UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Commscope Technologies, Inc.
Petitioner,

v.

Communications Components Antenna, Inc.,
Patent Owner.

Case IPR2016-00999
Patent No. 8,311,582
Title: ASYMMETRICAL BEAMS FOR SPECTRUM EFFICIENCY

PATENT OWNER PRELIMINARY RESPONSE TO PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 8,311,582 UNDER 35 U.S.C. §§ 311-319 AND 37 C.F.R. § 42.1 *et seq.*

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1) Exhibit 2001 - Declaration of Mr. Mark Cosgrove in Support of Patent Owner Preliminary Response

2) Exhibit 2002 - Mr. Mark Cosgrove *Curriculum Vitae*

3) Exhibit 2003 - "MIMO and Smart Antennas for 3G and 4G Wireless Systems" 3G Americas - White Paper - May 2010

4) Exhibit 2004- "Twin Beam technology adds immediate capacity without additional antennas" - Commscope -White Paper - May 2013

5) Exhibit 2005 - "Antenna Theory - Analysis and Design" - Balanis - Third Edition 2005 - (portions of chapter 2)

6) Exhibit 2006 - Metawave.com - seminars page - "Seminar 4: Practical Six-Sector Solution" (web.archive.org) - 2001

7) Exhibit 2007 - "Understanding UMTS Radio Network" - Nawrocki et al. - 2006

8) Exhibit 2008 - "Any-G to 4G" - Digi International - White Paper - 2014

8) Exhibit 2009 - "CDMA RF System Engineering" - Yang - 1998

9) Exhibit 2010 - Martek - U.S. Patent No. 5,929,823

10) Exhibit 2011 - Martek - U.S. Patent No. 6,198,434

11) Exhibit 2012 - Elson - U.S. Patent No. 6,317,100

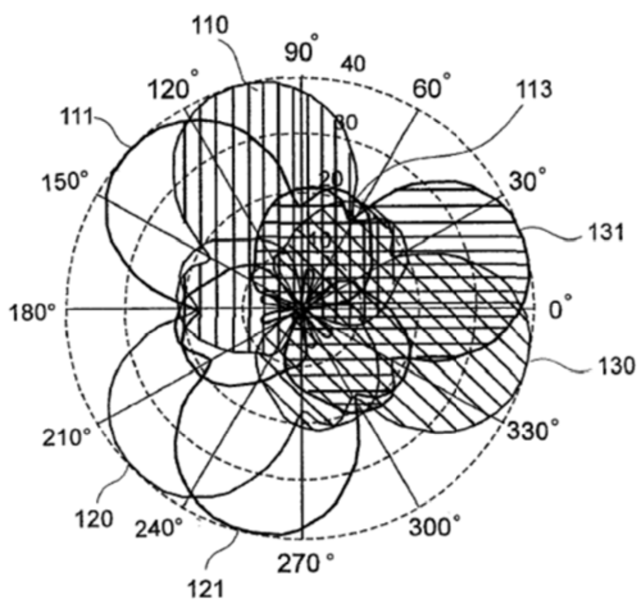
12) Exhibit 2013 - Martek - U.S. Patent No. 6,583,760

I. INTRODUCTION

Patent Owner Communications Components Antenna Inc., (CCAI) submits this Preliminary Response to the Petition filed by Commscope Technologies, seeking *inter partes* review of claims 1-28 of U.S. Patent No. 8,311,582 ("the '582 Patent). The Petition should be denied because it fails to demonstrate a reasonable likelihood of prevailing with respect to any of the challenged claims. The basis of all the Grounds proposed by the Petitioner is the Yea reference – either alone or in combination with other references -- which does not teach or suggest split-sector antennas having asymmetrical coverage areas extending therefrom.

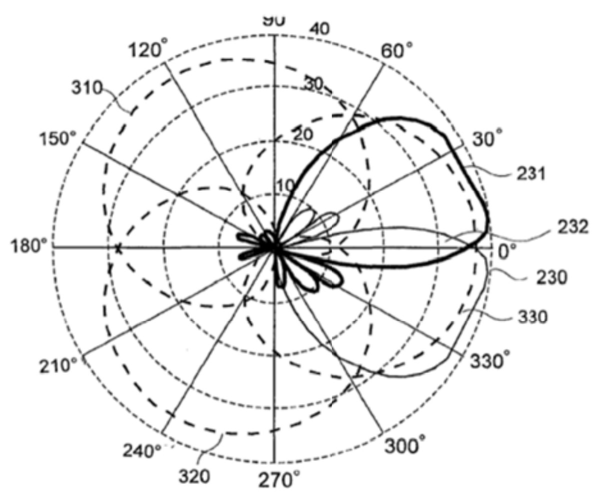
The independent claims of the '582 Patent are directed to an arrangement for replacing existing one or more cellular base station antennas with split-sector antennas that radiate asymmetrical beam shapes in such a way that the new coverage areas of the beams extending from a split-sector antenna are asymmetrical while their corresponding total coverage area are substantially equal to the coverage area of the replaced antenna. Furthermore, the asymmetrical beams are shaped in such a way that the overlap areas of the coverage areas extending from the new antenna are smaller than the overlap areas extending from the replaced antenna. (Ex 1001 - claims 1, 13, and 20).

Prior to the invention of the ’582 patent as claimed, the cellular antenna industry tried many approaches to increase the capacity of a base station to serve ever more increasing cellular phone users. The primary approach was to divide existing sectors within a cell, into smaller sub-sectors so that resources of the base station could be reused over additional sectors. The disadvantage with that approach was that it increased the size of overlap areas between coverage areas of the new sub-sectors. As mentioned by Patent Owner’s expert Mr. Cosgrove, the larger overlap areas required additional resources so as to allow the users travelling from one sector to the next to be seamlessly handed over to an adjacent sub-sector. (Ex 2001 at 46-50). Figure 1 of the ‘582 patent is an exemplary prior art cell site showing the details of such sectors. See Ex 1001 Figure 1 shown below:



PRIOR ART

The inventors of the '582 patent came up with an idea that managed to increase the number of sectors in a given cell of a cellular network without taking away valuable resources for handling handover operations. Contrary to conventional wisdom in the industry that aimed to employ symmetrical beams, the inventors' solution was to provide a split-sector antenna that radiated two or more asymmetrical beam patterns such that at least one of the corresponding coverage areas extending from the antenna define an asymmetrical shape in such a way that the coverage area of the new replacing antenna were substantially the same size of the coverage area of the replaced sector antenna. See Ex 1001 - Figure 3, shown below:



At the same time the beam patterns were shaped in such a way that the corresponding coverage areas had to have a reduced overlap area such that the overlap region of coverage area of the new antennas was reduced compared to the overlap regions of the replaced coverage area. This aspect of the invention allowed for a reduced allocation of resources for handover operations. (*Id*.)

This simple and elegant solution solved a long standing problem faced by the industry and was widely recognized as an effective approach, so much so that few industry wide white papers including one by the Petitioner applauded its effectiveness. (Ex 2001 at ¶ 77-78).

Petitioner's brief and supporting expert declaration fails to establish the necessary criteria required by the Board to institute Review. More specifically, every one of the 8 Grounds in the Petition relies solely on two figures of a single "Yea reference," (Ex 1016) either alone or in combination with other references. While, the text of the Yea reference makes no mention of asymmetrical coverage areas extending from sub-sector antennas, the Petitioner and its expert have spent the major part of their presentation, manually retracing and analyzing those two figures hoping to establish that the coverage area extending from the antenna referred in that reference has an asymmetrical shape, along with other characteristics that read on the '582 patent claims.

The drawings in Yea, however, lack all the perquisites that this Board imposes on prior art figures. These perquisites include the requirement that the prior art drawings are drawn with dimensions that are measurable and scalable, and that the scales are properly identified, and that the range of values and units of measurement are consistent. (Ex 2001 at ¶ 20). None of these are present in the two figures that form the basis for the entirety of the Petitioner's proposed Grounds.

Although the figures of Yea refer to or imply certain scales, it is not clear whether the plots can be accurately measured or whether the dimensions represent a constant ratio relative to the actual dimensions of the antenna pattern. (*Id.*) The Yea reference is a marketing article published in a trade magazine and not a scientific paper, with no teaching on how to recreate those plots. (*Id.*)

Moreover, the plots in Figure 4 of Yea illustrate antenna beam patterns and are drawn in a linear scale. (Ex 2001 at ¶ 21). The plots do not show coverage areas extending from the new antennas as specifically called for in the '582 patent claims. By observing the antenna beam patterns in the Yea plots, a POSITA cannot determine the shape of the coverage areas extending from the Yea antennas when the beam patterns are plotted in a linear scale. Although there is a one to one relationship between a logarithmic scale beam pattern and its corresponding coverage area, there is no such relationship between a linear scale beam pattern and its corresponding coverage area. (*Id.*)

More significantly, when the linear scale of the plots in Figure 4 of Yea is converted to a logarithmic scale, it becomes obvious that the plots do not have enough data points to show the coverage areas extending from the antenna called for in the ’582 patent. (*Id.* at ¶ 22-23).

The plots depicted in Figure 8 of Yea reference have their own deficiencies as well. Figure 8 plots illustrate the carrier to interference (Ec/Io) ratio pattern of the antennas. Because the ratio includes noise values from neighboring cells, the plots do not show the antenna radiation pattern, and cannot be used to show whether the coverage area extending from the new antennas is symmetric or not. (*Id.* at ¶ 24-25).

Aside from the shortcomings of the figures of Yea, it is telling that the company that manufactured the antenna described in that reference obtained at least four United States patents directed to antenna systems that viewed the asymmetrical beam patterns as a distortion to be avoided. During that time, another major cellular company, Ericsson, obtained the Wästberg patent (Ex 1018 - col. 5, lines 63-65) cited by the Petitioner, that viewed any asymmetry that is caused by sub-sector antennas as a negative characteristic that should be avoided. (Ex 2001 at ¶ 26-28).

It was only after the ’582 patent was filed that for the first time the industry acknowledged the concept of introducing and sculpting asymmetrical beam patterns so that coverage areas extending from the sub-sector antennas would have an asymmetrical shape. At least two White Papers, one published by the 3G Americas (*Id.* at ¶ 30-31), and the other by the Petitioner itself (*Id.* at ¶ 32), acknowledged the concepts called for by the ’582 patent claims as ground breaking allowing the operators to achieve “the theoretical doubling of sector capacity.”

Accordingly, Petitioner has failed to establish a reasonable likelihood of prevailing, and Patent Owner requests that the Patent Trial and Appeal Board (“Board”) deny institution of *inter partes* review.

