

















































Exhibit 5

Exhibit 5 – Claim Chart Showing Amphenol’s Infringement of U.S. Patent 11,012,252 (“’252 Patent”)

As outlined in the below claim chart, the Accused Products infringe, either literally or under the doctrine of equivalents, at least Claim 1 of the ’252 patent.


<u>’252 Patent</u>	<u>Accused Products</u>
<u>Claim 1</u>	
[1pre] An active Ethernet cable that comprises:	The Accused Products comprise an active Ethernet cable. See, e.g.:

'252 Patent	Accused Products
Claim 1	<div data-bbox="730 321 1564 430"> <h2>OSFP (Octal Small Form Factor Pluggable) Copper Cable Assemblies</h2> </div> <div data-bbox="730 479 1113 560"> <h3>200G / 400G / 800G / 1.6T SOLUTIONS</h3> </div> <div data-bbox="730 581 1249 787"> <p>Amphenol is leading the industry in OSFP cable development. Our Electronics Products 'Product of the Year' award-winning OSFP (Octal Small Form Factor Pluggable) cable assemblies are compatible with 25G/lane channel NRZ up to 224G/lane channel PAM4 signaling protocols that allow the cables to deliver aggregate bandwidths of 200G, 400G, 800G, and 1.6T per cable assembly. Available in both Passive and Active variants.</p> </div> <div data-bbox="730 812 1249 1112"> <ul style="list-style-type: none"> ▪ Comprehensive system integrated interconnect design for copper or optical based cable solutions ▪ Addresses current and future market desired bandwidth port capability requirements ▪ Optimized heat dissipative and airflow features to maximize the heat dissipative properties of the system ▪ Data Rate: 25G NRZ / 56G PAM4 / 112G PAM4 / 224G PAM4 ▪ Cable sizes: 25AWG – 32AWG ▪ 112G Passive cable lengths up to 2 meters ▪ 112G Active cable lengths up to 4 meters ▪ 224G Passive cable lengths up to 1 meter </div> <div data-bbox="1276 483 1780 971">  <p data-bbox="1297 857 1491 885">TARGET MARKETS</p> <div data-bbox="1297 894 1444 959">   </div> </div> <div data-bbox="699 1141 1843 1209"> <p><i>Amphenol OSFP Copper Cable Assemblies Datasheet</i> at https://cdn.amphenol-cs.com/media/wysiwyg/files/documentation/datasheet/cableassemblies/hsio_ca_osfp.pdf.</p> </div>

