

# Testing Short SM DUTs with the RL1



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One of the advantages of the RL1 compared to traditional OTDR IL/RL meters is its ability to measure the total return loss ( $RL_{Total}$ ) of a single-mode (SM) device under test (DUT).

Because  $RL_{Total}$  has no dead-zone, it is ideal for measuring short DUTs like cassettes. In this document, we will show how to measure a typical short SM DUT using the **RL1 Automated Return Loss Meter** and JGR's free software, **GMS**.

You can download GMS on our website: <https://jgroptics.com/downloads/software>

If you have any questions, please email [support@jgroptics.com](mailto:support@jgroptics.com)

## DUT Details

- 30 cm cassette
- 12 fibers (SM)
- MPO/APC to LC/PC



## Equipment Required

- **RL1** IL/RL meter
- **SX1** switch
- Computer or tablet with **GMS** software



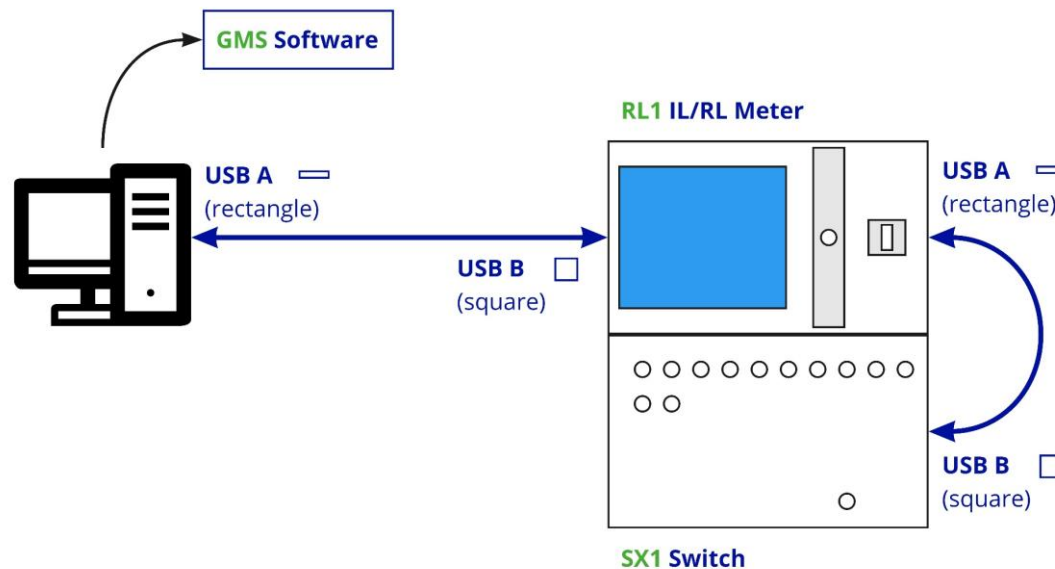
# Testing Short SM DUTs with the RL1

## Test Parameters

- **$IL_{Total}$** : because of the closed configuration of a cassette, it is not possible to insert the connectors into the detector. It is therefore standard practice to measure the total insertion loss ( $IL_A + IL_B$ ) of the DUT.
- **$RL_{Total}$** : for some DUTs shorter than 1.7m, it is not possible to accurately measure the return loss of each connector separately without terminating the far end. With the RL1, you can measure the total return loss ( $RL_A + RL_B + \text{fiber}$ ) of the DUT without the need for termination.

## Hardware Setup (option #1: USB)

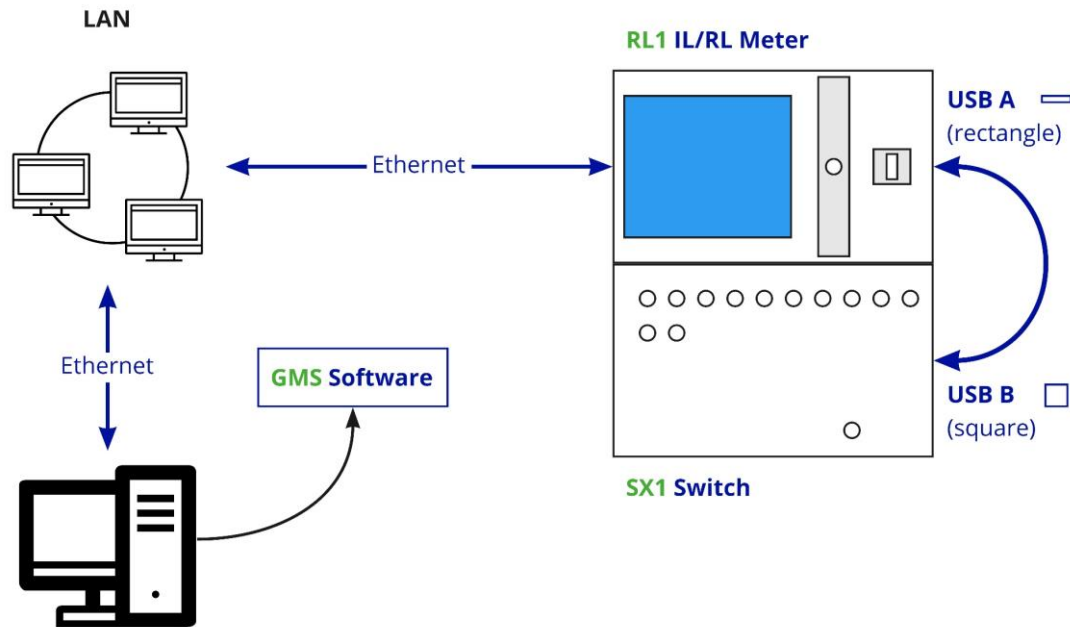
- Connect the SX1 directly to the RL1 via USB.
- Connect the RL1 directly to the PC or tablet via USB.



