

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SMARTSKY NETWORKS LLC,
Petitioner,

v.

GOGO BUSINESS AVIATION LLC,
Patent Owner.

Case No. IPR2025-00672
U.S. Patent No. 9,954,600

DECLARATION OF PAUL MIN PH.D.

1. I have been retained on behalf of Gogo Business Aviation LLC (“Patent Owner”) in connection with the above-captioned inter partes review (IPR). I have been retained to provide my opinions in support of Patent Owner’s Preliminary Response. I am being compensated for my time at my standard consulting rate. I have no interest in the outcome of this proceeding.

2. In preparing this declaration, I have reviewed and am familiar with the Petition for IPR2025-00672, U.S. Patent No. 9,954,600 (“the ’600 Patent”) and its file history, and all other materials cited and discussed in the Petition (including the declaration of Petitioner’s expert Dr. Gerard James Hayes), and cited and discussed in this Declaration.

3. The statements made herein are based upon my own knowledge and opinion. This Declaration represents only the opinions I have formed to date. I may consider additional documents as they become available or other documents that are necessary to form my opinions. I reserve the right to revise, supplement, or amend my opinions based on new information and on my continuing analysis.

I. QUALIFICATIONS

4. I am a Senior Professor of Electrical & Systems Engineering at Washington University in St. Louis, where I have served since 1990. I received my Ph.D. in Electrical Engineering from the University of Michigan in 1987, my M.S. in Electrical Engineering from the University of Michigan in 1984, and my B.S. in Electrical Engineering from the University of Michigan in 1982.

5. Before joining Washington University, I spent three years at Bellcore (now Telcordia Technologies, Inc.), where I served as a lead systems engineer for the Bell Operating Companies in transitioning away from their voice-centric networks at the time of the AT&T divestiture, into multi-services capable networks suited for the Internet era. I received an Outstanding Achievement Award for my contributions by Bellcore in 1989.

6. I am an internationally recognized expert in the field of high speed communication and computing, particularly in wireless communication systems and air-to-ground networks. I designed one of the earliest nationwide, commercial-scale, code division multiple access (CDMA) networks after winning a cellular communication license from the Korean Government through a highly competitive selection process. I was the leading author of the technical blueprint for this wireless cellular network.

7. I have conducted continuous research in 3G UMTS/4G LTE/5G IoT wireless networks as well as various generations of WiFi technology. My research areas include switching, routing, performance control and security in communication networks. I have developed methods that enable coordinated transmission and reception of wireless signals among multiple base stations, including techniques where clusters of base stations work together as a single resource to enhance signal quality across noisy wireless channels.

8. I hold 11 U.S. patents and have received multiple best paper awards, including the Best Paper Award at MOBILITY 2011 and the Best Paper Award at 18th ISATA Award of Technical Excellence. I have served as Chair of the Saint Louis Section of the Institute for Electrical and Electronics Engineering (IEEE) and have been involved in organizing international symposiums and serving as a guest editor for international journals.

II. LEGAL UNDERSTANDING

9. I am not a lawyer and will not provide any legal opinions. Though I am not a lawyer, I have been advised that certain legal standards are to be applied by technical experts in forming opinions regarding the meaning and validity of patent claims.

A. The Person of Ordinary Skill in the Art (“POSITA”)

10. I understand that a person of ordinary skill in the relevant art at the time of the invention (“POSITA”) is presumed to be aware of all pertinent art, thinks along conventional wisdom in the art, and is a person of ordinary creativity—not an automaton.

11. I have been asked to consider the level of ordinary skill in the field that someone would have had at the time the claimed invention was made. In deciding the level of ordinary skill, I considered the following:

- the levels of education and experience of persons working in the field;

- the types of problems encountered in the field; and
- the sophistication of the technology.

12. I have reviewed the declaration of Dr. Hayes, including his opinions regarding the Person of Ordinary Skill in the Art, which is a person with “a degree in electrical engineering or computer science, or a similar discipline, along with 4-5 years of experience with real-time systems architecture, design, and implementation. This POSA would be aware and generally knowledgeable about the aviation and aerospace industry as it relates to telecommunication systems.” Ex. 1002, ¶18.

13. My opinions set forth in this Declaration apply Dr. Hayes’s definition of a POSITA.

14. I am well-qualified to determine the level of ordinary skill in the art and was a person of at least ordinary skill in the art at the time of the relevant priority date of the ’600 patent. All of my statements below are to be understood as a person of ordinary skill in the art would have understood them as of the priority date of the ’600 patent.

B. Anticipation

15. I understand that to obtain a patent, a claimed invention must have, as of the priority date, been novel. I understand that to prove that a prior art reference anticipates a patent, the four corners of the prior art reference must describe element of the claimed invention, either expressly or inherently. I also understand that the prior art reference must describe the elements arranged as in the claim and that it is

improper to combine disparate embodiments to establish anticipation unless a POSITA when reading the reference could at once envisage such a combination.

C. Obviousness

16. I understand that to obtain a patent, a claimed invention must also have, as of the priority date, been nonobvious in view of prior art in the field. I understand that an invention is obvious when the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art.

17. I understand that to prove that prior art, or a combination of prior art, renders a patent obvious, it is necessary to: (1) identify the particular references that singly, or in combination, make the patent obvious; (2) specifically identify which elements of the patent claim appear in each of the asserted references; and (3) explain how the prior art references could have been combined to create the inventions claimed in the asserted claim, including how there would have been a reasonable expectation of success.

18. I understand that a patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art, and that obviousness cannot be based on the hindsight combination of components selectively culled from the prior art to fit the parameters of the patented invention.

19. I also understand that a reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant. Even if a reference is not found to teach away, I understand its statements regarding preferences are relevant to a finding regarding whether a skilled artisan would be motivated to combine that reference with another reference.

D. Claim Construction

20. I have been informed that patent claims are construed from the viewpoint of a person of an ordinary artisan and that patent claims generally should be understood consistent with their ordinary and customary meaning at the time of the invention. A review of the patent claim language, the patent specification, and its prosecution history are also necessary to determine the proper meaning and scope of the term at issue.

21. I have further been informed that in the specification and prosecution history the patentee may define a claim term in a way that differs from the ordinary and customary meaning. I understand that during prosecution of the patent before the U.S. Patent and Trademark Office, the Applicant may make representations or provide definitions of terms that may affect the scope of the patent claims. In particular, the Applicant may, during the course of prosecution, limit the scope of

the claims to overcome prior art and/or disavow claim coverage by making clear and unambiguous statements to that effect.

22. I have been informed that an ordinary artisan may, among other things, consider dictionaries, publications, other patents, and treatises (*i.e.*, “extrinsic evidence”). I understand that extrinsic evidence may generally not be relied on if it contradicts the meaning of claim language provided by the intrinsic evidence, such as express definitions given for terms in the specification.

E. Secondary Considerations of Non-Obviousness

23. I understand that one of the factual inquiries when determining the obviousness of a patent is to consider objective evidence related to the issue of obviousness, sometimes called “secondary considerations of non-obviousness” or “objective indicia of non-obviousness.” I understand that such evidence can often be probative of the issues of obviousness.

24. I understand that examples of objective evidence include (1) commercial success, (2) copying, (3) industry praise, (4) skepticism, (5) long-felt but unsolved need, and (6) failure of others.

25. I understand that there must be a nexus between the patented invention and the evidence of secondary considerations. I further understand that there is a presumption of such a nexus if the claims of the patent are coextensive with a product or products that are the subject of the secondary considerations evidence. I further understand that in order for a claim to be coextensive with a product, one must look

at the claims at the whole and not just the new claimed feature. In addition, the claimed invention should not be merely a subcomponent of the products sold but should encompass the entire apparatus.

III. CLAIM CONSTRUCTION

26. Based on my review of the Petition and the '600 Patent, I do not believe that any specific claim construction is necessary at this stage of the proceeding. The claim terms at issue can be understood according to their plain and ordinary meaning as would be understood by a person of ordinary skill in the art in light of the specification. Should specific claim construction issues arise during this proceeding, I reserve the right to address them as needed.

IV. TECHNOLOGY BACKGROUND

27. In what follows, I present a brief technology background in order to aid the understanding of my opinions in this declaration.