'252 Patent	Accused Products																																																						
Claim 1	<table border="1"> <thead> <tr> <th data-bbox="709 315 869 337"><input type="checkbox"/> PART NUMBER</th> <th data-bbox="869 315 1381 337">DESCRIPTION</th> <th data-bbox="1381 315 1457 337">PRODUCT DRAWING</th> <th data-bbox="1457 315 1583 337">3D MODEL (STP)</th> <th data-bbox="1583 315 1688 337">STATUS</th> <th data-bbox="1688 315 1885 337">DISTRIBUTOR STOCK CHECK</th> </tr> </thead> <tbody> <tr> <td data-bbox="709 370 869 393"><input type="checkbox"/> NJJJN8-0004</td> <td data-bbox="869 370 1381 393">  OSFP Cable Assembly, DSP Active, 32AWG, 4M, 112G / Lane, Flex Sleeve </td> <td data-bbox="1381 370 1457 393"></td> <td data-bbox="1457 370 1583 393"></td> <td data-bbox="1583 370 1688 393">Active</td> <td data-bbox="1688 370 1885 393"></td> </tr> <tr> <td data-bbox="709 435 869 457"><input type="checkbox"/> NJJJN8-0007</td> <td data-bbox="869 435 1381 457">  OSFP Cable Assembly, DSP Active, 32AWG, 1.5M, 112G / Lane, Flex Sleeve </td> <td data-bbox="1381 435 1457 457"></td> <td data-bbox="1457 435 1583 457"></td> <td data-bbox="1583 435 1688 457">Active</td> <td data-bbox="1688 435 1885 457"></td> </tr> <tr> <td data-bbox="709 500 869 522"><input type="checkbox"/> NJJJN8-0008</td> <td data-bbox="869 500 1381 522">  OSFP Cable Assembly, DSP Active, 32AWG, 2.5M, 112G / Lane, Flex Sleeve </td> <td data-bbox="1381 500 1457 522"></td> <td data-bbox="1457 500 1583 522"></td> <td data-bbox="1583 500 1688 522">Active</td> <td data-bbox="1688 500 1885 522"></td> </tr> <tr> <td data-bbox="709 565 869 587"><input type="checkbox"/> NJJJN8-0009</td> <td data-bbox="869 565 1381 587">  OSFP Cable Assembly, DSP Active, 32AWG, 3.5M, 112G / Lane, Flex Sleeve </td> <td data-bbox="1381 565 1457 587"></td> <td data-bbox="1457 565 1583 587"></td> <td data-bbox="1583 565 1688 587">Active</td> <td data-bbox="1688 565 1885 587"></td> </tr> <tr> <td data-bbox="709 630 869 652"><input type="checkbox"/> NJJJN80001</td> <td data-bbox="869 630 1381 652">  OSFP Cable Assembly, DSP Active, 32AWG, 1M, 112G / Lane, Flex Sleeve </td> <td data-bbox="1381 630 1457 652"></td> <td data-bbox="1457 630 1583 652"></td> <td data-bbox="1583 630 1688 652">Active</td> <td data-bbox="1688 630 1885 652"></td> </tr> <tr> <td data-bbox="709 695 869 717"><input type="checkbox"/> NJJJN80002</td> <td data-bbox="869 695 1381 717">  OSFP Cable Assembly, DSP Active, 32AWG, 2M, 112G / Lane, Flex Sleeve </td> <td data-bbox="1381 695 1457 717"></td> <td data-bbox="1457 695 1583 717"></td> <td data-bbox="1583 695 1688 717">Active</td> <td data-bbox="1688 695 1885 717"></td> </tr> <tr> <td data-bbox="709 760 869 782"><input type="checkbox"/> NJJJN80003</td> <td data-bbox="869 760 1381 782">  OSFP Cable Assembly, DSP Active, 32AWG, 3M, 112G / Lane, Flex Sleeve </td> <td data-bbox="1381 760 1457 782"></td> <td data-bbox="1457 760 1583 782"></td> <td data-bbox="1583 760 1688 782">Active</td> <td data-bbox="1688 760 1885 782"></td> </tr> <tr> <td data-bbox="709 824 869 847"><input type="checkbox"/> NJJJN80010</td> <td data-bbox="869 824 1381 847">  OSFP Cable Assembly, DSP Active, 32AWG, 4.5M, 112G / Lane, Flex Sleeve </td> <td data-bbox="1381 824 1457 847"></td> <td data-bbox="1457 824 1583 847"></td> <td data-bbox="1583 824 1688 847">Active</td> <td data-bbox="1688 824 1885 847"></td> </tr> </tbody> </table> <p data-bbox="709 922 1780 993"><i>Amphenol OSFP Cable Assemblies Webpage (annotated) at https://www.amphenol-cs.com/product-series/osfp-cable-assemblies.html#.</i></p>	<input type="checkbox"/> PART NUMBER	DESCRIPTION	PRODUCT DRAWING	3D MODEL (STP)	STATUS	DISTRIBUTOR STOCK CHECK	<input type="checkbox"/> NJJJN8-0004	 OSFP Cable Assembly, DSP Active, 32AWG, 4M, 112G / Lane, Flex Sleeve			Active		<input type="checkbox"/> NJJJN8-0007	 OSFP Cable Assembly, DSP Active, 32AWG, 1.5M, 112G / Lane, Flex Sleeve			Active		<input type="checkbox"/> NJJJN8-0008	 OSFP Cable Assembly, DSP Active, 32AWG, 2.5M, 112G / Lane, Flex Sleeve			Active		<input type="checkbox"/> NJJJN8-0009	 OSFP Cable Assembly, DSP Active, 32AWG, 3.5M, 112G / Lane, Flex Sleeve			Active		<input type="checkbox"/> NJJJN80001	 OSFP Cable Assembly, DSP Active, 32AWG, 1M, 112G / Lane, Flex Sleeve			Active		<input type="checkbox"/> NJJJN80002	 OSFP Cable Assembly, DSP Active, 32AWG, 2M, 112G / Lane, Flex Sleeve			Active		<input type="checkbox"/> NJJJN80003	 OSFP Cable Assembly, DSP Active, 32AWG, 3M, 112G / Lane, Flex Sleeve			Active		<input type="checkbox"/> NJJJN80010	 OSFP Cable Assembly, DSP Active, 32AWG, 4.5M, 112G / Lane, Flex Sleeve			Active	
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’252 Patent	Accused Products
Claim 1	
	<p style="text-align: center;">QSFP DD Cable Assemblies</p> <p style="text-align: center;">200G / 400G / 800G SOLUTIONS</p> <p>Amphenol’s QSFP DD (Double Density) copper cable assemblies double the number of channels from 4 to 8 lanes when compared to the existing QSFP cabling systems, enabling more bandwidth within the same mechanical envelope. Compatible with 25G/Lane NRZ up to 112G/Lane PAM4 signaling protocols that allow cables to deliver aggregate bandwidths of 200G, 400G, and 800G per cable assembly. Available in both Passive and Active variants.</p> <ul style="list-style-type: none"> ▪ Addresses current and future market desired bandwidth port capability requirements ▪ Backwards mate compatible with QSFP receptacles ▪ Data Rate: 25G NRZ / 56G PAM4 / 112G PAM4 ▪ Cable sizes: 25AWG – 32AWG ▪ 112G Passive cable lengths up to 2 meters ▪ 112G Active cable lengths up to 4 meters ▪ Ultra-low-power Active Electrical Cable featuring Smart CDR SoC up to 3 meters at only 4.5W per side <p><i>Amphenol QSFP DD Cable Assemblies Datasheet</i> at https://cdn.amphenol-cs.com/media/wysiwyg/files/documentation/datasheet/cableassemblies/hsio_ca_qsfp_dd.pdf.</p>
<p>[1a] electrical conductors connected between a first connector and a second connector,</p>	<p>The Accused Products comprise electrical conductors connected between a first connector and a second connector.</p> <p>For example, the Accused Products have first and second connectors at the end of the cables (e.g., the OSFP plugs shown below).</p> <p>See, e.g.:</p>

