CORNING

Resolution of comments 242 and 267 on Insertion loss measurements of installed fiber cables

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Current text in 86.10.1

- Insertion loss measurements of installed fiber cables are made in accordance with IEC 61280-4-1/Method 2. The fiber optic cabling (channel) contains 4 or 10 optical fibers for each direction to support 40GBASE-SR4 or 100GBASE-SR10, respectively. The fiber optic cabling interconnects the transmitters at the MDI on one end of the channel to the receivers at the MDI on the other end of the channel. As defined in clause 86.10.3, the optical lanes appear in defined locations at the MDI but the locations are intentionally not assigned specific lane numbers within this standard because any transmitter lane may be connected to any receiver lane. ***[Editor's note (to be removed prior to publication) -*** *IEC 61280-4-1/Method 2 will be renamed IEC 61280-4-1/Annex A when a revised IEC 61280-4-1 (currently at FDIS stage) is published.**]***

Comments on 86.10.1

- Swanson comment 242
  - We need to allow both the 1 jumper method and the 3 jumper method for the measurement of insertion loss because field test equipment may not have the MPO connector.
- Coleman comment 267
  - Referenced 1 jumper method is restrictive as it requires usage of field test equipment with MPO connector interfaces. To my knowledge, field test equipment with a MPO interface is not commercially available now or in the near future. Recommend inclusion of the 3 jumper method to accommodate utilization of legacy and existing commercial field test equipment.

IEC 61280-4-1

- Four measurement methods are designated. The four measurement methods use test cords to interface to the cable plant and are designated as follows:
  - one-cord reference method;
  - three-cord reference method;
  - two-cord reference method;
  - optical time domain reflectometer (OTDR) method.
- The main functional difference between these methods is the way the input power level, known as the reference power level, is measured and hence the inclusion or exclusion of the losses associated with the connections to the cabling under test, and the associated uncertainties of these connections.

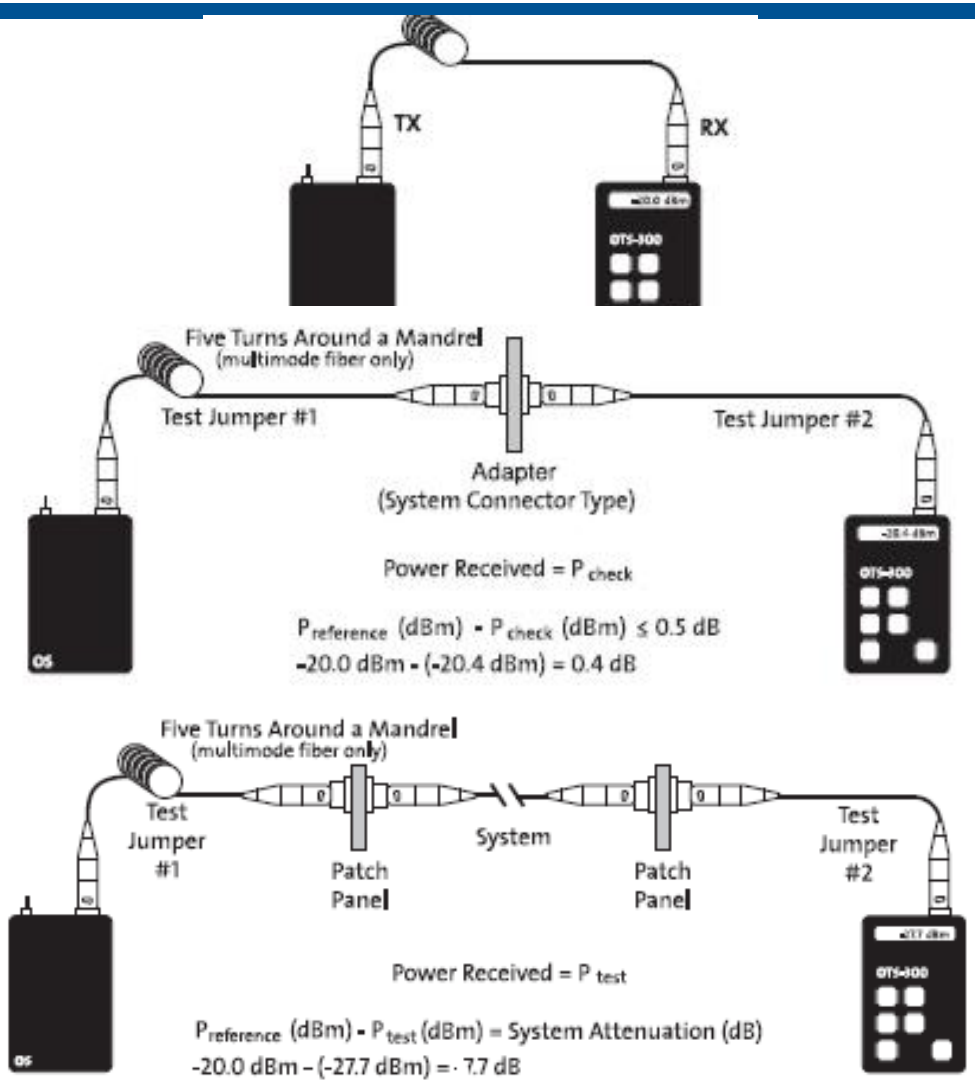
Overview of test methods

- A 1-jumper reference typically provides the most accurate and appropriate test for your system.
- A 2-jumper reference should only be used when your system begins at a patch panel and ends directly in end-equipment.
- A 3-jumper reference should be used when your system begins and ends directly in the end equipment.

