

## 1200 km Distance, 1 Gigabit Ethernet Application Using The Series 49SL-LH Repeaters



### **Overview**

This application required operating 1 Gigabit Ethernet communications over a distance of 1200 km. This distance is well beyond what most conventional fiber optic links are able to handle without using repeaters. The proposed solution is to use the AFI Series 49SL-LH single fiber repeaters. Each repeater segment is capable of operating over a distance of 70 km.

Below are some of the key system design considerations for this 1200 km application.

### **System Design Considerations**

1. Wavelengths of 1490nm and 1550nm are selected to minimize the optical loss of the single mode fiber. Attenuation at these wavelengths is ~ 0.2dB/km.
2. DFB (distributed feedback lasers) are selected to maximize the transmission distance since DFB lasers have the lowest chromatic dispersion.
3. Typical fiber slice attenuation is ~ 0.1 dB per splice.
4. Optical connector attenuation is ~ 1.0 dB per connector.
5. Recommended link safety margin should be ~ 3 dB.

Below is a system design spreadsheet that calculates the loss per repeater distance and the optical loss budget for the AFI Series 49SL-LH link. As seen from the spreadsheet, the loss per repeater segment is estimated to be 22.5 db including a 3 dB safety margin.

The Series 49SL-LH link has a minimum optical loss budget of 24 dB. Therefore the Series 49SL-LH link has the performance to operate over this 70 km distance consistent with the loss assumptions summarized above and in the spreadsheet.



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**Optical Loss Budget Spreadsheet**

Total Application Distance	1200	km		
Repeater Length	70	km		
Fiber Attenuation	0.2	dB/km		
Optical Loss per Repeater			14	dB
Splice Loss	0.1	dB		
Splice Distance	2	km		
# of Splices	35			
Total Slice Loss			3.5	dB
# of Connectors	2			
Connector Loss	1	dB		
Total Connector Loss			2	dB
System Safety Margin			3	dB
Total System Loss Calculation			22.5	dB
Series 49				
Transmitter Launch Power (min)			-3	dBm
Receiver Sensitivity (max)			-27	dBm
Repeater Optical Loss Budget			24	
Number of Repeats	17.1			
Number of Repeaters	19			

To accommodate the 1200 km distance, there will be 18 (17.1 rounded off) repeater segments and a total of 19 repeaters.