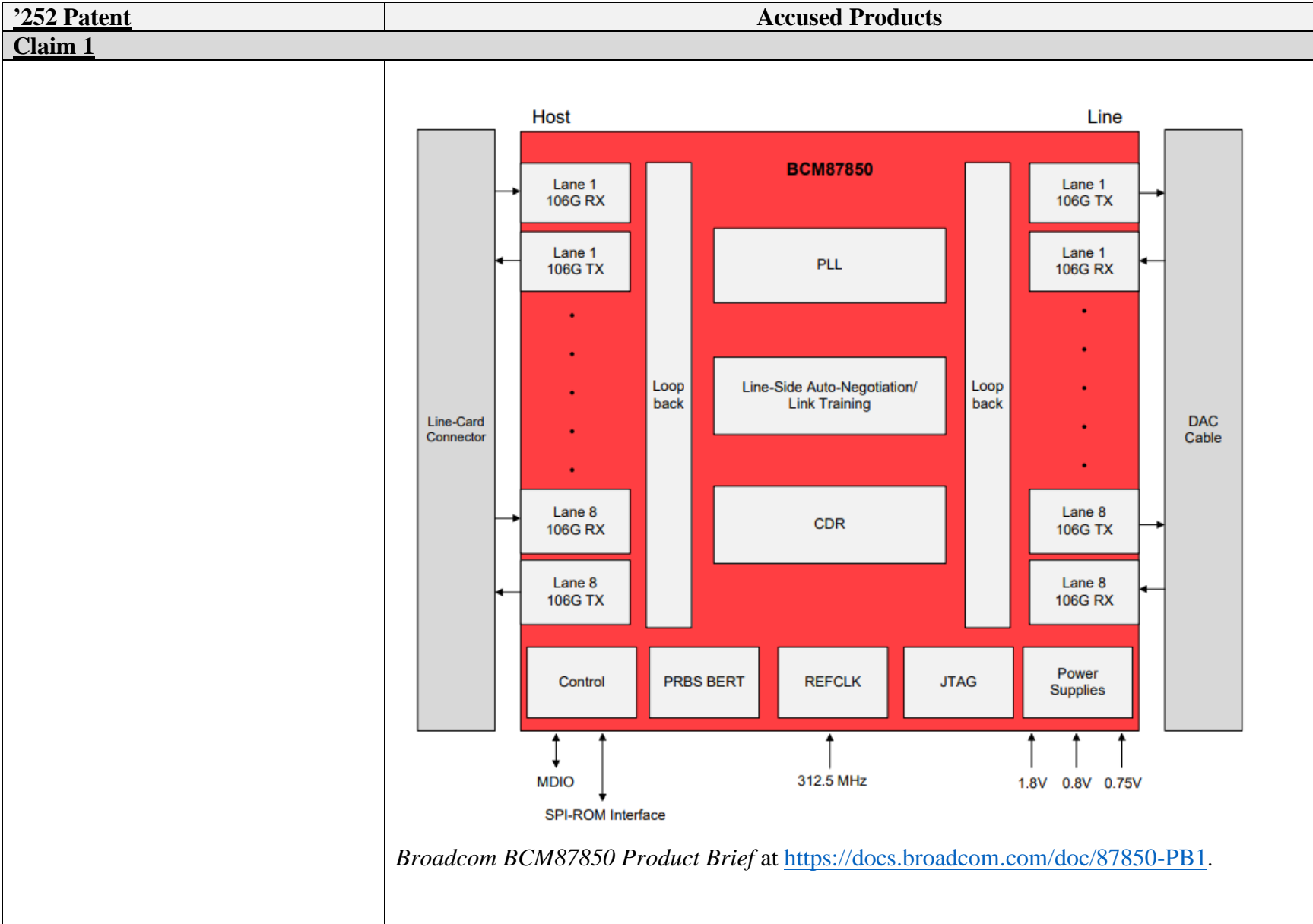


'252 Patent	Accused Products
Claim 1	<div data-bbox="730 321 1564 430"> <h2>OSFP (Octal Small Form Factor Pluggable) Copper Cable Assemblies</h2> </div> <div data-bbox="730 479 1113 560"> <h3>200G / 400G / 800G / 1.6T SOLUTIONS</h3> </div> <div data-bbox="730 581 1245 787"> <p>Amphenol is leading the industry in OSFP cable development. Our Electronics Products 'Product of the Year' award-winning OSFP (Octal Small Form Factor Pluggable) cable assemblies are compatible with 25G/lane channel NRZ up to 224G/lane channel PAM4 signaling protocols that allow the cables to deliver aggregate bandwidths of 200G, 400G, 800G, and 1.6T per cable assembly. Available in both Passive and Active variants.</p> </div> <div data-bbox="730 808 1245 1117"> <ul style="list-style-type: none"> ▪ Comprehensive system integrated interconnect design for copper or optical based cable solutions ▪ Addresses current and future market desired bandwidth port capability requirements ▪ Optimized heat dissipative and airflow features to maximize the heat dissipative properties of the system ▪ Data Rate: 25G NRZ / 56G PAM4 / 112G PAM4 / 224G PAM4 ▪ Cable sizes: 25AWG – 32AWG ▪ 112G Passive cable lengths up to 2 meters ▪ 112G Active cable lengths up to 4 meters ▪ 224G Passive cable lengths up to 1 meter </div> <div data-bbox="697 1140 1843 1209"> <p><i>Amphenol OSFP Copper Cable Assemblies Datasheet</i> at https://cdn.amphenol-cs.com/media/wysiwyg/files/documentation/datasheet/cableassemblies/hsio_ca_osfp.pdf.</p> </div> <div data-bbox="1276 483 1780 971">  <p>The image shows two OSFP copper cable assemblies. One is a shorter, more compact assembly with a blue connector, and the other is a longer assembly with a silver connector. Both have multiple lanes of copper contacts.</p> <div data-bbox="1297 857 1491 885"> <p>TARGET MARKETS</p> </div> <div data-bbox="1297 893 1444 958">  <p>Two icons representing target markets: a satellite dish and a server rack.</p> </div> </div>

