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Paper 10
Date: July 11, 2023

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

LG ELECTRONICS, INC.,
Petitioner,

v.

CONSTELLATION DESIGNS, LLC,
Patent Owner.

IPR2023-00228
Patent 10,693,700 B1

Before MIRIAM L. QUINN, BRENT M. DOUGAL, and
MICHAEL T. CYGAN, *Administrative Patent Judges.*

DOUGAL, *Administrative Patent Judge.*

DECISION
Denying Institution of *Inter Partes* Review
35 U.S.C. § 314, 37 C.F.R. § 42.4

I. INTRODUCTION

A. Background and Summary

Petitioner, LG Electronics Inc., requests that we institute an *inter partes* review challenging the patentability of claims 1, 4, 6–11, 14, 16–21, 24, and 26–30 (the "challenged claims") of U.S. Patent 10,693,700 B1 (Ex. 1001, "the '700 patent"). Paper 2 ("Petition" or "Pet."). Patent Owner, Constellation Designs, LLC, argues that Petitioner's request is deficient and should not be granted. Paper 7 ("Preliminary Response" or "Prelim. Resp.").

Applying the standard set forth in 35 U.S.C. § 314(a), which requires demonstration of a reasonable likelihood that Petitioner would prevail with respect to at least one challenged claim, we deny the Petition and decline to institute an *inter partes* review.

B. Related Matters

The parties identify the following related district court litigation: *Constellation Designs, LLC v. LG Electronics Inc. et al.*, No. 2:21-cv-00448 (E.D. Tex.). Pet. 94–95; Paper 5, 1. Patent Owner also identifies the following related *inter partes* reviews: IPR2022-01482, IPR2022-01549, IPR2023-00229, IPR2023-00319, and IPR2023-00320. Paper 5, 1–2.

