

LG Electronics, INC. (Petitioner)
v.
Constellation Designs, LLC (Patent Owner)
Petitioner Demonstratives

Case No. IPR2023-00319
U.S. Patent No. 10,693,700
Before Hon. Brent M. Dougal, Michael T. Cygan, Scott Raevsky

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DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

LGE 1033
LG Electronics, Inc. v. Constellation Designs, LLC
IPR2023-00319

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Overview of the Proceedings

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Overview of the Proceedings

- US Patent No. 10,693,700 (“the 700 Patent”)
 - 103 Prior Art Grounds
 - Combination of U.S. Patent No. 7,978,777 (“777 patent”) and ATSC Recommended Practice: Guidelines for the Physical Layer Protocol, Document no. A/327:2018 (“ASTC327”)
 - Patent Owner did not raise arguments against grounds —such arguments are waived
 - Patent Owner only argued with respect to priority claim and written description support of the invention.
- Patent Owner disclaimed claims 2-3, 12-13, and 22-23
 - Claims remaining: 5, 15, 25

Ground	Claims	Prior Art Basis
4A	2-3, 12-13, and 22-23	§103 — ‘777 patent in view of ATSC322
1B	5, 15, 25	§103 – ‘777 patent in view of ATSC327

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Indivior UK Ltd. v. Reddy's Labs. S.A.

Regarding claims 7 and 12, we also agree with the Board that there is no written description support for the range of "about 48.2 wt % to about 58.6 wt %" in the '571 application. This range also does not appear in the '571 application. Indivior argues that if one looks to Tables 1 and 5, plucks out the polymer components and creates a range from the percentage totals (while ignoring contradictory statements in paragraph 65), then one has obtained the range recited in claim 7. But that amounts to cobbling together numbers after the fact. Indivior failed to provide persuasive evidence demonstrating that a person of ordinary skill would have understood from reading the '571 application that it disclosed an invention with a *range* of 48.2 wt % to 58.6 wt %. A written description sufficient to satisfy the requirement of the law requires a statement of an invention, not an invitation to go on a hunting expedition to patch together after the fact a synthetic definition of an invention. "[A] patent is not a hunting license. It is not a reward for the search, but compensation for its successful conclusion." *Brenner v. Manson*, 383 U.S. 519, 536, 86 S. Ct. 1033, 16 L. Ed. 2d 69, 1966 Dec. Comm'r Pat. 74 (1966). The Board thus had substantial evidence on which to base its conclusion that the '571 application did not provide written description support for claims 1, 7, and 12.

Indivior UK Limited v. Dr. Reddy's Laboratories S.A., 18 F.4th 1323, 1328-29 (2021), Pet. p. 3.

Lockwood v. Am. Airlines, Inc.

It is the disclosures of the applications that count. Entitlement to a filing date does not extend to subject matter which is not disclosed, but would be obvious over what is expressly disclosed. It extends only to that which is disclosed. While the meaning of terms, phrases, or diagrams in a disclosure is to be explained or interpreted from the vantage point of one skilled in the art, all the limitations must appear in the specification. The question is not whether a claimed invention is an obvious variant of that which is disclosed in the specification. Rather, a prior application itself must describe an invention, and do so in sufficient detail that one skilled in the art can clearly conclude that the inventor invented the claimed invention as of the filing date sought. See *Martin v. Mayer*, 823 F.2d 500, 504, 3 U.S.P.Q.2D (BNA) 1333, 1337 (Fed. Cir. 1987) (stating that it is "not a question of whether one skilled in the art *might* be able to construct the patentee's device from the teachings of the disclosure Rather, it is a question whether the application necessarily discloses that particular device.") (quoting *Jepson v. Coleman*, 50 C.C.P.A. 1051, 314 F.2d 533, 536, 136 U.S.P.Q. (BNA) 647, 649-50 (CCPA 1963)).

Lockwood v. Am. Airlines, Inc., 107 F.3d 564, 1571-72 (Fed. Cir. 1997), Pet. p. 3.

Claim 1

A communication system, comprising:

a receiver capable of receiving signals via a communication channel having a channel signal-to-noise ratio (SNR), wherein the receiver comprises:

a demodulator capable of demodulating a received signal into a demodulated signal;

a demapper, coupled to the demodulator, capable of determining likelihoods using the demodulated signal and a multidimensional symbol constellation selected from a plurality of multidimensional symbol constellations; and

a decoder, coupled to the demapper, capable of using the likelihoods determined by the demapper to provide a sequence of received bits based upon a low density parity check (LDPC) code;

wherein the plurality of multidimensional symbol constellations comprises a plurality of different non-uniform multidimensional symbol constellations having the same number of constellation points, where the constellation points are non-uniformly spaced in each degree of freedom available to the multidimensional symbol constellations;

wherein the receiver is capable of selecting an LDPC code rate and multidimensional symbol constellation pair from a plurality of predetermined LDPC code rate and multidimensional symbol constellation pairs, where each of the plurality of different nonuniform multidimensional symbol constellations is only included in one of the plurality of predetermined LDPC code rate and multidimensional symbol constellation pairs.

LGE1001, claim 1; Pet. pp. 39-51.

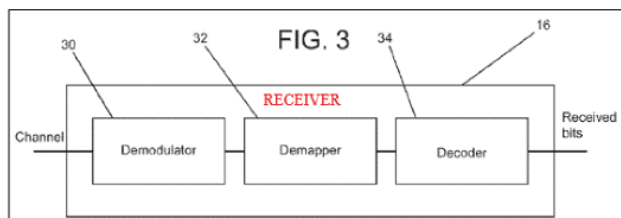
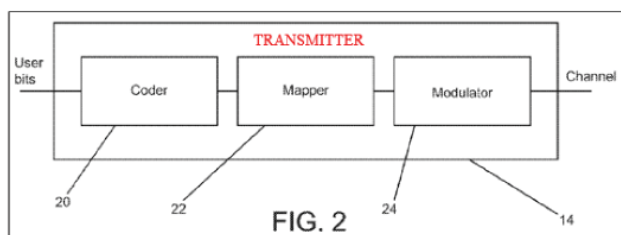
Claim 5

The communication system of claim 1, wherein each of the plurality of different non-uniform multidimensional symbol constellations is capable of providing a greater parallel decoding capacity at a specific SNR than the other symbol constellations in the plurality of multidimensional symbol constellations at the same SNR.

LGE1001, claim 5; Pet. pp. 75-79.

Brief Overview of the '700/'777 Patent

Communication Systems



LGE1015, FIG. 2-3; Pet., p. 22.

The '700 Patent discloses that “[t]ransmitters and receivers ... utilize geometrically shaped symbol constellations” and that a geometrically shaped symbol constellation can be “used that optimizes the capacity of the constellation.” LGE1001, 5:62-66. Various factors dictate the selection of a constellation, including whether the code rate is fixed and specific performance requirements (e.g., specified bit rate, a maximum transmit power). *Id.*, 5:66-6:1, 6:7-8. The '700 Patent states that in “many embodiments, a geometrically shaped constellation is used to replace a conventional constellation (i.e. a constellation maximized for d_{min}) in the mapper of transmitters and the demapper of receivers within a communication system.” *Id.*,

Petition (Pet.), p. 19.

PAM-4 constellations optimized for joint capacity at different rates

(bps)	0.50	0.75	1.00	1.25	1.50
(SNR)	0.03	2.71	5.00	7.15	9.24
x_0	-1.41	-1.41	-1.40	-1.37	-1.36
x_1	0.00	0.00	-0.20	-0.33	-0.39
x_2	0.00	0.00	0.20	0.33	0.39
x_3	1.41	1.41	1.40	1.37	1.36

FIG. 11a

LGE1015, FIG. 11a; Pet., p. 27.

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Brief Overview of the '700/'777 Patent

The '700 Patent explains that the "minimum distance (d_{min}) between constellation points is indicative of the capacity of a constellation at high signal-to-noise ratios (SNRs)," so "constellations used in many communication systems are designed to maximize d_{min} ." *Id.*, 1:46-50; LGE1003, ¶¶[85]-[92].

Pet., pp. 19-20.

