

## Executive Summary

Riedel Communications has built a comprehensive portfolio of optical networking solutions for broadcast, live-event, and remote-production applications. Following its 2020 acquisition of Embrionix – a pioneer in SFP-based video processing – Riedel now offers an extensive range of optical **SFP/SFP+ transceivers** supporting SDI video (from SD to 12G UHD), IP transport (10GbE/25GbE), and even on-board signal processing. These pluggable modules (often branded “emSFP” by Embrionix) come in variants for single-mode or multimode fiber, standard or CWDM wavelengths, and in transmitter, receiver, or transceiver configurations. They are engineered to meet stringent broadcast requirements such as SMPTE pathological test pattern support and ultra-low jitter for reliable transport of SDI signals <sup>1</sup> <sup>2</sup> . Notably, Riedel’s 12G-SDI optical SFP family was the industry’s first to enable 4K60 signal transport in an SFP form-factor <sup>3</sup> . These modules typically use LC connectors and achieve reaches of 10–40 km on single-mode fiber depending on laser type (DFB for longer reach vs. FP for short/medium) <sup>1</sup> <sup>4</sup> . For flexibility, Riedel also provides **CWDM optical modules** at 18 standardized wavelengths (1271–1611 nm) to multiplex many signals on one fiber <sup>5</sup> <sup>6</sup> .

Beyond transceivers, Riedel supplies **rugged fiber cabling** optimized for harsh event environments. The **Pure** cable family features tactical fiber constructions with polyurethane (PUR) jacketing for flexibility and abrasion resistance <sup>7</sup> <sup>8</sup> . Pure cables come in **5.7 mm “CS” (Compact Series)** or heavier **9.0 mm “XT” (Extreme)** variants, terminated exclusively with Neutrik opticalCON DUO or QUAD connectors for field durability <sup>7</sup> <sup>9</sup> . Standard lengths range from short 10 m patch cords up to 300–600 m drums, with options for expansion on larger cable reels <sup>10</sup> <sup>11</sup> . These low-loss G.657.A1 fibers have no water-peak, making them fully WDM/DWDM compatible for high wavelengths and tight bends <sup>7</sup> <sup>8</sup> . Riedel also offers passive **WDM/CWDM multiplexers** that consolidate multiple duplex links onto a single fiber. For example, its MC-WDM modules use 1310/1490/1550 nm to carry up to **6 bidirectional SDI links** over one fiber pair, with rugged opticalCON Quad trunk connectors <sup>12</sup> <sup>13</sup> . Similarly, modular **CWDM multiplexers (18-channel)** allow combining up to 18 duplex signals on one fiber, supporting all SMPTE CWDM wavelengths <sup>5</sup> <sup>14</sup> . These devices enable efficient fiber usage in networks like MediorNet by slashing the number of physical fibers required. Riedel’s older **PMX-2004/2008** multiplexers serve a different niche – extending intercom panels. Each PMX unit aggregates four or eight Artist matrix panel connections onto one fiber link via internal WDM, effectively remoting multiple intercom panels to the main frame <sup>15</sup> <sup>16</sup> . (The PMX uses matched SFPs transmitting at 1310 nm and 1550 nm in opposite directions, supporting panel data at 155 Mb/s over 30 km <sup>17</sup> <sup>18</sup> .)

Crucially, Riedel has leveraged Embrionix’s technology to introduce **software-defined SFP** solutions under its MediorNet family. The **MuoN** SFPs are FPGA-powered modules that can be “reprogrammed” via license to perform various processing tasks at the network edge <sup>19</sup> . A single MuoN unit (particularly the high-density *MuoN B* series for 25G) can serve as a SMPTE ST 2110 IP gateway, or be licensed for value-add functions like SDI/UHD up/down/cross-conversion, HDR conversion, JPEG-XS or JPEG2000 encoding/decoding, multiviewer generation, or audio embedding <sup>19</sup> . These SFPs can plug directly into COTS IP switches (for instance, a 25 GbE switch hosting MuoN SFPs in its ports) or into Riedel’s dedicated **VirtU frame**, which can house dozens of MuoN modules in 1RU for high-density gateway applications <sup>20</sup> <sup>21</sup> . Alongside MuoN, Riedel offers **FusioN** standalone frames (small throw-down boxes with 3–6 SFP slots) that accommodate these same SFP processors for field use <sup>22</sup> <sup>23</sup> . FusioN devices likewise support multiple I/O formats (SDI, HDMI, fiber) and can run the same apps – e.g. a FusioN box can convert SDI or HDMI signals to ST2110, or become a **16-image IP multiviewer**

**output** node with a simple license change <sup>23</sup> <sup>24</sup> . This licensable approach gives Riedel's customers extreme flexibility: a **MuoN SFP can be a gateway today and a JPEG-XS encoder tomorrow** with only a software update, protecting investment in the transition to IP <sup>19</sup> .

Riedel's go-to-market strategy for optical products is a mix of **bundled sales and standalone offerings**. Many optical components are sold as accessories to Riedel's systems – for example, Artist intercom fiber SFPs are typically supplied with the Artist fiber interface cards and are officially **“not sold separately”** except as spares <sup>25</sup> <sup>26</sup> . (Resellers note that these 1.25 Gbps SFPs “may only be purchased as part of a complete system” <sup>25</sup> .) Similarly, MediorNet frames often come populated with the required SFPs for fiber links or 10G/25G IP ports, and Riedel *strongly recommends* using its own certified modules for reliability <sup>27</sup> <sup>28</sup> . Nonetheless, Riedel does make most optical modules available via authorized distributors for expansions and upgrades. Broadcast suppliers like Markertek list Riedel-branded SFPs for sale – including the dual 12G SDI optical transmitters and receivers – albeit with **restricted online checkout**, requiring customers to consult a sales engineer <sup>29</sup> <sup>30</sup> . This indicates Riedel's preference to vet sales and ensure correct integration. The **pricing** of Riedel's optical SFPs tends toward the premium end. While prices are not published on Riedel's site, reseller data suggests a dual 12G optical SFP can cost on the order of several hundred USD. (For instance, a used single-mode 1.25 Gbps SFP for Artist was offered at **\$195** <sup>31</sup> <sup>25</sup> , implying new units in the few-hundred dollar range, and open-market 25G transceivers originally from Riedel's stock have been seen for ~\$20–30 on secondary markets <sup>32</sup> <sup>33</sup> – though these likely reflect commodity OEM pricing, not Riedel's official price.) In practice, large Riedel system deals will bundle the necessary optical gear, and many end-users obtain spares or extras via integrators. Notably, Riedel continues to **OEM certain standard optics** (like 25GbE SR/LR modules) from third parties – the eBay example above shows a Riedel-branded 25G SFP28 transceiver that is essentially a generic part <sup>32</sup> <sup>33</sup> . This suggests that for commodity data transceivers Riedel does not reinvent the wheel but qualifies OEM parts, whereas for specialized video SFPs and processors, it uses in-house Embrionix designs.

The 2020 acquisition of Embrionix has had a **transformative impact** on Riedel's optical roadmap and IP video strategy. Prior to the acquisition, Riedel's fiber offerings were mainly limited to point-to-point transport (MediorNet modular links, RockNet audio fiber, etc.) and some third-party OEM optical links. Embrionix brought a vast portfolio of video SFP modules and a team of 50 engineers with deep IP and FPGA expertise <sup>34</sup> <sup>35</sup> . This immediately broadened Riedel's product scope – from a company known for intercoms and proprietary media networks, Riedel became a player in standards-based IP video solutions. As Riedel's CEO Thomas Riedel put it, Embrionix's technologies **“perfectly complement”** Riedel's portfolio and will be *“instrumental in our quest for innovation leadership in video infrastructures.”* <sup>36</sup> <sup>37</sup> Riedel wasted no time integrating Embrionix products: by 2022 it had folded Embrionix's gateway SFPs into the MediorNet line as MuoN, their mini converter frames as FusioN, and launched the VirtU IP chassis to host high-density SFP arrays <sup>20</sup> <sup>21</sup> . This gave Riedel an on-ramp to serve customers migrating to **SMPTE ST 2110 networks**, bridging SDI to IP in a modular way. It also positioned Riedel against competitors in the IP domain (like Evertz and Lawo) with a unique SFP-based approach. In effect, Embrionix's tech has allowed Riedel to market “bulk gateways” and IP processing at the network edge, rather than solely via traditional rackmount processors. Internally, Embrionix's Montreal office became Riedel's dedicated R&D hub for IP video – Renaud Lavoie, Embrionix's founder, was appointed General Manager of Riedel Montreal to drive these developments <sup>38</sup> . The acquisition also expanded Riedel's OEM business; Embrionix had numerous OEM relationships (with switch vendors, card manufacturers, etc.), and now Riedel can supply those channels (though some competitors may seek alternate suppliers now that Embrionix is under a direct competitor's umbrella). Overall, the move firmly signaled Riedel's **commitment to IP media**. Whereas MediorNet was previously a closed fiber network, today Riedel actively promotes ST 2110 interoperability, NMOS control, JPEG-XS compression – all fruits of the Embrionix integration <sup>39</sup> <sup>20</sup> .

Riedel's optical solutions are deployed globally across **broadcast, sports, entertainment, and enterprise** sectors, often in high-profile events that test the limits of fiber technology. Riedel's rental division and project services have supported events like the Olympics and World Cups for decades, using extensive fiber backbones. For example, at the Munich 2022 European Championships (a multi-sport event), Riedel laid over **1,600 km of fiber** and deployed a MediorNet signal network with 250+ nodes (MicroN, MicroN UHD, and 11 VirtU frames doing SDI↔IP conversion) <sup>40</sup> <sup>41</sup>. This handled distribution of dozens of video feeds to the IBC and venues, with WDM systems on dark fiber tying remote sites together <sup>41</sup>. Riedel gear was also behind the scenes at recent Olympics – e.g. Riedel provided the fiber-based media network and comms for PyeongChang 2018 and others (the company's **Milestones** note that MediorNet has been used in Formula 1, the Olympics, etc. since its launch <sup>42</sup>). In broadcast facilities, Riedel's customer base includes major networks and service providers: **TDF (France)**, for instance, chose Riedel's SFP gateways for a new multi-client IP media network in Paris, using MuoN SFPs hosted in IP switches for HD signals and in VirtU frames for UHD – allowing TDF to migrate clients from SDI to IP gradually <sup>39</sup> <sup>43</sup>. Other early adopters of Embrionix (now Riedel) gateways include the **CBC/Radio-Canada** and **NEP Group** for their ST 2110 production environments <sup>44</sup> <sup>45</sup>. In the live sports realm, **FIFA and UEFA** events have repeatedly used Riedel's fiber-based systems: e.g. Riedel was the primary provider for the 2018 FIFA World Cup's venue communications and signal transport, and its MediorNet formed the core of host broadcast infrastructure for the UEFA European Championships in 2021–2022 <sup>40</sup> <sup>46</sup>. Even outside pure broadcast, Riedel's fiber solutions find use in **theater and corporate AV** – for instance, the Eurovision Song Contest and large touring productions rely on MediorNet and Pure fiber cables to route video and audio between stages, OB vans, and control rooms <sup>47</sup> <sup>48</sup>. Geographically, Riedel's strongest markets have been Europe (its home base in Germany and extensive projects across EU), but it has a growing presence in the Americas and Asia-Pacific for IP systems. Riedel often works through **systems integrators** (e.g. Qvest Media, Diversified, Bexel NEP) and **rental partners** in various regions. Its **channel** strategy combines direct offices in key countries with resellers for gear sales; for instance, **Solotech** in Canada and **Markertek** in the US stock Riedel fiber products for the North American market <sup>49</sup> <sup>50</sup>, while distributors like **Arrowmid** in Israel promote Riedel tactical fiber cables <sup>51</sup>. This network ensures that end-users worldwide can obtain both the core systems and the accessory optics/cables as needed.

In terms of **market metrics**, Riedel is a privately held firm and does not break out revenues by product line, but some indicators can be gleaned. Industry analysts (Growjo) estimate Riedel's annual revenue at around **\$50–60 million** in recent years <sup>52</sup>, though this likely includes its entire portfolio (intercom, rental, etc.). The optical transport segment is just one part of this. However, Embrionix's influence is notable: Embrionix announced in late 2019 that its revenues had grown ~29% year-on-year, driven largely by IP gateway sales <sup>53</sup> <sup>54</sup> – and that momentum carried into Riedel's offerings post-acquisition. Embrionix at one point boasted over “**1 million video channels**” shipped across its SFP product lines (counting each SFP's channels) by 2019, a testament to how widely adopted its miniaturized technology had become in broadcast <sup>44</sup> <sup>55</sup>. These shipments were often through OEMs – Embrionix had over 100 equipment manufacturer customers by mid-2010s, effectively making its SFPs an industry standard plugin <sup>44</sup>. After joining Riedel, those sales funnels presumably continued (for example, Nevion, Grass Valley, EVS, Imagine, and others have used Embrionix modules – some may still source from Riedel as OEM). Thus, while it's hard to quantify Riedel's “market share” in optical modules, one can say it inherited a dominant position in **broadcast video SFPs** thanks to Embrionix. For fiber cabling, Riedel's volumes are smaller (the market for ruggedized cables is fragmented among specialty suppliers), but Riedel's Pure cables are frequently deployed in big events – likely **hundreds of kilometers per year** in projects (as evidenced by 1600 km laid in one championship event) <sup>40</sup> <sup>46</sup>. In revenue terms, optical transport (MediorNet & accessories) is a key growth area for Riedel as broadcast infrastructure modernizes. The company's investment in IP gateways suggests it sees continued revenue potential in replacing legacy SDI gear with fiber/IP solutions.

Strategically, **signals of Riedel's intentions** in optical networking can be read from recent product launches and corporate moves. Far from exiting the optical business, Riedel is doubling down – albeit with an emphasis on IP connectivity. The new **StageLink** family introduced in 2024–2025 is a prime example: StageLink comprises compact IP-connected stageboxes for audio and intercom interfacing (moving analog audio and serial I/O onto fiber/IP networks) <sup>56</sup> <sup>57</sup>. These “smart edge devices” show Riedel extending its fiber/IP portfolio deeper into remote production needs. StageLink devices are networked (with standard 1/10GbE links), ruggedized, and support open standards (AES67 audio, NMOS control for GPIO, etc.), indicating Riedel's commitment to **layer-1/layer-2 transport tech** remains strong, just now oriented to IP transport over fiber rather than proprietary links <sup>58</sup> <sup>59</sup>. Similarly, Riedel's launch of the **SAME (Smart Audio Mixing Engine)** in 2025 – a cloud/software audio engine – might seem outside the optical domain, but it complements the StageLink I/O devices, suggesting Riedel wants to provide end-to-end solutions (signal acquisition on stage via StageLink, signal processing via SAME, and distribution via its fiber/IP networks) <sup>59</sup> <sup>60</sup>. On the flip side, there is little evidence Riedel is discontinuing its optical hardware; no end-of-life notices have surfaced for the core MediorNet fiber products or Embrionix-derived SFP modules. If anything, Riedel has *sunset older products in favor of newer tech* – for example, the classic MediorNet Modular frame (2010s era) has given way to MediorNet MicroN and VirtU with SFP IO, and the PMX panel multiplexers have been largely supplanted by IP-based solutions or simply less need as intercom panels now can connect via IP. The discontinuation of PMX-2004/2008 was quietly noted by resellers (“no longer available” as of a couple years ago) <sup>61</sup> <sup>62</sup>, aligning with the industry's shift from single-purpose fiber muxes to IP. But Riedel has not withdrawn from offering optical links – instead it often **outsources certain commodity optics** (like generic 1310 nm transceivers) and focuses on integrating those into its systems. Job postings and R&D news from Riedel show continued hiring in IP and fiber engineering (e.g. seeking FPGA developers, IP network specialists in Montreal), which reinforces that Riedel is **not outsourcing its core optical/IP tech development**. In summary, all signs – product announcements, trade show demos, and the integration of Embrionix IP – point to Riedel continuing to invest in optical and IP networking solutions as a cornerstone of its strategy, rather than exiting that space.

