UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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COMMSCOPE TECHNOLOGIES LLC.

Petitioner

v.

BELDEN INC.

Patent Owner

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Case IPR2023-01062
Patent No. 6,750,095 B2

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**EXPERT DECLARATION OF KENNETH CORNELISON IN SUPPORT OF PETITIONER REPLY**



**CommScope v. Belden**
**IPR2023-01062**
**CommScope Exhibit 1081**

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I, Kenneth Cornelison, declare as follows,

## I. INTRODUCTION

1. I have been retained by Petitioner, CommScope Technologies LLC, ("CommScope" or "Petitioner") to provide expert opinions in connection with a petition for *inter partes* review before the United States Patent and Trademark Office. I understand that this declaration involves my expert opinions and expert knowledge related to U.S. Patent No. 6,570,095 ("the '095 Patent"), titled "Multi-Pair Data Cable with Configurable Core Filling and Pair Separation," and its field of endeavor.

2. I have reviewed the response of the Patent Owner ("PO") and the Expert Declarations of Dr. Charles A. Eldering (Ex-2001 and Ex-2007, collectively "Eldering Declaration"). The statements made herein are in response and are based on my own knowledge and opinions. I did not find the arguments in the Patent Owner response and Eldering Declaration persuasive, and the arguments did not change my opinion that the challenged claims are invalid as I explained in my First Declaration.





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## II. QUALIFICATIONS

3. My Qualifications and background are set forth in my first Declaration in Support of Inter Partes Review (Ex-1007) ("First Declaration"). My Resume has been included as Ex-1008.

4. As in my First Declaration, my opinions in this declaration are based on the perspective of a person of ordinary skill in the art in the 1999 timeframe (and specifically prior to February 25, 1999). This is true even if the testimony is stated in the present tense.

## III. MATERIALS CONSIDERED

5. My technical review, analysis, insights, and opinions are based on my experience and other qualifications discussed above, as well as my study of relevant materials.

6. I have reviewed and am familiar with the materials discussed in my First Declaration, as well as any additional materials discussed in this Reply Declaration.

7. I have also reviewed and am familiar with the Eldering Declaration, as well as the exhibits cited therein.

## IV. RELEVANT LEGAL PRINCIPLES

8. My understanding of the relevant legal principles is set forth in my First Declaration.





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## V. CLAIM CONSTRUCTION

9. I understand that in the decision to institute this inter partes review, the Board preliminarily construed the term "twisted pair of insulated conductors" as "a pair of insulated conductors that are twisted together." Paper 10, 13. As I explained in my First Declaration, twisted pairs of insulated conductors were ubiquitous in the communications cable prior art. The preliminary definition provided by the Board is consistent with the ordinary meaning of that term at the relevant time.

10. I also understand that Dr. Eldering has proposed that a construction for "twisted pair[s]" to be "two insulated conductors twisted together around one another to form a balanced transmission line." Ex-2007, ¶148; *see also id.* ¶¶135-147. This proposed construction is not inconsistent with the ordinary meaning of a "twisted pair of insulated conductors" at the relevant time. *E.g.*, Ex-1017, 18 ("The twist also helps keep the conductors of the pair balanced"); Ex-1018, 6 (same); Ex-1016, 7 (pairs are twisted "to decrease unbalanced mutual capacitance"); Ex-1029, 25 ("[c]ables with twisted pairs are used where balanced signal transmission is required…").

11. My opinions do not change and would not change whether one or the other definition is applied.

## VI. RESPONSIVE OPINIONS



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### A. GROUND 1: Roberts Discloses Twisted Pairs As Claimed

12. Dr. Eldering misreads Roberts. As I explained in my First Declaration, Roberts discloses conventional telephone cable having conventional twisted pairs of conductors (the twisted pairs being pairs of insulated conductors that are twisted together to form a balanced transmission line) on each side of its separator. Ex-1007, ¶¶113-119 (citing, *e.g.*, Ex-1019, 1:10-15; Ex-1016, 7; Ex-1029, 23, 25, 33, Fig. 55.1; Ex-1017, 11; Ex-1035, 20; Ex-1013, 2:32-33). To a POSITA, this would have been apparent from the descriptions provided by Roberts, as well as from my many years of experience working with similar cables. Everyone who was in the field of telecommunications in the 1990s and before knew that "conventional" telephone cable of the type shown in Roberts used twisted pairs of insulated conductors.

13. Dr. Eldering's view that Roberts instead teaches groups of straight-line conductors with one wire of each "pair" on the opposite side of the separator transmitting in unbalanced mode also does not make sense functionally. As I discuss in more detail below, using bundles of straight-line conductors would have been highly ***un***conventional for telephone cables with large numbers of conductors like Roberts and in fact would not have been expected to work at all.





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### 1. Dr. Eldering Ignores that Roberts Teaches "Pairs" of a "Conventional" Telephone Cable

14. Dr. Eldering ignores that Roberts is describing "pairs" of an "otherwise conventional telephone cable design":

> ABSTRACT: Disclosed herein is an economical telephone cable structure and method of making same, such cable structure possessing improved crosstalk properties. A plurality of insulated electrical conductors (pairs), of an otherwise conventional telephone cable design are divided into at least two portions by plastic-coated metal foil strip or tape. …

Ex-1009, Title, Abstract (emphasis added). It is plain that the deviation from the "conventional" telephone cable is what Roberts considers its invention—the use of a coated metal foil strip or tape to divide the cable into two compartments, not from the conventional use of twisted pairs in telephone cables. *E.g.*, Ex-1009, Abstract, 12:51-65 (differentiating "cable structures utilizing a screen or shield tape" from "a conventional cable construction").

15. As I explained in my First Declaration, a POSITA would have known that "pairs" of conductors in a "conventional" telephone cable referred to *twisted* pairs, not to two disparate individual straight wires in physically separate groups. Ex-1007, ¶118 ("The use of twisted pairs in data communications cables was ***conventional*** and common practice [] at the time of the Roberts patent (1968)…").





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As I also showed in my First Declaration, numerous industry publications and other references confirm this:

- Ex-1019, 1:10-11 ("A ***typical*** telephone cable is constructed of ***twisted pairs*** of metal conductors for signal transmission");
- Ex-1024, 4:18-23 ("FIG. 3 depicts ***how a typical*** telecommunication multipair cable 50 can be constructed…First, the insulated conductors 10 or 11 are ***twisted into pairs***");
- Ex-1023, 1:4-7 ("…each unit ***conventionally*** being a ***twisted pair*** of conductors…");
- Ex-1017, 11 ("The ***most commonly*** used transmission media in present-day digital loop applications is ***twisted pair metallic (copper) cable***");
- Ex-1016, 7 ("***Most of the cables*** within the scope of AT&T's EC&W product line utilize the ***twisted pair construction.***");
- Ex-1020, 1:34-39 ("The larger aerial or underground paper insulated cables connecting the subscriber to the central office consist of a large number of lines ranging from 606 to 1212 actual pairs"), 2:31-34 ("Fig. 7 is an enlarged view of one of the groups of conductors constituting the cable showing that the individual conductors are twisted into pairs"), 2:55-59 ("A plurality of copper wires insulated





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with paper, cotton, silk, or other suitable material, ***usually twisted together in pairs***, are stranded together loosely to form a group or bundle 5");

- Ex-1029, 33 Fig. 55.1 (diagram of "***twisted pair"*** cable described as "***[t]ypical telephone cable*** layout").

- Ex-1021, 1:13-17 ("a plurality of twisted pairs of individually insulated electrical conductors are assembled and stranded or twisted together into a compact group or cable unit"), 1:43-47 ("assembling and twisting a plurality of twisted pairs of individual insulated electrical conductors into a single compact group or so-called cable unit").

See also references such as Ex-1016, 7; Ex-1018, 3; Ex-1029, 23, 25, 32-33; Ex-1014, 1:30-32.

16. The fact that "conventional" telephone cabling of the type Roberts is directed to (many conductors bundled together without individual shielding) used twisted pairs was something anyone working in the industry would just know as common knowledge. This is confirmed by the references I cited above. A POSITA would not have had to do any analysis to know that telephone cabling of the type Roberts is directed to "conventionally" used twisted pairs.





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17. Not only were twisted pairs conventional for telephone cables like those shown in Roberts, there were also industry standards that *required* twisted pairs for such cables. For example, the American National Standards Institute ("ANSI") 1995 standard for Telecommunications Cable Filled, Polyolefin Insulated Copper Conductor required twisted pairs. Ex-1072, 1, 18 ("Insulated conductors shall be formed into pairs using twist lengths that will ensure that the finished cables shall be capable of meeting the finished cable electrical requirements of this Standard."). The ANSI specification is for an outside plant or exchange cable. Ex-1072, 12. It also teaches the optional use of screened compartments, similar to Roberts' divided groups. Ex-1072, 12, 38-39. Similarly, the 1993 REA specification for filled telephone cables with expanded insulation requires twisted pairs. Ex-1073, 12 (7 C.F.R. §1755.890 (a)(ii)) (1993) ("The insulated conductors are twisted into pairs which are then stranded or oscillated to form a cylindrical core."), 13 ("(5) The insulated conductors must be twisted into pairs. (6) In order to provide sufficiently high crosstalk isolation, the pair twists must be designed to enable the cable to meet the capacitance imbalance and crosstalk loss requirements of paragraphs (k)(5), (k)(6), and (k)(8) this section."). The REA specification also is intended for outside plant or exchange cable use and has also optional screened compartments, like Roberts. *Id.*, 12. Based on my understanding and experience, the requirement to use twisted pairs for such





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telephone has been unchanged since at least the 1960s. In the course of my many years in the communications cabling industry, I became quite familiar with both the ANSI/ICEA and REA standards.

18. Roberts shows examples of what a POSITA would have referred to as a telephone trunk or exchange cable. Exchange cables were "used for exchange services such as regular subscriber or private line services." Ex-1018, 3. Like the cables shown in Roberts, exchange cables had a high pair count with many twisted pairs bundled together, and the pairs within a group were conventionally ***not*** individually shielded from each other. *See* Ex-1018, 3-4, 8. And like the cables shown in Roberts, exchange cables were used between repeaters for city to city or subdivision to subdivision connections. Roberts, Abstract, 13:13-15 (explaining that the telephone cable it is describing is intended to be used "between repeaters"). Conventional telephone exchange cables of the type shown in Roberts could be buried directly in earth, hung aerially, or installed underground in ducts or conduit. Ex-1018, 3-4; *see also* Ex-1009 (Roberts), 5:59-62 ("the cable using the polyethylene grease as disclosed can be directly buried in the ground"), 13:55-58 ("use of the polyethylene greaselike material allows a cable to be classified as a direct buried cable").

