

UNITED STATES INTERNATIONAL TRADE COMMISSION

Washington, D.C.

In the Matter of

**CERTAIN MOBILE PHONES,
COMPONENTS THEREOF, AND
PRODUCTS CONTAINING SAME**

Inv. No. 337-TA-1375

INITIAL DETERMINATION ON VIOLATION OF SECTION 337

Administrative Law Judge MaryJoan McNamara

(December 17, 2024)

SELECTED SUMMARY FINDINGS

Pursuant to the Notice of Investigation, 88 Fed. Reg. 80336, dated November 17, 2023, this is the Initial Determination (“ID”) of the Investigation in the Matter of Certain Mobile Phones, Components Thereof, and Products Containing Same, United States International Trade Commission Investigation No. 337-TA-1375. *See* 19 C.F.R. § 210.42(a).

It is a finding of this ID that Complainant Telefonaktiebolaget LM Ericsson (“Complainant” or “Ericsson”) has proven by a preponderance of evidence that Respondents Motorola Mobility LLC, Lenovo (United States) Inc. and Motorola (Wuhan) Mobility Technologies, Communication Co., Ltd. (collectively, “Respondents”) have violated subsection (b) of Section 337 of the Tariff Act of 1930, in the importation into the United States, the sale for importation, or the sale within the United States after importation of certain mobile phones, components thereof, and products containing the same.

It is a finding of this ID that Respondents have infringed asserted claims 10 and 13-15 of U.S. Patent No. 10,426,817 (“the ’817 patent”). It is also a finding of this ID that the asserted claims of the ’817 patent are valid.

It is a finding of this ID that Respondents have infringed asserted claims 8, 9, 15, and 17 of U.S. Patent No. 10,306,669 (“the ’669 patent”). It is also a finding of this ID that the asserted claims of the ’669 patent are valid.

It is a finding of this ID that Respondents have infringed asserted claims 34 and 39 of U.S. Patent No. 11,317,342 (“the ’342 patent”). It is also a finding of this ID that the asserted claims of the ’342 patent are valid.

It is a finding of this ID that Respondents have infringed asserted claim 4 of U.S. Patent No. 11,515,893 (“the ’893 patent”). It is also a finding of this ID that the asserted claims of the

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'893 patent are valid.

It is a finding of this ID that one or more of Ericsson's domestic industry products have satisfied the technical industry prong of the domestic industry requirement for the '817, '669, '342, and '893 patents. Respondents did not dispute that Ericsson has satisfied the economic prong of the domestic industry requirement under Section 337(a)(3)(A) and (B), which was addressed in an Initial Determination granting Ericsson's unopposed Motion for Summary Determination on this issue. (*See* Order No. 50 (Dec. 16, 2024).).

A recommendation on permanent relief, bonding and the public interest will be forthcoming in another document that will be filed pursuant to 19 C.F.R. 210.42(a)(1)(ii).

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f)	[1.F] / [4.F]: “wherein for the non-zero entry with number e the number k is defined by a shift coefficient given by $\text{mod}(V_e, Z)$, with V_e denoting the e -th element of the shift vector and the shift vector is: [307, 19, 50, 369, 181, 216, 317, 288, 109, 17 357, 215, 106, 242, 180, 330, 346, 1, 0 [. . .] 135, 149, 15, 0].”	155
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ABBREVIATIONS

The following shorthand references to the parties, related U.S. agencies, and related proceedings are used in this Initial Determination:

Complainant or Ericsson	Complainant Telefonaktiebolaget LM Ericsson
Respondents	Respondents Motorola Mobility LLC, Lenovo (United States) Inc., and Motorola (Wuhan) Mobility Technologies, Communication Co., Ltd., collectively
Staff	Commission Investigative Staff
CBP	U.S. Customs and Border Protection
PTO	U.S. Patent and Trademark Office
PTAB	U.S. Patent Trial and Appeal Board

The following abbreviations for pleadings, exhibits, briefs, transcripts, and Orders are used in this Initial Determination:

Compl.	Complaint
Resp.	Response of Respondents to the Notice of Investigation and Complaint Under Section 337 of the Tariff Act of 1930, as Amended
CX	Complainant's exhibit
CDX	Complainant's demonstrative exhibit
CPX	Complainant's physical exhibit
CPBr.	Complainant's Pre-Hearing Brief
CBr.	Complainant's Initial Post-Hearing Brief
CRBr.	Complainant's Post-Hearing Reply Brief
CPSt.	Complainant's Pre-Hearing Statement
COMBr.	Complainant's Opening <i>Markman</i> Brief

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JX	Joint exhibit
RX	Respondents' exhibit
RDX	Respondents' demonstrative exhibit
RPX	Respondents' physical exhibit
RPBr.	Respondents' Pre-Hearing Brief
RBr.	Respondents' Initial Post-Hearing Brief
RRBr.	Respondents' Post-Hearing Reply Brief
RPSt.	Respondents' Pre-Hearing Statement
ROMBr.	Respondents' Opening <i>Markman</i> Brief
SX	Staff's exhibit
SDX	Staff's demonstrative exhibit
SPX	Staff's physical exhibit
SPBr.	Staff's Pre-Hearing Brief
SBr.	Staff's Initial Post-Hearing Brief
SPBr.	Staff's Post-Hearing Reply Brief
SPSt.	Staff's Pre-Hearing Statement
SOMBr.	Staff's Opening <i>Markman</i> Brief
Tr.	Evidentiary hearing transcript
Dep. Tr.	Deposition transcript
COMBr.	Complainant's Opening <i>Markman</i> Brief
CPHMBR.	Complainant's Post-Hearing <i>Markman</i> Brief
ROMBr.	Respondent's Opening <i>Markman</i> Brief

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RPHMBr.	Respondents' Post-Hearing <i>Markman</i> Brief
SOMBr.	Staff's Opening <i>Markman</i> Brief
SPHMBR.	Staff's Post-Hearing <i>Markman</i> Brief
Joint CC Chart	Post-Hearing Joint Claim Construction Chart (Doc. ID No. 817820 (Apr. 5, 2024))
<i>Markman</i> Order	Order No. 48 (Oct. 16, 2024)

The following shorthand references to certain products and patents at issue are used in this Initial Determination:

'817 patent	U.S. Patent No. 10,425,817
'669 patent	U.S. Patent No. 10,306,669
'342 patent	U.S. Patent No. 11,317,342
'893 patent	U.S. Patent No. 11,515,893
Asserted Patents	'817, '669, '342, and '893 patents, collectively
Qualcomm-Based Lenovo Accused Products or QC- Lenovo Accused Products	Moto Edge/Edge 5G (2021), Moto Edge 30 Fusion (2022), Moto Edge+ (2020), Moto Edge+ (2022), Moto Edge+ (2023), Moto G 5G (2023), Moto G Stylus 5G (2021), Moto G Stylus 5G (2022), Moto G Stylus 5G (2023), Moto G100, Moto G71 5G, Moto One 5G, Moto 5G Ace, Moto Razr/Razr 5G (2020), Moto Razr (2022), Moto Razr (2023), Moto Razr+ (2023), ThinkPhone by Motorola
MediaTek-Based Lenovo Accused Products or MTK- Lenovo Accused Products	Moto Edge (2022), Moto Edge (2023), Moto G 5G (2022), Moto G Power 5G (2023)

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Accused Products

Moto Edge / Edge 5G (2021)
Moto Edge 30 Fusion (2022)
Moto Edge (2022)
Moto Edge (2023)
Moto Edge+ (2020)
Moto Edge+ (2022)
Moto Edge+ (2023)
Moto G 5G (2022)
Moto G 5G (2023)
Moto G Power 5G (2023)
Moto G Stylus 5G (2021)
Moto G Stylus 5G (2022)
Moto G Stylus 5G (2023)
Moto G100
Moto G71 5G
Moto One 5G
Moto One 5G Ace
Moto Razr / Razr 5G (2020)
Moto Razr (2022)
Moto Razr (2023)
Moto Razr+ (2023)
ThinkPhone by Motorola

Samsung DI Products

Galaxy S21
Galaxy S21 FE
Galaxy S21 Ultra
Galaxy S21+
Galaxy S22
Galaxy S22 Ultra
Galaxy S22+
Galaxy S23
Galaxy S23 Ultra
Galaxy S23+

Public Version

Ericsson DI Products

Baseband 5216
Baseband 6303
Baseband 6318
Baseband 6502
Baseband 6620
Baseband 6630
Baseband 6631
Baseband 6648
Radio Processor 6337
Radio Processor 6339
RAN Processor 6651
AIR 1281
AIR 1641
AIR 1652
AIR 32
AIR 3239
AIR 3246
AIR 4435
AIR 4455
AIR 5121
AIR 5322
AIR 5331
AIR 6419
AIR 6449
AIR 6464
AIR 6468

Public Version

AIR 6488
Radio 0208
Radio 2012
Radio 2203
Radio 2205
Radio 2208
Radio 2212
Radio 2217
Radio 2218
Radio 2219
Radio 4402
Radio 4408
Radio 4412
Radio 4415
Radio 4418
Radio 4422
Radio 4426
Radio 4435
Radio 4449
Radio 4455
Radio 4460
Radio 4478
Radio 4480
Radio 4490
Radio 4499
Radio 8823
Radio 8843
Radio 8863
Radio Gateway R608
Streetmacro 6701
Streetmacro 6705

DI Products

Samsung DI Products and Ericsson DI Products, collectively

I. INITIAL DETERMINATION ON VIOLATION OF SECTION 337, AND RECOMMENDED DETERMINATION ON REMEDY AND BOND

A. Technology Comment

The technology at issue in this Investigation relates to 5G NR technology, or the fifth generation of wireless technology that contains a new radio (“NR”) for transmission of signals from base stations to user devices that operate in a different frequency range than the previous 3G or 4G LTE generations of wireless. 5G NR technology was developed by the 3rd Generation Partnership Project (“3GPP”). (*See, e.g.*, Joint Technology Stipulation, Doc. ID No. 815603 (Mar. 6, 2024) at pp. 1-2.). The 3GPP promulgated certain 5G standards. Complainant Telefonaktiebolaget LM Ericsson (“Complainant” or “Ericsson”) alleged that the Asserted Patents are essential to those standards, which was not disputed. (*See* CPBr. at 8.). Each of the Asserted Patents is directed to certain features that support the 5G standard.

B. Summary of Findings

The findings in this recommended Initial Determination (“ID”) are summarized below.

Table No. 1: Summary of Findings

Product	Patent	Claims	Determination
Accused Products	'817 patent	10 and 13-15	Violation
	'669 patent	8, 9, 15, and 17	
	'342 patent	34 and 39	
	'893 patent	4	
DI Products	'817 patent	10 and 13-15	Satisfied
	'669 patent	8, 9, 15, and 17	
	'342 patent	34, 39, and 41	

Product	Patent	Claims	Determination
	'893 patent	4	

II. BACKGROUND

A. Institution and Selected Procedural History

On October 11, 2023, Telefonaktiebolaget LM Ericsson (“Complainant” or “Ericsson”) filed a complaint (“Complaint”) under Section 337 of the Tariff Act of 1930, as amended, 19 U.S.C. § 1337, alleging infringement of claims 10-16 of the U.S. Patent No. 10,425,817 (“the ’817 patent”); claims 1-23 of U.S. Patent No. 10,306,669 (“the ’669 patent”); claims 1-18 and 34-40 of U.S. Patent No. 11,317,342 (“the ’342 patent”); and claims 1-12 of U.S. Patent No. 11,515,893 (“the ’893 patent”). (Compl. at ¶ 1.).

The Commission instituted this Investigation pursuant to subsection (b) of Section 337 of the Tariff Act of 1930, as amended, on November 17, 2023. 88 Fed. Reg. 80336-37 (Nov. 17, 2023).

The Notice of Investigation (“NOI”) names as complainant: Telefonaktiebolaget LM Ericsson of Stockholm, Sweden (“Complainant”). *Id.* at 80336. The NOI names as respondents: Motorola Mobility LLC of Chicago, Illinois; Lenovo (United States) Inc. of Morrisville, NC; Lenovo Group Limited of Quarry Bay, Hong Kong SAR; and Motorola (Wuhan) Mobility Technologies, Communication Co., Ltd. of Wuhan, China (collectively, “Respondents”). *Id.* Commission Investigative Staff (“Staff,” and with Complainant and Respondents, the “Parties”) is also a party in this Investigation. *Id.*

On December 19, 2023, Respondents filed a response to the Complaint and NOI. (Doc. ID No. 810659 (Dec. 19, 2023).).

Public Version

A *Markman* hearing was held on March 11, 2024. (*See* Order No. 16 (Feb. 23, 2024); Doc. ID No. 815999 (Mar. 12, 2024).). On October 16, 2024, a *Markman* Order issued construing the disputed claim terms. (Order No. 48 (“*Markman* Order”) (Oct. 16, 2024).).

Ericsson filed one (1) motion *in limine* (“MIL”). (Motion Docket No. 1375-027 (June 3, 2024) (MIL No. 1).). Respondents filed two (2) MILs. (Motion Docket No. 1375-026 (June 3, 2024) (MIL No. 1); Motion Docket No. 1375-025 (June 3, 2024) (MIL No. 2).). Respondents withdrew MIL No. 2 on June 6, 2024. (Doc. ID No. 823208 (June 6, 2024).).

The Private Parties filed respective oppositions (Doc. ID Nos. 823452, 823456 (June 10, 2024)) and Staff filed an omnibus response (“Staff’s Response”) to the Private Parties’ MILs (Doc. ID No. 823408 (June 10, 2024)).

The MILs, and the rulings on these motions, are summarized in Table No. 2 below.

Table No. 2: Private Parties’ MILs

MIL No.	Issue	Ruling
Ericsson’s MIL No. 1 (Motion Docket No. 1375-027)	Motion seeking to preclude Respondents from relying on prior art and prior art combinations that exceed the limits set forth in the Procedural Schedule and were not disclosed in contentions during fact discovery	Granted in-part and denied in-part. (<i>See</i> Order No. 40 (July 1, 2024).). “With respect to Ericsson’s MIL No. 1 (Motion Docket No. 1375-027), for the reasons discussed in Staff’s Response, Ericsson’s request to strike the Frenger reference is hereby granted; Ericsson’s request to preclude Lenovo from introducing any invalidity grounds based on the 3GPP contributions is hereby denied.” (<i>Id.</i> at 1 (citing Staff Resp. at 3-4 (June 10, 2024).).
Respondents’ MIL No. 1 (Motion Docket No. 1375-026)	Motion seeking to preclude Ericsson from presenting or relying on witness testimony from Christina Petersson and expert opinions from	Denied. (Order No. 40 (July 1, 2024).). “With respect to Lenovo’s MIL No. 2 (Motion Docket No. 1375-025), for the reasons discussed in Staff’s Response, Lenovo’s request to preclude Ericsson

MIL No.	Issue	Ruling
	Robert Mills	from relying on source code for infringement and the technical prong of the domestic industry requirement is hereby denied; Lenovo's request to exclude the MediaTek source code is hereby denied." (<i>Id.</i> at 2 (citing Staff Resp. at 4-6)).

The evidentiary hearing ("Hearing") was held on July 10-12, 15-17, 2024. (*See, e.g.*, Order Nos. 39 (June 27, 2024), 42 (July 12, 2024)).

As a result of several partial terminations of certain asserted claims, the following asserted claims remain at issue in this Investigation: (i) claims 10, and 13-15 of the '817 patent; (ii) claims 8, 9, 15, and 17 of the '669 patent; (iii) claims 34 and 39 of the '342 patent; and (iv) claims 1 and 4 of the '893 patent. (*See* Order No. 10 (Jan. 3, 2024), *unreviewed*, Comm'n Notice, Doc. ID No. 813083 (Feb. 1, 2024); Order No. 15 (Feb. 7, 2024), *unreviewed*, Comm'n Notice, Doc. ID No. 824301 (June 24, 2024); Order No. 31 (June 3, 2024), *unreviewed*, Comm'n Notice, Doc. ID No. 824839 (July 1, 2024)).

Prior to the Hearing, Respondent Lenovo Group Limited was terminated from this Investigation. (*See* Order No. 30 (June 3, 2024), *unreviewed*, Comm'n Notice, Doc. ID No. 824839 (July 1, 2024)). Thus, the remaining Respondents are Motorola Mobility LLC, Lenovo (United States) Inc., and Motorola (Wuhan) Mobility Technologies, Communication Co., Ltd. (collectively, "Respondents").

In response to Order No. 44, the Parties filed a joint statement with respect to issues not in dispute ("Joint Statement"). (*See* Order No. 44 (Aug 1, 2024); Doc. ID No. 829338 (Aug. 12, 2024)). Respondents sought leave to amend the Joint Statement (Motion Docket No. 1375-042 (Aug. 27, 2024)), which was granted (Order No. 47 (Aug. 28, 2024)). The amended Joint

Statement (“Amended Joint Statement”) was attached to Respondents’ motion as Exhibit A.

B. The Parties

1. Complainant Telefonaktiebolaget LM Ericsson

Telefonaktiebolaget LM Ericsson is a Swedish corporation with a principal place of business in Stockholm, Sweden. (Compl. at ¶ 9.). According to Ericsson, it is “one of the world’s largest suppliers of telecommunications network equipment and related services to telecom operators. (*Id.* at ¶ 12.).

2. Respondents

a) Respondent Motorola Mobility LLC

Motorola Mobility LLC is a Delaware company with its principal place of business located in Chicago, Illinois. (Resp. at ¶ 14.). “Motorola Mobility LLC is engaged in the design, manufacture, importation, and sale within the United States after importation of certain products at issue in this Investigation[.]” (*Id.*).

b) Respondent Lenovo (United States) Inc.

Lenovo (United States) Inc. is a Delaware corporation with its principal place of business located in Morrisville, North Carolina. (Resp. at ¶ 15.). “Lenovo (United States) Inc. is engaged in the design, manufacture, importation, and sale within the United States after importation of certain products at issue in this Investigation[.]” (*Id.*).

c) Respondent Motorola (Wuhan) Mobility Technologies Communications Co., Ltd.

Motorola (Wuhan) Mobility Technologies Communications Co., Ltd. is a Chinese corporation with its principal place of business in Wuhan, China. (Resp. at ¶ 17.). “Motorola (Wuhan) Mobility Technologies Communications Co., Ltd. is engaged in the manufacture of certain products at issue in this Investigation[.]” (*Id.*).

III. JURISDICTION AND IMPORTATION

A. The Commission Has Jurisdiction

To have the authority to decide a case, a court or agency must have both subject matter jurisdiction and jurisdiction over either the parties or the property involved. *See Certain Steel Rod Treating Apparatus and Components Thereof*, Inv. No. 337-TA-97, Comm’n Opinion, 215 U.S.P.Q. 229, 231 (U.S.I.T.C. 1981).

Respondents did “not contest that the Commission has subject matter jurisdiction and in rem jurisdiction over the Accused Products. The parties entered a stipulation regarding importation of the Accused Products.” (RPBr. at 6; *see also* Doc. ID No. 818160 (Apr. 10, 2024) (Joint Stipulation Relating to Fact Discovery)).

B. Ericsson Has Standing in the Commission

The Commission recently clarified that 35 U.S.C. § 281 does not apply directly to the Commission.¹ *Certain Active Matrix Organic Light-Emitting Diode Display Panels & Modules for Mobile Devices, & Components Thereof*, Inv. No. 337-TA-1351, Comm’n Op. at 12-13 (Apr. 24, 2024). Rather, “the determination of who may bring a section 337 investigation begins with the language of the Commission’s governing statute and regulations promulgated pursuant to that authority.” *Id.* (citing 19 U.S.C. § 1337; 19 C.F.R. § 210.12); *see also id.* at 15 (“[T]he pertinent issue is whether [Complainant] satisfied the prerequisites of the Commission’s rules to bring a section 337 action as of the date the complaint was filed.”). Accordingly, consistent with the Commission’s rules and practice, “at least one complainant must be the owner or exclusive licensee of the patent.” *Id.* at 14; *see also id.* at 15-16 (finding it appropriate to consider whether complainant “is a ‘patentee’ who can bring a patent infringement action under 35 U.S.C. § 281”

¹ 35 U.S.C. § 281 states: “A patentee shall have remedy by civil action for infringement of his patent.”

in determining whether complainant is the owner or exclusive licensee).

In this Investigation, the Parties do not dispute that Ericsson is the named owner of the Asserted Patents by virtue of the official assignments granted to it and duly recorded with the PTO. Certified assignment documents were filed with the Complaint showing ownership of the Asserted Patents. (*See* Compl. at Ex. 2, 4, 6, 8.).

IV. OVERVIEW OF THE ASSERTED PATENTS

A. U.S. Patent No. 10,425,817

The '817 patent, titled "Subscription Concealed Identifier," was filed on November 26, 2018, as U.S. Patent Application Serial No. 16/200,037 ("the '037 application"). (JX-0001 ('817 patent) at (21), (22), (54).). The '037 application issued as the '817 patent on September 24, 2019, and names Vesa Torvinen, Noamen Ben Henda, David Catellanoes Zamora, Prajwol Kumar Nakarmi, Pasi Saarinen, and Monica Wifvesson as the inventors. (*Id.* at (10), (45), (72).). The '817 patent claims priority to Application No. PCT/EP2018/069432, filed on July 17, 2018, and U.S. Provisional Patent Application No. 62/536,632, filed on July 25, 2017. (*Id.* at (60), (63).).

The '817 patent is directed to a method of protecting subscriber privacy when a subscriber registers with a wireless network. (Tr. (Mark Mahon) at 176:1-21.).² The patent

² When he testified during the Hearing on July 10, 2024, Dr. Mark Mahon was a Teaching Professor at Pennsylvania State University, School of Electrical Engineering and Computer Science. (CPSt. at 2-3.). Ericsson identified Dr. Mahon as an expert to "testify about the background and subject matter of his expert reports, including the '669 and '817 Patents, technical background of the '669 and '817 Patents, the knowledge of a person of ordinary skill in the art, the interpretation and scope of the asserted claims of the '669 and '817 Patents, infringement of the '669 and '817 Patents by the Accused Products, the practice of the '669 and '817 Patents by the Domestic Industry Products, the scope of the alleged prior art, the validity and enforceability of the '669 and '817 Patents, and objective indicia regarding the validity of the '669 and '817 Patents, the charting and essentiality of Ericsson's cellular patents and contributions to the 5G standard, and Lenovo's current smartphone technology and platform." (*Id.* at 3.). Dr.

recognizes that “[i]t is important to maintain the confidentiality of a user equipment’s (UE’s) long-term subscription identifier (e.g., an IMSI (International Mobile Subscriber Identity)).” (JX-0001 at 1:22-24.). To solve the problem of maintaining user equipment confidentiality, the ’817 patent discloses using a Subscription Concealed Identifier (“SUCI”), which includes a clear text part and an encrypted part, as shown below in Figure 3 of the ’817 patent. (Tr. (Mahon) at 176:1-21.).

Figure 1: Figure 3 of the ’817 Patent Illustrating an Example of a SUCI

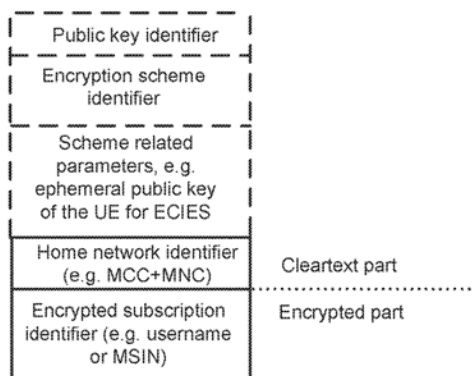


Fig. 3

(JX-0001 at Fig. 3, 5:43-44; *see also* Tr. (Mahon) at 177:21-178:14.).

Referring to Figure 3 of the ’817 patent, Dr. Mahon described the two (2) components of the claimed SUCI as follows:

Q. . . . What are the contents of the SUCI as described in the ’817 patent?

A. Well, Fig. 3, as shown on this slide from the ’817, has two main components. The first piece is that clear text part on the top, and clear text means plain text unprotected, and you can see four elements contained there.

The bottom part is the encrypted part. That’s where you take your permanent identifier, the subscription identifier, encrypt it and put it in there. So those four top components consist of the home network identifier, that’s your home network

Mahon was accepted without objection as an expert on the subject matter for which he was called to testify.

like Verizon, T Mobile, et cetera, a scheme related parameter such as ephemeral public key information, your encryption scheme identifier, which is really important on the back end, when you go to decrypt this thing, you need to know what encryption scheme was used, and then a public key identifier, and the public key is what's used as part of the encryption process.

(Tr. (Mahon) at 177:23-178:14.).

The clear text part consists of: (1) a home network identifier, which identifies your home network (e.g., Verizon, T-Mobile); (2) a public key identifier, which is used as part of the encryption process; and (3) an encryption scheme identifier, which identifies the encryption scheme used so that the encrypted part can be decrypted. (Tr. (Mahon) at 177:21-178:14.; JX-0001 at Fig. 3.).

The '817 patent also discloses how to transmit and de-conceal the SUCI, as shown below in Figure 6 of the '817 patent.

Figure 2: Figure 6 of the '817 Patent Illustrating an Example Registration Procedure

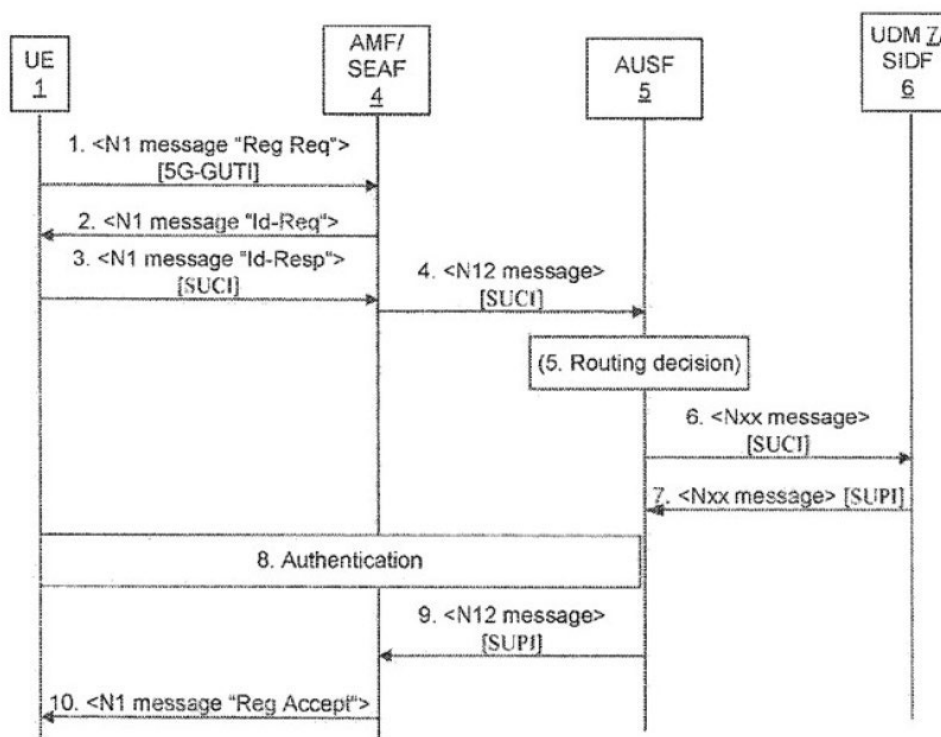


Fig. 6

(JX-0001 at Fig. 6.).

Dr. Mahon testified that the figure shows that the UE (user equipment) sends the SUCI up to the network in step 3, then the SEAF (security anchor function) relays the SUCI to the AUSF (authentication server function) in step 4, and then the AUSF makes the decision where to send the SUCI for de-concealing in steps 5 and 6 and then forwards to the SIDF in step 7. Then the SIDF (subscription identifier de-concealing function) de-conceals the SUCI and sends it back to the AUSF in step 8. (Tr. (Mahon) at 179:3-15.).

As noted above in Section I, at issue in this Investigation are claims 10 and 13-15 of the '817 patent. Independent claims 10 and 15, as well as dependent claims 13 and 14, are reproduced below.

10. A method performed by a user equipment (UE) for concealing a subscription permanent identifier (SUPI), wherein the SUPI is a globally unique identifier allocated to a subscriber and the SUPI comprises a home network identifier identifying a home network of the subscriber and a subscription identifier identifying a subscription within the home network, the method comprising:
 - the UE generating a subscription concealed identifier (SUCI) which comprises an encrypted part and a clear-text part, wherein a) the encrypted part of the SUCI generated by the UE comprises the subscription identifier identifying the subscription within a home network, but the encrypted part of the SUCI generated by the UE does not include the home network identifier and b) the clear-text part of the SUCI generated by the UE comprises i) the home network identifier, ii) an encryption scheme identifier that identifies an encryption scheme used by the UE to encrypt the subscription identifier in the SUCI, and iii) a public key identifier for a public key of the home network, but the clear-text part of the SUCI generated by the UE does not comprise the subscription identifier; and
 - the UE transmitting the SUCI to an authentication server for forwarding of the SUCI to a de-concealing server capable of decrypting the encrypted part.
13. The method of claim 10, wherein transmitting the SUCI to the authentication server comprises transmitting the SUCI to the authentication server in response to an identifier request message

received from an Authentication and Mobility management Function, AMF, as part of a procedure for registering the UE with a wireless communication network.

14. The method of claim 10, wherein the encryption scheme is an Elliptic Curve Integrated Encryption Scheme.

15. A user equipment (UE) for concealing a subscription permanent identifier (SUPI) , wherein the SUPI is a globally unique identifier allocated to a subscriber and the SUPI comprises a home network identifier identifying a home network of the subscriber and a subscription identifier identifying a subscription within the home network, the UE comprising:

processing circuitry and memory circuitry, the memory circuitry containing instructions executable by the processing circuitry, wherein the UE is operative to:

generate a subscription concealed identifier (SUCI) which comprises an encrypted part and a clear-text part, wherein a) the encrypted part of the SUCI generated by the UE comprises the subscription identifier identifying the subscription within a home network, but the encrypted part of the SUCI generated by the UE does not include the home network identifier and b) the clear-text part of the SUCI generated by the UE comprises i) the home network identifier, ii) an encryption scheme identifier that identifies an encryption scheme used by the UE to encrypt the subscription identifier in the SUCI, and iii) a public key identifier for a public key of the home network, but the clear-text part of the SUCI generated by the UE does not comprise the subscription identifier; and

transmit the SUCI to an authentication server for forwarding of the SUCI to a de-concealing server capable of decrypting the SUPI.

(JX-0001 at cls. 10, 13-15.).

B. U.S. Patent No. 10,306,669

The '669 patent, titled "Physical Uplink Control Channel (PUCCH) Resource Allocation," was filed on November 28, 2018, as U.S. Patent Application Serial No. 16/203,391 ("the '391 application"). (JX-0002 ('669 patent) at (21), (22), (54).). The '391 application issued as the '669 patent on May 28, 2019, and names Havish Koorapaty, Sorour Falahati, Robert Blademair, and Daniel Larsson as the inventors. (*Id.* at (10), (45), (72).). The '669 patent

claims priority to Application No. PCT/IB2018/058400, filed on October 26, 2018, and U.S. Provisional Patent Application No. 62/577,578, filed on October 26, 2017. (*Id.* at (60), (63).).

The '669 patent is directed to “systems and methods for determining an uplink control channel resource to use for transmitting uplink control information to a network node.” (JX-0002 at 3:7-9.). The method comprises a series of information exchanges between a UE and a network. (*Id.* at 1:22-24.). The '669 patent discloses that a UE can determine which uplink resources to use through various techniques. The '669 patent discloses that “the UE uses a combination of explicit signaling and implicit resource determination to handle flexible timing of HARQ ACK feedback and the reception of PDCCH in different control regions (e.g., CORESETs) in a slot,” where “[t]he explicit signaling consists of a combination of RRC signaling (semi-static) and fields in DCI messages (dynamic).” (*Id.* at 7:36-44.). According to the '669 patent, uplink control information (UCI) “can be transmitted on a separate control channel (e.g., occurring either at the end of the slot interval or during the slot interval), or the UCI can be multiplexed with data and transmitted on a data channel.” (*Id.* at 1:28-31.).

As noted above in Section I, at issue in this Investigation are claims 8, 9, 15, and 17 of the '669 patent. Dependent claims 8 and 9 depend from independent claim 6, which is not asserted. Dependent claim 15 depends from independent claim 11, and dependent claim 17 depends from independent claim 1. Independent claims 1 and 11 are also not asserted. Asserted dependent claims 8, 9, 15, and 17, as well as the independent claims upon which they depend, are reproduced below.

1. A method performed by a wireless device, comprising:
receiving a first downlink control channel message that schedules a first
downlink shared channel transmission;
receiving a second downlink control channel message that schedules a

second downlink shared channel transmission;

determining an uplink control channel resource to use for transmitting uplink control information to a network node on an uplink control channel, wherein:

the uplink control information comprises Hybrid Automatic Repeat Request, HARQ, feedback for both the first downlink shared channel transmission and the second downlink shared channel transmission; and wherein

determining the uplink control channel resource to use for transmitting the uplink control information comprises determining the uplink control channel resource based on (a) signaling received from the network node and (b) resource determination performed by the wireless device based on a latest received one of the first downlink control channel message and the second downlink control channel message; and

transmitting the uplink control information using the determined uplink control channel resource;

wherein the signaling received from the network node comprises information that provides a semi-static configuration of two or more uplink control channel resource sets each comprising two or more uplink control channel resources; and

wherein determining the uplink control channel resource based on (a) and (b) comprises selecting one of the two or more uplink control channel resource sets, and selecting, as the uplink control channel resource to use for transmitting the uplink control information to the network node, one of the two or more uplink control channel resources from the selected uplink control channel resource set based on dynamic signaling from the network node.

6. A wireless device, comprising:

an interface; and

processing circuitry configured to cause the wireless device to:

receive a first downlink control channel that schedules a first downlink shared channel transmission;

receive a second downlink control channel that schedules a second downlink shared channel transmission;

determine an uplink control channel resource to use for transmitting uplink control information to a network node, wherein:

the uplink control information comprises Hybrid Automatic Repeat Request, HARQ, feedback for both the first downlink shared channel transmission and the second downlink shared channel transmission, and

wherein determining the uplink control channel resource to use for transmitting the uplink control information comprises determining the uplink control channel resource based on (a) signaling received from the network node and (b) resource determination performed by the wireless device based on a latest received one of the first downlink control channel and the second downlink control channel; and

transmit the uplink control information using the determined uplink control channel resource;

wherein the signaling received from the network node comprises information that provides a semi-static configuration of two or more uplink control channel resource sets each comprising two or more uplink control channel resources; and

wherein determining the uplink control channel resource based on (a) and (b) comprises selecting one of the two or more uplink control channel resource sets, and selecting, as the uplink control channel resource to use for transmitting the uplink control information to the network node, one of the two or more uplink control channel resources from the selected uplink control channel resource set based on dynamic signaling from the network node.

8. The wireless device of claim 6 wherein:

each of the first downlink control channel message and the second downlink control channel message comprises a downlink control information message comprising bits for use to select one of the two or more uplink control channel resources from the selected uplink control channel resource set; and

selecting the one of the two or more uplink control channel resources from the selected uplink control channel resource set based on dynamic signaling from the network node comprises selecting, as the uplink control channel resource to use for transmitting the uplink control information to the network node, the one of the two or more uplink control channel resources from the selected uplink control channel resource set based on the bits for use to select one of the two or more uplink control channel resources from the selected uplink control channel resource set that are comprised in the latest received one of the first downlink control channel message and the second downlink control channel message.

9. The wireless device of claim 6, wherein determining the uplink control channel resource to use comprises determining the uplink control channel resource to use when the timing is variable between when the wireless device receives the first and second downlink control channel messages scheduling the first and second downlink shared channel transmissions and when the wireless device transmits the uplink control

information.

11. A wireless device comprising:
 - an interface; and
 - processing circuitry configured to cause the wireless device to:
 - receive a downlink control channel that schedules a downlink shared channel transmission to the wireless device;
 - receive, from the network node, signaling comprising information that provides a semi-static configuration of two or more uplink control channel resource sets each comprising two or more uplink control channel resources,
 - determine an uplink control channel resource to use for transmitting uplink control information to a network node, wherein the uplink control information comprises Hybrid Automatic Repeat Request, HARQ, feedback for the downlink shared channel transmission and determining the uplink control channel resource comprises selecting the uplink control channel resource from uplink control channel resources in two or more uplink control channel resource sets based on:
 - a payload size of the uplink control information;
 - a starting control channel element index of a downlink control channel candidate on which the downlink control channel was received; and
 - dynamic signaling received from the network node; and
 - transmit the uplink control information using the determined uplink control channel resource;
 - wherein selecting the uplink control channel resource from the two or more uplink control channel resources in the two or more uplink control channel resource sets comprises selecting one of the two or more uplink control channel resource sets, and selecting, as the uplink control channel resource to use for transmitting the uplink control information to the network node, one of the two or more uplink control channel resources from the selected uplink control channel resource set based on dynamic signaling from the network node.
15. The wireless device of claim 11 wherein determining the uplink control channel resource to use comprises determining the uplink control channel resource to use when the timing is variable between when the wireless device receives the downlink control channel messages scheduling the downlink shared channel transmission and when the wireless device transmits the uplink control information.
17. The method of claim 1, wherein determining the uplink control channel resource further comprises selecting the uplink control channel resource

from uplink control channel resources in two or more uplink control channel resource sets based on:

- a payload size of the uplink control information;
- a starting control channel element index of the latest received one of the first downlink control channel message and the second downlink control channel message downlink control channel; and
- dynamic signaling received from the network node.

(JX-0002 at cls. 1, 6, 8, 9, 11, 15, 17.).

C. U.S. Patent No. 11,317,342

The '342 patent, titled "Transmission and Reception of System Information in Parts," was filed on May 12, 2017, as U.S. Patent Application Serial No. 15/036,283 ("the '283 application"). (JX-0003 ('342 patent) at (21), (54), (86).). The '283 application issued as the '342 patent on April 26, 2022, and names Pål Frenger, Martin Hessler, and Joahn Rune as the inventors. (*Id.* at (10), (45), (72).). The '669 patent claims priority to Application No. PCT/SE2016/050310, filed on April 12, 2016. (*Id.* at (22), (86).).

The '342 patent is directed to improvements in transmitting system information. The patent states that the traditional way of "broadcast[ing] cell-specific system information from each of the system's cells" is "inefficient and costly in terms of radio resources and energy." (JX-0003 at 1:29-31.). The patent acknowledges that "[m]odern approaches seek to minimize the amount of system information that is broadcast, and to limit how often that information is broadcast." (*Id.* at 1:31-34.). To solve this problem the '342 patent describes a specific way of transmitting system information in parts. Specifically, the '342 patent discloses transmitting explicit signaling that is associated with a first part that indicates a sequence with which a second part of system information is to be demodulated or descrambled. (*Id.* at Abstract.).

As noted above in Section I, at issue in this Investigation are claims 34 and 39 of the '342

patent. Dependent claim 39 depends from unasserted dependent claim 38, which depends from independent claim 34. Asserted claims 34 and 39, as well as unasserted claim 38, are reproduced below.

34. A wireless communication device for receiving system information for a wireless communication system in parts, the wireless communication device comprising:

communication circuitry; and

processing circuitry configured to:

receive, over a first channel, a first part of system information, wherein the first part of system information comprises a master information block, wherein the master information block includes explicit signaling that indicates a sequence with which the wireless communication device is to demodulate or descramble a second part of system information; and

receive the second part of system information over a second channel, by demodulating or descrambling the second part using the indicated sequence.

38. The wireless communication device of claim 34, wherein the sequence is a demodulation reference signal sequence, wherein the second part of system information comprises a system information block, and wherein the processing circuitry is configured to:

demodulate the second part using the indicated sequence; and

access the wireless communication system using both the first and second parts of system information.

39. The wireless communication device of claim 38, wherein the demodulation reference signal sequence indicated by the explicit signaling distinguishes the second part of system information from one or more other second parts of system information that are receivable using one or more other respective demodulation reference signal sequences.

(JX-0003 at cls. 34, 38, 39.).

D. U.S. Patent No. 11,515,893

The '893 patent, titled "Shift Values for Quasi-Cyclic LDPC Codes," was filed on March 20, 2020, as U.S. Patent Application Serial No. 16/834,624 ("the '624 application"). (JX-0004 ('893 patent) at (21), (22), (54).). The '624 application issued as the '893 patent on November

29, 2022, and names Sara Sandberg, Mattias Andersson, and Yufei Blankenship as the inventors. (*Id.* at (10), (45), (72).). The '624 application is a continuation of U.S. Patent Application Serial No. 16/369,274 (“the '274 application”), filed on March 29, 2019, which issued as U.S. Patent No. 10,644,724. (*Id.* at (63).). The '274 application was a continuation of Application No. PCT/EP2018/067098, filed on June 26, 2018. (*Id.*). These applications claim priority from Provisional Application No. 62/525,453, filed on June 27, 2017 (“the '453 provisional application”). (*Id.* at (60).).

The '893 patent is directed to “low-density parity check (LDPC) shift coefficient designs for New Radio (NR),” which purportedly provides “good performance that avoids harmful cycles and improves the [block-error rate] performance.” (*Id.* at 1:17-19, 16:16-21.). Specifically, the '893 patent is directed to encoding information bits using a LDPC code and a parity-check matrix (PCM) with a particular base matrix and a particular shift vector of a particular shift size. (*See, e.g., id.* at cl. 1.).

The claimed shift vectors were formulated based on the base matrices and shift sizes supported by 5G NR as of the effective filing date (i.e., when the '453 provisional application was filed). For example, the '893 patent specification discloses that “New Radio (NR) supports LDPC codes with two different base matrices.” (JX-0004 at 2:60-63, 16:15-16; *see also* JXM-0005.0035 ('453 provisional application); JX-0004 at 6:61-63.). The 5G NR supported base matrices are labeled in the specification as “LDPC Base Matrix #1 for NR” and “LDPC base matrix #2 for NR.” (JX-0004 at 3:18-5:3; JXM-0005.0018-20.). The '893 patent also acknowledges that NR “supports” specific shift sizes at the time. (JX-0004 at 2:43-45, Table 1; *see also* JXM-0005.0018.). However, the '893 patent recognizes that “the corresponding shift coefficient designs that are as important for the performance of the LDPC codes have not been

specified.” (JX-0004 at 16:16-19; JXM-0005.0035.). The ’893 patent discloses that the shift vectors can be identified by applying a lifting algorithm to a base matrix supported by 5G NR and based on a shift size supported by 5G NR. (JX-0004 at 16:22-26; JXM-0005.0036.).

As noted above in Section I, at issue in this Investigation are claims 1 and 4 of the ’893 patent. Claims 1 and 4 are reproduced below.³ As claim 1 notes, 5G NR stands for 5th Generation, New Radio, or that defines the 5th Generation of transmission standards for wireless communications.

1. A wireless transmitter operable in a fifth generation, 5G, new radio, NR, wireless network, the wireless transmitter comprising processing circuitry operable to:
encode information bits for transmission in a 5G NR wireless network using a low-density parity check, LDPC, code and a parity check matrix, PCM, the PCM being partitioned into square sub-matrices of size $Z \times Z$ and being described by a base matrix and a shift vector, the shift vector using a shift size $Z=3 \cdot 2^j$, where j is one of 0, 1, 2, 3, 4, 5, 6 and 7; and
transmit the encoded information bits to a 5G NR wireless receiver,
wherein the base matrix has one entry for each $Z \times Z$ sub-matrix, the entry being 0 corresponding to the sub-matrix being a null matrix, and the entry being 1 corresponding to the sub-matrix being a cyclic-permutation matrix obtained from a $Z \times Z$ identity matrix by shifting columns to the right by k elements,
wherein non-zero entries in the base matrix are described by triples (e, r, c) denoting that the non-zero entry with number e is in row r and column c of the base matrix, the triples being given by: $[\dots]$
wherein for the non-zero entry with number e the number k is defined by a shift coefficient given by $\text{mod}(V_e, Z)$, with V_e denoting the e -th element of the shift vector and the shift vector is: $[\dots]$
4. A wireless receiver operable in a fifth generation, 5G, new radio, NR, wireless network, the wireless receiver comprising processing circuitry operable to:
receive encoded information bits from a 5G NR wireless transmitter; and
decode the information bits received from the 5G NR wireless network

³ The claimed base matrices and shift vectors have been omitted for brevity.

using a low-density parity check, LDPC, code and a parity check matrix, PCM, the PCM being partitioned into square sub-matrices of size $Z \times Z$ and being described by a base matrix and a shift vector, the shift vector using a shift size $Z=3 \cdot 2^j$, where j is one of 0, 1, 2, 3, 4, 5, 6 and 7,

wherein the base matrix has one entry for each $Z \times Z$ sub-matrix, the entry being 0 corresponding to the sub-matrix being a null matrix, and the entry being 1 corresponding to the sub-matrix being a cyclic-permutation matrix obtained from a $Z \times Z$ identity matrix by shifting columns to the right by k elements,

wherein non-zero entries in the base matrix are described by triples (e, r, c) denoting that the non-zero entry with number e is in row r and column c of the base matrix, the triples being given by: $[\dots]$

wherein for the non-zero entry with number e the number k is defined by a shift coefficient given by $\text{mod}(V_e, Z)$, with V_e denoting the e -th element of the shift vector and the shift vector is: $[\dots]$

(JX-0004 at cls. 1, 4.).

V. THE PRODUCTS AT ISSUE

A. Accused Products

Ericsson alleged that the following Accused Products practice one or more of the asserted claims of the Asserted Patents.

