IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ERICSSON INC. and CELLCO PARTNERSHIP D/B/A VERIZON WIRELESS.
Petitioners,

v.

PROCOMM INTERNATIONAL PTE. LTD
Patent Owner.

U.S. Patent No. 7,103,377
Issue Date: September 5, 2006
Title: SMALL SIGNAL THRESHOLD AND PROPORTIONAL GAIN DISTRIBUTED DIGITAL COMMUNICATIONS

Inter Partes Review No.: IPR2024-01453

PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 7,103,377 UNDER 35 U.S.C. §§ 311-319 and 37 C.F.R. §§ 42.1-.80, 42.100-.107

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Petitioner's Exhibit List

Exhibit #	*Description*
1001	U.S. Patent No. 7,103,377 ("the '377 Patent")
1002	Prosecution history of the '377 Patent ("File History")
1003	Declaration of Petitioners' Expert Henry Houh
1004	U.S. Patent Application Publication No. US2003/0162516 to Solum ("Solum")
1005	International Patent Application Publication No. WO1998000996A1 to Naidu et al. ("Naidu").
1006	International Patent Application Publication No. WO01/95427 to Owen ("Owen")
1007	U.S. Patent No. 5,867,763 to Dean et al. ("Dean")
1008	Intentionally left blank
1009	Intentionally left blank
1010	Related Patents

I. INTRODUCTION

Pursuant to 35 U.S.C. §§ 311 *et seq*. and 37 C.F.R. §§ 42.1 *et seq*., Ericsson Inc. and Cellco Partnership d/b/a Verizon Wireless ("Petitioner") hereby petition for an *inter partes* review of U.S. Patent No. 7,103,377 ("the '377 Patent"). Petitioners respectfully submit that Claims 1, 2, and 4-5 (the "Challenged Claims") of the '377 Patent are unpatentable under 35 U.S.C. §102 in view of the prior art reference discussed herein and the accompanying expert declaration of Dr. Henry Houh. This Petition demonstrates by a preponderance of the evidence that there is a reasonable likelihood that Petitioners will prevail with respect to at least one of these claims. Accordingly, it is respectfully requested that the Board institute an *inter partes* review of the '377 Patent pursuant to 37 C.F.R. § 42.108.

II. OVERVIEW

The Challenged Claims are unpatentable as anticipated by Solum. The claims are directed to prior art systems and combinations of conventional components that perform conventional functions regarding distributed antenna systems and signal gain control which were well-known in the art at the time of the purported invention of the '377 patent.

The ’377 Patent and Solum (EX-1004) each describe the same problem of exceeding the combined signal level threshold in a distributed antenna communication system and the same solution of signal gain adjustment of the individual signal levels based on a fair share threshold:

’377 Patent	Solum
Problem	
“Exceed[ing] the system’s allowable dynamic range.” EX-1001 1:50-55	“Exceed[ing] the dynamic range handling capability of the system” EX-1004 [0011]
Solution	
“Each signal level that is greater than the dynamic range fair share threshold is attenuated with a gain factor that is determined in response to a remaining portion of the total system dynamic range after attenuation of other signal levels.” EX-1001 1:59-2:1	“If one or more of the input power calculators 208_i to 208_n, reports a signal level that exceeds the threshold, signals from those input ports will be gain controlled by adjusting weights 214_i to 214_n until all input signal levels are at or below a level such that an overflow condition is avoided.” EX-1004 [0017]

The ’377 Patent is directed to a method of gain control of individual signal levels in a distributed antenna system (DAS). In a DAS, the dynamic range of the

communication system is shared over multiple antenna ports. One problem with distributed antennas on a single signal path is that the aggregate signal level along the signal path may exceed the system's allowable dynamic range signal level. EX-1001 1:50-55: EX-1003 ¶30.

The '377 Patent describes the solution to the dynamic range problem is to measure each of the plurality of signal levels and compare to a dynamic range fair share threshold. Each signal level that is greater than the dynamic range fair share threshold is attenuated with a gain factor that is determined in response to a remaining portion of the total system dynamic range after attenuation of other signal levels. EX-1001 1:59-2:1; 7:10-14; EX-1003 ¶31.

Solum is a parallel disclosure in which the same problem is described as well as the identical solution. Like the '377 Patent, Solum describes that in distributed systems, the dynamic range of the system is limiting on the system's performance, and the individual signal levels when combined may saturate (exceed) the dynamic range if the individual signal levels are not controlled. EX-1004 [0002], [0003], [0005] [0011]; EX-1003 ¶32.

> The operational range of a system that combines and distributes signals within buildings or other areas where wireless signal propagation is likely to be a problem, whether the signals are digital or analog or some combination of both, is limited by the dynamic range handling capability of the system. In a distributed system, …

> signals of varying levels are present at input ports, at signal combiners and at output ports. A large signal at a single input port may potentially saturate the output port (e.g., cause an overflow condition) if the large signal exceeds the dynamic range of the system and is not controlled in some way.

EX-1004 [0002]; EX-1003 ¶32.

Like the '377 Patent, Solum describes a solution that attenuates the individual signal levels using weighting coefficients when the individual signal levels exceed a threshold level so that the combined signal level avoids an overflow condition at the node. EX-1004 [0005], [0017]; EX-1003 ¶33.

Thus, Solum discloses the same problem and same solution as that claimed in the '377 Patent, and does so using the same architecture. Thus, the Challenged Claims are anticipated by Solum. EX-1003 ¶34.

III. GROUNDS FOR STANDING (37 C.F.R. § 42.104(A))

Petitioners certify that the '377 Patent is available for *inter partes* review and that Petitioners are not barred or estopped from requesting an *inter partes* review of the Challenged Claims on the grounds identified herein. 37 C.F.R. § 42.104(a). This Petition is filed pursuant to 37 C.F.R. § 42.106(a).

IV. REASONS FOR THE REQUESTED RELIEF

As explained in §§ II and VI-VIII of this Petition and in the attached Declaration of Petitioners' Expert, Dr. Henry Houh, EX-1003, the methods of gain

control, as described and claimed in the '377 Patent, were anticipated by the prior art as understood by a person of ordinary skill in the art ("POSA") at the time of the invention.

V. BACKGROUND

A. Summary of the '377 Patent

The '377 Patent is directed to a method of gain control of individual signal levels in a distributed antenna system (DAS). The use of a DAS provides better coverage than a conventional base station having a single antenna. The '377 Patent describes that there are problems, however, with using a distributed antenna system. For example, for a conventional system that has only one antenna port, the entire dynamic range is available to the single port signal. When the system has multiple antenna ports, as in the DAS, the same dynamic range is shared amongst the aggregate signal level from all the ports. This reduces the dynamic range available for each port when multiple ports are simultaneously active. One problem with distributed antennas on a single signal path is that the aggregate signal level along the signal path may exceed the system's allowable dynamic range. EX-1001 1:39-54; EX-1003 ¶35.

The '377 Patent describes that one solution is a method for proportional gain distribution for controlling the aggregate signal in a single path DAS. In one embodiment, a sampling function senses a signal level at each of the plurality of

distributed antennas. Each of the plurality of signal levels are compared with a dynamic range fair share threshold. EX-1001 1:59-64; EX-1003 ¶36.

As illustrated in Fig. 1, the system includes a base station (100) that communicates over an RF link using an antenna (110) using any appropriate air interface standard. For example, the air interface standard can be one of Advanced Mobile Phone System (AMPS), code division multiple access (CDMA), time division multiple access (TDMA), Global System for Mobile communications (GSM), or any other appropriate air interface standard. EX-1001 2:54-64; EX-1003 ¶37.

