

**UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE PATENT TRIAL AND APPEAL BOARD**

SAMSUNG ELECTRONICS CO., LTD.,
Petitioner

v.

ASUS TECHNOLOGY LICENSING INC.,
Patent Owner.

IPR2024-01246
U.S. Patent No. 10,986,585

DECLARATION OF MICHAEL ALLAN MARTIN DAVIES

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I. INTRODUCTION

1. My name is Michael Allan Martin Davies, and I have been retained by counsel (Greenberg Traurig, LLP) for Samsung Electronics Co., Ltd. (“Samsung”) as an expert witness in the *Inter Partes* Review of Claims 1-20 (the “Challenged Claims”) of U.S. Patent No. 10,986,585 B2 (Ex-1001, the “’585 patent”).
2. I have also been retained to provide an analysis regarding the level of ordinary skill in the art at the time of the invention of the ’585 patent, and what a person of ordinary skill in the art would have understood at the time of the earliest application underlying the ’585 patent.
3. I have been informed that Asus Technology Licensing Inc. (“the Patent Owner”) owns the ’585 patent. I have no financial interest in the Patent Owner of the ’585 patent, nor to my recollection have I had any contact with the Patent Owner for more than a decade, or the inventors of the ’585 patent. I also have no financial interest in Samsung.
4. All of the opinions stated in this declaration are based on my own expertise and professional judgement.
5. I am being compensated on an hourly basis for my work. My fee is not contingent on the outcome of any matter or on any of the technical positions explained or set forth in this declaration.
6. My opinions are based on my years of education, research and experience, as well as my investigation and study of relevant materials. The materials that I studied for this declaration include all the documents referenced in this declaration and the exhibits to Samsung’s Petition for *Inter Partes* Review of U.S. Patent No. 10,986,585 (Ex-1001.)

7. I may rely upon these materials, my knowledge and experience, and/or additional materials to rebut arguments raised by the Patent Owner. Further, I may also consider additional documents and information in forming any necessary opinions, including documents that may not yet have been provided to me.
8. This declaration represents only those opinions I have formed to date. I reserve the right to revise, supplement, and/or amend my opinions stated herein based on new information and on my continuing analysis of the materials produced in this proceeding.

II. QUALIFICATIONS

9. I am Chairman and Senior Partner of Endeavour Partners, LLC, a Senior Lecturer and erstwhile Principal Investigator at the Massachusetts Institute of Technology, a Guest Lecturer at London Business School, and the Co-Founder and Chief Executive Officer of WKD.SMRT, Inc.
10. I have spent more than thirty years working in telecommunications, electronics, and related industries. I worked first as an engineer, then as a manager and executive, and now as an academic, consultant, expert, entrepreneur, and advisor. I have worked for a wide variety of technology and manufacturing companies on issues relating to manufacturing, logistics, supply chain, research and development, product development, platform development, systems engineering, technology, strategy, software development and innovation. My work involves the connections amongst technology, innovation, new products and services, adoption and diffusion, consumer choice and behavior, and systems, architecture, platforms, and the emergence and evolution of business ecosystems.

11. I received a Bachelor of Arts and a Master of Arts in Engineering and in Electrical Sciences from St. Catharine's College at the University of Cambridge; a Master of Engineering in Cybernetics, Robotics and Microelectronics from the University of Durham; and a Master of Business Administration from London Business School (with Distinction.) My educational work focused on engineering and electrical sciences, including mathematics, physics and computer science; cybernetics and robotics; microelectronics including the design of microchips; and management science, with a particular focus on technology and innovation, business strategy and systems thinking. I have attached my curriculum vitae as Appendix 1.

12. I am currently Chairman and Senior Partner of Endeavour Partners, LLC, a strategy consulting firm with expertise in mobile, wireless and digital technologies, systems and businesses. I work with companies that create these products and services and those that are impacted by the business and technology forces at play in the mobile and digital sectors to help them anticipate technological innovations, consumer needs, and the emergence and evolution of business ecosystems so that they are capable of navigating opportunities for innovation and growth.

13. I have experience working throughout the mobile, wireless and digital sectors, including the convergence of mobile, broadband, Internet, and digital technologies. My work in this area includes the communications sector, such as mobile devices including mobile phones (basic cellular phones, feature phones, smartphones), tablets, services and networks (broadband and Internet), computers (servers, PCs, components, hardware, and software), electronic hardware (semiconductors and ICs, PCB design,

and manufacturing), consumer electronics, content (video, audio, and applications), and electronic commerce.

14. I have also worked on business and technology strategy with many leading mobile device manufacturers (“MDMs”) including HTC, Samsung, Nokia, Motorola, Sony Ericsson, and Mitsubishi Electric; supply chain companies such as Qualcomm and Analog Devices; and many leading network operators and service providers, including AT&T, Verizon, Vodafone, Sprint Nextel, British Telecom (BT), Deutsche Telekom, Virgin Mobile, Optus, and Telecom New Zealand.
15. I have significant experience serving as an expert consultant in this field. I served as an industry expert for the Department of Justice in 2011 in the anti-trust investigation (Civil Action No. 11-01560 (ESH)) of the proposed AT&T and T-Mobile merger. In this role, I analyzed the impact of the proposed merger, in particular as it related to consumer choice and to the technology and the economics of mobile networks and mobile services.
16. I also served as an industry expert for the Department of Justice in 2019 in the anti-trust investigation of the proposed T-Mobile and Sprint merger. In this role, I again analyzed the impact of the proposed merger, in particular as it related to consumer choice and to technology and the economics of mobile networks and mobile services. Additionally, I am serving as a technical and industry expert for the Department of Justice in the anti-trust investigation of Google, LLC (District Court for the District of Columbia Case No. 1:20-cv-03010-APM.)
17. I also served as an industry expert for the Department of Justice, Anti-Trust Division, Media, Entertainment, and Communications Section in 2022 during a recent major global anti-trust investigation in the communications

services sector. Internationally, I served as an industry expert on the public interest in 2022 for the Competition Bureau Canada during its assessment of the proposed acquisition of Shaw Communications by Rogers Communications.

18. I am a Senior Lecturer at the Massachusetts Institute of Technology (MIT) where I have held posts in both the School of Engineering (in Aero/Astro) and in the Sloan School of Management, where I have created and taught courses in fundamental and advanced topics in technology strategy, in systems engineering, in the leadership of high-tech businesses, and in integrated design and management. I have been responsible for creating, managing, and teaching two capstone leadership courses for postgraduate students, the Systems Leadership & Management Lab and Praxis programs, and for teaching the capstone leadership courses for undergraduates in the Gordon Engineering Leadership program. I teach topics including creative innovation, value creation, emerging technologies, product management, product marketing, basic finance and business models, pricing and marketing, competitive analysis, market opportunity identification, funding entrepreneurship, data-driven decision making and decision-making under uncertainty.

19. I have also been a Principal Investigator at MIT and have typically supervised the master's thesis work of several students each year, much of which also focuses on issues related to mobile and digital ecosystems and innovation. I also have supervised theses that have been the basis for being spun off as companies, and received funding from the National Science Foundation. I am the creator and co-leader of the program on Breakthrough

Innovation, and I also teach multiple modules of the Technology Leadership Program, including a significant portion of the core course.

20. I have been responsible for organizing and teaching the New Technology Ventures program at London Business School, which is designed to enable would-be entrepreneurs to evaluate novel technologies and ideas, many of them in the mobile and digital industries, and turn them into new entrepreneurial ventures. Additionally, I am the creator and course Academic Director for the path-breaking course on The Business of AI.
21. I have held significant leadership roles in the industry. I was the New Zealand representative to the International Telecommunication Union Radiocommunication Sector (ITU-R), the international standards making body, including the ITU-R, Task Group 8/1. I was elected as a Vice-Chairman of the Global System for Mobile Communication Memorandum of Understanding (the largest group of mobile network operators worldwide, which is now the GSMA with nearly 800 members) and was a founder and Chairman of its 3rd Generation Interest Group and have also chaired government working parties on PCS Spectrum.
22. I have been the Chairman of the Massachusetts Technology Leadership Council Mobile Cluster, and served on the Board of Advisors for the Department of Systems Engineering at the U.S. Military Academy at West Point, on the Board of Directors of the Kendall Square Association. I am an advisor to WGBH, a public television station, public radio station and public media production house located in Boston, Massachusetts, and to PRX, the leading public audio podcasting business.

III. SCOPE OF OPINION

23. I have been asked to provide my opinions regarding whether Claims 1-20 (the “Challenged Claims”) of the ’585 patent are unpatentable pursuant to the following grounds:

- Ericsson-based grounds
 - **Ground 1:** Whether Claims 1, 6, and 10 are rendered obvious under AIA 35 U.S.C. §103 by Ericsson in view of TS38.213.
 - **Ground 2:** Whether Claims 2-4 and 13-14 are rendered obvious under AIA 35 U.S.C. §103 by Ericsson in view of TS38.213 and further in view of TS38.321.
 - **Ground 3:** Whether Claims 5, 7, and 15 are rendered obvious under AIA 35 U.S.C. §103 by Ericsson in view of TS38.213 and TS38.321 and further in view of TS38.331.
 - **Ground 4:** Whether Claims 8-9, 11-12, and 16 are rendered obvious under AIA 35 U.S.C. §103 by Ericsson in view of TS38.213 and TS38.321 and further in view of Samsung.
 - **Ground 5:** Whether Claim 17 is rendered obvious under AIA 35 U.S.C. §103 by Ericsson in view of TS38.213 and U.S. Patent No. 2015/0358920 A1 to Sorrentino (“Sorrentino,” Ex-1017).
 - **Ground 6:** Whether Claims 18-19 are rendered obvious under AIA 35 U.S.C. §103 by Ericsson in view of TS38.213 and Sorrentino and further in view of TS38.321.
 - **Ground 7:** Whether Claim 20 is rendered obvious under AIA 35 U.S.C. §103 by Ericsson in view of TS38.213 and Sorrentino and further in view of Samsung.

- Huawei-based grounds
 - **Ground 8:** Whether Claims 1 and 10 are rendered obvious under AIA 35 U.S.C. §103 by Huawei in view of TS38.213.
 - **Ground 9:** Whether Claims 2-3, and 13 are rendered obvious under AIA 35 U.S.C. §103 by Huawei in view of TS38.213 and further in view of TS38.331.
 - **Ground 10:** Whether Claims 5, 7, and 15 are rendered obvious under AIA 35 U.S.C. §103 by Huawei in view of TS38.213 and TS38.321, and further in view of TS38.331.
 - **Ground 11:** Whether Claim 17 is rendered obvious under AIA 35 U.S.C. §103 by Huawei in view of TS38.213 and Sorrentino.
 - **Ground 12:** Whether Claims 18-19 are rendered obvious in view of TS38.213 and Sorrentino and further in view of TS38.321.

24. This Declaration, including the exhibits hereto, sets forth my opinion on these topics.

IV. TECHNICAL BACKGROUND

25. Mobile phones in wireless communications systems can receive over-the-air data transmissions from a network base station and can transmit data over-the-air to the network base station. While digital wireless communications have been known for decades, of interest to this Petition

are the generations of mobile communications standards known as 4G LTE (“Long Term Evolution”)¹ and 5G NR (“New Radio”).

26. First, some nomenclature. In 4G and 5G systems, the mobile terminal is known as User Equipment or “UE.” The base station in the 4G network is called an “eNodeB” or “eNB.” The base station in a 5G network is called a “gNodeB” or “gNB.” Communications sent from the network to the UE are sent over the *downlink* (think of looking down on the UE from a cell tower). Communications sent to the network from the UE are sent over the *uplink* (think of looking up from the UE to a cell tower).

A. Uplink Scheduling, Power Control and Power Headroom Reporting in 4G

27. If the power at which a UE transmits on the uplink is too low, the eNodeB will not be able to decipher the transmission properly. EX-1016, p.216. If the power at which a UE transmits on the uplink is too high, the UE’s signal can interfere with other signals from other UEs and unnecessary battery power is expended in transmitting data on the uplink. *Id.* During the development of the technical specifications for LTE, it was therefore decided that UEs would engage in two forms of uplink power control: open-loop and closed-loop power control. *Id.*, p.217. These power control mechanisms are applied to physical data channels such as the Physical Uplink Shared Channel, abbreviated “PUSCH.” *Id.*, pp.217, 221-223.

28. As implemented in LTE, open-loop power control requires determining the pathloss of the downlink signal. EX-1016, p.217. The downlink pathloss is determined based on a known pathloss reference. In LTE, the downlink

¹ General references to LTE are to Release 10, unless otherwise indicated.

pathloss is determined based on an identified signal and the known transmission power of that signal as broadcast from the network. EX-1005, pp.413-415. The UE gets an indication of the channel conditions and the distance to the eNodeB by determining the pathloss on the downlink. *Id.* The UE determines its uplink transmit power using open loop-power control techniques. EX-1005, pp.413-415; EX-1006, pp.216-223.

29. Closed-loop power control in LTE is controlled by the eNodeB. Using closed loop power control methods, the UE receives information from the eNodeB about how to adjust the transmit power on the uplink. EX-1005, pp.411-420, EX-1006, pp.216-223. UEs in LTE transmit a power headroom report (“PHR”) to the eNodeB, which indicates the UE’s power headroom, to provide the eNodeB with the UE’s uplink transmit power. EX-1019, pp.8, 28-30. As defined for LTE, power headroom is the difference between a UE’s nominal maximum transmit power and an estimated power for a PUSCH transmission (Type 1) or the difference between a UE’s nominal maximum transmit power and an estimated power for simultaneous PUSCH and PUCCH transmissions (Type 2). EX-1019, pp.28-30 (§5.4.6); EX-1005, p.644; EX-1006, pp.260-261.

30. PHRs were not to be sent every time a PUSCH transmission was scheduled. Instead, LTE used specified triggers to determine whether to transmit a PHR to the eNodeB, including expiration of the *prohibitPHR-Timer* when the pathloss changes by more than a specified threshold (*dl-PathlossChange*) for at least one activated Serving Cell; expiration of the *periodicPHR-Timer*; configuration or reconfiguration of the power headroom reporting functionality by upper layers; activation of an SCell with configured uplink; or the expiration of the *prohibitPHR-Timer* with

the presence of UL resources for new transmission, and a change in required power backoff for power management (as allowed by P-MPRc) by more than a specified threshold (*dl-PathlossChange*) since transmission of a prior power headroom report. EX-1019, pp.28-29.

B. Investigation and Development of Uplink Power Control and Power Headroom Reporting During 3GPP 5G Technical Specification Development

31. During the development of the 5G technical specifications, 3GPP decided that the uplink power control techniques used in LTE would be incorporated into 5G as best they could be. EX-1007, pp.1–4. Additionally, a 3GPP subgroup called “RAN 1” determined that power control should be implemented on a per-carrier basis. *Id.*

32. 5G UEs can switch downlink beams during normal operation. During development of the 5G standard, the developers considered how to determine when to “trigger” a power headroom report, or “PHR.” EX-1007, pp.2-3,; EX-1018, p.2. The ’585 patent purports to answer this question. EX-1001, 1:19-21 (stating that the disclosure relates to “a method and apparatus for triggering [a] power headroom report for multiple pathloss reference [in] a wireless communication system”). 3GPP contributors proposed various solutions during development of the 5G standard. It is my opinion that these solutions fall within the claims of the ’585 patent, thus rendering them unpatentable.

33. One challenge in developing the 5G standard was to determine which pathloss reference should be used to determine whether to trigger a PHR. Ericsson suggested using the original beam as the initial reference, take a pathloss measurement from a new beam, and trigger a PHR if the pathloss

change exceeded a set threshold. EX-1007, p.3. Huawei suggested averaging the pathloss over a first group of beams, and, upon switching beam groups, averaging the pathloss over a second group of beams and taking the difference between the two groups of beams to determine whether to trigger a PHR. EX-1018.

V. THE '585 PATENT

A. General Overview

34. The '585 patent relates to triggering power headroom reports when multiple pathloss references are available. (Ex-1001, 1:18-21.) A UE sends PHRs to the base station to inform the base station to “realize how much extra transmission power is available in the UE and how to schedule resource to the UE properly, e.g. is it proper to schedule more resource to the UE (e.g. UE has more power headroom).” (*Id.*, 6:62-67.) The '585 patent also refers to virtual PHRs, which are reported “while there is no current transmission” (*Id.*, 7:3-11.)

35. The '585 patent specification copies from 3GPP technical specifications and 3GPP technical documents. The provisional application also includes copy-and-paste reproductions of 3GPP documents. *E.g.*, (Ex-1004, pp. 21-22, 24-79.)

36. According to the '585 patent, a PHR can be triggered based on a comparison of a “previous pathloss value” with “a current pathloss value”—that is, the pathloss change exceeding a threshold. (Ex-1001, 27:10-11, 27:56-60, 31:6-7, 31:28-29, 32:15-17.) The '585 patent describes how to choose the “current pathloss value,” (*id.*, 31:6-27), and the “previous pathloss value,” (*id.*, 31:29-58), and then explains that these options may be combined in any way to “form a new embodiment.” (*Id.*, 31:59-63, 32:5-

20). The claims of the '585 patent are directed to the use of a pathloss reference for a prior PHR as the “previous pathloss value” and a pathloss reference identified after a new beam is being used by the UE as the “current pathloss value” and using that difference to determine whether to trigger a PHR.

B. Effective Filing Date

37. The '585 patent claims priority to May 10, 2018. I apply this date herein without taking a position on the entitlement of the '585 patent to the claimed effective filing date.

C. Prosecution History

38. I adopt the Petitioner's discussion of the prosecution history of the '585 patent.

D. The Challenged Claims

39. This Declaration relates to Claims 1-20 of the '585 patent, of which Claims 1, 10, and 17 are independent.

VI. PERSON OF ORDINARY SKILL IN THE ART

40. I understand that my assessment of the claims of the '585 patent must be undertaken from the perspective of what would have been known or understood by a person having ordinary skill in the art, reading the '585 patent on its priority date and in light of the specification and file history of the '585 patent. I may refer to such a person as a “POSITA.”

41. I understand that my analysis and opinions expressed in this declaration must be rendered based on the perspective of a POSITA as of the priority date of the '585 patent. I also understand that a POSITA is a hypothetical

person who is presumed to know the relevant art at the time of the alleged invention claimed in the '585 patent.

42. I further understand that in determining the level of ordinary skill in the art, I am to consider factors including:

- the type of problems encountered in the art or field of invention,
- prior art solutions to those problems,
- the rapidity with which innovations are made,
- sophistication of the technology, and
- the educational level of active workers in the field.

43. I have been instructed to assume a person of ordinary skill in the art is not a specific real individual, but rather a hypothetical individual having the qualities reflected by the factors discussed above.

44. I understand that a POSITA is a person of ordinary creativity, but not an automaton, and that a POSITA can often fit multiple patents or prior art references together like pieces of a puzzle as a result of this ordinary creativity. I also understand that I may consider the inferences and creative steps that a POSITA would employ. In addition, I understand that a POSITA would necessarily have been capable of understanding the scientific and engineering principles applicable to the pertinent art.

45. I also understand that when I consider what would have been obvious to a POSITA, I am not considering what would have been obvious to me at the time, nor to the inventors, judges, laymen, those skilled in other arts, or to geniuses in the art.

46.A POSITA in the field of the '585 patent, as of its first provisional filing date² of May 10, 2018 would have been aware that the 5G standards-setting process was well underway and iterations of the 5G specifications had been released. Such a person would have been familiar with techniques associated with power headroom reporting from the earlier LTE specification and would have been familiar with the use of pathloss estimates to perform uplink power control because such techniques were familiar from LTE. The POSITA would have had at least a bachelor's degree in electrical engineering, computer science, computer networking, or network engineering and familiarity with telecommunications. The POSITA would have also had some familiarity with the relevant 3GPP standards as of May 2018, as well as software for communications protocols. A POSITA would have had two years working in wireless communications, though a lack of experience may be accommodated with more education—such as a Master's degree with a focus on modern cellular communications technologies (and vice versa). Additional education may serve as a substitute for a lack of experience and vice versa.

47.In my own experience in this field, experience with reviewing 3GPP standards, including technical specifications and proposals, was important for individuals working in the field. Such materials informed those working in the field how 3GPP standard networks functioned, including for well-known networks like LTE.

48.The educational level of active workers in the field of the invention also informs my opinion. Such individuals usually had at least a bachelor's

² As explained previously, I take no position as to whether the '585 patent is entitled to claim priority to its provisional application.

degree in electrical engineering, computer science, computer networking or networking engineering or a related discipline and at least two years of experience working in the field of wireless communications networks or in academic research related thereto.

49. As of May 10, 2018, I had more than ordinary skill in the art. I am, however, familiar with the skills and knowledge possessed by those I would have considered to be of ordinary skill in the art as of that date. When I refer to the understanding of a POSITA, I am referring to the understanding of such a person as of May 10, 2018.

VII. CLAIM CONSTRUCTION

50. I adopt the Petitioner's argument that no claim constructions are required, and I have interpreted the claims at issue in accordance with their ordinary and customary meanings. 37 C.F.R. §41.100(b).

51. I also adopt the Petitioner's submission that "first" and "second" as used throughout the claims are not intended to identify a sequence, but instead are used merely to reflect multiple instances of the same type of thing (*e.g.*, "first pathloss reference" and "second pathloss reference").

VIII. PROPOSED GROUNDS AND PRIOR ART OVERVIEW

A. The Grounds Presented Herein Directly Address Reasons for Allowance And Show The Claims Should Not Have Issued.

52. As explained in the Petitioner's prosecution history, the claims of the '585 patent were allowed because the applicant amended the claims to require two separate pathloss references to be used in performing pathloss measurements for use in PHR triggering. Both Ericsson and Huawei describe techniques that use different pathloss references to determine a pathloss and ascertain whether to trigger a PHR as described in the Petition.

I understand that these references were not of record during the original prosecution, but it is my opinion that these references disclose the subject matter that led to the allowance of the claims.

1. Ex-1007: 3GPP Tdoc R2-1713484: “Power Headroom Reporting in NR”, 3GPP TSG-RAN WG2 #100, Nov. 27-Dec. 1, 2017 (“Ericsson”)

53. Ericsson is a technical contribution submitted to 3GPP TSG RAN WG2, meeting #100 which was held between November 27–December, 2017. I understand from counsel that Ericsson is prior art.

54. Like the '585 patent, Ericsson proposes a technique for selecting the pathloss reference to use to determine whether to trigger a PHR with beam switching. (Ex-1007 at p.3.) Ericsson describes how power headroom reports are triggered upon switching serving beams:

“For beamforming-based transmissions, the pathloss may experience a sudden fluctuation due to frequent blockage as well as the change of serving beam. For Option 2 [the UE only reports PHR for the beam used for PUSCH transmission] such a situation would imply, in the case of a beam switch, that the UE measures on the new beam but the reference measurement is from the old beam. If the DL PL change (referred to as “*dl-PathlossChange*”) becomes more than *dl-Pathloss Change* Db when switching beam, a new PHR would be triggered. This example explains how the beam switches would operate based on the LTE PHR format and trigger. From this example, it is also indicated that the subsequent DL PL measurements used in the PHR triggers may be from different serving beams.”

(Ex-1007 at p.3.)