A. Signal Quality versus Channel Capacity

28. In wireless communications, the term “signal quality” (or alternatively, the “quality of signal”) has been used widely with different meanings. For example, a textbook entitled “Adaptive Signal Processing in Wireless Communications” by M. Ibnkahla, CRC Press, 2009 (“Ibnkahla”) (Exhibit 2003) explains that “adaptive receiver designs allow the receiver to work with reduced signal quality values; i.e., a desired bit-error-rate (BER) or frame-error-rate (FER) performance can be achieved with a lower signal quality” (Ex. 2003 at 2), and that “for a target BER (or

FER), a required signal quality threshold can be calculated to be used with the adaptation algorithm” (Ex. 2003 at 13).

29. As another example, a published article entitled, “Characterization of Ultra-Wide Bandwidth Wireless Indoor Channels: A Communication-Theoretic View,” by M.Z. Win, IEEE Journal on Selected Areas in Communications, Vol. 20, No. 9, December 2002 (“Win”) (Exhibit 2004), shows the following table to illustrate the signal quality in the indoor wireless communication.

Room	≈ distance (meters)	Minimum (dB)	Maximum (dB)	$\hat{\mu}$ (dB)	Median (dB)	$\hat{\sigma}$ (dB)	# of Samples
F2	5.5	-12.9970	-9.64586	-11.5241	-11.6813	0.8161	49
N	5.5	-16.0060	-13.2949	-14.7260	-14.7690	0.5892	49
P	6.0	-15.5253	-12.2185	-14.2373	-14.2820	0.8091	49
L	8.0	-16.6966	-12.4310	-14.4500	-14.5538	0.8342	49
W	8.5	-20.0157	-17.0351	-18.7358	-18.7425	0.7622	49
F1	9.5	-14.4064	-9.79770	-12.0986	-12.1407	1.0563	49
H	10.0	-21.0415	-16.1628	-18.7141	-18.8142	1.1240	49
U	10.0	-21.1719	-17.6232	-19.4275	-19.4092	0.8024	49
T	10.5	-21.9113	-19.2986	-20.6100	-20.5419	0.5960	49
R	10.5	-23.7221	-20.8867	-22.2675	-22.3851	0.8686	21
M	13.5	-23.8258	-20.9277	-22.2568	-22.2064	0.6439	49
E	13.5	-24.1454	-20.2000	-22.5973	-22.7824	1.0332	49
A	16.0	-25.4171	-20.7822	-23.2826	-23.3541	1.1512	49
B	17.0	-24.7191	-21.2006	-22.9837	-22.9987	0.8860	49
C	17.5	-26.4448	-22.3120	-24.4842	-24.5777	1.0028	49
Hallways		-23.8342	-6.72469	-16.9317	-17.3286	4.5289	34

(Ex. 2004 at 1619.)

30. With reference to the table shown above, Win explains that “Table I shows the estimates $\hat{\mu}$, $\hat{\sigma}$ of the mean and standard deviation of the signal quality in each room, based on the samples taken in that area. The histogram and cumulative distribution function (CDF) of the signal quality for measurements made in these locations are shown in Fig. 7. This data indicates that the signal energy per received multipath waveform varies by at most 5 dB as the receiving position varies over the measurement grid within a room.” (Ex. 2004 at 1619.) In other words, Win equates the strength of the received signal as the signal quality.

31. As yet another example, a textbook entitled “Wireless Communications Principle and Practice, by T. Rappaport, Prentice Hall, 2002 (“Rappaport”) (Exhibit 2005) explains that “[e]qualization, diversity, and channel coding are three techniques which can be used independently or in tandem to improve received signal quality” (Ex. 2005 at 299), “[e]qualization compensates for intersymbol interference (ISI) created by multipath within time dispersive channels” (Ex. 2005 at 299), “[d]iversity is another technique used to compensate for fading channel impairments, and is usually implemented by using two or more receiving antennas” (Ex. 2005 at 299), and “[c]hannel coding improves mobile communication link performance by adding redundant data bits in the transmitted message” (Ex. 2005 at 300).

32. In summary, the term “signal quality” relates to the ability to extract the information from the received signal.

33. In contrast to the term “signal quality,” the term “channel capacity” has a much more precise definition. The following is an excerpt from a textbook entitled “Digital and Analog Communication Systems,” by Leon W. Couch, II, Eighth Edition (“Couch”) (Exhibit 2006).

**1-10 CHANNEL CAPACITY
AND IDEAL COMMUNICATION SYSTEMS**

Many criteria can be used to measure the effectiveness of a communication system to see if it is ideal or perfect. For digital systems, the optimum system might be defined as the system that minimizes the probability of bit error at the system output subject to constraints on transmitted energy and channel bandwidth. Thus, bit error and signal bandwidth are of prime importance and are covered in subsequent chapters. This raises the following question: Is it possible to invent a system with no bit error at the output even when we have noise introduced into the channel? This question was answered by Claude Shannon in 1948–1949 [Wyner and Shamai, 1998; Shannon, 1948, 1949]. The answer is yes, under certain assumptions. Shannon showed that (for the case of signal plus white Gaussian noise) a channel capacity C (bits/s) could be calculated such that if the rate of information R (bits/s) was less than C , the probability of error would approach zero. The equation for C is

$$C = B \log_2 \left(1 + \frac{S}{N} \right) \quad (1-10)$$

where B is the channel bandwidth in hertz (Hz) and S/N is the signal-to-noise power ratio (watts/watts, not dB) at the input to the digital receiver. Shannon does not tell us how to build this system, but he proves that it is theoretically possible to have such a system. Thus, Shannon gives us a theoretical performance bound that we can strive to achieve with practical communication systems. Systems that approach this bound usually incorporate error-correction coding.

(Ex. 2006 at 19.)

34. As explained in Couch, channel capacity C in the unit of bits per second is the maximum rate R (in bits per second) that can be transmitted over a communication channel reliably, i.e., without error. More specifically, for a given channel of bandwidth B hertz with the signal-to-noise ratio $\frac{S}{N}$, the theoretically maximum data rate for a reliable communication is the channel capacity, C , bits per second.

35. Claim 1 of the '600 patent recites “calculate a first forward-link user capacity estimate using the first signal-to-noise ratio of the first communication channel” and “calculate a second forward-link user capacity estimate using the second signal-to-noise ratio of the second communication channel.” In other words, claim 1 of the '600 is reciting the claim term “user capacity” to mean the channel capacity, $C = B \log_2 \left(1 + \frac{S}{N} \right)$, which is clearly based on the signal to noise ratio $\frac{S}{N}$.

36. In comparing the two concepts, the signal quality tells how well the receiver can extract the originally transmitted signal in the presence of obstructions, such as noise and interference. On the other hand, the channel capacity tells how fast the data can be transmitted across a channel in the presence of noise. The two concepts are distinct in the sense that the signal quality does not concern the rate of data transmission – the same signal may be sent over a longer or short period of time, but the signal quality would be the same as long as the receiver can extract the originally transmitted signal at the same performance level. In contrast, the channel capacity has a tight relationship with the time -- a signal can be transmitted at a slower transmission rate, e.g., r_1 bits per second, for the receiver to receive reliably, while this same signal may not be received reliably at a faster transmission rate, e.g., r_2 bits per second, based on which of the following are true: (e.g., $r_1 \leq C$, $r_2 \leq C$, $r_1 \geq C$, $r_2 \geq C$).

B. Signal-to-Noise Ratio (SNR) versus Signal-to-Interference plus Noise Ratio (SINR)

37. As explained above, the channel capacity is defined as

$C = B \log_2 \left(1 + \frac{S}{N} \right)$ bits per second, where $\frac{S}{N}$ is the signal-to-noise ratio (in power), SNR.

The signal-to-interference plus noise ratio (in power), $\text{SNIR} = \frac{S}{I + N}$, includes the level of interfering signals, which typically come from other transmitting devices. In the context of the air-to-ground (ATG) communication system, an airborne aircraft may be receiving signals from multiple ground stations at the same time, including those ground stations that are not transmitting signals to this aircraft.

38. In wireless communication systems, it is not simple to separate the interference from the noise in the received signal. This is because the signal received by a receiver is the sum of all interference and noise together with the originally transmitted signal that is intended to be received. As explained above with regard to the channel capacity, C (or the “user capacity” in the context of the ’600 Patent), the determination of $\frac{S}{N}$ is needed to calculate the channel capacity. In other words, to calculate the channel capacity, it is required to separate the interference, I , from $I + N$, which is together present in the received signal. This is not a straightforward task.

39. To be sure, while the noise and the interference both affect the transmitted signals, the interference is different from the noise in that an interfering

signal is typically not a random signal such as the noise, which can only be characterized in a statistical manner. For example, in the case of the ATG communication system, interfering signals at the receiver of one aircraft may come from the neighboring ground stations that are not in direct communication with this aircraft, but are transmitted signals by the neighboring ground stations intended for other aircrafts.

