DWDM Sweep Tool Kit
FX82s & FX87s

VeEX

The DWDM Sweep Tool Kit* revolutionizes and simplifies the testing of DWDM networks. Technicians can verify wavelength connectivity of a loaded 98-channel, C-band network in about a minute without disrupting service. End-to-end loss when cascading multiple filters via upgrade ports can be qualified using pre-defined Pass/Fail limits. The kit comprises a FX87s Optical Sweep Generator and an FX82s Optical Sweep Receiver working together as a pair.

Key Features

- Cost effective tool kit for construction and maintenance of DWDM, C-band networks
- Proprietary detection algorithm verifies 49 channels (100GHz) in about 30 seconds and all 98 channels (50GHz) in about a minute
- A single sweep transmitter (FX87s) and multiple receivers (FX82s) can verify wavelength routing and loss at independent locations simultaneously
- User-defined DWDM channel table in 50GHz or 100GHz thresholds
- User-defined network insertion loss threshold (Pass/Fail)
- Large, day light readable LCD display with built-in backlight
- Rechargeable Li-Polymer battery with >10 hours operation
- Internal memory stores >1000 results
- Data transfer via micro USB or optional Bluetooth®

*Patent Pending

Key Specifications

FX87s DWDM Sweep Generator
- Wavelength range: 1527.60 to 1566.31 nm
- Frequency range: 191.40 to 196.30 THz
- Channel spacing: 50/100 GHz per ITU G.694.1
- Built-in wavelength locker (stable to within ±3 GHz)
- User selectable output power: -5, 0, and +5 dBm ±0.5dB
- 5 User-definable channel tables
- Laser Safety: Class 1M per IEC 60825-1:2014

FX82s DWDM Sweep Receiver
- Supports up to 4 user-defined pass/fail loss thresholds
- Supports up to 5 user-definable FX87s Device IDs
- Supports up to 5 user-definable channel tables
- On-screen analysis for PASS, FAIL, ROGUE, VALID, TOTAL channels

FX82s/FX87s Optical Power Meter
- Calibrated wavelengths (850, 1300, 1310, 1490, 1550, 1625, 1650 nm)
- Measurement range: +25 to -50 dBm
- Accuracy: ± 0.2 dB (5%)
- Display resolution: 0.01 dB

DWDM Channel Drop and Insert Testing

DWDM filters located at the Headend or Central Office are typically equipped with Test, Upgrade and Express ports which can be utilized for different testing requirements. Test ports are normally reserved for spectral analysis applications using an Optical Channel Checker (OCC) or Optical Spectrum Analyzer (OSA) since they provide a -20dB protected monitoring output of both Tx/Rx directions. Express ports are reserved to pass out of band signals including Remote Fiber Test Systems (RFTS) operating at 1625nm or 1650 nm.

Upgrade ports are used to add, drop or pass C-band signals not already in use and thus can be utilized by the FX87s Source/Sweep generator to insert selected ITU-T G.694.1 channels into the DWDM network under test. The FX82s Receiver connected at the remote Demux point detects if the incoming test signal is present verifying the wavelength routing is correct and insertion loss is within prescribed limits.