II. OVERVIEW OF THE ’582 PATENT

Cellular communications technology is based on splitting a particular area into several “cells”, each of which is allocated a specific amount of resources to cater to a specific number of users or subscribers. To service a larger number of users, the operator needs to increase the number of such cells. (Ex 2001 at ¶ 42- 50). Initially, each cell employed an omni-directional antenna, located in the center of its coverage area. The omni-directional antenna emitted signals uniformly in a single plane in a 360-degree coverage area. (*Id* at ¶ 44-45).

The signal intensity of the omni-directional antenna, however, was not satisfactory in the outer fringes of the coverage area, causing calls to be dropped. The capacity of the system was also limited due to the unrestricted spillover of signal in all directions. (*Id.*)

To overcome the problems of omni-directional antennas, the concept of "sectorization" was introduced. Instead of a single omni-directional antenna, a number of directional or sector antennas were deployed. Such antennas divided the cell into a number of "sectors", thereby restricting the coverage of each sector antenna to a limited coverage area as compared to the circular "omni-area" covered by the omni-directional antenna. Each directional antenna, catered to subscribers in a corresponding sector by emitting a single symmetric beam. Typically, a 360-degree "cell" was split into three sectors using three directional-antennas, with the symmetric beams extending from each antenna covering a sub-coverage sector of 120 degrees. (*Id.* at ¶ 46).

As demand grew, adding more sectors was seen as a simple way of increasing capacity without the need for building new sites. However, adding new sectors increased the overlap between the sectors causing problems. Put simply, overlap areas cause interference, resulting in a situation where mobile phones have to process indeterminate dominant signals, leading to an excessive use of resources to handle the calls travelling through the overlap areas. These resources are referred to as overhead signaling, while the overlap areas are referred to as handover regions. Further, between the added sectors, an area of weak signal strength was also created. This weak signal strength area, in turn, caused spectrum inefficiency. (*Id.* at ¶ 47).

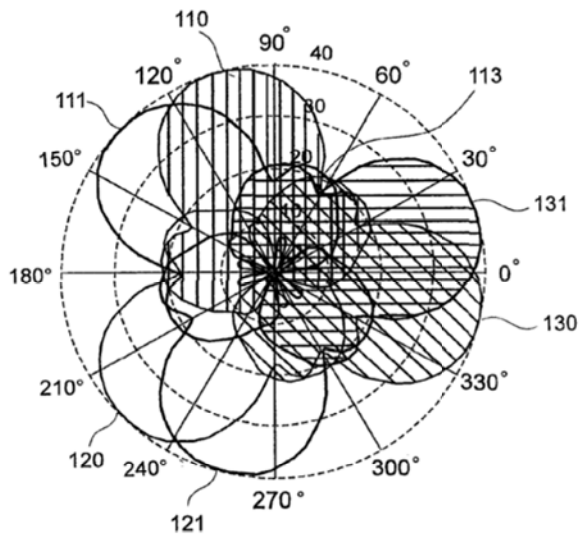
Apart from the technical disadvantages associated with increasing the number of sectors using directional antennas, creation of a new sector meant installing new conventional antenna on telecom towers at great cost without justifiable spectrum efficiency, in terms of user experience and subscriber capacity. (*Id.* at ¶ 48).

In addition to higher sectorization solutions, another approach called cell-splitting was introduced. Cell-splitting refers to the process of reducing the coverage of an existing cell site and introducing a new cell site in the newly created coverage hole. (Ex 1001 - col. 2, lines 64-67). However, cell-splitting is very expensive, since it requires new locations for the tower and equipment for the new site. (*Id.* at col. 3, lines 1-5) (See also Ex 2001 at ¶ 49). The problems associated with higher order sectorization and cell splitting, made the market of telecom antennas reach a saturation point. Cellular operators were unable to cope with increasing subscriber base, without compromising its spectrum efficiency. (*Id.* at ¶ 50).

The invention claimed in the ’582 patent managed to solve many of the deficiencies described above. The claims of the ’582 are directed to an improved arrangement where one or more sub-sector antennas replace an existing sector antenna. The sub-sector antenna is configured to generate a pair of asymmetrical beam patterns to form an asymmetrical coverage area extending from the antenna, in such a way that the total critical coverage area of the newly installed beam patterns are substantially equal to the critical coverage area of the replaced sector antenna, while at the same time the overlap area between the pair of the sub-sector coverage areas is reduced compared to the overlap of the replaced antenna. (Ex 1001 - col. 10, lines 3-23).

In order to observe and study the coverage areas extending from an antenna, the beam patterns or antenna patterns or radiation patterns are generated. An antenna pattern is often defined as a mathematical function or graphical representation of the radiation properties as a function of space coordinates. In most cases, the radiation pattern is defined in the far-field region and is represented as a function of directional coordinates. (Ex 2001 at ¶ 54).

Figure 1 of the '582 patent illustrates a polar plot horizontal pattern in a cell that is designed for a six-sector division, as reprinted below:



PRIOR ART

The plot shows the power emission in each direction around the 360 degrees horizontal plane as discussed by Patent Owner's expert Mr. Cosgrove. (Ex 2001 at ¶ 56). As mentioned in the '582 specification, antenna beam patterns had been consistently symmetrical, such as the illustrated 3 mirror-imaged pairs of symmetrical sub-sector beams. As shown previously, a coverage area corresponding to these beam patterns has large overlap regions between pairs of adjacent beams. (*Id*).

Larger overlap regions mean increased handoff or handover operations. As a subscriber moves between sectors and cells, a call is automatically transferred, through a handover process from one coverage region of an antenna to an adjoining coverage region. Excessive overlaps between antenna coverage areas lead to reduction of system capacity. This reduction in system capacity occurs because a substantial portion of system resources needs to be allocated to signals that coordinate the call for the users who are travelling in the handover regions. (*Id.* at ¶ 57).

As illustrated in the figures of the '582 patent, the polar plots of the antenna patterns are scaled logarithmically in decibels. This is due to the large range in power levels that need to be considered in order to observe the entire coverage area extending from the antenna. Furthermore, when the antenna beam patterns are plotted in a logarithmic decibel scale the corresponding coverage area of the antenna has a one to one relationship with the beam pattern and, as such, the antenna beam pattern and its corresponding coverage area extending from it can be observed interchangeably. (*Id.* at ¶ 58).

To this end in order to determine whether a reference discloses the asymmetrical coverage areas that extend from the antenna, it is necessary to observe the entire coverage area described or illustrated in the reference. In other words, the coverage areas, are those that extend all the way from the antenna towards the outer edge of the cell. For example, as illustrated in Figures 1-4 of the '582 patent, the logarithmic scale used to illustrate the claimed invention spans 10 decibels per division with a full range of 40 decibels or 40 dBs.

As such, the Figures 1-3 of the '582 patent are drawn in a logarithmic polar plot, the outside value being a normalized 40 dB and the inside value being zero dB. (*Id.* at ¶ 59).

The ’582 patent specification describes the antenna polar plot and its logarithmic scale in more detail as follows:

> “For ease in use, clarity and maximum versatility, radiation plots are usually normalized to the outer edge of the coordinate system. Furthermore, signal strength is not normally thought of in terms of strength in volts, microvolts, etc., so radiation plots are usually shown in relative decibels (dB).
>
> Decibels are used to express differences in power in a logarithmic fashion. A drop of 1 dB means that the power is decreased to about 80% of the original value, while a 3dB drop is a power decrease of 50% or one-half the power. The beam width specified on most data sheets is usually 3 dB or half-power bandwidth. A 10 dB drop is considered a large drop, a decrease to 10% of the original power level.” (Ex 1001 - col. 5, lines 30-42).

The 40 dB range is consistent with the range of values of the antenna pattern illustrated in every reference cited by the Petitioner, to show the coverage areas extending from the antenna, except for the Yea reference. *(Id.)*

The ’582 patent does away with a significant number of limitations and disadvantages associated with all the technologies in the prior art. The distinguishing feature of the split-sector antenna is that it has a design that generates asymmetric beam pattern or shape, in such a way that radically alters the efficiencies and practicalities of higher order sectorization. (Ex 1001 - Figure 1 - showing prior art symmetrical sub-sector beams). This is achieved by shaping or "tailoring" (Ex 1001 - col. 3, lines 11-13) the corresponding asymmetrical coverage areas of the beam patterns extending from the antenna, so that they are substantially equal to the critical coverage area of the replaced antenna and further that the overlap between the subsectors are reduced compared to the overlap of the replaced antenna beam patterns. (Ex 1001 - claims 1-28) (See also Ex 2001 at ¶ 63-64).

Another important aspect of the '582 patent is the flexibility afforded by this asymmetrical beam pattern configurations, which allows the operator of an existing 3 sector site to decide which one of the sector coverage areas of the three sectors need to be replaced with a split sector array as illustrated in Figure 3 of the '582 patent as shown below:

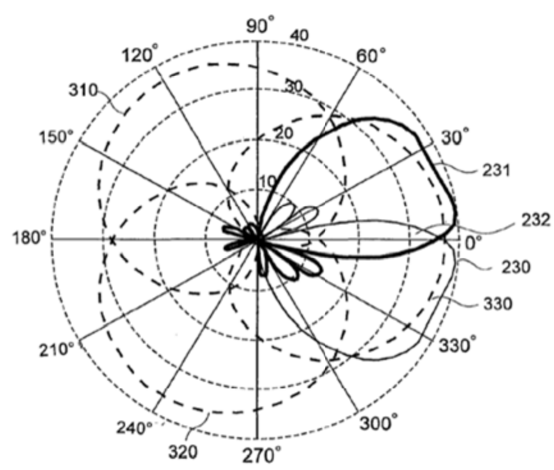


Figure 3 of the '582 patent

As shown above, the asymmetrical sub-sector beam patterns also exhibit a sharp roll off in area 232 where they overlap. This sharp roll off on one side reduces the overlap region compared to the traditional overlap regions generated by symmetrical beam patterns employed in higher sectorized cell structures as shown in Figure 1 of the ’582 patent. (Ex 1001 - col. 5, lines 19-24) (See also Ex 2001 at ¶66). Because of the asymmetrical pattern of the beams extending from the antenna, the asymmetrical coverage area generated from the split sector antenna also extend to the edge of the replaced coverage area leaving at the edges of the new coverage area a smaller region of coverage hole than before. This is the region that users experience dropped calls.

As further stated in the ’582 specification, “[b]ecause the beam patterns of the new antenna corresponding to a sector to sub-sector upgrade have largely the same overall beam pattern as the antenna being replaced, as shown in Fig. 3, upgrades would be made relatively transparently with regard to network planning, resulting in more efficient use of resources.” (Ex 1001 - col. 5, line 64 to col. 6, line 3).

