SENKO
SENKO GROUP® Advanced Components

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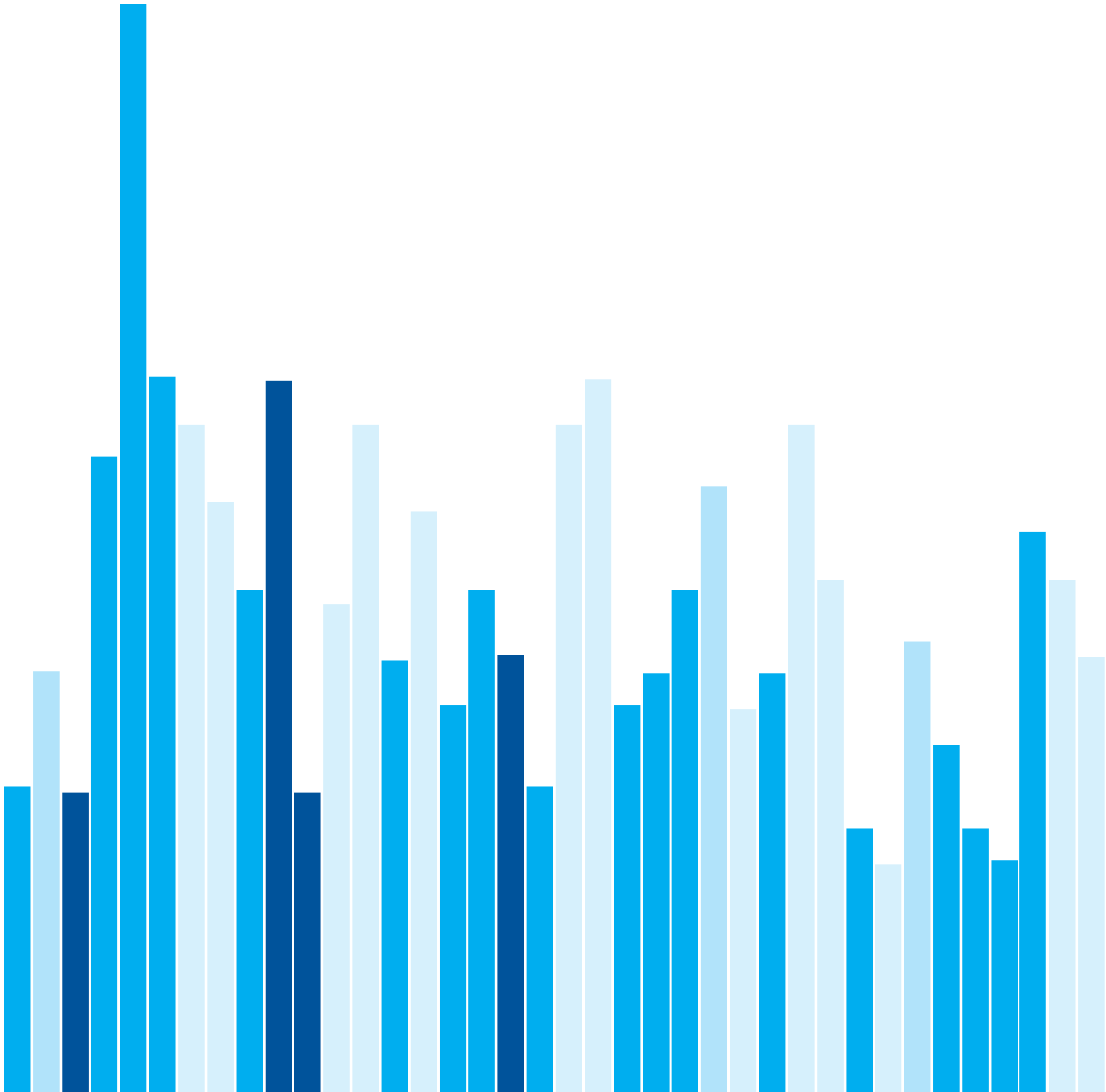
RANDOM MATING IL VS. IL BY MASTER JUMPER