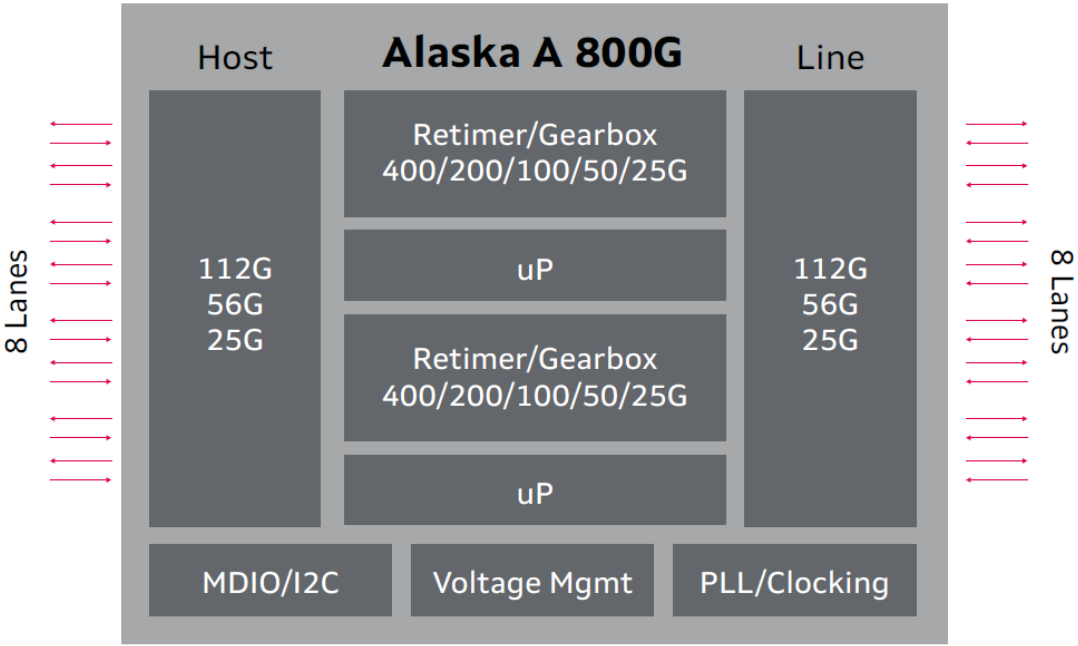
'252 Patent	Accused Products
<p>Claim 1</p>	<div data-bbox="722 315 1304 358"> <h2>QSFP DD Cable Assemblies</h2> </div> <div data-bbox="722 407 1247 443"> <h3>200G / 400G / 800G SOLUTIONS</h3> </div> <div data-bbox="722 472 1272 727"> <p>Amphenol's QSFP DD (Double Density) copper cable assemblies double the number of channels from 4 to 8 lanes when compared to the existing QSFP cabling systems, enabling more bandwidth within the same mechanical envelope. Compatible with 25G/Lane NRZ up to 112G/Lane PAM4 signaling protocols that allow cables to deliver aggregate bandwidths of 200G, 400G, and 800G per cable assembly. Available in both Passive and Active variants.</p> </div> <div data-bbox="722 748 1262 1040"> <ul style="list-style-type: none"> ▪ Addresses current and future market desired bandwidth port capability requirements ▪ Backwards mate compatible with QSFP receptacles ▪ Data Rate: 25G NRZ / 56G PAM4 / 112G PAM4 ▪ Cable sizes: 25AWG - 32AWG ▪ 112G Passive cable lengths up to 2 meters ▪ 112G Active cable lengths up to 4 meters ▪ Ultra-low-power Active Electrical Cable featuring Smart CDR SoC up to 3 meters at only 4.5W per side </div> <div data-bbox="1310 410 1860 989">  <p>TARGET MARKETS</p>  </div> <div data-bbox="705 1057 1892 1122"> <p>Amphenol QSFP DD Cable Assemblies Datasheet at https://cdn.amphenol-cs.com/media/wysiwyg/files/documentation/datasheet/cableassemblies/hsio_ca_qsfp_dd.pdf.</p> </div> <div data-bbox="705 1203 1507 1235"> <p>The electrical conductors are twin-axial, 8-pair or 16-pair wire.</p> </div> <div data-bbox="722 1284 1493 1349"> <ul style="list-style-type: none"> ▪ Assembled with industry leading twin-axial SKEWCLEAR® 8-pair or 16-pair wire </div>

’252 Patent	Accused Products
Claim 1	
	<p><i>Amphenol OSFP Copper Cable Assemblies Datasheet</i> at https://cdn.amphenol-cs.com/media/wysiwyg/files/documentation/datasheet/cableassemblies/hsio_ca_osfp.pdf.</p> <ul style="list-style-type: none"> ▪ Assembled with industry leading twin-axial SKEWCLEAR® 8-pair or 16-pair wire <p><i>Amphenol QSFP DD Cable Assemblies Datasheet</i> at https://cdn.amphenol-cs.com/media/wysiwyg/files/documentation/datasheet/cableassemblies/hsio_ca_qsfdd.pdf.</p>
<p>[1b] each of the first and second connectors being adapted to fit into an Ethernet port of a corresponding host device to receive from that host device an electrical input signal conveying an inbound data stream to the cable and to provide to that host device an electrical output signal conveying an outbound data stream from the cable,</p>	<p>The first and second connectors in the Accused Products are adapted to fit into an Ethernet port of a corresponding host device to receive from that host device an electrical input signal conveying an inbound data stream to the cable and to provide to that host device an electrical output signal conveying an outbound data stream from the cable.</p> <p>For example, the connectors in the Accused Products include DSPs manufactured by Broadcom and others. These DSPs are retimers that receive inbound Ethernet data streams from a host and convey them to the cable and conversely receive outbound Ethernet data streams from the cable and provide them to the host.</p> <ul style="list-style-type: none"> • Amphenol will highlight OAI expansion version 1.0, featuring Broadcom’s 1.6T (2x800G), 5nm retimer PHY, ExaMAX2® 112G backplane connector, OSFP 112 I/O connector and Mini Cool Edge, Expo Hall, Booth A8. <p><i>Broadcom 2022 OCP Global Summit Press Release</i> at https://investors.broadcom.com/news-releases/news-release-details/broadcom-showcases-industry-leading-hyperscale-solutions-2022.</p>

