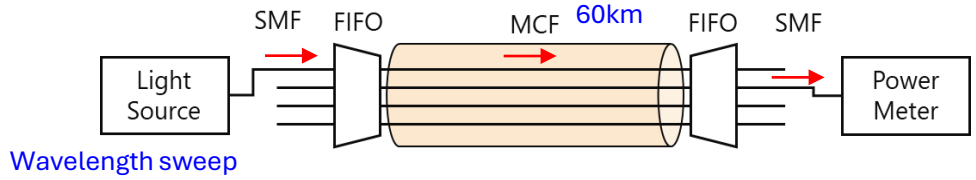
1. Appendix

2. Comparison XT value in each methods.

Comparison of Xtalk meauremtn between OTDR and Power-Through

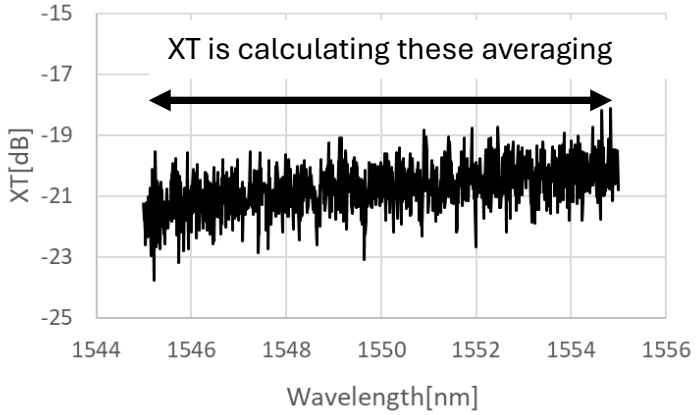
With IEEE, we evaluated Xtalk on adjacent cores by MT9100A and power meter method.

●Power meter method

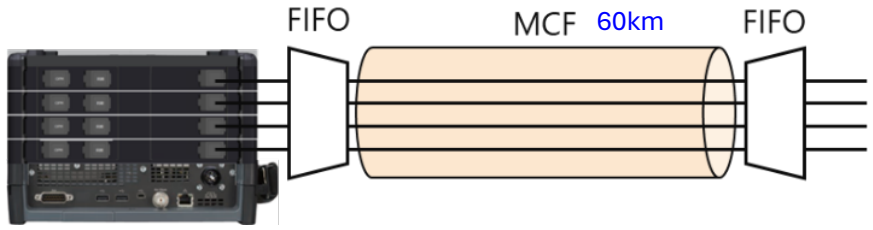


Sweep range : 1550/1625±5nm
Sweep step : 0.01 nm
Number of data : 1000 pts

This is based on following article
T. Hayashi et al., "Characterization of Crosstalk in Ultra-Low-Crosstalk Multi-Core Fiber," Journal of Lightwave technology, vol.30, no.4, 2012



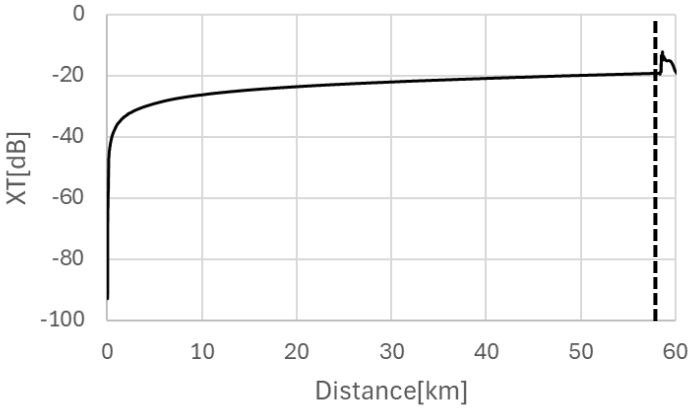
●Multi-channel OTDR method(MT9100A)



Wavelength : 1550/1625nm
Pulse width : 1000ns(1us)

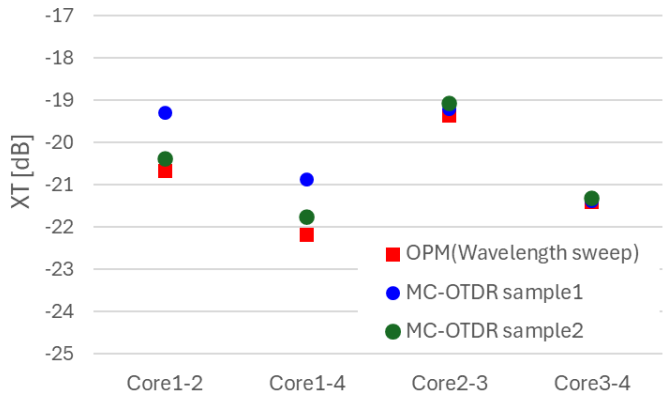
Note :
Actual wavelength is shifted few-nm from nominal wavelength.
Therefore, wavelength correction is performed

