

How to derive and apply aggregate royalty rates for SEP FRAND determinations

Among numerous legal, economic and commercial concerns about the European Commission's proposed legislation for Standard Essential Patent (SEP) licensing, its plans for aggregate rate setting and mandatory Fair, Reasonable and Non-Discriminatory (FRAND) rate determinations in various technology standards raises all kinds of issues and alarms.

I have previously argued against the Commission's apparent intention to abandon the established approach of using comparable licensing agreements directly as benchmarks in FRAND rate determinations, and instead set aggregate rates which are then apportioned among SEP owners based on their respective shares of total SEPs using the *top-down approach*.¹ For example, I was critical about use of patent counting to apportion royalties in FRAND determinations. My new submission focuses on aggregate royalty rate setting.

Any aggregate royalty rates set must be precisely defined, derived and applied. Aggregate rate setting for standards, as proposed by the Commission, will enable proposed rates to be depicted and manipulated in ways which are anticompetitive, unfair and will under-value patented standard-essential technologies. According to the proposed legislation, "'aggregate royalty' means the maximum amount of royalty for all patents essential to a standard."² The Commission also indicates "uncertainty about the SEP royalty burden" and that "Stakeholders consider that the FRAND licensing concept could benefit greatly from some clarification, notably with regard to the determination of an aggregate royalty burden."³

Aggregate royalty rates proposed to or set by the EU IPO could be in quantification of the total payment burden or of the rate to be used in determining individual FRAND royalty rates with the top-down approach.⁴ The latter should be a higher figure than the former to allow for SEPs that remain unlicensed and for which there is no payment.

Either of these aggregate royalty rate percentages might be derived somehow from among various different formulations of aggregate rates reported. However, these reported rates vary enormously, for example, global rates from more than 35% to less than 5% of a smartphone's selling price. The maximum aggregate rate burden implementers will have to pay and the correct Aggregate Royalty Rate for Apportionment (ARRFA) in a top-down approach FRAND determination will fall well within those two extremes.

An alternative approach in aggregate rate setting is to estimate value in standards with use of techniques including hedonic pricing or conjoint consumer preference analysis, and then apportion value somehow between SEP licensors and implementers.

If aggregate rates are to be set at all—as they are for patent pools in their rate cards, but in the opinion of many is unnecessary and dysfunctional in bilateral licensing⁵—such rates must be derived in the applicable context. Collective action—such as in patent pools—where some major licensors are typically also major licensees will tend to set rates that are lower than would be agreed

¹ [Feedback on draft EU legislation](#) by Keith Mallinson, WiseHarbor; June 14, 2023

² Article 2 (10).

³ Proposed regulation (page 8) and Impact Assessment (2.3.2)

⁴ "A SEP holder or an implementer may request the competence centre for a non-binding expert opinion on a global aggregate royalty." Article 18

⁵ Various court decisions including *Unwired Planet v. Huawei* and *InterDigital v. Lenovo* have avoided or explicitly rejected aggregate rate setting, while others including *Optis v Apple, also in the UK*, have also primarily used comparable licensing benchmarks in their FRAND determinations.

bilaterally. Another crucial difference is that patent pool aggregate rates are the rates licensees actually pay.

In FRAND determinations for bilateral licensing there is always a shortfall between the ARRFA and what is actually paid because the SEPs in any given standard are never fully licensed. The aggregate rates from which bilateral licensing rates are derived are never fully paid due to notional royalty allocations to patents that remain unlicensed. Any aggregate royalty setting must recognize this difference if such rates are to be used to determine FRAND rates using the top-down approach.

To mitigate shortcomings in rate setting, some guiding principles must be established on what the “SEP royalty burden” and ARRFA should include and exclude, as well as how and by whom such rates should be derived and applied. The interests of both SEP owners and implementers must be safeguarded while reflecting industry realities with the many factors that shape varied financial and other terms in established licenses. Application of economic theory must have full and proper regard for what royalty figures reported in the industry represent and how licensing actually gets done.

The Commission’s proposed regulation for FRAND rates and litigation

As noted in a recent paper for 4iP Council, by Dr Igor Nikolic, Research Fellow at the European University Institute, “the SEP Regulation: i) requires the registration of all SEPs in force in EU Member States before the newly established Competence Centre at the EU Intellectual Property Office (EUIPO), as a pre-condition for litigation of SEPs in the EU; ii) provides for annual essentiality checks of registered SEPs; iii) introduces a system of notification of aggregate royalty rates for standards, and iv) requires entering into mandatory FRAND determinations before initiating SEP litigation in the EU.”⁶

The Commission indicates “uncertainty about the SEP royalty burden” and that “Stakeholders consider that the FRAND licensing concept could benefit greatly from some clarification, notably with regard to the determination of an aggregate royalty burden.”⁷ The proposed regulation also notes that “In view of the global character of SEP licensing, references to aggregate royalty and FRAND determination may refer to global aggregate royalties and global FRAND determinations, or as otherwise agreed by the notifying stakeholders or the parties to the proceedings.”

Dr Nikolic highlights some practical and competition concerns surrounding all the above including that costs will largely be borne by licensors, not licensees. He notes, with regard to the aggregate rate setting:

- “SEP holders may jointly notify the Competence Centre of the aggregate royalty for SEPs covering a standard. The joint notification should, among others, include the estimated percentage of SEP holders making the notification from all other SEP owners and the estimated percentage of SEPs they collectively own.”
- “If SEP holders cannot reach an agreement, the competence centre may appoint a conciliator to mediate the discussion. Such an option can be requested by SEP owners holding at least 20% of all SEPs. The mediation process should last six months.”
- “A SEP owner or an implementer [can] request a non-binding expert opinion on a global aggregate royalty. The Competence Centre will appoint one or a panel of three conciliators,

⁶ [Some practical and competition concerns with the proposed Regulation on Standard Essential Patents](#), Dr Igor Nikolic, Research Fellow on the European University Institute, published by 4iP council, July 2023

⁷ Proposed regulation (page 8) and Impact Assessment (2.3.2)

depending on the percentage of SEP owners and implementers participating in the process. Conciliator(s) should produce an expert opinion on the global aggregate royalty rate within eight months.”

(citations omitted)

The proposed regulation and the above processes are evidently far from being fully defined, let alone planned out for execution. The Competence Centre needs to be set up from scratch. The EUIPO does not yet have the required expertise in SEPs, FRAND licensing, essentiality checking, aggregate rate setting and individual royalty rate determination.

Dr Nikolic is rightly alarmed about the possibility of buyers’ cartel effects (i.e. monopsony rate-setting). He states “it is unclear from the text of the Draft SEP Regulation if implementers are allowed to coordinate their submissions to conciliators.” He is concerned that “implementers might use the process to exchange commercially sensitive information and agree on the maximum global aggregate royalties they would pay.”

He is also uneasy that the draft regulation does not include the “competition safeguards against the exchange of commercially sensitive information in the process of joint notification of aggregate royalty rates.” Patent pools “are expressly required by the Technology Transfer Guidelines to prevent the exchange of sensitive commercial information among their members.”⁸

From an economic standpoint, price coordination (i.e. of royalty rates) among some SEP owners ought not to be problematic; but only so long as other licensors are not bound by such pricing. SEPs are necessarily complements—patented technologies are not in competition with each other once they have been selected for use in a standard and have become SEPs—and so the implementation and licensing of all of them is required.⁹ Competition authorities prevent anticompetitive effects by requiring that substitutes are not included in patent pools. This is one reason why essentiality checking is sometimes required by competition authorities and is undertaken by patent pools. Standard setting requires the selection of the best technology to perform a particular function so any alternative patented technology will not be included.