'252 Patent	Accused Products
<u>Claim 1</u>	<p>Key components used for validation include (1) Broadcom's BCM85361 1.6Tbps retimer/crossbar and Amphenol's ExaMAX2 112Gb/s high-speed backplane connector system.</p> <ul style="list-style-type: none"> • Broadcom's BCM85361 is a 16 lane, 112G SerDes retimer with support for long-reach backplanes with ~45dB of insertion loss and passive DAC cables up to 3 meters. The retimer supports Ethernet rates up to 2 x 800 GbE for scale-out and can also be configured as a flexible crossbar for scale-up requirements. BCM85361 is designed in the advanced 5nm process node, delivering low power to meet the challenges of increasing energy consumption in data centers. • Amphenol's ExaMAX2 connector system delivers industry leading SI performance needed to support OAI applications. The Vertical Header (VH) P/N: 10167063c and Right-Angle Receptacle (RAR) P/N:10167059c are configured as 4x16 and provide the connectivity to support both scale-out and switch implementations of the Expansion Card. The innovative beam-on-beam mating interface of the ExaMAX2 solution demonstrates a resonance-free Insertion Loss profile thru 60GHz and superb Return Loss performance. <p><i>Broadcom B-Connected Blog Post at https://www.broadcom.com/blog/broadcoms-112g-serdes-connects-generative-ai.</i></p>



'252 Patent	Accused Products
<u>Claim 1</u>	<p data-bbox="716 315 905 352">Overview</p> <p data-bbox="716 371 1793 548">The Broadcom® BCM87850 is a single-chip, eight-lane, ultra-low power, ultra-low latency PHY that integrates retimer and equalizer to support active cable applications. The BCM87850 is capable of equalizing 22 dB of loss on both the client-side and line-side interfaces. Each lane is capable of multiple data rates, including 106.25 Gb/s.</p> <p data-bbox="716 586 1709 686">The on-chip clock synthesis is performed by a low-cost 312.5-MHz reference clock through high-frequency, low jitter phase-locked loops (PLLs).</p> <p data-bbox="716 724 1793 824">The BCM87850 is fabricated in low-power 7-nm CMOS technology and is available in a 12 mm × 12 mm, 0.5-mm pitch, 485-ball BGA, RoHS-compliant package.</p> <p data-bbox="716 846 1864 914"><i>Broadcom BCM87850 Product Brief</i> (annotated) at https://docs.broadcom.com/doc/87850-PB1.</p>

'252 Patent	Accused Products
Claim 1	
	 <p data-bbox="703 641 745 755">8 Lanes</p> <p data-bbox="1753 641 1795 755">8 Lanes</p> <p data-bbox="703 1096 1858 1161"><i>Marvell Alaska Product Brief</i> at https://www.marvell.com/content/dam/marvell/en/public-collateral/phys-transceivers/marvell-alaska-a-800g-pam4-dsp-product-brief.pdf.</p>
<p>[1c] each of the first and second connectors including a respective transceiver that performs clock and data recovery on the electrical input signal to extract and re-modulate the inbound data stream for transit via the electrical conductors as a</p>	<p>Each of the first and second connectors in the Accused Products includes a respective transceiver that performs clock and data recovery on the electrical input signal to extract and re-modulate the inbound data stream for transit via the electrical conductors as a respective electrical transit signal conveying a transit data stream.</p> <p>For example, the Accused Products include a transceiver in the DSP chip on each end of the cable. The transceiver in each DSP performs clock and data recovery via “retiming” on the</p>

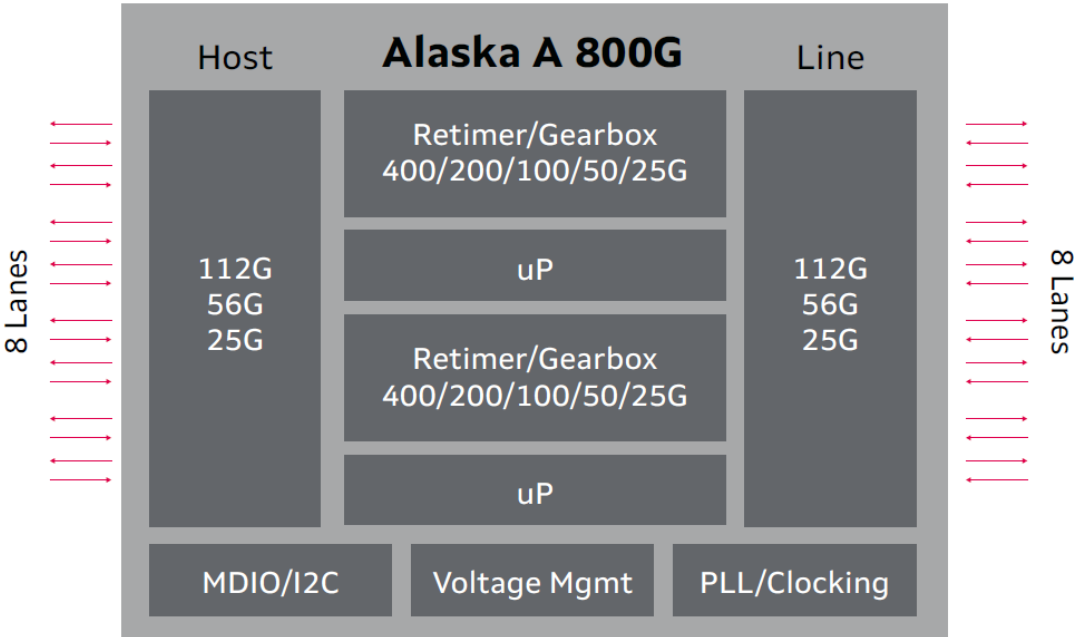
'252 Patent	Accused Products
<p>Claim 1</p> <p>respective electrical transit signal conveying a transit data stream,</p>	<p>electrical input signal to extract and re-modulate the inbound data stream for transit via the electrical conductors as a respective electrical transit signal conveying a transit data stream.</p> <p>See, e.g.:</p> <p>Overview</p> <p>The Broadcom® BCM87850 is a single-chip, eight-lane, ultra-low power, ultra-low latency PHY that integrates retimer and equalizer to support active cable applications. The BCM87850 is capable of equalizing 22 dB of loss on both the client-side and line-side interfaces. Each lane is capable of multiple data rates, including 106.25 Gb/s.</p> <p>The on-chip clock synthesis is performed by a low-cost 312.5-MHz reference clock through high-frequency, low jitter phase-locked loops (PLLs).</p> <p>The BCM87850 is fabricated in low-power 7-nm CMOS technology and is available in a 12 mm × 12 mm, 0.5-mm pitch, 485-ball BGA, RoHS-compliant package.</p> <p><i>Broadcom BCM87850 Product Brief</i> (annotated) at https://docs.broadcom.com/doc/87850-PB1.</p>

