The Verification Experts

FX87
DWDM Tunable Laser Source

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1.0   About This User Manual

This manual is suitable for novice, intermediate, and experienced users and is intended to help the operator successfully use the features and capabilities of the DWDM Tunable Laser Source. It is assumed that the user has basic computer experience and skills, and is familiar with optical fiber testing, telecommunication concepts, terminology, and safety.

Every effort was made to ensure that the information contained in this user manual is accurate. Information is subject to change without notice and we accept no responsibility for any errors or omissions. In case of discrepancy, the web version takes precedence over any printed literature. The content in this manual may vary from the software version installed.

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This user manual is suitable for novice, intermediate, and experienced users and is intended to help you successfully use the features and capabilities of the software. It is assumed that the user has basic computer experience and skills, and is familiar with optical fiber, telecommunication concepts, terminology, and safety. Please note that colors, buttons, screen fonts and element positions in the screenshots and hardware pictures can insignificantly vary in different software versions and device batches.

If you need assistance or have questions related to the use of this product, call or e-mail our customer care department for customer support. Before contacting our customer care department, you must have your product serial number and software version ready. Please provide this number when contacting VeEX customer service. For more technical resources, visit the VeEX, Inc. web site at *www.veexinc.com*.

> **Customer Care:**
> *Phone: + 1 510 651 0500*
> E-mail: *customercare@veexinc.com*
> Website: *www.veexinc.com*

2.0   Safety Information

Safety precautions should be observed during all phases of operation of this instrument. The instrument has been designed to ensure safe operation however please observe all safety markings and instructions. Do not operate the instrument in the presence of flammable gases or fumes or any other combustible environment. VeEX Inc. assumes no liability for the customer's failure to comply with safety precautions and requirements.

Optical Connectors

The test platform displays a laser warning icon when the laser source is active to alert the user about a potentially dangerous situation. Make sure that optical sources are inactive before connecting fiber to the test set to avoid skin or eye damage, or damage to the unit. It is recommended to:

Deactivate the laser before connecting or disconnecting optical cables or patchcords.

Never look directly into an optical patchcord or an optical interface (e.g. CFP, CFP2, CFP4, QSFP+, SFP+, SFP, OTDR, LS, VFL) while the laser is enabled. Even though optical transceivers are typically fitted with Class 1 lasers, which are considered eye safe, optical radiation for an extended period can cause irreparable damage to the eyes.

Never use a fiber microscope to check the optical connectors when the laser source is active.

The operator is assumed to have received basic training in fiber optics and related testing and measurement practices.

3.0 Product Introduction

The FX87 Tunable Laser Source has the following functionalities:

- DWDM Tunable Laser source from 1527.60 nm to 1566.31 nm (C14 – C62, H14 – H61 channels, *H62 channel (upon special factory request)) with 50/100 GHz spacing w/optional broadband OPM power meter (up to 7 calibrated wavelengths);
- High-power InGaAs photodiode with large sensitive area (1000 μm) integrated into the front panel adaptor;
- Interchangeable optical adaptors for Light Source and Power Meter;
- Fast Power On/Off and Laser Stabilization
- Extremely rugged, pocket-sized form factor with protective rubber boot;
- Rechargeable Li-Poly battery or AC or USB powered operation
- Extra-long battery life; > 10 hrs battery life (no backlight)

3.1 FX87 TLS/TLTS Features

- High Contrast Monochrome LCD display with backlight;
- Source Modulation: 270 Hz, 330 Hz, 1 kHz, 2 kHz, CW, AUTO
- Optional Broadband InGaAs power meter; Tone detection for fiber identification,
- Client USB software (LTSync) for data transfer to PC through USB (standard) or Bluetooth (option) or cloud for future analysis and reporting
- Up to 1920 measurements w/optional BB OPM
- WaveID detection for all 97 (or 98) lambdas/wavelengths with compatible VeEX FX-8x series OPM.
- Tone detection for fiber identification;

4.0　FX87 Overview

DWDM – Dense Wavelength Division Multiplexing is a WDM technology characterized by narrow, 0.4 nm (100 GHz) or 0.8 nm (50 GHz) channel spacing and grid wavelengths between 1530 nm to 1565 nm for C-band and 1565 nm – 1625 nm for L-band and is typically used for long range distances as found in Metro, Fiber Deep, and Core networks.