**Competitive Context:** In the niche of broadcast optical transceivers and SFP-based processing, Riedel's main competition comes from a mix of dedicated fiber transport vendors and larger broadcast systems providers, each with different approaches. **Lawo** and **Nevion (Sony)**, for instance, offer IP media platforms that utilize SFP modules for physical interfaces but generally do not sell the SFPs separately or develop unique SFP-based processors. Lawo's V\_matrix uses server-like blades with SFP cages for SDI or fiber connections, and Nevion's Virtuoso similarly has slots for SFPs (Nevion even lists its own range of optical and electrical video SFPs supporting 12G-SDI, MADI, etc. <sup>63</sup> <sup>64</sup>). It's likely many of those were actually sourced from Embrionix; indeed, Nevion's data sheets note SFP-based interfacing for SDI up to 12G and mention support for Embrionix protocols in control systems <sup>65</sup> <sup>66</sup>. Now that Embrionix is part of Riedel, competitors must either continue buying from Riedel or turn to alternatives (e.g. Macnica or Aptovision/Mirifice for IP SFPs, or generic OEMs for simple optics). **Ross Video** takes a somewhat different angle: it provides fiber I/O options for its routing systems (Ultrix routers and openGear cards), and sells SFPs like any other accessory. Ross markets a Dual 12G SDI SFP transceiver and others <sup>67</sup> <sup>68</sup>, but these are likely standard OEM modules re-badged. Ross does not have in-house SFP processing technology akin to Riedel's MuoN; instead, Ross's IP and conversion products are box-level (Ultrix FR routers, gateways like Newt, etc.). **Apantac**, known for multiviewers and openGear modules, also offers optical SFP solutions. Apantac's catalog includes 3G and 12G fiber SFP transmitter/receiver pairs (e.g. part codes SFP-FIB-3G, SFP-FIB-12G) as well as fiber extenders with SFPs for SDI <sup>69</sup> <sup>70</sup>. Again, these are likely manufactured by third-party SFP specialists. **Evertz** (a giant in broadcast video) historically developed its own fiber transport cards and IP gear, but even Evertz has used SFPs for optical I/O (and possibly sourced Embrionix for certain IP transition modules in the past). Smaller fiber-focused companies like **Artel Video Systems** and **Bluebell Opticom** compete on specific use cases (Artel at one point resold Embrionix SFPs as part of its DigiLink platform <sup>71</sup>). However, none of these

competitors combine all the elements Riedel now does: a broad catalogue of SFP-based **video converters, IP gateways, and processing apps**, plus the end-to-end solution (frames, network, cables, etc.). In effect, Riedel's acquisition of Embrionix gave it a unique position – it can pitch not just “we have fiber links” (like traditional fiber vendors) or “we have IP systems” (like Lawo/Evertz), but “we have **software-defined optical micro-devices** that you can deploy flexibly in your infrastructure.” This is a similar philosophy to some niche competitors like Grass Valley's **Aperi** platform or the ST 2110 **Smart NICs** from Mellanox/Macnica, but Riedel is ahead in turning that into a user-friendly product line. As the market converges IP and fiber transport, Riedel likely sees its competition less in standalone SFP sales (where dozens of OEMs exist) and more in integrated solutions. Its StageLink and audio offerings indicate it is positioning against companies like **Clear-Com** or **Bolero (itself)** for audio networking, while MuoN/Fusion position it against **Lawo V\_matrix**, **Evertz SCORPION/VIP**, and **Nevion Virtuoso** in the IP gateway arena. In that competitive landscape, Riedel's differentiator is the granularity and scalability of its SFP-based approach – instead of buying a 16-channel gateway appliance, a customer can deploy just the number of SFPs needed, even inside a network switch <sup>20</sup> <sup>21</sup>. This flexibility, combined with Riedel's established reputation in event communications, gives it a strong niche.

In conclusion, Riedel Communications has evolved from simply a fiber intercom and routing provider into a cutting-edge vendor of optical network solutions for media. Its catalog spans from robust tactical fiber cables and passive WDM multiplexers, to advanced optical transceivers and IP-enabled SFP processors. These offerings are deeply integrated into Riedel's larger systems (MediorNet media network and Artist intercom) and are increasingly aligned with industry IP standards. The company sells most optical products as part of solutions but maintains a channel for standalone purchases via authorized resellers – ensuring users can expand networks as needed. The Embrionix acquisition has supercharged Riedel's capabilities in the IP video domain, positioning it to compete in the era of ST 2110 while still supporting legacy SDI over fiber. Flagship deployments in global sports and broadcasting underscore the reliability and performance of Riedel's optical technology, and ongoing product launches (StageLink, etc.) highlight a strategy of continued innovation. As broadcast infrastructures continue to converge IT and fiber optics, Riedel is poised as a key player providing the “glue” – in the form of pluggable optics, fiber transport, and distributed edge processing – that connects the industry's future workflows.

## Optical Transceiver Modules (SFP/SFP+/SFP28) – Riedel Portfolio Overview (CSV)

**SKU / Part Number | Type & Channels | Wavelength / Mode | Reach | Connector | Supported Formats / Rates**

EB12LC2T-SN-13D | Dual Transmitter SFP+ (2× TX) – 12G/6G/3G/HD/SD-SDI | 1310 nm DFB, Single-mode | ~10 km (medium haul) <sup>1</sup> <sup>3</sup> | Duplex LC | 12G-SDI UHD (4K 60p), 6G-SDI, 3G-SDI, HD-SDI, SD-SDI <sup>1</sup> <sup>72</sup>

EB12LC2R-MN-P | Dual Receiver SFP+ (2× RX) – 12G/6G-SDI UHD | 1270–1610 nm wide Rx, Single-mode | ~10 km (medium haul Rx sensitivity) <sup>73</sup> <sup>74</sup> | Duplex LC | 12G/6G-SDI video (backwards compatible to 3G/HD/SD) <sup>74</sup> <sup>75</sup>

EB12LCRT (variants) | Transceiver SFP+ (1 TX + 1 RX) – 12G-SDI bidirectional | 1310/1550 nm pair (WDM), SM | 20–40 km (long haul) | Simplex LC | 12G/3G-SDI bidirectional over single fiber (e.g. one 12G Tx and one 12G Rx)

EB60LC2T-MN2-13F | Dual Transmitter SFP (2× TX) – 3G/HD/SD-SDI, ASI | 1310 nm FP, Single-mode | ~10 km (medium haul) <sup>2</sup> <sup>4</sup> | Duplex LC | 3G-SDI, HD-SDI, SD-SDI, DVB-ASI (270 Mb) <sup>2</sup> <sup>76</sup>

EB60LC2R-MN2-P | Dual Receiver SFP (2× RX) – 3G/HD/SD-SDI | 1260–1620 nm wide Rx, SM | ~10 km | Duplex LC | 3G/HD/SD-SDI (wideband receiver for 3G down to SD) <sup>73</sup> <sup>2</sup>

EB60LC1T-Lx-xxD | Single Transmitter SFP – 3G-SDI (CWDM options) | CWDM DFB (xx nm band), SM |

20–40 km (long haul) | Duplex LC | 3G/HD/SD-SDI (CWDM channel for MediorNet CWDM mux) <sup>5</sup> <sup>14</sup>  
 EB60LC1R-Lx-P | Single Receiver SFP – 3G-SDI (CWDM) | 1260–1620 nm (CWDM Rx) | 20–40 km | Duplex LC | 3G/HD/SD-SDI (receives specific CWDM channel) <sup>5</sup> <sup>14</sup>  
 ART-Z-SFP-CPU-MM-850-8.5-1.25G | Transceiver SFP (duplex) – Artist G2 CPU Fiber **Multi-mode** | 850 nm VCSEL, MM 50/125 | 0.5 km (500 m) <sup>18</sup> <sup>77</sup> | Duplex LC | 1.25 Gbps (Artist matrix control link) <sup>78</sup> <sup>79</sup>  
 ART-Z-SFP-CPU-MM-1310-10-1.25G | Transceiver SFP – Artist G2 CPU Fiber **Multi-mode** | 1310 nm LED, MM 62.5/125 | 2 km <sup>18</sup> <sup>80</sup> | Duplex LC | 1.25 Gbps (Artist link, MM variant) <sup>81</sup> <sup>79</sup>  
 ART-Z-SFP-CPU-SM-1310-10.5-1.25G | Transceiver SFP – Artist G2 CPU Fiber **Single-mode** | 1310 nm FP, Single-mode | 10 km <sup>82</sup> <sup>83</sup> | Duplex LC | 1.25 Gbps (Artist link, long-distance SM) <sup>81</sup> <sup>84</sup>  
 ART-Z-SFP-PMX-SM-TX1310/RX1550-18-155M | Transceiver SFP – PMX panel mux (Tx @1310 nm, Rx @1550 nm) | 1310 nm DFB TX / 1550 nm Rx, SM | 30 km <sup>85</sup> <sup>18</sup> | Simplex LC | 155 Mb/s (Artist panel data via WDM link) <sup>81</sup> <sup>86</sup>  
 ART-Z-SFP-PMX-SM-TX1550/RX1310-18-155M | Transceiver SFP – PMX panel mux (Tx @1550 nm, Rx @1310 nm) | 1550 nm DFB TX / 1310 nm Rx, SM | 30 km <sup>85</sup> <sup>80</sup> | Simplex LC | 155 Mb/s (complementary SFP to above, for far end of link) <sup>81</sup> <sup>86</sup>  
 MN-Z-SFP-25G-SR (EBC1LCRT-SR-P85V) | Transceiver SFP28 – 25G Ethernet short-range | 850 nm VCSEL, MM (OM4) | 100 m (OM4 fiber) <sup>87</sup> <sup>88</sup> | Duplex LC | 25GBASE-SR Ethernet (IEEE 802.3ae 25GbE) <sup>87</sup> <sup>89</sup>  
 MN-Z-SFP-25G-LR (EBC1LCRT-LR-P13D) | Transceiver SFP28 – 25G Ethernet long-range | 1310 nm DFB, SM | 10 km <sup>87</sup> <sup>90</sup> | Duplex LC | 25GBASE-LR Ethernet (25 Gbps, ST 2110-20/-30 streams) <sup>90</sup> <sup>89</sup>  
*(Above is a selection of Riedel optical modules; “EB” prefixed codes are legacy Embrionix video SFPs now sold by Riedel, and “ART” and “MN” codes are Riedel’s Artist and MediorNet part numbers. All modules support standard SMPTE compliance and pathological test patterns. Reach is approximate maximum distance over single-mode unless noted.)*

## 1. Product Taxonomy & Specifications of Riedel Optical Modules

Riedel’s optical transceiver lineup spans multiple families inherited or inspired by the Embrionix portfolio. The core video SFP groups are the **EB60** series for up to 3G-SDI signals and the **EB12** series for 12G-SDI/UHD signals, as well as a range of CWDM variants and specialized units. Each module is generally identified by a part code that encodes its capabilities (e.g. “EB12LC2T-SN-13D” indicates an Embrionix-designed, 12G-capable, LC-connector, dual transmitter, short/medium reach, 1310 nm DFB laser) <sup>1</sup> <sup>3</sup>. Key specifications for each category are as follows:

- **12G-SDI Optical SFP+ (EB12 series):** These are SFP+ form-factor modules supporting the full range of SDI rates from SD (143 Mb) up to 12G-SDI (~11.88 Gbps for 4Kp60). They are available as **dual transmitters**, **dual receivers**, or **transceivers** (1 Tx + 1 Rx in a single module), all with integrated reclocker circuits for signal integrity <sup>91</sup> <sup>74</sup>. They use LC duplex optical connections. The standard wavelength for “medium haul” versions is **1310 nm** using DFB lasers, typically good for ~10 km on single-mode fiber <sup>1</sup> <sup>73</sup>. There are also long-haul versions (noted by different suffixes, e.g. “LN”) which use 1550 nm lasers and/or higher power to reach 40 km or more. Receiver modules have wideband photodiodes covering ~1270–1610 nm to allow any standard wavelength input <sup>73</sup> <sup>74</sup> (this enables compatibility with CWDM channels or unknown wavelengths). The dual RX’s sensitivity is high: Riedel specifies these modules can detect down to ~ -18 dBm at 12G, and even ~ -24 dBm for lower rates, thanks to Embrionix’s design <sup>92</sup> <sup>93</sup>. In practice, a pair of EB12 modules (Tx and Rx) yields an optical budget around 10–15 dB for 12G (sufficient for 10 km SMF with margin). The modules are Non-MSA (proprietary pinout extensions) to support advanced features like out-of-band communication and low latency reclocking. They fully comply with SMPTE standards (ST 2082 for 12G, ST 297, etc.) and pass pathological test patterns at all rates <sup>1</sup> <sup>91</sup>. Notably, Embrionix announced these as “the

world's first UHD 4K60 optical SFPs" when introduced, capable of dual-link 12G (for 4K120) in one module <sup>3</sup>. The **EB12HD** (coax variant) is a related family for HD-BNC copper interfacing, but in optical context the EB12LC is primary <sup>91</sup>. Maximum power consumption is around 1.5 W each. Operating temperature range is typically 0 to +70 °C for standard units <sup>94</sup> (with industrial-temp versions on request).

- **3G-SDI Optical SFP (EB60 series):** These are SFP/SFP+ modules for signals up to 3G-SDI (2.97 Gbps). They also support HD-SDI, SD-SDI, and DVB-ASI. The EB60 family comes in similar flavors: dual TX, dual RX, etc. An example is the **EB60LC2T-MN2-13F**, a dual 3G transmitter with medium-haul reach <sup>2</sup> <sup>4</sup>. This unit uses **1310 nm FP lasers** (Fabry-Perot) and achieves about 10 km distance over single-mode <sup>4</sup>. It's fully SMPTE ST 297 compliant for SDI optical specs <sup>76</sup>. Embrionix emphasized the high sensitivity of the EB60 receivers – quoted sensitivity up to -23 dB optical at 3G-SDI with pathological patterns <sup>95</sup> <sup>96</sup>, which is better than SMPTE minimums. Some EB60 models also have versions with extended temperature (-40 °C to +85 °C) for military or outdoor use <sup>97</sup>. The EB60 series also includes **CWDM options**: modules like *EB60LC1T-Lx-xxD* where "Lx-xx" denotes a specific CWDM wavelength (e.g. 27 for 1271 nm, 33 for 1331 nm, etc.). These single-channel transmitters or receivers pair with Riedel's CWDM mux. There are even single-fiber "transceiver" versions (Embrionix code **LCRT** meaning one LC for Rx/Tx) – for example *EB60LCRT* variants that use one fiber for both directions via WDM (one channel 1310 nm up, 1550 nm down). Those support bidirectional 3G/HD-SDI extension on one strand and reach ~20 km using DFB lasers. In summary, the EB60 series covers all needs for SDI up to 3 Gbps, with options for multimode fiber too (Embrionix offered **MM** 850 nm versions for short-range – e.g. EB59 series likely corresponded to 850 nm multi-mode units to reach 300–500 m on OM3 fiber).

- **CWDM Optical SFPs:** For higher channel count fiber links, Riedel provides optical SFPs on **ITU CWDM wavelengths**. In practice, these are similar to the EB60 or EB12 electronics but with specific DFB laser wavelengths. Riedel's MediorNet CWDM modules list 18 wavelength options (1271, 1291, ..., 1611 nm) <sup>5</sup> <sup>14</sup>. For example, an EB60-based 3G SFP might come in a -1471 or -1551 suffix variant for 1471 nm or 1551 nm. The reach on these is typically long – 40 km – because they use DFB lasers and often paired with sensitive APD detectors for the long-haul versions (the datasheet notes 18 dB optical budget for 40 km on some 3G CWDM SFPs <sup>98</sup> <sup>99</sup>). These CWDM SFPs enable MediorNet Modular/Compact frames to send many signals through a single fiber when used with the **MC-CWDM passive mux** units <sup>5</sup> <sup>14</sup>. It's worth noting that because Riedel's receivers (like EB12LC2R) are wideband, a single Rx can actually receive any wavelength 1270–1610 nm <sup>73</sup>. But in a mux scenario, each channel is separated by the external prism/mux, so individual SFPs are still tuned per channel. Riedel's offering likely covers all 18 channels for 3G, and at least some for 12G (though 12G CWDM is trickier due to bandwidth – usually 12G optical links are just run at 1310 nm or a few bespoke wavelengths like 1550; CWDM filtering a 12G signal works but with tighter loss budgets). Indeed, MediorNet Modular offered a 4-channel CWDM option for 3G signals historically <sup>5</sup>; with Embrionix, they could potentially do 12G CWDM but that's not commonly reported (perhaps up to 6G on CWDM).

- **Standard Ethernet SFP/SFP28:** Riedel uses standard optical modules for data connectivity in its IP-enabled products. These include **1G and 10G Ethernet SFP/SFP+** transceivers (e.g. 1000BASE-LX, 10GBASE-LR), and **25G SFP28** modules for MediorNet VirtU or IP switches. Embrionix's own data SFP line includes a 25GBASE-SR (850 nm, 100 m) and 25GBASE-LR (1310 nm, 10 km) transceiver, which correspond to Riedel part codes like *MN-Z-SFP-RT-SM-1310-25* etc. <sup>87</sup> <sup>89</sup>. These are largely commodity parts (often manufactured by OEMs like Finisar, Lumentum, etc., and tested by Embrionix/Riedel). They adhere to IEEE standards. For example, the *Riedel MuoN 25G SFP28* short-reach uses a VCSEL and achieves 100 m on OM4 fiber <sup>90</sup>, while the long-reach uses a 1310 nm DFB for 10 km <sup>87</sup> <sup>89</sup>. By offering these, Riedel ensures that its IP gateway

products can interface with COTS network gear. In many cases, a client could use third-party SFPs for pure Ethernet links – but Riedel’s documentation often cautions that only approved SFPs guarantee performance <sup>27</sup> <sup>100</sup> .

- **Artist & Intercom Fiber SFPs:** Riedel’s intercom matrix (Artist) and related systems use lower-speed optical links for trunking and control. The **Artist 128 Fiber CPU** card uses a pair of SFPs (one per redundant CPU card) to connect frames via fiber. Riedel supplies 1.25 Gbps SFPs for this in three flavors: multi-mode 850 nm (500 m), multi-mode 1310 nm (2 km, using 50/125 fiber at 1310 which is somewhat unusual), and single-mode 1310 nm (10 km) <sup>101</sup> <sup>18</sup> . These are listed as *ART-Z-SFP-CPU-* modules and have optical budgets around 8.5–10.5 dB <sup>77</sup> . They basically function like 1000BASE gigabit Ethernet transceivers (and indeed likely use similar components, since 1.25 Gbps is GigE rate) but are specified by Riedel to carry the proprietary Artist frame data. The fact that Solotech’s listing said “**Only sold as part of system**” and Riedel’s note about not using non-Riedel SFPs <sup>25</sup> <sup>102</sup> suggests these are tuned/tested for the exact use. Another intercom-related SFP pair are the **PMX fiber SFPs** used in the Panel Multiplexer 2004/2008. These are actually **single-fiber WDM transceivers**: one SFP transmits at 1310 nm and receives at 1550 nm, and its mate does the opposite <sup>81</sup> <sup>103</sup> . They run at 155 Mb/s (sufficient for 4 AES3 signals for panels). They have a high budget (18 dB) for up to 30 km reach <sup>18</sup> <sup>104</sup> , allowing remote panel drops. Each PMX-2008 had two such SFPs, one per 4-panel bundle, connecting to a twin SFP at the matrix side. Even though the PMX is discontinued, these SFPs exemplify Riedel’s ability to support **niche optical links** (in this case, essentially an OC-3/STM-1 rate link over WDM).

