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Paper 10
Entered: February 28, 2019

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ZTE (USA), INC.,
Petitioner,

v.

FRACTUS S.A.,
Patent Owner.

Case IPR2018-01461
Patent 9,054,421 B2

Before PATRICK M. BOUCHER, KEVIN C. TROCK, and JOHN A. HUDALLA, *Administrative Patent Judges*.

BOUCHER, *Administrative Patent Judge*.

DECISION
Denying Institution of *Inter Partes* Review
35 U.S.C. § 314(a)

ZTE (USA), Inc. ("Petitioner") filed a Petition pursuant to 35 U.S.C. §§ 311–319 to institute an *inter partes* review of claims 1, 2, 4–12, 21 and 22 of U.S. Patent No. 9,054,421 B2 ("the '421 patent"). Paper 2 ("Pet."). Fractus S.A. ("Patent Owner") filed a Preliminary Response. Paper 7

("Prelim. Resp."). For the reasons set forth below, we exercise our discretion under 35 U.S.C. §§ 314(a) and 325(d) to deny institution of an *inter partes* review.

I. BACKGROUND

A. The '421 Patent

The '421 patent "relates to an antenna which includes at least one construction element in a multilevel structure form." Ex. 1001, 5:3–5. The patent identifies certain features that characterize such a "multilevel structure." Such features can be illustrated with Figure 1 of the '421 patent, which is reproduced below.

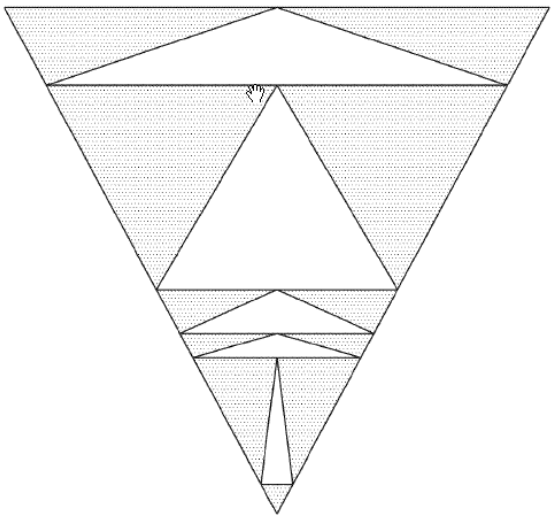

FIG. 1

Figure 1 "shows a specific example of a multilevel element comprising only triangular polygons," which are shown shaded in the drawing, in contrast to the empty space indicated in white. *Id.* at 4:33–34. More generally, a "multilevel structure is characterized in that it is formed by gathering several polygon[s] or polyhedr[a] of the same type," meaning that all of the polygons or polyhedra in the structure have the same number of sides or

faces.[1] *Id.* at 5:5–12, 5:27–30. The gathered polygons or polyhedra are "coupled to each other electromagnetically, whether by proximity or by direct contact between the elements." *Id.* at 5:10–12. In this context, "[a] multilevel structure or figure is distinguished from another conventional figure precisely by the interconnection (if it exists) between its component elements." *Id.* at 5:12–15.

In addition, "[i]n a multilevel structure at least 75% of its component elements have more than 50% of their perimeter (for polygons) not in contact with any of the other elements of the structure." *Id.* at 5:15–18. A consequence of this feature is that "in a multilevel structure it is easy to identify geometrically and individually distinguish most of its basic component elements, presenting at least two levels of detail: that of the overall structure and that of the polygon or polyhedron elements which form it." *Id.* at 5:18–23.

The '421 patent identifies the "most relevant properties" of an antenna having a multilevel structure as: (1) "the possibility of simultaneous operation in several frequency bands in a similar manner (similar impedance and radiation diagrams)"; and (2) "the possibility of reducing their size compared to other conventional antennae based exclusively on a single polygon or polyhedron." *Id.* at 6:46–52. Because "[s]uch properties are particularly relevant in the field of communications systems," the patent

[1] The '421 patent notes that "[n]aturally, this property [of all polygons or polyhedra having the same number of sides or faces] is broken when several multilevel structures of different natures are grouped and electromagnetically coupled to form meta-structures of a higher level." Ex. 1001, 5:30–33.

describes their implementation in a "portable telecommunication device," such as may be used in cell-phone systems. *Id.* at 6:52–7:4.

The '421 patent makes distinctions with other types of antenna systems, namely "fractal antennas" and antenna arrays, that are relevant to the challenged claims. With respect to the former, the '421 patent acknowledges that the multilevel-structure antennas it describes "have their origin in fractal and multitriangular type antennae." *Id.* at 2:10–11. But fractal antennas "are based on fractal geometry, which is based on abstract mathematical concepts which are difficult to implement in practice." *Id.* at 7:6–8. And fractal antennas also suffer from technical limitations such that "it is not always possible, viable or economic to design the antennae maintaining its fractal appearance and at the same time placing the bands at the correct area of the radioelectric spectrum." *Id.* 2:21–25. The '421 patent distinguishes fractal antennas from multilevel-structure antennas in terms of the Hausdorff dimension, which is non-integral for fractal objects. *Id.* at 7:8–10. The numerous structures illustrated in the '421 patent's drawings have an integral Hausdorff dimension (i.e., equal to 2 in the case of the structures shown in Figures 1 and 3–6, and equal to 3 in the case of the structures shown in Figure 7). *Id.* at 7:31–36.

With respect to antenna arrays, the '421 patent provides the following distinction: "Although it is true that an array is formed by sets of identical antennae, in these the elements are electromagnetically decoupled, exactly the opposite of what is intended in multilevel antennae." *Id.* at 7:38–41. The electromagnetic coupling allows a multilevel-structure antenna to be excited only in a few of its elements, while the elements of an array are powered independently. *Id.* at 7:41–48.

B. Illustrative Claim

Challenged independent claims 1 is illustrative of the challenged claims, and is reproduced below.

> 1. An apparatus comprising:
>
> an antenna element having a multi-band behavior and configured to operate in at least first and second non-overlapping frequency bands and comprising a plurality of geometric elements arranged to define empty spaces in the antenna element to provide at least first and second winding current paths through the antenna element, the at least first and second winding current paths circumventing the empty spaces and respectively corresponding to the at least first and second non-overlapping frequency bands to provide the antenna element with the multiband behavior; and
>
> a ground plane, the antenna element being electrically coupled to the ground plane;
>
> wherein the antenna element provides a substantially similar impedance level and radiation pattern in the at least first and second non-overlapping frequency bands;
>
> wherein the geometric elements are arranged such that the antenna element does not comprise a group of single band antennas that respectively operate in the at least first and second non-overlapping frequency bands; and
>
> wherein the antenna element is not a fractal type antenna element.

Ex. 1001, 10:12–34.

C. Evidence

Petitioner relies on the following references:

Ita Saha Misra and S. K. Chowdhury, *Study of Impedance and Radiation Properties of a Concentric Microstrip Triangular-Ring Antenna and Its Modeling Techniques Using FDTD Method*, 46 IEEE Trans. Antennas and Propagations 531 (1996) (Ex. 1003) ("Misra I")

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