'252 Patent	Accused Products
<u>Claim 1</u>	<p>Overview</p> <p>The Marvell Alaska A MV-CHA180C0C 800G is a PAM4 DSP retimer for 800G Active Electrical Cable (AEC) application, optimized for Switch to Switch and Switch to Server connectivity inside next generation cloud data center, high-performance computing and AI systems.</p> <p>Alaska A 800G is a retimer device which utilizes a 112G Gbps PAM4 DSP SERDES. There are 8-host and 8-line ports with each receiver port being able to recover 112Gbps PAM-4 signals and transmit to partnered TX. It can provide up to 800G (8 x 112G) full duplex mission mode traffic.</p>

'252 Patent	Accused Products
Claim 1	<div data-bbox="709 365 1785 1003" data-label="Diagram"> </div> <p data-bbox="699 1063 1642 1166"> <i>Marvell Alaska Product Brief</i> (annotated) at https://www.marvell.com/content/dam/marvell/en/public-collateral/phys-transceivers/marvell-alaska-a-800g-pam4-dsp-product-brief.pdf. </p> <div data-bbox="199 1174 678 1388"> <p>[1d] the respective transceiver for each of the first and second connectors performing clock and data recovery on the respective electrical transit signal to extract and remodulate the transit data stream as</p> </div> <div data-bbox="699 1174 1858 1424"> <p>The respective transceiver for each of the first and second connectors in the Accused Products performs clock and data recovery on the respective electrical transit signal to extract and remodulate the transit data stream as the outbound data stream from the cable.</p> <p>For example, the transceiver in each DSP performs clock and data recovery via “retiming” on the electrical input signal to extract and re-modulate the transit data stream as the outbound data stream from the cable.</p> </div>

<u>'252 Patent</u>	Accused Products
<u>Claim 1</u> the outbound data stream from the cable, and	See, e.g.: Overview The Broadcom® BCM87850 is a single-chip, eight-lane , ultra-low power, ultra-low latency PHY that integrates retimer and equalizer to support active cable applications . The BCM87850 is capable of equalizing 22 dB of loss on both the client-side and line-side interfaces . Each lane is capable of multiple data rates, including 106.25 Gb/s. The on-chip clock synthesis is performed by a low-cost 312.5-MHz reference clock through high-frequency, low jitter phase-locked loops (PLLs) . The BCM87850 is fabricated in low-power 7-nm CMOS technology and is available in a 12 mm × 12 mm, 0.5-mm pitch, 485-ball BGA, RoHS-compliant package. <i>Broadcom BCM87850 Product Brief</i> (annotated) at https://docs.broadcom.com/doc/87850-PB1 .

'252 Patent	Accused Products
<u>Claim 1</u>	<p>Overview</p> <p>The Marvell Alaska A MV-CHA180C0C 800G is a PAM4 DSP retimer for 800G Active Electrical Cable (AEC) application, optimized for Switch to Switch and Switch to Server connectivity inside next generation cloud data center, high-performance computing and AI systems.</p> <p>Alaska A 800G is a retimer device which utilizes a 112G Gbps PAM4 DSP SERDES. There are 8-host and 8-line ports with each receiver port being able to recover 112Gbps PAM-4 signals and transmit to partnered TX. It can provide up to 800G (8 x 112G) full duplex mission mode traffic.</p>

'252 Patent	Accused Products
<p>Claim 1</p>	 <p><i>Marvell Alaska Product Brief</i> (annotated) at https://www.marvell.com/content/dam/marvell/en/public-collateral/phys-transceivers/marvell-alaska-a-800g-pam4-dsp-product-brief.pdf.</p>
<p>[1e] the respective transceivers each employing fixed, cable-independent equalization parameters for each of: the remodulation of the transit data stream as the outbound data stream, and the clock and data recovery</p>	<p>The respective transceivers in the Accused Products employ fixed, cable-independent equalization parameters for each of: the remodulation of the transit data stream as the outbound data stream, and the clock and data recovery performed on the electrical input signal.</p> <p>For example, the DSPs at each end of the cable employ fixed, cable-independent equalization parameters for the remodulation of the transit data stream as the outbound</p>

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<p>Claim 1</p> <p>performed on the electrical input signal.</p>	<p>stream and the clock and data recovery performed on the input signal. These parameters (i.e., transmit and receive filter coefficient values) are fixed and cable-independent per the IEEE 802.3ck standard (which are independent of communications through the cable).</p> <p>See, e.g.:</p> <p>120G.3.4 Module input characteristics</p> <p>The module input shall meet the specifications given in Table 120G-9. Channel equalization is provided by an adaptive equalizer in the module.</p> <p><i>IEEE 802.3ck Specification at 7283 (annotated).</i></p> <p>The Accused Products comply with the OSFP standard.¹</p> <p>Amphenol is leading the industry in OSFP cable development. Our Electronics Products 'Product of the Year' award-winning OSFP (Octal Small Form Factor Pluggable) cable assemblies are compatible with 25G/lane channel NRZ up to 224G/lane channel PAM4 signaling protocols that allow the cables to deliver aggregate bandwidths of 200G, 400G, 800G, and 1.6T per cable assembly. Available in both Passive and Active variants.</p>

¹ The Accused Products that use a QSFP form factor likewise comply with the IEEE 802.3ck standard. See *Amphenol QSFP DD Cable Assemblies Datasheet*, https://cdn.amphenol-com/media/wysiwyg/files/documentation/datasheet/cableassemblies/hsio_ca_qsfp_dd.pdf; *QSFP-DD Specification*, <http://www.qsfp-dd.com/wp-content/uploads/2024/07/QSFP-DD-Hardware-Rev7.1.pdf> at 34; *QSFP112 Specification*, http://www.qsfp112.com/QSFP112_MSA_Specification_Rev2.1.1.pdf at 10.