- **HDMI/DVI and Other SFPs:** Embrionix also made some SFPs that convert HDMI or analog signals to optical, etc. Riedel lists MuoN SFPs with HDMI inputs (notably the MuoN B could have an HDMI 2.0 interface). Those SFPs typically output IP, not raw optical, so they fall more under converter than simple transceiver. For completeness, Embrionix had, for example, an HDMI 1080p receiver SFP and MADI audio SFPs. Riedel has integrated some of these: e.g. the MuoN A series includes SFPs with HDMI 1.4 or 2.0 connectors for monitoring or ingest <sup>105</sup> . There were also optical MADI SFPs (likely 1310 nm, 2 km for 125 Mb MADI). While not explicitly in Riedel’s public catalog, these could be available for special applications (the Panorama TDF case mentions MuoN SFPs with “including HDMI” interfaces <sup>20</sup> ).

Each optical SKU Riedel offers comes with a detailed spec sheet, and Riedel emphasizes that these have been tested for 100% compatibility with their gear <sup>102</sup> . They even warn that using non-Riedel SFPs could void guarantees <sup>102</sup> . This is partly a quality control measure and partly to ensure features like “**patented latching mechanism**” and monitoring are present (Embrionix SFPs have advanced diagnostic features accessible via host APIs <sup>106</sup> <sup>107</sup> ). In short, Riedel’s optical modules cover all needed link types in broadcast: from short-range multimode for studios, through medium-haul 1310 nm for inter-campus links, up to long-haul WDM for remote production.

## 2. Rugged Tactical Fiber Cables – PURE, TAC & opticalCON Systems

To complement its active optical hardware, Riedel provides a line of **rugged fiber optic cables** optimized for broadcast and event use. These were developed from Riedel’s rental experience in large events (Olympics, F1, ESC, etc.) where standard telecom fiber isn’t robust enough <sup>47</sup> <sup>108</sup> . The flagship family is branded “**Riedel PURE**” – marketed as “*the heavy duty fiber cable for demanding applications*” <sup>47</sup> . “PURE” cables are built as **tactical fiber cables**, meaning they use tight-buffered fiber



elements with reinforced jacketing suitable for repeated deployable use (as opposed to loose-tube or indoor fiber).

Within the PURE range, Riedel offers a couple of variants: - **PURE CS (Compact Series): a 5.7 mm outer diameter** tactical fiber cable <sup>109</sup> <sup>110</sup> . It contains (from context) likely 2 fibers (since it's terminated with opticalCON Duo or Quad). "CS" cables are single-mode fiber, ruggedized, with a **single jacket** (medium thickness). They are very flexible and relatively lightweight, ideal for portable patching. Despite the thin profile, they are built to be **crush resistant and resilient**. PURE CS cables are typically terminated with Neutrik opticalCON connectors – "**D**" in the product code indicates **DUO (2-fiber)** connectors on each end <sup>109</sup> <sup>111</sup> , and "**Q**" indicates **QUAD (4-fiber)** connectors <sup>111</sup> <sup>112</sup> . So for example, *PURE CS D* is a 2-fiber cable with opticalCON DUO, while *PURE CS Q* is a 4-fiber cable with opticalCON Quad. The fiber itself is single-mode and specified as ITU G.657.A bend-insensitive type (Riedel explicitly notes "low bending radius (G.657A specified)" as a feature) <sup>7</sup> <sup>8</sup> . This means the cable can be flexed around tight corners without significant signal loss – crucial for on-stage use. Another feature: the fiber has "**no waterpeak**" <sup>7</sup> , indicating it's optimized for the full spectrum (approximately 1260–1625 nm has no high attenuation region), hence it is **fully CWDM/DWDM compatible** <sup>7</sup> <sup>8</sup> . In practical terms, that ensures even older legacy wavelengths (around 1383 nm) or CWDM channels won't suffer extra loss – a sign of high-quality fiber.

- **PURE XT (Extreme, dual-jacket): a 9.0 mm outer diameter** tactical fiber cable with a **double jacket construction** <sup>109</sup> <sup>112</sup> . This cable is heavier and even more robust – the dual jacket likely means an inner jacket around the fiber bundle plus an outer polyurethane jacket, often with a layer of aramid strength members in between. PURE XT is designed for the most demanding environments – e.g. outside broadcast where cables might be run over by trucks or routinely dragged. The XT cables come in the same connector configurations: *XT D* (with opticalCON DUO ends, 2-fiber) and *XT Q* (with opticalCON QUAD, 4-fiber) <sup>109</sup> <sup>111</sup> . Being thicker, the XT cables can endure more strain and have higher tensile strength (the 9 mm cable likely contains multiple strength and filler elements). They might also contain two duplex fibers (for quad) in separate subunits. Riedel lists the same fiber performance features for XT: G.657.A, no water-peak, etc., so presumably the fiber itself is identical SM OS2 type, but the cable adds protection.

Both PURE CS and XT are **field-deployable** and come on drums for long lengths. The **length options** mentioned in Riedel literature are: - For PURE CS: standard offerings of **10 m**, then **200 m** (on a GT380 drum), **300 m** (GT450 drum), **600 m** (SK4731 large drum), and custom lengths on request <sup>10</sup> <sup>11</sup> . - For PURE XT: **10 m**, **100 m** (on GT380), **150 m** (GT450), **300 m** (SK4731), etc., also custom lengths <sup>113</sup> <sup>114</sup> . (The 2014 catalog indicated XT max ~300 m by default due to thickness/weight, but longer could be custom).

These cables use **Neutrik opticalCON** connectors exclusively, as highlighted: "*exclusively with Neutrik opticalCON QUAD or DUO connectors*" <sup>7</sup> <sup>115</sup> . Neutrik's opticalCON is a ruggedized connector system that houses standard LC termini inside a robust keyed shell with locking. The DUO version carries 2 fibers (usually for duplex TX/RX or redundant paths) and the QUAD carries 4 fibers (often for dual duplex or WDM trunk plus backup). Riedel presumably chose opticalCON so that these cables can integrate directly with MediorNet frame interfaces (the MediorNet Modular frames have options for opticalCON panel mounts). In fact, Riedel's passive WDM modules come in two types: ones with opticalCON Quad on the panel for trunk connection (e.g. MC-WDM-Q) and ones with LC (MC-WDM-L) <sup>12</sup> <sup>116</sup> – the use of opticalCON on those implies Riedel expects customers to use their Pure Quad cables to link frames.

Beyond PURE cables, Riedel documentation sometimes generically references "**tactical (TAC) fiber**" which is a common term in broadcast for military-style fiber cable. The PURE line is essentially Riedel's

branded TAC fiber. The term **"PURE"** itself hints at "PU" (polyurethane) and "RE" (Riedel) – indeed the jacket is PUR material, known for abrasion and chemical resistance <sup>7</sup> <sup>115</sup>. The combination of flexibility, toughness, and reliable performance under stress is what sets these cables apart from standard indoor fiber.

Riedel also has offered **hybrid fiber cabling** (for camera systems) in the past through partners, but in their own catalog the focus is on pure opticalCON cables. The **"Optical Fiber Cable" application note** <sup>117</sup> underscores features: extreme ruggedness, low bend radius, etc., which we see in PURE's spec.

By providing these cable solutions, Riedel ensures that customers have an end-to-end fiber infrastructure: you can go from an Artist or MediorNet device, plug in a Riedel optical SFP, and run a Riedel Pure cable to another device, perhaps through a Riedel WDM multiplexer – all components designed to work together under real-world conditions. This one-stop approach is valued in critical live events where using the wrong fiber cable (fragile or not rated for outdoor use) could lead to failures.

In summary, **PURE CS and PURE XT tactical cables** are Riedel's heavy-duty fiber offerings, featuring single-mode bend-insensitive fibers, PUR jackets, and Neutrik opticalCON connectors in 2- or 4-channel versions <sup>7</sup> <sup>109</sup>. They cover short patch leads to very long runs on reels, enabling flexible deployment of MediorNet and other systems in studios, arenas, and remote sites. These cables are engineered to maintain signal quality under punishing conditions – an essential factor when hundreds of video, audio, and comm signals are riding on a few fiber strands in a live broadcast.

### 3. WDM/CWDM Multiplexers, PMX Panel Multiplexers, and StageLink Edge Devices

**WDM/CWDM Multiplexers:** To maximize fiber efficiency, Riedel offers passive wavelength division multiplexers that pair with the aforementioned optical SFPs. In a scenario like connecting two MediorNet frames with multiple bidirectional signals, using separate fiber for each link is wasteful; Riedel's **WDM modules** solve this by combining several links onto one fiber. The catalog describes **MC-WDM-Q** – a *"WDM Dual Multiplexer/De-Multiplexer (passive) for up to 6 duplex fiber connections"* <sup>12</sup>. "Dual" here means the unit handles two groups of WDM channels (hence using 4 fibers total, which conveniently matches an opticalCON Quad connector) <sup>118</sup>. Specifically, it uses three wavelengths (1310, 1490, 1550 nm) in each direction to carry 3 full-duplex links per fiber pair. So two fiber pairs (4 fibers) can carry 6 duplex signals. The device has an opticalCON Quad for the trunk (all wavelengths) and breakout to 6 duplex LC pairs for the individual equipment connections <sup>12</sup> <sup>13</sup>. Insertion loss is about 6.9 dB max <sup>118</sup>, which is significant but within the budget of Riedel's SFPs (which have high link margins). There is also an **MC-WDM-L** variant – same concept but using dual LC connectors for the trunk instead of opticalCON (useful for installations where bulkhead LC is preferred) <sup>119</sup> <sup>120</sup>. Each of those comes in -T version as well (Q T or L T) which likely indicates a flipped connector arrangement or mounting on opposite side for certain frames <sup>121</sup> <sup>122</sup>. These WDM multiplexers were recommended to interconnect MediorNet Modular/Compact frames <sup>12</sup>, especially where fiber count was limited (e.g. between OB van and studio with one fiber strand available, you could run 3~6 signals each way on it).

For even larger trunking, Riedel's **CWDM multiplexers** allow up to 18 signals each way. The **MC-CWDM-Q** is a passive mux/demux using the full ITU CWDM 18-channel grid (1271–1611 nm) <sup>5</sup> <sup>123</sup>. It connects via opticalCON Quad on the trunk, meaning it likely also multiplexes two groups of 9 wavelengths on two fiber pairs (or simply provides a Quad connector which has 4 fibers, perhaps two are used for east-west directions in a redundant ring). The mention "SR12 housing for up to 2 modules" indicates these are modular cards that can fit in Riedel's 2RU frames (SR rack). The loss is similar (~7 dB). The unit expects **CWDM SFPs** at the end equipment matching the 18 wavelengths <sup>124</sup> <sup>123</sup>. There's an

**MC-CWDM-L** version with LC trunk similarly <sup>125</sup> . Essentially, using MC-CWDM, one can aggregate a very large number of signals – e.g. 18 3G-SDI feeds or any mix – onto one fiber pair, which is useful for venue-to-venue links or telco circuits. The trade-off is higher attenuation and the need for precise matching of wavelengths.

It's worth noting that these WDM/CWDM devices are **passive (unpowered)** optical filter banks, which makes them reliable for critical paths. They rely wholly on the SFPs for optical power. Riedel's SFPs (especially EB60 and EB12) have decent output powers (0 to +5 dBm for long haul DFBs <sup>126</sup> <sup>127</sup> ) and sensitive receivers (–18 dBm or better), so even with ~7 dB mux loss and fiber loss they can manage typical distances (e.g. 10 km of fiber + 7 dB mux leaves ~5 dB margin). For example, a 3G-SDI dual link might use 1490 nm and 1550 nm channels through the WDM – Riedel sells the corresponding SFPs – and thus run two signals on one fiber pair between frames.

**PMX-2004/2008 Panel Multiplexers:** The PMX series, introduced around 2014, addressed a very specific need: running multiple intercom panel connections over a single fiber. In a large venue, one might have several Artist matrix keypanels at a remote location; rather than home-running each panel's coax back to the matrix, the PMX allowed multiplexing them. The **PMX-2004** had 4 BNC ports and one duplex fiber port; the **PMX-2008** basically contained two PMX-2004 modules (8 BNCs, two fiber ports) <sup>128</sup> <sup>129</sup> . Each PMX BNC port connected to an Artist matrix port (carrying a panel's audio/data on AES3 or CAT5), and internally the PMX would modulate those onto a combined data stream for fiber. The mechanism was essentially TDM – the panels operate at 1.544 Mb/s or similar, so four of them plus overhead might be around 10 Mb/s, easily carried over fiber. However, Riedel implemented this with a pair of SFPs performing WDM: as noted earlier, the PMX SFPs were actually one transmitting at 1310 and receiving 1550, and vice versa <sup>81</sup> <sup>130</sup> . This indicates they likely ran a simple double wavelength link for redundancy (two wavelengths carrying presumably two directions of a multiplexed data stream). With 18 dB budget, PMX could reach 30 km <sup>82</sup> , meaning panels could be very far from the matrix – useful for remote production compounds. While innovative, this product has been **superseded** by IP solutions (today you might put panels on an IP network or use an Artist-1024 frame with AES67 connectors). Indeed, Riedel's website has quietly moved PMX to "Legacy products" and resellers mark it discontinued <sup>131</sup> . Still, the PMX demonstrated Riedel's approach to optical transport: it was an *SFP-based*, small 1RU box that solved a niche problem using fiber.

**StageLink Edge Devices:** In 2024, Riedel unveiled the **StageLink** family, which can be seen as a next-generation approach to stage connectivity and signal distribution. Unlike WDM or PMX which were purely layer-1 optical muxes, StageLink devices are **networked audio/video interfaces** that use IP protocols over standard networks. The StageLink boxes are compact, rugged I/O units designed for connecting microphones, intercom lines, and other audio or GPIO sources at the edge and then transporting them over an IP network (which can of course be a fiber IP network) <sup>56</sup> <sup>58</sup> . They effectively eliminate the need for point-to-point analog snakes or even point-to-point fiber muxes by leveraging Ethernet. From a layering perspective: StageLink takes baseband audio/GPIO, digitizes and packetizes it (likely as AES67 or similar) and sends it over a generic IP link (1 GbE or 10 GbE). So while StageLink is not an "optical multiplexer" in the WDM sense, it **relies on fiber/IP infrastructure** to do its job – e.g. connecting StageLink units to the core network will often involve fiber switches. Each StageLink device has an RJ45 or SFP uplink (the press release doesn't specify SFP, but given Riedel's design ethos, a 1/10Gb SFP port is likely for flexibility) and various XLR or DB25 audio ports. The series includes models like **NSA-003A Dual Partyline**, **NSA-004A Quad In**, **NSA-005A Quad Out**, **NSA-006A Workplace (with mic preamps and speaker outs)**, **NSA-007A Dual In/Out 4-wire** and **NSA-010C GPIO** <sup>57</sup> <sup>132</sup> . All share the concept of connecting legacy audio/intercom signals to an IP network. With StageLink, Riedel is essentially providing "edge nodes" that feed into its Artist or Bolero intercom systems via IP (or into third-party audio networks). One could imagine StageLink being used with Riedel's upcoming IP-based intercom infrastructure or as stand-alone audio routers.

The significance of StageLink in this context is that it underscores a shift from bespoke optical multiplexers (like PMX) to **standards-based IP transport** over fiber. StageLink boxes use **open IP standards** (NMOS IS-07 for GPIO, likely AES67 or Dante for audio) <sup>133</sup> <sup>134</sup>. They tout specs like 151 dB dynamic range audio, phantom power auto-detect, etc., focusing on audio quality and ease of use rather than raw optical specs <sup>135</sup> <sup>136</sup>. But practically, to connect StageLink devices across a venue, one would deploy fiber Ethernet – either via switches or direct fiber runs with SFP modules. So StageLink leverages the fiber connectivity but moves the multiplexing up to Layer 3 (IP). Riedel's statement that *"upcoming StageLink devices will expand beyond audio... transporting a broader range of signals over IP"* <sup>137</sup> hints that future StageLink variants could handle things like SDI or PTZ camera signals (perhaps small video encoders) – essentially replacing what older CWDM muxes did, but with IP encapsulation.

In a way, StageLink is the modern answer to something like a CWDM multiplexer. Instead of combining many signals optically, StageLink converts them to packet streams and lets a single fiber carry them via a 10GbE trunk. The advantage is flexibility and using commodity network gear; the trade-off is a bit more latency and complexity. Given that StageLink was introduced and even won awards (NAB 2025 Best of Show) <sup>138</sup>, it underscores Riedel's strategy: continue enabling signal transport at the edge, but using IP protocols – an evolution from purely optical combination to networked distribution.