Lenovo Product	Identified Chipset
Moto Edge / Edge 5G (2021)	Qualcomm SM7325
Moto Edge 30 Fusion (2022)	Qualcomm SM8350
Moto Edge (2022)	MediaTek MTK 6879
Moto Edge (2023)	MediaTek MTK 6879
Moto Edge+ (2020)	Qualcomm SM8250 + SDX55
Moto Edge+ (2022)	Qualcomm SM8450
Moto Edge+ (2023)	Qualcomm SM8550
Moto G 5G (2022)	MediaTek MT 6833
Moto G 5G (2023)	Qualcomm SD4350 Pro
Moto G Power 5G (2023)	MediaTek MTK 6855
Moto G Stylus 5G (2021)	Qualcomm SDM4350
Moto G Stylus 5G (2022)	Qualcomm SM6375
Moto G Stylus 5G (2023)	Qualcomm SM6450
Moto G100	Qualcomm SM8250 + SDX55
Moto G71 5G	Qualcomm SD6375
Moto One 5G	Qualcomm SM7250
Moto One 5G Ace	Qualcomm SM7225
Moto Razr / Razr 5G (2020)	Qualcomm SM7250
Moto Razr (2022)	Qualcomm SM8475
Moto Razr (2023)	Qualcomm SM7450- AB
Moto Razr+ (2023)	Qualcomm SM8475
ThinkPhone by Motorola	Qualcomm SM8475

(See, e.g., CBr. at Ex. 1; *see also id.* at Ex. 2.).

The Accused Products are various Motorola-branded cell phones that contain either Qualcomm (“QC-Lenovo Accused Products”) or MediaTek chipsets (“MTK-Lenovo Accused Products”). (*Id.* at 14-15.).

B. DI Products

Ericsson asserted that the following Samsung DI Products practice one or more claims of the Asserted Patents.

Public Version

Samsung Product	Identified Chipset
Galaxy S21	SM8350
Galaxy S21 FE	SM8350
Galaxy S21 Ultra	SM8350
Galaxy S21+	SM8350
Galaxy S22	SM8450
Galaxy S22 Ultra	SM8450
Galaxy S22+	SM8450
Galaxy S23	SM8550
Galaxy S23 Ultra	SM8550
Galaxy S23+	SM8550

(See, e.g., CBr. at Ex. 3.).

The Samsung DI Products are various Samsung-branded cell phones that contain Qualcomm chipsets. (CBr. at 15.).

Ericsson asserted that the following Ericsson DI Products practice one or more claims of the Asserted Patents.

Public Version

Product Group	Product
Baseband	Baseband 5216
Baseband	Baseband 6303
Baseband	Baseband 6318
Baseband	Baseband 6502
Baseband	Baseband 6620
Baseband	Baseband 6630
Baseband	Baseband 6631
Baseband	Baseband 6648
Baseband	Radio Processor 6337
Baseband	Radio Processor 6339
Baseband	RAN PROCESSOR 6651
Radio Units	AIR 1281
Radio Units	AIR 1641
Radio Units	AIR 1652
Radio Units	AIR 32
Radio Units	AIR 3239
Radio Units	AIR 3246
Radio Units	AIR 4435
Radio Units	AIR 4455
Radio Units	AIR 5121
Radio Units	AIR 5322
Radio Units	AIR 5331
Radio Units	AIR 6419
Radio Units	AIR 6449
Radio Units	AIR 6464
Radio Units	AIR 6468

Public Version

Radio Units	AIR 6488
Radio Units	Radio 0208
Radio Units	Radio 2012
Radio Units	Radio 2203
Radio Units	Radio 2205
Radio Units	Radio 2208
Radio Units	Radio 2212
Radio Units	Radio 2217
Radio Units	Radio 2218
Radio Units	Radio 2219
Radio Units	Radio 4402
Radio Units	Radio 4408
Radio Units	Radio 4412
Radio Units	Radio 4415
Radio Units	Radio 4418
Radio Units	Radio 4422
Radio Units	Radio 4426
Radio Units	Radio 4435
Radio Units	Radio 4449
Radio Units	Radio 4455
Radio Units	Radio 4460
Radio Units	Radio 4478
Radio Units	Radio 4480
Radio Units	Radio 4490
Radio Units	Radio 4499
Radio Units	Radio 8823
Radio Units	Radio 8843
Radio Units	Radio 8863
Radio Units	Radio Gateway R608
Radio Units	Streetmacro 6701
Radio Units	Streetmacro 6705

(See, e.g., *id.*).

The Ericsson DI Products are various baseband and radio unit products. (CBR. at 15.).

The list of Ericsson Products shows various combinations of Ericsson's Massive MIMO AIR Units and Radio Units in combination with Ericsson's Basebands to support different frequencies and radio access technologies, and Ericsson's self-contained Streetmacro products. (See, e.g., CX-0571C.0037-41; CX-0559C (NR SA Connectivity Guidelines); CX-0560C (Hardware-

Related Capabilities); CX-0562C (RBS Configurations); CX-0561C (Supported Capacity and Configurations); CX-0571C (Radio Configurations for NR); CX-0569C (RBS Configurations); CX-0570C (RBS Configurations).).

Ericsson's Massive MIMO AIR units (e.g., an AIR 6449) and Radio units (e.g., a Radio 4449) [REDACTED]

[REDACTED] (JX-0044C (Yuming Liu Dep. Tr.) at 26:22-27:1.).⁴ Ericsson's "Basebands" may include a Baseband 6630 or Baseband 6648. Ericsson's Baseband Units support significant telecommunication capabilities, including NR (i.e. "New Radio") communications as defined in the relevant 5G standards. Importantly, Ericsson's Baseband processors are used in connection with one or more of Ericsson's Radio or AIR products. (JX-0033C (Ali Raza Dep. Tr.)⁵ at 48:18-49:11; JX-0044C (Y. Liu Dep. Tr.) at 26:12-27:11, 28:2-14; JX-0037C (Michael Carlsson Dep. Tr.)⁶ at 140:11-143:6.). Together, these devices make up Ericsson's gNBs. The Streetmacro products similarly consist of a Baseband unit and an AIR unit. (CX-0564C.0106.).

C. Representativeness

The Parties did not dispute the representativeness of the Accused Products, Samsung DI Products, and Ericsson DI Products. Shown below are paragraphs taken from the Parties' Amended Joint Statement in which they agree on the representative products that represent either all Accused Products or the DI Products.

4

[REDACTED]
[REDACTED] He testified as a fact witness.

5

[REDACTED] He testified as a fact witness.

6

[REDACTED] He testified as a fact witness.

A. The Qualcomm-Based Lenovo Accused Products and Samsung Domestic Industry Products practice the accused functionalities in the same way for the purposes of this Investigation. Accordingly, the Motorola Edge+ (2023) and Samsung Galaxy S23 are representative of the Qualcomm-Based Lenovo Accused Products and Samsung Domestic Industry Products, and evidence for any Qualcomm-Based Lenovo Accused Product or Samsung Domestic Industry Product applies to the other Qualcomm-Based Lenovo Accused Products and Samsung Domestic Industry Products. Tr. (Mahon, VDW, Wesel) at 168:16-172:21, 329:6-330:15, 434:23-435:8, 436:7-437:5.

B. The MediaTek-Based Lenovo Accused Products practice the accused functionalities in the same way for the purposes of this Investigation. Accordingly, the Motorola Edge (2023) is representative of the MediaTek-Based Lenovo Accused Products, and evidence for any MediaTek-Based Lenovo Accused Product applies to the other MediaTek-Based Lenovo Accused Products. Tr. (Mahon, VDW, Wesel) at 168:16-172:21, 205:2-17, 329:6-330:15, 434:23-435:8, 436:7-437:5.

C. The Ericsson Domestic Industry Products operate in the same way for the purposes of the technical prong of domestic industry in this Investigation. Accordingly, the 1) Ericsson's AIR 6449 Product Plus Ericsson's Baseband 6630 or 6648 Product, 2) Radio 4449 Product Plus Ericsson's Baseband 6630 or 6648 Product, and 3) Streetmacro 6705 are representative of all of the Ericsson gNB products (the "Ericsson DI Products"). Tr. (VDW, Wesel) at 355:5-356:2, 437:10-438:20.

(Am. Joint Statement at § II.).

1. QC-Lenovo Accused Products and Samsung DI Products

Dr. Mahon testified that the [REDACTED] the Qualcomm Snapdragon 8 Gen 2 Mobile Platform in the representative Motorola Edge+ (2023) and Samsung Galaxy S23 operates consistently with, and in relevant part is materially the same as, all other

[REDACTED] QC-Lenovo Accused Products and Samsung DI Products. (Tr. (Mahon) at 168:16-172:21.). For example, for [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] Dr. Mahon confirmed

that the [REDACTED]

[REDACTED] (*Id.*).

In addition, Ericsson's expert, Dr. Richard Wesel,⁷ confirmed that the [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] (Tr. (Wesel) at 434:23-435:8.). For

example, for [REDACTED]

[REDACTED]

[REDACTED]. Dr. Wesel confirmed that the [REDACTED]

[REDACTED] (*Id.*).

As demonstrated in the documents cited in Exhibit 2 to Complainant's Initial Post-Hearing Brief, there are no relevant differences in the components and circuitry contained in the various QC-Lenovo Accused Products and Samsung DI Products.

2. MTK-Lenovo Accused Products

With respect to the MTK-Lenovo Accused Products, the Motorola Edge (2023) (with MediaTek Dimensity 7030 Platform) is representative of the Accused Products that contain MediaTek chipsets. This is consistent with [REDACTED]

⁷ When he testified during the Hearing on July 11, 2024, Dr. Richard Wesel was Associate Dean of Academic and Student Affairs for the Henry Samueli School of Engineering and Applied Science, and Professor of Electrical and Computer Engineering at University of California, Los Angeles. (CPSt. at Ex. 3.). Ericsson identified Dr. Wesel as an expert to "testify about the background and subject matter of his expert reports, including the '893 Patent, technical background of the '893 Patent, the knowledge of a person of ordinary skill in the art, the interpretation and scope of the asserted claims of the '893 Patent, infringement of the '893 Patent by the Accused Products, the practice of the '893 Patent by the Domestic Industry Products, the scope of the alleged prior art, the validity and enforceability of the '893 Patent, and objective indicia regarding the validity of the '893 Patent." (CPSt. at 3-4.). He was accepted without objection as an expert witness on the subject matter for which he was called to testify.

[REDACTED]

[REDACTED]⁸ Furthermore, as demonstrated in the documents cited in Exhibit 2 of Complainant's Initial Post-Hearing Brief, there are no relevant differences in the components and circuitry contained in the various MTK-Lenovo Accused Products.

3. Ericsson DI Products

Structurally, Ericsson's AIR 6449 Product plus Ericsson's Baseband 6630 or 6648 Product reflects the combination of Ericsson's Massive MIMO products as combined with FR1 and FR2 baseband products. (CX-0568C; CX-0553C; CX-0554C at CX-0554C.0005; CX-0602C.0005.). Ericsson's Radio 4449 Product plus Ericsson's Baseband 6630 or 6648 Product represents the combination of Ericsson's Radio products as combined with exemplary FR1 and FR2 baseband products. (CX-0553C.). Ericsson's Streetmacro 6705 represents Ericsson's standalone, all-in-one product offerings. (CX-0563C (Streetmacro 6701); CX-0567C (Streetmacro 6705).). As described in the claim analyses below in Sections VII-X, it is undisputed that each of these are representative products and that the Ericsson DI products include processing circuitry and communication circuitry. (*See also* Am. Joint Statement at §§ II, V.B, and VI.F.).

With respect to the transmission of system information, this functionality is carried out in Ericsson's software. Ericsson's software is [REDACTED]
[REDACTED] (*See, e.g.*, JX-0044C (Y. Liu Dep. Tr.) at 25:15-19; JX-0033C (Raza Dep. Tr.) at 46:13-17, 47:25-48:5; JX-0037C (Carlsson Dep. Tr.) at 140:11-143:6.).

⁸ [REDACTED]

Public Version

With respect to the [REDACTED]

[REDACTED]

[REDACTED] (Tr. (Wesel) at 437:10-438:20; *see also* JX-0037C (Carlsson Dep. Tr.) at 77:8-13; 83:16-84:5; 85:15-86:10.). Specifically, [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

(CBr. at 19 (citing CX-0035C (Ericsson's Resp. to ROG 1); JX-0037C (Carlsson Tr.) at 77:8-13; 83:16-84:5; 85:15-86:10).).

[REDACTED]

[REDACTED] (Tr. (Wesel) at 437:10-438:20.). [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] (*Id.*) Mr. Carlsson confirmed that [REDACTED]

[REDACTED].

(JX-0037C (Carlsson Dep. Tr.) at 140:14-141:3.). Mr. Carlsson also testified that [REDACTED]

[REDACTED].⁹ (*Id.* at 141:5-9.).

With respect to Ericsson's DI Products and [REDACTED]

[REDACTED]
[REDACTED]
[REDACTED]. (*See*,
e.g., JX-0044C (Y. Liu Dep. Tr.) at 25:15-19; JX-0033C (Raza Dep. Tr.) at 46:13-17, 47:25-48:5; JX-0047C (Carlsson Dep. Tr.) at 140:11-143:6.).

VI. PERSON OF ORDINARY SKILL IN THE ART¹⁰

A. Definition of a Person of Ordinary Skill in the Art

During the *Markman* proceedings, Ericsson contended that, with respect to the '342 and '893 patents, "one of ordinary skill in the art would have had a bachelor's degree in electrical engineering, computer engineering, or computer science with (1) at least three years of experience in the field of telecommunications or wireless systems; and/or (2) an advanced degree in electrical engineering, computer engineering, or computer science in the field of telecommunications or wireless systems." (COMBr. at 2.).

Respondents asserted that with respect to the '342 patent, a person of skill in the art "would have had a master's degree in electrical engineering, computer engineering, or computer science, or equivalent and at least three years of experience in the field of telecommunications or wireless systems." (ROMBr. at 2-3.). With respect to the '893 patent, Respondents argued that

⁹ The technology at issue in this Investigation relates to 5G NR technology developed by the 3rd Generation Partnership Project ("3GPP"). (Joint Technology Stipulation, Doc. ID No. 815603 at 1-2 (Mar. 6, 2024).). The 3GPP promulgated the 5G standards. TS 38.212 is one of the technical specifications of the 5G standard produced and issued by 3GPP. (*See* CX-0557 (TS 38.212).).

¹⁰ The legal standard for the level of ordinary skill in the art can be found in *Markman* Order. (*See Markman* Order at 9-10.).

one of ordinary skill “would have had a Ph.D. in mathematics, electrical or computer engineering, or computer science with emphasis in signal processing, communications, or coding with at least three years of research or work experience in this field at the time of the alleged invention.” (*Id.* at 2.). Additionally, Respondents submit that “[r]egarding either patent, additional education would compensate for less experience, and vice-versa” and that they do “not believe that a determination of the level of ordinary skill in the art is necessary to resolve the parties’ dispute concerning claim construction.” (*Id.* at 3; *id.* at 3 n.1.).

All proposals were found to be appropriate for a person of ordinary skill in the art because the differences among the proposed definitions had little, if any, effect on the claim construction analysis set forth in the *Markman* Order. (*Markman* Order at 9; *see also* SOMBr. at 6-7.).

VII. U.S. PATENT NO. 10,425,817

A. Direct Infringement

1. Legal Standard: Literal Infringement

“Determination of infringement is a two-step process which consists of determining the scope of the asserted claim (claim construction) and then comparing the accused product . . . to the claim as construed.” *Certain Sucralose, Sweeteners Containing Sucralose, and Related Intermediate Compounds Thereof*, Inv. No. 337-TA-604, Comm’n Opinion at 36 (U.S.I.T.C., April 28, 2009) (citing *Litton Sys., Inc. v. Honeywell, Inc.*, 140 F.3d 1449, 1454 (Fed. Cir. 1998)).

An accused device literally infringes a patent claim if it contains each limitation recited in the claim exactly. *Litton*, 140 F.3d at 1454. Each patent claim element or limitation is considered material and essential. *London v. Carson Pirie Scott & Co.*, 946 F.2d 1534, 1538

(Fed. Cir. 1991). In a Section 337 investigation, the complainant bears the burden of proving infringement of the asserted patent claims by a preponderance of the evidence. *Enercon GmbH v. Int'l Trade Comm'n*, 151 F.3d 1376, 1384 (Fed. Cir. 1998). If any claim limitation is absent, there is no literal infringement of that claim as a matter of law. *Bayer AG v. Elan Pharm. Research Corp.*, 212 F.3d 1241, 1247 (Fed. Cir. 2000).

2. Infringement Overview

Ericsson accused the Accused Products of directly infringing claims 10 and 13-15 of the '817 patent. (CPBr. at 26; CBr. 28.). The primary dispute is whether the Accused Products practice limitations [10.C] and [15.D]. Respondents did not contest that the other limitations are met. (See Am. Joint Statement at § III.B.).

For the reasons discussed below, Ericsson has met its burden and proven that the Accused Products directly infringe claims 10 and 13-15.

3. The Accused Products Practice Claims 10 and 15 of the '817 Patent

- a) **[10.A]: “A method performed by a user equipment (UE) for concealing a subscription permanent identifier (SUPI), wherein the SUPI is a globally unique identifier allocated to a subscriber and the SUPI comprises a home network identifier identifying a home network of the subscriber and a subscription identifier identifying a subscription within the home network, the method comprising:”**

[15.A]: “A user equipment (UE) for concealing a subscription permanent identifier (SUPI), wherein the SUPI is a globally unique identifier allocated to a subscriber and the SUPI comprises a home network identifier identifying a home network of the subscriber and a subscription identifier identifying a subscription within the home network, the UE comprising:”

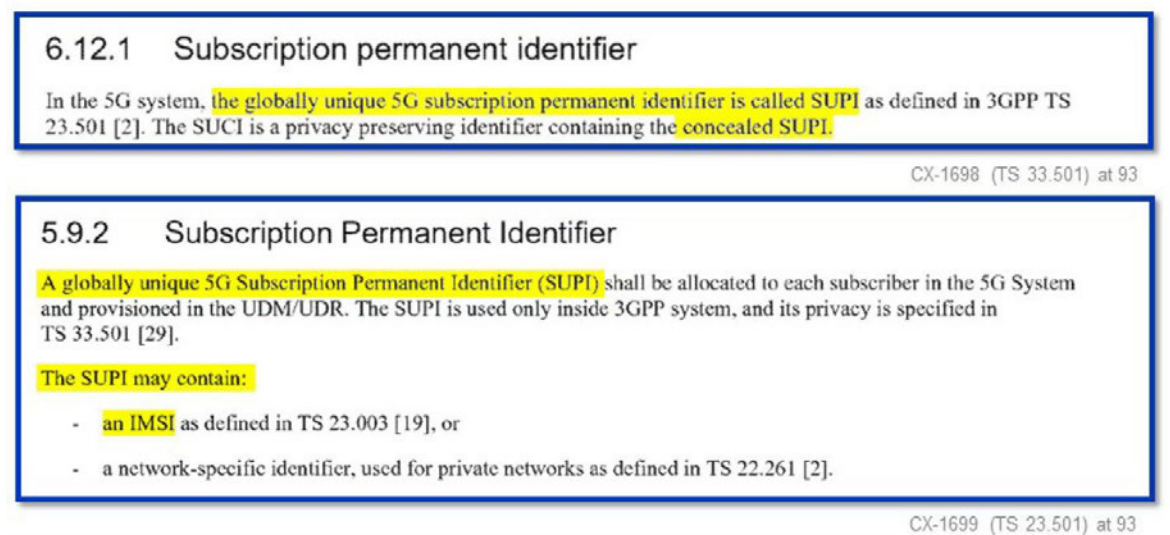
Respondents did not dispute that the Accused Products meet the preambles, i.e., [10.A] and [15.A], of claims 10 and 15. (Am. Joint Statement at § III.B.).

Dr. Mahon explained that the Accused Products perform a method of and comprise user equipment (“UEs”) for, concealing a subscription permanent identifier (SUPI), wherein the SUPI is a globally unique identifier allocated to a subscriber and the SUPI comprises a home network identifier identifying a home network of the subscriber and a subscription identifier identifying a subscription within the home network. (Tr. (Mahon) at 181:4-183:10.).

Respondents admitted that the Accused Products are UEs. (CX-0022 at RFA Nos. 290, 311, 332, 353, 374, 395, 420, 437, 458, 479, 500, and 522; *see also* Tr. (Mahon) at 81:4-11 (discussing CDX-0008C.0018, which cites Respondents’ admissions at CX-0022.)).

Additionally, the Accused Products conceal a subscription permanent identifier (SUPI) as defined by the 5G standard. (Tr. (Mahon) at 181:13-182:11; CX-1698.0093 (TS 33.501 at 6.12.1, describing “SUPI” and “SUCI”); CX-1699.0135 (TS 23.501 at 5.9.2, describing “SUPI”). As Dr. Mahon explained, the SUPI is a globally unique identifier and may contain an international mobile subscriber identity (“IMSI”). (Tr. (Mahon) at 181:13-182:11.). The SUPI is concealed within the subscription concealed identifier (“SUCI”). *Id.* Relevant portions of the 5G standard (CX-1698 (TS 33.501) and CX-1699 (TS 23.501)) are reproduced and annotated in Dr. Mahon’s demonstrative below.

Figure 3: Annotated Portions of the 5G Standard Discussing SUPI



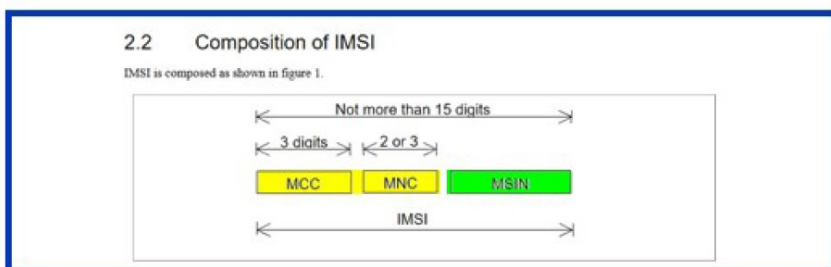
(CDX.0008C.0019 (citing CX-1698 (TS 33.501) at 6.12.1; CX-1699 (TS 23.501) at 5.9.2)).

Dr. Mahon also explained that the SUPI comprises a home network identifier and a subscription identifier. (Tr. (Mahon) at 182:12-183:10; CX-1697.0019 (TS 23.003 at 2.2); CX-1698.0094, 0173 (TS 33.501 at 6.12.2, Annex C). The home network identifier tells a system that a given subscriber's home network is, e.g., "T-Mobile or Verizon" and includes MCC or "Mobile Country Code," and MNC or "Mobile Network Code." (Tr. (Mahon) at 182:12-183:10.). The subscription identifier is the "mobile subscribers identity number" or MSIN part of the IMSI. (*Id.*). Relevant portions of the 5G standard ((CX-1698 (TS 33.501) and CX1697 (TS 23.003)) are reproduced and annotated in Dr. Mahon's demonstrative below.

Figure 4: Annotated Portions of the 5G Standard Discussing SUPI

When the SUPI is of type IMSI, the subscription identifier part of the IMSI (i.e., MSIN) that is used to construct the scheme-input shall be coded as hexadecimal digits using packed BCD coding where the order of digits within an octet is same as the order of MSIN digits specified in Figure 9.11.3.4.3a of TS 24.501 [35]. If the MSIN is composed of an odd number of digits, then the bits 5 to 8 of final octet shall be coded as "1111".

CX-1698 (TS 33.501) at annex C



CX-1697 (TS 23.003) at 19

The UE shall not conceal the Home Network Identifier and the Routing Indicator.

For SUPIs containing IMSI, the UE shall construct the SUCI with the following data fields:

- The SUPI Type as defined in TS 23.003 [19] identifies the type of the SUPI concealed in the SUCI.
- The Home Network Identifier is set to the MCC and MNC of the IMSI as specified in 23.003 [19].

CX-1698 (TS 33.501) at 94

(CDX-0008C.00020 (citing CX-1697.0019 (TS 23.003 at 2.2); CX-1698.0094, 0173 (TS 33.501 at 6.12.2, Annex C)).

Moreover, Dr. Mahon

. (Tr. (Mahon) at

202:1-203:8 ; CPX-

0003C ;

see also Tr. (Mahon) at 201:3-9

). Dr. Mahon also confirmed this

(Tr. (Mahon) 204:19-205:17

; CPX-0001C

.).

Furthermore, as Dr. Mahon explained, Respondents confirmed that the [REDACTED]

[REDACTED] (Tr. (Mahon) at 196:22-198:22 (discussing CDX-0008C.0032).). The

As Dr. Mahon testified, Lenovo [REDACTED]

[REDACTED] (Tr. (Mahon) at

196:22-198:22; CX-6130C.0047 [REDACTED] RX-0969C.0035

[REDACTED].). The [REDACTED]

[REDACTED] (Tr. (Mahon) at

198:16-199:21 discussing CDX-0008C.0033-34); CX-6120C.0033-34 [REDACTED]

[REDACTED]; CX-0734C.0148-149 [REDACTED].).

For the foregoing reasons, Ericsson has proven by a preponderance of evidence that the Accused Products meet the preambles, i.e., [10.A] and [15.A], of claims 10 and 15 of the '817 patent.

¹¹ This is an acronym for [REDACTED]. (See, e.g., JX-0029C (Klondorf Dep. Tr.) at 40:9-13.).

¹² [REDACTED]

- b) **[15.B]: “processing circuitry and memory circuitry, the memory circuitry containing instructions executable by the processing circuitry, wherein the UE is operative to:”**

Respondents did not dispute that the Accused Products satisfy limitation [15.B] of claim 15. (Am. Joint Statement at § III.B.).

Moreover, Dr. Mahon provided several confirmations that this element is met. First, Dr. Mahon explained the uncontroversial proposition that the Accused Products have processors, which all contain circuitry and memory chips. (Tr. (Mahon) at 183:11-23, 184:14-19; CDX-0008C.0021 (listing exhibits showing a processor for each Accused Product)). Second, Dr. Mahon pointed to Respondents’ admissions that its products contain processors and memory. (*Id.* at 183:24-184:7 (citing CX-0022, including RFA Nos. 280-281, 299-300, 320-321, 31-342, 362-363, 383-384, 404-405, 425-426, 446-447, 467-468, 509-510)). Third, [REDACTED]
[REDACTED]
[REDACTED]. (*Id.* at 184:8-13; JX-0029C (Klomsdorf Dep. Tr.) at 36:21-37:6.).

For these reasons, Ericsson has proven by a preponderance of evidence that the Accused Products meet this limitation of claim 15 of the ’817 patent.

- c) **[10.B]: “the UE generating a subscription concealed identifier (SUCI) which comprises an encrypted part and a clear-text part, wherein a) the encrypted part of the SUCI generated by the UE comprises the subscription identifier identifying the subscription within a home network, but the encrypted part of the SUCI generated by the UE does not include the home network identifier and b) the clear-text part of the SUCI generated by the UE comprises i) the home network identifier, ii) an encryption scheme identifier that identifies an encryption scheme used by the UE to encrypt the subscription identifier in the SUCI, and iii) a public key identifier for a public key of the home network, but the clear-text part of the SUCI generated by the UE does not comprise the subscription identifier; and”**

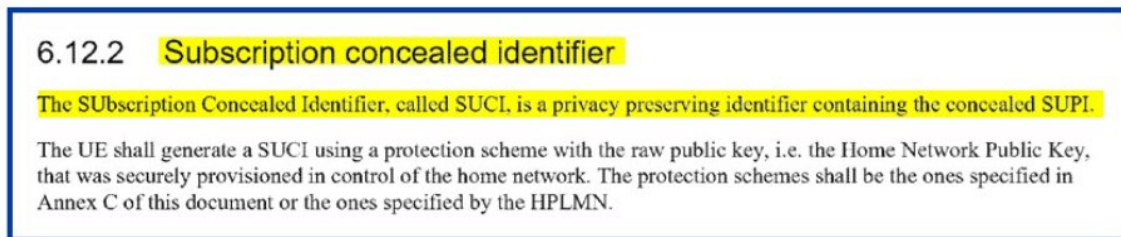
[15.C]: “generate a subscription concealed identifier (SUCI)

which comprises an encrypted part and a clear-text part, wherein a) the encrypted part of the SUCI generated by the UE comprises the subscription identifier identifying the subscription within a home network, but the encrypted part of the SUCI generated by the UE does not include the home network identifier and b) the clear-text part of the SUCI generated by the UE comprises i) the home network identifier, ii) an encryption scheme identifier that identifies an encryption scheme used by the UE to encrypt the subscription identifier in the SUCI, and iii) a public key identifier for a public key of the home network, but the clear-text part of the SUCI generated by the UE does not comprise the subscription identifier; and”

Respondents did not contest that the Accused Products satisfy limitations [10.B] and [15.C] of claims 10 and 15. (Am. Joint Statement at § III.B.).

Dr. Mahon explained that the Accused Products generate a SUCI, which the 5G standard defines as “privacy-preserving identifier[s] containing the concealed SUPI[s].” (Tr. (Mahon) at 185:1-5; CX-1698 (TS 33.501).). A relevant portion of 5G standard (CX-1698 (TS 33.501)) is reproduced and annotated below in Dr. Mahon’s demonstrative.

Figure 5: Annotated Portion of the 5G Standard Discussing SUCI



CX-1698 (TS 33.501) at 94

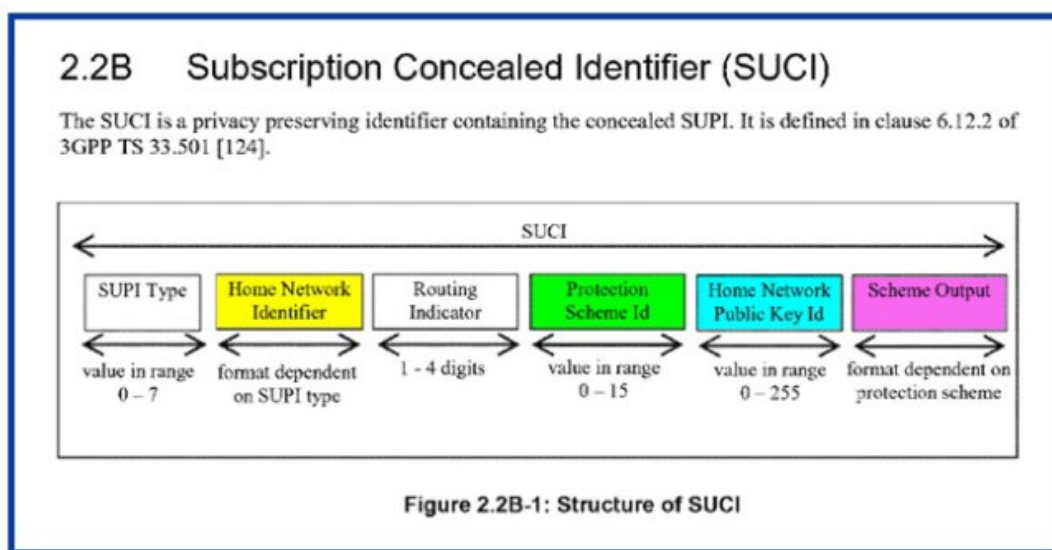
(CDX-0008C.0024 (citing CX-1698 (TS 33.501) at 94).).

Limitations [10.B] and [15.C] require a clear-text part and an encrypted part. Dr. Mahon testified about how the SUCIs defined by the 5G standard and generated by the Accused Products include both the clear-text part and encrypted part aspects. (Tr. (Mahon) at 185:6-13.). Dr. Mahon color-coded parts of the 5G standard to illustrate the various components of the

SUCI. (*Id.* at 185:6-186:7 (discussing CDX-0008C.0025), 186:8-188:5 (discussing CDX-0008C.0026).).

Referring to his demonstrative below, Dr. Mahon explained that the SUCIs include: (i), “in yellow [on CDX-0008C.0025],” the “home network identifier,” which could be “T-Mobile or Verizon, for example” (*id.* at 185:14-25); (ii) a “protection scheme identifier, now that means the encryption scheme, what type of encryption was used”; and (iii) a “home network public key, that the key that goes into the encryption process” (*id.*). Dr. Mahon also pointed out that the “purple or magenta part [of CDX-0008C.0025] is the encrypted part” of the SUCI. (*Id.*). Dr. Mahon explained that “everything to the left of the magenta box is the clear-text part, and then the purple scheme output, that’s the encrypted part.” (*Id.* at 186:1-7.). A relevant portion of the 5G Standard (CX-1697 (TS 23.003)) is reproduced and annotated below in Dr. Mahon’s demonstrative.

Figure 6: Annotated Portion of the 5G Standard Figure 2.2B Discussing SUCI

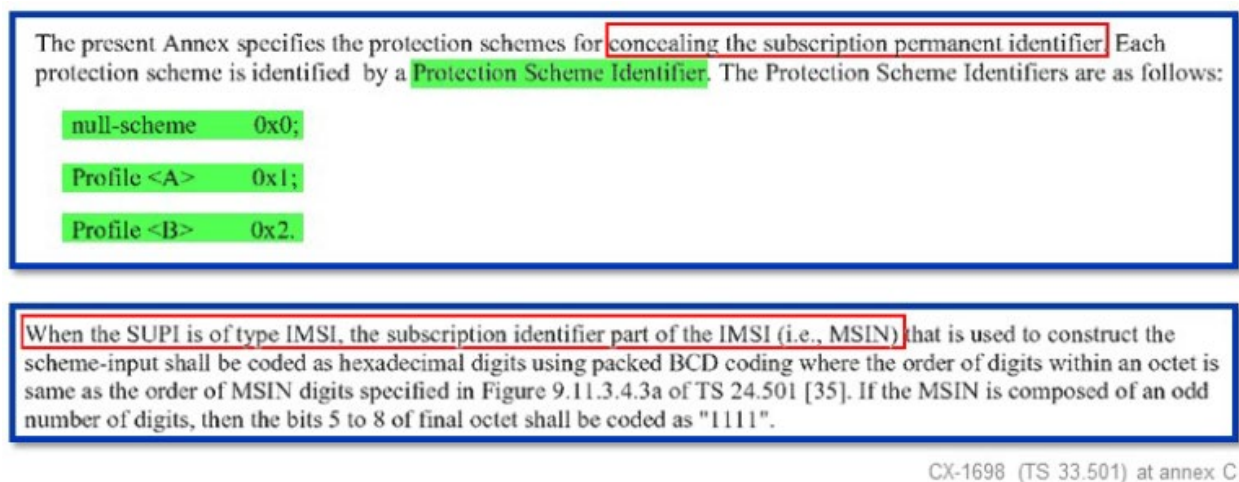


(CDX-0008C.0025 (citing CX-1697 (TS 23.003 at 2.2B).).

Dr. Mahon testified about the relationship between the encrypted part of the SUCI (the

scheme output with the subscription identifier) and the encryption scheme identifier (or “protection scheme identifier”). Dr. Mahon explained that the encryption scheme identifier informs the network how to decrypt a concealed identifier. (Tr. (Mahon) at 187:18-188:1.). Dr. Mahon testified that the 5G standard provides different “encryption schemes used to conceal the permanent identifier.” (*Id.* at 186:25-187:6.). The permanent identifier or “subscription identifier” is the MSIN (mobile subscriber identity number) of the SUPI. (*Id.* at 186:16-22.). Dr. Mahon explained how Profile <A> and Profile described in CX-1698.0172 (TS 33.501) at Annex C and depicted on CDX-0008C.0026 below are “ECIES, elliptical curve integrated encrypted schemes.” (Tr. (Mahon) at 187:9-17.). Relevant Portions of the 5G standard (CX-1698 (TS 33.501)) are reproduced and annotated below in Dr. Mahon’s demonstrative.

Figure 7: Annotated Portions of the 5G Standard Discussing Protection Scheme Identifiers of SUPI



(CDX-0008C.0026 (citing CX-1698 (TS 33.501) at Annex C (annotated))).

Dr. Mahon explained that the 5G standard has an option to not conceal or encrypt the permanent identifier as stated in the claims. Specifically, Dr. Mahon testified that for “null-scheme, whatever comes in goes out. There’s really no encryption happening here. It’s

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essentially unprotected at that point.” (Tr. (Mahon) at 187:9-17.). Dr. Mahon clarified that an Accused Product may forgo encrypting the permanent identifier in “emergency situations . . . to make sure all the calls get through as quickly, as efficiently as possible.” (*Id.* at 199:22-200:10.).

As Ericsson pointed out, despite the existence of emergency situations in which the null scheme (no encryption or concealment) rather than Profile <A> or Profile might be used, the Parties did not dispute that limitations [10.B] and [15.C] are satisfied. (Am. Joint Statement at § III.B.). The evidence demonstrates that the Accused Products can and do use Profile <A> and Profile to generate the encrypted part of SUCIs. For example, Dr. Mahon showed [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] (Tr. (Mahon) at 202:1-203:8 ([REDACTED])

[REDACTED]); CPX-0003C ([REDACTED])

[REDACTED]). Likewise, Dr. Mahon

showed [REDACTED]

[REDACTED] (Tr. (Mahon) at 204:19-205:17 (analyzing the

[REDACTED]); CPX-0001C ([REDACTED])

[REDACTED]). Moreover, Lenovo specifically [REDACTED]

[REDACTED]

[REDACTED] (Tr. (Mahon) at 196:22-198:22 (discussing CDX-0008C.0032); CX-6130C.0047 [REDACTED]; RX-0969C.0035

[REDACTED]).

Also, [REDACTED]

[REDACTED]. (Tr. (Mahon) at 198:16-199:21 (discussing CDX-0008C.0033-

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34); CX-6120C.0033-34 ([REDACTED]). For example, [REDACTED] (CX-0734C.0148-149 [REDACTED]; *see also* Tr. (Mahon) at 198:16-199:21.). [REDACTED] (*Id.*).

Beyond the use of [REDACTED] [REDACTED]. This includes the [REDACTED] [REDACTED] (Tr. (Mahon) at 202:1-203:8 [REDACTED]; CPX-0003C [REDACTED]; *see also* Tr. (Mahon) at 201:3-9 (discussing CX-5989C and CDX-0008C.0036, [REDACTED]).). This also includes the [REDACTED] [REDACTED]. (Tr. (Mahon) at 204:19-205:17 [REDACTED]; CPX-0001C [REDACTED]). Moreover, as discussed above, [REDACTED] (See, e.g., Tr. (Mahon) at 198:16-199:21 (discussing CDX-0008C.0033-34); CX-6120C.0033-34 [REDACTED]

[REDACTED]; CX-0734C.0148-149 [REDACTED]; *see also* Tr. (Mahon) at 196:22-198:22; CX-6130C.0047 [REDACTED]; RX-0969C.35 [REDACTED].).

For the foregoing reasons, Ericsson has proven by a preponderance of evidence that the Accused Products meet these limitations of claims 10 and 15 of the '817 patent.

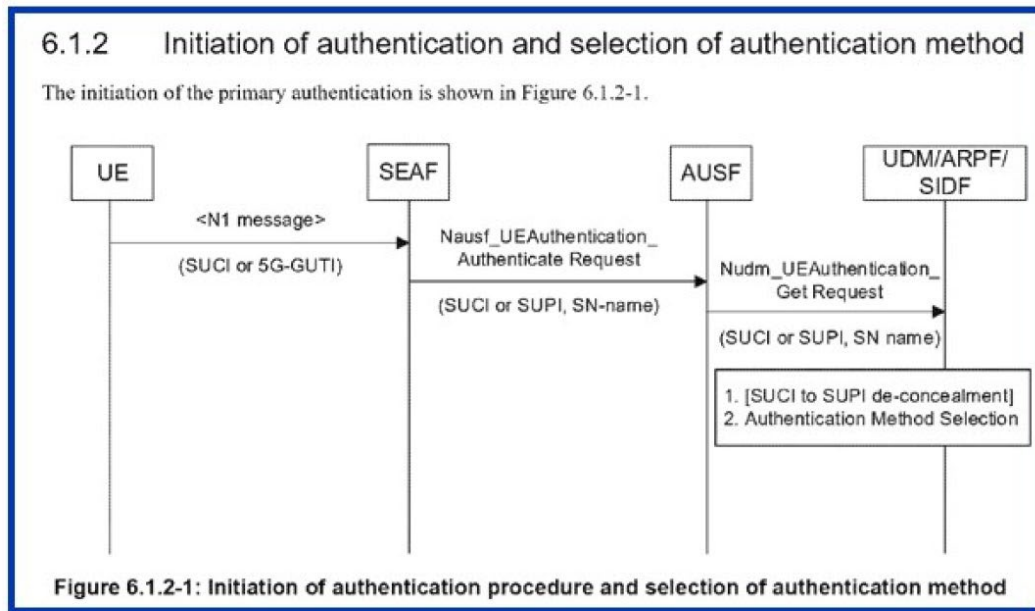
d) **[10.C]: “the UE transmitting the SUCI to an authentication server for forwarding of the SUCI to a de-concealing server capable of decrypting the encrypted part.”**

[15.D]: “transmit the SUCI to an authentication server for forwarding of the SUCI to a de-concealing server capable of decrypting the SUPI.”

Respondents’ main non-infringement argument is that the Accused Products do not practice these claim limitations. (RPBr. at 82-86; RRBBr. at 9-14.).

Dr. Mahon testified that the Accused and DI Products are UEs that transmit the SUCI to an authentication server for forwarding of the SUCI to a de-concealing server capable of decrypting the encrypted part or SUPI. (Tr. (Mahon) at 188:6-191:19.) He opined that this limitation is met either literally or under the doctrine of equivalents. (*Id.* at 191:20-192:11.).

Dr. Mahon explained that the 5G standard requires UEs to send up “the SUCI to the network,” specifically to the “AUSF, which is in your home network.” (*Id.* at 188:13-189:3.). The AUSF (Authentication Server Function) of the 5G standard is the “authentication server” of the claims. (*Id.*). Dr. Mahon also testified that the authentication server chooses a “SIDF [Subscriber Identity De-concealing Function]” and “sends [the SUCI] forward, that is for forwarding to the SIDF for de-concealing.” (*Id.*). A relevant portion of the 5G standard (CX-1698.0036-37 (TS 33.501)) is reproduced below from Dr. Mahon’s demonstrative.

Figure 8: 5G Standard Showing UE Sending SUCI to AUSF

CX-1698 (TS 33.501) at 36-37 (Clause 6.1.2) & figure 6.1.2-1.

(CDX-0008C.0027 (citing CX-1698.0036-37 (TS 33.501), Fig. 6.1.2-1.).

As shown above in Figure 8, the UE transmits a SUCI to the AUSF, “which is in home network,” through the SEAF, which “is in something called the visited or serving network.” (Tr. (Mahon) at 188:11-189:3.). Because the UE cannot practically reach the AUSF directly, the SEAF “relays, passes through” the UE’s SUCI to the AUSF as part of the UE’s transmission. (*Id.*). Dr. Mahon also explained the significance of the UE transmitting a SUCI to an authentication server “for forwarding of the SUCI to a de-concealing server capable of decrypting the encrypted part [SUPI].” (JX-0001 at cls. 10, 15.). Specifically, Dr. Mahon explained that “[o]nly another home network component, like the AUSF, can talk to the SIDF for security reasons. That’s kind of an important security element.” (Tr. (Mahon) at 189:5-8.).

Dr. Mahon mapped limitations [10.C] and [15.D] to the [REDACTED]

[REDACTED]. (*Id.* at 202:1-203:8 [REDACTED])

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[REDACTED]; CPX-0003C [REDACTED]
[REDACTED]; *see also* Tr. (Mahon) at
201:3-9 (discussing CX-5989C and CDX-0008C.0036 and [REDACTED]
[REDACTED]
[REDACTED]). Dr. Mahon also confirmed that [REDACTED]
[REDACTED] (*Id.* at 204:19-205:17 [REDACTED]
[REDACTED]; CPX-0001C [REDACTED]
[REDACTED]).

As discussed above in Section VII.A.3, Dr. Mahon testified to [REDACTED]
[REDACTED]
[REDACTED] (*See, e.g.*, Tr. (Mahon) at 196:22-
198:22; CX-6130C.0047 ([REDACTED] RX-0969C.0035 [REDACTED]
[REDACTED]; Tr. (Mahon) at 198:16-199:21 (discussing CDX-0008C.0033-34);
CX-6120C.0033-34 [REDACTED]; CX-0734C.0148-149 [REDACTED]
[REDACTED]).

Respondents did not dispute that the AUSF is an “authentication server.” (*See* Tr.
(Mahon) at 189:9-11.). Nor did Respondents contest that the SIDF is a de-concealing server.
(*See id.* at 189:12-14.). It also appears that the Parties did not dispute how the products at issue
transmit their SUCIs.

