UNITED STATES DISTRICT COURT
MIDDLE DISTRICT OF FLORIDA
JACKSONVILLE DIVISION

PARKERVISION, INC.,

Plaintiff,

vs.

QUALCOMM INCORPORATED,

Defendant.

Case No. 3:11-cv-719-J-37TEM

QUALCOMM INCORPORATED,

Counterclaim Plaintiff,

vs.

PARKERVISION, INC.; and STERNE, KESSLER, GOLDSTEIN & FOX PLLC,

Counterclaim Defendants.

ORDER

This cause is before the Court on the construction of forty-four terms that appear in eighty-nine claims of six U.S. patents.

BACKGROUND

ParkerVision contends that Qualcomm infringes, either directly or indirectly, the claims of U.S. Patent No. 6,061,551 ("the '551 Patent"), U.S. Patent No. 6,266,518 ("the '518 Patent"), U.S. Patent No. 6,370,371 ("the '371 Patent"), U.S. Patent No. 6,963,734 ("the '734 Patent"), U.S. Patent No. 7,496,342 ("the '342 Patent"), and U.S. Patent No. 7,724,845 ("the '845 Patent"). The patents-in-suit relate to methods, systems, and apparatuses used to convert electromagnetic signals from higher frequencies to lower

frequencies. Such down-conversion is used, for instance, in the operation of cellular telephones and similar devices.

The parties have requested pretrial claim construction by the Court. The parties presented a non-adversarial tutorial on the technology on July 24, 2012 (Doc. No. 146, July 24, 2012 Hr'g Tr.); submitted two joint statements (Doc. Nos. 110, 114); filed opening and closing briefs together with documents in support (Doc. Nos. 119, 120, 121, 122, 136, 137, 138, 139); and presented arguments at a claim construction hearing (Doc. No. 163, Aug. 8, 2012 Hr'g Tr.). The Court also appointed a technical advisor, Richard Egan of O'Keefe, Egan, Peterman & Enders, LLP. (Doc. No. 162.)

The Court now turns to the construction of the disputed claim terms.[1]

STANDARDS

Claim construction is a matter of law. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1330 (Fed. Cir. 2005) (en banc). The Federal Circuit directs district courts construing claim terms to focuses on intrinsic evidence—that is, the claims, specification, and prosecution histories—because intrinsic evidence is "the most significant source of the legally operative meaning of disputed claim language." *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1582 (Fed. Cir. 1996); *Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 979 (Fed. Cir. 1995) (en banc), *aff'd*, 517 U.S. 370 (1996). Claim terms must be interpreted from the perspective of one of ordinary skill in the relevant art at the time of the invention. *Phillips*, 415 F.3d at 1313.

Claim construction starts with the claims, *id.* at 1312, and remains centered on the words of the claims throughout, *Interactive Gift Express, Inc. v. CompuServe, Inc.*,

[1] The parties have agreed to the construction of a number of claim limitations (*see* Doc. No. 141, pp. 11–12; Doc. No. 137, p. 20), which the Court hereby adopts as stipulations.

256 F.3d 1323, 1331 (Fed. Cir. 2001). In the absence of an express intent to impart a different or unique meaning to claim terms, the terms are presumed to have their ordinary meaning. *Id.* Claim limitations, however, must be read in view of the specification and prosecution history. *Id.* Indeed, the specification is often "the single best guide to the meaning of a disputed term." *Phillips*, 415 F.3d at 1315.

ANALYSIS

For ease of reference, the Court's analysis of the forty-four disputed claim limitations proceeds in roughly the same order and format as presented by the parties in their Corrected Joint Claim Construction Pre-Hearing Statement. (Doc. No. 141.) Where possible, the Court discusses the construction of similar terms together.

1. Sampling and Similar Terms

In the claims identified in the table below, the patents-in-suit use the terms "sampling," "under-samples," "sub-sampling," and "sub-sample." The parties dispute the meaning of these terms as follows:

Term	Claims	ParkerVision	Qualcomm
"Sampling"	1, 2, 3, 12, 17, 24, 27, and 82 of the '518 Patent	"capturing energy of a signal at discrete times"	"reducing a continuous signal to a discrete signal"
"Under-samples"	5 and 13 of the '734 Patent[2]	"sampling at an aliasing rate"	"sampling at an aliasing rate using negligible apertures"

[2] The term "under-sample" is also used in claims 97 and 98 of the '518 Patent.

Term	Claims	ParkerVision	Qualcomm
"Sub-sampling"	77, 81, 90, and 91 of the '518 Patent[3]		"sampling/sample at a sub-harmonic rate""
"Sub-sample"	1, 2, 22, 23, 25, and 31 of the '371 Patent		

The Court first considers the parties' arguments as they relate to "sampling." The Court then considers the arguments that relate to the remaining terms.

A. "Sampling"

ParkerVision contends that the term "sampling" used in the claims of the '518 Patent refers to the capturing of energy at discrete times, which is how one skilled in the art would understand the term in the context of these patents. (Doc. No. 122, pp. 9–10.) Qualcomm argues that one skilled in the art would understand the term sampling to refer to the process by which a continuous signal is reduced to a discrete signal. (Doc. No. 119, pp. 3–4.) Qualcomm also argues that ParkerVision's definition improperly inserts the concept of "capturing energy" into this term. (*Id.* at 4.) ParkerVision asserts that Qualcomm's definition does not place the term in the proper context and merely adopts "basic" terminology. (Doc. No. 122, p. 10.)

The patents-in-suit do not expressly define the term sampling, nor is the term defined or expanded upon in the file wrappers. The specification of the '518 Patent introduces the concept of sampling as follows:

[3] *See* Doc. No. 141, p. 2. The Court notes that "sub-sampling" or a similar term is also found in claims 32, 77, 78, 90, and 93 of the '518 Patent.

> Conventional signal processing techniques follow the Nyquist sampling theorem, which states that, in order to faithfully reproduce a sampled signal, the signal must be sampled at a rate that is greater than twice the frequency of the signal being sampled. When a signal is sampled at less than or equal to twice the frequency of the signal, the signal is said to be under-sampled, or aliased. Conventional signal processing thus teaches away from under-sampling and aliasing, in order to faithfully reproduce a sampled signal.

'518 Patent col. 18 ll. 15–24; *see also* '551 Patent col. 19 ll. 45–53.

Similarly, Professor Alan Oppenheim[4] introduces the concept of sampling, which is significant enough to merit a chapter in his textbook, as follows:

> Under certain conditions, a continuous-time signal can be completely represented by and recoverable from knowledge of its values, or *samples*, at points equally spaced in time. This somewhat surprising property follows from a basic result that is referred to as the *sampling theorem*. This theorem is extremely important and useful. It is exploited, for example, in moving pictures, which consist of a sequence of individual frames, each of which represents an instantaneous view (i.e., a sample in time) of a continuously changing scene.

Alan V. Oppenheim, et al., *Signals & Systems* 514 (2d ed. 1996). Sampling is useful, teaches Professor Oppenheim, because "processing discrete-time signals is more flexible and is often preferable to processing continuous-time signals." *Id.* Sampling is therefore

> an extremely attractive and widely employed method for using discrete-time system technology to implement continuous-time systems and process continuous-time signals: We exploit sampling to convert a continuous-time signal to a discrete-time signal, process the discrete-time signal using a discrete-time system, and then convert back to continuous time.

Id. at 514–15.

In sum, while the specifications of the patents-in-suit do not explicitly define the term "sampling," they introduce the term by referring to what was well-known in the art

[4] Qualcomm cites to this text in support of its contentions.

and use the term in a manner consistent with how it is used in the art. Moreover, the patents-in-suit continue to use the term in its commonly understood sense, even when other well-known terms of art are expressly redefined or modified in the description. For example, the term "aliasing," which has a commonly understood meaning to those skilled in the art and is used in that way in some places in the disclosure, *see id.*, is expressly re-imagined by the inventors to broadly refer to the energy transfer techniques disclosed in the patents, as well as the more conventional signal processing technique of under-sampling, '518 Patent col. 20 ll. 55–59; *see also* '551 Patent col. 20 ll. 7–11 (defining the term aliasing as referring both to "down-converting an EM signal by under-sampling the EM signal at an aliasing rate and to down-converting an EM signal by transferring energy from the EM signal at the aliasing rate").

Given this contrast, the term's well-known meaning to those skilled in the art, and the lack of an explicit definition in the specifications, the Court concludes that the term "sampling" as used in the claims of the '518 Patent refers to "reducing a continuous-time signal to a discrete-time signal."

B. "Sub-Sampling"; "Sub-Sample"; and "Under-Samples"

These terms appear in the claims of the '518 Patent, the '371 Patent, and the '734 Patent. The '518 Patent matured from a continuation of the application that was issued as the '551 Patent. Thus, the '518 Patent has the same specification as the '551 Patent. The '371 Patent and the '734 Patent, however, do not claim priority to the '551 Patent but instead "incorporate by reference," among other things, the teachings of the '551 Patent. *See, e.g.*, '371 Patent col. 1 ll. 10–27.