The '700 Patent explains that PAM constellations can be paired with specific code rates to optimize capacity. LGE1001, 10:10-29. For example, FIG. 8a shows the lower SNR required for optimized constellations relative to classic PAM constellations. *Id.* The '700 Patent discloses certain conditions (e.g., bit rate, SNR) at which the PAM constellations can be optimized. For instance, FIGS. 11a-b provides a range of bit rates and SNRs at which PAM-4 constellations can be optimized for joint capacity or parallel decoding capacity. LGE1001, 11:9-16; LGE1003, ¶[92].

Pet., p. 25.

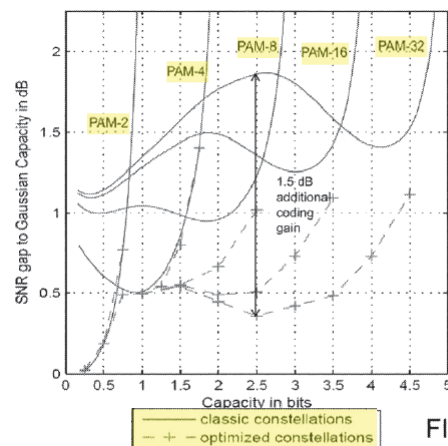
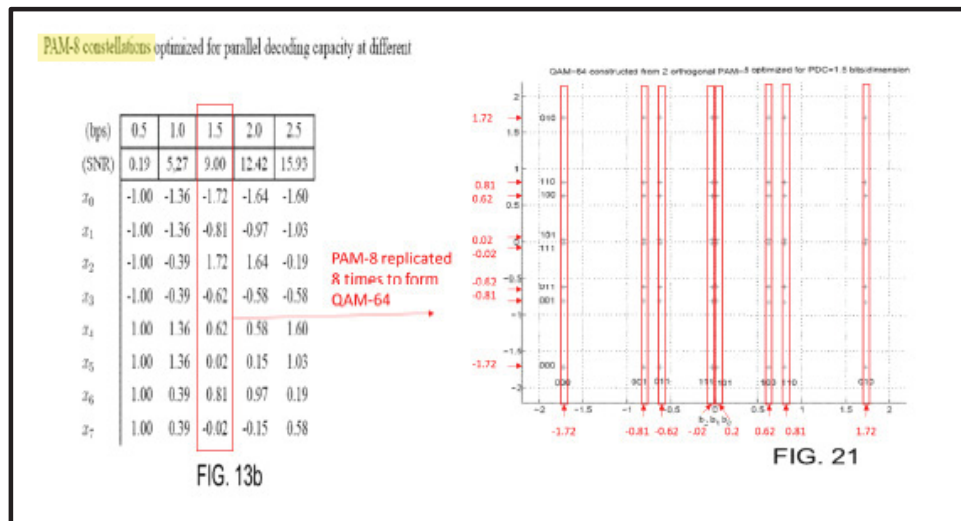


FIG. 8a

LGE1015, FIG. 8a; Pet., p. 26.

The '777 Patent Describes 1D-Constellations and Orthogonalized 2D constellations

POR, pp 25-26; POPR, p. 23; PR, p. 2-3, 19-20; LGE1001 3:25-34; LGE1015 3:9-19.



POR, pp 25-27; Pet. Rep., pp. 2-3, 19-20.

The Board previously determined that FIGS. 11B, 13B, 15B, and 17B provide written description support

“[one-dimensional PAM] constellations”

Patent Owner disagrees, arguing that the teachings related to optimizing a constellation for capacity at a first SNR also teach that other constellations optimized for a different SNR will not provide the same benefits at the first SNR. Prelim. Resp. 55–56 (citing Ex. 1015, 4:62–5:11, 7:26–29, 8:47–56). We agree. Patent Owner correctly points to the specific examples of Figures 11b, 13b, 15b, and 17b as each showing a plurality of constellations, each optimized for a particular SNR that provide a greater parallel decoding capacity at that specific SNR than the other symbol constellations in the plurality. *Id.* 56–58. More specifically, Figure 13b shows five constellations (i.e. a plurality), each optimized for a particular identified SNR that will perform better at that particular SNR than the other constellations, which have not been optimized at that particular SNR. *Id.* at 57–58.

For these reasons, we preliminarily determine that Petitioner has not shown that claims 5, 15, and 25 lack written description support in Barsoum.

Institution Decision, p. 15.

The '777 Disclosure Fails to Support Claims 5, 15, and 25

The '777 Disclosure provides capacity characteristics on a per-dimension basis, i.e., one dimension basis

LGE1001, 12:63-67 (Emphasis added.) Hence, a POSITA would understand that the QAM-64 constellations constructed from PAM-8 constellations would inherit the capacity-achieving properties of the PAM-8 constellations on a per-dimension basis, but not necessarily have the multidimensional characteristics called for in the claim language (e.g., “each ... non-uniform multidimensional symbol constellations ... providing greater parallel decoding capacity at a specific SNR than the other symbol constellations”). Indeed, the specification suggests that

LGE1029 (2nd Hochwald Dec.), ¶16; Pet. Rep., pp. 2-3. See also LGE1029 (2nd Hochwald Dec.), ¶19; Petitioner Sur-Reply (Pet. SR.), p. 3.

various SNRs. Consequently, the parallel decoding capacity and SNR at which a 1D constellation may be configured and optimized for, are not necessarily the same as the parallel decoding capacity and SNR of a 2D constellation formed from the 1D constellation.

LGE1029 (2nd Hochwald Dec.), ¶19.

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The '777 patent repeatedly describes capacity characteristics on a per dimension basis

capacity. Optimizing a constellation for a specified capacity often involves an iterative process, because the optimal constellation depends upon the SNR at which the communication system operates. The SNR for the optimal constellation to give a required capacity is not known a priori. Throughout the description of the present invention SNR is defined as the ratio of the average constellation energy per dimension to the average noise energy per dimension. In most cases the capac-

LGE1015, 7:26-33, Pet. p. 66.

Another embodiment of the invention includes selecting an appropriate constellation size and a desired capacity per dimension, estimating an initial SNR at which the system is likely to operate, and iteratively optimizing the location of the points of the constellation to maximize a capacity measure until a predetermined improvement in the SNR performance of the constellation relative to a constellation that maximizes d_{min} has been achieved.

LGE1015, 2:56-63, Pet. pp.14, 23.

constellation at all code rates). The constellations are optimized for PD capacity and joint capacity for different target user bits per dimension (i.e. code rates). The optimized constellations are different depending on the target user bits per dimension, and also depending on whether they have been designed to maximize the PD capacity or the joint capacity.

LGE1015, 9:52-10:3, Pet. pp. 34, 71.

In FIG. 21 we provide an example of a Quadrature Amplitude Modulation constellation constructed from a Pulse Amplitude Modulation constellation. The illustrated embodiment was constructed using a PAM-8 constellation optimized for PD capacity at user bit rate per dimension of 1.5 bits (corresponds to an SNR of 9.0 dB) (see FIG. 13b). The label-

LGE1015, 12:11-37, Pet. SR. p. 3.

very low-complexity de-mappers can be constructed. Due to the orthogonality of the in-phase and quadrature components the capacity characteristics of the resulting QAM-64 constellation are identical to that of the PAM-8 constellation on a per-dimension basis.

LGE1015, 12:11-37, Pet. SR. p. 3.

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1D Characteristics are not the Same as 2D Characteristics

Both Experts Agree that the Capacity Characteristics of 2D Constellations (Optimized in 2D) are Different than the Capacity Characteristics of 2D Constellations (Optimized in 1D)

[0012] Moreover, a QAM constellation created from PAM constellations may have different parallel decoding capacity and SNR characteristics, as a whole, compared to the individual PAM constellations used to create the QAM constellation. The different characteristics of a multidimensional symbol constellation created from a one-dimensional symbol constellation can be attributed to various factors, such as, for example, the nature of noise disturbances at the receiver, the presence of interference, nonlinearities in the transmitter or receiver hardware, bit assignments to the constellation points, and the channel characteristics, especially if there is fading. For example, as

LGE1029 (2nd Hochwald Dec.), ¶12.