Ky Ly - Senior Staff Engineer



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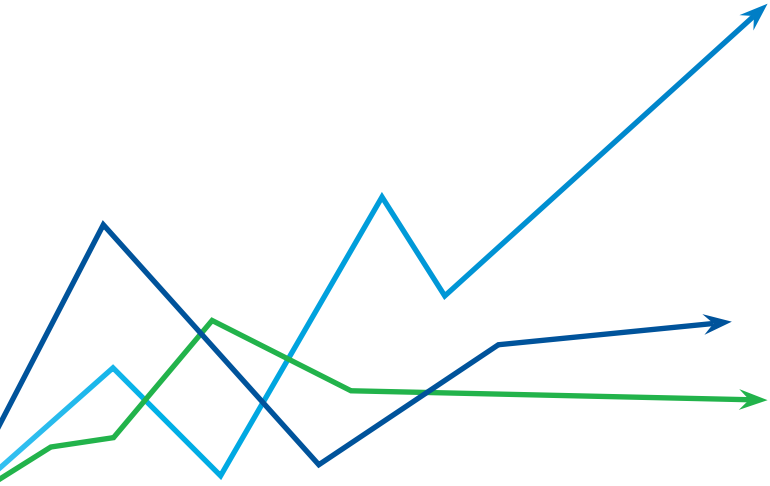


Introduction

The best laid plans of mice and men often go awry. Whether it is a System Designer, System Installer or Service Engineer, they all rely on connectorized fiber optic patchcords deployed into the field to meet the required performance expectations. Even when the individual components comply with industry standards, performance can still fall short of expectations.

Typically, Insertion Loss (IL) and Return Loss (RL) performance shortfalls are merely symptoms of the fiber optics industry's Achilles' heel, namely, lack of due care and attention during installation, and connector intermateability. Both can manifest themselves as poor IL and/or RL performance.

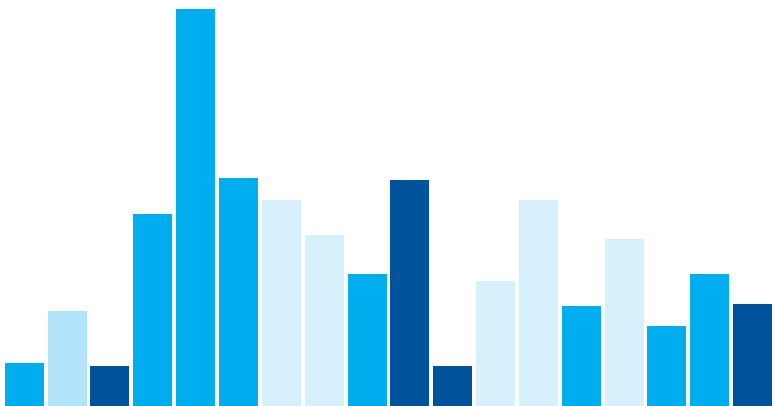
When connectorized fiber optic jumpers from differing manufacturers are used together as interconnects within a system, the resulting IL and/or RL performance expectations may not always be met. Theory suggests if all patchcords from all manufacturers are compliant to industry standards, then all are equal. This is not always the case. Specifications are not finite and have defined tolerances, and such tolerances however tight, will allow for inconsistencies, even with patchcords produced by the same manufacturer.

Overcoming such inconsistencies depend on more than just tight control of tolerances, they also depend on design considerations to allow for the best intermateability possible.

Insertion loss

For Insertion loss specification, the Telcordia GR-326 Core issue 4 states the IL should have the mean of 0.2dB and the max of 0.4dB. In IEC Specification it states the mean of 0.25dB and the max of 0.5dB. To adhere to these specifications, the "best case" scenario of Master or Reference patchcord and adaptor are used for testing in a controlled environment.

It is a common misconception that the IL performance obtained under such conditions truly replicate in the field performance and, therefore, manufacturers often quote the IL values. Although such values are a good reference of performance under controlled conditions, they are not good indicators of in the field performance, where generic patchcords are mated together using generic adapters. In such conditions, the majority of cases the IL will increase and, in some cases, the increase can be significant.