ParkerVision contends that one skilled in the art would understand these terms to "refer to sampling at an aliasing rate, i.e., at a rate that is less than or equal to twice the

frequency of the signal being sampled." (Doc. No. 122, p. 11.) Qualcomm, on the other hand, contends that "under-sampling" should be understood to mean "sampling at an aliasing rate using negligible apertures," and that the terms "sub-sample" and "sub-sampling" mean sampling "at a sub-harmonic rate." (Doc. No. 119, pp. 4–6.) These meanings, according to ParkerVision, improperly limit the scope of the claims. (Doc. No. 136, pp. 5–7.)

The terms "sub-sample" and "sub-sampling" generally do not appear in the patents-in-suit except in the claims.[5] To the extent they are discussed, they are introduced in the specifications during a discussion about the usefulness of the Nyquist sampling theorem. *See* '518 Patent col. 18 ll. 15–24; '551 Patent col. 19 ll. 45–53. The specifications note that "[w]hen a signal is sampled at less than or equal to twice the frequency of the signal, the signal is said to be under-sampled, or aliased." '518 Patent col. 18 ll. 15–24. Thus, according to the specification, "under-sampling" refers to a signal that was sampled at less than or equal to twice the frequency of the signal. Because the parties agree that the term "aliasing rate" means sampling at a rate "that is less than or equal to twice the frequency of the carrier signal," (Doc. 141, p. 11), the meaning of "under-sampling" therefore could be simplified to "sampling at an aliasing rate."

Qualcomm contends that "under-sampling" must also refer to an aliasing rate using negligible apertures. Figure 45 of the '518 Patent, for example, is a Venn diagram that suggests that "under-sampling" is a distinct concept from "transferring energy." Qualcomm's arguments spring from this inference, as well as an inference drawn from

[5] "Sub-sampling" also appears in the title of a master thesis publication listed on page 10 of the '518 Patent.

the general structure of the specification, which discusses under-sampling separately from transferring energy. According to Qualcomm, the time duration of the apertures used to sample the input signal is one of the critical distinctions between under-sampling and transferring energy. (Doc. No. 119, p. 5.) Qualcomm therefore points to a passage from the '551 Patent stating that "under-sampling systems utilize a sample and hold system controlled by an under-sampling signal" that "include[] a train of pulses having negligible apertures that tends toward zero time in duration," as support for its contention that under-sampling must also refer to an aliasing rate using negligible apertures. (*Id.*)

The patents-in-suit, however, do not use the term "under-sample" as narrowly as Qualcomm contends. While the specifications sometimes use the term "under-sampling" to distinguish certain systems from those systems that implement the disclosed transferred energy methods, the specifications use the term more broadly in other places.[6] The '734 Patent, for example, uses the term "under-sample" to refer to systems that transfer energy. *See* '734 Patent col. 12 ll. 46–52. Indeed, that patent refers to the "charge transferred during a pulse" as "an under-sample." *Id.* Further, the '845 Patent teaches, in connection with a "non-negligible aperture," that the "general concept is to under-sample the carrier while over sampling the information." '845 Patent col. 189 ll. 23–26. The claims of the '518 Patent containing the term "under-sampling" similarly use that term in its broader sense. Claim 97 of the '518 Patent, for example,

[6] A patent may, in some circumstances, use a term having multiple meanings. *See Ying-Nature (Guangdong) Wood Indus. Co., Ltd. v. Int'l Trade Comm'n*, 535 F.3d 1322, 1338 (Fed. Cir. 2008) (concluding that a claim term may have two different meanings).

encompasses a method having the step of "under-sampling the first signal over aperture periods to transfer energy from the first signal." '518 Patent col. 120 ll. 55–57.

In view of the use of "sampling" in the specification of the '734 Patent, and the use of the term "under-sampling" in the claims of the '518 Patent, the Court concludes that ParkerVision's proposed construction—"capturing energy of a signal at discrete times"—is the better one.

As for the terms "sub-sample" and "sub-sampling," the Court concludes that it would be improper to conflate the addition of the prefix "sub" to sampling in the claims of the '518 Patent and the '371 Patent with the discussion in the specifications concerning sub-harmonic frequencies. The Court concludes that the claims of the '518 Patent use the terms as synonyms for the term "under-sample." *See, e.g.*, *Tandon Corp. v. U.S. Int'l Trade Comm'n*, 831 F.2d 1017, 1023–24 (Fed. Cir. 1987). For example, claim 32 recites a "method of claim 29, wherein in step (2) the first signal is sub-sampled." '518 Patent col. 116 ll. 35–36. Step (2) of claim 29 is directed to "sampling the first signal over aperture periods to transfer energy from the first signal." *Id.* at col. 116 ll. 25–26. Additionally, claim 94 of the '518 Patent embraces an "apparatus of claim 93, wherein N indicates: a harmonic or sub-harmonic of the aliasing rate." '518 Patent col. 120 ll. 53–54. Claim 93 claims an apparatus having a "means for generating an energy transfer signal that is used to control said sub-sampling, the energy transfer signal having an aliasing rate determined according to: (a frequency of the first signal +/- a frequency of the second signal) divided by N." *Id. at col.* 120 ll. 41–46. Qualcomm's proposed construction conflicts with how "sub-sampling" is used in these and other claims. As such, the Court declines to adopt Qualcomm's construction for the terms "sub-sample" and "sub-sampling."

In view of the above, the Court construes "under-sampling," "sub-sampling," and "sub-samples" to mean "sampling at an aliasing rate."

2. "Transferring . . . Energy" and Similar Terms

In the claims identified in the table below, the patents-in-suit use several limitations directed at "transferring . . . energy," which the Court will refer to as "transferring energy" or "energy transfer" terms. The parties dispute the meaning of these terms as follows:

Term	Claims	ParkerVision	Qualcomm
"transferring non-negligible amounts of energy from the carrier signal"	1, 2, 3, 8, 9, 12, 16, 20, 39, 41, 50, 54, 55, 57, 92, 93, 108, 113,[7] and 126 of the '551 Patent	"transferring energy (i.e., voltage and current over time) in amounts that are distinguishable from noise"	"moving sufficient energy from the carrier signal into storage to cause substantial distortion of the carrier signal"
"sampling the carrier signal . . . to transfer energy"	1, 2, 3, 12, 17, 24, and 27 of the '518 Patent		
"transferring a . . . portion of the energy . . . of the carrier signal"	41 and 50 of the '551 Patent; and 5 and 6 of the '845 Patent		

[7] In claim 113 of the '551 Patent, this term is recited as "the step of transferring controlled substantial amounts of energy from the carrier signal during aperture periods."

Term	Claims	ParkerVision	Qualcomm
"receives non-negligible amounts of energy transferred from a carrier signal"	23, 24, 25, 26, 31, 32, 135, 149, 150, 161, 192, 193, 195, 196, 198, 202, and 203 of the '551 Patent	"receives energy (i.e., voltage and current over time) from the carrier signal in amounts that are distinguishable from noise"	"stores sufficient energy transferred from the carrier signal to cause substantial distortion of the carrier signal"
"sub-sampling the first signal . . . to transfer energy"	77, 81, 90, and 91 of the '518 Patent	"transferring energy (i.e., voltage and current over time) in amounts that are distinguishable from noise"	"moving sufficient energy from the carrier signal into storage to cause substantial distortion of the carrier signal"

ParkerVision argues that the dispute between the parties turns on what is meant by "non-negligible amounts of energy." (Doc. No. 122, pp. 4–5.) ParkerVision contends that one skilled in the art would, after reading the all of the disclosures in the patents-in-suit, recognize that these terms refer to techniques that involve transferring non-negligible energy in amounts distinguishable from noise. (*Id.*) Qualcomm, on the other hand, contends that these terms should be understood in the context of the "alleged novelty of the claimed method of down-conversion by 'transferring . . . energy.'" (Doc. No. 119, pp. 6–9.) Qualcomm argues that a person of ordinary skill in the art would understand this term to mean moving energy from the carrier signal into storage sufficient to cause substantial distortion of the carrier signal. (*Id.*) In support, it points to statements made by ParkerVision during the prosecution of a related U.S. patent application and a European patent application. (*Id.*)

The specifications teach that methods and systems for down conversion work by:

> transferring non-negligible amounts of energy from the EM signals. The resultant down-converted signals have sufficient energy to allow the down-converted signals to be distinguishable from noise. The resultant down-converted signals also have sufficient energy to drive lower impedance circuits without buffering.