55. Ericsson proposes that the pathloss, as determined while using an “old beam,” is used with a pathloss determined while the UE uses a “new beam” to determine “[i]f the DL PL change (referred to as ‘*dl-PathlossChange*’) becomes more than *dl-PathlossChange* dB when switching beam,” leading

to a new PHR to be triggered. *Id.* This is the same concept as the amendment made to the '585 patent claims to secure their allowance.

2. Ex-1018: Huawei, HiSilicon, Discussion on PHR calculation, 3GPP TSG RAN WG1 NR Ad Hoc Meeting, Qingdao, China, June 27-30, 2017, R1-1710475 (“Huawei”)

56. Huawei is a technical contribution submitted to 3GPP TSG RAN WG1, Ad Hoc meeting held between June 27–30, 2017. I understand from counsel that Huawei is prior art.

57. Like the '585 patent, Huawei proposes how to select the pathloss reference for determining whether to trigger a PHR with beam group switching and when multiple downlink beams are serving the UE. Huawei describes how a PHR is triggered:

“In the LTE system, PH triggering condition is defined with a set of events. The UE will be configured with two timer[s]: *prohibitPHR-Timer* and *periodicPHR-Timer* and a threshold parameter *dl-PathlossChange*.”

(Ex-1018 at §2.1.)

58. Huawei also describes which reference signals are used to derive pathloss.

“It was agreed pathloss can be derived from SS block/CSI-RS. In our contribution [4], we proposed that CSI-RS based L1 RSRP and/or SS block based L1/L3 RSRP can be configured for CONNECTED mode.”

(Ex-1018 at §2.1.)

59. Huawei indicates which scenarios a pathloss change would occur when a beam is changed and how PL change could be calculated:

“For example, if current beam is changed compared to the latest time, then the PL will possibly change. So, the PL change may exceed *dl-PathlossChange*. In this case, PL change condition for PHR triggering would always be occupied. One solution is that the UE could monitor PL change independently per beam. Once the timers satisfy PHR triggering condition, the UE could collect beams with large PL change and report the PHs of them. Then one or more PH are reported.”

(Ex-1018 at §2.1.)

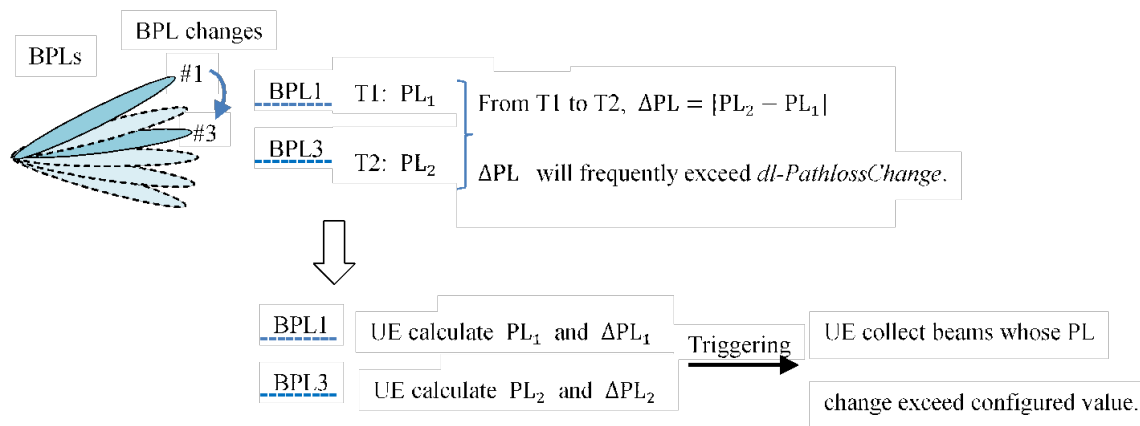


Figure 1 *Huawei Figure 1 indicates how pathloss change is calculated when a beam change occurs. (Ex-1018 at FIG. 1.)*

60. Huawei also indicates how a pathloss change could be calculated on a BPL group level. That is, pathloss can be averaged across several BPLs within a single group.

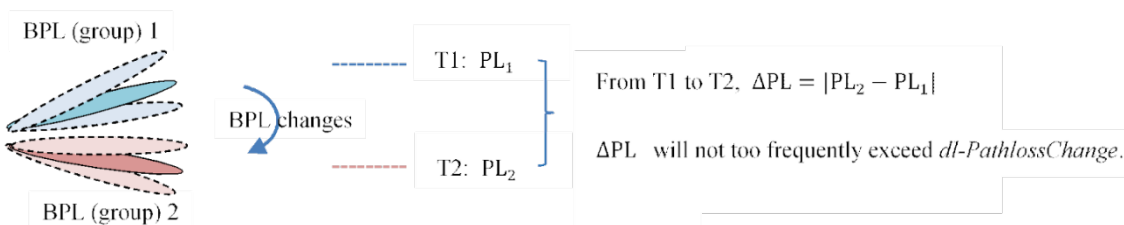


Figure 2 *Huawei Figure 2 indicates how pathloss change is calculated for a BPL group level. (Ex-1018 at FIG. 2.)*

3. Ex-1010: 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; NR; Services provided by the physical layer (Release 15), 3GPP TS 38.202 V15.1.0 (2018-03) (“TS38.202”)

61.3GPP TS38.202 v15.1.0 is a Technical Specification titled “3rd Generation Partnership Project; Technical Specification Group Radio Access Network; NR; Services provided by the physical layer (Release 15).” I understand from counsel that TS38.202 is prior art.

4. Ex-1008: 3rd Generation Partnership Project: Technical Specification Group Radio Access Network; NR; Physical layer procedures for control (Release 15), 3GPP TS 38.213 V15.1.0 (2018-03) (“TS38.213”)

62.3GPP TS 38.213 v15.1.0 is a Technical Specification titled “3rd Generation Partnership Project; Technical Specification Group Radio Access Network; NR; Physical layer procedures for control (Release 15).” I understand from counsel that TS38.213 is prior art.

63.TS38.213 describes how a UE derives pathloss from a reference signal:

- $PL_{b,f,c}(q_d)$ is a downlink path-loss estimate in dB calculated by the UE using reference signal (RS) resource q_d for UL BWP b of carrier f of serving cell c .

If the UE is not provided with higher layer parameter *pusch-pathloss-Reference-rs* and before the UE is provided with dedicated higher layer parameters, the UE identifies a RS resource from the SS/PBCH block that the UE obtains from higher layer parameter *MasterInformationBlock*.

Otherwise, the UE is configured with a number of RS resources by higher layer parameter *num-pusch-pathlossReference-rs* and a respective set of RS configurations for the number of RS resources is provided by higher layer parameter *pusch-pathloss-Reference-rs* that includes one or both of a set of SS/PBCH block indexes provided by higher layer parameter *pusch-pathlossReference-SSB* and a set of CSI-RS configuration indexes provided by higher layer parameter *pusch-pathlossReference-CSIRS*.

The UE identifies a RS resource in the set of RS resources to correspond to a SS/PBCH block or to a CSI-RS configuration as provided by higher layer parameter *pusch-pathlossreference-index* in *pusch-pathlossReference-rs-config*.

- If the UE is provided a higher layer parameter *SRI-PathlossReferenceIndex-Mapping*, the UE obtains a mapping between a set of values for the SRI field in DCI format 0_1 and a set of *pusch-pathlossreference-index* values provided by higher layer parameter *pusch-pathlossReference-rs-config*. If the PUSCH transmission is scheduled by a DCI format 0_1 and if the DCI format 0_1 includes a SRI field, the UE determines the RS resource q_d from the value of *pusch-pathlossreference-index* that is mapped to the SRI field value.
- If the PUSCH transmission is scheduled by a DCI format 0_0 or by a DCI format 0_1 that does not include a SRI field, or if a higher layer parameter *SRI-PathlossReferenceIndex-Mapping* is not provided to the UE, the UE determines a RS resource with a respective higher layer parameter *pusch-pathlossreference-index* value being equal to zero.

Figure 3 (Ex-1008 at p.15.)

64.TS38.213 also teaches how to determine uplink power control (Ex-1008 at §7.1.1.):

7 Uplink Power control

Uplink power control determines the transmit power of the different uplink physical channels or signals.

7.1 Physical uplink shared channel

For PUSCH, a UE first scales a linear value $\hat{P}_{\text{PUSCH},f,c}(i,j,q_d,l)$ of the transmit power $P_{\text{PUSCH},f,c}(i,j,q_d,l)$ on UL

BWP b , as described in Subclause 12, of carrier f of serving cell c , with parameters as defined in Subclause 7.1.1, by the ratio of the number of antenna ports with a non-zero PUSCH transmission to the number of configured antenna ports for the transmission scheme. The resulting scaled power is then split equally across the antenna ports on which the non-zero PUSCH is transmitted.

7.1.1 UE behaviour

If a UE transmits a PUSCH on UL BWP b of carrier f of serving cell c using parameter set configuration with index j and PUSCH power control adjustment state with index l , the UE shall determine the PUSCH transmission power $P_{\text{PUSCH},f,c}(i,j,q_d,l)$ in PUSCH transmission period i as

$$P_{\text{PUSCH},f,c}(i,j,q_d,l) = \min \left\{ P_{\text{CMAX},f,c}(i), P_{\text{O_PUSCH},f,c}(j) + 10 \log_{10} (2^{\mu} \cdot M_{\text{RB},f,c}^{\text{PUSCH}}(i)) + \alpha_{f,c}(j) \cdot PL_{f,c}(q_d) + \Delta_{\text{TF},f,c}(i) + f_{f,c}(i,l) \right\} \text{ [dBm]}$$

where,

- $PL_{b,f,c}(q_d)$ is a downlink path-loss estimate in dB calculated by the UE using reference signal (RS) resource q_d for UL BWP b of carrier f of serving cell c .

Figure 4 (Ex-1008 at §7.1.1.).

65.TS38.213 also teaches how to calculate power headroom from a pathloss value. (Ex-1008 at §7.7.1.):

7.7.1 Type 1 PH Report

If a UE transmits PUSCH in PUSCH transmission period i on UL BWP b of carrier f of serving cell c , the UE computes a power headroom for a Type 1 report as

$$PH_{\text{type1},b,f,c}(i,j,q_d,l) = P_{\text{CMAX},f,c}(i) - \left\{ P_{\text{O_PUSCH},b,f,c}(j) + 10 \log_{10}(2^{\mu} \cdot M_{\text{RB},b,f,c}^{\text{PUSCH}}(i)) + \alpha_{b,f,c}(j) \cdot PL_{b,f,c}(q_d) + \Delta_{\text{TF},b,f,c}(i) + f_{b,f,c}(i,l) \right\} \quad [\text{dB}]$$

where $P_{\text{CMAX},f,c}(i)$, $P_{\text{O_PUSCH},b,f,c}(j)$, $M_{\text{RB},b,f,c}^{\text{PUSCH}}(i)$, $\alpha_{b,f,c}(j)$, $PL_{b,f,c}(q_d)$, $\Delta_{\text{TF},b,f,c}(i)$ and $f_{b,f,c}(i,l)$ are defined in Subclause 7.1.1.

If the UE does not transmit PUSCH in PUSCH transmission period i on UL BWP b of carrier f of serving cell c , the UE computes a power headroom for a Type 1 report as

$$PH_{\text{type1},b,f,c}(i,j,q_d,l) = \tilde{P}_{\text{CMAX},f,c}(i) - \left\{ P_{\text{O_PUSCH},b,f,c}(j) + \alpha_{b,f,c}(j) \cdot PL_{b,f,c}(q_d) + f_{b,f,c}(i,l) \right\} \quad [\text{dB}]$$

where $\tilde{P}_{\text{CMAX},f,c}(i)$ is computed assuming MPR=0dB, A-MPR=0dB, P-MPR=0dB. ΔT_C =0dB. MPR, A-MPR, P-MPR and ΔT_C are defined in [8-1, TS 38.101-1] and [8-2, TS38.101-2]. The remaining parameters are defined in Subclause 7.1.1.

Figure 5 (Ex-1008 at §7.7.1.)

66.TS38.213 discloses that there are circumstances when the UE does not transmit any PUSCH transmission on the serving cell when transmitting the first power headroom report. (Ex-1008 at §7.7.1):

If the UE does not transmit PUSCH in PUSCH transmission period i on UL BWP b of carrier f of serving cell c , the UE computes a power headroom for a Type 1 report as

$$PH_{\text{type1},b,f,c}(i,j,q_d,l) = \tilde{P}_{\text{CMAX},f,c}(i) - \left\{ P_{\text{O_PUSCH},b,f,c}(j) + \alpha_{b,f,c}(j) \cdot PL_{b,f,c}(q_d) + f_{b,f,c}(i,l) \right\} \quad [\text{dB}]$$

where $\tilde{P}_{\text{CMAX},f,c}(i)$ is computed assuming MPR=0dB, A-MPR=0dB, P-MPR=0dB. ΔT_C =0dB. MPR, A-MPR, P-MPR and ΔT_C are defined in [8-1, TS 38.101-1] and [8-2, TS38.101-2]. The remaining parameters are defined in Subclause 7.1.1.

Figure 6 (Ex-1008 at §7.7.1.)

5. Ex-1009: 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; NR; Medium Access Control (MAC) protocol specification (Release 15), 3GPP TS 38.321 V15.1.0 (2018-03) (“TS38.321”)

67. 3GPP TS 38.321 v15.1.0 is a Technical Specification titled “3rd Generation Partnership Project; Technical Specification Group Radio Access Network; NR; Medium Access Control (MAC) protocol specification (Release 15).”

I understand from counsel that TS38.321 is prior art.

68. TS38.321 describes additional techniques intended for use in 5G NR systems, including the handling of Single Entry PHR MAC control elements (CEs). (Ex-1009 at pp.52-53.)

69. There are several “MAC Control Elements (CEs)” defined in TS38.321, one of which is the single entity Power Headroom Report (PHR) MAC CE. (Ex-1009 at §6.1.3.8.)

70. According to TS38.321, “the MAC entity shall multiplex MAC CEs and MAC SDUs in a MAC PDU according to clauses 5.4.3.1 and 6.1.2”, and thus the single entity PHR MAC CE is transmitted in a MAC PDU.

71. According to TS38.321 at §5.4.1 the MAC entity receives an uplink grant “dynamically on the PDCCH, in a Random Access Response, or configured semi-persistently by RRC.” This uplink grant enables the MAC entity to transmit on the UL-SCH (Ex-1009 at §5.4.1.)

6. Ex-1011: 3rd Generation Partnership Project: Technical Specification Group Radio Access Network, NR; Radio Resource Control (RRC) protocol specification (Release 15) 3GPP TS38.331 V15.1.0 (2018-03) (“TS38.331”)

72. 3GPP TS 38.331 v15.1.0 is a Technical Specification titled “3rd Generation Partnership Project; Technical Specification Group Radio Access Network, NR; Radio Resource Control (RRC) protocol specification (Release 15).” I understand from counsel that TS38.331 is prior art.

73. TS38.331 describes the configuration of bandwidth parts including ConfiguredGrantConfig, which is “used to configure uplink transmission without dynamic grant according to two possible schemes.” (Ex-1011 at p.73.)

74. This configuration information allows for the configuration of various PUSCH parameters including the pathlossReferenceIndex. (Ex-1011 at pp.73, 75.)

75. TS38.331 specifies the Radio Resource Control protocol for the radio interface between UE and NG-RAN. When a UE selects a cell, re-selects a cell, returns from out of coverage, is reconfigured upon sync completion, or enters a RAN, a UE must establish a Radio Resource Control (RRC) connection with the gNB. Once the UE is connected, it will acquire system information via the SI acquisition procedure:

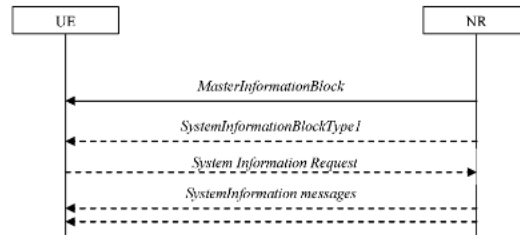


Figure 5.2.2.1-1: System information acquisition

Figure 7 *Diagram showing the system information acquisition procedure (Ex-1011 at §5.2.2.1, FIG. 5.2.2.1-1.)*

76. One piece of information that can be acquired during the system information acquisition procedure is the *BWP Information Element (BWP IE)*. The *BWP IE* is used to configure a bandwidth part. For each serving cell, the network configures at least an initial bandwidth part comprising at least a downlink bandwidth part and one or two uplink bandwidth parts (one if the serving cell is configured with an uplink, two if using a supplementary uplink (“SUL”)). (Ex-1011 at p.73.)

77. The *BWP-UplinkDedicated* contains the *ConfiguredGrantConfig* system information. *ConfiguredGrantConfig* is system information used to configure the uplink transmission without dynamic grant (and includes information used by the *PUSCH-PowerControl*. In the *ConfiguredGrantConfig*, the *rrc-ConfiguredbyUplinkGrant* defines a *pathlossReferenceIndex* as an integer between $(0..maxNrofPUSCH-PathlossReferenceRs-1)$. (See Ex-1011 at pp.83-84.) The *PUSCH-PowerControl* information element then provides the reference signal resource for pathloss estimation *pusch-pathlossReference-rs-config* from within the *pathlossReferenceIndex*.

7. Ex-1012: Samsung, Summary of NR UL power control – CA aspects, Tdoc R1-1805571, 3GPP TSG RAN WG1 #92bis, Sanya, (April 16-20, 2018) (“Samsung”)

78. Samsung is a technical contribution submitted to 3GPP TSG RAN WG1, meeting #92bis which was held between April 16–20, 2018. I understand from counsel that Samsung is prior art.

79. Samsung describes the state of various suggestions for NR uplink power control and particularly the carrier aggregation (“CA”) aspects:

“This contribution summarizes remaining issues on power control for NR-CA and EN-DC based on companies’ Tdocs submitted in AI 7.1.6.2 and AI 7.1.6.3.”

(Ex-1012 at p.1.)

80. Samsung identifies one open issue as being the default parameter setting for virtual PHR, which is a PHR that is transmitted when there is no actual PUSCH transmission—thus requiring the use of reference values in the reporting process rather than the PUSCH power. (*See, e.g.,* Ex-1013, ¶[183] (“[F]or an uplink carrier which has not been determined in or before the second reference subframe to transmit a PUSCH I the first reference subframe, the UE determines the PHR type of the uplink carrier as a virtual PHR. The PHR is calculated according to a predetermined reference format, i.e., according to the PHR formula type 1 ‘if the UE does not transmit a PUSCH’ in TS36.213.5.1,...”).))

81. Samsung teaches that *pusch-pathlossreference-index* = 0 is the pathloss reference (q_d) with the smallest entry (i.e., “0”) of the pathloss reference configuration of the serving cell (*pusch-pathloss-Reference-rs*) and should be used as a default parameter for virtual PHR. (Ex-1012 at pp.7-8.)

8. Ex-1017: U.S. Patent Application Publication No. 2015/0358920 to Sorrentino et. al (“Sorrentino”)

82.Sorrentino is U.S. Patent App. Pub. 2015/0358920, filed as a PCT application on January 14, 2014 and published December 10, 2015. I understand from counsel that Sorrentino is prior art.

83.Sorrentino discloses a method, and wireless terminal for performing the method, for handling uplink transmit power reporting. A UE provides a transmit power report based on at least one of multiple uplink reference signal transmission configurations. The UE transmits the transmit power report to a network node providing the network node with information about a transmit power used by the UE for transmitting the uplink reference signal. (Ex-1017 at [0013].)

84.Sorrentino is in relation to 3GPP LTE: “The cellular radio system may be according to or based on the LTE standard and the radio access network may be an E-UTRAN.” (Ex-1017 at [0021].)

85.The wireless terminal disclosed in Sorrentino is a User Equipment:

“Communication devices such as wireless devices may be also known as e.g. user equipments (UEs), mobile terminals, wireless terminals and/or mobile stations.”

(Ex-1017 at [0003].)

86.The UE in Sorrentino includes a processor, memory, and control circuitry:

“The embodiments of the first wireless terminal 210 may be fully or partly implemented through one or more processors, such as a processor 1505 depicted in FIG.15, together with a computer program for performing the functions and actions of embodiments herein...”

(Ex-1017 at [0159].)

“In some embodiments, also illustrated with support from the schematic drawings in FIGS. 18a-c, there is provided a computer program product, comprising a computer readable medium on which the computer program 1801a is stored. Examples of the a computer-readable medium is ... The mass storage device 1804a is typically based on hard drive(s) or Solid State Drive(s) (SSD)...The computer program 1801a may furthermore be provided as a pure computer program or comprised in a file or files. The file or files may be stored on the computer-readable memory...”

(Ex-1017 at [0161]-[0162].)

87.FIG. 15 illustrates the user equipment used in conjunction with Sorrentino:

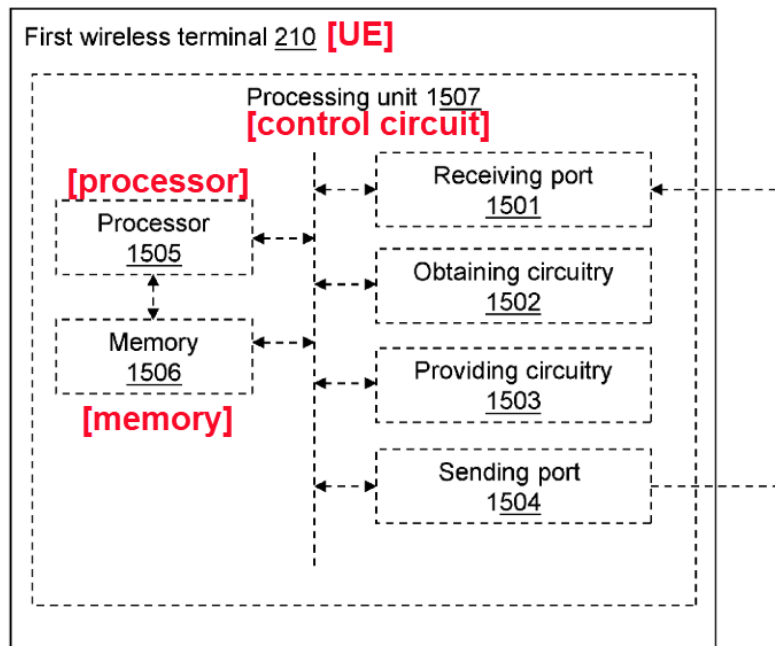


Fig. 15

Figure 8 Sorrentino FIG. 15 illustrating a wireless terminal (UE) with a processor, memory, and control circuit used in connection with providing PHR reporting. (Ex-1017 at FIG. 15.) Annotated by Petitioner.

88.Sorrentino explains that the wireless terminal can be used in connection with providing PHR reporting:

“The first wireless terminal 210 provides a respective transmit power report, e.g. PHR, for at least one of the multiple uplink reference signal transmission configurations comprised in the first wireless terminal 210.”

(Ex-1017 at [0066].)

IX. ERICSSON GROUNDS

A. Ground 1: Ericsson in view of TS38.213 renders obvious Claims 1, 6, and 10

1. Scope, Content, and Rationale for Combining Prior Art

89.A POSITA would have found it obvious to implement techniques from TS38.213 in connection with the techniques from Ericsson for determining whether to trigger a PHR when the UE undergoes beam switching. Ericsson does not explicitly describe how to calculate power headroom from the pathloss reference. However, TS38.213 provides a mathematical relationship intended to be used in NR systems and methods, and it would have been obvious to use these expressions for calculating a power headroom value to include in a PHR. One of ordinary skill in the art would have been led to look to NR specifications for techniques to be used in connection with calculating power headroom from published NR specifications, and would have been led to look at TS38.213 for that reason.