In summary, Riedel's **WDM/CWDM hardware** provided point-to-point multiplexing of multiple signals onto fewer fibers, ideal for earlier generations of MediorNet systems. The **PMX multiplexers** applied similar principles to intercom panel links. As IP networking takes hold, Riedel's new **StageLink devices** shift toward using fiber-based IP networks for distributing stage I/O, effectively taking on the role of multiplexers but with far more flexibility and integration into IP workflows <sup>56</sup> <sup>58</sup>. This evolution illustrates how Riedel is carrying forward its core mission (transporting many signals reliably over minimal cabling) into the IP era, ensuring that even as technology shifts, the problems solved by WDMs and multiplexers (decentralizing I/O, reducing cabling) are still solved – now by smart edge boxes and software.

## 4. MediorNet MuoN and FusioN SFP Processors (SDI↔IP Gateways via Licensing)

Riedel's MediorNet MuoN and FusioN series represent a highly innovative approach to media signal processing: they embed powerful FPGA-based processing engines inside the compact form-factor of SFP modules or small SFP enclosures. This concept, inherited from Embrionix, essentially allows an SFP to do tasks traditionally done by larger rackmount gear. A key aspect of the MuoN/FusioN offerings is that they are **software-defined** and feature-licensed – meaning the same hardware can serve multiple functions depending on the loaded firmware and purchased license <sup>19</sup>. This provides tremendous flexibility and upgradability.

**MuoN SFPs:** The MuoN is an umbrella name for Riedel's micro "Media Compute" SFPs. Physically, there are a few versions: - *MuoN A* series – these are SFP+ modules (10 GbE capable) that typically handle HD signals. They can plug into standard 10GbE switch ports. - *MuoN B* series – these are SFP28 modules (25 GbE capable) for UHD signals, often requiring a VirtU frame or a switch with 25G ports. - Possibly *MuoN C* for coaxial interface variants (Embrionix had some SFPs with built-in coax or HDMI connectors, which presumably map to certain MuoN models).

What sets MuoN apart is that they incorporate an FPGA (e.g. Xilinx Kintex/Intel Arria class) inside the SFP, along with necessary I/O (SDI drivers, etc.). They present various I/O configurations: some have an **electrical SDI connector** on the SFP (either a tiny HD-BNC or a MCX) so that the SFP itself plugs into a cage and a BNC pigtail comes out – enabling direct SDI on an SFP. Others have an HDMI mini-connector

on the SFP for monitoring. And others are “network-only” SFPs that strictly reside in a switch slot and convert IP to IP (processing only).

A given MuoN SFP can run different **“Media Function” firmware**. Riedel (via Embrionix) provides a library of these functions, often referred to as *Apps*. According to Riedel and the TICO Alliance write-up, by simply changing the software license, a MuoN device can morph into a host of different tools <sup>19</sup>. For example: - **SDI↔IP Gateway**: The most straightforward use – encapsulating SDI video into SMPTE ST 2110 or ST 2022-6 IP streams and vice versa. In this mode, a MuoN A (10G) could gateway one HD stream (for ST 2110-20 uncompressed HD fits in ~1.5 Gbps). A MuoN B (25G) could gateway one or two 3G/12G streams (25G is enough for a single 4K60 or multiple HD). The Panorama case confirms TDF used *“MuoN SFPs as IP gateways offering multiple convenient interfaces (BNC, fiber, HDMI) converting SDI to IP”* <sup>20</sup> <sup>105</sup>. - **Up/Down/Cross Converter**: The SFP can perform format conversion – e.g. 1080p to 720p downconvert, or HD to 4K upconvert, cross between 50 Hz and 59.94 Hz rates, etc. This is essentially using the FPGA for scalers and frame sync. Riedel lists a specific “MuoN UDX App” for this <sup>19</sup>. - **HDR Converter**: Another app adjusts HDR -> SDR or between HDR formats (PQ, HLG, SLog, etc.), useful in mixed dynamic range productions <sup>139</sup> (the menu in Riedel’s site shows “MuoN HDR Converter App”). - **JPEG-XS Encoder/Decoder**: Perhaps the most headline-grabbing feature – MuoN SFPs can encode or decode **JPEG-XS** (the ultra-low-latency lightweight compression) in realtime. IntoPIX (the JPEG-XS IP provider) publicized that Riedel’s MuoN uses its cores <sup>140</sup> <sup>141</sup>. With JPEG-XS, a 12G-SDI 4K signal (which is ~12 Gbps) can be compressed 10:1 to ~1.2 Gbps and sent over 10G Ethernet, enabling 4K over 10G networks. So a popular configuration is a MuoN B in a 25G slot handling two 4K signals: it could compress them to fit over 2×10G flows each. Or a MuoN A could handle one HD JPEG-XS, etc. The TICO Alliance note confirms *“simple license change turns device into a JPEG-XS encoder or decoder”* <sup>24</sup>. - **16×1 Multiviewer**: Impressively, a single MuoN SFP can generate a multiview output. The device can take up to 16 IP video streams and composite them into one output (say an HD mosaic), outputting either as HDMI or as an IP stream. This was not possible on older Embrionix SFPs but became possible on newer ones (likely the MuoN B with a beefier FPGA). The TICO Alliance blog for FusioN mentions the FusioN frame can be turned into a *“16 image ST2110 multiviewer”* <sup>23</sup> <sup>142</sup>, and likewise MuoN SFP with appropriate license can drive that. - **Audio router/embedders**: Another potential app – since ST2110 includes audio (2110-30) and separate essence flows, a MuoN could serve as an audio embedder or routing matrix, shuffling audio channels between streams. The TICO Alliance blurb explicitly mentions an app turning the SFP into an *“audio router”* <sup>24</sup>. - **ASI to IP or MADI to IP**: Embrionix historically had SFPs to packetize DVB-ASI or MADI audio into IP. Those likely persist as minor apps, though less demanded now.

Crucially, all these functions can coexist in a network of MuoN SFPs. Instead of having a fixed 4K gateway hardware, a broadcaster could keep a pool of MuoN SFPs and assign them roles via software as needed. Licensing is flexible: for example, one could buy a bunch of basic gateway licenses (cheapest), and only a few JPEG-XS licenses to apply to SFPs when compression is needed, etc.

**Licensing Mechanism**: Riedel provides a management software (MediorWorks or new web-based GUI) to load licenses onto SFPs. The license essentially unlocks a bitstream for the FPGA on the SFP. It can likely be re-hosted if SFPs are swapped. This approach is akin to how Evertz or Lawo license their bigger gear (e.g., a Lawo V\_matrix can be licensed per function). Riedel makes it per SFP. So a client might purchase a MuoN SFP hardware for, say, \$5k, and then license an ST2110 gateway app for \$X, or a JPEG-XS codec app for \$Y extra. The TICO Alliance confirmed *“simple change of software license... into UDX converter, JPEG-XS codec, audio router, or multiviewer”* <sup>19</sup>. That implies the SFP comes with a base function and can be upgraded.

The **FusioN** devices complement MuoN by providing a convenient enclosure. FusioN boxes (like FusioN 3 or FusioN 6) have slots for 3 or 6 SFPs and network/uplink ports (usually a dual 25G or dual

10G uplink). They basically allow using MuoN SFPs without needing an IP switch with SFP ports. For example, a FusioN 3 could be deployed in the field: you could insert, say, two MuoN SFPs licensed as decoders and one licensed as an encoder, and you have a mini 2-in/1-out gateway device for a venue. The **FusioN 3B** specifically is a 3-slot frame with two 25G uplinks and an on-board CPU for control <sup>143</sup>. FusioN also has baseband I/O built in depending on SFPs inserted (if SFP has HDMI, etc., that becomes a port on the device). The TICO Alliance “MediorNet FusioN with JPEG-XS” entry notes FusioN can convert between SDI/HDMI and IP (ST2110) and also handle JPEG-XS compression in the process <sup>23</sup>. It also reiterates a FusioN frame can be turned into a multiviewer output node by appropriate SFP and license <sup>23 142</sup>.

In practical deployment: The **VirtU chassis** takes this to the extreme by packing up to 40 SFPs in 1RU (if using dense boards) <sup>144 145</sup>. It’s essentially a bulk carrier for MuoNs, with high-speed backplane linking to 100G switches. VirtU allows a broadcast center to house dozens of gateway SFPs in one frame – serving as a “modular gateway”. This is how, for example, the European Championships 2022 used 11 VirtU frames for SDI-IP conversion of all their signals <sup>41 146</sup>. Each VirtU can host a mix of SFPs – some might be doing uncompressed 2110, others maybe doing J2K (Embrionix had JPEG2000 apps too for lower bandwidth). Embrionix had an older “emVIRTU” concept which Riedel has carried on.

To illustrate licensing turning a device into SDI↔IP gateway with compression: imagine a single MuoN B SFP in a switch port. By default it might do nothing. Load a “2110 Gateway – 2xHD” license: now it can ingest two HD-SDI from its dual BNC connectors and emit two 2110 streams on the network (or vice versa). Later, you stop that and load a “JPEG-XS Encoder – 4K” license: now connect one 12G-SDI into the SFP, and it outputs a JPEG-XS compressed IP stream, perhaps at 20:1 compression to fit 200 Mbps – useful for a contribution feed. All within the same physical SFP. This adaptability is hugely efficient and is exactly what Riedel is selling to forward-looking broadcasters who don’t want fixed-function devices. TDF’s deployment cited in Panorama confirms this approach: they used **MuoN A in switches for HD** and **MuoN B in VirtU for UHD**, achieving granular scalability and reducing single points of failure (each SFP is independent, so a failure affects one signal, not a whole 8-channel card) <sup>43 21</sup>. TDF’s director is quoted saying this hybrid SDI/IP migration with Riedel MuoN allowed minimal risk and progressive transition <sup>147</sup>.

From a **standards** perspective, the MuoN/FusioN platform supports SMPTE ST 2110 (uncompressed video, audio, ANC data streams) and ST 2022-6 (SDI over IP encapsulation) as well as JPEG-XS (XS is now ST 2110-22 for compressed video) <sup>39 20</sup>. For control, they support open APIs like NMOS IS-04/05 for discovery and connection management, and Embrionix’s own REST API for direct control <sup>65</sup>. This fits into broadcasters’ IP infrastructure easily.

In short, **MuoN SFP processors** represent a flexible toolbox: each SFP is a hardware piece that can be a gateway, converter, or processor depending on software. **Licensing** is the key that unlocks these roles, allowing broadcast engineers to tailor functionality on the fly or repurpose hardware as needs change <sup>24</sup>. This offers future-proofing (a purchased SFP can gain new features with licenses rather than needing entirely new hardware). The combination of MuoN SFPs and FusioN frames gives Riedel a scalable solution from a single channel at the network edge (one SFP in a switch) all the way to a fully loaded gateway hub (a VirtU with 32 SFPs handling dozens of streams). And all of it is managed under the same MediorNet control umbrella. This approach, originally an Embrionix differentiator, now anchors Riedel’s IP video strategy – effectively marrying the concept of small-form pluggables with big-system capabilities.

## 5. Go-to-Market Strategy for Riedel Optical Products

Riedel's sales approach for its optical transceivers and fiber accessories balances between selling **complete systems** (with optics included) and making components available **à la carte via resellers**. Historically, Riedel's core business was turn-key systems like MediorNet networks or Artist intercoms, where fiber links are part of the delivered solution. In those cases, Riedel tends to bundle the required optical modules and cables. For example, if a customer buys a MediorNet Compact frame with fiber ports, it typically comes populated with the appropriate SFPs (or Riedel will quote them together). Similarly, an Artist frame with a fiber interface card will ship with the needed SFPs installed. This ensures out-of-box functionality and relieves the customer from speculating which third-party SFP to use.

At the same time, Riedel recognizes that customers may need to **expand or replace** optical modules over time, or integrate Riedel optics into other equipment. Thus, the company does allow sales of individual optical modules through authorized channels – primarily system integrators and pro AV/broadcast resellers. The availability on sites like *Markertek* and *Solotech* confirms this. Markertek's dedicated page for "Video SFP Modules" lists multiple Riedel-branded SFPs (with Embrionix part numbers) alongside those from other brands <sup>148</sup> <sup>149</sup>. Markertek even highlights Riedel as an authorized line. However, Riedel imposes some restrictions: Markertek notes "*manufacturer does not permit online sales*" for these items <sup>29</sup>. Instead, buyers are prompted to call or email, allowing a Riedel representative or dealer to verify the application and ensure the correct part is sold. This strategy likely serves two purposes: (1) to prevent misapplication (e.g., someone buying a non-MSA Riedel SFP for a standard MSA switch – which might not work), and (2) to maintain pricing discipline and client engagement rather than commoditizing the SFPs.

There are exceptions in product policy: **Artist intercom SFPs** (for the fiber-connected frame controller) are generally *not sold standalone* to end-users. Solotech's site explicitly mentions the optical SFP for Artist CPU "may only be purchased as part of a complete system" <sup>25</sup>. That indicates Riedel doesn't want users trying to add fiber to an Artist frame without proper configuration – possibly because those SFPs go hand-in-hand with a specific fiber card (Artist "CPU128F" card). In practice, if a customer needs a spare, they would go through Riedel support. It also hints that these particular SFPs aren't generic (they run at 1.25 Gbps but with specific settings for intercom data), so Riedel controls their distribution to avoid support issues.

For **MediorNet and Embrionix-derived SFPs**, Riedel seems more open to selling individually. Embrionix, before acquisition, sold SFPs to many OEM customers and through partners like Markertek, and that channel still exists but under Riedel branding. For example, Markertek lists the Riedel/Embrionix EB12LC2T 12G transmitter and has an "Usually ships in 5-14 days" lead time <sup>150</sup>, implying these are build-to-order or stocked in limited quantities at Riedel and distributed per demand. The lead time and lack of pricing online suggest these are not high-volume consumables but rather specialty items integrated into project sales.

Additionally, **bundling inside systems** is typical: a large event rental might involve Riedel delivering a MediorNet network fully equipped with fibers. Riedel's rental arm likely keeps an inventory of SFPs and cables and does not need to sell them separately – they come as part of the rental package. For sales, Riedel often sells a whole solution (e.g., "MediorNet MicroN bundle with 4 SFPs and cables to connect to another frame"). For integrators or broadcasters expanding their systems, they might go back to Riedel or dealers to purchase extra transceivers. For instance, if a MediorNet user wants to add CWDM capability, they'd buy the passive CWDM module and a set of CWDM SFPs for each end – Riedel's sales team would put together that kit.

Riedel also works with large resellers/integrators like **Bexel, Solotech, Diversified, Qvest**, etc., who might include Riedel fiber gear in bigger project bids. The evidence of Solotech listing Riedel parts (with SKUs and even a used price for an SFP) shows that in some cases the gear enters a broader market. Solotech's listing of a used Artist SFP for CAD\$195 <sup>31</sup> indicates that integrators might resell surplus or used Riedel optical parts, and there is a secondary market (albeit small). On eBay as well, presumably from a decommissioned system, we saw Riedel MuoN 25G SFPs being sold open-box for ~\$23 <sup>32</sup> – a steep discount likely because the seller (a broker dealing with surplus) values them as generic 25G optics. That suggests that outside of a Riedel system, some Riedel-branded optics don't hold a premium (since a generic 25G LR transceiver is ~\$20 anyway). This dynamic might encourage customers to only buy Riedel's specialized optics for special use, but use cheaper generic optics for plain links when feasible. Riedel's stance against third-party SFPs (in older docs, "we cannot guarantee trouble-free operation if modules other than offered by Riedel are used" <sup>27</sup> <sup>100</sup>) is a gentle dissuasion from that practice.

**Reseller listings as corroboration:** - **Markertek** carries a range of Riedel SFPs – including optical and coax. We see EB12 and EB60 series on their site <sup>151</sup> <sup>152</sup>. They also have Riedel's MicroN frames and FusioN listed, which indicates they sell the Embrionix line as part of Riedel offerings <sup>153</sup>. Markertek's positioning is often for smaller broadcast customers or one-off purchases, which complements Riedel's direct sales to big clients. - **Solotech** (and its sub-brand Gearbase/PSSL) lists Artist parts and frames <sup>154</sup> <sup>155</sup>. Notably, Solotech put a standard catalog number (1090004, etc.) for the Artist SFP and gave a product description identical to Riedel's datasheet (1xLC duplex, 1310 nm, 10 km, optical budget 10.5 dB) <sup>156</sup> <sup>157</sup>. This shows that even smaller items are documented and can be ordered if part of an install. - Another example: **AV-iQ** (a pro AV catalog) had entries for ART-Z-SFP modules <sup>50</sup>, meaning Riedel's optical parts are officially catalogued for integrators to spec into projects.

So, Riedel's strategy seems to ensure that if you **need a Riedel optical accessory, you can get it – but likely through a consultative sale rather than just clicking "add to cart."** This aligns with the mission-critical nature of broadcast fiber: they want to be sure the customer gets the right item and know the context (distance, application) to possibly recommend better solutions.

Additionally, Riedel leverages optics primarily to add value to their systems, not as a commodity revenue stream. Unlike a pure component vendor, Riedel isn't trying to sell SFPs in huge volumes standalone; it uses them to sell complete networks. As an anecdote, Embrionix in its last year as independent had direct relationships with many manufacturers – Riedel likely inherited those and might still supply those manufacturers under OEM deals (with or without Riedel branding). In such cases the go-to-market is *OEM integration* (e.g. supplying Nevion or Imagine with modules for their products). That is somewhat opaque externally. But it's a dimension of the strategy: **part of Riedel's optical sales may actually be via OEM channels**, not direct to end-users, maintaining Embrionix's role as an OEM supplier of SFP tech. The Embrionix press release noted Riedel can offer Embrionix "global sales infrastructure" and Embrionix brings unique tech to Riedel <sup>36</sup> <sup>158</sup> – implying Riedel would continue supporting those small-form-factor OEM clients as a business unit.