Random Mating

Random Mating, a method of cross-mating patchcords from differing manufacturers or manufactured batches without the use of Master Patchcords or adapters, as specified by IEC 61300-3-34 Attenuation of Random Mated Connectors, and compliance with performance grades outlined in IEC 61753-1, provides the best replication of IL results seen in the field. Using this method, even a product complying with GR-326-COREs 0.2dB Mean IL and 0.4dB Max IL against Master specification can have an IL in excess of 1.0dB.

The IL distribution characteristics obtained from Random Mating, illustrate the probability of obtaining a certain IL level when connectors are randomly mated, providing a guarantee of manufacturer independent intermateability. So it is imperative that patchcords perform in accordance with these specifications to guarantee intermateability with generic patchcords

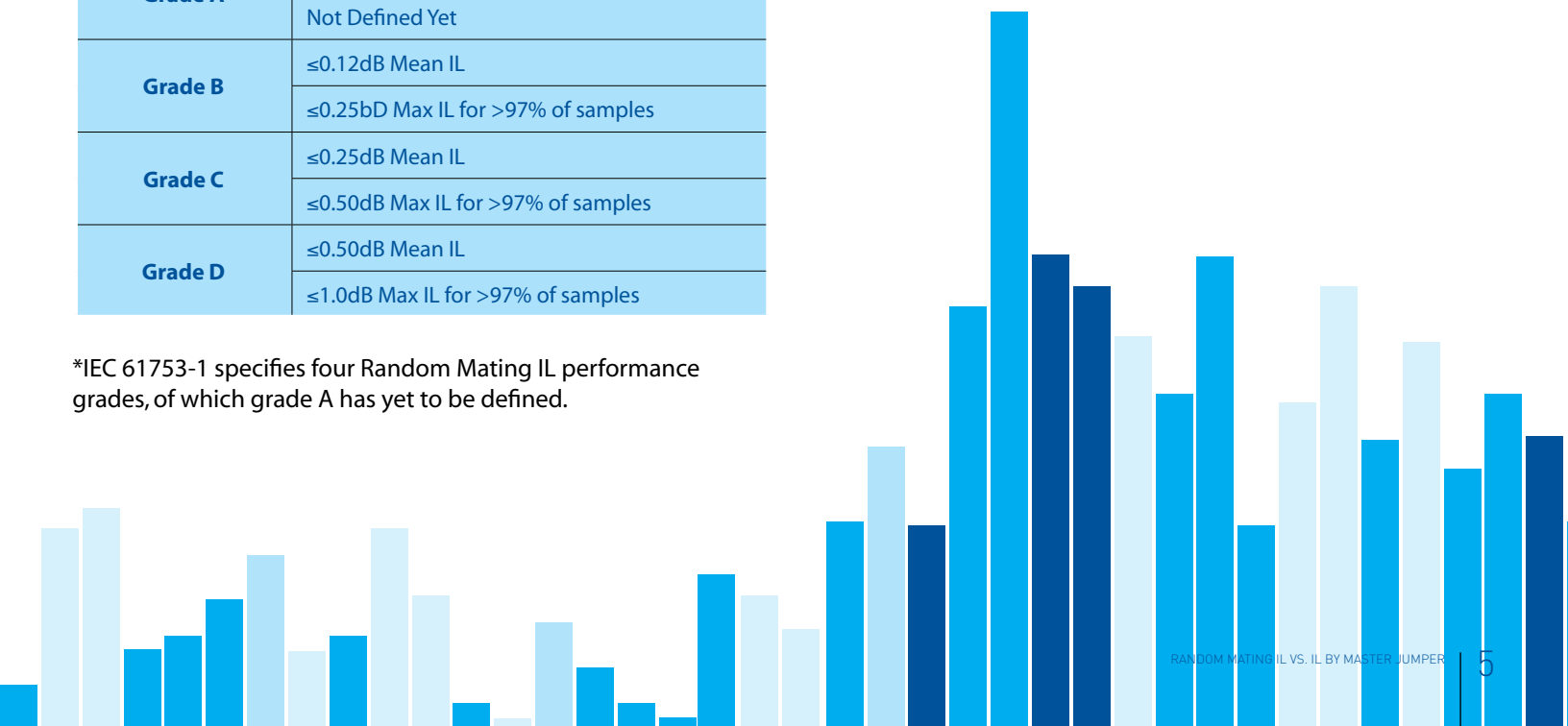
Attenuation Grade	Attenuation Random Mated IEC 61300-3-34
Grade A	Not Defined Yet
	Not Defined Yet
Grade B	≤0.12dB Mean IL
	≤0.25bD Max IL for >97% of samples
Grade C	≤0.25dB Mean IL
	≤0.50dB Max IL for >97% of samples
Grade D	≤0.50dB Mean IL
	≤1.0dB Max IL for >97% of samples