FIG. 21 illustrates a QAM-64 constructed from orthogonal Cartesian product of two PD optimized PAM-8 constellations in accordance with an embodiment of the invention.

Pet., p.43 (citing to LGE1015, 4:29-31).

Pet. SR., pp. 6-7.

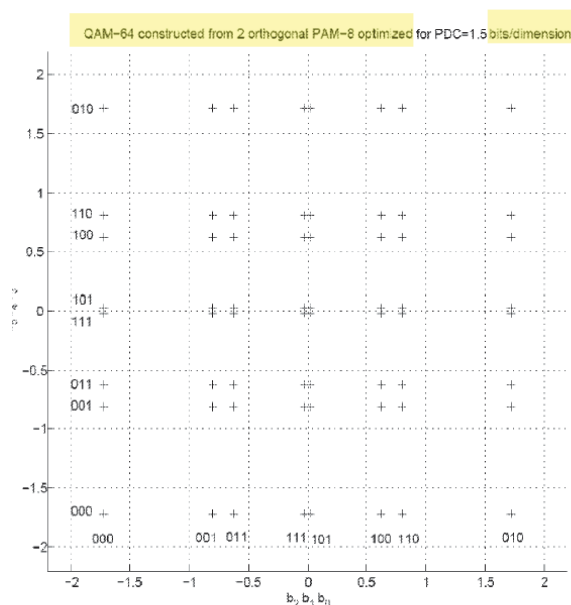
orthogonalized 1D constellations. Dr. Caire acknowledged that the parallel decoding capacity can change and is not the same when increasing dimensions (and particularly when constellations are considered as a whole, not on a per dimension basis). LGE1032, 122:7-25, 123:1-6, 124:2-11 (“an example in which the capacity is not the same ... would be an example in which the constellation in two dimensions is not the Cartesian product of two identical one-dimensional constellations”).

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FIG. 21 is directed to orthogonalized 1D constellations that yield a 2D constellation



0.02), (110, 0.81), (111, -0.02)}. Examination of FIG. 21 shows that the QAM constellation construction is achieved by replicating a complete set of PAM-8 points in the quadrature dimension for each of the 8 PAM-8 points in the in-phase dimension. Labeling is achieved by assigning the PAM-8 labels to the LSB range on the in-phase dimension and to the MSB range on the quadrature dimension. The resulting 8x8 outer product forms a highly structured QAM-64 for which very low-complexity de-mappers can be constructed. Due to the orthogonality of the in-phase and quadrature components the capacity characteristics of the resulting QAM-64 constellation are identical to that of the PAM-8 constellation on a per-dimension basis.

LGE1015, 12:11-37, Pet. SR. p. 3.

FIG. 21

LGE1015, FIG. 21, Pet. p. 43.

Orthogonalized Constellations may also have Different Characteristics than their 1D Counterparts”

[0013] A zoomed-in version of the POR’s annotated FIG. 21 shows that where the PAM constellation originally had two constellation symbol locations (0.62 and 0.81) within a close proximity, the created QAM constellation now has four corresponding symbol locations within close proximity.

LGE1029 (2nd Hochwald Dec.), ¶13; Pet. Rep., pp. 5-11.

LGE1029 (2nd Hochwald Dec.), ¶14; Pet. Rep., pp. 5-11.

[0014] In such circumstances, it can become more difficult for the demapper to correctly identify symbol locations. Indeed, due to the presence of noise or other signal distortions, such symbol locations can often be incorrectly determined by the receiver resulting in different characteristics of the demapped QAM. The risk of such overlaps is greater in higher order constellations, and thus, additional processing and circuitry is desired to correctly demap symbols.

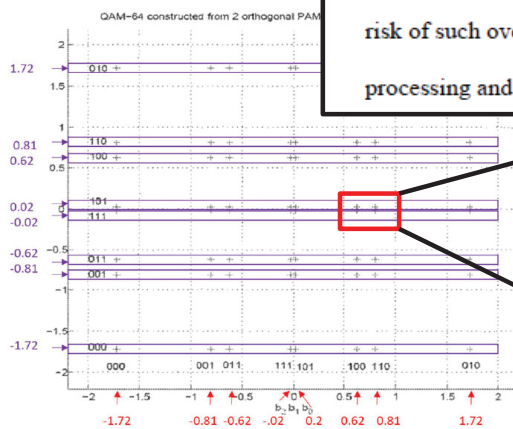


FIG. 21

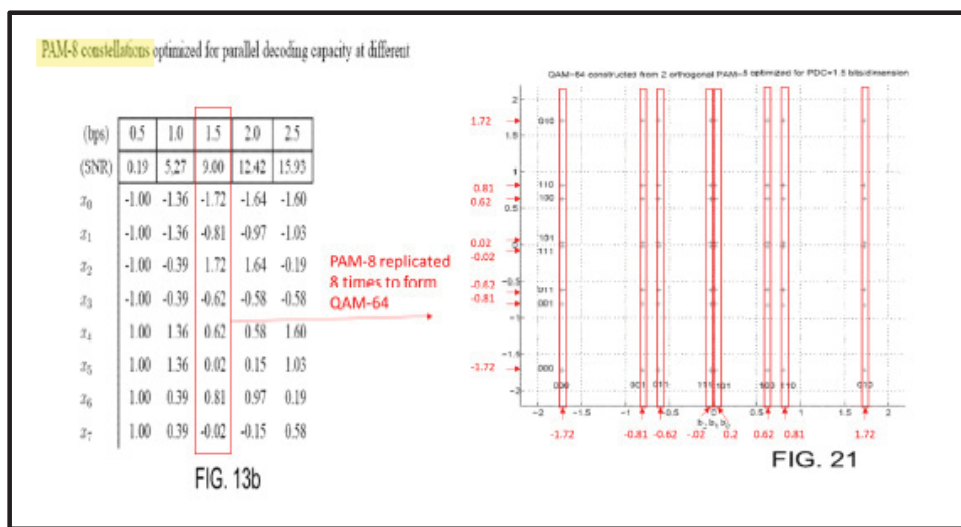
LGE1029 (2nd Hochwald Dec.), ¶¶13-14; Pet. Rep., pp. 5-11.

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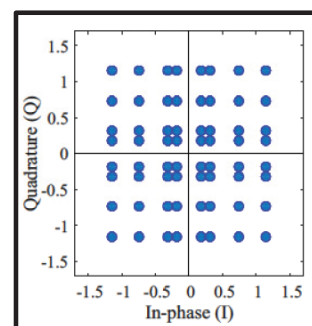
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PO relies on orthogonalized constellations for support of claims 5, 15, and 25

POR, pp 25-26; POPR, p. 23; PR, p. 2-3, 19-20; LGE1001 3:25-34; LGE1015 3:9-19.



POR, pp 25-27;
Pet. Rep., pp. 2-3,
19-20.



- Fuentes demonstrates this method:

POSR, p. 22; LGE1030 FIG. 1.2.

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PO relies on PAM (1D) constellations for support of multidimensional symbol constellations

In addition to the disclosure of the written description, the specification includes a number of tables identifying a plurality of different non-uniform multidimensional symbol constellations that are capable of providing a greater parallel decoding capacity at a specific SNR than the other symbol constellations in the plurality of multidimensional symbol constellations at the same SNR. For example, Barsoum's Figs. 11b, 13b, 15b and 17b all disclose constellations that are capable of providing the greatest parallel decoding capacity at a specific SNR. Figures 11b and 13b are shown below.

POR, p. 43.

PAM-4 constellations optimized for parallel decoding capacity at different LGE1001, FIG. 11b; LGE1015, FIG. 11b; POR, p. 43.
PAM-8 constellations optimized for parallel decoding capacity at different LGE1001, FIG. 13b; LGE1015, FIG. 13b; POR, p. 43.
PAM-16 constellations optimized for parallel decoding capacity at different LGE1001, FIG. 15b; LGE1015, FIG. 15b; POR, p. 43.
PAM-32 constellations optimized for parallel decoding capacity at different LGE1001, FIG. 17b; LGE1015, FIG. 17b; POR, p. 43.