# Testing Short SM DUTs with the RL1

## Hardware Setup (option #2: Ethernet)

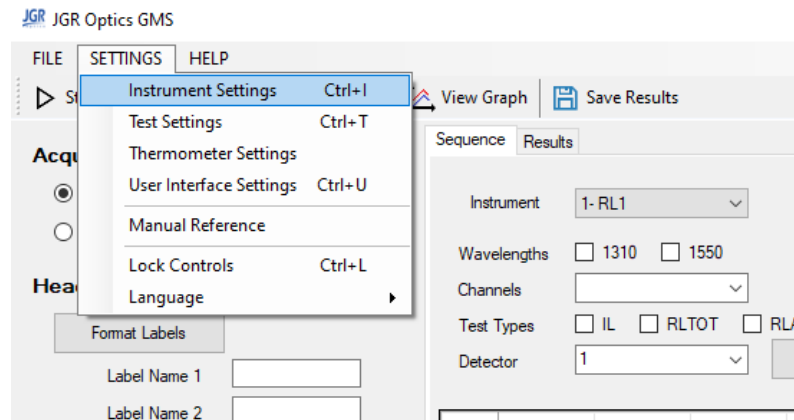
- Connect the SX1 directly to the RL1 by USB.
- Connect the RL1 and PC to a LAN via Ethernet.



# Testing Short SM DUTs with the RL1

## GMS: Establishing Communications

- Launch GMS and go to *Settings > Instrument Settings*.



# Testing Short SM DUTs with the RL1

## GMS: Establishing Communications

1. Use the settings below and select the appropriate port (USB or Ethernet) for your setup.
2. Use the drop-down menu to select the RL1's IP address or USB port. If your network settings prevent the auto-discover function for Ethernet, manually enter the IP address of the RL1.
3. Click *Test Port*.

The screenshot shows the 'JGR Instrument Settings' dialog box. A red rectangle highlights the top section containing the following fields:

- # of Instruments: 1
- Instrument #: 1 (dropdown)
- Instrument: RL1 (dropdown)
- Port: Ethernet (dropdown)

A red arrow labeled '1' points to the 'Instrument #' dropdown. Below this, the 'Address / Com port' field has a dropdown menu open, showing a list of IP addresses: 192.168.12.66, 192.168.12.108, 192.168.12.19, and 192.168.12.61. A red circle highlights the dropdown arrow, with a red arrow labeled '2' pointing to it. Below the IP list, the 'Number of Channels' and 'Number of Detectors' fields are visible. Further down, the 'Wavelengths' section has two input fields with values 1310 and 1550. At the bottom right, the 'Test Port' button is circled in red, with a red arrow labeled '3' pointing to it. Other buttons include 'Auto Select', 'OK', and 'Cancel'. A checkbox at the bottom left is labeled 'Sync Switch with Chn if Possible'.

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## GMS: Establishing Communications

- You will get a pop-up confirming the active status of the instrument and be prompted to automatically detect the wavelengths. Click Yes.
- The software will automatically detect the switch's number of channels and the RL1's number of detectors and wavelengths.
- Click OK.