However, it should also be recognised that there is no clear line between implementers and SEP owners. Few SEP owners are not also implementing the standards in some way. Submissions as SEP owners would thus likely also reflect some interests—possibly predominating interests—as implementers, and vice versa.

Dr Nikolic is also rightly concerned that even the basis, as well as the level, of aggregate royalty rates in joint notifications will vary confusingly. For example, a group of SEP owners could announce an aggregate rate of \$10 per end-product, another group announce a rate of 5% of the end-product

⁸ Commission, ‘Guidelines on the Application of Article 101 of the Treaty on the Functioning of the European Union to Technology Transfer Agreements’ (2014) c 89/03, paras 259-261.

⁹ Cournot complements theory indicates that prices will be higher when complementary inputs are monopolised by different suppliers acting independently. There were some joint announcements including several SEP owners (that were also major device implementers at the time) that aimed to limit aggregate rates in 3G and 4G. However, others were not and should not be bound by such statements, and some have publicly rejected any suggestion they should be. [As stated by Qualcomm in 2008](#), “Contrary to recent claims by a small number of manufacturers, FRAND does not, and never has, prescribed formulas for imposing cumulative royalty caps or proportional allocations of such royalty caps. Such formulas would arbitrarily limit the value of standards essential patents, discourage innovation, encourage the filing of marginal patents, complicate and delay the standardization process, and be impossible to implement in practice.”

price, while a third group would prefer a lower \$1 per-product rate. And, many licences indicate lump sum payments. Translating between running-rate ad valorem and monetary amounts per unit, and between these and lump sum payment figures—in order to make comparisons—is always subject to various subjective and often questionable assumptions. He also regards the aggregate rate notification deadline of 120 days from publication of the standard as unrealistic because this is insufficient time to know how a standard will be implemented. He notes that patent pool experience shows “it may take years for patent owners to agree on mutually acceptable and market-realistic rates.”

Aggregate rate setting for patent pools is different than in bilateral rate apportionments

Patent pools that have been most successful in attracting both licensors and licensees over decades are those such as VIA LA’s AVC/H.264 pool where major licensors are also major licensees. They balance their interests in minimizing outpayments as licensees and maximizing in-payments as licensors by seeking modest aggregate rates per unit and annual royalty payment caps per licensee. Otherwise, those companies would not join pools and would instead license bilaterally including significant cross-licensing. Smaller licensors forgo the possibility of higher bilateral rates in order to avoid the operational costs of doing all the licensing and enforcement themselves.

As previously mentioned, there are also competition safeguards in patent pool licensing. The EU’s Technology Transfer Guidelines expressly require patent pools to prevent the exchange of sensitive commercial information among their members. Competition authorities also insist that the existence of a patent pool must not preclude competition among pools or bilateral licensing outside the pool.

Licensing elsewhere outside the pool enables market forces to establish different pricing levels outside versus inside the pool to reflect potentially very different commercial conditions and other terms in licensing (e.g. lump sums versus running royalties, various caps and bundling with other standards’ SEPs outside the pool). As previously mentioned, patent pool royalty rates tend to be significantly affected by the interests of SEP licensors that are also major licensees preferring relatively low rates with annual total payment caps. Competition for SEP owners among pools, such as between VIA LA and Access Advance in HEVC also allows a wide range in aggregate and individual rates. Even a strong consensus on the aggregate rate among a large and extensively licensed patent pool is unlikely to be a valid pricing benchmark for bilateral licensing. Some licensors may prefer to incur higher operational costs outside the pool so that they can obtain higher royalty rates bilaterally.

There are other major differences between what an aggregate rate depicts and how it is apportioned by patent pools, such as the above, versus in bilateral licensing. Pool licensees are charged set aggregate royalty rates on their product sales to license all SEPs in the pool. After deducting administrator fees and covering some other operational costs, patent pools distribute all the cash they collect from licensees to licensors. Licensors’ shares of that are largely based on relative patent strength in nations of licensees’ manufacture and of sale—for example, based on counts of patents deemed standard essential—and extent to which their products employ different profiles or parts of the standard. Netting-off of those charges occurs in the cash payments made or received for licensors that are also licensees.

Reasons why patent pools in general, and particularly minor patent pools, are inapplicable benchmarks for bilateral licensing of SEPs are that:

- a. Patent pools are downstream-oriented despite including large proportions of vertically-integrated members. According to Judge Robart’s decision in *Microsoft v. Motorola* “[t]he uncontroverted evidence before the court demonstrates that an SEP licensor in a patent

pool receives both royalty rates from the pool and value to the SEP holder in terms of unfettered access to the intellectual property of the pool.”¹⁰ This neglects the fact that some licensors, such as upstream core technology developers, including universities (who do not manufacture products), might not need access to others’ IPRs. This is a major reason why such companies are disinclined to join. In contrast, minimizing royalty out-payments is more important than generating cash royalties for most implementers, including those with upstream core-technology development activities. Where these kinds of vertically-integrated companies predominate in the formation and ongoing control of patent pools, as they invariably do, they conspire to keep rates relatively low. In *In re Innovatio*, Judge Holderman concludes, with respect to the Via Licensing patent pool for 802.11, that it was not that licensing prices were set too high (as suggested by testifying expert Dr. Lynde), on the contrary, “[t]he court finds it more plausible, however, that the prices are too low to give patent holders a reasonable return on their technology.”¹¹

- b. Even to the extent patent pool participants are not downstream oriented, there are many reasons to join the patent pool without agreeing to its valuation of the underlying patents. In many instances, bilateral negotiations are too costly given the potential royalties owed. Thus, transaction costs exceed the anticipated reasonable returns. In those circumstances (*i.e.* small portfolios, small licensees) it makes sense for a patent holder to join a patent pool and reduce its transaction costs because some return is better than no return.¹² In such instances, it should not be read as an indication that the proportionate share of the patent pool is the true value of the patents or an endorsement of the methodology or that the overall rate is somehow indicative of the true total value of the standard.
- c. The lowered transaction costs associated with patent pools mean that the price of the pooled patents is less than the combined price of individual bilateral licenses that would be required to license the pooled patents from the SEP owners one by one. According to the Federal Trade Commission “[i]ndeed, theoretical economic models show that if only complementary patents are pooled, the royalties the pool charges should be lower than those that would be charged if no pool were formed.”¹³ Similarly, the European Commission has recognized that “[i]f royalties for complementary technologies are set individually, the total of these royalties may often exceed what would be collectively set by a pool for the package of the same complementary technologies.”¹⁴ The economic reasoning for this is provided by the aforementioned Cournot complements theory (see footnote 9).
- d. Failed pools set particularly poor licensing rate benchmarks. Patent pools have only succeeded or significantly existed for a relatively small number of particular standards-based technologies. Some patent pools for audio and video streaming technologies have been successful in pooling most of the SEP technologies for the relevant standards; but pools have generally fared poorly elsewhere, including those that have sought to license 3G and 4G in mobile phones.

¹⁰ *Microsoft*, 2013 U.S. Dist. LEXIS 60233 at *237.