40. One important technique used to mitigate such interference is the directional antenna. When the location and the direction of the interfering ground stations are known, the receiving antenna on an aircraft can be pointed directly to the intended ground station, minimizing (or even eliminating) the unintended signals transmitted from the interfering ground stations.

41. In general context, there are several techniques to minimize the effects of the interference. A published article entitled “A Survey on the Successive Interference Cancellation Performance for Single-Antenna and Multiple-Antenna OFDM Systems,” by N. Miridakis, IEEE Communications Survey & Tutorials, Vol. 15, No. 1, First Quarter 2013 (“Miridakis”) (Exhibit 2007), explains that “[i]nterference plays a crucial role for performance degradation in communication networks nowadays. An appealing approach to interference avoidance is the Interference Cancellation (IC) methodology. Particularly, the Successive IC (SIC) method represents the most effective IC-based reception technique in terms of Bit-

Error-Rate (BER) performance and, thus, yielding to the overall system robustness.”
(Ex. 2007 at 312.)

42. The following is a figure from Miridakis, which categorizes the different types of interference.

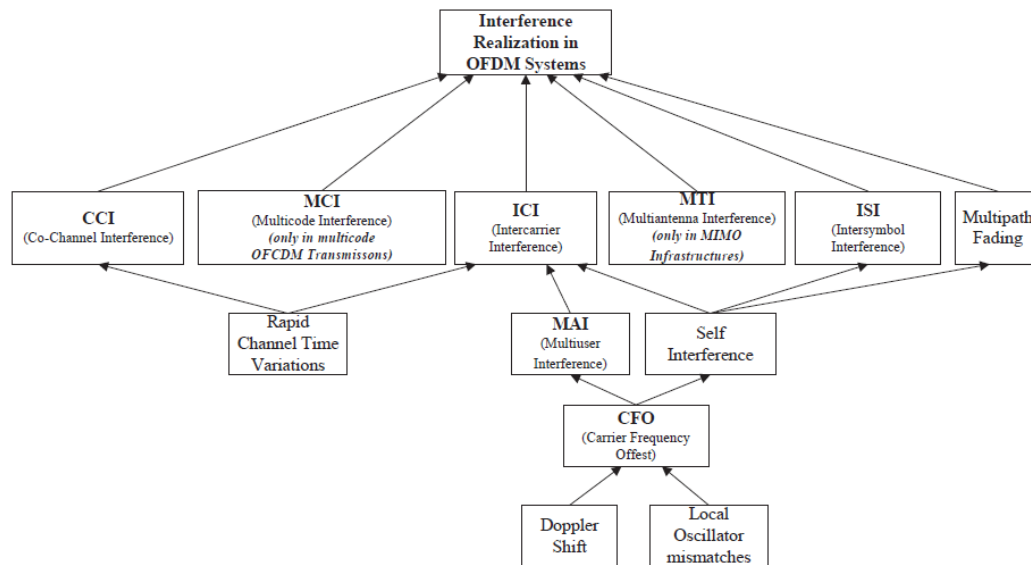


Fig. 2. Representation of the major interference influences in OFDM systems.

(Ex. 2007 at 316.)

43. The above figure illustrates that for each of the interference types, the cause and the source are known. With the known causes and the sources of interference, it is possible for the receiver to mitigate or cancel the interference from the received signal by employing mathematical techniques such filtering and signal processing.

44. In the context of the ATG communication system, one of the techniques that can be used to minimize or eliminate the interference from the neighboring

ground stations is the use of directional antennas, as contemplated by the '600 Patent.

45. A published article entitled “An Overview of Using Directional Antennas in Wireless Networks,” by H. N. Dai et. al., International Journal of Communication Systems, 2013 (“Dai”) (Exhibit 2008), explains that “[c]ompared with omni-directional antennas, directional antennas have many merits, such as lower interference, better spatial reuse, longer transmission range, and improved network capacity” (Ex. 2008 at 413) and that “[c]ompared with an omni-directional antenna, a directional antenna can concentrate its transmitting or receiving capabilities to a certain direction. Thus, using directional antennas in wireless networks allows more concurrent transmissions in the vicinity of a pair of communication nodes and consequently leads to less interference to other on-going transmissions” (Ex. 2008 at 414).

46. The following is a figure from Dai illustrating different types of antennas.

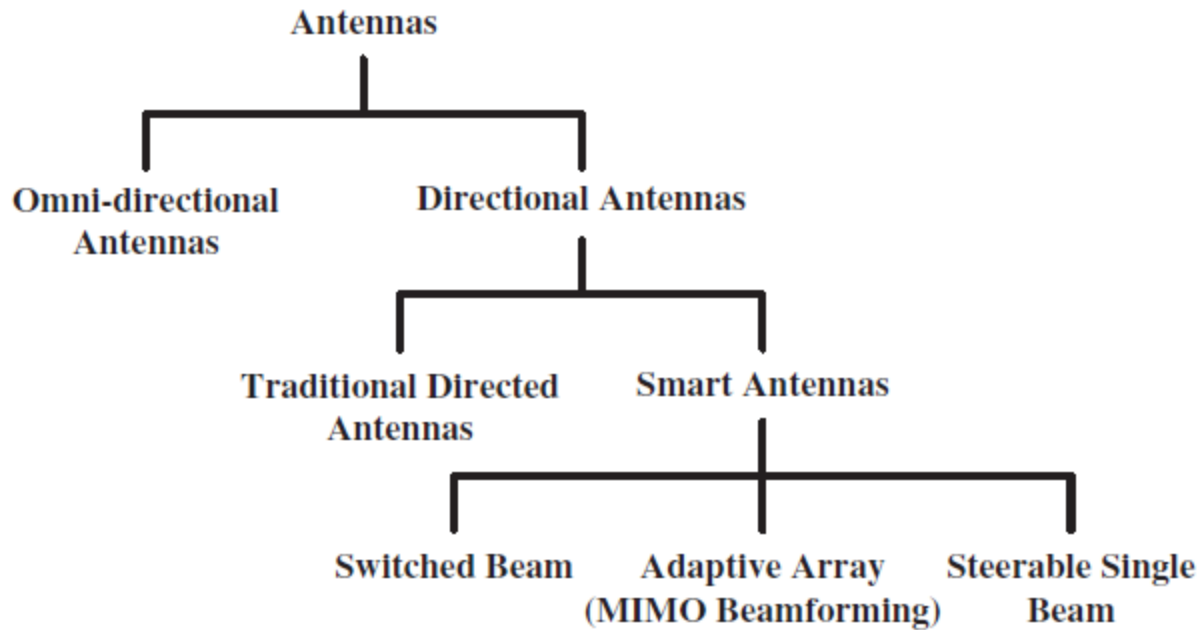


Figure 1. Antenna classification.

(Ex. 2008 at 416.)

47. The following is another figure from Dai showing the radiation patterns of the directional antennas.

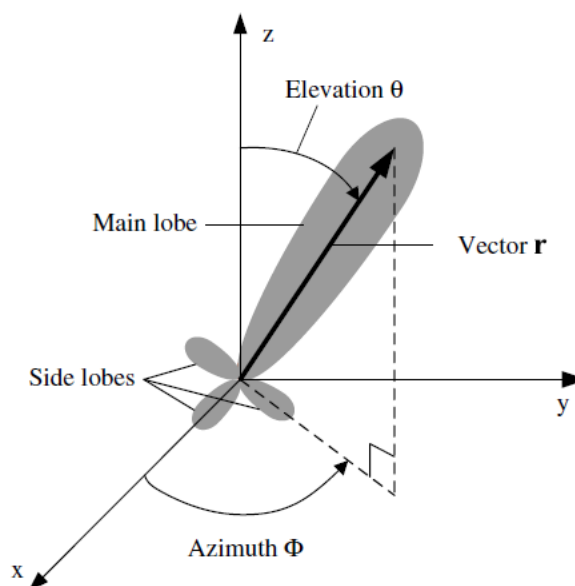


Figure 3. Radiation patterns.

(Ex. 2008 at 418.)

48. Dai further explains that “[i]n general, a directional antenna has a main lobe (beam) of the peak gain and sidelobes/backlobes of smaller gains, which account for nothing but interference to other nodes.” (Ex. 2008 at 418.)