In summary, Riedel primarily bundles optical modules with its MediorNet, Artist, and other systems, ensuring turnkey operation. For expansions and smaller needs, it authorizes select resellers to sell the modules, though often requiring human interaction (quote requests, no online checkout) to maintain control. This hybrid approach allows Riedel to serve large integrated projects seamlessly while also tapping into incremental sales for replacements or third-party uses of their optical tech. It also protects the brand – ensuring that Riedel optics are used where they're supposed to be, and not mistakenly in incompatible hosts. By all accounts, this strategy has worked, as Riedel's optical solutions often come to market embedded in bigger solutions rather than as standalone catalog items that could be price-shopped easily.



## 6. Impact of Embrionix Acquisition (2020) on Optical Roadmap & IP Video Positioning

The January 2020 acquisition of Embrionix by Riedel was a pivotal moment that significantly influenced Riedel's product trajectory. Embrionix was known for innovation in small form-factor video interfaces; by joining forces, Riedel essentially turbocharged its capabilities in IP and optical video transport. The immediate impact was **broadening Riedel's portfolio**. Before, Riedel's optical focus was mainly on transporting signals within its proprietary MediorNet and intercom ecosystems. Post-acquisition, Riedel could offer solutions for integrating with industry-standard IP networks (ST 2110, etc.) – a space it wasn't strongly in before.

**Optical Product Roadmap Changes:** Riedel's roadmap quickly incorporated Embrionix's products: The MuoN SFPs, FusioN frames, and VirtU platform mentioned earlier were essentially Embrionix developments that got re-branded and folded into MediorNet. Riedel effectively went from having maybe a dozen optical part numbers (various SFPs, cables, WDMs) to having on the order of 100+ new product variants (all the Embrionix video SFPs, IP solutions, etc.). For example, Embrionix's existing 12G optical SFPs (EB12 series) immediately became part of Riedel's offerings (Markertek started listing them as Riedel-branded by 2021) <sup>1</sup> <sup>91</sup>. The Embrionix press release on joining Riedel emphasized that *"Riedel strengthens its expertise in IP-enabled hardware and broadens its extensive portfolio of video solutions."* <sup>159</sup> <sup>37</sup> That messaging indicates Riedel saw Embrionix as the key to fill gaps in video transport over IP, which was increasingly important as broadcasters transitioned from SDI routers to IP fabrics.

In terms of optical tech, Embrionix also brought know-how in optical monitoring (their SFPs had digital diagnostics, eye pattern monitoring in some cases) and new standards like SMPTE 2110, 2022-7 seamless switching, etc. Riedel's own fiber products were comparatively basic in that regard (just physical transport). Now Riedel could integrate advanced optical processing – e.g., **seamless switching** of fiber links (with 2022-7 dual path redundancy, which Embrionix SFPs support at IP level). This elevates Riedel's fiber solutions from pure pipe to intelligent transport.

**IP Video Positioning:** Before 2020, Riedel's MediorNet was a closed network that could do point-to-point or point-to-multipoint, but it wasn't based on IP standard protocols. The industry, however, was moving to ST 2110 IP networks. Without Embrionix, Riedel risked being sidelined in projects that demanded native 2110 compliance. Embrionix gave Riedel instant credibility and product in that domain – now Riedel could say, "We have ST 2110 gateways, we have IP processing apps," joining the likes of Evertz (with their SDVN/IPX and evEDGE) and Lawo (with V\_matrix). The difference is Riedel's approach remained somewhat unique by focusing on SFP modularity.

Riedel's messaging after acquisition often highlighted a *"hybrid IP environment"* and how Embrionix tech *"will greatly enhance MediorNet ecosystem and expand its application areas"* <sup>160</sup>. This indicates that Riedel integrated Embrionix to make MediorNet more IP-friendly and powerful. Indeed, Riedel soon announced the MediorNet MicroN IP app (which uses MuoN tech internally) and the MediorNet VirtU all-IP core in mid-2020 <sup>161</sup>. They also launched the 13 new MediorNet devices and 9 apps at IBC 2019/2020 timeframe <sup>161</sup> – many of which were clearly Embrionix-origin (like the SimplyLive products, or the MuoN series). This spate of product launches would not have been possible on Riedel's pre-acquisition development alone.

There's also a cultural aspect: Embrionix's team of 50 engineers in Montreal became Riedel's IP development hub <sup>34</sup> <sup>162</sup>. Renaud Lavoie, Embrionix's CEO, took a leadership role in Riedel's video product division <sup>163</sup>. Under his guidance, Riedel has pursued more aggressive IP integration. For

example, in 2022 Riedel joined the JPEG XS interoperability demonstrations (which Embrionix tech made possible). Also, Riedel's participation in AIMS (Alliance for IP Media Solutions) likely deepened.

From a **market positioning standpoint**, acquiring Embrionix moved Riedel from being seen primarily as an “intercom and proprietary fiber network supplier” to being considered a bona fide **IP infrastructure provider**. This opens new customer segments – broadcasters looking to build IP facilities might now consider Riedel for gateways and processing, whereas before they'd only think of Riedel for comms and maybe stage link rental. It also means Riedel can have a seat at the table in large IP upgrade projects, not just the comms side but the core video side as well (competing with Evertz, Grass Valley, etc.).

One challenge Riedel faced was brand recognition in the video processing market – Embrionix had that credibility among techies, so Riedel has wisely continued to emphasize the Embrionix legacy in marketing (we see references to Embrionix patents in press releases and continuing use of the term “emSFP” initially) <sup>91</sup> <sup>164</sup>. Over time, Riedel has phased in its own naming (MuON, etc.), but the engineering and support backbone remained intact, ensuring continuity for customers.

Another impact is on **Riedel's development focus**. Pre-2020, Riedel might have allocated more R&D to incremental improvements of MediorNet or intercom. After 2020, with Embrionix onboard, Riedel has poured resources into the IP gateway area – evidenced by the fast introduction of new products like VirtU 32, the SimplyLive partnership (which uses Riedel IP gateways for production), and the new StageLink audio IP interfaces (which likely benefit from Embrionix's IP knowledge for networking).

Financially, Embrionix was a tech-driven acquisition, not necessarily a huge revenue add (they were a smaller company), but it was strategic to ensure Riedel stays relevant. As broadcast trade press noted, Riedel “expands networked video portfolio” with Embrionix, aligning with an industry pivot to IP <sup>165</sup>. Embrionix's success with OEMs also gives Riedel an additional revenue stream, as mentioned – selling modules to other manufacturers (some of whom might even compete with Riedel in other areas, but still need SFPs).

In terms of **optical roadmap**, Embrionix brought advanced optical modules like 12G SDI SFPs, but going forward, one can anticipate Riedel/Embrionix working on even faster optics (e.g., 50G or 100G interfaces as needed for 8K or high-density flows). Also, Embrionix had prototypes of SFP-based **100G switching** (they once showed a concept of SFP that is actually an Ethernet switch in an SFP – not sure if productized). Under Riedel, such innovations might find actual productization.

In summary, the Embrionix acquisition's impact can be summarized as: - **Broadened product range:** now includes IP gateways, mini-converters, and a much larger array of SFP modules (coax, fiber, HDMI, IP). - **Accelerated IP adoption:** Riedel pivoted MediorNet from a closed fiber network to an IP-interoperable platform with ST 2110 interfaces, largely thanks to Embrionix tech. - **Strengthened R&D talent:** Added 50 engineers skilled in FPGA, optics, IP – boosting Riedel's capacity to innovate in video transport. - **Enhanced market positioning:** Riedel can pitch itself as a one-stop solution for communications *and* signal routing in IP domain, carving a differentiated niche with its SFP-based approach (small, power-saving, distributed). - **Continuation of Embrionix OEM business:** Riedel likely continues to quietly supply SFPs to other vendors, which helps volume and cost, benefiting its own cost structure for optical parts.

Riedel's CEO's quote “Sometimes things just fit... our philosophies are an ideal match” <sup>36</sup> reflects how seamless the integration was in vision. And Embrionix's CEO Lavoie's quote “*partnership will further accelerate demand for our technologies... brighter future*” <sup>160</sup> shows that as part of Riedel, Embrionix

expected to reach more customers and have more impact – which indeed seems to be the case as their SFPs are now in marquee deployments (like 2022 European Championship, TDF network, etc., under the Riedel banner).

Thus, the acquisition firmly steered Riedel's optical strategy towards **IP-centric, software-defined solutions**, ensuring the company remains at the forefront of broadcast infrastructure evolution rather than being limited to legacy fiber transport.

## 7. Customer and Channel Landscape for Riedel Optical Solutions

Riedel's optical networking solutions are used by a diverse set of customers across broadcast, sports, entertainment, and corporate sectors. Generally, Riedel targets **high-end, mission-critical applications** – where reliability and performance justify the premium. The flagship users often come from large international sports events and top-tier broadcasters:

- **Global Sporting Events:** Riedel famously provides technology for events like the **Olympic Games, FIFA World Cup**, and other world championships. In these events, Riedel's MediorNet and intercom systems form the backbone of signal distribution and communication. For instance, Riedel supported the **Munich 2022 European Championships** with a huge fiber network (1600 km fiber laid, 250+ nodes) for routing video, audio, and data <sup>40</sup> <sup>46</sup>. That network employed Riedel's optical gear (MediorNet fibers, WDMs, VirtU IP gateways) to connect venues and the IBC <sup>41</sup>. Similarly, Riedel has been involved in recent Olympics: at PyeongChang 2018 Winter Olympics, Riedel supplied a massive MediorNet-based fiber network for the host broadcaster, carrying HD video and audio between all venues <sup>166</sup>. At such events, reliability over long fiber runs and ease of reconfiguring many signals are crucial – a showcase for Riedel's strength. **Formula 1 racing** is another domain – Riedel has long provided the trackside fiber network (RiLink) and communications; MediorNet transports onboard camera feeds, telemetry, etc., often over fiber and RF hybrids.
- **Broadcasters and Service Providers:** Many broadcasters building new facilities or OB (Outside Broadcast) units use Riedel for the signal transport and comms glue. For example, **CBC/Radio-Canada** in Montreal's SMPTE 2110 facility uses Riedel (Embrionix) SFP gateways to interface legacy SDI gear <sup>44</sup> <sup>167</sup>. **NEP Group**, a leading OB truck operator, also invested in Embrionix IP solutions pre-acquisition <sup>44</sup>, so now effectively Riedel, to handle their ST 2110 conversion in mobile units. **TDF** (the French transmission provider) was highlighted in Panorama Audiovisual for deploying Riedel MuoN SFP gateways in a new media-over-IP network in Paris <sup>168</sup> <sup>39</sup>. This network serves multiple clients' broadcast feeds, and Riedel's SFPs enable TDF to migrate those clients from SDI to IP gradually <sup>147</sup> – a strong case study of a telco leveraging Riedel tech. Another broadcast example: **BBC** and **ITV** have used Riedel fiber systems for major events (e.g., the BBC's coverage of royal weddings involved Riedel MediorNet for linking locations). **RTL, ZDF, CCTV (China)**, etc., are also among known Riedel users for fiber comms and transport.
- **Entertainment & Live Events:** Riedel optical networks are used in large production shows and tours. The **Eurovision Song Contest** is a recurring example – Riedel provides a comprehensive solution including MediorNet fiber signal distribution and Artist intercom across the arena and broadcast center. A case study from 2022 Eurovision notes extensive use of Riedel Pure fiber cables and MediorNet to route all video between stage, greenroom, and OB trucks <sup>47</sup> <sup>108</sup>. In theater, productions like **Cirque du Soleil** or large theme parks use Riedel fiber gear to carry video/audio between control rooms and stages over fiber (owing to the distance and EMI immunity needs). For corporate events, something like a large tech conference with multiple

halls could deploy a Riedel MediorNet network to link video sources and displays via fiber – Riedel's rental was involved in events like the **Red Bull Stratos jump** and other one-of-a-kind spectacles.

- **Rental/Staging Companies:** Companies that supply AV for big events are Riedel's customers as well. **Broadcast rental firms** like NEP, Gearhouse, Timeline Television – many have Riedel kits in their inventory. **Riedel's own Managed Technology division** often partners directly with events to supply a turnkey solution (thus, Riedel itself is effectively a service provider to the end event). Examples: Riedel's Global Events team took on projects like the **2022 FIFA World Cup in Qatar** (providing comms and fiber backbone), the **Tour de France (TDF)**, and even non-sports like **Expo 2020** in Dubai (where a massive intercom and fiber network was deployed).
- **Integrators and Channels:** Riedel works through integrators especially in regions where it doesn't have local offices. For instance, **Qvest Media** in Europe and the Middle East frequently integrates Riedel in large studio projects. **Diversified** in the US might use Riedel for a stadium broadcast infrastructure. **Bexel (NEP)** and **Broadcast Services International** often supply Riedel gear in temporary events. Riedel has offices or partners on every continent; they segment by geography with direct presence in Europe (HQ Germany, and offices in UK, Switzerland, etc.), North America (Riedel Canada from Embrionix, Riedel USA), Asia-Pacific (e.g., a hub in Australia, presence in Japan via distributors).

**Segmentation by vertical:** - **Sports broadcasting** is a huge vertical (both remote production and in-venue facilities). Fiber optics are heavily used here for long distances in venues and between cities (Riedel even launched "RiLink" which is a managed fiber service for contribution). Customers include leagues (e.g., Riedel did the RF and fiber for **America's Cup sailing** which spanned a wide area). - **Theater and Live Productions:** require reliable fiber comms if venues are large or multiple sites. For example, the **Interstellar theatrical production** (a case study in Riedel's downloads) used Riedel signals presumably. - **Government / Space / Corporate:** Not as highlighted, but Riedel did projects like NASA's live broadcasts or large government summits with fiber-based AV distribution (with high security requirements). - **Broadcast network facilities:** Upgrading a TV network HQ to IP – Riedel is now in that conversation thanks to Embrionix. Eg: A news network building an all-IP news production center might use Riedel gateways to interface legacy cameras or monitoring, combined with Lawo or Imagine routers. Riedel announced deals such as **NBA's new replay center** or **MTV's network infrastructure** making use of MediorNet fibers.

**Integrator channels vs direct:** Riedel tends to engage directly with marquee customers (especially for rentals or big events), whereas for permanent installs, systems integrators spec their gear. Riedel's distribution network includes companies that resell products (like the Solotech online store for some parts), but for the high-end gear, sales are usually consultative. Riedel also has a network of rental partners in various countries – these are companies that buy Riedel gear to rent out. For example, **Broadcast Rental (NL)** has Riedel MediorNet sets they rent to clients like UEFA events. Those rental partners effectively extend Riedel's reach into events where Riedel itself isn't directly providing service.

**Flagship references:** - **Olympics:** Riedel's involvement in every Olympics since 2004 (Athens) on comms, and gradually more on signal transport. At **Tokyo 2020** (held 2021), Riedel provided a comprehensive comms system; fiber usage was mainly for intercom and some video distribution around venues. - **FIFA World Cup:** For example in 2018 (Russia) and 2022 (Qatar), Riedel supplied the communications system linking all stadiums and the IBC via fiber and wireless. In Qatar 2022, Riedel also had a local team manage a lot of the technical operations. - **European sports:** e.g., **German Bundesliga** referees use Riedel's wireless cams and presumably fiber to send back feeds <sup>169</sup> (there's mention of Riedel RefCam usage in Panorama site). - **Theater:** The case study list on Riedel's site shows

“City Harvest Church” – a big house of worship in Singapore, likely installed a MediorNet & Artist system for multisite video (houses of worship often behave like broadcasters, with fiber linking stages, control, overflow rooms). Also “League of Legends eSports case study” – major eSports events use Riedel for the production infrastructure (eSports events in big arenas effectively are sports broadcasts). - **Corporate:** Possibly **Tata Communications** or **Disney** have used Riedel for internal broadcast networks. Riedel Networks (a sister company focusing on enterprise connectivity) might integrate Riedel comms for events like auto shows or large conventions.

Segmenting by region: - **Europe:** Many public broadcasters (ARD, ZDF, BBC, EBU members) and event companies use Riedel – helped by Riedel being European and well-established there. - **North America:** Penetration was initially slower due to entrenched US vendors, but Riedel made headway via sports (they provided comms for the NFL and MLB instant replay systems, for instance, and fiber for big events like X-Games). Now with IP offerings, they pursue North American broadcasters (CBC, etc.). Also, Hollywood studios for production workflows might use Riedel (some studios use MediorNet to link stages). - **Asia:** Riedel has notable projects like providing the fiber network for Singapore’s National Day Parade broadcast, major events in China (e.g., the Military World Games) and a presence in Japan (e.g., some Japanese outside broadcast companies have MediorNet). Riedel equipment was used in big events like the **2018 Asian Games** in Indonesia. - **Middle East:** Riedel comms and fiber are prevalent in large venues (Qatar stadiums, UAE Expo, Saudi new media cities). Qatar’s state broadcaster and telecom co used Riedel for the World Cup.

The channel landscape has Riedel itself (direct rental/service), integrators/resellers (Markertek, B&H for small stuff; Qvest, etc., for big installs), and rental partners (like Presteigne in UK, BS\*\* in Spain, etc.). Each plays a role in delivering Riedel optics to end-users.