90.Additionally, one of ordinary skill in the art would have found it obvious to use the pathloss value from the pathloss reference to perform uplink power control as set forth in TS38.213 for these same reasons: Ericsson and TS38.213 were both designed to be used in connection with NR systems, and Ericsson and TS38.213 each describe using pathloss references for various purposes, including performing uplink power control on a per-beam basis and for determining whether to trigger a PHR.

91. Finally, one of ordinary skill in the art would have also looked to TS38.213 to determine which pathloss reference to use based on a downlink control information (“DCI”) that schedules a PUSCH. One of ordinary skill in the art reading Ericsson would have looked for other techniques to determine which of numerous possible pathloss references to use for uplink power control, triggering a PHR, and calculating the power headroom value. Looking at the DCI used to schedule the PUSCH transmission was a known technique for identifying the pathloss reference. Using this known technique in connection with Ericsson would have merely used a prior art technique for its known purpose with predictable results of being able to use the DCI to identify the pathloss reference to use for various procedures performed in the UE.

92. Indeed, one of ordinary skill in the art would have looked to the 3GPP NR specifications, including TS38.213, to identify additional procedures to be used and implemented on Ericsson’s UE because the technical specifications described known procedures that were intended to be used in NR-compatible UEs with expected results of being able to communicate over interoperable wireless communication networks. One of ordinary skill in the art would have reasonably expected to succeed in making the claimed combinations because each of Ericsson and TS38.213 were designed to be used together in NR-compatible UEs.

2. Challenged Claims

93. Ground 1 addresses Claims 1, 6, and 10

a. [Claim 1: preamble], [Claim 10: preamble]

94. Insofar as the preambles of Claims 1 and 10 are limiting, it is my opinion that Ericsson discloses and renders obvious “a method for deriving pathloss change.”

95. One exemplary method disclosed and suggested by Ericsson explains that when a UE switches beams, a pathloss change is calculated:

“[f]or beamforming-based transmissions, the pathloss may experience a sudden fluctuation due to frequent blockage as well as the change of serving beam. For Option 2 [i.e., the UE only reports PHR for the beam used for PUSCH transmission] such a situation would imply, in the case of a beam switch, that the UE measures [pathloss] on the new beam but the [pathloss] reference measurement is from the old beam. If the DL PL change (referred to as “*dl-PathlossChange*”) becomes more than *dl-PathlossChange* dB when switching beam, a new PHR would be triggered. This example explains how the beam switches would operate based on the LTE PHR format and trigger.”

(Ex-1007 at p.3.)

96. One of ordinary skill in the art would have understood that Ericsson’s “*dl-PathlossChange*” and “DL PL change” are equivalent to pathloss change. A POSITA would have understood that a UE measuring a pathloss on a new beam and comparing that to a reference measurement from the old beam (i.e., $dl-PathlossChange = pathloss_{new_beam} - pathloss_{old_beam}$) is a method for deriving a pathloss change.

97. Thus Ericsson discloses a method for deriving a pathloss change—i.e., *dl-PathlossChange*.

b. Limitations [1A] and [10A]

98. In my opinion, Ericsson discloses a UE derives “a first pathloss value from a first pathloss reference of a serving cell” as recited in Limitations [1A] and [10A].
99. One of ordinary skill in the art would have understood that Ericsson describes that a UE practices the step whereby the UE (User Equipment) derives a first pathloss value from a first pathloss reference of a serving cell.
100. According to Ericsson, “the UE” determines when to report the power headroom. ((Ex-1007 at p.3) (“Option 2: the UE only reports PHR with respect to beam specific power control.”)). To do this, the UE takes multiple pathloss measurements. When there is a “change of serving beam... the UE measures [pathloss] on the new beam but the reference measurement is from the old beam. If the DL PL change (referred to as the ‘*dl-PathlossChange*’) becomes more than *dl-PathlossChange* dB when switching beam, a new PHR would be triggered.” (Ex-1007 at p.3.)
101. One of ordinary skill in the art would have understood from Ericsson that “the first pathloss reference of a serving cell” is that of the old beam. Ericsson’s UE determines a pathloss value from the first pathloss reference measurement provided by the serving cell of the old beam. The UE also determines a pathloss value from the measurement it takes for the new beam. Ericsson calculates the downlink pathloss change by measuring the difference between the pathloss reference measurement of the old beam and the pathloss measurement of the new beam (i.e., $\Delta PL = PL_{\text{new beam}} - PL_{\text{old beam}}$) and if this downlink pathloss change is greater than a *dl-PathlossChange* dB, then a PHR would be triggered. (Ex-1007 at p.3.)

102. Thus Ericsson discloses this limitation.

c. Limitations [1B] and [10B]

103. In my opinion, Ericsson in view of TS38.213 renders obvious that “the first pathloss value is used for deriving a power headroom value included in a first power headroom report” as recited in Limitations [1B] and [10B].

104. Ericsson teaches that a “UE will maintain one pathloss estimation per beam” and the network “will use one of these beams for PUSCH transmission and it will also decide when to change to another beam upon reception of UE measurements.” (Ex-1007 at p.3.) A POSITA would have known that pathloss measurements are used to determine both (1) when to trigger a PHR, and (2) calculating a power headroom value to include in the PHR.

105. When Ericsson’s UE only reports PHR for the beam used for PUSCH transmission, “...the UE measures [pathloss] on the new beam but the [pathloss] reference measurement is from the old beam. If the DL PL change (referred to as “*dl-PathlossChange*”) becomes more than *dl-PathlossChange* dB when switching beam, a new PHR would be triggered. This example explains how the beam switches would operate based on the LTE PHR format and trigger.” (Ex-1007 at p.3.)

106. Based on Ericsson, one of ordinary skill in the art would have understood how to determine the first pathloss reference (i.e., the pathloss reference measurement from the old beam) and when to send a PHR (i.e., when *dl-PathlossChange* exceeds a threshold).

107. Ericsson also teaches that the “PH value can be calculated based on the power allocation associated with the active BWP.” (Ex-1007 at p.3.)

108. One of ordinary skill in the art would also have understood that Ericsson teaches that the pathloss reference could be used to derive a power headroom value which could be included in the PHR.
109. Ericsson further explains that when the network receives a PHR, it can “interpret PHR” and thus be informed of “the power headroom situation when PHR is transmitted at the time . . . for each serving cell.” (Ex-1007 at p.3.)
110. Ericsson does not describe the details for deriving the power headroom value to include in the PHR. But such a technique had been known to those skilled in the art from the LTE specifications, was included in early developments of the NR standards, and would have been obvious to implement in the context of Ericsson’s techniques for triggering the PHR.
111. One of ordinary skill in the art would have found the use of the first pathloss value for deriving a power headroom value included in a first PHR based on TS38.213.
112. TS38.213 describes a technique for using the first pathloss value to derive a power headroom value included in a first power headroom report in its description of UE uplink power control, for example, in section 7.7.1. (See Ex-1008 at p.24.)
113. For example, TS38.213 describes a “Type 1 PH Report” and explains that:

7.7.1 Type 1 PH Report

If a UE transmits PUSCH in PUSCH transmission period i on UL BWP b of carrier f of serving cell c , the UE computes a power headroom for a Type 1 report as

$$PH_{type1,b,f,c}(i, j, q_d, l) = P_{MAX,f,c}(i) - \left\{ P_{O_PUSCH,b,f,c}(j) + 10 \log_{10} (2^{\mu} \cdot M_{RB,b,f,c}^{PUSCH}(i)) + \alpha_{b,f,c}(j) \cdot PL_{b,f,c}(q_d) + \Delta_{TF,b,f,c}(i) + f_{b,f,c}(i, l) \right\} \quad [\text{dB}]$$

where $P_{MAX,f,c}(i)$, $P_{O_PUSCH,b,f,c}(j)$, $M_{RB,b,f,c}^{PUSCH}(i)$, $\alpha_{b,f,c}(j)$, $PL_{b,f,c}(q_d)$, $\Delta_{TF,b,f,c}(i)$ and $f_{b,f,c}(i, l)$ are defined in Subclause 7.1.1.

Figure 9 (Ex-1008 at p.24.) Note: various variables in this expression including $(PL_{b,f,c})$ “are defined in Subclause 7.1.1)

114. In the equation for power headroom value, various variables, including $(PL_{b,f,c})$ are defined in Subclause 7.1.1. According to Subclause 7.1.1, $(PL_{b,f,c})$ is defined as “a downlink path-loss estimate in dB calculated by the UE using reference signal (RS) resource q_d for UL BWP b of carrier f of serving cell c .” (Ex-1008 at p.14.)
115. A POSITA would have understood that the “power headroom value” is $PH_{type1,b,f,c}(i, j, q_d, l)$. One of ordinary skill in the art would have also understood that the power headroom value $PH_{type1,b,f,c}(i, j, q_d, l)$ is derived from a first pathloss value $(PL_{b,f,c})$ and included in a first power headroom report (“Type 1” PHR). (See Ex-1008 at §§ 7.1.1, 7.7.1.)
116. One of ordinary skill in the art would have found it obvious to use Ericsson’s first pathloss value to derive a power headroom value (using TS38.213 at §7.7.1.) to be included in the first power headroom report because this was a known use of pathloss values. A POSITA would have been familiar with using pathloss values to calculate the power headroom for an uplink transmission and reporting it the network in a PHR to inform

the network of the UE's power headroom value. This technique had been known at least since the development of LTE.

d. Limitations [1C] and [10C]

117. In my opinion, Ericsson discloses and renders obvious “the UE derives a second pathloss value from a second pathloss reference of the serving cell after deriving the first pathloss value, wherein the second pathloss reference is separate from the first pathloss reference” as recited in Limitations [1C] and [10C].
118. In Ericsson, the claimed second pathloss reference of the serving cell is the “new beam” on which a second pathloss value is derived after deriving the first pathloss value.
119. Ericsson teaches that after a beam change (“change of serving beam”), the “UE measures [the pathloss] on the new beam.” (Ex-1007 at p.3.) Ericsson's “new beam” therefore provides a second pathloss reference of the serving cell which “is separate from the first pathloss reference,” as it is derived from the “new beam,” whereas the first pathloss reference was based on the “old beam.” The “new beam” is different from the “old beam.”
120. Calculating Ericsson's “DL PL change (referred to as *dl-PathlossChange*)” to determine whether it is “more than *dl-PathlossChange* dB when switching beam,” requires the UE to determine the claimed second pathloss value from the second pathloss reference (i.e., a second PL on the new reference beam of the serving cell). One of ordinary skill in the art would have understood that this is determined after deriving the first pathloss value as described in Ericsson because the second pathloss value is described as being measured after “a beam switch” and “on a new beam.” (Ex-1007 at p.3.)

e. Limitations [1D] and [10D]

121. Claims 1 and 10 differ as to Limitations [1D] and [10D]. It is my opinion that these Limitations are disclosed and rendered obvious by Ericsson in view of TS38.213.
122. **Limitation [1D]:** In my opinion, Ericsson in view of TS38.213 discloses and renders obvious that the second pathloss reference “is used for power control for a first Physical Uplink Shared Channel (PUSCH) transmission on the serving cell” as recited in Limitation [1D].
123. Ericsson explains that “[a] UE may be connected to multi-beams for enhanced bit rate or improved transmission reliability. RAN 1 has already agreed that NR supports beam specific power control.” (Ex-1007 at p.3.) One of ordinary skill in the art would have understood that beam specific power control was already supported in NR according to the 3GPP RAN1. (*Id.*).
124. As discussed above, when Ericsson switches beams, the “UE measures [the pathloss] on the new beam.” (Ex-1007 at p.3.) One of ordinary skill in the art would have understood that the pathloss on the new beam is the *second* pathloss, as it is measured *after* the first pathloss (i.e., the pathloss associated with the old beam).
125. Ericsson describes “two options for PHR report with respect to beam specific power control,” one of which is that “the UE only reports a PHR for the beam used for PUSCH transmission.” (Ex-1007 at p.3.) A POSITA would have understood that when switching beams, the new beam would be used for PUSCH transmission and its pathloss (i.e., the second pathloss reference) should be used in determining power control for the PUSCH.

126. Ericsson also explains that there was an agreement that there would be “two power control processes per cell” in NR. (Ex-1007 at p.2.) Ericsson further explains that “one PUSCH transmission should be subject to only one power control process.” (*Id.*) One of ordinary skill in the art would have understood that, if the second pathloss reference were used to determine power control for the PUSCH, then no other pathloss reference could be used in that determination.

127. Insofar as Ericsson does not explicitly state that the second pathloss reference is used for power control for a first PUSCH, one of ordinary skill in the art would have known that uplink power control is determined from the pathloss value estimate for the next transmission on the PUSCH. In other words, the second pathloss reference is used to derive the second pathloss value estimate, which is in turn used to determine power control for a first PUSCH transmission on the serving cell. This was known to those of ordinary skill in the art as shown by TS38.213.

128. TS38.213 explains the details of determining the PUSCH power control, which in combination with Ericsson, renders obvious the use of the second pathloss reference for power control of the first PUSCH transmission. Specifically, TS38.213 at §7.1.1 details:

7 Uplink Power control

Uplink power control determines the transmit power of the different uplink physical channels or signals.

7.1 Physical uplink shared channel

For PUSCH, a UE first scales a linear value $\hat{P}_{\text{PUSCH},f,c}(i,j,q_d,l)$ of the transmit power $P_{\text{PUSCH},f,c}(i,j,q_d,l)$ on UL BWP b , as described in Subclause 12, of carrier f of serving cell c , with parameters as defined in Subclause 7.1.1, by the ratio of the number of antenna ports with a non-zero PUSCH transmission to the number of configured antenna ports for the transmission scheme. The resulting scaled power is then split equally across the antenna ports on which the non-zero PUSCH is transmitted.

7.1.1 UE behaviour

If a UE transmits a PUSCH on UL BWP b of carrier f of serving cell c using parameter set configuration with index j and PUSCH power control adjustment state with index l , the UE shall determine the PUSCH transmission power $P_{\text{PUSCH},f,c}(i,j,q_d,l)$ in PUSCH transmission period i as

$$P_{\text{PUSCH},f,c}(i,j,q_d,l) = \min \left\{ P_{\text{CMAX},f,c}(i), P_{\text{O_PUSCH},f,c}(j) + 10 \log_{10} (2^{\mu} \cdot M_{\text{RB},f,c}^{\text{PUSCH}}(i)) + \alpha_{f,c}(j) \cdot PL_{f,c}(q_d) + \Delta_{\text{TF},f,c}(i) + f_{f,c}(i,l) \right\} \text{ [dBm]}$$

where,

- $PL_{b,f,c}(q_d)$ is a downlink path-loss estimate in dB calculated by the UE using reference signal (RS) resource q_d for UL BWP b of carrier f of serving cell c .

Figure 10 (Ex-1008 at §7.1.1.)

129. One of ordinary skill in the art would have understood from the above equation for power control that the power control for a PUSCH transmission ($P_{\text{PUSCH},f,c}(I,j,q_d,l)$) on a serving cell is a function of the pathloss value ($PL_{b,f,c}(q_d)$), which was derived from a pathloss reference q_d .
130. Based on the combined teachings of Ericsson and TS38.213, the second pathloss reference in Ericsson would have been used to determine the second pathloss value ($PL_{b,f,c}(q_d)$) which would be used by the UE to determine the power control for a PUSCH transmission ($P_{\text{PUSCH},f,c}(I,j,q_d,l)$) on a serving cell. (Ex-1008 at §7.1.1, p.13; Ex-1007 at p.3.)

131. A POSITA would have therefore found it obvious to use the second pathloss reference for power control for a first Physical Uplink Shared Channel (PUSCH) transmission on the serving cell.
132. **Limitation [10D]:** In my opinion, Ericsson in view of TS38.213 discloses and renders obvious that “the second pathloss reference...is used for deriving a second power headroom value” as recited in Limitation [10D].
133. Ericsson explains that when there is a “change of serving beam...the UE measures [pathloss] on the new beam” to determine whether the downlink PL change (i.e., the second pathloss (on the new beam) minus the first pathloss (on the old beam)) exceeded *dl-PathlossChange* dB, and thus whether to trigger a new PHR. (Ex-1007 at p.3.) Thus, Ericsson teaches measuring the second pathloss on a second pathloss reference. As explained in connection with Limitations [1B] and [10B], TS38.213 explains that the measured pathloss value ($PL_{b,f,c}(q_d)$) (here, the second pathloss value from the second pathloss reference) is used to derive a second power headroom value ($PH_{type1, b, f, c}(i, j, q_d, l)$)—i.e., a power headroom value determined using the pathloss from the second pathloss reference after a beam switch to include in a “Type 1” PHR to be sent in a PUSCH transmission (as defined in TS38.213 at §7.7.1). (Ex-1008 at p.24.)
134. It would have been obvious to use the second pathloss reference for deriving a second power headroom value to include in a PHR sent via the first PUSCH transmission after a beam switch (and thus change in the pathloss reference) because this was a known use of pathloss values. Specifically, it was known to use pathloss values to calculate the power headroom for an uplink transmission and report them to the network in a

PHR to inform the network of the UE's power headroom value. This technique had been known at least since the development of the LTE.

f. Limitations [1E] and [10E]

135. In my opinion, Ericsson discloses and renders obvious that “the UE derives the pathloss change based on the first pathloss value and the second pathloss value” as recited in Limitations [1E] and [10E].

136. Ericsson describes the use of a pathloss reference measurement on an “old beam” (i.e., a first pathloss reference signal from which the UE derives a first pathloss value) and a pathloss measurement on a “new beam” (i.e. a second pathloss reference signal from which the UE derives a second pathloss value) to calculate the pathloss change – *dl-PathlossChange*.

“For beamforming-based transmissions, the pathloss may experience a sudden fluctuation due to frequent blockage as well as the change of serving beam. For Option 2 such a situation would imply, in the case of a beam switch, that the UE measures on the new beam but the reference measurement is from the old beam. If the DL PL change (referred to as “*dl-PathlossChange*”) becomes more than *dl-PathlossChange* dB when switching beam, a new PHR would be triggered. This example explains how the beam switches would operate based on the LTE PHR format and trigger. From this example, it is also indicated that the subsequent DL PL measurements used in the PHR triggers may be different serving beams.”

(Ex-1007 at p.3.)

137. One of ordinary skill in the art would have understood that the first pathloss reference signal (measured on the “old beam”) and second pathloss reference signal (measured on the “new beam”) would be used to derive a first pathloss value and a second pathloss value, and that these pathloss values would be used to calculate pathloss change. Thus, Ericsson teaches

that the UE derives the pathloss change (*dl-PathlossChange*) based on the first pathloss value and the second pathloss value.

g. Limitations [1F] and [10F]

138. Limitations [1F] and [10F] both require that “the UE determines whether a second power headroom report is triggered based on whether the pathloss change is more than a threshold.” Limitation [10F] further requires the second PHR to include the second power headroom value. In my opinion, these limitations are disclosed or rendered obvious over Ericsson alone or in view of TS38.213.
139. Ericsson explains that “in the case of a beam switch, . . . the UE measures [pathloss] on the new beam but [uses] the [pathloss] reference measurement from the old beam [to calculate the DL PL change]. If the DL PL change (referred to as ‘*dl-PathlossChange*’) becomes more than *dl-PathlossChange* dB when switching beam, a new PHR would be triggered. This example explains how the beam switches would operate based on the LTE PHR format and trigger.” (Ex-1007 at p.3.)
140. Ericsson explains that “a new PHR would be triggered” when the pathloss change “*dl-PathlossChange*” exceeds a threshold “*dl-pathlossChange* dB.” One of ordinary skill in the art would have understood that the “new PHR” is the second PHR associated with the second pathloss value (derived from the “new beam”). After “a beam switch,” Ericsson teaches that the UE determines whether to trigger a second PHR based on whether the pathloss change (*dl-PathlossChange*) is more than a threshold (i.e., “becomes more than *dl-PathlossChange* dB”).
141. Additionally, Ericsson explains that “[u]pon reception of the PHR, the network can interpret PHR accordingly, i.e., the power headroom situation

when PHR is transmitted at the time (beginning of the TTI, that used to transmit PHR) for each serving cell.”(Ex-1007 at p.3.)

142. The network is informed of “the power headroom situation when the PHR is transmitted” because the PHR includes the second power headroom value derived using the second pathloss reference. At the very least, this additional aspect of Limitation [10F] would have been obvious over Ericsson in view of TS38.213 because TS38.213 explains that the pathloss value ($PL_{b,f,c}(q_d)$) is used to calculate the power headroom ($PH_{type1,b,f,c}(i,j,q_d,l)$) to include in a Type 1 PHR. In my opinion, including this additional feature in the system contemplated by Ericsson would have been obvious.

h. Claim 6

143. In my opinion, Ericsson in view of TS38.213 renders obvious “a first DCI scheduling the first PUSCH transmission indicates the second pathloss reference” as recited in Claim 6.

144. As explained above, Ericsson describes a beam switching scenario and further describes how a second pathloss reference is used to determine whether to trigger a second PHR. Ericsson does not explicitly describe how the first PUSCH transmission is scheduled or mention that DCI scheduling the first PUSCH transmission indicates the second pathloss reference. However, these features are described by TS38.213.

145. TS38.213 explains that a downlink control information (DCI), such as “DCI format 0_1,” is used to schedule a PUSCH transmission, such as a first PUSCH transmission. (See Ex-1008 at § 7.1.1 (“If the PUSCH transmission is scheduled by a DCI format 0_1...”))

146. The DCI described in TS38.213 indicates the second pathloss reference as detailed in TS38.213 at § 7.1.1, which explains, “[i]f the PUSCH transmission is scheduled by DCI format 0_1 and if the DCI format 0_1 includes a SRI field, the UE determines the RS resource q_d from the value of *pusch-pathlossreference-index* that is mapped to the SRI field value.” (Ex-1008 at § 7.1.1.) Thus, the pathloss reference (RS resource q_d) is determined from value *pusch-pathlossreference-index* mapped to the SRI field value in the DCI format 0_1.

147. It is my opinion that it would have been obvious to implement Ericsson using DCI format 0_1 with an SRI field indicating the second pathloss reference (to be used when determining whether to trigger a new PHR) when scheduling the first PUSCH transmission.

B. Ground 2: Ericsson in view of TS38.213 and further in view of TS38.321 renders obvious Claims 2-4 and 13-14

1. Scope, Content, and Rationale for Combining Prior Art

148. One of ordinary skill in the art would have found it obvious to implement techniques from TS38.213 and TS38.321 in connection with Ericsson’s techniques for determining whether to trigger a PHR when the UE undergoes beam switching. For example, while Ericsson does not explicitly state that the PHR is transmitted “via” a first or second PUSCH, TS38.321 explains how MAC control elements, including the MAC CE for the PHR, are conveyed to the physical layer via the UL-SCH transport channel in order to be transmitted over the air via a PUSCH transmission. (Ex-1009, pp. 9, 52-53; *see also* EX-1010, p.7 (“The physical-layer model for Uplink Shared Channel transmission is described based on the corresponding PUSCH physical-layer-processing chain[.]”)) One of

ordinary skill in the art would have looked to TS38.321 to find a discussion of how a PHR is conveyed from the MAC layer over the air via the physical layer. *Id.* One of ordinary skill in the art would thus have found it obvious transmit Ericsson's PHR via the claimed PUSCH transmissions because this was a known way for a PHR to be transmitted to the network.