19. As I explained in my First Declaration, in the context of a conventional telephone cable like Roberts (e.g., a telephone cable with many pairs





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of conductors bundled into groups with the pairs not individually shielded from each other), it was not uncommon to shorten "twisted pairs" to simply "pairs." Ex-1007, ¶33, ¶115 (where I discuss the description in Ex-1022 of the "disturbed pair" and "disturbing pair"), ¶118. This is also shown in many of the references I cited in my First Declaration (I've added the bolding below):

- *Subscriber Loop Signaling and Transmission Handbook – Analog*, Whitham D. Reeve (EX-1018), *e.g.*, 4 ("Depending on the gauge, exchange cables are available in standard ***pair*** counts from 6 through 4,200 pairs. When cables up to around 1,200 ***pairs*** are manufactured for direct burial and aerial applications, the core may be filled with a jelly- or rubber-like substance to prevent insulation damage and higher attenuation from moisture…. Many ***pairs*** are combined together to form a cable. The individual ***pairs*** are formed into units, and the units are then assembled or cabled into cores (much like a rope).")

- U.S. Patent No. 3,803,340 to Jachimowicz (Ex-1022), *e.g.,* 1:7-16 ("One form of interference called 'crosstalk' is the induction of current in the 'disturbed' ***pair*** by currents flowing in the 'disturbing' pair. The 'disturbed' ***pair*** therefore carries two currents. One, which is the information intended for transmission and the other unwanted





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induced by neighboring ***pairs,*** which superimpose themselves on the transmitted signal reducing the clarity and reliability of transmission.")

- U.S. Patent No. 3,894,172 to Jachmowicz (Ex-1014), *e.g.*, 1:6-8 ("There is an increased use of telephone cables having symmetrical (balanced) ***pairs*** as a transmission medium for sending pulse code modulated (PCM) signals); 1:30-32 ("In order to minimize crosstalk, it is necessary to avoid proximity of ***pairs*** of the same, or nearly the same, twist (lays)."; Abstract ("This communication cable for telephone use has comparatively small numbers of ***pairs*** with conductors of each ***pair*** twisted together with different lays and the ***pairs*** are assembled into shielded units."); 2:28-30 ("FIG. 1 shows a ***pair*** of insulated conductors 10, another ***pair*** of insulated conductors 12 are located in the same regain as the ***pair*** 10 but somewhat lower down.")

- American National Standards Institute, Standard for Telecommunications Cables Filled, Polyolefin Insulated, Copper Conductor (May 26, 1995) (Ex-1072), 18 ("Insulated conductors shall be formed into ***pairs*** using twist lengths that will ensure that the finished cables shall be capable of meeting the finished cable





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electrical requirements of this Standard….Insulated conductors shall be formed into ***pairs*** in accordance with the following color code and pair designations…")

- Canadian Patent Application No. 2,058,046 (EX-1023), 2 (Abstract) ("A telecommunications cable in which ***pairs*** of twisted together conductors are spaced apart to minimize capacitance unbalance and cross-talk. A central core member may be provided with the conductor ***pairs*** extending around the core member which may have spokes to separate the conductor ***pairs***."); 5:1-5 ("In a fourth embodiment as shown in Figure 4, a cable 40 is provided with four ***pairs*** 14 of insulated conductors 16. The four ***pairs*** 14 are surrounded by a jacket 42 which incorporates spacer means for holding the ***pairs*** of conductors in spaced apart positions.")

- U.S. Patent No. 4,262,164 (EX-1024), *e.g.*, 1:34-36 ("Each T1 system provides 24 channels on two ***pairs*** by displacing two voice channels.").

20. Patent Owner contends that I "admitted" that the term "pair" in the "data communications cable context" generally does not always necessarily refer to twisted pairs. Paper 19, 17. However, the context is key here. For conventional telephone cable designs like Roberts discloses, I have consistently explained that





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"pairs" refers to twisted pairs. Ex-1007, ¶33, ¶115 (citing, e.g., the discussion in Ex-1022 of the "disturbed pair" and "disturbing pair"), ¶118. And as I discussed in the preceding paragraph, this is confirmed by numerous references.

21. The only evidence Dr. Eldering cites of "pairs" referring to untwisted wires—my discussion of "twinax" cable at my deposition, and the Lemke patent (Ex-2005, discussed at Ex-2007, ¶¶151-157)—are from an entirely different context than the conventional telephone cables of Roberts.

22. Referring specifically to the twinax cable I referenced during my deposition, such twinax cable is not like the "conventional" telephone cable of Roberts. The "twinax" cable I referenced is a particular type of high-speed data cable where the whole cable was just two wires, surrounded by a shield. A POSITA would have known that this twinax cable is very different from the Roberts "conventional" telephone cables. Because the single pair in a twinax cable is individually shielded from the outside world, and because there was only one pair, a POSITA would not be concerned about crosstalk between pairs, and it was possible to use untwisted wires.

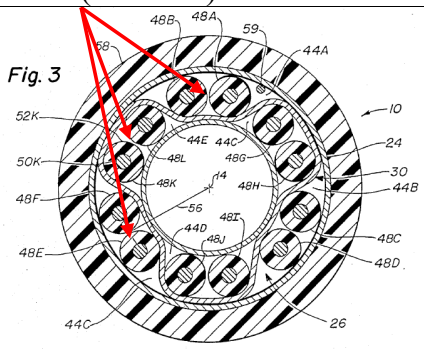
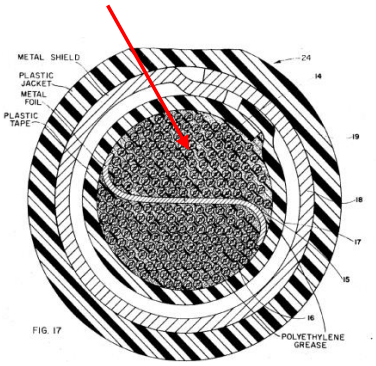
23. Referring specifically to the Lemke patent Dr. Eldering discusses at ¶¶151-157 of his declaration, Lemke's data cables are also nothing like the "conventional" telephone cables Roberts is directed to. Unlike Roberts, in Lemke each conductor or conductor pair is in an individually shielded chamber. *E.g.*, Ex-





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2005, Abstract, Figs. 1-9, 5:55-62. This is very different from the "conventional" telephone cables of Roberts, which had large groups of tens to hundreds of twisted pairs bundled together in a single shielded envelope or group and the pairs within that group not individually shielded from each other. *See* Ex-1009, Fig. 17. I illustrate this below:

| Lemke (Ex-2007) | Roberts (Ex-1009) |
|---|---|
|  |  |





24. A POSITA would have known that while straight (untwisted) pairs may work in cables like twinax and Lemke, where each pair was individually shielded, they would not work in conventional telephone cables like Roberts where many pairs are bundled together without individual shielding. As I also explain in more detail below, the crosstalk between conductors in a Roberts-like telephone cable—if they were not twisted pairs—would be far too much to be a workable cable.





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### 2. Dr. Eldering's Opinion that Roberts Discloses "Pairs" of Straight-Line Conductors Would Not Have Made Sense to a POSITA and a POSITA Would Not Have Expected that to Be Viable

25. Dr. Eldering argued that Roberts actually discloses pairs that consist of "one straight-line conductor within group (14) that is transmitting in one direction, and another straight-line conductor within group (16) that is transmitting in the opposite direction." Ex-2001, ¶¶47, 51-54; Ex-2007, ¶¶159, 165. Telephone cable configured this way would have been ***un***conventional and highly unusual to a POSITA. In all my years working in the industry (most of that experience with twisted pair cabling specifically), the Roberts-like telephone cable I have seen (e.g., trunk or exchange-like cables with many conductors bundled together into groups) has had twisted pairs. I have never seen a Roberts-like telephone cable configured the way Dr. Eldering says Roberts is configured. In fact, a POSITA would not have expected a telephone cable configured like what Dr. Eldering contends Roberts discloses to be a viable cable (e.g., to have satisfactory performance), due to prohibitively high levels of crosstalk that would have been present.

26. When a high frequency signal is transmitted on a wire, it emits a magnetic field. The emitted electromagnetic field can induce signals on adjacent wires. As I explained in my First Declaration, this electromagnetic disturbance on an adjacent wire is called ***crosstalk.*** Ex-1007, ¶¶36-38. The circuit creating the





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electromagnetic field is referred to as the disturbing circuit, and the circuit where the (undesirable) signals are induced is referred to as the disturbed circuit. *See* Ex-1009, 3:21-27. Every signal transmission causes some level of crosstalk on the other wires within the cable. However, some types of signal transmission cause far more crosstalk than others.

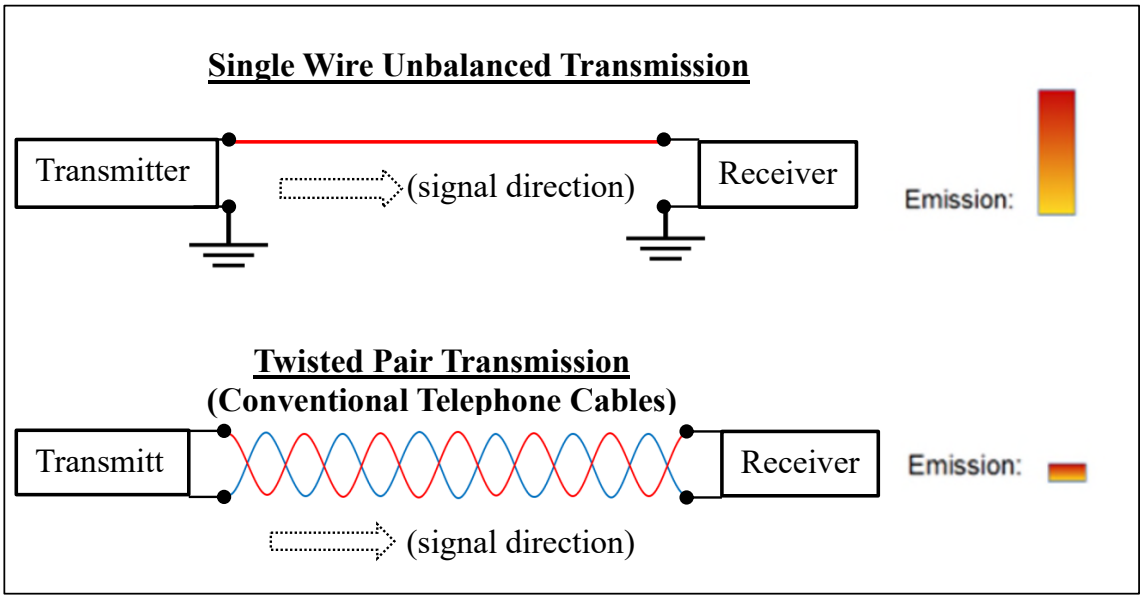
27. One way a signal could be transmitted was via a single wire, called unbalanced transmission. This was where each individual wire transmitted a separate signal, and the transmitted signal was measured with reference to a common ground. Single wire unbalanced transmission was known to produce a very strong electromagnetic emission. A single wire in unbalanced transmission not only *emitted* very high levels of electromagnetic radiation, it was also known to be correspondingly susceptible to electromagnetic emissions from other wires (susceptible to being electrically disturbed). Another way of transmitting the signal was what conventional telephone cables used—twisted pairs to provide balanced transmission of signals. *E.g.,* Ex-1018, 3, 6; Ex-1017, 18. This was where the twisted pair transmitted a single signal, and the transmitted signal was measured between the two wires of the twisted pair with each wire providing equal but opposite polarity. A twisted pair was known to produce far less electromagnetic emission and therefore to significantly reduce crosstalk problems for adjacent signal-transmitting pairs. *See* Ex-1007, ¶¶34-35; Ex-1016, 7; Ex-1018, 6; Ex-1017,