Patent pending sweep functionality along with proprietary WaveID functions ensures the correct DWDM wavelength is detected quickly.
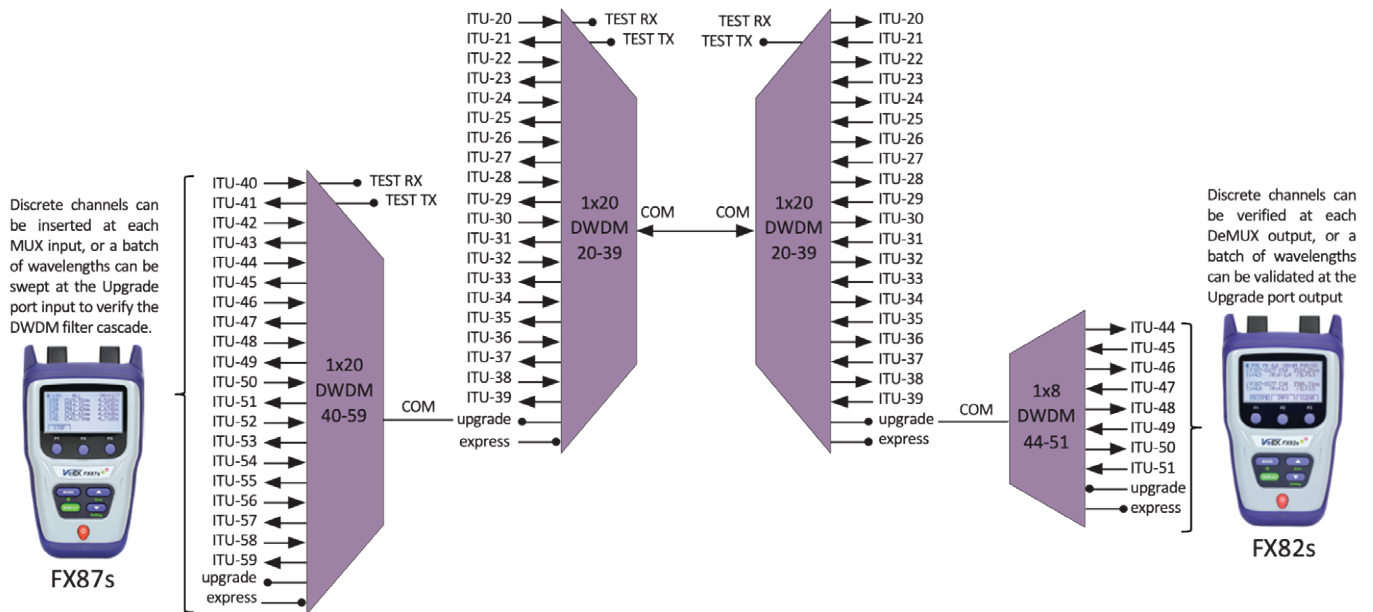
Network Expansion to Add DWDM to an Existing CWDM Network

Legacy CWDM networks can be leveraged to transport DWDM wavelengths to increase system bandwidth. Hybrid CWDM/DWDM networks however present different test challenges since the wavelength spectrum and properties of each WDM signal is quite different and the passband parameters of the CWDM MUX Upgrade port might be restricted to certain wavelength windows. For this reason, CWDM filter devices are equipped with either an Upgrade port or Express port, but not both.

Depending on mux type, the FX87s sweep generator can insert select DWDM channels that coincide with the CWDM mux passband specifications. In addition, The FX87s sweep generator can also insert select ITU-T G.694.1 channels into specific ITU-T G.694.2 channel inputs. For example, DWDM ITU-T channel numbers 25-40 pass through the 1551nm CWDM passband (±6.5nm) while DWDM ITU-T channel numbers 50-61 pass though the 1531 nm CWDM passband (±6.5nm).