'551 Patent col. 63 ll. 29–34. Continuing, the specifications teach:

> Unlike under-sampling signals that have negligible aperture pulses, the energy transfer signal includes a train of pulses having non-negligible apertures that tend away from zero. This provides more time to transfer energy from an EM input signal. One direct benefit is that the input impedance of the system is reduced so that practical impedance matching circuits can be implemented to further improve energy transfer and thus overall efficiency. The non-negligible transferred energy significantly improves the signal to noise ratio and sensitivity to very small signals, as well as permitting the down-converted signal to drive lower impedance loads unassisted. Signals that especially benefit include low power ones typified by RF signals. One benefit of a non-negligible aperture is that phase noise within the energy transfer signal does not have as drastic of an effect on the down-converted output signal as under-sampling signal phase noise or conventional sampling signal phase noise does on their respective outputs.

Id. at col. 66 ll. 36–54.

Rather than address these and other portions of the specifications, Qualcomm relies on statements made during the prosecution of a subsequent patent, the prosecution of a foreign counterpart application, and a press release. The Court does not find these statements persuasive. The comments in the U.S. application appear to have been made not to define transferring energy but rather to distinguish the storage devices that were the subject of that subsequent application from the devices used when a signal is under-sampled.

As for the statements made during the prosecution of the European application, the Federal Circuit has cautioned "against indiscriminate reliance on the prosecution of corresponding foreign applications in the claim construction analysis." *AIA Eng'g Ltd. v. Magotteaux Int'l S/A*, 657 F.3d 1264, 1279 (Fed. Cir. 2012). Such caution is warranted

here because the language that Qualcomm points to in the foreign prosecution was offered in support of the addition of the following limitation: "wherein said transferring of energy substantially prevents accurate voltage reproduction of the modulated carrier signal during the time apertures." (Doc. No. 120-7.) This limitation is not the same as those at issue in this case. Further, the Court has not been presented with the context in which these statements were made, that is, the claims that the limitation modified, the requirements of foreign laws to which the applications are responding, and the examination practices of the foreign office. *See, e.g.*, *AIA Eng'g Ltd.*, 657 F.3d at 1279. As such, the import and relevance of these statements are murky at best.

While the Court finds ParkerVision's definition more persuasive, the Court sees no reason to explicitly define "energy" as ParkerVision does in its proposed claim construction. One skilled in the art clearly would know what is meant by energy. The parenthetical is unnecessary and will be omitted from the Court's construction of these terms.

Accordingly, the Court will construe "transferring non-negligible amounts of energy from the carrier signal," "sampling the carrier signal . . . to transfer energy," and "transferring a . . . portion of the energy . . . of the carrier signal" to mean "transferring energy in amounts that are distinguishable from noise." The remaining terms, "receives non-negligible amounts of energy transferred from a carrier signal" and "sub-sampling the first signal . . . to transfer energy," to mean "receives energy from the carrier signal in amounts that are distinguishable from noise" and "transferring energy in amounts that are distinguishable from noise," respectively.

3. "Lower Frequency Signal"

"Lower frequency signal" appears in claims 1, 2, 3, 8, 9, 12, 16, 20, 23, 24, 25, 26, 31, 32, 39, 41, 50, 54, 55, 57, 92, 93, 108, 113, 126, 135, 149, 150, 161, 192, 193, 195, 196, 198, 202, and 203 of the '551 Patent and claims 1, 2, 22, 23, 25, and 31 of the '371 Patent. The parties offer the following constructions of this limitation:

ParkerVision	**Qualcomm**
"a signal with frequency below the carrier signal frequency"	"a signal with frequency below the carrier signal frequency and above the baseband frequency"

The dispute between the parties turns on whether this claim limitation embraces the baseband frequency. ParkerVision argues that the plain language used encompasses all frequencies lower than that of the carrier signal. (Doc. No. 122, pp. 7–8.) It contends further that there has been no lexicography or disclaimer which would limit the scope of this claim term in a way that would exclude the baseband frequency. (*Id.* at 7.)

Qualcomm asserts that this term was explicitly defined in the specification to exclude the baseband frequency. (Doc. No. 137, pp. 6–7.) Qualcomm reaches this conclusion because the specification of the '551 Patent states that "the terms lower frequency, intermediate frequency, intermediate and IF are used interchangeably herein," '551 Patent col. 14 ll. 46–47, and "[w]hen a modulated carrier signal is down-converted to a lower frequency signal, the lower frequency signal is referred to herein as an intermediate frequency (IF) signal F_{IP}," *id.* at col. 19 ll. 15–18. According to Qualcomm, "the specification identifies direct conversion to baseband as a special case, distinct from down-conversion utilizing an intermediate frequency." (Doc. No. 137, p. 7.)

On their face, the words chosen by the patentee do not evince the intent to exclude the baseband frequency. Thus, ParkerVision's definition—"a signal with frequency below the carrier signal frequency"—more closely aligns with the plain language of the claim. The statements from the specification to which Qualcomm points do not show an intention to exclude the baseband frequency. The first statement is taken from the portion of the specification that defines the term "intermediate frequency." The specification states:

> The term intermediate frequency (IF) signal, when used herein, refers to an EM signal that is substantially similar to another EM signal except that the IF signal has a lower frequency than the other signal. An IF signal frequency can be any frequency above zero HZ. Unless otherwise stated, the terms lower frequency, intermediate frequency, intermediate and IF are used interchangeably herein.

'511 Patent col. 14 ll. 42–48. The final sentence in this passage does not imply that the terms "lower frequency," "intermediate frequency," "intermediate," and "IF" are identical. Rather, that sentence informs the reader that the identified terms may be used interchangeably, which is to say that the description of the invention is drafted so as to allow one of these terms to be exchanged with another without loss of function.

The second statement is taken from the portion of the specification of the '551 Patent in which the patentees discuss the demodulation of the carrier signal. *Id.* at col. 19 ll. 6–43. The specification introduces this concept by referencing a common problem in the technical field—that is, "it is generally impractical to demodulate the baseband signal F_{MB} directly from the modulated carrier signal F_{MC}"—and a well-known solution to that problem—that is, the down-conversion of the carrier signal to a frequency lower than the carrier signal but higher than the baseband signal. *Id.* at col. 19 ll. 10–14. The statement cited by Qualcomm is an extension of this discussion

that identifies the latter as an "intermediate frequency." When taken in context, one skilled in the art would recognize that the lower frequency signal in this discussion can be either (1) the baseband signal or (2) an intermediate frequency.

Accordingly, the Court construes the term "lower frequency signal" to mean "a signal with frequency below the carrier signal frequency."

4. "Harmonic or Sub-Harmonic of the Carrier Signal" and Similar Terms

In the claims identified in the table below, the patents-at-issue use the terms "n represents a harmonic or sub-harmonic of the carrier signal" and "n indicates a harmonic or sub-harmonic of the carrier signal." The parties' proposed meanings of these terms are as follows:

Term	**Claims**	**ParkerVision**	**Qualcomm**
"where n represents a harmonic or sub-harmonic of the carrier signal"	1, 2, 3, 8, 9, 12, 16, 20, 23, 24, 25, 26, 31, 32, 39, 41, 50, 54, 55, 57, 92, 93, 108, 113, 126, 135, 149, 150, 161, 192, 193, 195, 196, 198, 202, and 203 of the '551 Patent	"n is 0.5 or an integer greater than or equal to 1"	"n is 0.5 or an integer greater than 1"
"wherein N indicates a harmonic or sub-harmonic of the carrier signal."	1, 2, 3, 12, 17, 24, 27, and 82 of the '518 Patent		

The parties dispute whether the terms "harmonic or sub-harmonic of the carrier signal" embrace the situation where "n" is equal to 1. Qualcomm argues that when n

equals 1, the specifications teach that the corresponding aliasing rate is the "fundamental frequency," which it contends is different than a harmonic or sub-harmonic. (Doc. No. 119, p. 13.)

The Court declines to adopt Qualcomm's construction. The specifications teach that n can be equal to 1, *see, e.g.*, '551 Patent col. 30 ll. 23, and that "n identifies a harmonic or sub-harmonic of the aliasing rate (generally, n=0.5, 1, 2, 3, 4, . . .)," *id.* at col. 23 ll. 48–59. The Court therefore construes these terms to mean "n is 0.5 or an integer greater than or equal to 1."