The ’582 patent describes and summarizes its advantages in Table 1 of the specification. The data illustrated in Table 1 relates to an embodiment where only one of the three sectors has been upgraded to a split sector antenna. In all important categories the upgrade exhibits significant improvements. For example, the improvement in handover overhead in one sector is about 9.2% compared to the configuration before the upgrade. As will be discussed later in connection with the prior art references cited by the Petitioner, there is no teaching or suggestion of an improved handover overhead in a higher sectorized cell configuration. (Ex 2001 at ¶ 70).

With the above teachings from the specification of the '582 patent in mind, claim 1 of the patent states:

> "A method for increasing subscriber capacity in a sectorized cellular communications network having a plurality of subscribers and a base station supporting at least one sector, each of the at least one sector having one or more associated sector antennae at the base station having a critical coverage area extending therefrom and overlapping neighbouring sectors thereof in a sector handover zone, the method comprising a step of:
>
> **replacing the associated one** or more sector antennae for a given sector with a split-sector antenna having a plurality **of sub-sector coverage areas extending therefrom,** at least one of which is **asymmetrical**, each corresponding to a sub-sector and overlapping a neighbouring sub-sector coverage area in a sub-sector handover zone,
>
> whereby a **total critical coverage area** provided by the plurality of sub-sector coverage areas is substantially **equivalent** to a **critical coverage area of the replaced** one or more associated sector antennae,
>
> wherein said at least **one asymmetrical sub-sector coverage area reduces overlap** with said neighbouring sub-sector coverage area comparing to overlap of the replaced antennae while maintaining the critical coverage area of the replaced antenna." (Ex 1001 - col. 10). (emphasis added).

Although the beams in the prior art systems typically used in six sector applications were referred to as "symmetrical beams", in some applications that employed multi-beam antennas, there was a degree of uncontrolled asymmetry associated with such beams owing to factors, including the phenomena of beam steering away from the main axis, manufacturing tolerances, imprecise control of electrical signals, coupling effects between closely spaced elements and other aspects of the design process such as scan loss for offset beams. As mentioned by Patent Owner's expert, and as evidenced by the industry's research and development, this asymmetry was viewed as a defect in the prior art, and was in fact sought to be removed. (Ex 2001 at ¶ 71).

In fact Metawave Communications the company that manufactured the Spot Light 2000 featured in the Yea reference, filed numerous patent applications at around the same time, directed to eliminating the asymmetry of the beam patterns generated by their antennas. (Ex 2001 at ¶ 72).

Such undesired asymmetry in the radiation patterns of multi-beam antennas was, therefore, never seen or described as an advantage in the prior art, and had been either accidental or an unfortunate consequence of design process. In other words, there was no teaching, suggestion or motivation for any person to deliberately create a desired asymmetry in the antenna beam patterns in prior art, nor there was any attempt ever made to enhance or functionalize such asymmetry to exploit any new advantages, especially to achieve the advantages discussed and claimed in the ’582 patent, such as creating asymmetrical coverage areas extending from sub-sector antennas. (Ex 2001 at ¶ 73).

The technology employed and claimed by the ’582 patent deliberately introduces a desired asymmetry to the beam shape, so that the asymmetrical coverage area extending therefrom can be used to overcome several shortcomings associated with prior art, without having any impact on the network planning of a cellular operator. (*Id.* at ¶ 74).

It was only after the ’582 patent was filed that for the first time the industry acknowledged the concept of introducing asymmetrical beam patterns so that coverage areas extending from the sub-sector antennas would have an asymmetrical shape. At least two White Papers, one published by the 3G Americas and the other by the Petitioner itself, acknowledged and applauded the concepts called for the ’582 patent claims.

The industry wide 3G Americas White Paper dedicated an entire section to discuss the fixed multi-beam array antennas providing a pair of asymmetrical beam patterns “to address the need of increasing capacity in high-density macro-cell sites,” where “fixed multi-beam antennas can provide an effective solution using multiple fixed beams.” The asymmetrical beams are reprinted below:

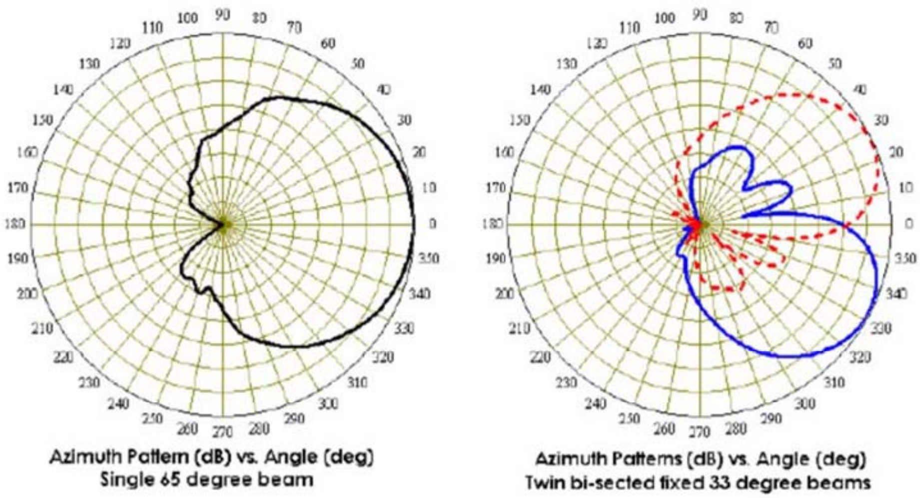
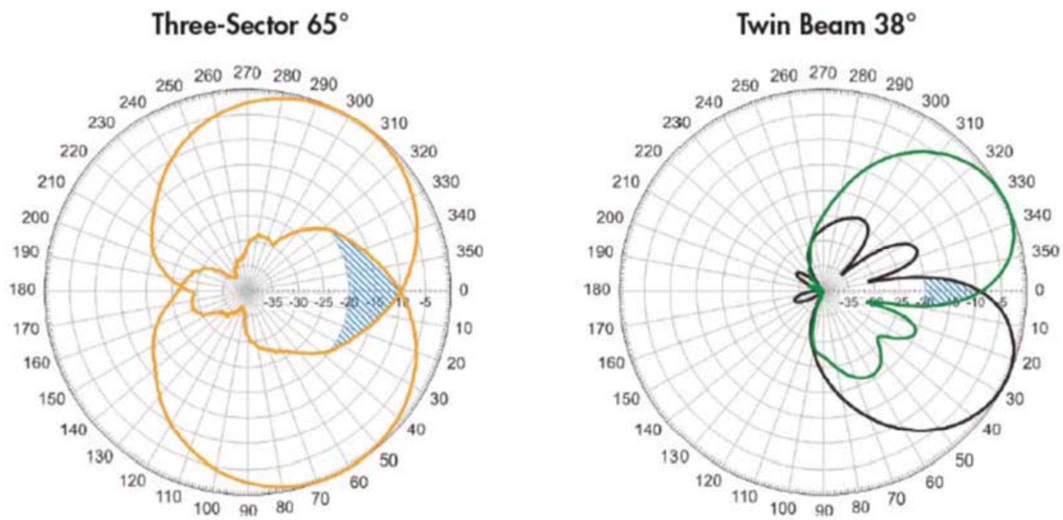


Figure 24. Single 65-degree antenna and twin fixed 33-degree beams.

wherein, "the patterns on the right show the paired asymmetrical azimuth beams created by a twin beam antenna." (Ex 2003 - pg. 41 at § 4.3) (See also Ex. 2001 at ¶ 77).

Petitioner Commscope also published a White Paper that recreated the asymmetrical beam patterns as a way to achieve the "theoretical doubling of sector capacity." (Ex 2004 – Pg 6-7). The paper shows the asymmetrical beam patterns that look exactly the same as the 3G America's beam patterns, introducing the same asymmetrical coverage areas called for in the '582 patent claims. See Ex 2004, Figure 4 reproduced below:

Figure 4



The advantages of the optimized asymmetrical beam shape/pattern of the ’582 patent as acknowledged and applauded by the industry, including the Petitioner, are that it significantly reduces gaps/voids in the existing coverage areas, and that it minimizes the interfering overlap between the two neighboring beams, while covering substantially the same critical coverage area as covered by the replaced beam(s).

III. THE PETITION SHOULD BE DENIED BECAUSE IT FAILS TO DEMONSTRATE A REASONABLE LIKELIHOOD OF PREVAILING AS TO ANY CHALLENGED CLAIM

A. Level of Ordinary Skill in the Art

Petitioner alleges that a person of ordinary skill in the art would be “a person having at least a bachelor’s degree in electrical engineering (or equivalent) and at least 3 years of experience working on cellular antenna technology (or equivalent). Alternatively, a POSITA could have a Master's Degree in electrical engineering (or equivalent) and at least 2 years of experience working on cellular antenna technology or a Ph.D. Degree with research related to antenna technology and at least 1year of experience working on cellular antenna technology." Ex. 1024 at ¶ 53.

Petitioner offers no testimony at all from such a person as of the effective filing date of the '582 patent or from one who would have known what such a person would have understood as of that date.

For purposes of its Preliminary Response, however, Patent Owner accepts Petitioner's asserted level of ordinary skill in the art but reserves the right to offer an alternative if this *inter partes* review is instituted.

B. Claim Construction

In this proceeding, claim terms should be given their broadest reasonable interpretation absent a clear definition to the contrary in the patent. 37 C.F.R. § 42.100(b); *Cuozzo Speed Techs., LLC v. Lee,* 136 S. Ct. 2131, 2146 (2016). Because the claim terms are not afforded such a definition, they should be given their broadest reasonable construction as understood by one of ordinary skill in the art and consistent with the disclosure.

The Petitioner has proposed a construction for "**A plurality of sub-sector coverage areas extending therefrom, at least one of which is asymmetrical,"** to mean a “plurality of replacement sub-sector beams, at least one of which has an asymmetrical shape.” (Petitioner’s Request, p. 29). There is no reason to construe this term any differently than its ordinary meaning. To this end, the ‘582 patent specification supports each of the terms in this element of the claim. The specification distinguishes the concept of beam patterns from their corresponding coverage area as such:

> Accordingly it is desirable to provide an antenna with beam patterns that are tailored for specific sector coverage. (Ex 1001 col. 3, lines 11-12).
>
> …
>
> The present invention accomplishes these aims by replacing a single sector coverage area with at least one coverage area, at least one of which is asymmetrical. The use of asymmetrical coverage areas permits the total coverage area to closely approximate the symmetrical sector coverage area being replaced…(Ex 1001, col. 3, lines 16-23).