¹¹ *In re Innovatio IP Ventures, LLC*, No. 11 C 9308, 2013 U.S. Dist. LEXIS 144061, *156 (N.D. Ill. Sept. 27, 2013).

¹² See Antitrust Enforcement and Intellectual Property Rights: Promoting Innovation and Competition, Issued by the U.S. Department of Justice and the Federal Trade Commission (April 2007) at 57, 65

¹³ *Id.* at 83.

¹⁴ [Communication from the Commission: Guidelines on the application of Article 101 of the Treaty on the Functioning of the European Union to technology transfer agreements \(2014/C 89/03\)](#), March 28, 2014 at ¶ 253

- e. The existence of royal-free patent licensing schemes that also pool patents under a common agreement, for example, for Bluetooth, USB and DOCSIS, does not indicate that SEPs to those standards are worthless and that aggregate rates for them elsewhere should be zero. Instead, it means that patent owners forgo the ability to generate cash royalty fees in return for other benefits including reciprocal licensing rights to others' SEPs.

Malapportionment in top-down approach with widely different kinds of aggregate rate

In marked contrast to patent pool charges, which are aggregate royalties for all SEPs in the pool, nobody would ever pay as much in total as an aggregate rate figure that is used in making bilateral licensing rate determinations with the top-down approach. Aggregate rate figures, however they are derived, are notional maximums of some kind with no reconciliation between those figures and totals paid across all bilateral licensing. Consequently, as illustrated in the *TCL v. Ericsson* decision, amounts actually paid will significantly undershoot any aggregate figure chosen due to: the many owners' SEPs that remain unlicensed; sales in jurisdictions with less than the maximum patent protection; and expired patents.¹⁵ Where there is cross-licensing between SEP owners, rates paid are also reduced by the netting off (i.e. offsetting) of royalty charges between the parties licensing.

The rest of this article focuses on the aggregate rate ARRFA which is used as the input to top-down approach FRAND determinations in bilateral licensing. It concentrates on the mechanics of top-down allocations with many factors reducing how much in royalties is actually paid. It concludes that the input aggregate rate must be carefully chosen. Some aggregate rate benchmarks—such as those of average or typical rates paid—understate total value because many potential FRAND royalties are not actually paid due to many SEPs remaining unlicensed.

A top-down approach has been employed in various SEP FRAND litigation cases by the courts for at least a decade. The Commission's proposed new legislation and that proposed in the US Standard Essential Royalties Act (SERA Act)¹⁶ will centralize, institutionalize and bureaucratize this rate-setting in an administrative agency at an EU IPO Competence Centre and in a new federal court, respectively.

Setting ad valorem or monetary charge per unit aggregate rates?

An aggregate royalty rate—like an individual royalty rate—can be an ad valorem percentage or a fixed monetary figure per unit of licensed product sales. A fundamental question in any aggregate rate setting process is which to select. I am not prescribing or proscribing either. The most applicable and best to select depends on the application.

However, considering how SEP licensing has been agreed and how royalties have mostly been depicted, measured and compared since the 1990s, I am focusing most of my analysis in this paper on ad valorem percentage royalties as applied to mobile phone selling prices. This is most illustrative because it enables me to draw upon many published aggregate royalty rate figures which almost invariably until the late 2010s were and still mostly are also ad valorem percentages.

Ad valorem percentage royalty charging suited implementers as average selling prices for handsets reduced substantially in the 1990s and until the 2000s when the growth of smartphone sales started increasing overall Average Selling prices (ASPs). Since then, licensees have increasingly sought to cap the handset price used as the royalty base. On the other hand, with basic mobile phone prices as low

¹⁵ The way the *TCL v. Ericsson* decision reduced rates geographically and for expired patents is not generally accepted. The decision was unanimously and entirely reversed on appeal.

¹⁶ [Standard Essential Royalties Act](#)

as \$20 since the mid-2000s, some licensors have also introduced floors to their licensing terms. When ASPs rise above a cap, or fall below a floor, royalty rates become fixed monetary amounts. In some cases, such as Nokia in 5G, its standard charge is a fixed monetary charge of €3.00 (\$3.36) per unit. In IoT, where selling prices for licensed items vary enormously (e.g. from as little as \$10 for a basic module to typically tens of thousands of dollars for a car), royalty rates as monetary charges per unit tend to make best sense.

Major cellular technology SEP licensors typically have many executed agreements including ad valorem rates, fixed fee rates per unit and lump sum payments. Translating figures into a common basis to enable comparisons or additions— for example, in compiling aggregate rate figures— requires what is referred to as “unpacking.” This is far from straightforward and requires various subjective assumptions including a cost of capital and quantification of risk to a forecast of expected business outcomes. Additional unpacking is also required to derive effective “one-way” rates from cross-licenses. An assumption about the relative strengths of parties’ SEP portfolios is also required for that.

However, the applicable basis for these comparisons and additions is contentious. For example, while the *TCL v. Ericsson* decision, and the *Unwired Planet v. Huawei* decision upheld by the UK’s Supreme Court, used percentage rates for aggregate royalties and individual royalties as the basis for its comparisons and determinations, the *Interdigital v. Lenovo* decision was based on monetary figures per unit. In the latter decision, Justice Mellor was critical of Judge Selva in *TCL v. Ericsson* stating that “Ericsson’s use of floors in its rates is itself discriminatory.”

Basing comparisons on monetary amounts versus ad valorem percentages can give very different impressions and lead to significantly different outcomes in FRAND determinations for a whole host of reasons depending on the specifics of the licensing terms (e.g. the levels of royalty base price and sales volume caps) and given the actual product sales volumes and prices achieved.

Many experts and practitioners in this field contest the legitimacy of employing any aggregate rate limit in determination of FRAND royalty rates and refute advocates’ arguments that such a figure is required to prevent alleged royalty stacking. Rather than weighing-in here myself against the narrative that royalty stacking is excessive as I have elsewhere previously,¹⁷ I am confining myself in the rest of this article to assuming that such an aggregate input figure is required, and will be derived, somehow. Furthermore, while I am critical elsewhere of royalty apportionments based on patent counts,¹⁸ that topic is also outside the scope of this article.

While an aggregate rate figure needs to be set in order to do a full and standalone top-down determination of FRAND royalty charges, the top-down approach formula is also used to imply an aggregate rate as a cross-check derived from other valuation methods including those based on comparable licenses. The *implied* aggregate can be compared for reasonableness against aggregate rates of different derivations from various preexisting sources, without the need to set such a rate per se.¹⁹ Notable examples of this are in the UK with *UP v. Huawei* (including a Supreme Court

¹⁷ [The smartphone royalty stack: a long-term look](#), by Keith Mallinson, IAM, 2 March 2022. This article shows that aggregate royalties that are actually paid are modest and have declined.

¹⁸ [Essentiality checks might foster SEP licensing, but they won’t stop over-declarations from inflating patent counts and making them unreliable measure](#), by Keith Mallinson, IP Finance, 16th November 2022

¹⁹ Sources include public announcements for individual rates and target aggregate rates, and estimated maximums, averages or typical figures derived by industry analysts and in various court judgments.

judgment), and *Optis v. Apple*. The recent *Interdigital v. Lenovo* judgment rejected using the top-down approach, even only for cross-checking, at least “as pleaded” in that case.