5. "Integrating . . . Energy" and Similar Terms

In the claims identified in the table below, the patents-in-suit contain limitations relating to "integrating . . . energy." The parties dispute the meaning of these terms as follows:

Term	**Claims**	**ParkerVision**	**Qualcomm**
"integrating the . . . energy"	50, 108, and 113 of the '551 Patent; and 1, 2, 3, 12, 17, 24, 27, 77, 81, 82, 90 and 91 of the '518 Patent	"accumulating the energy"	term is indefinite, or "storing in a storage module the energy transferred during an aperture period"
"energy is . . . integrated"	1, 2, 22, 23, 25, and 31 of the '371 Patent	"energy is accumulated"	term is indefinite, or "the energy transferred during an aperture period is stored in a storage module"

Term	Claims	ParkerVision	Qualcomm
"integrates the . . . energy"	161, 198, and 202 of the '551 Patent	"accumulates the energy"	term is indefinite, or "stores in a storage module the energy transferred during an aperture period"
"integrates . . . energy"	203 of the '551 Patent	"accumulates energy"	term is indefinite, or "stores in a storage module the energy transferred during an aperture period"
"the integrated energy"	198, 202, and 203 of the '551 Patent	"the accumulated energy"	term is indefinite, or "the transferred energy stored in a storage module during an aperture period"

Qualcomm contends that these claim limitations are indefinite. (Doc. No. 119, pp. 14–15.) It argues that a person skilled in the art would not understand what is meant by these terms because "integrating . . . energy" has no well-known physical meaning and none has been explicitly supplied in the specifications. ParkerVision responds that the term "integration" is easily understood by a person skilled in the art, as is the term "energy." (Doc. 136, p. 11.) As such, ParkerVision argues, these claim terms are not insolubly ambiguous and without discernible meaning. (*Id.*)

A patent specification must "conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention." 35 U.S.C. § 112, ¶ 2. This requirement is satisfied where "one skilled in the art would understand the bounds of the claim when read in light of the specification

. . . ." *Exxon Research & Eng'g Co. v. United States*, 265 F.3d 1371, 1375 (Fed. Cir. 2001). A claim is not indefinite merely because it is difficult to construe. *Id.* To be indefinite, a claim term must be "not amenable to construction or insolubly ambiguous." *Ultimax Cement Mfg. Corp. v. CTS Cement Mfg. Corp.*, 587 F.3d 1339, 1352 (Fed. Cir. 2009).

The Court concludes that the "integrating . . . energy" terms are not so unknowable as to render the claims indefinite. "Integrate" is a transitive verb meaning "to form, coordinate, or blend into a functioning or unified whole," "to unite with something else," or "to incorporate into a larger unit." *Merriam-Webster's Collegiate Dictionary* 650 (11th ed. 2007). While "integrate" may also have a precise mathematical meaning, the claims and specifications can be understood to use "integrating" in the more common sense, that is, to add together.

For instance, claim 53 of the '551 Patent encompasses the "method according to claim 52, wherein step (3) comprises the step of integrating the transferred energy and generating the lower frequency signal from the integrated energy." Claim 52 recites a method comprising the step of "transferring a substantial portion of energy contained in N periods of the carrier signal . . . ." When read together, these claims show that "integrated energy" is collected over discrete time periods and added together.[8] Because the specifications teach a method of transferring energy from one signal to another, one skilled in the art, after reading the claims and specification, would come to

[8] In addition, at least one of the references cited in the '551 Patent uses the term "integration" in this way, which suggests that at least some persons skilled in the art use the term to mean accumulation of an item of interest over time. *See* '551 Patent p. 5 (citing Augusto Burgueño et al., *Influence of Rain Gauge Integration Time on the Rain Rate Statistics Used in Microwave Communications*, 43 Annales des Telecommunications 522–27 (Sep./Oct. 1988)).

appreciate the "integrating energy" terms to refer to the process of adding together or summing the energy transferred during one or more aperture periods.

Thus, of the two proffered constructions, ParkerVision's is the more persuasive. Accumulate is a close approximation to the plain meaning of integrate, and it is descriptive of one of the functions of capacitors, which the Court understands are used in one embodiment of the invention. ParkerVision's construction is also preferable because it encompasses uses like that in claim 52, which clearly contemplates the accumulation of energy from more than one aperture period, whereas Qualcomm's definition does not.

Accordingly, the Court adopts ParkerVision's claim construction for these terms.

6. "Finite Time Integrating Module" and "Finite Time Integrating Operation"

The parties dispute the meaning of the terms "finite time integrating module" and "finite time integrating operation." These terms appear in the claims identified below from the '845 Patent. The parties dispute the meaning of these terms as follows:

Term	Claims	ParkerVision	Qualcomm
"finite time integrating module"	1, 3, 4, 5, 6, 7, 8, 9, 12, 13, 17, 18, 19, 20, 22, 23, and 24	"circuitry that can perform a finite time integrating operation"	"a module with a switch, a pulse generator, and a storage module that stores the energy transferred during an aperture period"
"finite time integrating operation"	1, 3, 4, 5, 6, 7, 8, 9, and 12	"convolving a portion of the carrier signal with an approximate representation of itself"	"an operation that distorts the carrier signal and stores the energy transferred during an aperture period"

A. "Finite Time Integrating Operation"

ParkerVision contends that the inventors of the patents-in-suit coined the term "finite time integrating operation" as an alternative solution to matched filtering/correlating processors. (Doc. No. 122, pp. 13–14.) According to ParkerVision, the specification of the '845 Patent teaches that a finite time integrating operation works by convolving a portion of the carrier signal with an approximate representation of itself. (*Id.*) While the specification teaches one skilled in the art to use an approximate half cycle of the carrier signal, ParkerVision contends instead that the invention is not limited to that embodiment. (*Id.*) It argues that the correct construction of "finite time integrating operation" refers to "convolving a portion of a signal" rather than to "an approximate half cycle of the carrier signal." (*Id.*)

Qualcomm, on the other hand, argues that the term "finite time integrating operation" involves the transfer of energy from a carrier signal into storage. (Doc. No. 119, pp. 16–17.) Thus, according to Qualcomm, such an operation results in the distortion of the carrier signal during each aperture period. (*Id.*) Qualcomm argues that ParkerVision's proposed construction is incorrect because it fails to account for the distinctions between the three categories of operations taught by the '845 Patent. (Doc. No. 137, pp. 12–13.) Qualcomm argues that a person skilled in the art would understand that a "matched filter/correlating operation" is distinct from a "finite time integrating operation," based on an election/restriction requirement interposed by the patent examiner during the prosecution of the '845 Patent. Qualcomm contends that, as construed by ParkerVision, the "matched filter/correlating operation" taught by the '845 Patent would be identical to the "finite time integrating operation." (*Id.*)

The parties' differences encompass roughly two issues. First, the arguments relate to the signal that is convolved with the carrier signal during the down-conversion process, which is referred to in the specification as an "impulse response." Second, the parties dispute whether a finite time integrating operation is limited to a single aperture period.

1. Impulse Response

The '845 Patent teaches those skilled in the art that the disclosed invention can be implemented using, among other things, a "matched filtering/correlating operation" and a "finite time integrating operation." '845 Patent col. 128 ll. 44–48. Both of these embodiments operate by accumulating the energy of a carrier signal and using the accumulated energy to form a down-converted signal.[9] *Id.* at col. 128 ll. 26–51. According to the specification, both operations "recursively determine a voltage or current value for approximate half cycles (e.g., ½, 1½, 2½, etc.) of a carrier signal, typically at a sub-harmonic rate, and use the determined voltage or current values to form a down-converted version of an electromagnetic signal." *Id.* at col. 128 ll. 62–66.

The "matched filtering/correlating" operation and "finite time integrating operation" differ in that the first operation involves "convolving an approximate half cycle of the carrier signal with a representation of itself," *id.* at col. 129 ll. 30–34; in other words, it involves convolving an input signal (the modulated carrier signal) with an impulse response "identical to the modulated carrier signal, $S_i(t)$, to be processed," *id.* at col. 129 ll. 58–61; *see also id.* at col. 129 ll. 34–36.

[9] As such, the Court rejects Qualcomm's proposed construction of this term for the reasons expressed in the section construing the "transferring energy" terms.

A "finite time integrating operation," on the other hand, involves convolving the carrier signal with a "half sine impulse response," a "rectangular impulse response," or a "step function having a duration that is substantially equal to the time interval defined for the waveform, typically a half cycle of the electromagnetic signal." *See id.* at col. 137 ll. 60–65; *see also id.* at col. 130 ll. 35–40; *id.* at col. 131 ll. 28–30. Similarly, the '845 Patent's claims are directed to finite time integrating operations in which the impulse responses are "approximately rectangular," *id.* at col. 192 ll. 12–16 (claim 2), and step functions, *id.* at col. 192 ll. 21–27 (claim 4). According to the specification of the '845 Patent, such impulse responses become, in practice, "triangular or nearly sinusoidal for very high frequency implementations. *Id.* at col. 138 ll. 19–26. These impulse responses are not representations of the original signal, nor are they approximations of the original signal. Rather, they are simply-generated functions that are useful because when they are used as described in the specification, the resulting output approximates the output of a matched filtering/correlating operation. *Id.* at col. 131 ll. 47–48.

The '845 Patent therefore teaches that a finite time integrating operation involves convolving the carrier signal with a half sine impulse response, a rectangular impulse response, a step function, a triangular response, or a nearly sinusoidal response. While the Court is most reluctant to substitute its judgment for that of the parties and counsel, who are intimately familiar with the patents-in-suit, it nonetheless appears that neither proposed construction comports with the description of "finite time integrating operation" that was provided by the '845 Patent's specification. This is problematic because "finite time integrating operation" has no precise and generally understood meaning in the art. As such, the Court must look to the specification for guidance as to the meaning of the term. *On-Line Tech. v. Bodenseewerk Perkin-Elmer*, 386 F.3d 1133, 1138 (Fed. Cir.