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PO's alleged support incorrectly relies on PAMs

PAM-4 constellations optimized for parallel decoding capacity at different

(bps)	0.50	0.75	1.00	1.25	1.50
(SNR)	0.19	3.11	5.26	7.22	9.25
x_0	-1.00	-1.30	-1.36	-1.37	-1.36
x_1	-1.00	-0.56	-0.39	-0.33	-0.39
x_2	1.00	1.30	1.36	0.33	1.36
x_3	1.00	0.56	0.39	1.37	0.39

FIG. 11b

PAM-32 constellations optimized for parallel decoding capacity at different

(bps)	2.0	2.5	3.0	3.5	4.0	4.5
(SNR)	12.21	15.27	18.42	21.52	24.79	28.20
x_0	-2.25	-2.16	-2.14	-2.05	-1.97	-1.85
x_1	-1.52	-1.64	-1.75	-1.74	-1.72	-1.66
x_2	2.20	2.10	1.71	2.05	1.97	-1.35

PAM-16 constellations optimized for parallel decoding capacity at different

(bps)	1.5	2.0	2.5	3.0	3.5
(SNR)	9.00	12.25	15.42	18.72	22.13
x_0	-1.72	-1.98	-1.89	-1.84	-1.75
x_1	-1.72	-1.29	-1.36	-1.42	-1.42
x_2	-0.81	1.94	1.89	1.84	1.75
x_3	-0.81	-1.17	-1.14	-1.11	-1.15
x_4	1.72	-0.38	-0.35	-0.40	-0.47
x_5	1.72	-0.65	-0.70	-0.65	-0.68
x_6	-0.62	-0.38	-0.34	-0.29	-0.28
x_7	-0.62	-0.68	-0.76	-0.83	-0.90
x_8	0.62	1.09	1.13	1.11	1.15
x_9	0.62	0.76	0.76	0.84	0.90
x_{10}	0.02	1.26	1.35	1.42	1.42
x_{11}	0.02	0.76	0.70	0.65	0.68
x_{12}	0.81	0.06	0.00	0.65	0.09
x_{13}	0.81	0.29	0.34	0.29	0.28
x_{14}	-0.02	0.06	0.00	-0.65	-0.09
x_{15}	-0.02	0.29	0.35	0.40	0.47

FIG. 15b

PAM-8 constellations optimized for parallel decoding capacity at different

(bps)	0.5	1.0	1.5	2.0	2.5
(SNR)	0.19	5.27	9.00	12.42	15.93
x_0	-1.00	-1.36	-1.72	-1.64	-1.60
x_1	-1.00	-1.36	-0.81	-0.97	-1.03
x_2	-1.00	-0.39	1.72	1.64	-0.19
x_3	-1.00	-0.39	-0.62	-0.58	-0.58
x_4	1.00	1.36	0.62	0.58	1.60
x_5	1.00	1.36	0.02	0.15	1.03
x_6	1.00	0.39	0.81	0.97	0.19
x_7	1.00	0.39	-0.02	-0.15	0.58

FIG. 13b

FIG. 17b

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LGE1001, FIG. 11b, 13b, 15b, 17b; LGE1015, FIG. 11b, 13b, 15b, 17b; POR, p. 43.

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Patent owner assumes without evidence that QAMs will have the same capacity characteristics as PAMs

Thus, a system using a PAM-8 (or orthogonalized to QAM-64) operated at an SNR of 5.27 dB would utilize a constellation having points located at the positions indicated in the second column of figure 13b, and this constellation would provide greater capacity than all other PAM-8 (or QAM-64) constellations at that operating SNR of 5.27 dB. If the system switches to an operating SNR of 9.00 dB, then the system would utilize a constellation having points located at the positions indicated in the third column of figure 13b, and this constellation would provide greater capacity than all other PAM-8 (or QAM-64) constellations at that operating SNR of 9.00 dB, including the constellation defined by the locations indicated in the second column of figure 13b (i.e., the optimized constellation for an operating SNR of 5.27 dB).

Patent Owner erroneously assumes that the PAM and QAM constellations are interchangeable.

Patent owner omits essential claim terms in its analysis

2. Petition's Priority Challenge (and Ground 1B) Fails Because Challenged Claims 5, 15, And 25 Properly Claim Priority to Barsoum

Challenged claims 5, 15, and 25 recite a communication system having, among other things, a plurality of constellations, where each constellation is capable of providing greater parallel decoding capacity at a specific signal-to-noise ratio (SNR) that the other constellations in the plurality.

Patent, at claims 5, 15, and 25). For example, claim 5 reads:

5. The communication system of claim 1, wherein *each* of the plurality of different non-uniform multidimensional symbol constellations *is capable of providing a greater parallel decoding capacity at a specific SNR than other symbol constellations in the plurality of* multidimensional symbol constellations at the same SNR.

Patent Owner specifically omits the word “multidimensional” in its analysis of the claims.

Pet. Rep., p. 18 (citing POR, p. 40).

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'777 Patent has no disclosure of multidimensional capacities

uniform *multidimensional* symbol constellations. For instance, even if one were to orthogonalize the various PAM-8 constellations of FIG. 13b into various corresponding QAM-64 constellations, the '700 patent does not disclose the parallel decoding capacities of these corresponding QAM-64 constellations.

EX1029, ¶[39]; Pet. Rep., p.19.

Issue 2

The '777 patent lacks written description of the claimed multidimensional symbol constellation characteristics even if multidimensional optimization is used

The '777 Patent Provides Limited Description of Optimization over Multiple Dimensions

LGE1001, 13:7-10; LGE1015, 12:33-37; Petitioner Response (Pet. Rep.), pp. 2-3, 19-20.

With respect to the first approach, the '700 patent is devoid of any details for directly optimizing each degree of freedom. In fact, the '700 patent explicitly notes that "[t]he complexity of the optimization step grows exponentially in the number of dimensions as does the complexity of the resulting receiver de-mapper."²

LGE1001, 13:1-11. The '700 patent provides no details of the additional complexity

Pet. Rep., pp. 3, 19-20.

N-Dimensional Constellation Optimization

Rather than designing constellations in 1-D (PAM for instance) and then extending to 2-D (QAM), it is possible to take direct advantage in the optimization step of the additional degree of freedom presented by an extra spatial dimension. In general it is possible to design N-dimensional constellations and associated labelings. The complexity of the optimization step grows exponentially in the number of dimensions as does the complexity of the resulting receiver de-mapper. Such constructions constitute embodiments of the invention and simply require more 'run-time' to produce.

Pet. Sur-Reply, p. 5 (citing to LGE1015, 12:38-48); Pet. Rep., p. 3.

PO's Expert's Testimony Confirms that the '777 Patent lacks sufficient details

When asked during his deposition “why does the complexity of the resulting receiver demapper increase exponentially,” Dr. Caire stated “[t]hat's very difficult to explain” and that his explanation will “need a little bit of time” before providing several pages of explanation—none of which can be found in the '777 patent.

LGE1032, 143:8-145:11. For instance, Dr. Caire explains why multi-dimensional constellations involve exponential growth and that “Exponential is very bad.” *Id.* Dr. Caire also provided a lengthy explanation for why different demappers may be needed for 1D constellations and 2D constellations. LGE1032, 72:9-76:4. Again, none of this description can be found in the '777 patent. Consistent with this lack

LGE1032, 143:8-14.

Pet. SR., pp. 5-6.

8	Q.	Okay. Why does the complexity of the
9		resulting receiver demapper increase exponentially?
10	A.	Okay. That's very difficult to
11		explain.
12	Q.	I can ask a --
13	A.	I can explain it. I can explain, but
14		I need a little bit of time.

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DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

The '700 Patent explains that increasing the dimensionality modifies the constellation characteristics

[0029] Far from disclosing that 1D constellation optimization would also apply to 2D constellation optimization, the '700 patent discloses the opposite. In particular, the '700 patent reveals that:

LGE1029 (2nd Hochwald Dec.)
(citing LGE1001, 1:45-52, ¶29;
Pet. Rep., pp. 13-14.

the constellation. The minimum distance (d_{min}) between constellation points is indicative of the capacity of a constellation at high signal-to-noise ratios (SNRs). Therefore, constellations used in many communication systems are designed to maximize d_{min} . Increasing the dimensionality of a constellation allows larger minimum distance for constant constellation energy per dimension. Therefore, a number of

LGE1001, 1:45-52;
Pet. 19; Pet. Rep., pp.
13-14.