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18. A twisted pair not only produced far less electromagnetic radiation, it was also far less susceptible to being disturbed by electromagnetic radiation received from surrounding sources. I have provided the below illustration:

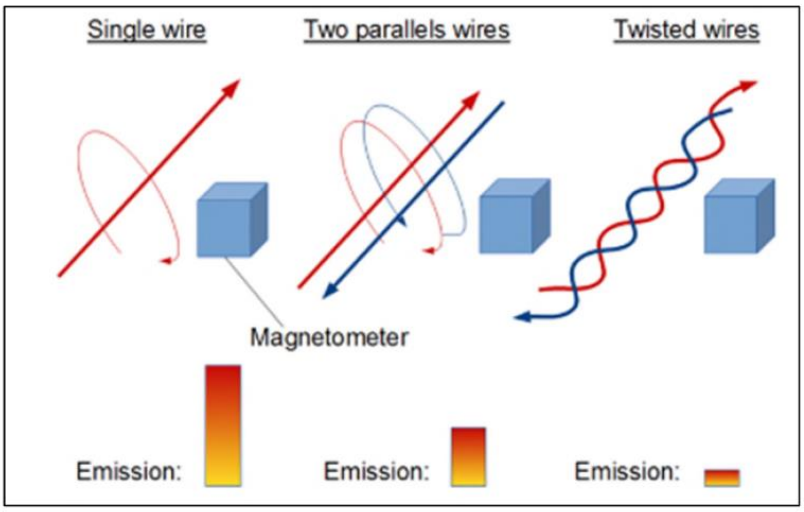



28. Dr. Eldering agrees that unbalanced transmission via a single wire produces a far stronger electromagnetic emission than transmission via a twisted pair. Dr. Eldering illustrates this at paragraph 145 of Ex-2007:





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*See also* Ex-2007, ¶146 (stating that "the periodic field reversals caused by the two conductors of a twisted pair being twisted together around one another work to balance out the overall electromagnetic radiation of the twisted pair, such that electromagnetic emission from the twisted pairs, as measured through the strength of the resulting magnetic field, is less than that of either a single conductor wire or two parallel conductor wires.").

29. The fact that single wire unbalanced transmission produces far stronger electromagnetic radiation than twisted pair balanced transmission means that the crosstalk caused on adjacent conductors is far more significant and problematic for the single wire transmission. *See* Ex-1007, ¶¶34-35; Ex-1016, 7 ("reasons for twisting pairs…are to minimize or eliminate crosstalk and to decrease unbalanced mutual capacitance"); Ex-1018, 6 ("The twist is used to decrease electromagnetic interference (EMI) due to crosstalk between adjacent pairs in a





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cable."); Ex-1017, 18. The fact that a single wire is also correspondingly more *susceptible* to electromagnetic emissions (far more susceptible to being electrically disturbed), only compounds the crosstalk problem for groups of adjacent single wires.

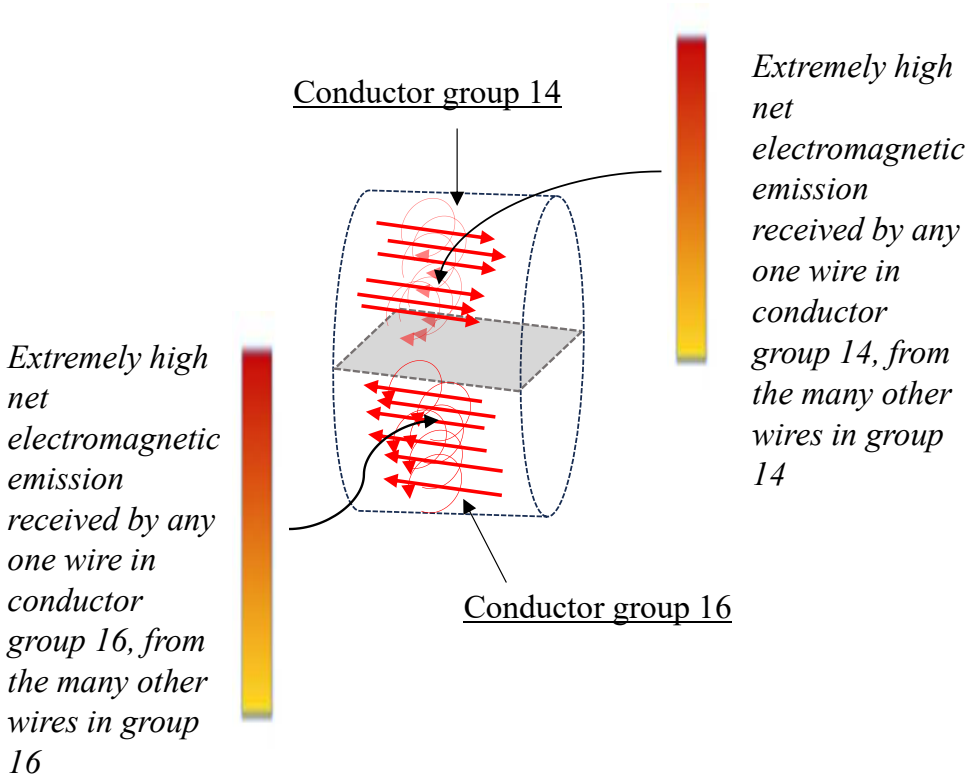
30. A POSITA would have recognized that Dr. Eldering's interpretation of how Roberts is configured results in multiple straight wires transmitting multiple signals in unbalanced mode. I understand Dr. Eldering confirmed that this is what he is contending Roberts teaches. Ex-2001, ¶47 (Dr. Eldering stating that "Roberts is directed to a system for isolating straight-line transmit and receive wires in an unbalanced transmission system using a conductive metallic shield"). As I explained above, a POSITA would have understood that if Roberts had such a configuration—groups of straight wires transmitting in unbalanced mode—there would be **far more crosstalk *within* a group** (at both the near and far ends) than there would be with twisted pairs. The *many* conductors that Roberts shows grouped together without any shielding around them individually would ***compound***





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the crosstalk problem manyfold. I illustrate this below:




31. The compounded effect of the collective electromagnetic emissions of all the straight wires within a conductor group (14 and 16) on any one particular wire within that same conductor group would result in extremely high levels of crosstalk, such that a POSITA would have not expected a cable configured that way to provide acceptable electrical performance. The strong levels of crosstalk between many signal wires in a group would have been expected to be particularly unworkable for cables of the type Roberts is directed to, that extended "miles" in length. *E.g.*, Ex-1009, 3:60-61 ("When considering a cable of many miles in





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length…"), Abstract ("a greater spacing between repeaters can be designed into a telephone cable…"). The already-strong and problematic levels of crosstalk would have been expected to increase significantly with increased length, as with length the undesirable signal induced on disturbed conductors continues to build, and at the same time the transmitted (desired) signal weakens. See, for example, Ex-1014, 1:24-30, which notes that "far end crosstalk" is "cumulative with cable length" and with length became the limiting factor even for twisted pairs. A POSITA would have known that this problem would have been far, far worse if not using twisted pairs but instead using single wires.

32. A POSITA would have known that this is precisely the issue that twisted pairs are designed to address and why "conventional" telephone cables—such as the "pairs" in Roberts—were *twisted* pairs to provide balanced transmission, and not individual wires on opposite sides of the separator each operating in unbalanced mode. Using twisted pairs of conductors was known to drastically reduce crosstalk between the transmitting conductors and allow for a functional telephone cabling with acceptable electrical performance. *E.g.,* Ex-1016, 7; Ex-1018, 6.

33. I understand that Dr. Eldering stated at his deposition that Roberts relies on "appropriate signal to noise and launched power" to make sure within-group crosstalk is "at acceptable levels" and that the cable of Roberts is "tolerant"





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of within-group crosstalk. Ex-1070, 157:8-158:9. I do not see that he explained why or how. And there is no indication of this in Roberts. As I explained above, Roberts shows groups of *many* conductors without any individual shielding between them. As I also explained above, it was well known that if these conductors were straight wires transmitting in unbalanced mode, there would be very high and problematic levels of crosstalk within a group (which is why such cables conventionally used twisted pairs). I also understand that Dr. Eldering admitted that he had never encountered a cable configured as he contends Roberts is configured that was used for distances of a kilometer or more. Ex-1070, 142:13-21.

34. Roberts explains that its invention—the plastic-coated metal shield 15 that divides the group of conductors 14 transmitting carrier frequencies in one direction and the group of conductors 16 transmitting carrier frequencies in the other direction into separate "compartments"—was intended to reduce crosstalk *between* the signals being transmitted opposite directions, i.e. to limit crosstalk ***between the groups*** of conductors 14 and 16. Ex-1009, 1:22-26 ("*The shield has the effect of* ***reducing so called 'near-end' crosstalk*** *since the weak attenuated currents coming in at a repeater point* ***are in a compartment*** *of the cable electrically* ***shielded from*** *a large amplified current entering the* ***conductors in the other compartment of the cable***."). As Roberts explains, a transmitted signal is





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strongest near the source point for the transmission, while a signal being transmitted in the opposite direction is at its weakest at that point, and thus most susceptible to crosstalk.

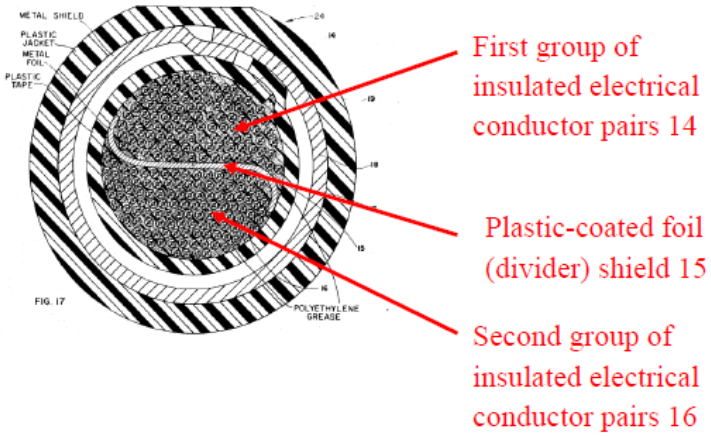
35. Dr. Eldering's read of Roberts entirely ignores another type of crosstalk—the well-known issue of crosstalk (at both the near end and far end) ***within*** **a single group of conductors** transmitting in the same direction that I discussed above. Roberts does not talk about this type of crosstalk. That is because a POSITA would have understood that in an "otherwise conventional" telephone cable (to which Roberts is directed), crosstalk ***within*** **each group** (which was known to build with length) was controlled and brought down to manageable levels by using twisted pairs. *See* Ex-1007, ¶¶34-35; Ex-1016, 7 ("reasons for twisting pairs…are to minimize or eliminate crosstalk.."); Ex-1018, 6 ("The twist is used to decrease electromagnetic interference (EMI) due to crosstalk between adjacent pairs in a cable"); Ex-1017, 18.

