

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

LG ELECTRONICS, INC.

Petitioner,

v.

CONSTELLATION DESIGNS, LLC

Patent Owner.

Case IPR2023-00319
U.S. Patent 10,693,700

PETITIONER'S SUR-REPLY TO PATENT OWNER SUR-REPLY

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EXHIBITS

LGE1001	U.S. Patent No. 10,693,700
LGE1002	Prosecution History for U.S. Patent No. 10,693,700
LGE1003	Expert Declaration of Dr. Bertrand Hochwald
LGE1004	RESERVED
LGE1005	RESERVED
LGE1006	RESERVED
LGE1007	RESERVED
LGE1008	Ulrich Reimers et al., <i>DVB The Family of International Standards for Digital Video Broadcasting</i> , Second Edition, 2005 (“Ulrich”)
LGE1009	RESERVED
LGE1010	U.S. Provisional application No. 60/933,319 (“’319 Provisional”)
LGE1011	Declaration of June Munford (ATSC322)
LGE1012	Second Stipulation by Petitioner, LGE, <i>Constellation Designs, LLC v. LG Electronics, Inc. et al</i> , Case No. 2:21-cv-00448 (E.D. Tex.)
LGE1013	RESERVED
LGE1014	De Gaudenzi et al., <i>Turbo-coded APSK modulations design for satellite broadband communications</i> , Int. J. Satell. Commun. Network. 2006; 24:261–281, Published online 19 May 2006 in Wiley InterScience (“DeGaudenzi”)

LGE1015	U.S. Patent No. 7,978,777
LGE1016	RESERVED
LGE1017	RESERVED
LGE1018	Memorandum, Interim Procedure for Discretionary Denials in AIA Post-Grant Proceedings with Parallel District Court Litigation (USPTO June 21, 2022) (“Interim Procedure”)
LGE1019	Docket Control Order, <i>Constellation Designs, LLC v. LG Electronics, Inc. et al</i> , Case No. 2:21-cv-00448 (E.D. Tex.)
LGE1020	Complaint, <i>Constellation Designs, LLC v. LG Electronics, Inc. et al</i> , Case No. 2:21-cv-00448 (E.D. Tex.)
LGE1021	RESERVED
LGE1022	ATSC Recommended Practice: Guidelines for the Physical Layer Protocol, Document no. A/327:2018
LGE1023	ATSC 3.0 Standard: Physical Layer Protocol, Document no. A/322:2018
LGE1024	Loghin, et al., <i>Non-Uniform Constellations for ATSC 3.0</i> , IEEE Transactions on Broadcasting, Vol 62, No. 1, March 2016. (“Loghin”)
LGE1025	G. Ungerboeck, Channel Coding with Multilevel/Phase Signals, IEEE Trans. Inform. Theory, Vol. IT-28, No. 1, Jan. 1982, pp. 55-67 (“Ungerboeck”)
LGE1026	Declaration of June Munford (ATSC327)
LGE1027	Declaration of June Munford (DG)
LGE1028	Declaration of June Munford (Loghin)

LGE1029	Second Declaration of Dr. Bertrand Hochwald
LGE1030	Muela, Manuel Fuentes, <i>Non-Uniform Constellations for Next-Generation Digital Terrestrial Broadcast Systems</i> , Departamento de Comunicaciones Universitat Politècnica de València, June 2017. (“Fuentes”)
LGE1031	Proakis, John G. <i>Digital Communications</i> , Fourth Edition, 2000. (“Proakis”)
LGE1032	Transcript of the Deposition of Dr. Caire

For the reasons noted below, the Board should find that the '700 Patent lacks written description support and is not entitled to claim priority from U.S. Patent No. 7,978,777 (the “’777 patent”).

I. DR. CAIRE CONFIRMED THAT CLAIM 5 INVOLVES A COMPARING OPERATION—WHICH IS NOT DESCRIBED IN THE ’777 PATENT

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. 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 operation and thus fails to provide support for claims 5, 15, and 25. Notably, PO’s counsel did not address this argument in its reply, instead choosing to dodge the

argument under the cover of a purported missing claim construction, which clearly is not necessary here, as indicated by both experts' statements. Patent Owner Response (Paper 12/POR), 41.

II. FUENTES AND DR. CAIRE CONFIRM THAT NON-UNIFORM MULTIDIMENSIONAL SYMBOL CONSTELLATIONS OPTIMIZED IN 2D HAVE DIFFERENT CAPACITY CHARACTERISTICS THAN NON-UNIFORM MULTIDIMENSIONAL SYMBOL CONSTELLATIONS OPTIMIZED IN 1D AND ORTHOGONALIZED TO 2D

PO misunderstood LGE's remarks in the Petitioner Reply, and, in responding, further confirmed LGE's argument that optimizing multidimensional constellations is not the same as optimizing constellations in 1D and then converting the optimized 1D constellations to 2D constellations.

In particular, PO accuses LGE of having misunderstood Fuentes' 1D-NUCs as being one-dimensional and not two-dimensional. Patent Owner Sur-Reply (Paper 14/POSR), 21. PO misunderstands or mischaracterizes LGE's position.