2004) (noting that courts should turn to the intrinsic evidence, such as the specification, for guidance as to the meaning of terms having no generally understood meaning in the art). The Court therefore rejects the parties' proposed constructions.[10]

2. Single Aperture Period

Qualcomm's proposed construction limits a "finite time integrating operation" to energy that is transferred during a single aperture period. The specification does not explicitly teach such a limitation, and Qualcomm provides no reason for importing a "single aperture" requirement into the definition of "finite time integrating operation" other than its conclusion that the operation must necessarily be completed during a single aperture period.

The Court is not persuaded that such an conclusion is warranted. First, the Court is not inclined to include a single aperture requirement in view of the Federal Circuit's instruction not to import limitations from the specification into the claims. *Phillips*, 415 F.3d at 1323. Second, the '845 Patent explicitly teaches that some embodiments of the disclosed inventions can accumulate energy over multiple aperture periods. *See, e.g.*, '845 Patent col. 151 ll. 30–45. As such, Qualcomm's proposed construction is not consistent with the specification. *3M Innovative Props. Co. v. Avery Denninson Corp.*, 350 F.3d 1365, 1372 (Fed. Cir. 2003) (rejecting a proposed claim construction where the specification discloses embodiments not consistent with the proposal). Third, because the finite time integrating operation in step (1) of claim 1 of the '845 Patent is

[10] The Court is not inclined to define this term by reference to individual components, as Qualcomm urges, because Qualcomm has not shown that those components can be used to generate all of the different impulse responses that are taught in the specification of the '845 Patent.

explicitly performed "on a portion of a carrier signal," it would be confusing to include a reference to aperture periods in the definition of "finite time integrating operation."

B. "Finite Time Integrating Module"

ParkerVision contends that "finite time integrating module" should be construed to mean "circuitry that can perform a finite time integrating operation." (Doc. No. 122, pp. 13–14.) ParkerVision points out that this term was added to overcome a Section 101 rejection to the original claims, which referred only to a "finite time integrating operation." (*Id.*) Qualcomm contends that ParkerVision's claim construction is incorrect because it is purely functional. (Doc. No. 137, pp. 12–13.) Qualcomm's proposed construction consists of a list of certain electrical components. (*Id.*)

The specification discloses examples of embodiments of the disclosed invention. *See, e.g.*, '845 Patent col. 131 ll. 26–32 (describing "an example finite time integrating system 15100, which can be used to implement method 15000. . . . As can be seen in FIG. 151, system 15100 comprises a switching module 15102 and an integrating module 15104"). The specification also teaches that embodiments of a "finite time integrating processor" can be implemented using a complementary metal oxide semiconductor. *Id.* at col. 137 ll. 53–56; col. 138 ll. 1–29.

The Court agrees with ParkerVision that Qualcomm's proposed construction is too limiting. The Federal Circuit has made it quite clear that, while claim terms are understood in light of the specification, a claim construction must not import limitations from the specification into the claims. *See Phillips*, 415 F.3d at 1323. Moreover, as noted above, Qualcomm has not demonstrated that the components it identified can be used to generate all of the different impulse responses that are taught in the

specification of the ’845 Patent. The Court therefore will not limit the definition of this term to the single embodiment identified by Qualcomm.

* * * * *

Accordingly, the Court construes these terms as follows. The term “finite time integrating operation” refers to “convolving a portion of the carrier signal with an impulse response that is a rectangular, triangular, half sine, nearly sinusoidal, or a step function.” A “finite time integrating module” is “circuitry that can perform a finite time integrating operation.”

7. “Accumulating the Result”

The term “Accumulating the Result” appears in claims 1, 3, 4, 5, 6, 7, 8, 9, and 12 of the ’845 Patent. The parties propose the following meanings for this term:

ParkerVision	**Qualcomm**
no construction necessary	“storing in a storage module the energy transferred over multiple aperture periods”

Claim 1 of the ’845 Patent embraces:

> A method for down-converting an electromagnetic signal, comprising the steps of
>
> (1) performing with a finite time integrating module a finite time integrating operation on a portion of the carrier signal;
> (2) accumulating the result of the finite time integrating operation of step (1); and
> (3) repeating steps (1) and (2) for additional portions of the carrier signal.

The Court agrees with ParkerVision that no construction of “accumulating the result” is necessary. Nothing in the plain language of the claim suggests that the energy accumulated in the second step of the method must be “transferred over multiple

aperture periods." Accordingly, the Court declines to adopt Qualcomm's claim construction.

8. "Impedance Matching" and Similar Terms

In the claims identified in the table below, the patents-in-suit contain limitations relating to "impedance matching." The parties dispute the meaning of these terms as follows:

Term	Claims	ParkerVision	Qualcomm
"impedance matching"	77, 81, 90, and 91 of the '518 Patent	"transferring desired power"	"maximizing power transfer throughout a signal path"
"output impedance match circuit"	25 of the '551 Patent	"a circuit configured to transfer desired power from the energy sampling circuitry"	"a circuit configured to maximize power transfer throughout the output path"
"substantially impedance matched input path"	12 of the '551 Patent; and 12 of the '518 Patent	"circuitry configured to transfer desired power to the input path of the energy sampling circuitry"	"a circuit configured to maximize power transfer throughout the input path"
"input impedance match circuit"	24 of the '551 Patent; and 23 of the '371 Patent	"circuitry configured to transfer desired power to the input of the energy sampling circuitry"	
"first impedance match coupled to said . . . input terminal"	4 of the '734 Patent	"first circuitry configured to transfer desired power to said input terminal"	

Term	Claims	ParkerVision	Qualcomm
"second impedance match coupled to said . . . input terminal"	4 of the '734 Patent	"second circuitry configured to transfer desired power to said input terminal"	

The nub of the dispute concerning these terms is whether power transfer must be "maximized." Qualcomm contends the term "impedance matching" refers to a variety of methods used to "avoid the deleterious effects of impedance mischance, and thus maximize power transfer." (Doc. No. 119, p. 19.) In support, Qualcomm relies on a prior art reference cited by the examiner during the prosecution of the '551 Patent. (*Id.*)

ParkerVision, on the other hand, contends that Qualcomm's definition is too rigid and that a person skilled in the art would understand that the amount of power transferred would not need to be perfectly maximized throughout the input path. (Doc. No. 122, pp. 17–18.) In support, ParkerVision offers a definition from the 7th edition of *The Authoritative Dictionary of IEEE Standards Terms* which defines impedance matching in the same manner as the term "load matching." (Doc. No. 136, pp. 13–14.) That dictionary defines "load matching" as:

> (1) (induction and dielectric heating) The process of adjustment of the load-circuit impedance to produce the desired energy transfer from the power source to the load.
>
> (2) The technique of either adjusting the load-circuit impedance or inserting a network between two parts of a system to produce the desired power transfer or signal transmission.

(Doc. No. 136-2.)

According to the specifications, impedance matching is used to "*optimize* power transferred through the receiver system." '551 Patent col. 25 ll. 25–26 (emphasis

added); *see also* '518 Patent col. 105 ll. 35–38 (teaching that an "impedance matching circuit can be utilized to efficiently couple the down-converted signal with an output impedance"). "Optimized" does not mean "maximized" but rather something more like "adjusted," "equal," or "appropriate."

The specifications teach that an impedance matching circuit could be used to "efficiently couple" a source—say, "an input EM signal" with an impedance of fifty ohms—to the circuitry of the invention—say, an "energy transfer module" with a different impedance. '551 Patent col. 105 ll. 7–17. In other words, impedance matching is used to refer to the process of marrying up the impedance of different components of the system. While this may, under some circumstances, result in maximum power transfer, that is not the only outcome taught in the specification. Thus, Qualcomm's understanding of this term is different than what is taught in the specifications.

Accordingly, the Court is not inclined to define these terms as requiring maximum power transfer. These terms shall be construed in the manner proposed by ParkerVision.