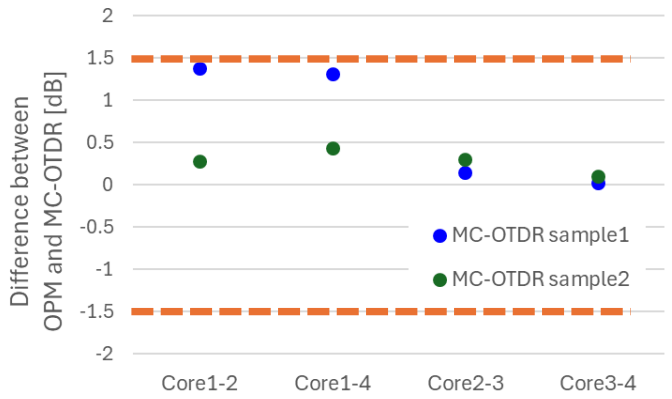
XT is value at end of fiber

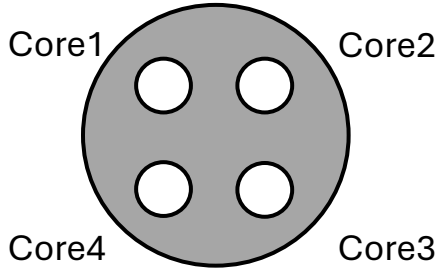


Comparison of Xtalk measurement methods

1550nm

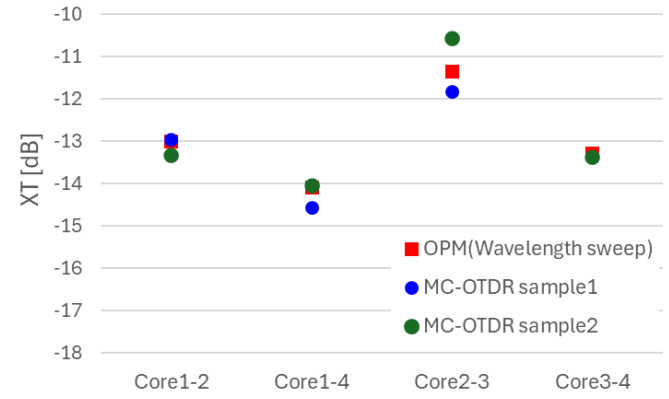


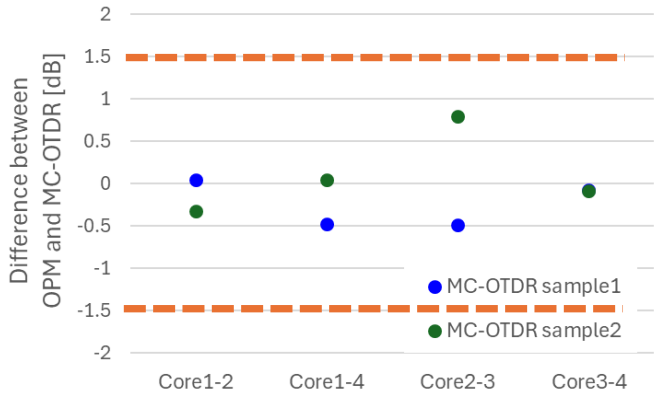




Regarding MC-OTDR, we evaluate with 2 units(sample1/2).

1625nm



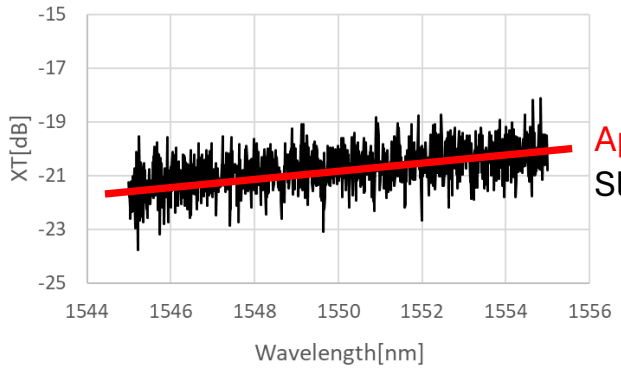


In our environment, XT difference in two methods was within ±1.5dB.

Comparison XT value in each methods

Reference：how to wavelength correction.