JGR Instrument Settings

# of Instruments: 1

Instrument #: 1

Instrument: RL1

Port: Ethernet

Address / Com port: 192.168.12.108

Number of Channels: 24

Number of Detectors: 1

Wavelengths: 1310, 1550

Switch: Auto

Auto Select

Test Port

☐ Sync Switch with Chn if Possible

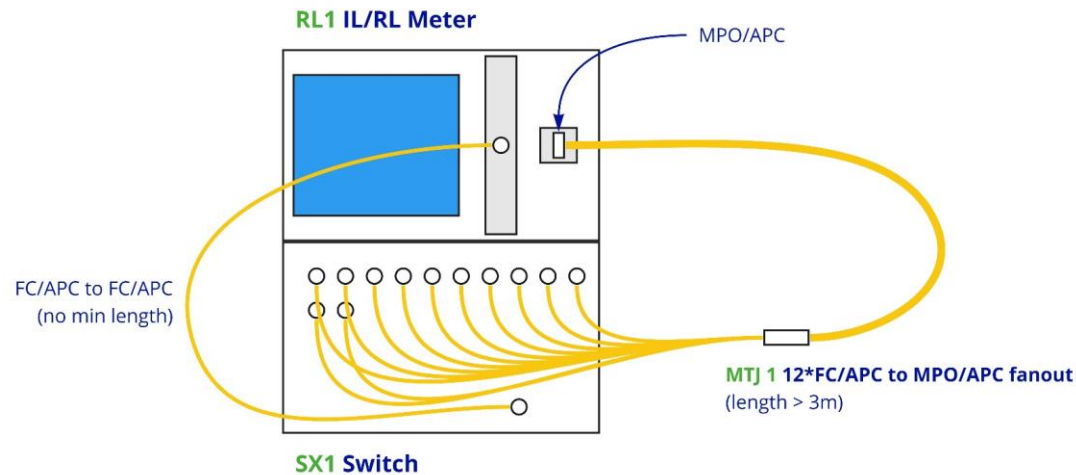
OK Cancel

If you have more than one switch connected, use the drop-down menu to select the appropriate one and click *Test Port* to confirm.

# Testing Short SM DUTs with the RL1

## Reference

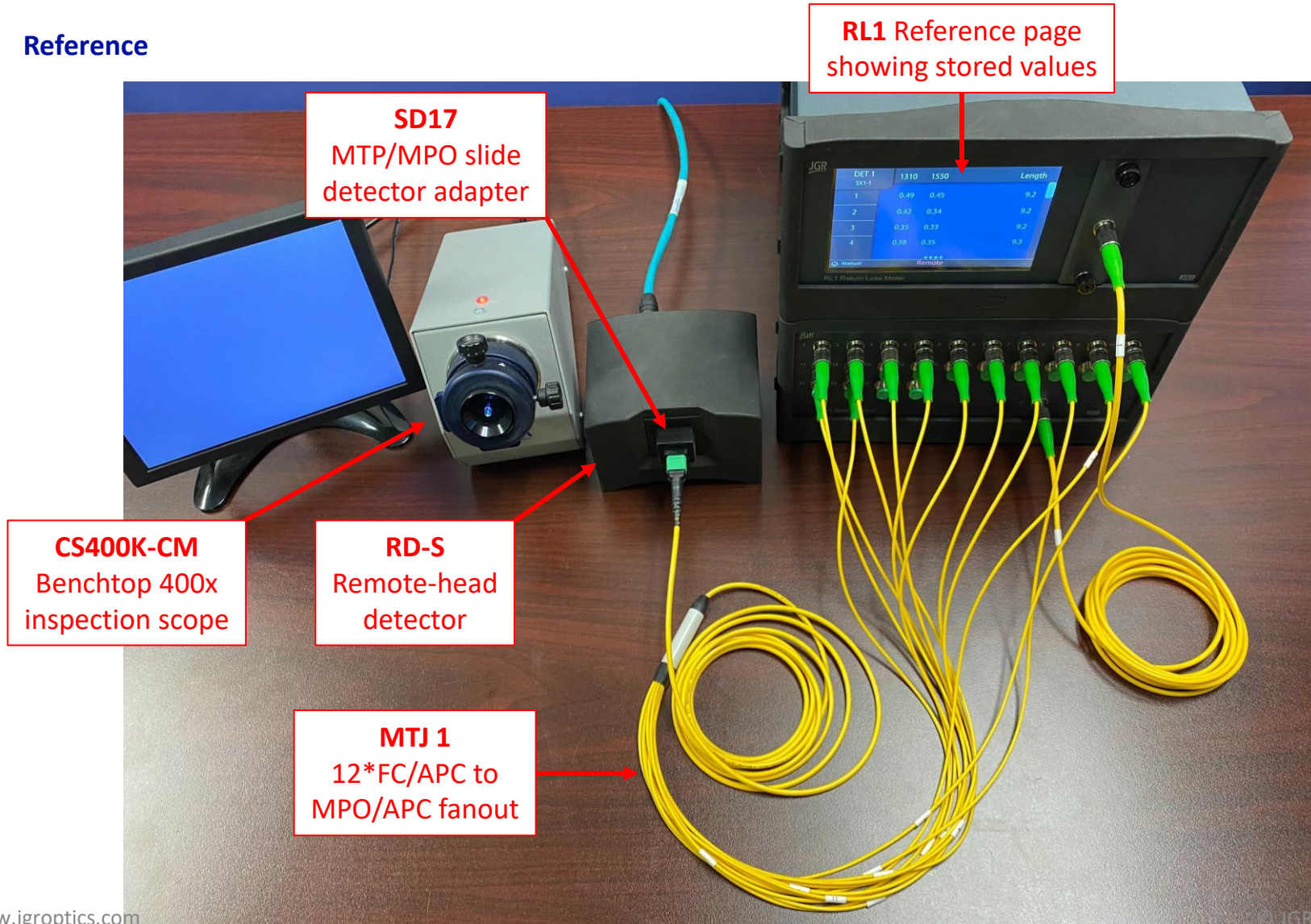
- Inspect and connect an **FC/APC to FC/APC SM jumper** between the RL1 output and the SX1 common.
- Inspect and connect a **12\*FC/APC to MPO/APC SM fanout** between the SX1 outputs and the RL1 detector.
  - The length must be at least 3m.
  - The fanout will act as the master test jumper (MTJ) or reference cable.
  - Short protection or sacrificial jumpers can be used **before** the MTJ but the last cable before the DUT must be at least 3m.