The FX82s receiver connected to the remote DWDM mux Upgrade port or discrete demux output can detect the FX87s signal to verify wavelength routing and end-to-end insertion loss of the network under test.
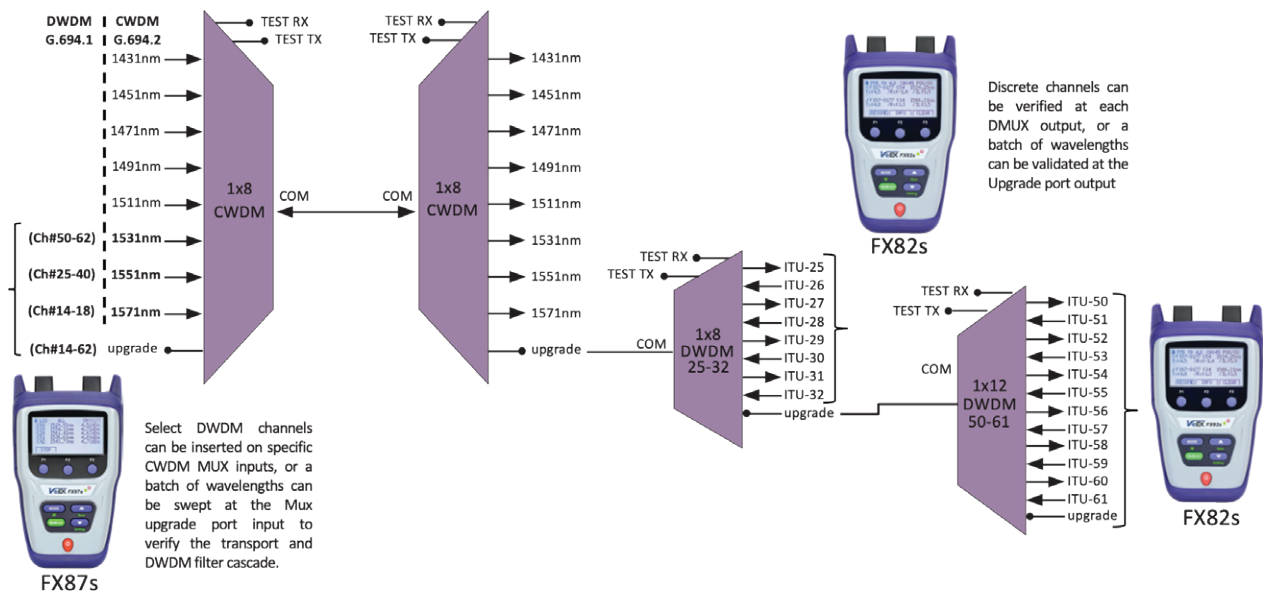
Multiple Fiber WDM Network

Multiple FX87s and FX82s can be used, at the same time, to verify proper cable routing and insertion loss in WDM networks with multiple fibers and multiplexers, to ensure that cable routing and multiplexing are configured properly.
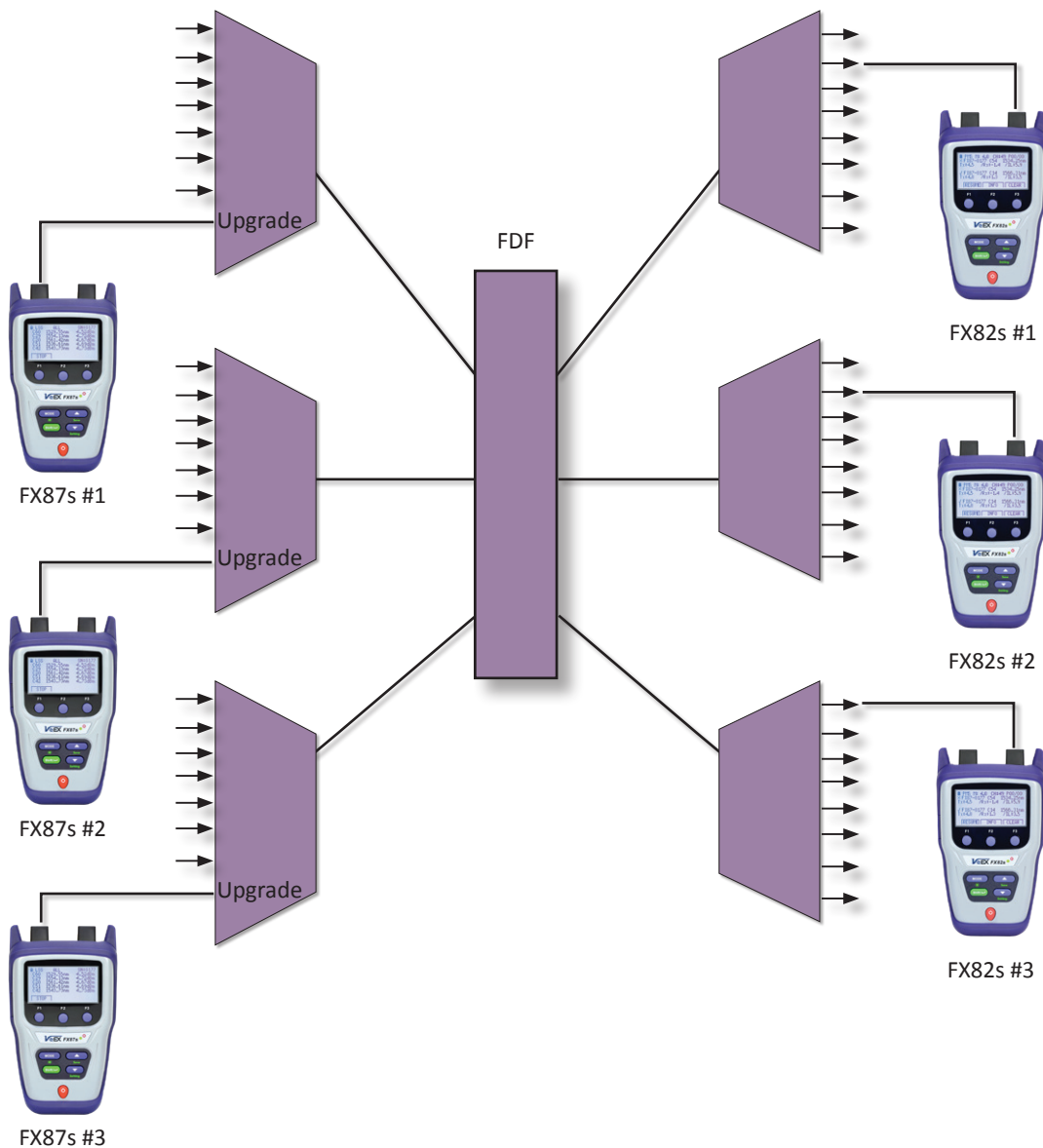
Bi-Directional Testing