9. "Differential Down-Converted Output Signal" and Similar Terms

The parties dispute the meaning of three similar terms found in the '734 Patent relating to differential down-conversion. The terms, the claims in which they are found, and the parties' proposed constructions are as follows:

Term	Claims	ParkerVision	Qualcomm
"differential down-converted output signal"	1, 4, 5, 6, 9, 12, 13, 14, and 15	no construction necessary, or "the output signal from the differential frequency down-conversion module"	"a signal that is the down-converted replica of the differential input signal"
"differential frequency down-conversion module"	1, 4, 5, 6, 9, 12, 13, 14, and 15	"circuitry for frequency down-converting a carrier signal by differentially combining positive and negative transferred energy samples"	"a circuit that down-converts a differential input signal and outputs a differential down-converted replica of the input signal"
"differentially down-converting"	12, 13, 14, and 15	"down-converting a carrier signal by differentially combining positive and negative transferred energy samples"	"down-converting a differential input signal and outputting a differential down-converted replica of the input signal"

ParkerVision contends that the '734 Patent teaches that its energy-transfer technology can be used in a differential architecture "by combining positive and negative energy samples" to reduce a problem known as "DC offset." (Doc. No. 122, pp. 15–16.) Qualcomm, on the other hand, contends that the "differential . . . signals" terms would be understood by a person of ordinary skill in the art to "refer to a pair of signals, one of which is the inverted version of the other." (Doc. No. 119, p. 19.) Qualcomm's expert explains that the components of a differential signal are commonly designated as positive and negative, which is similar to the manner in which the

specification of the ’734 Patent designates the components of the differential frequency down-conversion module. (*Id.* at 20.)

Claim 1 of the ’734 Patent is directed to:

> An apparatus for down-converting an electromagnetic signal, comprising:
>
> a differential frequency down-conversion module that differentially receives an input signal, wherein said differential frequency down-conversion module comprises a positive input terminal and a negative input terminal, and wherein said differential frequency down-conversion module outputs a differential down-converted output signal;
>
> wherein said differential frequency down-conversion module comprises:
> a first switch,
> a second switch, and
> a storage element coupled between said first and second switches

’734 Patent col. 84 ll. 47–54. The first wherein clause clearly and succinctly identifies the “differential down-converted output signal” as the output from the differential frequency down-conversion module, which is the construction proposed by ParkerVision.

Likewise, the specification of the ’734 Patent is consistent with ParkerVision’s proposed construction. That patent teaches:

> In a preferred embodiment, differential UFD module 9508 comprises a first UFT module 9522, a second UFT module 9524, and a storage module 9534. In a preferred embodiment, storage module 9534 comprises a second capacitor 9526.
>
> A positive or “plus” signal input of a differential RF input signal 9528 is input through first impedance match 9502 to a first terminal 9536 of tank circuit 9506. A negative or “minus” signal input of differential RF input signal 9528 is input through second impedance match 9504 to a second terminal 9538 of tank circuit 9506.
>
> First UFT module 9522 is coupled to first terminal 9536 of tank circuit 9506, and receives the “plus” signal input of differential RF input signal 9528. Second UFT module 9524 is coupled to second terminal 9538 of tank circuit 9506, and receives the “minus” signal input of differential RF input signal 9528.

> First and second UFT modules 9522 and 9524 down-convert differential RF input signal 9528 according to a control signal 9532, which is output by control signal generator 9510, in a manner as described elsewhere herein. The outputs of first and second UFT modules 9522 and 9524 are stored in storage module 9534, and output as differential output signal 9530.
>
> First UFT module 9522 outputs a "plus" output of differential output signal 9530. Second UFT module 9524 outputs a "minus" output of differential output signal 9530. Differential output signal 9530 is equal to the difference voltage between these "plus" and "minus" outputs.

Id. at col. 59, ll. 30–58. Later, the specification notes that a "differential down-converted signal comprises a positive node down-converted signal and a negative node down-converted signal." *Id.* at col. 60 ll. 28–33; *see also* Fig. 113. The specification then describes that, in a subsequent step, the "the differential down-converted signal is measured between the positive node down-converted signal and the negative node down-converted signal. The DC offset voltages in the positive node down-converted signal and the negative node down-converted signal substantially cancel, as described above." *Id.* at col. 60, ll. 41–46.

The specification does not describe the down-converted output signal as a replica of the input signal. Rather, it describes the output signal as being derived from the plus and minus signals. This difference is notable. By describing the output signal in this way, the differential output signal can be described using commonly understood terminology while at the same time capturing the application of that technique to the energy-transfer technology that is the subject of the patents-in-suit.

Accordingly, the Court declines to adopt Qualcomm's claim constructions. The Court finds that "differential down-converted output signal" does not need to be construed, while the remaining terms should be construed in the manner proposed by ParkerVision.

10. "Interpolation Filter"

The term "interpolation filter" appears in claim 9 of the '845 Patent. The parties propose the following meanings:

ParkerVision	**Qualcomm**
"circuitry that outputs a smoothed signal between the input sampled values"	"a component that adds additional values between sampled values and then filters both the original samples and the added values"

ParkerVision contends that one skilled in the art would understand that an "interpolation filter smoothes a signal by interpolating the input values" (Doc. No. 122, p. 18.) It points to an embodiment disclosed in the specification of the '845 Patent known as a "zero order data hold filter" (also referred to in the patents as "Z0DH") as an example interpolation filter. (*Id.*) Qualcomm argues that the concept of interpolations would be known to one skilled in the art as "the fitting of a continuous signal to a set of sample values." (Doc. No. 119, p. 22.) This is commonly used, according to Qualcomm, "for reconstructing a function, either approximately or exactly, from samples." (*Id.*)

The '845 Patent does not explicitly define the term "interpolation filter," and neither party has offered any additional intrinsic evidence of its meaning. The specification teaches that the output of the down-conversion process is passed to a "reconstruction filter or an interpolation filter." '845 Patent col. 129 ll. 53–55; *id.* at col. 131 ll. 23–25; *id.* at col. 132 ll. 31–34. The specification equates a "Z0DH" filter with a type of interpolation filter. *Id. at col.* 160, ll. 19–21 ("This energy is directly used to drive the energy storage element of ~~Z~~0DH filter or other interpolation filter . . . ."). The specification also states, "The Z0DH is a type of lowpass filter or sample interpolator

which provides a memory in between acquisitions." *Id.* at col. 164 ll. 25–26. "Each acquisition," according to the specification, "becomes an accumulated initial condition for the next acquisition." *Id.* at col. 164 ll. 27–28. Likewise, in connection with a discussion of the matched filter embodiments of the invention, the specification teaches:

> In addition, the matched filter operation of embodiments of the present invention is applied recursively to the bandpass signal at a rate sub-harmonically related to the carrier frequency. Each matched filtered result or correlation of embodiments of the present invention is retained and accumulated to provide an initial condition for subsequent recursions of the correlator. This accumulation is approximated as a zero order data hold filter.

Id. at col. 135 ll. 4–11.

The Court understands the '845 Patent to teach that once the sampled input signal is down-converted, the output is passed through a filter that converts the discrete samples to a continuous signal. The method taught by the specification does this by "accumulating" the prior sample for use as the starting point for the next sample. The Court understands this to mean that the continuous signal is generated from samples in a step-like fashion. That is to say, the interpolation filter takes a measurement of a sample and holds that value until the next sample is presented to it to measure. The output from such a filter would be a step-like approximation of the "true" down-converted continuous signal.

In this regard, neither definition offered by the parties sufficiently conveys what is meant by "interpolation filter." On the one hand, the filter does "add additional values between sampled values," as proposed by Qualcomm. However, this definition obscures what the filter is doing and is confusing in that way. ParkerVision is closer when it describes the filter as "circuitry that outputs a smoothed signal between the input sampled values," but "smoothed" is not quite right, either. An "interpolation filter"

creates an approximation of the signal; "smoothed" evokes the sense of a close approximation than may necessarily occur for some embodiments of the invention, like those using a Z0DH or similar interpolation filter.

Rather, it seems to the Court that the simplest, most encompassing, and most correct definition of interpolation was presented in the *Signals & Systems* textbook. (Doc. No. 120–2, p. 522.) That reference states, in a section titled "Reconstruction of a Signal From Its Samples Using Interpolation," as follows:

> Interpolation, that is, the fitting of a continuous signal to a set of sample values, is a commonly used procedure for reconstructing a function, either approximately or exactly, from samples. One simple interpolation procedure is the zero-order hold discussed in Section 7.1.

Id.[11]

Accordingly, the Court declines to adopt either proffered definition of the term "interpolation filter." Instead that term shall be construed as "circuitry used to reconstruct a continuous signal, either approximately or exactly, from a set of samples."

11. "Asynchronous Energy Transfer Signal"

The term "asynchronous energy transfer signal" appears in claims 20 and 32 of the '551 Patent and claim 31 of the '371 Patent. The parties' proposed definitions are:

ParkerVision	**Qualcomm**
"an energy transfer signal with a phase that varies with respect to the phase of the carrier signal"	indefinite or "nonsynchronous energy transfer signal"

[11] Section 7.1 of this reference, which is also of record, describes how the output of a zero order hold operation "in essence represents a possible, although admittedly very coarse, interpolation between the sample values." (Doc. No. 120–2, p. 522.)

Qualcomm argues that the term "asynchronous energy transfer signal" is indefinite because the term "asynchronous" is used "without defining a proper frame of reference—i.e., the signal to which it is asynchronous." (Doc. No. 119, pp. 22–23.) ParkerVision argues that this term is not indefinite because "asynchronous" is a common term in the art with a well-known meaning. (Doc. No. 136, pp. 16–17.)

