IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

TQ DELTA, LLC,
 	
   Plaintiff,
 	
  v.
 	
COMCAST CABLE COMMUNICATIONS, LLC
 	
   Defendant.
	Civil Action No. 1:15-cv-00611-RGA

TQ DELTA, LLC,
 	
   Plaintiff,
 	
  v.
 	
COXCOM LLC and COX COMMUNICATIONS INC.,
 	
   Defendants.
	Civil Action No. 1:15-cv-00612-RGA

TQ DELTA, LLC,
 	
   Plaintiff,
 	
  v.
 	
DIRECTV, LLC,
 	
   Defendant.
	Civil Action No. 1:15-cv-00613-RGA

TQ DELTA, LLC,

        Plaintiff,

    v.

DISH NETWORK CORPORATION, DISH NETWORK LLC, DISH DBS CORPORATION, ECHOSTAR CORPORATION, and ECHOSTAR TECHNOLOGIES, LLC

        Defendants.

Civil Action No. 1:15-cv-00614-RGA

TQ DELTA, LLC,

        Plaintiff,

    v.

TIME WARNER CABLE INC. and TIME WARNER CABLE ENTERPRISES LLC,

        Defendants.

Civil Action No. 1:15-cv-00615-RGA

TQ DELTA, LLC,

        Plaintiff,

    v.

VERIZON SERVICES CORP.,

        Defendant.

Civil Action No. 1:15-cv-00616-RGA

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MEMORANDUM OPINION

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November **30**, 2016

Richard G. Andrews
ANDREWS, U.S. DISTRICT JUDGE:

Presently before the Court is the issue of claim construction of multiple terms in U.S. Patent Nos. 8,718,158 ("the '158 patent"), 9,014,243 ("the '243 patent"), 8,611,404 ("the '404 patent"), 9,094,268 ("the '268 patent"), 7,835,430 ("the '430 patent"), and 8,238,412 ("the '412 patent"). The Court has considered the Parties' Joint Claim Construction Brief. (Civ. Act. No. 15-611-RGA, D.I. 144; Civ. Act. No. 15-612-RGA, D.I. 141; Civ. Act. No. 15-613-RGA, D.I. 141; Civ. Act. No. 15-614-RGA, D.I. 135; Civ. Act. No. 15-615-RGA, D.I. 141; Civ. Act. No. 15-616-RGA; D.I. 146).[1] The Court heard oral argument on October 18, 2016. (D.I. 158).

I.   BACKGROUND

Plaintiff filed these actions on July 17, 2015, alleging infringement of eight patents. (D.I. 1). On July 14, 2016, Plaintiff dismissed two of these patents with prejudice. (D.I. 102). The parties divide the remaining contested patents into three groupings: the phase scrambling patents, the low power mode patents, and the diagnostic mode patents. The phase scrambling patents, which include the '158 and '243 patents, claim methods for reducing the peak to average power ratio of a multicarrier transmission system. The low power mode patents, which include the '404 and '268 patents, claim methods for causing a multicarrier communications system to enter a low power mode while storing state information for full power mode to enable a rapid start up without the need for reinitialization. The diagnostic mode patents, which include the '430 and '412 patents, claim both an apparatus and method for the reliable exchange of diagnostic and test information over a multicarrier communications system.

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[1] Unless otherwise specifically noted, all references to the docket refer to Civil Action No. 15-611-RGA.

II.   LEGAL STANDARD

"It is a bedrock principle of patent law that the claims of a patent define the invention to which the patentee is entitled the right to exclude." *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312 (Fed. Cir. 2005) (en banc) (internal quotation marks omitted). "'[T]here is no magic formula or catechism for conducting claim construction.' Instead, the court is free to attach the appropriate weight to appropriate sources 'in light of the statutes and policies that inform patent law.'" *SoftView LLC v. Apple Inc.*, 2013 WL 4758195, at *1 (D. Del. Sept. 4, 2013) (quoting *Phillips*, 415 F.3d at 1324) (alteration in original). When construing patent claims, a court considers the literal language of the claim, the patent specification, and the prosecution history. *Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 977–80 (Fed. Cir. 1995) (en banc), *aff'd*, 517 U.S. 370 (1996). Of these sources, "the specification is always highly relevant to the claim construction analysis. Usually, it is dispositive; it is the single best guide to the meaning of a disputed term." *Phillips*, 415 F.3d at 1315 (internal quotation marks omitted).

"[T]he words of a claim are generally given their ordinary and customary meaning. . . . [Which is] the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention, i.e., as of the effective filing date of the patent application." *Id.* at 1312–13 (citations and internal quotation marks omitted). "[T]he ordinary meaning of a claim term is its meaning to [an] ordinary artisan after reading the entire patent." *Id.* at 1321 (internal quotation marks omitted). "In some cases, the ordinary meaning of claim language as understood by a person of skill in the art may be readily apparent even to lay judges, and claim construction in such cases involves little more than the application of the widely accepted meaning of commonly understood words." *Id.* at 1314.

When a court relies solely upon the intrinsic evidence—the patent claims, the specification, and the prosecution history—the court's construction is a determination of law. *See Teva Pharm. USA, Inc. v. Sandoz, Inc.*, 135 S. Ct. 831, 841 (2015). The court may also make factual findings based upon consideration of extrinsic evidence, which "consists of all evidence external to the patent and prosecution history, including expert and inventor testimony, dictionaries, and learned treatises." *Phillips*, 415 F.3d at 1317–19 (internal quotation marks omitted). Extrinsic evidence may assist the court in understanding the underlying technology, the meaning of terms to one skilled in the art, and how the invention works. *Id.* Extrinsic evidence, however, is less reliable and less useful in claim construction than the patent and its prosecution history. *Id.*

"A claim construction is persuasive, not because it follows a certain rule, but because it defines terms in the context of the whole patent." *Renishaw PLC v. Marposs Societa' per Azioni*, 158 F.3d 1243, 1250 (Fed. Cir. 1998). It follows that "a claim interpretation that would exclude the inventor's device is rarely the correct interpretation." *Osram GMBH v. Int'l Trade Comm'n*, 505 F.3d 1351, 1358 (Fed. Cir. 2007) (citation and internal quotation marks omitted).