# Testing Short SM DUTs with the RL1

## Reference



# Testing Short SM DUTs with the RL1

## Reference

- Insert the sequences below.
  1. The RL1 requires an IL reference for each channel and wavelength.
  2. The RL1 requires a length reference for each channel but only one wavelength.
- You can save the profile for future use (*File > Save Profile as...*).

Sequence Results

Instrument 1- RL1

Wavelengths ☒ 1310 ☒ 1550

Channels 1-12

Test Types ☒ IL ☐ RLTOT ☐ RLA ☐ RLB ☐ Length ☐ PWR

Detector 1

Insert

Sequence Results

Instrument 1- RL1

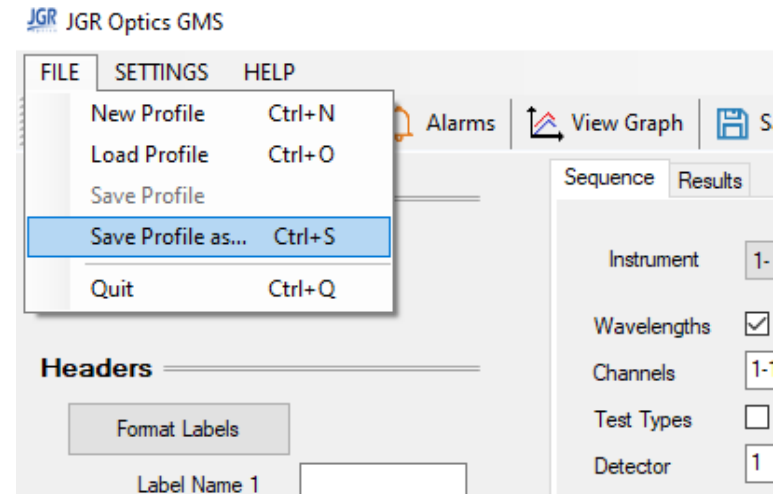
Wavelengths ☒ 1310 ☐ 1550

Channels 1-12

Test Types ☐ IL ☐ RLTOT ☐ RLA ☐ RLB ☒ Length ☐ PWR

Detector 1

Insert



# Testing Short SM DUTs with the RL1

The screenshot shows the JGR Optics GMS software interface. The 'Acquisition' tab is selected, with 'Reference' chosen as the acquisition type. The 'Headers' section shows 'Format Labels' and four label name input fields. The 'Sequence' tab is also visible, showing settings for Instrument (1-RL1), Wavelengths (1310, 1550), Channels (1-12), Test Types (IL, RLTOT, RLA, RLB, Length, PWR), and Detector (1). The 'Results' table displays test data for 36 rows, including Instrument, Ch#, Wave, Test, Detector, Reading, Pause, Pause Message, and Description. The table is divided into two sections: IL (rows 17-24) and Length (rows 25-36). The IL section shows readings ranging from 0.29 to 0.47 dB. The Length section shows readings ranging from 9.10 to 9.30 m. A red box highlights the 'Reference' acquisition type and the 'Start' button. A blue box highlights the 'Results' table. A red arrow points from the 'Reference' acquisition type to the 'Start' button. A blue arrow points from the 'Results' table to the 'Typical values are < 1 dB.' text box. A red arrow points from the 'Reference' acquisition type to the 'Select Reference acquisition and click on Start.' text box. A blue arrow points from the 'Results' table to the 'Typical values are within +/- 0.2 m of each other.' text box. A red arrow points from the 'Reference' acquisition type to the 'The reference values are stored on the RL1 meter.' text box. A blue arrow points from the 'Results' table to the 'Higher variations could indicate a bad mating to the switch output causing a very high reflection or damaged fiber on the MTJ.' text box.

Typical values are < 1 dB.

If you have more than 2 dB in your reference IL value, it is recommended to inspect each connector end face from the RL1 output to the end of MTJ 1.

Select *Reference* acquisition and click on *Start*.

The reference values are stored on the RL1 meter.

Typical values are within +/- 0.2 m of each other.

Higher variations could indicate a bad mating to the switch output causing a very high reflection or damaged fiber on the MTJ.