149. One of ordinary skill in the art reading Ericsson would also have looked for ways to determine which of the numerous possible pathloss references to use for various purposes, including uplink power control, determining whether to trigger a PHR, and for calculating the power headroom value. A POSITA would have known that one common technique for identifying the pathloss reference was to look at the DCI used to schedule the PUSCH transmission for an indication of the pathloss reference to use. Using this known technique in connection with Ericsson was to merely use a prior art technique for its known purpose with predictable results (i.e., being able to use the DCI to identify the pathloss reference to use for various procedures performed in the UE).

150. Indeed, a POSITA would have looked to the NR specifications from 3GPP, including TS38.213, to identify additional procedures to be used and implemented on Ericsson's UE because the technical specifications described known procedures that were intended to be used in NR-compatible UEs with expected results—i.e., being able to communicate over interoperable wireless communication networks. One of ordinary skill in the art would have reasonably expected to succeed in making the claimed combinations because each of Ericsson and TS38.213 were designed to be used together in NR-compatible UEs.

2. Challenged Claims

151. Ground 2 addresses Claims 2-4 and 13-14.

a. Claim 2

152. In my opinion, Ericsson in view of TS38.213 and further in view of TS38.321 discloses or at least renders obvious that “the second power headroom report is transmitted via the first PUSCH transmission when the second power headroom report is triggered” as recited in Claim 2.

153. As explained in connection with Limitation 1[d], Ericsson teaches that one proposed technique for transmitting power headroom reports was that “the UE only reports a PHR for the beam used for PUSCH transmission.” (Ex-1007 at p. 3.) After a UE switches beams and measures the pathloss “on the new beam” and compares it to the pathloss reference measurement of “the old beam,” if “*dl-PathlossChange*” is “more than *dl-PathlossChange* dB,” the second power headroom report is triggered and is transmitted via the first PUSCH transmission. (*Id.*)

154. TS38.321 describes how a PHR is provided from the MAC layer to the physical layer for transmission. A “Single Entry PHR MAC CE” is an example of a MAC Control element. (Ex-1009 at pp.52-53.) The “Single Entry PHR MAC CE” has a fixed size and consists of two octets as shown below:

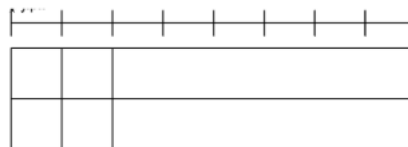


Figure 6.1.3.8-1: Single Entry PHR MAC CE

Figure 11 *Single Entry PHR MAC CE (Ex-1009 at pp.52-53) indicating a fixed size, with two octets.*

155. The Single Entry PHR MAC CE contains the following fields: reserved bits (R, set to “0”), Power Headroom (PH) (a field of 6 bits indicating the power headroom level), and $P_{\text{CMAX},c}$ (a field indicating the $P_{\text{CMAX},c}$ used for calculation of the PH field). (Ex-1009 at pp.52-53.) A MAC entity of the UE handles transport channels such as the UL-SCH (uplink shared channel). (Ex-1009 at p.9.; *see also* Ex-1010 at p.7.).

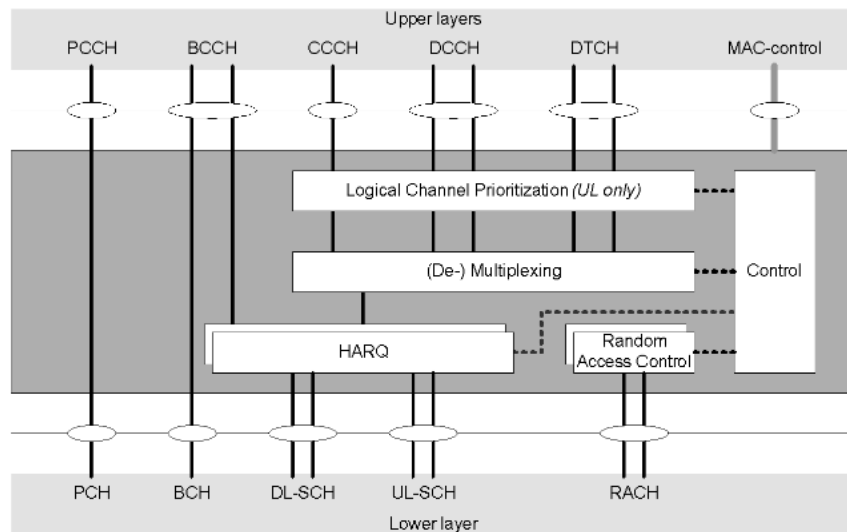


Figure 4.2.2-1: MAC structure overview

Figure 12 *A possible structure of the MAC entity (when Secondary Cell Group (SCG) is not configured) (Ex-1009 at p.10.). Notice that the MAC entity handles the UL-SCH transport channel.*

156. One of ordinary skill in the art would have understood that UL-SCH transport blocks from the MAC layer undergo physical layer processing to map them onto the OFDM symbols of the PUSCH (physical channel). (Ex-1010, p.7.)

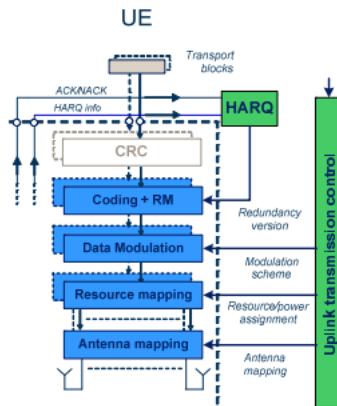


Figure 13 *Physical Layer Processing for the PUSCH. A UL-SCH transport block from the MAC layer undergoes Physical Layer Processing in order be mapped onto the OFDM symbols of the PUSCH. (Ex-1010 at p.7.).*

157. Thus, a PHR included in a MAC CE is conveyed by the MAC entity of the UE on the UL-SCH transport channel, which undergoes physical layer processing to enable it be physically transmitted via PUSCH to the network. Thus, the second PHR is transmitted via the first PUSCH transmission after a beam switch, and the second PHR is triggered as described above.

158. One of ordinary skill in the art would have found it obvious to transmit the second PHR via the first PUSCH transmission when the PHR is triggered based on the combination of Ericsson in view of TS38.213 and further in view of TS38.321 because Ericsson's PHR triggering and reporting techniques were intended to be used in NR systems, and TS38.213 and TS38.321 are technical specifications for NR systems which describe power headroom reporting and transmission of MAC CEs, like PHR MAC control elements.

b. Claims 3 and 13

159. In my opinion, Ericsson in view of TS38.213 and further in view of TS38.321 renders obvious "the first pathloss value is used for power control

for a second PUSCH transmission on the serving cell, wherein the first power headroom report is transmitted via the second PUSCH transmission” as recited in Claim 3, and renders obvious “the first pathloss value is used for power control for a PUSCH transmission on the serving cell, wherein the first power headroom report is transmitted via the PUSCH transmission” as recited in Claim 13. Claim 13 is the same as Claim 3 except that it omits the word “second.” Thus, explanations for Claim 3 are applicable to Claim 13.

160. Ericsson’s first pathloss value is the pathloss value derived from the “old beam” before a beam switch has occurred, as discussed in connection with Limitation 1[a], above.
161. Ericsson’s first PHR is described in connection with Limitation 1[b] above. This PHR includes the first power headroom value derived from the first pathloss value derived from the first pathloss reference.
162. Ericsson does not explicitly state that the first pathloss value is used for power control for a second PUSCH. However, using a pathloss value as measured on the “old beam” to control the power used to transmit on the PUSCH transmission associated with that “old beam” is a technique that would have been obvious over TS38.213. (Ex-1008 at pp.13-14.) TS38.213 at §7.1.1 defines the expression for determining PUSCH transmit power $P_{\text{PUSCH},f,c}(I, j, q_d, l)$ using $PL_{b,f,c}(q_d)$, which is the downlink pathloss estimate in dB. (*Id.*):

7 Uplink Power control

Uplink power control determines the transmit power of the different uplink physical channels or signals.

7.1 Physical uplink shared channel

For PUSCH, a UE first scales a linear value $\hat{P}_{\text{PUSCH},f,c}(i,j,q_d,l)$ of the transmit power $P_{\text{PUSCH},f,c}(i,j,q_d,l)$ on UL

BWP b , as described in Subclause 12, of carrier f of serving cell c , with parameters as defined in Subclause 7.1.1, by the ratio of the number of antenna ports with a non-zero PUSCH transmission to the number of configured antenna ports for the transmission scheme. The resulting scaled power is then split equally across the antenna ports on which the non-zero PUSCH is transmitted.

7.1.1 UE behaviour

If a UE transmits a PUSCH on UL BWP b of carrier f of serving cell c using parameter set configuration with index j and PUSCH power control adjustment state with index l , the UE shall determine the PUSCH transmission power $P_{\text{PUSCH},f,c}(i,j,q_d,l)$ in PUSCH transmission period i as

$$P_{\text{PUSCH},f,c}(i,j,q_d,l) = \min \left\{ P_{\text{CMAX},f,c}(i), P_{\text{O_PUSCH},f,c}(j) + 10 \log_{10} (2^{\mu} \cdot M_{\text{RB},f,c}^{\text{PUSCH}}(i)) + \alpha_{f,c}(j) \cdot PL_{f,c}(q_d) + \Delta_{\text{TF},f,c}(i) + f_{f,c}(i,l) \right\} \text{ [dBm]}$$

where,

- $PL_{b,f,c}(q_d)$ is a downlink path-loss estimate in dB calculated by the UE using reference signal (RS) resource q_d for UL BWP b of carrier f of serving cell c .

Figure 14 *Determining PUSCH transmit power $P_{\text{PUSCH},f,c}(l,j,q_d,l)$ using $PL_{b,f,c}(q_d)$, which is the downlink pathloss estimate in dB. (Ex-1008 at pp.13-14.).*

163. The first power headroom report is a PHR transmitted while the UE is measuring the pathloss on the “old beam.” One of ordinary skill in the art would have found it obvious to transmit the first power headroom report via the second PUSCH transmission—i.e., on the uplink beam used before a beam switch—based on the teachings of TS38.321, which explain that PHR MAC CEs are transmitted via PUSCH, as described above. (Ex-1009, pp. 9, 52-53.)

164. It would have therefore been obvious to use a technique whereby the first pathloss value was used for a second PUSCH transmission on the

serving cell and that the first power headroom report is transmitted via the second PUSCH transmission based on TS38.213 and TS38.321.

c. Claims 4 and 14

165. In my opinion, Ericsson in view of TS38.213 and further in view of TS38.321 renders obvious “a second downlink control information (DCI) scheduling the second PUSCH transmission indicates the first pathloss reference” as recited in Claim 4. Claim 14 omits the word “second” when referring to the DCI and PUSCH transmission, but is otherwise the same and in my opinion is also rendered obvious by Ericsson in view of TS38.213 and further in view of TS38.321. Thus, explanations for Claim 4 are applicable to Claim 14.

166. As explained above, Ericsson describes a second PUSCH transmission—i.e., the one that includes the PHR transmitted before a beam switch and using the “old beam” as the pathloss reference. TS38.213 describes how a UE goes about identifying the pathloss reference to use for calculating the PUSCH transmission power. (Ex-1008 at pp.13-14). As explained above, TS38.213 indicates that “ $PL_{b,f,c}(q_d)$ is a downlink pathloss estimate in dB calculated by the UE using reference signal (RS) resource q_d for UL BWP b of carrier f of serving cell c .” (Ex-1008 at p.14.) One of the ways that the pathloss reference is identified is described as follows by TS38.213:

“If the PUSCH transmission is scheduled by a DCI format 0_1 and if the DCI format 0_1 includes a SRI field, the UE determines the RS resource q_d from the value of the pusch-pathlossreference-index that is mapped to the SRI field value.”

(Ex-1008 at p.14.)

167. Thus, TS38.213 discloses using downlink control information—i.e., “DCI format 0_1” scheduling the second PUSCH transmission—i.e., transmission on PUSCH before a beam switch according to Ericsson—and the DCI indicates the first pathloss reference—i.e., the “RS resource q_d ” as reflected in the value of `pusch-pathlossreference-index`. (Ex-1008 at p.14.) The DCI would have obviously been a “second” DCI because different DCI would have obviously been used to schedule PUSCH before and after a beam switch in the combined techniques of Ericsson, TS38.213, and TS38.321.

168. In the context of NR systems, in which Ericsson was designed to be used, it would have been obvious to include the use of a second downlink control information (DCI) scheduling the second PUSCH transmission which indicates the first pathloss reference.

C. Ground 3: Ericsson in view of TS38.213 and TS38.321 and further in view of TS38.331 renders obvious Claims 5, 7, and 15

1. Scope, Content, and Rationale for Combining Prior Art

169. It would have been obvious to use the techniques described in TS38.331, including the use of *ConfiguredGrantConfig*, to configure Ericsson’s first and second PUSCH transmission as well as to indicate the first and second pathloss reference depending on whether the PUSCH transmission occurs before or after beam switching. First, Ericsson was intended to be used in connection with NR systems and methods. Second, TS38.213, TS.38.321, and TS38.331 each form a part of the comprehensive technical specification intended to define the NR standard. Therefore, one of ordinary skill in the art would naturally have thought of combining the

various specified techniques of Ericsson, TS38.213, TS.38.321, and TS38.331.

170. Additionally, one of ordinary skill in the art considering Ericsson would have looked for known techniques for use in configuring the PUSCH transmission before the beam switching occurred in addition to identifying which reference to use for determining pathloss to use for PUSCH power control and to determine whether to transmit a PHR. A POSITA would have been aware that 3GPP had already specified the techniques for configuring PUSCH transmissions and identifying the reference to use for determining whether a PHR is triggered. A POSITA would have also been aware that 3GPP had already described techniques for uplink power control. Therefore, a person of ordinary skill in the art would have found it obvious to use those techniques, such as *ConfiguredGrantConfig*, to configure Ericsson's second PUSCH and to identify the pathloss reference to use for uplink power control and PHR triggering purposes.

171. This combination of these references is suggested implicitly by their context as being part of the same NR standard-setting efforts. Not only this, but the combination of TS38.331 with Ericsson, TS38.213, and TS-38.321 would have merely have resulted in the combination of prior art techniques according to known methods to achieve predictable results—namely combining Ericsson's technique for triggering PHRs with beam switching techniques with techniques specified by the standard for identifying the pathloss reference to use for determining downlink pathloss, and configuring PUSCH transmissions as defined in various parts of the 3GPP technical specifications including TS38.213, TS38.321, and TS38.331.

2. Challenged Claims

172. Ground 3 addresses Claims 5,7,15

a. Claims 5, 7, and 15

173. In my opinion, Ericsson in view of TS38.213, and TS38.321, and in further view of TS38.331 renders obvious “the second PUSCH transmission is configured by a parameter *ConfiguredGrantConfig* and the *ConfiguredGrantConfig* indicates the first pathloss reference” as recited in Claims 5, 7, and 15.

174. As described above, Ericsson’s second PUSCH transmission is a PUSCH transmission that occurs before a beam switch. The first PUSCH transmission is a PUSCH transmission that occurs *after* a beam switch. Draft NR standard specifications include several suggested techniques for configuring PUSCH transmissions, as well as techniques for identifying the pathloss reference to use for uplink power control. One such way to configure PUSCH transmissions and identify which pathloss reference to use for power control and PHR triggering applies when configuring a bandwidth part. (Ex-1011 at p.64.) TS38.331 specifies that “at least an initial bandwidth part comprising of at least a downlink bandwidth part and” one or two uplink BWPs are configured. (*Id.*) Further, the “IE *ConfiguredGrantConfig* is used to configure uplink transmission without dynamic grant according to two possible schemes. The actual uplink grant may either be configured via RRC (type 1) or provided via the PDCCH (addressed to CS-RNTI) (type 2).” (*Id.* at p.73.) Therefore, TS38.331 discloses that a PUSCH transmission is configured by a parameter *ConfiguredGrantConfig*. This technique would apply to both the first and second PUSCH transmission contemplated by Ericsson.

175. *ConfiguredGrantConfig* includes “*pathlossReferenceIndex*” which indicates the pathlossreference to use (first or second) in connection with power control for the applicable PUSCH transmission and in determining whether to trigger a PHR.

```
-- ASN1START
-- TAG-CONFIGUREDGRANTCONFIG-START
ConfiguredGrantConfig ::= SEQUENCE {
    mcsAndTBS INTEGER (0..31),
    -- Enables intra-slot frequency hopping with the given frequency hopping offset
    -- Corresponds to L1 parameter 'UL-TWG-hopping' (see 38.214, section PDS_Section)
    frequencyHoppingOffset INTEGER (1..maxNrofPhysicalResourceBlocks-1),
    pathlossReferenceIndex INTEGER (0..maxNrofPUSCH-PathlossReferenceRSs-1),
    ...
} OPTIONAL -- Cond-Type1
```

Figure 15 (Ex-1011 at pp. 73, 75.)

176. It would have been obvious to use the techniques described in TS38.331, including the use of *ConfiguredGrantConfig*, to configure Ericsson’s first and second PUSCH transmission. It would have also been obvious to use these techniques to indicate the first and second pathloss reference depending on whether the PUSCH transmission occurs before or after beam switching. Such is because (1) Ericsson was intended to be used in connection with NR systems and methods, (2) TS38.213, TS38.321, and TS38.331 are part of a comprehensive technical specification that was intended to define the NR standard, thus leading to one of ordinary skill in the art to have naturally thought of combining the various specified techniques. Additionally, a POSITA considering Ericsson would have looked for known techniques to configure the PUSCH transmission before beam switching occurred, and to identify the reference to use for determining pathloss to use for PUSCH power control and to determine whether to transmit a PHR.

177. One of ordinary skill in the art would have been aware that the 3GPP had specified techniques for configuring PUSCH transmissions and identifying the reference to use for determining whether a PHR is triggered and for uplink power control, and would have found it obvious to use those techniques, such as the use of *ConfiguredGrantConfig*, to configure Ericsson's second PUSCH transmission and to identify the pathloss reference to use for uplink power control and PHR triggering purposes.

178. Not only is the combination of these references suggested implicitly by their context as being part of the NR standard setting efforts, the combination of TS38.331 with Ericsson, TS38.213, and TS38.321 would have merely combined prior art techniques according to known methods to achieve predictable results—namely, combining Ericsson's technique for triggering PHRs with beam switching techniques specified by the standard for identifying the pathloss reference to use for determining downlink pathloss and configuring PUSCH transmissions as defined in various parts of the 3GPP Technical Specifications including TS38.213, TS38.321, and TS38.331.

D. Ground 4: Ericsson in view of TS38.213 and TS38.321 and further in view of Samsung renders obvious Claims 8-9, 11-12, and 16

1. Scope, Content, and Rationale for Combining Prior Art

179. It would have been obvious to modify Ericsson to generate a virtual PHR in the scenario in which the UE does not transmit any PUSCH transmission on the serving cell when transmitting a PHR, and the pathloss reference is a pathloss reference with a smallest entry of a pathloss reference configuration of the serving cell in view of TS38.213 and Samsung. One of ordinary skill in the art would have been motivated to use

known processes for transmission of virtual PHRs because it would allow the UE to report its power headroom even when no PUSCH is scheduled, thus allowing the network to better manage performance and be aware of the power headroom of a particular UE for resource allocation purposes.

180. Additionally, a POSITA seeking to implement a virtual PHR in the context of Ericsson would have found it obvious to implement a technique such as that disclosed in Samsung and identify the pathloss reference (q_d) as the smallest entry of a pathloss reference configuration, and use PUSCH-PathlossReferenceRS as the pathloss reference configuration, because this would have merely combined a known technique for identifying the pathloss reference to use to calculate the power headroom for a virtual PHR, according to known methods of implementing techniques for PHR in wireless systems (such as NR) to achieve predictable results. This would allow a virtual PHR to be sent using an appropriate pathloss reference. Indeed, the '585 patent itself admits that this was the technique that had been agreed to in setting the NR specifications. (Ex-1001 at 14:66-15:6.) One of ordinary skill in the art would have reasonably expected to succeed in combining these techniques for PHR because they were intended to be implemented in connection with NR systems and methods.

2. Challenged Claims

181. Ground 4 addresses Claims 8-9, 11-12, and 16.

a. Claims 8 and 16

182. In my opinion, Ericsson in view of TS38.213 and TS38.321 and further in view of Samsung renders obvious “the first pathloss reference is a pathloss reference with the smallest entry of a pathloss reference configuration of the serving cell when the UE does not transmit any PUSCH

transmission on the serving cell with transmitting the first power headroom report” as recited in Claims 8 and 16.

183. These claims addresses a scenario related to a virtual PHR, which is a PHR generated when a PUSCH is not transmitted to the serving cell.

184. As explained in connection with Limitation 1[a], Ericsson discloses a first pathloss reference—i.e., the pathloss reference used to determine pathloss on the “old beam.”

185. TS38.213 discloses that there are circumstances when the UE does not transmit any PUSCH transmission on the serving cell when transmitting the first power headroom report. (Ex-1008 at p.24.) In describing a “Type 1 PH Report,” TS38.213 explains that:

If the UE does not transmit PUSCH in PUSCH transmission period i on UL BWP b of carrier f of serving cell c , the UE computes a power headroom for a Type 1 report as

$$PH_{\text{type1},b,f,c}(i,j,q_d,l) = \tilde{P}_{\text{MAX},f,c}(i) - \left\{ P_{\text{O_PUSCH},b,f,c}(j) + \alpha_{b,f,c}(j) \cdot PL_{b,f,c}(q_d) + f_{b,f,c}(i,l) \right\} \text{ [dB]}$$

where $\tilde{P}_{\text{MAX},f,c}(i)$ is computed assuming MPR=0dB, A-MPR=0dB, P-MPR=0dB. ΔT_C =0dB. MPR, A-MPR, P-MPR and ΔT_C are defined in [8-1, TS 38.101-1] and [8-2, TS38.101-2]. The remaining parameters are defined in Subclause 7.1.1.

Figure 16 (Ex-1008 at p.24.)

186. Therefore, TS38.213 describes a situation in which a PHR is calculated when the UE does not transmit any PUSCH transmission on the serving cell—i.e., when a virtual PHR is calculated. (*Id.*)

187. Samsung collects and describes various submissions and suggestions for NR uplink power control for use with carrier aggregation. (Ex-1012 at p.1.). For example:

“This contribution summarizes remaining issues on power control for NR-CA and EN-DC based on companies’ Tdocs submitted in AI 7.1.6.2 and AI 7.1.6.3.”

(Ex-1012 at p.1.)

188. Samsung identifies several open issues in developing the NR standard for uplink power control. One such open issue was the default parameter setting for virtual PHR, which, as described above, is a PHR that is transmitted when there is no actual PUSCH transmission and thus requiring the use of reference values in the reporting process rather than the PUSCH power. (See, e.g. Ex-1013 at [183] (“[F]or an uplink carrier which has not been determined in or before the second reference subframe to transmit a PUSCH I the first reference subframe, the UE determines the PHR type of the uplink carrier as a virtual PHR.”)) One of ordinary skill in the art would have understood that the calculation of a virtual PHR relies on references rather than current calculated transmission power.