This element of the claim, requiring the arrangement, wherein “the sub-sector coverage areas extending therefrom, at least one of which is asymmetrical,” was part of the claim language of the parent priority application of the ‘582 patent as originally filed on March 17, 2006. (Ex 1001 pp 718, 731). As such the claim requires that the “coverage area” of the sub-sector antennas that “extends therefrom” to be “asymmetrical.” This may or may not be equivalent to the beam pattern, but the claim is clear that it is the “coverage area,” “extending from” the sub-sector antenna that needs to meet certain limitations including the asymmetry and the remaining "whereby" and "wherein" clauses of the claim.

Petitioner's proposed construction unduly changes the scope of this term by suggesting that this term means any "replacement beam pattern," that is asymmetrical.

Patent Owner expressly reserves the right to assert a different claim construction for any term if the Board decides to institute a Review in this proceeding, or if the '582 patent would be a subject to a litigation in a different proceeding. Otherwise, Patent Owner believes that the terms of the '582 patent are clear and do not require any construction beyond their ordinary meaning.

C. Yea Does Not Anticipate Claim 1 of the '582 Patent

The Yea Reference

A considerable portion of Petitioner's expert declaration concentrates on the Yea reference (Ex 1016). In fact, all 8 Grounds in the Petitioner's brief rely upon the Yea reference either alone or in combination with other references. Fundamental to the Petitioner's position is its argument that Yea discloses asymmetrical coverage areas extending from the split-sector antennas. If the Board concludes that Yea does not teach or suggest such a limitation, Petitioner's Request should be denied.

The Smart Antenna system discussed in the Yea reference is a system for higher order sectorization of cell sites. The key feature of the system is that the antenna beam patterns can be synthesized to achieve their shapes. As mentioned by Petitioner's expert, the Technology Brief page of the Metawave Website teaches that "Spot Light 2000's Sector Synthesis technology allows precise and flexible customization of CDMA antenna radiation patterns . . . Spot Light 2000's software-controlled multibeam antennas display much sharper sector rolloff than do conventional antennas . . . Additionally, Sector Synthesis gives the operator the ability to reposition handoff zones from high-to low-traffic areas, further reducing handoff overhead." (Ex 1015 at pg. 16) (See also Ex 1024 at ¶ 130).

To this end Yea's Smart Antenna managed to decrease its handover regions by synthesizing beams that had "much sharper sector rolloff" than the prior art systems. (Ex 2001 at ¶ 90-91). See also, Metawave's website that explains:

> "The Achilles heel of the typical six-sector deployment with conventional antennas is handoff overhead…The amount of handoff overhead of a cell is proportional to the number and the size of handoff regions where sector and cell footprints overlap. Unfortunately, conventional antennas typically display gradual rolloff characteristics, which produces large handoff zones.
>
> By contrast, the rolloff of SpotLight 2000's software-controlled, multibeam antenna array is so sharp that a SpotLight 2000 six-sector site has just slightly more handoff overhead than a conventional three-sector site. The result in commercial service has been up to 75% more CDMA capacity than the three-sector baseline configuration. (Ex 2006 - pg 1)

The Yea reference lacks the necessary teaching or suggestion to a POSITA to come up with the inventive features of the ’582 patent as claimed.

a. The Yea Reference Does Not Teach or Suggest The Step of “Replacing The associated one or more sector antenna for a given sector,”

The Yea reference discusses a higher order sectorization solution, similar to all prior art higher order sectorizations schemes relied upon by the Petitioner. All these solutions implement an arrangement that requires replacing all of the antennas of the 3-sector configuration with a new set of antennas based on the order of sectorization. The Smart Antenna’s contribution to the art was the ability to synthesize the antenna beams with sharp rolloffs so as to reduce the overlap regions. (Ex 2001 at ¶ 93).

The Petitioner’s claim chart with respect to item 1.3 discusses the higher order sectorization schemes envisioned by Yea which includes four, five and six sector configurations. (Ex 1024 - pg. 85). However, Petitioner has not pointed out to any portion of the Yea reference that discusses the claimed feature of the ’582 wherein only one sector antenna can be replaced.

More specifically, there is no teaching or suggestion in Yea where only one sector of a 3 sector configuration can be replaced with a new antenna as called for in the independent claims. The Smart Antenna system described in the Yea reference requires all three antennas to be replaced regardless of whether the site is configured for three, four, five or six sectors:

> With a smart antenna system, **as few as three antennas do the job,** regardless of whether the site is configured for three, four, five, six sectors. (Ex 1016 - pg. 5 (emphasis added))

In fact, the Yea reference teaches away from the concept of replacing only one sector antenna. Once the Yea's Smart antenna with as few as three antennas is installed, sectorization changes are controlled by an algorithm as stated at page 15 of the Yea reference:

> "Flexible smart antenna technology makes it practical for an operator to take a three-sector antenna site to a four-, five-, six-sector site and back again as traffic and RF demands change. As an example of the real-world uses of this feature, imagine implementing a three-sector smart antenna solution to balance traffic loading in a highly imbalanced cell. A year later, after new shopping mall, freeway and housing development have appeared within the footprint of the cell, one might conclude that the heavy loading across all three sectors indicated a six-sector solution. And a year later after that, one might decide to take the site back to four sectors to help manage pilot pollution arising from a new neighboring off-load site. **Smart antennas can provide the flexibility to make such a change with minimal base station equipment changes and with no changes whatsoever to the antennas on the tower. (**Ex 1016 - pg. 15 (emphasis added))

Thus according to Yea once its minimum three antennas are installed, there is never a need to replace one of the antennas to accommodate a higher sectorization configuration, as all the network planning is handled by a smart software algorithm.

Since the claims of the '582 patent allow for replacing one or more sector antennas, and the Yea reference requires the replacement of at least three antennas, Yea does not anticipate or render obvious the claims of the '582 patent. (Ex 2001 at ¶ 95-96).

b. The Yea Reference Does Not Teach or Suggest replacing "with a split-sector antenna having a plurality of sub-sector coverage areas extending therefrom, at least one of which is asymmetrical"

Petitioner's and its expert acknowledge that there is no indication that the text of the Yea reference teaches or suggest the asymmetrical nature of the antenna radiation patterns. That is an important concession, considering the importance of the asymmetrical coverage area in the claimed invention. The '582 patent refers to the term "asymmetrical" at least 37 times compared to the complete absence of such a term in Yea. Undaunted, Petitioner relies on its expert's interpretation of Figures 4 and 8 alone, to establish the fact that Yea indeed teaches an asymmetrical beam pattern that meets all the limitations recited in claim 1 of the '582 patent.

D. Perquisite Standard for Prior Art Drawing

Time and again this Board has denied petitions to institute trial when the only teaching that the Petitioner relied upon were drawings that were not drawn to scale, or lacked measurements, or where the text accompanying the drawings was silent on the issues petitioner aimed to prove.

For example the Board in *Instradent USA, Inc. v. Nobel Biocare Services, AG,* IPR2015-01784 slip op. p. 8 and 25 (February 17,2016) stated that in assessing the prior art, "[i]t is well established that patent drawings do not define the precise proportions of the elements and may not be relied on to show particular sizes if the specification is completely silent on the issue," (citing *Nystrom v. Trex Co.,* 424 F.3d 1136, 1149 (Fed. Cir. 2005). *See also* MPEP § 2125 ("When the reference does not disclose that the drawings are to scale and is silent as to dimensions, arguments based on measurement of the drawing features are of little value.").

Similarly, in *Epic Lift Systems, LLC v. Integrated Production Services, Inc.* IPR2015-00430 slip op. p.4-5 (July 28, 2015), this Board held that "drawings cannot be relied on to disclose dimensions or proportions absent a disclosure in the specification of dimensions or proportions, or a disclosure that the drawings are drawn to scale." *See also, Fujian Newland Computer Co., Ltd. v. Hand Held Products, Inc.* IPR 2013-00595 slip op. p.9 (May 4, 2015) (Figures not drawn to scale are not reliable), *Toshiba Corporation v. Optical Devices, LLC* IPR 2014-01440 slip op. p. 3-4 (April 15, 2015) (drawings and pictures must clearly show the claimed element, or the specification must describe the drawings).

For all of the same reasons, Petitioner's reliance on Figures 4 and 8 of

Yea must be rejected.

a. Figures 4 and 8 of Yea Do Not Show or Suggest A Split-Sector Antenna Having an Asymmetrical Coverage Area Extending Thereof

While the Petitioner's expert Mr. Collins relies heavily on Figure 4 of Yea, shown below,

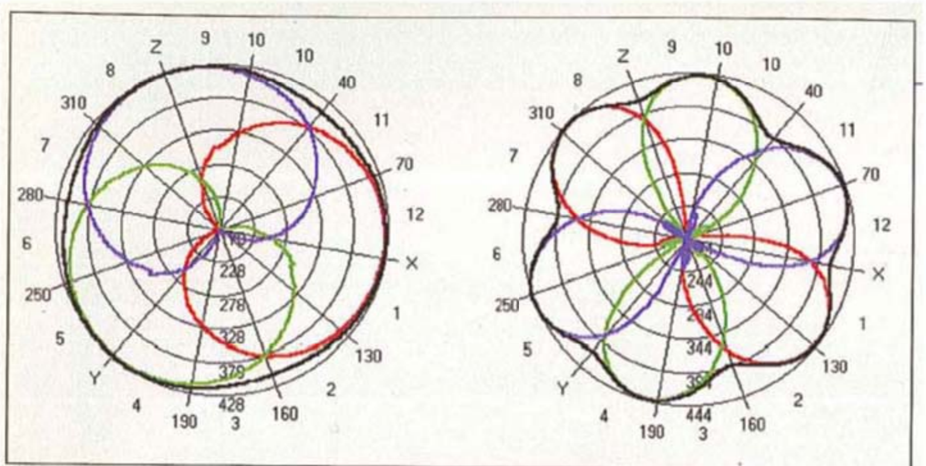


Figure 4. ERP plots comparing antenna patterns of the three-sector baseline configuration (left) and the SpotLight 2000 six-sector configuration (right).

he fails to address the following deficiencies (Ex 2001 at ¶ 102-103) .

First, although the plots in Figure 4 refer to scales, it is not clear or evident whether they can be accurately measured or whether the dimensions represent a constant ratio relative to actual dimensions of the antenna pattern.

Second, the plots are clearly marked in a scale commensurate with ERP (Watts), which is a linear scale. Furthermore, the left and the right plots use different linear scales and hence cannot be simply overlaid on each other.