36. Like I explained in my First Declaration, a POSITA would understand Roberts to be disclosing conventional telephone cable having many conductors conventionally configured as twisted pairs, with a group of twisted pair conductors 14 transmitting carrier frequencies in one direction shielded via a plastic-coated metal shield 15 from a second group of twisted pair conductors 16 transmitting carrier frequencies in the other direction:

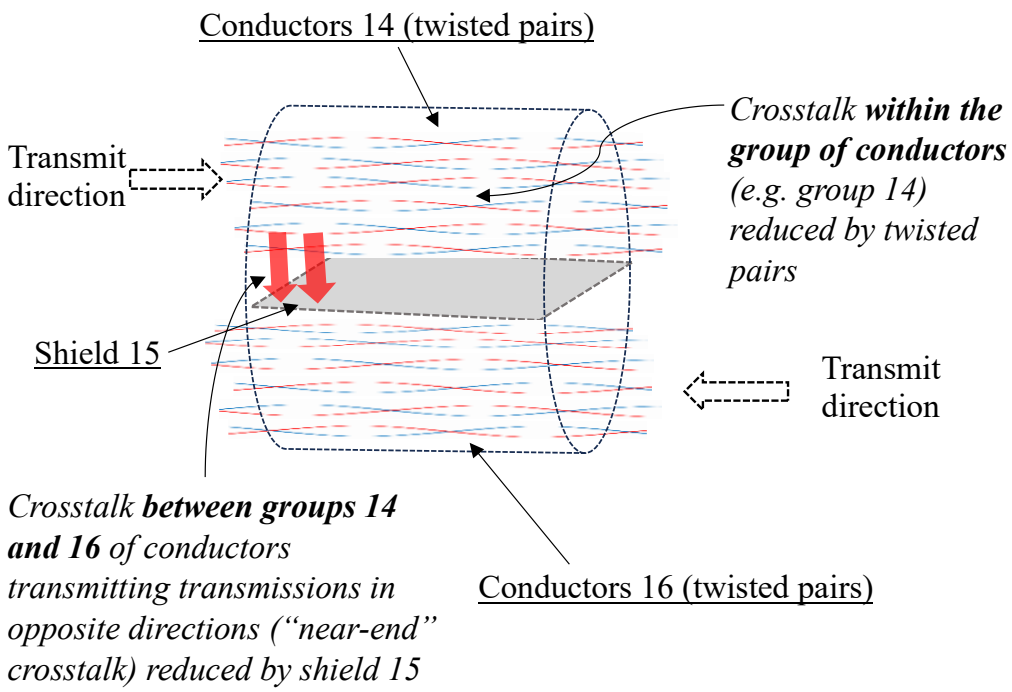




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Ex-1007, ¶91; *see also id.* ¶¶113-120; Ex-1009, Abstract, 1:5-31. A POSITA would understand that Roberts mitigated both sources of crosstalk—crosstalk between the groups of conductors transmitting in opposite directions and crosstalk within a single group of conductors transmitting in the same direction—in different ways. Near-end crosstalk ***between the groups*** transmitting in opposite directions was reduced by the shield 15, and crosstalk ***within a single group*** 14 or 16 transmitting in the same direction (most significant and problematic at the far end of the group) was reduced by use of the "pairs" of a "conventional" cable (i.e., twisted pairs). I have illustrated this below:




37. Roberts' configuration, separating a group of twisted pairs transmitting in one direction from a group of twisted pairs transmitting in the opposite direction by placing a shield between the groups, disclosed in a 1968 patent application, is exactly how many telephone cables by the 1990s worked. Some examples are below:

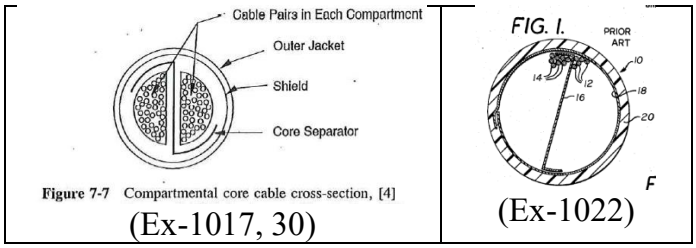


Exhibit 1017, which is a well-known telecommunications handbook by Reeve, describes "compartmental core cable" that separates pairs of "twisted conductors" into two compartments "to reduce crosstalk between the transmit and receive pairs," using what was by then known as "Z-screen," "D-screen," or "T-screen." Ex-1017, 30, 35 and Fig. 7-7. Ex-1022 also describes a telephone cable for PCM transmission (which Roberts also discloses) having a "S or Z-shaped screen" for shielding a group of twisted pairs carrying signals in one direction from a group of twisted pairs carrying signals in the other direction. Ex-1022, 1:5-48 and Fig. 1.

38. Dr. Eldering also contends that the figures of Roberts show straight-line conductors and cites Watts[1] (Ex-2006) for support. Ex-2001, ¶48; Ex-2007, ¶¶163-164. However, neither Watts nor Roberts' figures show a lack of twisted pairs. It would not be surprising to a POSITA that the pair twisting is not immediately visible in the limited isometric sections provided in the figures of Roberts (and Watts) because the twist length of such cables was quite long. See, for example, Ex-1014, 1:32-34 ("The length of pair twist which can be employed is

[1] I note that Watts is a patent that discusses Roberts. *See* Ex-2006, 1:47-2:2. Watts' discussion of Roberts focuses on Roberts' metal shielding and armor. *See id.* Watts does not discuss the type of conductors used by Roberts or Watts itself.





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limited…from the smallest (approximately 1 ½ inches) to the largest (approximately 5 inches).").

39. Consistent with this, the twisting of the pairs is also not immediately visibly evident in many catalog images and industry publication figures of actual twisted pair cables:

## Cable Construction

CONDUCTORS: Solid bare annealed copper. Sizes 19, 22, 24 and 26 AWG (.9, .64, .5 and .4mm).

INSULATION: Individual copper conductors insulated with a color coded, high density polyethylene or a color coded polypropylene.

TWISTED PAIRS: Insulated conductors twisted to form pairs with varying lays to minimize crosstalk and meet capacitance unbalance limitations.

CABLE ASSEMBLY: Cables 25 pair and less are assembled in concentric layers to form a cylindrical core. Cables having 37 pair and more are assembled from concentrically formed units with not more than 25 pair per unit, which may be cabled into 50 pair super or 100 pair super quad units, which are cabled to form the complete cylindrical core assembly.

CABLE CORE COVERING: A non-hygroscopic core wrap is applied over the assembled core which furnishes mechanical as well as high dielectric protection between shielding and individual conductors.

SHIELD: Type GEF: Electrically continuous, .008" (0.203mm) corrugated aluminum shielding tape applied longitudinally with a polyethylene film fused and chemically bonded to both sides.

JACKET: Virgin, black, high molecular weight, linear low density or medium density polyethylene.

IDENTIFICATION, LENGTH MARKING: Manufacturer's identification, year of manufacture, gauge, pair count, and cable type surface marked on jacket at two-foot (610mm) intervals. Sequentially numbered length markings are located at alternate two-foot (610mm) intervals.



(Ex-1035, 13)

## Cable Construction

CONDUCTORS: Solid bare annealed copper. Sizes 19, 22, 24 and 26 AWG. (.9, .64, .5 and .4mm).

INSULATION: Individual copper conductors insulated with a color coded high density polyethylene or a color coded polypropylene.

TWISTED PAIRS: Insulated conductors twisted to form pairs with varying lays to minimize crosstalk and meet capacitance unbalance limitations.

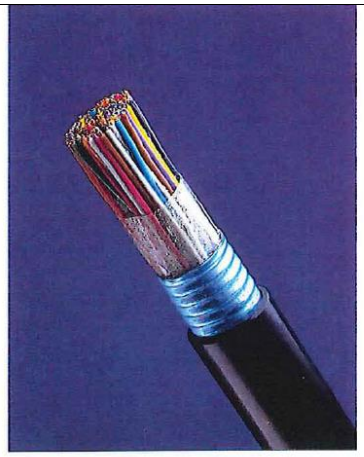
CABLE ASSEMBLY: Cables 25 pair and less are assembled in concentric layers to form a cylindrical core. Cables having 37 pair and more are assembled from concentrically formed units with not more than 25 pair per unit, which may be cabled into 50 pair super or 100 pair super quad units, which are cabled to form the complete cylindrical core assembly.

MOISTURE RESISTANCE: To the cable core is applied a moisture-resisting compound which completely coats each insulated conductor and fills the interstices between pairs and units.

CABLE CORE COVERING: A non-hygroscopic core wrap is applied over the assembled core which furnishes mechanical as well as high dielectric protection between shielding and individual conductors.

FLOODING COMPOUND: A flooding compound is applied to fill all the depressions of the corrugations over and under the shield unless the shield is bonded to the jacket, in which case, flooding compound is applied under the shield only.

SHIELD: Type GEBW: Electrically continuous, .008" (.203mm) corrugated aluminum shielding tape applied longitudinally with a polyethylene film fused and chemically bonded to both sides.

