 2G, 3G, and 4G standards by keeping Ericsson's proportional share constant.

c. Accounting for Expired and Expiring SEPs.

Both sides argued over the essentiality of patents that expired before any license would begin. (See, e.g., Kakaes Decl. ¶ 172 n.5.) United States patent law does not permit Ericsson to demand value for patents that have expired. Brulotte

[23]The Court actually suspects that Ericsson will be less successful in obtaining future 4G patents than its current proportional share of 4G SEPs suggests because 4G LTE is based on 2G GSM, so some of Ericsson's 4G SEPs reflect investments in research and development Ericsson made years ago

v. Thys Co., 379 U.S. 29, 32 (1964) ("we conclude that a patentee's use of a royalty agreement that projects beyond the expiration date of the patent is unlawful per se."). Because the FRAND undertaking is an encumbrance and commitment that exists on top of national patent systems, FRAND cannot permit what domestic patent law prohibits. (ETSI IPR Policy § 12, Ex. 223 at 6.)[24] SEPs that expire before a license begins therefore have no bearing on a fair and reasonable prospective royalty rate. Absent suggestion or stipulation by the parties, the Court adopts the date of closing arguments (May 18, 2017) as the most appropriate date to use for determining whether SEPs have expired. Expired and Expiring SEPs has the largest impact on Ericsson's 2G SEPs. For example, while TCL concedes that Ericsson owns 29 2G SEPs, 7 of them expired before closing arguments were made, and another 15 will expire before May 1, 2022. Unlike other adjustments which should generally affect both the numerator and the denominator of the proportional share, expirations should only modify the numerator. Because the total aggregate royalty represents the value of all expired and unexpired inventions in the standard, also removing an expired SEP from the denominator treats the invention as no longer having value. The invention however still has value, that value has merely been transferred to the public domain. To remove expired patents from the denominator (without decreasing the total aggregate royalty) would result in transferring the value from expired inventions to the remaining patents in the standard instead of the public. By removing expired SEPs from only the numerator of the top down formula the Court therefore apportions their value from the still patented features of the standard. Ericsson, Inc. v. D-Link Systems, Inc., 773 F.3d 1201, 1232 (Fed. Cir. 2014).

The first step in adjusting for SEPs that expire during the course of the license is to determine when Ericsson's U.S. patents expire. The Court relies on Trial Exhibit 1116. If that exhibit lists a U.S. patent for any standard, then the Court applies that expiration date to all other standards covered by this family if Ericsson argued that the U.S. patent was essential to each standard. (Ex. 1577.) For two families (P11899 and P14897), no U.S. patent was listed on Trial Exhibit 1116 for any standard, although the patent family did include U.S. patents. For those families the Court applied the expiration date of the European patents that were listed on Trial Exhibit 1116.

[24]ETSI IPR Policy does not oblige its members to act in violation of national laws or regulations, except where derogation by agreement between the parties is permitted.

After compiling the expiration dates of Ericsson's U.S. SEPs at issue, the Court calculates how many months each SEP will be valid over the course of the license. The Court prefers to calculate based on months instead of days because it provided much more workable numbers.[25] After determining the total number of months of validity for each of Ericsson's SEPs in each standard, the Court divides that number by 60 to represent the effective number of unexpired SEPs Ericsson will own throughout the license. This did result in some fractional results for the numerator, but this is not a problem because there is no particular reason the numerator must be a whole number.

The results were that based on TCL's patent numbers Ericsson owns 12 2G SEPs, 19.65 3G SEPs, and 69.88 4G SEPs. Based on Ericsson's patent numbers, it owns 12 2G SEPs, 24.65 3G SEPs, and 111.51 4G SEPs.

3. Calculating Ericsson's Proportional Share of SEPs.

Ericsson's proportional share of 2G, 3G, and 4G essential patents can be determined by dividing how many patents the parties assert Ericsson owns for each standard (the numerator) by the total number of patents in each standard (the denominator).

For 2G, both parties agreed that Ericsson owns 12 out of 365 essential patent families, which is 3.280% of all 2G essential patents.

For 3G, TCL conceded that Ericsson owns 19.65 out of 953 essential patent families, which is 2.061% of all 3G essential patents. However, Ericsson argued that it owns 24.65 3G essential patents, which would give it 2.58% of 3G essential patents.

For 4G, TCL conceded that Ericsson owns 69.88 out of 1481 4G essential patents, which would give it 4.761% of 4G essential patents. However, Ericsson

[25]Doing so required the Court to assume that each patent expires at the end of the month, and to treat the license as if it started on May 1, 2017 and ended on May 1, 2022. A patent that expired May 2017 would therefore have 1 month of validity, while a patent that expired April 2017 would have 60 months of validity. Both of these assumptions very slightly favor Ericsson (generally less than 1%), but the Court believes these assumptions are justified in view of TCL's failure to justify its own expiration calculations, as well as the simplicity they add to the calculations.

argued that it owns 111.51 4G essential patents, which would give it 7.525% of 4G essential patents.

C. Adjusting Ericsson's Proportional Share to Account for the Relative Strength of its SEPs.

After determining how many Ericsson patents were essential to each standard, TCL then analyzed the importance and contribution of Ericsson SEPs it conceded were essential to determine how valuable they are compared to other SEPs. While the Court reviews TCL's analysis, it found it too flawed to be used to calculate the overall rates which the Court derives from the top down analysis.

The rationale for evaluating the importance of SEPs is that even in the universe of standard essential patents, many are relatively trivial, while some are key features of the standard. TCL ranked Ericsson's SEPs on a scale from 1-3, with a 1 for patents that were important or technically valuable, 2 for patents that were moderately important, and 3 for patents that were only marginally important. (Kakaes Decl. ¶ 12.)

"Contribution" as TCL used the term in this context evaluates the invention compared to the alternatives that were available at the time the standard was adopted. This is because there are many parts of the standard that are essential and even very important because they add substantial value, but are a small contribution because there were other almost as useful options ETSI could have chosen when the standard was adopted. A contribution rank of 1 meant that TCL did not identify a viable alternative to the patent, a 2 meant the patent provided moderate improvement relative to the alternative, a 3 meant the feature provided marginal improvement relative to the alternative, and a 4 meant it provided no improvement to the standard relative to the alternative. (Id. ¶ 13.)

Dr. Leonard then used the importance and contribution scores to determine how many of Ericsson's SEPs would be ranked in the top 10% of SEPs. Based on a study done of patents in various industries, Dr. Leonard concluded that the top 10% of SEPs provide 65% of the value of the standard. He used this study to create a value share, which is Ericsson's proportional share adjusted based on the value of Ericsson's SEPs relative to the value-distribution of all SEPs in the standard.