Third, the linear scale of the plots is in sharp contrast with the logarithmic scale of the '582 patent plots. Although there is a one to one relationship between a logarithmic scale beam pattern and its corresponding coverage area extending from the antenna such as the one shown and discussed in the '582 patent, there is no such relationship between a linear antenna pattern and its corresponding coverage area as used in Yea Figure 4. As such a POSITA cannot discern the coverage area extending from the antenna in the Yea reference, other than assume that it is symmetric.

Fourth, since the plots in Yea are drawn in a linear scale, they must be converted to a logarithmic scale if one desires to observe the coverage area extending from the Yea antenna. When the linear scale of the Yea figure 4 plots are converted to a logarithmic scale, it becomes apparent that the Yea plots do not show the entire coverage area extending from the antenna. They only show a 4dB range from the outside perimeter of the cell. Furthermore, the left and the right plots use different linear scales and hence cannot be simply overlaid on each other.

Fifth, the claims of the '582 patent refer to one or more split-sector "antenna having a plurality of sub-sector coverage areas extending therefrom, at least one of which is asymmetrical." As pointed out in the '582 patent, radiation patterns extending from an antenna span around 40dB's of coverage. As such, in order to consider any prior art reliably, the prior art must show the entire coverage area extending from the antenna as called for in the claims of the ’582 patent and supported by the radiation plots in its specification. Yea’s 4dB range fails to even come close to meeting that requirement.

Sixth, Mr. Collins’ states that “the shape of polar patterns plotted using any of these conventions will be identical provided the radial scale spans the same number of decibels.” (Ex 1024 at ¶ 60). Petitioner’s argument fails its own standard, when the Yea plots miss almost 36 dB’s worth of data extending from the antenna.

b. Detailed Discussion of Figures 4 and 8 Deficiencies

The plots shown in Figures 4 and 8 of Yea do not teach or suggest the concept of desired asymmetrical beam shape patterns as called for by the claims of the ’582 patent. The Yea reference was printed as a marketing material rather than a scientific journal, and therefore it is not clear whether the plots can be accurately measured or whether the dimensions represent a constant ratio relative to the actual dimensions of the antenna patterns, yet alone the dimensions of the coverage area extending from the antenna. (Ex 2001 at 103). Petitioner’s expert, Mr. Collins does not even indicate whether the articles presented to the publication are peer reviewed. More importantly, there is no explanation in the text of the article that there is sufficient underlying parameters disclosed that can allow a POSITA to scientifically and reliably recreate the plots to scale. (*Id.*)

Mr. Collins has analyzed the plots based on recreating them through copying the drawings and tracing the copied patterns and applying his analysis to the traced lines. (Ex 1014 and Ex 1017). Without any explanation in the text of the Yea reference, such an analysis is misplaced and is also highly error prone and misleading.

It is clear that the plots in Figure 4 of Yea reference are plotted in a linear scale. Ex 2001 at ¶105 . To this end, Mr. Collins, points out that the plots of Figure 4 of the Yea reference are identified as ERP (Effective Radiated Power), but fails to point out that these plots are expressed in Watts of power. A POSITA can quickly identify that the values depicted in Figure 4 of the Yea reference represent a linear scale and are consistent for known antenna systems of this era (444W is equal to a 20 W MCPA with 3dB cable attenuation and a typical antenna gain of 16.5 dB) and hence the numbers attributed to the ERP would be instantly recognizable as Watts of power. (*Id.*)

As explained in Mr. Cosgrove's declaration, the significance of representing an antenna pattern in a linear scale is that the pattern does not have a one to one relationship with its corresponding coverage area, whereas an antenna beam pattern shown in a logarithmic scale and its corresponding coverage area provide a one to one relationship. This is because radio signals attenuate as an exponential function of a distance from antenna. (Ex 2001 at ¶ 106). As such, by looking at the linear scale antenna pattern of Yea's Figure 4, a POSITA cannot surmise the shape of the coverage area corresponding to the antenna pattern. (*Id.*)

Furthermore, the plot on the right hand side of Figure 4 illustrates the concentric rings that are clearly marked as 428, 378, 328, 278, 228, and 178 (decreasing rings of 50 intervals). In the left plot the concentric rings are clearly marked as 444, 394, 344, 294, 244, and 194 (decreasing rings of 50 intervals.). The numbers on the right plot do not match with the numbers on the left plot. As such, even a "before and after" comparison within the same plots is not without error. (Ex 2001 at ¶ 108-110).

While Mr. Collins recognizes the need to compare apples to apples he fails to follow his own advice, when he stated in his declaration that "before visually comparing radiation patterns, **it is very important to make sure** that they are plotted using the same scales." (Ex 1024 at ¶ 19 (emphasis added)).

Following Mr. Collins' advice, in order to compare apples with apples, a POSITA must first convert the linear scale of the Yea reference to the logarithmic scale employed and depicted in the '582 patent. The conversion from Watts to dB follows a well-known mathematical formula, resulting in a table as follows:

	Power Levels of Fig 4 Left			Power Levels of Fig 4 Right		
	(Watts) ["A"]	dBm ["B"]	Attenuation from peak (dB) [Max(A)-B]	(Watts) ["A"]	dBm ["B"]	Attenuation from peak (dB) [Max(A)-B]
1.	428	56.3	0.0	444	56.5	0.0
2.	378	55.8	0.5	394	56.0	0.5
3.	328	55.2	1.2	344	55.4	1.1
4.	278	54.4	1.9	294	54.7	1.8
5.	228	53.6	2.7	244	53.9	2.6
6.	178	52.5	3.8	194	52.9	3.6

As can be seen from the last column, in a logarithmic scale the range of numbers depicted in each plot is less than 4 dBs. (*Id.* at ¶ 111-112). The concentric circles in the '582 patent span 10 dB's starting from 40 dB going down to 30 dB, then to 20 dB, then to 10 dB, etc. In sharp contrast, the concentric circles in Yea Figure 4 do not span the same number of decibels. In fact the concentric circles of Yea are not constant in the logarithmic domain, starting at 0.5dB, decreasing by 0.7dB, and then by 0.8 dB and then by 0.9 dB, as opposed to the concentric circles of the '582 patent plots that span at around 10dB from one circle to the next covering a maximum range of about 40dB's. (Ex 2001 at ¶ 113).

Later Mr. Collins again states that "the shape of polar patterns plotted using any of these conventions will be identical, **provided the radial scale spans the same number of decibels.” (**Ex 1024 at ¶ 117 (emphasis added)). From the table above, it is evident that the plots in Figure 4 of Yea do not have the same radial scale as the plots in the ’582 patent, and do not show the shape of the coverage area extending from the antenna to the outer portions of the cell. (*Id.)*.

As mentioned before, the polar plot horizontal radiation pattern shows the power emitted by an antenna in horizontal plane, and is usually expressed in the decibel scale. This is due to the large range in power levels that need to be considered in order to observe a coverage area fully from where it extends from the antenna to the outer perimeter of a cell. The ’582 patent claims specifically call for such an observation when the claims refer to “a split-sector antenna having a plurality of sub-sector coverage areas extending therefrom.” The coverage areas called for in the claims have a range extending from the antenna itself to the outer portions of a cell’s coverage. (*Id.* at ¶ 118).

While Mr. Collins correctly discusses the required standards for interpreting a prior art figure, he fails to apply the standard within the same paragraph of his testimony which states:

> “The shape of polar patterns plotted using any of these conventions will be identical provided the radial

scale spans the same number of decibels." (Ex 1024 - pg. 60).

The problem with Mr. Collins and hence the Petitioner's argument is that after converting the values in Yea to decibels, the radial scale of Figure 4 spans around 4 dB's from outer edges of the cell coverage, while the asymmetrical coverage area extending from the split-sector antennas claimed and illustrated in the '582 patent drawings span about 40 dBs. In effect, Figure 4 of the Yea references misses about 36 dB's worth of data to illustrate the coverage area extending from its antennas. (Ex 2001 at ¶ 121).

A POSITA could make no meaningful as to the shape of the beam or the coverage area extending from the antenna of Yea given the 4dB range of values illustrated in Figure 4. (*Id.* at ¶ 122).

Mr. Collin's analysis to show asymmetrical coverage areas also lacks consistency when he treats the plots of Figure 4 as being drawn in a logarithmic scale. A review of Mr. Collins' analysis of the plot of Figure 4 in Exhibit 1017 reveals that Mr. Collins has treated the measurement values of the plots as decibels. (Ex 2001 at ¶ 123- 128). Any conclusion based on such an error is inconclusive.

More specifically, Mr. Collins makes his findings for the beam shapes in Figure 4 and Figure 8 based on the tables below:

Paragraph 122

Beam Centre (nominal) (degrees)	Angle from beam max to -15dB Left (degrees)	Right (degrees)	Difference
007	37	46	9
074	49	37	12
129	41	46	5
196	49	38	11
247	38	49	11
315	45	38	7
Mean angle between beam maximum and -15dB points			
Mean inner beam separation (degrees)		38.2	
Mean outer beam separation (degrees)		47.3	

47.3/38.2 = 1.24

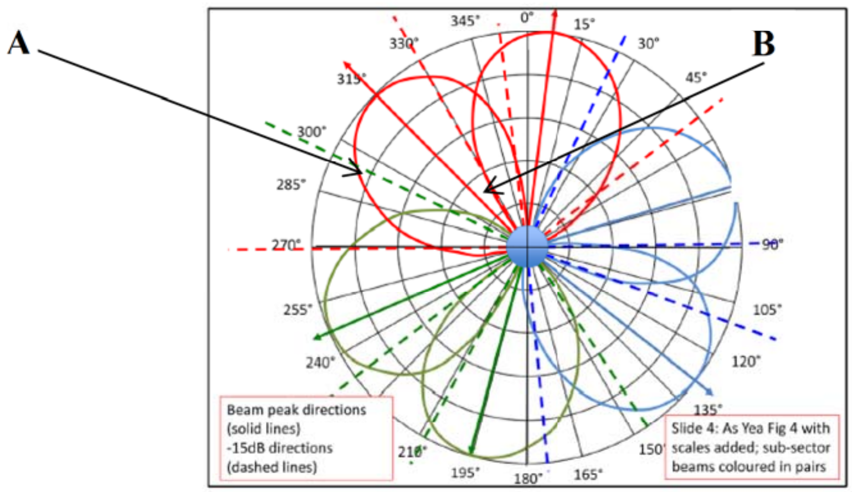
Paragraph 122

Beam Centre (nominal) (degrees)	Angle from beam max to -15dB Left (degrees)	Right (degrees)	Difference
005	40	47	7
070	49	44	5
129	42	51	9
193	46	44	2
250	41	49	8
298	46	43	3
Mean angle between beam maximum and -15dB points			
Mean inner beam separation (degrees)		42.3	
Mean outer beam separation (degrees)		48.0	

48.0/42.3 = 1.13

These tables purport to show the angles from beam maximum to a point on the beam patterns at a -15dB attenuation level. However, it is impossible to reproduce measurements for the 15dB attenuation level, where no such data in Figure 4 exists. (Ex 1017) (See also Ex 2001 at ¶ 124).