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<p><u>Claim 1</u></p>	<p><i>Amphenol OSFP Copper Cable Assemblies Datasheet</i> (annotated) at https://cdn.amphenol-cs.com/media/wysiwyg/files/documentation/datasheet/cableassemblies/hsio_ca_osfp.pdf.</p> <p>As explained in the OSFP specification, the high-speed signals of the Accused Products meet the requirements of the IEEE 802.3ck standard.</p> <p>The high-speed signals follow the electrical specifications of IEEE802.3bs, IEEE802.3cd, IEEE 802.3ck and CEI-56G-VSR-PAM4 as defined in OIF-CEI-05.2 for 400GAUI-8 mode and IEEE802.3bj, IEEE802.3bm for CAUI-4 mode.</p> <p><i>OSFP Specification</i>, https://www.osfpmsa.org/assets/pdf/OSFP_Module_Specification_Rev5_1.pdf at 147.</p> <p>The 802.3ck standard defines the chip-to-module connection, including requiring that the transmitters use a pre-equalized set of filters as part of selecting a short or long channel.</p> <p>120G.3.2.1 Module output modes</p> <p>The module output shall support two modes: short and long. The means of controlling the module output mode is implementation dependent. For each output mode, the module shall meet the requirements for eye height (min) and VEC (max) in Table 120G-3 for both near-end and far-end measurements (see 120G.3.2.2.1).</p> <p><i>IEEE 802.3ck Specification at 7275</i> (annotated).</p> <p>The OSFP standard also requires compliance of the control plane to the CMIS standard.</p>

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<u>Claim 1</u>	<p>The OSFP specification defines:</p> <ul style="list-style-type: none">• The OSFP module mechanical form factor, including the latching mechanism;• The host cage together with the mating connector;• The electrical interface, including pin-out, data, control, and power and ground signals;• The mechanical interface, including the package outline, front panel, and printed circuit board (PCB) layout requirements;• Thermal requirements and limitations, including heat sink design and airflow;• Electrostatic discharge (ESD) requirements;• The module management interface as contained in the Common Management Interface Specification (CMIS). <p><i>OSFP Specification</i> (annotated), https://www.osfpmsa.org/assets/pdf/OSFP_Module_Specification_Rev5_1.pdf at 15.</p> <p>The CMIS standard controls the equalization of the port transceiver, including employing fixed, cable-independent equalization parameters for each of: the remodulation of the transit data stream as the outbound data stream, and the clock and data recovery performed on the electrical input signal.</p>

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Claim 1												
	<p>6.2.5.1 Tx Input Equalization Control</p> <p>The controls for Tx input equalization can be grouped by equalization type, as shown in Table 6-5.</p> <p>Table 6-5 Tx Input Eq control relationship to AdaptiveInputEqEnableTx</p> <table border="1" data-bbox="772 430 1827 576"> <thead> <tr> <th>Equalization Type</th> <th>Control</th> <th>AdaptiveInputEqEnableTx</th> </tr> </thead> <tbody> <tr> <td rowspan="3">Adaptive</td> <td>AdaptiveInputEqFreezeTx</td> <td rowspan="3">1</td> </tr> <tr> <td>AdaptiveInputEqStoreTx</td> </tr> <tr> <td>AdaptiveInputEqRecallTx</td> </tr> <tr> <td>Non-Adaptive</td> <td>FixedInputEqTargetTx</td> <td>0</td> </tr> </tbody> </table> <p>The controls relevant for adaptive Tx input equalization are described in section 6.2.5.4.</p> <p>The controls relevant for non-adaptive Tx input equalization, when Tx input equalization settings are pre-determined or host provisioned, are described below.</p> <p>The module ignores control field values that are not relevant for the current AdaptiveInputEqEnableTx setting.</p>	Equalization Type	Control	AdaptiveInputEqEnableTx	Adaptive	AdaptiveInputEqFreezeTx	1	AdaptiveInputEqStoreTx	AdaptiveInputEqRecallTx	Non-Adaptive	FixedInputEqTargetTx	0
Equalization Type	Control	AdaptiveInputEqEnableTx										
Adaptive	AdaptiveInputEqFreezeTx	1										
	AdaptiveInputEqStoreTx											
	AdaptiveInputEqRecallTx											
Non-Adaptive	FixedInputEqTargetTx	0										