49. In contrast, non-directional antenna may have a radiation pattern as depicted by the following figure from a textbook entitled “Antennas and Wave Propagation,” by A. R. Harish, et. al, Oxford University Press, 2007 (“Harish”) (Exhibit 2009).

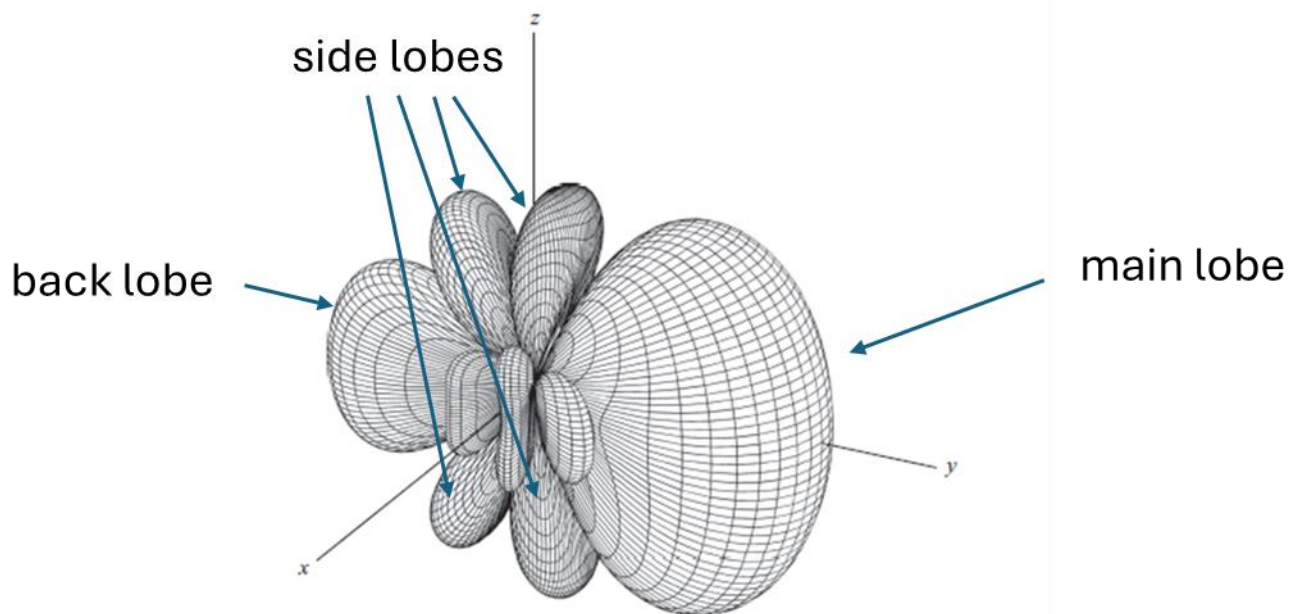


Fig. 2.4 Normalized power pattern of an antenna

(Ex. 2009 at 39) (annotations added)

50. The figure above illustrates that the signal strength at the main lobe (shown on the right of the figure), while higher than the other lobes, the back lobe

(shown on the left of the figure) and the side lobes (shown between the main lobe and the back lobe) still show significant radiation strength. Since the interfering signals are mainly received by the back lobe and the side lobes due to the directions of the interfering ground stations, we can clearly see the advantage of the directional antenna used by the '600 Patent in reducing or even eliminating the interference from the neighboring ground station. With a highly effective directional antenna, i.e., a directional antenna with a narrow main lobe, and side lobes separated from the main lobe at substantial angles (as shown in Figure 3 of Dai above), it becomes straightforward to determine $\frac{S}{N}$ for the calculation of the channel capacity,

$C = B \log_2 \left(1 + \frac{S}{N} \right)$, without the interference, I , corrupting the received signal.

C. Matrix

51. The term “matrix” is a well-known concept in mathematics. A widely used textbook entitled “Advanced Engineering Mathematics” by Erwin Kreyszig (“Kreyszig”) (Exhibit 2010) states that “[a] matrix is a rectangular array of numbers. Such arrays occur in various branches of applied mathematics. In many cases they form the coefficients of linear transformations (examples in Sec. 7.1) of systems of linear equations (simultaneous linear equations) arising, for instance, from electrical networks, frameworks in mechanics, curve fitting in statistics, and transportation problem. Matrices are useful because they enables us to consider an array of many

numbers as a single object, denote it by a single symbol, and perform calculations with these symbols in a very compact form.” (Ex. 2010 at 282.)

52. The following is an excerpts from Kreyszig:

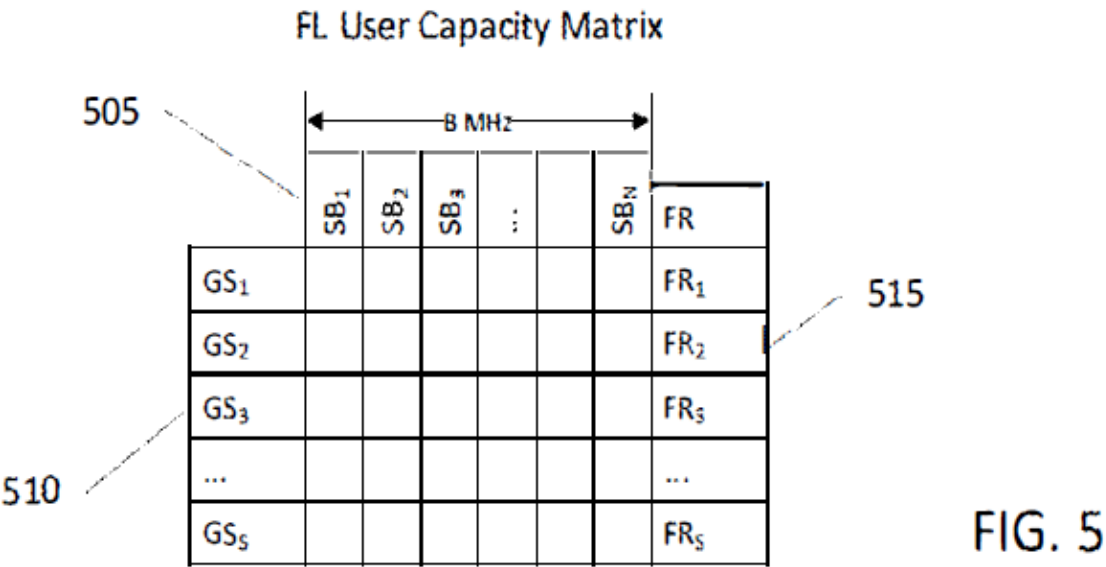
A rectangular array of (real or complex) numbers of the form

$$\begin{pmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \cdots & \vdots \\ a_{m1} & a_{m2} & \cdots & a_{mn} \end{pmatrix}$$

is called a **matrix**. The numbers $a_{11}, \dots, a_{mn}$ are called the **elements** of the matrix. The horizontal lines are called **rows** or *row vectors*, and the vertical lines are called **columns** or *column vectors* of the matrix. A matrix with m rows and n columns is called an $(m \times n)$ *matrix* (read “ m by n matrix”).

(Ex. 2010 at 283.) What Kreyszig is explain is that while the term “matrix” is defined as a “rectangular array of numbers,” not any rectangular array of numbers is a matrix. A matrix contains numbers that can be indexed in rows and columns as shown in the excerpt above.

53. In comparison, the “forward-link user capacity matrix” recited in certain claims of the ’600 Patent is illustrated by the following figure.



(Ex. 1001, FIG. 5.)

54. As shown in FIG. 5 above, the “forward-link user capacity matrix” is a two-dimensional array, conceptually arranged in rows and columns, and also is organized in terms of the column index (GS₁, GS₂, GS₃, ..., GS_s) of ground stations and the row index (SB₁, SB₂, SB₃, ..., SB_N) sub-bands. If the forward link capacity is organized by the ground stations (GS₁, GS₂, GS₃, ..., GS_s) only without further categorizing in terms of the sub-bands (SB₁, SB₂, SB₃, ..., SB_N) operating in each of the ground stations (GS₁, GS₂, GS₃, ..., GS_s), the result would not be a matrix – rather the result will be an indexed list of ground stations (GS₁, GS₂, GS₃, ..., GS_s).

