



# EC CablingNews

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## News on International Standardisation

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### Next generation cabling – 40 Gbit/s Ethernet on balanced twisted pair copper cabling

The new set of standards for 40 Gbit/s on twisted pairs are progressing well in the different standardisation organisations - from the 40GBASE-T standard (40 Gbit/s Ethernet over twisted pair cabling) being developed in IEEE, over the new Class I and Class II channels and permanent links being specified in ISO/IEC JTC 1/SC 25, to the standards for the new Category 8.1 and Category 8.2 cables and connectors under development in the component committees IEC TC 46 and IEC TC 48. The development plan for the IEEE 40GBASE-T standard currently operates with publication early 2016, but already during 2015, the Class I and Class II channel and link requirements will probably have reached a reasonably mature level.

### IEEE 802.3 Ethernet working group

The development of the new Ethernet standard supporting a data rate of 40 Gbit/s on twisted pair cabling, the 40GBASE-T, is undertaken by the IEEE P802.3bq Task Force. As previously reported, the 4-pair, twisted pair channel configuration for the future 40GBASE-T has been restricted to a length of (at least) 30 m and to having up to 2 connections only with the primary objective of providing as EoR (End-of-Row) and ToR (Top-of-Rack) connections in data centres. The communication protocol has now been decided, and with that the bandwidth requirements, based on which the upper frequency for the cabling has now been settled at 2 GHz. The proposed channel performance requirements in IEEE are based on the current drafts of the ISO/IEC Class I and the TIA Cat. 8 channel requirements, with minor adjustments (requirements are similar, but not identical at present) and, of course, upper frequency extended to 2 GHz for Class I. It should be noted that channel requirements are still not final. The choice of connector has also been discussed in IEEE, resulting in the RJ45 type (future Cat. 8.1) being adopted as *one option* for the MDI connector (medium dependent interface). Other possible MDI connectors are still being discussed, some of which will probably be included in IEEE 802.3bq as alternatives.

At the November plenary of IEEE 802.3, a call for interest was made to form a study group for the definition of 25GBASE-T as a supplement to 40GBASE-T. This was supported and it was decided to extend the existing project P802.3bq to include this activity. The 25GBASE-T standard is expected to build on the same channel requirements as 40GBASE-T, incl. bandwidth and reach, but will require less power and complexity, and thus provide a desirable intermediate step in the transition from 10GBASE-T to 40GBASE-T.

The current development plan for IEEE P802.3bq operates with a publication date of March/April 2016. It is not clear whether the addition of 25GBASE-T could delay the project.

Other activities of interest in IEEE 802.3 include the task forces P802.3bp and P802.3bt, which are briefly presented below.

P802.3bq addresses “Reduced Twisted Pair Gigabit Ethernet”, RTPGE, which will support 1 Gbit/s operation over a single twisted pair and which is targeted for use in automotive and industrial environments. Related to this activity, work is ongoing on defining a power distribution technique for one twisted pair cabling (1-pair PoE).

The objective of P802.3bt is to define a 4-pair Power over Ethernet standard (amendment of existing remote powering options of IEEE 802.3) to deliver minimum 49 Watts to the powered device. Delivery of up to 100 W at the powered device is under consideration, which may cause significant cable heating and lead to enhanced requirements for cable resistance, resistance unbalance, ventilation etc.

### **Standardisation of cabling in ISO/IEC JTC 1/SC 25/WG 3**

Working group 3 of JTC 1/ SC 25 is responsible for cabling standards - with ISO/IEC 11801 - Generic cabling for customer premises - being one of the most important. The scope of WG 3 also includes test procedures and planning and installation guides.

The 57<sup>th</sup> meeting of ISO/IEC JTC 1/SC 25/WG 3 was held on 15 – 18 September 2014 in Beijing, China. The meeting was attended by more than 50 experts, and DELTA was represented by Lars Lindskov Pedersen.

Below, a summary is given for selected projects in the work programme of WG 3.

#### ***Balanced cabling for 40 Gbit/s data transmission***

The technical report (TR) ISO/IEC TR 11801-9901 “Information technology - Generic cabling for customer premises - Part 9901: Guidance for balanced cabling in support of at least 40 Gbit/s data transmission” was published in October 2014. As previously reported, one of the main objective of this project was from the beginning to describe which channel performances were considered achievable with balanced cabling, and thus to provide input to IEEE for the development of the 40GBASE-T standard. It must be emphasized that the Class I and Class II channels as described in the TR do not reflect the latest developments in IEEE, and that the limits presented cannot be used to qualify channels for support of the 40GBASE-T application. DELTA recommends disregarding the TR and instead referring to the 3<sup>rd</sup> edition of ISO/IEC 11801-x, which is currently in progress (see below).