III. CONSTRUCTION OF DISPUTED TERMS

A. The Phase Scrambling Patents

The '158 patent is directed to a method for scrambling the phase characteristics of carrier signals in a multicarrier communications system. Claim 1 is representative and reads as follows:

> 1. In a *multicarrier* modulation system including a first *transceiver* in communication with a second *transceiver* using a transmission signal having a plurality of *carrier signals* for modulating a plurality of data bits, each *carrier signal* having a phase characteristic associated with at least one bit of the plurality of data bits, a method for *scrambling the phase characteristics of the carrier signals* comprising:
> transmitting the plurality of data bits from the first *transceiver* to the second *transceiver*;

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associating a *carrier signal* with a value determined independently of any bit of the plurality of data bits carried by the *carrier signal*, the value associated with the *carrier signal* determined by a pseudo-random number generator;

determining a phase shift for the carrier signal at least based on the value associated with the *carrier signal*;

modulating at least one bit of the plurality of data bits on the *carrier signal*;

modulating the at least one bit on a second *carrier signal* of the plurality of *carrier signals*.

('158 patent, claim 1) (disputed terms italicized).

The '243 patent is also directed to a method for scrambling the phase characteristics of carrier signals in a multicarrier communications system. Claim 1 is representative and reads as follows:

1. A method, in a *multicarrier* communications *transceiver* comprising a *bit scrambler* followed by a *phase scrambler*, comprising:

scrambling, using the *bit scrambler*, a plurality of input bits to generate a plurality of scrambled output bits, wherein at least one scrambled output bit is different than a corresponding input bit;

scrambling, using the *phase scrambler*, a plurality of *carrier* phases associated with the plurality of scrambled output bits;

transmitting at least one scrambled output bit on a first *carrier*; and

transmitting the at least one scrambled output bit on a second *carrier*.

('243 patent, claim 1) (disputed terms italicized).

1. "carrier signal" and "carrier"

    a.   *Plaintiff's proposed construction*: "plain meaning"

    b.   *Defendants' proposed construction*: "wave that can be modulated to carry data"

    c.   *Court's construction*: "signal that can be modulated to carry data"

The parties agree that "carrier signal" and "carrier" should have the same construction. (D.I. 144 at 36). Defendants argue strenuously that the proper construction for this term requires that the carrier signal be a wave and that this construction is supported by the specification itself. (*Id.* at 33). Contrary to Defendants' assertion, however, neither "wave" nor "waveform" appear anywhere in the specification. To require that the carrier be a wave, therefore, would be to import

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a term that itself requires construction. Plaintiff argues that the wave Defendants refer to throughout their briefing and during oral argument is simply the time domain representation of a signal that exists only after the carrier signals are modulated and combined. (*Id.* at 21, 33, 35; D.I. 158 at 70:12-18). The specification supports Plaintiff's position, describing the carrier signals as being modulated in the frequency domain prior to being combined into the time domain transmission signal. ('158 patent at 4:12-24). While I find support for Plaintiff's opposition to using the word "wave" in the construction of this term, I agree with Defendants that some construction is needed, so I will adopt Defendants' construction modified as follows: "signal that can be modulated to carry data."

2.   "determin[e/ing] a phase shift for the carrier signal"

    a.   *Plaintiff's proposed construction*: "plain meaning"

    b.   *Defendants' proposed construction*: "use/using an equation to compute the degrees or radians that the phase of the carrier signal can be shifted"

    c.   *Court's construction*: "comput[e/ing] an amount by which the phase of the carrier signal will be shifted"

As an initial matter, the parties disagree as to whether the phase shift must be determined in units of degrees or radians. There is no support in the intrinsic record for Defendants' attempt to import these terms into the claim. Degrees and radians are merely units of measure, akin to feet or meters. I see no reason to limit this claim term to require specific units of measure for the phase shift.

Defendants next argue that this term should be construed to limit the meaning of "determine" to mean compute. Defendants cite the invention as described in the "Summary of the Invention" section of the specification as support and argue that the invention as a whole is described using the word "compute" with respect to how the phase shift is determined. (D.I. 144

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at 38). I agree with Defendants. The specification, in describing the "present invention," states that "[a] phase shift is computed for each carrier signal." ('158 patent at 2:39-40). Every reference to the phase shift in the Summary of the Invention section reflects that the shift is "computed." *See id.* at 2:43, 2:58-59, 2:63-64. "When a patent thus describes the features of the 'present invention' as a whole, this description limits the scope of the invention." *Verizon Servs. Corp. v. Vonage Holdings Corp.*, 503 F.3d 1295, 1308 (Fed. Cir. 2007).

Defendants further argue that "by definition, to 'compute' is to use an equation." (D.I. 144 at 39). Plaintiff counters that the definition of compute is broader and that Defendants are "attempting to import a limitation from an example embodiment." (*Id.* at 39-40). On this point I agree with Plaintiff. Although the example embodiments do employ an equation to compute the phase shifts, the specification disclaims reliance on any particular method, stating that "additional and/or different phase shifting techniques can be used by the phase scrambler." ('158 patent at 8:14-15). Defendants also cite to the provisional application as further support for their argument; however, the provisional application also disclaims reliance on any particular method for determining the phase shifts, stating that "[t]he fundamental principle used in this invention is to use known parameters at the transmitter and the receiver to randomize the phase of the tones in a multicarrier system." (D.I. 146 at A355).

Therefore, I decline to adopt either Plaintiff's or Defendants' proposed constructions. Instead I construe the term "determin[e/ing] a phase shift for the carrier signal" to mean "comput[e/ing] an amount by which the phase of the carrier signal will be shifted."