LGE1029 (2nd Hochwald Dec.), ¶30;
Pet. Rep., pp. 13-14.

[0030] This disclosure clearly indicates that the d_{min} used to optimize capacity at a high SNR for a single dimensional symbol constellation could be different for a d_{min} associated with a constellation with increased dimensionality (i.e., multidimensional constellation). Consequently, any optimization of a parallel decoding capacity at a specific SNR for a single dimensional symbol constellation, such as a PAM, would not necessarily be the same or applicable for a non-uniform multidimensional symbol constellation, such as a QAM, even if that QAM were formed using an optimized PAM.

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DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

Dr. Caire admits that increasing dimensionality can change a constellation's characteristics

orthogonalized 1D constellations. Dr. Caire acknowledged that the parallel decoding capacity can change and is not the same when increasing dimensions (and particularly when constellations are considered as a whole, not on a per dimension basis). LGE1032, 122:7-25, 123:1-6, 124:2-11 ("an example in which the capacity is not the same ... would be an example in which the constellation in two dimensions is not the Cartesian product of two identical one-dimensional constellations"). Fuentes also explains that BICM capacity gain, and SNR change

Pet. SR., pp. 6-7.

2 So we are filling one more dimension,
3 but in terms of bit-to-real dimension, the capacity
4 will be the same. Now, an example in which the
5 capacity is not the same would be -- let's say not
6 necessarily the same would be -- would be an
7 example in which the constellation in two
8 dimensions is not the Cartesian product of two
9 identical one-dimensional constellations. But in
10 labeling and position of the points, in this case,
11 not necessarily the capacity remains the same.
12 Right.

7 Q. (BY MR. KHAN:) Does increasing the
8 number of dimensions in a signal constellation
9 impact the parallel decoding capacity of that
10 signal?
11 MR. DIXON: Objection, form.
12 A. I think that the question is imposed.
13 It may or may not. It depends on the
14 constellation. It depends on the labeling. It
15 depends, of course, to have -- to respond to the
16 question, first of all, we have to agree that we
17 are talking about capacity expressed as bits per
18 dimension; otherwise it is not --
19 (Off-the-record discussion.)
20 A. Bits per dimension. So bit per
21 dimension, otherwise, of course, if I doubled the
22 dimension and I get more bit per symbol. But, you
23 know, you have to normalize bit per dimension. And
24 then, of course, the impact -- it may impact, it
25 may not impact. It depends what you do, right?

LGE1032 (Dr. Caire Deposition), 122:7-25;
Pet. SR., pp. 6-7.

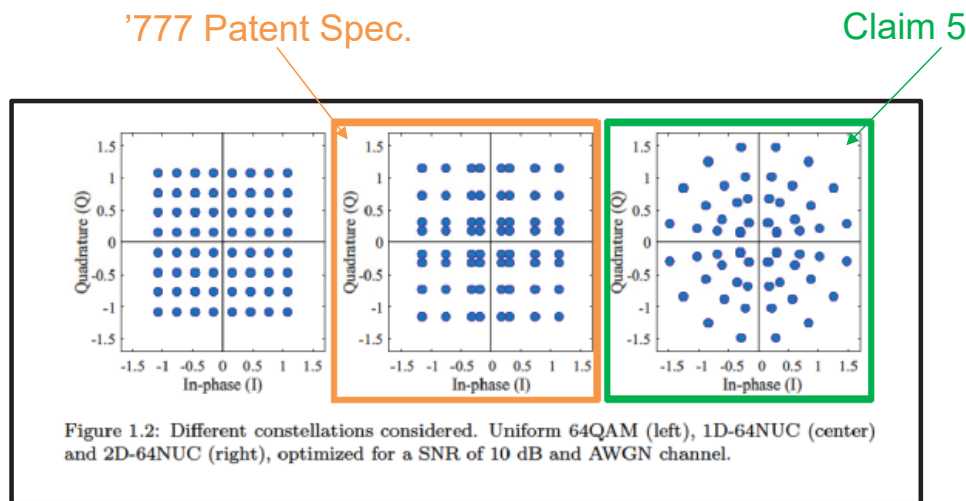
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LGE1032 (Dr. Caire Deposition), 122:7-25; Pet. SR., pp. 6-7.

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DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

Fuentes demonstrates the difference between the '777 Patent specification and the claimed invention



Pet. SR., pp. 2-4 (citing to LGE1030, FIG. 1.2).

Fuentes demonstrates that optimizations in 1D and multidimensions can have different results.

constellations"). Fuentes also explains that BICM capacity gain, and SNR change when the constellation order (dimensions) change. LGE1030, 75-77. Thus, while claims 5, 15, and 25 are focused on the parallel decoding capacity and SNR of non-uniform *multidimensional* symbol constellations, the disclosure in the '777 patent is focused on 1D capacity characteristics or per dimension characteristics of 2D constellations. This is why all the figures that PO points to for support describe 1D-optimized PAM constellations.

Pet. SR., pp. 6-7.

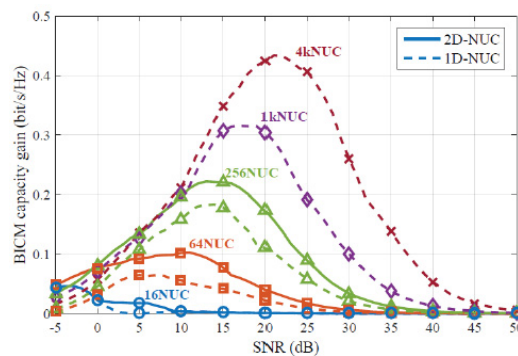


Figure 3.16: Gain of 1D/2D-NUC over QAM, for the i.i.d. Rayleigh channel model, and a range of SNR values between -5 and 50 dB.

LGE1030, FIG. 3.16.

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LGE1028 ¶9; Pet. Rep., pp. 6-7.

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DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

Issue 3

There is no comparison of parallel decoding capacity or SNR between different non-uniform multidimensional symbol constellations

Both Experts agree that claim 5 involves comparing operations

LGE's expert, Dr. Hochwald, had previously explained that one of the reasons claims 5, 15, and 25 were not supported was because the claims "define[] a very specific relative relationship between two groupings of non-uniform spaced constellations" and "[n]othing in the '777 patent provides sufficient written description support for the *comparison of these two groups of constellations*."

LGE1003, ¶[73]; Petition (Pet.), 13-14.

Pet. SR., pp. 1-2.

Another embodiment of the invention includes selecting an appropriate constellation size and a desired capacity per dimension, estimating an initial SNR at which the system is likely to operate, and iteratively optimizing the location of the points of the constellation to maximize a capacity measure until a predetermined improvement in the SNR performance of the constellation relative to a constellation that maximizes d_{min} has been achieved.

LGE1015, 2:56-63, Pet. pp.14, 23.

[0073] This limitation defines a very specific relative relationship between two groupings of non-uniform spaced constellations that is not supported by the '777 Patent specification. LGE-1003, [zz]. In particular, claim 5 recites an observation of a relative relationship between a first group of *non-uniform multidimensional symbol constellations*¹ to a second group of other symbol constellations² when the two groups are *operated at the same SNR*. Nothing in the '777 patent provides sufficient written description support for the *comparison of these two groups of constellations*. To the contrary, the '777 patent, at best, only describes determining a relative relationship between a geometrically shaped (i.e., unequally spaced) constellation and a constellation optimized for d_{min} . LGE1015, 6:14-20, 2:56-63. This disclosure of the '777

LGE1003, ¶[73]; Pet., pp. 13-14; Pet. SR., pp. 1-2.