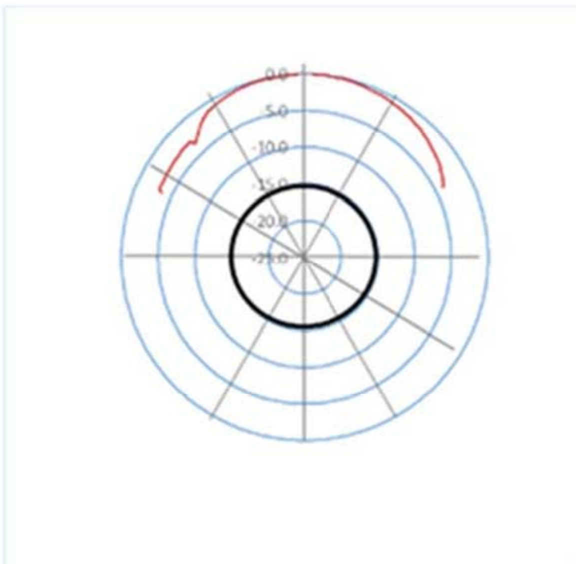
In order to find the angles listed in Exhibit 1017, Mr. Collins refers to the measurements he conducted and shown in Exhibit 1014 as reprinted below:



The radiation patterns have now been colored in pairs, each corresponding to a replaced antenna covering a 120° sector.

Firstly, Mr. Collins has left out the measurement values that were originally referred in Yea's reference, such as 428 Watts for the outer circle, to 378 Watts for the next, and 328 for the next and 278 for the following circle. Secondly, for angle 007 ° beam center, Mr. Collins has drawn a red arrow line in the plot above that crosses the 7° angle. In order to measure the angle from the beam max to what he identifies as the -15 dB attenuation line, the plot shows a dotted line that intersects the radiation beam at that purported -15dB concentric circle, as indicated by the arrowed lines A and B . However the supposed -15dB circle is actually the 278 Watts circle illustrated in Yea's Figure 4. Mr. Collins has wrongly assumed that the concentric circles of Figure 4 of the Yea reference represent 5 dB attenuation increments, where the second circle from the center is -15 dB. This would assume the range of data is 0 to -25 dB (attenuation range). The linear Watts scale of Yea plots do not span such a wide logarithmic range. (Ex 2001 at ¶ 127-128).

For reference the correct plot is shown below together with Mr. Collins assumed measurement ring. (Ex. 2001 at ¶ 129). As can be seen it is not possible to make any conclusion about the nature of the Yea beam patterns at a -15dB contour as claimed by the Petitioner and its expert:



Furthermore, it is well recognized in the prior art that plots depicted in a logarithmic scale have a different shape than the plots depicted in a linear scale. To this end, it is not possible for a POSITA by looking at figure 4 of the Yea reference to understand that the plots are teaching an asymmetrical coverage area extending from the split-sector antenna similar to the arrangement of the coverage areas depicted and claimed in the ’582 patent. (*Id.* at ¶ 130-132).

The analysis of Figure 8 of the Yea reference by Mr. Collins faces the same deficiencies as his analysis of Figure 4. For example, Mr. Collins again reproduces the carrier to interference ratio plot Ec/Io, without even explaining what exactly Ec/Io represents. (*Id.* at ¶ 133).

A carrier to interference ratio plot is not the same as an antenna radiation plot. Furthermore, Mr. Collins does not, and cannot show anything in the text of the reference that explains or discusses the scale used to illustrate the plot in Figure 8.

A review of the plot as reproduced below shows a scaling -20, -70, -120, -150, -170, -220. It is not clear from the text what do these numbers represent. (Ex 1016 - pg. 9).

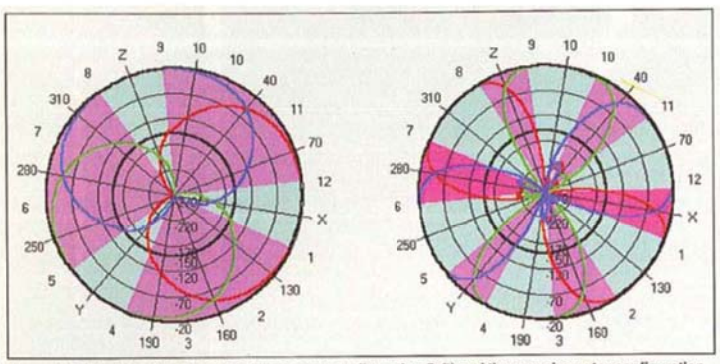


Figure 8. Ec/I0 plots of the baseline three-sector configuration (left) and the new six-sector configuration (right) reveal similar total handoff overhead

Mr. Collins also fails to point out that the beam shapes shown in green, blue and red in Fig 8 are significantly different than those shown in Figure. 4 although they are claimed to be the same beams. (Ex 2001 at ¶ 136).

Mr. Collins again without referring to any explanation in the text and only relying on the Figure, claims that the concept of lower interference zones by controlling the overlap is clearly shown. (*Id.* at ¶ 137).

As mentioned before, although the radiation plots in the '582 patent are depicted in a logarithmic scale, and therefore any comparison of a plot should also depict the plot in the same scale with the same range in dBs, the scale in figure 8 of Yea is not readily recognized as having a standard range. Further, it is not clear or evident whether the plots can be accurately measured or whether the dimensions represent a constant ratio relative to the actual dimensions of the antenna patterns or their corresponding coverage areas extending therefrom. (*Id.* at ¶ 138).

Based on the definition of Carrier to Interference ratio, which is defined in a power ratio format (as Ec/Io is a power ratio), a POSITA expects the plot to be drawn with a decibel scale. However, the plots in figure 8 start at -20 and go to -250. Even if they were logarithmic they do not fall within the same range of the plots in the '582 patent or the same range that a POSITA would have expected for Carrier to Interference ratio plots should fall, as explained by Mr. Cosgrove. (*Id.* at ¶ 139-144).

As such, not only the range of the measurements in Figure. 8 of Yea is not consistent with what a POSITA expects as a typical Carrier to interference ratio plot Ec/Io should cover, the comparison of such a plot with an antenna radiation pattern is scientifically incorrect. Whereas an antenna radiation pattern is used to show the power of the antenna, the Carrier to Interference ratio is used to show the effect of noise or interference on a radiated signal caused by neighboring cells or other sources of interference. (*Id.* at ¶ 145).

As shown above, Yea's Figure 8 deals with a completely different measurement unit that is only loosely related to an antenna radiation beam pattern. Whatever the shape of the plots in Figure 8 of Yea show, they cannot teach or suggest a radiation beam pattern as called for by the claims of the '582 patent. (*Id.* at ¶ 146).

Furthermore, it is certainly not clear that the beams are asymmetrical in nature and these show significantly different shape to those of Figure 4. It is clear that depending on whether the observer looks in the power domain (radiated power domain of Figure 4) or the interference domain of figure 8 the observed "beam patterns" alter significantly. (*Id.* at ¶ 147).

The basis of the '582 patent is that the critical coverage areas, and the handover areas are all measured in the same domain (traditionally the radiated power domain). Any conclusion reached by mixing different measurements in different domains is purely one of conjecture and would also be highly system dependent. (*Id.* at ¶ 148).

What is most telling is that even if Mr. Collins can show that the plots in Figure 4 and Figure 8 are asymmetrical, there is no evidence that such an asymmetry is produced to achieve what the claims of the '582 patent are calling to achieve. If anything, there is ample evidence that during the same time period that Mr. Yea published his article his employer Metawave Communications (Ex 1016 - pg. 17) was filing patents directed to systems and methods for correcting the asymmetrical distortion in cellular antenna beam patterns.

For example, a review of the United States Patent Numbers 5,929,823, 6,198,434 , 6,317,100 and 6,583,760 (Ex 2010, 2011, 2012 and 2013) all issued during the same time period as the Yea reference published and assigned to Metawave Communications, described and claimed antenna arrangements that intended to remedy undesired asymmetrical characteristics of multi-beam antenna beam patterns. (Ex 2001 at ¶ 150-161). As mentioned before, Metawave was not the only company that deemed any asymmetry in antenna beam patterns as a distortion aiming to correct it so as to generate symmetrical beam patterns. (*Id.* at ¶ 149-150).

It appears that Metawave Smart Antenna system achieved its capacity improvement by synthesizing antenna beam patterns to change the prior art gradual rolloff characteristics to very sharp rolloffs. (*Id.* at ¶ 162).

As such, and based upon the analysis explained above, to a POSITA, Yea does not teach or suggest replacing one or more sector antennas "with a split-sector antenna having a plurality of sub-sector coverage areas extending therefrom, at least one of which is asymmetrical," as required by the independent claims of the '582 patent.

c. The Yea Reference Does Not Teach or Suggest an arrangement where "a total critical coverage area …is substantially equivalent to a critical coverage of the replaced one or more associated sector antenna"

As shown, the inventors of the '582 patent took the uncontrolled and undesired asymmetrical distortions of antenna radiation patterns and devised a way to control and to tailor the asymmetry in such a way that the new total coverage area of the sub-sector antenna is substantially the same as the critical coverage area of the replaced antenna.

The design of the antenna in accordance with the '582 patent claims requires that the critical coverage area of the replaced antenna is used as a reference, so as to shape the asymmetrical patterns of the replacing antenna to cover the same coverage area of the replaced antenna.

Petitioner's expert, Mr. Collins relies again on the same Figures 4 and 8 of the Yea reference to establish Yea's teaching of this element of claim 1 of the '582 patent. At the outset, the same deficiencies and problems mentioned above in connection with those figures, plagues Mr. Collin's testimony again. (*Id.* at ¶166).

Absent any discussion or explanation in the text of Yea there is no way that a POSITA faced with the Yea reference would have understood that Yea teaches a design for split-sector antennas that provides for a coverage area extending therefrom and having an asymmetrical characteristic in such a way that they can replace a sector antenna with a beam pattern where the total coverage area of the split sector antenna is substantially equal to the critical coverage area of the replaced antenna. (*Id.* at ¶ 169).

d. The Yea Reference Does Not Teach or Suggest an arrangement wherein "said at least one asymmetrical sub-sector coverage area reduces overlap with said neighbouring sub-sector coverage area comparing to the overlap of the replace antenna."