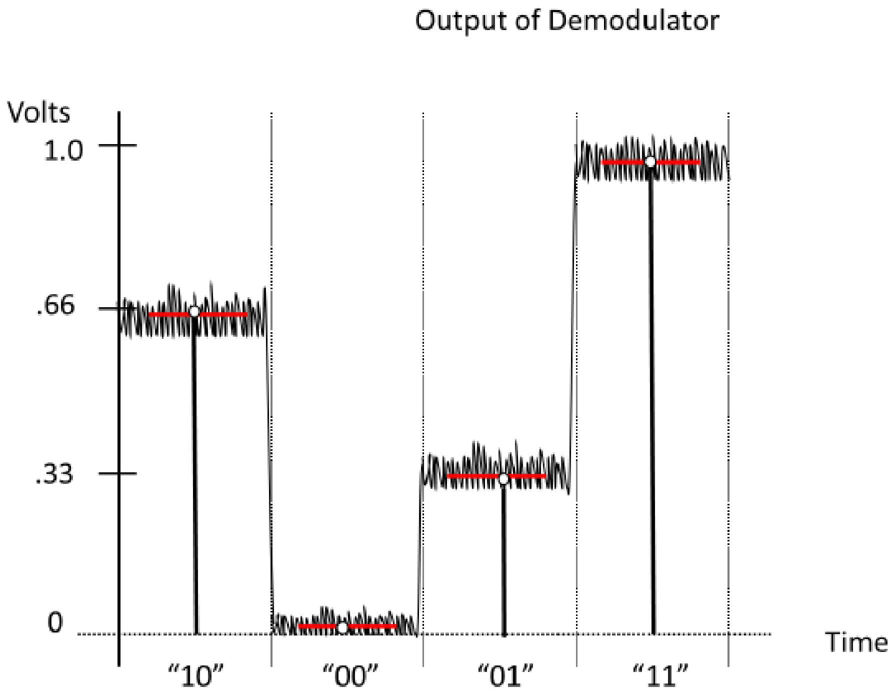
C. The '700 Patent

The '700 patent is directed to digital communication or transmission systems with "unequally spaced constellations." Ex. 1001, 1:38–44. As background to the technology, "[a] digital communication system is used to transmit digital bits (sequences of 0s and 1s) from one device (a transmitter) to another (a receiver)." Ex. 2001 ¶ 11. "Each digital communication system has a measurable 'capacity,' which is the maximum amount of information that the system can reliably send over the channel." *Id.* ¶ 14. The transmitter maps each new bit sequence to constellation points. *Id.* ¶¶ 15, 18. "[A] 'constellation' point is a carrier signal value (such as amplitude and/or phase) that can be used to represent a longer sequence of bits." *Id.* The receiver in turn attempts to detect symbols that were received, from the transmitter, by mapping a received signal to a constellation. Ex. 1001, 1:44–46. The minimum distance (d_{min}) between constellation points at high signal-to-noise ratios (SNRs) correlates to the capacity of the constellation, and accordingly, many communication systems aim to maximize this value in order to maximize capacity of the system. Ex. 2001 ¶¶ 46–54. This is to decrease the risk that the noise in the signal makes the signal unreadable, i.e. decreases the risk that the system is unable to determine which signal value was intended between two adjacent signal values.

As a simple illustration, Patent Owner's declarant, Dr. Giuseppe Caire, provides the following example of a one-dimensional constellation, with bit values (constellation label) and signal amplitude values (constellation location):

Constellation Label	Constellation Location
"00"	0
"01"	.33
"10"	.66
"11"	1.0

Ex. 2001 ¶ 29. An output based on this constellation, and including an illustration of signal noise, is reproduced below.



Id. ¶ 32. The above figure, provided by Dr. Caire, is a graph of the signal amplitude, in volts, over time. As can be seen above, "a time-dependent continuous waveform is shown in black including noise, the average of the time-dependent continuous waveform is shown in red, the output of the demodulator is shown as discrete time values in black, and the figure is again annotated with the corresponding bit sequence." *Id.* Thus, it can be seen how each bit value (constellation label) corresponds to the signal amplitude value (constellation location) in wave form. The receiver, with information about the constellation, is thus able to determine the bit values communicated from the transmitter.

As mentioned, the '700 patent is directed to digital communication systems with "unequally spaced constellations." Ex. 1001, 1:38–44. Rather than focusing on maintaining a minimum distance (d_{min}) between the signal values of the constellation, the '700 patent attempts to provide "direct optimization of the constellation points of a communication system utilizing a capacity approaching channel code, [that] can yield different constellations depending on the SNR for which they are optimized" *Id.* at 5:11–16. The ’700 patent explains that "capacity optimized constellation at low SNRs are geometrically shaped constellations that can achieve significantly higher performance gains (measured as reduction in minimum required SNR) than constellations that maximize d_{min}." *Id.* at 8:24–29. The ‘700 patent provides that "a constellation at one code rate can achieve gains that cannot be achieved at another code rate." *Id* at 5:20-21. Dr. Caire provides one example of "a constellation optimized for a code rate of 1/2 may not have the same performance at a code rate of 2/3," and "[i]nstead, a different constellation optimized for a code rate of 2/3 may perform better when the system is operating at a code rate of 2/3 than if the system used the constellation optimized for a code rate of 1/2." Ex. 2001 ¶ 55.

"Capacity measures that can be used in the selection of the location of constellation points include . . . parallel decode (PD) capacity and joint capacity." Ex. 1001, 5:6–8. The "PD capacity of a channel can be viewed in terms of the mutual information between the output bits of the encoder (such as an LDPC encoder) at the transmitter and the likelihoods computed by the demapper at the receiver," and it is "influenced by both the placement of points within the constellation and by the labelling assignment." *Id.* at 6:64–7:3. Joint capacity describes "the achievable capacity between the input of the mapper on the transmit side of the link and the output of the channel (including for example AWGN and Fading channels)." *Id.* at 7:18–21.

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