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DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

Both Experts agree that claim 5 involves comparing operations

LGE1003, ¶[73]; Petition (Pet.), 13-14. During his deposition, Dr. Caire confirmed that the features in claim 5 would be realized by performing a comparison of the position of constellation points between different constellations. LGE1032, 163:6-165:21 (Dr. Caire described comparing a non-uniform constellation in a subset of constellations to a library of constellations – “How? *By comparison*. Every constellation”). Accordingly, LGE and Patent Owner (PO)’s experts have both indicated that a POSITA would have understood claim 5 to involve a comparison of constellation points. But the ‘777 patent does not describe such a comparing

Pet. SR., pp. 1-2.

LGE1032 (Dr. Caire Deposition), 163:6-165:21; Pet. SR., pp. 1-2.

Q. (BY MR. KHAN:) So to be clear, how does it figure out that it is greater than everything else that is in the library?

MR. DIXON: Objection to form.

A. How? By comparison. Every constellation, which means position of the points, number of points, labeling has a parallel decoding capacity curve as a function of SNR. You look at all the curves, and you see the one that is on top of all the others for each SNR. So you take like the upper and the lower of these curves, and these curves, they intersect. So one is on top of all the others in a certain interval SNR; another one is on top of all the others in another interval SNR and so on and so forth, and this is what is written here.

Issue 4

Dr. Caire's declaration testimony should be given minimum weight

Dr. Caire did not review the '777 Patent

2 Q. (BY MR. KHAN:) Sorry, just to be
3 clear, you reviewed Exhibit 1015, the '777 Patent,
4 at the time of preparing your first and your second
5 declaration; is that right?

6 A. No, it is not correct. At the time
7 of the second declaration, I reviewed only the '700
8 Patent.

LGE1032 (Dr. Caire
Deposition) 13:2-8; Pet.
SR., pp. 9-10.

Yet, EX1015 is repeatedly
cited in his declaration
unknownst to him.

9. Barsoum also provides additional details. For example, Barsoum describes how to optimize constellations including the use of unconstrained or constrained non-linear optimization. (EX1015 8:34-37). Barsoum provides possible objective functions for the optimization. (EX1015 8:37-40, 49-56). Barsoum discloses that point locations are varied. (EX1015 8:41-42, 49-56). Barsoum describes running the optimization process iteratively. (EX1015 8:49-56). Barsoum identifies various optimization constraints. (EX1015 2:37-41, 2:55-66, 8:23-24, 8:57-9:2). Barsoum even includes a detailed flow diagram (FIG. 5) of an example optimization process. (EX1015 7:10-8:23).

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EX2025 (Dr. Caire 2nd declaration), ¶9.

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DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

Dr. Caire did not understand the claim being challenged

During his deposition, Dr. Caire also repeated several times that *he did not understand claim 5*, and even engaged in an exercise with LGE's counsel to rewrite claim 5.

Pet. SR., pp. 9-10.

23 A. Frankly, this is a point on which the
24 patent is not so clear, because here is written the
25 communication system of Claim 1. In Claim 1 it is

LGE1032 (Dr. Caire Deposition)
153:14-156:9; Pet. SR., pp. 9-10.

21 So since I, frankly, do not exactly
22 know what the -- we may imagine that we have
23 several pluralities, as described by Claims 2, 3,

LGE1032 (Dr. Caire Deposition)
153:14-156:9; Pet. SR., pp. 9-10.

8 A. I confirm that, in my opinion, it is
9 not clear.

LGE1032 (Dr. Caire Deposition)
153:14-156:9; Pet. SR., pp. 9-10.

7 A. I do not understand what each of the
8 plurality means. It can mean two different things.

LGE1032 (Dr. Caire Deposition)
168:1-25; Pet. SR., pp. 9-10.

19 A. This is where my understanding is not
20 so clear, because Claim 5 says wherein each of the
21 plurality of different nonuniform multidimensional
22 symbol constellations. So each of the plurality in
23 English doesn't make sense, because each of, you
24 want the plural. So pluralities.

LGE1032 (Dr. Caire Deposition)
168:1-25; Pet. SR., pp. 9-10.

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DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

Dr. Caire did not apply the proper POSITA standard

invention. *Id.* at 13, 17. Petitioner asserts that a person of ordinary skill in the art

would have had at least a Master's degree in an academic area emphasizing electrical engineering or a similar discipline, and at least two years of experience in the field working with, teaching, or researching communication systems including the use of constellations in transmitting signals between devices. [Ex.]1003, ¶[93]. Superior education could compensate for a deficiency in work experience, and *vice-versa*. *Id.*

Pet. 28.

Institution Decision, p. 9.

5 A. Okay. I would say probably a person
6 with a Ph.D. in electrical engineering, specialized
7 with a thesis done in these topics, and possibly
8 some years of work after Ph.D. in these topics.
9 These are fairly advanced topics that are not
10 taught in undergraduate or even master-level
11 courses. So it requires courses -- advanced
12 courses in digital communication plus direct
13 experience, research experience.
14 Normal students, in my experience,
15 cannot read and understand papers like the ones
16 that are in the exhibits. Simply -- I'm not aware
17 of any program where a student after a course would
18 just read this paper and understand, to the point
19 of actually implementing or designing a system.

Pet. Sur-Rep., 10; LGE1032, 22:20-23:19

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DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

Issue 5

Patent Owner's "new argument" allegations are without merit



DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

Petitioner responds to PO's assertions

C. Patent Owner only points to evidence of 1D constellations being optimized, which is not enough to support claims 5, 15, and 25

In attempting to defend the lack of support of claims 5, 15, and 25 in the '700 patent, Patent Owner turns to evidence that addresses optimizations in 1D. For instance, Patent Owner turns to Figures 11b, 13b, 15b, and 17b, 10:8-13, and other portions of the '700 patent in support of claim 5. POR, 42-45. But none of these disclosures teach optimization of a multidimensional symbol constellation. As one

Focusing on the example of FIG. 13b which Patent Owner highlights in its POR, as shown below, Patent Owner attempts to link FIG. 13b to the multidimensional constellation shown in FIG. 21. POR, 27-28. But the title of FIG. 21 states "QAM-64 constructed from 2 orthogonal PAM-8 optimized for PDC=1.5 bits/dimension." The '700 patent does not describe the QAM-64 constellation as

Pet. SR., p. 15.

Patent Owner contends that there are two approaches for optimizing multidimensional QAM constellations. POR, 25-26. The first approach "for

With respect to the first approach, the '700 patent is devoid of any details for directly optimi

For example, for the second approach, Patent Owner focuses on two portions of the '700 patent, but these portions disclose how a QAM constellation can be created from a PAM constellation, not how a QAM constellation is optimized. LGE1001, 3:25-34 ("creating an orthogonalized PAM constellation using the

Pet. SR., p. 14.

Pet. SR., p. 16.

Moreover, throughout the POR, Patent Owner mischaracterizes the alleged supporting disclosure. For instance, Patent Owner contends that: the specification includes a number of tables identifying a plurality of different non-uniform multidimensional symbol constellations that are capable of providing a greater parallel decoding capacity at a specific SNR than the other symbol constellations in the plurality of multidimensional symbol constellations at the same SNR. For example, Barsoum's Figs. 11b, 13b, 15b and 17b all disclose constellations that are capable of providing the greatest parallel decoding capacity at a specific SNR.

POR, 43. But none of Figs. 11b, 13b, 15b and 17b are related to multidimensional constellations. As shown below, the same holds true for various other disclosure Patent Owner points to as allegedly supporting the claim features at issue. Indeed, such mischaracterizations may have contributed to the Board being misled by Patent Owner regarding support for claims 5, 15, and 25 at the stage of institution. (Institution Decision), 15; LGE1029, ¶¶0034-0038.

Pet. SR., p. 17.

Pet. SR., pp. 2-4.