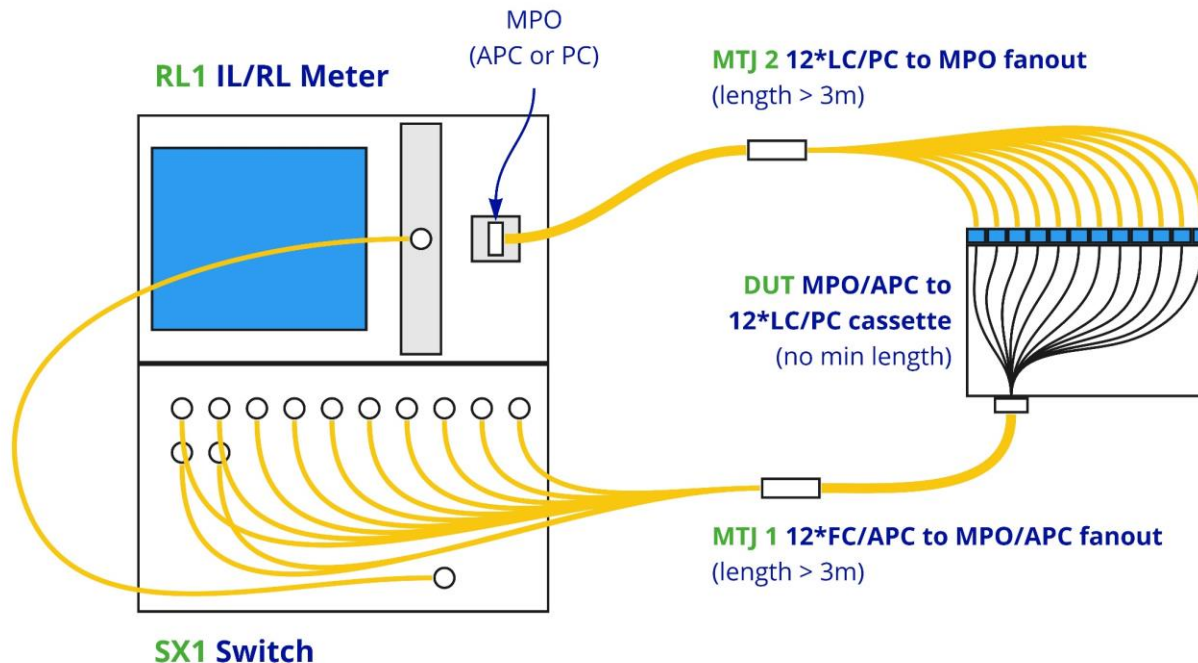
|    | Instrument | Ch# | Wave | Test   | Detector | Reading | Pause                    | Pause Message | Description |
|----|------------|-----|------|--------|----------|---------|--------------------------|---------------|-------------|
| 17 | 1-RL1      | 9   | 1310 | IL     | 1        | 0.33    | <input type="checkbox"/> |               |             |
| 18 | 1-RL1      | 9   | 1550 | IL     | 1        | 0.31    | <input type="checkbox"/> |               |             |
| 19 | 1-RL1      | 10  | 1310 | IL     | 1        | 0.44    | <input type="checkbox"/> |               |             |
| 20 | 1-RL1      | 10  | 1550 | IL     | 1        | 0.40    | <input type="checkbox"/> |               |             |
| 21 | 1-RL1      | 11  | 1310 | IL     | 1        | 0.47    | <input type="checkbox"/> |               |             |
| 22 | 1-RL1      | 11  | 1550 | IL     | 1        | 0.30    | <input type="checkbox"/> |               |             |
| 23 | 1-RL1      | 12  | 1310 | IL     | 1        | 0.34    | <input type="checkbox"/> |               |             |
| 24 | 1-RL1      | 12  | 1550 | IL     | 1        | 0.29    | <input type="checkbox"/> |               |             |
| 25 | 1-RL1      | 1   | 1310 | Length | 1        | 9.20    | <input type="checkbox"/> |               |             |
| 26 | 1-RL1      | 2   | 1310 | Length | 1        | 9.20    | <input type="checkbox"/> |               |             |
| 27 | 1-RL1      | 3   | 1310 | Length | 1        | 9.20    | <input type="checkbox"/> |               |             |
| 28 | 1-RL1      | 4   | 1310 | Length | 1        | 9.30    | <input type="checkbox"/> |               |             |
| 29 | 1-RL1      | 5   | 1310 | Length | 1        | 9.10    | <input type="checkbox"/> |               |             |
| 30 | 1-RL1      | 6   | 1310 | Length | 1        | 9.10    | <input type="checkbox"/> |               |             |
| 31 | 1-RL1      | 7   | 1310 | Length | 1        | 9.20    | <input type="checkbox"/> |               |             |
| 32 | 1-RL1      | 8   | 1310 | Length | 1        | 9.30    | <input type="checkbox"/> |               |             |
| 33 | 1-RL1      | 9   | 1310 | Length | 1        | 9.20    | <input type="checkbox"/> |               |             |
| 34 | 1-RL1      | 10  | 1310 | Length | 1        | 9.10    | <input type="checkbox"/> |               |             |
| 35 | 1-RL1      | 11  | 1310 | Length | 1        | 9.10    | <input type="checkbox"/> |               |             |
| 36 | 1-RL1      | 12  | 1310 | Length | 1        | 9.10    | <input type="checkbox"/> |               |             |