1. Calculate approximate straight line and get XT slope($\mathrm{dW[dB/nm]}$)from data of power meter method



Approximate straight line
Slope = $\mathrm{dW[dB/nm]}$

2. Measured center wavelength(λ_{act}) of each port

3. Calculate correction value($\Delta\mathrm{XT}$) and XT after wavelength correction(XT_C).

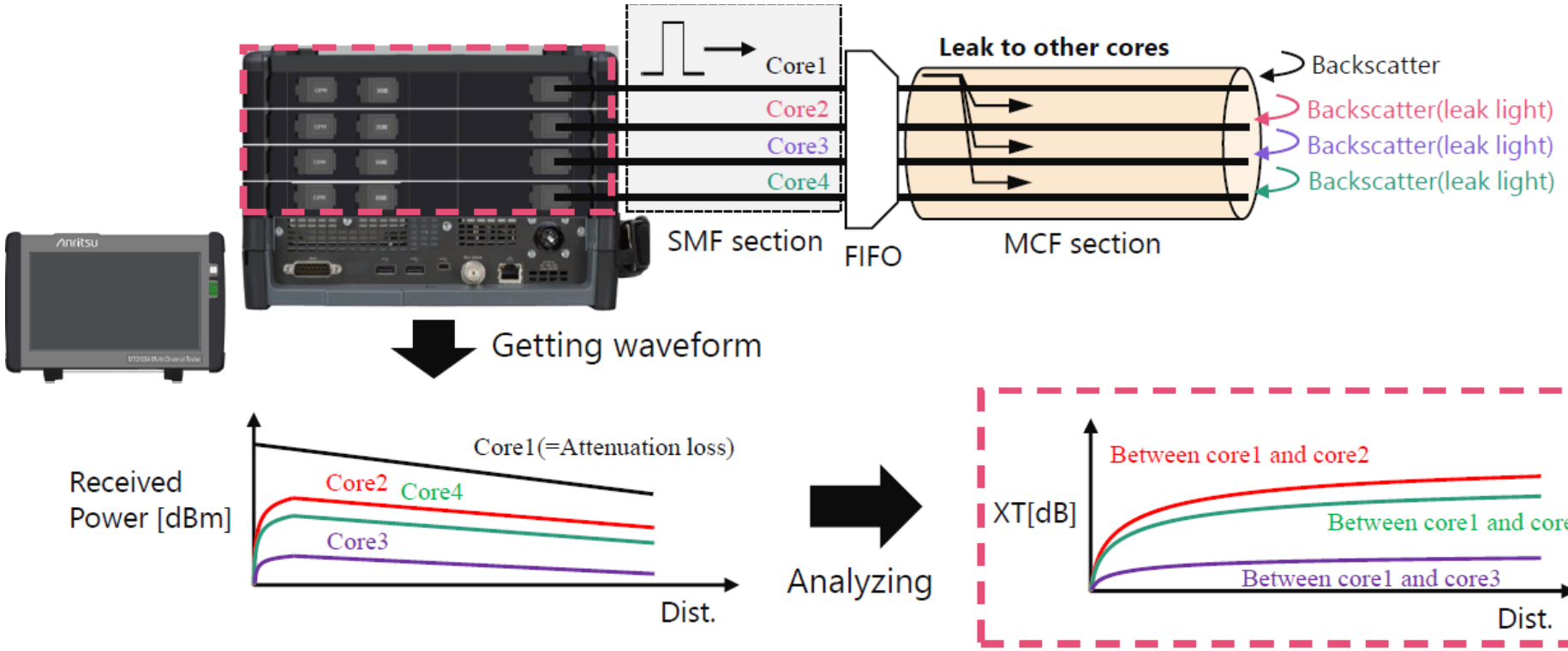
$$\Delta\mathrm{XT} = -\mathrm{dW} \times (\lambda_{\mathrm{act}} - \lambda_{\mathrm{nom}})$$ λ_{nom} is 1550 or 1625nm, that is nominal wavelength.

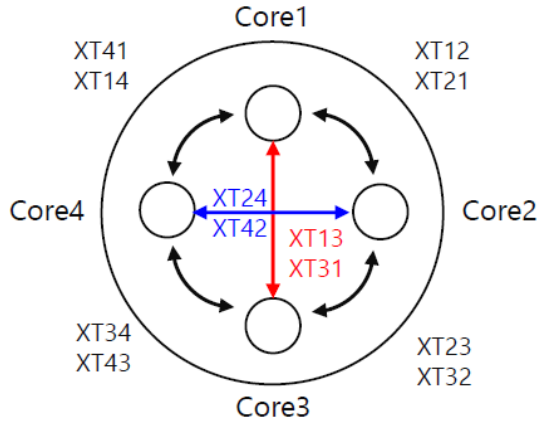
$$\mathrm{XT_c} = \mathrm{XT_m} - \Delta\mathrm{XT}$$ $\mathrm{XT_m}$ is XT before wavelength correction