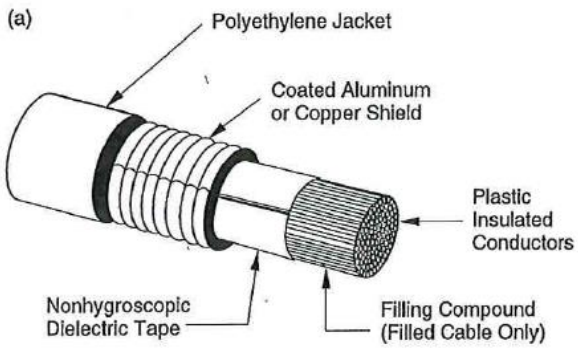


(Ex-1035, 20)





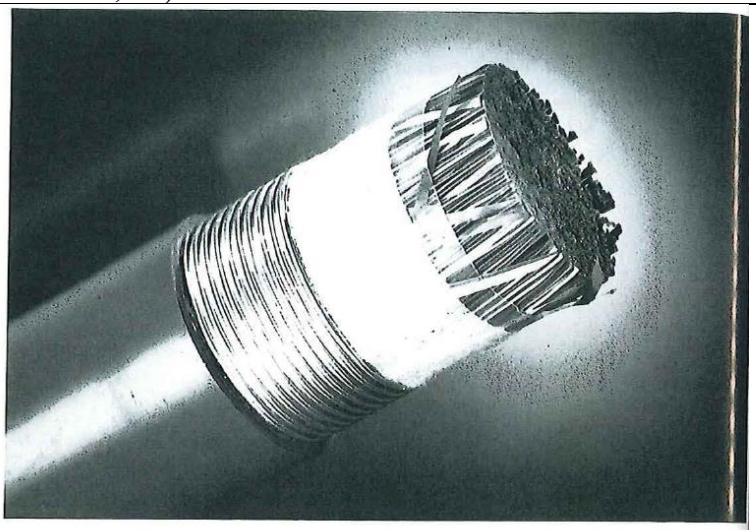
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[…]

**Figure 7-3** Twisted pair cable constructions, [4]
Reeve, © 1992 Institute of Electrical and Electronics Engineers. Reprinted with permission

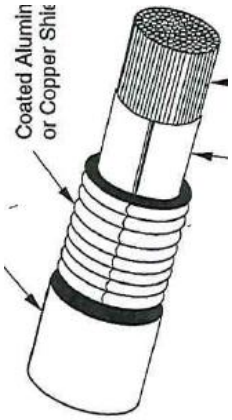
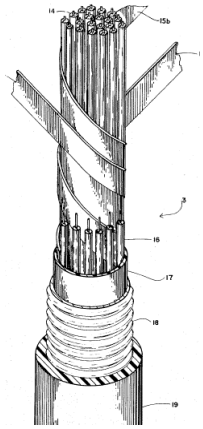
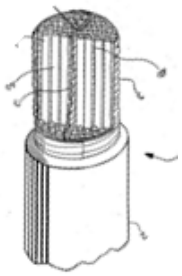
(Ex-1017, 24)



This riser cable consists of 1,800 pairs of dual insulated (expanded polyethylene with PVC skin) 24 gauge conductors. Note the cluster appearance due to the units and multi-units which form the cable core. A double core wrap is used – one clear, and one "mat wrap".

(Ex-1016, 13)

Ex-1035, 13 (depicting a cable with "TWISTED PAIRS"). These images are very similar to the Roberts and Watts figures Dr. Eldering cites, as can be seen in the example I provide below:

| | | | |
|---|---|---|---|
|  |   |  |  |
| Alcatel Catalogue (Ex-1035, 13, telecommunications exchange cable with "TWISTED PAIRS") | Reeve Handbook (Ex-1017, 24, "Twisted pair cable construction[]") | Roberts (Ex-1009, Fig. 3) | Watts (Ex-2006, Fig. 1) |

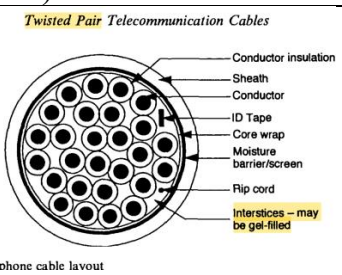
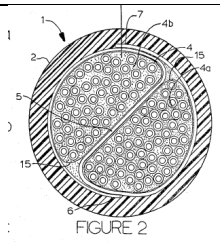
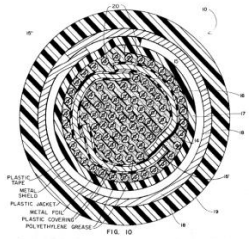
40. Patent Owner also argues that Roberts and Watts show grease-filled "spaces" between the conductors. Paper 19, 22-25 ("the Figures in Roberts depict individual insulated conductors with irregular ***spacing*** between them, which Roberts repeatedly describes as being filled with 'polyethylene greaselike material.'") (emphasis in original). But this would not indicate straight (untwisted) pairs to a POSITA. To the contrary, the prior art depicts twisted pairs with gel-





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filled spaces between conductors using images that look like the Watts and Roberts figures Patent Owner cites:

| Electric Cables Handbook depicting "Twisted Pair" cable (Ex-1029, 33) | Watts Figure 2 (Ex-2006) | Roberts Fig. 10 (Ex-1009) |
|---|---|---|
|  Fig. 55.1 Typical telephone cable layout |  FIGURE 2 |  |

41. Patent Owner contends that Roberts' description of "holes (33) through which ***twisted*** electrical conductors (14) and (16) pass" does not indicate twisted pairs because I said during deposition that the portions of the manufacturing process disclosed in Figures 22 and 23 do not relate to the formation of twisted pairs. Paper 19, 26-27. However, a POSITA would know that the manufacturing process disclosed in Figures 22 and 23 of Roberts is about the bunching or cabling process (the twisting of all the elements about a common axis). I did not say, and Roberts does not indicate, that the die plates *form* or create the twisted pairs. Rather, as I explained in my prior declaration, a POSITA would understand Roberts to indicate that each strand pulled through the dieplate holes is (already) a twisted pair. Ex-1007, ¶116. Such pairs were known to be fed through from a twisted pair wire supply. *Id.* This is illustrated in industry texts:





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Ex-1016, 9. I have also personally seen and worked with machines like this in manufacturing plants, as well as spools of twisted pair wire, throughout my 40+ years working in the cabling industry (most of that time working with twisted pair cabling specifically). A POSITA would have understood Roberts to indicate that the twisted pairs were already twisted when they enter the first dieplate of Roberts' cabling machine.

### B. GROUND 3: GmbH-866 Discloses Twisted Pairs

42. Dr. Eldering argues that GmbH-866 does not disclose twisted pairs. Ex-2001, ¶¶79-96. This is incorrect.

43. As I noted in my First Declaration, GmbH-866 expressly discloses twisted pairs in at least three different places:

> Data transfer cables of this kind typically consist of four pairs of two stranded isolated copper conductors or wires. …
>
> A data transfer cable according to the invention, shown in Fig. 1, comprises four pairs 1, each consisting of two isolated, stranded copper conductors 2 or wires. …
>
> [T]he invention can also comprise just two pairs of stranded conductors.





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Ex-1010, 2, 3, 4; *see also id.* Figs. 1-5; *see also* Ex-1007, ¶¶174-176.

### 1. GmbH-866's Description of "*Pairs*" that Each Consist of "*Two Stranded Isolated Copper Conductors or Wires*" Discloses Twisted Pairs

44. Dr. Eldering contends that the word "stranded" in GmbH-866's description of "*pairs*" of "*two stranded isolated copper conductors or wires*" does not mean each of the two wires are stranded (twisted) around each other, but rather refers to the conductive core an insulated wire of the pair consisting of multi-filament smaller-diameter copper wires. Ex-2001, ¶¶80-82. Dr. Eldering is wrong. When describing a pair as consisting of "two stranded… copper conductors or wires," to a POSITA GmbH-866 is plainly describing twisted pairs.

45. Patent Owner says that I admitted that "stranded" wire can mean where you have multiple fine filaments braided together to make up an overall larger conductor. It is true, as I stated at my deposition, that in certain contexts stranded can have that meaning. But as I further explained during my deposition, it is clear that in GmbH-866 "stranded" means twisted.

46. GmbH-866 consistently uses the word "stranded" to mean twisted. GmbH-866 uses "stranded" and "stranding" to refer to twisted and twisting in various portions. For example:

- Ex-1010, 3 ("stranding…of the conductor pairs")





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- Ex-1010, 3 ("The stranding of the pairs 1 can consist in what is known as helix stranding or in an SZ stranding…")
- Ex-1010, 3 ("in the case of an SZ stranding of the pairs")
- Ex-1010, 4 ("the invention can also comprise just two pairs of stranded conductors")
- Ex-1010, 5 ("stranding or the conductor pairs 1")
- Ex-1010, 5-6 ("in the case of the stranding of the conductor pairs in the SZ stranding method")
- Ex-1010, 8 cl. 11 ("the conductor pairs (1) are stranded in a helical or SZ-like manner").

Despite these consistent uses, Dr. Eldering argues that where GmbH-866 explains that each "pair" consists of "stranded…conductors or wires," a POSITA would understand GmbH-866 uses stranded to mean multi-filament wire. Ex-2001, ¶¶79-82. A POSITA would not agree with Dr. Eldering. There is no indication in GmbH-866 that it is suddenly using stranded in a different sense when talking about the pairs of "conductors or wires." A POSITA would have understood that GmbH-866 uses the words stranding/stranded consistently across the patent to refer to components that are twisted around each other.

47. Dr. Eldering's interpretation of the sentences describing "*stranded isolated copper conductors or wires*" from GmbH-866 are also contradictory and





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do not make sense as a matter of ordinary sentence structure. *See* Ex-1010, 2, 3. On the one hand, Dr. Eldering focuses on the word "isolated" and argues that it shows that GmbH-866's use of the word "isolated" "teaches away" from the conductors or wires being "intertwined" or twisted. Ex-2001, ¶83. In doing so, he appears to be arguing that "isolated" modifies ***both*** the subsequent "conductors" and "wires" options. At the same time, Dr. Eldering argues that the word "stranded" modifies ***only*** "conductors" and ***not*** "wires": "the conductor pairs in GmbH-866 are disclosed as consisting of either stranded copper conductors or solid wires." Ex-2001, ¶80. This interpretation of "stranding" as modifying only the "conductors" option but "isolated" modifying both is contradictory and does not make sense.

48. In reality, a POSITA would have understood each of the words "stranded," "isolated" and "copper" to modify each of the "conductors" or "wires" options that followed:

> four pairs of two **stranded isolated copper** *conductors or wires*…
>
> four pairs 1, each consisting of two **isolated, stranded copper** *conductors 2 or wires*…

Ex-1010, 2, 3 (emphasis added). This sentence structure is an additional indication that in the context of GmbH-866 "stranded" is twisted. Given that "stranded" plainly modifies both of the "conductors or wires" options, it would not make





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sense for stranded to mean multifilament braided wire (as Dr. Eldering argues). If it did, then the "conductors or wires" options would be nonsensically redundant (as they would both be comprised of braided filaments).

49. It would also not make sense for GmbH-866 to be disclosing straight (untwisted) "pairs." As I explained at my deposition, in my 40-plus years in the industry, I have never seen a four-pair data cable of the type disclosed by GmbH-866 that did not use twisted pairs. Ex-2004, 215:15-216:7. To a POSITA, it would be implausible to read GmbH-866 as excluding cables with twisted pairs. I am not aware of any high-speed, four-pair data cables of the type GmbH-866 discloses (e.g. transfer speeds up to 100 or 600 MHz) that did not use twisted pairs. This is not surprising, because standards for four-pair data cables like those shown in GmbH-866 and within the 1-100 MHz transfer speed range described by GmbH-866 *required* twisted pairs or quads. *E.g.,* Ex-1074, 15, 25, 43 (1995 ISO/IEC 11801 standard, a common data cable standard used in Europe, defining "pair" as "a twisted pair" (at 3.1.31) and stating that each cable unit have at least four "pairs"); *see also id.* at 25 (speeds up to 100 MHz); Ex-1079, 14-15, 30, 34, 54-55, 59, 78-79, 83, 89, 121 (TIA/EIA-568-A standard, a common data cable standard used in the United States). I am familiar with the ISO/IEC 11801 and TIA/EIA-568-A standards from my many years of experience in the industry.