189. In describing a solution for addressing virtual PHRs in NR, Samsung describes setting the default parameters for a virtual PHR. (Ex-1012 at p.6.) One such default parameter is the pathloss reference, q_d , which is set using “*pusch-pathlossreference-index=0* of *pusch-pathloss-Reference-rs*.” (Ex-1012 at p.7.) Specifically, *pusch-pathlossreference-index=0* is the pathloss reference with the smallest entry (i.e., “0”) of the pathloss reference configuration of the serving cell (*pusch-pathloss-Reference-rs*). (*Id.*)

190. The combined teachings of Ericsson, TS38.213, and Samsung disclose that when a virtual PHR is transmitted, the first pathloss reference—i.e., the pathloss reference used to calculate the power headroom for the virtual power headroom report—is the pathloss reference (q_d) with the smallest entry of a pathloss reference configuration of the serving cell (i.e., q_d is set

to “ q_d , *pusch-pathlossreference-index* = 0 of *pusch-pathloss-Reference-rs*”).

191. Ericsson in view of TS38.213 and further in view of Samsung renders obvious claim 8.

b. Claim 9

192. In my opinion, Ericsson in view of TS38.213 and Samsung renders obvious “the pathloss reference configuration is *PUSCH-PathlossReferenceRS*” as recited in Claim 9.

193. As explained above in connection with the discussion of claim 8, the smallest entry of a pathloss reference is *pusch-pathlossreference-index*=0 of *pathloss-reference-rs*. Thus, the pathloss reference configuration is *PUSCH-PathlossReferenceRS* as recited in claim 8. (Ex-1012-Samsung at pg. 7.)

c. Claim 11

194. In my opinion, Ericsson in view of TS38.213 as applied to claim 10 above, and further in view of Samsung, renders obvious that the “the second pathloss value is not used for power control for a Physical Uplink Shared Channel (PUSCH) transmission on the serving cell” as recited in Claim 11.

195. As explained above in connection with Claim 8, there are instances in which there is no PUSCH scheduled in a time period i . In such instances, a virtual PHR may be granted and transmitted. When a virtual PHR is created, there is no PUSCH transmission to perform power control on and thus, the second pathloss value is not used for power control for a PUSCH transmission on the serving cell. Rather, the second pathloss value is used in the generation of a *virtual* PHR after the UE switches to the new beam

in the context of Ericsson's techniques for PHR triggering with beam switching.

196. In my opinion, for the reasons given above in connections with claim 8, claim 11 would have been obvious over Ericsson, TS38.213 and Samsung.

d. Claim 12

197. In my opinion, Ericsson in view of TS38.213, as applied to claim 10, and further in view of Samsung renders obvious “wherein the smallest entry of a pathloss reference configuration of the serving cell is the second pathloss reference” as recited in Claim 12.

198. As explained above in connection with Claim 8, when there is no scheduled PUSCH transmission at time i , a virtual PHR may be transmitted as explained in, for example, Samsung, and at least suggested by TS38.213. When a virtual PHR is generated, Samsung explains that the second pathloss reference signal (RS) q_d^3 is identified using “*pusch-pathlossreference-index* = 0 of *pusch-pathloss-Reference-rs*.” (Ex-1012 at p.7.) Where *pusch-pathlossreference-index* = 0 is the pathloss reference with the smallest entry (i.e., “0”) of the pathloss reference configuration (*pusch-pathloss-Reference-rs*).

199. This claim would have been obvious over Ericsson in view of TS38.213 and further in view of Samsung for the reasons I explained in connection with Claim 8, above.

³ TS38.213 § 7.1.1 describes q_d as “reference signal (RS) resource.”

E. Ground 5: Ericsson in view of TS38.213 and further in view of Sorrentino renders obvious Claims 17

1. Scope, Content, and Rationale for Combining Prior Art

200. Claim 17 would have been obvious over Ericsson in view of TS38.213 and Sorrentino. Sorrentino describes techniques for “handling uplink transmit power reporting in a radio access network of a cellular radio system.” (Ex-1017 at Abstract.) Sorrentino also describes the hardware used in connection with the UE for power headroom reporting, and it describes transmitting a PHR when the pathloss difference exceeds a threshold. (*Id.* ¶¶[0117], FIG. 15.) Reference is made to the discussion above regarding the procedures for triggering a PHR when the UE is undergoing beam switching in a NR system why such procedures would have been obvious over the combined teachings of Ericsson and TS38.213. The functionality of the processor recited in claim 17 would have been obvious for the same reasons as those discussed above.

201. It would have further been obvious to look to known hardware configurations, such as those in Sorrentino, for implementing cellular communications techniques such as uplink power reporting to allow the combined teachings of Ericsson and TS38.213 to be implemented in hardware. One of ordinary skill in the art would have known that Ericsson and the 3GPP technical specifications such as TS38.213 specified functionality that may be supported by UEs, but do not dictate the hardware to be used to implement the functionality. One of ordinary skill in the art therefore would have looked to references like Sorrentino to determine how to implement the functionality in a UE. Including the functionality of Ericsson in view of TS38.213 in software stored in Sorrentino’s memory

and executed by Sorrentino's processor in its control circuitry would have been an obvious way to implement the functionality defined by the combined teachings of Ericsson in view of TS38.213.

202. The claimed subject matter merely combines Sorrentino's known hardware for its intended purpose—processing instructions to support cellular communications functionality including power reporting to the network. (Ex-1017, ¶¶[0152], [0159], [0163], [0164]-[0165].) Thus, combining the functionality of Ericsson in view of TS38.213 with Sorrentino's hardware would have merely combined prior art elements (the functionality of the combined teachings of Ericsson and TS38.213) according to known methods (e.g., implementing cellular communications functionality in software/firmware) to yield predictable results (e.g., a UE that can implement functionality specified in technical specifications for cellular communications).

2. Challenged Claims

203. Ground 5 addresses Claims 17.

a. [Claim 17: preamble]

204. In my opinion, even if the preamble of claim 17 is a limitation, Ericsson in view of TS38.213 and Sorrentino would render obvious “[a] User Equipment (UE) for communication with a network node, comprising: a control circuit, a processor provided with the control circuit; and a memory operatively coupled to the processor; wherein the processor is configured to execute program code.”

205. As described in detail above, Ericsson describes techniques used for power control and PHR reporting from a UE for use in connection with NR

applications. According to Ericsson, the UE determines when to report the power headroom. (See, e.g., Ex-1007 at p.3) (“Option 2: the UE only reports PHR report with respect to beam specific power control”.) To accomplish this, the UE takes multiple pathloss measurements. When there is a “change of serving beam...the UE measures [the pathloss] on the new beam but [uses a pathloss] reference measurement [for] the old beam. If the DL PL change [between the new beam and the old beam] (referred to as the ‘*dl-PathlossChange*’) becomes more than *dl-PathlossChange* dB when switching beams, a new PHR would be triggered.” (Ex-1007 at p.3.)

206. Sorrentino describes the UE that includes the hardware components required by claim 17. (Ex -1017at FIG. 15.) As described further below, it would have been obvious to use Sorrentino’s hardware as a way to “execute [the] program code” to implement the combined techniques of Ericsson and TS38.213.

b. Limitations 17A, 17B, and 17C

207. In my opinion, Ericsson in view of TS38.213 and Sorrentino disclose “a control circuit” (Limitation [17A]), “a processor provided with the control circuit” (Limitation [17B]), and “a memory operatively coupled to the processor” (Limitation [17C]) where the “processor is configured to execute a program code.”

208. Specifically, Sorrentino discloses the claimed hardware recited in these limitations of claim 17 as shown in the illustration below:

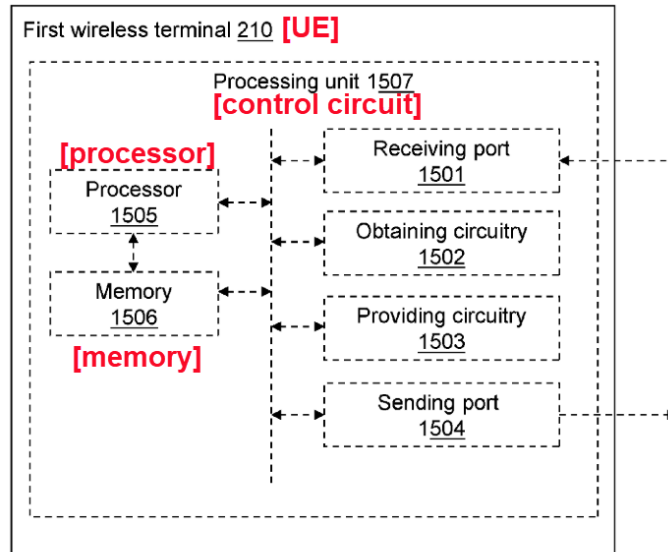


Fig. 15

Figure 17 Sorrentino’s UE with a control circuit, memory, and processor (Ex-1017 at FIG. 15, annotated by Petitioner)

209. Sorrentino describes a UE that can be used in connection with a PHR transmission:

“The first wireless terminal 210 provides a respective transmit power report, e.g., PHR, for at least one of multiple uplink reference signal transmission configurations comprised in the first wireless terminal 210.”

(Ex-1017 at [0066].)

“To perform the actions 1401-1404 for handling uplink transmit power reporting in the radio access network 202, the first wireless terminal 210 may comprise an arrangement schematically depicted in FIG. 15.”

(Ex-1017 at [0152].)

210. Sorrentino discloses that the first wireless terminal is a UE:

“Communication devices such as wireless devices may also be known as e.g. user equipments (UEs), mobile terminals, wireless terminals, and/or mobile stations.”

(Ex-1017 at [0003].)

211. Sorrentino's UE includes a control circuit shown as a "processing unit 1507" in FIG. 15. (Ex-1017 at FIG. 15, [0164]-[0165]). Further, Sorrentino's "wireless terminal 210 may comprise a processing unit 1507, which may comprise one or more" circuits. (Ex-1017 at [0164]-[0165].)

212. Sorrentino also discloses "a processor provided with the control circuit" as item 1505 ("Processor") as shown in the annotated version of FIG. 15 above. (Ex-1017 at FIG. 15.) Further:

"The embodiments of the first wireless terminal 210 may be fully or partly implemented through one or more processors, such as processor 1505 depicted in FIG. 15..."

(Ex-1017 at [0159].)

213. Additionally, Sorrentino discloses "a memory operatively coupled to the processor" as shown in the annotated version of FIG. 15, above. (Ex-1017 at FIG. 15.) For instance, Sorrentino explains that:

"[t]he wireless terminal 210 may further comprise a memory 1506 comprising one or more memory units. The memory 1506 is arranged to store data, such as configurations and/or applications involved in or for performing the functions and actions of the embodiments herein."

(Ex-1017 at [0163].)

214. Because Sorrentino's processor is configured to execute the processes associated with transmitting PHRs, the "processor is configured to execute a program code" to carry out specified methods.

“Those skilled in the art will also appreciate that the ports and circuitry 1501-1505 may refer to a combination of analog and digital circuits, and/or one or more processors configured with software and/or firmware (e.g., stored in memory) that, when executed by the one or more processors such as processor 1505, perform as described above.”

(Ex-1017 at [0164].)

215. Sorrentino thus describes the hardware for the UE recited in claim 17.

216. For these reasons, it would have also been obvious to use Sorrentino’s control circuit in connection with the UE implementing the combined techniques of Ericsson in view of TS38.213.

c. Limitations [17Ci]-[17Cvi]

217. The functionality performed by the processor recited in claim 17 tracks Limitations [1A]-[1F] of claim 1. The analysis of these limitations of claim 1 is equally applicable to claim 17. It would have been obvious to implement these techniques as rendered obvious by Ericsson in view of TS38.213 in Sorrentino’s hardware including control circuitry, processor, and memory for the reasons explained in the previous section.

F. Ground 6: Ericsson in view of TS38.213 and Sorrentino and further in view of TS38.321 renders obvious Claims 18-19

a. Claim 18

218. Claim 18 tracks the language of claim 2 but is recited as functionality that the processor of claim 17 is configured to perform. In my opinion, the functionality specified in claim 18 would have been obvious over the combined teachings of Ericsson in view of TS38.213 and further in view of TS38.321 as explained in connection with the discussion of claim 2 and the obviousness of claim 2. It would have been obvious to implement the

functionality specified in claim 18 in Sorrentino's hardware for the reason explained in connection with claim 17, above.

b. Claim 19

219. Claim 19 tracks the language of claim 3 but is recited as functionality that the processor of claim 17 is configured to perform. The functionality specified in claim 19 would have been obvious over the combined teachings of Ericsson in view of TS38.213 and further in view of TS38.321 as explained in connection with the discussion of claim 3 and the obviousness of claim 3. It would have been obvious to implement the functionality specified in claim 19 in Sorrentino's hardware for the reason explained in connection with claim 17, above.

G. Ground 7: Ericsson in view of TS38.213 and further in view of Sorrentino and further in view of Samsung renders obvious claim 20

a. Claim 20

220. Claim 20 tracks the language of claim 8 but is recited as functionality that the processor of claim 17 is configured to perform. In my opinion, the functionality specified in claim 20 would have been obvious over the combined teachings of Ericsson in view of TS38.213 and further in view of Samsung as explained in connection with the discussion of claim 8 and the obviousness of claim 8. It would have been obvious to implement the functionality specified in claim 20 in Sorrentino's hardware for the reason explained in connection with claim 17, above.

X. HUAWEI GROUNDS

A. Ground 8: Huawei in view of TS38.213 renders obvious Claims 1 and 10

1. Scope, Content, and Rationale for Combining Prior Art

221. It would have been obvious to a person of ordinary skill in the art to implement techniques from TS38.213 and TS38.321 in connection with the techniques for determining whether to trigger a PHR when the UE undergoes beam group switching during multi-beam operation as described by Huawei. For example, Huawei does not explicitly state that a PHR is transmitted “via” a first or second PUSCH. However, TS38.321 explains how MAC control elements, including the MAC CE for the PHR are conveyed to the physical layer via the UL-SCH transport channel to be transmitted over the air via a PUSCH transmission. (Ex-1009 at pp.52-53.) A POSITA would have looked to TS38.321 to find discussion of how a PHR is conveyed from the MAC layer over the air via the physical layer. (*Id.*) It would have been obvious to use expressions for calculating a power headroom value to be included in a PHR from TS38.213, which provides a mathematical relationship for use in NR, which would have been further obvious to modify for Huawei’s multi-beam scenario in which multiple pathloss values are averaged. A POSITA would thus have found it obvious to transmit Huawei’s PHR via the claimed PUSCH transmissions because this was a known way for a PHR to be transmitted to the network.

222. Indeed, a POSITA would have looked to the 3GPP technical specifications for NR, including TS38.213, to identify additional procedures to be used and implemented on Huawei’s UE because the technical specifications described procedures that were intended to be used in NR-compatible UEs with expected results of being able to communicate

over interoperable wireless communication networks. And Huawei's UE was designed, and TS38.213 was written, to be used in NR networks, and TS38.213 describes using pathloss references for performing uplink power control (on a per-beam basis) and for determining whether to trigger a PHR. A POSITA would have reasonably expected to succeed in making the claimed combinations because each of Huawei and TS38.213 were designed to be used together in NR-compatible UEs.

2. Challenged Claims

223. Ground 8 addresses Claims 1 and 10.

a. [Claim 1: preamble] and [Claim 10: preamble]

224. To the extent the preambles of Claims 1 and 10 are limiting, it is my opinion that Huawei discloses "a method for deriving a pathloss change."

"One solution is that the UE could monitor PL change independently per beam. Once the timers satisfy PHR triggering condition, the UE could collect beams with large PL change and report the PHs of them. The one or more PH are reported."

(Ex-1018 at ¶¶4-5.)

225. According to FIG. 1 (reproduced below) Huawei describes subtracting the first pathloss value (PL_1) from the second pathloss value (PL_2) to determine the pathloss change (ΔPL).

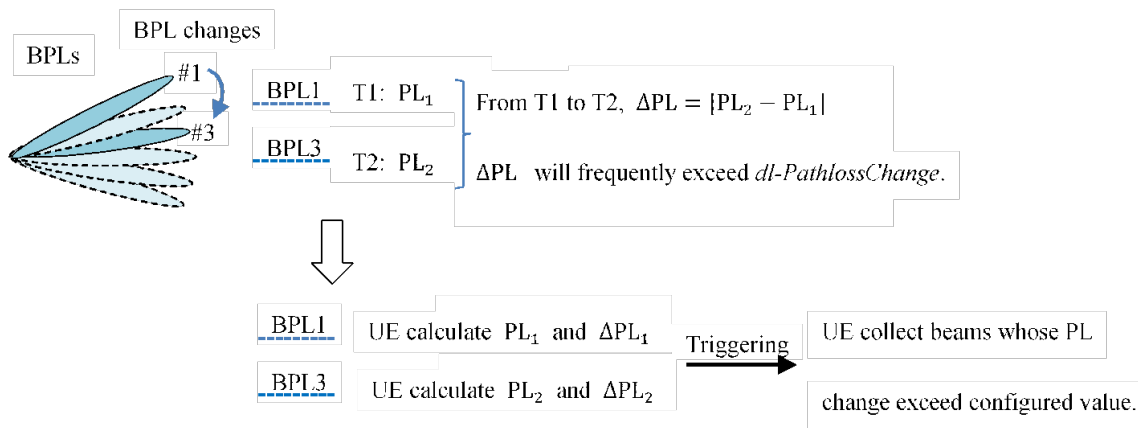


Figure 18 Huawei FIG.1 depicts how pathloss change is calculated, $\Delta PL = |PL_2 - PL_1|$ (Ex-1018 at FIG. 1.)

226. Additionally, PL can be measured on a BPL group level. Thus, PL can be averaged from multiple BPLs within one group. Change of PL for PHR triggering is also based on BPL group level. It would be simpler to suffer minor PH accuracy loss, due to one PH for a group of BPLs. (see Ex-1018 at FIG. 2.)

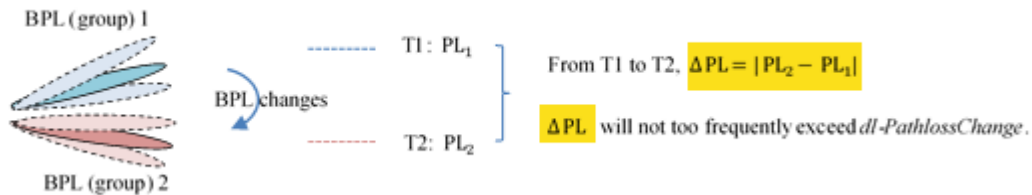


Figure 19 Huawei FIG. 2 indicates that PL can be measured on a BPL group level. (Ex-1018 at FIG. 2.)

b. Limitations [1A] and [10A]

227. In my opinion, Huawei discloses that “a UE (User Equipment) derives a first pathloss value from a first pathloss reference of a serving cell” as recited in Limitations [1A] and [10A]. One of ordinary skill in the art would have understood that Huawei discusses techniques to be implemented on

UEs. In particular, Huawei discusses an “uplink power control” that controls how much power is used to transmit from the UE to the network and a PHR that a UE transmits to the network.

228. Huawei’s UE derives a first pathloss value from a first pathloss reference of a serving cell because it describes calculating “ PL_1 ” (pathloss reference value 1) based on “BPL (group) 1” (a first pathloss reference of a serving cell) as shown below. (See Ex-1018 at FIG. 2)

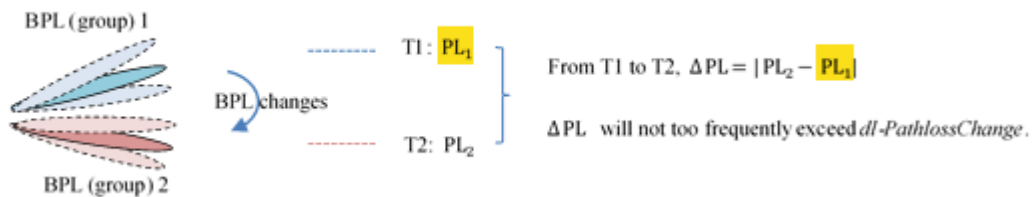


Figure 20 FIG. 2 of Huawei with PL_1 highlighted to indicate that the first pathloss value from a first pathloss reference of a serving cell is calculated based on BPL (group) 1 and is indicated as PL_1 (Ex-1018 at FIG. 2.)

229. A POSITA would have understood the beams to have originated from a serving cell serving the UE, which provides data over the downlink to the UE, because the serving cell is the network entity that provides radio resources to the UE.

c. Limitations [1B] and [10B]

230. In my opinion, Huawei in view of TS38.213 discloses or renders obvious using “the first pathloss value for deriving a power headroom value included in a first power headroom report” as recited in Limitations [1B] and [10B].

231. Huawei explains that in multi-beam operation, “each BPL (group) would lead to one PH value,” where “PH Value” would have been understood to mean power headroom value. (Ex-1018 at p.2.)

232. Huawei also explains how power headroom values (i.e., PH value) are included in the power headroom report. (Ex-1018 at p.2.)

“...the UE could collect beams with large PL change and report the PHs of them. Then one or more PH are reported.”

(Ex-1018 p.2.)

233. Even if Huawei did not disclose using the first pathloss value for deriving a power headroom value to be included in a first PHR, this would have been obvious over TS38.213. TS38.213 details calculating the power headroom value. (Ex-1008 at p.24.) For example, TS38.213 describes a “Type 1 PH Report,” and explains that:

7.7.1 Type 1 PH Report

If a UE transmits PUSCH in PUSCH transmission period i on UL BWP b of carrier f of serving cell c , the UE computes a power headroom for a Type 1 report as

$$PH_{type1,b,f,c}(i,j,q_d,l) = P_{MAX,f,c}(i) - \left\{ P_{O_PUSCH,b,f,c}(j) + 10 \log_{10} (2^{\mu} \cdot M_{RB,b,f,c}^{PUSCH}(i)) + \alpha_{b,f,c}(j) \cdot PL_{b,f,c}(q_d) + \Delta_{TF,b,f,c}(i) + f_{b,f,c}(i,l) \right\} \quad [\text{dB}]$$

where $P_{MAX,f,c}(i)$, $P_{O_PUSCH,b,f,c}(j)$, $M_{RB,b,f,c}^{PUSCH}(i)$, $\alpha_{b,f,c}(j)$, $PL_{b,f,c}(q_d)$, $\Delta_{TF,b,f,c}(i)$ and $f_{b,f,c}(i,l)$ are defined in Subclause 7.1.1.

Figure 21 (Ex-1008 at p.24.)

234. The “power headroom” is a value, $PH_{type1,b,f,c}(i,j,q_d,l)$ derived from $PL_{b,f,c}$, which is a first pathloss value. (Ex-1008 at p.24.) More specifically, $PL_{b,f,c}(q_d)$ is defined as a “downlink pathloss estimate in dB calculated by the UE using reference signal RS resource q_d for UL BWP b of carrier f of serving cell c .” (Ex-1008 at pp. 14, 24.)

235. Based on these expressions, one of ordinary skill in the art would have understood that TS38.213 describes that the first pathloss value ($PL_{b,f,c}(q_d)$) is used for deriving a power headroom value

$(PH_{type1,b,f,c}(i,j,q_d,l))$ included in the first power headroom report—i.e., a “Type 1” PHR as defined in TS38.213. (Ex-1008 at p.24.)