1. Appendix

2. Quick measurement guide

MT9100A Multi Core Fiber channel Characterization and Certification

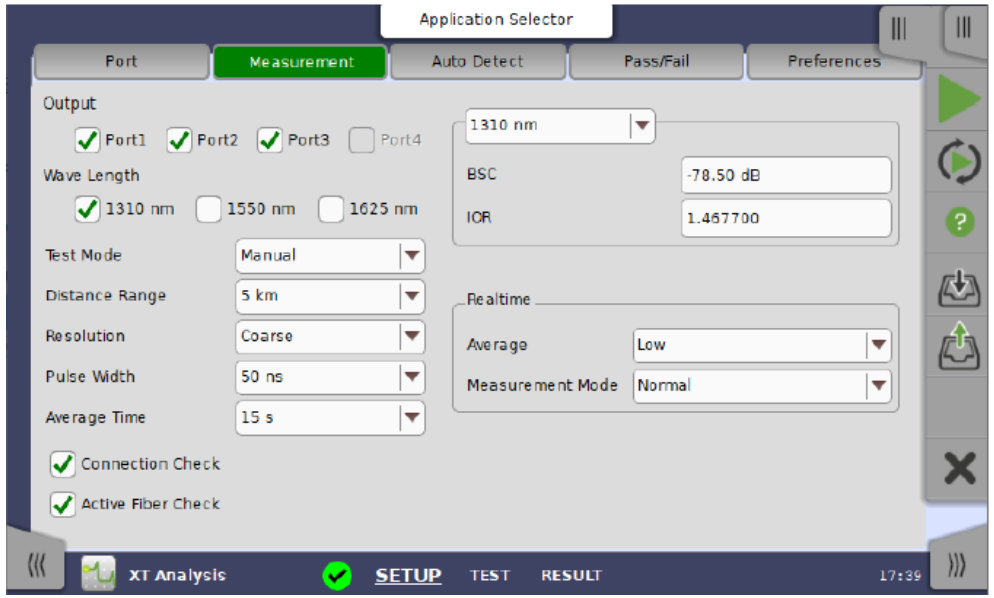


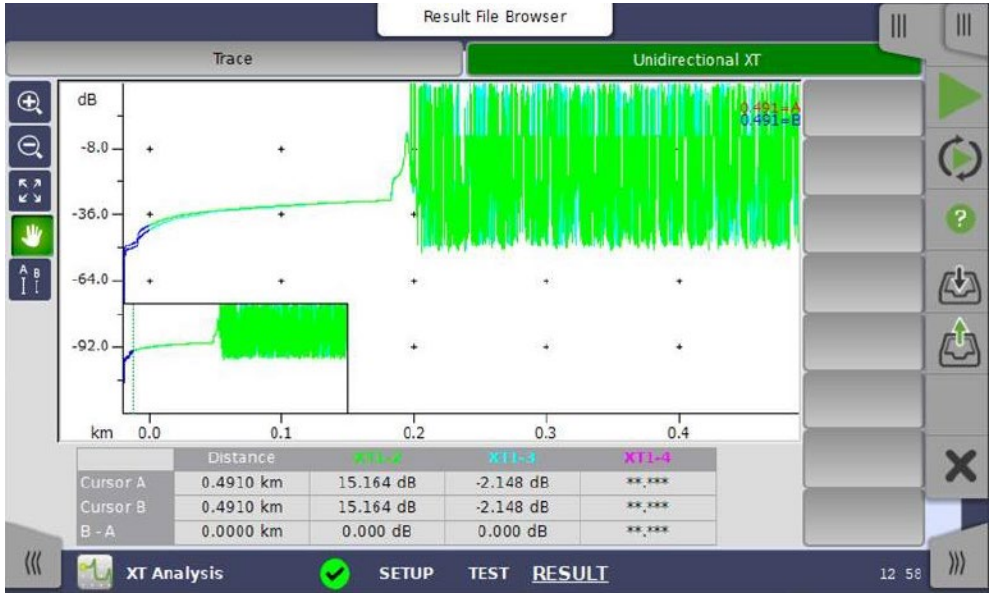


- Fully automated 4 core test
- Traditional OTDR measurements
- Core to core crosstalk measurement

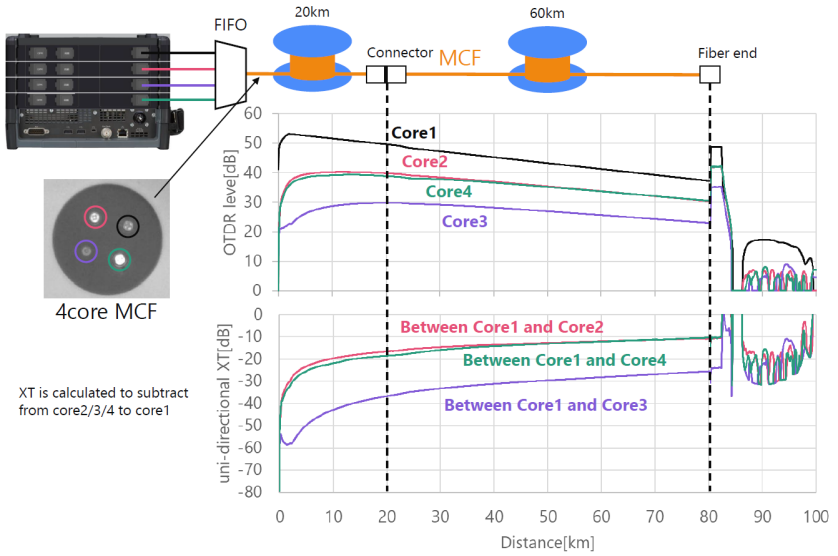
Length, Attenuation, Return Loss	Core 1/2/3/4
Uni-Directional Crosstalk	XT12 / XT13 / XT14 XT21 / XT23 / XT24 XT31 / XT32 / XT34 XT41 / XT42 / XT43

Example of MT9001A MCF Measurements





- Single ended test
- 3 wavelength testing (1310, 1550, 1625)
- Distance; Event IL, RL and location; Total IL and RL
- Core to core XT distribution measurement
- XT location / cause determination
- Automated measurement across all 4 cores : estimated at 120 seconds



Measurement time and result comparison

Evaluation time at 1fiber/1wavelength.

	Total	XT evolution			Att. Loss evaluation		
		Sub total	Measurement	Change connection	Sub total	Measurement	Change connection
SLS,OPM, OTDR	645sec	465sec	15sec×16回	225sec (15回)	180sec	30sec×4回	60sec(4回)
SLS,OPM, OTDR,Switch	375sec	240sec	15sec×16回	None	135sec	30sec×4回	15sec(1回)
MC OTDR	120sec	120sec	30sec×4回	None	0sec	Measure with XT at the same time	

- Single ended test
- 3 wavelength testing (1310, 1550, 1625)
- Distance; Event IL, RL and location; Total IL and RL
- Core to core XT distribution measurement
- XT location / cause determination
- Automated measurement across all 4 cores : estimated at 120 seconds