3. "phase scrambler"

    a.   *Plaintiff's proposed construction*: "a component operable to adjust the phases of the carriers, by pseudo-randomly varying amounts"

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b. *Defendants' proposed construction*: "component that adjusts the phases of modulated carrier signals by pseudo-randomly varying amounts"

c. *Court's construction*: "component operable to adjust the phases of the carrier signals, by pseudo-randomly varying amounts"

"scrambling the phase characteristics of the carrier signals"

a. *Plaintiff's proposed construction*: "adjusting the phase characteristics of the carrier signals by pseudo-randomly varying amounts"

b. *Defendants' proposed construction*: "adjusting the phases of the modulated carrier signals by pseudo-randomly varying amounts"

c. *Court's construction*: "adjusting the phase characteristics of the carrier signals by pseudo-randomly varying amounts"

The parties' only dispute with respect to these two claim terms is whether the carrier signals are modulated before or after phase scrambling occurs. Plaintiff argues that in every embodiment disclosed in the specification phase scrambling occurs before modulation. (D.I. 144 at 42). Defendants counter that the specification requires "adding phase shifts to modulated carrier signals." (*Id.* at 43). I find that Plaintiff's position is supported by the patent. For example, the specification describes the process that takes place in the transmitter as "adjusting the phase characteristic of each carrier signal and combining these carrier signals to produce the transmission signal." ('158 patent, 5:16-19). The specification also provides descriptions of several different phase shifting examples, and then states, "The DMT transmitter 22 then combines (step 130) the carrier signals to form the transmission signal 38." (*Id.* at 8:17-19). Defendants' attempt to parse phrases such as "method that scrambles the phase characteristics of the modulated carrier signals in a transmission signal" to require that the signals be modulated before phase scrambling is unavailing. (D.I. 144 at 48-49). This phrase, taken from the Summary of the Invention, is nothing more than a high-level description of the transmission signal as being composed of modulated carrier signals whose phases have been scrambled. Nothing in the claims or the descriptions of

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example embodiments supports Defendants' argument that the phase scrambling occurs after modulation. I will adopt Plaintiff's construction.

4.   "transceiver"

      a.   *Plaintiff's proposed construction*: "a communications device capable of transmitting and receiving data over the same physical medium wherein the transmitting and receiving functions are implemented using at least some common circuitry"

      b.   *Defendants' proposed construction*: "communications device with a transmitter and receiver"

      c.   *Court's construction*: "communications device capable of transmitting and receiving data wherein the transmitter portion and receiver portion share at least some common circuitry"

This term appears in all six of the asserted patents and the parties agree that the term should have the same construction in each claim. (D.I. 144 at 22). The parties also agree that a transceiver is a device that can both transmit and receive data. The parties dispute, however, whether the transmission and reception must occur over the same physical medium, *e.g.*, over cable or air, and whether the transmitter and receiver components of the transceiver must share common circuitry. As to the first point of dispute, there is no support in either the intrinsic or extrinsic record for the limitation that the transmission and reception of data occur over the same physical medium. Plaintiff cites only to an expert declaration to support its contention that a person of ordinary skill in the art would understand that the transmitting and receiving must occur over the same physical medium. (D.I. 144 at 25). However, nothing in the claims or specification supports this construction and Plaintiff has not pointed to any dictionary definitions or evidence other than the expert declaration to support its construction. I decline to import this limitation into the claim term.

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As to the common circuitry limitation, the only information to be gleaned from the claim language itself is that the transceiver contemplated by these patents must be able to both transmit and receive data. (*See, e.g.,* '158 patent, claim 1). The specifications do not provide an explicit definition of transceiver. In the phase scrambling patents, the specification and figures indicate that the transceiver as described is a singular device housing both a transmitter portion and a receiver portion. (*Id.* at 3:31-33). These patents do not provide any specific indication that any circuitry is shared between the two. In the low power mode patents, however, the specification and figure do indicate the presence of shared components. For example, the clock, controller, and frame counter are shared by the transmitter and receiver portions of the transceiver. ('404 patent at Fig. 1).

The parties provide five different dictionary definitions for transceiver, three of which include a limitation that the transmitter and receiver share common circuitry. (D.I. 146 at A423, A433, A444, A891, A938-39). Evaluating the intrinsic evidence in light of these dictionary definitions suggests that the transmitter and receiver portions do share common circuitry or components. Therefore, I will construe transceiver to mean "a communications device capable of transmitting and receiving data wherein the transmitter portion and receiver portion share at least some common circuitry."

5.   "multicarrier"

   a.   *Plaintiff's proposed construction*: "having multiple carrier signals that are combined as a group by simultaneous modulation to produce a transmission signal"

   b.   *Defendants' proposed construction*: "having multiple carrier signals that are combined to produce a transmission signal"

   c.   *Court's construction*: "having multiple carrier signals that are combined to produce a transmission signal"

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The parties' only disagreement is whether this term should be construed to specify a particular method by which the carrier signals are combined. Plaintiff's opposition to Defendants' broader construction appears to stem from its disagreement with Defendants' proposed construction of "carrier." (D.I. 158 at 30:20-31:7). Since I have rejected Defendants' proposed limitations on "carrier," this concern is unwarranted. As discussed above, I have concluded that the patents disclose combination and modulation of carrier signals in the frequency domain, that is, before a time domain signal, or wave, exists. Turning to Plaintiff's proposed limitation, I find that the claim language itself does not impose any limitation on how the carrier signals are to be combined. Nor does the specification provide such limitations. Therefore, I will adopt Defendants' proposed construction.