Length Test on wavelength 1310, channel 6, detector 1:  
Length Test on wavelength 1310, channel 7, detector 1:  
Length Test on wavelength 1310, channel 8, detector 1:  
Length Test on wavelength 1310, channel 9, detector 1:  
Length Test on wavelength 1310, channel 10, detector 1:  
Length Test on wavelength 1310, channel 11, detector 1:  
Length Test on wavelength 1310, channel 12, detector 1:  
Test Finished - 2021-03-24 10:28:20

# Testing Short SM DUTs with the RL1

## Measure

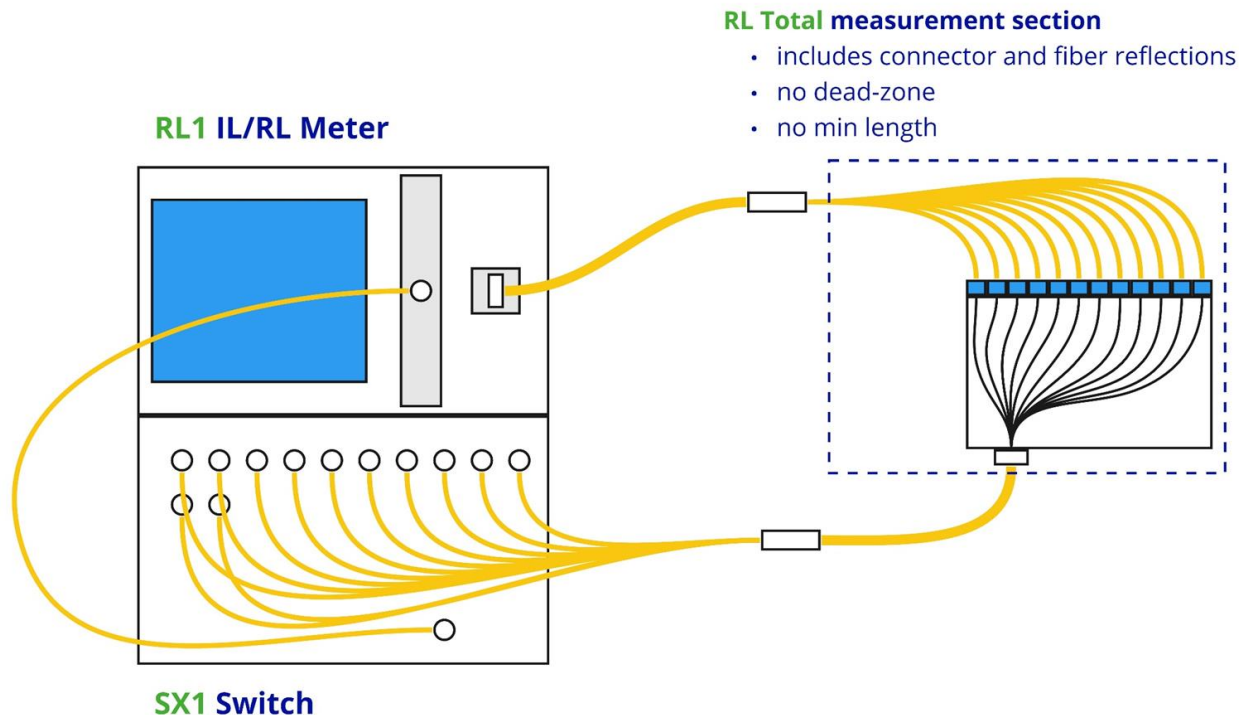
- Disconnect **MTJ 1**'s MPO connector from the detector.
- Inspect and insert the MPO connector of **MTJ 2 12\*LC/PC to MPO fanout** in the detector.
  - The recommended length is 3m but it can be longer.
- Inspect and connect the **DUT MPO/APC to 12\*LC/PC cassette** between **MTJ 1** and **MTJ 2**.
  - There is no minimum length for the DUT.