236. It would have been obvious to one of ordinary skill in the art to use Huawei’s first pathloss value for deriving a power headroom value included in the first power headroom report because this was a known use of pathloss values. Specifically, it was known to use pathloss values to calculate the power headroom for an uplink transmission and report them to the network in a PHR to inform the network of the UE’s power headroom value. This technique had been known at least since the development of the LTE specifications.

d. Limitations [1C] and [10C]

237. In my opinion, Huawei discloses or renders obvious having “the UE derive a second pathloss value from a second pathloss reference of the serving cell after deriving the first pathloss value, wherein the second pathloss reference is separate from the first pathloss reference.”

238. In Huawei, the claimed second pathloss reference of the serving cell is “BPL (group) 2” on which a second pathloss value (“PL₂”) is derived after deriving the first pathloss value (“PL₁”)—i.e., at time 2 (“T2”) that is after time 1 (“T1”) as shown below:

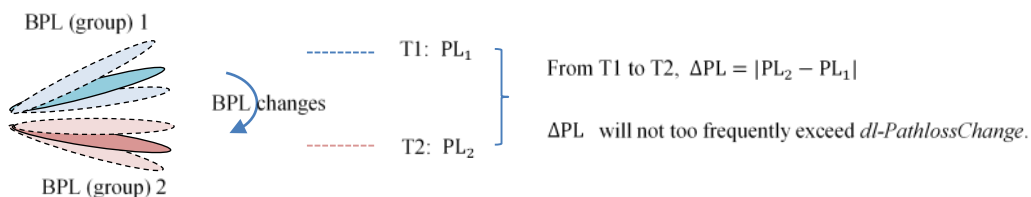


Figure 22 (Ex-1018 at p.2) Demonstrating DL PL change (i.e. *dl-PathlossChange*) calculation upon a BPL group change. Note here PL is averaged from multiple BPLs within one group.

239. As can be seen in the above illustration from Huawei, a second pathloss reference is separate from the first pathloss reference. The BPLs are different groups of beams from the serving cell that are monitored to determine the pathloss and whether it has changed more than dl-PathlossChange.

e. Limitations [1D] and [10D]

240. Claims 1 and 10 differ as to Limitations [1D] and [10D]. In my opinion, these Limitations are disclosed and rendered obvious by Huawei in view of TS38.213.

241. **Limitation [1D]:** Huawei in view of TS38.213 renders obvious that the second pathloss reference “is used for power control for a first Physical Uplink Shared Channel (PUSCH) transmission on the serving cell” as recited in Limitation [1D].

242. Although Huawei makes it clear that RAN1 was considering the impacts of multiple beams on power control:

“In previous meetings, it was agreed that NR supports beam specific power control as baseline.”

“NR defines beam specific open & closed loop parameters.”

(Ex-1018 at p.1.)

243. And while Huawei describes using PL (pathloss) in power control:

“Once the timers satisfy PHR triggering condition, the UE could collect beams with large PL change and report the [Power Headroom] of them. One or more PH are reported.”

(Ex-1018 at p.2.)

244. Huawei does not explicitly describe how the second pathloss reference (BPL(group)2) is used for power control for a first PUSCH transmission on the serving cell. However, TS38.213 describes the details of the PUSCH power control process, and, in combination with Huawei, renders obvious the use of the second pathloss reference for power control for the first PUSCH transmission.

245. Specifically, TS38.213 states:

7 Uplink Power control

Uplink power control determines the transmit power of the different uplink physical channels or signals.

7.1 Physical uplink shared channel

For PUSCH, a UE first scales a linear value $\hat{P}_{\text{PUSCH},f,c}(i,j,q_d,l)$ of the transmit power $P_{\text{PUSCH},f,c}(i,j,q_d,l)$ on UL BWP b , as described in Subclause 12, of carrier f of serving cell c , with parameters as defined in Subclause 7.1.1, by the ratio of the number of antenna ports with a non-zero PUSCH transmission to the number of configured antenna ports for the transmission scheme. The resulting scaled power is then split equally across the antenna ports on which the non-zero PUSCH is transmitted.

7.1.1 UE behaviour

If a UE transmits a PUSCH on UL BWP b of carrier f of serving cell c using parameter set configuration with index j and PUSCH power control adjustment state with index l , the UE shall determine the PUSCH transmission power $P_{\text{PUSCH},f,c}(i,j,q_d,l)$ in PUSCH transmission period i as

$$P_{\text{PUSCH},f,c}(i,j,q_d,l) = \min \left\{ P_{\text{CMAX},f,c}(i), P_{\text{O_PUSCH},f,c}(j) + 10 \log_{10} (2^{\mu} \cdot M_{\text{RB},f,c}^{\text{PUSCH}}(i)) + \alpha_{f,c}(j) \cdot PL_{f,c}(q_d) + \Delta_{\text{TF},f,c}(i) + f_{f,c}(i,l) \right\} \text{ [dBm]}$$

where,

- $PL_{b,f,c}(q_d)$ is a downlink path-loss estimate in dB calculated by the UE using reference signal (RS) resource q_d for UL BWP b of carrier f of serving cell c .

Figure 23 The PUSCH power control calculation (Ex-1008 at §7.1.1.)

246. Based on the combined teachings of Huawei and TS38.213, the PUSCH transmission power ($P_{\text{PUSCH},f,c}(i,j,q_d,l)$) in PUSCH transmission period i is

calculated based on (i.e., is a function of) the downlink pathloss reference ($PL_{f,c}(q_d)$), where the downlink pathloss reference would have been determined by the UE based on averaging the downlink pathloss from multiple BPLs within “BPL(group) 2”. (Ex-1008 at p.13.) This PUSCH transmission is on “carrier f of serving cell c ” and thus reflects a first PUSCH transmission on the serving cell.

247. One of ordinary skill in the art would have found it obvious to use Huawei’s second pathloss reference (“BPL(group)2”) for power control for a first PUSCH transmission on the serving cell.

248. **Limitation [10D]:** Limitation [10D] requires the second pathloss reference is used for deriving a second power headroom value. In my opinion, this also would have been obvious over Huawei in view of TS38.213.

249. Huawei explains that in multi-beam operation, “each BPL (group) would lead to one PH value,” (i.e., power headroom value). (EX-1018 at p.2) These PH values are reported in the PHRs:

“[T]he UE could collect beams with large PL change and report the PHs of them. Then one or more PH are reported.”

(EX-1018 at p.2.)

250. As explained in connection with Limitations [1B] and [10B], TS38.213 discloses that the measured pathloss value ($PL_{b,f,c}(q_d)$) (here, the second pathloss value from the second pathloss reference) is used for deriving a second power headroom value ($PH_{type1,b,f,c}(i,j,q_d,l)$)—i.e., a power headroom value determined using the pathloss from the second pathloss reference after a beam switch to include in a “Type 1” PHR to be sent in a PUSCH transmission as defined in TS38.213. (EX-1008 at p.24.)

251. It would have been obvious to use the second pathloss reference for deriving a second power headroom value to include in a PHR sent via the first PUSCH transmission after a beam group switch (and thus change in the pathloss reference) because this was a known use of pathloss values, including to use them to calculate the power headroom for an uplink transmission and report them to the network in a PHR to inform the network of the UE's power headroom value. Indeed, using the pathloss reference to calculate a power headroom had been known at least since the development of the LTE specifications.

f. Limitations [1E] and [10E]

252. In my opinion, Huawei discloses and renders obvious that “the UE derives the pathloss change based on the first pathloss value and the second pathloss value” as recited in limitation [1E].

253. Specifically, Huawei's UE derives the pathloss change (ΔPL) by subtracting the first pathloss value (PL_1) from the second pathloss value (PL_2) as shown in the illustration below:

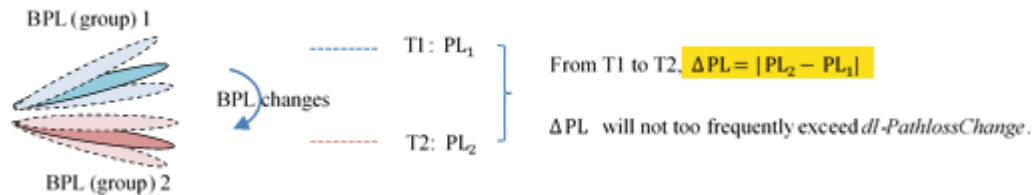


Figure 24 *FIG. 2 of Huawei indicates that the UE derives pathloss change (ΔPL) from the first and second pathloss values (Ex-1018 at FIG. 2.)*

g. Limitations [1F] and [10F]

254. In my opinion, Huawei discloses and renders obvious that the “UE determines whether a second headroom report is triggered based on whether

the pathloss change is more than a threshold” as recited in Limitations [1F] and [10F]. Limitation [10F] further requires the second PHR to include the second power headroom value. These limitations, in my opinion, are also disclosed or rendered obvious over Huawei alone or in view of TS38.213.

255. Huawei discloses that a PHR will be transmitted if ΔPL is greater than *dl-PathlossChange*.

“In LTE system, PH triggering condition is defined with a set of events. The UE will be configured with two timers: *prohibitPHR-timer* and *periodicPHR-timer*, and a threshold parameter *dl-Pathloss Change*.”

(Ex-1018 at §2.1.)

256. One of ordinary skill in the art would have understood that if the timers expired or the Pathloss Change exceeded the *dl-Pathloss Change* threshold, a PHR would be triggered. One of ordinary skill in the art would have recognized that the same process would be used for a single BPL or BPL group (i.e., “Change of PL for PHR triggering is also based on a BPL group level.” (Ex-1018 at p.2.) Further:

“For example, if current beam is changed compared to the latest time, then the PL will possibly change. So, the PL change may exceed *dl-Pathloss Change*. In this case, PL change condition for PHR triggering would always be occupied. One solution is that the UE could monitor PL change independently per beam. Once the timers satisfy PHR triggering condition, the UE could collect beams with large PL change and report the PHs of them. Then one or more PH are reported.”

(Ex-1018 at §2.1.)

257. One of ordinary skill in the art would have understood that once a first PHR was reported, the UE would continue to monitor the PL change and,

when it exceeded the *dl-Pathloss Change* threshold, it could generate a second PHR.

258. Limitation [10F] further requires that the second PHR include the second power headroom value. In my opinion, this additional aspect of Limitation [10F] would have been obvious over Huawei in view of TS38.213 because TS38.213 explains that the pathloss value ($PL_{b,f,c}(q_d)$) is used to calculate the power headroom ($PH_{type1,b,f,c}(i,j,q_d,l)$) to include in a Type 1 PHR as explained above. Including this additional feature in the system contemplated by Huawei would have been obvious.

B. Ground 9: Huawei in view of TS38.213 and TS38.321 and further in view of TS38.331 renders obvious Claims 2-3 and 13.

1. Scope, Content, and Rationale for Combining Prior Art

259. A POSITA would have found it obvious to implement techniques from TS38.213 and TS38.321 in connection with the techniques for determining whether to trigger a PHR when the UE undergoes beam group switching during multi-beam operation as described by Huawei.

260. For example, while Huawei does not explicitly state that the power headroom report is transmitted “via” a first or second PUSCH, TS38.321 explains how MAC control elements, including the MAC CE for the PHR are conveyed to the physical layer via the UL-SCH transport channel to be transmitted over the air via a PUSCH transmission. (EX-1009 at pp.9, 52-53.) A POSITA would have looked to TS38.321 to find a discussion of how a PHR is conveyed from the MAC layer over the air via the physical layer. (*Id.*) A POSITA would thus have found it obvious transmit Huawei’s PHR via the claimed PUSCH transmissions because this was a known way for a PHR to be transmitted to the network.

261. Indeed, a POSITA would have looked to the 3GPP technical specifications for NR including TS38.213 to identify additional procedures to be used and implemented on Huawei's UE because the technical specifications described known procedures that were intended to be used in NR-compatible UE's with expected results of being able to communicate over interoperable wireless communication networks. A POSITA would have reasonably expected to succeed in making the claimed combinations because each of Huawei and TS38.213 were designed to be used together in NR-compatible UEs.

2. Challenged Claims

262. Ground 9 addresses Claims 2-3 and 13.

a. Claim 2

263. In my opinion, Huawei in view of TS38.321 discloses "wherein the second power headroom report is transmitted via the first PUSCH transmission with the second power headroom report is triggered" as recited in Claim 2.

264. Huawei alone or in view of TS38.213 renders obvious triggering a second PHR after switching beams for the reasons explained above in connection with Limitations [1f] and [10f]. It would have been obvious to transmit the PHR via the first PUSCH transmission in the context of Huawei based on TS38.321.

265. 3GPP TS38.321 describes how a PHR is provided from the MAC layer to the physical layer for transmission. A "Single Entry PHR MAC CE" is an example of a MAC Control element. (Ex-1009 at pp.52-53.) The "Single

Entry PHR MAC CE” has a fixed size and consists of two octets as shown below:



Figure 6.1.3.8-1: Single Entry PHR MAC CE

Figure 25 *Single Entry PHR MAC CE (Ex-1009 at pp.52-53) indicating a fixed size, with two octets.*

266. The Single Entry PHR MAC CE contains the following fields: reserved bits (R, set to “0”), Power Headroom (PH) (a field of 6 bits indicating the power headroom level), and $P_{\text{CMAX},c}$ (a field indicating the $P_{\text{CMAX},c}$ used for calculation of the PH field). A MAC entity of the UE handles transport channels such as the UL-SCH (uplink shared channel). (Ex-1009 at p.9.)

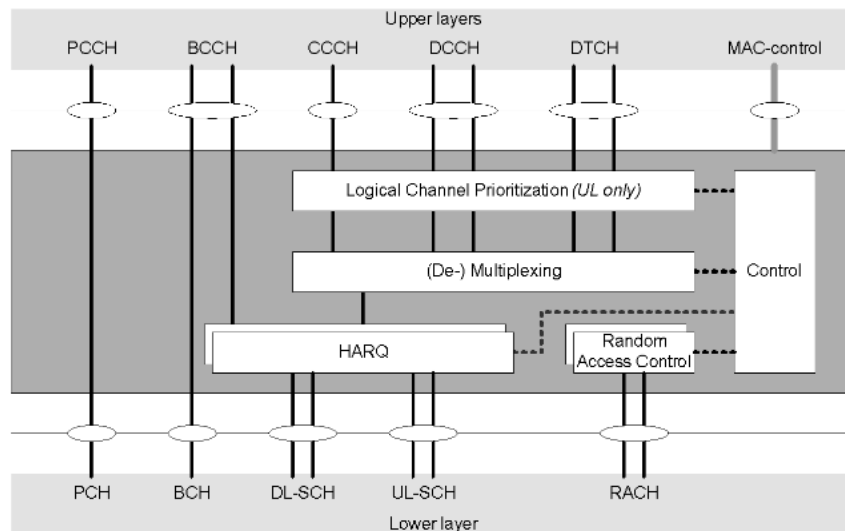


Figure 4.2.2-1: MAC structure overview

Figure 26 *A possible structure of the MAC entity (when Secondary Cell Group (SCG) is not configured) (Ex-1009 at p.10.) Notice that the MAC entity handles the UL-SCH transport channel.*

267. One of ordinary skill in the art would have understood that UL-SCH transport blocks from the MAC layer undergo physical layer processing to

map them onto the OFDM symbols of the PUSCH (physical channel). (Ex-1010 at p.7.)

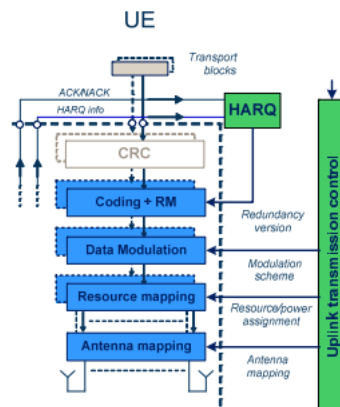


Figure 27 *Physical Layer Processing for the PUSCH. A UL-SCH transport block from the MAC layer undergoes Physical Layer Processing in order be mapped onto the OFDM symbols of the PUSCH. (Ex-1010 at p.7.)*

268. Thus, a PHR is included in a MAC CE, is conveyed by the MAC entity of the UE on the UL-SCH transport channel which undergoes physical layer processing to enable it to be physically transmitted via PUSCH to the network. (Ex-1010 at p.7.) Thus, the second PHR is transmitted via the first PUSCH transmission after a beam group switch and the second PHR is triggered as described above.

269. One of ordinary skill in the art would have found it obvious to transmit the second PHR via the first PUSCH transmission when the PHR is triggered based on the combination of Huawei in view of TS38.213 and further in view of TS38.321 because Huawei's PHR triggering and reporting techniques were intended to be used in NR systems, and TS38.213 and TS38.321 are technical specifications for NR systems which describe power headroom reporting and transmission of MAC CEs, like PHR MAC control elements.

b. Claims 3 and 13

270. In my opinion, Huawei in view of TS38.321 and TS38.213 render obvious “the first pathloss value is used for power control for a second PUSCH transmission on the serving cell, wherein the first power headroom report is transmitted via the second PUSCH transmission” as recited in Claim 3, and renders obvious “the first pathloss value is used for power control for a PUSCH transmission on the serving cell, wherein the first power headroom report is transmitted via the PUSCH transmission” as recited in Claim 13. Claim 13 is the same as claim 3 except that it omits the word “second.” Thus, explanations for Claim 3 are applicable to Claim 13.

271. As explained in connection with Limitation 1[a], the first pathloss value is determined using the BPL(group)1 before beam group switching. Huawei does not explicitly state that the first pathloss value is used for power control for a second PUSCH, but using a pathloss value as measured and averaged on a first group of beams before beam group switching to control the power used for PUSCH transmission associated with the original group of beams is a technique that would have been obvious over TS38.213. TS38.213 at §7.1.1 defines the expression for determining PUSCH transmit power ($P_{\text{PUSCH},f,c}(i,j,q_d,l)$) based on the downlink pathloss estimate ($PL_{b,f,c}(q_d)$):

7 Uplink Power control

Uplink power control determines the transmit power of the different uplink physical channels or signals.

7.1 Physical uplink shared channel

For PUSCH, a UE first scales a linear value $\hat{P}_{\text{PUSCH},f,c}(i,j,q_d,l)$ of the transmit power $P_{\text{PUSCH},f,c}(i,j,q_d,l)$ on UL

BWP b , as described in Subclause 12, of carrier f of serving cell c , with parameters as defined in Subclause 7.1.1, by the ratio of the number of antenna ports with a non-zero PUSCH transmission to the number of configured antenna ports for the transmission scheme. The resulting scaled power is then split equally across the antenna ports on which the non-zero PUSCH is transmitted.

7.1.1 UE behaviour

If a UE transmits a PUSCH on UL BWP b of carrier f of serving cell c using parameter set configuration with index j and PUSCH power control adjustment state with index l , the UE shall determine the PUSCH transmission power $P_{\text{PUSCH},f,c}(i,j,q_d,l)$ in PUSCH transmission period i as

$$P_{\text{PUSCH},f,c}(i,j,q_d,l) = \min \left\{ P_{\text{CMAX},f,c}(i), P_{\text{O_PUSCH},f,c}(j) + 10 \log_{10} (2^{\mu} \cdot M_{\text{RB},f,c}^{\text{PUSCH}}(i)) + \alpha_{f,c}(j) \cdot PL_{f,c}(q_d) + \Delta_{\text{TF},f,c}(i) + f_{f,c}(i,l) \right\} \text{ [dBm]}$$

where,

- $PL_{b,f,c}(q_d)$ is a downlink path-loss estimate in dB calculated by the UE using reference signal (RS) resource q_d for UL BWP b of carrier f of serving cell c .

Figure 28 Expression for determining PUSCH transmit power ($P_{\text{PUSCH},f,c}(i,j,q_d,l)$) based on the downlink pathloss estimate ($PL_{b,f,c}(q_d)$). (Ex-1008 at §7.1.1.)

272. The first power headroom report is a PHR transmitted while the UE is measuring the pathloss on BPL (group) 1. One of ordinary skill in the art would have found it obvious to transmit that first PHR via the second PUSCH transmission—i.e., on the uplink beam used before beam group switching—based on the teachings of TS38.321, which explains that PHR MAC CEs are transmitted via PUSCH, as described above.

273. It would have been obvious to use a technique in which the first pathloss value was used for a second PUSCH transmission on the serving cell, and that the first PHR is transmitted via the second PUSCH transmission based

on TS38.213 and TS38.321 for reasons explained above in connection with Limitation 2.

C. Ground 10: Huawei in view of TS38.213, TS38.321 and further in view of TS38.331 renders obvious Claims 5, 7, 15

1. Scope, Content, and Rationale for Combining Prior Art

274. It would have been obvious to use the techniques described in TS38.331, including the use of *ConfiguredGrantConfig*, to configure Huawei's first and second PUSCH transmission and to indicate the first and second pathloss reference depending on whether the PUSCH transmission occurs before or after beam group switching because (1) Huawei was intended to be used in connection with NR systems and methods, and (2) TS38.213, TS.38.321, and TS38.331 are part of a comprehensive technical specification that were intended to define the NR standard, thus leading a POSITA to naturally have thought of combining the various specified techniques. Additionally, a POSITA considering Huawei would have looked for known techniques to use to configure the PUSCH transmission before the beam group switching occurred, to identify the reference to use for determining pathloss to use for PUSCH power control, and to determine whether to transmit a PHR. A POSITA would have known that 3GPP had specified techniques for configuring PUSCH transmissions and identifying the reference to use for determining whether a PHR is triggered and for uplink power control, and would have found it obvious to use those techniques, such as the use of *ConfiguredGrantConfig* to configure Huawei's second PUSCH and to identify the pathloss reference to use for uplink power control and PHR triggering purposes.

275. Not only is the combination of these references suggested implicitly by their context as being part of the NR standard-setting efforts, the combination of TS38.331 with Huawei, TS38.213, and TS-38.321 would have merely combined prior art techniques according to known methods to achieve predictable results: combining Huawei's technique for triggering PHRs with beam group switching techniques with techniques specified by the standard for identifying the pathloss reference to use for determining downlink pathloss and configuring PUSCH transmissions as defined in various parts of the 3GPP Technical Specifications including TS38.213, TS38.321, and TS38.331.

2. Challenged Claims

276. Ground 10 addresses Claims 5, 7, and 15

a. Claims 5, 7, and 15

277. In my opinion, Huawei in view of TS38.213 and TS38.321 and further in view of TS38.331 renders this claim obvious. According to TS38.331, "the second PUSCH transmission is configured by a parameter *ConfiguredGrantConfig* and the *ConfiguredGrantConfig* indicates the first pathloss reference" as recited in Claims 5, 7, and 15. (EX-1011 at pp.73.)