The term "asynchronous energy transfer signal" is not indefinite. The specifications as a whole teach the down-conversion of carrier signals and the transfer of energy from such signals. The specifications identify embodiments in which a switch-and-storage device is used to transfer the energy of a signal, in a manner resulting in the down-conversion of the signal to an intermediate signal. *See* '551 Patent col. 98 ll. 4–24. Thus, the "relative" nature of the term "asynchronous" is clear in the context of the disclosure—the energy-transfer signal is asynchronous vis-à-vis the carrier signal. *See Exxon Research & Eng'g Co. v. United States*, 265 F.3d 1371, 1375 (Fed. Cir. 2001). Accordingly, Qualcomm's indefiniteness argument is without merit.

As for the construction of this term, Qualcomm's proposed claim construction amounts to replacing "asynchronous" with its synonym. Qualcomm does not offer any intrinsic or extrinsic evidence in support of this construction. ParkerVision, on the other hand, offers in support of its proposed construction an expert's opinion that "asynchronous" is well-known term of art. In view of the teachings of the specification noted above and the proffered expert opinion, the Court determines that "asynchronous energy transfer signal" shall be construed to mean "an energy transfer signal with a phase that varies with respect to the phase of the carrier signal."

12. "Universal Frequency Down Converter"

The term "universal frequency down converter" appears in claim 1 of the '371 Patent. ParkerVision and Qualcomm offer the following meanings:

ParkerVision	**Qualcomm**
"circuitry that generates a down converted output signal from an input signal"	"circuitry with a switch, an integrator coupled to said switch, and a pulse generator coupled to said switch"

ParkerVision and Qualcomm agree that the inventors coined the term "universal frequency down converter." ParkerVision argues that a universal frequency down converter is a type of universal frequency translation module that is configured to down-convert an signal. (Doc. No. 122, pp. 16–17.) Qualcomm contends that the term should be defined in purely structural terms and proposes a definition based on the language of the claim term. (Doc. No. 137, p. 15.)

The '371 Patent teaches that a universal frequency translation module "operates to generate an output signal from an input signal, where the frequency of the output signal differs from the frequency of the input signal." '371 Patent col. 4 ll. 41–43. It also teaches that a universal frequency module can be configured as a universal frequency down-conversion module. *Id.* at col. 4 ll. 65–67. It then goes on to teach in detail how a universal frequency translation module can be used to down-convert a signal. *Id.* cols.5–9. The specification does not limit the implementation of a universal frequency down-conversion module to the configuration present in Qualcomm's proposed definition.

Accordingly, the Court declines to adopt Qualcomm's claim construction. The Court concludes that the term "universal frequency down converter" should be

construed as “circuitry that generates a down converted output signal from an input signal.”

13. “Generating a Lower Frequency Signal” and Similar Terms

In the claims identified in the table below, the patents-in-suit contain limitations relating to “generating a lower frequency signal.” The parties dispute the meaning of these terms as follows:

Term	Claims	ParkerVision	Qualcomm
“generating a lower frequency signal from the transferred energy”	1, 2, 3, 8, 9, 12, 16, 20, 39, 41, 50, 54, 55, 57, 92, 93, 108, 113, and 126 of the ’551 Patent	no construction necessary	“creating a lower frequency signal from the previously transferred energy”
“lower frequency signal is generated from the transferred energy”	23, 24, 25, 26, 31, 32, 135, 149, 150, 161, 192, 193, 195, 196, 198, 202, and 203 of the ’551 Patent; and 1, 2, 22, 23, 25, and 31 of the ’371 Patent		
“generating the lower frequency signal from the integrated energy”	50 of the ’551 Patent		terms are indefinite, or “creating a lower frequency signal from the previously integrated energy”

Term	Claims	ParkerVision	Qualcomm
"generates a lower frequency signal from the integrated energy"	202 of the '551 Patent		
"generating the baseband signal from the integrated energy"	1, 2, 3, 12, 17, 24, 27, and 82 of the '518 Patent		term is indefinite, or "creating a baseband signal from the previously integrated energy"
"generating the second signal from the integrated energy"	77, 81, 90, and 91 of the '518 Patent		term is indefinite, or "creating a second signal from the previously integrated energy"

The nub of the dispute regarding these terms is that Qualcomm prefers a claim construction that makes clear that there is a distinct temporal relationship between the transfer of energy as disclosed in the patents and the use of that energy to generate (or create) a down-converted signal.[12] Qualcomm's proposed claim constructions would explicitly inform the jury that the devices and methods of the disclosed invention perform an energy transfer step prior to performing the following step of generating a signal.

This argument is not persuasive for two reasons. First, the Court does not understand the disclosed inventions to require the completion of an "energy transfer step" before the generation of a down-converted signal begins. The disclosed inventions

[12] The Court understands Qualcomm's indefiniteness objections to these terms to be related to the use of the "integrated energy" language. The Court rejects Qualcomm's contentions for the reasons discussed *supra* in section 5.

could, for instance, integrate energy while simultaneously generating a down-converted signal. Qualcomm's proposed claim construction, which implies that these steps have precise start and end points, would likely confuse a jury.

Second, because the specifications and claims do not explicitly recite that each step must occur in the order listed in the claims, Qualcomm's proposed construction is the similar to arguing that the claimed steps implicitly require that they be performed in a certain order. There is some case law in support of this proposition, *see Loral Fairchild Corp. v. Sony Corp.*, 181 F.3d 1313, 1322 (Fed. Cir. 1999), but ordinarily, unless "the steps of a method actually recite an order, the steps are not ordinarily construed to require one," *Interactive Gift Express, Inc. v. Compuserve Inc.*, 256 F.3d 1323, 1342–43 (Fed. Cir. 2001). The claims here do not clearly denote a temporal relationship. Rather, one could understand the claim language identified by Qualcomm as referring to the fact that transferred energy is the source of the energy used to generate the down-converted signal.

Accordingly, the Court declines to adopt Qualcomm's proposed construction of the "generating a lower frequency signal" terms. The Court also finds that no construction of these terms is necessary in view of the terms' use of plain and direct language.

14. "Controlling a Charging and Discharging Cycle of the First and Second Capacitors with First and Second Switching Devices, Respectively"

This claim term is found in claims 18, 19, 20, 21, 22, and 23 of the '342 Patent. ParkerVision and Qualcomm offer the following claim construction:

ParkerVision	**Qualcomm**
no construction necessary; or "using a first switch device to control the charging and discharging of a first capacitor and a second switch device to control the charging and discharging of a second capacitor"	"using the switching devices to control separately the time during which the charging of the capacitors occurs and the time during which the discharging of the capacitors occurs"

ParkerVision contends that this term, which is an entire step of several method claims, is not eligible for construction. (Doc. No. 122, pp. 8–9.) Qualcomm argues in response that it is appropriate to construe an entire step of a method where, as here, one cannot understand its subparts in isolation. (Doc. No. 137, pp. 7–8.) Qualcomm argues further that its construction is more appropriate because the specifications teach that the switching devices must control separately the charging and discharging cycles of the capacitors. (Doc. No. 119, pp. 21–22.) In response, ParkerVision contends that inserting the word "separately" into the proposed claim construction adds ambiguity and fails to impart Qualcomm's understanding of the scope of the claim. (Doc. No. 19–20.)

The Court declines to construe this term. The Court is not persuaded that it is proper to construe an entire step of a method claim. Qualcomm does not contend that a particular subpart of the step cannot be understood. Instead, it argues that the switching devices control separately the charging and discharging cycles of the capacitors. This argument seems, to the Court, to be the same as reading a limitation (that is, the word "separately") into the language of the claim. A court construing claim terms may not limit the scope of those terms based on the disclosure of a preferred embodiment. *Acumed LLC v. Stryker Corp.*, 483 F.3d 800, 807 (Fed. Cir. 2007); *see also TI Grp. Auto. Sys. (N. Am.), Inc., v. VDO N. Am., L.L.C.*, 375 F.3d 1126, 1136 (Fed. Cir. 2004). Rather, "a

patentee is entitled to a definition that encompasses all consistent meanings" of the term. *TI Grp.*, 375 F.3d at 1136.

The Court also agrees with ParkerVision that Qualcomm's use of the word "separately" is ambiguous, confusing, and may not convey the meaning that Qualcomm intends. The Court agrees with ParkerVision that the language used in the claim is concise and straightforward. Further explanations are unnecessary and unwarranted. Therefore, the Court declines to construe this claim limitation.

15. "Means for Operating Said UFD to Perform at Least Frequency Translation Operations . . . ."

The parties agree that the function of this means-plus-function element from claim 1 of the '371 Patent is "operating said UFD to perform at least frequency translation operations for at least one of (a)–(l)." (Doc. No. 141, p. 8; *see also* Doc. No. 119, p. 23.) The parties dispute whether a corresponding structure was clearly linked to this function in the '371 Patent's disclosure.