Sharing the pie

The top-down approach apportions an aggregate royalty figure to derive the different FRAND royalty rates for individual SEP owners. The top-down approach calculation is usually made to derive the royalty rate for a licensor using this apportionment formula:

$$\text{Licensor's royalty rate (R1)} = \text{aggregate rate (T1)} \times \text{licensor's share (S) of SEPs}$$

R1 is the rate to be applied to actual sales figures net of royalty caps.²⁰

Adjusting for geography and expired patents is more subtle. It all depends on what the aggregate rate is supposed to represent.

The starting point aggregate figure is typically described as a maximum, but that is ambiguous. Is it supposed to be the maximum :

- a) That could ever be paid on any individual device sold in the nation with strongest patent protection?
- b) Of royalties averaged across all devices sold in that nation in a certain period?
- c) Of royalties averaged across all devices sold in a certain period?

The devil is in the detail with any averaging versus the hypothetical corner case in a).

For example, in *TCL v. Ericsson*, R1 was further reduced to R2 for geographies where the licensor has fewer SEPs.²¹

The Court found:

Ericsson’s 4G patent strength in China is 69.80% of its U.S. patent Strength” and “that “0.45% is an appropriate FRAND for Ericsson ‘s 4G SEP portfolio in the United States. This means that the FRAND rate for Ericsson’s portfolio for the Rest of the World (“RoW”) is 0.314%” .²²

The RoW rate is nearly a third less than the US rate. With most sales outside the US, the blended global average set by the court was rather closer to the RoW rate than the US rate.

The court also made a reduction for expired patents in its rate determinations. It included expired patents in the denominator while it excluded them from the numerator in calculating S. This also has a diluting effect on the royalty rate determined. In contrast, patent pools typically remove expired

²⁰ Much larger aggregates of headline maximum royalty rates before any discounting, as in licensors’ individual rate card disclosures, than in the aggregates of rates actually paid after discounting is only to be expected. For example, if a licensee sells a handset for \$400 where rates are subject to \$200 cap, the royalty percentage rate actually paid will be only half as much as the headline royalty rate percentage.

²¹ These adjustments, for example, as used in the *TCL v. Ericsson* Decision are contentious, [as I have noted in a previous publication](#). However, the issue is not necessarily whether these reductions are made, but whether the aggregate royalty rate used as the top-down approach input correspondingly anticipates such adjustments. Some aggregate figures do, and others do not. If these reductions are taken, then the applicable input figure T needs to be higher than otherwise. For example, with regard to geography, is the aggregate the maximum to be paid where patent protection is strongest, or is it a globally a blended “maximum” across all licensed sales in a given period?

²² *TCL v. Ericsson* Decision, page 99

patents from their patent counts in both the numerator and denominator in calculating shares of fees for distribution.

Was it anticipated in existing licenses that royalty rate figures would reduce over time as patents expired? Alternatively and more realistically, for example, are rates agreed for simplicity at the same level for the duration of the standard or licensing agreement regardless of expirations and new patent additions?

To be clear, I am not advocating application of adjustments to the royalty rate and apportionment factor as undertaken in *TCL v. Ericsson*, I am merely explaining what was done and stating that if such an approach is taken the ARRFA must be set accordingly.

Aggregate rate setting and checking

In the case of *Unwired Planet v. Huawei*, the court was unwilling to set a top-down rate due to the uncertainties in doing that.²³ Instead, the court used the same apportionment formula the other way around to *imply* an aggregate rate burden from comparable licenses (comps), as a cross check.

$$\text{Implied aggregate rate (T2)} = \text{Licensor's royalty rate implied from comps (R3)} \div S$$

This is a crucial difference in use of the same simple algebraic formula, because T2 is implied rather than set as it is in conventional use the formula.

These aggregate royalty rates are absent cross-licensing effects that reduce net payments. All the above algebra is applied to one-way royalty rates (i.e. after any cross-license payment figures have been grossed-up in unpacking). Rates actually paid after cross-licensing were lower.

You take the high rate and I'll take the low rate

According to the proposed legislation, "'aggregate royalty' means the maximum amount of royalty for all patents essential to a standard."²⁴ The Commission's proposals imply this could be: the expected total burden to be paid by licensees; or the ARRFA to be used in conjunction with patent counting by EUIPO Conciliators to derive FRAND royalties using the top-down approach.

The top-down approach is still rather immature with significant ambiguity and contention about how it should be applied. No wonder it has been rejected in several decisions—outright as pleaded, or as anything other than a cross-check in which aggregate rates are implied from comparable license rates and where aggregate rates are not set per se.

It is important to recognize differences in the types of aggregate rates from among various benchmarks and estimates—whether these are depicted as percentages of device selling prices or as monetary figures per unit.

²³ The *Unwired Planet v Huawei* decision states "the main conceptual difficulty I have with the using a total stack in a top-down approach as opposed to using it as a cross-check is in the selection of the total royalty burden T to start with. In my judgment the statements set out above have little value in arriving at a benchmark rate today for a number of reasons. The claims are obviously self-serving. The statements about aggregate royalties in particular are statements about other people's money on the footing that the person making the statement says at the same time that the cake is quite small but they are entitled to a large piece of it." UP, 268-9

²⁴ Article 2 (10).

There is insufficient distinction in naming, definition and applicability between what are different kinds of aggregate. Associated figures can differ by an order of magnitude for the very same SEPs depending on what exactly is being depicted.

There are conceptually two different ways the input aggregate rate for the top-down approach can be derived: from royalty rates sought or paid in the licensing marketplace; and from valuation models that measure the economic surplus arising from the inclusion of SEP technologies in products and then divide it between implementers and patent owners before further dividing it among the latter.

Aggregate royalties based on rates sought and paid include:

- 1) The sum of all the maximum rates (i.e. before any caps or other discounting), either publicly disclosed or privately indicated, for the given standard
- 2) Academics' and analysts' published estimates
- 3) The overall royalty yield for standards in all potentially licensable sales
- 4) Publicly-stated aggregate royalty rate goals by certain companies
- 5) Other estimates of hypothetical rates and actual rates paid

1) The sum of all the program rates disclosed, or otherwise, for the given standard

Simply adding up all licensors' maximum royalty rates inevitably produces a maximum aggregate royalty rate figure that is inflated far above what anyone would ever pay. For example, before the introduction of LTE in 2009, NGMN appointed a Trusted-Third-Party (TTP) to collect publicly and privately indicated maximum royalty rates for licensing cellular standards from as many prospective licensees as it could and add up all those rates. In other words, it was attempting to measure a theoretical maximum "stack." Aggregate figures of around 30% for 4G LTE were derived. While this process was ostensibly to increase transparency on royalties, aggregate rate figures were only ever leaked and were never made public officially.

Licensing expert Eric Stasik published a widely-cited 2010 paper adding up the only the nine publicly-announced 4G LTE royalty rates at that time for an aggregate royalty of 14.8% from a list of more than 30 firms with patents declared essential to the standard.²⁵

No licensee ever paid anywhere near as much as the aggregate rates the TTP derived. Many of the figures in the summation resulted from wishful thinking by SEP owners. Maximum rates are very often reduced by selling price caps on ad valorem rates and many SEPs go totally unlicensed by any implementer. Fully licensed aggregate rates are thus not paid on a single device or model, let alone overall for any OEM when blended across all product sales in a nation or accounting period.