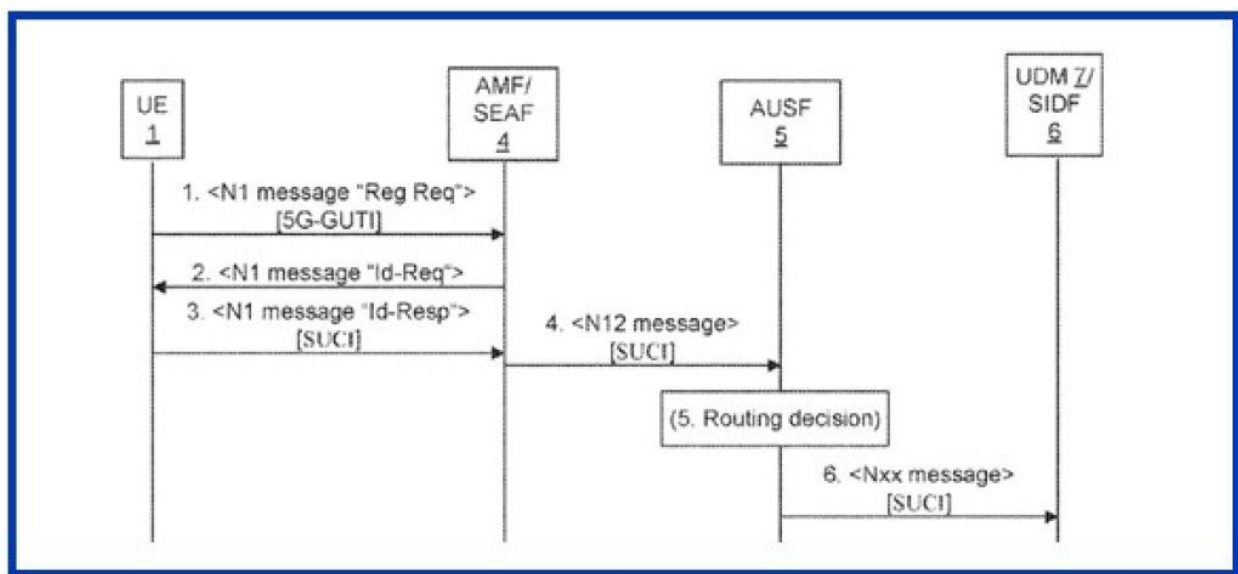
The only non-infringement argument Respondents provided during the Hearing is based
on the idea that a SUCI cannot, as a practical matter, travel directly from a phone to the AUSF
of a home network. (Tr. (Mahon) at 188:13-189:3.). For example, other network elements exist
in the transmission path, including base stations and serving network elements. (*Id.* at 190:5-

11.). The SUCI must pass through “something called the visited or serving network. So, for example, if you roam outside your home area, you start a call, you’re going to attach to some other network.” (*Id.* at 188:13-189:3.). The role of the Security Anchor Function or “SEAF” of a serving network is to pass[] through that SUCI to the AUSF, which is in your home network.” (*Id.*). The SEAF is part of the serving network. (*Id.*). Ericsson’s and Respondents’ experts both agreed that the SEAF plays no role in the home network’s authentication and de-concealing processes. (*Id.* at 190:12-16; Tr. (Harry Bims)¹³ at 1313:14-18.). Both experts also agreed that the SEAF never modifies the SUCI as it passes through the SUCI to the authentication server. (Tr. (Mahon) at 190:12-16; Tr. (Bims) at 1313:19-20 (“Right, [the SEAF] never modifies the SUCI, right.”).). The 5G standard refers to the SEAF as a “relay or passthrough.” (Tr. (Mahon) at 281:20-23.). Respondents’ expert, Dr. Bims, agreed that “the SUCI goes from the UE to the SEAF” and then “the exact same SUCI goes from the SEAF to the AUSF.” (Tr. (Bims) at 1313:21-1314:3.).

That a UE’s SUCI would pass through serving network elements, including the SEAF, as the UE transmits that SUCI to the authentication server of the home network is described throughout the patent. For example, Figure 6 of the ’817 patent has “the same flow” as Figure 6.1.2-1 of CX-1698 (TS 33.501). (Tr. (Mahon) at 190:17-191:10 (discussing CDX-0008C.0028).). Figure 6 of the ’817 patent is reproduced below.

¹³ When he testified during the Hearing on July 16, 2024, Dr. Harry Bims was the CEO/CTO and Founder of AirFlow Networks, Inc. LLC. (RPSt. at Ex. A.). Respondents identified Dr. Bims as “an expert in the technology related to the ’817 patent.” (RPSt. at 2.). Respondents stated that “[h]e will testify on the opinions in his expert reports, including, *inter alia*, regarding the technology and state of the art at issue, Ericsson’s alleged technical domestic industry, the invalidity of the asserted claims of the ’817 patent, whether the Motorola accused products allegedly infringe the asserted claims of the ’817 patent, and other topics related to the ’817 patent.” (*Id.*). Dr. Bims was accepted without objection on the subject matter for which he was called to testify.

Figure 9: Figure 6 of the '817 Patent



(JX-0001 at Fig. 6.).

As Dr. Mahon testified, a person of ordinary skill would understand that the “transmitting” step of claims 10 and 15 would involve a pass-through in the serving network as a matter of practical reality. (Tr. (Mahon) at 298:16-299:11.). First, Dr. Mahon explained that a skilled artisan would understand that nodes exist between the UE and the AUSF. (*See id.*). “[A] person of ordinary skill in the art would understand, if you’re transmitting your credentials to log into an Amazon.com server, you know it’s going to touch four or five, six or seven routers along the way. . . . You’re sending it to Amazon.com. It’s relayed through that system to get to the endpoint.” (*Id.*). Second, Respondents’ expert, Dr. Bims, testified on cross-examination that “[a]ccording to the ’817 Patent, the UE accesses the home network using the serving network.” (Tr. (Bims) at 1309:4-6.). Dr. Bims confirmed that one of ordinary skill would know that a UE on a serving network would communicate with that serving network. (*See id.* at 1309:18-22.). The ’817 patent expressly discloses this.

FIG. 1 illustrates an example wireless communication network 30 that includes a UE 1, a serving network 2, and a home network 3. ***The UE and home network are both communicatively connected to, and exchange signals with each other via, the serving network.*** The UE is configured with a subscription identifier identifying a subscription supported by the home network, and ***accesses the home network using the serving network.***

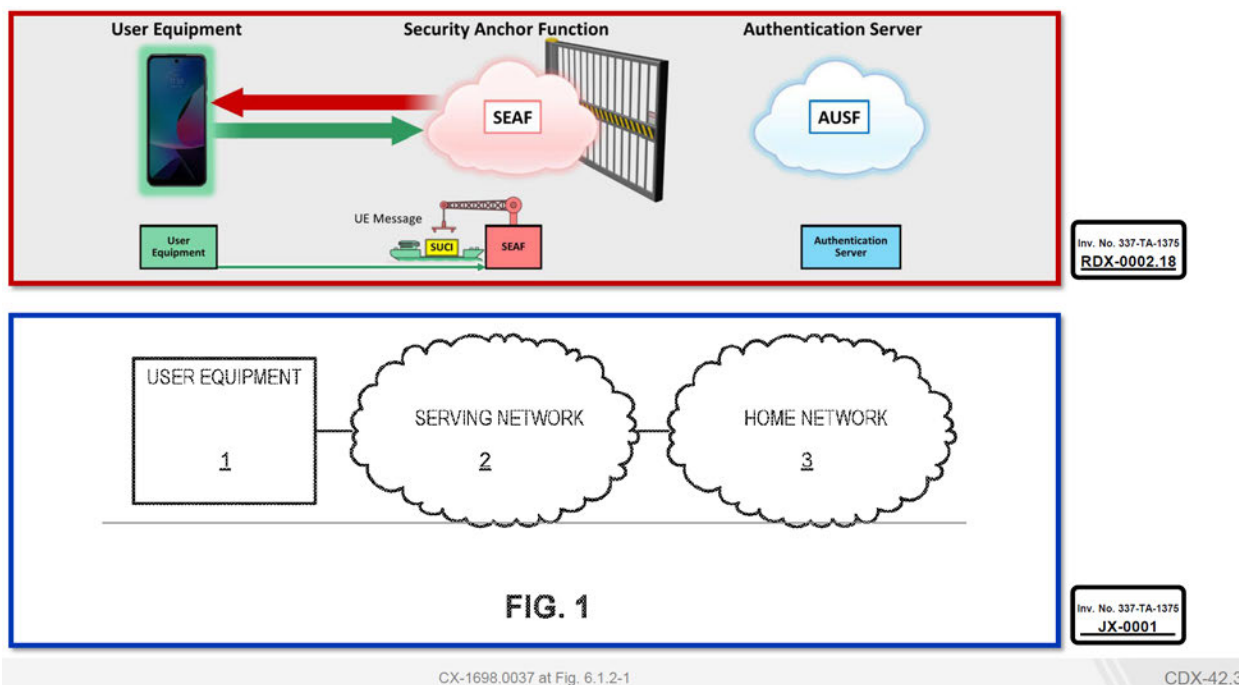
(JX-0001 at 6:14-21 (emphases added)).

When asked by Lenovo's counsel, Dr. Bims testified that for purposes of his noninfringement position, "the UE[,], security anchor function[,], and authentication server arrangement" is "the same" in a "non-roaming" situation and "roaming" situation.¹⁴ (Tr. (Bims) at 1325:22-1326:9.). Dr. Mahon clarified what a serving network is: "The serving network is the network you attach to It can be your network operator." (Tr. (Mahon) at 1493:24-1494:9.). Dr. Mahon also explained that "by design the AUSF, the authentication server, and the de-concealing server, are tucked away in the home network on the right side [of Figure 6 of the '817 Patent]." (*Id.*).

As Ericsson pointed out, Respondents' non-infringement argument disregards that: (1) a person of ordinary skill would readily appreciate that serving network elements (or network elements more generally) exist between the UE and AUSF; and (2) that the '817 patent repeatedly explains to those of ordinary skill that this is the case. (CBr. at 43.). Respondents' expert's, Dr. Bims's, cross-examination demonstrative, CDX-0042.0003 is provided below, which depicts Respondents' non-infringement argument illustration next to Figure 1 of the '817 patent. (*See* Tr. (Bims) at 1308:22-1309:6.).

¹⁴ In their Pre-Hearing Brief, Respondents did not argue that its non-infringement argument would apply differently when the Accused Products are in roaming versus non-roaming situations.

Figure 10: Bims Demonstrative Comparing Respondents' Non-Infringement Argument with Figure 1 of the '817 patent



(CDX-0042.0003 (citing RDX-0002.0018; JX-0001 at Fig. 1.).

Dr. Bims testified that the SEAF “can do one of three things [to the SUCI] – act on it, drop it, or forward it.” (Tr. (Bims) at 1303:8-11.). In Dr. Bims’ “forward” or pass through scenario, Dr. Bims agreed that “the SUCI goes from the UE to the SEAF” and then “the exact same SUCI goes from the SEAF to the AUSF.” (*Id.* at 1313:21-1314:3.). This is what happened when, for example, the Accused and Domestic Industry Products Dr. Bims testified about connected to 5G SA networks. (*See id.* at 1298:23-1302:10 (discussing the Motorola Edge+ 2023, Moto Edge 2022, and Samsung S23, which were all on 5G SA networks).).

With respect to Dr. Bims’ “drop it” scenario where the SEAF would allegedly refuse to relay a SUCI to the AUSF based on a “policy,” Dr. Bims provided no evidence of this ever occurring or what such a “policy” would be in real life. (*Cf. id.* at 1306:14-24.). Dr. Bims

acknowledged that he does not “actually follow carrier deployments of 5G technology in the United States.” (*Id.* at 1307:14-16.). Moreover, Respondents’ argument would apply to any transmission that passes through multiple network elements, such as a SUCI, because a network element, like a base station, could hypothetically (like Dr. Bims’ hypothetical SEAF) reject a message. As Dr. Bims testified “if the base station were to intercept the SUCI and perform its own internal policy on that SUCI, that could lead to the SUCI not being relayed by the base station. That would be yet another reason why the 5G UE does not transmit a SUCI to the authentication server.” (*Id.* at 1326:19-1327:4.).

That a serving network may, according to Dr. Bims, contains nodes such as base stations and SEAFs that could hypothetically refuse to pass through a SUCI does not change the fact the ’817 patent expressly tells persons of ordinary skill that the “UE and home network are both communicatively connected to, and exchange signals with each other via, the serving network.” (JX-0001 at 6:14-21.). Even if, hypothetically, a SEAF or base station of a serving network refused to pass through a message to a home network AUSF in some special yet unspecified scenario, as Ericsson noted, that would not change all the other instances that the Accused and Domestic Industry Products practice the claims (and the fact that the products can practice the claims). (CBr. at 44.).

With regard to Dr. Bims’ “act on it” scenario, Dr. Bims provided no specifics about what a SEAF “act[ing] on” a SUCI would entail. During the Hearing, Dr. Bims agreed that “the SEAF will not ever authenticate a user based on a SUCI.” (Tr. (Bims) at 1313:14-18.). Under Respondents’ theory, it is unclear what the SEAF would ever do with a subscriber concealed identifier (SUCI) if the SEAF will not ever authenticate a user based on that SUCI. Moreover, Dr. Bims provided no citation to the 5G standard showing that 5G standard even contemplates

such an “act on it” scenario. (*See, e.g.*, RDX-0002.0017-21 (containing the only citations to the 5G standard provided by Dr. Bims)). When Dr. Bims was asked the following question (referring to RDX-0002.0019): “What does it mean for the SEAF to act on the SUCI?”, Dr. Bims responded with the following answer: “Well, what it means is the standard is not very clear as to what particular actions the SEAF can take, but one thing that it does make clear is that, when the SEAF acts on the SUCI, it does not forward it to an authentication server.” (Tr. (Bims) at 1325:13-21.).

Dr. Bims was unable to explain what “act on it” means according to the 5G standard or otherwise. He was unable to point to any evidence suggesting that a SEAF will ever “act on” a SUCI. As mentioned, Dr. Bims does not “actually follow carrier deployments of 5G technology in the United States.” (*Id.* at 1307:14-16.).

For the reasons discussed above, Ericsson has proven by a preponderance of evidence that the Accused Products meet this limitation of claims 10 and 15 of the ’817 patent.

e) Doctrine of Equivalents

Dr. Mahon provided an alternative position under the doctrine of equivalents. (Tr. (Mahon) at 191:20-192:11.). Specifically, Dr. Mahon explained that a UE transmitting a SUCI to the AUSF (authentication server) for forwarding to a SIDF (de-concealing server) capable of decrypting the encrypted part through intervening pass-through network elements is “substantively the same function and substantively the same way resulting in substantively the same result.” (*Id.*). The function is transmitting the SUCI. (*Id.*). The “way” is from the UE “to the AUSF, whether it’s directly or indirectly.” (*Id.*). The result is that the AUSF forwards the SUCI “to the SIDF for de-concealing.” (*Id.*). These are the same regardless of whether the SUCI transmitted by the UE passes through other network elements (base stations or SEAFs) en

route to the AUSF. As Dr. Mahon explained, the SEAF and other network elements do not modify the SUCI as it passes through on its way to the AUSF. (*Id.* at 190:12-16.).

Dr. Bims argued that “the way” and the “result” were “substantially different.” (Tr. (Bims) at 1273:13-1274:10.). Dr. Bims first argued that the “SUCI is transmitted only to a security anchor function [SEAF].” (*Id.* at 1273:19-25.). However, this argument is inconsistent with Dr. Bims’ other positions. For his doctrine of equivalents analysis, Dr. Bims did not address the fact that a base station exists between the UE and the SEAF such that, under his own theory, a UE does not “transmit” a SUCI to the SEAF. (*Id.* at 1326:19-1327 (“[I]f the base station were to intercept the SUCI and perform its own internal policy on that SUCI, that could lead to the SUCI not being relayed by the base station. That would be yet another reason why the 5G UE does not transmit a SUCI to the authentication server.”)). In any event, Dr. Bims did not identify any substantial difference between: (1) a UE transmitting a SUCI that passes through network nodes en route to an intended destination; and (2) a UE transmitting a SUCI that does not pass through network nodes prior to reaching an intended destination other than to state the following: “In the 5G standard the SUCI is transmitted only to a security anchor function, which is not what the claims state. The claims state that the SUCI is only transmitted to an authentication server.” (*Id.* at 1273:19-25.).

However, this testimony underscores Dr. Bims’ opinion that the claim limitations are not met literally. The doctrine of equivalents involves separate factual determinations from literal infringement. *See Intendis GMBH v. Glenmark Pharms. Inc., USA*, 822 F.3d 1355, 1360 (Fed. Cir. 2016) (“Even when an accused product does not meet each and every claim element literally, it may nevertheless be found to infringe the claim if there is equivalence between the elements of the accused product or process and the claimed elements of the patented invention.”)

(citations and internal quotations omitted).

As for whether the “result” is substantially different, Dr. Bims argued the following:

[T]he result is that the SUCI is transmitted to a security anchor function, which then determines what to do with it. The result in the claims is that the SUCI is transmitted by the user equipment to an authentication server for forwarding to a de-concealing server, and that’s not what you see here in the 5G standard.

(Tr. (Bims) at 1274:1-10.).

The problem with Dr. Bims’ argument here is that Dr. Bims disregarded the scenario in which “the SUCI goes from the UE to the SEAF” and then “the exact same SUCI goes from the SEAF to the AUSF.” (*Id.* at 1313:21-1314:3.). Dr. Bims stated that “the fact that the accused products connect to 5G SA” has “no effect” on his opinions. (*Id.* at 1324:18-1325:5.). However, Dr. Bims never addressed that. Under Dr. Bims’s own interpretation, in scenarios where the Accused and Domestic Industry Products are connecting to 5G SA, the “exact same SUCI” that is transmitted from the UE goes to the AUSF for forwarding to the de-concealing server, which is the same result (i.e., the SUCI goes from the UE to the AUSF) as the claims. (*Id.* at 1274:1-10 (“The result in the claims is that the SUCI is transmitted by the user equipment to an authentication server for forwarding to a de-concealing server.”)).). Dr. Bims’ arguments were either neither supported nor accurate.

For these reasons, Ericsson has proven that these limitations are met under the doctrine of equivalents.

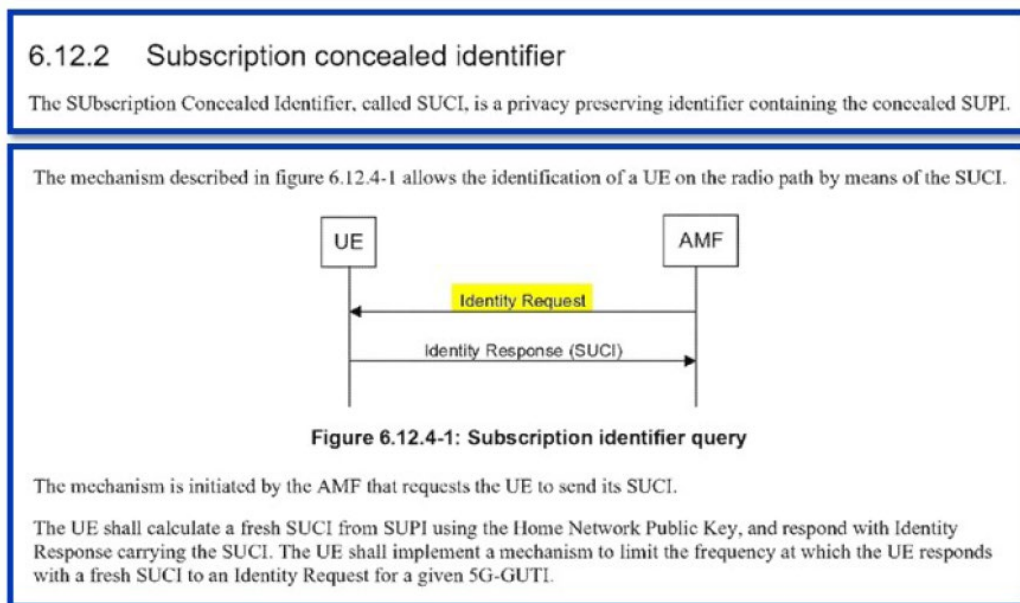
4. The Accused Products Practice Claim 13 of the '817 Patent

- a) **“The method of claim 10, wherein transmitting the SUCI to the authentication server comprises transmitting the SUCI to the authentication server in response to an identifier request message received from an Authentication and Mobility management Function, AMF, as part of a procedure for registering the UE with a wireless communication network.”**

The evidence shows that the Accused Products practice claim 13. (Tr. (Mahon) at 192:15-193:9; CDX-0008C.0029.). Respondents’ expert, Dr. Bims, did not present any non-infringement arguments specific to claim 13. (See Tr. (Mahon) at 193:7-9; RRBBr. at 9-23.).

Dr. Mahon testified that the 5G standard describes that the UE transmits the SUCI to the AUSF in response to an identity request (i.e., an “identifier request message”) received from an AMF as part of a procedure for registering the UE. (*Id.* at 192:23-193:6; CX-1698 (TS 33.501) at 6.12.2.). The subscription identification procedure set forth in the 5G standard is reproduced and annotated in Dr. Mahon’s demonstrative below.

Figure 11: Annotated Portion of the 5G Standard Showing the Subscription Identification Procedure



(CDX-0008C.0029 (citing CX-1698 (TS 33.501) at 6.12.2 (annotated))).

Dr. Mahon also testified that the [REDACTED]

[REDACTED] (Tr. (Mahon) at 202:1-203:8 [REDACTED]

[REDACTED], 204:19-205:17 [REDACTED]

[REDACTED].).

Accordingly, Ericsson has proven by a preponderance of evidence that the Accused Products meet the additional limitation recited in claim 13 of the '951 patent.

5. The Accused Products Practice Claim 14 of the '817 Patent

a) “The method of claim 10, wherein the encryption scheme is an Elliptic Curve Integrated Encryption Scheme.”

The evidence shows that the Accused Products practice claim 14. (Tr. (Mahon) at 193:7-194:11; CDX-0008C.0030.). Like dependent claim 13, Dr. Bims, did not present any non-infringement arguments specific to claim 14. (*See, e.g.*, CBr. at 53; RRB. at 9-23.).

Dr. Mahon testified that the encryption scheme used by the Accused Products is “an Elliptic Curve Integrated Encryption Scheme.” (Tr. (Mahon) at 193:10-24.). Dr. Mahon explained that the Profile <A> and Profile protection schemes are Elliptic Curve Integrated Encryption Schemes. (Tr. (Mahon) at 193:25-194:8; CX-1697 (TS 23.003) at 2.2B.).

Additionally, Dr. Mahon testified that the [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] (Tr. (Mahon) at 204:6-15; CDX-0008C.0037 (fourth bullet point showing [REDACTED]

[REDACTED]). For the MediaTek-Based Accused Products, Dr. Mahon testified that [REDACTED]

(Tr. (Mahon) at 204:19-205:17

).

For these reasons, Ericsson has proven by a preponderance of evidence that the Accused Products meet the additional limitation recited in claim 14 of the '817 patent.

B. Technical Prong of Domestic Industry

1. Legal Standard

A complainant in a patent-based Section 337 investigation must demonstrate that it is practicing or exploiting the patents at issue. *See* 19 U.S.C. § 1337(a)(2) and (3); *Certain Microsphere Adhesives, Process for Making Same, and Prods. Containing Same, Including Self-Stick Repositionable Notes*, Inv. No. 337-TA-366, Comm'n Op. at 8, Pub. No. 2949 (U.S.I.T.C. Jan. 16, 1996) ("*Microsphere Adhesives*"). "In order to satisfy the technical prong of the domestic industry requirement, it is sufficient to show that the domestic industry practices any claim of that patent, not necessarily an asserted claim of that patent." *Certain Ammonium Octamolybdate Isomers ("Certain Isomers")*, Inv. No. 337-TA-477, Comm'n Op. at 55 (U.S.I.T.C. Jan. 5, 2004).

The test for claim coverage for the purposes of the technical prong of the domestic industry requirement is the same as that for infringement. *Certain Doxorubicin and Preparations Containing Same*, Inv. No. 337-TA-300, Initial Determination at 109, 1990 WL 710463 (U.S.I.T.C. May 21, 1990), *aff'd*, Views of the Commission at 22 (October 31, 1990) ("*Doxorubicin*"). "First, the claims of the patent are construed. Second, the complainant's article or process is examined to determine whether it falls within the scope of the claims." *Id.* The technical prong of the domestic industry can be satisfied either literally or under the doctrine of equivalents. *Certain Dynamic Sequential Gradient Devices and Component Parts Thereof*,

Inv. No. 337-TA-335, Initial Determination at 44, Pub. No. 2575 (U.S.I.T.C. Nov. 1992).

2. The DI Products Practice Claims 10 and 13-15

The Samsung Domestic Industry Products practice the asserted claims of the '817 patent for the reasons described above. The Parties agreed that the Samsung Domestic Industry Products “practice the accused functionalities in the same way for the purposes of this Investigation” as the Qualcomm-Based Lenovo Accused Products. (Am. Joint Statement at § II.A.). The Parties additionally did not dispute that, like the Accused Products, the Samsung Domestic Industry Products “comply with the portions of the 3GPP 5G NR technical specifications relevant to the '817 Patent.” (*Id.* at § III.A (listing TS 33.501 at 5.2.5, 6.0, 6.1.1, 6.1.2, 6.12, Annex C (CX-1698); TS 23.501 at 5.9.2 (CX-1699), TS 23.003 at § 2.2 (including 2.2A and 2.2B) (CX-1697))).

For these reasons, Ericsson has proven by a preponderance of evidence that the DI Products practice claims 10 and 13-15 of the '817 patent.

C. Invalidity

1. Legal Standards

a) Patent Eligibility

Section 101 limits patent eligible subject matter to “any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof.” 35 U.S.C. § 101. Under Supreme Court precedent, “applications” of abstract concepts “to a new and useful end” remain patent eligible. *Alice Corp. Pty. v. CLS Bank Intern.*, 573 U.S. 208, 217 (2014) (“*Alice*”) (citation omitted). Determining whether a claim is invalid for being directed to a patent-ineligible abstract idea involves a two-step analysis. The court first determines whether the claim is “directed to” an abstract idea, and second determines “whether the claim nonetheless

includes an ‘inventive concept’ sufficient to “‘transform the nature of the claim” into a patent-eligible application.” *Yu v. Apple Inc.*, 1 F.4th 1040 (Fed. Cir. 2021) (“*Yu*”) (citations omitted). “[F]eatures that are not claimed are *irrelevant* as to step 1 or step 2 of the *Mayo/Alice* analysis.” *Am. Axle & Mfg., Inc. v. Neapco Holdings LLC*, 967 F.3d 1285, 1293 (Fed. Cir. 2020) (“*American Axle*”) (emphasis added) (collecting cases).

b) Obviousness

Under 35 U.S.C. § 103(a), a patent is valid unless “the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made” to a person having ordinary skill in the art. 35 U.S.C. § 103(a). The ultimate question of obviousness is a question of law, but “it is well understood that there are factual issues underlying the ultimate obviousness decision.” *Richardson-Vicks*, 122 F.3d 1476, 1479 (Fed. Cir. 1997) (citing *Graham v. John Deere Co. of Kansas City*, 383 U.S. 1, 17 (1966)).

After claim construction, “[t]he second step in an obviousness inquiry is to determine whether the claimed invention would have been obvious as a legal matter, based on underlying factual inquiries including: (1) the scope and content of the prior art, (2) the level of ordinary skill in the art, (3) the differences between the claimed invention and the prior art, and (4) secondary considerations of non-obviousness.” *Smiths Indus. Med. Sys., Inc. v. Vital Signs, Inc.*, 183 F.3d 1347, 1354 (Fed. Cir. 1999) (citing *Graham*, 383 U.S. at 17). The existence of secondary considerations of non-obviousness does not control the obviousness determination; a court must consider “the totality of the evidence” before reaching a decision on obviousness. *Richardson-Vicks*, 122 F.3d at 1483.

The Supreme Court clarified the obviousness inquiry in *KSR Int’l Co. v. Teleflex Inc.*,

550 U.S. 398 (2007). The Supreme Court said:

When a work is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field or a different one. If a person of ordinary skill can implement a predictable variation, § 103 likely bars its patentability. For the same reason, if a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill. *Sakraida* and *Anderson's-Black Rock* are illustrative—a court must ask whether the improvement is more than the predictable use of prior art elements according to their established functions.

Following these principles may be more difficult in other cases than it is here because the claimed subject matter may involve more than the simple substitution of one known element for another or the mere application of a known technique to a piece of prior art ready for the improvement. Often, it will be necessary for a court to look to interrelated teachings of multiple patents; the effects of demands known to the design community or present in the marketplace; and the background knowledge possessed by a person having ordinary skill in the art, all in order to determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue. To facilitate review, this analysis should be made explicit.

* * *

The obviousness analysis cannot be confined by a formalistic conception of the words teaching, suggestion, and motivation, or by overemphasis on the importance of published articles and the explicit content of issued patents. The diversity of inventive pursuits and of modern technology counsels against limiting the analysis in this way. In many fields it may be that there is little discussion of obvious techniques or combinations, and it often may be the case that market demand, rather than scientific literature, will drive design trends. Granting patent protection to advances that would occur in the ordinary course without real innovation retards progress and may, in the case of patents combining previously known elements, deprive prior inventions of their value or utility.

KSR, 550 U.S. at 417-19.

The Federal Circuit has since held that when a patent challenger contends that a patent is invalid for obviousness based on a combination of several prior art references, “the burden falls on the patent challenger to show by clear and convincing evidence that a person of ordinary skill in the art would have had reason to attempt to make the composition or device, or carry out the claimed process, and would have had a reasonable expectation of success in doing so.”

PharmaStem Therapeutics, Inc. v. ViaCell, Inc., 491 F.3d 1342, 1360 (Fed. Cir. 2007) (citations omitted).

The TSM¹⁵ test, flexibly applied, merely assures that the obviousness test proceeds on the basis of evidence--teachings, suggestions (a tellingly broad term), or motivations (an equally broad term)--that arise before the time of invention as the statute requires. As *KSR* requires, those teachings, suggestions, or motivations need not always be written references but may be found within the knowledge and creativity of ordinarily skilled artisans.

Ortho-McNeil Pharm., Inc. v. Mylan Labs., Inc., 520 F.3d 1358, 1365 (Fed. Cir. 2008).

2. Invalidity Overview

Respondents asserted that asserted claims 10, and 13-15 of the '817 patent are directed to the abstract idea of concealing data. (RBr. at 34.). Although the asserted claims may result in the concealment of a user's subscription permanent identifier, Respondents disregarded important claim elements that run counter to the Federal Circuit's *Alice* inquiry.

Respondents also contended that the claims are comprised only of known components by lodging two alleged obviousness grounds. (*Id.* at 13-34). Respondents relied on up to four references to allege certain obviousness grounds against certain claims. (*Id.*). Moreover, Respondents' alleged motivations to combine contradict the express teachings of both of Respondents' primary references (Nair and Forsberg).

For the reasons discussed below, the asserted claims of the '817 patent are patent-eligible and not rendered obvious by the asserted prior art references.

3. The Asserted Claims of the '817 Patent Are Patent-Eligible

a) *Alice* Step One

Here, the asserted claims of the '817 patent are not directed to abstract ideas or other

¹⁵ TSM is an acronym that stands for teaching, suggestion, motivation.

ineligible subject matter. The asserted claims are directed to a specific way to improve security in communications networks using a SUCI with clear text and encrypted parts. (See JX-0001 at cls. 10 and 15; Tr. (Mahon) at 177:21-178:14.). The claims recite specific technical improvements that overcome deficiencies of conventional architecture for encrypting subscriber information. (JX-0001 at cls. 10, 15; Tr. (Mahon) at 1488:18-1489:12.).

The claims are not merely directed to “concealing a subscription permanent identifier,” as Dr. Bims testified. (RBr. at 34; Tr. (Bims) at 1293:7-16.). Ericsson’s expert, Dr. Mahon, testified that the ’817 patent “discloses a particular structure and the SUCI is transmitted in a particular way.” (Tr. (Mahon) at 1495:1-20; *see also* JX-0001 at cls. 10 and 15.). Dr. Bims’ testimony falls short and is contradicted by Dr. Mahon’s accurate and credible testimony. Thus, Respondents have not proven by clear and convincing evidence that the asserted claims of the ’817 patent are directed to an abstract idea under *Alice* step one.

b) *Alice* Step Two

Because *Alice* step one demonstrates that the asserted claims are drawn to patentable-subject matter, it is not necessary to consider *Alice* step two. *See CardioNet LLC v. InfoBionic, Inc.*, 955 F.3d 1358, 1371 (Fed. Cir. 2020); *Enfish, LLC v. Microsoft Corp.*, 822 F.3d 1327 (Fed. Cir. 2016). If, however, the asserted claims are found to be patent-ineligible under *Alice* step one, those claims would still be directed to patentable subject matter under *Alice* step two because they are not simply applying conventional and well-understood techniques to the claimed concept. *See BSG Tech LLC v. BuySeasons, Inc.*, 899 F.3d 1281, 1290 (Fed. Cir. 2018). The evidence demonstrates that the combination of limitations of the asserted claims supply an inventive concept that is sufficient to transform the nature of the claim to patent-eligible subject matter. *See id.*

In particular, the asserted claims recite a specific clear text and encrypted parts to be

transmitted by the UE. (JX-0001 at cls. 10 and 15.). The claimed invention enables a “future proof” design which allows the network and UE to update the encryption scheme identifier. (Tr. (Mahon) at 488:18-1489:12.). The asserted claims are not directed to the effect of concealing a subscription identifier. (See JX-0001 at cls. 10 and 15.). Dr. Mahon testified that the claims of the ’817 patent could not have been implemented on then existing UEs in 2017 because the UE would not know how to calculate it. (Tr. (Mahon) at 1496:1-7.). Respondents’ “proof” falls short. Moreover, Dr. Mahon’s testimony is supported and persuasive. Accordingly, Respondents have not proven by clear and convincing evidence that the asserted claims are directed to patent-ineligible subject matter under *Alice* step two.

4. The Asserted Claims of the ’817 Patent Are Not Obvious

a) Overview of the Prior Art

Respondents relied on the four (4) prior art references described below for obviousness. (RBr. at 11-13.). For the reasons discussed below, Respondents did not prove by clear and convincing evidence that the asserted claims of the ’817 patent are obvious.

i. Nair (RX-0828)

U.S. Patent Publication No. 2018/0324585 to Nair et al. (“Nair Publication,” RX-0832), entitled “Privacy Indicators for Controlling Authentication Requests,” filed on October 26, 2017, and published on November 8, 2018, claims priority to U.S. Provisional Application No. 62/502,266 (“Nair Provisional,” RX-0828), filed on May 5, 2017. Respondents asserted that they are only relying on the disclosure in the Nair Provisional application for obviousness. (RBr. at 11.). Although Ericsson contested the Nair Publication’s prior-art status in its Pre-Hearing Brief (CPBr. at 43), in another filing that Ericsson joined, the Parties did not dispute that the Nair Provisional is prior art to the ’817 patent. (Am. Joint Statement at § III.C.). Therefore,

Ericsson's acknowledgment of the Nair Publication's prior art status is accepted rather than its belated attempt at contesting the Nair's status.

ii. Forsberg (RX-0830)

U.S. Patent Publication No. 2013/003971 ("Forsberg"), entitled "Identifiers in a Communication System," was filed on September 13, 2012 and published on January 3, 2013. (RX-0830.). The Parties did not dispute that Forsberg is prior art to the '817 patent. (Am. Joint Statement at § III.C.).

iii. Togawa (RX-0834)

U.S. Patent No. 8,005,219 ("Togawa"), entitled "Data Decryption Apparatus and Data Encryption Apparatus," was filed on June 23, 2007 and issued on August 23, 2011. (RX-0834.). The Parties did not dispute that Togawa is prior art to the '817 patent. (Am. Joint Statement at § III.C.).

iv. 5G-Ensure (RX-0806)

5G-Ensure Deliverable D3.1, entitled "5G-PPP security enablers technical roadmap," (early version) ("5G-Ensure") was published on November 3, 2016. (RX-0806.). The Parties did not dispute that 5G-Ensure is prior art to the '817 patent. (Am. Joint Statement at § III.C.).

b) Ground 1: Nair in Combination with Forsberg, Togawa, and 5G-Ensure

Nair does not disclose or suggest: (1) an "encryption scheme identifier that identifies an encryption scheme used by the UE to encrypt the subscription identifier in the SUCI"; and (2) a "public key identifier" as recited limitations [10.B] and [15.C]. (Tr. (Mahon) at 1497:23-1498:10; Tr. (Bims) at 1317:12-18.). To fill these deficiencies, Respondents relied on Togawa for the claimed "encryption scheme identifier" and Forsberg for the claimed "public key identifier." (RBr. at 15.).

i. “encryption scheme identifier”

It is undisputed that Nair does not disclose the claimed “encryption scheme identifier.” (RBr. at 15.). Respondents argued that “Nair in combination with Togawa” teaches the claimed clear-text encryption scheme identifier. (*Id.* at 16.). The Parties generally agreed that Nair’s “privacy indicator” indicates whether encryption is turned on. (Tr. (Mahon) at 1498:6-10 (testifying that the privacy indicator indicates “either yes or no, encrypted or not.”); Tr. (Bims) at 1278:23-1280:14; RBr. at 16.).

The main dispute is whether a person of ordinary skill in the art would need to know what type of encryption scheme is being used to modify Nair with Togawa’s “encryption method ID.” (*See* RBr. at 14-15; CRBr. at 16.). Dr. Mahon’s opinion is supported by the express disclosure in Nair.

Figure 12: Mahon Demonstrative Highlighting Nair Disclosure

Nair Disclosed a Simple Approach Without Encryption Scheme Identifiers and Public Key Identifiers

Source: RX-0828 at 6:17-30

CDX-21.10

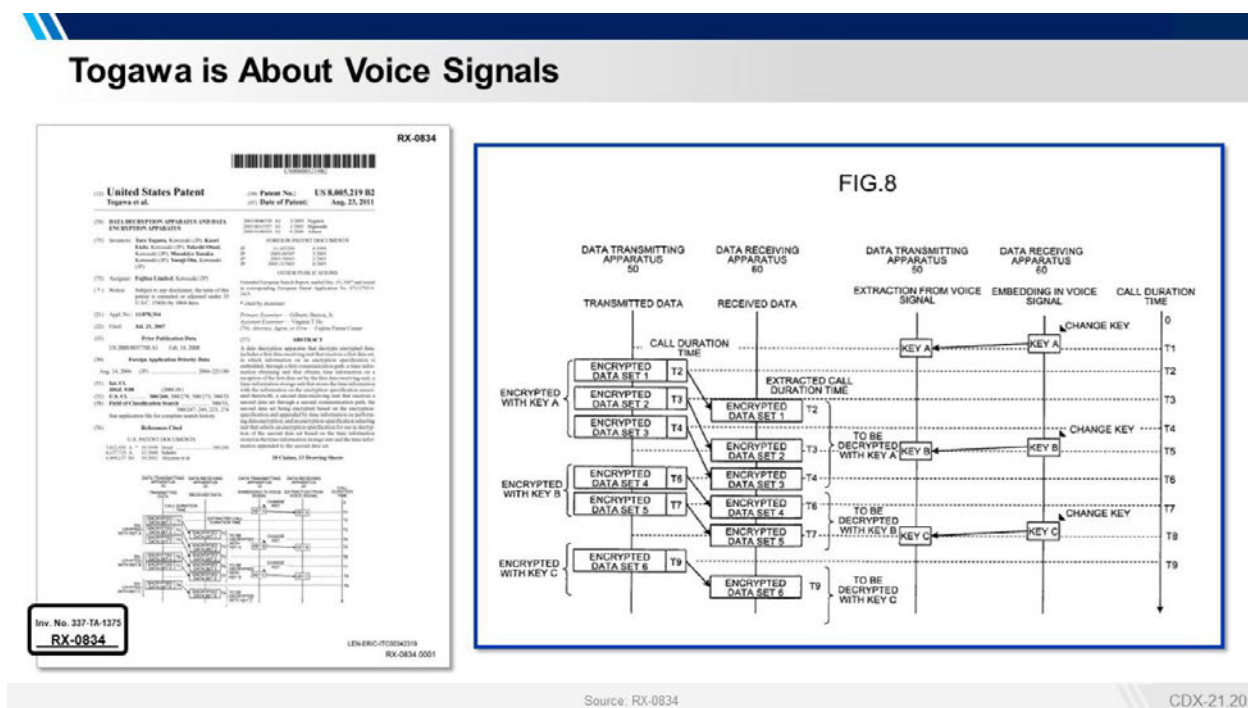
(CDX-0021C.0010 (citing RX-0828 at 6:17-30) (annotated)).).

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Based on this portion of Nair, Dr. Mahon explained that Nair does not contemplate or have a need for an encryption scheme identifier because it “assumes that both the UE and the network know what the encryption scheme is.” (Tr. (Mahon) at 1498:6-10, 1499:24-1500:1.). Respondents’ expert, Dr. Bims, did not address this portion of Nair. Dr. Bims opined that Nair’s disclosure of “multiple privacy indicators imply to a [person of ordinary skill in the art] that an encryption scheme is being used when privacy is enabled,” but “Nair does not disclose what [type of] encryption scheme is used when privacy is enabled.” (RBr. at 16.). By contrast, Dr. Mahon testified that Nair expressly discloses that the UE and network know the encryption scheme. (Tr. (Mahon) at 1498:6-10, 1499:24-1500:1.). Dr. Bims did not point to any language in Nair that expresses a user’s need to know the encryption scheme associated with the privacy indicator. (RBr. at 17-18.).

Moreover, Respondents did not show or prove by clear and convincing evidence that a person of ordinary skill in the art would have combined Nair with Togawa. Togawa is directed to sending “voice signals” during a call. (Tr. (Mahon) at 1503:15-23.). For example, Togawa discloses the sending encrypted voice signal data with an encryption key. To provide additional security, the encryption is changed during the call, so the encryption key is switched. (*Id.* at 1505:10-1506:3.).

Figure 13: Mahon Demonstrative Showing Figure 8 of Togawa



(CDX-0021C.0020.).

Dr. Mahon explained that the sending of voice signals is “a very different construct from what happens during authentication,” where the network is trying to determine whether the UE is a valid user to attach to the network. (Tr. (Mahon) at 1505:24-1506:3.).

Thus, Respondents have not presented clear and convincing evidence or proven that a person of ordinary skill in the art would have modified Nair to include the encryption method ID of Togawa.

ii. “public key identifier”

Respondents did not dispute that Nair does not disclose a “public key identifier,” and relied on Forsberg for this limitation. (RBr. at 16.). Respondents’ expert, Dr. Bims, testified to the following:

Q. So what is it about Nair’s disclosure of a public-key-based solution that would

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provide reason and motivation to one of skill in the art to combine Forsberg's public key identifier with Nair?

A. So a person of ordinary skill reading Nair would understand that, when a home operator is providing its public key to all of its home network subscribers, that a public key ID would be involved. But a person of ordinary skill would have to consider multiple ways of involving a public key ID. Forsberg solves that problem by expressly disclosing a public key identifier that is provided along with the encrypted IMSI as a solution to that problem.

Q. Would one of skill in the art have a reasonable expectation of success in combining Forsberg with Nair for the public key identifier?

A. Yes.

(Tr. (Bims) at 1282:1-17.).

While Ericsson's expert, Dr. Mahon, did not provide specific testimony combining Nair with Forsberg in the way Dr. Bims opined, Dr. Bims' testimony does not provide a meaningful explanation for why one of ordinary skill in the art would be motivated to combine these references at the time of the invention. As discussed above, Dr. Bims testified that "a person of ordinary skill would have to consider *multiple* ways of involving a public key ID." (*Id.* (emphasis added)). However, Dr. Bims did not explain why the reference would be used in the particular way claimed by the '817 patent.

Thus, Respondents have not carried their burden in establishing or proving that a person of ordinary skill would have been motivated to combine Nair with Togawa and Forsberg.

c) Ground 2: Forsberg in Combination with Togawa and 5G-Ensure

Forsberg does not disclose: (1) an "encryption scheme identifier," recited in limitations [10.B] and [15.C]; and (2) that the UE "transmit[s] the SUCI to an authentication server for forwarding of the SUCI to a de-concealing server capable of decrypting the SUP-I" as recited in limitations [10.C] and [15.D]. To fill these deficiencies, Respondents relied on Togawa for the

“encryption scheme identifier.” (RBr. at 29-31.).

The Parties did not dispute that Forsberg does not disclose the claimed “encryption scheme identifier.” (RBr. at 25.). For the same reasons as discussed above in Section VII.C.4(b), Respondents have not presented let alone proven by clear and convincing evidence that a person of ordinary skill in the art would combine Forsberg, which is directed to authentication, with Togawa, which is directed to voice signals.

VIII. U.S. PATENT NO. 10,306,669

A. Direct Infringement

1. Infringement Overview

Ericsson accused the Accused Products of directly infringing claims 8, 9, 15, and 17 of the '669 patent. (CBr. 63.). The asserted claims are all dependent claims. Asserted claims 8 and 9 depend from independent claim 6, which is not asserted. Dependent claim 15 depends from independent claim 11, and dependent claim 17 depends from independent claim 1. Independent claims 1 and 11 are also not asserted. Thus, although claims 1, 6, and 11 have not been asserted, in addition to asserted claims 8, 9, 15, and 17, claims 1, 6, and 11 are also addressed in the analysis below.

For the reasons discussed below, Ericsson has met its burden and proven that the Accused Products directly infringe claims 8, 9, 15, and 17.

2. The Accused Products Practice Claims 1, 6, 11, and 17

- a) [1.A]: “A method performed by a wireless device, comprising:”**
[6.A]: “A wireless device, comprising:”
[11.A]: “A wireless device comprising:”

It is undisputed that the Accused Products meet the “wireless device” elements, i.e.,

[1.A], [6.A], and [11.A]. (Am. Joint Statement at § IV.B.). Each of the Accused Products is [REDACTED]. (JX-0029C (Klomsdorf Dep. Tr.) at 33:2-4.). Respondents admitted that the products are wireless devices. (See CX-0006 (Lenovo's Resps. to RFAs (Nos. 13-529) at Nos. 283, 302, 323, 344, 365, 386, 407, 428, 449, 470, 491, 512.). Moreover, Ericsson's expert, Dr. Mahon, testified that the Accused Products are wireless devices. (Tr. (Mahon) at 212:20-213:1; CDX-0008C.0046.). Respondents' expert, Dr. Sundeep Rangan,¹⁶ did not dispute Dr. Mahon's opinion.

Accordingly, Ericsson has proven by a preponderance of evidence that the Accused Products meet the preambles of claims 1, 6, and 11 of the '669 patent.

b) [6.B]: “an interface; and”

[11.B]: “an interface; and”

There is no dispute that the Accused Products include the “interface” elements recited in limitations [6.B], and [11.B]. (Am. Joint Statement at § IV.B.). Each Accused Product [REDACTED]. (JX-0029C (Klomsdorf Dep. Tr.) at 33:2-4; CX-0558.).

Respondents admitted that the Accused Products include an interface. (See CX-0006 (Lenovo's Resps. to RFAs (Nos. 13-529) at Nos. 291, 312, 333, 354, 375, 396, 421, 438, 459, 480, 501, 521.). Furthermore, Dr. Mahon testified that the Accused Products have an interface. (Tr.