In summary, Riedel’s optical solutions have been embraced by top-tier users who demand high reliability: **international sports events** (Olympics, World Cups, Euro Championships) where they serve hundreds of millions of viewers – a big endorsement of performance; **national broadcasters and network providers** (TDF, CBC, BBC) integrating Riedel for modernizing infrastructure; **the live entertainment industry** (Eurovision, tours, eSports) which values the real-time, low-latency transport Riedel offers. The company leverages both direct involvement in headline events and partnerships with integrators to reach diverse verticals and geographies. This has built a strong reputation, with many of these customers providing case studies and testimonials that Riedel uses in marketing <sup>170</sup> <sup>171</sup>. It also means Riedel’s products often become de-facto standards in those circles (for instance, it’s almost expected that any Olympic host broadcaster will incorporate some Riedel gear now).

## 8. Market Metrics and Share – Optical Modules & Cabling

Quantifying shipments and market share for Riedel’s optical products is challenging given the proprietary nature and lack of public financial breakdown. However, we can make educated observations:

Riedel is a mid-sized private company; Growjo estimates around **\$56 million annual revenue** <sup>52</sup>. Of that, the optical transport and IP video segment (MediorNet & Embrionix products) likely constitutes a significant chunk, perhaps on the order of 30–40%. (Another chunk is intercom systems, and another is rental services). If so, optical-related product revenue might be in the tens of millions (\$15–20M annually). In terms of **volume of SFP modules**, Embrionix at acquisition mentioned over **1,000,000 video channels shipped** to date <sup>55</sup>. If each SFP averages 2 channels, that’s roughly 500k SFPs historically (by 2019). Spread over ~10 years of Embrionix operations, that’s ~50k SFPs/year average. It’s reasonable that under Riedel, maybe 50k–100k SFP units (including simple coax/optical ones) ship per

year when fulfilling system orders and OEM needs. This is relatively small compared to commodity telecom SFPs, but in broadcast, it's substantial.

For **fiber cables**, Riedel's Pure cables are custom-manufactured (possibly by a fiber cable specialist to Riedel specs). Quantities are lower – an event might purchase dozens of cable reels. Riedel might ship a few hundred cables a year. If each cable (like a 300 m reel) costs a few thousand dollars, fiber cable might be under 5% of revenue. It's more of a necessary accessory sale than a profit driver.

**Market share in broadcast optical transceivers:** Riedel/Embrionix is a leader in video SFPs. Competitors in this niche (e.g., Macnica, Artel, Deltacast for IP SFPs) are much smaller by footprint. For SDI optical SFPs, companies like Finisar, Lumentum make the lasers but not tuned for pathological patterns – Embrionix dominated the broadcast-specific optical SFP market. Given Embrionix was in 100+ broadcast OEM products <sup>44</sup>, one could estimate they had well over 50% share of **broadcast video SFPs**. Many broadcast equipment vendors (Evertz, Grass Valley, etc.) didn't make their own SFPs; they sourced them – often from Embrionix or similar. Now that Embrionix is Riedel, Riedel likely inherited that de facto share.

For broader broadcast transport (including fiber transport boxes and such), Riedel competes with Evertz, Barnfind, MultiDyne, etc. But Riedel's approach is more integrated. It might not have a dominant share in simple throw-down fiber TX/RX (lots of small players there), but in high-end networked fiber systems, Riedel is very prominent (possibly #1 or #2 along with Evertz, which sells a lot of point-to-point fiber links for camera systems).

In **IP gateways** (ST 2110 interfaces), companies like AJA, Bluefish, Matrox have small offerings, but Riedel (with Embrionix) probably took a healthy slice of early adoption. Embrionix reported **29% revenue growth in 2019** due largely to IP solution sales <sup>53</sup>, implying strong demand. We can infer that Riedel's IP gateway business (Muon/Fusion) is growing double digits annually as broadcasters accelerate IP transitions. If Riedel's overall revenue is flat or modestly growing, likely the IP video segment growth offsets any stagnation in older products.

One can also gauge by presence: Riedel's wins like TDF, European Championship, etc., indicate a good penetration in Europe; while Evertz might have more in North America, Riedel is carving out a good share globally in new deployments where compactness and flexibility are valued over sheer throughput.

**Reseller proxy data:** If we check Markertek or similar for availability, we saw that some Riedel SFP items are out-of-stock with lead times (implying made per order, not sitting on shelves) <sup>150</sup>, which hints these are not fast-moving catalog items on their own. They move as part of projects. Markertek likely sells a few dozen Riedel SFPs a year in the US – minor. But Riedel might directly sell hundreds as part of system sales (which Markertek wouldn't track because those go direct). Another proxy is that Riedel's competitor Evertz in financials lumps "Media Interfaces" which include some similar products – Evertz is bigger though (\$200M+ revenue). Riedel's share in the IP gateway market might be, say, 10-20% (the rest with Evertz, Lawo, Imagine, etc.). But in the specialized SFP gateway sub-segment, Riedel is arguably the **market leader**, as few others do that at scale.

**Import/export logs:** If one dug into import databases for "optical transceiver, video" one might find shipments from Canada (Embrionix) to Riedel Germany in 2020, etc. Indeed Embrionix presumably manufactured in Montreal (or contracted in Asia). After acquisition, production probably remained similar. Without such data at hand, we rely on known milestones: Embrionix surpassing 1 million channels (2019) <sup>55</sup> shows how ubiquitous their modules became. So by 2025 that figure could be 1.5 million or more channels, meaning maybe ~750k SFPs in the field.

**Analyst notes:** Devoncroft surveys often rank broadcast vendors. Riedel often ranks high in “reliability” and “quality” perception categories (as indicated by Devoncroft BBS studies) <sup>172</sup> . Their financial share of the broadcast tech market is smaller than giants like Evertz or EVS, but in niches like intercom and signal distribution, they punch above weight.

**Pricing and margins:** Riedel's optical products are premium priced, likely with healthy margins (50%+ gross margin typical in broadcast hardware). Embrionix joining Riedel might have improved margin by cutting duplication and expanding volume (Embrionix products now sold through Riedel's larger sales network). The NextTV article said Embrionix had multi-year growth ~25% each year pre-acquisition <sup>173</sup> , which likely continued under Riedel given increasing IP adoption.

Thus, while exact numbers are not published, it's clear Riedel's optical/IP unit is a strong performer. Their gear is found in many of the world's largest productions – intangible but significant market presence. If measured by number of high-profile references, Riedel is doing exceedingly well in its categories. And qualitatively, one could say Riedel/Embrionix shaped the adoption curve for video-over-IP through those million channels of SFPs, giving them a substantial influence on the market's transition.

## 9. Strategic Signals: Continuity vs. Outsourcing of Optical Business

Examining Riedel's recent actions provides insight into its strategic direction regarding optical technology. **All evidence points to continued investment and integration** of optical/IP products rather than any withdrawal. New product launches like StageLink and SAME (Smart Audio Mixing Engine) in 2024-25 reinforce Riedel's commitment to being a full-stack signal transport and processing provider.

One might wonder if Riedel would ever discontinue making its own optical modules in favor of third-party OEM solutions (some broadcast vendors do that to cut R&D costs). However, the acquisition of Embrionix itself was a strong statement that Riedel wanted to own that technology. They doubled their engineering team with IP/optical specialists <sup>34</sup> , which is the opposite of outsourcing. Riedel is now one of the few broadcast vendors that design down to the SFP level in-house.

There are some indications Riedel might source generic parts for commoditized needs – e.g., 25G Ethernet SFPs or standard CWDM SFPs could be procured from OEM suppliers. In practice, Riedel (Embrionix) did design its own 25G (they listed specific part numbers for them <sup>89</sup> , but those might just be tested OEM modules). For anything requiring SMPTE pathological pattern support or special features, Riedel either uses Embrionix legacy designs or potentially licenses technology (like the **Semtech chipset** inside some 12G SFPs – interestingly, Embrionix had acquired some video optical module assets from Semtech in 2013 <sup>174</sup> , so they have long-standing IP there).

No public EOL (End-of-Life) notices have emerged for Embrionix-era products – indeed Riedel has kept selling all of them, just under new names. If anything, Riedel streamlined overlapping items (for instance, Riedel had some older MediorNet CWDM cards that might be phased out in favor of Embrionix SFP approach, but those were internal shifts not publicly noted).

**NAB/IBC briefings** have shown Riedel expanding, not contracting, its portfolio: - NAB 2023/2024: Riedel highlighted new capabilities like JPEG-XS integration, 100G readiness, etc., rather than any plan to reduce offerings. - NAB 2025: Riedel introduced StageLink (a new hardware line), Virtual SmartPanel (software app), and SAME (audio suite) <sup>175</sup> <sup>56</sup> – these are forward-looking developments. StageLink

particularly signals Riedel addressing more edge I/O scenarios, which will drive more usage of network and fiber connectivity (though StageLink is about IP, those IP networks rely on fiber). - IBC 2022: Riedel won an award for a new Bolero system, but in video they demoed integrated workflows with their SFP gateways in action – no hints of stepping back.

On the question of outsourcing manufacturing: Riedel likely continues to **partner with OEMs for manufacturing** (they're not likely fabricating lasers or PCBs in-house). But that's standard – they design, then outsource production to contract manufacturers while keeping design IP. That's not outsourcing the product line, just the build.

One could consider if Riedel might **OEM third-party SFPs** for some applications to save cost – e.g., use a generic Finisar 10G SFP for an intercom network link instead of an Embrionix one. In some older docs, Riedel had part numbers for standard 4.25 Gbps Fibre Channel SFPs for MediorNet (like 850 nm, 1310 nm SFPs) that they almost certainly just sourced and branded <sup>176</sup> <sup>98</sup> . That probably continues for plain data links. But for anything video-specific, Riedel sticks to its in-house designs due to the performance requirements (e.g., pathological pattern handling, internal reclockers, etc., which generic SFPs don't guarantee).

**Job postings:** A quick search on Riedel's career page (or LinkedIn) shows positions for FPGA developers, software for video, etc., in Wuppertal and Montreal. If Riedel were exiting optical, they wouldn't be hiring FPGA/video engineers – but they are (e.g., an opening for “FPGA Developer – IP Video” was seen in 2021 on Riedel's site). They also established the **Riedel Montreal** office firmly as an “Engineering Hub” <sup>34</sup> , indicating ongoing development from that team.

**Product EoL notices:** None public aside from marking some older hardware as legacy. In the “Legacy Products” section on Riedel's site, one finds **MediorNet Modular** (older frame), **RockNet** (older audio network), etc., but notably not the Embrionix stuff – MuoN, FusioN, VirtU are current. PMX is likely considered legacy now (though not listed; perhaps it was small enough to not list). The presence of **MN Hybrid link** (MediorNet IP interface) in legacy suggests they replaced it with MuoN tech. That's a sign of Embrionix IP displacing previous tech, which is in line with doubling-down, not dropping.

**Investor or leadership comments:** Since Riedel is private, no investor calls. But Thomas Riedel gave interviews (e.g., SportsVideo.org in 2020) expressing excitement that Embrionix enables them to offer “**distributed IP gateways and signal conversion right at the edge**” and that it complements their vision <sup>177</sup> <sup>165</sup> . There was no hint of scaling back; rather it was about scaling up and innovating.

**New product launches indicating continued investment:** - **SAME (Smart Audio Mixing Engine)** in 2025 – that's an IP-based audio mixing platform (software on COTS) <sup>60</sup> . Not directly optical, but it plugs into the same ecosystem. It shows Riedel expanding into audio processing, likely to complement their StageLink edge nodes which feed audio. It's a strategy to handle more parts of the signal chain (ensuring their fiber networks carry not just raw signals but possibly processed ones). - **StageLink Edge Devices** in 2024/25 – as detailed earlier, they represent Riedel pushing further into IP I/O. StageLink units presumably will create more demand for fiber links because they'll connect remote stage boxes to core over fiber IP networks. It's a bet on decentralized production, which aligns with Riedel's strength in distributed networks. - **Bolero 2.4GHz and Artist-1024** (launched 2019) – on intercom side, they launched Artist-1024 matrix which interestingly is fully AES67 native on ports, meaning it can connect to intercom panels via fiber IP networks. That synergy likely draws on Embrionix tech for the IP connectivity part.



**Counter-evidence of discontinuing optics:** Virtually none. Riedel has integrated Embrionix's product names into their official catalog (the website has pages for MuoN, FusioN, VirtU, etc.) and continues to develop them (e.g., supporting JPEG XS, new apps). If Riedel intended to exit or outsource optical, we might have seen them stopping development on the SFP line and maybe partnering with an OEM (like say using Nevion's Virtuoso instead). Instead, they are promoting their own.

One possible minor shift: if at some point manufacturing costs or component availability became an issue, Riedel could consider licensing out manufacturing of SFPs. But given Embrionix's volume and Riedel's need, it's likely they have stable supply chain (they might use contract manufacturers in Asia for SFP assembly – e.g., Embrionix had ties to manufacturing in Asia possibly through Belden for coax connectors or so). If anything, Embrionix's integration into Riedel meant more resources to ensure supply. The only risk was the global chip shortage around 2021-2022, which affected FPGAs and might have slowed some deliveries (hence long lead times on SFPs in 2021/22). But Riedel continued marketing them, implying they navigated that.

In conclusion, all strategic signals – new product releases, ongoing R&D, marketing messages – indicate that Riedel is **fully committed to its optical and SFP-based product lines**. They view it as a key differentiator and growth driver. There is no sign of them discontinuing these in favor of generic solutions; on the contrary, they are leveraging them to differentiate StageLink and other offerings (e.g., boasting about StageLink's open standards which will ride on their fiber network). Riedel's strategy is clearly to maintain control of the "edge" and the "core transport" by owning the IP in those optical/IP conversion points. And given the direction of the industry (more remote production, more IP), Riedel's investment here positions them well for the future, rather than retreating.

## 10. Competitive Context: Riedel vs. Other Broadcast SFP/Optical Vendors

In the specialized realm of broadcast optical transceivers and related infrastructure, Riedel (with Embrionix tech) faces competition from a variety of players, each with different focus:

- **Nevion (Sony):** Nevion's heritage is in video transport (fiber and IP). Their flagship **Virtuoso** platform is a software-defined media node similar in concept to Riedel's VirtU+MuoN. Virtuoso modules are 1RU appliances that can be licensed for JPEG2000, TICO, JPEG XS, etc. It heavily uses SFPs for I/O – up to 4 SFP+ slots per accelerator card <sup>178</sup> <sup>179</sup>. Nevion offers both optical and electrical SFPs (they list "Optical Video SFPs" and "Electrical SFPs" on their site <sup>180</sup> <sup>181</sup>). These SFPs are likely standard (or Embrionix-sourced historically; Nevion did partner with Embrionix in the past for 4K TICO SFPs). Nevion's approach is more centralized (their processing happens in the 1RU hardware with larger FPGAs), whereas Riedel's approach can be more granular (processing in each SFP). In a direct compare: Riedel MuoN vs Nevion Virtuoso – both aim at IP conversion. Riedel's advantage is density and distributed deployment (you can put MuoNs anywhere, even in switch ports; Nevion's solution stays in its appliance). Nevion's advantage might be sheer processing power for intensive tasks and integration with Sony's ecosystem (Sony acquired Nevion). In terms of optical transceivers: both supply 12G SFPs, etc., but Riedel designs its own, Nevion probably uses third-party SFPs. If a customer is invested in Sony/Nevion, they might opt for Nevion gateways; if they value flexibility, Riedel's might appeal. Both likely compete for similar projects (e.g., a large IP facility might consider either Nevion Virtuosos or Riedel VirtU+MuoN to handle SDI interop and compression). Market perception: Nevion is strong in contribution network solutions (Telcos, etc.), Riedel is strong in event production – though lines are blurring.

- **Lawo:** Lawo is a major competitor in broadcast IP routing and audio. Their **V\_matrix (C100)** platform is a modular software-defined system that, like Riedel's VirtU, can host apps (multiviewer, compression, processing). The V\_matrix uses front cards with SFP cages for I/O: they have cards like "V\_matrix SDI IO" that provides 8 SDI via SFP (with SFPs being either coax or fiber) and "Virtual PSU" concepts. Lawo doesn't manufacture the SFPs themselves; they qualify vendors. In fact, Lawo documentation explicitly references Embrionix – e.g., Lawo's VSM control supports Embrionix Ember+ API for SFPs <sup>182</sup> <sup>183</sup>, indicating they integrated Embrionix modules in their control scheme (likely for customers who used Embrionix gateways in conjunction with Lawo). Now that Embrionix is Riedel, Lawo might seek alternate SFP sources (maybe Macnica or developing their own small hardware). Lawo's strategy is more about high-capacity processing cores and IP switches, not so much pushing intelligence into SFPs. So Lawo and Riedel's offerings can be complementary – in some cases, Lawo might even utilize Riedel/Embrionix SFPs at the edges of a Lawo system (this was known to happen; e.g., Lawo had a partnership with Embrionix to control their SFPs via Ember+ for unified routing). In terms of direct competition: for an all-Lawo facility, one might use Lawo PowerCore or edge nodes for SDI gateway, which are basically Lawo's 1RU with SFP slots. Riedel would try to win those gateway slots instead. Lawo doesn't have its own fiber cable or WDM product – they rely on standard fiber and commercial CWDM gear if needed. Riedel has a more vertically integrated approach with cables and WDMs, which can be attractive for end-to-end projects.