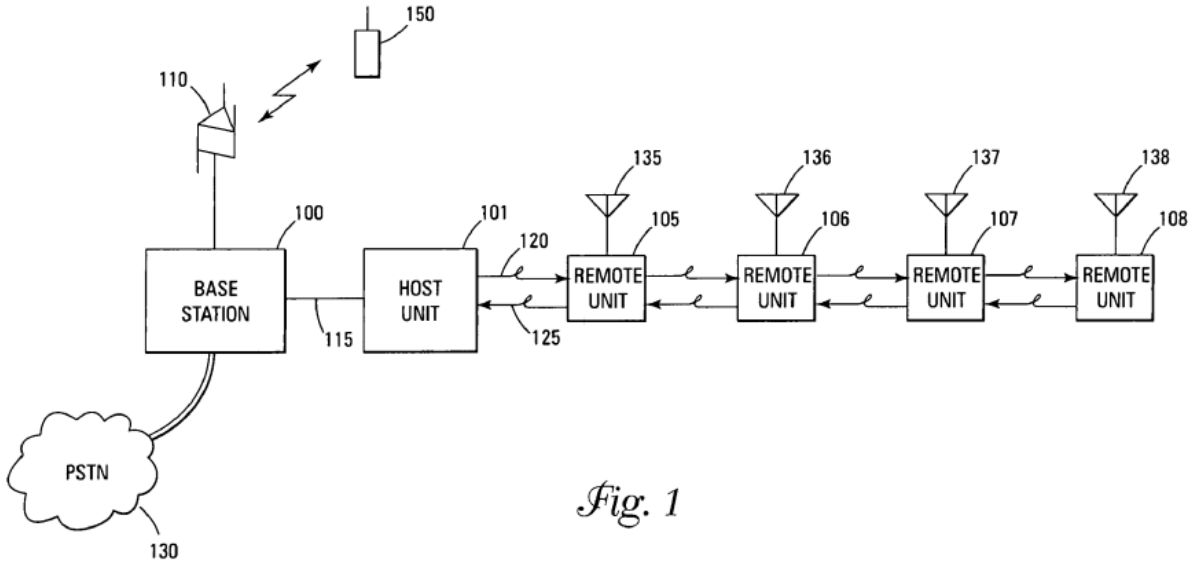

Fig. 1

The RF link is made up of a wireless forward link over which the base station (100) transmits to a subscriber unit (150). The subscriber unit (150) transmits back to the base station (100) over a reverse link. The subscriber unit

(150) is either a mobile station or a fixed station. The base station (100) has the transmitters and receivers that enable the subscriber unit (150) to communicate with the public switched telephone network (PSTN)(130). In one embodiment, the base station links the subscriber unit (150) to other subscriber units that are communicating with other base stations. EX-1003 ¶38.

A host unit (101) is connected to the base station (100) through an RF link (115). The host unit (101) is responsible for converting the RF signal from the base station (100) to an optical signal for transmission over an optical medium. The host unit (101) also converts a received optical signal to an RF signal for transmission to the base station (100). One or more remote units (105-108) are connected to the host unit (101) through an optical medium, such as fiber optic lines (120 and 125), in a daisy-chain arrangement. The remote units (105-108) are placed in locations that require additional signal coverage due to a lack of coverage by the base station (100). The remote units (105-108) communicate with subscriber units in a particular remote units coverage area over an RF link provided by the remote unit antennas (135–138). EX-1003 ¶39.

The '377 Patent describes that in order to perform the fair and balanced attenuation method, each individual antenna port input is sensed with a sampling function that is well known in the art to determine each input signal level. EX-1001 7:10-14; EX-1003 ¶40. Each of the plurality of signal levels are compared with a

dynamic range fair share threshold. EX-1001 1:59-64; EX-1003 ¶40. Each signal level that is greater than the dynamic range fair share threshold is attenuated with a gain factor that is determined in response to a remaining portion of the total system dynamic range after attenuation of other signal levels. EX-1001 1:61-67; EX-1003 ¶40.

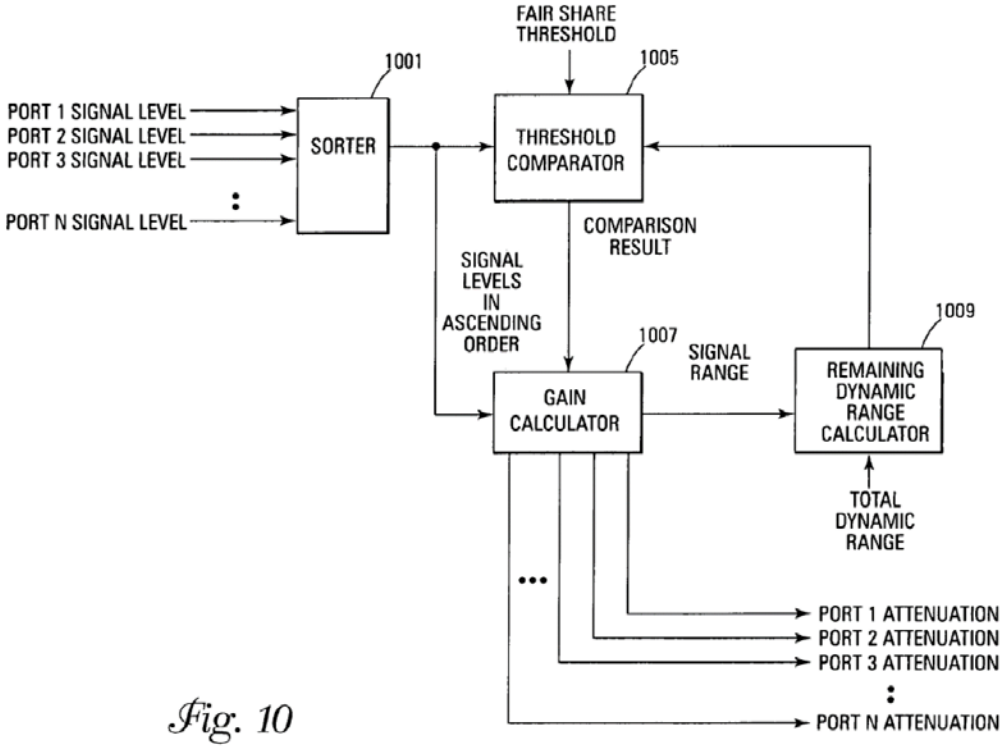

Fig. 10

EX-1001 Fig. 10; EX-1003 ¶40.

The '377 Patent describes that a "fair share" threshold is input to the threshold comparator, but does not define what "fair share" means. It does however describe that the claimed method encompasses proportional gain distribution in a DAS. EX-1001 1:58-61; 7:20-21. Further, the '377 Patent

provides an example of a dynamic range fair share threshold, but describes that in "alternative embodiments, other appropriate threshold calculations are used." EX-1001 7:20-25; EX-1003 ¶41.

The '377 Patent describes that each of the plurality of signal levels are compared with a dynamic range fair share threshold. Each signal level that is greater than the dynamic range fair share threshold is attenuated with a gain factor that is determined in response to a remaining portion of the total system dynamic range after attenuation of other signal levels. Each signal level that is less than or equal to the dynamic range fair share threshold are attenuated with a unity gain factor. EX-1001 1:64-2:3; EX-1003 ¶42.

In one embodiment, the attenuation factor is not applied directly to the individual remote units' attenuation functions (810–813). Instead, if a port signal is more than 0.5 of the total dynamic range, the remote units' AGL function (815–818) instructs the appropriate attenuation function (810–813) to apply a set attenuation factor, e.g., 0.5 attenuation factor, to the port input. If the signal is equal to or less than 0.5, no attenuation factor is not applied. EX-1001 10:15-22; EX-1003 ¶43.

The '377 Patent describes different methods of attenuation. These methods include stepped attenuation, continuous attenuation, and fair and balanced attenuation. EX-1001 6:38-41; EX-1003 ¶44.

The Challenged Claims are directed to methods, with Claim 1 being the only independent claim:

> 1. A method for gain distribution in a system comprising a plurality of distributed antennas and a total system dynamic range, the method comprising:
>
> sensing a signal level at each of the plurality of distributed antennas,
>
> comparing at least one of the plurality of signal levels with a dynamic range fair share threshold; and
>
> attenuating each of the at least one of the compared signal levels that is greater than the dynamic range fair share threshold with a gain factor that is determined in response to a remaining portion of the total system dynamic range after attenuation of other signal levels of the plurality of signal levels.