ITU-T G.694.1 Table 1 – Example nominal central frequencies of the DWDM grid

Nominal central frequencies (THz) for spacings of:				Approximate nominal central wavelengths (nm) (Note)
12.5 GHz	25 GHz	50 GHz	100 GHz and above	
195.8875	–	–	–	1530.4318
195.8750	195.875	–	–	1530.5295
195.8625	–	–	–	1530.6271
195.8500	195.850	195.85	–	1530.7248
195.8375	–	–	–	1530.8225
195.8250	195.825	–	–	1530.9203
195.8125	–	–	–	1531.0180
195.8000	195.800	195.80	195.8	1531.1157
195.7875	–	–	–	1531.2135
195.7750	195.775	–	†	1531.3112
195.7625	–	–	–	1531.4090
195.7500	195.750	195.75	–	1531.5068
195.7375	–	–	–	1531.6046
195.7250	195.725	–	–	1531.7024
195.7125	–	–	–	1531.8003
195.7000	195.700	195.70	195.7	1531.8981
195.6875	–	–	–	1531.9960
195.6750	195.675	–	–	1532.0938
195.6625	–	–	–	1532.1917
·	·	·	·	·
·	·	·	·	·
·	·	·	·	·
·	·	·	·	·
·	·	·	·	·
·	·	·	·	·
193.2375	–	–	–	1551.4197
193.2250	193.225	–	–	1551.5200
193.2125	–	–	–	1551.6204
193.2000	193.200	193.20	193.2	1551.7208
193.1875	–	–	–	1551.8212
193.1750	193.175	–	–	1551.9216
193.1625	–	–	–	1552.0220
193.1500	193.150	193.15	–	1552.1225
193.1375	–	–	–	1552.2229
193.1250	193.125	–	–	1552.3234
193.1125	–	–	–	1552.4239

DWDM Spectrum Graph

The FX87 DWDM Tunable Laser Source is specially engineered to test DWDM systems operating in C-band frequencies. The unit measures loss at the specified wavelengths with the combination of the DWDM laser and optional broadband OPM with WaveID. The measurement results can be transferred to a PC or uploaded to the cloud using a Fiberizer Cloud account.

To make the fiber identification in a rack more convenient, the laser signal from FX87 with a calibrated wavelength (see the DWDM set of calibrated wavelengths above) is also modulated with the following frequencies:

- CW (Continuous Wave)
- 270 Hz
- 330 Hz
- 1000 Hz
- 2000 Hz
- AUTO

 FX87 units are configured at the time of manufacture according to customer requirements. A single device can be configured with Broadband OPM option and upon special request for H62 channel addition.

5.0 Basic Operation

5.1 FX87 Front Panel Layout

Colors, buttons, and screen fonts can slightly vary in different software and hardware versions.

FX87 front view

- **|Power|**: Turn device ON/OFF. Press and hold the button for 3 sec. The display will initially show the VeEX logo, current date and time, and current mode of operation.
- **|MODE|**: Select the mode of operation: DWDM LS, Read, PM1 or PM2. For more information about FX87 TLS/TLTS modes, see Section *8.1. Mode for Optical Power Measurements*.
- **|Shift/Enter|**: Start editing a parameter and confirm choice when setting up the device; execute the selected action.
- **|Up|**, **|Down|**: Change the selected parameter.

Button combinations:
- **|Shift/Enter|+|Up|**: Save measurement results;
- **|Shift/Enter|+|Down|**: Enter **Instrument Settings** mode;
- **|Shift/Enter|+|Mode|**: Turn backlight ON/OFF.

|F1|, **|F2|**, **|F3|**: Context-defined, the function indicated at the screen bottom.

5.2 FX87 TLS/TLTS Ports

5.2.1 Optical Ports

FX87 optical ports

- **OLS port**: Used to transmit a single tunable DWDM lambda for DWDM system/component verification, such as demultiplexors, and multiplexors (e.g., ROADMs), EDFAs. *Supported adaptor options*: SC/APC or FC/APC fixed.
- **OPM port [optional]**: Used for measuring absolute optical power level and relative optical power for insertion loss and end to end continuity testing for a DWDM when paired with the OLS port. Supported interchangeable adaptors options: SC, FC, Universal 2.5 mm, Universal 1.25 mm, and etc. (subject to availability on price list).

5.2.2 Service Port
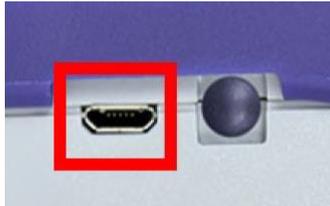
FX87 Service Port

The service port (micro-USB) located on the left side of the device is used for charging, data communication/transferring OPM results with a PC using LTSync software, or for upgrading the firmware if necessary.