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50. It is true that in some contexts "stranded wire" can mean wire with a multi-filament braided copper core (as opposed to a solid copper core), as I acknowledged at my deposition. Ex-2004, 213:3-214:4. And I do not read GmbH-866 to exclude that option—that is what a POSITA would understand GmbH-866 to be referring to with its alternative of "wires." In other words, GmbH is describing a "pair," where each pair consists of stranded (meaning twisted) set of two [solid] conductors or [multi-filament braided] wires. In the context of the GmbH-866 reference, a POSITA would understand "stranded" to mean twisted, for all of the reasons I have previously explained. Ex-2004, 151:8-21, 214:5-16, 215:15-216:7; Ex-1007, ¶¶174-178.

51. Dr. Eldering argues that GmbH-866 "teaches away" from twisted pairs because it describes the pairs as consisting of "two isolated conductors in each case." Ex-2001, ¶¶83-84. A POSITA would not have agreed with Dr. Eldering. A POSITA would have instead understood "isolated" conductors to refer to the fact that both of the conductors are electrically insulated from each other, not that they are somehow physically separated from each other. In fact, all the figures in GmbH-866 show that for each "pair 1" each insulated conductor 2 is touching or nearly touching the other one of the pair (which is consistent with a twisted pair), not "isolated" in the sense of individualized or separated from it. Ex-1010, Figs. 1-





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5. Isolated was a known way to refer to conductors of the pair being electrically insulated from one another.

52. Dr. Eldering also contends that because GmbH-866 does not specifically teach that the "insulation (3)" covering each of the copper conductors or wires is twisted or stranded, that indicates that the copper conductors or wires of each pair are not a twisted pair. Ex-2001, ¶87. A POSITA would not agree. A POSITA would not have expected a reference to separately describe the stranding of the conductors and *the insulation* that covers the conductors. A POSITA would know that the insulation is part of (adhered to) the conductor. GmbH-866 explains this: "The copper conductors or wires preferably ***have*** an insulation 3 consisting of a thermoplastic polymer." Ex-1010, 3.

### 2. GmbH-866's Statement that the Invention that "*Can Also Comprise Just Two Pairs of Stranded Conductors*" Is Describing Stranding (Twisting) the Conductors of Each Pair, Not the Stranding (Twisting) of the Overall Cable Components

53. Dr. Eldering contends that Petitioner "mischaracterizes" GmbH-866's teaching that the invention can also "comprise just two pairs of stranded conductors," and that this actually just refers to the stranding (twisting) of the pair units and the other cable components together. Ex-2001, ¶¶89-95. A POSITA would not have agreed with Dr. Eldering.





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54. A POSITA would recognize that GmbH-866 consistently refers to the "stranded" "conductors or wires" when it is talking about the wires being stranded into twisted pairs, and GmbH-866 consistently refers to the "stranding" of the "pairs," when it is talking about stranding the cable components together about a central axis. I have put together the chart below that shows this:

| | |
|---|---|
| Stranded modifies "conductors or wires" | • "four pairs of two stranded isolated copper conductors or wires" Ex-1010, 2.<br>• "four pairs 1, each consisting of two isolated, stranded copper conductors 2 or wires" Ex-1010, 3<br>• "just two pairs of stranded conductors" Ex-1010, 4 |
| Stranding modifies "pairs" | • "stranding and/or the longitudinally extending deformation of the conductor pairs" Ex-1010, 3<br>• "The stranding of the pairs 1 can consist in what is known as a helix stranding or in an SZ stranding…" Ex-1010, 3<br>• "In the case of an SZ stranding of the pairs…" Ex-1010, 3<br>• "with the stranding or the conductor pairs 1…" Ex-1010, 5<br>• "in the case of the stranding of the conductor pairs in the SZ stranding method…" Ex-1010, 5-6<br>• "conductor pairs (1) are stranded in a helical or SZ-like manner" Ex-1010, 8 (claim 11) |

55. Dr. Eldering argues that I admitted that "GmbH-866 teaches that the pairs (1) are stranded into a helical or SZ form, not that the individual conductors (2) of pair are twisted together to form a twisted pair." Ex-2001, ¶92, ¶94. This is incorrect and misleading. As I explained in my First Declaration, GmbH-866





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teaches *both* types of twisting—that the insulated wires of each pair are stranded (twisted) around each other to form a twisted pair, and that the components of the overall cable (the twisted pair units and the shieldings) are themselves stranded (twisted) about a central axis. EX-1007, ¶¶174-178, 188-194; Ex-1010, 2-4, 5.

56. Patent Owner alleges that I admitted that GmbH-866 refers to "cable assembly as 'stranding' four (4) times throughout the specification" and cites to my deposition (Ex-2004) at 149:2-22, 150:17-152:13; 153:8-155:2, and 156:1-157:1. Paper 19, 47-48. I accurately answered that these portions of GmbH-866 refer to cable assembly. Patent Owner did not ask me about the portions of the specification where the stranding modifies "conductors or wires." I also explained that an earlier (different) portion of one of the paragraphs Patent Owner asked me about did disclose that the conductor pairs were also stranded (twisted) themselves. Ex-2004, 150:17-152:13.

57. The paragraph on pages 3-4 of Ex-1010 (GmbH-866) does discuss stranding "of the pairs 1" and also discusses stranded "conductors." Ex-1010, 3-4. A POSITA would have understood that when stranding modifies "the pairs," it refers to stranding the twisted pair units about a central axis of the cable, while when stranded modifies "the conductors," it refers to stranding the two conductors of the pair into a twisted pair.





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### C. GROUND 7: Yanagita Discloses Twisted Pairs, and Therefore Anticipates Claims 27-29

58. Dr. Eldering argues that Yanagita's discussion of stranded "pairs" merely describes the prior art. Ex-2001, ¶¶69, 73. A POSITA would not understand Yanagita's disclosure that "alternatingly twisted"/"alternatedly stranded"[2] cables can use either individual straight wires or stranded "pairs" or "quads" to be merely describing the prior art. Rather, a POSITA would understand Yanagita to be describing the types of cables that the invention can be used with. The paragraph discussing stranded "pairs" is immediately under the heading "Detailed Explanation of the Invention." Ex-1012, 1. The paragraph also begins by stating that "the present invention relates to an improvement of an alternatingly twisted cable," and then proceeds to describe the "alternatingly twisted cable" to which the invention is directed in the very next sentence and includes alternatively twisted cables using stranded pairs or quads. Ex-1012, 1. A POSITA would not have read Yanagita as Dr. Eldering contends.

59. Dr. Eldering also argued that Yanagita discloses only "straight line wires" and the only twisting described is of the overall cable components as they follow along the shape of the twisted core material 2. Ex-2001, ¶¶62, 64-77; Ex-2007, ¶¶170-171. A POSITA would understand that Yanagita is not limited to "only

[2] "Alternatedly stranded" is another term for SZ-stranding.





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individual straight line conductors." A POSITA would understand Yanagita to disclose two types of twisting: a cable where the overall cable core components are alternatingly stranded, and also that wires themselves can be either straight-line wires or twisted pairs or quads. For example, Yanagita distinguishes between the overall "twisted cable" created by the shape of the core material 2 (underlined text below), and the options for the individual wires that are laid alongside that core material (in italicized text below):

> [A] first invention thereof is an alternatingly twisted cable *wherein a large number of insulated wire strands, or that wherein the insulated wire strands are twisted together,* are laid, while twisting along the surfaces, along both surfaces of a core material. . .

Ex-1012, 1.

60. In particular, when describing the options for the wires that are laid along the core material surface (italicized text), Yanagita clearly uses the word "or" to indicate alternative options. Either the wires are individual straight wires "or" they are groups of "twisted together" wires (meaning twisted pairs or quads):

> [A] first invention thereof is an alternatingly twisted cable *wherein a large number of insulated wire strands,* ***or that wherein the insulated wire strands are twisted together****,* are laid, while twisting along the surfaces, along both surfaces of a core material. . .

Ex-1012, 1.





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61. Yanagita consistently repeats these alternative options for the wires (I've italicized this text)—that they can be either straight wires "or" twisted pairs or quads. This is evident from Ex-1012 (a certified English-language translation obtained for this IPR) and it is corroborated by and consistent with Ex-1055. While the translations use various phrasings (for example, "pairs thereof or quad strands," "strands are twisted together," "stranded pairs or stranded quad," "stranded groupings of such"), a POSITA would understand the disclosures to clearly indicate that the invention may be used with a cable having twisted pairs. Below are examples of Yanagita explaining that (i) the overall cable components are alternatingly twisted to prevent unraveling of the over cable bunch (underlined text) and (ii) the wires of the cable may be straight wires[3] (italics) or twisted pairs or quads (bold italics):

| Ex-1012, 1 | Ex-1055, 1 |
|---|---|
| "The present invention relates to an improvement of an <u>alternatingly twisted cable</u>…There is trend to often using, as communication cables, so-called 'alternatingly twisted cables,' | "The present invention relates to a favorable <u>alternatedly stranded cable</u>…As communications cable, there is a tendency to use *a plurality of either insulated element wires* ***or else*** |

[3] I note that while Yanagita has a very broad disclosure that includes straight wires, a POSITA would not have expected that configuration to work very effectively, particularly for longer distance transmission.





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| | |
|---|---|
| wherein that wherein *a large number of strands of insulated wires* ***or pairs thereof or quad strands***, or units thereof, are twisted together so as to reverse the direction of twisting thereof with given periodicity." | ***stranded pairs or stranded quad of such,*** or otherwise to use so-called alternatedly stranded cable with which units of the wires are stranded in a manner so that the stranding direction is reversed at points in time within a fixed cycle" |
| "first invention thereof is an alternatingly twisted cable wherein *a large number of insulated wire strands,* ***or that wherein the insulated wire strands are twisted together***, are laid, while twisting along the surfaces, …" | "first invention constitutes an alternatedly stranded cable…; onto both surfaces of the core material, *a plurality of either insulated element wire* ***or else stranded groupings of such*** are vertically run along the surfaces while being twisted" |
| "1 *is an insulated wire* ***or that wherein insulated wires are twisted together***, laid divided onto both sides of a core material 2" | "reference numeral 1 *constitutes an insulated element wire* ***or stranded groupings of such***; these are divided and longitudinally run along both surfaces of core material 2" |

If the bolded text merely referred to the twisting (stranding) of all the cable components, it would be redundant of the other (underlined) text that already says that.