#### ***ISO/IEC 11801 3<sup>rd</sup> edition***

The work on the 3<sup>rd</sup> edition of ISO/IEC 11801-x is progressing well in WG 3, until now on working group level. This 3<sup>rd</sup> edition will include a restructuring of the ISO/IEC generic cabling standards (11801, 15018, 24702, and 24764) into a series of standards ISO/IEC 11801-x where ISO/IEC 11801-1 will contain the general requirements, and each of the following parts -2 to -5 will contain the specific requirements for different premises (offices, industrial, homes, data centres). A new standard specifying cabling for distributed building services is included in the series as part 6. In addition to the editorial “re-shuffling”, the 3<sup>rd</sup> edition will consist of a technical revision and update, such as the inclusion of new cabling classes in support of 40 Gbit/s data transmission. Comments received for the first working drafts of the six parts were resolved at the Beijing meeting, including aligning the requirements for the new classes with the current IEEE requirements for 40GBASE-T, e.g. extending the upper frequency to 2 GHz. A new working draft has been circulated in WG 3 for discussion at the next WG 3 meeting in March 2015.

Work is also continuing on the technical reports ISO/IEC TR 11801-9902 on End-to-End (E2E) link and ISO/IEC TR 11801-9903 on matrix modelling of channels and links. The E2E link, which allows for field terminated plugs at the ends and may have no internal connections, is primarily used in industrial environments, and the TR is intended to provide guidelines and recommended limits for this new type of structured cabling, e.g. for field testing. The TR on matrix modelling is based on the results from the work carried out in the JMTG – Joint Modelling Task Group – and the objective is to support new improved cabling specifications to be included in the 3<sup>rd</sup> edition of ISO/IEC 11801.



### **Revision of ISO/IEC TR 29125 (remote powering)**

With reference to the increased power levels for remote powering under consideration in IEEE P802.3bt, cable heating has – again – become a “hot” topic, and work has started on a second edition of the technical report ISO/IEC TR 29125 “Information technology - Telecommunications cabling requirements for remote powering of terminal equipment”. The 4-pair Power over Ethernet will re-introduce requirements for resistance unbalance between pairs, and the increased power levels will impose restrictions on installation practices, such as the bundle sizes, types of trays used, category of cable used (cf. conductor sizes), need for forced ventilation etc. Test methods for determining the temperature rise vs. current load are under discussion, and experimental data have been presented for a number of cable types and installation conditions. At the recent meeting in Beijing there was some discussion on how to qualify the cabling for the different power classes. The power handling capability (or heating at given load and installation conditions) will have a strong correlation with the DC resistance of the conductors (and thus conductor size), but will also depend on the cable construction and dimensions. Although the different cable categories may have different “typical” conductor sizes and DC resistance properties, this is not reflected in the requirements of the standards (e.g. same DC resistance requirements for Category 5, 6, and 6<sub>A</sub>), and therefore the cable category alone cannot be used for this classification.

### **Standardisation of cables and related test methods in IEC TC 46**

TC 46 and its subcommittees develop and maintain standards for e.g. coaxial and balanced cables, cable assemblies (e.g. cords), and coaxial connectors, as well as related test methods such as screening effectiveness test methods (transfer impedance, coupling attenuation etc.). The latest meetings of the working groups under IEC TC 46 and its subcommittees were held in Berlin, Germany, 13 – 17 October 2014 with participation by Lars Lindskov Pedersen from DELTA.

New standards for cables characterised up to 2 GHz are being developed in WG 7 of SC 46C as IEC 61156-9 (horizontal cable) and IEC 61156-10 (work area cable). Comments for the second committee drafts (2<sup>nd</sup> CD) were discussed and resolved at the Berlin meeting, taking also into account the recent developments for the channel requirements as discussed in ISO/IEC JTC 1/SC 25/WG 3 (e.g. extending upper frequency to 2 GHz). The standards will now progress to CDV stage (committee draft for vote), whereas publication of the final standards is not expected until 2016. The standards contain specifications for Category 8.1 and Category 8.2 cables, and list characteristics and minimum transmission requirements up to 2000 MHz. In addition to the requirements given in IEC 61156-9 (IEC 61156-10), a Category 8.1 cable shall meet all requirements for a Category 6<sub>A</sub> cable as given in IEC 61156-5 (IEC 61156-6). Similarly, the Category 8.2 cable shall also meet all Category 7<sub>A</sub> requirements, which will ensure backwards compatibility.