A pair of FX87s and FX82s can be used at opposite ends of a DWDM link to verify the connection of a bi-directional DWDM network. This measurement provides total end-end insertion loss at the discrete ITU-T G.694.1 wavelength.
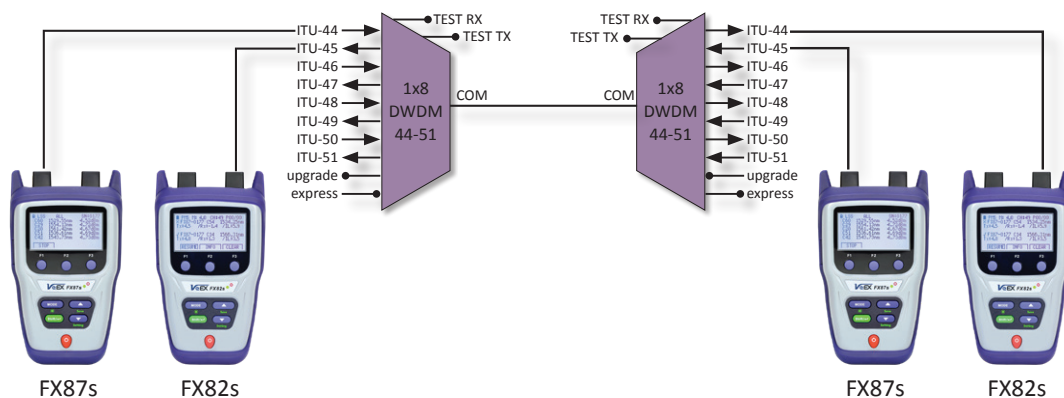
User Defined Loss Thresholds