¹⁶ When Dr. Sundeep Rangan testified during the Hearing on July 15, 2024, Dr. Rangan was a Professor of Electrical and Computer Engineering at New York University. (RPSt. at Ex. B.). Respondents identified him as “an expert in the technology related to the '342 and '669 patents. He will testify on the opinions in his expert reports, including, inter alia, regarding the technology and state of the art at issue, including technical comparisons of 4G and 5G wireless technology, Ericsson's alleged technical domestic industry, the invalidity of the asserted claims of the '342 and '669 patents, whether the Motorola accused products allegedly infringe the asserted claims of the '342 and '669 patents, and other topics related to the '342 and '669 patents. Dr. Rangan will also testify regarding Ericsson's alleged 4G and 5G patent portfolio.) (RPSt. at 2.). Dr. Rangan was accepted without objection as an expert for the subject matter upon which he was called to testify.

(Mahon) at 213:3-214:18; CDX-0008C.0048.). Dr. Mahon explained that he [REDACTED]

[REDACTED]. (*Id.*; CDX-0008C.0049;

CBr. at Ex. 2 (listing exhibits upon which Dr. Mahon based his hardware opinions).). Dr.

Rangan did not dispute this opinion.

For these reasons, Ericsson has proven by a preponderance of evidence that the Accused Products meet these limitations of claims 6 and 11 of the '669 patent.

c) **[6.C]: “processing circuitry configured to cause the wireless device to:”**

[11.C]: “processing circuitry configured to cause the wireless device to:”

It is undisputed that the Accused Products include the “processing circuitry” elements, i.e., [6.C] and [11.C]. (Am. Joint Statement at § IV.B.). Each Accused Product [REDACTED]. (JX-0029C (Klomsdorf Dep. Tr.) at 33:2-4; CX-0558.).

Respondents admitted that the Accused Products include a processor. (*See* CX-0006 (Lenovo’s Resps. to RFAs (Nos. 13-529) at Nos. 280, 299, 320, 341, 362, 383, 404, 425, 446, 467, 488, 509; *see also* JX-0029C (Klomsdorf Dep. Tr.) at 36:21-37:1.). Additionally, Dr. Mahon testified that the Accused Products have processing circuitry. (Tr. (Mahon) at 213:3-214:18; CDX-0008C.0047.). Dr. Mahon explained that [REDACTED]

[REDACTED]. (*Id.*; CDX-0008C.0049; CBr. at Ex. 2 (listing exhibits upon which Dr. Mahon based his hardware opinions).). Dr. Rangan, Respondents’ expert, did not dispute this opinion.

For the foregoing reasons, Ericsson has proven by a preponderance of evidence (without rebuttal) that the Accused Products meet these limitations of claims 6 and 11 of the '669 patent.

d) **[1.B]: “receiving a first downlink control channel message that schedules a first downlink shared channel transmission;”**

[6.D]: “receive a first downlink control channel that schedules a first downlink shared channel transmission;”

[11.D]: “receive a downlink control channel that schedules a downlink shared channel transmission to the wireless device;”

It is undisputed that the Accused Products meet the “[first] downlink control channel message” elements recited in limitations [1.B], [6.D], and [11.D]. (Am. Joint Statement at § IV.B.). As Dr. Mahon explained and the 5G NR standard defines, the Accused Products must be configured to and actually do receive a first Physical Downlink Control Channel (“PDCCH”) message containing a Downlink Control Information (“DCI”) message of format 1_0 or 1_1. (Tr. (Mahon) at 214:19-215:21; CDX-0008C.0050; CX-1700 (TS 38.213) at § 10.). DCI messages schedule Physical Downlink Shared Channel (“PDSCH”) transmissions. (*Id.*; CX-0557 (TS 38.212) at §§ 7.3.1.2.1, 7.3.1.2.2.). Dr. Rangan did not dispute that the Accused Products meet these limitations.

For the reasons discussed above, Ericsson has proven by a preponderance of evidence that the Accused Products meet these limitations of claims 1, 6, and 11 of the ’669 patent.

e) **[1.C]: “receiving a second downlink control channel message that schedules a second downlink shared channel transmission;”**

[6.E]: “receive a second downlink control channel that schedules a second downlink shared channel transmission;”

There is no dispute that the Accused Products meet the “second downlink control channel message” elements, i.e., [1.C] and [6.E]. (Am. Joint Statement at § IV.B.). As Dr. Mahon explained by Dr. Mahon and the 5G NR standard defined, the Accused Products can receive multiple PDCCH messages, each containing a DCI message of format 1_0 or 1_1. (Tr. (Mahon)

at 215:22-216:2; CDX-0008C.0051; CX-1700 (TS 38.213) at § 10.). As with the first DCI message scheduling a first PDSCH transmission, the second DCI message likewise schedules a second PDSCH transmission. (*Id.*; CX- 0557 (TS 38.212) at §§ 7.3.1.2.1, 7.3.1.2.2.). Dr.

Rangan did not dispute that the Accused Products practice these limitations.

For the foregoing reasons, Ericsson has proven by a preponderance of evidence that the Accused Products meet these limitations of claims 1 and 6 of the '669 patent.

- f) **[1.D]: “determining an uplink control channel resource to use for transmitting uplink control information to a network node on an uplink control channel, wherein:”**
[6.F]: “determine an uplink control channel resource to use for transmitting uplink control information to a network node, wherein:”
[11.F]: “determine an uplink control channel resource to use for transmitting uplink control information to a network node, wherein”

It is undisputed that the Accused Products meet the “[determine/determining] an uplink control channel resource to use” elements, i.e., [1.D], [6.F], and [11.F]. (Am. Joint Statement at § IV.B.). As Dr. Mahon explained, the 5G NR standard defines the UE procedure for reporting uplink control information (“UCI”) to a network node on the PUCCH. (Tr. (Mahon) at 217:1-20; CDX-0008C.0052; CX-1700 (TS 38.213) at § 9.2.). As defined in the standard, a PUCCH resource corresponds to “basically a time and frequency allocation for sending that HARQ information back up” to the base station. (*Id.*). Multiple PUCCH resources are organized into “PUCCH Resource Sets.” (CX-1700 (TS 38.213) at § 9.2.1; Tr. (Mahon) at 221:7-15.). Dr. Mahon explained that “for a PUCCH transmission with HARQ-ACK information, a UE determines a PUCCH resource” after determining a set of PUCCH resources as described in the standard. (Tr. (Mahon) at 217:6-12; CX-1700 (TS 38.213) at § 9.2.3.). Dr. Rangan did not

contest that this limitation is met.

For these reasons, Ericsson has proven by a preponderance of evidence that the Accused Products meet these limitations of claims 1, 6, and 11 of the '669 patent.

g) **[1.E]: “the uplink control information comprises Hybrid Automatic Repeat Request, HARQ, feedback for both the first downlink shared channel transmission and the second downlink shared channel transmission; and wherein”**

[6.G]: “the uplink control information comprises Hybrid Automatic Repeat Request, HARQ, feedback for both the first downlink shared channel transmission and the second downlink shared channel transmission, and”

[11.G]: “the uplink control information comprises Hybrid Automatic Repeat Request, HARQ, feedback for the downlink shared channel transmission and”

There is dispute that the Accused Products meet the “uplink control information comprises [HARQ]” elements recited in limitations [1.E], [6.G], and [11.G]. (Am. Joint Statement at § IV.B; Tr. (Mahon) 218:7-9.).

With respect to claim element [11.G], the 5G NR standard defines the “UE procedure for reporting HARQ-ACK,” one of the types of uplink control information in 5G. (CX-1700 (TS 38.213) at § 9.2.3.). Dr. Mahon explained that the HARQ-ACK sent on an uplink control channel in a 5G system provides feedback for the data sent on the downlink shared channel. (Tr. (Mahon) at 207:17-208:12.). Respondents did not contest that this limitation is met. (*Id.* at 218:10-14.).

With respect to claim elements [1.E] and [6.G], the 5G standard defined, and Dr. Mahon testified, that “[f]or a PUCCH transmission with HARQ-ACK information . . . [t]he PUCCH resource determination is based on a PUCCH resource indicator field [] in a last DCI format 1_0 or DCI format 1_1, among the DCI formats 1_0 or DCI formats 1_1 that have a value of a

PDSCH-to-HARQ feedback timing indicator field indicating a same slot for the PUCCH transmission, that the UE detects and for which the UE transmits corresponding HARQ-ACK information in the PUCCH.” (Tr. (Mahon) at 218:15-219:4.).

Figure 14: Mahon Demonstrative Showing Annotated 5G Standard Regarding PUCCH Transmission

For a PUCCH transmission with HARQ-ACK information, a UE determines a PUCCH resource after determining a set of PUCCH resources for O_{UCI} HARQ-ACK information bits, as described in Clause 9.2.1. The PUCCH resource determination is based on a PUCCH resource indicator field [5, TS 38.212] in a last DCI format 1_0 or DCI format 1_1, among the DCI formats 1_0 or DCI formats 1_1 that have a value of a PDSCH-to-HARQ feedback timing indicator field indicating a same slot for the PUCCH transmission, that the UE detects and for which the UE transmits corresponding HARQ-ACK information in the PUCCH where, for PUCCH resource determination, detected DCI formats are first indexed in an ascending order across serving cells indexes for a same PDCCH monitoring occasion and are then indexed in an ascending order across PDCCH monitoring occasion indexes.

(CDX-0008C.0053 (citing CX-1700 (TS 38.213) at § 9.2.3 (annotated))).).

In other words, whenever a 5G NR wireless device receives multiple DCI messages with PDSCH-to-HARQ feedback timing indicators indicating a same slot for the corresponding PUCCH transmission, “the PUCCH resource” within “which the UE transmits corresponding HARQ-ACK information” for the multiple PDSCHs is determined by “the PUCCH resource indicator field [] in a last” received of the DCI messages. (CX-1700 (TS 38.213) at § 9.2.3; Tr. (Mahon) at 219:5-23; CDX-0008C.0054.). For example, “when a UE provides HARQ-ACK information in a PUCCH transmission in response to detecting a last” of multiple DCIs, “the UE determines a PUCCH resource” (singular) based on a formula and the last DCI. (CX-1700 (TS 38.213) at § 9.2.3; Tr. (Mahon) at 219:24-220:11; CDX-0008C.0055.).

Ericsson inventor, Dr. Sorour Falahati,¹⁷ confirmed this functionality in 5G NR systems,

¹⁷

explaining that [REDACTED]

[REDACTED] (JX-0035C (Falahati Dep. Tr.) at 138:1-19; *see also* Tr. (Mahon) at 220:12-20; CDX-0008C.0056.). Ericsson's technical documents confirm the same, stating that [REDACTED]

[REDACTED] (CX-0677C (Ericsson Algorithm Specification) at § 6.7; Tr. (Mahon) at 242:19-243:13; CDX-0008C.0079.).

Respondents' expert, Dr. Rangan, did not dispute that these limitations are satisfied.

Accordingly, Ericsson has proven by a preponderance of evidence that the Accused Products meet these limitations of claims 1, 6, and 11 of the '669 patent.

- h) **[1.F]: “determining the uplink control channel resource to use for transmitting the uplink control information comprises determining the uplink control channel resource based on (a) signaling received from the network node and (b) resource determination performed by the wireless device based on a latest received one of the first downlink control channel message and the second downlink control channel message; and”**

[6.H]: “determining the uplink control channel resource to use for transmitting the uplink control information comprises determining the uplink control channel resource based on (a) signaling received from the network node and (b) resource determination performed by the wireless device based on a latest received one of the first downlink control channel and the second downlink control channel; and”

The Accused Products meet the “. . . (a) signaling received from the network node and (b) resource determination performed by the wireless device based on a latest received . . .” elements, i.e., [1.F] and [6.H]. Ericsson's expert testimony on the Accused Products' infringement of these elements is un rebutted. (Tr. (Mahon) at 222:18-20.).

With respect to sub-element (a), as Dr. Mahon explained and as defined by the 5G NR standard, the Accused Products determine an uplink control channel resource based on PUCCH resource set configuration signaling received from the network node in the form of the *PUCCH-Config* information element that includes the *PUCCH-ResourceSet* message and *resourceList* field. (CX-1700 (TS 38.213) at § 9.2.1; CX-2008 (TS 38.331) at § 6.3.2; Tr. (Mahon) at 221:7-222:1; CDX-0008C.0057-58.).

For sub-element (b), as described above, the Accused Products determine a PUCCH resource to use for transmitting from the selected set “based on a PUCCH resource indicator field [] in a last DCI format 1_0 or DCI format 1” (i.e., a latest received one of the first downlink control channel message and the second downlink control channel message). (CX-1700 (TS 38.213) at § 9.2.3; Tr. (Mahon) at 222:3-17; CDX-0008C.0059.). Dr. Rangan did not dispute that these limitations are met.

For the foregoing reasons, Ericsson has proven by a preponderance of evidence that the Accused Products meet these limitations of claims 1 and 6 of the '669 patent.

- i) **[11.G]: “determining the uplink control channel resource comprises selecting the uplink control channel resource from uplink control channel resources in two or more uplink control channel resource sets based on: a payload size of the uplink control information; a starting control channel element index of a downlink control channel candidate on which the downlink control channel was received; and dynamic signaling received from the network node; and**

[17]: “The method of claim 1, wherein determining the uplink control channel resource further comprises selecting the uplink control channel resource from uplink control channel resources in two or more uplink control channel resource sets based on: a payload size of the uplink control information; a starting control channel element index of the latest received one of the first downlink control channel message and the second downlink control channel message downlink control

channel; and dynamic signaling received from the network node.”

The Accused Products meet the “. . . payload size of the uplink control information; a starting control channel element index . . . and dynamic signaling received from the network node” elements, i.e., [11.H] and [17]. Ericsson’s expert testimony on the Accused Products’ infringement of these elements is unrebutted. (Tr. (Mahon) at 224:6-9)

As Dr. Mahon explained and as defined by the 5G NR standard, the Accused Products “can be configured with up to four PUCCH resource sets” provided by the PUCCH-*ResourceSet* message. (CX-1700 (TS 38.213) at § 9.2.1; Tr. (Mahon) at 226:3-6; CDX-0008C.0062.). When transmitting HARQ, the Accused Products select a PUCCH resource set from the configured resource sets based on the payload size—i.e., the number of bits—of the UCI, OUCI, and the parameter *maxPayloadSize*—with each resource set corresponding to a different range of sizes. (CX-1700 (TS 38.213) at § 9.2; Tr. (Mahon) at 224:10-18; CDX-0008C.0060.). The Accused Products determine a PUCCH resource within the selected set based on the starting control channel element (“CCE”) index and dynamic signaling in the form of the resource indicator field in the last received DCI message. (Tr. (Mahon) at 224:19-225:4.).

Figure 15: Mahon Demonstrative Showing Annotated 5G Standard Regarding PUCCH Resource

If the UE transmits O_{UCI} UCI information bits, that include HARQ-ACK information bits, the UE determines a PUCCH resource set to be

- a first set of PUCCH resources with *pucch-ResourceSetId* = 0 if $O_{\text{UCI}} \leq 2$ including 1 or 2 HARQ-ACK information bits and a positive or negative SR on one SR transmission occasion if transmission of HARQ-ACK information and SR occurs simultaneously, or
- a second set of PUCCH resources with *pucch-ResourceSetId* = 1, if provided by higher layers, if $2 < O_{\text{UCI}} \leq N_2$ where N_2 is equal to *maxPayloadSize* if *maxPayloadSize* is provided for the PUCCH resource set with *pucch-ResourceSetId* = 1; otherwise N_2 is equal to 1706, or

* * * *

If the UE provides HARQ-ACK information in a PUCCH transmission in response to detecting a DCI format 1_0 or DCI format 1_1, the UE determines a PUCCH resource with index r_{PUCCH} , $0 \leq r_{\text{PUCCH}} \leq 15$, as

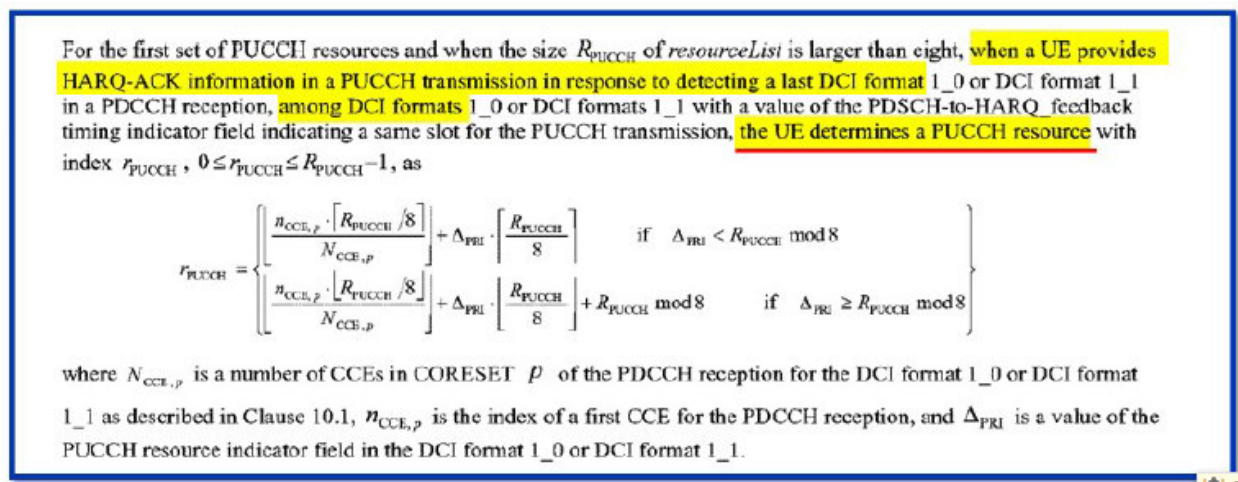
$$r_{\text{PUCCH}} = \left\lfloor \frac{2 \cdot n_{\text{CCE},0}}{N_{\text{CCE}}} \right\rfloor + 2 \cdot \Delta_{\text{PRI}}, \text{ where } N_{\text{CCE}} \text{ is a number of CCEs in a CORESET of a PDCCH reception with DCI format 1_0 or DCI format 1_1, as described in Clause 10.1, } n_{\text{CCE},0} \text{ is the index of a first CCE for the PDCCH reception, and } \Delta_{\text{PRI}} \text{ is a value of the PUCCH resource indicator field in the DCI format 1_0 or DCI format 1_1.}$$

If $\lfloor r_{\text{PUCCH}} / 8 \rfloor = 0$

(CDX-0008C.0060 (citing CX-1700 (TS 38.213) at § 9.2.1 (annotated))).

As an additional example, Dr. Mahon described that “when a UE provides HARQ-ACK information in response to detecting a last DCI format” message, the Accused Products determine a PUCCH resource within the selected set based on the starting CCE index and dynamic signaling in the form of the resource indicator field in the last received DCI message in accordance with the formula below. (Tr. (Mahon) at 218:20-219:4.).

Figure 16: Mahon Demonstrative Showing Annotated 5G Standard Regarding PUCCH Resource



(CDX-0008C.0055 (citing CX-1700 (TS 38.213) at § 9.2.3 (annotated))).

Dr. Rangan did not dispute that this limitation is satisfied.

For the foregoing reasons, Ericsson has proven by a preponderance of evidence that the Accused Products meet these limitations of claims 11 and 17 of the '669 patent.

- j) [1.G]: “transmitting the uplink control information using the determined uplink control channel resource;”
- [6.I]: “transmit the uplink control information using the determined uplink control channel resource;”
- [11.I]: “transmit the uplink control information using the determined uplink control channel resource;”

The Accused Products meet the “[transmit/transmitting] the uplink control information” elements, i.e., [1.G], [6.I], and [11.I]. There is no dispute that the Accused Products meet [6.I] (Am. Joint Statement at § IV.B), and Ericsson’s expert testimony on the Accused Products’ infringement of nearly identical elements [1.G] and [11.I] (Tr. (Mahon) at 225:5-15) is un rebutted. As Dr. Mahon explained, the 5G NR standard defines the UE procedure for reporting, i.e., transmitting, HARQ-ACK. (*Id.*; CX-1700 (TS 38.213) at § 9.2.3 (“if the UE

detects a [DCI] scheduling a PDSCH reception . . . the UE provides corresponding HARQ-ACK information in a PUCCH transmission”); CDX-0008C.0061.). Dr. Rangan does not dispute that this limitation is met.

For these reasons, Ericsson has proven by a preponderance of evidence that the Accused Products meet these limitations of claims 1, 6, and 11 of the ’669 patent.

- k) **[1.H]: “wherein the signaling received from the network node comprises information that provides a semi-static configuration of two or more uplink control channel resource sets each comprising two or more uplink control channel resources; and”**
- [6.J]: “wherein the signaling received from the network node comprises information that provides a semi-static configuration of two or more uplink control channel resource sets each comprising two or more uplink control channel resources; and”**
- [11.E]: “receive, from the network node, signaling comprising information that provides a semi-static configuration of two or more uplink control channel resource sets each comprising two or more uplink control channel resources,”**

The Accused Products meet the “. . . semi-static configuration of two or more [] resource sets each comprising two or more [] resources” elements recited in limitations [1.H], [6.J], and [11.E]. Dr. Mahon’s testimony with respect to the Accused Products’ infringement of these elements is unrebutted. (Tr. (Mahon) at 225:16-22.).

As Dr. Mahon testified and as the 5G NR standard has defined, the Accused Products receive radio resource control (RRC) signaling¹⁸ in the form of the *PUCCH-Config* information element, which contains the parameter *PUCCH-ResourceSet* that configures up to four (two or more) sets of PUCCH resources. (CX-1700 (TS 38.213) at § 9.2.1; Tr. (Mahon) at 225:23-

¹⁸ “[A]n RRC, radio resource control message, . . . [is] a semi static configuration message[.]” (Tr. (Mahon) at 226:12-13.).

226:9; CDX-0008C.0062.). Each PUCCH resource set contains up to 32 PUCCH resources, which are specified by the parameter *resourceList*. (CX-2008 (TS 38.331) at 6.3.2; CDX-0008C.0058.). RRC signaling is a type of semi-static configuration. (Tr. (Mahon) at 226:10-15; JX-0002 ('669 patent) at 2:41-42.). Dr. Rangan did not dispute that this limitation is met.

For the reasons discussed above, Ericsson has proven by a preponderance of evidence that the Accused Products meet these limitations of claims 1, 6, and 11 of the '669 patent.

I) [1.I]: “wherein determining the uplink control channel resource based on (a) and (b) comprises selecting one of the two or more uplink control channel resource sets, and selecting, as the uplink control channel resource to use for transmitting the uplink control information to the network node, one of the two or more uplink control channel resources from the selected uplink control channel resource set based on dynamic signaling from the network node.”

[6.K]: “wherein determining the uplink control channel resource based on (a) and (b) comprises selecting one of the two or more uplink control channel resource sets, and selecting, as the uplink control channel resource to use for transmitting the uplink control information to the network node, one of the two or more uplink control channel resources from the selected uplink control channel resource set based on dynamic signaling from the network node.”

[11.J]: “wherein selecting the uplink control channel resource from the two or more uplink control channel resources in the two or more uplink control channel resource sets comprises selecting one of the two or more uplink control channel resource sets, and selecting, as the uplink control channel resource to use for transmitting the uplink control information to the network node, one of the two or more uplink control channel resources from the selected uplink control channel resource set based on dynamic signaling from the network node.”

The Accused Products meet the “. . . selecting one of the two or more uplink control channel resource sets, and selecting . . . one of the two or more [] resources from the selected []

resource set based on dynamic signaling from the network node” elements, i.e., [1.I], [6.K], and [11.J]. Dr. Mahon’s testimony on the Accused Products’ infringement of these elements is unrebutted. (Tr. (Mahon) at 226:16-227:3.).

As Dr. Mahon explained and defined by the 5G NR standard, “for a PUCCH transmission with HARQ-ACK information,” the Accused Products “determine[] a PUCCH resource after determining a set of PUCCH resources.” (CX-1700 (TS 38.213) at § 9.2.3; Tr. (Mahon) at 227:4-8; CDX-0008C.0063.). The Accused Products’ resource determination is “based on a PUCCH resource indicator field” in the latest received DCI, and DCI messages are dynamic signaling from the network node. (CX-1700 (TS 38.213) at § 9.2.3; Tr. (Mahon) at 227:9-228:2; CDX-0008C.0064.). Dr. Rangan did not contest that this limitation is satisfied.

For the foregoing reasons, Ericsson has proven by a preponderance of evidence that the Accused Products meet these limitations of claims 1, 6, and 11 of the ’669 patent.

3. The Accused Products Practice Claim 8

- a) “The wireless device of claim 6 wherein: each of the first downlink control channel message and the second downlink control channel message comprises a downlink control information message comprising bits for use to select one of the two or more uplink control channel resources from the selected uplink control channel resource set; and selecting the one of the two or more uplink control channel resources from the selected uplink control channel resource set based on dynamic signaling from the network node comprises selecting, as the uplink control channel resource to use for transmitting the uplink control information to the network node, the one of the two or more uplink control channel resources from the selected uplink control channel resource set based on the bits for use to select one of the two or more uplink control channel resources from the selected uplink control channel resource set that are comprised in the latest received one of the first downlink control channel message and the second downlink control channel message.”**

The Accused Products additionally practice “the wireless device of claim 6 wherein: each of the first downlink control channel message and the second downlink control channel message comprises a downlink control information message comprising bits for use to select one of the two or more uplink control channel resources from the selected uplink control channel resource set” elements. Respondents did not rebut Dr. Mahon’s expert testimony on the Accused Products’ infringement of these elements. (Tr. (Mahon) at 229:12-16.).

As Dr. Mahon explained and as the 5G NR standard defines, the Accused Products receive downlink control channel (DCI) messages of the format 1_0 or 1_1, and these messages comprise bits for use to select one of the two or more uplink control channel resources from the selected uplink control channel resource set—specifically, the PUCCH resource indicator field, which is 3 bits. (CX-0557 (TS 38.212) at §§ 7.3.1.2.1, 7.3.1.2.2; Tr. (Mahon) at 228:9-229:16; CDX-0008C.0065.). “The PUCCH resource indicator field values map to values of a set of PUCCH resource indexes, as defined in Table 9.2.3-2[.]” (CX-1700 (TS 38.213) at § 9.2.3; CDX-0008C.0067.).

In other words, the Accused Products use the bits in the PUCCH resource indicator field to select one of the two or more uplink control channel resources from the selected uplink resource set. (*Id.*). Dr. Rangan did not dispute that these limitations are met.

The Accused Products also practice the “selecting the one of the two or more uplink control channel resources from the selected uplink control channel resource set based on dynamic signaling from the network node comprises selecting, as the uplink control channel resource to use for transmitting the uplink control information to the network node, the one of the two or more uplink control channel resources from the selected uplink control channel resource set based on the bits for use to select one of the two or more uplink control channel

resources from the selected uplink control channel resource set that are comprised in the latest received one of the first downlink control channel message and the second downlink control channel message” element. Respondents did not rebut Dr. Mahon’s expert testimony on the Accused Products’ infringement of these elements. (Tr. (Mahon) at 229:24-230:3.).

As Dr. Mahon explained and as the 5G NR standard defines, “[f]or a PUCCH transmission with HARQ-ACK information,” the Accused Products “determine[] a PUCCH resource after determining a set of PUCCH resources.” (CX-1700 (TS 38.213) at § 9.2.3; Tr. (Mahon) at 229:18-230:3; CDX-0008C.0066.). Here, “the PUCCH resource determination is based on a PUCCH resource indicator field [] in a last DCI format 1_0 or DCI format 1_1”—i.e., the bits for use to select a resource from the set in a latest received—among the received DCI formats. (CX-1700 (TS 38.213) at § 9.2.3.). Dr. Rangan did not dispute that the Accused Products meet this element.

Accordingly, Ericsson has proven by a preponderance of evidence that the Accused Products meet the additional limitations recited in claim 8 of the ’669 patent.

4. The Accused Products Practice Claims 9 and 15

- a) [9]: “The wireless device of claim 6, wherein determining the uplink control channel resource to use comprises determining the uplink control channel resource to use when the timing is variable between when the wireless device receives the first and second downlink control channel messages scheduling the first and second downlink shared channel transmissions and when the wireless device transmits the uplink control information.”

[15]: “The wireless device of claim 11 wherein determining the uplink control channel resource to use comprises determining the uplink control channel resource to use when the timing is variable between when the wireless device receives the downlink control channel messages scheduling the downlink shared channel transmission and when the wireless device

transmits the uplink control information.”

The Accused Products practice claims 9 and 15. Respondents did not rebut Ericsson’s expert testimony on the Accused Products’ infringement of these claims. (Tr. (Mahon) at 230:10-12.).

As Dr. Mahon testified and as the 5G NR standard defines, the timing is variable between when the Accused Products receive the first and second control channel (DCI) messages and when the wireless device transmits the uplink control information, in accordance with the PDSCH-to-HARQ_feedback timing indicator in the DCI format 1_0 and/or DCI format 1_1 messages. (Tr. (Mahon) at 230:10-25.).

Figure 17: Mahon Demonstrative Showing Annotated 5G Standard Regarding PDSCH-to-HARQ Feedback Timing Indicator

Table 9.2.3-1: Mapping of PDSCH-to-HARQ feedback timing indicator field values to numbers of slots			
PDSCH-to-HARQ_feedback timing indicator			Number of slots k
1 bit	2 bits	3 bits	
'0'	'00'	'000'	1 st value provided by <i>dl-DataToUL-ACK</i>
'1'	'01'	'001'	2 nd value provided by <i>dl-DataToUL-ACK</i>
	'10'	'010'	3 rd value provided by <i>dl-DataToUL-ACK</i>
	'11'	'011'	4 th value provided by <i>dl-DataToUL-ACK</i>
		'100'	5 th value provided by <i>dl-DataToUL-ACK</i>
		'101'	6 th value provided by <i>dl-DataToUL-ACK</i>
		'110'	7 th value provided by <i>dl-DataToUL-ACK</i>
		'111'	8 th value provided by <i>dl-DataToUL-ACK</i>

(CX-1700 (TS 38.213) at § 9.2.3 (annotated); CDX-0008C.0066-67.).

Specifically, “[w]ith reference to slots for PUCCH transmissions, if the UE detects a DCI format 1_0 or a DCI format 1_1 scheduling a PDSCH reception ending in slot $n \dots$, the UE provides corresponding HARQ-ACK information in a PUCCH transmission within slot $n+k$, where k is a number of slots and is indicated by the PDSCH-to-HARQ-timing-indicator field in the DCI format.” (*Id.*). The timing indicator field varies the timing of PUCCH transmissions for

both downlink messages from between two and eight possible values. (*Id.*).

For the reasons discussed above, Ericsson has proven by a preponderance of evidence that the Accused Products practice the additional limitations recited in claims 9 and 15 of the '669 patent.

B. Technical Prong of Domestic Industry

1. The DI Products Practice Claims 8, 9, 15, and 17

As Dr. Mahon explained, the Samsung DI Products practice claims 8, 9, 15, and 17 of the '669 patent for the same reasons as described in Section VIII.A.2 with respect to infringement of the Accused Products. (Tr. (Mahon) at 168:11-15, 245:1-3.). Dr. Mahon's technical domestic industry opinions for the '669 patent are unrebutted. Dr. Mahon testified that no party identified any differences, relevant to the asserted patent claims, as between any of the Lenovo Accused Products and the Samsung Domestic Industry Products. (Tr. (Mahon) at 172:12-21.). Respondents' expert, Dr. Rangan, did not dispute Dr. Mahon's opinions. Additionally, the Parties did not raise any arguments specific to technical domestic industry for the '669 patent. (*Id.* at 210:17-22.).

With respect to the asserted claims, Dr. Mahon testified that the Samsung DI Products meet the "wireless device," "processing circuitry" and "interface" elements, i.e., [1.A], [6.A]-[6.C], and [11.A]-[11.C]. (Tr. (Mahon) at 212:20-214:18; CDX-0008C.0011, 0046-49; CBr. at Ex. 2.). Moreover, there is no dispute that the Samsung DI Products comply with the sections of the 5G NR standard relevant to the '669 patent. (Am. Joint Statement at § IV.A.). As the Parties stipulated in the Amended Joint Statement at §IV.A, the Samsung DI Products comply with the relevant portions of the 3GPP standard defined in 3GPP TS 38.212, 38.213, and 38.331. As discussed in Section V.C.1, the Samsung DI Products

[REDACTED]. (Tr. (Mahon) at 171:5-22; CDX-0008C.0011; CX-6356; CX-6499.). Dr. Mahon also explained that the [REDACTED]

[REDACTED]. (Tr. (Mahon) at 234:12-237:1; CDX-0008C.0070-71.). Additionally, Dr. Mahon explained that he [REDACTED]

[REDACTED] (Tr. (Mahon) at 243:14-245:3, 296:12-18; CDX-0008C.0080C; CPX-0003C-CPX-0004C [REDACTED].).

For the foregoing reasons, Ericsson has proven by a preponderance of evidence that the Samsung DI Products practice claims 8, 9, 15 and 17 of the '669 patent.

C. Invalidity

1. Legal Standard

a) Anticipation

A determination that a patent is invalid as being anticipated under 35 U.S.C. § 102 requires a finding, based upon clear and convincing evidence, that each and every limitation is found either expressly or inherently in a single prior art reference. *See Celeritas Techs. Inc. v. Rockwell Int'l Corp.*, 150 F.3d 1354, 1361 (Fed. Cir. 1998). Anticipation is a question of fact, including whether a limitation, or element, is inherent in the prior art. *In re Gleave*, 560 F.3d 1331, 1334-35 (Fed. Cir. 2009). The limitations must be arranged or combined the same way as in the claimed invention, although an identity of terminology is not required. *Id.* at 1334 (“the reference need not satisfy an *ipsissimis verbis* test”); MPEP § 2131.

In addition, the prior art reference’s disclosure must enable one of ordinary skill in the art to practice the claimed invention “without undue experimentation.” *Gleave*, 560 F.3d at 1334-

35. A prior art reference that allegedly anticipates the claims of a patent is presumed enabled; however, a patentee may present evidence of nonenablement to overcome this presumption.

Impax Labs., Inc. v. Aventis Pharmaceuticals Inc., 468 F.3d 1366, 1382 (Fed. Cir. 2006).

“[W]hether a prior art reference is enabling is a question of law based upon underlying factual findings.” *Gleave*, 560 F.3d at 1335.

2. The Asserted Claims of the '669 Patent Are Not Anticipated or Obvious

a) Overview of the Prior Art

i. Ahn (RX-0688)

U.S. Patent No. 10, 333,679 (“Ahn”), entitled “Method for Transmitting ACK/NACK in Wireless Communication System and Device Using Same,” was issued on June 25, 2019.¹⁹ (RX-0688 at (10), (45), (54).). There is no dispute that Ahn is prior art to the '669 patent. (Am. Joint Statement at § IV.D.).

ii. 3GPP-Intel (RX-0684)

It is undisputed that 3GPP-Intel was published to the 3GPP FTP server on January 10, 2017. (See Am. Joint Statement at § IV.D; RX-2293; RX-1323.). 3GPP-Intel was a contribution Intel made to the 3GPP during the development of the 5G standard. (Tr. (Rangan) at 1060:20-1061:12; RX-0684.0002.). The PTAB considered 3GPP-Intel during a petition for *inter partes* review that Apple filed. (See CX-3754 (*Apple Inc. v. Telefonaktiebolaget LM Ericsson*, IPR2022-00561, Paper 7 (PTAB Oct. 11, 2022)) at 9, 30; Tr. (Mahon) at 1511:13-19; CDX-0021C.0026.).

¹⁹ ACK/NACK is an acronym for “positive-acknowledge (ACK)/negative-acknowledgement (NACK).” (RX-0688 at 1:24-29.).

iii. Park '389 (RX-0695)

PCT Application Publication No. WO 2012/050389 43F44 (“Park ’389”) is dated April 19, 2012. It is undisputed that Park ’389 is prior art to the ’669 patent. (Am. Joint Statement at § IV.D.). Park ’389 was disclosed to the examiner during prosecution and is cited on the face of the ’669 patent. (JX-0002 (’669 patent) at (56); Tr. (Mahon) at 1511:2-12; CDX-0021C.0025.).

3. Invalidity Overview

Respondents asserted that Ahn anticipates claim 8²⁰ of the ’669 patent (Ground 1) (RBr. at 42-53), and/or renders the claim obvious in combination with Park ’389 (Ground 2) or 3GPP-Intel (Ground 3) (*id.* at 53-67.). With respect to alleged anticipation, Respondents relied solely on Ahn. (*Id.* at 42-53.). For obviousness, Respondents relied on 3GPP-Intel and Park ’389 for claim limitation [11.H], and claims 9, 15, and 17 only.²¹ (*Id.* at 53-67.). To be clear, for claim 8 (and independent claim 6, from which claim 8 depends), Respondents relied solely on Ahn for both its anticipation and obviousness arguments. (*Id.*). Additionally, Respondents and Dr. Rangan did not advance any inherency arguments. (Tr. (Mahon) at 1520:4-6.). For the following reasons, Ahn does not anticipate or render obvious the claim.

4. Ground 1: Anticipation of Claim 8 by Ahn

a) Claim Elements [6.H] and [8.C]

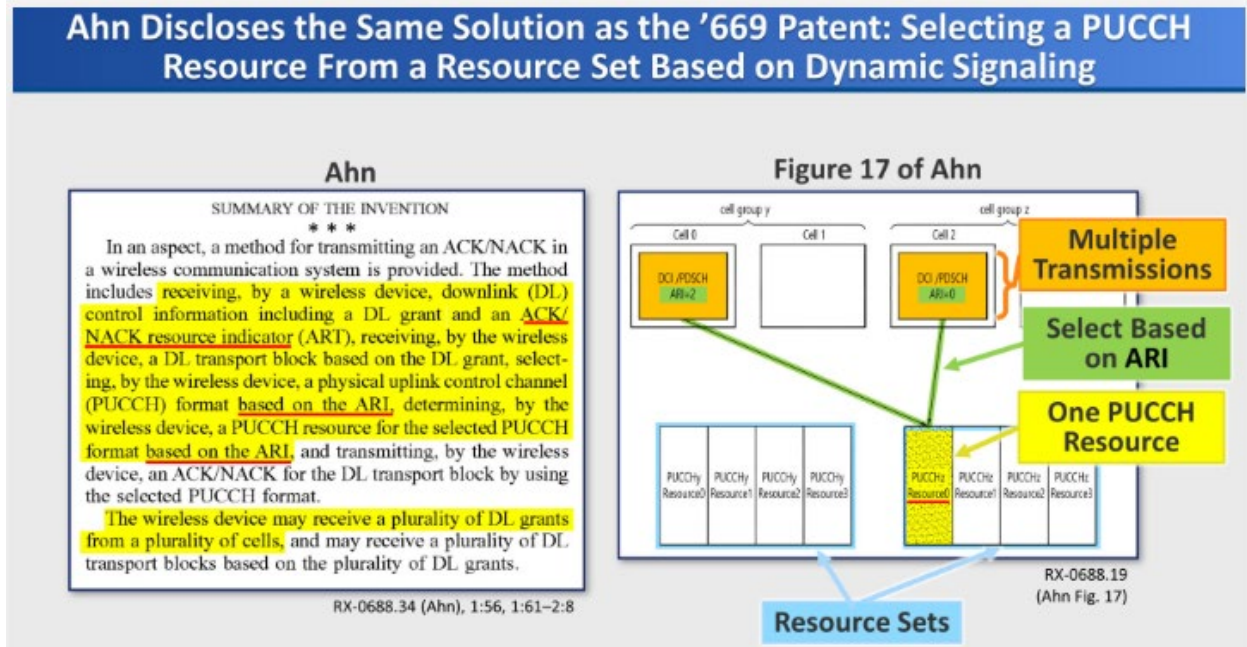
Respondents’ expert, Dr. Rangan, pointed to Ahn’s “ACK/NACK resource indicator (ARI)” in support of his opinion that Ahn teaches selecting a PUCCH resource based on

²⁰ As noted above in Section IV.B, dependent claim 8 depends from independent claim 6, which is not asserted.

²¹ As noted above in Section IV.B, dependent claim 9 depends from independent claim 6, which is not asserted. Dependent claim 15 depends from independent claim 11, and dependent claim 17 depends from independent claim 1. Independent claims 1 and 11 are also not asserted.

dynamic signaling. (Tr. (Rangan) at 1076:12-22; RDX-0006.0048, 0071.). An exemplary slide from Dr. Rangan's demonstratives is copied below.

Figure 18: Exemplary Rangan Demonstrative Showing Annotated Ahn Disclosures



(RDX-0006.0048 (citations omitted)).

Specifically, based on Ahn's disclosures of determining a PUCCH resource based on an ARI, Dr. Rangan concluded that "Ahn discloses the same solution as the '669 patent: selecting a PUCCH resource from a resource set based on dynamic signaling," as shown above in his demonstrative. (*Id.*).

However, as Ericsson noted, Ahn does not disclose the "same solution" as claim 8. (CRBr. at 34.). Even assuming, *arguendo*, that Ahn discloses "selecting a PUCCH resource from a resource set based on dynamic signaling," the resource determination of the claim 8 includes additional elements not disclosed by Ahn. (See Tr. (Mahon) at 1523:15-18; CDX-0021C.0027, 0040.). For example, as Dr. Mahon explained, claim 8 covers "determin[ing] the

uplink control channel resource to use” based on, e.g., (semi-static) “signaling received from the network node” configuring two or more resource sets and resource determination based on a “latest received” downlink control channel message, “selecting one of the two or more uplink control channel resource sets,” and “selecting” a particular PUCCH resource “from the selected uplink control channel resource set . . . based on the bits for use to select one of the two or more uplink control channel resources from the selected uplink control channel resource set that are comprised in the latest received one of the first downlink control channel message and the second downlink control channel message.” (*Id.*).

Ahn does not disclose this full solution. For example, even under Dr. Rangan’s incorrect assumption that selecting a PUCCH format is the same as selecting a PUCCH resource set, Ahn’s disclosures fall short of selecting a PUCCH resource “from [within] the selected set” based on the “latest received” control message as recited in [8.C]. As Ericsson pointed out, Ahn has only one embodiment directed to the “most recently received” downlink control information (DCI), which is what Respondents relied on for all the claims “latest received” elements. (CRBr. at 35 (citing RX-0688 (Ahn) at 20:6-41; Tr. (Rangan) 1116:14-21).). However, that Ahn embodiment does not mention selecting a PUCCH **resource** from within the selected set. (*Id.*). Instead, it teaches only selecting a PUCCH **format** or arranging the PUCCH payload based on a most recently received DCI message. (RX-0688 (Ahn) at 20:15-22, Figs. 16-17, 30; Tr. (Mahon) at 1513:17-20.).

Ahn defines a PUCCH resource as “a time/frequency/code resource used in PUCCH transmission.” (RX-0688 (Ahn) at 6:59-60.). As Dr. Mahon testified, a PUCCH **format** is fundamentally different concept from a PUCCH **resource**. (Tr. (Mahon) at 1513:21-1514:3 (“Q. Is a PUCCH format the same thing as a PUCCH resource? A. Absolutely not. Two different

things. A PUCCH format is basically a particular way to arrange bits, and we talked about this with the DCI messages, and what goes into it. So that's very different than selecting a time and frequency resource for transmitting data.").

Thus, as Dr. Mahon testified (and it is a finding here) Ahn provides different solutions for a UE "determin[ing] a PUCCH resource" based on, e.g., an "ACK/NACK resource indicator (ARI)" and a UE determining PUCCH format or payload arrangement based on a "received last DAI" (downlink assignment index) or "received last total DAI" indicator value. (RX-0688 (Ahn) at 6:59-60; 20:6-41; 15:19-47; 19:57-20:10; Tr. (Mahon) at 1516:1-1517:16; CDX-0021C.0032.).

Ahn teaches using its "most recently received" DAI solution to address a problem where, "when ACK/NACK information for a plurality of PDSCHs" is "transmitted through one UL subframe as in the TDD system, a BS may not be able to determine the ACK/NACK payload size until PDSCH scheduling is complete for M subframes." (RX-0688 (Ahn) at 19:64-20:2.). Ahn's solution is that the UE "may select a PUCCH format or may configure an ACK/NACK payload through DCI in a most recently received subframe." (*Id.* at 20:8-10.). Again, as Dr Mahon explained, this has nothing to do with selecting a PUCCH resource from within a selected resource set. (Tr. (Mahon) at 1516:1-24.). Dr. Mahon testified that "you won't see the work 'resource' here anywhere in the embodiment." (Tr. (Mahon) at 1516:21-24; *see also* CDX-0021C.0032.).

Additionally, during cross-examination, Dr. Rangan acknowledged that Ahn's "most recently received" method does not mention ARI. (Tr. (Rangan) at 1118:7-1120:6 ("Q. Ahn doesn't tell you make the selection based on ARI, does it. Yes or no? A. It doesn't have the word 'ARI' in this."); RX-0688 (Ahn) at 6:59-60; 20:6-41; 15:40-42; CDX-0021C.0032; Tr.

(Mahon) at 1516:21-1517:1.). Instead, according to Dr. Mahon, Ahn expressly teaches making PUCCH-related format determinations based on something else, i.e., other DCI indicators (e.g., DAI, total DAI) or a cell group correspondence rule. (Tr. (Mahon) at 1517:2-16; CDX-0021C.0032.).

Respondents attempted to bridge the gap in their argument by pointing out that, in Ahn, “an ARI value may designate a combination of the PUCCH format and the PUCCH resource.” (RDX-0006.0073; RX-0688 (Ahn) at 9:12-23.). However, as Dr. Mahon emphasized, Ahn describes this method as a “reinterpretation of an ARI” for one particular embodiment. (RX-0688 (Ahn) at 9:6-11; Tr. (Mahon) at 1518:16-1519:17; CDX-0021C.0034.) Dr. Mahon testified that Dr. Rangan did not provide a reason why one of ordinary skill would combine this reinterpretation (in Ahn column 9) with the “most recently received” method (in Ahn column 20). (Tr. (Mahon) at 1519:12-17; CDX-0021C.0034.). Furthermore, Ahn’s “most recently received” method explicitly teaches using something besides ARI to determine the PUCCH format, e.g., the DAI. (RX-0688 (Ahn) at 20:6-41; Tr. (Mahon) at 1517:2-8.). Thus, Ahn appears to *teach away* from using its (dual-function) reinterpretation ARI for determining the PUCCH format.