Also according to Stasik's testimony in *Optis v. Apple* citing his same report:

- "In 1998, ITSUG (an obscure organisation representing some operators and manufacturers) filed a complaint with the European Commission claiming that "when GSM mobile handsets first appeared on the market place cumulative royalties amounted to as much as 35 per cent to 40 per cent of ex-works selling price."
- "In 2007, Lemley and Shapiro commentated that they had "seen estimates for [W-CDMA] as high as 30 per cent of the total price of each phone...based on summing royalty demands

²⁵ [Royalty Rates And Licensing Strategies For Essential Patents On LTE \(4G\) Telecommunication Standards](#), Eric Stasik, Les Nouvelles, September 2010

before any cross-licensing negotiations began.”

2) Academics and analysts’ published estimates

Over the decades, academics and various industry and financial analyst firms have come up with widely differing estimated aggregate royalty rates, in some cases including some additional indication of what the figures represent. In addition to the above estimate of academics Lemley and Shapiro, estimates for WCDMA also included 25% to 30% by Dr Bekkers in 2006,²⁶ 31.5% by ABI Research in 2008,²⁷ and 17.5% by ABI Research in 2011.²⁸ In 2005, investment bank Credit Suisse First Boston provided an estimate for cumulative WCDMA royalties at 17.3%, noting that rates “could be as high as 25-30%.”²⁹ Industry expectation for aggregate royalties on the UMTS standard (which is effectively the same as WCDMA) were also reportedly up to 20% by Dr Bekkers in 2009.³⁰

Estimates for 4G LTE have also varied, with rates including 23.6% by ABI Research in 2008³¹ and 35.4%. by ABI Research in 2011.³²

3) The overall royalty yield for standards in all potentially licensable sales

My seminal empirical research in 2015 indicated that the overall aggregate royalty paid as a percentage of total phone sales revenues for all standards and including all cellular handset vendors was no more than around 5%.³³

This article is where I coined the term *royalty yield* for that kind of aggregate rate.³⁴ The term was subsequently adopted by others in their published literature where they validated my methodology and derived even lower rates than mine.³⁵ Such labeling, and that of ARRFA, are required in FRAND licensing royalty assessments to distinguish between the different complexions of aggregate rate with significant differences among them in what various figures presented are actually depicting.

²⁶ Bekkers, *The Rules, Norms, and Standards on Knowledge Exchange*, DIME Working Papers on Intellectual Property Rights, Working Paper No. 9, March 2006.

²⁷ *ABI Research Report*, 4Q 2008, Table 1.2 (royalty stacks of 31.5% for 3G likely for licensees without patent strength).

²⁸ *ABI Research Report*, December 20, 2011, pp. 31-33 (royalty rate for licensees without patent strength is 17.5% for GSM/WCDMA).

²⁹ *3G Economics*, Credit Suisse First Boston (6th September 2005).

³⁰ *The Limits to IPR Standardization Policies as Evidenced by Strategic Patenting in UMTS*, Telecommunications Policy, February/March 2009, p. 22 (total royalties of up to 20% for UMTS).

³¹ Carlaw, Stuart and Clint Wheelock, *Mobile Device Royalties: Intellectual Property Rates for GSM, WCDMA, and LTE*, ABI Research, 4Q 2008, Table 1.2 (royalty stack of 23.6% for single-mode LTE is likely for licensees without patent strength).

³² Solis, Phil and Stuart Carlaw, *Mobile Device Royalties: GSM, WCDMA, and LTE*, ABI Research, December 20, 2011, Table 10 (royalty rate for licensees without patent strength is 35.4% for LTE multimode devices).

³³ [Cumulative mobile-SEP royalty payments no more than around 5% of mobile handset revenues](#), by Keith Mallinson, IP Finance, August 19, 2015.

³⁴ The royalty yield for a licensee, licensor or an entire standard is defined as royalties paid by licensee to licensor, divided by corresponding handset revenues. It can be considered to be the effective royalty rate achieved across all licensed and unlicensed phone sales after all omissions and adjustments including, caps, discounts (e.g. for volume and geography) and net of cross-licensing. The sum of yields for all licensors, all licensees, and in a standard, is the same.

³⁵ Galetovic, Haber and Zaretski in [An estimate of the average cumulative royalty yield in the world mobile phone industry: Theory, measurement and results](#), April 2018.

The huge differences between aggregate figures in 1) and 2) versus the above royalty yield of only around 5% or even less result from many omissions and reductions. Licensors' aggregate royalty yields—after royalty caps, volume and geographic discounts, discounts to get deals done, discounts on prior sales, cross-licensing and patents that remain unlicensed—tend to be a lot lower, as I have illustrated. The headline maximum rates and “program rates”³⁶ disclosed by many licensors are much higher than the individual royalty yields paid by licensees after all those exclusions and reductions.

For example, royalty caps can result in dramatically lower royalty yields than program rates. Interdigital's web site rate card indicates a 0.5% headline maximum royalty rate with a \$200 royalty cap on handset price (i.e. \$1.00 maximum royalty) for 4G.³⁷ The corresponding royalty yield on a \$1,000 phone is, therefore, only 0.1%.

4) Publicly-stated aggregate royalty rate goals by certain companies

The first collective attempts to agree aggregate rates “enable[ing] the cumulative royalty rate for W-CDMA to be at a modest single digit level” and for a “single-digit percentage of the sales price” for 4G LTE were around when the standards were first introduced in the early 2000s and late 2000s, respectively.³⁸ A key objective in setting these single-mode aggregate rate goals was to encourage adoption of these standards in competition to 3G CDMA2000 and WiMAX, respectively.³⁹ Public announcements in press releases were made by various SEP owners including Alcatel-Lucent, Ericsson, Nokia and Siemens. All of these also had predominant interests—then, but no longer today—as net payers of royalties on handset sales, as did other OEMs and network operators making these announcements. For example, Nokia's global handset market share was in excess of 40% for much of the 2000s. Nokia and all the other European companies named above had exited the handset market by 2014.⁴⁰

These announcements by only a handful of companies faced plenty of opposition from others. While the former companies have maintained that they were seeking broader support, they have also argued that was not obtained and the goals were not achieved (i.e. aggregate rates paid ended up being higher than goals).

³⁶ Program rates are also referred to as rate card rates. Absent clear or universally accepted definitions, I am distinguishing between undiscounted headline maximum rates indicated on rate cards and the lower rates that are actually applied with any discounts including those due to handset selling price caps that are also made explicit on those rate cards.

³⁷ [Interdigital Rate Disclosure](#).

³⁸ [Press release; Industry leaders NTT DoCoMo, Ericsson, Nokia and Siemens, and Japanese manufacturers reach a mutual understanding to support modest royalty rates for the W-CDMA technology worldwide](#), November 6, 2002: “This arrangement would enable the cumulative royalty rate for W-CDMA to be at a modest single digit level.” [Press release; Wireless Industry Leaders commit to framework for LTE technology IPR licensing, April 14, 2008](#): “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.”

³⁹ An additional objective was to reallocate shares of royalties among SEP owners, versus some existing licensing, with “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” and for LTE “according to the licensors' proportional share of all standard essential IPR for the relevant product category.”

⁴⁰ [How Europe can build on strengths in SEPs to reclaim leadership in cellular with 5G and 6G](#), A paper for 4iP Council by Keith Mallinson, WiseHarbor; April 28, 2022

As these announcements were targets for aggregate rates actually paid, these are also effectively target royalty yields, rather than figures that should be used as ARRFAs, which would necessarily need to be higher figures given that standards are never fully licensed.

