

Question 4/15 – Broadband access over metallic conductors

(Continuation of Question 4/15)

1 Motivation

The continuing customer demand for ever higher bit rate data services, high-speed Internet access and other innovative services, and the on-going needs of network operators to fully exploit their installed base of metallic conductors (including copper pair and coaxial cables), will require the development of new Recommendations and enhancements to existing Recommendations covering all aspects of Transceivers operating over metallic conductors in the access part of the network, extending into the customer premises. These studies will include, but are not limited to, the transport of higher layer protocols, the management and test of the access systems, spectral management aspects and energy saving techniques.

G.fast has raised bit rates up to 2 Gbit/s, and beyond by combining the best aspects of optical, coaxial, and DSL technologies in hybrid systems with total wire length to the customers' transceiver up to 400 m, and by using 106MHz and 212MHz bandwidth profiles. Higher bit rates can be achieved by bonding. Functional and performance improvements are still under study.

MGfast will raise bit rates further to 5 Gbit/s and targets further enhancements to bit rates up to 10 Gbit/s and beyond by combining the best aspects of optical, coaxial, and DSL technologies in hybrid systems with total wire length to the customers' transceiver up to 200 m, and by using higher bandwidth profiles, and/or bonding. MGfast will also facilitate service distribution over the premises by using point-to-multipoint operation from the access node or distribution point to multiple end-user devices in the premises. MGfast will also introduce security and QoS-awareness (e.g., latency differentiation) in the physical layer. Functional and performance improvements are still under study.

The following major Recommendations, in force at the time of approval of this Question, fall under its responsibility: G.991.x series, G.992.x series, G.993.x series, G.994.1, G.996.x series, G.997.x, G.998.x series, G.999.1, G.970x, and G.971x series.

The target audience for this question are the technology suppliers, chipset vendors, equipment vendors, and service providers active in the domain of providing access to a high-speed network from the customer premises. A global audience is targeted to facilitate a unified approach to the broadband access over metallic conductors.

2 Question

- What enhancements are needed to the G.99x and G.970x series of Recommendations:
 - in the light of design, network deployment experience, and evolving service requirements?
 - to optimise the transport of IP-based services?
 - to optimize bit rates achieved by means of vectored groups of metallic pairs?
 - to optimize time/frequency duplexing and multi-line operation?
 - to increase the reach at high bit rates?
- What new Recommendations are needed:
 - for transceivers for customer access over metallic conductors?
 - to carry out line testing?
 - to enable higher bit rates to be achieved by means of e.g., full duplex transmission, enhanced coding schemes, metallic pair bonding or coordination and/or vectoring over a group of metallic pairs?

- to enable transport of higher layer protocols?
 - to optimize the quality-of-experience to the end user?
 - to enable point-to-multipoint operation from the access node or distribution point to multiple end-user devices in the premises?
 - to enable data slicing, multi-QoS and low latency data transport in the context of IMT-2020/5G?
 - to enable cascading of access equipment supporting G.fast or MGfast (G.fastback) ?
 - to enable security aspects in point-to-point and point-to-multipoint topologies?
 - to enable medium access control across the binder in point-to-point and point-to-multipoint topologies?
 - to improve co-existence of DSL and G.fast with other technologies, e.g., G.hn over powerline (joint with Q18/15)?
 - for reverse power feeding (RPF) of access equipment and sustaining minimum service in the absence of mains electrical power?
 - for system (non-transceiver related) aspects of access network and customer premises equipment?
- What enhancements to existing Recommendations are required to provide energy savings directly or indirectly in Information and Communication Technologies (ICTs) or in other industries?
- What enhancements to developing or new Recommendations are required to provide such energy savings?
- Study items include, but are not limited to:
- Modulation and transport techniques, tools for spectrum management (including dynamic spectrum management), handshaking procedures, testing procedures, physical layer management procedures, energy saving techniques.
 - Real noise environments and loop characteristics.
 - Techniques for optimizing energy usage e.g., to adapt to actual user traffic on a pair, to mitigate power failures, and to support battery operation.
 - Techniques for coordination of the transceivers in a group of metallic pairs as to operate within given limitations, e.g., limitations related to aggregate energy usage or aggregate data rate.
 - Techniques for signal coordination in a group of metallic pairs to improve performance by use of vectoring (FEXT and NEXT cancellation, beamforming) and PSD control/shaping.
 - Techniques for transport of time and synchronization over the copper access network, in collaboration with Q13/15.
 - Coordination within the digital access section between optical access and copper access to minimize complexity and optimize QoS.
 - Techniques for inter-connection of transceivers with other physical layer and higher layer functionality.
 - Techniques dealing with security aspects in point-to-point and point-to-multipoint topologies.
 - Techniques dealing with medium access control across the binder in point-to-point and point-to-multipoint topologies.

- System (non-transceiver related) aspects of access network and customer premises equipment.
- Considerations of aspects of network function virtualization (NFV) and software defined networks (SDN) control.
- These studies should take account of the different regulatory environments around the world.
- These studies will include any specific requirements:
 - to optimise the transport of IP-based services
 - to optimise the transport of Ethernet based services
 - to optimize for mobile fronthaul/backhaul (e.g., for low latency)
 - to support the management of access systems operating over metallic conductors

3 Tasks

Tasks include, but are not limited to:

- Maintenance and enhancements of existing Recommendations and production of new Recommendations in the G.99x (e.g., G.991.x series, G.992.x series, G.993.x series, G.994.1, G.996.x series, G.997.x, G.998.x series and G.999.1), G.970x, and G.971x series, and supporting Technical Papers and Supplements.

An up-to-date status of work under this Question is contained in the SG15 work programme (https://www.itu.int/ITU-T/workprog/wp_search.aspx?sg=15).

4 Relationships

Recommendations:

- None.

Questions:

- Q1/15, Q2/15, Q18/15, Q13/15

Study Groups:

- ITU-R SG1 and SG5
- ITU-T SG5 on EMC, energy efficiency, and various copper cable topics
- ITU-T SG9 on television and sound programme transport
- ITU-T SG11 on testing and interoperability aspects
- ITU-T SG16 on multimedia aspects

Other bodies:

- IEC CISPR I on EMC requirements
- IEEE 802.1 and 802.3
- ISO/IEC JTC1/SC25 on interconnection of Information Technology equipment
- CENELEC TC210 on EMC requirements
- ETSI TC ATTM, EE and ERM on Reverse Power Feeding, Environmental Engineering and EMC matters.
- ATIS Committee STEP and its subcommittee on Telecom Energy Efficiency (TEE)
- CCSA on xDSL topics
- Broadband Forum on access network use cases, requirements, architecture, and management

- Broadband Forum on (certification) testing of the ITU-T G.99x, G.970x, and G.971x series