6.   "bit scrambler"

   a.   *Plaintiff's proposed construction*: "a component that pseudo-randomly changes the value of a bit"

   b.   *Defendants' proposed construction*: "component that pseudo-randomly inverts the bits in a byte of data one bit after another"

   c.   *Court's construction*: "component that pseudo-randomly changes the value of a bit"

The parties disagree on two points in their proposed constructions of this term: first, whether the bit scrambler operates on a byte of data; and second, whether the bits are scrambled in sequence, one after another. The parties' disagreement appears to center around whether a person of ordinary skill in the art would find that a bit scrambler is different from a byte scrambler. I do not think it is necessary to resolve this disagreement as the patent itself provides sufficient guidance as to the meaning of "bit scrambler."

The word "byte" does not appear in either the claims or specification of the '243 patent. The patent refers to "scrambling, using the bit scrambler, a plurality of input bits." ('243 patent,

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claim 1). A plurality of input bits simply means more than one input bit. A byte of data is commonly understood to consist of eight bits of data. *See, e.g.,* OXFORD ENGLISH DICTIONARY (2d ed. 1989), *available at* http://www.oed.com/oed2/00030648 (defining byte as "[a] group of eight consecutive bits operated on as a unit in a computer"). There is no basis in the claim itself or in the specification for requiring that the "plurality of input bits" consist of a byte, or eight bits, of data. Nor is there any indication in the patent that the data must be presented to the scrambler a byte at a time. Rather, as Defendants themselves point out, the data is presented a bit at a time. Defendants cite the ADSL standards as extrinsic evidence of what a person of ordinary skill would understand a "bit scrambler" to be. (D.I. 144 at 52-53). The device described in the standards, however, is simply called a "scrambler," not a "bit scrambler." (D.I. 145 at A503). Furthermore, the standards show that data is input to this scrambler a byte at a time, not as a serial bit stream. (*Id.*). This is inconsistent with the bit scrambler described in the specification.

As to Defendants' argument that the scrambling must be performed sequentially, the claim language does not support such a limitation. The claim itself is indifferent to whether the scrambling is sequential, stating that the bit scrambler scrambles "a plurality of input bits to generate a plurality of output bits." (*Id.*). The specification states that the bit scrambler "receives the input serial bit stream" and, after scrambling, passes the bits to the QAM encoder. (*Id.* at 5:6-9). The QAM encoder is described as "receiving an input serial data bit stream." (*Id.* at 3:63-64). This seems to indicate that the input and output of the bit scrambler are both serial. This does not mean, however, that the scrambling itself necessarily takes place sequentially. Therefore, the intrinsic evidence does not support Defendants' proposed limitations and I will adopt Plaintiff's construction.

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B.   The Low Power Mode Patents

The '404 patent is directed to a multicarrier transmission system with low power sleep

mode and rapid-on capability. Claim 6 is representative and reads as follows:

> 1. An *apparatus comprising a transceiver operable to*:
>   receive, in a full power mode, a plurality of superframes, wherein the superframe comprises a plurality of *data* frames followed by a *synchronization frame*;
>   receive, in the full power mode, a *synchronization signal*;
>   transmit a message to enter into a *low power mode*;
>   *store, in the low power mode, at least one parameter* associated with the full power mode operation *wherein the at least one parameter comprises at least one of a fine gain parameter and a bit allocation parameter*;
>   receive, in the *low power mode*, a *synchronization signal*; and
>   exit from the *low power* [sic] and restore the full power mode by using the at least one parameter and without needing to reinitialize the transceiver.

('404 patent, claim 6) (disputed terms italicized).

The '268 patent is also directed to a multicarrier transmission system with low power

sleep mode and rapid-on capability. Claim 4 is representative and reads as follows:

> 4. A method, in a multicarrier transceiver, comprising:
>   transmitting or receiving a message to enter a *low power mode*;
>   entering the *low power mode*, wherein a transmitter portion of the transceiver does not transmit *data* during the *low power mode* and a receiver portion of the transceiver receives *data* during the *low power mode*; and
>   *storing, during the low power mode, at least one parameter* associated with a full power mode.

('268 patent, claim 4) (disputed terms italicized).

1.   "low power mode"

   a.   *Plaintiff's proposed construction*: "a state of operation in which power is consumed, but the amount of power consumed is less than when operating in a state with full data transmission capabilities"

   b.   *Defendants' proposed construction*: "state of operation in which available power is reduced"

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c.	*Court's construction*: "state of operation in which power is consumed, but the amount of power consumed is less than when operating in a state with full data transmission capabilities"

The primary dispute between the parties with respect to this term appears to center on whether low power mode requires that less power be supplied to the circuitry or whether less power is consumed by the device. The parties also disagree about whether the claimed "low power mode" includes both the "sleep mode" and "idle state/mode" described in the specification.

Neither sleep mode nor idle state/mode are mentioned in any of the claims. Defendants expended significant effort both in briefing and at oral argument to argue that "idle state" is not a low power mode. I disagree. The specification states in a number of different places that the invention could be incorporated into a computer and that it would be desirable in that situation that it could "enter a 'sleep' mode in which it consumes reduced power." ('404 patent at 6:2-3). The specification describes this as an "'idle' state . . . similar in many ways to the sleep mode state." (*Id.* at 6:19:24). Defendants argue that it is significant that the specification sometimes calls this a "state" instead of a "mode." (D.I. 158 at 21:10-22:3). I do not think so. Elsewhere in the specification, the same idle state is referred to as an "idle mode." ('404 patent at 8:63). It seems to me that sleep mode and idle state/mode are both low power modes implemented in different contexts.

The dispute over whether low power mode is achieved through lower power consumption or lower power supply is readily resolved by looking to the claim language. Low power mode appears in independent claims 1, 6, 11, and 16 of the '404 patent. Although claim 1 of the '404 patent is not asserted, "we look to the words of the claims themselves, both asserted and nonasserted, to define the scope of the patented invention." *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1582 (Fed. Cir. 1996). Claims 1 and 11 read, in part, "[enter/entering] into the low

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power mode by reducing a power consumption of at least one portion of a transmitter." ('404 patent, claims 1 & 11). Claims 6 and 16 do not include this phrase describing how low power mode is achieved. "Unless the patent otherwise provides, a claim term cannot be given a different meaning in the various claims of the same patent." *Georgia-Pac. Corp. v. U.S. Gypsum Co.*, 195 F.3d 1322, 1331 (Fed. Cir. 1999). Read in the context of the specification, I find no reason why the term should be given different meaning in claims 6 and 16 than it has in claims 1 and 11, which indicate that low power mode is achieved through lower consumption of power.