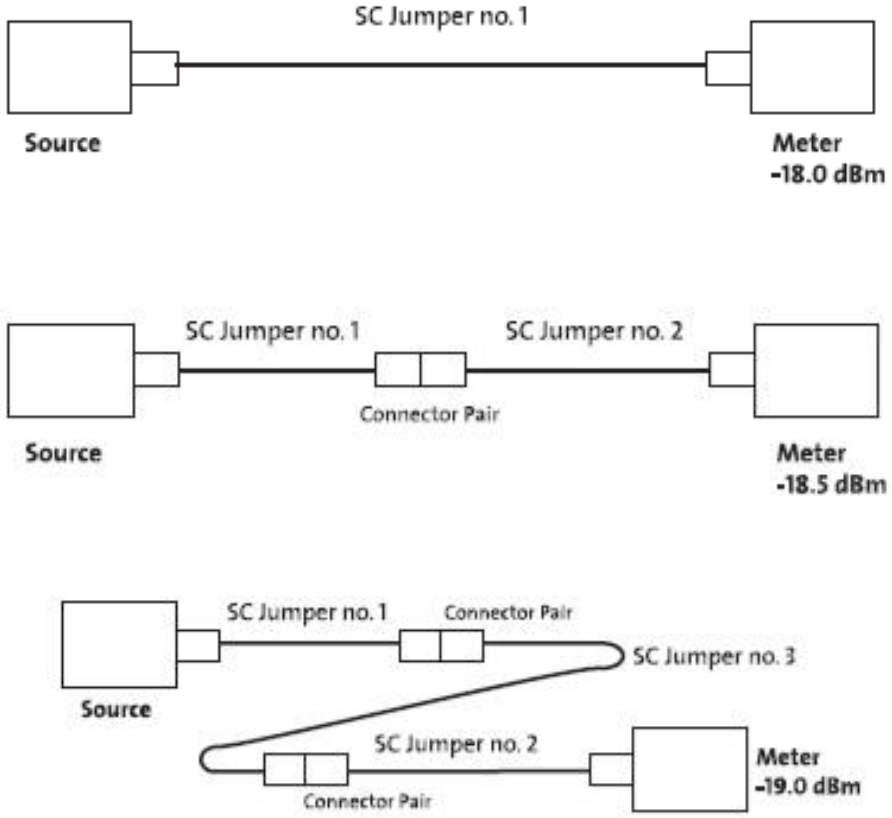
1-jumper vs. 3-jumper test method

- The one-cord reference method includes the attenuation associated with connections at both ends of the cabling under test.
- The three-cord reference method attempts to exclude the attenuation of the connections of both ends of the cabling under test.
- The maximum allowed cabling attenuation specified (e.g. optical power budget or channel insertion loss) for a transmission system normally excludes the connections made to the transmission equipment.
- It is therefore appropriate to use the three cord reference method where the cabling under test is intended to be connected directly to transmission equipment.
- Either method can be used – adjustments are needed

1-jumper test configuration



3-jumper test configuration



Cabling configurations

Table 1 – Cabling configurations

Configuration	Description
A	Adapters attached to plugs or sockets attached to both ends of the cabling
B	Plugs on both ends
C	Mixed, where one end of the cabling is terminated with an adapter and the other end is terminated with a plug

RTMs

Table 2 – Test methods and configurations

Configuration	RTM	Alternative method
A	Annex A	Annex B[a]
B	Annex B	–
C	Annex C	Annex B
[a] For situations where pinned/unpinned or plug/socket style connectors are used such as MTRJ, SG or other harsh environment connector but the power meter does not accept the unpinned or plug connector of the launch cord, Figure C.3 may be used.		
NOTE These configurations, RTMs and annexes are ordered according to the frequency in which different configurations are typically encountered.		

Example for 1-jumper test

- A multimode cabling system 100 m long is terminated in a patch panel at each end. The expected loss, assuming standard grade connectors, would be a total of up to 1,35 dB, assuming 3,5 dB/km cabled optical fibre loss and 0,5 dB per connection.
- If this system is measured using the one test cord reference method as described, and using reference grade terminations on the test leads, then the loss will be up to 0,95 dB (0,35 dB for the 100 m of optical fibre plus 0,3 dB for each connection between reference grade and standard grade terminations).
- For each reference grade to standard grade connection, i.e. in the measurement configuration, an adjustment of 0,2 dB should be subtracted from the acceptance figure.

Example for 3-jumper test

- Consider the above cabling system but with equipment connection cords with standard grade terminations connected into the patch panels. The loss excluding the terminal connectors will be the same as in example 1, i.e. 1,35 dB.
- If this is tested as a cabling system terminated with connector plugs using the three-test-cord reference method, then the measured loss will 1,75 dB. This assumes 1,35 dB for the cabling as before, plus 2 × 0,2 dB, since two reference-grade-to-reference-grade connections were included in the reference measurement, which are replaced by two reference-grade-to standard grade connections in the measured power level through the cabling.
- For each reference-grade-to-reference-grade connection in the reference measurement that is replaced by a reference-grade-to-standard grade connection in the measurement configuration, an adjustment of 0,2 dB should be added to the acceptance figure.

Summary

- Either method can be used provided the results are adjusted to reflect what is being measured
  - For the 1-jumper method, the acceptance figure is adjusted down
  - For the 3-jumper method, the the acceptance figure is adjusted up
- 1-jumper is preferred if cable plant can be plugged directly to power meter (same connectors)
- 3-jumper is preferred if cable plant cannot be plugged directly to power meter (different connectors)