# Testing Short SM DUTs with the RL1

## Measure

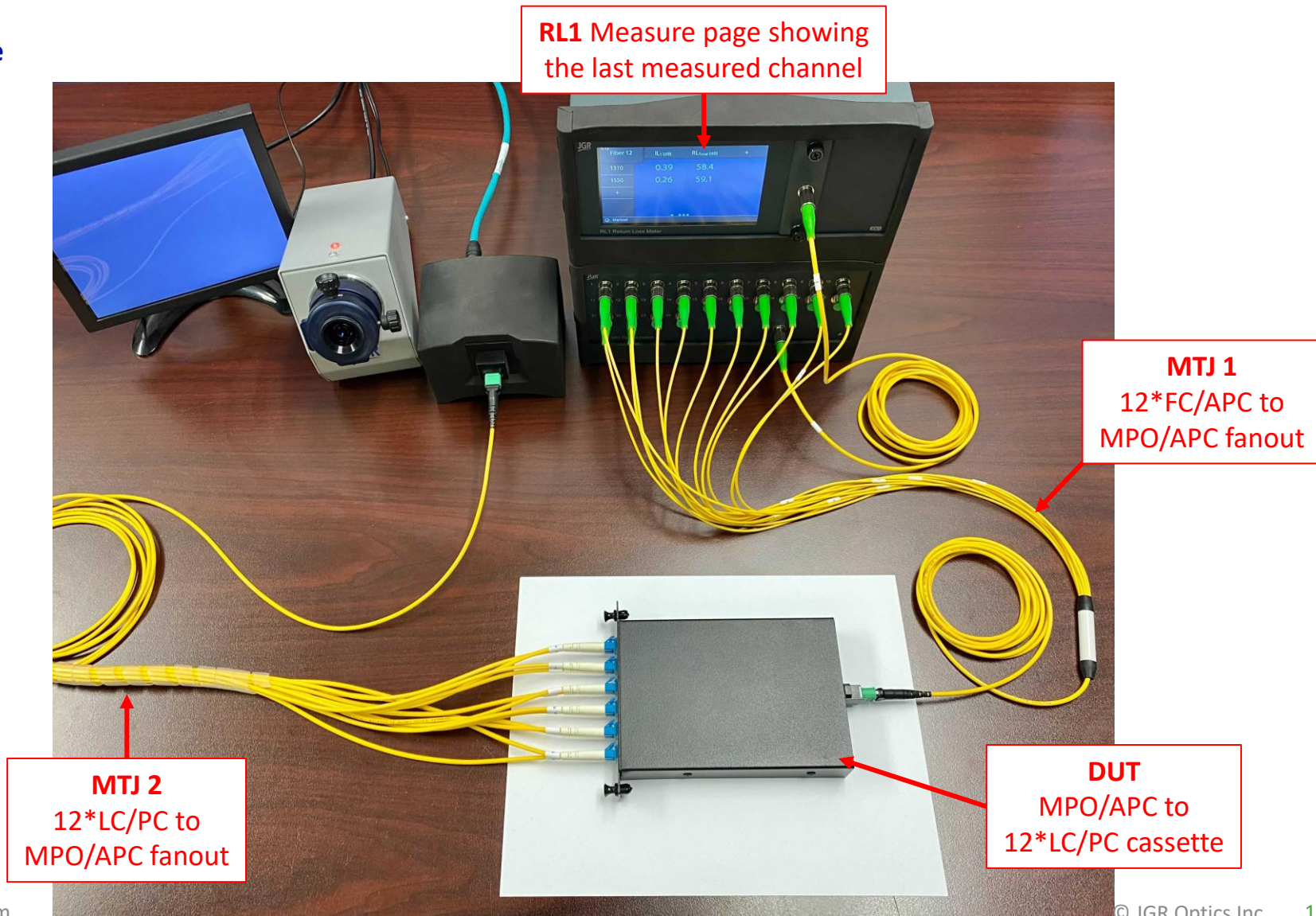
- The RL1's detection algorithm automatically identifies the DUT. It measures the total return loss of the device without needing to set a measurement window thereby eliminating operator error and simplifying the testing process.
- While it includes a small amount of fiber reflection of each MTJ, it is negligible compared to the DUT.
- No physical termination required and the detector side MPO connector can be either APC or PC.





# Testing Short SM DUTs with the RL1

## Measure



# Testing Short SM DUTs with the RL1

## Measurement

1. Click in the top left cell of the sequence window to select all then press *Delete*.
2. Select the parameters below then click *Insert*.

**Sequence** Results

Instrument: 1- RL1

Wavelengths: ☒ 1310 ☒ 1550

Channels: 1-12

Test Types: ☒ IL ☒ RLTOT ☐ RLA ☐ RLB ☐ Length ☐ PWR

Detector: 1

|    | Instrument | Ch# | Wave | Test   | Detector | Reading | Pause                    | Pause Message | Description |
|----|------------|-----|------|--------|----------|---------|--------------------------|---------------|-------------|
| 30 | 1- RL1     | 6   | 1310 | Length | 1        |         | <input type="checkbox"/> |               |             |
| 31 | 1- RL1     | 7   | 1310 | Length | 1        |         | <input type="checkbox"/> |               |             |
| 32 | 1- RL1     | 8   | 1310 | Length | 1        |         | <input type="checkbox"/> |               |             |
| 33 | 1- RL1     | 9   | 1310 | Length | 1        |         | <input type="checkbox"/> |               |             |
| 34 | 1- RL1     | 10  | 1310 | Length | 1        |         | <input type="checkbox"/> |               |             |
| 35 | 1- RL1     | 11  | 1310 | Length | 1        |         | <input type="checkbox"/> |               |             |

Length Test on wavelength 1310, channel 6, detector 1:  
Length Test on wavelength 1310, channel 7, detector 1:  
Length Test on wavelength 1310, channel 8, detector 1:  
Length Test on wavelength 1310, channel 9, detector 1:  
Length Test on wavelength 1310, channel 10, detector 1:  
Length Test on wavelength 1310, channel 11, detector 1:  
Length Test on wavelength 1310, channel 12, detector 1:  
Test Finished - 2021-03-24 10:28:20

Iteration: 1 Time Elapsed: 00:00:50

# Testing Short SM DUTs with the RL1

## Measurement

- Select the test parameters below then click *Insert*.
- You can save the profile for future use (*File > Save Profile as...*).