*IEC 61753-1 specifies four Random Mating IL performance grades, of which grade A has yet to be defined.

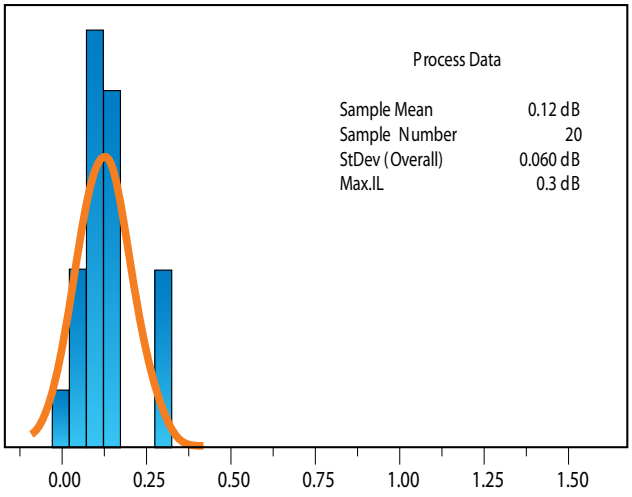
Connector IL difference

By observing only the difference in IL measurements tested against a Master Patchcord, it can be difficult to differentiate good and bad quality connectors. However, it is much easier to differentiate between the two using the Random Mating method.

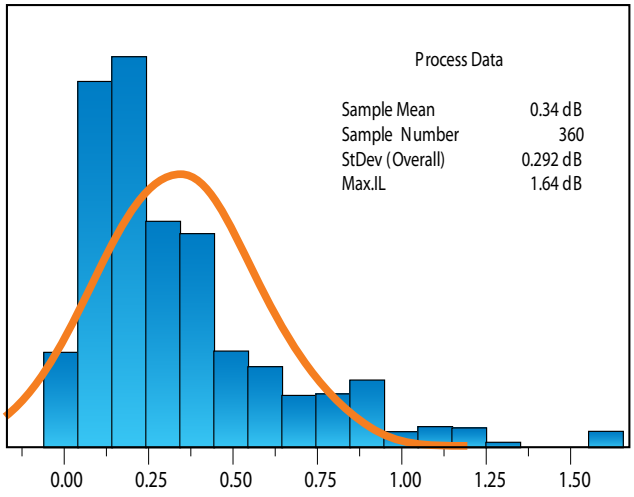
As an Example: The following graphs representing sample batches 1 and 2, both of which comply with the GR-326-CORE specification of Max IL 0.4dB against Master Patchacord. However, when randomly mated the Max IL of batch 1 exceeds 1.0dB, whereas batch 2 is 0.25dB.