The specification of the '377 Patent describes an embodiment with a serial arrangement of the remote units; dynamic readjustment of the "fair share threshold" and sorting of the signals, however, these features are not recited in the Challenged Claims. Nonetheless, these features were known in the art. EX-1003 ¶46.

B. Prosecution History

The '377 Patent issued from application no. 10/414,907 following a First Action Allowance. EX-1002 21. In the Examiner's reasons for allowance, the Examiner merely recited the last three limitations [1.2], [1.3] and [1.4] of Claim 1.

None of the references relied upon in this petition were discussed in the prosecution history.

C. Claim Construction

Petitioners propose that each claim term in the Challenged Claims be given its plain and ordinary meaning in this proceeding, and that no specific construction of any claim term is required because the prior art relied on in this Petition meets each of the claim terms under any reasonable construction.

It is noted that this interpretation is only applicable to the *inter partes* review sought herein and should not be construed as constituting, in whole or in part, Petitioner's own interpretation of any claims for any other purposes, including any litigation. Accordingly, Petitioner expressly reserves the right to present an interpretation of a claim term in other proceedings, which is different, in whole or in part, from that presented in this Petition.

D. Priority Date of the Challenged Claims

The application that issued as the '377 Patent was filed on Apr. 16, 2003 claiming priority benefit of U.S. Provisional Patent Application No. 60/430,435 filed on Dec. 3, 2002.

For the purposes of this Petition, Petitioners do not challenge the earliest possible priority date of the Challenged Claims of Dec. 3, 2002.

E. Person of Ordinary Skill in the Art

With respect to the '377 Patent, a POSA would have been familiar with Distributed Antenna Systems and wireless communications in general. EX-1003 ¶49. A POSA would have a working knowledge of network communication systems. EX-1003 ¶49.

A POSA would have gained knowledge of these concepts through a mixture of training and work experience, such as by having a Bachelor's degree in electrical engineering or related degree and four years of experience; or by obtaining a Master's degree in electrical engineering or related degree, but having only one to two years of experience; or by having no formal education but experience in wireless communications networks of at least eight years. EX-1003 ¶50.

F. State of the Art

The following section describes the state of the art for DAS wireless systems as of the priority date. EX-1003 ¶51. The prior art references, and the discussions of what was known to a POSA, provide the factual support for the general description of the state of the art at the time of the invention, provide additional motivation to modify or combine the reference. Accordingly, these references should be considered by the Board.

1. Comparing Signal Strength to Threshold

Sensing signal power levels and comparing the signal strength to a threshold were well-known in the art and fundamental to gain control. For example, Naidu (EX-1005), which is directed to a distributed antenna network, utilized a signal strength comparator 130_n which compares a predetermined reference level [*threshold*] with the received signal 127_n in order to control the gain of the output signal 129_n. EX-1005 5:15-26; EX-1003 ¶52.

Naidu describes:

> the system comprises a plurality of remote antenna units where each remote antenna unit includes a signal level comparator for comparing the level of the signals received by the respective antenna unit with a predetermined reference level,

EX-1005 4:1-6; EX-1003 ¶53.

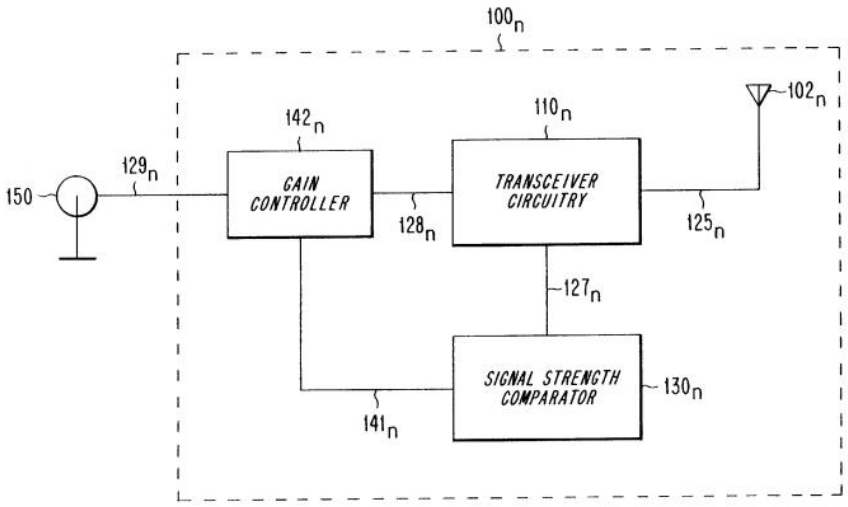

Fig. 3(a)

EX-1005 Fig. 3(a); EX-1003 ¶53.

Dean (EX-1007) also describes a DAS in which signal levels are sensed and compared to a threshold for gain control. Dean describes a signal is measured and compared to the other upstream gain reference signal levels received. EX-1007 16:6-23; EX-1003 ¶54.

2. Attenuating Signals

Attenuating signals utilizing gain control was also well-known in the art. For example, Naidu teaches attenuation of signal 127n to signal 129n with a proper output level based upon the comparison in the signal strength comparator 130n. EX-1005 4:1-6; EX-1003 ¶55

Dean also discloses that the RAD (radio antenna device) is directed by a controller at the head end to decrease (or increase) the signal power supplied to the cable plant in response to the comparison discussed above. EX-1007 16:11-14; EX-1003 ¶56.

3. Controlling Gain Based On Dynamic Range

Dynamic range of signal levels in wireless systems was a well-known concept at the time of the '377 Patent. It was also known that saturation of the dynamic range was an issue in distributed antenna systems. For example, Naidu discloses "signal levels output from the remote antenna units are prevented from

exceeding a maximum signal level so that strong signals do not saturate the system." EX-1005 4:1-6; EX-1003 ¶57.

Owen also discloses a distributed antenna system which controls gain (attenuation) of each of the signals with respect to the maximum dynamic range. EX-1006 10:10-25; EX-1003 ¶58.

VI. IDENTIFICATION OF CHALLENGES

A. Challenged Claims

Claims 1, 2, and 4-5 of the '377 Patent are challenged in this Petition.

B. Statutory Grounds for Challenges

The Challenges are set forth in detail below and summarized as follows:

Ground	Claims	Basis	Reference
1	1, 2, and 4-5	§ 102	Solum

Ground 1: Claims 1, 2, and 4-5 of the '377 Patent are invalid as being anticipated by Solum.

Solum

United States Patent Application Publication 2003/0162516 is titled "Distributed Automatic Gain Control System" and it published on Aug. 28, 2003 from an application filed on Feb. 25, 2002 ("Solum"). EX-1004. Solum qualifies as prior art under §102(e). It was cited but not applied by the examiner during prosecution of the Challenged Claims.

VII. IDENTIFICATION OF HOW THE CHALLENGED CLAIMS ARE UNPATENTABLE

A. Challenge 1: Claims 1, 2, and 4-5 are anticipated by Solum

1. The Solum Reference

As illustrated in FIG. 1, Solum discloses a wireless distribution system with a plurality of digital remote units (DRU) 202 (blue) distributed in a coverage area to receive wireless signals and provide the signals to a plurality of input ports 205. A plurality of input power calculators 208 (gold) are operatively connected to the input ports to determine power levels of the signals provided to each port.