As for the work in WG 7 concerning measurement techniques for frequencies higher than 1 GHz (e.g. for the Category 8.1 and 8.2 cables), the amendment to IEC TR 61156-1-2 was published in September 2014. The amendment had as its main objective to add mixed mode or balunless test methods for test of transmission characteristics of cables to the TR.

Cable heating is – as described above – becoming an important topic with the increased power levels for remote powering. A new work item in WG 7 for the revision of IEC/PAS 61156-1-4 “Multicore and symmetrical pair/quad cables for digital communications - Assessment of the conductor heating in bundled cables due to the deployment of power transmission based on IEEE 802.3 PoE-regime” was approved end of 2014, and will convert the PAS (Publicly Available Specification) into a formal test standard. The intention of the work is to simplify the measurement method and to harmonise it with other approaches, e.g. methods used in Cenelec, and thus to become a generally accepted test method and reference for determining the remote powering capabilities of a given cable construction.

Test methods for screening effectiveness of cables and cable assemblies are under the responsibility of WG 5 of TC 46. One of the topics being discussed in WG 5 is how to test coupling attenuation up to 2 GHz, cf. the coupling attenuation requirements to be included for the new Category 8.1 and 8.2 cables. Two methods are under investigation: Coupling attenuation measurement using absorbing clamps acc. to IEC 62152-4-5, and coupling attenuation using a triaxial test setup with an open test head acc. to IEC 62153-4-9. At the Berlin meeting, test results were also presented for a triaxial test setup with a standard test head, and it was agreed to revise IEC 62153-4-9 to include this option. It is still not decided which of the given test methods will be the preferred one up to 2 GHz.

TC 46/WG 9 covers cable assemblies and testing of installed cabling. The work continues on the 4<sup>th</sup> edition of IEC 61935-1 with the addition of Class E<sub>A</sub> and Class F<sub>A</sub> cabling, and test methods for alien crosstalk as the most important technical changes. A first CDV was circulated in December 2014, and if no critical comments are received, publication should be possible end of 2015. Already now, preparations are ongoing to start work on the next edition (edition 5), which will address testing of the new Class I and Class II channels/links. Balance parameters (TCL, ELTCTL), and DC resistance parameters (incl. unbalance within and between pairs) are also considered for field testing, either as part of edition 5 or as supporting documents.

### **Standardisation of connectors and related test methods in IEC TC 48/SC 48B**

Working group 3 of IEC TC 48/SC 48B is responsible for standards for electrical connectors such as the "RJ45"-type standardised with the IEC 60603-7-series. Working group 5 is responsible for standards for related test methods such as the IEC 60512-series. The latest meetings in WG 3 and WG 5 were held in Tokyo, Japan, in November 2014 in connection with the IEC General Meeting.

WG 3 of SC 48B is currently working on extending the frequency range up to 2 GHz or even 3 GHz for a number of connector standards, making them suitable for 40GBASE-T applications. New developments include IEC 60603-7-81 and -82 which will be the new connector standards for Category 8.1 and Category 8.2 connectors, respectively. For IEC 60603-7-81, a CDV was circulated in October 2014 (closing date 06-02-2015), whereas for IEC 60603-7-82 a CDV is expected to be circulated very soon. IEC 60603-7-81 is based on the standard RJ45-type connector, characterised up to 2000 MHz and being backwards compatible to the IEC 60603-7-51 connector (Cat. 6<sub>A</sub>), whereas IEC 60603-7-82, likewise characterised up to 2000 MHz, will be based on and backwards compatible with the IEC 60603-7-71 (Category 7<sub>A</sub>) connector. For both standards, new test methods are required to test and validate performance up to the specified upper frequency. Work has started in WG 5 to accommodate this need, but generally there is some concern as the upgrading of the test methods seem to lack a little behind, and thus it can be difficult to verify the performance acc. to the given requirements.

The next EC CablingNews with news on standardisation is planned to follow after the ISO/IEC JTC 1/SC 25/WG 3 and the IEC TC 46 WG meetings in the spring of 2015.