



Record-breaking Transmission Field Trial of 38.4 Tbps over 762 kilometers Lyon-Marseille-Lyon Fiber Optic Link

Paris, France, 23 June 2015 - For the first time, several tens of terabits per second (i.e. 38.4 Tbps) have been transported over a 762 kilometers Lyon-Marseille-Lyon fiber optic link in the Orange optical transport network, thanks to 1 Tbps and beyond super-channels. This multi-terabit field trial, which took place over the Orange legacy fiber infrastructure in May, constitutes a world-record transmission not only in terms of aggregated capacity (38.4 Tbps) but also in terms of transmission reach (762 km). This record-breaking field trial was conducted using the latest advances in ultra-high-capacity optical communications technologies. For Orange, the objective was to demonstrate that its legacy fiber infrastructure is able to transport such multi-terabit capacity. For Coriant, Ekinops, Keopsys, and Socionext, the aim was to validate the compliance of their most advanced optical transport solutions with the real operational constraints of a “live” optical transport network.

In this record-breaking field trial, advanced technology engineers from Orange, Coriant, Ekinops, Keopsys, and Socionext successfully demonstrated the highest ever C-band transmission capacity using 24 x 1 Tbps/DP-16QAM (i.e. 24 Tbps), 32 x 1 Tbps/DP-32QAM (i.e. 32 Tbps), and 32 x 1.2 Tbps/DP-64QAM (i.e. 38.4 Tbps) modulation formats in a “live” networking environment. The companies also achieved a record-setting transmission reach of 762 kilometers in the same live environment, more than twice the distance of any previous field records for 32QAM, and the first ever regional transmission for 64QAM. These achievements represent an important milestone in the research and development of highly scalable, spectrally-efficient optical networking technologies optimized for future network growth.

The 1 Tbps and beyond super-channels (implemented by Coriant) used the most advanced optical transmission technologies and capabilities, including spectrally-efficient modulation formats for optical communications (8 bits/s/Hz achieved with 64QAM), powerful forward error correction codes, and the most sophisticated digital signal processing algorithms to compensate for hardware and transmission impairments. The transmitters and receivers were based on the newest generation of ultra high-speed digital-to-analog and analog-to-digital converters (developed by Socionext Network Business Unit) using 92 GSa/s high-bandwidth coherent receivers.

The hybrid Raman/Erbium-doped optical amplifiers (provided by Ekinops and Keopsys) have been developed to be low-cost and energy-

efficient. They implement only two pumps at two different wavelengths, and are equipped with all the safety mechanisms required by the field. The flatness of the hybrid amplifier is obtained thanks to an optimization of the joint working of the Raman and Erbium-doped gain blocks. The record distance achieved in this field trial (i.e. 762 km) is due not only to the transceiver quality but also to the high-level of performance of the hybrid optical amplifiers developed here, which have been systematically used on each of the amplification spans.

The field infrastructure provided by Orange is constituted of high-quality G.652 single-mode fibers with loss-reduced connections between the equipment (terminals, amplifiers) and the cable heads, and as such is able to support distributed Raman amplification and to transport 1 Tbps and beyond super-channels.

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