55. In contrast, the following is a table from one of the secondary references the Petitioner relied on. In this table, while the numbers are organized in a rectangle, the numbers in the same row cannot be indexed as these numbers have very different meaning according to the column headings. In other words, in the table below, it

make no sense to index the column headings “MESSAGE TRAFFIC DENSITY,” “SIGNAL STRENGTH DATA (dB),” and “AVERAGE (dB)” (as opposed to column headings “SB₁, SB₂, SB₃, ..., SB_N” in FIG. 5 of the ’600 Patent, which can be conveniently indexed).

TABLE 1			
GROUND STATION	MESSAGE TRAFFIC DENSITY	SIGNAL STRENGTH DATA (dB)	AVERAGE (dB)
1	6	1, 1, 2, 2, 1, 2	1.5
2	3	0, 1, 0	0.3
3	5	6, 5, 3, 5, 4	4.6
4			
•	•	•	•
•	•	•	•
•	•	•	•
n			

(Ex. 1008 at 6.)

V. OVERVIEW OF THE ’600 PATENT

56. The ’600 Patent, titled “Servicing Cell Selection in Air to Ground Communication Systems,” addresses fundamental challenges in providing reliable communication links between aircraft and ground-based infrastructure. Ex. 1001, Title; Abstract.

57. The patent identifies a critical technical problem: the limited availability of RF spectrum compels ATG communication systems to operate within already-allocated or unlicensed frequency bands, such as the 2.4 GHz range, where noise levels have increased significantly over time, resulting in substantial degradation of link quality and available bandwidth. Ex. 1001, 1:20-41. Traditional

systems that relied on static cell assignments based on instantaneous signal strength or proximity measurements could not maintain reliable and consistent data rates in these increasingly challenging noise environments. Ex. 1001, 1:46-59.

58. The '600 Patent introduces an innovative approach to address these challenges: instead of depending on static measurements, the system performs dynamic evaluation of candidate forward links using calculated user capacity estimates. Ex. 1001, 4:57-67. These capacity estimates are derived in part from measured “signal-to-noise ratio (SNR)” values for each forward link. Ex. 1001, 4:63-66.

59. The user capacity estimates are structured into a “forward-link user capacity matrix” and a “return-link user capacity matrix.” The forward-link user capacity matrix enables the system to perform dynamic selection of the optimal forward link based on predicted throughput performance rather than relying solely on instantaneous metrics. Ex. 1001, 4:57-67. Conversely, the return-link user capacity matrix structures noise power measurements collected at different azimuths and elevations to characterize the reverse communication path from the aircraft to ground stations. This matrix facilitates identification of ground stations with optimal reception characteristics for aircraft transmissions, as demonstrated in Figures 7 and 8 of the patent. Ex. 1001, 10:29-33, Fig. 8. This matrix-driven selection methodology allows the system to evaluate multiple candidates and intelligently select the link providing the highest user capacity in real time. Ex. 1001, 5:5-11.

60. Furthermore, the '600 Patent describes that user capacity estimates may be temporally averaged using both a “short-term average value” and a “long-term average value,” allowing the system to adapt to transient variations in interference and signal quality. Ex. 1001, 7:12-18. The system can also choose between forward-link and return-link user capacity matrices, depending on which link provides superior performance under the current conditions. Ex. 1001, 8:28-34.

61. Through this dynamic, predictive, matrix-based selection methodology, the '600 Patent provides a substantial advancement over prior ATG communication systems, improving connection stability, maximizing bandwidth, and reducing latency even in noisy RF environments. Ex. 1001, 5:5-22.

VI. OVERVIEW OF THE CITED ART

62. The Petition challenges claims 1-19 of the '600 Patent on four asserted grounds. Ground 1 asserts that claims 1-4, 6, 13-15, 17, and 19 are anticipated by de La Chapelle (Ex. 1005). Ground 2 asserts that claims 1-4, 6-15, and 17-19 are rendered obvious by the combination of de La Chapelle and Jalali (Ex. 1006). Ground 3 asserts that claims 5 and 16 are rendered obvious by the combination of de La Chapelle, Jalali, and Nelson (Ex. 1007). Ground 4 asserts that claims 1-19 are rendered obvious by the combination of de La Chapelle, Jalali, Nelson, and McGuffin (Ex. 1008). Below are summaries of the references relied upon for the challenged claims.

A. de La Chapelle (Ex. 1005)

63. de La Chapelle, titled “Soft Handoff Method and Apparatus for Mobile Vehicles Using Directional Antennas,” issued April 5, 2016. de La Chapelle serves as the primary reference in all four asserted grounds.

64. de La Chapelle describes a handoff system for mobile vehicles equipped with directional antennas that facilitates transitions between base stations. Ex. 1005, 1:52-57, 3:29-37. The system monitors signal characteristics from multiple potential base stations and initiates handoffs when signal conditions suggest a superior alternative is available. Ex. 1005, 8:57-9:4, 4:20-22. Handoff determinations are based on current signal measurements, with emphasis on managing antenna directionality during cell transitions to preserve link quality. Ex. 1005, 8:63-9:4, 17:48-53.

65. de La Chapelle’s methodology centers on maintaining service continuity through directional antenna management and signal-to-interference (S/I) ratio comparisons. Ex. 1005, 8:57-67, 4:20-27. However, despite Petitioner’s assertions that this reference teaches forward-link user capacity estimates and matrices, de La Chapelle does not calculate user capacity estimates or predict data rates based on SNR measurements. Ex. 1005, 8:57-9:7, 16:43-50. Additionally, although Petitioner contends that de La Chapelle inherently teaches a user capacity matrix, the reference provides no indication of structuring quality measurements into matrix formations for throughput optimization or comparative analysis. Ex. 1005,

4:11-31, 9:13-21. Petitioner's anticipation argument depends on treating S/I as equivalent to SNR and "quality" as synonymous with "capacity," but de La Chapelle establishes no such equivalencies and fails to teach the specific capacity-based matrix methodology claimed in the '600 patent. Ex. 1005, 9:16-21, 17:48-53.

B. Jalali (Ex. 1006)

66. Jalali, titled "Aircraft To Ground Communication Antenna System," published August 14, 2014. Jalali is a secondary reference used in Grounds 2, 3, and 4.

67. Jalali describes an aircraft-to-ground communication system that employs beamforming antennas for spectrum sharing between ATG applications and satellite communication systems. Ex. 1006, [0025]-[0026]. The system utilizes multi-beam switchable array antennas on aircraft to communicate with ground base stations across various frequency bands including C, Ku, and Ka bands as the aircraft moves through different coverage areas. Ex. 1006, [0017]-[0018], [0025], [0028]-[0029].

68. While Jalali discusses measurement of signal parameters including signal-to-interference-plus-noise ratio (SINR) for beam selection purposes, it does not describe calculating user capacity estimates in the manner claimed by the '600 patent. Ex. 1006, [0057], [0059]. Furthermore, Jalali does not teach organizing such measurements into the specific matrix structures recited in the claims. In my opinion, even if the SINR measurements in Jalali could be considered the claimed "signal-to-

noise ratio” (which they are not) and even if user capacity estimates could be derived from SINR measurements (which they cannot be in the manner claimed), the results could only be organized in a one-dimensional index and cannot be formed into the required matrix structure.

C. Nelson (Ex. 1007)

69. Nelson, titled “Aircraft Data Communications Services for Users,” issued February 13, 2007. Nelson is a secondary reference used in Grounds 3 and 4 only for dependent claims 5 and 16, which require transmitting capacity matrices through an out-of-band channel.

70. Nelson describes systems for providing wireless data communication services to passengers aboard aircraft. Ex. 1007, 3:1-15. Nelson discloses that an aircraft may communicate with terrestrial networks using multiple types of communication links, including cellular and satellite systems. Ex. 1007, 3:53-67.

71. Petitioner relies on Nelson solely for its mention of an “out-of-band protocol,” but this reference falls short of teaching the claimed use of an out-of-band channel for transmitting user capacity matrices. Ex. 1007, 10:23-27. Nelson’s out-of-band protocol relates specifically to data flow between modems rather than transmission of control information such as user capacity matrices. The reference provides no architectural details about using out-of-band channels for transmitting system management data like capacity matrices, nor does it mention capacity estimates, SNR measurements, or matrices of any kind.

D. McGuffin (Ex. 1008)

72. McGuffin, titled “Method and System for Datalink Ground Station Selection,” published July 14, 2010. McGuffin is a secondary reference used only in Ground 4 for all challenged claims.

73. McGuffin describes a ground station selection method for ground-to-air communication. McGuffin discloses a selection methodology in which “the average of the signal strength values stored in each data structure is calculated to determine an average signal strength, and the average signal strength of each of the one or more ground stations is compared.” Ex. 1008, [0012]. The comparison process involves data storage in structures presented in various tabular formats. Ex. 1008, [0034]-[0038].