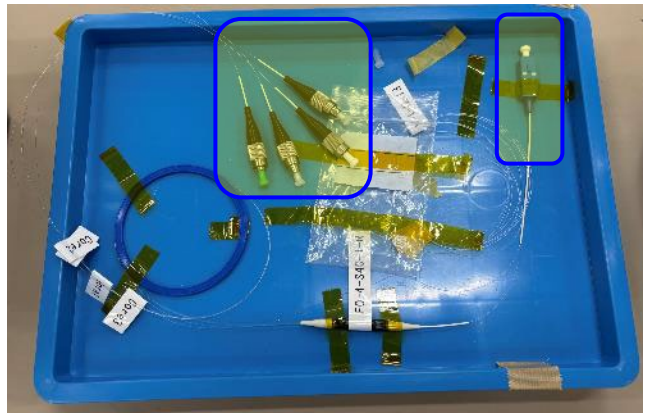
Quick measurement guide(1/8)

- **Preparation item**

Item	Pcs	Note
MT9100A	1	Optical interface : UPC/SC
AC adapter	1	
Fan-in device	1	UPC/SC is good for SMF side
Multicore fiber	1	Weakly-coupled MCF

MT9100A

SMF side MCF side

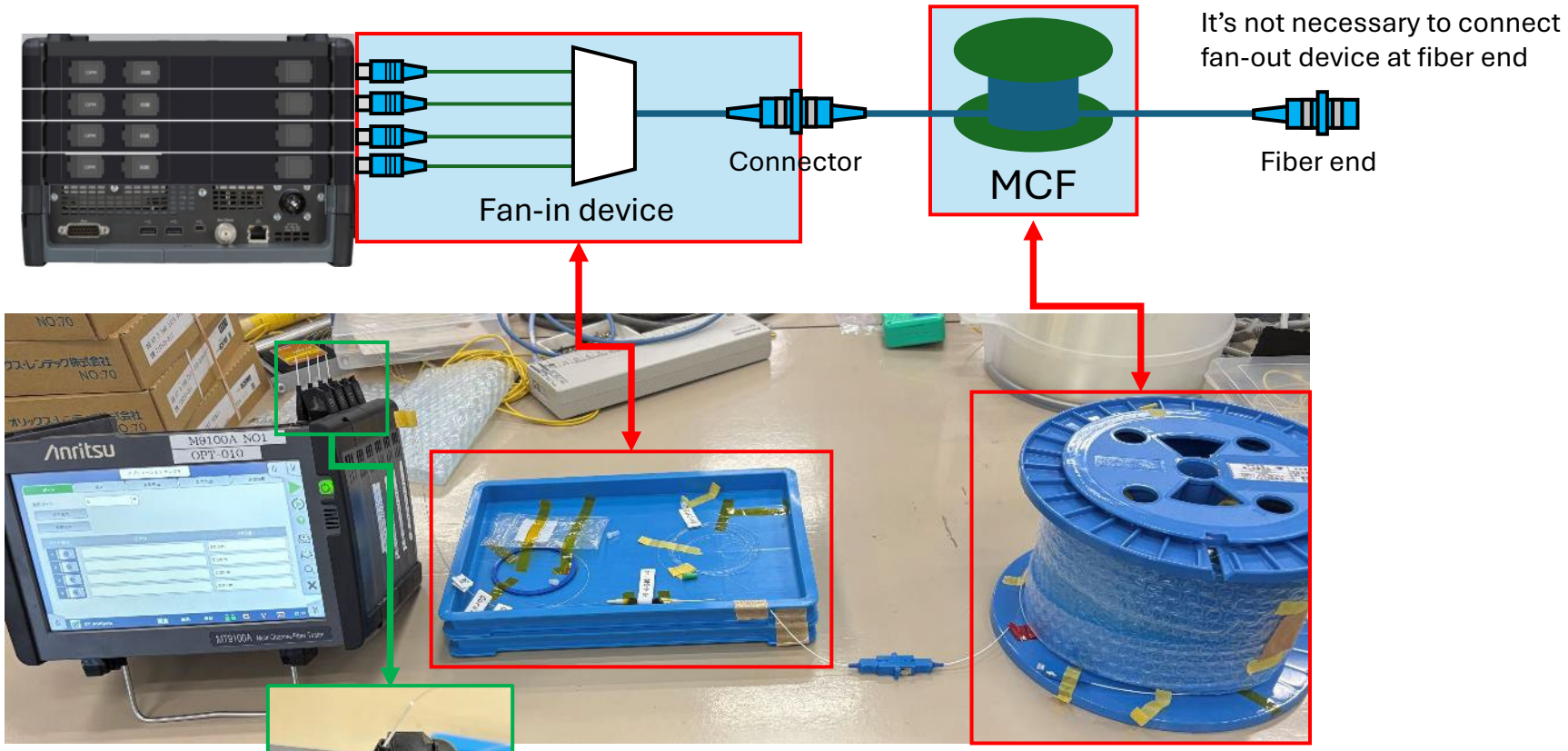


Fan-in device

Multicore fiber (DUT)

Quick measurement guide(2/8)

