Fibre marches on

OPTRIBUTION

Compared to other technologies the advance of optical transmission techniques into satellite communication and CATV infrastructures is now gathering momentum. Despite numerous technical merits and economical advantages even in new installations, still only about one quarter of all installations are implementing opto-electronics, albeit with an upward tendency.

DEV Systemtechnik in Friedberg, Germany, thought twice about the causes for this situation and possible ways and means to speed up the trend, resulting in "Optribution"– Optical Transmission and Distribution of RF Signals.

"Now or in the near future, 80 to 90 per cent of all satellite communications and CATV operators will have to deal with signal distribution systems using copper lines as well as glass fibre cables as transmission media in parallel" says Joerg Schmidt, General Manager of DEV Systemtechnik, and gives four good reasons for:

- low transmission losses over long distances,
- no frequency dependent losses in the L-band,
- galvanic isolation between segments,
- Fully tolerant to electro-magnetic interference and very high interception security.

It is generally accepted that transmission over glass fibre results in less attenuation losses than e.g. coax cables.
But how much less? is a question that results in a lot of different answers.
In the opinion of Joerg Schmidt, the often cited rule-of-thumb „maximum distance equals acceptable losses divided by the fibre's attenuation constant of 0,35 dB/km" is simply naive, as it considers neither connector, splice, mismatch losses nor the margin for the remaining C/N specified and the value for the resolution bandwidth while measuring C/N.

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Optical signal transmission and distribution system DEV 7104, front view with two receiver modules removed

How far is far?

The moment of truth is when the network operator wants to bridge a distance of more than 40 km with one piece of cable only. It is not possible to calculate the link budget by just using the rule of thumb. DEV in all cases will specify the acceptable loss while maintaining a C/N of $\leq$10 dB and measured at a bandwidth of 1MHz. The maximum achievable distance is then always related to the optical transmission losses. If for example a loss of 28 dB is acceptable, then the maximum distance is 80 km of straight

fibre at a wavelength of 1310 nm. This is based upon the latest optical transmitter card from DEV with a noise figure of less than 10 dB, this is the first of its kind to that specification on the market today, adds Schmidt with some pride. So DEV simply cut the noise figure in half.

Frequency dependent losses correlate with relative bandwidth. L-Band over coax spreads from 950 to 2150 MHz, equaling 1.3 octaves. Fibre transmission offers a carrier of up to 230 THz at 1310 nm. Transmitting amplitude modulated L-Band to this spectrum gives just 5 x 10^{-6} octaves, or, with the words of Joerg Schmidt: You don't need to be concerned over frequency dependent losses when using optical transmission.

*Optical signal transmission and distribution system DEV 7104, rear view with signal distribution **of** 16 x 1:8 or 8 x 1:16 maximum*

Engineering and economy

The advantages of galvanic isolation are self-explanatory, and so is the tolerance against electro-magnetic disturbance. Fibre is neither influenced by interference nor a source of it.
Fibre also offers significantly higher security against illegal interception when compared to copper cables is an advantage for military and governmental authorities.

On the other hand, network operators have to base their decisions not only on the opinion of engineers but also and primarily on that of economists. Both will require rather different facts and figures. Engineers will require the best solution for today's system and always include for future expansion and accountants will be looking for the lowest cost for today only. The argument is rather easy, say's Schmidt, when looking at new installations. Regarding future expansion, fibre is surely the first choice. Optical waveguides need significantly less installation space in cable ducts, this of huge benefit for in-house installations. For a run length of more than 80 m, the cost of fibre cable is comparable to that of very low loss premium coax cable. Moreover, the investment in bandwidth reserve for future expansion is almost zero.

Best of both worlds

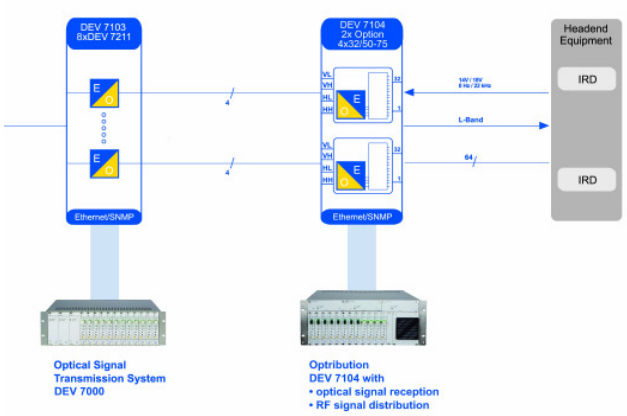
So why are many network operators still hesitating, and why are only less than 25 per cent of systems relying on optical transmission techniques which are used in wide-area communication networks since decades with no problems at all? The answer, says Schmidt, can be found in the different technical cultures that clash in such projects. There are systems engineers who gained their experience in developing RF infrastructures talking to vendors of optical equipment and systems with roots in research or in digital communications, and sometimes they simply don't understand each other.

After talking and listening to customers and prospective users and a comprehensive market research study, DEV Systemtechnik decided to enter the field of RF signal transmission and distribution via optical media with one single conclusive approach we called it „Optribution“ for „Optical Transmission and Distribution of RF Signals“, emphasizing DEV’s competence as the premier vendor of seamless end to end solutions for opto-electronic transmission and distribution of RF signals over the entire transmission path.

Optribution is DEV Systemtechnik’s systematic approach to the ongoing development of the signal distribution infrastructure. It applies DEV’s RF expertise to the optical system parts and enables a homogenous and seamless growth of the user’s infrastructure, realized with system components from one trusted source, “one-stop shopping” for excellent signal quality from the antenna to the receiver, via fibre or coax.

Focusing on the signal

Optribution in fact is much more than a product range, but the underlying expertise is demonstrated best by looking at breakthrough innovations such as the already mentioned optical transmitter card with less than 10 dB noise figure. The dynamic range of optical transmitters now spans +15 to -70 dBm and with a link gain of up to 40 dB, the user has neither to attenuate nor to amplify the signal. This feature also differentiates DEV from the competition.



Integration accomplished – DEV 7104 with optical receiver and RF signal distribution (middle), on the left side the optical signal transmission system DEV 7103

Well-tried and proven products show a continuously increasing level of integration, allowing for smaller set-ups of higher functionality and less rack space at the user’s premises. As an example, the Optical Signal Transmission System DEV 7103 now accommodates 20 instead of 16 modules in a 3 RU chassis to receive the signals of five instead of four satellite antennas in one single unit. New L-Band transmitter and receiver modules are now available in 4 instead of 5 width units, so the Optical Signal and Distribution System DEV 7104 now can hold up to 16 receiver modules, in a 4 RU enclosure.

Finally, the Optribution portfolio will offer optical transmitters, receivers, splitters, multiplexers and de-multiplexers, integrated RF splitters and matrix switches 4:xy and 8:xy as well as redundancy switches 1+1 and N+1, with more functions in less boxes, starting with the integration of distribution amplifiers and matrix switches into the optical transmission path.

Joerg Schmidt, General Manager, DEV Systemtechnik GmbH & Co. KG, Friedberg/ Germany

According to Joerg Schmidt the system designer must always be aware that:

- Every item of transmission line, every amplifier and connector influences the signal,
- Any active device can fail,
- All equipment needs space,
- Equipment consumes power so producing heat and this must be managed.

Optribution brings to the user all the advantages of optimized functionality with optical transmission and distribution of RF signals. Less equipment, lower rack space, low power, simple operation, and full web and SNMP control and monitoring.
Optribution ensures that the RF signals are safely delivered from the satellite antenna to the receiver.

Mission accomplished!

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