ParkerVision contends that the patent teaches the use of a control signal to operate the component of the universal frequency down-conversion module ("UFD"). (Doc. No. 122, p. 24.) Qualcomm argues that this is not correct because the operating means must be capable of working on "said UFD," that is, "a switch, an integrator coupled to said switch, and a pulse generator coupled to said switch." (Doc. No. 137, pp. 19–20.) Qualcomm reasons that the control signal proposed by ParkerVision as the structure for this claim element cannot serve as an operating means because it is generated by a pulse generator, which is a component of a UFD. (*Id.*) Further, Qualcomm argues that the '371 Patent fails to disclose a structure because the

specification does not disclose an algorithm for use with a general purpose microprocessor. (Doc. No. 119, p. 24.)

A means-plus-function claim limitation is limited to the structures disclosed in the specification and equivalents. *Mettler-Toledo, Inc. v. B-Tek Scales, LLC*, 671 F.3d 1291, 1296 (Fed. Cir. 2012). This Court must look to the specification to determine which structures correspond to the claimed function. *Id.* The structure "disclosed in the specification is a 'corresponding' structure only if the specification or prosecution history clearly links or associates that structure to the function recited in the claim." *Id.* (quoting *B. Braun Med. Inc. v. Abbott Labs.*, 124 F.3d 1419, 1424 (Fed. Cir. 1997)). A disclosure is sufficient if it permits one of ordinary skill in the art to know and understand what structure corresponds to the means-plus-function limitation so that he may perceive the bounds of the invention. *In re Aoyama*, 656 F.3d 1293, 1298 (Fed. Cir. 2011). Further, if a patentee chooses to disclose a single embodiment, then any means-plus-function claim limitation will be limited to the single disclosed structure and equivalents thereof. *Mettler-Toledo*, 671 F.3d at 1296.

The Court does not find Qualcomm's arguments persuasive. The '371 Patent links a control signal to the operation of a UFD and UFT, and it teaches that a UFT is a component of a UFD. The '371 Patent further teaches that a control signal consists of a train of pulses generated by a pulse generator. This is sufficient for one skilled in the art to appreciate what structure corresponds to this means-plus-function claim limitation.

With regard to Qualcomm's second argument, the case law relied on by Qualcomm is applicable only "where the disclosed structure is a computer programmed to implement an algorithm." *Aoyama*, 656 F.3d at 97. Qualcomm does not point to any language disclosing a general-purpose as the structure corresponding to this means-

plus-function claim limitation. As such, Qualcomm has not shown that the general-purpose computer line of cases is applicable.

Accordingly, the Court construes "means for operating said UFD to perform at least frequency translation operations" as follows. The function of this limitation is "operating said UFD to perform at least frequency translation operations for at least one of (a)–(l)." The corresponding structure is "a control signal of the UFD disclosed as signal 108 of Figures 1A–1C, 2006 of Figures 20A and 20A-1, or equivalents thereof."

16. "Means for Integrating the Energy over the Aperture Periods" and "Means for Integrating the Transferred Energy over the Aperture Periods"

The parties agree as to the function of these means-plus-function claim limitations, which appear in claims 82, 90, and 91 of the '518 Patent.[13] (Doc. No. 141, p. 8; *see also* Doc. No. 119, p. 23.) The parties disagree as to which structures correspond to the functions of these limitations. ParkerVision contends that its proposed construction identifies "all corresponding structure that actually performs the recited functions and includes no extraneous structure." (Doc. No. 122, p. 21.) Qualcomm, on the other hand, contends that ParkerVision's proposal is wrong in that the specification does not clearly link the disclosure found in Figure 68F with the function of these claim limitations. (Doc. No. 137, pp. 18–19.)

The parties appear to agree that the specification of the '518 Patent links a capacitive storage device to the prescribed functions. The specification specifically describes a number of ways in which such devices may be implemented. '518 Patent col. 99 l. 35–col. 100 l. 9. The specification also specifically refers to the embodiment

[13] The Court understands Qualcomm's indefiniteness objections to these terms to be related to the use of the "integrated energy" language. The Court rejects Qualcomm's contentions for the reasons discussed *supra* in section 5.

described in Figure 68F as an "illustration" of a capacitive storage unit. *Id.* at col. 99 ll. 59–64. For these reasons, the Court finds ParkerVision's arguments more persuasive.

Accordingly, the Court construes these terms as follows. The function associated with the means-plus-function limitation "means for integrating the energy over the aperture periods" is "integrating the energy over the aperture periods." The structure that corresponds to that function is "one or more of energy storage circuitry disclosed in Figures 68C, 68F, or equivalents thereof." The function associated with "means for integrating the transferred energy over the aperture periods" is "integrating the transferred energy over the aperture periods." The structure that corresponds to that function is "one or more of energy storage circuitry disclosed in Figures 68C, 68F, or equivalents thereof."

17. "Means for Generating the Baseband Signal from the Integrated Energy" and "Means for Generating the Second Signal from the Integrated Energy"

The parties agree as to the functions of these two means-plus-function claim limitations, which appear in claims 82, 90, and 91 of the '518 Patent.[14] (Doc. No. 141, p. 8; *see also* Doc. No. 119, p. 23.) As above, the parties disagree as to which structures correspond to these functions. ParkerVision contends that the corresponding structure is a number of disclosed arrangements consisting of switch circuitry controlled by pulse generators and capacitors. (Doc. No. 122, p. 23.) Qualcomm argues that ParkerVision's corresponding structure is incorrect because the functions of these limitations relate to

[14] The Court understands Qualcomm's indefiniteness objections to these terms to be related to the use of the "integrated energy" language. The Court rejects Qualcomm's contentions for the reasons discussed *supra* in section 5.

the accumulation of energy from several aperture periods, whereas the structures identified by ParkerVision are not linked to the claimed functions. (Doc. No. 137, p. 19.)

This dispute is related to the parties' disagreements regarding the "integrating energy" terms and the "accumulating the result" term. Qualcomm's arguments distinguish between energy that accumulates over aperture periods and energy that accumulates during an aperture period. Because the Court has rejected Qualcomm's attempts to limit the scope of the previous terms in that fashion, the Court also rejects its attempt to limit the scope of these terms.

Accordingly, the Court adopts ParkerVision's proposed claim construction for these terms. The function associated with the means-plus-function limitation "means for generating the baseband signal from the integrated energy" is "generating the baseband signal from the integrated energy." The structure that corresponds to that function is "any arrangement of (i) one or more of the switch circuitry controlled by any one of pulse generators and (ii) one or more of the energy storage circuitry disclosed or described in Figures 63, 64A, 64B, 65, 67A, 68G, 69, 74, 76A–E, 77A–C, 82A, 82B, 86, 88, 90, 92, 94A, 95, 101, 110, 111, or equivalents thereof." The function associated with "means for generating the second signal from the integrated energy" is "generating the second signal from the integrating energy." The structure that corresponds to that function is "any arrangement of (i) one or more of the switch circuitry controlled by any one of pulse generators and (ii) one or more of the energy storage circuitry disclosed or described in Figures 63, 64A, 64B, 65, 67A, 68G, 69, 74, 76A–E, 77A–C, 82A, 82B, 86, 88, 90, 92, 94A, 95, 101, 110, 111, or equivalents thereof."

* * * * *

Qualcomm also raises two indefiniteness issues. (Doc. No. 119, p. 25.) The first is related to certain "words of degree" that are used in "the claims of the '551 Patent and '518 Patent in which they appear." (*Id.*) The second relates to the use of what Qualcomm contends are undefined mathematical terms that appear in claim 4 of the '845 Patent. (*Id.*)

The Court declines to address Qualcomm's arguments at this time. First, Qualcomm does not ask the Court to construe terms related to these issues; rather, Qualcomm seeks an adjudication of one of its affirmative defenses. Such a request should be made in the form of a dispositive motion, where it can put the opposing party on notice of the potential adjudication of claims and can be briefed in a comprehensive fashion. *Cf. Milburn v. United States*, 734 F.2d 762, 765–66 (11th Cir. 1984) (holding that district courts should not convert pretrial motions to a motion for summary judgment under Federal Rule of Civil Procedure 56 where the opposing party has not been notified of the potential adjudication of claims).

Second, Qualcomm's argument relating to "words of degree" is not well-defined. There are 204 claims in the '551 Patent and 99 claims in the '518 Patent. This Court is not inclined to rule on a potentially dispositive issue where its proponent has not specifically identified all of the claims to which the argument applies. Nor is it possible for the Court to scour 303 patent claims on its own so that it can fully appreciate the scope of the relief requested.

Qualcomm may raise these issues again on summary judgment, if it so chooses.

CONCLUSION

The Court therefore construes the disputed claim terms as set forth above. **IT IS SO ORDERED**.

DONE AND ORDERED in Chambers in Jacksonville, Florida, on February 20, 2013.

ROY B. DALTON JR.
United States District Judge

Copies:

Counsel of Record