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	<p>Host Controlled Equalization</p> <p>Tx input equalization values in dB are based on a reference CTLE and may not directly apply to the equalizer implemented in the module.</p> <p>SCS<k>::FixedInputEqTargetTx<i> is a four-bit control field for lane <i> and encoded as shown in Table 6-6. This field allows the host to specify a fixed (non-adaptive) Tx input equalization target and is ignored by the module if AdaptiveInputEqEnableTx<i> is set for that lane.</p> <p>The module advertises support of non-adaptive Tx input equalization control as described in Table 8-48.</p> <p>The module advertises the maximum supported Tx input equalization values as described in Table 8-44.</p> <p style="text-align: center;">Table 6-6 Fixed Tx Input Equalization Codes</p> <table border="1" data-bbox="953 643 1619 938"> <thead> <tr> <th>Code Value</th> <th>Bit pattern</th> <th>Input Equalization</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0000b</td> <td>No Equalization</td> </tr> <tr> <td>1</td> <td>0001b</td> <td>1 dB</td> </tr> <tr> <td>2</td> <td>0010b</td> <td>2 dB</td> </tr> <tr> <td>3 - 8</td> <td>0011b ... 1000b</td> <td>3 dB ... 8 dB</td> </tr> <tr> <td>9</td> <td>1001b</td> <td>9 dB</td> </tr> <tr> <td>10</td> <td>1010b</td> <td>10 dB</td> </tr> <tr> <td>11</td> <td>1011b</td> <td>11 dB</td> </tr> <tr> <td>12</td> <td>1100b</td> <td>12 dB</td> </tr> <tr> <td>13-15</td> <td></td> <td>Custom</td> </tr> </tbody> </table>	Code Value	Bit pattern	Input Equalization	0	0000b	No Equalization	1	0001b	1 dB	2	0010b	2 dB	3 - 8	0011b ... 1000b	3 dB ... 8 dB	9	1001b	9 dB	10	1010b	10 dB	11	1011b	11 dB	12	1100b	12 dB	13-15		Custom
Code Value	Bit pattern	Input Equalization																													
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	<p>6.2.5.2 Rx Output Equalization Control</p> <p>Rx output equalization is defined at an appropriate test point defined by the relevant standard.</p> <p>SCS<k>::OutputEqPreCursorTargetRx<i> and SCS<k>::OutputEqPostCursorTargetRx<i> are four-bit control fields for lane <i> and encoded as shown in Table 6-7.</p> <p>The module advertises support of Rx output equalization control as described in Table 8-48.</p> <p>The module advertises the maximum supported Rx output equalization values as described in Table 8-44.</p> <p>Modules that require only output emphasis utilize the SCS<k>::OutputEqPostCursorTargetRx<i> fields and set the SCS<k>::OutputEqPreCursorTargetRx<i> fields to zero.</p> <p style="text-align: center;">Table 6-7 Rx Output Equalization Codes</p> <table border="1" data-bbox="821 607 1705 943"> <thead> <tr> <th>Code Value</th> <th>Bit pattern</th> <th>Post-Cursor Equalization</th> <th>Pre-Cursor Equalization</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0000b</td> <td>0dB (No Equalization)</td> <td>0dB (No Equalization)</td> </tr> <tr> <td>1</td> <td>0001b</td> <td>1 dB</td> <td>0.5 dB</td> </tr> <tr> <td>2</td> <td>0010b</td> <td>2 dB</td> <td>1.0 dB</td> </tr> <tr> <td>3</td> <td>0011b</td> <td>3 dB</td> <td>1.5 dB</td> </tr> <tr> <td>4</td> <td>0100b</td> <td>4 dB</td> <td>2.0 dB</td> </tr> <tr> <td>5</td> <td>0101b</td> <td>5 dB</td> <td>2.5 dB</td> </tr> <tr> <td>6</td> <td>0110b</td> <td>6 dB</td> <td>3.0 dB</td> </tr> <tr> <td>7</td> <td>0111b</td> <td>7 dB</td> <td>3.5 dB</td> </tr> <tr> <td>8-10</td> <td>1000b-1010b</td> <td>Reserved</td> <td>Reserved</td> </tr> <tr> <td>11-15</td> <td>1011b-1111b</td> <td>Custom</td> <td>Custom</td> </tr> </tbody> </table> <p>Note: The pre-cursor equalizer settings in dB approximates to $\text{Pre EQ (dB)} = -20 \cdot \log_{10} \left(1 - C_{-1} / (C_{-1} + C_0 + C_1) \right) \quad (\text{Eq. 6-1})$ The post-cursor equalizer settings in dB approximates to $\text{Post EQ (dB)} = -20 \cdot \log_{10} \left(1 - C_1 / (C_{-1} + C_0 + C_1) \right) \quad (\text{Eq. 6-2})$ Equalizer coefficients C_n are pre-cursor for $n < 0$ and post-cursor when $n > 0$.</p> <p>CMIS Specification, https://www.oiforum.com/wp-content/uploads/OIF-CMIS-05.2.pdf at 60–61.</p> <p>The datasheet for the exemplary Accused Products notes that they support the 802.3ck standard:</p> <p>See, e.g.:</p>	Code Value	Bit pattern	Post-Cursor Equalization	Pre-Cursor Equalization	0	0000b	0dB (No Equalization)	0dB (No Equalization)	1	0001b	1 dB	0.5 dB	2	0010b	2 dB	1.0 dB	3	0011b	3 dB	1.5 dB	4	0100b	4 dB	2.0 dB	5	0101b	5 dB	2.5 dB	6	0110b	6 dB	3.0 dB	7	0111b	7 dB	3.5 dB	8-10	1000b-1010b	Reserved	Reserved	11-15	1011b-1111b	Custom	Custom
Code Value	Bit pattern	Post-Cursor Equalization	Pre-Cursor Equalization																																										
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<u>Claim 1</u>	<p>SPECIFICATIONS</p> <ul style="list-style-type: none">▪ Refer to the latest revision specification of the OSFP octal small form factor pluggable module▪ Applicable IEEE specifications▪ IEEE802.3by▪ IEEE802.3bj▪ IEEE802.3cd▪ IEEE802.3ck▪ The InfiniBand™ architecture specification and annexes <p><i>Amphenol OSFP Copper Cable Assemblies Datasheet</i> at https://cdn.amphenol-cs.com/media/wysiwyg/files/documentation/datasheet/cableassemblies/hsio_ca_osfp.pdf.</p>

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<u>Claim 1</u>	<p>SPECIFICATIONS</p> <ul style="list-style-type: none">▪ Refer to the latest revision of the QSFP-DD hardware specification for QSFP double density 8X pluggable transceiver▪ Applicable IEEE specifications<ul style="list-style-type: none">▪ IEEE802.3by▪ IEEE802.3bj▪ IEEE802.3cd▪ IEEE802.3ck▪ The InfiniBand™ architecture specification and annexes <p><i>Amphenol QSFP DD Cable Assemblies Datasheet</i> at https://cdn.amphenol-cs.com/media/wysiwyg/files/documentation/datasheet/cableassemblies/hsio_ca_qsfp_dd.pdf.</p>