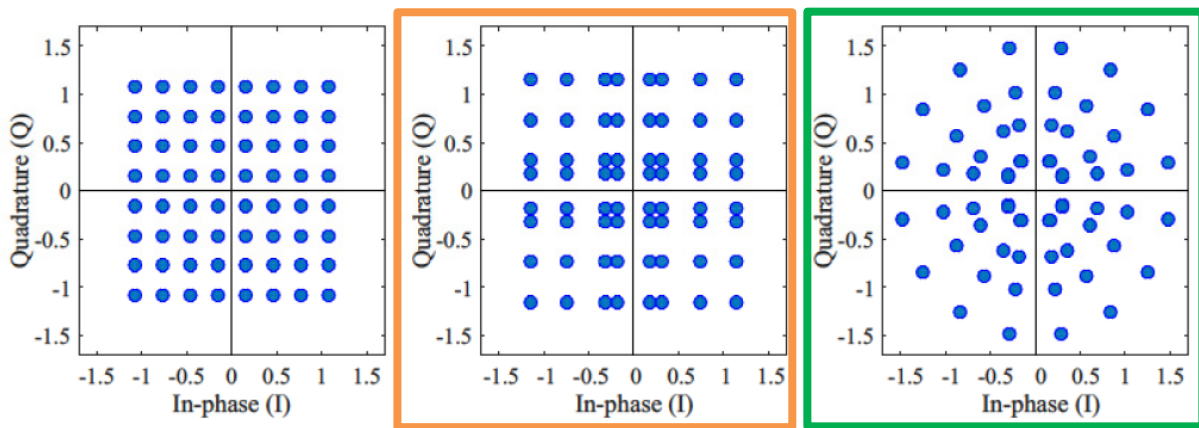


Figure 1.2: Different constellations considered. Uniform 64QAM (left), 1D-64NUC (center) and 2D-64NUC (right), optimized for a SNR of 10 dB and AWGN channel.

A quick look at Fuentes' FIG. 1.2 makes it apparent that the 1D-64NUC (center/orange) is a two-dimensional constellation. However, it is referred to as a 1D constellation because it is formed by optimizing a 1D constellation, orthogonalizing the 1D constellation, and creating the resulting 64NUC constellation which has the same capacity characteristics on a per dimension basis as a 1D constellation—similar to the orthogonalized 2D constellations described in the '777 patent. As confirmed by Dr. Caire, such constellations *are often referred to as one-dimensional* (LGE1032, 148:11-149:16) because they retain the 1D characteristics on a per dimension basis relative to the 1D constellation used to form them¹.

However, when a multidimensional (e.g., 2D) constellation is optimized in multiple dimensions, the resulting constellation has different constellation points,

¹ Consistent with Dr. Caire's testimony, the Petitioner Reply used the term 1D constellation or 1D-NUCs in the discussion of Fuentes because the capacity characteristics of the 1D NUCs are the same as 2D constellations that are formed by orthogonalizing the 1D NUCs. The "1D" or "2D" thus referred to the dimensions optimized or for which capacity characteristics were obtained, not necessarily the actual number of dimensions in the constellation.

shape, and capacity characteristics as shown in the 2D-64NUC on the right side (green box) of FIG. 1.2. Claims 5, 15, and 25 are similarly directed to the characteristics (parallel decoding capacity, SNR) of *multidimensional* symbol constellations, not 1D constellations. But the '777 patent does not describe the parallel decoding capacity or SNR characteristics of multidimensional symbol constellations optimized in multiple dimensions, and thus fails to provide support for the claimed features. Put simply, the '777 patent provides disclosure directed to the center figure of Fuentes' FIG. 1.2, whereas the claims are directed to the right figure of Fuentes' FIG. 1.2. Dr. Caire also confirmed that these constellations are generated as a result of different optimizations. LGE1032, 153:2-8.

III. PO HAS FAILED TO ESTABLISH THAT THE '777 PATENT DESCRIBES THE CLAIMED NON-UNIFORM MULTIDIMENSIONAL SYMBOL CONSTELLATION FEATURES

In its sur-reply, PO alleges that LGE reads “optimization” into the claims. POSR, 12. Such allegations are without merit. Specifically, in its POR, PO points to the '777 patent's disclosure of optimizing constellations as allegedly providing support for claims 5, 15, and 25. POR, 40-45. Yet, when LGE pointed to deficiencies in the optimization-related disclosure relied upon by PO, LGE is accused of reading “optimization” into the claims. Lacking substance, such accusations merely serve to distract from the clear lack of written description support of the claimed features in the '777 patent.

Importantly, despite having numerous opportunities, to date, PO has failed to identify adequate written description support for claims 5, 15, and 25. For instance, with respect to the first approach of optimization, PO argues that because the '777 patent includes a general statement mentioning the optimizing of QAMs over an additional degree of freedom (N-degrees of freedom) and because “[s]uch constructions constitute embodiments of the invention,” the '777 patent provides written description support. LGE1015, 12:38-48.