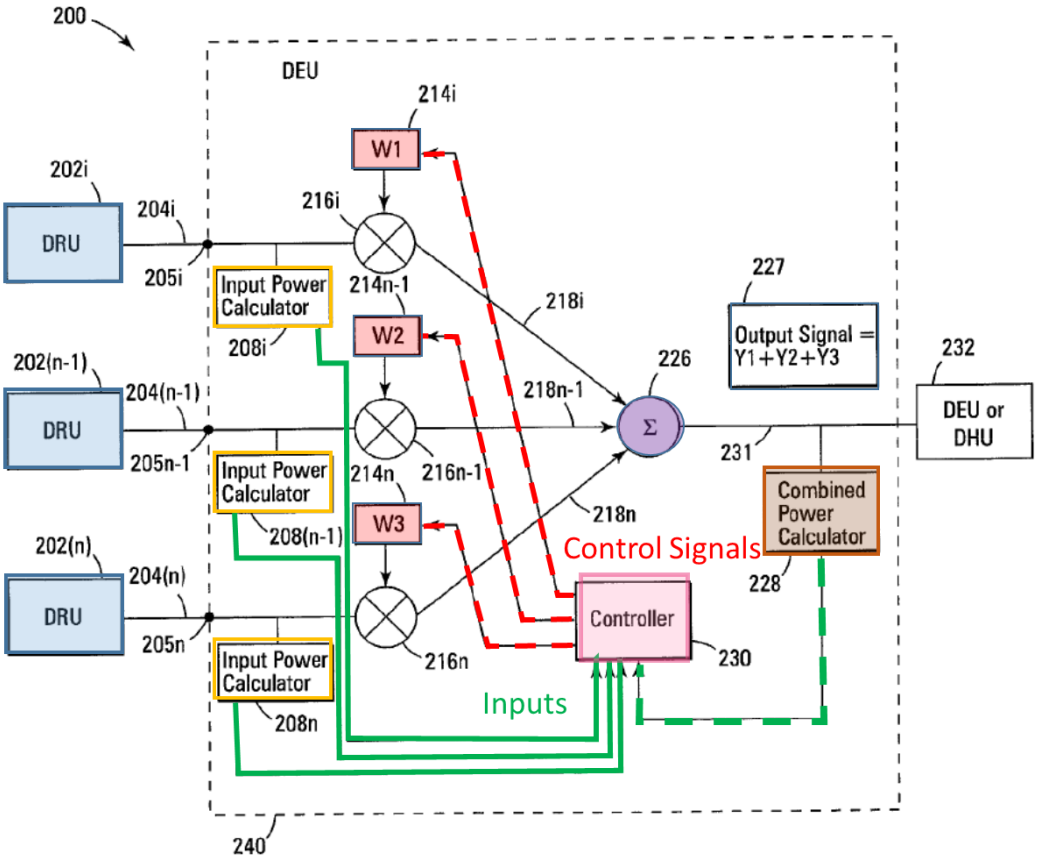

Fig. 2

EX-1004 Fig. 2[1]; EX-1003 ¶62.

Solum provides a plurality of variable gain controllers 214 (red) to control the gain of received signals in response to a control signal (red dashed line) from controller 230. The controller provides control signals that individually control each of the variable gain controllers based on the respective signal levels (green solid line) and the combined signal level (dashed green line) received from the combined power calculator 228 (brown). The controller 230 determines weights 214 (pink) for individually controlling the gain of signals received at multipliers 216 so that the individual signals do not exceed a predetermined threshold level. The attenuated signals are then provided to node 226 which digitally sums the signals. Combined power level calculator (brown) 228 determines the power level of the signals combined at node 226 and provides the combined power level signal to controller 230. The combined signals are then transmitted to digital host unit (DHU) 232. EX-1004 [0008], [0013], [0015]; EX-1003 ¶63.

Solum explains that in operation, signal levels at each input port 205 are monitored and evaluated by input power calculators 208 to determine whether any signal level exceeds a predetermined level. If one or more of the input power calculators 208 reports a signal level that exceeds the threshold, signals from those

[1] All coloring of the figures are annotations by Petitioners.

input ports will be gain controlled by adjusting weights 214 until all input signal levels are at or below a level such that an overflow condition is avoided. EX-1004 [0014]; EX-1003 ¶64.

The process of determining the weighting coefficients is iterative and considers the signal levels of the combined signal subsequent to attenuation. For example, when the combined signal 231 at power calculator 228 is lower than a predetermined "decay threshold", the weighted coefficients 214 are increased over time based on a decay time constant and a fair weighting based on input power calculators 208 is applied to the input signals 204 until a satisfactory power level is achieved at combined power calculator 228. Conversely, when the combined signal 231 at combined power calculator 228 is higher than a predetermined "attack threshold," the weighted coefficients 214 are decreased over time based on an attack time constant and a fair weighting based on input power calculators 208, is applied to the input signals 204, until a satisfactory power level is achieved at combined power calculator 228. EX-1004 [0015]; EX-1003 ¶65.

Solum further describes that the weighting function is proportional to power received at each input port, as determined by the input power monitor. EX-1004 [0019]. In other words, the weighting function ensures that the initial signal levels that make up a larger portion of the signal are treated differently than signals that make up small portion of the combined signal. For signals above the threshold,

higher signal levels are attenuated more than signals with lower signals levels. Thus, like the '377 Patent, the signal gains are proportional as applied to the signals, rather than applying equal gains across all signals. EX-1003 ¶66.

Monitoring of the signal levels at the input ports may take place continuously or may be triggered only after combined power calculator 228 senses a combined signal level that warrants a change in gain control of the combined signals at the node. Alternatively, signal levels at the input ports may be polled periodically to determine whether signal levels may have changed. EX-1004 [00017]. Solum's process of determining the weighting coefficients or gains is iterative and considers the signal levels of the combined signal subsequent to attenuation. Depending upon the amount of or lack of dynamic range capacity the weighting coefficients are increased or decreased respectively. EX-1004 [0015]; EX-1003 ¶67.

For example, Solum discloses:

> When the signal, 231, at Power Calculator 228 is lower than a predetermined "decay threshold", the weighted coefficients 214 to 214 are increased over time based on a decay time constant and a fair weighting based on input Power calculators 208, to 208, is applied to the input signals 204 to 204 until a satisfactory power level is achieved at combined power calculator 228. Conversely, when the signal, 231, at combined power calculator 228 is higher than a predetermined "attack threshold," the weighted coefficients 214 to

214 are decreased over time based on an attack time constant and a fair weighting based on input Power calculators 208, to 208, is applied to the input signals 204, to 204, until a satisfactory power level is achieved at combined power calculator 228.

EX-1004 [0015]; EX-1003 ¶67.

2. Detailed Application of Solum to the Challenged Claims

Claim 1

[1.0] A method for gain distribution in a system comprising a plurality of distributed antennas and a total system dynamic range, the method comprising

To the extent the preamble is limiting, Solum discloses a method to control the gain of received signals [*method for gain distribution*] in a system including a plurality of remote units/DRUs (blue) [*plurality of distributed antennas*] having a dynamic range handling capability [*total system dynamic range*].

> A wireless distribution system according to one aspect of the present invention includes a plurality of remote units distributed in a coverage area to receive wireless signals in the coverage area and provide the signals to a plurality of input ports to receive signals comprising the signals provided by the plurality of remote units a plurality of input power monitors operatively connected to one or more of the plurality of input ports to determine power levels of signals received at the input port a plurality of variable gain controllers to control the gain of signals received at the one or more of the plurality of input ports in response to a control signal, a node to combine a plurality of signals

from the plurality of input ports, and a controller to provide control signals to individually control each of the variable gain controllers.

EX-1004 [0008]; EX-1003 ¶68.