Finally, the parties dispute whether low power mode includes, as Defendants argue, a state in which the device is completely off. (D.I. 144 at 61). Defendants' argument on this point is inconsistent with the claims and specification. While in low power mode, the transceiver must be able to either transmit or receive a synchronization signal. ('404 patent, claims 1 and 6). The argument that some power is consumed by the transceiver even in low power mode is supported by the specification. (*Id.* at 7:44-56). For these reasons, I will adopt Plaintiff's construction.

2.   "stor[e/ing], in [a/the] low power mode, at least one parameter"

   a.   *Plaintiff's proposed construction*: "maintaining in memory at least one parameter associated with a mode of operation with full data transmission capabilities, while in a low power mode"

   b.   *Defendants' proposed construction*: "maintain[ing] in memory throughout a/the low power mode, at least one parameter"

   c.   *Court's construction*: "maintain[ing] in memory, while in low power mode, at least one parameter"

The parties first dispute whether the construction should include the limitation that the parameter must be associated with full power mode. Defendants argue that this limitation already appears in the claim language and including this in the claim construction would be superfluous. (D.I. 144 at 66). Plaintiff did not reply to this argument. I agree with Defendants. The claim

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language includes this limitation already when it calls for storing "at least one parameter associated with the full power mode operation." ('404 patent, claim 6). It would be redundant to include this in the court's construction of this term.

The parties also disagree about whether the parameter must be maintained throughout the duration of the low power mode. Plaintiff argues that there is no support in the claim language for requiring a particular duration for how long the parameter is stored. (D.I. 144 at 65). Defendants counter that it is a "fundamental requirement" of the invention that the parameter be stored for the entire duration of the low power mode. (*Id.*). Reading the claim as a whole, I find it is unnecessary to include this requirement in the construction of this term. The claim specifies that the device will "exit from the low power mode and restore the full power mode by using the at least one parameter." ('404 patent, claim 6). Therefore, the rest of the claim itself implies that the parameter is stored at least until the device exits from low power mode. This is captured by the court's construction of "maintain[ing] in memory, while in low power mode, at least one parameter."

3.   "wherein the at least one parameter comprises at least one of a fine gain parameter and a bit allocation parameter"

     a.   *Plaintiff's proposed construction*: "wherein the at least one parameter includes a fine gain parameter and/or a bit allocation parameter"

     b.   *Defendants' proposed construction*: "wherein the at least one parameter includes both a fine gain parameter and a bit allocation parameter"

     c.   *Court's construction*: "wherein the at least one parameter includes a fine gain parameter and/or a bit allocation parameter"

Plaintiff argues that its construction follows the plain language of the claim and notes that the parameters listed in the claim are not categories but rather two parameters from a list of parameters that may be stored. (D.I. 144 at 90-92). Defendants argue that the phrase "at least one of" modifies both terms, requiring that both a fine gain and a bit allocation parameter must be

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stored, citing Federal Circuit case law in support of their position. (*Id.* at 91). Defendants are correct that the Federal Circuit has previously construed this same phrase to require one of each of the terms in the list as a matter of grammatical construction. *SuperGuide Corp. v. DirecTV Enterprises, Inc.*, 358 F.3d 870, 886 (Fed. Cir. 2004). As a number of district courts have recognized, however, "*SuperGuide* did not erect a universal rule of construction for all uses of 'at least one of' in all patents." *Fujifilm Corp. v. Motorola Mobility LLC*, 2015 WL 1265009, at *8 (N.D. Cal. Mar. 19, 2015).

I find that this phrase is readily construed by looking at the full context of the claim itself, without having to resort to grammatical arguments. The relevant portion of the claim reads "storing, in the low power mode, *at least one parameter* associated with the full power mode operation wherein the at least one parameter comprises at least one of a fine gain parameter and a bit allocation parameter." ('404 patent, claim 11 (emphasis added)). The phrase "at least one parameter" indicates that the patent contemplates a situation where only one parameter would be stored. Defendant's construction would require a minimum of two parameters to be stored and is, therefore, inconsistent with the plain language of the claim. For this reason, I will adopt Plaintiff's construction.

4.   "fine gain parameter"

    a.   *Plaintiff's proposed construction*: "a parameter used to determine power level on a per subcarrier basis"

    b.   *Defendants' proposed construction*: "Indefinite"

    c.   *Court's construction*: "parameter used to determine power level on a per subcarrier basis"

Defendants only argument with respect to this term is that "fine" is a word of degree and, therefore, this term is necessarily indefinite. (D.I. 144 at 68). I disagree. The claim language does

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not instruct that anything be measured or adjusted, as in, "make a fine adjustment to the gain," for example. Rather, the claim instructs that a specific parameter, named the "fine gain parameter," is to be stored. Although the claim language itself does not provide specific guidance as to the meaning of this term, the specification supports Plaintiff's construction, particularly when considered in the context of the extrinsic evidence Plaintiff presents to show that a person of ordinary skill in the art would understand that "fine gain" refers to the gain on a subchannel. For example, the specification discusses the requirements of initialization, and in doing so distinguishes between "setting the channel gains" and "adjusting the fine gains on the subchannels." ('404 patent at 3:12-14). This distinction is substantially supported by the ITU-T G.992.1 Standards Plaintiff referenced in its briefing and presented at oral argument as evidence of what a person of ordinary skill in the art would understand "fine gain" to mean.[2] (D.I. 144 at 70; D.I. 190 at 121:17-122:5). Therefore, I will adopt Plaintiff's construction.