However, in this short paragraph of the '777 patent, there is no mention of SNR, parallel decoding capacity, or non-uniformity of the constellations—features which are the focus of claims 5, 15, 25. *Id.* As noted in the Petitioner Reply, the '777 patent explains that the “complexity of the optimization step grows exponentially in the number of dimensions as does the complexity of the resulting receiver de-mapper,” but then provides no further description or even explanation of which optimization function is used or how optimization would be performed. 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 of disclosure, PO has captured greater patent coverage than it is entitled. Indeed, while the claims are directed to “multidimensional” symbol constellations, the '777 patent even fails to describe constellations that have 3 dimensions (much less N dimensions) with the claimed characteristics, as acknowledged by Dr. Caire. LGE1032, 60:11-13.

With respect to the second approach of optimization, PO has not provided any evidence that describes how forming a 2D constellation from orthogonalized 1D constellations can provide the type of non-uniform multidimensional symbol constellation parallel decoding capacity and SNR characteristics being claimed in claims 5, 15, and 25. Nor can it. There is no disclosure in the '777 patent of further optimizing multidimensional constellations after forming them from 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 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.

IV. PO’S NEW ARGUMENT ALLEGATIONS ARE WITHOUT MERIT

For several reasons, PO incorrectly argues that the Petitioner Reply includes new arguments and should therefore be excluded. POSR, 3-10.

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

Ariosa Diagnostics v. Verinata Health, Inc., 805 F.3d 1359, 1380 (Fed. Cir. 2015)).

Like in *Rembrandt*, LGE's arguments in the Petitioner Reply are responsive in nature and remain directed to the same legal invalidity ground and the same claim features alleged to be lacking support in the Petition. Specifically, in response to the Petition, PO relied upon different optimization-related disclosure for support of 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.

Case law cited by PO in the sur-reply does not supersede *Rembrandt*. For instance, in *Wasica*, the Petitioner did not make out its obviousness case in its petition, and switched to a new obviousness theory in its reply. This is not the case in this proceeding, as LGE still maintains that the '777 patent lacks written description support for the exact same claimed features in the '700 patent and continues to identify deficiencies in the evidence and arguments provided by PO.

V. DR. CAIRE'S DECLARATION SHOULD BE GIVEN MINIMUM WEIGHT, IF ANY, BECAUSE HE ACKNOWLEDGED THAT HE

DID NOT REVIEW THE '777 PATENT, DID NOT UNDERSTAND CLAIM 5, AND USED A DIFFERENT POSITA STANDARD

During his deposition, Dr. Caire confirmed that *he never reviewed the '777 patent* (EX1015), which is one of the documents being examined for written description support, when preparing his second declaration (EX2025). LGE1032, 12:18-13:8 (reproduced below). While Petitioner understands that the disclosures of the '700 and '777 patents are similar, EX1015 was cited throughout Dr. Caire's declaration (at least 17 times). The extensive citations to a document that he did not review (and for which the citations are different from the '700 patent) clearly indicate that the statements in Dr. Caire's declaration were not his own or, at a minimum, were submitted without sufficient diligence to confirm whether his statements were supported by the evidence he cited to in his declaration.

Q. (BY MR. KHAN:) Sorry, just to be clear, you reviewed Exhibit 1015, the '777 Patent, at the time of preparing your first and your second declaration; is that right? A. No, it is not correct. At the time of the second declaration, I reviewed only the '700 Patent.
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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. LGE1032, 153:14-156:9 ("I confirm that, in my opinion, it [claim 5] is not clear"), 168:1-25 ("I do not understand what each of the plurality means"), 169:17-

173:22. Moreover, in forming his opinions, Dr. Caire applied a definition of a POSITA that required an education level (PhD and some years of work experience) that exceeded the level specified by the POSITA definition used by the Board and the parties. LGE1032, 22:20-23:19 (“I would say probably a person with a Ph.D. in electrical engineering, specialized with a thesis done in these topics, and possibly some years of work after Ph.D. ... Normal students, in my experience, cannot read and understand papers like the ones that are in the exhibits”). Taken as a whole, Dr. Caire’s testimony should be accorded minimum weight, if any, because (1) he confessed to not understanding the claim(s) at issue, (2) he applied a different POSITA standard and thereby cannot speak to what a POSITA would have known or understood, and (3) he did not review the document he repeatedly cited to for support in his declaration.

Notably, Dr. Caire’s first declaration (EX2001) did not address claims 5, 15, and 25. Thus, if the Board agrees that Dr. Caire’s second declaration (EX2025) should be accorded minimal weight for the reasons noted above, ***the evidentiary record in this proceeding is lopsided***, with LGE providing multiple expert declarations and corroborating references and PO only providing a single questionable expert declaration in response.

Respectfully submitted,

Dated: April 3, 2024

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CERTIFICATE OF SERVICE

Pursuant to 37 CFR §§ 42.6(e)(4)(i), the undersigned certifies that on April 3, 2024, a complete and entire copy of this Petitioner Sur-Reply and all supporting exhibits were provided via email to the Patent Owner, by serving the correspondence address of record as follows:

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