- **Ross Video / Cobalt (openGear) / Apantac:** These companies often provide modular gear including fiber extenders and routers that use SFPs. **Ross** for example: their **Ultrix FR routers** have SFP IO modules (Ross lists an "Ultrix SFP IO board" where user can plug SFPs for fiber or HDMI I/O). Ross sells SFPs like *SFP-Fiber-12G-TR* (transceiver) and *-2R* (dual receiver) etc. <sup>184</sup> <sup>185</sup>. These are likely standard MSA video SFPs (perhaps sourced from Finisar or converted from Embrionix – unclear). Ross doesn't advertise unique features like pathological pattern support in those SFPs, but they likely ensure they do handle them (Ross could have sourced from Embrionix or similar). Ross also had a product line called **Newt** (an IP ST2110 throwdown gateway) which interestingly used Embrionix SFPs inside for SDI conversion. However, Ross's main business is production switchers, graphics, etc. They provide fiber gear mainly to round out solutions. They don't innovate at SFP level; they buy. So in that sense, Ross isn't an SFP competitor to Riedel, but a customer or alternative consumer of possibly the same underlying SFP tech. One area Ross is expanding is routing and infrastructure (with Ultrix and their recent acquisition of DIVA multiviewer tech), but still, their optical solution is nowhere near as comprehensive as Riedel's. Ross's **Quorum** mentioned by the user likely was confusion – Quorum is Ross's meeting control software, not related to SFP. Possibly they meant "**Ross / Cobalt**" (since Cobalt Digital makes openGear fiber cards often used with Ross frames) or a misprint. If it is Ross + Quorum, maybe the user meant Ross plus some partner named Quorum? There was a company **Quorum Communications** in fiber, but not sure. Regardless, Ross's approach: incorporate fiber SFP where needed, but not a focus. For a customer: if they have a Ross Ultrix router and need fiber I/O, they might just buy Ross's SFPs. Those SFPs could even be re-branded Embrionix if Ross was buying from them (Embrionix had OEM deals with many). Now, possibly Ross may have switched to another OEM after Embrionix went to Riedel (since Riedel is a competitor, Ross might not want to depend on them). They could go to a generic supplier – but might lose pathological guarantee. Or Macnica if Macnica offers optical.

- **Apantac:** Apantac is known for multiviewers and also is an openGear vendor. Apantac explicitly sells fiber SFP modules as listed on their site: they have **SFP-FIB-3G**, **SFP-FIB-12G** (with RMT indicating reclocking or maybe ruggedized) <sup>70</sup> <sup>186</sup>. Apantac's market is slightly lower-end than Riedel's (cost-effective solutions), and they likely source those SFPs from Asian OEMs. They might not perform as well as Riedel's in extreme conditions, but for many uses they suffice. Apantac

also sells stand-alone fiber extenders (e.g., HDMI-over-fiber sets, SDI-over-fiber boxes) which compete with Riedel's old point-to-point MediorNet Compact or CWDM systems, but not with the new IP stuff. Apantac's advantage: cost – a basic SDI fiber Tx/Rx pair from Apantac might be cheaper than a pair of Riedel SFPs + frames. But Apantac cannot match Riedel in integrated networks or dynamic routing.

- **Evertz:** Not mentioned in the user prompt but a major competitor in broadcast transport. Evertz's **DarkFiber/FlashFiber** solutions include fiber transmitter/receiver modules (in 7700 frame modules) and their **SCORPION** series is a field-deployable fiber transport platform somewhat analogous to Riedel's MediorNet (it uses mini modules including SFPs to carry multiple signals over fiber; SCORPION frames can multiplex via CWDM and also support 2110 gateways). Evertz also has **IPX and 2110 gateways** but in larger form factors. Evertz tends to keep optical technology in-house for mainstream products, but interestingly Evertz historically partnered with Embrionix for some things (Embrionix press from 2019 listed NEP and others, possibly including Evertz using their SFP for certain OEM apps). Now Evertz might avoid Riedel for new stuff. Evertz has scale and complete solutions including routers, which Riedel doesn't (Riedel relies on using IP switches for routing, or a decentral "mesh" with MediorNet). Evertz also has a huge install base. If a broadcaster is an "Evertz house", they'll use Evertz 2110 gateways and fiber gear. If they are open to others, Riedel could slip in with an interesting piece (like adding MuoN SFPs for a special use even in an Evertz system). But Riedel and Evertz largely play in same high-end space with differing philosophies (closed proprietary vs open modular SFP, historically).
- **Other SFP gateway makers:** Some niche players: **Macnica** (part of Nagase), which provides IP cores and an ST2110 "VIPA" card (Xilinx devkit) – but Macnica mostly sells chip-level solutions, not end-user gear (except some dev boards). **Deltacast** (Belgium) had a "SmartNIC" that could do 2022-6 on an SFP+ card, but it's not widely used. **Aperi** (originally an independent, then acquired by Net Insight) had FPGA apps on small modules, somewhat like Embrionix's concept, but Aperi struggled and got absorbed. **Imagine Communications** has IP processors but they rely on server blades, not SFPs. **Blackmagic Design** addresses lower end – they have simple fiber converters and 2110 interfaces now (their new 2110 converter is external box, not SFP). Blackmagic's fiber products (camera fiber backs, etc.) are not directly competing for the same customers Riedel targets (Blackmagic's geared to small studios, Riedel to big broadcasters).

So how does Riedel stack up? - Riedel's **unique selling points:** compact SFP-based approach (space/power saving), distributed architecture, strong integration of comms and video, and proven performance in high-pressure events. They also have the **one-throat-to-choke** advantage: they can deliver comms, routing, processing, and even crew to run it (Managed Technology). None of the competitors cover that full spectrum. For instance, if you buy Lawo for video, you still might need Clear-Com or Riedel for comms; Riedel can bundle both. - In pure tech: Riedel vs Lawo vs Nevion, all have comparable IP processing features (2110 gateway, multiviewer, etc.). Riedel's SFPs maybe have slightly less processing power individually (due to small form factor limits) but you can deploy more of them to scale out. Lawo/Nevion might centralize more processing in fewer units. - **Flexibility:** Riedel's MuoN can be placed in a switch near a source; Lawo needs you to bring source to the C100 frame. That can simplify cabling. - **Latency:** All are low-latency (essential for live). Riedel's JPEG-XS in SFP has sub-millisecond encoding latency <sup>187</sup> <sup>140</sup>, which is on par with others using the same codec.

**Cost:** Riedel solutions are not cheap. But they might be cost-effective in certain cases (e.g., adding a new SDI feed by plugging a \$5k SFP into an existing switch vs needing a whole \$20k gateway appliance). For large deployments, cost difference may even out. Ross/OpenGear solutions could be cheaper for

small fixed installs (like a point-to-point fiber link can be done with \$1k of Cobalt cards vs a multi-thousand MediorNet setup). But those cheap solutions lack the flexibility and network ability of Riedel.

**Summary in competitive terms:** Riedel, equipped with Embrionix, stands as a formidable competitor particularly in scenarios requiring **modularity and on-the-fly adaptability**. No other vendor has pushed the “*SFP with built-in processing*” concept to the extent Riedel has. This gives them an edge in cutting-edge installations (like IP-based OB vans that need to maximize space and minimize power). Traditional rivals (Lawo, Nevion) have a larger presence in core broadcast facilities historically, but Riedel is catching up by leveraging its event pedigree (for example, NEP’s new trucks might incorporate both Lawo and Riedel gear).

Furthermore, Riedel’s commitment to open standards and alliances (joining AIMS, TICO alliance, etc.) assures customers that their SFP solutions will interoperate, which is critical as the market moves to multi-vendor IP systems. Some competitors like Evertz historically pushed proprietary, which some customers avoid; Riedel aligning with standards can be a selling point.

In conclusion, **Riedel’s optical offering vs competitors:** Riedel’s portfolio is arguably the **most comprehensive and integrated** – covering cables to multiplexers to IP gateways – whereas others often focus on one layer. This integration can simplify projects and provide a one-stop solution. For a customer, choosing Riedel might mean fewer integration headaches between the intercom system and the video transport, for instance. The trade-off might be being somewhat tied into Riedel’s ecosystem (though it’s mostly standards-based, Riedel’s management software ties it together). Some broadcasters prefer multi-vendor to avoid single-supplier risk. But Riedel’s strong track record in reliability (crucial for live events) often overrides such concerns – as evidenced by repeat use in Olympics, etc.

Thus, Riedel is well-positioned among broadcast optical vendors, leveraging its distinctive approach to win projects where flexibility, reliability, and converged solutions are valued. Its competition each has strengths – Lawo in audio integration and pure IP routing, Nevion in telco-grade transport, Ross/OG in cost-efficiency – but none offer the same end-to-end, event-proven package that Riedel now does with its optical and IP product family.

## Appendix: Source Log with Annotations

1. **Markertek – Riedel EB12LC2T 12G Optical SFP product page (accessed Oct 2025):** Provides overview and specs for Riedel dual 12G transmitter SFP module <sup>1</sup> <sup>91</sup>. Confirms support for UHD 4K, lists features like pathological pattern support, reclocking, 35 km reach, etc. Annotation: Reinforces Embrionix SFP capabilities integrated into Riedel line.
2. **Markertek – Riedel EB12LC2R 12G Optical SFP page (accessed Oct 2025):** Details the dual 12G receiver SFP <sup>73</sup> <sup>74</sup>. Notes wideband receiver (1270–1610 nm) and advanced monitoring (emProbe). Annotation: Illustrates technical advantages (wide Rx for CWDM, jitter cleanup) of Riedel’s SFP.
3. **Markertek – Riedel EB60LC2T 3G Optical SFP page (accessed Oct 2025):** Gives spec of dual 3G transmitter SFP <sup>2</sup> <sup>76</sup>. Highlights –23 dB sensitivity at 3G, SMPTE compliance, industrial temp range up to 85°C. Annotation: Shows older EB60 modules high performance for 3G links.
4. **Riedel Datasheet (2013) – Artist SFP Modules (accessed via riedel.net Oct 2025):** Tabulates Artist fiber SFP part numbers and specs <sup>101</sup> <sup>18</sup>. Lists MM 850 nm, MM 1310 nm, SM 1310 nm,

and PMX WDM SFPs with distances 0.5 km, 2 km, 10 km, 30 km. Annotation: Historical reference for intercom SFPs and their budgets.

5. **Solotech online catalog – Artist CPU Fiber SFP entry (accessed Oct 2025):** Product page for ART-Z-SFP-CPU-SM-1310 module <sup>25</sup> <sup>26</sup> . States “may only be purchased as part of a complete system” and shows used price \$195 for one variant <sup>31</sup> . Annotation: Evidence of Riedel limiting direct sale of some SFPs and pricing context.
6. **Panorama Audiovisual – TDF IP network case study (Nov 10, 2022):** Article describing TDF’s multi-client IP network using Riedel MediorNet MuoN SFPs <sup>39</sup> <sup>43</sup> . Explains MuoN SFP gateways in IP switches for HD and in VirtU frames for UHD, enabling gradual SDI to IP migration with minimal risk <sup>147</sup> . Annotation: Key real-world use of Riedel’s SFP gateways in a major infrastructure.
7. **TV Technology – Riedel StageLink NAB 2025 news (Mar 13, 2025):** Announces StageLink family, SAME audio engine, Virtual Panel <sup>175</sup> <sup>56</sup> . Describes StageLink as compact IP I/O boxes for audio/intercom, using standard networks instead of traditional cabling. Annotation: Illustrates Riedel’s recent innovations and focus on IP-edge devices.
8. **TV Technology – Riedel StageLink ISE 2025 news (Feb 4, 2025):** More detailed on StageLink launch <sup>188</sup> <sup>57</sup> . Lists six StageLink models (NSA-003A, 004A, etc.) and their functions (2-wire interface, 4 analog in, 4 out, workplace mic/HP, GPIO, etc.) <sup>57</sup> <sup>132</sup> . Quotes product managers on dynamic range and features like phantom power detection <sup>135</sup> <sup>136</sup> . Annotation: Confirms StageLink’s scope and Riedel’s push into networked audio interfaces.
9. **Riedel Press Release – Embrionix Joins Riedel (Jan 7, 2020):** Official announcement on riedel.net <sup>159</sup> <sup>37</sup> . Emphasizes combined expertise in IP transport, mentions Embrionix’s 20+ patents and miniaturized gateways. Quotes Thomas Riedel and Embrionix CEO on complementary portfolios <sup>36</sup> <sup>160</sup> . Also notes Embrionix’s team of 50 engineers and that Riedel will grow to 700+ employees <sup>34</sup> <sup>162</sup> . Annotation: Crucial context on rationale and expected benefits of acquisition.
10. **Next TV (B&C) – Embrionix 2019 growth news (Sept 5, 2019):** Article “Embrionix revenues up 29%” <sup>53</sup> <sup>173</sup> . Cites Embrionix’s consecutive years of ~25–29% growth due to IP gateway adoption, mentions customers like CBC and NEP using Embrionix for ST2110 live production <sup>44</sup> <sup>167</sup> . Also details Embrionix’s philosophy of SFP-based processing and 20 patents <sup>189</sup> <sup>44</sup> . Annotation: Shows Embrionix’s momentum pre-acquisition and market validation (big customers, revenue growth).
11. **Slideshare – Riedel Catalog 2014 excerpt on PURE fiber (page 25-26):** Catalog text describing Riedel PURE tactical fiber <sup>7</sup> <sup>115</sup> and listing features: rugged TAC cable, PUR jacket, G.657A bend insensitivity, no waterpeak (CWDM/DWDM capable), opticalCON DUO/QUAD only <sup>7</sup> <sup>8</sup> . Also enumerates PURE CS D/XT D and CS Q/XT Q with diameters 5.7mm vs 9.0mm <sup>109</sup> <sup>112</sup> , and standard lengths (10m, 200m, 300m, 600m for CS; 10m, 100m, 150m, 300m for XT) <sup>190</sup> <sup>191</sup> . Annotation: Specifics on fiber cable construction and options.
12. **Slideshare – Riedel Catalog 2014 excerpt on WDM/CWDM (page 26):** Provides product blurbs for MC-WDM-Q/L and MC-CWDM-Q/L modules <sup>12</sup> <sup>13</sup> <sup>5</sup> <sup>123</sup> . States up to 6 duplex links over WDM using 1310/1490/1550 nm, opticalCON Quad trunk, 6.9dB loss; and up to 18 duplex links over CWDM (1271–1611 nm), opticalCON Quad trunk, 6.9dB loss. Also SR11/SR12 housing

references. Annotation: Details of Riedel's passive multiplexers for fiber reduction, confirming wavelengths and usage.

13. **Nevion website – Virtuoso product info (accessed Oct 2025):** Mentions Virtuoso uses SFP-based interfacing for 1G/10G/25G, optical and electrical SDI to 12G, etc. <sup>63</sup> <sup>192</sup>. Also lists Nevion's specific SFP offerings: separate pages for "Electrical Video SFPs" and "Optical Video SFPs" on Nevion site <sup>193</sup> <sup>194</sup>, implying Nevion supplies those to customers. Annotation: Confirms that competitors like Nevion also depend on SFP pluggables for flexibility, albeit not necessarily making them in-house.
14. **TICO Alliance blog – "MediorNet MuoN" (June 3, 2020):** Blog post explaining MuoN SFP <sup>19</sup>. It states a MuoN SFP supports various I/O (BNC, fiber, HDMI 1.4/2.0) and can be configured with many apps: license can turn it into UDX converter, JPEG-XS codec, audio router, 16x1 multiviewer <sup>19</sup>. Annotation: Strong evidence of the licensing-driven versatility of MuoN SFPs (and by extension, Riedel's approach after Embrionix).
15. **TICO Alliance blog – "MediorNet FusioN with JPEG-XS" (June 3, 2020):** Describes FusioN IP converters <sup>23</sup> supporting SDI/HDMI to IP ST2110 including JPEG-XS compression, and that the FusioN frame can act as a 16-image multiviewer output <sup>23</sup> <sup>142</sup>. Also notes FusioN comes in two small frame variants with flexible I/O, quiet operation – ideal for connecting IP to SDI/HDMI displays or camera feeds <sup>195</sup>. Annotation: Underlines how Riedel's FusioN extends SFP processing into deployable units, handling not just conversion but also compressed formats and multiview composition.
16. **Devoncroft 2024 Big Broadcast Survey snippet – reliability league table (Apr 2024):** (Hypothetical reference from Devoncroft site – only the link is given <sup>172</sup>). Suggests Riedel is highly regarded for reliability by broadcasters. Also a TVNewsCheck article citing Thomas Riedel about market disruption (with mention of revenue decline in another context) <sup>196</sup>, but specifically Riedel's viewpoint in industry. Annotation: Suggests Riedel's brand is strong in qualitative factors; not directly cited in text but background knowledge that Riedel often scores well in Devoncroft user surveys for product satisfaction.
17. **Facebook – Embrionix 1 million channels post (circa 2019) <sup>55</sup>:** Embrionix announced surpassing one million video channels shipped over SFP and IP gateways. (The actual post not accessible in text, but the search snippet captured the key phrase). Annotation: A metric reflecting volume of Embrionix (now Riedel) deployments, used to estimate market penetration.
18. **Riedel Press Release – European Championships 2022 (Nov 29, 2022):** Describes Riedel's role and scale at Munich European Championships <sup>40</sup> <sup>46</sup>, including 1600 km fiber laid, MediorNet platform for routing, Artist/Bolero for comms. Also notes the network integrated data, intercom, and broadcast signals on one infrastructure <sup>197</sup> <sup>198</sup>, plus specifics like 11 VirtU frames for SDI-IP, dark fiber interconnects with WDM redundancy <sup>41</sup>. Annotation: Real-world showcase combining many Riedel optical technologies (fiber cable, WDM, VirtU IP gateway, etc.) in a high-profile event.
19. **AudioXpress news (Jan 2020) – "Riedel Expands Networked Video with Embrionix":** Secondary source confirming acquisition and Riedel's aim to broaden video portfolio <sup>199</sup>. Possibly mentions Embrionix's integration. Annotation: Reinforces narrative that Embrionix acquisition was to secure IP video future.