74. However, McGuffin’s tables have significant limitations that distinguish them from the claimed matrices. The data in McGuffin’s tabular formats are not user capacity estimates as claimed in the ’600 patent. Additionally, while the data are organized in two-dimensional table format, this does not constitute a matrix as claimed. McGuffin’s tables are indexed by base station number in the rows, but the columns are not indexed. Instead, the column entries have descriptive headings that describe the data contents in the columns. In other words, McGuffin’s tables represent three separate single-indexed data sets (each with different headings such as message traffic density, signal strength data, and average) rather than the integrated matrix structure claimed in the ’600 patent.

VII. GROUND 1: PETITIONER FAILS TO ESTABLISH THAT DE LA CHAPELLE ANTICIPATES THE CHALLENGED CLAIMS

75. In Ground 1, Petitioner alleges that de La Chapelle alone anticipates multiple independent claims of the '600 Patent. In my opinion, this ground fails because de La Chapelle does not disclose several fundamental elements required by the claims, including signal-to-noise ratio measurements, user capacity estimates, user capacity matrices, or the coordinated control of both directional antennas and transceivers.

A. Claims 1 and 13: de La Chapelle Does Not Disclose Signal-to-Noise Ratio Measurements

76. Claims 1 and 13 specifically require measurement of “signal-to-noise ratio” (SNR) values. Ex. 1001, 15:58-67, 18:41-62. However, de La Chapelle discloses only signal-to-interference (S/I) ratio measurements, not SNR measurements. Ex. 1005, 8:57-67, 9:16-21.

1. *The Technical Distinction Between S/I and SNR Is Well-Established*

77. In my opinion, based on my extensive experience in wireless communication systems, signal-to-interference ratio and signal-to-noise ratio represent fundamentally different measurements that serve different purposes in communication system design. SNR compares the desired signal power to the background noise power, while S/I compares the desired signal power to interfering signals from other transmitters. These measurements capture different aspects of channel quality and lead to different optimization strategies.

78. As used in the art, “noise” refers to any source of unwanted random modifications to a signal during transmission, including baseline background power levels from thermal and environmental sources which can vary based on the communication environment. In contrast, “interference” refers to competing transmissions from nearby systems or devices. A person of ordinary skill in the art would understand that noise can be reduced through signal processing to recover the original signal from the one corrupted by noise, while interference requires the use of interference cancellation or avoidance techniques. Interference can contribute to a noisy and corrupted signal received by a receiver, but noise and interference are not interchangeable as the Petition argues.

79. The distinction is particularly important in de La Chapelle’s context. The reference explicitly defines its approach: “S” is the signal power from the selected BTS targeted by the main lobe, and “I” is the aggregate interference power from all other BTSs received on the sidelobes or side of the main lobe. Ex. 1005, 9:8-27. This approach fundamentally differs from measuring noise on the main lobe where the transmitted signal is received. As contemplated by de La Chapelle, the aggregate interference power, “I,” is measured on the sidelobes or side of the main lobe, which are spatially separate from the main lobe. Since the aggregate interference power can be separately measured from the signal, de La Chapelle is considering the sidelobes or side of the main lobe as not part of the same

communication channel comprising the main lobe, making de La Chapelle's measurements categorically different from the claimed SNR measurements.

2. *Petitioner's Expert Provides No Technical Basis for "Interchangeability"*

80. Petitioner argues that S/I and SNR are "interchangeable" and that a POSITA would understand them as equivalent. Pet. 9-10; Ex. 1002, ¶46. However, Dr. Hayes provides no technical foundation for this assertion. He offers no industry standards, technical literature, or factual support for this claimed equivalency, instead simply asserting that a POSITA would find them interchangeable without explaining the technical basis for this conclusion.

81. As explained above, generally, the received signal at a receiver is the sum of the originally transmitted together with all of the interfering signals and noises. It takes special care and techniques to separate the interfering signals from the noise in the received signal as contemplated by the '600 Patent. Dr. Hayes does not explain how de La Chapelle teaches this separation of interference from the noise.

82. In my opinion, this lack of technical foundation renders Dr. Hayes's testimony inadequate to establish the equivalency necessary for an anticipation argument.

3. *The Claims Specifically Require SNR, Not S/I*

83. The '600 patent specification distinguishes between noise and interference, noting that “radio frequency spectrum surveys show that RF noise and interference sources have risen over time” and that “such high levels of interference have the ability to significantly degrade the quality and available data bandwidth of the radio link.” Ex. 1001, 2:4-14.

84. In doing so, the patent treats noise and interference as distinct sources of signal degradation. The patent also expressly describes a “noise-plus-interference” ratio, called SINR, further confirming that the patent distinguishes between noise and interference. Ex. 1001, 6:35-39. The claims then specifically require measurement of a signal-to-noise ratio, not signal-to-interference, confirming that the applicants chose to focus on noise and not interference for the claimed measurements..

B. Claims 1 and 13: de La Chapelle Does Not Disclose User Capacity Estimates or User Capacity Matrices

85. Claims 1 and 13 require calculation of “forward-link user capacity estimates” and organization of these estimates into “forward-link user capacity matrices.” Ex. 1001, 16:4-12, 18:42-52. de La Chapelle fails to disclose either of these critical elements.

1. *de La Chapelle Does Not Calculate User Capacity Estimates*

86. de La Chapelle describes handoff decisions based on “higher quality communications link” comparisons, but it does not calculate user capacity estimates

as required by the claims. Ex. 1005, 4:20-22. The reference makes no mention of converting signal measurements into capacity estimates or predicting data throughput based on measured parameters.

87. In my opinion, a POSITA would recognize that “quality” measurements and “capacity estimates” serve different purposes and are derived through different methodologies. A true user capacity estimate requires a rigorous mathematical calculation that accounts for both signal-to-noise ratio and available bandwidth. As demonstrated in the authoritative communications textbook “Digital and Analog Communication Systems” by Leon W. Couch, II, Eighth Edition, channel capacity is calculated using the fundamental Shannon capacity equation:

$C = B \log_2 \left(1 + \frac{S}{N} \right)$, where C is the channel capacity in bits per second, B is the channel bandwidth in hertz, and $\frac{S}{N}$ is the signal-to-noise power ratio. Ex. 2006 at 19. This equation, established by Claude Shannon in 1948-1949, provides the theoretical foundation for calculating channel capacity and represents the performance bound that practical communication systems strive to achieve.

88. In my opinion, this fundamental equation demonstrates why S/I measurements cannot substitute for SNR in capacity calculations. The Shannon capacity formula specifically requires the signal-to-noise ratio, not signal-to-interference ratio, because noise represents the fundamental limiting factor in channel capacity. While interference can be modeled and sometimes removed

through signal processing techniques, noise is random and cannot be cancelled or removed. The ratio of the signal power of the target BTS on the main lobe to the aggregate signal power of all interfering BTSs on the sidelobes or side of the main lobe, as described in de La Chapelle, cannot determine or estimate the user capacity as expressed in the Shannon capacity equation.

2. *de La Chapelle Does Not Disclose User Capacity Matrices*

89. de La Chapelle also fails to disclose the required matrix structure for organizing capacity estimates. While the reference discusses comparing signal characteristics between base stations, it provides no teaching or suggestion of organizing these comparisons into the matrix format required by the claims. Ex. 1005, 4:11-31, 9:13-21.

90. In my opinion, the matrix structure claimed in the '600 patent serves a specific technical purpose in enabling efficient comparison and selection among multiple candidates based on predicted capacity. A matrix requires two-dimensional indexing with both rows and columns that allow systematic organization and comparison of capacity estimates across multiple dimensions, as illustrated in Figure 5 of the '600 patent. de La Chapelle's measurements have only one-dimensional indexing (i.e., the BTS number) and therefore cannot constitute the required matrix structure.

3. *Petitioner's Expert Cannot Fill These Fundamental Gaps*

91. In my opinion, Dr. Hayes attempts to bridge these gaps through assertions that de La Chapelle “inherently” employs capacity matrices and that “quality” is equivalent to “capacity.” Ex. 1002, ¶66. However, he provides no technical analysis explaining how signal measurements could be transformed into capacity estimates, no structural description of how one-dimensional data could form a two-dimensional matrix, and no explanation for why “quality” equals “capacity.” As explained in the Technology Background section above, the term “quality” does not consider the time factor in the context of communication—the quality of a signal is the same whether this signal spans a short time period or a longer time period, whereas the capacity is tightly related to the time—how many bits can be sent reliably over a unit time.