Batch n°1 Low Cost Vendor, SC UPC Patchcord

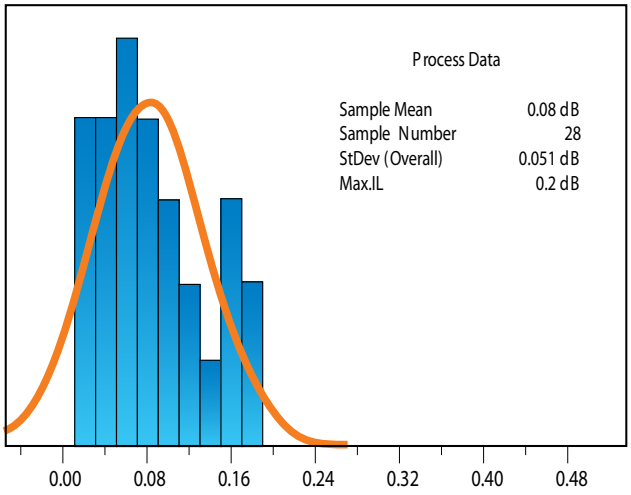


IL measured against Master Patchcord
Meets GR-326 Max IL 0.4dB

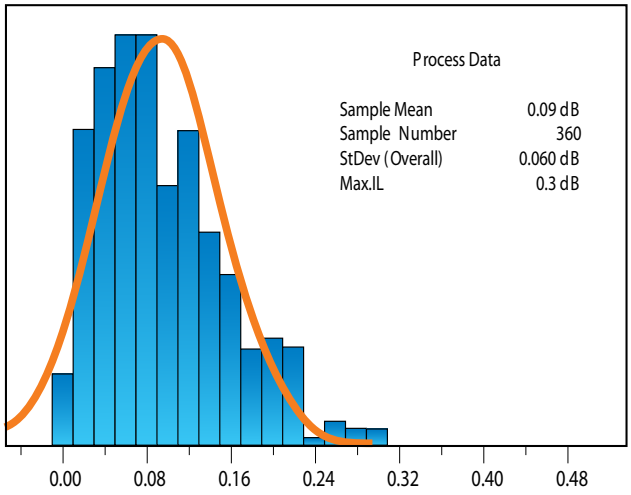


IL measured by Random Mating
Exceeds IEC Random Mating Grade D

Batch n°2 High Quality Vendor, using Senko Premium SM UPC Connector



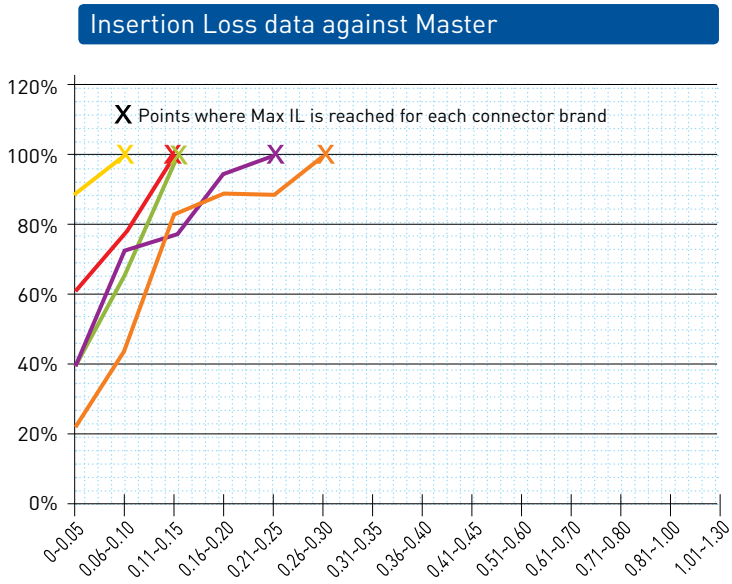
IL measured against Master Patchcord
Meets GR-326 Max IL 0.4dB