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DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

PO's assertion of "new arguments" lacks merit

Under 37 C.F.R. § 42.23(b), a petitioner is allowed to "respond to arguments raised in the corresponding opposition patent owner preliminary response, or patent owner response." The Federal Circuit recently affirmed that a Petitioner can expand on previous arguments in the Petition and can provide responsive arguments in a Petitioner Reply. *Rembrandt Diagnostics, LP v. Alere, Inc.*, 2021-1796, 10-16 (Fed. Cir. 2023). The Court explained that "the very nature of the reply and sur-reply briefs are to respond (whether to refute, rebut, explain, discredit, and so on) to prior raised arguments," and that when a reply is responsive but still pursues the "same legal ground," such arguments are permissible. *Id.*, 12. The Court also "cautioned the Board not to parse 'arguments on reply with too fine of a filter.'" *Id.*, 11 (quoting

Pet. SR., pp. 7-8.

claims 5, 15, and 25. POR, 42-45. In the Petitioner Reply, LGE *explicitly* cited to the arguments in the POR and provided responsive arguments. *See, e.g.*, Pet. Rep., 2-4 ("Patent Owner contends that there are two approaches for optimizing multidimensional QAM constellations. POR, 25-26. ... With respect to the first approach, the '700 patent is devoid of any details for directly optimizing each degree of freedom.") Thus, LGE's Petitioner Reply arguments are responsive, permissible, and should not be excluded.

Pet. SR., pp. 7-8.

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DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

Appendix

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DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

The '777 Disclosure - Orthogonalization

“Orthogonalizing [a] PAM . . . to form the QAM”

POR, pp25-26;POPR, p. 23; PR, p. 2-3, 19-20; LGE1001 3:25-34; LGE1015 3:9-19.

EX1015 at 12:39-48). Another disclosed approach to optimizing a multidimensional QAM constellation is to first optimize a PAM constellation, then apply that PAM constellation to both of the in-phase and quadrature components.

The '700 Patent describes this approach as orthogonalizing the PAM constellation into a second dimension to form the QAM constellation. (EX1001 at 3:25-34; 12:42-67; *see also, e.g.*, EX1015 at 3:9-19, 12:11-37). This results in a

POR, pp. 25-27; Pet. Rep., pp. 2-3, 19-20.

The '700 illustrates an example of this orthogonalizing approach in Figure 21, showing that a PAM-8 constellation optimized for capacity at a user bit rate per dimension of 1.5 bits per second can be used to construct a QAM-64 constellation. As shown below in annotated Figures 13b and 21, orthogonalizing a capacity optimized PAM-8 includes replicating a full PAM-8 constellation 8 times. (EX1001 at 3:25-34; 12:42-67; *see also, e.g.*, EX1015 at 3:9-19, 12:11-37).

POR, pp 25-27; Pet. Rep., pp. 2-3, 19-20.

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DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

The '777 Patent's Optimization

Multidimensional optimization also lacks sufficient description in the '777 Patent

Seemingly recognizing the lack of disclosure of the first approach in the '700 patent, Patent Owner focuses on the second approach in its POR for written description support. POR, 25-33, 42-45; LGE1029, ¶¶0006-0007. However, a careful review of the '700 patent, reveals that *even the second optimization approach* (even if true, which Petitioner does not concede) *is not described in the '700 patent*. LGE1029, ¶¶0006-0007.

Pet. Rep., pp. 2-3.

precedent or reasons requiring such purportedly missing “details.” (Reply at 3). And such details are *not* required because “written description is about whether the skilled reader of the patent disclosure can recognize that what was claimed corresponds to what was described; it is not about whether the patentee has proven to the skilled reader that the invention works, or how to make it work, which is an enablement issue.” *CenTrak, Inc. v. Sonitor Techs., Inc.*, 915 F.3d 1360, 1365-69 (Fed. Cir. 2019) (citation and internal quotation marks omitted).

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POSR, p. 15.

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DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

“Per-dimension basis” v. overall characteristics

same capacity characteristics. For example, Fuentes explains that “2D-NUCs [(Non-Uniform Constellations)] are always a better option than 1D-NUCs from the capacity point of view. ... First, the *BICM capacity gain increases with the constellation order, regardless of the type of NUC used*. Second, the relative gain between 2D- and 1D-NUCs is always higher for the medium range of SNRs in which each order of constellation works. Logically, *the SNR range also increases with the constellation order*.”² (emphasis added) LGE1030, 75-77. Thus, Fuentes explains that a 1D-NUC (Non-Uniform Constellation) and 2D-NUC do not necessarily have the same capacity characteristics when 1D constellations and 2D constellations (as a whole) are compared. Indeed, Fuentes teaches that the opposite is true and that SNR and capacities of 1D and 2D constellations can be different. For instance, the difference between the dashed lines and the solid lines in Fuentes’ FIG. 3.16 (reproduced below) show how different the BICM or parallel decoding capacities for various 1D and 2D NUC QAM constellations can be at

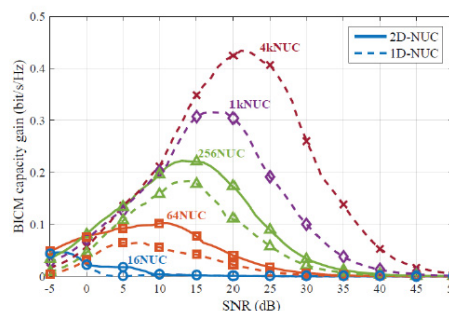


Figure 3.16: Gain of 1D/2D-NUC over QAM, for the i.i.d. Rayleigh channel model, and a range of SNR values between -5 and 50 dB.

LGE1030, FIG. 3.16.

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LGE1029 (2nd Hochwald Dec.), ¶¶9-10; LGE1030, FIG. 3.16 Pet. Rep., pp. 6-7.

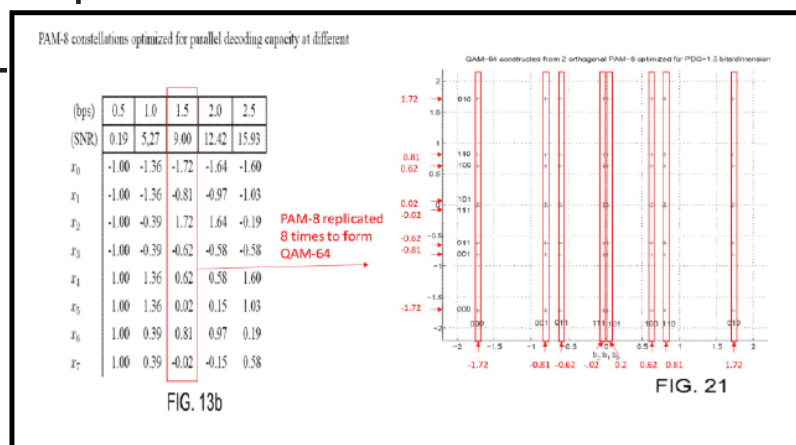
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DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

Patent owner attempts to link optimization of 1D and 2D constellations

[0026] Patent Owner attempts to link the optimization of a 1D constellation to a 2D constellation, for example as shown in FIGS. 13B and 21 on page 27 of the POR. However, these figures and Patent Owner's annotations merely reinforce that the constellations are, at best, a collection of replicated PAM constellations optimized in one-dimension, not a "non-uniform multidimensional symbol constellations [] capable of providing a greater parallel decoding capacity at a specific SNR than the other symbol constellations in the plurality of multidimensional symbol constellations at the same SNR", which is what the claims require. LGE1001, 14:65-15:3; EX2001, 25-28; POR, 26-28.

LGE1029 (2nd Hochwald Dec.), ¶¶26-27;
Pet. Rep. pp. 5-11.



POR, 27.

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DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

The '777 Patent is silent regarding Comparisons

PAM to "a PAM constellation that maximizes d_m ." LGE1001, 3:25-34. Thus, the '700 patent discloses comparing the capacity of a geometrically shaped PAM constellations to constellations maximized for d_{min} , which is not the same as comparing the parallel decoding capacity at a particular SNR of a non-uniform multidimensional symbol constellation to "other symbol constellations in the plurality of multidimensional symbol constellations at the same SNR," as claimed in claims 5, 15, and 25. LGE1011, 14:65-15:3; LGE1029, ¶¶0039-0040.

Pet. Rep., pp. 20-21.

A yet further embodiment of the invention includes obtaining a geometrically shaped PAM constellation with a constellation size that is the square root of said given constellation size, where the geometrically shaped PAM constellation has a capacity greater than that of a PAM constellation that maximizes d_{min} , creating an orthogonalized PAM constellation using the geometrically shaped PAM constellation, and combining the geometrically shaped PAM constellation and the orthogonalized PAM constellation to produce a geometrically shaped QAM constellation.