Petitioner's expert, Mr. Collins relies again on the same Figures 4 and 8 of Yea to establish Yea's teaching of this element of claim 1 of the '582 patent. The same deficiencies and problems mentioned above in connection with those figures, plagues Mr. Collins' testimony again.

Absent any discussion or explanation in the text of the Yea reference there is no way that a POSITA faced with Yea would have understood that the asymmetrical nature of the coverage area extending from a split-sector antenna provides for a reduced overlap with said neighboring sub-sector coverage area comparing to the overlap of the replaced antenna.

In fact, Yea includes explanations that point to a contrary conclusion. As explained above, the overlap area of the neighboring sub-sector contributes to the additional overhead signaling that a higher order sectorization scheme experiences. To this end, if the overlap area of the neighboring sub-sectors has been reduced, the system would experience an improvement on overhead. (*Id.* at ¶ 172).

The Metawave seminar discussed above explaining the advantages of the Spot Light 2000 specifically explains that "the amount of handoff overhead of a cell is proportional to the number and the size of handoff regions where sector and cell footprints overlap." (Ex 2006 - pg 1). The same document admits that the handoff overhead of SpotLight 2000 is only slightly more than handoff overhead of a conventional three-sector site. (Ex 2001 at ¶ 173).

In the paper cited by Mr. Collins, Yea explains the results of the overhead changes after installing a higher order sectorization smart antenna as follows:

> "By inspection, the amount of handoff overhead appears roughly equivalent between the two configurations. In fact as measured by the ratio of Walsh-code Erlangs to primary Erlangs, handoff overhead increased less than 7% in moving from the three sector baseline to the six sector configuration, despite the 100% increase in the number of handoff zones." (Ex 1016 - pg 9)

Despite the assertions by Mr. Collins based on the drawings of Yea, there is no teaching or suggestion that the overlap between the neighboring sub-sectors of Yea have been reduced, specifically in view of the fact that Yea reference indicates that there has been at least a 7% increase in handoff overhead. (*Id.* at ¶ 175).

On the other hand, as previously indicated in Table 1 of the ’582 patent, the asymmetrical beam patterns of the ’582 patent as claimed have reduced the overlap of the neighboring sub-sectors and hence have improved the handoff overhead by 9.2%.

E. Proposed rejection of Claims 1, 13, and 20 as obvious in view of Yea (Ex 1016) and Metawave Website (Ex 1015) and/or Asymmetric Beam Prior Art, identified as Litva Book (Ex 1009 at Fig. 2.14) and Wästberg (Ex 1018 at 1:5-7, 5:43-44, Figs 2 and 18)

In conceding that the Yea reference does not expressly mention the concept of asymmetrical beam patterns, let alone an asymmetric sub-sector coverage area extending from an antenna as claimed in the ’582 patent, the Petitioner refers to the Metawave website reference, stating that the reference teaches steered planar array antennas and as such the beams would exhibit asymmetric patterns.

The asymmetrical characteristics exhibited in the prior art systems were viewed as a distortion. During the same time that Metawave was promoting its Spot Light 2000 system, it obtained at least four United States patents directed towards remedying what it deemed to be distortion effects due to the asymmetrical beam characteristics. (Ex 2001 at ¶ 150-161).

The asymmetrical characteristics exhibited in the Wästberg system was both acknowledged in the Wästberg reference and denounced as such:

> "The directional couplers could have arbitrary coupling and directivity, depending on which beam parameters are added. The **drawback** with the tree port Nolan network is that **it is not symmetric and will not generate symmetric beams."** (Ex 1018 - col.,5, lines 60-65 (emphasis added)).

To this end, Yea, the Metawave website, Wästberg or Litvia either alone or in combination do not teach or suggest an arrangement wherein a split-sector antenna can replace one or more sector antennas, where at least one sub-sector coverage area extending from the split-sector antenna is asymmetrical in such a way that a total critical coverage area is substantially equivalent to a critical coverage area of the replaced antenna and asymmetrical sub-sector coverage area reduces overlap with a neighboring sub-sector coverage area, compared to the overlap of the replaced antenna.

F. Dependent Claims 2, 6, 7, 9,11,12, 14, 15, 18, 19, 21, 22, 24 And 27 Are Not Anticipated By Yea And Are not Obvious In View of Yea And The Metawave Website

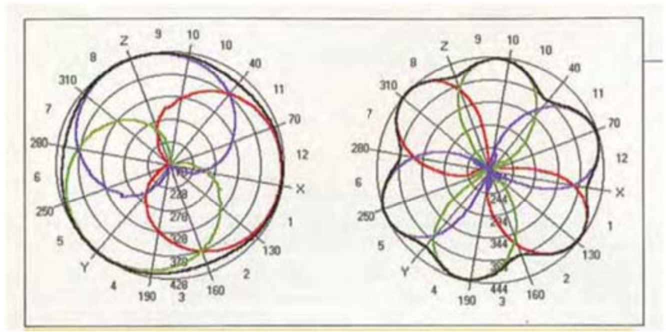
Claim 2 depends from Claim 1, and as such includes all the limitations called for in claim 1 of the '582 patent. Neither Yea, not the Metawave website teach or suggest the limitations of claim 1 as set forth above and therefore, Petitioner's proposed rejection should be denied.

Claim 6, depends from claim 1, and as such includes all the limitations called for in claim 1 of the '582 patent. Neither Yea, nor the Metawave Website teach or suggest the limitations of claim 1 as set forth above and therefore, Petitioner's proposed rejection should be denied.

Claim 7 depends from claim 1, and as such includes all the limitations called for in claim 1 of the '582 patent. Neither Yea, nor the Metawave website teach or suggest the limitations of claim 1 as set forth above and therefore, Petitioner's proposed rejection should be denied.

Claim 9 depends from claim 1, and as such includes all the limitations called for in claim 1 of the '582 patent. Neither Yea, nor the Metawave website teach or suggest the limitations of claim 1 as set forth above.

Furthermore, Yea's Figures 4 and 8 do not teach an arrangement where a half power beam width of the split-sector antenna is about half of the critical coverage area of a replaced antenna. As shown below, the half power beam width is at a point on each beam lobe that intersects somewhere near the 222 Watts power line for Figure 4. The beam width at that location is narrower than half of the critical coverage area of the replaced antenna. (Ex 2001 at ¶ 185).



To this end, Petitioner's proposed rejection must be denied.

Claim 11 depends from claim 1, and as such includes all the limitations called for in claim 1 of the '582 patent. Neither Yea, nor the Metawave website teach or suggest the limitations of claim 1 as set forth above.

Furthermore, claim 11 states that "at least one asymmetrical sub-sector coverage area has a smaller overlapping area in the sub-sector handover zone with respect to an adjacent sub-sector in the plurality of sub-sector coverage areas, than overlapping that exist between a pair of symmetrical sectors." This feature is not present in the Yea or Metawave Website references. (*Id.* at ¶ 168).

Petitioner in its support for invalidating this claim has compared the right and left plots of Figures 4 and 8 of the Yea reference. However, claim 11 is not directed to a comparison of handover zones between the beams of the sub-sector antenna and the beams of the replaced antenna. As stated before, the '582 patent teaches a novel method of replacing one or more sector antennas with sub-sector antennas. Claim 11 is directed to an arrangement wherein the handover zone of a new sub-sector antenna is smaller than the handover zone of the remaining antennas with their corresponding symmetrical beams, which have not been replaced. Neither Yea nor the Metawave website teach or suggest an antenna arrangement where only one or more of the sector antennas are replaced with a sub-sector antenna. To this end, claim 11 is not taught or suggested by Yea or the Metawave Website reference. (*Id.* at ¶ 189).

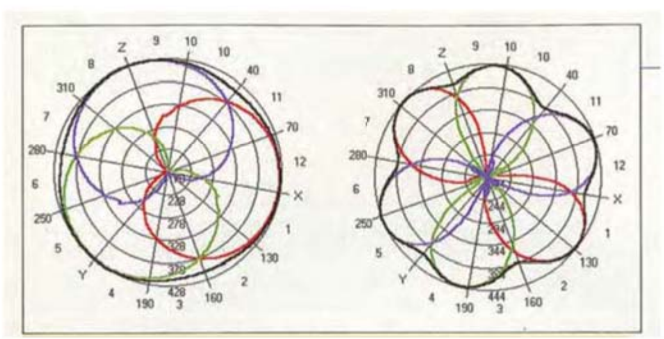
Claim 12 depends from claim 1, and as such includes all the limitations called for in claim 1 of the '582 patent. Neither Yea, nor the Metawave website teach or suggest the limitations of claim 1 as set forth above and therefore, Petitioners proposed rejection must be denied.

Claim 14 depends from claim 13, and as such includes all the limitations called for in claim 13 of the '582 patent. Neither Yea, nor the Metawave website teach or suggest the limitations of claim 1 as set forth above and therefore, Petitioner's proposed rejection should be denied.

Claim 15 depends from claim 14, and as such includes all the limitations called for in claims 13 and 14 of the '582 patent. Neither Yea, nor the Metawave website teach or suggest the limitations of claims 13 and 14 as set forth above, and therefore, Petitioner's proposed rejection should be denied.

Claim 18 depends from claim 13, and as such includes all the limitations called for in claim 13 of the ’582 patent. Neither Yea, nor the Metawave website teach or suggest the limitations of claim 1 as set forth above.

Furthermore, Yea’s Figures 4 and 8 do not teach an arrangement where a half power beam width of the split-sector antenna is about half of the critical coverage area of a replaced antenna. As shown below, the half power beam width is at a point on each beam lobe that intersects somewhere near the 222 Watts power line for Figure 4. The beam width at that location is narrower than half of the critical coverage area of the replaced antenna. (Ex 2001 at ¶ 194).



To this end, Petitioner’s proposed rejection must be denied.

Claim 19 depends from claim 13, and as such includes all the limitations called for in claim 13 of the ’582 patent. Neither Yea, nor the

Metawave website teach or suggest the limitations of claim 13 as set forth above.

Furthermore, claim 19 states that "the sub-sector handover zone is substantially equal to the sector handover zone." This feature is not present in the Yea or Metawave Website references. Assuming for the sake of argument that Figure 4 of Yea illustrates radiation patterns, there is no doubt that the sector handover zones in the left side of the Figure are larger than the sub-sector handover zones in the right side of the Figure 4 of the Yea reference. (*Id.* at ¶ 197).