Each DWDM channel transmitted by the FX87s is tagged with a unique device and wavelength ID that includes its calibrated transmit power level. The FX82s decodes the received tag and optimizes the receiver based on the wavelength IDs.

```
Mode:PMS
   CH:C21    1560.61nm
Tx:4.2dBm      Rx:0.8dBm
MAXIL:3.0dB      IL:FAIL
```

The insertion loss is accurately derived from the ratio of the transmitted optical power reference and the received power. Programmable loss thresholds stored in the FX82s memory are used for pass/fail certification at defined test points/locations.

```
        NONE
        5.0dB
      ▶ 8.0dB ◀
        10.0dB
        15.0dB
   NEXT        EDIT
```

Sweep Generator ID

Multiple FX87s Sweep Generators can be used simultaneously to test complex DWDM networks. Since each FX87s generates a unique ID based on the last 4 digits of its serial #, each remote FX82s quickly recognizes its test partner and proceeds to verify the wavelength routing at the respective demux point.

```
       FX87 ANY
       FX87 ANY
     ▶ FX87-2534 ◀
       FX87-0245
       FX87-9999
   NEXT        EDIT
```
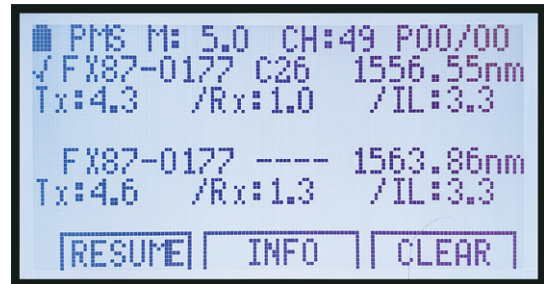
User Defined Channel Table

The FX87s and FX82s allows users to customize and name each available WDM test plan; verifying all channels adhere to the channel plan. The FX82s measures all received channels and compares to the expected channel table to measure unexpected or missing channels.

```
          ALL
      ▶ TELCO-32 ◀
        TELCO A
        TELCO B
  SWEEP     EDIT     CAL
```
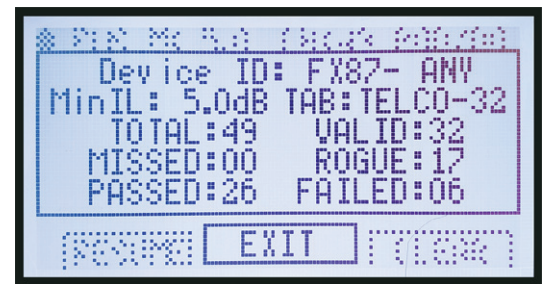
Sweep Measurement & Analysis

Sweep results provide valuable information to evaluate the network and filter performance. Insertion loss for each individual channel, including pass/fail indicator, enables technicians to make informed decisions about routing and connectivity issues.

```
■ PMS M: 5.0  CH:49 P00/00
✓FX87-0177 C26   1556.55nm
Tx:4.3   /Rx:1.0   /IL:3.3

  FX87-0177 ----  1563.86nm
Tx:4.6   /Rx:1.3   /IL:3.3
 RESUME    INFO    CLEAR
```

Valid, Passed, Failed and Missed channels are detected and those with an unexpected ID are reported as rogue channels. Technicians can compare the Total channels versus the predefined channel plan to see what has been received.

```
    Device ID: FX87- ANY
 MinIL: 5.0dB TAB:TELCO-32
    TOTAL:49     VALID:32
    MISSED:00    ROGUE:17
    PASSED:26    FAILED:06
           EXIT
```

Optical Power Meter (OPM)

The FX82s and FX87s OPM features a large 1mm InGaAs detector ensuring superb measurement accuracy over a wide dynamic range including high power CaTV applications. The photodetector's flat response across the C-band spectrum is well suited for DWDM measurement.

```
■ PM2            1310nm
                 27.16pW
  <-55dBm
   WAVE           MORE
```