Respondents alleged that “Dr. Mahon admits that selection of a PUCCH format (which dictates the format of the message to be transmitted on the PUCCH) needs to happen before selection of a PUCCH resource.” (RBr. at 46 (citing RDX-0006.0067; Tr. (Mahon) at 1561:12-1563:5.)). According to Respondents:

This makes sense, because, as Dr. Mahon explained, different formats require a different number of resources or differently sized resources to transmit their messages. *Id.* Ahn also expressly discloses that “a plurality of candidate resources may be designated” for each PUCCH format, PUCCH_y and PUCCH_z. RX-0688, 9:12-23, 11:37-47. Each PUCCH format is associated with a set of PUCCH

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resources, i.e., each format is or has a resource set. *Id.* It makes no sense to select a PUCCH format/set (e.g., PUCCHz) based on the latest DCI, but then select a resource within that PUCCH format/set based on an ARI from a different DCI that has a different format (e.g., PUCCHy). The number of resources would not fit. Thus, a POSA would understand that selection of the format is selection of the resource set within the context of Ahn.

(RBr. at 46-47 (citation omitted)).

Respondents' characterization of Dr. Mahon on this issue is not accurate. The testimony to which Respondents cited is replicated below.

Q. Okay. And then the other thing you told us on direct is that in this passage Ahn suggests using the latest received DCI for selection of the PUCCH format, not the resource, correct?

A. That's exactly what it says, yes.

Q. And in your view that selection of a format does not disclose selection of a resource, right?

A. That is correct.

Q. So now when we refer to a PUCCH format, we are referring to the format of the message that will go up on the PUCCH, right?

A. Correct.

Q. And different PUCCH formats might require different amount of resources for that message, right?

A. As I indicated, the PUCCH format is a particular arrangement with particular elements in it. So depending upon the length of that, sure, you're going to need a different amount of resources.

Q. And to select a PUCCH resource, I would first need to know the PUCCH format that I'm using, right?

A. Well, you know, one has -- in terms of doing the uplink transmission, you need to know what the format is to be able to send the message, and obviously you're going to have to do a determination of the resource to send it on. So both elements are required.

Q. Right. In fact, it wouldn't make sense to choose the resource first and then find out what the format is, right?

A. Well, again, certainly if you're going to be picking a resource, you know, before you do the selection, there's a balance there in terms of how you're going to implement the system, are you wasting resources, are you going to be short on resources. So that would be a less than probably advantageous approach.

Q. Right. You would want to know the format before you actually select the resource, right?

A. Well, it's certainly -- the format has to be able to be chosen based upon what's going to go up in terms of -- and, therefore, what resource is going to be used. So it certainly makes sense to do it that way.

Q. Right. It makes sense to use the resource after you've chosen the format, right?

A. Yeah, just in general.

(Tr. (Mahon) at 1561:12-1563:5.).

As Ericsson pointed out, although Dr. Mahon explained that both a format and a resource need to be determined before the uplink PUCCH message can be transmitted, Dr. Mahon did not agree at any point in his testimony that a PUCCH format "needs" to be determined before the resource. (CRBr. at 37.). Neither did he admit that Ahn's PUCCH resource needs to be selected based on the ARI in the latest received control message. (*Id.*).

Not only does Ahn fail to suggest using a latest-in-time ARI to override a prior one for the PUCCH resource determination, Ahn *teaches against* it. Ahn discloses several embodiments depicted in Figures 8-10, 12-15, 18-21, and 27-29. (RX-0688 (Ahn) at Figs. 8-10, 12-15, 18-21, 27-29.). As Ericsson and Dr. Mahon noted, the ARIs in these Ahn figures are either the same in each of the multiple downlink messages, or the PUCCH determination conflict resolution is based on something other than a time-order rule, e.g., the number of resource blocks, or cell group correspondence. (CRBr. at 38 (citing RX-0688 (Ahn) at 9:24-31; Figs. 16-17, 23; Tr. (Mahon) at 1514:23-1515:17; CDX-0021C.0031.).

To explain away Ahn's "latest received" deficiencies, Dr. Rangan argued that it would be

“insane” or “crazy” to use anything besides the latest received ARI to determine the PUCCH format and resource even though the relevant disclosure “doesn’t have the word ‘ARI,’” and even though, as Dr. Mahon pointed out, Ahn’s “latest received” embodiment uses three of four other DCI related options to determine the PUCCH format and “is not using ARI at all in this embodiment.” (Tr. (Rangan) at 1118:7-1120:6; Tr. (Mahon) at 1517:2-25.). This argument, which disregards Ahn’s actual disclosures and fills in the gaps with hindsight, is impermissible and thus not supported. *ActiveVideo Networks, Inc. v. Verizon Commc’ns, Inc.*, 694 F.3d 1312, 1327 (Fed. Cir. 2012) (affirming district court’s grant of judgment as a matter of law of no invalidity because the district court correctly determined that expert’s obviousness opinions were “conclusory and factually unsupported” and, as such, “fraught with hindsight bias”).

For the reasons discussed above, Respondents have failed to prove by clear and convincing evidence that Ahn anticipates these limitations of claims 6 and 8 of the ’669 patent. *See, e.g., Net MoneyIN*, 545 F.3d at 1369 (noting as a general matter that an anticipatory reference “must not only disclose all elements of the claim within the four corners of the document,” but must also disclose those elements “arranged as in the claim”) (citation omitted).

b) Claim Elements [1.H], [6.J], and [11.E]

Respondents contended that Ahn’s disclosure that the base station may “predetermine a plurality of candidate resources for the PUCCH_y and a plurality of candidate resources for the PUCCH_z through RRC signaling.” (RBr. at 49-50 (citing RX-0688 (Ahn) at 8:25-29).). Dr. Mahon testified that Ahn does not disclose “two or more resource sets” because this disclosure refers to multiple PUCCH formats rather than multiple resources in a resource set. (Tr. (Mahon) at 1520:18-1521:9; CDX-0021C.0036.).

In addition to the “latest received” elements recited in limitations [6.H] and [8.C], Ahn

fails to anticipate limitations [1.H], [6.J], and [11.E] directed to receiving signaling of a semi-static configuration of two or more resource sets of two or more resources. (Tr. (Mahon) at 1520:18-1521:9; CDX-0021C.0036.).

As an initial matter, Dr. Rangan admitted that the '669 patent "introduced the idea of hierarchically" configuring resources in resource sets. (Tr. (Rangan) at 1054:3-9; RDX-0006.0038; JX-0002 at 9:45-10:13.). In the '669 patent, resources are organized into two or more "resource sets," each configured together on a "semi-static" (as opposed to the more bandwidth intensive dynamic) basis. (JX-0002 at 9:45-10:13.).

The '669 patent uses the concepts of "resource sets" and PUCCH formats distinctly, and explains the benefits of its hierarchical set-based approach as follows:

It will be apparent to those skilled in the art that [] flexibility is provided by the inclusion of multiple alternatives in the PUCCH resource set chosen by the implicit determination and that the PUCCH resource sets can be configured to provide other types of flexibility. For instance, the PUCCH resource set could have multiple entries corresponding to different PUCCH formats so that the gNB can dynamically direct the UE to choose between the different formats, or the different entries in the chosen PUCCH set could correspond to PUCCH resources in different OFDM symbols within the same slot.

(JX-0002 at 11:12-22; *see also* Tr. (Mahon) at 1520:18-1521:9.).

Despite this disclosure, Dr. Rangan collapsed the two concepts into one, added his own annotations to Ahn's relevant Table 3, and relied on Ahn's configuration of multiple PUCCH formats for the patent's configuration of multiple PUCCH sets. (*Compare* RDX-0006.0067 ("Format Y," "Format Z") with RDX-0006.0069 ("Set Y," "Set Z"); Tr. (Rangan) at 1073:23-1074:10 (PUCCH formats); Tr. (Rangan) at 1075:1-17 (PUCCH resource sets).). However, Ahn does not disclose multiple "resource sets" generally, much less discloses semi-statically configuring the resources of multiple PUCCH formats two or more resource sets of two (2) or

more resources. (RX-0688 (Ahn) at 7:1-18, 8:25-29, 11:43-47; Tr. (Mahon) at 1521:2-8.). In Ahn, there is only ever one “set.” (RX-0688 (Ahn) at 7:1-18, 8:25-29, 11:43-47.).

For the foregoing reasons, Respondents have failed to prove by clear and convincing evidence that Ahn anticipates these limitations of claims 1, 6, and 11 of the ’669 patent.

c) Claim Elements [1.I], [6.K], and [11.J]

As discussed above for limitations [1.H], [6.J], and [11.E], Ahn fails to disclose signaling configurations for two (2) or more “resource sets.” (*See* Section VIII.C.4(b), *supra*.).

Accordingly, Ahn fails to disclose selecting a set and then selecting a resource from that set.

Moreover, Dr. Rangan pointed to Ahn’s “ARI” to satisfy the dynamic signaling elements of the claim. (RDX-0006.0071; Tr. (Rangan) at 1076:12-22.). He otherwise relied on Ahn’s “most recently” received embodiment for the claims’ “latest received” limitations. Ahn’s “most recently” received embodiment fails to even mention the word “resource” and, as Dr. Mahon credible testified, it has nothing to do with selecting a PUCCH resource from within a selected resource set. (RX-0688 (Ahn) at 6:59-60, 20:6-41, 15:40-42; Tr. (Mahon) at 1516:1-24; CDX-0021C.0032.). It is also incompatible with the ARI determination embodiments for the reasons explained above.

Accordingly, Respondents have failed to prove by clear and convincing evidence that Ahn anticipates these limitations of claims 1, 6, and 11 of the ’669 patent.

5. Ground 2: Obviousness of Claims 8, 9, 15, and 17 by Ahn in View of Park ’389

a) Claim Elements [1.F], [6.H], and [8.C]

For these claim elements, Respondents relied solely on Ahn. (RBr. at 60.). As discussed above in Sections VIII.C.4(a), Ahn fails to disclose or suggest these claim elements.

b) Claim Elements [1.H], [6.J], and [11.E]

For these claim elements, Respondents relied solely on Ahn. (RBr. at 60.). As discussed above in Sections VIII.C.4(b), Ahn fails to disclose or suggest these claim elements.

c) Claim Elements [1.I], [6.K], and [11.J]

For these claim elements, Respondents relied solely on Ahn. (RBr. at 60.). As discussed above in Sections VIII.C.4(c), Ahn fails to disclose or suggest these claim elements.

d) Claim Element [11.H] and Claim 17

For these claim elements, Dr. Rangan relied on a combination of Ahn and Park '389. (RBr. at 56.). These claim elements require that the UE determine a PUCCH resource by selecting the PUCCH resource from two or more PUCCH resource sets based on three inputs: (1) payload size of the uplink control information ("UCI"); (2) a starting control channel element index of a downlink control channel candidate on which the downlink control channel message was received; and (3) dynamic signaling received from the network node. (Tr. (Mahon) at 222:24-223:3.).

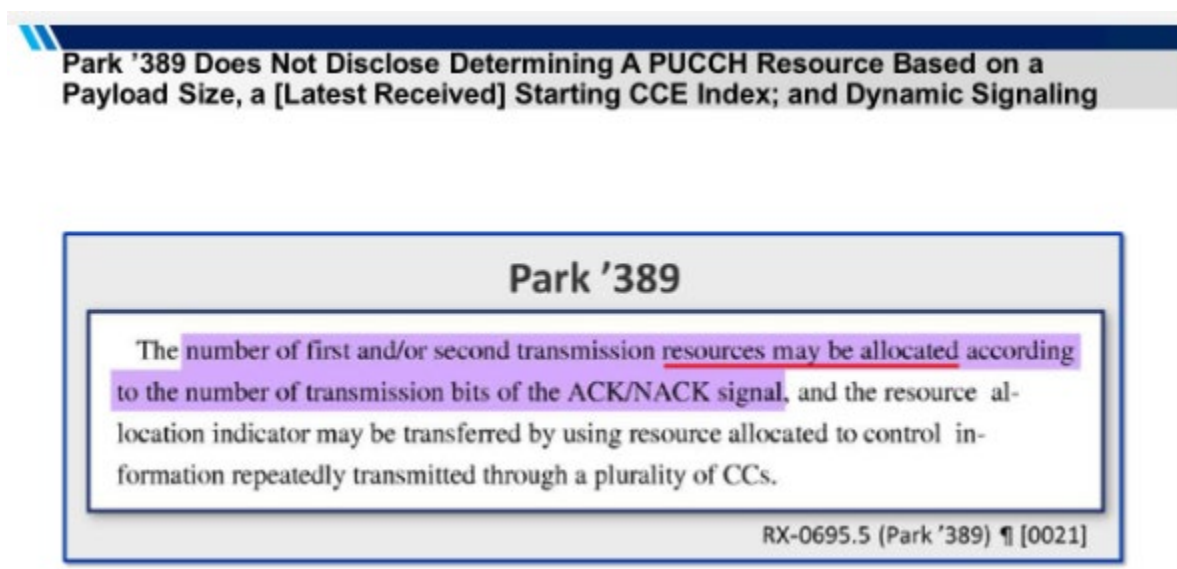
As an initial matter, Ahn fails to render obvious the claimed combination of PUCCH determination rules and signaling for the same reasons as described in Section VIII.C.4 above. Dr. Rangan conceded that Ahn does not expressly disclose "using the CCE index for resource determination." (RBr. at 59; Tr. (Rangan) at 1124:22-1125:1.).

With respect to Park '389, Dr. Rangan identified several disclosures scattered throughout the reference. (Tr. (Rangan) at 1080:23-1081:25, 1083:8-1084:3; RDX-0006.0077-80.). In doing so, Dr. Rangan picked and chose selectively only certain aspects of multiple different embodiments. (*Id.*) However, none of the cited disclosures teaches the full solution of determining a PUCCH resource on all three inputs. (Tr. (Mahon) at 1526:7-1527:20; CDX-

0021C.0046-48.). Dr. Rangan did not explain how or why a one of ordinary skill would have combined his selected, or even relevant aspects of Park, into a comprehensive solution. (*Id.*).

With regard to payload size, although Park '389 discloses that resources may be “allocated” by the base station according to payload, the reference says nothing of the wireless device (e.g., UE) itself using the payload size to determine the PUCCH resource. (Tr. (Mahon) at 1526:7-20 (referring to CDX-0021C.0046) (“Q. Do you agree that this disclosure shows a UE determining a PUCCH resource based on payload? A. I certainly do not. Again, you don’t see any reference here to a UE doing any determination, and it just calls out a number of first or second transmission resources may be allocated.”)).

Figure 19: Mahon Demonstrative Showing Annotated Excerpt of Park '389



(CDX-0021C.0046 (citing RX-0695 (Park '389) at [0021] (annotated))).

As Dr. Mahon suggested, and as this decision agrees, Dr. Rangan’s reliance on Park '389’s resource index formula (RX-0695 at ¶¶ [0062]-[0063]) is equally unsupported. (Tr. (Mahon) at 1526:7-1527:20; CDX-0021C.0047.). Here, Respondents argued that the payload size is “used to determine the format, or resource set, for which the resource is being calculated.”

(RBr. at 58 (citing Tr. (Rangan) at 1081:7-25; RDX-0006.0078; RX-0695 at ¶¶ [0062]-[0063])).

However, as Dr. Mahon explained, Park '389's resource index formula, shown in his annotated demonstrative below in Figure 20 (outlined in red), does not show that payload size is used to the select the PUCCH resource set.²²

Figure 20: Mahon Demonstrative Showing Annotated Excerpt of Park '389

[Table 2]

	Dynamic scheduling	Semi-persistent scheduling
Resource index	$n_{\text{PUCCH}}^{(1)} = n_{\text{CCE}} + N_{\text{PUCCH}}^{(1)}$	Signaled by higher layer or a control channel
Higher Layer Signaling value	$N_{\text{PUCCH}}^{(1)}$	$n_{\text{PUCCH}}^{(1)}$

Namely, the HARQ ACK/NACK signal with respect to the PDCCH transmitted at an nth subframe is transmitted at a (n+4)th subframe by using resource index $n_{\text{PUCCH}}^{(1)}$, the sum of a first CCE (Control Channel Element) index n_{CCE} of the PDCCH transmitted in the nth subframe and the value $N_{\text{PUCCH}}^{(1)}$ obtained through higher layer signaling or a separate control channel. For example, $N_{\text{PUCCH}}^{(1)}$ may be a total number of PUCCH

RX-0695.11 (Park '389) ¶¶ [0062]-[0063]

[0062] [Table 2]

	Dynamic scheduling	Semi-persistent scheduling
Resource index	$n_{\text{PUCCH}}^{(1)} = n_{\text{CCE}} + N_{\text{PUCCH}}^{(1)}$	Signaled by higher layer or a control channel
Higher Layer Signaling value	$N_{\text{PUCCH}}^{(1)}$	$n_{\text{PUCCH}}^{(1)}$

(CDX-0021C.0047 (citing RX-0695 at ¶¶ [0062]-[0063] (annotated))); RX-0695 at ¶¶ [0062]).

Dr. Mahon explained below that the formula merely shows that for PUCCH

²² A clearer, unannotated copy from RX-0695 at ¶ [0062] is provided below Dr. Mahon's annotated demonstrative.

corresponding to superscript 1, (e.g., format 1), the resources can be calculated according to the formula.

Q. . . . Does what Dr. Rangan relies on here meet the determination based on all three of these elements as well?

A. No. If you look at the middle of this slide, you see that red box with the N superscript 1 in parentheses there, that's a resource index. So that's actually a resource.

And on the right of the equation, the equal sign, to the right of the equal sign, you just see the CCE and then green indicating dynamic signaling.

So you can't do determination based on what you're calculating. I mean, that's -- those other two are inputs to the third. You can't do the determination based on that equation.

(Tr. (Mahon) at 1526:21-1527:8 (referring to CDX-0021C.0047).).

Thus, as Ericsson noted, there is nothing in Park '389 to suggest that the wireless device itself determines anything, including the PUCCH format, based on the payload size. (CRBr. at 50.).

Additionally, Respondents contended that Dr. Mahon's invalidity opinions are inconsistent with his opinions regarding infringement. (RBr. at 58.). As Ericsson pointed out, claim element [11.H] and claim 17, unlike claim 8 (where the wireless device selects a resource set and then selects the resource "from the selected set" based on the bits in the latest received message), the wireless device here has not yet selected a resource set (as evidenced by the claims' language of "selecting the [] resource from [] resources in two or more [] resource sets"). (CRBr. at 50; *compare* JX-0002 at cl. 8 *with id.* at cls. 11, 17).). Thus, Dr. Mahon correctly relied on the Accused Products' use of payload size to "determine[] a PUCCH resource set" to support his opinion that this claim element is met and infringed. (Tr. (Mahon) at 224:10-19; CX-1700 at § 9.2; CDX-0008C.0060.). On invalidity, Dr. Mahon distinguished Park '389 from the

'669 patent on the basis that the reference does not teach that the wireless device uses the payload size to determine anything. (Tr. (Mahon) at 1526:14-19.). Separately, as explained in Section VIII.C.4(a), determining a PUCCH format is not the same as determining a PUCCH set. Based at least on these distinctions, Dr. Mahon concluded that Park '389 fails to teach or render obvious this limitation. (*Id.*). Specifically, Dr. Mahon's opinions on invalidity here does not conflict with his opinions on infringement.

Finally, with respect to alleged motivation to combine, Dr. Rangan here provided only the same three (3) conclusory motivations to combine Park '389 with Ahn as he did for 3GPP-Intel. (Tr. (Rangan) at 1082:6-1083:7; RDX-0006.0079.). Accordingly, even if Park '389 did disclose determining a PUCCH determination based on payload size, Dr. Rangan's obviousness analysis fails for the same reasons (lack of motivation) as explained in Section VIII.C.6(d) below.

For the foregoing reasons, Respondents have failed to prove by clear and convincing evidence that Ahn in view of Park '389 renders obvious claim element [11.H] and claim 17.

e) Claims 9 and 15

For these claims, Dr. Rangan relied on a combination of Ahn and Park '389. Ahn fails to render obvious and in fact *teaches away* from the claims for the same reasons as described in Section VIII.C.4 above.

With respect to Park '389, Dr. Rangan pointed to a single sentence in Park '389 that states, "the transmission time of the ACK/NACK signal with respect to downlink data or resource allocation may be dynamically informed by the BS." (Tr. (Rangan) at 1087:4-14; RX-0695 (Park '389) at ¶ [0055]; RDX-0006.0084.). As with 3GPP-Intel, Park '389's disclosure on "informing" the timing stops short of an express disclosure of variable timing. The reference

also fails to suggest or render obvious claim 9's variable timing from both a first and second downlink control message. Dr. Rangan did not allege that the reference even discloses transmitting HARQ for two downlink messages on a single uplink message. The relevant Park '389 disclosure does not use a single uplink control message for multiple downlink messages—instead, the reference discloses a one-to-one relationship between downlink data and uplink control messages. (RX-0695 (Park '389) at ¶ [0055], Fig. 1.).

As with his other obviousness analyses, Dr. Rangan provided nothing more than conclusory motivations to combine. (Tr. (Rangan) at 1082:6-1083:7, 1087:20-1088:6; RDX-0006.0079.). His analysis, therefore, fails for the same reasons as explained in Section VIII.C.4 above.

For these reasons, Respondents have failed to prove by clear and convincing evidence that Ahn in view of Park '389 renders obvious claims 9 and 15.

6. Ground 3: Obviousness of Claims 8, 9, 15, and 17 by Ahn in View of 3GPP-Intel

a) Claim Elements [1.F], [6.H], and [8.C]

For these claim elements, Respondents relied solely on Ahn. (RBr. at 60.). As discussed above in Section VIII.C.4(a), Ahn fails to disclose or suggest these claim elements.

b) Claim Elements [1.H], [6.J], and [11.E]

For these claim elements, Respondents relied solely on Ahn. (RBr. at 60.). As discussed above in Section VIII.C.4(b), Ahn fails to disclose or suggest these claim elements.

c) Claim Elements [1.I], [6.K], and [11.J]

For these claim elements, Respondents relied solely on Ahn. (RBr. at 60.). As discussed above in Section VIII.C.4(c), Ahn fails to disclose or suggest these claim elements.

d) Claim Element [11.H]

Dr. Mahon explained that claim 11's set of PUCCH determination signaling and rules differs from the other asserted claims in that it requires only one downlink message—not the latest received of two—and its PUCCH determination is based on three factors: payload size, starting CCE, and dynamic signaling. (Tr. (Mahon) at 212:5-11.). Here, payload size refers to the number of bits in the uplink transmission, and the starting Control Channel Element (CCE) index refers to the frequency location where the UE finds its downlink control information. (*Id.* at 223:4-15; JX-0002 at 9:59-62.). None of the three references Respondents advanced discloses a wireless device determining a PUCCH resource based on this specific combination of factors.

With respect to Ahn, the reference fails to disclose the combination of PUCCH determination factors because it does not even mention the concept of a starting CCE. (Tr. (Mahon) at 1523:6-14; CDX-0021C.0039.). Respondents' expert, Dr. Rangan, acknowledged this to be the case. (Tr. (Rangan) at 1080:13-20 (“So CCE index doesn't appear in the Ahn directly.”); RDX-0006.0076.). Instead, he opined that adding this determination factor to the solutions disclosed in Ahn would have been obvious because “CCE index was a well-known idea.” (*Id.*).

In Dr. Rangan's view, even though “dozens of companies” submitted “hundreds of contributions” directed to arriving at the best specific combination of PUCCH determination rules, if the relevant factors were individually known, the combination is obvious as there was nothing “innovative” to solve. (Tr. (Rangan) at 1111:18-1114:9; *see also* CX-1292 (CATT) at 1 (“[D]etails of PUCCH resource determination rule including implicit resource mapping and/or explicit signaling” is “for future study”); CDX-0021C.0023.).

It is well settled that “a patent composed of several elements is not proved obvious

merely by demonstrating that each of its elements was, independently, known in the prior art.” *KSR*, 550 U.S. at 401. Rather, there must be a reason (or motivation) provided for a skilled artisan to combine those elements in the claimed manner. *Id.* at 401; *see also In re Kahn*, 441 F.3d 977, 988 (CA Fed. 2006). In other words, “obviousness concerns whether a skilled artisan not only could have made but would have been motivated to make the combinations or modifications of prior art to arrive at the claimed invention.” *Belden Inc. v. Berk-Tek LLC*, 805 F.3d 1064, 1073 (Fed. Cir. 2015). “[T]his analysis should be made explicit, and the “factfinder should be aware of the distortion caused by hindsight bias and must be cautious of arguments reliant upon ex post reasoning.” *KSR*, 550 U.S. at 421; *see also Virtek Vision Int’l ULC v. Assembly Guidance Sys., Inc.*, 97 F.4th 882, 889, (Fed. Circ. 2024) (affirming no invalidity where expert offered only conclusory testimony to address “why or whether” a skilled artisan would have been motivated to combine known elements of multiple references). Here, Dr. Rangan provided little more than the fact that these elements were “well-known” in support of his conclusions. Under *KSR* and its progeny, this analysis is insufficient to carry Respondents’ invalidity burden.

With respect to 3GPP-Intel, Dr. Rangan answered all of two (2) questions related to this limitation, quickly concluding that in his view the reference disclosed the claimed PUCCH determination combination. (Tr. (Rangan) at 1084:11-1085:2; RDX-0006.0081.). However, as Dr. Mahon explained, although 3GPP-Intel mentions that “multiple NR PUCCH formats can be supported . . . in order to accommodate various UCI types and payload sizes,” there is simply no disclosure of the wireless device itself using the payload size to make a PUCCH resource determination. (RX-0684 (3GPP-Intel); Tr. (Mahon) at 1524:8-15; CDX-0021C.0044.). That is, just because a format may be associated with a payload in the standard does not mean that the

UE uses the payload to determine the format or a resource. The reference also fails to disclose the UE using the payload size in combination with the other claimed factors to make the determination.

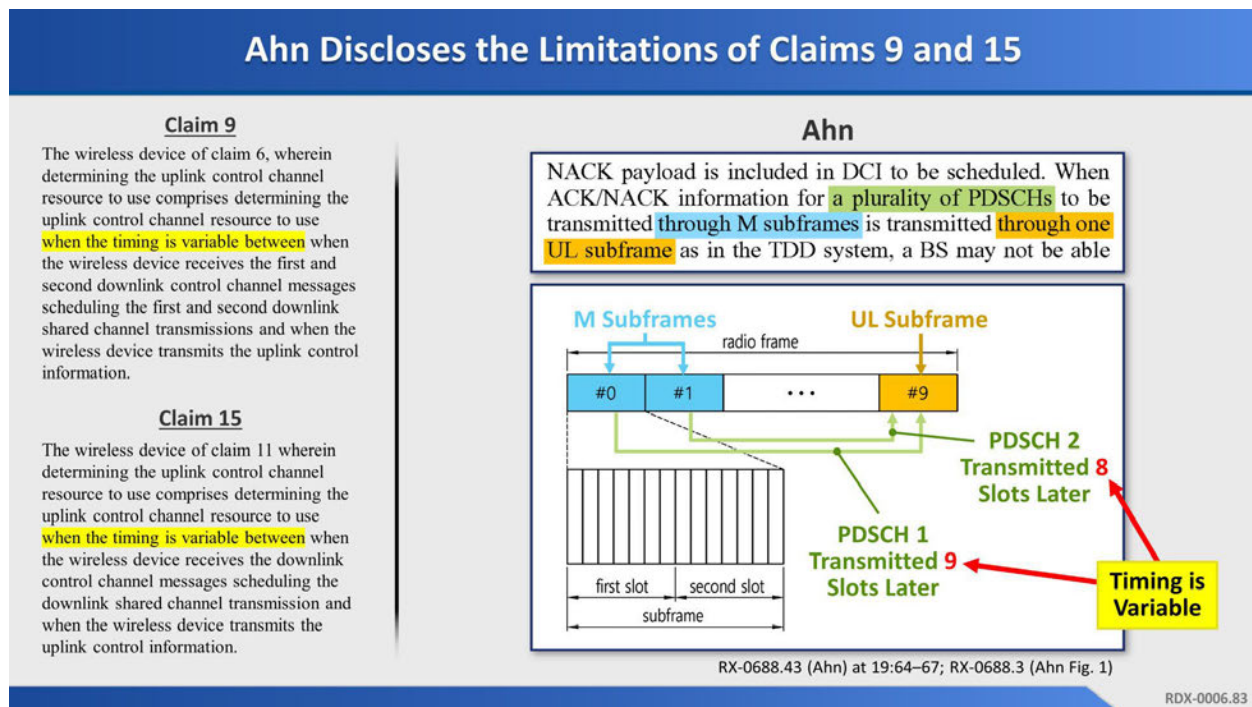
Even assuming, *arguendo*, 3GPP-Intel discloses determining a PUCCH resource based on payload size, here again, Dr. Rangan provided only conclusory motivations to combine this element, i.e., the references “are aimed at the same problem,” they are “directed to 3GPP standards,” and they use “known, predictable techniques.” (Tr. (Rangan) at 1085:3-20; RDX-0006.0082.). Dr. Rangan did not explain how or why one of ordinary skill would have combined the relevant elements into the claims’ comprehensive solution. His conclusion, based on hindsight, is undermined by the fact that hundreds of contributions tried but failed to arrive at such a combination.

Accordingly, Respondents have failed to prove by clear and convincing evidence that Ahn in view of 3GPP-Intel renders obvious claim element [11.H].

e) Claims 9 and 15

For claims 9 and 15, Respondents relied on a combination of Ahn and 3GPP-Intel. (RBr. at 63.). Dr. Rangan opined that Figure 1 of Ahn, which is replicated and annotated below in Dr. Rangan’s demonstrative, discloses the variable timing limitation recited in claims 9 and 15.

Figure 21: Rangan Demonstrative Showing Annotated Figure 1 of Ahn



(RDX-0006.0083 (citing RX-0688 at 19:64-67, Fig. 1 (annotated))).

In his demonstrative above, Dr. Rangan annotated Figure 1 of Ahn based on disclosures in column 19 of the reference and concluded that Ahn discloses a variable timing system. (Tr. (Rangan) at 1086:9-1087:3; RDX-0006.0083.). However, on cross-examination, he agreed that the description in Figure 1 does not address timing “at all.” (Tr. (Rangan) at 1121:1-5.). Moreover, Dr. Mahon testified that Ahn discloses fixed timing, rather than variable timing. (Tr. (Mahon) at 1522:1-1523:5; RX-0688 (Ahn) at 5:40-47, Fig. 2.). Specifically, Dr. Mahon explained that Ahn discloses that the “wireless device transmits ACK/NACK signal for the DL (downlink) transport block on a PUCCH 210 in a UL (uplink) subframe $n+4$.” (Tr. (Mahon) at 1522:1-1523:5; RX-0688 (Ahn) at 5:40-47.). He explained that the number “4” is a constant, not a variable. (*Id.*).

To support his opinion, Dr. Rangan pointed to an Ahn embodiment (shown above in his

demonstrative RDX-0006.0083) where ACK/NACK for multiple downlink messages transmitted in (an undefined number of) “M” downlink subframes is transmitted through one uplink subframe. (Tr. (Rangan) at 1086:9-1087:3; RDX-0006.0083.). However, this implicit and incomplete disclosure cannot overrule Ahn’s express statements to the contrary. Even if Dr. Rangan’s theory is given some weight, Ahn stops short of teaching the claimed variable timing from both the downlink control messages. That is, as Dr. Mahon explained, in light of Ahn’s express n+4 fixed timing disclosure, a person of ordinary skill in the art would understand the uplink timing to be n+4 from either the first or second, but not both, downlink messages, and as such, lacks variability from both downlink messages. (Tr. (Mahon) at 1522:10-1523:5.). Thus, Ahn fails to render obvious claims 9 and 15.

Dr. Rangan additionally pointed to a single bullet from 3GPP-Intel, noting that it should be possible to “dynamically indicate” the timing between data reception and HARQ. (Tr. (Rangan) at 1087:4-10; RX-0684 (3GPP-Intel); RDX-0006.0084.). Even if indicating timing implies variability as Dr. Rangan opined (Tr. (Rangan) at 1087:15-19), the reference’s passing statement fails to suggest or render obvious the claims’ variable timing from both a first and second downlink control message. As Ericsson noted, 3GPP-Intel does not mention sending HARQ together for both a first and second downlink message. (CRBr. at 46 (citing RX-0684 (3GPP-Intel)).).

In addition, Dr. Rangan provided little to no evidence that would have supported his motivation to combine analysis. (Tr. (Rangan) at 1085:3-20; RDX-0006.0082.). Dr. Rangan’s entire analysis is “[a]gain they are addressing the same problem, they are on related systems, and they’re using known and predictable techniques.” (Tr. (Rangan) at 1087:20-1088:6). Dr. Rangan did not provide any explanation for why or how a skilled artisan would have been

motivated to combine Ahn with 3GPP-Intel's alleged disclosure of determining PUCCH resources when the timing is variable between the downlink message(s) and the uplink response.

As Ericsson pointed out, the superficiality of Dr. Rangan's analysis is evident in light of three facts: (i) Ahn teaches away from a variable timing system (with its $n+4$ disclosure) (RX-0688 (Ahn) at 5:40-47, Fig. 2); (ii) "dozens of companies" submitted "hundreds of contributions" directed to arriving at the best combination of PUCCH determination rules (Tr. (Rangan) at 1111:18-1114:9; CX-1292 (CATT) at 1); and (iii) the core problem the '669 patent's claims are meant to solve is a PUCCH resource determination solution in a variable timing system (JX-0002 at 7:9-35).).

For the foregoing reasons, Respondents have failed to prove by clear and convincing evidence that Ahn in view of 3GPP-Intel renders obvious claims 9 and 15.

f) Claim 17

For claim 17, Respondents relied on a combination of Ahn and 3GPP-Intel. (RBr. at 65.). Claim 17 depends from claim 1 and encompasses the claims' latest received and three-factor determination elements. (See Tr. (Mahon) at 211:24-212:15; CDX-0008C.0045.). Respondents' arguments fail at least for the same reasons as described in Sections VIII.C.6(a)-(c) with respect to claim 1.

Claim 17 recites a method for making the PUCCH determination based on "a starting control channel element [CCE] index of the latest received" control message. (JX-0002 at cl. 17,). Dr. Rangan did not allege that any single reference discloses this limitation. Nor did he provide evidence for the same. (Tr. (Rangan) 1088:16-1089:20; 1090:21-1091:13; RDX-0006.0085.). Instead, for the Ahn and 3GPP-Intel combination, Dr. Rangan relied on Ahn for the alleged "latest received" aspect and 3GPP-Intel for the alleged starting CCE aspect. (Id.).

However, as Dr. Mahon pointed out, Ahn does not have a disclosure on starting CCEs, and 3GPP-Intel has no disclosure on using the latest received of multiple downlink control messages to make the PUCCH determination. (Tr. (Mahon) at 1527:21-1528:20; CDX-0021C.0049.). He thus concluded that neither reference individually discloses the entire claim element of basing the PUCCH resource determination on “a starting [CCE] index of the latest received” control message as is required legally. (*Id.*).

Respondents argued that Ahn teaches determining PUCCH resources based on the latest received DCI, and pointed out that the CCE is related to the DCI. (RBr. at 65 (“Ahn expressly teaches using the latest received DCI for resource determination.”)). This is wrong. As discussed above in Section VIII.C.4, Ahn at most teaches using that latest message for the *format*. To the extent Ahn refers to the latest received DCI at all, it teaches using specific aspects of the latest DCI, e.g., the latest DAI. (RX-0688 (Ahn) at 20:5-41.). Ahn does not suggest using the starting CCE (or anything like it) either in the context of this latest DCI embodiment, as Respondents contended.

Again, Dr. Rangan based his motivation to combine opinion only on conclusory assertions that the references allegedly “solv[e] the same problem,” are “related to 3GPP systems,” and “us[e] very similar techniques.” (Tr. (Rangan) at 1091:1-4.). He did not explain how or why a person of ordinary skill in the art would have been motivated to combine these partial elements to arrive at the entire limitation or the claim as a whole. Dr. Rangan’s conclusory analysis here fails.

For the reasons discussed above, Respondents have failed to prove by clear and convincing evidence that Ahn in view of 3GPP-Intel renders obvious claim 17.

7. Secondary Considerations of Non-Obviousness

Ericsson contended that the claims addressed a long-felt but unmet need. (CRBr. at 52.). Ericsson based its contention on the fact that “dozens of companies” submitted “hundreds of contributions” directed to arriving at the best specific combination of PUCCH determination rules. (*Id.* (citing Tr. (Rangan) at 1111:18-1114:9).). Ericsson also relied on Dr. Mahon’s testimony that the other 5G standard delegates confirmed that “the details of the PUCCH resource determination rule including implicit resource mapping and/or explicit signaling” was “for future study.” (*Id.* (citing Tr. (Mahon) at 1510:6-16; CX-1292 (CATT) at 1; CDX-0021C.0023.)). However, as Staff noted, the submission of other contributions does not necessarily mean that there was a long felt but unmet need. (SRBr. at 23-24.).

Additionally, Ericsson argued that “[t]he claims are also practiced by 5G products, which have enjoyed tremendous commercial success.” (CRBr. at 53.). Again, as Staff observed, Ericsson has not shown a nexus between the asserted claims and the asserted commercial success because the commercial success of 5G products are a result of many different features unrelated to the asserted claims. *Ormco Corp. v. Align Tech., Inc.*, 463 F.3d 1299, 1312 (Fed. Cir. 2006) (“[I]f the commercial success is due to an unclaimed feature of the device, the commercial success is irrelevant.”).

With respect to industry praise, Ericsson asserted that “[i]ndustry praise is demonstrated by proposals covering the claims being proposed to and then adopted by the 3GPP delegates at the standard.” (CRBr. at 53.). Again, as Staff noted, Ericsson has not shown a nexus between the asserted claims and the alleged secondary considerations. *In re GPAC Inc.*, 57 F.3d 1573, 1580 (Fed.Cir.1995) (“For objective [evidence of secondary considerations] to be accorded substantial weight, its proponent must establish a nexus between the evidence and the merits of

the claimed invention.”).

For these reasons, Ericsson’s asserted secondary considerations are not sufficiently tied to the asserted claims such that they would weigh in favor of patentability.

IX. U.S. PATENT NO. 11,318,342

A. Direct Infringement

1. Infringement Overview

Ericsson accused the Accused Products of directly infringing claims 34 and 39 of the ’342 patent. (CPBr. at 84; CBr. 84-85.). Dependent claim 39 depends from unasserted dependent claim 38, which depends from independent claim 34. Accordingly, claim 38 is also addressed in the analysis below.

For the reasons summarized directly below, and as discussed in more detail in Sections IX.A.2-4 below, Ericsson has met its burden and proven that the Accused Products directly infringe claims 34 and 39.

2. The Accused Products Practice Claim 34

a) **[34.A]: “A wireless communication device for receiving system information for a wireless communication system in parts, the wireless communication device comprising:”**

[34.B]: “communication circuitry; and”

[34.C]: “processing circuitry configured to:”

The weight of the evidence confirms and supports a finding that the Accused Products meet claim elements [34.A], [34.B], and [34.C]. (Tr. (van der Weide) at 331:9-24, 333:3-18; CDX-0002C.0018.). Respondents did not dispute that these claim elements are met. (Am. Joint Statement at § V.B; Tr. (Rangan) at 1096:17-1097:6; CDX-0043.0002.).

The weight of the evidence also demonstrates a finding that the Accused Products are

“wireless communication devices.” Dr. van der Weide testified that the 5G standard requires that system information (MIB and a number of SIBs) be sent in parts. (Tr. (van der Weide) at 333:3-22; *see also* CX-2008.0027 (TS 38.331 Fig. 5.2.2.11); CX-6232.0035-36 (TS 38.300 at § 7.3.1); Tr. (Rangan) at 1096:7-12.).

The weight of the evidence, virtually without rebuttal, also indicates that the Accused Products comprise “communication circuitry.” (Tr. (van der Weide) at 331:9-24, 332:8-18 (communication circuitry in the Qualcomm chipset), 332:19-333:2 (communication circuitry in the MediaTek chipset).) Specifically, Dr. van der Weide testified that [REDACTED] [REDACTED]. (*Id.* at 331:9-333:2; CDX-0002C.0017 [REDACTED]; CDX-0002C.0018 [REDACTED]).

Additionally, the Accused Products comprise “processing circuitry.” (Tr. (van der Weide) at 331:9-24, 332:8-18 (processing circuitry in the Qualcomm chipset), 332:19-333:2 (processing circuitry in the MediaTek chipset).) Dr. van der Weide testified that the [REDACTED] [REDACTED]. (Tr. (van der Weide) at 331:9-333:2; CDX-0002C.0017 [REDACTED] [REDACTED]; CDX-0002C.0018 [REDACTED] [REDACTED]).

For these reasons, Ericsson has proven by a preponderance of evidence that the Accused Products meet these limitations of claim 34 of the ’342 patent.

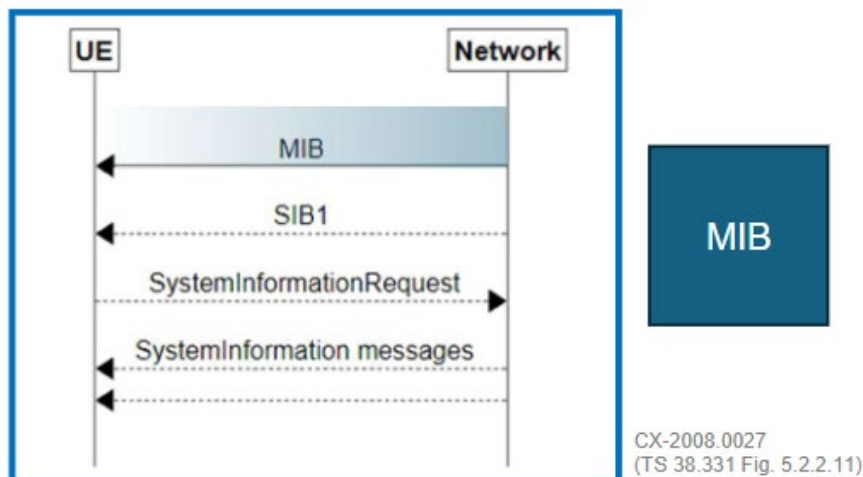
b) [34.D]: “receive, over a first channel, a first part of system information,”

[34.E]: “wherein the first part of system information comprises a master information block,”

The Accused Products practice limitations [34.D] and [34.E]. (Tr. (van der Weide) at 333:23-334:13.). Respondents did not dispute that these limitations are satisfied by the Accused Products. (Am. Joint Statement at § V.B; *see also* Tr. (Rangan) at 1096:17-1097:6, 1097:15-19 (discussing CDX-0043.0002, identifying disputed and undisputed limitations).).

As Dr. van der Weide explained, the 5G MIB corresponds to the first part of system information of the claims. (Tr. (van der Weide) at 333:23-334:10 (discussing CDX-0002C.0019); CX-2008 (TS 38.331) at Fig. 5.2.2.11.). According to the 5G standard, the MIB is transmits and receives over the physical broadcast channel (“PBCH”), which is the first channel of the claims. (Tr. (van der Weide) at 333:23-334:10 (discussing CDX-0002C.0019); CX-6232 (TS 38.300) at § 7.3.2; CX-0557 (TS 38.212) at Table 4.2-1.). This can be seen in Dr. van der Weide’s demonstrative, reproduced below, which illustrates the communication system information in 5G networks as specified by TS 38.331.

Figure 22: Van Der Weide Demonstrative Showing Communication System Information in 5G Networks According to the 5G Standard



(CDX-0002C.0019 (citing CX-2008.0027 (annotated))).

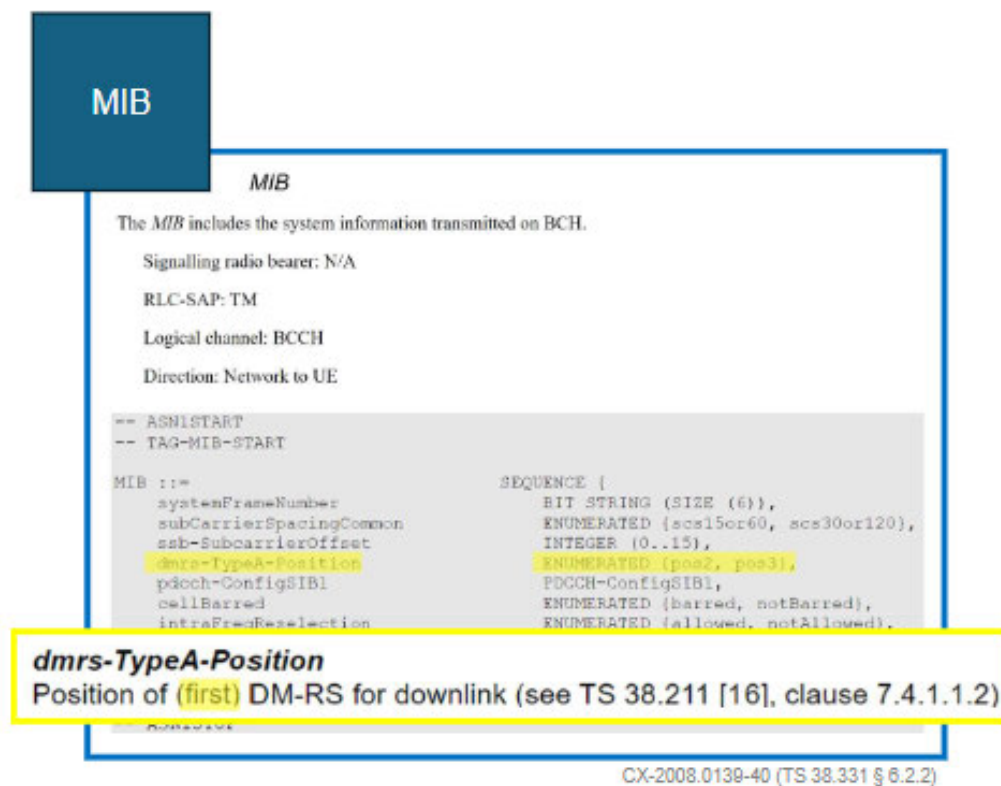
For the foregoing reasons, Ericsson has proven by a preponderance of evidence that the Accused Products meet these limitations of claim 34 of the '342 patent.