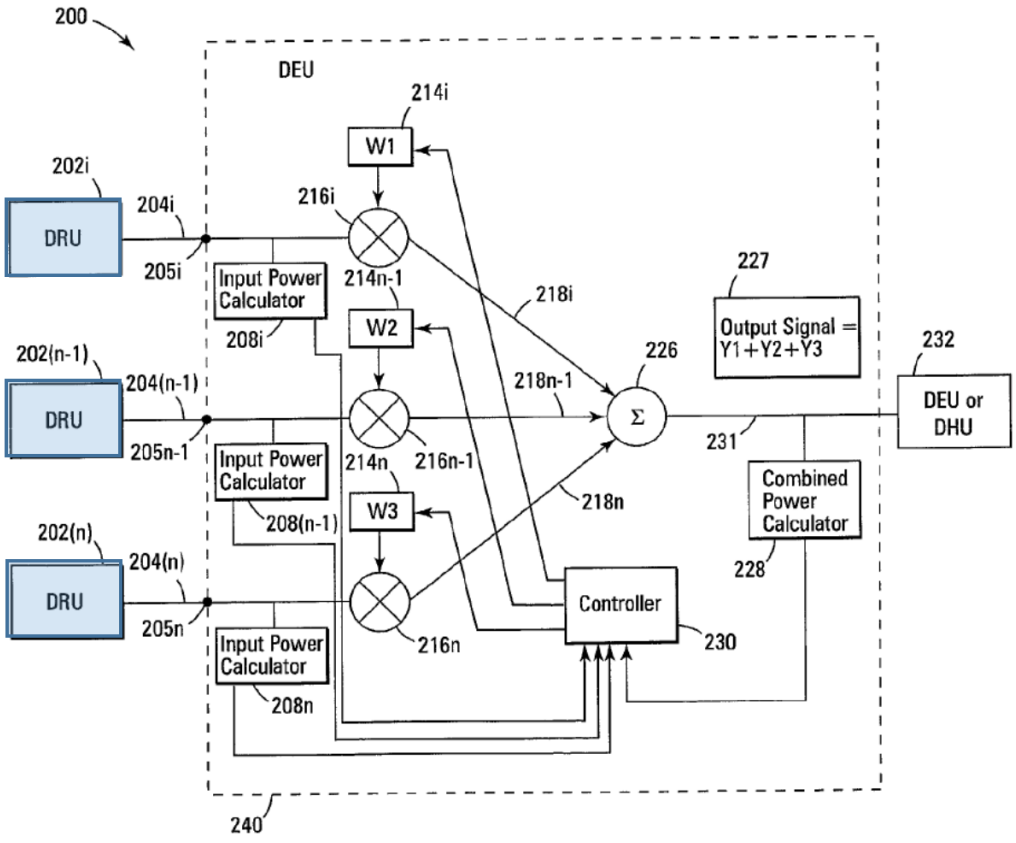

Fig. 2

EX-1004 Fig. 2; EX-1003 ¶68.

The distributed wireless communication system has a limited dynamic range and accordingly must be protected from signals that would saturate or otherwise exceed the dynamic range handling capability of the system.

EX-1004 [0011]; EX-1003 ¶68.

A POSA understood that each of the digital remote units (DRUs) of Solum includes a radio transceiver with an antenna to receive wireless signals. EX-1005 9:36-40, 12:20-22; EX-1003 ¶69.

> The system 100 includes a number of digital remote units (DRUs) 102_i to 102_n that receive a frequency spectrum of wireless signals, such as may be transmitted by low power wireless devices in and around the building.

EX-1004 [0010]; EX-1003 ¶69.

> Each DRU 202_i to 202_n, includes an input port or receiver that receives, processes and digitizes a wireless bandwidth.

EX-1004 [0013]; EX-1003 ¶69.

[1.1] sensing a signal level at each of the plurality of distributed antennas;

Solum discloses monitoring [*sensing*] the signal level at each of the plurality of remote units [*plurality of distributed antenna units*] by the input power calculator 208 (gold) to determine if the signal level exceeds a threshold:

> **Signal levels at each input port 205_i, to 205_n, are monitored and evaluated by input power calculators 208_i, to 208_n**, to determine whether any transmission link 204_i to 204_n, is providing a signal that exceeds a predetermined level.

EX-1004 [0017]; EX-1003 ¶70.

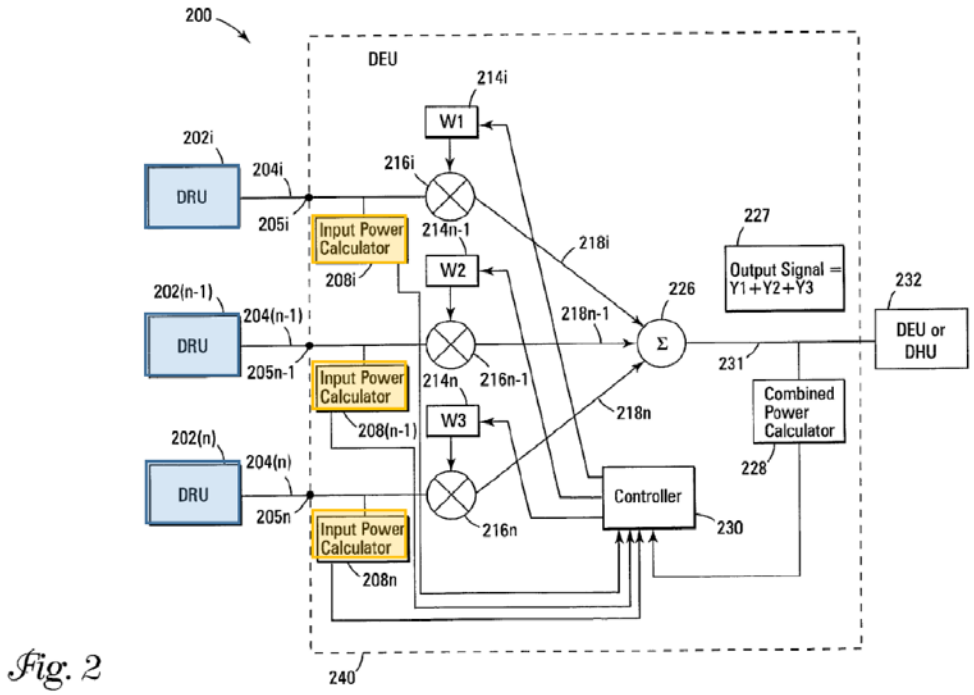

Fig. 2

EX-1004 Fig. 2; EX-1003 ¶70.

In Solum, the signals levels at each remote unit are monitored [*sensed*] via the respective input ports 205_{i-n}, This is the same manner as described in the '377 Patent ("each individual antenna port input is sensed with a sampling function that is well known in the art to determine each input signal level" EX-1001 7:11-13). EX-1004 [0017]; EX-1003 ¶71. A POSA understood the signal level at the antenna input port corresponds to or at a minimum is highly reflective of the signal level at the antenna of the DRU because only de minimis losses would be expected between an antenna port and the output port of the DRU. Thus, a POSA understood that sensing the signal level at the input port is sensing the signal level at the antenna of DRU. EX-1003 ¶71.

[1.2] comparing at least one of the plurality of signal levels with a dynamic range fair share threshold; and

Solum discloses comparing each of the received signal levels with a predetermined level [*dynamic range fair share threshold*].

> Signal levels at each input port 205_i, to 205_n, are monitored and evaluated by input power calculators 208_i, to 208_n, to determine whether **any transmission link 204_i to 204_n, is providing a signal that exceeds a predetermined level.**

EX-1004 [0017]; EX-1003 ¶72.

> If one or more of the input power calculators 208_i to 208_n, reports **a signal level that exceeds the threshold**, signals from those input ports will be gain controlled by adjusting weights 214_i to 214_n until all input signal levels are at or below a level.

EX-1004 [0017]; EX-1003 ¶72.

While Solum describes that the threshold is related to the dynamic range of the system, Solum does not refer to its threshold as a *dynamic range fair share threshold*. EX-1004 [0011]. However, Solum does describe that the weighting function is proportional to power received at each input port, as determined by the input power monitor.

> [A] controller to provide control signals to control the gain of each of the variable gain controllers based on a weighting function that is

proportional to power received at each input port, as determined by the input power monitors such that the combined power as determined by the combined power monitor does not exceed a predetermined level.

EX-1004 [0019]; EX-1003 ¶73.

For signals above the threshold, higher signal levels are attenuated more than signals with lower signals levels. EX-1004 [0014]. Thus, like the '377 Patent, the signal gains are proportional as applied to the signals, rather than applying equal gains across all signals. Thus, a POSA understood that Solum's threshold is a *dynamic range fair share threshold* because just like the '377 Patent, the threshold is used to identify which signals require attenuation; such that all signals are treated fairly (proportionally) rather than each treated equally. EX-1003 ¶74.

[1.3] attenuating each of the at least one of the compared signal levels that is greater than the dynamic range fair share threshold with a gain factor

Solum discloses controlling the gain [*attenuating*] of a received signal by adjusting the gain weighting coefficients (red) [*gain factor*] via the gain control signals (dashed red lines), from the controller, when the signal level measured at 205i as determined by the respective input power calculator 208_i (gold) exceeds the predetermined level/threshold [*greater than the dynamic fair share threshold*]. The

weighting coefficients [*gain factors*] are applied to the signals [*attenuating*] via multipliers 216 (blue).