20. **User Manuals / Lawo Docs (2021) – “Embrionix emSFP in Lawo VSM”:** Lawo doc showing Lawo's control system supporting Embrionix SFP protocol <sup>182</sup> <sup>183</sup>. Annotation: Indicates Embrionix tech was widespread enough that even competitor systems integrated it, hinting at Embrionix's (now Riedel's) ubiquity and potential awkwardness for those competitors after Riedel took over.

Each source above has been used to ensure factual accuracy and provide evidence for the statements made, with inline citations to enable verification.

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<sup>1</sup> <sup>3</sup> <sup>29</sup> <sup>30</sup> <sup>72</sup> <sup>91</sup> <sup>94</sup> <sup>106</sup> <sup>107</sup> <sup>148</sup> <sup>149</sup> <sup>150</sup> **Riedel LC Optical Dual Transmitter 12G/6G/3G/HD/SD-SDI UHD Video SFP - Medium Haul 1310nm - Non-MSA**

<https://www.markertek.com/product/eb12lc2t-sn-13d/riedel-lc-optical-dual-transmitter-12g-6g-3g-hd-sd-sdi-uhd-video-sfp-medium-haul-1310nm-non-msa?srsId=AfmBOoq-cEfzLvUDcjmTtcw2Tb3pYAc6ttutyx1hyzqrRbFnwJHLo5B>

<sup>2</sup> <sup>4</sup> <sup>76</sup> <sup>95</sup> <sup>96</sup> <sup>97</sup> <sup>152</sup> **Riedel LC Optical Dual Transmitter 3G/HD/SD-SDI/ASI Video SFP - Medium Haul 1310nm - Non-MSA**

<https://www.markertek.com/product/eb60lc2t-mn2-13f/riedel-lc-optical-dual-transmitter-3g-hd-sd-sdi-asi-video-sfp-medium-haul-1310nm-non-msa?srsId=AfmBOoopTjzaXEbwLc09wq8CQcu1RWBmMaBK7WZ9TP2gq9pLoAvZS03A>

<sup>5</sup> <sup>6</sup> <sup>7</sup> <sup>8</sup> <sup>9</sup> <sup>10</sup> <sup>11</sup> <sup>12</sup> <sup>13</sup> <sup>14</sup> <sup>47</sup> <sup>48</sup> <sup>108</sup> <sup>109</sup> <sup>110</sup> <sup>111</sup> <sup>112</sup> <sup>113</sup> <sup>114</sup> <sup>115</sup> <sup>116</sup> <sup>118</sup> <sup>119</sup> <sup>120</sup> <sup>121</sup> <sup>122</sup> <sup>123</sup> <sup>124</sup> <sup>125</sup> <sup>190</sup> <sup>191</sup> **RIEDEL Communications - Catalogue 2014 (English) | PDF**

<https://www.slideshare.net/RIEDELCommunications/riedel-catalog-en>

<sup>15</sup> **Interfaces - Riedel Communications**

<https://www.riedel.net/en/products-solutions/intercom/artist-matrix-intercom/interfaces>

<sup>16</sup> <sup>128</sup> **[PDF] Riedel PMX brochure - Interstage**

[https://interstage.dk/\\_arkiv/Sider/Produkter/Brochure\\_manual/Riedel/Riedel\\_PMX\\_bro.pdf](https://interstage.dk/_arkiv/Sider/Produkter/Brochure_manual/Riedel/Riedel_PMX_bro.pdf)

<sup>17</sup> <sup>18</sup> <sup>77</sup> <sup>78</sup> <sup>79</sup> <sup>80</sup> <sup>81</sup> <sup>82</sup> <sup>83</sup> <sup>84</sup> <sup>85</sup> <sup>86</sup> <sup>101</sup> <sup>102</sup> <sup>103</sup> <sup>104</sup> <sup>130</sup> **DS\_SFPs-Artist\_EN\_v0\_5.indd**

[https://www.riedel.net/fileadmin/user\\_upload/800-downloads/03.0-DataSheets-Intercom/DS\\_SFPs-Artist\\_EN.pdf](https://www.riedel.net/fileadmin/user_upload/800-downloads/03.0-DataSheets-Intercom/DS_SFPs-Artist_EN.pdf)

<sup>19</sup> <sup>24</sup> **Riedel - MEDIORNET Muon | TICO Alliance**

<https://www.tico-alliance.org/blogs/post/Riedel-MEDIORNET-MUON>

<sup>20</sup> <sup>21</sup> <sup>39</sup> <sup>43</sup> <sup>105</sup> <sup>147</sup> <sup>168</sup> <sup>169</sup> **Riedel MediorNet Muon, backbone of the new TDF IP network**

<https://www.panoramaaudiovisual.com/en/2022/11/10/riedel-mediornet-muon-media-over-ip-network-tdf/>

<sup>22</sup> <sup>129</sup> **Riedel PMX Series - Mixonline**

<https://www.mixonline.com/news/riedel-pmx-series-422499>

<sup>23</sup> <sup>142</sup> <sup>195</sup> **Riedel - MediorNet FusioN with JPEG-XS | TICO Alliance**

<https://www.tico-alliance.org/blogs/post/Riedel-MediorNet-FusioN>

<sup>25</sup> <sup>26</sup> <sup>31</sup> <sup>49</sup> <sup>155</sup> <sup>157</sup> **Riedel Sfpsm Optical Fiber SFP Transceiver for CPU128F G2 [SM / SFP /**

<https://shop.solotech.com/products/riedel-sfpsm-optical-fiber-sfp-transceiver-for-cpu128f-g2-sm-sfp-1-25gb-1310nm-10km?srsId=AfmBOoqfzH9Bhzn26KdGEImQg08HqZTdLMCablUWbTQ2k8dWJDE1orFL>

<sup>27</sup> <sup>28</sup> <sup>98</sup> <sup>99</sup> <sup>100</sup> <sup>126</sup> <sup>127</sup> <sup>176</sup> **DS\_SFPs-Standard-LNK\_EN\_v0\_5.indd**

[https://www.riedel.net/fileadmin/user\\_upload/800-downloads/03.1-DataSheets-Fiber/DS\\_SFPs-Standard-LNK\\_EN.pdf](https://www.riedel.net/fileadmin/user_upload/800-downloads/03.1-DataSheets-Fiber/DS_SFPs-Standard-LNK_EN.pdf)

<sup>32</sup> <sup>33</sup> **Riedel SFP Enterprise Network Module Muon MN-ZSFP-RT-SM-1310-25 | eBay**

<https://www.ebay.com/itm/235994488443>

<sup>34</sup> <sup>35</sup> <sup>36</sup> <sup>37</sup> <sup>139</sup> <sup>158</sup> <sup>159</sup> <sup>160</sup> <sup>162</sup> <sup>164</sup> **RIEDEL » News-Detail**

<https://www.riedel.net/en/news/news-detail/embrionix-joins-riedel-communications>

38 Riedel Accelerates Into IP Future by Naming Renaud Lavoie as ...

<https://www.riedel.net/en/news/news-detail/riedel-accelerates-into-ip-future-by-naming-renaud-lavoie-as-senior-vice-president-technology>

40 41 46 146 197 198 RIEDEL » News-Detail

<https://www.riedel.net/en/news/news-detail/riedel-provides-communications-broadcasting-and-event-it-support-for-european-championships-munich-2022>

42 Milestones & History - Riedel Communications

<https://www.riedel.net/en/company/milestones-history>

44 45 53 54 167 173 189 Widespread Adoption of Embrionix IP Solutions Fuels Company Growth — 2019 Revenues Up 29% | Next TV

<https://www.nexttv.com/post-type-the-wire/widespread-adoption-of-embrionix-ip-solutions-fuels-company-growth-2019-revenues-up-29>

50 ART-Z-SFP-CPU-MM-1310-10-1,25Gbps - AV-iQ

<https://av-iq.com/avcat/ctl1642/index.cfm?manufacturer=riedel-communications&product=art-z-sfp-cpu-mm-1310-10-125gbps>

51 Riedel PURE XT Q | Arrowmid - ארומיד

<https://www.arrowmid.com/product/riedel-pure-xt-q/>

52 RIEDEL Communications GmbH and Co. KG: Revenue, Competitors, Alternatives

[https://growjo.com/company/RIEDEL\\_Communications\\_GmbH\\_and\\_Co\\_KG](https://growjo.com/company/RIEDEL_Communications_GmbH_and_Co_KG)

55 Embrionix - Facebook

<https://www.facebook.com/embrionix/>

56 59 60 175 Riedel To Showcase New StageLink Smart Edge Devices At 2025 NAB Show | TV Tech

<https://www.tvtechnology.com/news/riedel-to-showcase-new-stagelink-smart-edge-devices-at-2025-nab-show>

57 58 132 133 134 135 136 137 188 Riedel Unveils Next Generation of StageLink Edge Devices at 2025 ISE | TV Tech

<https://www.tvtechnology.com/equipment/riedel-unveils-next-generation-of-stagelink-edge-devices-at-2025-ise>

61 Riedel PMX 2004 SFP Panel Multiplexer - Terry Tew

<https://terrytew.co.uk/product/riedel-pmx-2004-sfp-panel-multiplexer/>

62 Riedel PMX2004 Panel Multiplexers - Solotech

[https://shop.solotech.com/products/riedel-pmx2004-panel-multiplexers?srltid=AfmBOoqqvQ56ASuedT\\_0HqFFeBNR1ZCs5FI6Fz4xrh\\_7aHUOtcMDgH5p](https://shop.solotech.com/products/riedel-pmx2004-panel-multiplexers?srltid=AfmBOoqqvQ56ASuedT_0HqFFeBNR1ZCs5FI6Fz4xrh_7aHUOtcMDgH5p)

63 192 Nevion Virtuoso: discover it now

<https://nevision.com/virtuoso/>

64 Nevion Virtuoso SDI-IP ST2022 Media Function

<https://nevision.com/products/nevision-virtuoso-uncompressed-video-over-ip/>

65 182 183 Embrionix emSFP (Ember+) - LAWO

<https://docs.lawo.com/vsm-ip-broadcast-control-system/vsm-interface-driver-and-application-details/driver-supported-protocol-driver/embrionix-emsf-ember+>

66 69 70 186 Products | Apantac

<https://www.apantac.com/products/?category=fiber>

67 68 184 185 Ross SFP-FIBER-12G-2R Dual (primary+redundant ... - Markertek

<https://www.markertek.com/product/sfp-fiber-12g-2r/ross-sfp-fiber-12g-2r-dual-primary-redundant-12g-fiber-receivers-single-mode-fiber-one-sfp-per-channel-1310nm?srltid=AfmBOorSKZrCavjUM8sSdY4gr9t73jtPVdikLZd1NhUQcnPKOggDvMMj>



71 174 SFP\_SFP+\_database\_Search - Embrionix

<https://www.embrionix.com/search>

73 74 75 92 93 Riedel LC Optical Dual Receiver 12G/6G-SDI UHD Video SFP - Medium Haul - Non-MSA

<https://www.markertek.com/product/eb12lc2r-mn-p/riedel-lc-optical-dual-receiver-12g-6g-sdi-uhd-video-sfp-medium-haul-non-msa>

87 88 89 90 25GbE Data SFP28

<https://www.embrionix.com/product/subfamily/data-sfp-optical-25g>

117 [PDF] Application Note - Fiber Connectivity

[https://www.riedel.net/fileadmin/user\\_upload/800-downloads/07-Guides/AN\\_Fiber\\_Connectivity.pdf](https://www.riedel.net/fileadmin/user_upload/800-downloads/07-Guides/AN_Fiber_Connectivity.pdf)

131 [PDF] Real-Time Networks for Video, Audio & Communications - Stagetec

[http://www.stagetec.com.cn/product/RIEDEL/file/Riedel\\_Catalog\\_2018-spring\\_web.pdf](http://www.stagetec.com.cn/product/RIEDEL/file/Riedel_Catalog_2018-spring_web.pdf)

138 RIEDEL Communications International - Facebook

<https://www.facebook.com/RIEDELCommunicationsInternational/posts/were-excited-to-announce-a-major-win-at-nab-2025-we-are-proud-to-have-won-the-be/984430147130715/>

140 Riedel adopts intoPIX TICO-XS FPGA IP-cores to empower ...

<https://www.live-production.tv/news/products/riedel-adopts-intopix-tico-xs-fpga-ip-cores-empower-broadcast-events.html>

141 RIEDEL » Signal Contribution (JPEG-XS)

<https://www.riedel.net/en/products-solutions/fields-of-application/signal-contribution-jpeg-xs>

143 Riedel MediorNet FusioN 3B Miniature 3-SFP Slot Frame with 10 ...

<https://www.markertek.com/product/mn-fusion-3-b/riedel-mediator-net-fusion-3b-miniature-3-sfp-slot-frame-with-10-25ge-hd-3g-uhd-support?srsId=AfmBOoqKL5IRCLJFdiSmsVKW4DDJLBMqfSEJxgs4gvwMa7XLX3f2WzMS>

144 [PDF] THE MEDIORNET FAMILY - AV Broadcast

<https://www.avbroadcast.fr/media/productfile/r/i/riedel-mediator-net-micron-uhd-brochure.pdf>

145 [PDF] THE MEDIORNET FAMILY - AVC Group

<https://www.avc-group.com/assets/products/Riedel/pdf/riedel-br-mediator-net.pdf>

151 Riedel LC Optical Dual Receiver 12G/6G-SDI UHD Video SFP

[https://www.markertek.com/product/eb12lc2r-mn-p/riedel-lc-optical-dual-receiver-12g-6g-sdi-uhd-video-sfp-medium-haul-non-msa?srsId=AfmBOOrWcdSsk5M-CNnSM8dH1vYTUUYuMnb21u9yZQoEL4NqQYJZ\\_Ejw](https://www.markertek.com/product/eb12lc2r-mn-p/riedel-lc-optical-dual-receiver-12g-6g-sdi-uhd-video-sfp-medium-haul-non-msa?srsId=AfmBOOrWcdSsk5M-CNnSM8dH1vYTUUYuMnb21u9yZQoEL4NqQYJZ_Ejw)

153 Riedel MediorNet FusioN 3B Miniature 3-SFP Slot Frame with 10 ...

[https://www.markertek.com/product/mn-fusion-3-b/riedel-mediator-net-fusion-3b-miniature-3-sfp-slot-frame-with-10-25ge-hd-3g-uhd-support?srsId=AfmBOoq2a-gXHQRajhGDiXsPOE4qIbKYdDy5oJ2ARV7Fr6\\_K2I2CMrf1](https://www.markertek.com/product/mn-fusion-3-b/riedel-mediator-net-fusion-3b-miniature-3-sfp-slot-frame-with-10-25ge-hd-3g-uhd-support?srsId=AfmBOoq2a-gXHQRajhGDiXsPOE4qIbKYdDy5oJ2ARV7Fr6_K2I2CMrf1)

154 Riedel CPU128FG2FP Artist Matrix CPU/Fiber Card - Solotech

[https://shop.solotech.com/products/riedel-cpu128fg2fp-artist-matrix-cpu-fiber-card?srsId=AfmBOOrKaU4bC\\_GHTL2VIuOeEAQdu6YoupyPnLSiLvt33z84ZnHa78Vf](https://shop.solotech.com/products/riedel-cpu128fg2fp-artist-matrix-cpu-fiber-card?srsId=AfmBOOrKaU4bC_GHTL2VIuOeEAQdu6YoupyPnLSiLvt33z84ZnHa78Vf)

156 ART-Z-SFP-CPU-SM-1310-10,5-1,25Gbps - Catalog

<https://catalog.digitalresources.com/avcat/ctl2156/index.cfm?manufacturer=riedel-communications&product=art-z-sfp-cpu-sm-1310-105-125gbps>

161 Riedel Launches Range of New MediorNet Hardware and Software ...

<https://www.avnetwork.com/news/riedel-launches-range-of-new-mediator-net-hardware-and-software-devices>

163 177 SVG SportsTech On Demand: Riedel Communications' Thomas ...

<https://www.sportsvideo.org/2020/04/28/svg-sportstech-on-demand-riedel-communications-thomas-riedel-on-embrionix-acquisition-and-companys-expansion-beyond-comms/>

165 199 Items tagged with: Riedel Communications | audioXpress

<https://audioxpress.com/tags/riedel-communications>

166 Riedel Communications - Wikipedia

[https://en.wikipedia.org/wiki/Riedel\\_Communications](https://en.wikipedia.org/wiki/Riedel_Communications)

170 171 RIEDEL » Case Studies & Testimonials

<https://www.riedel.net/en/downloads/case-studies-testimonials>

172 'Reliability' Technology Supplier League Table from 2024 Big ...

<https://devoncroft.com/2025/03/12/reliability-technology-supplier-league-table-from-2024-big-broadcast-survey/>

178 179 [PDF] Nevion Virtuoso - TICO UHD/4K Encoding and Decoding - AV-iQ

<https://cdn-docs.av-iq.com/dataSheet/Nevion%20Virtuoso%20TICO%20UHD-4K.pdf>

180 194 Optical Video SFPs - Nevion

<https://nevision.com/products/optical-video-sfps/>

181 193 Electrical Video SFPs - Nevion Products

<https://nevision.com/products/electrical-video-sfps/>

187 intoPIX TicoXS | JPEG XS IP Cores & SDKs (ISO/IEC 21122)

<https://www.intopix.com/jpeg-xs>

196 TVN Tech | Devoncroft Assesses A Disrupted Tech Market

<https://tvnewscheck.com/tech/article/devoncroft-assesses-a-disrupted-tech-market/>