- c) **[34.F]: “wherein the master information block includes explicit signaling that indicates a sequence with which the wireless communication device is to demodulate or descramble a second part of system information; and”**

The Accused Products practice limitation [34.F]. (Tr. (van der Weide) at 338:1-346:13.).

Dr. van der Weide explained that the MIB, according to the 5G standard, includes the field “dmrs-TypeA-Position,” and the value of that field constitutes “explicit signaling” of the DMRS sequence that must be used to demodulate the SIB1. (*Id.* at 338:1-23 (discussing CDX-0002C.0023-24); CX-2008 (TS 38.331) at § 6.2.2 (MIB).). According to the 5G standard, the dmrs-TypeA-Position field can take on the value of either “2” or “3,” and that value determines the DMRS sequence that is generated by the Accused Products.). Tr. (VDW) at 338:13-23 (discussing CDX-0002C.0024); CX-2008 (TS 38.331) at § 6.2.2 (MIB).).

Figure 23: Van Der Weide Demonstrative Showing Annotated 5G Standard with Respect to Dmrs-TypeA-Position



(CDX-0002C.0024 (citing CX-2008-0139-40 (annotated))).

Dr. van der Weide explained that the dmrs-TypeA-Position value is “explicit signaling that indicates a sequence with which the wireless communication device is to demodulate or descramble the second part of system information” because it is “an input to [the] C_{init} equation” when that equation is used to generate the DMRS sequence used to demodulate the SIB1. (Tr. (van der Weide) at 340:10-341:3 (discussing CDX-0002C.0026)). As shown in the 5G standard, the dmrs-TypeA-Position is defined by the 5G standard as the “Position of (**first**) DM-RS for downlink.” (CX-2008 (TS 38.331) at § 6.2.2 (MIB) (emphasis added)). Dr. van der Weide confirmed that the **first** DMRS signal for downlink is the DMRS signal used to demodulate the SIB1. (Tr. (van der Weide) at 336:12-16, 338:13-23, 341:4-9.). As Dr. van der Weide explained

with respect to limitation [34.G], the input variable l in the C_{init} equation corresponds to the position of the received DMRS signal. Thus, the variable l is set to the value of the dmrs-TypeA-Position field in order to generate the DMRS sequence used to demodulate SIB1.

Figure 24: Van Der Weide Demonstrative Showing Annotated 5G Standard with Respect to Sequence Generation of the Dmrs-TypeA-Position

= l

dmrs-TypeA-Position
Position of (first) DM-RS for downlink (see TS 38.211 [16], clause 7.4.1.1.2)

CX-2008.0140 (TS 38.331 § 6.2.2) (annotated)

7.4.1.1 Demodulation reference signals for PDSCH
7.4.1.1.1 Sequence generation
 The UE shall assume the sequence $r(n)$ is defined by

$$r(n) = \frac{1}{\sqrt{2}}(1 - 2 \cdot c(2n)) + j \frac{1}{\sqrt{2}}(1 - 2 \cdot c(2n+1))$$

where the pseudo-random sequence $c(i)$ is defined in clause 5.2.1. The pseudo-random sequence generator shall be initialized with

$$c_{\text{init}} = \left(2^{17} \left(N_{\text{sym}}^{\text{slot}} n_{s,f}^{\mu} + l + 1 \right) \left(2 N_{\text{ID}}^{\text{SCID}} + 1 \right) + 2 N_{\text{ID}}^{\text{SCID}} + n_{\text{SCID}} \right) \bmod 2^{31}$$

where l is the OFDM symbol number within the slot, $n_{s,f}^{\mu}$ is the slot number within a frame, and

CX-6229.0083-84 (TS 38.211 § 7.4.1.1.1)

(CDX-0002C.0026 (citing CX-6229.0083-84 (annotated))).

Under the Parties' agreed construction of "explicit signaling that indicates a sequence" / "explicit signaling indicates a sequence," i.e., "signaling that comprises one or more bits, symbols, or other information elements that encode or represent a sequence" (*Markman* Order at 9-12), the dmrs-TypeA-Position value is "signaling that comprises one or more bits, symbols, or other information elements that encode or represent a sequence" and thus satisfies the Parties' agreed construction, as Dr. van der Weide opined. (Tr. (van der Weide) at 341:10-23.) Specifically, Dr. van der Weide testified that the value of the dmrs-TypeA-Position field is "a bit,

it takes on two values, and those values are 2 or 3.” (*Id.*). Dr. van der Weide also explained that the values of dmrs-TypeA-Position are explicit signaling that indicate a sequence because the value 2 or 3 is “literally plugged into C_{init} as ‘ l .’” (*Id.* at 341:10-23.). Additionally, Dr. van der Weide explained that the dmrs-TypeA-Position bit thus “encodes or represents a sequence, namely, the demodulation reference signal sequence.” (*Id.*).

Respondents’ expert, Dr. Rangan, did not dispute that the dmrs-TypeA-Position value is used as the variable l in the C_{init} equation to generate the DMRS sequence used to demodulate SIB1. (Tr. (Rangan) at 1106:5-14 (agreeing that “the dmrs-TypeA-Position value is used as the value of . . . to generate the DMRS sequence”).). Rather, Dr. Rangan contended that the dmrs-TypeA-Position is not explicit signaling because it only has “an indirect influence” on the DMRS sequence because the variable l is one of several inputs that go into the sequence generation function. (*Id.* at 1038:17-1039:18.). However, as Dr. van der Weide explained, the other inputs to the equation are “defaults that describe the structure of the communication channel prior to the wireless mobile device getting further information.” (Tr. (van der Weide) at 342:11-23 (discussing CDX-0002C.0028).). He explained that those other inputs do not change the function of the dmrs-TypeA-Position value or the fact that only that value can be signaled by the base station to indicate the DMRS sequence that the UE must use to demodulate the SIB1. (*Id.*).

Figure 25: Van Der Weide Demonstrative Showing Annotated 5G Standard Regarding Demodulation Reference Signals for PDSCH

7.4.1.1 Demodulation reference signals for PDSCH

7.4.1.1.1 Sequence generation

The UE shall assume the sequence $r(n)$ is defined by

$$r(n) = \frac{1}{\sqrt{2}}(1 - 2 \cdot c(2n)) + j \frac{1}{\sqrt{2}}(1 - 2 \cdot c(2n+1)).$$

where the pseudo-random sequence $c(i)$ is defined in clause 5.2.1. The pseudo-random sequence generator shall be initialized with

$$c_{\text{init}} = \left(2^{17} \left(N_{\text{slot}}^{\text{slot}} n_{\text{s,f}}^{\mu} + l + 1 \right) \left(2 N_{\text{ID}}^{\text{scid}} + 1 \right) + 2 N_{\text{ID}}^{\text{scid}} + n_{\text{scid}} \right) \bmod 2^{31}$$

where l is the OFDM symbol number within the slot, $n_{\text{s,f}}^{\mu}$ is the slot number within a frame, and

- $N_{\text{ID}}^0, N_{\text{ID}}^1 \in \{0, 1, \dots, 65535\}$ are given by the higher-layer parameters *scramblingID0* and *scramblingID1*, respectively, in the *DMRS-DownlinkConfig* IE if provided and the PDSCH is scheduled by PDCCCH using DCI format 1_1 with the CRC scrambled by C-RNTI, MCS-C-RNTI, or CS-RNTI
- $N_{\text{ID}}^0 \in \{0, 1, \dots, 65535\}$ is given by the higher-layer parameter *scramblingID0* in the *DMRS-DownlinkConfig* IE if provided and the PDSCH is scheduled by PDCCCH using DCI format 1_0 with the CRC scrambled by C-RNTI, MCS-C-RNTI, or CS-RNTI;
- $N_{\text{ID}}^{\text{scid}} = N_{\text{ID}}^{\text{cell}}$ otherwise;

The quantity $n_{\text{scid}} \in \{0, 1\}$ is given by the DM-RS sequence initialization field, in the DCI associated with the PDSCH transmission if DCI format 1_1 in [4, TS 38.212] is used, otherwise $n_{\text{scid}} = 0$.

CX-6229.0083-84 (TS 38.211 § 7.4.1.1.1)

(CDX-0002C.0028 (citing CX-6229.0083-84 (annotated)).).

Referring to his annotated demonstrative reproduced above in Figure 25, Dr. van der Weide testified that the variable $N_{\text{ID}}^{\text{scid}}$ (in blue in CDX-0002C.0028) takes the value of the physical layer cell identity for the purposes of demodulating SIB1. (Tr. (van der Weide) at 391:14-392:3; Tr. (Rangan) at 1042:7-14.). Dr. van der Weide explained that this value is assigned to a base station so that one base station can be distinguished from another. (Tr. (van der Weide) at 377:11-17.). He opined that this physical layer cell identity is thus just a constant for purposes of generating a DMRS sequence and cannot be altered by a particular base station to

change the DMRS sequence used to demodulate the SIB1. (*Id.* at 378:11-14.). Respondents' expert, Dr. Rangan, agreed that the physical layer cell identity "typically" does not change and that "[s]tandard practice is you're going to have an identity and you're going to stick with it because people need to know who you are." (Tr. (Rangan) at 1101:6-18.).

Dr. Rangan described the other variable that he identified, $n_{s,f}^{\mu}$, as "semi-statically configured" and is "part of the frame structure for the base station." (*Id.* at 1102:7-1103:9.). As Dr. van der Weide testified with respect to the variable N_{ID}^{SCID} , such a value cannot be used to signal different DMRS sequences because the frame structure remains static depending on the configuration of the particular base station. (*See* Tr. (van der Weide) at 378:11-14.).

Dr. van der Weide explained that "the only thing that signals the sequence is that value of 'l.'" (Tr. (van der Weide) at 342:11-23 (discussing CDX-0002C.0028).). The dmrs-TypeA-Position thus acts like a "turn signal," deciding between one of two possible DMRS sequences for a particular base station that the UE is accessing. (*Id.* at 395:19-396:18.). As Ericsson pointed out, Dr. van der Weide's testimony is also consistent with the testimony of Pål Frenger,²³ who is one of the inventors of the '342 patent. (CBr. at 96.). In particular, Dr. Frenger testified that [REDACTED]

[REDACTED]

[REDACTED] (JX-0038C (Frenger Dep. Tr.) at 161:21-162:22.).

Dr. Rangan also contended that the dmrs-TypeA-Position does not "explicitly signal" the DMRS sequence because the dmrs-TypeA-Position explicitly signals the position of the first

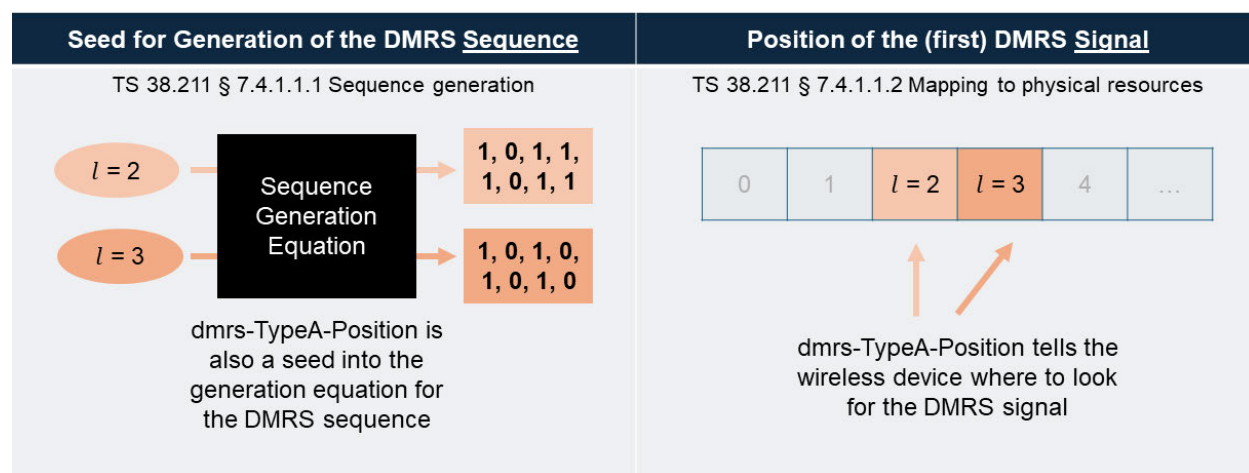
²³ [REDACTED]

DMRS for downlink. (Tr. (Rangan) at 1039:7-13 (emphasis added); *see also* RDX-0006.0022.).

However, this argument disregards how the dmrs-TypeA-Position value is used in the DMRS sequence generation process.

As Dr. van der Weide explained, and as Dr. Rangan conceded, the dmrs-TypeA-Position performs “double duty” because the dmrs-TypeA-Position: (1) points to the position of where the wireless communication device can find the distorted version of the first DMRS signal in the time-frequency grid; but also (2) acts as seed l to generate the local copy of the corresponding DMRS sequence used to demodulate SIB1. Referencing his demonstrative, copied below in Figure 26, Dr. van der Weide provided the following testimony.

Figure 26: Van Der Weide Demonstrative Illustrating Dmrs-TypeA-Position



(CDX-0002C.0025.).

Q. Next slide, please. We’re on slide 25.

Could you just explain to Judge McNamara what you’ve illustrated here?

A. Yes. So this input “ l ” does two things: It provides, as I just said, a seed for the generation of the DMRS sequence, and I’m illustrating that in block form on the left, where “ l ” equals 2 or “ l ” equals 3, and that gets fed into the Cinit calculation, which ultimately outputs a different set of numbers. But those numbers are knowable. That’s the reference sequence that we’re talking about.

It also, this same value, dmrs TypeA Position, is specified by the standard to be the position in the slot or the timing in the slot where the mobile device or the wireless communication device should look for that received distorted version of the signal, the red one, it comes in at a particular time and on a particular set of subcarriers, and this is informing the device, hey, look here, and now do your demodulation.

Q. At the top of the slide you reference double duty.

What is that a reference to?

A. Well, that double duty is just my shorthand for the fact that dmrs TypeA Position is working both as a seed to generate the sequence and as a pointer to the position of where the received sequence can be found in that time frequency grid.

(Tr. (van der Weide) at 339:4-340:4 (discussing CDX-0002C.0025).

Respondents' expert, Dr. Rangan, provided the following testimony with regard to the same, i.e., "double-duty" function of the dmrs-TypeA-Position value.

Q. And the dmrs-TypeA-Position value is actually doing double-duty in the sense that it is both telling the mobile device where to look for the DMRS signal from the base station and it's also providing a seed value for C_{init} that determines what the DMRS sequence is, correct?

A. You could say that. I guess I would say that it's explicitly signaling " l ," which we talked about, 2 or 3, a position, and it's providing one of several inputs to C_{init} explicitly.

(Tr. (Rangan) at 1106:15-23.).

Dr. Rangan did not dispute that the dmrs-TypeA-Position value is used as the variable l in the C_{init} equation to generate the DMRS sequence used to demodulate SIB1. (Tr. (Rangan) at 1106:5-14.). As Dr. Rangan conceded, the particular value of the dmrs-TypeA-Position is one factor that determines the particular DMRS sequence that is generated for purposes of demodulating the SIB1. (*Id.* at 1107:18-23.). That satisfies the Parties' agreed construction because the dmrs-TypeA-Position value indicates one of two (2) possible sequences that the UE must use to demodulate the SIB1. (Tr. (van der Weide) at 396:16-18.). For SIB1, the other inputs to the DMRS sequence generator are static or fixed for the particular base station with

which the UE is communicating and cannot be used to signal which sequence the UE should use. (*Id.* at 398:5-10.).

Additionally, on cross-examination, Dr. Rangan agreed that the claims do not require “explicitly signaling” the DMRS sequence. (Tr. (Rangan) at 1103:19-25 (agreeing that the claims require “explicit signaling, not “explicitly signaling” the sequence).). The claims require “explicit signaling that indicates a sequence,” and Dr. Rangan did not contest that the dmrs-TypeA-Position is explicit signaling. Dr. Rangan also agreed that, under the agreed construction, “explicit signaling” means the signal is “represented in the MIB by bits, symbols, or other information elements” (*id.* at 1104:1-11) and that the dmrs-TypeA-Position is in the MIB as bits, symbols, or other information (*id.* at 1098:6-12, 1109:19-22.). That is all that the claim requires.

Even if the claims did require “explicitly signaling,” Dr. Rangan testified that the dmrs-TypeA-Position is “**explicitly** signaling *l*” and provides “one of several inputs to C_{init} **explicitly**.” (*Id.* at 1106:11-23 (agreeing that *l* is set to 2 or 3 because that value is “explicitly signaled in the dmrs-TypeA-Position field in the MIB”) (emphases added).). Thus, the dmrs-TypeA-Position **explicitly** signals the DMRS sequence used to demodulate SIB1 and satisfies the claims even under Respondents’ narrow interpretation of the agreed construction.

Additionally, the dmrs-TypeA-Position value further satisfies the claims under the doctrine of equivalents, regardless of how they are interpreted. (Tr. (van der Weide) at 341:24-345:2 (discussing CDX-0002C.0029).). As Dr. van der Weide explained, the dmrs-TypeA-Position performs the same function, in the same way, to achieve the same result. He testified that the function of the explicit signaling in the claim is to provide “information used to demodulate a second part of the system information.” (*Id.* at 343:11-17.). Dr. van der Weide also explained, the dmrs-TypeA-Position value performs the same function because it also

“inform[s] the wireless communication device of which sequence it should use to demodulate SIB1.” (*Id.* at 343:18-22.). Dr. van der Weide also explained that the claimed explicit signaling and the dmrs-TypeA-Position perform this function in the same way because the master information block is used to signal the UE as to which DMRS sequence it should generate based on the value of the dmrs-TypeA-Position. (*Id.* at 343:23-15 (“The way in the claim language is the master information block includes explicit signaling”).). In addition, Dr. van der Weide explained that the explicit signaling and the dmrs-TypeA-Position achieve the same result: “the wireless communication device receives that second part of system information by demodulating or descrambling the second part using the indicated sequence.” (*Id.* at 344:16-345:2.).

Dr. Rangan argued that limitation [34.F] is not met under the doctrine of equivalents “[b]ecause the applicants decided to restrict their claim” during prosecution. (Tr. (Rangan) at 1048:24-1049:3 (discussing RDX-0006.0029)). This argument is not supported in law or fact.

The applicability of amendment-based prosecution history estoppel does not completely bar the benefit of the doctrine of equivalents from all litigation related to the amended claim. *See Intervet Inc. v. Merial Ltd.*, 617 F.3d 1282, 1291 (Fed. Cir. 2010) (citing *Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co.*, 535 U.S. 722, 737-38 (2002)). The scope of estoppel must fit the nature of the narrowing amendment. *Id.* (“A district court must look to the specifics of the amendment and the rejection that provoked the amendment to determine whether estoppel precludes the particular doctrine of equivalents argument being made.”). If the rationale underlying an amendment bears no more than a tangential relation to the equivalent in question, then prosecution history does not preclude doctrine of equivalents. *Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co.*, 344 F.3d 1359, 1368-69 (Fed. Cir. 2003).

Dr. van der Weide’s opinion under the doctrine of equivalents is that the dmrs-TypeA-

Position is equivalent to “explicit signaling that indicates a sequence.” Dr. Rangan pointed to the applicant’s amendment that narrowed “explicit signaling that is associated with the first part [of system information]” to “wherein the first part of system information comprises a master information block, wherein the master information block includes explicit signaling.” (Tr. (Rangan) at 1048:24-1049:3 (discussing RDX-0006.0029); RX-2280 (’342 Patent File History) at 308; *see also* RDX-0006.0029.). As Dr. Rangan agreed, including the explicit signaling in the master information block is one example of “explicit signaling [that] is associated with the first part.” (Tr. (Rangan) at 1030:23-1031:10.).

The amendment at issued was made during prosecution to overcome prior art that did not have “bits, symbols, or information that were actually included in the MIB.” (*Id.* at 1108:8-25; *see also* RX-2280 at 356 (“[T]he combination . . . fails to teach that a master information block (MIB) includes explicit signaling that indicates a sequence with which a wireless communication device is to demodulate or descramble another part of system information.”)). Although this amendment excludes explicit signaling that is not in the MIB, the amendment did not narrow the scope of explicit signaling or require that the explicit signaling could not indicate a sequence by specifying which of two possible sequences the UE should use.

Dr. Rangan did not contest that the dmrs-TypeA-Position is “in the MIB and it is bits, symbols, or other information,” nor do they dispute that the only parameter in the MIB that the base station can use to change the DMRS sequence is the value of the dmrs-Type A-Position. (Tr. (Rangan) at 1109:19-22; *see also* Tr. (van der Weide) at 338:1-23 (discussing CDX-0002C.0023-24); Tr. (Rangan) at 1098:6-12, 1136:13-19; CX-2008 (TS 38.331) at § 6.2.2 (MIB)). Moreover, Dr. Rangan acknowledged that the applicant did not amend “explicit signaling that indicates a sequence.” (*See* Tr. (Rangan) at 1109:1-6.). Thus, the amendment at

issue does not bear any relation to the equivalent in question, i.e., whether the dmrs-TypeA-Position is equivalent to “explicit signaling that indicates a sequence.” Because the amendment did not narrow the subject matter of the claim term at issue here, estoppel does not apply. *See AquaTex Indus., Inc. v. Techniche Sols.*, 479 F.3d 1320, 1326 (Fed. Cir. 2007) (explaining that an amendment directed to different claim limitation did not create prosecution history estoppel).

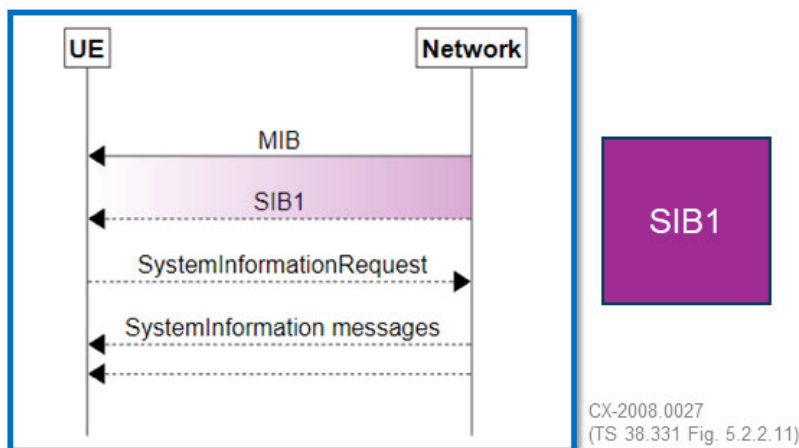
For the reasons discussed above, Ericsson has proven by a preponderance of evidence that the Accused Products meet this limitation of claim 34 of the '342 patent.

d) [34.G]: “receive the second part of system information over a second channel, by demodulating or descrambling the second part using the indicated sequence.”

The Accused Products practice limitation [34.G]. (Tr. (van der Weide) at 334:14-337:25.). To the extent limitation [34.F] is satisfied, Respondents did not dispute that this limitation is satisfied by the Accused Products. (Am. Joint Statement at § V.C; *see also* Tr. (van der Weide) at 1096:17-1097:6, 1097:15-19 (discussing CDX-0043.0002, identifying disputed and undisputed limitations).).

Dr. van der Weide explained that the SIB1 corresponds to the second part of system information of the claims. (Tr. (van der Weide) at 334:14-335:7 (discussing CDX-0002C.0020); CX-2008 (TS 38.331) at Fig. 5.2.2.11.). According to the 5G standard, the SIB1 is transmitted and received over the physical downlink shared channel (“PDSCH”), which is the second channel of the claims. (Tr. (van der Weide) at 334:14-335:4, 335:8-9 (discussing CDX-0002C.0020); CX-6232 (TS 38.300) at § 7.3.2; CX-0557 (TS 38.212) at Table 4.2-1.). This is shown in Dr. van der Weide’s demonstrative, reproduced below.

Figure 27: Van Der Weide Demonstrative Showing Annotated 5G Standard of SIB1 Transmission over the PDSCH



7.3.2 Scheduling

The MIB is mapped on the BCCH and carried on BCH while all other SI messages are mapped on the BCCH, where they are dynamically carried on DL-SCH. The scheduling of SI messages part of Other SI is indicated by SIB1.

Table 4.2-1

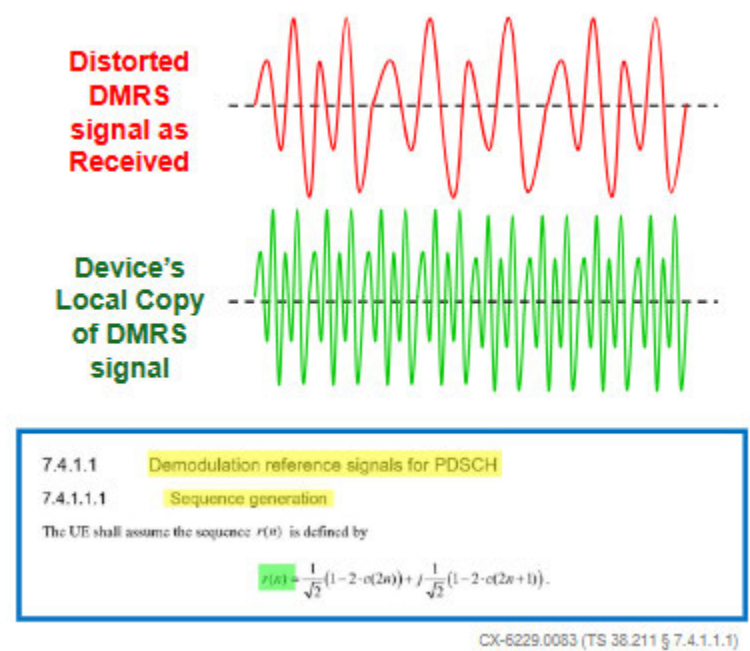
TrCH	Physical Channel
DL-SCH	PDSCH
BCH	PBCH
PCH	PDSCH

CX-6232.0037 (TS 38.300 § 7.3.2); CX-0557.0009 (TS 38.212 Table 4.2-1)

(CDX-0002C.0020 (citing CX-2008.0027; CX-6232.0037 (annotated); CX-0557.0009 (annotated))).

Dr. van der Weide also testified that the UE uses the sequence generator to locally generate a DMRS sequence, denoted as “ $r(n)$,” to demodulate the SIB1. This is shown in Dr. van der Weide’s demonstrative, copied below.

Figure 28: Van Der Weide Demonstrative Showing SIB1 Demodulation via DMRS Signal and Corresponding Annotated 5G Standard



(CDX-0002C.0021 (citing CX-6229.0083) (annotated).).

As discussed above in Section IX.A.2(c), a local copy of a DMRS signal is used to perform channel estimation, which is a necessary part of demodulation. (Tr. (van der Weide) at 324:16-326:20; Tr. (Rangan) at 1036:8-20.). Specifically, § 7.4.1.1.1 of Technical Standard 38.211 provides a sequence generation equation $r(n)$ used to generate a DMRS sequence which is used to create a local copy of the DMRS signals for the PDSCH. (*Id.*; CX-6229 (TS 38.211) at § 7.4.1.1.1.). Dr. van der Weide explained that the formula $r(n)$ is “used to generate that local copy of the DMRS signal . . . that’s used for demodulating SIB1.” (Tr. (van der Weide) at 335:10-336:3 (discussing CDX-0002C.0021); CX-6229 (TS 38.211) at § 7.4.1.1.1.).

In addition, Dr. van der Weide explained that in 5G systems, the sequence generation formula $r(n)$ is initialized with the value C_{init} , which is shown in pink below. Tr. (van der Weide) at 336:17-337:25 (discussing CDX-0002C.0022); CX-6229 (TS 38.211) at § 7.4.1.1.1.)

Figure 29: Van Der Weide Demonstrative Showing Annotated 5G Standard with Respect to Sequence Generation Formula of the Dmrs-TypeA-Position

7.4.1.1 Demodulation reference signals for PDSCH

7.4.1.1.1 Sequence generation

The UE shall assume the sequence $r(n)$ is defined by

$$r(n) = \frac{1}{\sqrt{2}}(1 - 2 \cdot c(2n)) + j \frac{1}{\sqrt{2}}(1 - 2 \cdot c(2n+1)).$$

where the pseudo-random sequence $c(i)$ is defined in clause 5.2.1. The pseudo-random sequence generator shall be initialized with

$$C_{\text{init}} = \left(2^{17} \left(N_{\text{slot}}^{\text{slot}} n_{\text{s},f}^{\mu} + l + 1 \right) \left(2N_{\text{ID}}^{\text{scid}} + 1 \right) + 2N_{\text{ID}}^{\text{scid}} + n_{\text{scid}} \right) \bmod 2^{31}$$

where l is the OFDM symbol number within the slot, $n_{\text{s},f}^{\mu}$ is the slot number within a frame, and

CX-6229.0083-84 (TS 38.211 § 7.4.1.1.1)

(CDX-0002C.0022 (citing CX-6229.0083-84).).

As Dr. van der Weide explained, the value C_{init} is “basically a way of kicking off this sequence that would be unique for given inputs to that C_{init} calculation.” (Tr. (van der Weide) at 336:17-337:9.). The variable l (highlighted in yellow above) is one of the inputs to the C_{init} equation and corresponds to the “OFDM symbol number within the slot.” (*Id.* at 337:10-25; CX-6229 (TS 38.211) at § 7.4.1.1.1.). Dr. van der Weide explained that “symbol number” is a way to describe the position of the received DMRS signal using a time-frequency structure. (Tr. (van der Weide) at 337:10-25 (“[T]his position or symbol number is also corresponding to a particular time.”); CX-6229 (TS 38.211) at § 7.4.1.1.1.). Dr. van der Weide also explained that changing the variable l will change the sequence generated by $r(n)$. (Tr. (van der Weide) at 337:22-25.).

Additionally, Dr. van der Weide testified that § 7.4.1.1.1 describes a “generic sequence generation process” and that the formula $r(n)$ can be used to generate different DMRS sequences

used for purposes other than demodulating SIB1. (Tr. (van der Weide) at 336:4-11.). Dr. van der Weide explained that the device uses the sequence corresponding to the “first” DMRS signal sent from the base station in order to demodulate and receive SIB1. (*Id.* at 336:12-16.). He clarified that this is because the device needs to receive minimum system information (MIB and SIB1) and access the network before it can receive any other information on the PDSCH. (*Id.* at 321:16-21, 336:12-16.). Dr. van der Weide thus opined that the wireless communication device needs to know the position of the first DMRS signal in order to generate the DMRS sequence used to demodulate SIB1. (*Id.*; *see also* Tr. (Rangan) at 1102:14-17, 1106:5-8, 1107:18-23.).

Accordingly, Ericsson has proven by a preponderance of evidence that the Accused Products meet this limitation of claim 34 of the '342 patent.

3. The Accused Products Practice Claim 38

- a) **[38.A]: “The wireless communication device of claim 34, wherein the sequence is a demodulation reference signal sequence, wherein the second part of system information comprises a system information block, and wherein the processing circuitry is configured to: demodulate the second part using the indicated sequence; and”**

The Accused Products infringe and practice limitation [38.A]. (Tr. (van der Weide) at 346:21-347:8.). Respondents did not dispute that this limitation is satisfied by the Accused Products. (Am. Joint Statement at § V.C; *see also* Tr. (Rangan) at 1096:17-1097:6, 1097:15-19 (discussing CDX-0043.0002, identifying disputed and undisputed limitations).

As described above in Sections IX.A.2(c)-(d). with respect to limitations [34.F] and [34.G], Dr. van der Weide identified a demodulation reference signal sequence as the sequence of the claims and a system information block SIB1 as the second part of system information. (*See* Tr. (van der Weide) at 346:14-347:9.). As further described in Sections IX.A.2(c)-(d), the

Accused Products demodulate the SIB1 using the DMRS sequence.

For these reasons, Ericsson has proven by a preponderance of evidence that the Accused Products meet the additional limitation recited in claim 38 of the '342 patent.

[38.B]: “access the wireless communication system using both the first and second parts of system information.”

The UE Products infringe and practice limitation [38.B]. (Tr. (van der Weide) at 347:9-348:1.). Respondents did not dispute that this limitation is satisfied by the Accused Products. (Am. Joint Statement at §V.B; *see also* Tr. (Rangan) at 1096:17-1097:6, 1097:15-19 (discussing CDX-0043.0002, identifying disputed and undisputed limitations).).

Dr. van der Weide explained that the wireless communication device receives “MIB plus SIB1” in order to access the network. (Tr. (van der Weide) at 347:16-22.). The 5G standard states that “Minimum SI comprises basic information required for initial access” and the minimum system information consists of the MIB and the SIB1. (CX-6232 (TS 38.300) at § 7.3.1.).

Accordingly, Ericsson has proven by a preponderance of evidence that the Accused Products meet the additional limitation recited in claim 38 of the '342 patent.

4. The Accused Products Practice Claim 39

- a) “The wireless communication device of claim 38, wherein the demodulation reference signal sequence indicated by the explicit signaling distinguishes the second part of system information from one or more other second parts of system information that are receivable using one or more other respective demodulation reference signal sequences.”**

The Accused Products infringe and practice the additional limitation of claim 39. (Tr. (van der Weided) at 348:2-349:22.). Respondents did not dispute that the additional limitations of claim 39 is satisfied by the Accused Products. (Am. Joint Statement at §V.C; *see also* Tr.

(Rangan) at 1096:17-1097:6, 1097:15-19 (discussing CDX-0043.0002, identifying disputed and undisputed limitations).).

As explained above in Section IX.A.2(c) with respect to limitation [34.F], the value of the dmrs-TypeA-Position (2 or 3) acts as a seed for the DMRS sequence $r(n)$ used to demodulate SIB1. Dr. van der Weide explained that the DMRS signals for SIBs other than SIB1 can be sent in different positions, and so the l value in the C_{init} equation can change for different SIBs. (Tr. (van der Weide) at 348:2-25 (discussing CDX-0002C.0033).). Dr. van der Weide also explained that changing the variable l will change the sequence generated by $r(n)$. (*Id.* at 337:22-25.).

Figure 30: Van Der Weide Demonstrative Showing SIBs

SIB1 SIB2 SIB3 ...			
System Information Block		possible l value	
SIB1		dmrs-TypeA-Position = 2 or 3	
SIB2, SIB3, ...		1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, or 12	

(CDX-0002C.0033.).

Dr. van der Weide further explained that the DMRS sequence used to extract SIBs after SIB1 “will be informed by additional system information” and that the other variables in the C_{init} equation can also change for subsequent SIBs. (Tr. (van der Weide) at 348:2-349:14.). Specifically, Dr. van der Weide testified that the “structure of the communication channel is very flexible in 5G,” and different 5G numerologies can change the variables in the C_{init} equation for SIBs other than SIB1. (*Id.*). Although these variables can change for SIBs other than SIB1, Dr. van der Weide explained that these parameters do not change for SIB1, and that is why the DMRS sequence used to demodulate other SIBs are distinguishable from one another. (*Id.*).

For the reasons discussed above, Ericsson has proven by a preponderance of evidence that the Accused Products meet the additional limitations recited in claim 39 of the '342 patent.

B. Technical Prong of Domestic Industry

1. The Samsung DI Products Practice Claims 34 and 39

The weight of the evidence proves that the Samsung DI Products practice claims 34 and 39 of the '342 patent for the same reasons as the Qualcomm-Based Accused Products. As discussed above in Section V.C.1, the weight of the evidence demonstrates that the [REDACTED]

[REDACTED]. (See also Am. Joint Statement at § V.A.).

Accordingly, Ericsson has proven by a preponderance of evidence that the Samsung DI Products practice claims 34 and 39 of the '342 patent.

2. The Ericsson DI Products Practice Claim 41

- a) **[41.A]: “A radio node for use in a wireless communication system in which system information is transmitted in parts, including a first part of system information and a second part of system information, the radio node comprising:”**

[41.B]: “communication circuitry; and”

[41.C]: “processing circuitry configured to:”

The evidence shows and proves that the Ericsson DI Products practice claim elements [41.A], [41.B], and [41.C]. Respondents did not dispute that these claim elements are met. (Am. Joint Statement at ¶ V.D; see also Tr. (van der Weide) at 357:24-358:1.0.).

Dr. van der Weide testified that the Ericsson DI Products are each a “radio node” (or a base station). (Tr. (van der Weide) at 356:3-16; CDX-0002C.0038.). Dr. van der Weide explained that, according to the 5G standard, a base station transmits system information to a UE in parts, such as the MIB and SIB1. (Tr. (van der Weide) at 356:17-358:11; CDX-0002C.0039;

see also CX-2008.0027 (TS 38.331 Fig. 5.2.2.11); CX-6232.0035-36 (TS 38.300 § 7.3.1).).

Dr. van der Weide testified that the Ericsson DI Products comprise antennas (i.e., “communication circuitry”) and baseband processors (i.e., “processing circuitry”). (Tr. (van der Weide) at 357:12-23; CDX-0002C.0040.). [REDACTED]

[REDACTED]

(JX-0044C (Y. Liu Dep. Tr.) at 26:22-27:1.).

For the foregoing reasons, Ericsson has proven by a preponderance of evidence that the Ericsson DI Products practice these limitations of claim 41 of the ’342 patent.

b) [41.D]: “generate explicit signaling that is included in a master information block,”

The evidence demonstrates that the Ericsson DI Products meet claim element [41.D]. (Tr. (van der Weide) at 358:3-359:6; CDX-0002C.0041.). Respondents did not dispute that the Ericsson DI Products generate the dmrs-TypeA-Position, but disputed that the dmrs-TypeA-Position is “explicit signaling.” (Tr. (Rangan) at 1096:17-1097:6, 1097:15-19.). Respondents’ expert, Dr. Rangan, acknowledged that he did not provide any testimony that limitation [41.D] was not met. (Tr. (Rangan) at 1096:17-1097:6, 1097:15-19 (discussing CDX-0043.0002, identifying disputed and undisputed limitations).).

Dr. van der Weide testified that the base station generates the dmrs-TypeA-Position (i.e., “explicit signaling”) that is included in the MIB. (Tr. (van der Weide) at 358:3-359:6.).

Accordingly, Ericsson has proven by a preponderance of evidence that the Ericsson DI Products practice this limitation of claim 41 of the ’342 patent.

c) **[41.E]: “wherein the first part of system information comprises the master information block,”**

[41.G]: “transmit the explicit signaling as included in the master information block.”

The Ericsson Domestic Industry Products practice limitations [41.E], and [41.G]. (Tr. (van der Weide) at 358:2-359:6.). Respondents did not dispute that limitations [41.E] and [41.G] are satisfied by the Ericsson Domestic Industry Products. (Am. Joint Statement at § V.E.).

Dr. van der Weide explained that the Ericsson Domestic Industry Products transmit the master information block, MIB, on the physical broadcast channel. (Tr. (van der Weide) at 358:2-359:6 (discussing CDX-0002C.0041); CX-2008 (TS 38.331) at Fig. 5.2.2.11.). Dr. van der Weide also explained that the dmrs-TypeA-Position field is included within the MIB. (Tr. (van der Weide) at 358:2-359:6 (discussing CDX-0002C.0041); CX-2008 (TS 38.331) at § 6.2.2 (MIB).).

For these reasons, Ericsson has proven by a preponderance of evidence that the Ericsson DI Products practice these limitations of claim 41 of the '342 patent.

d) **[41.F]: “wherein the explicit signaling indicates a sequence with which the second part of system information is to be demodulated or descrambled; and”**

The weight of the evidence indicates and supports a finding that the Ericsson DI Products meet claim element [41.F]. (Tr. (van der Weide) at 359:7-25; CDX-0002C.0042.). Dr. van der Weide testified that the 5G standard requires that gNB transmits system information where MIB includes dmrs-TypeA-Position, which is explicit signaling. (Tr. (van der Weide) at 359:16-25.). As discussed above in Section IX.A.2(c) for limitation [34.F], dmrs-TypeA-Position is a turn signal that the UE uses to generate the DMRS sequence, which is used to demodulate the PDSCH (on which the SIB1 is transmitted). (*Id.*).

To the extent this claim element is not literally met, Dr. van der Weide testified that this claim element is met under the doctrine of equivalents for the same reasons as the Accused Products meet claim element [34.F]. (Tr. (van der Weide) at 360:1-11; *see* Section IX.A.2(c), *supra*.).

C. Invalidity

Respondents did not challenge the validity of the '342 patent. (Am. Joint Statement § V.F; *see also* Tr. (Rangan) at 1097:7-14.).

X. U.S. PATENT NO. 11,515,893

A. Direct Infringement

1. Infringement Overview

Ericsson contended that the Accused Products directly infringe claims 1 and 4 of the '893 patent. (CPBr. at 122; CBr. 109.). Asserted claims 1 and 4 of the '893 patent are largely identical, and the differences only pertain to whether a given claim is directed toward an encoder or a decoder. (Tr. (Wesel) 422:14-423:6; CDX-0012C.0030.). Accordingly, limitations [1.A] and [4.A], [1.B] and [4.C], and [1.C] and [4.B] are addressed together, with any differences discussed in the following analysis. Limitations [1.D] and [4.D], [1.E] and [4.E], and [1.F] and [4.F] are identical and, accordingly, treated together.

For the reasons discussed below, Ericsson has met its burden and proven that the Accused Products directly infringe claim 4 but not claim 1.

2. The Accused and DI Products Practice Claim 4 but Do Not Practice Claim 1

- a) [1.A]: “A wireless transmitter operable in a fifth generation, 5G, new radio, NR, wireless network, the wireless transmitter comprising processing circuitry operable to”

[4.A]: “A wireless receiver operable in a fifth generation, 5G,

new radio, NR, wireless network, the wireless receiver comprising processing circuitry operable to:

Each of the Accused Products practices limitations [1.A] and [4.A]. (Tr. (Wesel) at 423:11-424:14.). Respondents did not dispute that these limitations are satisfied with respect to the Accused and DI Products. (Am. Joint Statement at § VI.C.).

The “5G NR Terms,”²⁴ which were hotly disputed during the *Markman* proceedings, were not found to be indefinite, and were given their “plain and ordinary meaning . . . in accordance with the 5G NR standards.” (*Markman* Order at 13-14.). Respondents did not dispute that the Accused and DI Products are operable in a fifth generation, 5G, new radio, NR, wireless network. (Am. Joint Statement at § VI.E; RDX-0008C.0015.).

Dr. Wesel explained that, as mandated by the 5G standard (TS 38.212), the Accused and DI Products are transmitters and receivers that transmit data of the transport channel (TrCH) denoted uplink shared channel (UL-SCH) and receive data of the TrCH denoted downlink shared channel (DL-SCH), with LDPC coding. (Tr. (Wesel) at 422:4-13; CX-0557 at §§ 4, 5.3; CDX-0012C.0029.).

Respondents did not contest that the Accused and DI Products include processing circuitry and transmit and receive data as described in limitations 1.A and 4.A. (Am. Joint Statement at § VI.F.). Dr. Mahon, Dr. Wesel, and Dr. van der Weide confirmed that the Accused Products each contain “processing circuitry.” (Tr. (Mahon) at 183:13-19; Tr. (van der Weide) at 331:16-333:3, 357:13-358:1; Tr. (Wesel) at 424:1-14.).

Specifically, the Motorola Edge+ (2023) materials advertise that the device includes a

²⁴ The “5G NR Terms” refers to the following disputed claim terms: “5G NR,” “a fifth generation, 5G, new radio, NR, wireless network,” “fifth generation, 5G, new radio, NR wireless communication network,” “5G NR wireless network,” “5G NR wireless receiver,” and “5G NR wireless transmitter.” (See *Markman* Order at 13-14.).

Qualcomm SM8550 chipset. (CX-0558, CX-0632, CX-0703C; CX-0704C, CX-0705C; CX-0012C.). The Motorola Edge (2023) includes a MediaTek Dimensity 7030 (MT6879) chipset. (CX-6099; CX-6352; CX0012C.).

The Samsung Galaxy S23 materials advertise that the device includes a Qualcomm SM8550 chipset. (CX-0558; CX-0632; CX-0703C; CX-0704C; CX-0705C; CX-0012C.). These [REDACTED] (JX-0029C (Klomsdorf Dep. Tr.) at 36:21-37:1.).

The Ericsson DI Products also each contain “processing circuitry.” (Tr. (Wesel) at 424:1-14; CX-0568C; CX-0553C; CX-0554C.0005; CX-0602C.0005; CX-0565C.0013; *see also* CX-0571C.0046.). [REDACTED]

[REDACTED]. (JX-0033C (Raza Dep. Tr.) at 48:18-11; JX-0044C (Y. Liu Dep. Tr.) at 26:12-27:11, 28:2-14; JX-0037C (Carlsson Dep. Tr.) at 140:11-143:6.). As. Mr. Liu testified, [REDACTED]

[REDACTED]

[REDACTED] (JX-0044C (Y. Liu Dep. Tr.) at 27:2-27:7.). [REDACTED]

[REDACTED]

[REDACTED] (CX-0554C [REDACTED]; CX-0602 [REDACTED]; CX-0567C [REDACTED]; CX-0565C.0005; JX-0037C (Carlsson Dep. Tr.) at 129:7-16.).

For these reasons, Ericsson has proven by a preponderance of evidence that the Accused and DI Products practice these limitations of claims 1 and 4 of the '893 patent.