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62. That Yanagita is, unsurprisingly, including in its disclosure the common and conventional use of twisted pairs is evident in its repeated use of "or" to describe the options for the configurations of each of the elements "1" that are laid about the plastic core. Yanagita repeatedly says that element "1" can be either "an insulated wire ***or*** that insulated wires are twisted together." Ex-1012, 1. Ex-1055, the other English translation that I understand the Patent Owner used in previous proceedings, says the same thing: "numeral 1 constitutes an insulated element wire ***or*** stranded groupings of such." I understand that Dr. Eldering has argued that this "or" clause is just redundant, and instead refers again to the overall stranding of the components along the twisting plastic core. Ex-1070, 205:1-22. This would not make sense to a POSITA. Yanagita consistently uses this same phrasing. It consistently states two options for what the wire units "1"—element 1 is either a straight wire, "or" wires that are twisted together (stranded groupings) of such (i.e., twisted pairs or quads). Yanagita even repeats this phrasing in both claims. Ex-1012, claims 1, 2; Ex-1055, claims 1, 2. A POSITA would understand that in Yanagita "or" means "or," as in an alternative option.

63. Patent Owner contends that I admitted during my deposition that Yanagita is not clear in what it means by "stranding" and "twisting." *See* Paper 19, 36, 32. This is a mischaracterization of what I said. I explained in both my First Declaration and during my deposition that Yanagita is "clear" with respect to





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disclosing twisted pairs. *See* Ex-2004, 121:5-8, 210:16-211:14. Patent Owner cited my response when asked whether there was anything in Yanagita that was not "perfectly" clear. I noted that the words "stranding" and "twisting" would need close attention. Ex-2004, 121:9-122:2. I in no way said that Yanagita is not "clear" with respect to its disclosure of twisted pairs.

64. I also note that by the date of the Yanagita patent the vast majority of communication cables used twisted pairs or quads. For example, Ex-1017, 11 ("The most commonly used transmission media in present-day digital loop applications is twisted pair metallic (copper) cable"); Ex-1019, 1:10-15 ("A typical telephone cable is constructed of twisted pairs of metal conductors for signal transmission…."); Ex-1016, 7; Ex-1020, 1:7-14; Ex-1023, 1:4-7 (…each unit conventionally being a twisted pair of conductors…); Ex-1020, 1:34-39, 2:31-34, 2:55-59 ("A plurality of copper wires insulated with paper, cotton, silk, or other suitable material, usually twisted together in pairs, are stranded together loosely to form a group or bundle 5"); *see also* Ex-1021, 1:13-17 and 1:43-47; Ex-1029, 23, 25, 32, 33 Fig. 55.1; Ex-1014, 1:30-32; Ex-1072 (ANSI standard); Ex-1073 (REA standard). See also my discussion above at paragraph 15. Yanagita discloses an invention for use with "communications cables." To a POSITA, it would have been implausible to read Yanagita as limiting its invention to only bundles of straight wires, (and excluding twisted pairs). This is particularly true given that





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both translations of Yanagita expressly refer to stranded "pairs." Ex-1012 ("strands of insulated wires or pairs thereof"); Ex-1055, 1 ("either insulated element wires or else stranded pairs …of such"). As I explained above with respect to Roberts, it was common to shorthand twisted pairs to simply "pairs." And in the context of Yanagita (a large number of "pairs" of conductors bundled together without individual shielding between each pair), a POSITA would have understood the description of the wires could be "pairs"/"stranded pairs" to refer to twisted pairs.

### D. GROUND 5: Obvious in view of Roberts, one or more of GmbH-866, Jachimowicz and Gingue, and/or the knowledge of a POSITA.

65. As discussed above in Section VI.A, Dr. Eldering is wrong about what Roberts teaches. However, if Roberts were "directed to a system for isolating straight-line transmit and receive wires in an unbalanced transmission system using a conductive metallic shield" (Ex-2001, ¶47), as Dr. Eldering argues, a POSITA would have immediately been motivated to substitute pairs that are twisted to form a balanced transmission line for the groups of straight-line wires. As I explained in my First Declaration twisted pairs were conventional for such cables, and twisted pairs were known to (and would have been expected to) vastly improve the cable performance by providing for low crosstalk and balanced transmission. Ex-1007, ¶¶233-240, citing evidence including:





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- EX-1029 at 25 ("Cables with twisted pairs are used where balanced signal transmission is required, together with low crosstalk");
- EX-1016 at 7 ("The two main reasons for twisting pairs of conductors are to minimize or eliminate crosstalk and to decrease unbalanced mutual capacitance");
- EX-1035 at 20 ("Insulated conductors twisted to form pairs with varying lays to minimize crosstalk and meet capacitance unbalance limitations").

66. Dr. Eldering argues that a POSITA would not have been motivated to use twisted pairs for the electrical advantages because "Roberts already provides an effective solution to the problem of crosstalk in a communication cable," citing Roberts' shield 15 that divides a group of conductors transmitting in one direction from a group of conductors transmitting in the other direction. Ex-2001, ¶103, *see also* ¶¶102-107. Dr. Eldering argues that with the shield 15, Roberts "chose a different solution to the crosstalk problem" that did not utilize twisted pairs. Ex-2001, ¶¶101, 104. Dr. Eldering also argues "there would be no motivation to modify Roberts to include the… twisted pairs of Jachimowicz" because Jachimowicz's "shielding around each unit" reduces crosstalk between the different conductor units and Roberts shielding between conductor groups already





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provide a solution to the near-end crosstalk problem. Ex-2001, ¶¶101-104; Ex-2007, ¶¶175-176.

67. If Roberts were configured as Dr. Eldering contends, Roberts' shielding 15 between groups would not have "solved" the crosstalk problem. Dr. Eldering ignores that there would be multiple sources of highly problematic crosstalk, including between conductors ***within the same group*** transmitting in the same direction, under his interpretation of Roberts. As I explained in my First Declaration and above, a POSITA would have known that there was (i) crosstalk between the different groups of conductors transmitting in opposite directions (usually measured as "near-end" crosstalk), *and also* (ii) crosstalk between conductors within the same group transmitting in the same direction (sometimes measured as "far-end" crosstalk). Ex-1007, ¶¶37-38; §VI.A.2, *supra.* As I discussed above, a POSITA would not have expected Roberts to sufficiently control crosstalk if configured as Dr. Eldering argues, because of the extremely high levels of crosstalk between adjacent conductors within the same group that would result. *Id.*

68. Roberts' shielding between the bundled groups of conductors does not address the problem of crosstalk between conductors ***within the same*** **group**. I understand that Dr. Eldering admitted this. Ex-1070, 138:10-16. As I discussed above in Section VI.A.2, a POSITA would have understood that using twisted





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pairs (like those taught by Jachimowicz) rather than single-wire transmission would drastically reduce crosstalk between the conductors ***within a group*** and therefore drastically improve the electrical performance of the cable. Twisted pairs were the well-known way to improve electrical performance by allowing balanced communication that limited crosstalk between neighboring conductors in communications cabling. See, for example, Ex-1016, 7 ("reasons for twisting pairs…are to minimize or eliminate crosstalk.."); Ex-1017, 18 ("The twist is used to decrease electromagnetic interference (EMI) due to crosstalk between adjacent pairs in a cable"); Ex-1029, 23, 25, 33; Ex-1014, 1:30-39; Ex-1018, 6; Ex-1035, 20 ("Insulated conductors twisted to form pairs with varying lays to minimize crosstalk and meet capacitance unbalance limitations"); see also my First Declaration (Ex-1007), at for example ¶¶34-35, 236 and 238 (citing evidence).

69. As I explained above, Roberts' shielding (15) around/between groups of conductors in Roberts does help reduce the other source of crosstalk—the crosstalk ***between*** twisted pairs of conductors in ***different*** **groups** transmitting in opposite directions, often measured at the near end where it is most problematic. §VI.A.2; Roberts, 1:8-31. However, if the groups of conductors were not twisted pairs providing balanced transmission but rather single wires transmitting in unbalanced mode as Dr. Eldering argues, there would be a massive amount of crosstalk-causing electromagnetic emission generated within each of the shielded





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compartments of Roberts. A POSITA knew that shielding would not have blocked all crosstalk. If Roberts had groups of single wires rather than twisted pairs, a POSITA would also expect a significant portion of the large amount of electromagnetic emission generated by the group to leak across the shield 15, creating across-the-shield noise problems at the near-end of the cable. Therefore, modifying Roberts to use the conventional approach of groups of *twisted pairs*, rather than straight wires, would have resulted in far less crosstalk-inducing electromagnetic emissions within each shielded compartment and less leak across the shield, beneficially further reducing across-the-shield crosstalk between the groups of conductors at the near end.

70. Dr. Eldering's opinion that there would be "no motivation" to use twisted pairs for Roberts' groups of conductors 14 and 16 because the crosstalk solution provided by twisted pairs would be "redundant" of the crosstalk solution provided by Roberts' shield (*e.g.* Ex-2001, ¶¶103-104, 106-107) is just wrong. A POSITA would have immediately recognized that using twisted pairs for Roberts' conductor groups 14 and 16 would have drastically improved the electrical performance of the cable, both by bringing within-group crosstalk (particularly far-end crosstalk) down to acceptable and workable levels, and also by further reducing near-end crosstalk between the groups of conductors transmitting in opposite directions.





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71. Dr. Eldering also argues that the "mechanical benefits" of ensuring the individual wires stay grouped together during the cabling process makes no sense because Roberts purportedly teaches to divide and separate each wire of the pair. Ex-2001, ¶108. Patent Owner also contends that twisted pairs would "alter the principle of operation in Roberts." Paper 19, 65. Using twisted pairs in a telephone cable such as Roberts was a known and ubiquitous solution, and doing so would not "alter the principle of operation" of Roberts. As I explained above if Roberts were configured as Dr. Eldering contends, the crosstalk between conductors in a group would have been so high as to render the cable effectively nonviable. §VI.A.2. As I also explained above, twisted pairs would allow for a functional cable (e.g., by reducing within-group crosstalk), while *maintaining* and in fact improving the beneficial near-end (between-group) crosstalk reductions that Roberts provides. *Id.*

72. Dr. Eldering also argues that the substitution of twisted pairs for straight-line conductors would alter the principle of operation of Roberts by doubling the number of wires, increasing the diameter of the cable, and "require[ing] a far more complex cable termination solution involving doubling the number of wire terminations." Ex-2001, ¶¶110-113. Dr. Eldering also argues that the increase in "cable cross section and resulting increase in diameter also would





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lower flexibility of the overall cable, reducing the number of applications it could be utilized in, either because of space or turn radius requirements." Ex-2001, ¶112.