Such figures have created self-reinforcing “anchoring.”⁴¹ Despite all the above, the figures in these announcements are still commonly cited, for example, in FRAND licensing litigation (e.g. *Unwired Planet*), and are proposed as prospective benchmarks for use in making FRAND rate determinations.

5) Other estimates of hypothetical rates and actual rates paid

Cases in litigation include consideration of various estimates for aggregate royalties. Little or no weight is given to the hypothetical maximum aggregate rates in 1) that nobody would actually ever pay because these ignore discounting and unlicensed SEPs. At the other end of the scale, consideration is given to royalty yields derived from royalties paid, but these are typically higher than in 3) because the denominators in those royalty yields focus on sales of phones conforming to specific standards such as 4G or 5G, albeit in multimode devices, and because rates considered are typically one-way rates after unpacking.

In *Unwired Planet v. Huawei*, the court derived an “implied total burden” of 8.8% for multimode 4G from the comparable licenses and the share of Unwired Planet’s relevant SEPs. The court also noted that “On Huawei’s figures the implied total aggregate [4G] royalty burden T would be 13.3% while for Unwired Planet it would be 10.4%.” The rates derived from “unpacking” comparable licenses are based on amounts that would be paid, but for cross-licensing, which means they are adjusted royalty yields. Consequently, aggregate rates implied from these with use of the top-down formula are theoretical. They are also adjusted royalty yields, before cross-licensing reductions and elevated by including notional royalties (i.e. that are not paid) for unlicensed SEPs that are counted in the denominator for the derivation of S.

In the UK’s *Optis v. Apple* FRAND trial, expert witness Eric Stasik, with many years’ experience in licensing negotiations was:

‘asked by Optis’ solicitors to give [his] view as to whether it would be reasonable, assessed as of today, for implementers to be expected to bear a theoretical notional aggregate royalty burden for 4G multimode handsets in the range of around 8% to 15% (i.e. a total royalty burden in respect of all relevant (i.e. handset) SEPs in the 2G, 3G and 4G “universe”.’

In response he testified:

“in the (hypothetical) scenario where implementers do all behave as willing licensees and all in fact therefore pay truly “FRAND rates” for the whole stack, a range of 8% to 15% is appropriate” [‘in respect of all relevant (i.e. handset) SEPs in the 2G, 3G and 4G “universe”’].

Stasik also noted that “In practice, implementers do not pay the theoretical total aggregate royalty burden for a 4GMM handset because implementers in my experience are never fully licensed under all SEPs in the 4G, 3G and 2G universe.” His description is therefore, seemingly of more than a royalty yield—by pretending unwilling licensees are willing and licensed. While I presume cross-licensing did not feature much in the case, it is unclear whether the rate at the lower end of the range is supposed to be net of cross-licensing reductions.

⁴¹ In their research about the anchoring effect, [psychologists Daniel Kahneman and Amos Tversky showed that when we’re asked to make a judgment in the face of uncertainty, we are easily swayed by the first figure that’s introduced into the conversation](#), however irrelevant, outrageous, or insulting it may seem.

The wide percentage range—with the top figure nearly double the bottom figure—seemingly reflects the variability in amounts paid—largely to major licensors. Major licensees such as Apple, Samsung and Sony with relatively large sales and ability to pay large lump sum fees up front might be able to obtain significant further discounts to those that are initially offered in rate cards. In contrast, payments made by small licensees with little or no negotiating power will be much closer to those indicated in rate cards offered initially and as are disclosed on licensors’ web sites.⁴²

Various aggregate rate figures have also been presented to government agencies including competition authorities.

Where figures are reported, it is not always clear how terms such as “typical” aggregate rate are defined—if at all— or what exactly what they depict.

Modal rates for standard modes

A common source of additional confusion and misunderstandings across all the different types of aggregate rate described above is whether royalty rates are for only a single mode or are multimode rates (e.g. 2G and 3G; or 2G, 3G, 4G and 5G). In some statements this is only implicit in others it is explicit. Both single-mode and multimode rates are seldom indicated together. However, NGMN did that when it had the TTP tot-up rates for single-mode 4G and multimode 4G including 3G and 2G.

For example, as I explained in great detail when analyzing various opinions in the *TCL v. Ericsson* decision, the Court misinterpreted the press release statement about 3G and 4G LTE aggregate rates, cited in 4), believing they were indications of multimode rates.⁴³

These statements, targeted at sophisticated licensing professionals (i.e. in licensee companies), including “cumulative royalty rate for W-CDMA to be at a modest single digit level” and “aggregate royalty level for LTE essential IPR in handsets is a single digit percentage of the sales price” indicate single-mode rates, not multimode rates.

Notwithstanding the above, handsets are always defined by the latest-generation technology they include, and these are almost invariably multimode devices including previous standard generations. In other words, 3G devices usually also include 2G standardized technology, and 5G devices usually also include 4G, 3G and 2G.

It was widely recognized in the industry, including by licensee professionals, that 4G LTE handsets would be multimode devices and subject to additional royalties for other standards and that the individual 4G LTE licensing rates being announced by many companies, including those identified above, were single-mode rates. It was also understood that devices would be subject to additional

⁴² As I pointed out in my previous feedback to the Commission’s proposed legislation, the top-down approach makes no attempt to determine non-discriminatory variations in rates among differently situated licensees: [European Commission is recklessly replacing established and effective FRAND valuation and licensing practices with dubious top-down rate setting](#), IP Finance, 14th June 2023. It is beyond the scope of this paper to consider whether or how to adjust aggregate rates for apportionment to deal with this major issue in FRAND licensing.

⁴³ [Unreasonably-low royalties in top-down FRAND-rate determinations for TCL v. Ericsson](#), by Keith Mallinson, IP Finance, April 30, 2018.

royalties for previous-generation technologies including 2G and 3G. This was indicated, for example, in an extensively-cited article published by Eric Stasik in September 2010:⁴⁴

‘Both Nokia and Qualcomm made clear in their announcements that a different, higher royalty rate should be charged for end-user devices employing more than one standard.’²³

‘multi-mode, end-user devices which employ the LTE standard and other standards will likely see higher royalties than those displayed’

‘23. Nokia Press Release (undated), “When multiple wireless standards are used in the same end product... Nokia will not charge more than 2.0 percent [versus 1.5% for LTE] from the sales price of an end-user device...”

Qualcomm Press Release (December 2008) “Qualcomm [indicating a 3.25% rate for LTE] expects that it will not charge a royalty rate on such multi-mode devices... that is greater than Qualcomm’s standard 3G CDMA royalty rate...” Qualcomm Press Release (December 2008) On June 3, 2009 during a Global Technology Conference sponsored by Merrill Lynch, Qualcomm COO Len Lauer suggested that Qualcomm normally charges 4 percent-5 percent as royalty for 3G shipments.”’

In *TCL v. Ericsson*, the Court incorrectly asserted, without foundation, that announced rates were multimode rates (and not single-mode rates) on the basis that Ericsson and others needed to announce multimode rates to compete with WiMAX.