- b) **[1.B]:” encode information bits for transmission in a 5G NR wireless network using a low-density parity check, LDPC, code and a parity check matrix, PCM, the PCM being partitioned into square sub-matrices of size $Z \times Z$ and being described by a base matrix and a shift vector, the shift vector using a shift size $Z=3*2^j$, where j is one of 0, 1, 2, 3, 4, 5, 6 and 7; and”**

[4.C]: “decode the information bits received from the 5G NR wireless network using a low-density parity check, LDPC, code and a parity check matrix, PCM, the PCM being partitioned into square sub-matrices of size $Z \times Z$ and being described by a base matrix and a shift vector, the shift vector using a shift size $Z=3 \cdot 2^j$, where j is one of 0, 1, 2, 3, 4, 5, 6 and 7,”

Each of the Accused and DI Products encode and decode information bits as recited in limitations [1.B] and [4.C]. (Tr. (Wesel) at 424:13-427:15; CDX-0012C.0035-37.).

Respondents did not dispute that these limitations are satisfied by the Accused and DI Products. (Am. Joint Statement at § VI.D; RDX-0008C.0015 0031, 0033.).

As discussed above in Section X.A.2(a), the 5G NR Terms were not found to be indefinite. They also were given their “plain and ordinary meaning . . . in accordance with the 5G NR standards.” (*Markman* Order at 13-14.). Respondents did not contest that the Accused and DI Products are involved in the transmission or reception of information bits in a “5G NR” wireless network. (Am. Joint Statement at § VI.E.).

Although these limitations were not disputed, as Dr. Wesel testified, these portions of the claims set up the requirement that the encoder and decoder “is required by the claims to use a parity check matrix that we’re going to find out about later in the claim. But then the ‘described by’ tells us that the rest of the claim is describing the parity-check matrix that must be used.” (Tr. (Wesel) at 425:13-19.). He explained that as mandated by the 5G standard (TS 38.212) shown below in Figure 31, the Accused and DI Products each encode and decode information bits using an LDPC PCM, “H,” which is *described by* a base matrix, H_{BG} , where each element in H_{BG} corresponds to a Z_c -by- Z_c submatrix in H. (Tr. (Wesel) at 425:24-426:16.).

Figure 31: 5G Standard Showing LDPC PCM “H”

The matrix $\mathbf{H}$ is obtained by replacing each element of $\mathbf{H}_{\text{BG}}$ with a $Z_c \times Z_c$ matrix, according to the following:

- Each element of value 0 in $\mathbf{H}_{\text{BG}}$ is replaced by an all zero matrix $\mathbf{0}$ of size $Z_c \times Z_c$;
- Each element of value 1 in $\mathbf{H}_{\text{BG}}$ is replaced by a circular permutation matrix $\mathbf{I}(p_{i,j})$ of size $Z_c \times Z_c$, where i and j are the row and column indices of the element, and $\mathbf{I}(p_{i,j})$ is obtained by circularly shifting the identity matrix $\mathbf{I}$ of size $Z_c \times Z_c$ to the right $p_{i,j}$ times. The value of $p_{i,j}$ is given by $p_{i,j} = \text{mod}(v_{i,j}, Z_c)$. The value of $v_{i,j}$ is given by Tables 5.3.2-2 and 5.3.2-3 according to the set index i_{LS} and LDPC base graph.

For LDPC base graph 1, a matrix of $\mathbf{H}_{\text{BG}}$ has 46 rows with row indices $i = 0, 1, 2, \dots, 45$ and 68 columns with column indices $j = 0, 1, 2, \dots, 67$. For LDPC base graph 2, a matrix of $\mathbf{H}_{\text{BG}}$ has 42 rows with row indices $i = 0, 1, 2, \dots, 41$ and 52 columns with column indices $j = 0, 1, 2, \dots, 51$. The elements in $\mathbf{H}_{\text{BG}}$ with row and column indices given in Table 5.3.2-2 (for LDPC base graph 1) and Table 5.3.2-3 (for LDPC base graph 2) are of value 1, and all other elements in $\mathbf{H}_{\text{BG}}$ are of value 0.

(CDX-0012C.0035 (citing CX-0557 (TS 38.212) at § 5.3.2 (annotated))).).

Dr. Wesel and Respondents' expert, Dr. Lingjia Liu,²⁵ explained that Table 5.3.2-2 below shows a base matrix, $\mathbf{H}_{\text{BG}}$, and shift vector, $\mathbf{V}_{i,j}$, and describes the same parity check matrix as the claims. (Tr. (Wesel) at 426:17-25; Tr. (Liu) at 1187:1-11.).

²⁵ When he testified during the Hearing on July 15, 2024, Dr. Lingjia Liu was a Professor & Bradley Senior Faculty Fellow in the Bradley Department of Electrical and Computer Engineering at Virginia Tech. (RPSt. at Ex. C.). Respondents identified Dr. Liu as "an expert in the technology related to the '893 patent. He will testify on the opinions in his expert reports, including, *inter alia*, regarding the technology and state of the art at issue, the public availability of certain 3GPP materials, Ericsson's alleged technical domestic industry, the invalidity of the asserted claims of the '893 patent, whether the Motorola accused products allegedly infringe the asserted claims of the '893 patent, and other topics related to the '893 patent." (RPSt. at 2-3.). Dr. Liu was accepted with objection as an expert on the testimony for which he was called to testify.

Figure 32: Table 5.3.2-2 of the 5G Standard Showing PCMs

Table 5.3.2-2: LDPC base graph 1 (H_{BG}) and its parity check matrices ($V_{i,j}$)

H_{BG}		$V_{i,j}$								H_{BG}		$V_{i,j}$							
Row index	Column index	Set index i_{LS}								Row index	Column index	Set index i_{LS}							
i	j	0	1	2	3	4	5	6	7	i	j	0	1	2	3	4	5	6	7
0	0	250	307	73	223	211	294	0	135	15	1	96	2	290	120	0	348	6	138
	1	69	19	15	16	198	118	0	227		10	65	210	60	131	183	15	81	220
	2	226	50	103	94	168	167	0	126		13	63	318	130	209	108	81	182	173
	3	159	369	49	91	188	330	0	134		18	75	55	184	209	68	178	53	142
	4	100	181	240	74	219	207	0	84		25	179	269	51	81	64	113	46	49
	5	10	216	39	10	4	165	0	83		37	0	0	0	0	0	0	0	0
	6	59	317	15	0	29	243	0	53		1	64	13	69	154	270	190	88	78
	7	229	288	162	205	144	250	0	225		3	49	338	140	164	13	293	198	152
	8	110	109	215	216	118	1	0	205		11	49	57	45	43	99	332	160	84
	9	191	17	164	21	216	339	0	128		20	51	289	115	189	54	331	122	5
	10	9	357	133	215	115	201	0	75		22	154	57	300	101	0	114	182	205
	11	190	215	298	14	233	53	0	135		38	0	0	0	0	0	0	0	0
	12	23	106	110	70	144	347	0	217	0	7	260	287	56	153	110	91	183	
	13	190	242	113	141	95	304	0	220	14	164	303	147	110	137	228	184	112	
	14	35	180	16	198	216	167	0	90	16	59	81	128	200	0	247	30	106	
	15	239	330	189	104	73	47	0	105	17	1	358	51	63	0	116	3	219	
	16	31	346	32	81	261	188	0	137	21	144	375	228	4	162	190	155	129	
	17	1	1	1	1	1	1	0	1	39	0	0	0	0	0	0	0	0	
	18	0	0	0	0	0	0	0	0	1	42	130	260	199	161	47	1	163	

(CDX-0012C.0036 (citing CX-0557 (TS 38.212) at Table 5.3.2-2 (annotated))).

Additionally, Table 5.3.2-1, shown below, provides a set index i_{LS} for the value Z_c , which is determined as shown in § 5.2.2. If set index $i_{LS} = 1$, the value Z_c is of the form $3 \cdot 2^j$, $j=0, 1, 2, 3, 4, 5, 6, 7$, which Dr. Wesel explained, if you “do a little bit of math,” corresponds to the values shown in Table 5.3.2-1. (Tr. (Wesel) at 427:1-5.). He testified that the same is true for each “j” value listed below. (*Id.*).

Figure 33: Wesel Demonstrative Showing Annotated Table 5.3.2-1 of the 5G Standard

Table 5.3.2-1: Sets of LDPC lifting size Z

Set index (i_{LS})	Set of lifting sizes (Z)
0	{2, 4, 8, 16, 32, 64, 128, 256}
1	{3, 6, 12, 24, 48, 96, 192, 384}
2	{5, 10, 20, 40, 80, 160, 320}
3	{7, 14, 28, 56, 112, 224}
4	{9, 18, 36, 72, 144, 288}
5	{11, 22, 44, 88, 176, 352}
6	{13, 26, 52, 104, 208}
7	{15, 30, 60, 120, 240}

$Z = 3 \cdot 2^j$

j is one of 0, 1, 2, 3, 4, 5, 6 and 7

$Z = 3 \cdot 2^0$

$Z = 3$

(CDX-0012C.0037 (citing CX-0557 (TS 38.212) at Table 5.3.2) (annotated)).).

For the foregoing reasons, Ericsson has proven by a preponderance of evidence that the Accused and DI Products practice these limitations of claims 1 and 4 of the '893 patent.

c) **[1.C]: “transmit the encoded information bits to a 5G NR wireless receiver”**

[4.B]: “receive encoded information bits from a 5G NR wireless transmitter”

Ericsson asserted that the Accused and DI Products transmit the encoded information bits to a 5G NR wireless receiver and receive the encoded information bits from a 5G NR wireless transmitter. (CBr. at 123; Tr. (Wesel) at 427:16-428:16.).

Respondents did not dispute that the Accused and DI Products “receive encoded information bits from a 5G NR wireless transmitter,” as recited in limitation [4.B]. (Am. Joint Statement at § VI.E.).

Respondents and Staff contended that the Accused and DI Products do not practice claim limitation [1.C] because they do not “transmit *the encoded information bits* to a 5G NR wireless receiver,” as recited in the claim. (RRBr. at 44 (emphasis in original); SRBr. at 31 (emphasis added)). These “encoded information bits” correspond to those bits encoded in limitation [1.B] using the specific PCM of the claim. Limitations [1.A]-[1.C] are replicated below.²⁶

[1.A] A wireless transmitter operable in a fifth generation, 5G, new radio, NR, wireless network, the wireless transmitter comprising processing circuitry operable to:

[1.B] encode information bits for transmission in a 5G NR wireless network using a low-density parity check, LDPC, code and a parity check matrix, PCM, . . . ; and

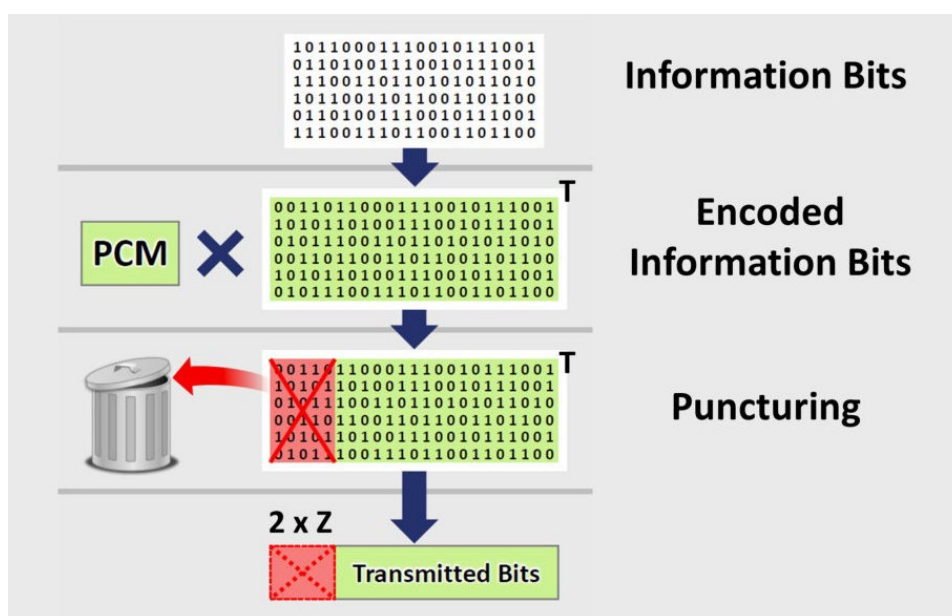
[1.C] transmit *the encoded information bits* to a 5G NR wireless receiver

²⁶ In their Post-Hearing Reply Brief, Respondents referred to limitations [1.A], [1.B], and 1.C] as [1], [1.1], and [1.2], respectively. (See, e.g., RRBr. at 44.).

(JX-0004 at cl. 1 (emphasis added)).

Both experts agreed that after encoding, certain encoded information bits are discarded (i.e., “punctured”) such that those punctured bits are not transmitted. Respondents’ expert, Dr. Liu, illustrated the general concept of puncturing in his demonstrative, copied below in Figure 34.

Figure 34: Liu Demonstrative Illustrating “Puncturing”



(RDX.0008C.0018.).

Referring to his demonstrative, Figure 34, Dr. Liu, Respondents’ expert, provided the following testimony:

Q. Which information bits are the encoded information bits referred to in limitation [1.C]?

A. Referred to limitation [1.B] encode information bits using the parity check matrix.

Q. RDX 8.18. Are all of the bits encoded by the specific parity check matrix of the claims transmitted?

A. No. As illustrated in this slide, 5G standards mandate that the first 2 x Z block

of encoded bits removed from transmission, they are called puncturing. Also some other encoded bits will also be omitted unless the lowest decoder rate of one third is used for transmission.

(Tr. (Liu) at 1146:1-12.).

Ericsson's expert, Dr. Wesel also testified as follows:

Q. In terms of what you told us previously in your testimony, the way the products at issue in this investigation implement the required puncturing is that they first encode the information bits and then they puncture the encoded bits, correct?

A. That's correct. That's talking about the parity bits.

Q. Okay. And puncturing the encoded bits means that some of the encoded information bits are **removed** from the stream of data, correct?

A. **Correct.**

* * *

Q. And those punctured bits that are removed are **not transmitted**, correct?

A. **Correct, the punctured bits are not transmitted.**

(Tr. (Wesel) at 476:18-477:3, 477:12-14 (emphases added).).

Additionally, Dr. Wesel confirmed that "the [first] 2xZ systemic [sic] bits ... are always punctured," and "are never transmitted." (*Id.* at 476:3-6, 477:15-18.). He also agreed that "puncturing means that it [i.e., the transmitter] would remove some of the encoded bits," "just tak[ing] them out of the stream of data," such that "**some of the encoded bits** would **not** then be transmitted." (*Id.* at 478:3-16. (emphases added).). This was consistent with Dr. Liu's testimony that in addition to the first 2xZ systematic bits, certain parity bits may also be punctured, and thus not transmitted. (Tr. (Liu) at 1146:6-12.).

There does not appear to be a dispute that all of the encoded information bits resulting from the encoding process in claim element [1.B] must be transmitted in claim element [1.C].

(*See* CBr. at 124; RRBBr. at 44.). Instead, the crux of the dispute is about which encoded

information bits result from [1.B]. (*Id.*). During the Hearing, Ericsson's expert, Dr. Wesel, testified for the first time that only a subset of the "encoded information bits" (i.e., the unpunctured bits) are "for transmission" because the encoder knows the code rate. (Tr. (Wesel) at 428:10-16 ("So in 5G there are a lot of different data rates that could be used. But at the time you're transmitting you know what your data rate is, and for your data rate you encode for transmission the bits associated with that data rate.")). He provided the following explanation as to why sending only the unpunctured bits constitutes the encoded bits "for transmission."

Q. . . . Dr. Wesel, what is puncturing?

A. Puncturing, as we discussed earlier and during cross examination, it's a way to obtain a higher rate code from a lower rate code by not sending some of the bits in the higher rate code.

Q. If puncturing occurs, are the encoded bits still transmitted?

A. All of the encoded bits of the higher rate code are transmitted.

Q. And why is that?

A. Well, so if you perform puncturing to obtain the higher rate code, you're not sending -- you don't send the punctured bits, but you send all of the unpunctured bits, and the unpunctured bits are exactly the encoded bits for the higher rate code.

Q. If code word bits are omitted during puncturing, why are the encoded information bits still transmitted?

A. Well, the claim language says encode bits for transmission, and then later it says transmit the encoded bits. Well, the encoded bits refers to the bits encoded for transmission. So those are the bits that are encoded for the rate that has been selected by that 5G transmitter. And so all of the bits that have been encoded for transmission are transmitted.

There are some other bits that were encoded for convenience, but not for transmission. Those bits aren't transmitted and they shouldn't have been.

(*Id.* at 484:2-485:3.).

As shown above in the quoted testimony, Dr. Wesel opined that the punctured bits are not

“for transmission,” and thus not required to be transmitted. (*Id.* at 485:1-3.).

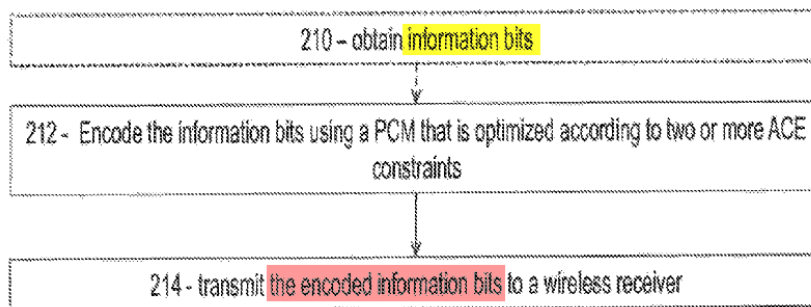
However, as Staff noted, Dr. Wesel’s reading of the claim language “encode information bits for transmission,” i.e., [1.B], is inconsistent with plain language of claim 1 read in light of the specification. Limitation [1.B] requires the transmitter to encode “information bits for transmission,” not encode for transmission “information bits.” (SRBr. at 32 (citing CBr. at 124).). The ’893 patent specification uses the term “information bits for transmission” in the following way:

The method may begin at step 210 where the wireless transmitter obtains information bits. For example, network node 120 may obtain ***information bits (e.g., user data)*** from a high layer ***for wireless transmission*** to wireless device 110.

(JX-0004 at 27:45-49 (emphases added).).

It is clear that the term “information bits” refers to the “user data” that is the input to the “encode” operation recited in limitation [1.B], i.e., “encode information bits for transmission.” (*Id.* at 27:46-48, cl. 1.). By contrast, the “***encoded*** information bits” recited in limitation [1.C] are the ***result*** of the “encode” operation. This distinction between “information bits” and “encoded information bits” is depicted below in annotated Figure 2 of the ’893 patent, wherein the transmitter “obtain[s] information bits” at step 210, which are provided to the “encode” step 212, and which then produces distinct “encoded information bits” that are transmitted in step 214.

Figure 35: Annotated Figure 2 of the '893 Patent



(RRBr. at 49 (citing JX-0004 at Fig. 2 (annotated))).

In limitation [1.C], “the encoded information bits” resulting from the previous “encode” step are then “transmit[ed] ... to a 5G NR wireless receiver.” (JX-0004 at cl. 1.). The claim does *not* recite transmission of only so-called “encoded information bits *for transmission*,” as Dr. Wesel contended.

As Respondents asserted, by reciting that “the encoded information bits” must be “transmit[ted],” rather than a subset thereof, this refers to the entire set of encoded information bits that were encoded using the PCM. (RRBr. at 47.). *See Harris Corp. v. Fed. Exp. Corp.*, 502 F. App’x 957, 963 (Fed. Cir. 2013) (holding that limitation reciting “transmitting the accumulated, stored generated aircraft data” requires all such data to be transmitted, because “although the claim does not expressly require that ‘all’ of the accumulated data must be transmitted, it similarly lacks any indication that some subset of the accumulated data should be transmitted, and if so what that subset should be”); *see also Infernal Tech., LLC v. Activision Blizzard Inc.*, No. 2021-2349, 2023 WL 370602, at *3 (Fed. Cir. Jan. 24, 2023) (“That the patentee did not claim a subset of ‘observer data’ . . . indicates that the patentee intended to refer to the same ‘observer data’ . . .”).

Here, Dr. Wesel admitted that “the way the products at issue in this investigation

implement puncturing is that they first encode the information bits and then puncture the encoded bits.” (Tr. (Wesel) at 486:3-7.). Thus, there is no dispute that the punctured “encoded information bits” are encoded but discarded before transmission. Accordingly, because less than all encoded information bits are transmitted as required in claim 1, the limitation is not met.

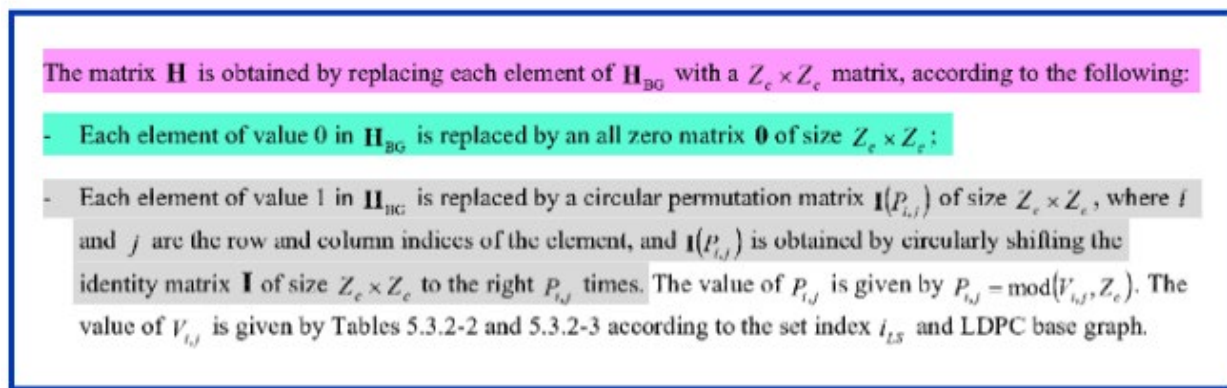
For the reasons discussed above, Ericsson has proven by a preponderance of evidence that the Accused and DI Products practice limitation [4.C] of claim 4 but have failed to meet its burden that limitation [1.C] of claim 1 of the '893 patent.

- d) **[1.D] / [4.D]: “wherein the base matrix has one entry for each $Z \times Z$ sub-matrix, the entry being 0 corresponding to the sub-matrix being a null matrix, and the entry being 1 corresponding to the sub-matrix being a cyclic-permutation matrix obtained from a $Z \times Z$ identity matrix by shifting columns to the right by k elements,”**

The Accused and DI Products use a PCM *described by* limitations [1.D] and [4.D]. (Tr. (Wesel) at 428:17-430:10.).

As Dr. Wesel explained, as shown in his demonstrative below, TS 38.212 requires that the Accused and DI Products carry out LDPC coding using a PCM where each element of value 0 in the base matrix H_{BG} is to be replaced by an all zero matrix (highlighted in green below), and each element of 1 by a circular permutation matrix $I(P_{i,j})$ (highlighted in pink below). (Tr. (Wesel) at 428:17-430:10.). The matrix $I(P_{i,j})$ is obtained by circularly shifting the columns of the identity matrix I of size $Z_c \times Z_c$ to the right $P_{i,j}$ times. (*Id.*).

Figure 36: Wesel Demonstrative Showing Annotated 5G Standard Regarding Base Matrix H



(CDX-0012C.0039 (citing CX-0557(TS 38.212) at § 5.3 (annotated))).

Respondents and Dr. Liu argued that the Accused and DI Products do not practice limitations [1.D] and [4.D] because the claims require the source code of the Accused and DI Products to store or otherwise represent all 3,128 zeros and ones of the base matrix. (RDX-0008C.0019; Tr. (Liu) at 1153:1-4.). In other words, as Ericsson noted, Respondents and Dr. Liu did not dispute that encoding and decoding is done using the claimed PCM; instead, they disputed what they understood to be a required implementation of encoding and decoding under which each component of the PCM must be represented in exactly the same form as the description of the PCM in the claims. (CBr. at 126.). However, as discussed in Section X.A.2(b), the format of the description of the PCM is not required by the claims. All the claims require is that the PCM *described by* that description be used in encoded or decoding information bits.

Respondents' argument to the contrary is disconnected from the language of the claims. As Dr. Wesel described, the claim language does not require that a given encoder and decoder implementation of the Accused and DI Products actually store or represent each and every one

and zero of a given base matrix; instead, the claims require that the Accused and DI Products use a parity check matrix that is described by a base matrix with 3,128 zeroes and ones in combination with the other components of the description. (Tr. (Wesel) 412:18-22.). However, Respondents' contrary reading of the claim does not make any logical sense. During cross-examination, Dr. Liu agreed that there are 316 1s in a base matrix described in the '893 patent. (Tr. (Liu) at 1188:11-13.). Dr. Liu also agreed that for encoding and decoding using a particular PCM, it is sufficient for a given encoder or decoder to omit some or all of the zero entries of the base matrix as long as the positions of the "one" entries are known. (*Id.* at 1188:7-10.). As Ericsson noted, Dr. Liu's position that the Accused and DI Products must include a description of 3,128 values would effectively require a given encoder or decoder to store or otherwise include ten times the amount of information necessary to encode or decode using the PCM described in the claims. (CBr. at 127.).

In sum, the Accused and DI Products use the PCM *described by* a base matrix of ones and zeros as recited in the claims for encoding and decoding. Respondents and Dr. Liu agreed that the products comply with the TS 38.212 standard. (Tr. (Liu) at 1187:1-4.). Dr. Liu also agreed that the PCM described by the claims is the same PCM described in TS 38.212. (Tr. (Liu) at 1187:5-18.).

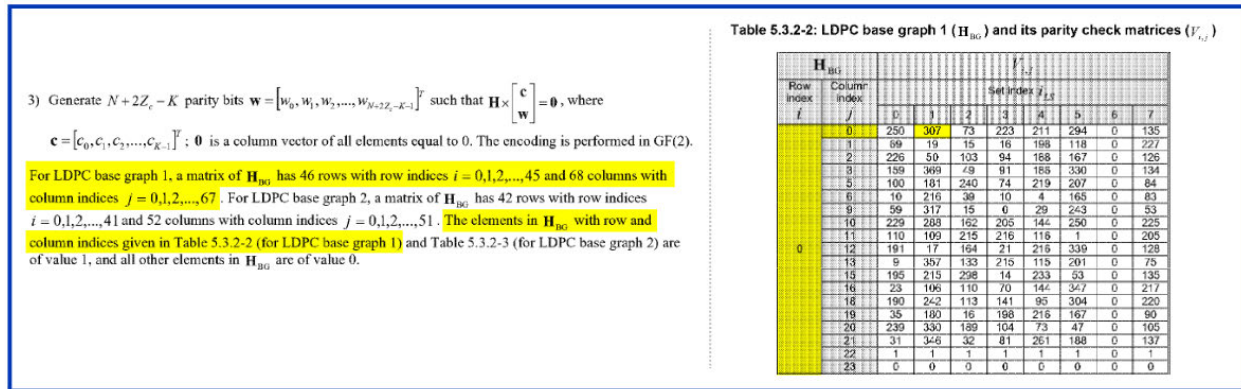
Accordingly, Ericsson has proven by a preponderance of evidence that the Accused and DI Products practice these limitations of claims 1 and 4 of the '893 patent.

- e) [1.E] / [4.E]: “wherein non-zero entries in the base matrix are described by triples (e, r, c) denoting that the nonzero entry with number e is in row r and column c of the base matrix, the triples being given by: (1, 1, 1) (2, 1, 2) (3, 1, 3) (4, 1, 4) (5, 1, 6) (6, 1, 7) (7, 1, 10) (8, 1, 11) (9, 1, 12) (10, 1, 13) (11, 1, 14) (12, 1, 16) (13, 1, 17) (14, 1, 19) [. . .] (307, 44, 66) (308, 45, 1) (309, 45, 8) (310, 45, 10) (311, 45, 23) (312, 45, 67) (313, 46, 2) (314, 46, 7) (315, 46, 11) (316, 46, 68),”

The Accused and DI Products implement LDPC channel coding using a PCM *described* by limitations [1.E] and [4.E]. (Tr. (Wesel) at 430:11-431:6.).

Dr. Wesel explained that, as mandated by 38.212, the Accused and DI Products each use LDPC coding with a PCM described by base matrix where the ones are described by a triple consisting of the row number for Set Index $i_{LS} = 1$ in Table 5.3.2-2, the row index, and the column index denotes each non-zero entry of the matrix. (Tr. (Wesel) at 430:11-431:6.).

Figure 37: Wesel Demonstrative Showing Annotated Table 5.3.2-2 of the 5G Standard



(CDX-0012C.0040 (citing CX-0557 (TS 38.212) at § 5.3.2 (annotated))).

Dr. Wesel explained that the number “e” in the triples of the claim corresponds to the row number in Table 5.3.2-2. (Tr. (Wesel) at 430:11-431:6.). The “row r” corresponds to a row index $i=r-1$, and the “column c” corresponds to a column index $j=c-1$ in Table 5.3.2-2. (*Id.*). For the example of set index $i_{LS}=1$, the triple “(e, r, c)” = “(1,1,1)” specifies that the e=1st row

of Table 5.3.2-2 denotes an entry “1” in the element with row index $i=0$ ($= 1 - 1$) and with column index $j = 0$ ($= 1 - 1$) of matrix H_{BG} . (*Id.*).

Respondents and Dr. Liu presented two (2) arguments to suggest that this limitation is not met. First, Respondents appear to be arguing that because there is no label associated with rows in the table of the standard, there is no row corresponding to the “e” value, and therefore the “ones” of the base matrix are not described by the triples values set forth in the claims. (*See, e.g.,* RRRBr. at 57.). Second, Respondents and Dr. Liu relied on their interpretation of the [REDACTED] [REDACTED] (Tr. (Liu) at 1153:5-10.).

As discussed above in Section X.A.2(d), this argument again is disconnected from the language of the claims. As Dr. Wesel described, the claim language does not require that a given encoder and decoder implementation of the Accused and DI Products actually store or represent the 316 triples of a given base matrix (though, in many cases they do); instead, the claims require that the Accused and DI Products *use* a parity check matrix that is described by a base matrix where the 1s are located as described by the recited triples. (Tr. (Wesel) 412:18-22.).

Additionally, Respondents’ assertion that TS 38.212 does not include the claimed “triples” of the claim because the value “e” is not explicitly “labeled” is incorrect. Dr. Wesel explained where each value of the triples, including “e,” can be located in Table 5.3.2-1 of TS 38.212.

Q. And what are each of those three values?

A. So the first value is a counter. It tells us which one of the 316 1’s in the base graph we’re talking about just by going sequentially through them. The second entry is the row position of the 1, and the third entry is the column position of the 1.

Public Version

Q. If I could get CDX 12.40. So here we have the portion of the standard that you've been identifying with respect to the triples. Can you share with us which values correspond to the row, the column, and the counter, as you've been calling it?

A. So the counter is telling us which row to look at in the table, and the row index is -- or the middle entry which tells us the row is under the column row index in the table. And the third entry that tells us the column is under the column index in the table.

Q. And when you're saying the counter value, if we could go to the next slide, slide 41, counsel asked you a few questions about the calculation here where $V_{i,j}$ -- or the value of $V_{i,j}$ and seemed to indicate that that only indicates two values. What does the set index ILS tell us?

A. So if we look in the column under the set index ILS equals 1, we can see that those values of $V_{i,j}$ show up in the row that corresponds to that counter e .

Q. So what row is the value 307 in?

A. It's in the first row, row 1.

Q. And the value of 19, what row is that in?

A. That's in row 2.

(Tr. (Wesel) at 482:17-483:21.).

When Dr. Liu was asked whether he could locate the "e" value of given triple of TS 38.212, Dr. Liu did not have any problem identifying the value that corresponds to the "e" of the triples.

Q. All right. Now if we look at where set index equals 1 there, highlighted in yellow, the value 307 is in the first row, right?

A. 307 in the first row, yes.

Q. Which row is the value 19 in?

A. The second row?

Q. The second row.

Public Version

A. If you're starting 307 as the first row, defined as the first row, then 19.

Q. So you don't have any issue identifying which row these values are in, right?

A. At this moment I don't.

(Tr. (Liu) at 1190:21-1191:7.).

Dr. Liu also confirmed that the Accused and DI Products comply with the 5G standard.

Tr. (Liu) at 1187:1-4 ("Q. Dr. Liu, you don't contest that the accused and domestic industry products comply with what's in the standard, correct? A. They comply."). Although the base matrix described in the 5G NR standard and as used in the Accused and DI Products are not expressly written out in exactly the same format as the claims, the claims do not require such a format.

In sum, the Accused and DI Products use the exact PCM described by the claimed triples for encoding and decoding. Dr. Liu agreed that the products comply with the TS 38.212 standard. (Tr. (Liu) at 1187:1-4.). Dr. Liu also agreed that the PCM described by the claims is the same PCM described in TS 38.212. (Tr. (Liu) at 1187:5-18.). Additionally, Dr. Liu agreed that triples are one way to describe that parity check matrix (Tr. (Liu) at 1184:6-1185:5), which is all that the claims require.

For the foregoing reasons, Ericsson has proven by a preponderance of evidence that the Accused and DI Products practice these limitations of claims 1 and 4 of the '893 patent.

f) **[1.F] / [4.F]: "wherein for the non-zero entry with number e the number k is defined by a shift coefficient given by $\text{mod}(V_e, Z)$, with V_e denoting the e-th element of the shift vector and the shift vector is: [307, 19, 50, 369, 181, 216, 317, 288, 109, 17, 357, 215, 106, 242, 180, 330, 346, 1, 0 [. . .] 135, 149, 15, 0]."**

The Accused and DI Products encode and decode using an LDPC PCM *described by* limitations [1.F] and [4.F]. (Tr. (Wesel) at 431:6-432:7.).

Dr. Wesel described that, as mandated by TS 38.212, the Accused and DI Products encode and decode using a PCM where the value of $P_{i,j}$ is given by $P_{i,j} = \text{mod}(v_{i,j}, z_c)$. “Ve” in the claims corresponds to the element $V_{i,j}$ for set index $i_{LS}=1$ in the i th row of Table 5.3.2-2.

Figure 38: Wesel Demonstrative Showing Annotated 5G Standard

The matrix $\mathbf{H}$ is obtained by replacing each element of $\mathbf{H}_{BG}$ with a $Z_c \times Z_c$ matrix, according to the following:

- Each element of value 0 in $\mathbf{H}_{BG}$ is replaced by an all zero matrix $\mathbf{0}$ of size $Z_c \times Z_c$;
- Each element of value 1 in $\mathbf{H}_{BG}$ is replaced by a circular permutation matrix $\mathbf{I}(P_{i,j})$ of size $Z_c \times Z_c$, where i and j are the row and column indices of the element, and $\mathbf{I}(P_{i,j})$ is obtained by circularly shifting the identity matrix $\mathbf{I}$ of size $Z_c \times Z_c$ to the right $P_{i,j}$ times. The value of $P_{i,j}$ is given by $P_{i,j} = \text{mod}(v_{i,j}, Z_c)$. The value of $v_{i,j}$ is given by Tables 5.3.2-2 and 5.3.2-3 according to the set index i_{LS} and LDPC base graph.

(CDX-0012C.0041 (citing CX-0557 (TS 38.212) at § 5.3.2 (annotated))).

Dr. Wesel explained that the values of the claims exactly match the values of Table 5.3.2-2 for set index $i_{LS}=1$, which is shown below. (Tr. (Wesel) at 431:23-432:7.). In both the claims and the 5G standard, the values start with 307, and match each of the specific values recited in the claims.

Figure 39: Wesel Demonstrative Showing Annotated Table 5.3.2-2 of the 5G Standard

$\mathbf{H}_{BG}$		Set index i_{LS}							
Row index i	Column index j	0	1	2	3	4	5	6	7
0	0	250	307	73	223	211	294	0	135
	1	69	19	15	16	198	118	0	227
	2	226	50	103	94	188	167	0	126
	3	159	369	49	91	186	330	0	134
	5	100	181	240	74	219	207	0	84
	6	10	216	39	10	4	165	0	83
	9	59	317	15	0	29	243	0	53
	10	229	288	162	205	144	250	0	225
	11	110	109	215	216	116	1	0	205
	12	191	17	164	21	216	339	0	128
	13	9	357	133	215	115	201	0	75
	15	195	215	298	14	233	53	0	135
	16	23	106	110	70	144	347	0	217
	18	190	242	113	141	95	304	0	220
	19	35	180	16	198	216	167	0	90
	20	239	330	189	104	73	47	0	105
	21	31	346	32	81	261	188	0	137
	22	1	1	1	1	1	1	0	1
	23	0	0	0	0	0	0	0	0

(CDX-0012C.0041 (citing CX-0557 at § 5.3 (annotated))).

Dr. Liu disputed whether the Accused and DI Products compute a modulo and use the claimed shift vectors to arrive at the shift coefficients of the claims. (Tr. (Liu) at 1154:5-24.). Respondents and Dr. Liu did not dispute that encoding and decoding is done using the claimed PCM; rather, they disputed what they believed to be a required implementation of encoding and decoding.

This argument is again disconnected from the language of the claims. As Dr. Wesel explained, the claim language does not require that a given encoder and decoder implementation of the Accused and DI Products actually compute a modulo; instead, the claims require that the Accused and DI Products use a parity check matrix that is described by specific shift coefficients that result from the computation using a modulo mapping function. (Tr. (Wesel) at 412:23-413:2.). There is no dispute that the actual values of the shift coefficients computed using the modulo mapping function are the same as the values recited in the 5G standard and used in the Accused and DI Products. (Tr. (Liu) at 1187:1-4.). Again, a parity check matrix described by the exact shift coefficients described in the claims must be used in order to encode and decode information bits in a 5G-compliant device. The claim only requires the use of a PCM that is described by the combination of shift coefficients, base matrix and shift sizes set forth in the claims.

Moreover, Respondents' reading of the claim is inconsistent with operations of the Accused and DI Products themselves. Dr. Liu's own testimony confirms that the Accused and DI Products do, in fact, use the shift vectors of the claims. Specifically, Dr. Liu stated that [REDACTED] (Tr. (Liu) at 1154:20-21.). This statement is a distinction without a difference. [REDACTED]

[REDACTED], demonstrating that both a modulo and the shift vector of the claims are used by the Accused and DI Products. (Tr. (Wesel) at 446:15-24.).

In sum, as Dr. Wesel testified, the Accused and DI Products use the PCM *described by* the claimed shift coefficients for encoding and decoding. Dr. Liu agreed that the products comply with the TS 38.212 standard. (Tr. (Liu) at 1187:1-4.). Dr. Liu agreed that the PCM described by the claims is the same PCM described in TS 38.212. (Tr. (Liu) at 1187:5-18.). Dr. Liu also agreed that the claimed shift coefficients are one descriptor of the parity check matrix of the claims and the standard. (Tr. (Liu) at 1185:6-15.).

Accordingly, Ericsson has proven by a preponderance of evidence that the Accused and DI Products practice these limitations of claims 1 and 4 of the '893 patent.

B. Technical Prong of Domestic Industry

1. The DI Products Practice Claim 4

The DI Products practice the asserted claim 4 of the '893 patent for the reasons described above. The Parties agreed that the Samsung DI Products “practice the accused functionalities in the same way for the purposes of this Investigation” as the Qualcomm-Based Lenovo Accused Products. (Am. Joint Statement at § II.A.). The Parties additionally did not dispute that, like the Accused Products, the Samsung and Ericsson DI Products “comply with the portions of the 3GPP 5G NR technical specifications relevant to the '893 Patent.” (*Id.* at § VI.A (listing TS 38.212 (CX-0557).).

For these reasons, Ericsson has proven by a preponderance of evidence that the DI Products practice claim 4 of the '893 patent.

C. Invalidity

1. The Asserted Claims of the '893 Patent Are Patent Eligible

Respondents have not presented let alone proven by clear and convincing evidence that the asserted claims of the '893 patent are directed to patent-ineligible subject matter.

a) *Alice* Step One

Respondents argued that the asserted claims of the '893 patent are directed to “abstract mathematical conception.” (RBr. at 88.). By contrast, Dr. Wesel testified, the claims are directed to a specific 5G NR transmitter or receiver that encodes/decodes using a specific PCM (described by a shift coefficient design) to improve block-error rate performance. (Tr. (Wesel) at 1444:22-1445:25.). Because the weight of the evidence shows that the claimed invention of the '893 patent improves an existing technological process, it is a finding that the asserted claims are not directed to an abstract idea. *See Enfish*, 822 F.3d at 1335; *Koninklijke*, 942 F.3d at 1150.

With respect to claims directed to improvements in computer-related technology, “it [is] relevant to ask whether the claims are directed to an improvement to computer functionality versus being directed to an abstract idea, even at the first step of the *Alice* analysis.” *Enfish*, 822 F.3d at 1335. The Federal Circuit has “found software inventions to be patent-eligible where they have made non-abstract improvements to existing technological processes and computer technology.” *Koninklijke*, 942 F.3d at 1150. “To be patent-eligible, the claims must recite a specific means or method that solves a problem in an existing technological process.” *Id.* However, simply because a claim employs a mathematical formula does not mean that it is patent ineligible. *California Institute of Technology v. Broadcom Ltd.*, 25 F.4th 976, 988 (Fed. Cir. 2022) (claim not patent ineligible where it “claims more than a mathematical formula because it is directed to an efficient, improved method of encoding data that relied in part on

irregular repetition”).

Here, the asserted claims of the ’893 patent are directed to specific PCM’s used to improve block-error rate performance. (JX-0004 at cls. 1, 4.). There is a restriction on how to improve block-error rate recited in the claims—using the PCM described by the base matrix, shift size, and shift coefficients. In other words, the asserted claims of the ’893 patent do not merely recite the improved result, but instead recite the specific transmitter and PCM that is used to achieve that improved result. The asserted claims are not so broad as to encompass *any* transmitter that encodes using any PCM that improves block error rate performance. *Finjan, Inc. v. Blue Coat Sys., Inc.*, 879 F.3d 1299, 1305-06 (Fed. Cir. 2018) (holding that claims “recite more than the mere result”).

Respondents’ argument that the claimed invention does not improve block error rate has little to no merit because the patent specification makes clear that the invention is directed to improving block-error rate performance. Moreover, in its obviousness arguments, Respondents conceded that the PCM has an effect on block-error rate performance. In other words, its concession effectively invalidates its other, contradictory argument that the claimed invention does not improve block rate error.

For the foregoing reasons, Respondents have not proven by clear and convincing evidence that the ’893 patent is directed to an abstract idea under *Alice* step one.

b) *Alice* Step Two

Because the asserted claims are not directed to an abstract idea under step one of *Alice*, there is no need to proceed to step two of the *Alice* analysis. *See CardioNet*, 955 F.3d at 1371; *Enfish*, 822 F.3d at 1334. However, even if the claims were abstract under *Alice* step one, it is a finding of this ID that the asserted claims would still be eligible under step two of *Alice*.

Under the second step of the Alice analysis, the elements of the claims must be considered “both individually and as an ordered combination to determine whether the additional elements transform the nature of the claim into a patent-eligible application.” *Alice*, 134 S.Ct. at 2355 (internal quotations omitted). “Whether the claim elements or the claimed combination are well-understood, routine, convention is a question of fact.” *Aatrix Software, Inc. v. Green Shares Software, Inc.*, 882 F.3d 1121, 1128 (Fed. Cir. 2018).

Here, the asserted claims in their totality are directed to a specific transmitter that is operable to encode/decode using a specific PCM. *Visual Memory LLC v. NVIDIA Corp.*, 867 F.3d 1253, 1260 (Fed. Cir. 2017). Accordingly, Respondents have not shown let alone proven by clear and convincing evidence that the asserted claims are directed to patent-ineligible subject matter under *Alice* step two.

2. The Asserted Claims of the '893 Patent Are Not Obvious

a) Overview of the Prior Art

i. Jayasinghe (RX-0822, RX-1438)

Tdoc R1-1711545 (“Jayasinghe”) is titled “Summary of [89-24] Email discussion on LDPC code base graph #1 for NR.” (RX-0822.0001.). Jayasinghe was authored by Nokia engineer Keeth Jayasinghe and is dated June 20, 2017. (*Id.*). According to Respondents, Jayasinghe “summarize[s] the state of agreement regarding the details of LDPC encoding to be adopted into the 5G NR standard.” (RPBr. at 64 (citing RX-0822; RX-1437; RX-1438; RX-2095C ¶¶ 151–57; RX-1304; RX-1391).).