5.   "bit allocation parameter"

      a.   *Plaintiff's proposed construction*: "parameter used to determine a number of bits to be carried by a subcarrier on a per subcarrier basis"

      b.   *Defendants' proposed construction*: "parameter specifying the number of bits to be carried by a subchannel"

      c.   *Court's construction*: "parameter used to determine a number of bits to be carried by a subcarrier on a per subcarrier basis"

The parties have two disputes in construing this term. First, they disagree on whether the parameter is used to determine the number of bits or whether it specifies the number of bits. Second, they dispute whether the parameter provides the number of bits carried by a single subcarrier or whether it provides the number of bits on a per subcarrier basis, i.e. whether the Bit

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[2] The relevant time period for this understanding is January 26, 1998, the priority date of both the '404 and '268 patents.

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Allocation Table referenced in the specification is itself a bit allocation parameter. As to the first dispute, limiting the term to mean "specifying" would encompass how the number of bits is determined when a Bit Allocation Table is used, as described in the exemplary embodiment. The word "determine" also encompasses the use of a table to perform this task. Defendants argue that using "determine" unduly broadens the definition. I disagree. Only if I were to limit the claim to require that the only form of a bit allocation parameter be a Bit Allocation Table would Defendants' argument carry the day. The specification describes a method for constructing the Bit Allocation Table. But it is a parameter and not the Table itself that is claimed. It is not difficult to imagine other methods of determining the number of bits to be carried that do not involve a Bit Allocation Table being the parameter that is stored. Thus, I do not limit the construction to the exemplary embodiment.

The second dispute is readily resolved by turning to the specification. The patent lists some of the requisite parameters for waking from sleep mode and "Bit Allocation Tables" is included in that list. ('404 patent at 8:6-12). It seems to me that a full Bit Allocation Table is one example of the bit allocation parameter referenced in the claims. Therefore, Defendants' argument that a bit allocation parameter is nothing more than a single entry in a Bit Allocation Table must fail. Plaintiff's position that the number of bits must be specified for each subcarrier, not just a single subcarrier, is supported by the specification and comports with the purpose of the invention, i.e., allowing a transceiver to wake from sleep mode without reinitializing. Furthermore, the claim does not limit the form of the parameter to only a Bit Allocation Table. Therefore, I will adopt Plaintiff's construction.

6.   "synchronization frame"

   a.   *Plaintiff's proposed construction*: "a frame that indicates a superframe boundary"

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b.   *Defendants' proposed construction*: "frame that carries no user or overhead bit-level data and is inserted to establish superframe boundaries"

c.   *Court's construction*: "frame that indicates a superframe boundary"

The parties agree that synchronization frames indicate or establish superframe boundaries. The parties disagree, however, as to whether the synchronization frame must be limited to that defined in the ITU Document G922.2. Defendants insist that it must be so limited, pointing to the specification, which references this ITU Document. ('404 patent at 5:5-12). There are two problems with Defendants' argument, however. First, the reference to the ITU document is made after the reference to data frames and is also given specifically as an example ("data frames (*e.g.*, sixty-eight frames for ADSL as specified in ITU Document G.992.2)"). No reference is made to the ITU document after the synchronization frame is mentioned. Second, this is a simply an exemplary embodiment and I find no evidence to support limiting the claim to one exemplary embodiment. Therefore, I will adopt Plaintiff's construction.

7.   "synchronization signal"

a.   *Plaintiff's proposed construction*: "an indication used to establish or maintain a timing relationship between transceivers"

b.   *Defendants' proposed construction*: "reference wave used to establish or maintain a timing relationship between transceivers"

c.   *Court's construction*: "signal used to establish or maintain a timing relationship between transceivers"

The only dispute between the parties with respect to this term is whether the signal is "an indication" or a "reference wave." Defendant argues strenuously that the signal must be a wave, arguing that all of the examples of synchronization signals given in the specification are "reference waves." (D.I. 144 at 81). Defendant does not explain, however, what exactly a reference wave is in this context. The phrase "reference wave" does not appear anywhere in the patent and

Defendant has offered no definition. I will not construe this claim term to include a phrase that adds ambiguity and uncertainty to the meaning of the term. Plaintiff's proposal of "indication," however, is little better as the word "indication" could easily be deemed to include things that are not "signals." It seems to me that "signal" is a well-understood term that has a plain meaning to those skilled in the art. I see no need to substitute a different word that would introduce ambiguity into the meaning of the term. Therefore, I will adopt Plaintiff's proposed construction, modified as follows: "signal used to establish or maintain a timing relationship between transceivers."

8.   "apparatus comprising a transceiver operable to"

    a.   *Plaintiff's proposed construction*: "See above for the construction of 'transceiver'; otherwise plain meaning"

    b.   *Defendants' proposed construction*: "The preamble is limiting[3] and this is a means-plus-function limitation. The "transceiver" is the CPE transceiver depicted in Figure 2"

    c.   *Court's construction*: "plain meaning with 'transceiver' as previously construed"

Defendants argue that this element from the preamble of several claims is limiting as a means-plus-function claim element governed by 35 U.S.C. § 112 ¶ 6 because the word transceiver does not impart definite structure. (D.I. 144 at 85). Plaintiff responds that transceiver has a well-understood structural meaning in the art. (*Id.* at 86). When the word "means" does not appear in the claim element, there is a presumption that the element is not means-plus-function. *Williamson v. Citrix Online, LLC*, 792 F.3d 1339, 1349 (Fed. Cir. 2015). "[T]he presumption can be overcome and § 112, para. 6 will apply if the challenger demonstrates that the claim term fails to 'recite sufficiently definite structure' or else recites 'function without reciting sufficient structure for performing that function.'" *Id.*

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[3] Defendants argue only that the preamble provides a functional limitation. Therefore, I decline to address whether the preamble is otherwise limiting.