To the contrary, for WiMAX to compete with LTE in mobile phones, or to compete in mobile phones at all (e.g. against 3G and 2G phones), WiMAX phones also needed to include the very same 2G and 3G technologies that LTE phones incorporated. For example, Sprint’s flagship WiMAX phone the HTC EVO also included 2G/3G CDMA2000 technologies for backward compatibility with Sprint’s legacy network and for roaming.⁴⁵ WiMAX phones used on other networks had to include GSM and WCDMA/HSPA.⁴⁶ That 4G LTE, through technological integration (e.g. on the same chip instead of requiring a separate chip as in above examples) in all but the earliest devices, provided much better backward compatibility with 3G and 2G than WiMAX did not enable WiMAX phones to get away without incorporating any 2G and 3G capabilities at all.

These licensing-rate announcements were therefore to signal to manufacturers how much more they would need to pay in royalties to include the additional 4G LTE technology. The handset market was well established. Nobody was in anything like as good a position to know how much any given OEM would need to pay for 2G and 3G than that OEM itself—based on what it was already paying. Therefore, it was most appropriate only to indicate the additional amount to be paid for 4G (i.e. LTE). In other words, the aggregate rate for a multimode device should be the 2G+3G+4G rates, less any discounts that might be negotiated for overlap and bundling among patent portfolios for these three standards.

Pie eating humbly at Goldilocks rates

The aggregate royalty rate selected as the starting point *input* for apportionment among licensors in top-down approach determinations of FRAND royalties for SEPs (i.e. the ARRFA) must reflect the

⁴⁴ [Royalty Rates And Licensing Strategies For Essential Patents On LTE \(4G\) Telecommunication Standards](#), by Eric Stasik, Les Nouvelles, September 2010, at 3

⁴⁵ https://www.gsmarena.com/htc_evo_4g-3427.php

⁴⁶ https://www.gsmarena.com/htc_max_4g-2605.php and https://www.gsmarena.com/htc_j-4997.php

actuality that the *output* aggregate rate paid in cash or in kind by licensees will generally be lower. Some SEP royalty pie is left uneaten when it is shared in top-down approach apportionments.

It would be inapplicable to use the maximum stack of single-mode or multimode program rates in 1) as the ARRFA because the inflated claims of some owners would over-value the entire pie, and in turn, also the apportionments.

However, apportioning only the aggregate royalty rate figures in 3) and 4) will in turn result in sub-FRAND rate determinations for individual licensors and licensees and yet lower aggregate royalty rate payments. If this approach caught on, there would be a vicious cycle of rates spiraling lower and lower as sub-FRAND rates are used to set the next aggregate rate for apportionment, and so on ad infinitum. Aggregate royalty yields in 3) are inapplicable as the input for apportionment because the top-down approach allocates proportions of royalties that are not paid. Unpaid royalty allocations are not licensing costs. The total of all licensors' R1 figures, let alone the sum of all R2 figures, would fall short of T1. Similarly target maximum payments in 4) also appear to be something like royalty yields—derived from what is actually paid, or would actually be paid in accordance with those announcements—not based on what should be available for payment in the hypothetical and unrealistic circumstance of full licensing. All those paid rates, or to be paid rates, would need to be grossed-up by various factors before being used as a top-down input.

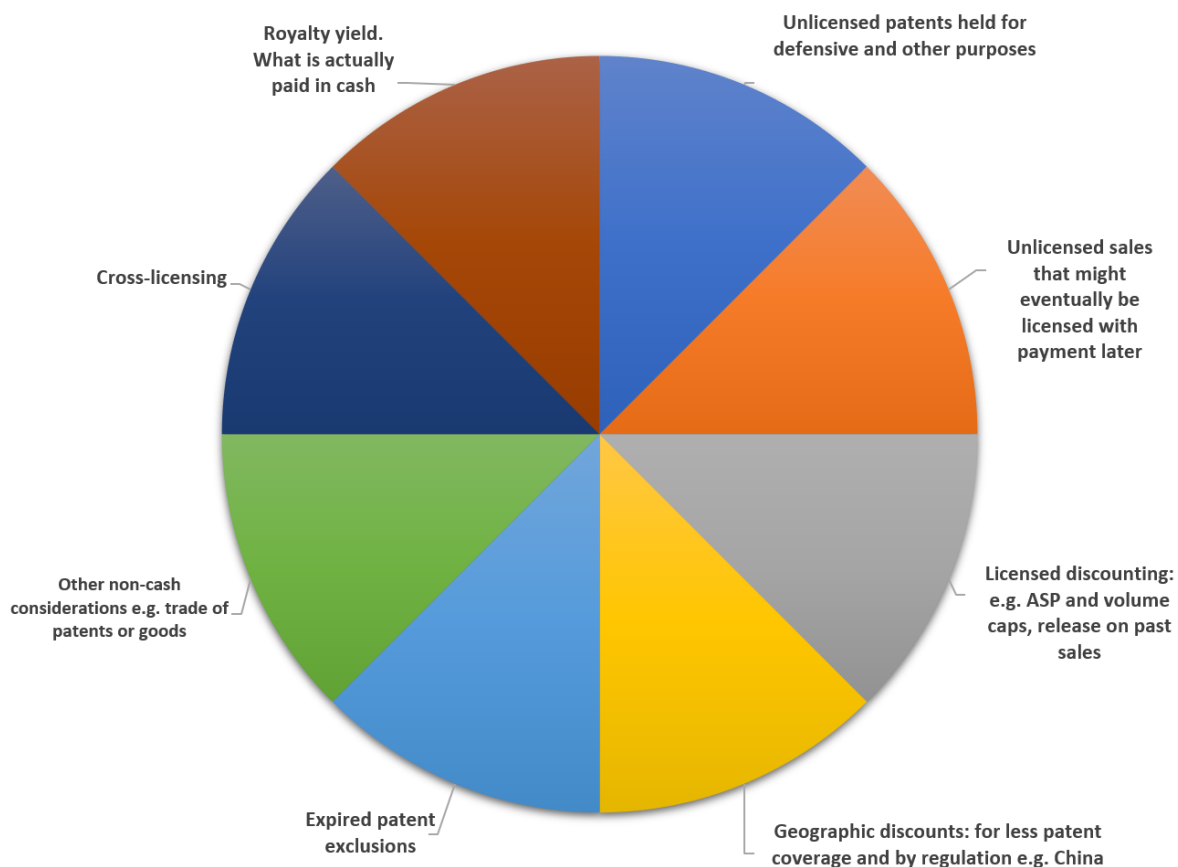
Implied total burden figures such as those derived in *Unwired Planet* appear to be more appropriately formulated to be used as ARRFA's because they account for unlicensed SEPs. However, the precision and reliability of such figures is highly questionable—particularly as an ARRFA, rather than as an implied figure for cross checking, as was the sole intention. The court noted there that for 4G from the comparable licenses its “[8.8%] is lower than the aggregate implied by either party’s case (Huawei’s 13% and Unwired Planet’s 10.4%). The implied aggregate rates are proportionate to a licensee’s rates, as derived from unpacking, divided by that licensee’s estimated shares of all SEPs in the respective standards.

The cost to the licensee is what it actually pays, not what it avoids paying when it should pay, or the discount it receives for geography or patent expirations, or for any other notional charges that it has not and will not be asked for. Unpaid liabilities might eventually be paid, but back royalties are often only paid as deeply discounted release payments when new licenses are negotiated and agreed.

While the formulation in 1) depicts rates that are too high, even as the starting point input for apportionment, let alone an indication of what one would have to pay, the royalty yield formulations in 3) and 4) indicate rates that are too low to be the ARRFA. In between, with suitable adjustments to such formulations and figures, and some formulations in 2) and 5) might well be “just right” for that purpose, subject to applicability of the timing and verified accuracy of such estimates.