1. Connect fan-in device and MCF to MT9100A

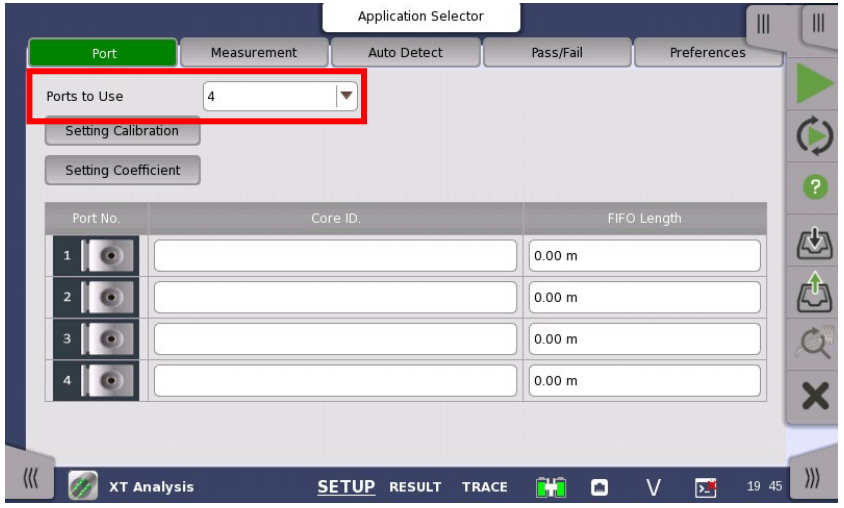


Setup example

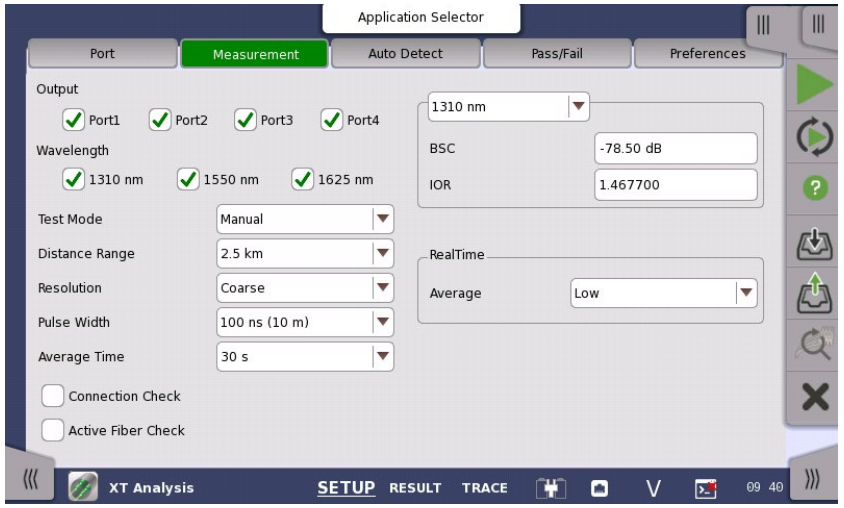
You can connect FC or SC connector.
Replaceable optical connector(J0617B or J0619B) is needed.

Quick measurement guide(3/8)

2. Start up XT Analysis, and set some measurement parameter.



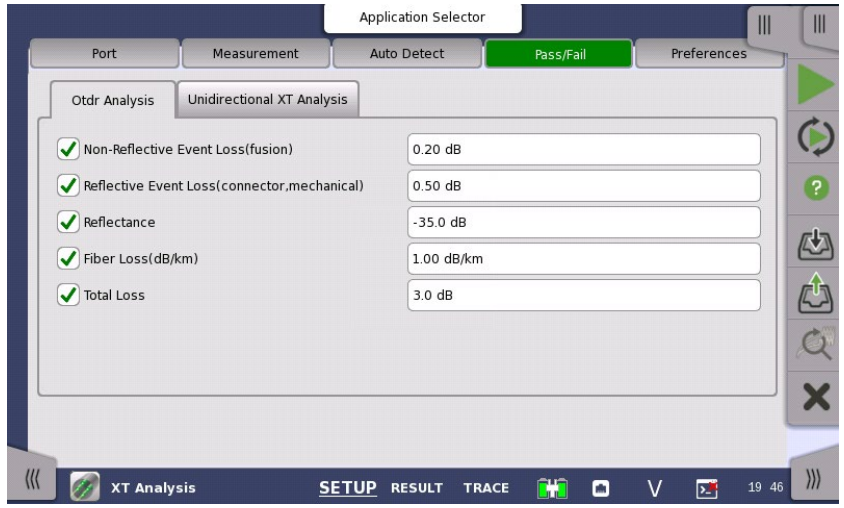
- If number of cores is less than 4, please change **Ports To Use** from 4 to 3 or 2

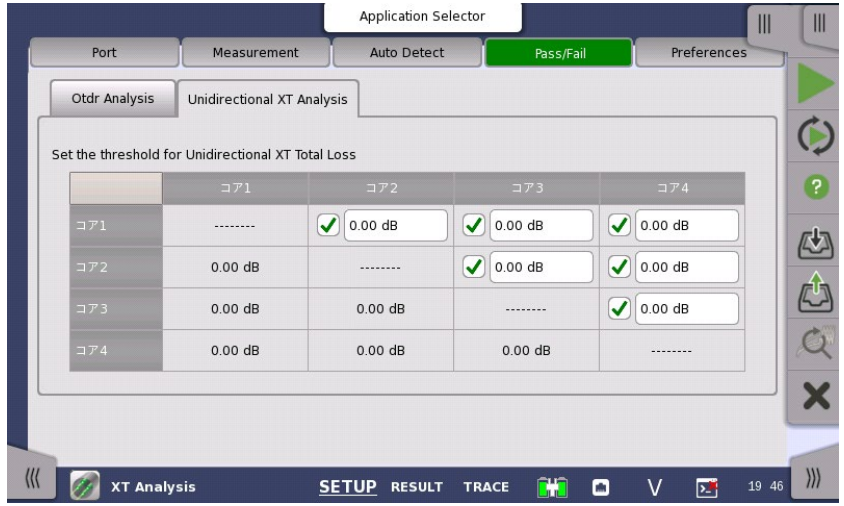


- **Output** means which port to output the pulse from.
- Below is recommend parameter if you set Manual
  Distance Range : above fiber length
  Resolution : Coarse
  Pulse width : above 1us (100m)
  Average Time : 30sec
- It is recommended to set **Connection Check** and **Active Fiber Check**.