92. I understand that expert testimony cannot substitute for missing disclosures in the prior art. I understand that the expert’s role is to educate the decision-maker about what the reference meant to persons of ordinary skill in the field, not to fill gaps in the reference through speculation. In my opinion, de La Chapelle does not disclose user capacity estimates or user capacity matrices.

B. Claims 1 and 13: de La Chapelle Does Not Disclose Commanding Both the Directional Antenna and Transceiver

93. Claims 1 and 13 require that the “computer processor” “command a directional antenna installed on the aircraft and a transceiver disposed within the aircraft” to measure signal-to-noise ratios. Ex. 1001, 15:58-67, 18:41-62. The claims

specifically require commanding both components together for the measurement process.

94. de La Chapelle does not disclose this coordinated control requirement. While de La Chapelle describes that the aircraft radio terminal (ART) determines or controls the directional antenna, it does not teach commanding the transceiver disposed within the aircraft. Ex. 1005, 6:39-45. The reference specifically states that “the ART determines antenna pointing directions completely independently of the operation of the radio transceivers. This is a significant feature because it permits the use of commercial off-the-shelf (COTS) transceiver modules and transmission standards that are designed to operate with standard cellular handsets having omnidirectional antennas.”

95. In my opinion, this disclosure directly contradicts the coordinated control required by the claims. de La Chapelle’s system deliberately operates the antenna control independently from the transceiver operation, while the claims require coordinated commanding of both components by the computer processor.

C. Capacity Matrices Are Not Inherent

96. Petitioner attempts to overcome these deficiencies through inherency arguments, claiming that capacity matrices must be “inherent” in de La Chapelle’s functionality. Pet. 14. However, I understand that inherency requires that the missing limitation be necessarily and inevitably present in the prior art, not merely possible or helpful.

97. In my opinion, nothing in de La Chapelle necessitates the formation of capacity matrices or the calculation of user capacity estimates. The reference describes a handoff algorithm based on S/I measurements, but provides no disclosure—express or inherent—of the sophisticated matrix-based capacity calculation approach claimed in the '600 patent. A POSITA reading de La Chapelle would not necessarily conclude that capacity matrices must be present or that the system must calculate user capacity estimates as claimed.

VIII. GROUND 2: PETITIONER FAILS TO SHOW THAT THE CHALLENGED CLAIMS ARE OBVIOUS OVER DE LA CHAPELLE AND JALALI

98. In Ground 2, Petitioner contends that the challenged claims would have been obvious over the combination of de La Chapelle and Jalali. However, in my opinion, this combination suffers from the same fundamental deficiencies as Ground 1, as it relies on de La Chapelle as the primary reference. In my opinion, neither reference discloses critical claim limitations such as the forward- and return-link user capacity matrices, user capacity estimates based on measured SNR, threshold comparisons, or temporal averaging of signal measurements.

A. A POSITA Would Not Be Motivated to Combine de La Chapelle and Jalali

99. In my opinion, the Petition provides no adequate explanation for why a POSITA would be motivated to combine de La Chapelle's directional antenna handoff procedures with Jalali's beam-based antenna system. The Petition offers

only boilerplate reasoning, stating that “a POSA would have been motivated to combine the teachings of Jalali and de La Chapelle” because “the references clearly teach similar methods for solving the same problem.” Pet. 58. However, in my opinion, this generic assertion fails to identify any specific technological problem that would motivate a POSITA to combine these particular references in the manner claimed.

100. In my opinion, the references address fundamentally different technical challenges. de La Chapelle focuses on managing handoffs between base stations for mobile vehicles using directional antennas, with emphasis on maintaining service continuity through antenna directionality control. Jalali, conversely, describes spectrum sharing between ATG applications and satellite communication systems using multi-beam switchable arrays. While both references involve aircraft communication systems, in my opinion, they employ different technical approaches and serve different primary objectives.

B. de La Chappelle And Jalali Could Not Be Combined

101. In my opinion, the Petition fails to explain how these disparate technologies would be integrated or why a POSITA would expect success from such a combination. de La Chapelle’s system operates by comparing signal-to-interference ratios for handoff decisions, while Jalali’s system uses signal-to-interference-plus-noise ratio (SINR) measurements for beam selection. In my opinion, the Petition provides no technical rationale for why a POSITA would

substitute one measurement approach for another or how the different antenna architectures would be reconciled.

102. Moreover, the Petition provides no explanation whatsoever of which elements of the claims Jalali would supply, instead of de La Chapelle, in their purported combination. In my opinion, this represents a fundamental flaw in the obviousness analysis.

C. Jalali Does Not Cure the Deficiencies of de La Chapelle

103. Even assuming a motivation to combine existed, in my opinion, Jalali does not remedy the fundamental deficiencies in de La Chapelle’s disclosure.

1. Jalali Does Not Disclose SNR Measurements

104. The claims specifically require signal-to-noise ratio measurements, but Jalali discloses signal-to-interference-plus-noise ratio (SINR) measurements. Ex. 1006, [0057], [0059]. While Petitioner argues that SNR, S/I, and SINR are merely “obvious alternatives of one another for use in the same process,” Pet. 27, in my opinion, this assertion lacks technical foundation.

105. In my opinion, SNR and SINR are technically distinct measurements that serve different purposes. As I have explained above, separating the interference component from the received signal takes special care and techniques that the ’600 Patent contemplates. This distinction is not superficial—channel capacity calculations, such as those defined in the Shannon limit, depend specifically on the signal-to-noise ratio (SNR), not SINR. As demonstrated by the Couch textbook

equation $C = B \log_2 \left(1 + \frac{S}{N} \right)$, the theoretical foundation for channel capacity requires isolation of the noise component. Ex. 2006 at 19. In my opinion, interference can be modeled and sometimes removed through signal processing, but noise is random and cannot be cancelled or removed. In practice, SINR is easier to estimate, but it provides a composite value that includes both interference and noise, masking the true noise level in the channel that is essential for accurate capacity calculations. Jalali makes no effort to isolate noise or calculate SNR and without SNR Jalali cannot calculate user capacity as required by the '600 patent.

2. Jalali Does Not Disclose User Capacity Estimates

106. In my opinion, Jalali does not calculate or estimate user capacity as required by the claims. While Jalali's title references "high data rate aircraft to ground communication antenna system" and states a goal of providing high data rates, in my opinion, simply mentioning "high data rate" in a title does not teach calculation of user capacity estimates based on SNR measurements.

107. In my opinion, Jalali's beam selection algorithm compares SINR values to determine the best communication beam, but it does not calculate capacity or data rate estimates. The reference describes that "the aircraft will report SINR measurements... [T]he ground base station may find the improved or optimal transmit beam by adjusting its beam based on the SINR feedback received from the aircraft." Ex. 1006, [0059]. In my opinion, there is no teaching in Jalali of computing

an expected data rate based on SINR or of using SINR to estimate forward-link capacity as required by the '600 patent. A reference aimed at “providing” a high data rate does not teach one that calculates it.

3. *Jalali Does Not Disclose User Capacity Matrices*

108. In my opinion, Jalali does not disclose organizing measurements into the matrix structures required by the claims. Even if SINR measurements could somehow be converted to user capacity estimates (which they cannot), in my opinion, the results could only be organized in a one-dimensional index and cannot be formed into the required two-dimensional matrix structure. The reference provides no teaching or suggestion of the systematic matrix organization claimed in the '600 patent.

4. *Jalali Does Not Disclose The Claimed “Computer Processor”*

109. In my opinion, Jalali fails to disclose the claimed “computer processor [configured] to command a directional antenna” and associated transceiver. As shown in Figure 2 of Jalali, each antenna element covers a fixed azimuth and is associated with a dedicated transceiver. See Ex. 1006, Fig. 2; *id.*, [0030] (“In this aspect, each element is coupled to its own transceiver.”). There is no disclosure of steering, tuning, or processor-based command of the antenna. Instead, the antenna array consists of fixed, sectorized elements with pre-assigned transceivers, requiring no processor command. Ex. 1006, Fig. 2, [0030]. In my opinion, this structure cannot

satisfy the '600 patent's claims' requirement that the processor command the antenna and transceiver to perform directional SNR measurements.