LGE1001, 3:25-34; LGE1015, 3:9-19;
Pet. pp. 35, 45, 55-58.

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DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

Purdue Pharma

As *Ruschig* makes clear, one cannot disclose a forest in the original application, and then later pick a tree out of the forest and say here is my invention. In order to satisfy the written description requirement, the blaze marks directing the skilled artisan to that tree must be in the originally filed disclosure. *See id.* at 994-95, [54 C.C.P.A. 1551](#), [379 F.2d 990](#), [154 USPQ at 122](#); *Fujikawa*, [93 F.3d at 1570-71](#), [39 USPQ2d at 1905](#); *Martin v. Mayer*, [823 F.2d 500, 505](#), [3 USPQ2d 1333, 1337](#) (Fed. Cir. 1987) (It is "not a question of whether one skilled in the art might be able to construct the patentee's device from the teachings of the disclosure. . . . Rather, it is a question whether the application necessarily discloses that particular device.") (quoting *Jepson v. Coleman*, [50 C.C.P.A. 1051](#), [314 F.2d 533, 536](#), [136 USPQ 647, 649-50](#) (1963)). Under that standard, we conclude that the district court did not commit clear error in finding that nothing in the '688 application "necessarily" . . . described the later claimed subject matter of the '360 patent. *In re Daniels*, [144 F.3d 1452, 1456](#), [46 USPQ2d 1788, 1790](#) (Fed. Cir. 1998).

Purdue Pharma, 230 F.3d at 1326-1327, Pet. pp. 3, 10-11.

Indivior UK Ltd. v. Reddy's Labs. S.A.

What is needed to satisfy written description in patent law is highly fact-dependent, but the contours are well-known. Under [35 U.S.C. § 112](#), "[t]he specification shall contain a written description of the invention." The test for adequate written description "is whether the disclosure of the application relied upon reasonably conveys to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date." [Ariad Pharms., 598 F.3d at 1351](#). We have said that it is not necessary that the limitations of a claim be set forth *in haec verba*, [id. at 1352](#), or, presumably, in the case where numbers, not words, are at issue, *in haec numera*. But the specification must indicate with some clarity what the claim recites. In the case of a claimed range, a skilled artisan must be able to reasonably discern a disclosure of that range. No range of "about 40 wt % to about 60 wt %" appears in the ['571](#) application. Moreover, various other indications of the polymeric content of the film are present in the ['571](#) application, rendering it even less clear that an invention of "about 40 wt % to about 60 wt %" was contemplated as an aspect of the invention.

Indivior UK Limited v. Dr. Reddy's Laboratories S.A., 18 F.4th 1323, 1328-29 (2021), Pet. pp. 3.

Lizardtech, Inc. v. Earth Res. Mapping Inc

That is, a recitation of how to make and use the invention across the full breadth of the claim is ordinarily sufficient to demonstrate that the inventor possesses the full scope of the invention, and vice versa. This case is no exception. Whether the flaw in the specification is regarded as a failure to demonstrate that the patentee possessed the full scope of the invention recited in claim 21 or a failure to enable the full breadth of that claim, the specification provides inadequate support for the claim under [section 112](#), paragraph one.

Lizardtech, Inc. v. Earth Res. Mapping Inc., 424 F.3d 1336, 1345 (Fed. Cir. 2005). Pet. pp. 3.

Lizardtech, Inc. v. Earth Res. Mapping Inc

Claim 21 is directed to creating a seamless array of DWT coefficients generically. The specification, however, is directed at describing a particular method for creating a seamless DWT, as opposed to using the disfavored, nonseamless prior art, and it teaches only that method of creating a seamless array. While the embodiment in LizardTech's specification covers only one way of creating a seamless DWT, claim 21 is not invalid simply for that reason. A claim will not be invalidated on [section 112](#) grounds simply because the embodiments of the specification do not contain examples explicitly covering the full scope of the claim language. See [Union Oil Co. v. Atl. Richfield Co.](#), 208 F.3d 989, 997 (Fed. Cir. 2000). That is because the patent specification is written for a person of skill in the art, and such a person comes to the patent with the knowledge of what has come before. [In re GPAC Inc.](#), 57 F.3d 1573, 1579 (Fed. Cir. 1995). Placed in that context, it is unnecessary to spell out every detail of the invention in the specification; only enough must be included to convince a person of skill in the art that the inventor possessed the invention and to enable such a person to make and use the invention without undue experimentation. In this case, however, LizardTech has failed to meet either requirement. After reading the patent, a person of skill in the art would not understand how to make a seamless DWT generically and would not understand LizardTech to have invented a method for making a seamless DWT, except by "maintaining updating sums of DWT coefficients."

Lizardtech, Inc. v. Earth Res. Mapping Inc., 424 F.3d 1336, 1345 (Fed. Cir. 2005). Pet. pp. 3.

Lockwood v. Am. Airlines, Inc.

One shows that one is "in possession" of *the invention* by describing *the invention*, with all its claimed limitations, not that which makes it obvious. *Id.* ("The applicant must also convey to those skilled in the art that, as of the filing date sought, he or she was in possession of *the invention*. The invention is, for purposes of the 'written description' inquiry, *whatever is now claimed*.") (emphasis in original). One does that by such descriptive means as words, structures, figures, diagrams, formulas, etc., that fully set forth the claimed invention. Although the exact terms need not be used *in haec verba*, see [*Eiselstein v. Frank*, 52 F.3d 1035, 1038, 34 U.S.P.Q.2D \(BNA\) 1467, 1470 \(Fed. Cir. 1995\)](#) ("The prior application need not describe the claimed subject matter in exactly the same terms as used in the claims . . ."), the specification must contain an equivalent description of the claimed subject matter. A description which renders obvious the invention for which an earlier filing date is sought is not sufficient.

Lockwood v. Am. Airlines, Inc., 107 F.3d 564, 1571-72 (Fed. Cir. 1997), Pet. pp. 3.

Lockwood v. Am. Airlines, Inc.

One shows that one is "in possession" of *the invention* by describing *the invention*, with all its claimed limitations, not that which makes it obvious. *Id.* ("The applicant must also convey to those skilled in the art that, as of the filing date sought, he or she was in possession of *the invention*. The invention is, for purposes of the 'written description' inquiry, *whatever is now claimed*.") (emphasis in original). One does that by such descriptive means as words, structures, figures, diagrams, formulas, etc., that fully set forth the claimed invention. Although the exact terms need not be used *in haec verba*, see [*Eiselstein v. Frank*, 52 F.3d 1035, 1038, 34 U.S.P.Q.2D \(BNA\) 1467, 1470 \(Fed. Cir. 1995\)](#) ("The prior application need not describe the claimed subject matter in exactly the same terms as used in the claims . . ."), the specification must contain an equivalent description of the claimed subject matter. A description which renders obvious the invention for which an earlier filing date is sought is not sufficient.

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Lockwood further argues that his expert's declaration was sufficient to raise a genuine issue of material fact regarding what the intervening applications disclosed to one skilled in the art. However, as American argues, one intervening application failed to disclose a computer system connected to multiple vendors and another, while disclosing a central computer with a video disk player, failed to disclose individual merchandising apparatus that contained video disk players or other equivalent storage means. Lockwood's expert averred that the disclosed terminal in the former application "can be connected" to multiple vendors and that, although the latter application only "discusses the use of a television set and a keypad at a consumer's home," it would have been apparent to one skilled in the art that "Lockwood also envisioned the use of a terminal" containing a video disk player. That does not solve Lockwood's problem. Lockwood claimed a distinct invention from that disclosed in the specification. It is not sufficient for purposes of the written description requirement of § 112 that the disclosure, when combined with the knowledge in the art, would lead one to speculate as to modifications that the inventor might have envisioned, but failed to disclose. Each application in the chain must describe the claimed features. It is undisputed that one of the intervening applications does not describe an individual terminal containing a video disk player. Therefore, the declaration by Lockwood's expert does not raise a genuine issue of material fact. The district court correctly held that the '355 patent was invalid as anticipated by the '359 patent.

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