The Parties did not dispute that Jayasinghe is prior art to the '893 patent. (Am. Joint Statement at § VI.G.).

ii. Yue (RX-0849)

U.S. Patent Publication No. 2010/0257425 A1, entitled “Systems and Methods for Constructing the Base Matrix of Quasi-Cyclic Low-Density Parity Check Codes,” to Guosen Yue et al. (“Yue”), was filed on January 28, 2020 and published on October 7, 2010. (RX-0849 at (10), (22), (43), (54), (75).). The Parties did not dispute that Yue is prior art to the ’893 patent. (Am. Joint Statement at § VI.G.).

iii. Chiu (RX-0848)

U.S. Patent No. 10,164,659, entitled “QC-LDPC Coding Methods and Apparatus,” to Chiu et al. (“Chiu”), was filed on May 12, 2017 and issued on December 25, 2018. (RX-0848 at (10), (22), (45), (54), (72).). The Parties did not dispute that Chui is prior art to the ’893 patent. (Am. Joint Statement at § VI.G.).

b) Jayasinghe Fails to Render Obvious the Asserted Claims of the ’893 Patent

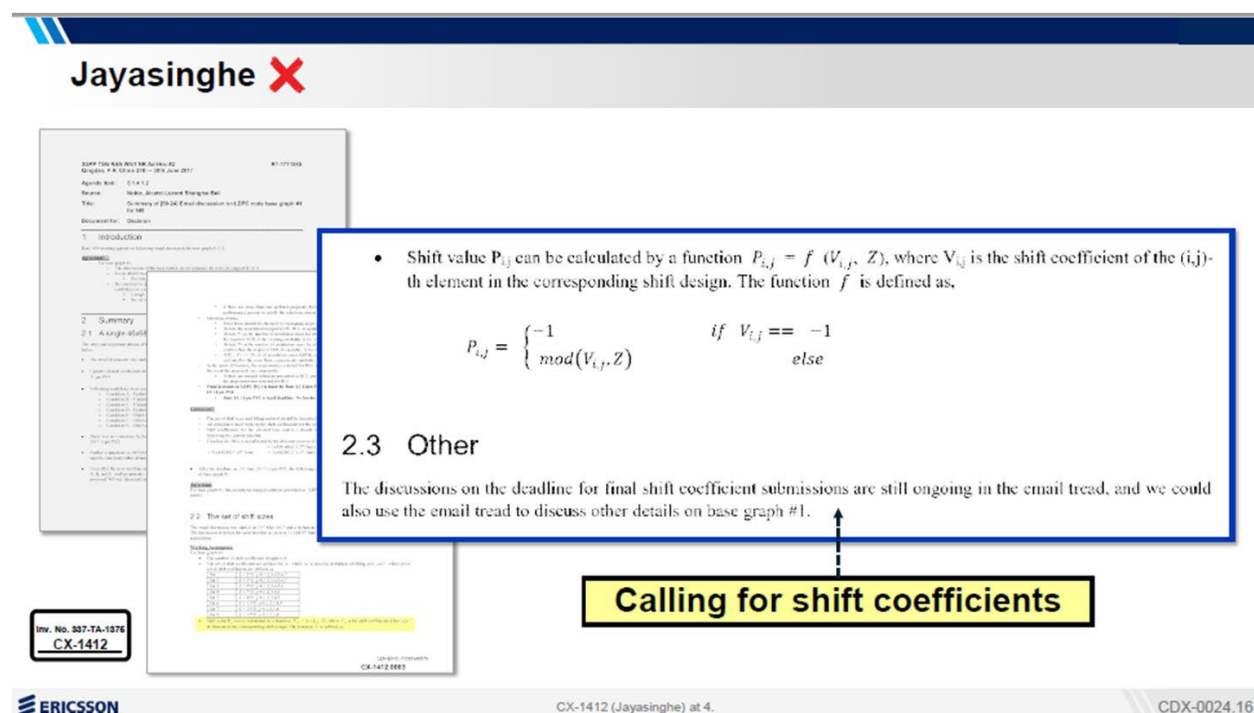
Respondents’ assertion that “[n]o dispute exists that Jayasinghe discloses, either explicitly or implicitly, all elements of claims 1 and 4 except the specific shift vector values” is incorrect. (RPBr. at 64 (citations omitted).). As Dr. Wesel testified, there was not an encoder or decoder in the prior art that used the parity check matrices described by the shift coefficients of the ’893 patent. (Tr. (Wesel) at 1481:22-1482:7.). Although Ericsson did not contest that certain claim limitations in isolation were known in the prior art, there did not exist in the prior art an LDPC encoder or decoder that used PCMs described by the shift coefficients of limitations [1.F] and [4.F] of the asserted claims. *Id.*

Specifically with respect to limitations [1.F] and [4.F],²⁷ there is no dispute that

²⁷ Respondents referred to limitations [1.F] and [4.F] as [1.6] & [1.7], and [4.6] & [4.7].

Jayasinghe does not disclose any shift coefficient design, let alone the PCMs defined by the shift coefficients claimed in the '893 patent, and therefore does not anticipate or render obvious the claims. (Tr. (Wesel) at 1447:23-1448:1.). Respondents and Dr. Liu agreed. (Tr. (Liu) at 1199:24-1200:4, 1167:5-12.).

Figure 40: No Disclosure in Jayasinghe of Shift Coefficients



(CDX-0024C.0016.).

Jayasinghe merely identifies the need for a shift coefficient design for different lifting factors, but it does not suggest or provide motivation for the claimed shift coefficient design or resulting shift coefficients. (CX-1412 (Jayasinghe)²⁸ at 4; Tr. (Wesel) at 1447:5-1448:1.).

c) Jayasinghe in Combination with Yue Fails to Render Obvious the Asserted Claims of the '893 Patent

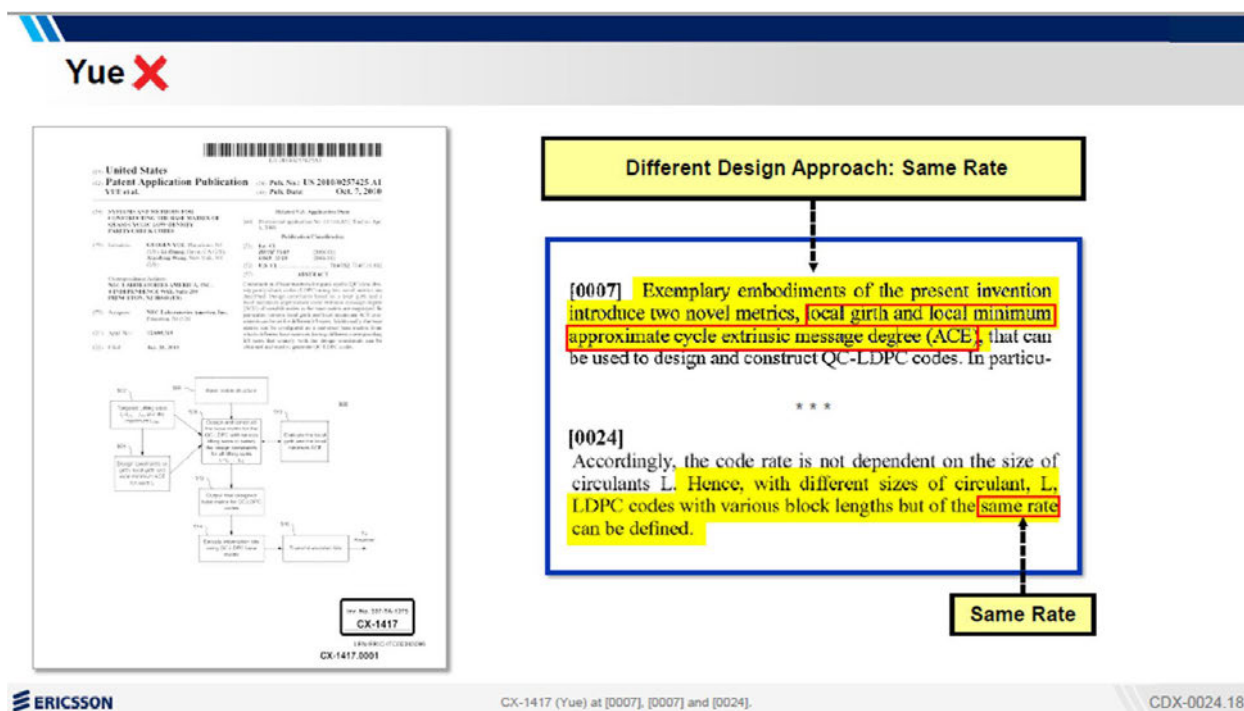
Dr. Wesel explained that Jayasinghe and Yue do not disclose or render obvious the

²⁸ This is the same exhibit as RX-0822.

values of the shift vector or shift coefficient for the PCMs claimed in [1.F] and [4.F]. (Tr. (Wesel) at 1447:5-1449:12.). Respondents' expert, Dr. Liu, did not contest that any of these references disclose the values claimed or an encoder or decoder that uses the PCMs resulting from those values. (Tr. (Liu) at 1199:24-1200:4; 1201:4-19.).

As discussed above in Section X.C.2(b), Jayasinghe does not teach the shift coefficient design or claimed shift coefficients. In addition, Yue, which was before the examiner during prosecution, does not disclose the claimed shift coefficients, and neither teaches nor suggests generating shift coefficients using different ACE constraints for different code rates. (Tr. (Wesel) at 1448:2-1449:12.). As Ericsson pointed out, Yue only considers the design of shift coefficients for a family of QC-LDPC codes that all have the same rate. (CRBr. at 68; CX-1417 (Yue) at [0024].). Dr. Wesel explained that Yue: (1) "teaches its own version, its own novel way of using ACE called local girth and local ACE"; and (2) "is directed towards designing LDPC codes with the same base graph, different [. . .] shift size, with various block lengths but of the same rate." (Tr. (Wesel) at 1449:2-12.).

Figure 41: No Disclosure in Yue of Claimed Shift Coefficients



(CDX-0024C.0018; Tr. (Wesel) at 1449:2-12.).

Yue's disclosure is the prior art approach that the '893 patent improves upon. As observed in the '893 patent, existing solutions, like Yue, applied ACE constraints to the full PCMs. (JX-0004 at 7:17-28.). The '893 patent's invention improved over these previous designs by applying different ACE constraints for the different submatrices that correspond to the different rates of the family of rate compatible LDPC codes. (*Id.* at 5:19-22, 7:29-39.). This resulted in improved PCMs as described in the claims that provided better performance for a variety of different coding rates.

Accordingly, Yue did not consider designing for different submatrices that correspond to the different rates of the family of rate compatible LDPC codes. Dr. Wesel explained that, without this fundamental innovation, the optimization approach of Yue would not have produced the specific shift coefficient vectors and resulting PCMs disclosed in claim elements [1.F] and

[4.F]. (Tr. (Wesel) at 1451:17-21.).

In sum, Jayasinghe and Yue, alone and in combination, fail to render obvious the shift vector or shift coefficient for the PCMs disclosed in claim elements [1.F] and [4.F]. Yue teaches away from the approach of the '893 patent by suggesting that shift coefficients should be generated by applying local girth ACE constraints for a single rate, rather than different ACE constraints for the distinct submatrices of the PCMs associated with transmitting at different rates. (CX-1417 (Yue) at [0024]; Tr. (Wesel) at 1449:2-12.).

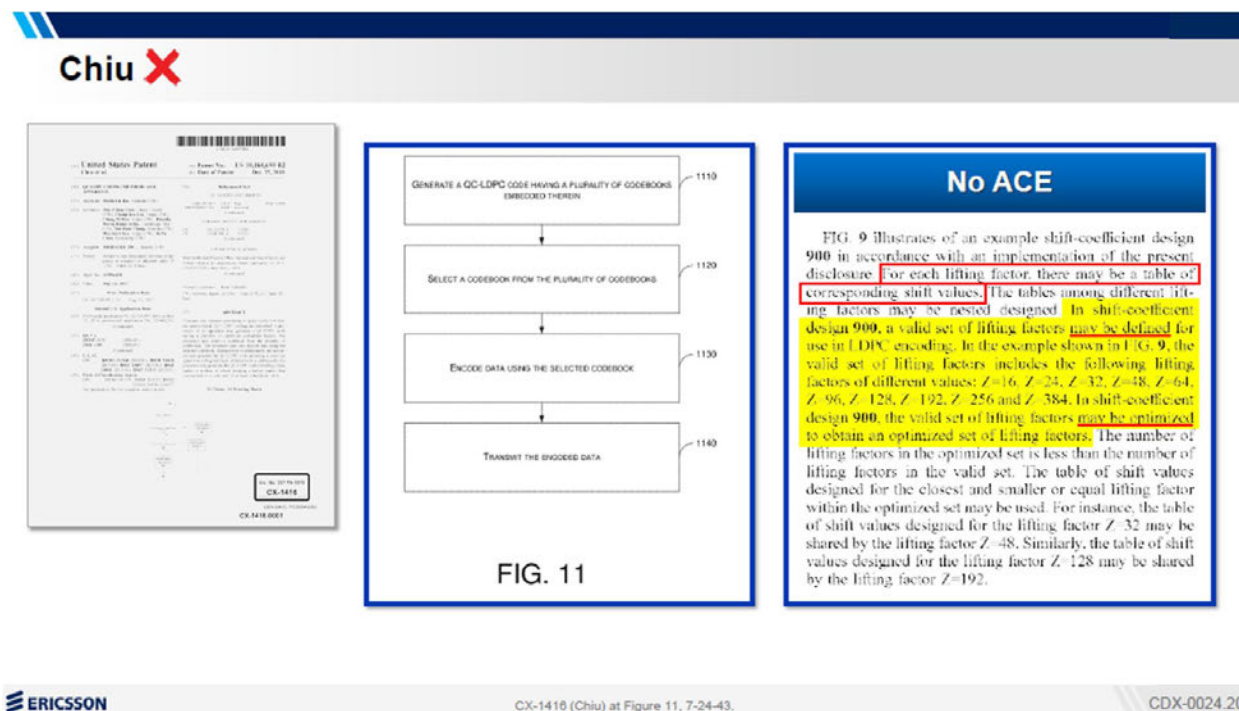
Thus, for these reasons, Respondents have failed to prove by clear and convincing evidence that the asserted claims of the '893 patent are rendered obvious by Jayasinghe in view of Yue.

d) Jayasinghe in Combination with Chiu Fails to Render Obvious the Asserted Claims of the '893 Patent

Dr. Wesel testified that Jayasinghe and Chiu do not disclose or render obvious the specific values of the shift vectors in [1.F] and [4.F] or the PCMs described by those values. (Tr. (Wesel) at 1447:23-1448:1; 1449:13-1450:4.). Respondents and Dr. Liu did not contest that either of these references disclose the values claimed. (Tr. (Liu) at 1199:24-1200:4; 1201:12-19.).

As discussed above in Section X.C.2(b), Jayasinghe does not teach the shift coefficient design or claimed shift coefficients. Dr. Wesel explained that the teachings of Chiu are not sufficient to teach a one of ordinary skill how to design shift coefficients using ACE parameters at all, let alone to produce the shift vector or shift coefficients for the PCMs that are disclosed in elements [1.F] and [4.F]. (Tr. (Wesel) at 1449:17-1449:4.).

Figure 42: No Disclosure in Chiu of Claimed Shift Coefficients



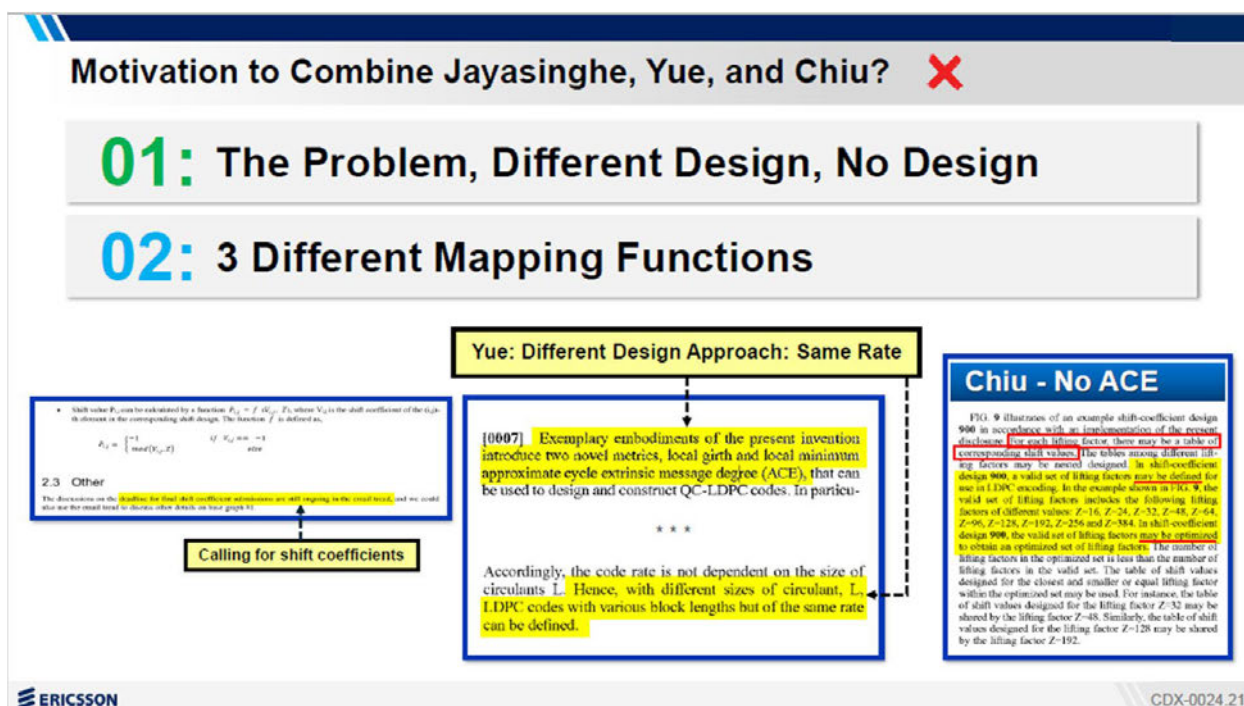
(CDX-0024C.0020 (citing CX-1416 (Chiu) at Fig. 11, 7:24-43).).

As Ericsson noted, there is no disclosure of an actual procedure to design shift coefficients anywhere in the Chiu patent. (CRBr. at 70 (citing CX-1416 (Chiu)). Chiu merely states that it would use a procedure to design shift coefficients for some values of Z and reuse them for other values of Z and describes a method of storing the shift coefficients in a table once generated. (CX-1416 (Chiu) at 7:24-60; Tr. (Wesel) at 1449:17-1449:4.). Thus, the only teaching provided in Chiu about shift coefficient design is incompatible with Jayasinghe and fails to teach the claimed PCMs or any design approach that would have suggested it.

e) No Motivation to Combine Jayasinghe, Yue, and Chiu

Dr. Wesel further explained that there is no motivation to combine Jayasinghe, Yue, and Chiu. (Tr. (Wesel) at 1450:5-1451:6.).

Figure 43: Wesel Demonstrative Showing No Motivation to Combine



(CDX-0024C.0021).

First, Dr. Wesel testified that the three (3) references are directed toward solving different problems. Dr. Wesel explained that where Jayasinghe calls for shift coefficients generally, Yue considers designing shift coefficients based on a given ACE constraint for LDPC codes of the same rate, and Chiu does not consider the design of shift coefficients through ACE constraints at all, but instead focuses on a method of storing shift coefficients after they've already been generated. (Tr. (Wesel) at 1450:10-20; 1451:4-15.).

Second, Dr. Wesel testified that the three (3) methods taught in these three (3) references teach different, incompatible mapping functions. (Tr. (Wesel) at 1450:21-1451:3.). In Jayasinghe, the method for recovering the cyclic shifts for a specific lifting size is taught to be calculated by a modulo function $P_{i,j} = \text{mod}(V_{i,j}, Z)$, where $V_{i,j}$ is the shift coefficient of the (i,j) -th element and Z is the lifting size. (CX-1412 (Jayasinghe) at 4.). In contrast, the mapping

function taught by Yue to recover the set of cyclic shifts $\{\alpha_{ij}\}$ for a specified lifting size L by using the floor function. (CX-1417 (Yue) at [0051]). Chiu teaches yet another mapping function, a modulo mapping with a perturbation function $f(Z)$. (CX-1416 (Chiu) at 7:44-60.). Dr. Wesel explained that given the differences in the mapping functions, a person of skill would not have been motivated to combine the teachings of any combination of Jayasinghe, Yue, or Chiu. (Tr. (Wesel) at 1450:21-1451:3.).

Because of these incompatibilities, it is a finding that one of ordinary skill would not have been motivated to combine the teachings of Jayasinghe, Yue, and Chiu, nor had a reasonable expectation of success. Moreover, for the reasons described above, because Jayasinghe combined with either Yue and Chiu alone does not render the claimed PCMs obvious, it is also a finding that any combination of Jayasinghe, Yue, and Chiu would still fall short of teaching the claimed PCM using Ericsson's novel shift coefficients as claimed.

f) The File History Does Not Render the Asserted Claims Obvious

Respondents contended that the prosecution history of the asserted claims of the '893 patent and its purported interpretation that the "Examiner found that the claims were obvious over the claims of the U.S. Patent No. 10,644,724" support their claims of obviousness. (RBr. at 95.). In making this argument, Respondents claimed that "the reason for allowance [of the '724 Patent] was that the claimed base matrix was not found in the prior art." (*Id.* at 96.). Respondents then focused on the examiner's double-patenting rejections (statutory and non-statutory obviousness-type) and Ericsson's subsequent filing of a terminal disclaimer.²⁹ (*Id.*).

²⁹ "A rejection based on [statutory] double patenting of the 'same invention' type finds its support in the language of 35 U.S.C. 101 which states that 'whoever invents or discovers any new and useful

Respondents' reliance on the file history is flawed for the following reasons.

First, Respondents reasoned that "Ericsson's ability to overcome [the Examiner's obviousness-type double-patenting rejection] via terminal disclaimer, appears to be based on the mistaken belief that Ericsson had invented the claimed base matrix." (*Id.* at 97.). As Ericsson pointed out, Respondents' argument is disconnected from the disclosures of the '724 and '893 patents that explicitly state that the base matrix and shift sizes were known, and the statements in the file history. (CRBr. at 73.). As Ericsson noted, despite Respondents' claims to the contrary, the patent specifications make it clear that the base matrix was already known. (Tr. (Wesel) at 1483:10-13; JX-0004 at 2:43, 7:39-29, 2:60-62, 16:15-19.). The patent specifications make clear that the invention pertains to the shift coefficients themselves.

process . . . may obtain a patent therefor . . . [.]” (JX-0014.0290 ('893 file history).). “[T]he term ‘same invention,’ in this context means an invention drawn to identical subject matter.” (*Id.* (citing *Miller v. Eagle Mfg. Co.*, 151 U.S. 186 (1894); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); *In re Ockert*, 245 F.2d 467, 114 USPQ 330 (CCPA 1957).). This type of rejection cannot be overcome by filing a terminal disclaimer. (*Id.*).

“The nonstatutory double patenting rejection is based on public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the ‘right to exclude’ granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s).” (JX-0014.0349 (citing *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); *In re Thornton*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).). This type of rejection can be overcome by the timely filing of a terminal disclaimer. (*Id.*).

Through a terminal disclaimer filed in accordance with 35 U.S.C. § 253, “any patentee or applicant may disclaim or dedicate to the public the entire term, or any terminal part of the term, of the patent granted or to be granted.” 35 U.S.C. § 253; *see also* MPEP 804.02.

Figure 44: '893 Patent Disclosures Regarding Shift Coefficients

NR supports shift sizes Z according to Table 1. One set of values $V_{i,j}$ may be specified for each set in the table for each base matrix. The specific shift coefficient design for a given Z is found by applying the function above to the values $V_{i,j}$ that are specified for the set that Z belongs to.

TABLE 1

Shift sizes Z that NR shall support

Set 1	$Z = 2 \cdot 2^j$	$j = 0, 1, 2, 3, 4, 5, 6, 7$
Set 2	$Z = 3 \cdot 2^j$	$j = 0, 1, 2, 3, 4, 5, 6, 7$
Set 3	$Z = 5 \cdot 2^j$	$j = 0, 1, 2, 3, 4, 5, 6$
Set 4	$Z = 7 \cdot 2^j$	$j = 0, 1, 2, 3, 4, 5$
Set 5	$Z = 9 \cdot 2^j$	$j = 0, 1, 2, 3, 4, 5$
Set 6	$Z = 11 \cdot 2^j$	$j = 0, 1, 2, 3, 4, 5$
Set 7	$Z = 13 \cdot 2^j$	$j = 0, 1, 2, 3, 4$
Set 8	$Z = 15 \cdot 2^j$	$j = 0, 1, 2, 3, 4$

New Radio (NR) includes two different base matrices that describe the structure of the LDPC codes. However, the corresponding shift coefficient designs that are as important for the performance of the LDPC codes have not been specified. Particular embodiments use the ACE constraints to find a shift coefficient design with good performance that avoids harmful cycles and improves the BLER performance. In particular embodiments, different ACE constraints may be used for the systematic bits and the parity bits. The following examples are the result of applying the lifting algorithm to base matrix #1 and #2 specified for NR. The format of the example vectors below is described above in the Introduction.

(CDX-0012.0019; JX-0004 at 2:43, 7:39-29, 2:60-62, 16:15-19.).

As Dr. Wesel testified, the '893 patent is directed toward the design and values of the shift coefficients of the parity-check matrix. (Tr. (Wesel) at 413:16-414:5.). Contrary to Respondents' assertions, during examination of the '724 patent, the patent examiner did not state that he understood Ericsson had invented only the claimed base matrix. (RX-0318.0171.).

Moreover, Ericsson specifically responded to the patent examiner and indicated that it "respectfully disagrees" with the examiner's reasons for allowance. (*Id.* at 0205.). Thus, the patent examiner's statements during examination do not decisively control the validity issues present here. *See, e.g., Innova/Pure Water, Inc. v. Safari Water Filtration Sys., Inc.*, 381 F.3d 1111, 1124 (Fed. Cir. 2004) ("[I]t is the applicant, not the examiner, who must give up or disclaim subject matter that would otherwise fall within the scope of the claims."); *Salazar v. Procter & Gamble Co.*, 414 F.3d 1342, 1347 (Fed. Cir. 2005) (holding a finding disavowal of claim scope is improper where the patentee does not adopt a examiner's notice of allowance).).

Additionally, during prosecution of the '893 patent, in response to the examiner's statutory double-patenting rejection, Ericsson explained that the differences between the claims

of the '724 and '893 patents were different: (1) shift vectors; (2) shift sizes; and (3) triples that describe the base matrix. (JX-0014.0326.). Again, in response to the examiner's notice of allowance, Ericsson similarly indicated that it "respectfully disagrees" with the reasons for the double patenting rejection and the examiner's reasons for the notice of allowance. (Tr. (Wesel) at 1453:22-1454:20; JX-0014.0384, 0508.).

Second, Ericsson filed a terminal disclaimer to overcome the obviousness-type double-patenting rejection, a common practice in patent prosecution. Accordingly, Ericsson properly overcame the Examiner's rejections in exchange for a reduced life of the '893 patent. Federal Circuit law is clear that "[a] terminal disclaimer is not an admission that a later-filed invention is obvious." *Motionless Keyboard Co. v. Microsoft Corp.*, 486 F.3d 1376, 1385 (Fed. Cir. 2007); *see also Ortho Pharm. Corp. v. Smith*, 959 F.2d 936, 941 (Fed. Cir. 1992) ("In legal principle the filing of terminal disclaimer simply serves the statutory function of removing the rejection of double patenting, and it raises neither presumption nor estoppel on the merits of the rejection. It is improper to convert this simple expedient 'obviation' into an admission or acquiescence or estoppel on the merits."). Thus, as Ericsson noted, Ericsson's action of filing a terminal disclaimer is not any indication of obviousness. (CRBr. at 74.).

g) The Asserted Claims Are Not the Result of Routine Optimization

Respondents argued that "the shift values are simply the non-obvious result of applying routine optimization to the prior art," and, thus, Ericsson bears the burden to demonstrate unexpected results. (RBr. at 98.). Respondents based their position on *Pfizer v. Sanofi Pasteur Inc.*, 94 F.4th 1341 (Fed. Cir. 2024), which requires that "where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by

routine experimentation.” (*Id.* (citing *In re Aller*, 220 F.2d 454, 456, 42 C.C.P.A. 824, 1955 Dec. Comm’r Pat. 136 (CCPA 1955)) (internal quotations omitted).).

However, as Ericsson pointed out, the “general conditions” of the claims of the ’893 patent are not “disclosed in the prior art.” (CRBr. at 75.). Specifically, Respondents attempted to equate the ’893 patent’s specific encoder and decoder using specific PCMs based on carefully designed shift coefficients to a generic “parameter or a variable to be optimized.” (RBr. at 99.). As Ericsson noted, the claimed PCMs are not the result of routine optimization, but rather, are the result of a novel design approach that used different ACE parameters for different code rates, as described above, and this approach yielded novel PCMs described by novel shift coefficients that was not known in the prior art at all and thus would not have been obvious. (CRBr. at 75 (citing *Grunenthal GmbH v. Alkem Labs. Ltd.*, 919 F.3d 1333, 1344 (Fed. Cir. 2019) (finding that where a variable was not known in the prior art, “[t]his lack of knowledge in the field shows there was little to no basis from which a POSA could expect a probability of success in producing Form A.”)).). Accordingly, the claims of the ’893 patent are not the result of routine optimization and there is no burden on Ericsson to demonstrate unexpected results. *See In re Geisler*, 116 F.3d 1465, 1469 (Fed. Cir. 1997).

Rather, the claimed invention of the ’893 patent involves developing a new method, different ACE constraints for different code rates not found in the prior art, that generated novel shift coefficients to define a novel parity check matrix. As Dr. Wesel explained, the inventors testified that when using the methods taught in the prior art, the inventors experienced very poor performance. (Tr. (Wesel) at 1441:13-21 (“Basically [the inventors] tried first using the prior art. So just applying ACE to the overall parity-check matrix. But it didn’t work. They got bad performance, and that’s what launched them on their investigation of the novel technique that

they ended up using.”). Dr. Wesel was referencing the following testimony of inventor Sara Sandberg:³⁰



(JX-0040C (Sandberg Dep. Tr.) at 58:13-20; *see also id.* at 127:5-23

[REDACTED]

; CDX.0024C.0009.).

Based on the inventors’ testimonies, it is clear that they applied an intentional and novel approach to determine an improved design that produced improved results. (Tr. (Wesel) at 1440:22-1441:12 (“Q. Is the parity check matrix that’s claimed random? A. No. The ultimate parity check matrix that you end up with is not a random matrix of bits. It is a parity check matrix that’s the result of a specific and complicated design process.”); *see also id.* at 414:8-17.).

In their argument that the parity check matrix of the ’893 patent produced “no unexpected results,” Respondents repeatedly relied on other 3GPP members’ development of *different* shift

³⁰ [REDACTED]

coefficients and Ericsson's allegedly "*poor* results" as compared to the contemporaneous designs by others. (RBr. at 100-101.). As Ericsson noted, the shift coefficients of other members of 3GPP are not prior art and irrelevant to the analysis of obviousness. (CRBr. at 77.). The consideration is not, as Respondents contended, whether Ericsson's proposal performed better than the proposals of competing 3GPP submissions, but rather whether Ericsson's proposed shift coefficients and PCM improved performance over the prior art, as discussed above. *In re Baxter Travenol Labs.*, 952 F.2d at 392 ("[W]hen unexpected results are used as evidence of nonobviousness, the results must be shown to be unexpected compared with the closest prior art.").

To the extent they are relevant, the proposed shift coefficients of other members of 3GPP appear to demonstrate the nonobvious nature of Ericsson's invention. First, Respondents' expert, Dr. Liu, agreed that there is no evidence to suggest that the other companies utilized the same design approach or arrived at the same shift coefficients in their proposals. (Tr. (Liu) at 1203:13-1204:1.). He confirmed that the other industry participants provided different PCMs with different performance.

Q. And the other companies that were working on LDPC coding in 5G, they went back and they designed their own shift coefficient proposals for a parity check matrix, right?

A. They designed their own parity check shift, yes.

Q. And none of the other companies came up with the same values for the parity check matrix as the '893 patent, correct?

A. They did not come up with the same value, but they came up with better performance.

Q. None of the other companies disclose the design parameters that they used to develop their shift coefficients, right?

A. True.

(Tr. (Liu) at 1203:13-1204:1; *see, e.g.*, RX-1359.0006 (R1-1711963 (Crosscheck Results for PCM of BG1, Samsung).).

Dr. Liu's unrebutted testimony demonstrates that the specific design recited in the '893 patent was not obvious because others skilled in the art proposed different solutions to address the same problem. *Eurand, Inc. v. Mylan Pharms., Inc. (In re Cyclobenzaprine Hydrochloride Extended-Release Capsule Patent Litig.)*, 676 F.3d 1063, 1082 (Fed. Cir. 2012) ("Evidence that others were going in different ways is strong evidence that the [inventor's] way would not have been obvious.").

Furthermore, as Ericsson noted, there is no evidence that other companies' or individuals' submitted designs produced superior performance. (CRBr. at 77.). As Ericsson pointed out, the inventors testified that Ericsson's proposals were the best. (*Id.* (citing JX-0043C (Yufei Blankenship Dep. Tr.)³¹ at 176:16-177:2; 224:5-25; 228:1-12; 230:14-231:11; 233:3-234:7; JX-0040C (Sandberg Dep. Tr.) at 112:20-113:8; 127:24-128:2; JX-0036C (Mattias Andersson Dep. Tr.) at 66:5-15.).³² Neither the inventors' testimonies nor Respondents' criticism and establish that others' designs were, in fact, superior. (RBr. at 101-102.).

In sum, the proposals that were submitted for consideration of inclusion in the 5G NR standards by other members of 3GPP do not prove the obviousness of the invention, but rather demonstrate that others in the industry applied different approaches and arrived at different

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³²

solutions to the problems at issue. The scope and range of the different submission as described, demonstrate that Ericsson's invention is far more than the result of "routine optimization."

h) Secondary Considerations of Non-Obviousness

Ericsson argued that there is evidence of copying by others and of industry praise for the claimed features of the '893 patent. Dr. Wesel explained that the Space Development Agency (SDA) has adopted the PCMs of the asserted claims for payload forward error correction in all of its optical communication terminal modems. (CRBr. at 78 (citing CX-1409 (OCT Standard Version 3.1.0) at 29-30; Tr. (Wesel) at 1453:15-18).). In addition, the inventors of the '893 patent received awards in recognition of their inventions. (*See* RX-0359.). The adoption of the specific claimed PCMs by the SDA weighs in favor of patentability.

Additionally, Ericsson contended that the '893 patent has enjoyed commercial success "demonstrated through 3GPP's adoption of the '893 Patent into the standard and confirms the importance of that technology to standard-compliant products." (CRBr. at 78-79.).

However, as Staff noted, Ericsson has not established the required nexus to the asserted claims. (SRBr. at 30.). *See In re GPAC Inc.*, 57 F.3d 1573, 1580 (Fed.Cir.1995) ("For objective [evidence of secondary considerations] to be accorded substantial weight, its proponent must establish a nexus between the evidence and the merits of the claimed invention."). As Staff pointed out, standard-compliant products have many features that may not be tied to the asserted claims. (SRBr. at 31.). Thus, Ericsson has not proven that a nexus exists between industry praise and the asserted claims.

XI. INDIRECT INFRINGEMENT OF THE ASSERTED PATENTS

A. Legal Standard

1. Induced Infringement³³

“Whoever actively induces infringement of a patent shall be liable as an infringer.” 35 U.S.C. § 271(b). A patentee asserting a claim of inducement must show (i) that there has been direct infringement and (ii) that the alleged infringer “knowingly induced infringement and possessed specific intent to encourage another’s infringement.” *Minnesota Mining & Mfg. Co. v. Chemque, Inc.*, 303 F.3d 1294, 1304-05 (Fed. Cir. 2002). With respect to the direct infringement requirement, the patentee “must either point to specific instances of direct infringement or show that the accused device necessarily infringes the patent in suit.” *ACCO Brands, Inc. v. ABA Locks Mfrs. Co., Ltd.*, 501 F.3d 1307, 1313 (Fed. Cir. 2007) (citation omitted). This requirement may be shown by circumstantial evidence. *Vita-Mix Corp. v. Basic Holding, Inc.*, 581 F.3d 1317, 1326 (Fed. Cir. 2009). “[A] finding of infringement can rest on as little as one instance of the claimed method being performed during the pertinent time period.” *Lucent Techs., Inc. v. Gateway, Inc.*, 580 F.3d 1301, 1317 (Fed. Cir. 2009); *Toshiba Corp. v. Imation Corp.*, 681 F.3d 1358, 1364 (Fed. Cir. 2012) (citing *Lucent Techs.*, 580 F.3d at 1317).).

The specific intent requirement for inducement necessitates a showing that the alleged infringer was aware of the patent, induced direct infringement, and that he knew that his actions would induce actual direct infringement. *Commil USA, LLC v. Cisco Sys., Inc.*, 720 F.3d 1361, 1367 (Fed. Cir. 2013), *aff’d and vacated in-part on other grounds*, 135 S. Ct. 1920, 1926-28 (2015); *Global-Tech Appliances, Inc. v. SEB S.A.*, 131 S. Ct. 2060, 2068-70 (2011). Specific

³³ Ericsson did not assert that Respondents contributorily infringe the Asserted Patents. (See, e.g., CBr. at 26-27.).

intent can be shown by, for example: (1) changes in importation practices effectuated to shift infringement liability; (2) the infringer's copying of patented technology; and (3) the infringer's willful blindness of the underlying direct infringement. *Certain Network Devices, Related Software and Components Thereof (I)*, Inv. No. 337-TA-944, Initial Determination at 82; *see also Commil USA, LLC v. Cisco Sys., Inc.*, 135 S. Ct. 1920, 1924-25 (2015) ("It was not only knowledge of the existence of [the asserted] patent that led the Court to affirm the liability finding but also it was the fact that [the accused infringer] copied 'all but the cosmetic features of the [patented product],' demonstrating [the accused infringer] kn[ew] it would be causing customers to infringe [the asserted] patent.") (quoting *Global-Tech*, 131 S. Ct. at 2071).

Willful blindness, which also constitutes "knowledge," has two basic requirements: "(1) the defendant must subjectively believe that there is a high probability that a fact exists"; and "(2) the defendant must take deliberate actions to avoid learning of that fact." *Global-Tech*, 131 S. Ct. at 2070.

The intent to induce infringement may be proven with circumstantial or direct evidence and may be inferred from all the circumstances. *Commil*, 720 F.3d at 1366; *Global-Tech*, 131 S. Ct. 2071-72.

B. Acts of Direct Infringement

Respondents directly infringe the asserted apparatus claims of the '817, '669, '342, and '893 patents through making, using, selling, offering to sell, and importing the Accused Products into the United States. (*See, e.g.*, Tr. (Mahon) 246:9-12.). Lenovo stipulated "that it has offered for sale and/or sold at least one of each [Accused Product] to customers in the United States." (Am. Joint Statement at § I.B.). Lenovo did not dispute that it imports the Accused Products or that it maintains inventory in the United States of the Accused Products. (*Id.*).

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Moreover, the evidence is un rebutted that the use of the asserted apparatus claims of the '817 and '669 patents is required for the Accused Products' connection to 5G networks (5G Standalone networks for the '817 patent). (Tr. (Mahon) at 248:14-18 ('817 and '669 patents).). With respect to the '342 patent, the evidence is un rebutted that a successful receipt and transmission of system information as claimed is required for a user device to connect to a 5G network. (Tr. (van der Weide) at 330:17-331:8.). Similarly, for the '893 patent, the evidence is un rebutted that the use of the defined LDPC PCMs is required for successful receipt and transmission of data in 5G NR networks. (Tr. (Wesel) at 421:23-422:13, 439:3-13.). Thus, the sale, importation, use or testing by Respondents of any Accused Products, which all connect to 5G networks (including 5G Standalone networks in the case of the '817 patent), constitute infringing acts.

Respondents directly infringe the asserted method claims of the '817 and '669 patents through their use of the Accused Products, including their use of the Accused Products for business purposes and testing. (Tr. (Mahon) at 246:17-248:18; JX-0029C (Klomsdorf Dep. Tr.) at 45:1-46:20, 54:8-55:4 (testifying to Motorola's use of the Accused Products, including for testing); *see also* CDX-0008C.0083.). With regard to the '817 patent, the generation and transmission of a SUCI as claimed is required to connect to a 5G Standalone network. (Tr. (Mahon) at 248:14-18, 196:8-21 ("In order to connect to a 5G-Standalone network, you're going to have to generate a SCUI to be able to attach [to] that 5G core. You can't get to the 5G core without a SUCI.")). For the '669 patent, the successful receipt and transmission of control information as claimed is required to connect to any 5G network. (Tr. (Mahon) at 248:14-18.). The un rebutted testimony that Dr. Mahon gave are findings of this decision.

C. Respondents Induced and Continues to Induce Users to Infringe the Asserted Patents

Respondents indirectly infringe the asserted method claims of the '817 and '669 patents by inducing its customers to connect the Accused Products to 5G networks. (Tr. (Mahon) at 248:19-249:10; CDX-0008C.0084-85; *see also* CX-6355, CX-6356, CX-3431, CX-5798, CX-6330 (Exemplary Lenovo 5G Advertisements and Troubleshooting Guides).).

With respect to the '817 patent, Lenovo's website and marketing materials reflect that it instructs, encourages, and advertises its customers, retailers, and others to infringe, including by advertising support of infringing 5G modes of operation. (Tr. (Mahon) at 249:5-10 (referring to CDX-0008C.0085) ("[I]f you go to [Lenovo's] website and click on 5G, you see all their 5G smartphones come up, and you'll see under these phones that they all advertise that they connect to 5G-Standalone and run standalone networks."); CX-6355, CX-6356, CX-3431, CX-5798, CX-6330 (Exemplary Lenovo 5G Advertisements and Troubleshooting Guides).). Additionally, Lenovo has had knowledge of the '817 patent at least as early as the filing of the Complaint. Thus, the evidence demonstrates and proves that Respondents indirectly infringe the asserted claims of the '817 patent.

Like induced infringement of the '817 patent, with respect to the '669 patent, Lenovo instructs, encourages, and advertises to its customers the infringing 5G modes of operation. (*See, e.g.*, CX-6355; CX-6356; CX-6354; CX-5732; CX-5740; CX-0558; CX-6350.). Again, Lenovo has had knowledge of the '669 patent at least as early as the filing of the Complaint. Accordingly, the evidence demonstrates that Respondents indirectly infringe the asserted claims of the '669 patent.

XII. DOMESTIC INDUSTRY REQUIREMENT: ECONOMIC PRONG

Ericsson moved for summary determination that the economic prong of the domestic industry requirement was satisfied (“Economic Prong MSD”), which Respondents did not oppose. (Motion Docket No. 1375-020 (May 8, 2024).). Staff submitted a response supporting Ericsson’s motion. (See Doc. ID No. 821912 (May 20, 2024).). An Initial Determination granting Ericsson’s Economic Prong MSD addressed the relevant evidence. (See Order No. 50.).

In sum, Ericsson presented evidence that a domestic industry exists with respect to each Asserted Patent under Sections 337(a)(3)(A) and (B). In particular, the evidence demonstrates the following investments, which are sufficient to show a domestic industry exists.

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

XIII. RECOMMENDATION ON REMEDY, BOND, AND PUBLIC INTEREST

A recommendation on permanent relief, bonding and the public interest will be forthcoming in another document that will be filed pursuant to 19 C.F.R. 210.42(a)(1)(ii).

XIV. WAIVER OR WITHDRAWAL OF RESPONDENT'S DEFENSES

Respondents did not raise in their Pre-Hearing Brief or offer any evidence during the Hearing to support its: (i) Fourth Affirmative Defense of Failure to State a Claim; (ii) Ninth Affirmative Defense of Ensnarement; and (iii) Fourteenth Affirmative Defense of Government Sales. (Resp. at ¶¶ 14, 19, 31.).

Consequently, it is a finding of this decision that Respondents have withdrawn, waived and/or abandoned their Fourth, Ninth, and Fourteenth Affirmative Defenses consistent with Ground Rules 7.2 and 10.1. *Kinik Co. v. Int'l Trade Comm'n*, 362 F.3d 1359, 1367 (Fed. Cir. 2004).

XV. CONCLUSIONS OF FACT OR LAW: THIS INITIAL DETERMINATION FINDS A SECTION 337 VIOLATION BASED UPON INFRINGEMENT OF U.S. PATENT NO. 10,425,817, U.S. PATENT NO. 10,306,669, U.S. PATENT NO. 11,317,342, AND U.S. PATENT NO. 11,515,893

1. Jurisdiction and standing requirements are satisfied.
2. Claims 10 and 13-15 of U.S. Patent No. 10,426,817; claims 8, 9, 15, and 17 of U.S. Patent No. 10,306,669; claims 34 and 39 of U.S. Patent No. 11,317,342; and claim 4 of U.S. Patent No. 11,515,893 have been found to directly infringe.
3. The asserted claims of U.S. Patent No. 10,426,817 and U.S. Patent No. 10,306,669 have been found to indirectly infringe.
4. Ericsson's DI Products have been found to practice one or more claims of the Asserted Patents.
5. The Asserted Patents are valid and specifically have not been found to be invalid.

The lack of discussion of any matter raised by the Parties, or any portion of the record, does not indicate that it has not been considered. Rather, any such matter(s) or portion(s) of the record has/have been determined to be irrelevant, immaterial or meritless. Arguments made on briefs, which were otherwise unsupported by record evidence or legal precedent, have been accorded no weight.

XVI. CONCLUSION AND ORDER

This Initial Determination on Violation of Section 337 of the Tariff Act of 1930 is certified to the Commission. All orders and documents, filed with the Secretary, including the exhibit lists enumerating the exhibits received into evidence in this Investigation, that are part of the record, as defined in 19 C.F.R. § 210.38(a), are not certified, since they are already in the Commission's possession in accordance with Commission Rules. *See* 19 C.F.R. § 210.38(a). In accordance with 19 C.F.R. § 210.39(c), all material found to be confidential under 19 C.F.R. § 210.5 is to be given *in camera* treatment.

After the Parties have provided proposed redactions of confidential business information ("CBI") that have been evaluated and accepted, the Secretary shall serve a public version of this ID upon all parties of record. The Secretary shall serve a confidential version upon counsel who are signatories to the Protective Order (Order No. 1) issued in this Investigation.

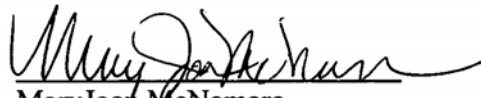
Pursuant to 19 C.F.R. § 210.42(h), this Initial Determination shall become the determination of the Commission unless a party files a petition for review pursuant to 19 C.F.R. § 210.43(a) or the Commission, pursuant to 19 C.F.R. § 210.44, orders on its own motion a review of the Initial Determination or certain issues therein.

Within fourteen (14) days of the date of this document, the Parties shall submit to the Office of Administrative Law Judges a joint statement regarding whether or not they seek to have any portion of this document deleted from the public version. The Parties' submission must include a copy of this ID with yellow highlighting, with or without red brackets, that indicate words, phrases, sentences or paragraphs that they assert contain CBI and that they ask be deleted from the public version. The Parties' submission shall also include an index identifying the pages of this document where proposed redactions are located. The Parties' submission

Public Version

concerning the public version of this document need not be filed with the Commission Secretary.

SO ORDERED.


Mary Joan McNamara
Administrative Law Judge