> Each input port 205_i, to 205_n, has associated with it an input power level calculator 208_i, to 208_n, to determine power levels of signals received over transmission links 204_i to 204_n. The input power level calculators 208_i to 208_n provide power level signals to controller 230. Controller 230, which may be a dedicated controller or part of a larger system-wide controller, **determines weights for gain control of the distribution system. Controller 230 determines weights 214 to 214 for individually controlling the gain of signals received over transmission links 204 to 204, at multipliers 216, to 216, so that the signals do not exceed a predetermined threshold level.**

EX-1004 [0014]; EX-1003 ¶75.

> Signal levels at each input port 205_i to 205_n are monitored and evaluated by input power calculators 208_i, to 208_n, to **determine whether any transmission link 204_i to 204_n is providing a signal that exceeds a predetermined level**.

EX-1004 [0017]; EX-1003 ¶75.

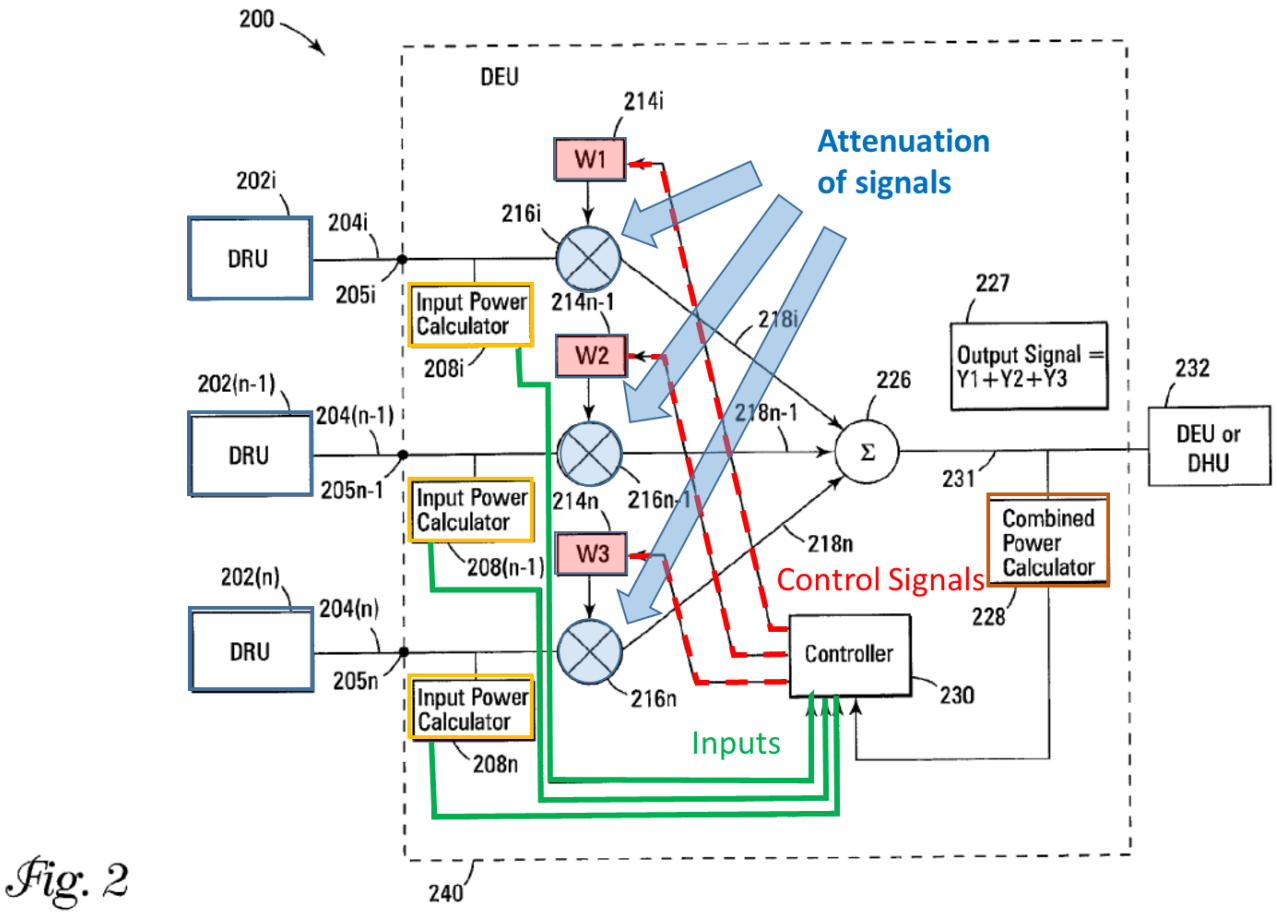

Fig. 2

EX-1004 Fig. 2; EX-1003 ¶75.

[1.4] [a gain factor] that is determined in response to a remaining portion of the total system dynamic range after attenuation of other signal levels of the plurality of signal levels.

Solum discloses the weighted coefficients for a signal are determined as a function of [*responsive to*] at least the power level of the signal i (determined by the respective input power calculator 208_i), the power level of the other signals (determined by the respective input power calculators 208_{i-n}), and the power level of the combined signal (determined by the combined input power calculator 228)

[*after attenuation of other signal levels*] with respect to the total dynamic range handling capability of the system [*a remaining portion of the total system dynamic range after attenuation of other signal levels of the plurality of signal levels*.] EX-1004, [0015],[0017], [0019];EX-1003 ¶76.

As shown in Fig. 2 of Solum, the input power calculators 208 (gold) provide input (solid green) regarding the signal level received on input port 205 to the controller 230, the controller also receives input (dashed green) from the combined power calculator 228 (brown).

> [A] controller to provide control signals to control the gain of each of the variable gain controllers based on a weighting function that is proportional to power received at each input port, as determined by the input power monitors such that the combined power as determined by the combined power monitor does not exceed a predetermined level.

EX-1004 [0019]; EX-1003 ¶77.

The controller receives feedback input (dashed green) from the combined power calculator (brown) relating to whether the combined signal exceeds or is lower than a predetermined threshold [*total system dynamic range*]. A POSA understood that a decision with respect to the predetermined threshold is a measure of the utilization of the total dynamic range capacity of the system. EX-1004 [0014[, [0015]; EX-1003 ¶78.