Quick measurement guide(4/8)

3. Set Pass/Fail threshold parameter if you need.

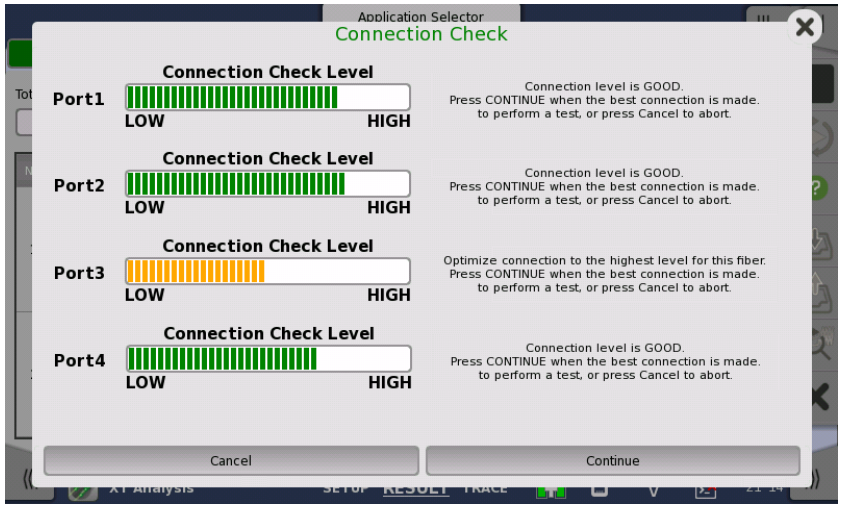




- Pass/Fail of Crosstalk is adapted value at fiber end.

Quick measurement guide(5/8)

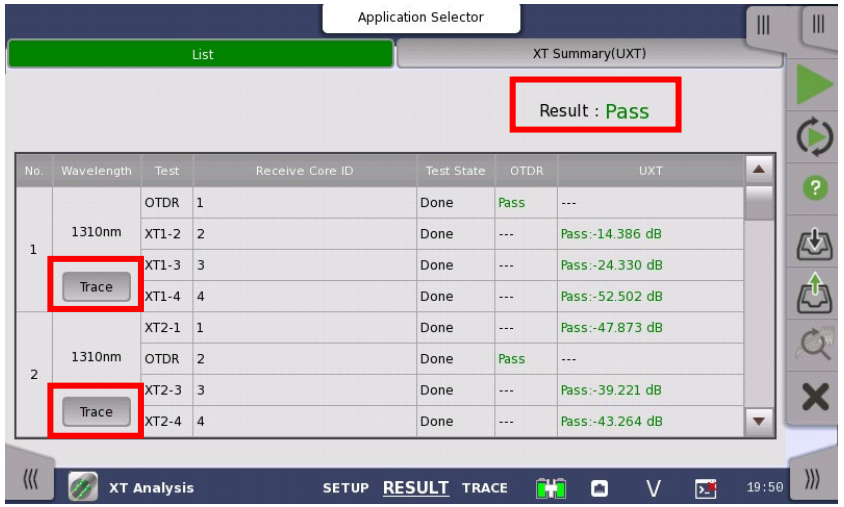
3. Touch average measurement



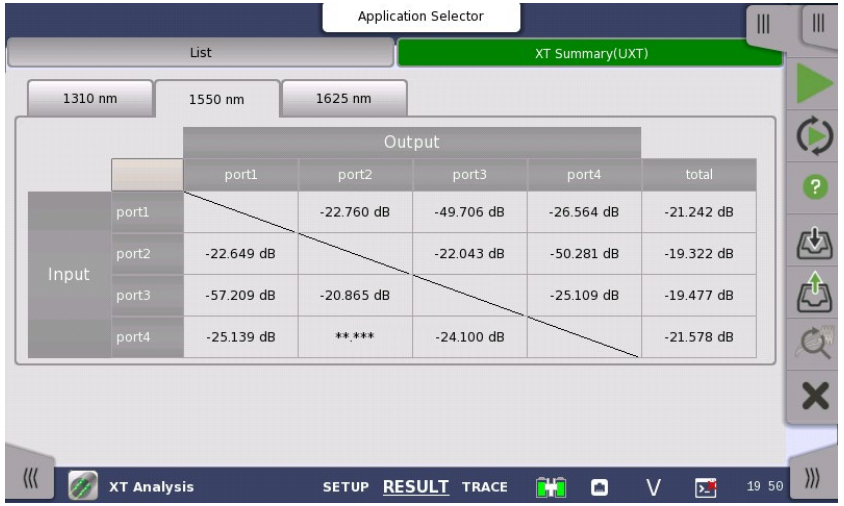
- In case that connection check is valid, it is shown connection check level each port before measurement.
- If the level is low(Yellow or Red), please check connection and clean the connector.