I conclude that § 112 ¶ 6 does not apply to this claim element. The word "means" does not appear in the claim element, so I begin with the presumption that § 112 ¶ 6 does not apply. Defendants have not overcome this presumption. Although "apparatus" is a non-structural term, the word "transceiver" imparts sufficient structure to the claim element. Transceiver is not a generic term like module or device. *Id.* at 1350. Rather, transceiver is the name of a device well known in the field of communications and, furthermore, the claimed transceiver is sufficiently described in the specification. (*See* '404 patent at 4:14-5:36). I will adopt Plaintiff's construction.

9.   "data"

      a.   *Plaintiff's proposed construction*: "non-control information"

      b.   *Defendants' proposed construction*: "digital information"

      c.   *Court's construction*: "content"

Plaintiff initially argued that this term should be construed to have its plain meaning. (D.I. 144 at 87-88). Plaintiff proposed "non-control information" in response to Defendants' initial proposed construction, "information." (*Id.* at 89). At oral argument, Defendants proposed to narrow their construction to "digital information." (D.I. 190 at 144:21). I am not persuaded that any of these constructions provide any clarity as to the meaning of the term "data." At oral argument, I proposed construing the term to mean "content." (*Id.* at 151:21). Plaintiff agreed to this proposed construction. (*Id.* at 155:9-156:1).

Defendants, however, argue that construing data to mean "content" would impermissibly narrow the meaning of "data" in some of the claims because "user data" is used in other claims. (*Id.* at 156:4-12). According to Defendants, user data is content. This position is contradicted by the patent specification, however. The specification provides that during sleep mode, "user data provided by the CO transceiver will be benign idle data such as ATM IdleCells or HDLC Flag

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octets." ('268 patent at 7:34-36). Although this information is defined to be user data by the patent

itself, it is not content. Therefore, I will construe data to mean content.

C.   The Diagnostic Mode Patents

The '430 patent is directed to multicarrier modulation messaging for frequency domain

received idle channel noise information. Claim 1 is representative and reads as follows:

> 1. A transceiver capable of *transmitting test information over a communication channel* using multicarrier modulation comprising:
> a transmitter portion capable of transmitting a message, wherein the message comprises one or more data variables that represent the *test information*, wherein bits in the message are modulated onto DMT symbols using Quadrature Amplitude Modulation (QAM) with more than 1 bit per subchannel and wherein at least one data variable of the one or more data variables comprises an *array representing frequency domain received idle channel noise information.*

('430 patent, claim 1) (disputed terms italicized).

The '412 patent is directed to multicarrier modulation messaging for power level per

subchannel information. Claim 1 is representative and reads as follows:

> 1. A transceiver capable of *transmitting test information over a communication channel* using multicarrier modulation comprising:
> a transmitter portion capable of transmitting a message, wherein the message comprises one or more data variables that represent the *test information*, wherein bits in the message are modulated onto DMT symbols using Quadrature Amplitude Modulation (QAM) with more than 1 bit per subchannel and wherein at least one data variable of the one or more data variables comprises an *array representing power level per subchannel information.*

('412 patent, claim 1) (disputed terms italicized).

1.   "[transmitting/receiving] test information over a communication channel"

   a.   *Plaintiff's proposed construction*: "plain meaning"

   b.   *Defendants' proposed construction*: "transmitting/receiving test information to/from a central office modem"

   c.   *Court's construction*: "plain meaning"

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Defendants seek to import a limitation into this claim requiring that the test information be transmitted either to or from a central office modem. This limitation is unsupported by either the claims or the specification. The specification does indicate that the receiving transceiver is "typically located" at the central office, but typically does not mean always. ('412 patent at 1:53). Defendants argue that the patent is directed to the solution of a particular problem: diagnosing problems without the need to dispatch a technician to the customer's home. (D.I. 144 at 97). This may be a problem identified in the specification that is solved by this patent, but the solution to the problem is not so limited. I find no basis for importing this limitation into the claim. I agree with Plaintiff that this term should be given its plain meaning. Defendants are prohibited from arguing that the term is limited to communications over a channel that includes the central office modem.

2. "test information"

    a.   *Plaintiff's proposed construction*: "information relating to a measured characteristic of a communication channel"

    b.   *Defendants' proposed construction*: "information relating to a disturbance in the communication channel"

    c.   *Court's construction*: "information relating to a characteristic of a communication channel or the communications equipment operating on that channel"

The parties dispute whether the test information must be measured and whether the information must relate to a disturbance in the communications channel. I find that neither of these limitations is supported by the intrinsic evidence.

Defendants contend that the description of the invention as a whole in the specification is limiting and that test information must therefore be limited to information "relate[d] to the diagnosis and resolution of communications problems caused by a disturbance on a communications channel." (D.I. 144 at 102). Defendants' argument is unavailing. The

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specification states, "The systems and methods of this invention are directed toward reliably exchanging diagnostic and test information between transceivers over a digital subscriber line in the presence of voice communications and/or other disturbances." ('430 patent at 1:44-47). Nothing in this description provides any limitation on the definition of test information. The reference to disturbances means only that the invention provides a method for the exchange of test information when there is a disturbance on the line. The specification later provides an extensive, but not exhaustive, list of what test information might include. (*Id.* at 2:24-43). Many of the items in this list are unrelated to disturbances. It would be inappropriate to limit the definition of test information when nothing in the specification indicates such a limitation.

With respect to whether the information must be measured, Plaintiff argues that a person of ordinary skill in the art would recognize that the test information as claimed must be measured. (D.I. 144 at 105). Defendants counter that the specification includes a list of categories of information that may be included as the test information and that a number of the items on the list, such as Chip Type, do not require measurement to determine. (*Id.* at 104). I agree with Defendants. Although some types of test information, as defined in the specification, must be measured, other types are simply characteristics of the communications system.