73. As I explained above, if Roberts were configured as Dr. Eldering contends, the crosstalk between conductors within a group would have been so high as to render the cable effectively nonfunctional. §VI.A.2. So to a POSITA the vastly improved electrical performance provided by twisted pairs would have easily outweighed a somewhat larger, less flexible cable.

74. Further, a POSITA would have known that Roberts-type cables (e.g., those with a large number of bundled conductors, such as exchange-type cables) would have been used in applications where they were usually buried or hung. Ex-1009 (Roberts), 5:59-62 ("the cable using the polyethylene grease as disclosed can be directly buried in the ground"), 13:55-58; Ex-1018, 4 ("filled cable is normally considered for direct buried applications, but is also used in aerial and underground service"). In such applications, the electrical performance of the cable was far more important than considerations of cable size or flexibility, and electrical performance would have been vastly enhanced by the use of twisted pairs as I explained above. Further, the existing Roberts-like exchange cables used at the time used twisted pairs and would have had a comparable number of conductors, and thus would have had a comparable diameter and flexibility. *See* Ex-1018, 3-4.





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75. Dr. Eldering also argues that using twisted pairs would "eviscerate the advantages that the Robets cable already offered, namely a space-saving, economical cable". Ex-2001, ¶111. A POSITA would not agree. Roberts is not directed to a space-saving cable. Instead, it says its invention provides the *electrical* benefit of reduced near-end crosstalk between groups of conductors to allow "greater spacing" between repeaters. Ex-1009, Abstract, 1:5-31. Twisted pairs would be expected to predictably maintain that benefit, and at the same time give the additional benefit of allowing a functional overall cable, by bringing within-group crosstalk down to functional levels.

76. Additionally, while Dr. Eldering cites the Lemke patent (Ex-2005) as an example identifying drawbacks of twisted pairs, a POSITA would not have agreed that analysis applied to Roberts-like cable. Lemke had each conductor or pair in its own separate shielded chamber. See Ex-2005 generally. The cost of manufacturing a high pair count cable like Roberts with Lemke's corrugated separator member configured to separate each pair from every other one would likely be far greater (not to mention the engineering far more complex) than the same data cable just using twisted pairs. This is because Lemke's corrugated separator member would be far more complicated and time consuming to implement with a large number of pairs. A POSITA would not have expected





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Lemke's corrugated pair separation scheme to be a desirable or even feasible option for a high-pair count cable like Roberts.

77. Also, using twisted pairs would have brought Roberts in line with standard telephone cables, and in fact simplified the cable termination solution. A POSITA would have known that the existing hardware for telephone operations that use exchange cables like Roberts were designed to work with *twisted pairs*, not single-wire unbalanced transmission. Ex-1018, 3; Ex-1017, 11; Ex-1073 (REA), 12; Ex-1072 (ANSI/ICEA), 18.

### E. GROUNDS 2, 4, and 8[4]: Claims 30-33, the "Foamed Polymer" Claims, Are Obvious

78. Patent Owner contends that because none of the three primary references (Roberts, GmbH-866, and Yanagita) disclose twisted pairs, Grounds 2, 4, and 8 also fail. Paper 19, 51-53. For the reasons I explained above, each of those references does disclose twisted pairs.

79. Patent Owner also argues that adding Mylar or foamed polymers to a cable would increase flammability and cites my deposition transcript stating that Mylar and foamed polymers are flammable. Paper 19, 53. Patent Owner mischaracterizes what I said in my deposition. When asked whether Mylar and

[4] Grounds 5 and 6 are obviousness grounds based on Roberts and GmbH-866, respectively, that each challenge claims 27-33. Because Grounds 5 and 6 include claims 30-33, they also incorporate Grounds 2 and 4, respectively.





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foam polyethylene is flammable, I responded "to some extent." Ex-2004, 129:20-130:1.

80. Patent Owner's argument that this means that the proposed modification would therefore "increase [the cable's] overall flammability" is wrong and overly simplistic. As I explained in my First Declaration, Gingue teaches that for a given volume of material, foaming decreases the amount of flammable material present. Ex-1007, ¶¶213-214, 286. I also explained that Gingue teaches foamed polymer can have a flame-retardant additive, and that foamed polymer "achieve[ed] a favorable balance of electrical properties and flame retardancy" when used in data communications cable. *Id.* Patent Owner also entirely ignores references showing that foamed polymer was a commonly used component in communications cabling and had many known benefits, such as predictably increasing electrical performance and enhancing dielectric protection. Ex-1007, ¶¶141-152, 211-213, 281-286; *see also e.g.*, Ex-1015, 2:62-64, 6:1-3.

81. Dr. Eldering argues that "neither Gingue, nor Jachimowicz, disclose a substantially flat foamed polymer tape." Ex-2001, ¶¶97-114; Ex-2007, ¶¶178-192. Dr. Eldering is incorrect.

82. Dr. Eldering focuses on Jachimowicz's teaching that a foamed polymer "jacket" may be "extruded" over the bundle of twisted pairs to "lock" the pairs together. Ex-2007, ¶¶182-185. However, that argument misses the point,





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because in my First Declaration I focused on Jachimowicz's alternative teaching that pairs can also "be held together in the bundle…by applying a tape made of foamed thermoplastic." Ex-1014, 2:50-54; *see also e.g.*, Ex-1007, ¶¶142, 206, 279. Dr. Eldering also contends that a POSITA would understand that the "jacket" needs to "be of sufficiently rigid composition" to make the pairs "locked." Ex-2007, ¶184. A POSITA would expect that the foamed polymer tape Jachimowicz teaches for holding twisted pairs together (which an alternative to the extruded "jacket") could very easily be applied as part of the separator shown in Roberts, GmbH-866 or Yanagita. Ex-1014, 2:50-54; *see also* Ex-1007, ¶¶142-156, 206-218, 279-288. The term "tape" itself would have indicated a more than sufficient degree of flexibility to a POSITA.

83. Dr. Eldering also contend that a POSITA would understand Jachimowicz's foamed tape to have an "undulating surface" and therefore is not substantially flat. Ex-2007, ¶¶186-88. A POSITA would disagree for several reasons. First, the foamed polymer 20 shown in Figure 1 of Jachimowicz shows a cross section of Jachimowicz's embodiment using an "extruded" jacket of "foamed polyethylene 20," not the alternative option using "tape." Ex-1014, 2:46-50. Dr. Eldering points to the wrong embodiments. A POSITA would understand that Figure 1 of Jachimowicz, which shows the extruded foam jacket, shows the interior surface of the extruded foam as undulating because during the extrusion





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process the foam would conform to the twisted pairs it was being extruded over. A foamed tape, by contrast, would be flat to begin with (i.e. before being wrapped around the twisted pairs). While the foamed tape may compress and conform to the twisted pairs after being wrapped around them (potentially creating some indentations in the foam), it would be expected to be flat before it was applied.

84. Second, Patent Owner attempts to mischaracterize my statement at my deposition—that I did not know whether "all tapes" are substantially flat—to argue that Jachimowicz's tape is not substantially flat. A POSITA would understand the "tape" referenced by Jachimowicz is a substantially flat tape. Ex-2004, 103:1-8 (referencing paragraph 93 of Ex-1007 from the -01061 IPR); *see also* Ex-1007, ¶¶144, 210, 280. During my deposition, I explained I was familiar with Mylar-backed foamed tapes like that described by Jachimowicz, due to my experience in the industry. Ex-2004, 103:4-104:16. Such tapes were substantially flat.

85. Also, even if a tape did have an "undulating surface" such as Dr. Eldering depicts at ¶187, a POSITA would still have considered that tape to be "substantially flat." The term is "substantially flat," not "flat." A POSITA would understand this to mean that the claim term does not require a tape to be completely flat. There is nothing in the patent specification or prosecution history that indicates that "substantially flat" was intended to require a completely flat surface. A POSITA would have understood the specification and prosecution





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history to indicates the opposite. For example, Figure 4 of the '095 and '537 patent specifications shows "pair separator 14" as a ridged tape and yet describes it as a "flat configurable tape." Ex-1001, Fig. 4, 6:12-13. The '095 and '537 patents' specification also refers to a prior art cable jacket with small valleys in its top and bottom surfaces as having a "flat" configuration. Ex-1001, Fig. 1, 2:1-12 ("jacket 102 has a wide, flat configuration"). In view of the plain language of the claim, a POSITA would have understood a tape with an undulating or ridged surface such as what is shown at ¶187 of Ex-2007 (the drawing in Dr. Eldering's declaration) to be "substantially" flat.

86. Dr. Eldering alleges that I had an "erroneous understanding" of the function performed by the alternative "tape" embodiment in Jachimowicz. Ex-2007, ¶190. Dr. Eldering is wrong. As I noted in my deposition, Jachimowicz's specific description of the two alternative embodiments describes the function of the extruded foamed jacket as to "lock" the pairs, while noting that alternatively the pairs can be "held together in the bundle" by a foamed polymer tape. Ex-2004, 106:16-112:2; *see also* Ex-1014, 2:46-54. Dr. Eldering incorrectly attributes the "locking" and "h[olding] together" functions to a purported ridged structure on the surface of the foam. Ex-2007, ¶¶184, 190. Jachimowicz never mentions or describes any ridged features with respect to either the extruded foam or the





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foamed tape, much less indicates that the locking or holding together is caused by ridged features.

87. A POSITA would have actually understood that the ridged surface of the foam shown in the cross section of Figure 1 of Jachimowicz is merely the physical result of extruding foam over a bundle of twisted pairs. A POSITA would have understood that the "locking" function is performed by the physical presence of the extruded foam over the twisted pairs, not by any deliberate creation of ridges. As to the foamed polymer tape embodiment described by Jachimowicz, a POSITA would have understood that the tape performs the function of holding the pairs together by the applications of mechanical pressure caused by the wrapping of the tape, not by any ridges on the tape.

88. Dr. Eldering also implies that Gingue's teachings regarding the use of foamed polymers are not relevant because it does not specifically discuss using foam in the form of a substantially flat tape. Ex-2007, ¶¶180-81. As I explained in my First Declaration, Gingue teaches that foamed polymers were a known component of data communication cables and that there were known advantages of using foamed polymer in data communications cables. EX-1007, ¶¶103-104. Dr. Eldering does not dispute that those advantages of using foamed polymers were known. Those are the same advantages that I explained in my First Declaration would motivate a POSITA to use a substantially flat foamed polymer tape as





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claimed with the substantially flat separators of each of Roberts, GmbH-866, and Yanagita. Ex-1007, ¶¶143-152, 208-214, 280-286.

89. A POSITA would have known that using a substantially flat foamed polymer tape as recited in claims 30-33 was just using a known component with known benefits to predictably obtain those benefits.





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90. I declare that all statements made herein of my knowledge are true and that all statements made on information and belief are believed to be true, and that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Executed on: July 9, 2024

Kenneth Cornelison

Kenneth Cornelison





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