While the following pie chart is not to scale it is intended to include everything that might be depicted in various different aggregate rate figures. Some slices might be very small or non-existent under certain circumstances. It also shows how pieces of aggregate royalty pie will be left uneaten (e.g. unlicensed SEPs). A proportion of the of the value ascribed from any aggregate rate figure other than the royalty yield is not paid for in cash. Instead, some payments are made in kind.

Exhibit: Aggregate pie gets left on the table in top-down apportionments among licensors (not to scale)



The chart aims to include all hypothetically possible charges, including the maximum rates and for all SEP owners, as the highest among aggregate rates presented of 30% for LTE in 1) does. However, only the royalty yield slice is actually monetized in cash payments to licensors. It corresponds to the lowest among aggregate rates, such only around 5% or even less including all standards, as I indicated in 3).

How much more for full licensing?

The “fully licensed” aggregate rate is the applicable ARRFA.⁴⁷ The aggregate royalty allocated needs to include all the SEPs counted in the denominator of the apportionment calculation of S as if all SEPs are fully licensed for FRAND royalty payments. In contrast, in the special case of patent pools, there are no allocations for patents outside the pool because patent pools do not count SEPs that are outside the pool, even though some of them might be licensed bilaterally or by another pool. In the top-down approach, the count of all SEPs in a standard are included in the denominator calculating S whether or not they are licensed. Consequently, the aggregate rate for apportionment must be increased above the aggregate royalty yield figures, as if those additional SEPs are under license and paid for at FRAND rates.

The same goes for geographic reductions. If the overall royalty rates being determined are attenuated due to geographies where patent protection is relatively weak, as I illustrate above with the example in the *TCL v. Ericsson* decision, then the aggregate rate needs to be increased

⁴⁷ “Fully licensed” is a term that was used with this meaning by Eric Stasik in the *Otis v. Apple* decision.

correspondingly. It will be taken back out to the extent applicable on case-by-case basis in specific FRAND determinations. In practice, for example, handset OEMs almost invariably sell in multiple jurisdictions, with higher rates paid in some than others, and so royalty rates paid will average out.

There also needs to be an upward adjustment if expired patents are excluded from the numerator while being retained in the denominator in calculating the rate of apportionment S . Alternatively, as patents expire they should be removed from both the numerator and denominator. Similarly, new SEPs should be added to both numerator and denominator. Fully licensed royalties should be derived entirely from the non-expired patents in the standard, as numbers of these fluctuate.

It is also necessary to gross-up for cross-licensing. Imagine a world where the aggregate royalty yield was zero due to completely balanced cross licensing. While net royalty rates are zero there, one-way rates could still be substantial. Top-down apportionments derive one-way rates. These can then be netted off to determine how much should be paid in cash and to whom.

However, there should be no upward adjustment for licensors' discounting against their maximum headline rates or for rates agreed below the indicated discounts offered in rate cards. This is on the assumption that their SEPs are being fully monetized by receiving FRAND royalties overall at the discounted rates they have offered or agreed through negotiation and that they receive in payments.

Other methods for deriving the ARRFA

Aggregate valuation figures for standards such as 5G can also be derived from hedonic pricing regression models or from consumer willingness to pay in conjoint analysis. For example, I showed in 2015 that the total value in patented cellular technologies is substantial with a very simple hedonic pricing model example where all the features apart from cellular connectivity in an Apple iPhone, versus an iPodTouch were inherently controlled for by being identical.⁴⁸ Hedonic models typically include many features and quality metrics (e.g. memory size and display pixel density) as explanatory variables so that many different device phone models can be included in the analysis. Modeling controls for various variables to isolate and quantify the relationship between the inclusion of cellular standards and device price.

Limitations to this approach include the fact that price is not the same thing as value. For example, OEMs might price smartphones on a cost-plus basis while value in use to consumers might vary very differently. Problematically, explanatory variables are generally not entirely independent of each other. For example, one hedonic model included talk time and battery capacity variables in mobile phones.⁴⁹ It unsurprisingly found these two variables to have significant correlation with a coefficient of 0.71. This collinearity impairs the predictive power of the model. Faster cellular communications also significantly correlates with other features because it enables or enriches those capabilities. By way of example, consider an HD or UHD TV that is fed only SD signals from a set top box or broadcast feed. The picture quality would be no better and no more valuable in use than that on a less costly SD TV.

Conjoint analysis measures consumers' perceived value in various combinations of features by analyzing consumers' stated preferences.

⁴⁸ [George Mason University CPIP conference speech](#) by Keith Mallinson, October 2015

⁴⁹ [Hedonic Prices for Multicomponent Products](#). J. Gregory Sidak & Jeremy O. Skog, *The Criterion Journal on Innovation*. [Vol. 4:301] 2019.

However, both methods derive a figure for total economic surplus— not only the proportion of it attributable to the SEP owners. How that surplus should be divided between OEMs and SEP owners overall to come up with an aggregate figure for apportionment among SEP licensors is also a major question. An expert for Interdigital in *Interdigital v. Lenovo* proposed a 50:50 division of the output from his hedonic model. The judge was having none of that simplistic split. He indicated there was insufficient substantiation to that and there were procedural deficiencies in submitting evidence on this. We need to and can do better.

Finding Goldilocks rates

In 2014 we were still being told by some that aggregate royalty rates on smartphones could be as much as 30%.⁵⁰ In 2015 I showed that rates paid were only around 5%.⁵¹ While both percentages are aggregate rates, they are depicting very different phenomena. An appropriate percentage to be used as the ARRFA in FRAND rate determinations for smartphone licensing will surely fall well between those two extremes and will be higher than any of the royalty yield figures derived.

ARRFA figures need to be net of licensors' rate reductions, such as royalty base price caps and other discounts agreed bilaterally between licensor and licensee. However, figures such as royalty yields should be grossed-up for what is unilaterally missing from aggregate payments received including all licensors. These unpaid royalties are due to SEPs being unlicensed, for example, where licenses are not offered and the SEPs are held only for defensive purposes, and where implementers are unwilling licensees and are not paying. Upward adjustments to royalty yield figures are also needed for adjust for the effects of cross-licensing in existing licenses.

In *Optis v. Apple*, Eric Stasik confirmed that an aggregate rate range from 8% to 15% would be applicable for multimode 4G, and he also indicated that those rates are what would be paid if fully licensed.

We are still in the process of properly identifying and describing all the factors that should be incorporated or excluded in setting aggregate rates for apportionment, and building rigorously-reasoned consensus on what the figures should be with coherent methods for their apportionment.

If we are going to do top-down apportionment properly and with precision, we must develop well-defined ARRFA among other kinds of aggregate rates. For example, some will need to be monetary figures rather than percentages, depending on application (e.g. monetary figures in IoT). This paper contributes to the ongoing debate about the need for such figures, what exactly they should include and exclude, where to find the benchmark royalty data and what other valuation methods can be used in determining those rates.

⁵⁰ [The Smartphone Royalty Stack: Surveying Royalty Demands for the Components Within Modern Smartphones](#), by Ann Armstrong, Joseph J. Mueller, and Timothy D. Syrett, 2014

⁵¹ [Cumulative mobile-SEP royalty payments no more than around 5% of mobile handset revenues](#), by Keith Mallinson, IP Finance, August 19, 2015.