110. Further, in my opinion, neither Jalali nor de La Chapelle disclose claim 7's requirement of "calculating, with the computer processor, a first reverse-link noise estimate" and "a second reverse-link noise estimate" using respective noise power levels. Ex. 1001, 17:30-36. Neither de La Chapelle nor Jalali discloses calculating directional reverse-link noise estimates.

111. Directional reverse-link noise estimation requires the system to isolate noise power received from specific angular directions—defined by azimuth and elevation—and associate that with a given communication link. *See* Ex. 1001, 17:30-36. This cannot be inferred from a single SINR value or from ambient noise levels, which are not spatially resolved. Jalali and de La Chapelle do not disclose any mechanism for measuring noise directionally, and not in the reverse link (aircraft to ground). Their systems lack the directional antenna control and per-beam measurement logic needed to make such estimates.

112. Jalali describes SINR-based beam adjustments (Ex. 1006, ¶[0059]), and de La Chapelle evaluates forward-link S/I from the aircraft (Ex. 1005, 17:48-53), but in my opinion neither reference teaches the claimed directional noise measurements or the calculation of reverse-link estimates from those measurements.

B. A POSITA Could Not Combine de La Chapelle And Jalali With A Reasonable Expectation of Success

113. I understand that obviousness requires not only a motivation to combine references but also a reasonable expectation that the combination would be successful. Here, in my opinion, the Petition provides no analysis of whether combining de La Chapelle's S/I-based handoff approach with Jalali's SINR-based beam selection would yield a workable system, let alone one that calculates user capacity estimates and organizes them into matrices.

114. In my opinion, a POSITA would recognize significant technical challenges in attempting to integrate these different measurement approaches and antenna architectures. The references employ different signal processing methodologies and serve different primary functions, making successful integration uncertain at best.

IX. GROUND 3: PETITIONER FAILS TO ESTABLISH THAT ADDING NELSON RENDERS CLAIMS 5 AND 16 OBVIOUS OVER DE LA CHAPELLE AND JALALI

A. Ground 3 Suffers From the Same Fundamental Deficiencies as Grounds 1 and 2

115. Ground 3 asserts that claims 5 and 16 are obvious over the combination of de La Chapelle, Jalali, and Nelson. However, in my opinion, this combination suffers from the identical foundational problems that render Grounds 1 and 2 deficient. Since Petitioner has failed to establish that de La Chapelle and Jalali teach

the basic claim elements—including SNR measurements, user capacity estimates, and user capacity matrices—adding Nelson cannot cure these fundamental gaps.

B. Petitioner Provides No Adequate Motivation for the Three-Way Combination

116. In my opinion, Petitioner offers no compelling technical rationale for why a POSITA would combine Nelson with de La Chapelle and Jalali. The entirety of Petitioner’s motivation consists of a single assertion that a POSITA “would find motivation from Nelson’s discussion of the use of out-of-band protocols.” Pet. 55. However, this superficial statement fails to explain what specific technical problem would drive such a combination or why these particular references would be selected from the vast universe of prior art.

117. In my opinion, Nelson addresses an entirely different technical domain than de La Chapelle and Jalali. Nelson focuses on providing data communication services to aircraft passengers through various communication links, while de La Chapelle concerns handoff management for directional antennas and Jalali describes beam selection for spectrum sharing between ATG and satellite systems. No coherent technical motivation exists for integrating these disparate technologies.

C. Nelson’s Out-of-Band Protocol Does Not Render The Claims Obvious

118. Claims 5 and 16 specifically require transmitting user capacity matrices through an “out-of-band communication channel.” Ex. 1001, 16:53-58, 19:7-10. In

my opinion, Nelson's brief reference to an out-of-band protocol falls far short of teaching this claimed functionality.

119. Nelson's out-of-band protocol disclosure appears in a narrow context relating to modem negotiation procedures. Ex. 1007, 10:23-27. The reference provides no architectural details about using out-of-band channels for transmitting system management data such as capacity matrices. In my opinion, Nelson's protocol is specifically designed for maintaining modem communication during call setup and negotiation—not for transmitting complex control structures like the user capacity matrices claimed in the '600 patent.

120. Furthermore, Nelson contains no disclosure of capacity estimates, SNR measurements, or matrices of any kind. In my opinion, it is impossible for Nelson to teach or suggest transmitting such data structures via an out-of-band channel when the reference provides no foundation for understanding what these data structures are or how they would be formatted for transmission.

X. GROUND 4: PETITIONER FAILS TO ESTABLISH THAT THE FOUR-WAY COMBINATION RENDERS THE CLAIMS OBVIOUS

A. Petitioner Offers No Coherent Rationale for Combining Four Disparate References

121. In Ground 4 Petitioner asserts that all claims 1-19 are obvious over the combination of de La Chapelle, Jalali, Nelson, and McGuffin. In my opinion, this four-way combination fails because Petitioner provides no coherent technical

rationale for why a POSITA would integrate these fundamentally different technologies.

122. Petitioner's entire motivation argument consists of boilerplate language stating that "a POSA would have been motivated to combine the teachings of Jalali and de La Chapelle (along with Nelson and McGuffin), since the references clearly teach similar methods for solving the same problem." Pet. 58. In my opinion, this generic assertion fails to identify any specific technological problem that would motivate a POSITA to combine these particular references in the manner claimed.

123. In my opinion, the four references address entirely different technical challenges using incompatible approaches. de La Chapelle focuses on directional antenna handoff management using S/I measurements, Jalali describes beam selection for spectrum sharing using SINR measurements, Nelson addresses modem protocols for passenger communication services, and McGuffin discloses simple tabular organization of signal strength data for ground station selection. These references employ different measurement methodologies, serve different primary functions, and target different aspects of aircraft communication systems.

B. McGuffin's Tables Are Not User Capacity Matrices

124. Petitioner relies on McGuffin's Tables 1-4 as alleged evidence of the claimed matrix structure. However, in my opinion, McGuffin's tables have fundamental structural and content limitations that distinguish them from the claimed user capacity matrices.

125. First, McGuffin's tables do not contain user capacity estimates as required by the claims. Instead, they store basic signal strength values, message traffic density, and average delay metrics. Ex. 1008, [0034]-[0038]. Petitioner effectively concedes this deficiency by arguing that McGuffin's tables "could easily be augmented" with capacity data, thereby admitting that McGuffin does not actually disclose the claimed matrix structure or contents.

126. Second, while McGuffin's data is presented in a two-dimensional table format, this does not constitute a true matrix as claimed in the '600 patent. In my opinion, McGuffin's tables are indexed by base station number in the rows, but the columns lack indexing and instead use descriptive headings that characterize the data contents. This structure represents three separate single-indexed data sets (message traffic density, signal strength data, and average delay) rather than the integrated two-dimensional matrix structure claimed in the '600 patent.

127. In my opinion, the claimed user capacity matrices require systematic indexing across both spatial and directional parameters to enable the dynamic, predictive selection methodology described in the '600 patent. McGuffin's simple tabular presentation of unrelated metrics cannot satisfy this structural requirement.

C. The Four-Way Combination Lacks Any Reasonable Expectation of Success

128. In my opinion, Petitioner provides no technical analysis of how these four disparate technologies would actually work together or why a POSITA would

expect success from such a combination. The Petition offers no explanation of how McGuffin's signal strength tables would integrate with de La Chapelle's directional antenna control, Jalali's beam switching methodology, and Nelson's modem protocols.

129. A POSITA would recognize significant technical challenges in attempting to merge these different measurement approaches, antenna architectures, and communication protocols. In my opinion, the references employ incompatible signal processing methodologies and serve fundamentally different primary objectives, making successful integration highly uncertain.

D. A POSITA Would Not Make The Proposed Combination Without Hindsight

130. In my opinion, Petitioner's four-way combination represents precisely the type of hindsight reconstruction that I understand patent law prohibits. Rather than explaining why a POSITA would naturally combine these references to solve a recognized problem, the Petition appears to work backward from the claimed invention to selectively gather elements from disparate prior art sources.

131. The complete absence of technical motivation for this complex combination, combined with the fundamental teaching gaps in each reference, demonstrates that Petitioner's obviousness theory relies on hindsight rather than the objective perspective of a POSITA at the time of the invention.

XI. CONCLUSION

132. In signing this declaration, I recognize that the declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I also recognize that I may be subject to cross-examination in the case and that cross-examination will take place within the United States. If cross-examination is required of me, I will appear for cross-examination within the United States during the time allotted for cross-examination.

133. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on the 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: July 14, 2025

A handwritten signature in black ink, appearing to read "Paul Min", is written above a horizontal line.

Paul Min, Ph.D.