Defendants further challenge Plaintiff's construction as improperly limiting the test information to characteristics of a communications channel. (*Id.*) Defendants point out that information such as Chip Type and Vendor ID are characteristics of the modems, not of the communications channel itself. (*Id.*). I agree with Defendants. The test information defined in the specification appears to more broadly encompass information related not only to the communications channel itself, but also to the equipment used at one end of the channel. Therefore, I will adopt the following construction for test information: "information relating to a

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characteristic of a communication channel or the communications equipment operating on that channel."

3.   "array representing frequency domain received idle channel noise information"

    a.   *Plaintiff's proposed construction*: "ordered set of values representative of noise in the frequency domain measured on respective subchannels while no input signals are being transmitted on the subchannels"

    b.   *Defendants' proposed construction*: "ordered set of values representative of noise in the frequency domain that was received by a transceiver on a channel in the absence of a transmission signal"

    c.   *Court's construction*: "ordered set of values representative of noise in the frequency domain that was received by a transceiver on respective subchannels in the absence of a transmission signal"

The parties have three disputes with respect to this term: whether the values must be measured; whether the values represent noise on a subchannel basis; and whether the idle channel noise corresponds to "no input signals" being transmitted or simply "the absence of a transmission signal." The first and third disputes are readily resolved. There is no indication, either in the claims or in the specification, as to how these values are obtained. Certainly the values may be measured, but I cannot find support in the intrinsic evidence to limit the construction to measured values only. Furthermore, Plaintiff's own extrinsic evidence, and the only evidence presented with respect to the meaning of "idle channel noise," indicates that Defendants propose the better construction. *See* NEWTON'S TELECOM DICTIONARY 410 (15th ed. 1999) (defining idle channel noise as "[n]oise which exists in a communications channel when no signals are present"). There is no support for limiting idle channel noise to noise present in the absence of "input signals." Therefore, as to these two disputes, I adopt Defendants' proposed construction.

As to the dispute over whether the values are measured on respective subchannels, I find Defendants' arguments unavailing. Defendants are correct to point out that the applicants used the

phrase "per subchannel" explicitly in the '412 patent. ('412 patent, claim 1). However, the "array" terms of the two patents are differently worded. Thus, the absence of this phrase in the claims of the '430 patent does not necessarily render the phrase superfluous in the '412 patent. Furthermore, the fact that what is claimed is an "array" implies that more than one value is included. Therefore, I decline to adopt either party's proposed construction and instead will construe this term to mean "ordered set of values representative of noise in the frequency domain that was received by a transceiver on respective subchannels in the absence of a transmission signal."

4.   "array representing power level per subchannel information"

   a.   *Plaintiff's proposed construction*: "ordered set of values representative of power levels measured on respective subchannels"

   b.   *Defendants' proposed construction*: "ordered set of values representative of power levels of respective subchannels"

   c.   *Court's construction*: "ordered set of values representative of power levels of respective subchannels"

The parties' only dispute with respect to this term is whether the values must be measured. Plaintiff argues that without specifying that the values are measured, the term could be understood to mean that the values represent power level settings. (D.I. 144 at 115). Plaintiff further argues that the very definition of test information requires that the values be measured. (*Id.* at 116). I have already rejected the argument that all test information must be measured, however. Plaintiff cites to dependent claims specifying that the power levels are "based on a Reverb signal" and, therefore, must be measured. (*Id.*). Plaintiff further points to the specification, which provides that the power levels are "detected during the ADSL Reverb signal." (*Id.*). Defendants counter that detecting is not the same as measuring and that nothing in the claims or specification require that "the *only* way to obtain power level information is to measure it." (*Id.* at 117). Defendants

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further argue that there is a presumption that a limitation present in a dependent claim is not present in the independent claim. (*Id.*).

As an initial matter, I reject Defendants' argument that detect and measure have different meanings in this context. I do, however, agree with Defendants argument that the limitation in the dependent claim should not be imported into the independent claim. Plaintiff's citations to the specification describe a preferred embodiment which, it seems to me, directly corresponds with the dependent claims. While I do not see any reason these power levels could not be measured, or that they must be obtained in any particular way, I also do not see any support for requiring that they be measured. Therefore, I will adopt Defendants' proposed construction.

5.   "Reverb signal"

     a.   *Plaintiff's proposed construction*: "a signal generated by modulating carriers in a multicarrier system with a known pseudo-random sequence to generate a wideband modulated signal"

     b.   *Defendants' proposed construction*: "any 'REVERB' signal defined in the ITU or ANSI ADSL standards in existence as of January 8, 2001"

     c.   *Court's construction*: "signal generated by modulating carriers in a multicarrier system with a known pseudo-random sequence to generate a wideband modulated signal"

The primary dispute between the parties with respect to this construction is whether, as Defendants argue, the Reverb signal is limited to that defined in the referenced standards. Defendants find support for this limitation both in the fact that the term is capitalized, which Defendants take to indicate a reference to the REVERB1 signal from the standards, as well as from the reference to the standards in the specification. (D.I. 144 at 112-13). I find Defendants' argument unconvincing. Although the term "Reverb" is capitalized in the claims, it is not spelled out in all capital letters, nor does it include the number "1" at the end. Everywhere the specific standard is mentioned in the specification, it is given as "REVERB1." ('412 patent at 3:57-4:3).

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If the applicant had meant to claim the specific REVERB1 signal from the relevant standards, it seems likely he would have named that specific signal in the claim. The specification refers to the REVERB1 signal from the standards when describing an exemplary embodiment and there is no evidence in the specification of any disclaimer of other ways of generating a Reverb signal.

Plaintiff's proposed construction, on the other hand, is drawn directly from the specification. (*Id.* at 3:62-64). The applicant chose to define how the Reverb signal was to be generated. Having found no compelling reason to impose additional limitations on the meaning of this term, I will adopt Plaintiff's construction.

IV.   CONCLUSION

Within five days the parties shall submit a proposed order consistent with this Memorandum Opinion suitable for submission to the jury.