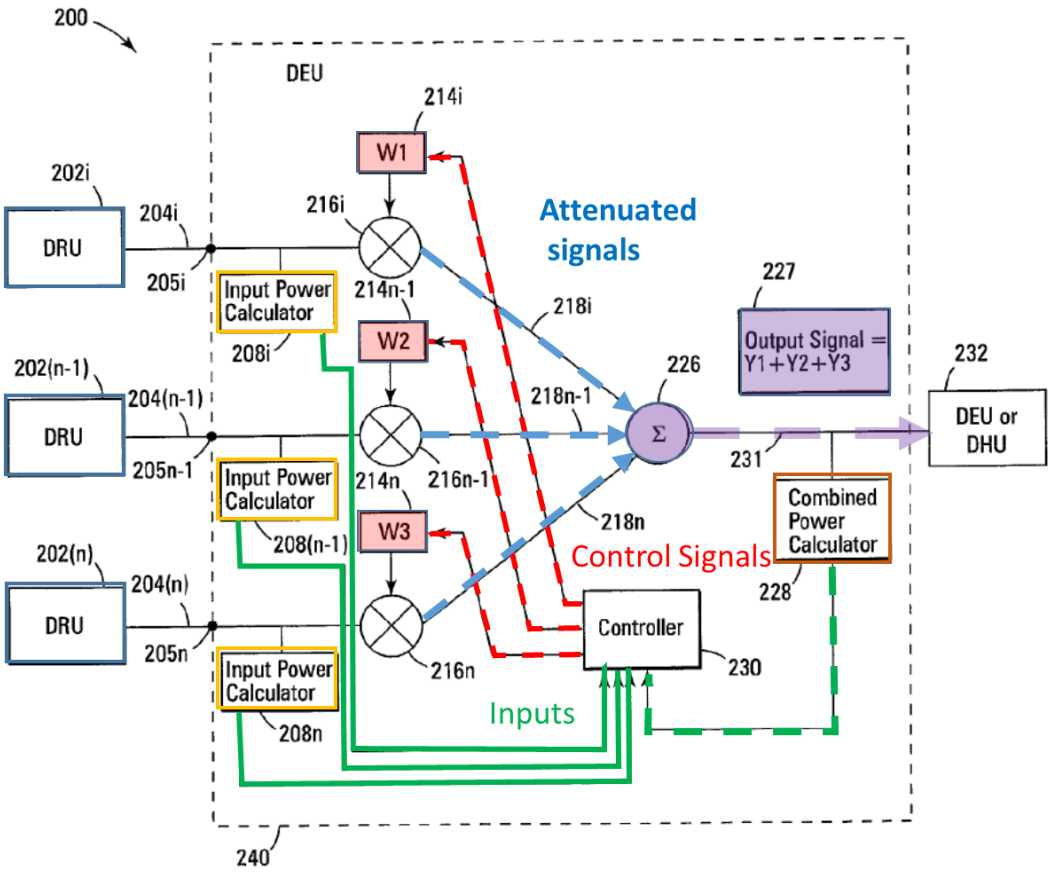

Fig. 2

EX-1004 Fig. 2; EX-1003 ¶78.

Just like the '377 Patent (EX-1001 7:54-66, 10:11-45), Solum's process is continuous and thus the measuring of the combined signals and the determination of the weighting coefficients [*gain factors*] are iterative, forming a feedback loop. Solum in the determination of the weighting coefficients [*gain factors*] considers the signal level of the combined signal (purple dashed line) which is formed from contributing signals 218_i-218_n (blue dashed lines) representing respective signals

received at ports 205 and attenuated by multipliers 216 (light blue), as feedback. EX-1004 [0015], [0017], [0019]; EX-1003 ¶79.

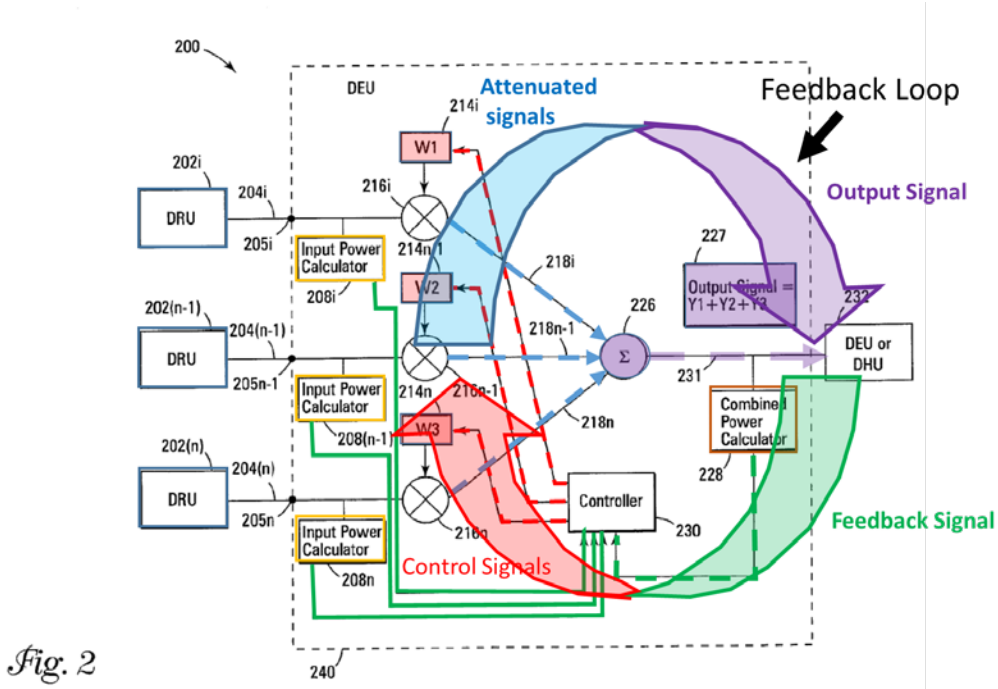

Fig. 2

EX-1004 Fig. 2; EX-1003 ¶79.

Solum discloses determining the dynamic range utilization by comparing the power level of the combined signal (purple) to a predetermined threshold (e.g. "decay threshold" or "attack threshold"). Depending upon whether the dynamic range is underutilized (i.e. capacity available) or over utilized (i.e. overflow condition) the weighting coefficients are increased (via a "decay time constant") or decreased (via an "attack time constant") respectively. EX-1004 [0015], [0017]; EX-1003 ¶80.

> When the signal, 231, at **Power Calculator 228 is lower than a predetermined "decay threshold", the weighted coefficients 214 to**

> **214 are increased over time based on a decay time constant** and a fair weighting based on input Power calculators 208, to 208, is applied to the input signals 204 to 204 until a satisfactory power level is achieved at combined power calculator 228**. Conversely, when the signal, 231, at combined power calculator 228 is higher than a predetermined "attack threshold," the weighted coefficients 214 to 214 are decreased over time based on an attack time constant** and a fair weighting based on input Power calculators 208, to 208, is applied to the input signals 204, to 204, until a satisfactory power level is achieved at combined power calculator 228.

EX-1004 [0015] emphasis added; EX-1003 ¶80.

Because the signals being combined are continually changing, a POSA understood that upon feedback that the combined power level of the aggregated attenuated signals $218_{i\text{-}n}$ is lower than a decay threshold, which is a measure of the unused portion of the systems total dynamic range capacity after attenuation of the individual signals, Solum discloses that the weighted coefficients are subsequently increased. Solum discloses the weighting coefficients [*gain factor*] are determined as a function of this feedback (i.e. the system's unused dynamic range after attenuation of other signals) and thus Solum discloses the gain factor *is determined in response to a remaining portion of the total system dynamic range after attenuation of other signal levels of the plurality of signal levels.* EX-1003 ¶81.

Claim 2

The method of claim 1 wherein the dynamic range fair share threshold is initially determined by an inverse of a quantity of the plurality of distributed antennas.

Solum does not expressly state that the dynamic range fair share threshold is initially determined by an inverse of a quantity of the number of antennas. However, a POSA understood that the initial threshold of Solum is set as a function of the number of antennas. As the number of antennas goes up, the number of signals at port 205 go up. For a given dynamic range, the threshold level for each signal at port 205 must go down as the number of antennas goes up so as to not exceed the combined signal threshold—which defines an inverse relationship between the threshold level and the number of antennas [*threshold is initially determined by an inverse of a quantity of the plurality of distributed antennas*]. EX-1003¶82.

Claim 4

The method of claim 1 and further including attenuating with unity gain signal levels that are less, than or equal to the dynamic range fair share threshold.

Solum discloses attenuating signals only if those signals are exceeding a predetermined level, therefore as understood by a POSA, signals not exceeding [*less than or equal to*] the predetermined level [*fair share threshold*] are not attenuated thus have a gain of 1 [*unity*].

> [the] controller 230 [determines]which signal or signals exceed a threshold level and will attenuate those signals. So that the combined power at 228 avoids an overflow condition at the node.

EX-1004 [0017]; EX-1003 ¶83.

Claim 5

> ***The method of claim 1 wherein if the signal level is greater than the dynamic range fair share threshold, the gain factor applied to a first signal level is inversely proportional to the first signal level.***

Solum discloses the coefficient weights [*gain factor*] applied to signal exceeding the predetermined level [*dynamic range fair share threshold*] are inversely proportional to the respective signal level.

> The weights of coefficients 214 to 214 are set by the controller based on the individual input power calculators 208_i to 208_n Thus, the smaller the input signal the larger the corresponding weighted coefficient.

EX-1004 [0014]; EX-1003 ¶84.