Claim 21 depends from claim 20, and as such includes all the limitations called for in claim 20 of the '582 patent. Neither Yea, nor the Metawave website teach or suggest the limitations of claim 20 as set forth above.

Claim 22 depends from claim 20, and as such includes all the limitations called for in claim 20 of the '582 patent. Neither Yea, nor the Metawave website teach or suggest the limitations of claim 20 as set forth above.

Claim 24 depends from claim 20, and as such includes all the limitations called for in claim 20 of the '582 patent. Neither Yea, nor the Metawave website teach or suggest the limitations of claim 20 as set forth above.

Furthermore, claim 24 states that "the sub-sector handover zone is substantially equal to the sector handover zone." This feature is not present in the Yea or Metawave Website references. Assuming for the sake of argument that Figure 4 of Yea illustrates radiation patterns, there is no doubt that the sector handover zones in the left side of the Figure 4 are larger than the sub-sector handover zones in the right side of the Figure 4 of the Yea reference. (*Id.* at ¶ 201).

Claim 27 depends from claim 20, and as such includes all the limitations called for in claim 20 of the '582 patent. Neither Yea, nor the Metawave website teach or suggest the limitations of claim 20 as set forth above.

G. Proposed Rejection of Dependent Claims 3-5 as obvious in view of Yea and Mouly

Claim 3

Mr. Collins claims that section 6.3.10 of Mouly teaches and suggests that adjacent pairs of sectors could be operated as a single cell and the neighboring sectors could be operated as separate cells. Neither the Patent owner nor its expert have been able to find the section that Mr. Collins claims to have discussed such an arrangement in Mouly. Section 6.3.10 of Mouly describes the message content of the BCCH and its associated paging and control channels. However the description does not state how the BCCH is allocated across the cells, other than stating that a BCCH is allocated per cell. (*Id.* at ¶ 203).

It appears that Mr. Collins has misinterpreted the inventive feature of claim 3. Claim 3 states: "The method according to claim 1, further comprising a step of allocating a common control resource to a pair of sub-sector coverage areas, each neighboring a third sub-sector coverage area having a different allocated resource." (*Id.* at ¶ 204).

As such claim 3 refers to the arrangement described in the specification where alternating sub-sectors employ the same control resource, as stated below:

> "For example, alternating or adjacent beams may use common control frequency and/or code resources. With the excellent front-to-back ratio of modern antennas, there would be minimal co-channel interference between sectors and with the alternating beam approach described, the need for extra control channels or code offsets could be dispensed with, resulting in better spectrum efficiency. For example, in Fig. 2, sub-sector beams 210 and 221 could be commonly controlled with minimal loss of performance." (Ex 1001 - col. 7, lines 18-25)

There is no teaching in Yea or Mouly for employing a common control resource as described and claimed by the '582 patent. As such, Petitioner's ground for rejection should be denied. (*Id.* at ¶ 205).

Claim 4

Petitioner's brief along with Mr. Collins' declaration have misinterpreted claim 4. Claim 4 requires that the "task of broadcasting control information" is allocated to the "replaced one or more sector antennae." By definition, this claim requires that the antenna's that are being replaced for the task of providing cellular coverage remain in place along with the replacing sub-sector antennas, for the specific task of broadcasting the control information. In other words, both the replacing sub-sector antennas and the replaced antennas co-exist each antenna having a separate and specific task. (*Id.* at ¶ 207).

The '582 specification more clearly describes this specific feature of the invention as claimed in claim 4 as such:

> Alternatively, the asymmetrical beams of the present invention may be used for adaptive beam forming applications wherein a specific subscriber is tracked by the best serving beam. In such a case, the old antenna may continue to be used for the broadcast of control information while the new antenna is used for traffic channels dedicated to the specific subscribers. (Ex 1001 - col. 6, lines 22-28)

To a POSITA neither Yea, nor Mouly teach or suggest a concept of maintaining both the old and new antennas and allocating the task of broadcasting the control information to the old antenna and replacing the task of providing cellular coverage areas to the new sub-sector antenna. (*Id.* at ¶

209).

Claim 5

For the same reason mentioned above with respect to claim 4, it is apparent that the Petitioner's brief and Mr. Collins have misinterpreted claim 5 as well. More specifically, claim 5 also requires that both the old and new antenna operate simultaneously for different tasks. Claim 5 states that the method of claim 1 includes an additional step of "transferring the task of broadcasting control information from the replaced one or more sector antennae to the split-sector antenna, "and then "removing the replaced one or more sector antennae." (*Id.* at ¶ 210).

Both Yea and Mouly require that the higher sectorization arrangement is handled by a complete replacement of the old set of antennas with at least three new multi-beam antennas. There is no teaching or suggestion in Yea or Mouly that provide for an arrangement where both the replaced and replacing antenna are tasked with different functions, while working together. (*Id.* at ¶ 211).

H. Proposed rejection of claims 8, 16, and 23 as obvious in view of Yea in combination with the Smith '935 Patent

Claim 8

Claim 8 calls for a symmetrical central sub-sector coverage area. As stated in the specification, the introduction of the symmetrical central sub-sector beam is contingent on the same qualifications required for the asymmetrical beam patterns as called for in claim 1, as stated below:

> "In both FIGS. 5, and 6, it may be seen that the introduction of asymmetrical beams allows close approximation of the coverage area of the conventional sector antenna being replaced, with small side lobes and **minimal overlap."** (Ex 1001 - col. 5, lines 60-65 (emphasis added)

Neither Yea, nor Smith teach or suggest such an arrangement, wherein the introduction of a central symmetrical beam is subject to the same requirements of maintaining the same coverage area of the replaced antenna and reducing the overlap of the asymmetrical beams. (Ex 2001 at ¶ 212-213). In fact, Smith is not at all concerned with the overlap of its beams as stated below:

> "Preferably said antenna arrangement is operable to produce a plurality of non-orthogonal overlapping beams. Such 10 beams may exhibit **arbitrary overlap** and typically have beamwidths of at least 20° to 30° (measured at conventional -3 dB points on the gain pattern)…" (Ex 1019 - col. 5, lines 9-13 (emphasis added))

> "The beams are suitably **heavily overlapped**, being non-orthogonal. Suitably, the beams are overlapped closely enough to each other to provide a cusping loss of around 1dB or les, but the method is applicable to formation of beams having a cusping loss in the range of 4dB to substantially 0 dB." (Ex 1019 - col. 5, lines 49-54 (emphasis added))

The beams are described as arbitrarily overlapping at -1dB. There is no mention of any differential in the overlap in the left and right side beams as would be expected if the beams were designed to be asymmetrical with the qualifications required in the claims of the '582 patent. (Ex 2001 at ¶ 214). This is confirmed by looking at Figure. 6 of the Smith patent which shows symmetrical beams when plotted in a polar coordinate as follows:

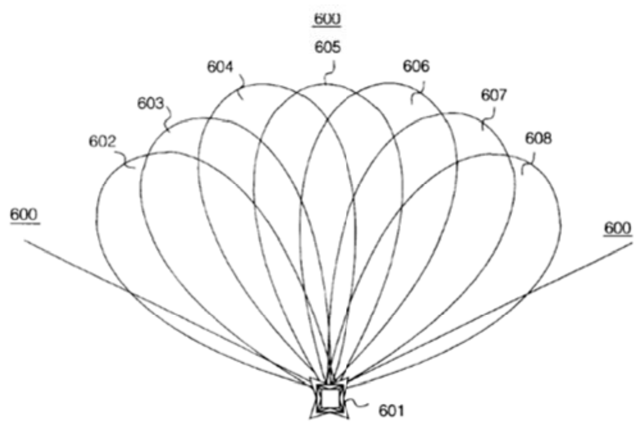


Fig. 6 of the Smith Patent (Ex 1019)

As such, claim 8 of the '582 patent is not taught or suggested by either Yea or Smith references either alone or in combination with each other. (Ex 2001 at ¶ 215). Claims 16 and 23 of the '582 patent include the same limitation as discussed above in connection with claim 8 and for the same reasons should be deemed patentable in view of Yea and Smith. (*Id.*)

I. Proposed rejection of Claims 10 as obvious in view of Yea and CSA Antennas and dependent claim 28 is obvious in view of Yea in combination with Metawave Website, Johansson and Ebine

Claims 10 and 28 both depend from their corresponding independent claims 1 and 20, and as such include all the limitations in those claims. None of the references cited by the Petitioner teach or suggest all of the elements called for in the '582 patent claim, such as the arrangement for replacing one or more sector antennas with a sub-sector antenna that is configured to generate an asymmetrical beam pattern in such a way that the combined coverage of the asymmetrical total coverage area is equal to the critical coverage area of the replaced sector and wherein the overlap areas are smaller than the overlap areas of the replaced sector. (*Id.* at ¶ 216).

J. Proposed rejection of dependent claims 17 and 25 as obvious in view of Yea in combination with Wästberg; and dependent claim 26 as obvious in view of Yea in combination with Derneryd

Claims 17, 25 and 26 depend from their corresponding independent claims 13 and 20, and as such include all the limitations in those claims. None of the references cited by the Petitioner teach or suggest all of the elements called for in the '582 patent claim, such as the arrangement for replacing one or more sector antennas with s sub-sector antenna that is configured to generate an asymmetrical beam pattern in such a way that the combined coverage of the asymmetrical total coverage area is equal to the critical coverage area of the replaced sector and wherein the overlap areas are smaller than the overlap areas of the replaced sector.

Furthermore, as mentioned above, Wästberg in fact has taught away the concept of asymmetrical beam patterns by denouncing such pattern as an undesired characteristic of its antenna. (*Id.* at ¶ 218).

IV. CONCLUSION

Based upon the foregoing, Patent Owner believes that the Petition's deficiencies to establish invalidity do not raise any facts that may require a trial.

Respectfully submitted,

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CERTIFICATE OF COMPLIANCE
WITH TYPE-VOLUME LIMITATION

Pursuant to 37 C.F.R. § 42.24, the undersigned certifies that this Patent Owner Preliminary Response complies with the 14,000-word-type-volume limitation. The Preliminary Response contains 13,786 words in total.

Respectfully submitted,

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CERTIFICATE OF SERVICE

The undersigned certifies that on August 3, 2016, a complete copy of the Patent Owner's Preliminary Response, along with all cited exhibits 2001-2013, was served today by email to lborchers@myersbigel.com and psiddoway@myersbigel.com identified in Petitioner's Mandatory Notice.

Respectfully submitted,

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