6.0   Getting Started

6.1   Charging and Battery Care

Before using the FX87 TLS, make sure the battery is charged. If the charge is low, connect the FX87 service port to the charging unit provided with the device. While FX87 battery is charging, the LED indicator on the front panel will be orange. When the battery is fully charged, the LED indicator will be green provided the FX87 is powered ON. The LED will turn off when the unit is turned OFF.

When the FX87 is connected to AC power or an external power supply, the **Plug** icon will appear in the top left corner of the screen. If the device operates with the internal battery, the icon changes to **Battery**).

6.2   Setting Date and Time

Set the device date and time before attempting to save any measurement results:

1. Turn ON the FX87 by pressing and holding the **|Power|** button for 3 seconds;

2. Press **|Shift/Enter|**+**|Down|** to enter the **Settings** mode. The following parameters can be set:

    - Auto Shutdown mode;
    - Time;
    - Date;
    - Sound.

The current selected test parameter available to edit will be flashing.
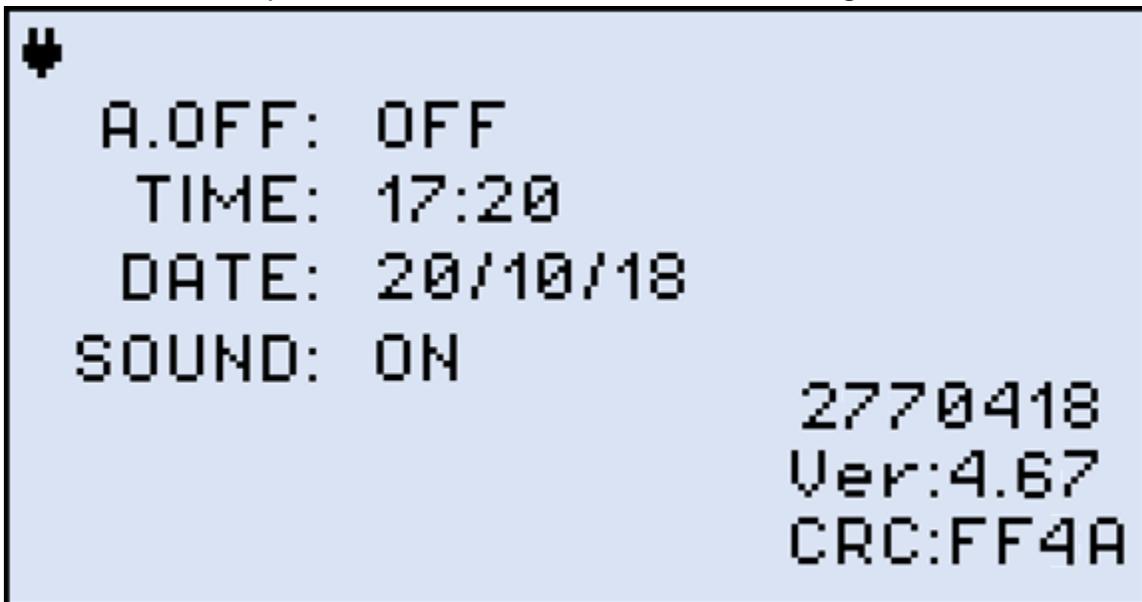
FX87 Instrument Setting screen

3. Press **|Up|** and **|Down|** to select the parameter to edit.

4. Press **|MODE|** to select the field to edit, then change the value if necessary, by pressing
|Up| and **|Down|**.

5. Press **|Shift/Enter|** to save the date and time settings.

6.3   Resetting FX87

On rare occasions resetting the FX87 device may be needed. To do this:

1. Disconnect external power supply from the device;

- With device OFF, press the red **|Power|** button and hold it for at least 15 seconds. The FX87 will reboot. Set the date and time after every reboot (see Section *6.2. Setting Date and Time*).

Because of the reset, the reference values will be lost, so set these values again and also perform ZERO level operation (see Section 8.2.1. Setting ZERO Level).

The reset DOES NOT erase any previously stored measurement data.

7.0   FX87 as a Tunable Light Source

DWDM LS: use this mode to generate optical signal of a specified wavelength within the operating range (1527.60 – 1566.31 THz, incremented by 50GHz/100GHz spacing).