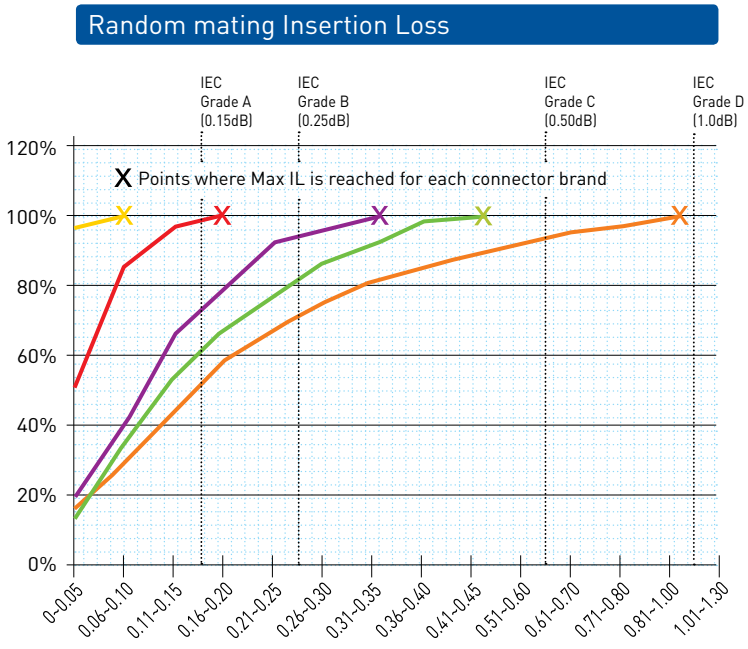
IL measured by Random Mating
Meets IEC Random Mating Grade B

Solution

SENKO has refined the designs of its Premium connector range to give better performance on Random Mating. A number of improvements have been made, including but not limited to, better ferrule bore concentricity, ferrule flange key re-design to improve Key Error, and therefore, Apex Offset repeatability and controlled free-floating ferrule. This has enabled much improved manufacturer independent IL results. The graphs illustrate the performance difference between SENKO's connectors and that of High Quality and Low Cost alternatives.



SENKO has categorized its connectors to reflect the IEC Random Mating specified grades A*, B, and C, allowing the end-user to make an informed decision when selecting connectors, of how finished patchcords using SENKO connectors will perform.



Conclusion

In the Random Mating tests conducted, performance of SENKOs new connectors exceeded the highest requirements specified by both Telcordia GR-326-CORE and IEC industry standards. Products from a High Quality competitor only able to meet the IECs Grade C rating, comparable to that of SENKOs standard connectors. In comparison however, SENKOs Premium connectors delivered outstanding Random Mating IL results.

The performance of SENKOs Premium and Premium Low Loss connectors was such, that they easily exceeded IECs 61753-1 Grade B requirement. In fact, performance of the Premium Low Loss connector could even meet the projected Grade A requirement. Such conclusive results highlight the effectiveness of the new designs, and a guarantee of compliance with industry standards for IL against Master Patchcord, Random Mating IL and repeatability.

<table>
<tr><th colspan="2">RANDOM MATING IEC VALUE</th><th>SENKO UPC Connector</th><th>SENKO APC Connector</th><th>Typical Competitor</th></tr>
<tr><td rowspan="2">IEC Random Mating Grade A</td><td>≤ 0.07dB Mean*</td><td rowspan="2">Premium Low Loss SM UPC Connector</td><td></td><td rowspan="2"></td></tr>
<tr><td>≤ 0.15dB Max*</td><td rowspan="2">Premium Low Loss SM APC Connector</td></tr>
<tr><td rowspan="2">IEC Random Mating Grade B</td><td>≤ 0.12dB Mean</td><td rowspan="2">Premium SM UPC Connector</td><td rowspan="2"></td></tr>
<tr><td>≤ 0.25dB Max</td><td rowspan="2">Premium SM APC Connector</td></tr>
<tr><td rowspan="2">IEC Random Mating Grade C</td><td>≤ 0.25dB Mean</td><td rowspan="2">Standard SM UPC Connector</td><td rowspan="2">Typical High Quality UPC Connector</td></tr>
<tr><td>≤ 0.50dB Max</td><td rowspan="2">Standard SM APC Connector</td></tr>
<tr><td rowspan="2">IEC Random Mating Grade D</td><td>≤ 0.50dB Mean</td><td rowspan="2"></td><td rowspan="2">Low cost quality UPC Connector</td></tr>
<tr><td>≤ 1.00dB Max</td><td></td></tr>
</table>

* Maximum IL, 97% to meet the specification.
* For Random Mating Grade A, specification is not determined yet. Above spec for grade A is a proposed spec.
* Insertion Loss are only guaranteed when product terminated with Senko's recommended rocedure.