278. Huawei's second PUSCH transmission is a PUSCH transmission that occurs after beam group switching (or beam group switching) as explained above and the first PUSCH transmission is a PUSCH transmission that occurs before beam switching (or beam group switching). The draft specifications for the NR standard include several techniques via which PUSCH transmissions may be configured and which identifies the pathloss reference for use in connection with uplink power control. One way to configure PUSCH transmissions and identify the pathloss reference to use

for power control and PHR triggering applies when configuring a bandwidth part. (Ex-1011 at p.64.) Specifically, “at least an initial bandwidth part comprising of at least a downlink bandwidth part and” one or two uplink BWPs are configured. (*Id.*)

279. “The IE *ConfiguredGrantConfig* is used to configure uplink transmission without dynamic grant according to two possible schemes. The actual uplink grant may either be configured via RRC (type 1) or provided via the PDCCH (addressed to CS-RNTI) (type 2).” (*Id.* at p.73.) Therefore, TS38.331 discloses that a PUSCH transmission is configured by a parameter *ConfiguredGrantConfig*. This technique would apply to both the first and second PUSCH transmission contemplated by Huawei.

280. *ConfiguredGrantConfig* includes “*pathlossReferenceIndex*” which indicates the [first/second] pathlossreference to use in connection with power control for the applicable PUSCH transmission and in determining whether to trigger a PHR.

```

--ASN1START
--TAG-CONFIGUREDGRANTCONFIG-START
$
ConfiguredGrantConfig ::= SEQUENCE {
$
    mcsAndTBS INTEGER (0..31),
    -- Enables intra-slot frequency hopping with the given frequency hopping offset
    -- Corresponds to L1 parameter 'UL-TxG-hopping' (see 38.214, section FFS_Section)
$
    frequencyHoppingOffset INTEGER (1..maxNrofPhysicalResourceBlocks-1),
    pathlossReferenceIndex INTEGER (0..maxNrofPUSCH-PathlossReferenceRSs-1),
    ...
}
$
OPTIONAL -- Cond Type1
}

```

Figure 29 (*Ex-1011 at pp.73, 75.*)

281. Therefore, TS38.331 teaches the additional requirements of claim 5.

282. One of ordinary skill in the art would have understood that in implementing the techniques described in Huawei, the modification would

have included identifying pathloss references associated with BPL groups described by Huawei, either by group or individually.

283. It would have been obvious to use the techniques described in TS38.331 including the use of *ConfiguredGrantConfig* to configure Huawei's first and second PUSCH transmission and to indicate the first and second pathloss reference depending on whether the PUSCH transmission occurs before or after beam group switching. First, Huawei was intended to be used in connection with NR systems and methods. Second, TS38.213, TS38.321, and TS38.331 are part of the NR specification to define the NR standard, thus leading to one of ordinary skill in the art to have naturally thought of combining the various specified techniques. Additionally, one of ordinary skill in the art considering Huawei would have looked for known techniques to use to configure the PUSCH transmission before the beam group switching occurred, and to identify the reference to use for determining pathloss to use for PUSCH power control, and to determine whether to transmit a PHR. A POSITA would have been aware that the 3GPP had specified techniques for configuring PUSCH transmissions and identifying the reference to use for determining whether a PHR is triggered and for uplink power control and would have found it obvious to use those techniques, such as the use of *ConfiguredGrantConfig*, to configure Huawei's second PUSCH and to identify the pathloss reference to use for uplink power control and PHR triggering purposes.

284. Not only is the combination of these references suggested implicitly by their context as being part of the NR standard setting efforts, the combination of TS38.331 with Huawei, TS38.213, and TS38.321 would have merely combined prior art techniques according to known methods to

achieve predictable results—combining Huawei’s technique for triggering PHRs with beam switching techniques specified by the standard for identifying the pathloss reference to use for determining downlink pathloss and configuring PUSCH transmissions as defined in various parts of the 3GPP Technical Specifications including TS38.213, TS38.321, and TS38.331.

D. Ground 11: Huawei in view of TS38.213 and Sorrentino renders obvious Claim 17

1. Scope, Content, and Rationale for Combining Prior Art

285. Claim 17 would have been obvious over Huawei in view of TS38.213 and Sorrentino. Reference is also made to the discussion of why the procedures for triggering a PHR when the UE is undergoing beam group switching in a NR system would have been obvious over the combined teachings of Huawei and TS38.213. Further, the functionality of the processor recited in claim 1 would have been obvious for the same reasons as those discussed above.

286. It would have further been obvious to look to known hardware configurations, such as those in Sorrentino, for implementing cellular communications techniques such as uplink power reporting to allow the combined teachings of Huawei and TS38.213 to be implemented in hardware. A POSITA would have known that Huawei and the 3GPP technical specifications such as TS38.213 specified functionality that may be supported by UEs, but did not dictate the specific hardware to be used to implement the functionality. The POSITA therefore would have looked to references like Sorrentino for instruction on how to implement the functionality in a UE. Including the functionality of Huawei in view of

TS38.213 in software stored in Sorrentino's memory and executed by Sorrentino's processor in its control circuitry would have been an obvious way to implement the functionality defined by the combined teachings of Huawei in view of TS38.213.

287. The claimed subject matter merely combines Sorrentino's known hardware for its intended purpose—processing instructions to support cellular communications functionality including power reporting to the network. (Ex-1017 at ¶¶[0152], [0159], [0163], [0164]-[0165].) Thus, combining the functionality of Huawei in view of TS38.213 with Sorrentino's hardware would have merely combined prior art elements (the functionality of the combined teachings of Huawei and TS38.213) according to known methods (e.g., implementing cellular communications functionality in software/firmware) to yield predictable results (e.g., a UE that can implement functionality specified in technical specifications for cellular communications).

2. Challenged Claims

288. Ground 11 addresses claim 17.

a. [Claim 17: preamble]

289. Even if the preamble of claim 17 is a limitation, it is my opinion that it would have been obvious to have “a User Equipment for communication with a network node” based on Huawei in view of TS38.213 and in further view of Sorrentino.

290. As described above, Huawei describes techniques used for power headroom reporting from a UE for use in connection with NR applications and specifically those in which multi-beam operation is used and beam

group switching is employed. According to Huawei, the UE takes multiple pathloss measurements to derive an average pathloss value from “multiple BPLs within one group” and then, at a later time, determined a pathloss value from a second BPL group. (Ex-1018 at p.2.)

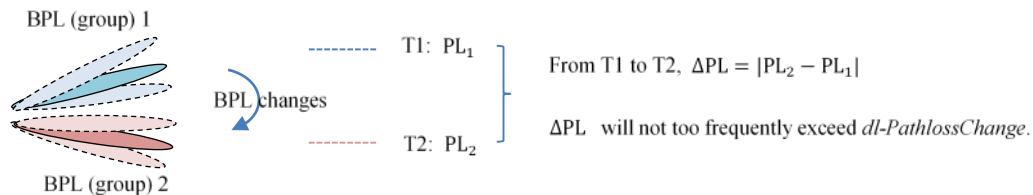


Figure 30 How pathloss change is determined upon switching BPL group (Ex-1018 at p.2.)

291. When the difference in pathloss (ΔPL) exceeds *dl-PathlossChange*, a PHR is triggered. (EX-1018 at p.2.)
292. Section 7 of TS38.213 describes “Uplink Power Control,” and various User Equipment (UE) behavioral aspects as described in connection with the discussion of Claims 1 and 10, above.
293. Sorrentino describes a UE that includes the various hardware components required by claim 17. (Ex-1017 at FIG. 15.) It would have been obvious to employ Sorrentino’s hardware to implement the combined techniques defined by Huawei in view of TS38.213.

a. Limitations [17A], [17B], and [17C]

294. In my opinion, Huawei in view of TS38.213 and Sorrentino disclose “a control circuit” (Limitation 17[A]) and “a processor provided with the control circuit” (Limitation 17[B]) and “memory operatively coupled to the processor” (Limitation 17[C]), where “the processor is configured to execute a program code.”

295. Specifically, Sorrentino discloses the claimed hardware recited in these limitations of claim 17 as shown in the illustration below:

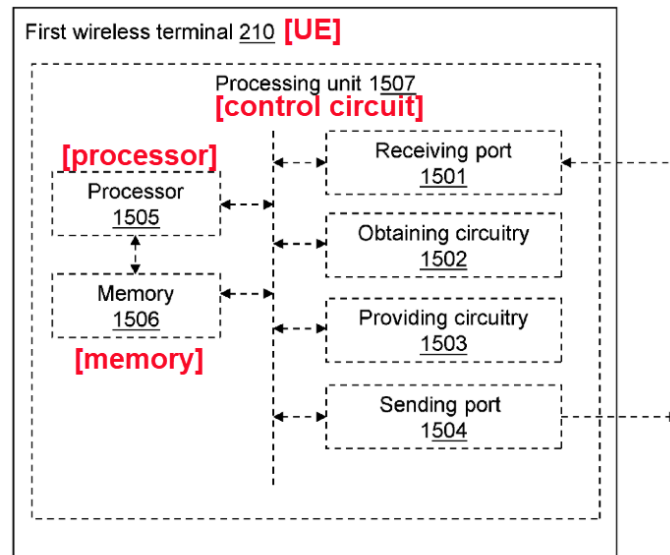


Fig. 15

Figure 31 *Sorrentino's UE with a control circuit, memory, and processor (Ex-1017 at FIG. 15, annotated by Petitioner)*

296. Sorrentino describes a UE that can be used in connection with a PHR transmission.

“The first wireless terminal 210 provides a respective transmit power report, e.g., PHR, for at least one of multiple uplink reference signal transmission configurations comprised in the first wireless terminal 210.”

(Ex-1017 at [0066].)

“To perform the actions 1401-1404 for handling uplink transmit power reporting in the radio access network 202, the first wireless terminal 210 may comprise an arrangement schematically depicted in FIG.15.”

(Ex-1017 at [0152].)

297. Sorrentino discloses that the first wireless terminal is a UE:

“Communication devices such as wireless devices may also be known as e.g. user equipments (UEs), mobile terminals, wireless terminals, and/or mobile stations.”

(Ex-1017 at [0003].)

298. Sorrentino’s UE includes a control circuit shown as a “processing unit 1507” in FIG. 15 and where “wireless terminal 210 may comprise a processing unit 1507, which may comprise one or more” circuits. (Ex-1017 at [0164]-[0165].)

299. Sorrentino also discloses “a processor provided with the control circuit” as item 1505 (“Processor”) as shown in the annotated version of FIG. 15 above. (Ex-1017 at FIG. 15).

“The embodiments of the first wireless terminal 210 may be fully or partly implemented through one or more processors, such as processor 1505 depicted in FIG. 15...”

(Ex-1017 at [0159].)

300. Additionally, Sorrentino discloses “a memory operatively coupled to the processor” as shown in the annotated version of FIG. 15, above. (Ex-1017 at FIG. 15.) For instance, Sorrentino explains that:

“[t]he wireless terminal 210 may further comprise a memory 1506 comprising one or more memory units. The memory 1506 is arranged to store data, such as configurations and/or applications involved in or for performing the functions and actions of the embodiments herein.”

(Ex-1017 at [0163].)

301. Because Sorrentino’s processor is configured to execute the processes associated with transmitting PHRs, the “processor is configured to execute a program code” to carry out specified methods.

“Those skilled in the art will also appreciate that the ports and circuitry 1501-1505 may refer to a combination of analog and digital circuits, and/or one or more processors configured with software and/or firmware (e.g., stored in memory) that, when executed by the one or more processors such as processor 1505, perform as described above.”

(Ex-1017 at [0164].)

302. Therefore, Sorrentino describes the hardware for the UE recited in claim 17. It would have been obvious to use Sorrentino’s control circuit in connection with the UE implementing the combined techniques of Huawei in view of TS38.213.

b. Limitations [17Ci]-[17Cvi]

303. The functionality performed by the processor recited in claim 17 tracks limitations [1A]-[1F] of claim 1. The analysis of these limitations of claim 1 is equally applicable to claim 17. It is my opinion that it would have therefore been obvious to implement these techniques as rendered obvious by Huawei in view of TS38.213 in Sorrentino’s hardware including control circuitry, processor, and memory for the reasons explained above.

E. Ground 12: Huawei in view of TS38.213 and Sorrentino and in further view of TS38.321 renders obvious Claims 18-19

1. Challenged Claims

304. Ground 12 addresses claim 18-19.

a. Claim 18

305. Claim 18 tracks the language of claim 2 but is recited as functionality that the processor of claim 17 is configured to perform. In my opinion, the functionality specified in claim 18 would have been obvious over the combined teachings of Huawei in view of TS38.213 and further in view of

TS38.321 as explained in connection with the discussion of claim 2 and the obviousness of claim 2. It would have been obvious to implement the functionality specified in claim 18 in Sorrentino's hardware for the reason explained in connection with claim 17, above.

b. Claim 19

306. Claim 19 tracks the language of claim 3 but is recited as functionality that the processor of claim 17 is configured to perform. In my opinion, the functionality specified in claim 19 would have been obvious over the combined teachings of Huawei in view of TS38.213 and further in view of TS38.321 as explained in connection with the discussion of claim 3 and the obviousness of claim 3. It would have been obvious to implement the functionality specified in claim 19 in Sorrentino's hardware for the reason explained in connection with claim 17, above.

XI. CONCLUSION

307. I hereby declare that all statements made herein are of my own knowledge and are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Executed on this 8th day of August, at Cambridge, Massachusetts.



Michael Allan Martin Davies

Michael A M Davies

Chairman and Senior Partner, Endeavour.Partners

Senior Lecturer, Massachusetts Institute of Technology

Guest Lecturer, London Business School

Co-founder and CEO, WKD.SMRT, Inc.

Co-founder and former Chairman, Silverthread Inc.

Expertise

Michael Davies' specialist expertise and relevant experience cover the technical, business, strategic, economic, and broad policy issues involved in deep high tech and throughout the high-tech sector—in particular mobile devices and services—and wireless (cellular and satellite) and broadband networks, consumer electronics, the Internet of Things (IoT), electronic components, and semiconductors.

- the architecture and economics of communication services networks and computing services, in particular broadband cellular, fiber infrastructure, packet networks, cloud services, computing services, 'edge computing' services, satellite networks, video codecs, robotics, payment systems, IoT, and smart home technologies
- the architecture and economics of state-of-the art electro-mechanical devices, systems, and components that combine hardware and software, in particular mobile devices and systems, consumer electronics, personal computing and cloud computing, hardware manufacturing, semiconductors, and the related supply chains
- creative business models, co-opetition, and building business ecosystems, including open innovation, open source, shared infrastructure, and other ground-breaking approaches
- the economics of systems, platforms, architecture, modularity, and bottlenecks, in particular as this relates to complex products and services that combine software, computing, and communications
- consumer behavior and segmentation and the adoption and diffusion for high-tech that are novel products
- strategy and management for R&D, product creation, and technological innovation; knowledge-intensive technical teams, such as R&D staff; effective work practices; and the economics of innovation and intellectual property (trade secrets, patents, and licensing strategies)
- harnessing digital technologies knowledge and the challenges associated with innovation and how to address them

Michael has several areas of specialist expertise relevant to these challenges:

- consumers' purchase preferences and buying behaviors as well as projects adoption and diffusion of new technologies;
- anticipates the future by developing insight into the co-evolution of technological innovation and technology architecture, the potential demand opportunity, and platforms and business ecosystems;
- develops creative and robust business strategies by identifying opportunities and options for initiatives, investments, and novel business models that create and capture value; and
- provides effective leadership through decision-making under uncertainty, agile methods, and building resilience

Experience

Michael has worked for more than forty years in high tech telecommunications and mobile devices.

His experience spans the design, development, and deployment of mechanical, electrical, electronic, and high-tech products; manufacturing; software coding; video; supply chain management; research and development; technology; product creation; and business strategy.

Endeavour.Partners provides services to:

- delivers expert witness testimony on matters related to public policy, intellectual property, and commercial relationships within the mobile, wireless, and digital sectors
- provides consulting services on business strategy to companies throughout the mobile and wireless industry, including cellular infrastructure providers, mobile device manufacturers, and mobile network operators; companies involved in the broadband, fiber and satellite sectors
- provides consulting services on business strategy to industrial companies that are being impacted by digital and other deep technology

As a Senior Lecturer at MIT, Michael:

- created and taught courses in fundamental and advanced topics in technology strategy, systems engineering, leadership of high-tech businesses, and integrated design and product development process in both the School of Engineering (in Aero/Astro) and in the Sloan School of Management
- teaches creative innovation, value creation, emerging technologies, product management, product marketing, basic finance and business models, pricing and marketing, competitive analysis, market opportunity identification, funding entrepreneurship, data-driven decision-making, and decision-making under uncertainty
- created and leads, with colleague Blade Kotelly, Breakthrough Innovation: Creating Value in Times of Uncertainty

As a Guest Lecturer at the London Business School, Michael:

- created and for more than a decade has taught the New Technology Ventures program, which enables emerging entrepreneurs to evaluate novel ideas and inventions and turn them into new technology ventures
- created and serves as course Academic Director for the path-breaking course on The Business of AI.

As the Founder of WKD.SMRT, Michael:

- leads a company that is accelerating innovation in healthcare by provide superior real-life data for clinical trials, through a turnkey solution that combines state-of-the-art technologies in sensing, machine learning, and computer processing

As the Founder of Silverthread Inc, Michael:

- founded a company that helps clients diagnose and improve the economics of maintaining, evolving, and developing very large-scale software systems

Education**London Business School** 1989–1991

Master of Business Administration (With Distinction)

- Specialized in Business Strategy, Technology Management, and Decision Sciences
- Participated in the PhD Program on Systems Dynamics

University of Durham, UK 1982–1984

Master of Engineering

- Microelectronics
- Cybernetics and Robotics
- Management Science

St Catharine's College, University of Cambridge 1979–1987

Bachelor of Arts (1982) and Master of Arts (1987)

- Electrical Sciences Tripos (Computer Science, Mathematics, Engineering, and Physics)
- Engineering Part I and Part II

Harvard Business School

Post-graduate study in Innovation & Organizations

Expert Reports and Testimony Experience

United States of America et al v AT&T Inc et al.

- Department of Justice anti-trust investigation, Civil Action No. 11-01560 (ESH)
- Industry Expert: Antitrust
- Expert Report (2011)

Apple Inc v Samsung Electronics America Inc, Samsung Telecommunications America LLC, and Samsung Electronics Co Ltd

- International Trade Commission Investigation No. 337-TA-796
- Industry Expert: Public Interest
- Expert Declaration (2013)

Ericsson Inc and Telefonaktiebolaget LM Ericsson v Samsung Electronics America Inc, Samsung Telecommunications America LLC, and Samsung Electronics Co Ltd

- International Trade Commission Investigation No. 337-TA-862
- Industry Expert: Public Interest
- Expert Report, Rebuttal Expert Report, Deposition Testimony, Hearing Testimony (2013)

Samsung Electronics Co Ltd and Samsung Telecommunications America LLC v Ericsson Inc and Telefonaktiebolaget LM Ericsson

- International Trade Commission Investigation No. 337-TA-866
- Industry Expert: Public Interest
- Expert Report, Rebuttal Expert Report, Deposition Testimony, Hearing Testimony (2013)

InterDigital Communications Inc, InterDigital Technology Corporation IPR Licensing Inc, and InterDigital Holdings v Samsung Electronics America Inc and Samsung Telecom America LLC

- International Trade Commission Investigation No. 337-TA-868
- Industry Expert: Public Interest
- Expert Report, Rebuttal Expert Report, Deposition Testimony, Hearing Testimony (2013)

Sasken Communication Technologies Limited v Spreadtrum Communications Inc and Spreadtrum Communications USA

- American Arbitration Association, International Centre for Dispute Resolution No. 50-117-T-0092-12
- Technical Expert and Industry Expert: Arbitration
- Expert Report, Deposition Testimony, Hearing Testimony (2013)

On Track Innovations LTD v T-Mobile USA Inc

- United States District Court, Southern District of New York No. 12-cv.02224-AJN-JCF
- Technical Expert
- Expert Report, Deposition Testimony (2013-2014)

Hand Held Products Inc v Amazon.com Inc et al.

- United States District Court, District of Delaware No. 1:12-CV-00768-RGA-MPT
- Technical Expert
- Expert Report, Code Analysis (2014)

Enterprise Systems Technologies SARL v Samsung Electronics America Inc, Samsung Electronics Co Ltd, and Samsung Telecommunications America LLC

- International Trade Commission Investigation No. 337-TA-925
- Industry Expert: Public Interest
- Expert Report, Deposition Testimony (2015)

NVIDIA Corporation v Samsung Electronics America Inc, Samsung Electronics Co Ltd, and Samsung Telecommunications America LLC

- International Trade Commission Investigation No. 337-TA-932
- Industry Expert: Public Interest
- Expert Report, Deposition Testimony, Hearing Testimony (2015)

Nokia Corporation v Samsung Electronics Co Ltd

- Arbitration, International Chamber of Commerce No. 19602/AGF/RD (c.19638/AGF)
- Industry Expert and Technology Expert: intellectual property, patent royalties
- Expert Report, Deposition Testimony, Hearing Testimony (2015)

Ericsson Inc and Telefonaktiebolaget LM Ericsson v Apple Inc

- International Trade Commission Investigation No. 337-TA-952
- Industry Expert: Public Interest
- Expert Report, Deposition Testimony, Hearing Testimony (2015)

Core Wireless Licensing SARL v LG Electronics Inc and LG Electronics Mobilecomm USA Inc

- United States District Court, Eastern District of Texas No. 2-14-cv-00911-JRG-RSP
- Technical Expert
- Expert Declaration, Expert Report, Deposition Testimony (2015)

St. Lawrence Communications v ZTE Corporation

- United States District Court, Eastern District of Texas No. 2:15-cv-394-JRG and 2:15-cv-00351-JRG
- Technical Expert
- Preliminary work performed; case settled (2016)

ParkerVision Inc v Apple Inc, Samsung Electronics Co Ltd, Samsung Electronics Inc, LG Electronics Inc, LG Electronics Mobilecomm USA Inc, and Qualcomm Inc

- International Trade Commission Investigation No. 337-TA-982
- Industry Expert: Public Interest
- Expert Report, Deposition Testimony (2016)

T-Mobile USA Inc v Huawei Device USA Inc and Huawei Technologies Co Ltd

- United States District Court, Western District of Washington No. 14-cv-01351-RAJ
- Industry Expert: Trade Secrets
- Expert Report, Deposition Testimony (2016), Declarations, Trial Testimony (2017)

Immersion Corporation v Apple Inc and AT&T Mobility LLC

- International Trade Commission Investigation No. 337-TA-1004/990
- Industry Expert: Public Interest
- Expert Report (2016), Deposition Testimony, Hearing Testimony (2017)

Netlist Inc v SK hynix America Inc, SK hynix Inc, SK hynix memory solutions Inc

- International Trade Commission Investigation No. 337-TA-1023
- Industry Expert: Public Interest
- Expert Report, Deposition Testimony, Hearing Testimony (2017)

Andrea Electronics Corporation v Samsung Electronics America Inc and Samsung Electronics Co Ltd

- International Trade Commission Investigation No. 337-TA-1026
- Industry Expert: Public Interest
- Expert Report, Deposition Testimony (2017)

Motorola Solutions Inc v Hytera America Inc and Hytera Communications America (West) Inc

- International Trade Commission Investigation No. 337-TA-1053
- Technical Expert
- Inter Partes Review, Expert Report, Rebuttal Report, Deposition Testimony (2017)

WiLAN v LG Electronics Inc

- United States District Court, Southern District of California No. 3:17-cv-00358-BEN-BGS
- Technical Expert
- Preliminary work performed; case settled (2017)

Huawei Technologies Co Ltd et al. v Samsung Electronics Co Ltd et al.