The screenshot shows the JGR Optics GMS software interface. The 'Acquisition' section is highlighted with a blue box, showing 'Measurement' selected. The 'Sequence' section is highlighted with a red box, showing 'Instrument' set to '1- RL1', 'Wavelengths' set to '1310' and '1550', 'Channels' set to '1-12', 'Test Types' set to 'IL' and 'RLTOT', and 'Detector' set to '1'. The 'Insert' button is highlighted. A text box on the left says 'Make sure the acquisition mode is set to Measurement'. The 'Results' table is visible, showing a list of tests. The status bar at the bottom indicates 'Iteration: 1 Time Elapsed: 00:00:50'.

**Acquisition**

☐ Reference  
☒ Measurement

**Sequence**

Instrument: 1- RL1  
Wavelengths: ☒ 1310 ☒ 1550  
Channels: 1-12  
Test Types: ☒ IL ☒ RLTOT ☐ RLA ☐ RLB ☐ Length ☐ PWR  
Detector: 1

|   | Instrument | Ch# | Wave | Test  | Detector | Reading: | Pause                    | Pause Message | Description |
|---|------------|-----|------|-------|----------|----------|--------------------------|---------------|-------------|
| 1 | 1- RL1     | 1   | 1310 | IL    | 1        |          | <input type="checkbox"/> |               |             |
| 2 | 1- RL1     | 1   | 1310 | RLTOT | 1        |          | <input type="checkbox"/> |               |             |
| 3 | 1- RL1     | 1   | 1550 | IL    | 1        |          | <input type="checkbox"/> |               |             |
| 4 | 1- RL1     | 1   | 1550 | RLTOT | 1        |          | <input type="checkbox"/> |               |             |
| 5 | 1- RL1     | 2   | 1310 | IL    | 1        |          | <input type="checkbox"/> |               |             |
| 6 | 1- RL1     | 2   | 1310 | RLTOT | 1        |          | <input type="checkbox"/> |               |             |

Length Test on wavelength 1310, channel 6, detector 1:  
Length Test on wavelength 1310, channel 7, detector 1:  
Length Test on wavelength 1310, channel 8, detector 1:  
Length Test on wavelength 1310, channel 9, detector 1:  
Length Test on wavelength 1310, channel 10, detector 1:  
Length Test on wavelength 1310, channel 11, detector 1:  
Length Test on wavelength 1310, channel 12, detector 1:  
Test Finished - 2021-03-24 10:28:20

Iteration: 1 Time Elapsed: 00:00:50



# Testing Short SM DUTs with the RL1

Click Start

**JGR Optics GMS**

FILE SETTINGS HELP

**Start** | Pause | Stop | Alarms | View Graph | Save Results

**Mode:** Measurement **Status:** Pass

**Acquisition**

- ☐ Reference
- ☒ Measurement

**Headers**

Format Labels

Label Name 1:

Label Name 2:

Label Name 3:

Label Name 4:

**Profiles**

Filter Profiles...

Add Remove

**Sequence Results**

Instrument: 1-RL1

Wavelengths: ☒ 1310 ☒ 1550

Channels: 1-12

Test Types: ☒ IL ☒ RLTOT ☐ RLA ☐ RLB ☐ Length ☐ PWR

Detector: 1

|    | Instrument | Ch# | Wave | Test  | Detector | Reading: | Pause                    | Pause Message | Description |
|----|------------|-----|------|-------|----------|----------|--------------------------|---------------|-------------|
| 43 | 1- RL1     | 11  | 1550 | IL    | 1        | 0.51     | <input type="checkbox"/> |               |             |
| 44 | 1- RL1     | 11  | 1550 | RLTOT | 1        | 59.10    | <input type="checkbox"/> |               |             |
| 45 | 1- RL1     | 12  | 1310 | IL    | 1        | 0.39     | <input type="checkbox"/> |               |             |
| 46 | 1- RL1     | 12  | 1310 | RLTOT | 1        | 58.40    | <input type="checkbox"/> |               |             |
| 47 | 1- RL1     | 12  | 1550 | IL    | 1        | 0.26     | <input type="checkbox"/> |               |             |
| 48 | 1- RL1     | 12  | 1550 | RLTOT | 1        | 59.10    | <input type="checkbox"/> |               |             |

RLTOT Test on wavelength 1310, channel 11, detector 1: Pass  
IL Test on wavelength 1550, channel 11, detector 1: Pass  
RLTOT Test on wavelength 1550, channel 11, detector 1: Pass  
IL Test on wavelength 1310, channel 12, detector 1: Pass  
RLTOT Test on wavelength 1310, channel 12, detector 1: Pass  
IL Test on wavelength 1550, channel 12, detector 1: Pass  
RLTOT Test on wavelength 1550, channel 12, detector 1: Pass  
Test Finished - 2021-03-24 15:17:59

Iteration: 1 Time Elapsed: 00:00:28