Legacy/CWDM Wavelength Support

The FX82s OPM is factory calibrated for all legacy wavelengths. Additional CWDM calibrated wavelengths can be added as an option. The FX82s can detect if signals in CW or modulated signal mode enabling easy fiber identification.
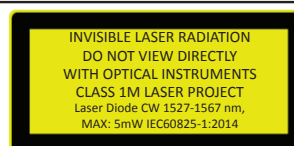
```
        1270nm
        1290nm
      ▶ 1300nm ◀ dBm
        1310nm
        1330nm
   EXIT
```
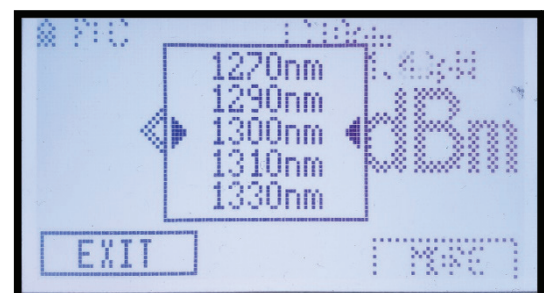
Preliminary Specifications[1,2]

FX87s Sweep Generator	Specification
Number of Channels @50GHz channel spacing	98
Wavelength Range (nm)	1527.60 to 1566.31
Frequency Range (THz)	191.40 to 196.30
Linewidth (kHz)	500
SMSR (dB)	40
Minimum channel spacing (GHz)	50
Internal Wavelength Stabilization (GHz)	±3
Output Power (dBm)	-5, 0, +5, (±0.5dB)
Laser Safety (IEC 60825-1:2014)	Class 1M
Connector type	SC-APC
FX87s Tunable Laser Source	
Output Power (dBm)	+5
Wave ID	DWDM Channel Number
Modulation (Hz)	270/330/1000/2000
FX82s Sweep Receiver	
Wavelength range (nm)	1527.60 to 1566.31
Power measurement range (dBm)	+25 to -50
Power measurement accuracy %, (dB)	± 8, (0.5)
Display resolution	0.1 dB
Measurement analysis	Pass/Fail, Valid/Missed/Rogue/Total
FX87s/FX82s Optical Power Meter	
Wavelength range (nm)	850 to 1650
Power measurement range (dBm)	+25 to -50
Calibrated Wavelengths (nm)	850, 1300, 1310, 1490, 1550, 1625, 1650
Power measurement accuracy %, (dB)	± 5, (0.22)
Optional Wavelengths	1270, 1290, 1330, 1350, 1370, 1390, 1410, 1430, 1450, 1470, 1510, 1530, 1570, 1590, 1610
Display Resolution	0.01 dB
Optical adaptors (interchangeable)	SC, FC, LC, Universal 1.25 & 2.5 mm
Tone Detection (Hz)	270/330/1000/2000
Wave ID	Automatic, compatible with VeEX Light Source

Notes:

1. All specifications valid at 23°C ± 10°C after 15 minutes warm up
2. Refer to *FX80 Series* data sheet and FX87s data sheet for full details

INVISIBLE LASER RADIATION
DO NOT VIEW DIRECTLY
WITH OPTICAL INSTRUMENTS
CLASS 1M LASER PROJECT
Laser Diode CW 1527-1567 nm,
MAX: 5mW IEC60825-1:2014

General Specifications

Size:	164.39 x 100 x 46.93 mm (H x W x D)** 6.47 x 3.94 x 1.85 in	Power Supply:	Micro USB interface, 5 VDC charger
Weight:	<400 g (<0.7 lbs.)**	Data connection:	Micro USB and optional Bluetooth (FX82s)
Construction:	Rugged, Polycarbonate chassis, 1 meter drop tested	Display:	Monochrome LCD with backlight
		Operating Temp:	-10 °C to +50 °C
		Storage Temp:	-20 °C to +70 °C
Battery:	Built-in Rechargeable Li-Polymer, Operation time >10 hours, no backlight	Humidity:	0% to 95%, non-condensing

*US patent pending, **Per unit

VeEX
The Verification Experts
CE