VIII. THE BOARD SHOULD NOT EXERCISE ITS DISCRETION TO DENY INSTITUTION

A. The Board Should Not Deny Institution Under 35 U.S.C. § 325(d)

Petitioners respectfully submit that the Board should not exercise its discretion under 35 U.S.C. § 325(d) to deny this Petition. When determining whether to exercise discretion under § 325(d), "the Board uses the following two part framework: (1) whether the same or substantially the same art previously was

presented to the Office or whether the same or substantially the same arguments previously were presented to the Office; and (2) if either condition of first part of the framework is satisfied, whether the petitioners have demonstrated that the Office erred in a manner material to the patentability of the challenged claims." *Advanced Bionics, LLC v. MED-EL Elektromedizinische Geräte GmbH*, IPR2019-01469, Paper 6, p. 8 (Feb. 13, 2020) (designated: March 24, 2020).

Denial under § 325(d) is not warranted because the challenges presented in this Petition are neither cumulative nor redundant to the prosecution of the '377 Patent. While Solum was cited on the face of the '377 Patent, it was not applied by the examiner. Instead, during prosecution of the '377 Patent, Solum was provided in an IDS. The applicant did not make any attempt to identify the relevance of Solum with respect to the limitations of the Challenged Claims, or otherwise meaningfully bring Solum to the attention of the examiner. Thus, Solum was not effectively before the examiner. As demonstrated in this Petition, Solum discloses each and every limitation of Claim 1, thus Solum is an anticipating reference. As a result, the examiner erred in allowing the claims of the '377 without issuing a substantive rejection of the claims over Solum.

B. The Board Should Not Deny Institution Under 35 U.S.C. § 314(a)

Under *Fintiv*, the Board takes a holistic view of whether efficiency, fairness, and the merits support the exercise of authority to deny institution in view of an earlier trial date in the parallel proceeding. *Apple Inc. v. Fintiv, Inc.*, Case IPR2020-00019, Paper 11 at 6 (March 20, 2020).

According to the latest guidance from the Director:

> The Board should first assess Fintiv factors 1–5; if that analysis supports discretionary denial, the Board should engage the compelling merits question. If the Board reaches the compelling merits analysis and finds compelling merits, it shall provide reasoning to explain its determination.

CommScope Techs. LLC. V. Dali Wireless Inc. IPR2022-01242, Paper 23 at 6 (February 27, 2023).

Nevertheless, the Board's decision in *Sotera Wireless, Inc. v. Masimo Corp.*, IPR2020-01019, Paper 12 (Dec. 1, 2020) instructs that a holistic view of the remaining *Fintiv* factors also weighs in favor of institution.

Factor 1 is neutral because no request for stay has been filed.

Under factor 2, trial has been set for October 20, 2025. A Final Written Decision is expected in the present matter in June 2026. However, given the variability of trial schedules, this factor is neutral.

Factor 3 favors institution. The co-pending litigation is in its early stages, and the investment in it has been minimal. Thus, this factor weighs against discretionary denial.

Factor 4 weighs against discretionary denial, Petitioners stipulate that if the IPR is instituted, it will not pursue the same grounds in the district court litigation. *Sand Revolution II LLC v. Continental Intermodal Group – Trucking LLC*, IPR2019-01393, Paper 24 at 7 (June 16, 2020) (informative). In addition, PO has only identified in the Complaint a subset of the claims (Claim 1 vs. Claims 1, 2, 4 and 5) that are being challenged in the present Petition. Thus, it is unlikely the district court will be addressing the validity of all of the claims challenged by this Petition.

Under factor 5, Petitioners are defendants in the Related Litigation. Nothing within *Fintiv* suggests that the same party between the proceedings weighs in favor of discretionary denial. *See HP Inc. v. Slingshot Printing LLC*, IPR2020-01084, Paper 13 at 9 (having the "same parties as parallel proceeding" makes factor 5 "neutral")).

Assessing *Fintiv* factors 1–5, the Board should find that discretionary denial is not supported. Nevertheless, should the Board reach the compelling merits question, the merits of the Petition are particularly strong, as Solum is an anticipating reference from the same corporate entity as the '377 Patent, including

explicit disclosures of limitations [1.3] and [1.4] upon which the '377 Patent gained allowance. EX-1002 21. Solum, as described in the petition (§ II. above), is a parallel disclosure to the '377 Patent, meaning that it is directed at the same problem and proposes the same solution as the '377 Patent, and discloses identical architecture and the identical concepts disclosed in the '377 Patent, but uses some different words (§ VII.A. above), thus demonstrating that the Petition is particularly strong in the underlying merits. Thus, the evidence presented herein, if unrebutted in trial, would lead to a conclusion that one or more claims are unpatentable by a preponderance of the evidence.

When viewed holistically, the timing of the present Petition is reasonable, there has been relatively limited investment in the Related Litigation, and there is minimal overlap between the present IPR and the Related Litigation. Further, coupling these *Fintiv* considerations with compelling evidence of unpatentability presented in the Petition, the efficiency and integrity of the IPR process is best served by instituting review.

IX. MANDATORY NOTICES UNDER 37 C.F.R. §42.8

A. Real Party-in-Interest (37 C.F.R. § 42.8(b)(1))

The real parties-in-interest in this Petition are Ericsson Inc., Telefonaktiebolaget LM Ericsson, and Cellco Partnership d/b/a Verizon Wireless.

No other parties have directed, funded, or controlled the filing of this IPR, and this IPR was not filed at the behest of any other party.

Additionally, out of an abundance of caution in light of prior challenges to the named real parties-in-interest in separate and unrelated IPR petitions, Verizon Wireless further identifies Verizon Communications Inc. and Verizon Corporate Resources Group LLC as real parties-in-interest for the IPR requested by this Petition, solely to the extent that Patent Owner contends that these separate legal entities should be named real parties-in-interest in the requested IPR, and Verizon Wireless does so to avoid the potential expenditure of resources to resolve such a challenge. Also, Verizon Wireless notes that Verizon Wireless has several hundred affiliated entities and each of these entities agrees to be estopped under the provisions of 35 U.S.C. §315 as a result of any final written decision in the requested IPR to the same extent that Verizon Wireless is estopped..

B. Related Matters (37 C.F.R. § 42.8(b)(2))

1. Judicial Matters

As of the filing date of this Petition and to the best knowledge of Petitioners, the '377 Patent is involved in the following litigations:

Procomm Int'l PTE LTD v. Verizon Commc'ns, Inc. et al., Case No. 2:24-cv-009-RWS-RSP (E.D. Tex) (filed Jan. 8, 2024) (ongoing).

2. Administrative Matters:

As of the filing date of this Petition and to the best knowledge of Petitioners, the '377 Patent was not subject to any *inter partes* reviews or reexaminations

3. Related Patents

See Exhibit. EX-1010.

C. Lead/Back-up Counsel (37 C.F.R. § 42.8(b)(3)):

Lead Counsel:

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D. Notice of Service Information (37 C.F.R. § 42.8(b)(4)):

Please direct all correspondence to lead and back-up counsel at the above addresses and DC-IPdocketing@duanemorris.com. Petitioners consent to electronic service at the email addresses above.

X. CONCLUSION

For the reasons set forth above, Petitioner has established a reasonable likelihood of prevailing with respect to all Challenged Claims of the '377 Patent and requests the Board institute *inter partes* review and then cancel all claims as unpatentable.

Respectfully submitted,

DUANE MORRIS LLP

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Dated: December 31st, 2024

CERTIFICATION OF SERVICE ON PATENT OWNER

Pursuant to 37 C.F.R. §§ 42.6(e), 42.8(b)(4) and 42.105, the undersigned certifies that on the 31st of December 2024, a complete and entire copy of this Petition for *Inter Partes* Review of U.S. Patent No. 7,103,377 and all supporting exhibits were served via Federal Express, postage prepaid, to Procomm International PTE. LTD by serving the correspondence address of record for the '377 Patent:

34206 - FOGG & POWERS LLC
4600 W 77th Street
Suite 305
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Curtesy copies were also served on litigation counsel at the following email addresses:

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ATTORNEY FOR PETITIONER

CERTIFICATE OF COMPLIANCE

Pursuant to 37 C.F.R. § 42.24 *et seq*., the undersigned certifies that this document complies with the type-volume limitations. This document contains 6,903 words as calculated by the "Word Count" feature of Microsoft Word 2010, the word processing program used to create it.

Dated: December 31st, 2024

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