- United States District Court, Northern District of California No. 16-cv-02787-WHO
- Technical Expert: Standards Essential Patents
- Expert Report (2018)

Seven Networks Inc v Google LLC

- United States District Court, Eastern District of Texas No. 2:17-CV-00442-JRG
- Technical Expert
- Expert Report (2018)

BiTMICRO LLC v Samsung Electronics America Inc, Samsung Electronics Co Ltd, SK Hynix America Inc, and SK Hynix Inc

- International Trade Commission Investigation No. 337-TA-1097
- Industry Expert: Public Interest
- Expert Report, Deposition Testimony (2018)

United States of America et al. in the matter of T-Mobile USA Inc and Sprint Corporation

- United States District Court, District of Columbia No. 1:19-cv-02232-TJK
- Technical Expert and Industry Expert: industry background, anti-trust, economics
- Expert Report, Model (2018)

EVS Codec Technologies and St Lawrence Communications v Sony Mobile Communications Inc

- United States District Court, Southern District of New York No. 1:18-cv-09518-JSR
- Technical Expert and Industry Expert: intellectual property, patent royalties
- Expert Declarations, Expert Report (2019)

Peloton Interactive Inc v Flywheel Sports Inc

- United States District Court, Eastern District of Texas 2:2018-cv-00390-RWS-RSP and 2:19-cv-00317-JRG-RSP
- Industry Expert: Trade Secrets, Intellectual Property, Inter Partes Review, Indicia of Non-obviousness
- Expert Reports (2020)

Neodron Limited v Samsung Electronics Co Ltd, Amazon.com Inc, Motorola Mobility LLC, Microsoft Corp, and Apple Inc

- International Trade Commission Investigation No. 337-TA-1162 and No. 337-TA-1193
- Industry Expert: Public Interest
- Expert Report (2020)

Helios Towers plc v Orange SA

- Arbitration, International Chamber of Commerce No. 25115/dda
- Technical Industry Expert: Arbitration
- Expert Report (2020)

United States of America v Huawei Technologies Co Ltd

- Western District of Washington Docket No. CR19-010-RSM
- Eastern District of New York Docket No. 18-CR-457 (AMD)
- Industry Expert: Theft of trade secrets, and conspiracy to steal trade secrets, violating the Racketeer Influenced and Corrupt Organizations (RICO) Act
- Advisory capacity (2020)

RED v CloudMinds Inc

- JAMS Arbitration No. 1220062943
- Technical Expert and Industry Expert: Arbitration
- Expert Report, Deposition Testimony, Hearing Testimony (2020)

Nokia Corporation v Lenovo Group Limited

- International Trade Commission Investigation No. 337-TA-1208
- Industry Expert: Public Interest, Domestic Industry, Bonding
- Expert Report, Deposition Testimony (2020)

Evolved Wireless LLC v Samsung Electronics Co Ltd and others

- International Trade Commission Investigation No. 337-TA-1253
- Industry Expert: Public Interest
- Expert Report, Deposition Testimony (2021)

Competition Bureau of Canada in the matter of Rogers Communication and Shaw Communication

- Assessment of the proposed acquisition by Rogers Communication of Shaw Communication
- Industry Expert: Public Interest
- Expert Report for §104 Injunction
- Expert Report for §92 Hearing
- Testimony at Competition Tribunal
- Affidavit for Stay and Injunction for Appeals Court Canada (2021)

Sonrai Memory Limited v Intel Corp (on behalf of Dell Technologies Inc, Lenovo Group Limited, and LG Electronics Inc), Samsung Electronics Co Ltd, and Samsung Electronics America

- International Trade Commission Investigation No. 337-TA-1280
- Industry Expert: Public Interest
- Expert Report, Rebuttal Expert Report, Deposition Testimony (2021)

Ericsson Inc v Apple Inc

- International Trade Commission Investigation No. 337-TA-1299
- Industry Expert: Public Interest
- Expert Report, Rebuttal Expert Report, Deposition Testimony, Hearing Testimony (2022)

Ericsson Inc v Apple Inc

- International Trade Commission Investigation No. 337-TA-1300
- Industry Expert: Public Interest
- Expert Report, Rebuttal Expert Report, Deposition Testimony, Hearing Testimony (2022)

Ericsson Inc v Apple Inc

- International Trade Commission Investigation No. 337-TA-1301
- Industry Expert: Public Interest
- Expert Report, Rebuttal Expert Report, Deposition Testimony, Hearing Testimony (2022)

AliveCor Inc v Apple Inc

- International Trade Commission Investigation No. 337-TA-1266
- Industry Expert: Public Interest
- Declaration on Public Interest (2022)

Arigna Technology Limited v Apple Inc

- International Trade Commission Investigation No. 337-TA-1308
- Industry Expert: Public Interest
- Expert Report, Rebuttal Report, Deposition Testimony (2022), Hearing Testimony (2023)

United States of America v Google LLC

- United States District Court, District of Columbia No. 1:20-cv-03010-APM
- Technical Expert and Industry Expert: industry background, anti-trust
- Expert Report, Reply Report, Deposition Testimony (2020)

Department of Justice, Anti-Trust Division, Media, Entertainment and Communications Section

- Anti-trust investigation in the communications services sector
- Industry Expert and Technical Expert: Anti-trust
- Advisory capacity (2022)

Daedalus Prime LLC v Samsung Electronics Co Ltd, Samsung Telecommunications America LLC, and Qualcomm Incorporated

- International Trade Commission Investigation No. 337-TA-1335
- Industry Expert: Public Interest
- Expert Report (2022)

Daedalus Prime LLC v Samsung Electronics Co Ltd, Samsung Electronics America Inc, Taiwan Semiconductor Manufacturing Company Limited, and TSMC North America

- International Trade Commission Investigation No. 337-TA-1336
- Industry Expert: Public Interest
- Expert Report. (2022)

Masimo Corporation v Apple Inc

- International Trade Commission Investigation No. 337-TA-1276
- Industry Expert: Public Interest
- Declaration on Public Interest (2023)

PayRange Inc v KioSoft Technologies LLC

- United States District Court, Southern District of Florida No. 1:20-CV-24342-RNS
- Technical Expert and Industry Expert: intellectual property, damages estimation
- Expert Report, Rebuttal Report, Deposition (2023)

Interdigital Inc v Samsung Electronics Co Ltd

- Arbitration, International Chamber of Commerce No. 27699/PDP
- Industry Expert: Arbitration
- Expert Report (2023), Rebuttal Report (2024)

ASUS Inc v Samsung Electronics Co Ltd

- Technical legal case No. 2:23-CV-00409-JRG-RSP
- Technical Expert
- Inter Partes Review

Telefonaktiebolaget LM Ericsson v Lenovo (United States)

- International Trade Commission Investigation No. 337-TA-1387
- Industry Expert: Public Interest
- Expert Report

Professional Experience**Endeavour.Partners***Founder and Chairman**2003–Present*

Endeavour.Partners is a boutique consulting firm that empowers business leaders to create a future that is more prosperous and more humane, equitable, sustainable, and resilient by harnessing digital technologies—and other deep technologies—to create new value and accelerate growth both in leading technology and for other global leaders worldwide in many diverse sectors to harness digital and deep technology.

Endeavour.Partners leverages its deep and broad expertise in technology to help achieve positive outcomes for people and the planet in vital and critical areas, such as anti-trust and the public interest, which encompasses, for example, public health and welfare, competitive conditions, and outcomes for consumers.

Michael and his team have experience working throughout the digital ecosystem: across mobile, cellular, satellite, Internet, and digital convergence and commerce. This includes extensive work in communications, in particular mobile devices (feature phones, smartphones, tablets, cameras, connected homes, smart homes), services (video/PnP, data, messaging, mobile payment, codecs, Bluetooth), components (processor, memory, sensors), cellular and satellite networks (network infrastructure and equipment), broadband and Internet, computing (from semiconductors through personal computing to software services), consumer electronics, content (video, audio, gaming), commerce, and convergence of these domains.

The firm specializes in technological innovation, the adoption and diffusion of new products, and the emergence and evolution of business ecosystems from a systems point of view. This expertise encompasses the key digital technologies redefining business, the economy, and society: smartphones, cloud services, the Internet of things (IoT), Artificial Intelligence (AI), and robotics.

The firm is headquartered in Cambridge, MA, with a presence in Seattle, WA, and in London, United Kingdom.

Clients

Endeavour.Partners clients include:

- most of the leading mobile device and connected consumer electronics vendors, including HTC, Samsung, Apple, Nokia, LG, Sony Ericsson, and Motorola
- leading network operators and service providers, such as Verizon Wireless, AT&T, Sprint, T-Mobile, Deutsche Telekom, Vodafone, BT, Optus, and Virgin Mobile
- network infrastructure owners and providers, such as Crown Castle, Samsung, and Lucent
- other firms throughout the high-technology supply chain, including semiconductor companies such as Intel, SK Hynix, Qualcomm, and Analog Devices
- leading global businesses in diverse sectors harnessing digital and other deep technologies, including Thomson Reuters, Swiss Re, Husqvarna, Arla, TetraPak, TechnipFMC, and A.C. Milan
- innovative new technology ventures, such as PowerByProxi, Soul Machines, and zero360
- leading public sector organizations, including public broadcaster WGBH and the American Archive of Public Broadcasting (AAPB)

Scope of Work

Michael's work through Endeavour.Partners exemplifies his wide-ranging expertise in business strategy, technology strategy, technology innovation, product creation, supply chain, and public policy issues. He has provided industry expertise in patent and antitrust litigations on behalf of:

- U.S. Department of Justice—anti-trust case over the proposed AT&T and T-Mobile merger (2011)
- Commercial Arbitration participants—industry and technical expert providing multi-billion-dollar patent arbitrations concerning both Standard Essential Patents (SEPs) and non-SEPs on mobile connectivity and mobile services
- ITC complainants and respondents—industry expert opining on the public interest for litigation focused on wireless infrastructure and networks, mobile devices, wearables, smart home devices, semiconductors, software applications, and digital ecosystems
- United States District Court plaintiffs and defendants—technical expert opining on the (in)validity and (non)infringement related to several technologies involved in mobile devices and wireless networks, including the capture and decoding of real-time video signals, communication on smartphones, and audio codecs

Endeavour.Partners has also worked in strategy projects on behalf of:

- wireless carriers—video/PnP, 4G and LTE technologies, Bluetooth and data/messaging, particularly around innovative business models
- one of the world's largest and most successful network operators and service providers—video and media platform strategy
- a major wireless carrier—strategies in NFC technology and mobile payments, including a deep technical analysis of competing solutions, as well as assessment on the surrounding business ecosystem, viable business models, and drivers of consumer adoption patterns
- R&D department (~20,000 people) of one of the world's largest software development organizations—renewal of product creation
- world's number one mobile device vendor—"R&D University" for top management team (in collaboration with the world's top academics)
- world's number one consumer electronics business—the future of the consumer electronics, connected home devices, computing business ecosystem, and communications business ecosystem
- a multi-billion-dollar diversified global technology business—renewal of their technology management, from semiconductors through software platforms to devices and complete solutions
- top-tier service providers and network operators, such as BT and Deutsche Telekom—corporate and business strategy for communications services, software businesses, innovative start-ups, and infrastructure vendors
- world's number one device vendor—platform strategy for its flagship product line
- innovation leader in mobile devices—a family of modular products
- world's number one global provider of subsea robotics—new networking approaches for robust, high-bandwidth, multi-model subsea communications systems

Endeavour.Partners has also provided broad industry expertise in regard to:

- business strategies on Internet and mobile advertising, including market sizing, opportunity assessment, and business model deployment for various service providers
- business strategies on machine learning as a service, disease management, green hydrogen, carbon nanotubes, and sensors
- comprehensive projection of the medium- and long-term demand for all digital services and devices, and the related attributes driving consumer choice and preference, including projected market share for major players under a variety of alternative scenarios and the implications thereof
- analysis of the full spectrum of the communications sector, from underlying physical infrastructure, through cellular networks, fiber networks, and satellite networks
- standards for smart home products and connectivity

WKD.SMRT, Inc.*Co-founder and Chief Executive Officer**2019–present*

WKD.SMRT delivers superior real-life data for clinical trials in the home. Its solution makes clinical trials faster, easier, lower cost, and lower risk by combining state-of-the-art sensing, machine learning, and computing technologies to deliver data that is more precise, more complete, more objective, and more real-life.

It is partnering with the world's leading pharma company focused on neurodegenerative diseases, the world's number one academic neurology department, and the world's leading research group focused on the medical aspects of activities of daily living and quality of life.

Silverthread, Inc.*Co-founder, former Chairman**2013–present*

Silverthread's services and tools help clients diagnose and improve the design architecture of large software systems to improve predictability of project schedules, reduce unnecessary overhead costs, and prevent compounding complexity. The company's clients include large corporations and government entities that own and manage large, complex software systems.

Zero-360*Co-Founder and founding Chairman**2012–2015*

Strategic thought leader for this next-generation wearable device and solutions company focused on unique interactions and bio-sensing capabilities. Its particular focus is on how to support behavioral change. Zero-360's cloud platform provided an open and scalable solution that integrated with third-party wellness programs in capturing valuable health and wearable data.

EquuSys*Co-Founder and Chief Technology Officer**2004–present*

EquuSys is an animal instrumental business that provides real-time, real-world data to enhance the evaluation, diagnosis, rehabilitation, training, and conditioning of elite horses. The company commercialized Michael's patented inventions, including the development of a hardware electronics sensor product and the accompanying software. This included developing novel wireless protocols for high-speed asymmetric data transmission in shared spectrum.

Mercator Partners*Founder and Chairman Emeritus**1998–2009*

This technology strategy consulting firm designed, directed, and delivered training programs in strategy and technology. Its alumni now fill top strategy roles within a number of industry-leading firms, including Google, HTC, Nielsen, Yahoo!, Sony Ericsson, HTC, and Vodafone. Client work focused on building creative new business models and developing effective business strategies on behalf of:

- leading US mobile company—business ecosystems, business strategies, and anticipating likely customers behavior

- major global JV with European and Japanese parents—emerging applications and potential business models
- most successful MVNO in the world—data services, market entry, and partnership development
- several high-tech R&D-intensive businesses across consumer electronics, telecommunications, automotive, and aerospace—how to commercialize highly innovative technologies
- for the number one US communications infrastructure company—customer needs and company strategy for 3G mobile
- leading Japanese consumer electronics and industrial conglomerate—evolution of consumer electronics; monetizing its semiconductor intellectual property; consumer segmentation; creative business models; and product portfolios, pipeline, and positioning
- variety of media companies—business models and content plays in the Internet and mobile service space
- leading European mobile operator—values- and lifestyle-based consumer segmentations to increase customer loyalty and reduce costs
- several broadband and IP players—business models and market entry strategies
- several top-tier private equity players, such as The Carlyle Group, Providence Equity, Kohlberg Kravis Roberts, Blackstone, and Berkshire Partners—due diligence and strategic counsel on technology and telecom investments
- UK 3G auctions—assembled a consortium bid (SpectrumCo), and raising >\$4 billion for an innovative business model, with players such as Virgin, Sonera, Nextel, and Tesco, including strategies for sharing spectrum amongst multiple competing uses

GeoPartners Research

Principal

1996–1998

GeoPartners Research provided technology evaluation and strategy focused on broadband, IP, and next generation wireless technologies on behalf of and in regard to:

- AT&T—overall corporate strategy, including IP, VoIP, local entry, wireless and broadband, including network infrastructure and equipment (including NAT and DNS for VoIP)
- Qualcomm—new technologies, business ventures, and organizational design, including work on Qualcomm's first smartphone and on the design parameters for spectrum sharing on its next generation of data-oriented technologies such as EV-DO and EV-DV
- Ember Networks—the IEEE 802.15.4 and the standardization of the Zigbee protocols, and comparative evaluation of these protocols versus other wireless mesh protocols, with a particular focus on frequency hopping to mitigate interference in unlicensed spectrums
- HP, Northern Telecom (subsequently Nortel Networks), and Intel—business models and building business ecosystems

AT&T (formerly BellSouth International)*Chief of Strategy, One NZ (formerly BellSouth NZ)*

1992–1996

Corporate and business strategy, government relations and industry relations, and R&D, including:

- Chairman of the 3rd Generation Interest Group of the GSM MoU (the largest organization of mobile network operators in the world)—assessed the alternative protocols available for 3G, with particular focus on the use of frequency hopping and other techniques to mitigate interference, the requirements to support global roaming, and to qualify state-of-the-art mobile devices for advanced services
- Chairman of the New Zealand Personal Communications Services working group—assessed the coexistence of various wireless protocols, with a particular focus on their frequency hopping strategies, including, for example, the interaction between DECT and the Japanese Personal Handyphone System (PHS)
- one of the leaders of a global task force evaluating the technologies and business models for satellite networks, including major new networks such as Iridium, Globalstar, and Teledesic
- pioneered the first PDA with digital cellular connectivity (Apple Newton, Nokia Data Card and Nokia 2110) and collaborated with Nokia on the development and testing of the very first modern smartphone, the Nokia Communicator
- built the business from pre-launch through to profitability, which has now become the clear market leader and Vodafone's most successful business worldwide
- designed and drove a path-breaking multi-million-dollar global academic research program on the economics of communications, networks, and technologies in deregulated markets. Fellow participants included Jean-Jacques Laffont, Jean Tirole, Paul David, David Teece, David Gabel, and Glenn Woroch.

Boston Consulting Group*Manager*

1991–1993

Michael focused on technology and telecoms businesses, including Philips Electronics, Telecom NZ, Telstra, and in particular BellSouth International. Responsible for training programs in advanced analytical techniques for strategy development.

Braxton Associates*Manager*

1987–1991

Michael worked on a wide range of strategy projects, focusing on electronics and defense businesses in particular, such as companies involved in command and control systems, aircraft, tanks, submarines, and satellite networks. Also worked on corporate strategy, product development, manufacturing and operational transformation, and market entry. Played a leading role in development and training, focusing in particular on approaches to organizational transformation.

Mars Electronics*Project Manager, Program Manager*

1984–1987

Michael worked as roboticist; cyberneticist; and designer, developer, and program manager for large-scale real-time systems for manufacturing and logistics. Involved in the development of overall business strategy.

Cookson Group*Robotics Engineer, Project Manager*

1982–1984

Michael worked as a robotics engineer and automation manager overseeing and supporting many existing robotic handling and other automation systems. Designed, developed, and deployed additional state-of-the-art robotic and automation systems for manufacturing processes and material handling.

Academic Experience**Massachusetts Institute of Technology***Senior Lecturer–Integrated Design and Management*

Michael was invited to create and teach, as part of Integrated Design Lab I and Integrated Design Lab II (EM.441 and EM.442), courses that present fundamentals of and advanced topics in integrated design and product development process.

Michael developed and taught fundamental concepts, including innovation, emerging technologies, product management, product marketing, basic finance and business models, and pricing and marketing. Developed and taught advanced topics, including competitive analysis and market opportunity identification, funding entrepreneurship, business plan and pitch, and data-driven decision-making.

Senior Lecturer–Engineering Systems Division (now Institute for Data, Systems, and Society)

Michael was responsible for creating, managing, and teaching two capstone leadership courses, the Systems Leadership & Management Lab (SL&M Lab) and Praxis (ESD.39 and ESD.S51).

SL&M Lab is a semester-long course in which System, Design, and Management (SDM) Fellows work at least one full day per week (~fifteen person-days) on average with the top management of a high-tech business on a relevant real-world systems and management challenge. The host companies set the focus; therefore, project teams work on problems of true concern to the host companies.

The course also focuses on challenges such as team roles, logical thinking and writing, and the use of graphical communication. Assignments can range from high-level systems thinking issues to building a prototype. SDM students take this experience with them as they work with their host companies or continue in their career progression and development.

The SL&M Praxis course is about praxis: practice—application or use of knowledge or skills—as distinguished from theory. The course gives SDM Fellows insights into the realities of decision-making and managerial behavior in large, complex, high-tech, and systems businesses. It provides students with systematic approaches to apply their systems, architecture, technology, and strategy learnings to real-world leadership and management challenges. This course runs during the summer session as a complement to and preparation for the SL&M Lab course.

Senior Lecturer–Bernard M. Gordon-MIT Engineering Leadership Program, School of Engineering

The Bernard M. Gordon-MIT Engineering Leadership Program (<http://web.mit.edu/gordonelp/>) fosters new approaches that prepare the nation's young engineering leaders for productive and effective careers in engineering companies, and continues MIT's rich, innovative tradition of engineering leadership.

Michael taught the capstone undergraduate leadership course, Engineering Leadership (ESD.045).

The Engineering Leadership course exposes students to the models and methods of engineering leadership within the contexts of conceiving, designing, implementing, and operating products, processes, and systems. In particular, taught the Engineering Systems elements of the course, homed within AeroAstro.

Michael taught the Technology & Strategy course (15.905/15.965).

The Technology & Strategy course provides a strategic framework for managing high-tech businesses. It emphasizes the development and application of ways of thinking or mental models that bring clarity to the complex co-evolution of technological innovation, the demand opportunity, business ecosystems, decision-making, and execution within the business.

These tools help managers anticipate and decide how to respond to the behavior of competitors, complementors, and customers; and decide which technologies to invest in, opportunities to target, or partnerships to pursue.

Principal Investigator—Engineering Systems Division (now Institute for Data, Systems, and Society)

Involved in the research on the improvement of software project outcomes by attacking complexity and technical debt as part of a National Science Foundation (NSF) I-Corps program.

Researcher and Thesis Advisor

Supervises thesis work on related areas, including recent prize-winning work on the future of the smart grid, and theses on a broad range of issues.

Conducts research on how psychology shapes consumers' buying behavior and how product features and specifications influence consumers' choices among products and their liking for products. This culminated in a keynote presentation at MIT in Europe, held in Vienna, Austria and a keynote presentation at MIT in South America, held in Chile in 2023

London Business School

The Business of Artificial Intelligence

Course director for the highly rated flagship online program in how to create business value from Artificial Intelligence.

New Technologies Ventures Program

Manage and teach this unique program that brings MBAs and business students from London Business School together with post-doctoral researchers from University College London.

The goal of this course is to enable would-be entrepreneurs to evaluate novel ideas and inventions and turn them into new technology ventures. Participants, who are business professionals, scientists, engineers, and would-be entrepreneurs, explore how entrepreneurs and investors identify and analyze the feasibility of innovative technical ideas, turn them into products and services, and take these products and services to market, as both start-ups and established businesses. A key element of the program is projecting demand for innovative products and new product features

Professional Affiliations

Recognized as a World Class New Zealander (March 2007)

Member, Board of Advisors, Department of Systems Engineering at the United States Military Academy at West Point

Appointed to U.S. Beachhead Board of New Zealand Trade & Enterprise (NZTE) (July 2006)

Member, Board of Directors, Massachusetts Technology Leadership Council (MassTLC)

Co-Chairman, Mobile Cluster, Massachusetts Technology Leadership Council (MassTLC)

Member, Executive Committee, Boston Area Chapter of the Communications Society of the Institute of Electrical and Electronic Engineers (IEEE)

Member, Association for Computing Machinery (ACM)

Member, Academy of Management

Member, Strategic Management Society

Member, Institute for Operations Research and the Management Sciences (INFORMS)

Member, Product Development Management Association (PDMA)

Freeman of the Worshipful Company of Ironmongers