



January 14, 2016

To: Scott Smith
Fiber Optic Subcommittee

From: Tom Cruz AFSI & Claes Jacobsson GigaCom/Cinch

Subject: Response to TE Connectivity EN4165/EB16-MM Action Items

I have reviewed and analyzed various ball-lens terminus designs along with the information provided by Tyco. To optimally interface to the existing Tyco ball-lens terminus design, there needs to be an adequate description of following optical parameters using single mode propagation at 1310 nm wavelength:

Rayleigh range

Beam waist radius

Beam waist location (As measured from the transmitting lens front surface vertex: is the waist location virtual or real?)

These parameters should be in the form of derived theoretical calculations or output from a standard optical simulation software (i.e. Zemax). Standard beam profile methods should supplement the above beam parameters, but not used exclusively. The beam size information at 50 mm and 100 mm will not help other suppliers determine the optimum exit and entrance pupil parameters needed to interface to the existing system since the measurements presented are multimode. Graded index multimode fiber is self-focusing and has inherent consistency issues when used to launch light into a system. All analysis, simulation and data presented for the purposes of defining the interface parameters (above), must use single mode propagation.

Measurements using graded index multimode fiber will give varying results depending on fiber length, setup, and wavelength. There are more than 200 modes propagating in a 50 um graded-index fiber and their effect on the propagating Gaussian beam can vary. The cylindrical spatial field distribution varies with position in the fiber due to the square law index variation. Light leaving the fiber can vary in field intensity distribution depending on fiber length. This is not a problem when calculations /measurements are performed using single mode propagation exclusively. The three optical SM parameters of Rayleigh range, waist radius and waist location will be sufficient for suppliers to design compatible expanded beam optical termini for both SM and MM operation.

In conclusion, even though the optical system uses multimode fiber, measurements and calculations must be made using single mode propagation and analysis. Without exact prescription information, the Gaussian parameters derived from single mode propagation will allow suppliers to design an optical interface that can match the system parameters of Rayleigh



range, beam waist, and waist location of the existing Tyco design. The calculations provided on sheet 7 of the TE presentation are for primary mode (SM) propagation and does not account for the multimode aspect of the beam measurements presented. Tyco must provide the three calculated parameters above and supplement the data with actual measured values, if possible, in order for other suppliers to couple their designs optimally. The above optical parameters, derived using single mode analysis, will be sufficient to design a system and then allow suppliers to analyze and develop a compatible multimode system.

Pursuant to ARINC SPECIFICATION 800P1, CABIN CONNECTORS AND CABLES, PART 1, DESCRIPTION AND OVERVIEW (PUBLISHED NOVEMBER 12, 2012), Section 3.4, bullet 3 (shown below for reference), we respectfully request a detailed Failure Modes and Effects Analysis (FMEA) for each of the TE terminus lens ARINC 845 design baselines for group review.

3.4 Preparation of ARINC Standard

Component suppliers should prepare the design characteristics and all documentation required for inclusion in ARINC Project Paper 800 or the next Supplement to ARINC Specification 800. The documentation should include the following information:

- Component outline dimensions with critical features required for full intermateability and interchangeability (e.g., interface dimensions, contact dimensions (if supplied uninstalled), accessories, materials, finishes, etc.).
- Performance requirements, test methods, and Qualification Test Plan.
- The component manufacturer may also be asked by the industry SMEs or stakeholders to prepare a FMEA (Failure Modes and Effects Analysis).
- Design modifications made in response to comments/recommendations for improvement during concept selection session.

Note: MIL or EN specs may be used as a format for this section

The proponents will be advised that their input constitutes a "draft" submittal. Draft inputs that are mature are then circulated to industry for broad review using the established AEEC process.

Tom Cruz | Product Manager

Amphenol Fiber Systems International

1300 Central Expressway North, Suite 100

Allen, TX 75013

Office: 214-547-2408

Fax: 214-547-9344

Email: tcruz@fibersystems.com

Website: www.fibersystems.com

Amphenol Fiber Systems International

1300 Central Expressway North, #100 • Allen, Texas 75013 U.S.A

214.547.2400 • Fax: 214.547.9344 • 800.472.4225

www.fibersystems.com • info@fibersystems.com