Quick measurement guide(6/8)

4. Check summary result



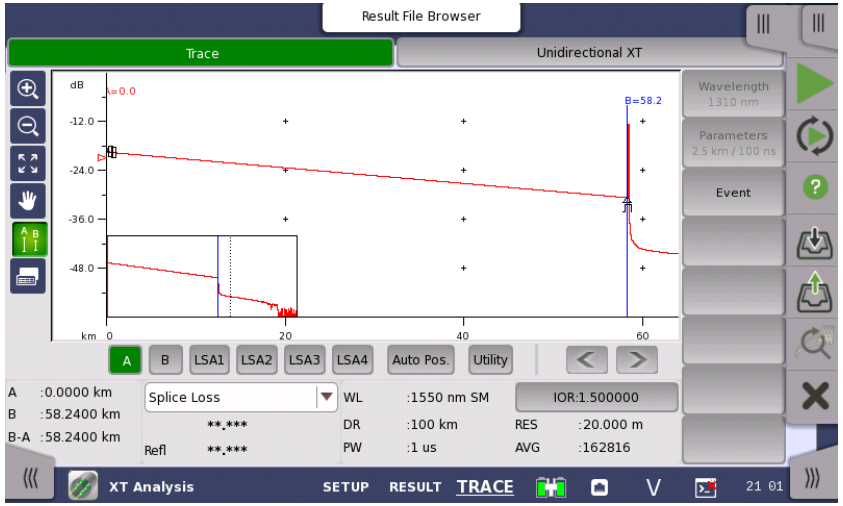
- After all of measurement is finished, you can see final result
- As you touch **[Trace]** of Wavelength column, you can see each waveform data.
- The value of UXT column means crosstalk at fiber end.



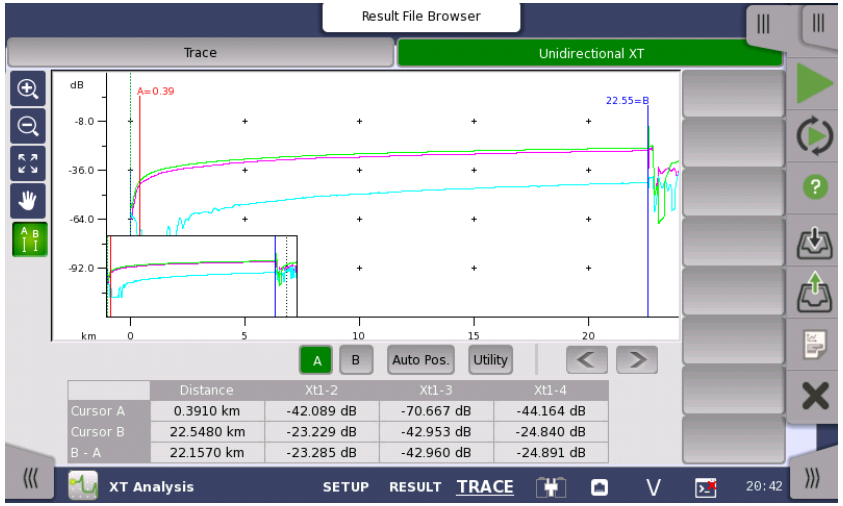
- XT summary shows crosstalk of each core combination at fiber end.

Quick measurement guide(7/8)

5. Check waveform



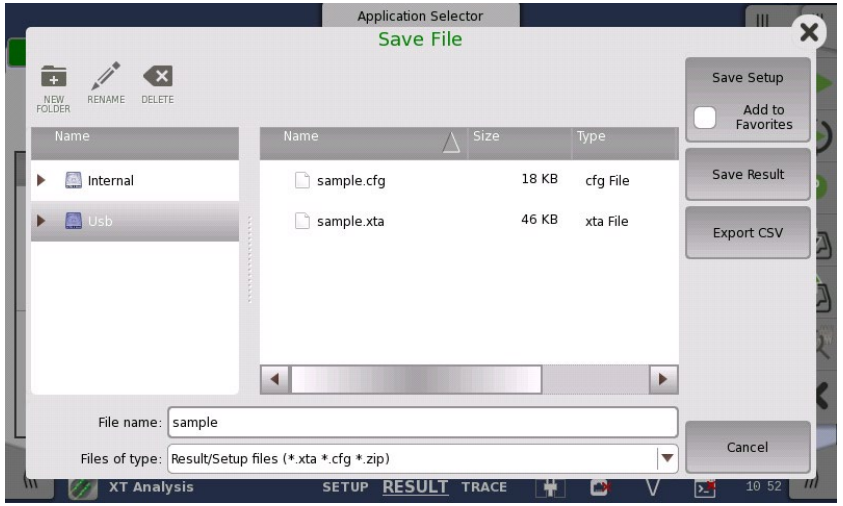
- You can check OTDR and XT waveform.
- regarding OTDR waveform, you can see event table to touch 



- Using cursor A/B, you can check crosstalk value at specific point, and crosstalk difference between cursor A/B.
- If you need to check any other waveform, please back to RESULT window, and touch [Trace].

Quick measurement guide(8/8)

6. Save result



- When you save the measurement data, touch 
- There are three type to save mode.
  Save Setup : Only save measurement setup
  Save Result : Save measurement data as XTA format
  Export CSV : Save measurement data as CSV format

Note :
XTA format can be seen by only MT9100A. If you want to use data on your PC, please save as CSV format.


Anritsu
Advancing beyond