Chapter 4. Appendices

4.1 Appendix I: Optical Test Procedure

This section describes the methods applied to test fiber optic cable's optical insertion loss and return loss.

4.1.1 Fiber Optic Cable Test

Due to the extended distances that analog signal transmissions travel on cable, the major challenge is to determine the status of the cable.

In order to determine that the cables are functioning, technical personnel need to perform optical power tests.

The optical power tests covered in this document are:

- Optical insertion loss measurement test
- Optical return loss measurement test

4.1.2 MobileAccess System Characteristics

The MobileAccess™ system consists of the following characteristics:

- Singlemode fiber
- Wavelength 1310nm
- Fiber Optic Cable Measurement Tests

Cable can be measured through several procedures. This document describes the following tests:

- Optical insertion loss measurement test
- Optical return loss measurement test

These tests are intended to be performed by technical personnel that deal with MobileAccess systems. Other equipment can be used to perform these tests, however the results have to be the same as will appear in the fiber optic cable test results table (Table 4-1), at the end of this document.

The insertion loss measurement determines whether the optical signal power traveling the cable length is strong enough to be received by the photo diode, in the receiver.

Following the completion of the insertion loss test, the return loss test determines the optical signal power that returns to the laser. The return power affects the laser, changing the laser's base current.

4.1.3 Test Equipment

In order to perform these tests, the following equipment is necessary:

- Light source (for wavelength 1310nm , 0dbm)
- Optical power meter
- Optical coupler (hosed and connectorized)
- Fiber optic jumper
- Adapter parts for the cable connectors

For information about equipment suppliers, contact MobileAccess.

4.1.4 Optical Insertion Loss Measurement Test

The optical insertion loss measurement tests the attenuation of the cable. The insertion loss' value should be minimal and remain in scale to 0.4dB/Km.

The insertion loss measurement can be performed in two methods:

- Two point test
- Single point test

4.1.4.1 Method #1: Two Point Test

Connection description: Light source connected at one end of the cable and an optical power meter at the other end.

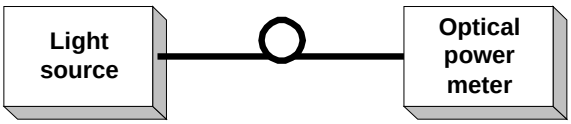

Figure 4-1: Two Point Test

1. Connect light source directly to the optical power meter.
2. Measure light source signal power, verifying power of 0dBm.
3. Connect light source to cable end.
4. Connect optical power meter to cable at other end.
5. Measure light source signal power using the optical power meter.
6. Calculate the difference between two signals (dB):

(Insertion loss)dB = (Light source signal at one end)dBm – (Measured signal at other end)dBm

4.1.4.2 Method #2: Single Point Test

Connection description: This method assumes that there are two parallel fibers on the path to be tested. Connect fiber jumper at end of the cable being tested to another parallel cable. Connect the light source, optical power meter and optical jumper as shown in Figure 4-2. This measurement can test two cables simultaneously.

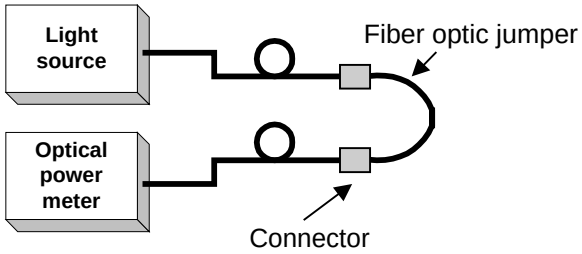

Figure 4-2: Single Point Test

1. Use optic jumper to connect the two cables.
2. Connect light source directly to the optical power meter.
3. Measure the power of light source signal , verify power of 0dBm.
4. Connect a light source and optical power meter to one end of each cable.
5. Measure the power of the signal.
6. Calculate the difference between the two signals in dB

(Insertion loss)dB =(Light source signal)dBm– (Measure signal)dBm

4.1.5 Other Test Equipment

The optical insertion loss measurement test can be performed with more sophisticated measurement equipment.

For information on other types of test equipment contact MobileAccess.

4.1.6 Optical Return Loss Measurement Test

Connection description: Connect a light source and optical power to the inputs. If the coupler has one output, connect the tested cable to this output. If the coupler has two outputs make a pigtail at the second output.

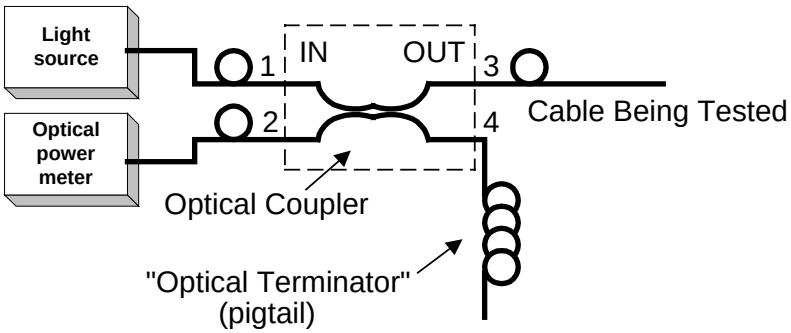

Figure 4-3: Optical Return Loss Measurement

4.1.7 Measurement Procedure

4.1.7.1 Measuring Power Input To Cable Being Tested

- Verify that light source power is at 0dBm.
- Connect a light source to connector #1.
- Connect optical power meter to connector #3.
- Measure signal power (P3), power should be approximately –4dBm.

4.1.7.2 Measuring Coupler Power Loss

- Move power meter from connector #3 to connector #2.
- Move light source from connector #1 to connector #3.
- Measure power loss of coupler (Lc).

4.1.7.3 Measuring Return Power

To measure return power:

- Move light source from connector #3 to connector #1.
- Connect cable being tested to output connector #3.
- If coupler has two outputs, then make a pigtail at second output.
- If cable is longer than 100 meter, then cable needs to be isolated.

To isolate cable:

1. Find place near test point where winding the cable into a pigtail is possible.
1. Make pigtail.
2. If cable is shorter than 100 meter, then verify that cable is disconnected at end.
3. Measure the return light power (P2), connector #2.

Calculating Return Loss

Calculate the difference between the signals in dB.

(Return loss)dB = (P2)dBm – (P3)dBm + (Lc)dB

4.1.8 Results

The following table is to be filled in by technical personnel testing the fiber optic cables.

Table 4-1: Fiber optic Cable Test Results

Test	Measurement	Pass Range	Pass/Fail
Optical insertion loss		<0.5 dB/Km	
Optical return loss		< -50 dB	

4.1.9 Summary

If the fiber fails in the optical insertion loss or optical return loss tests, then the connector needs to be cleaned. Connector cleaning is carried out according to a standard cleaning procedure. Following cleaning, the fiber needs to be tested again. If the failure continues in the fiber following cleaning, then the technical personnel need to refer to the fiber optic cable manufacturer's troubleshooting guide.If the fiber passes the optical insertion loss and optical return loss tests, then the tested fiber optic cable is considered suitable for use with MobileAccess equipment