To use FX87 as a light source, connect the fiber to the OLS port located on the left on the top panel of the device. Then press the **|MODE|** button until the **DWDM LS** mode appears at the upper left corner of the display. To toggle between **Laser: ON** and **Laser: OFF**, press the **|F1|** (ON/OFF) button. When the laser is on, the Channel # and its wavelength is shown onscreen:
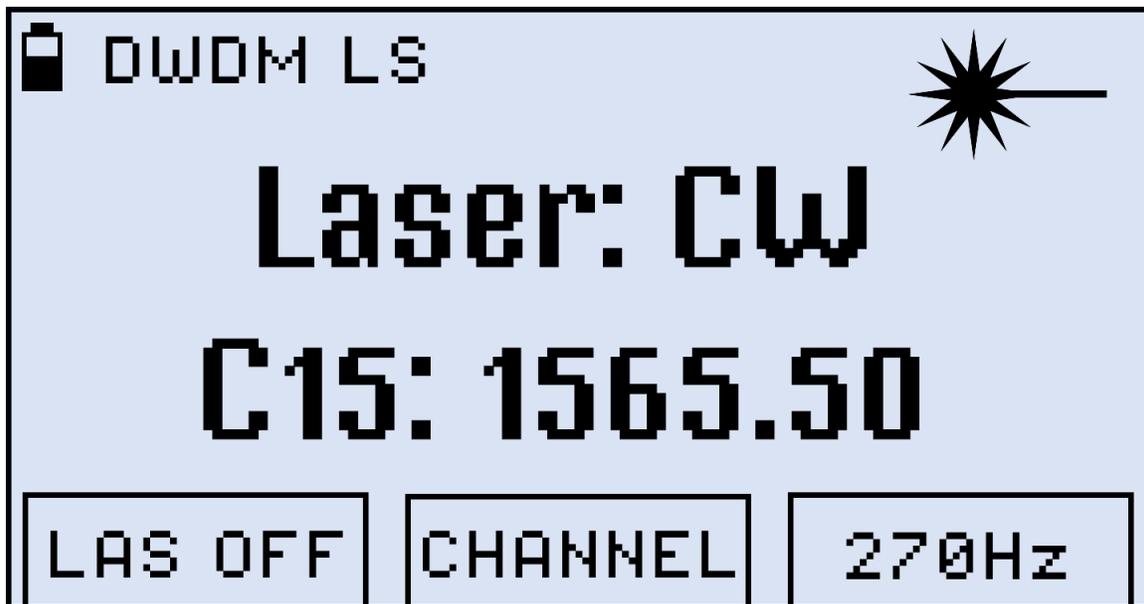
DWDM Light Source mode

To select the necessary channel, press the **|F2|** (CHANNEL) button, scroll up or down with the help of the **|Up|** and **|Down|** buttons, make selection, and confirm it by pressing **|Shift/Enter|**.
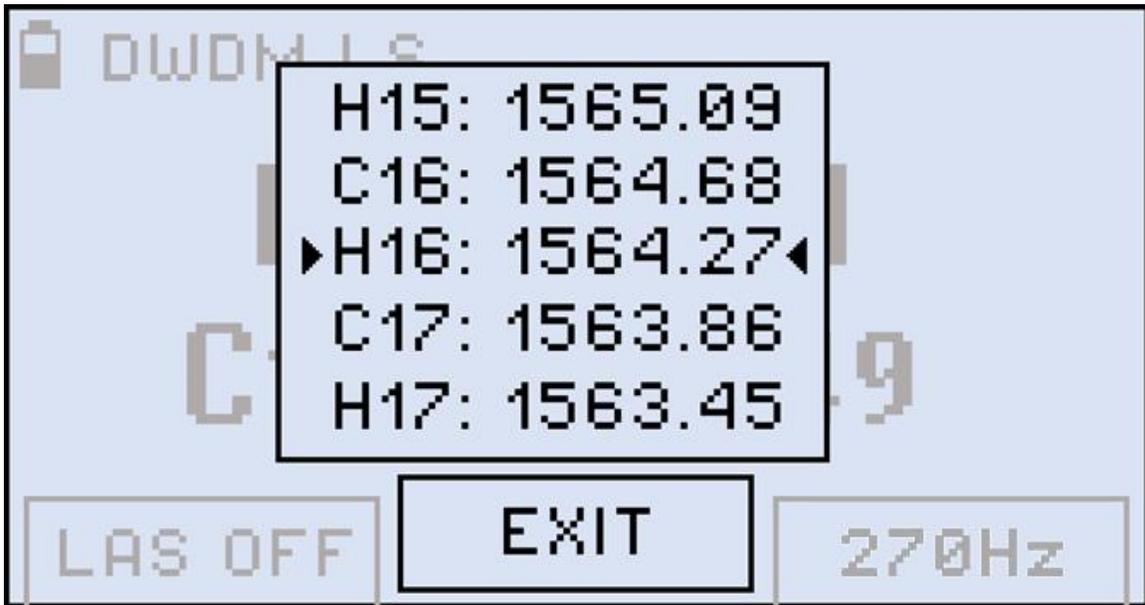
Selecting the channel for the DWDM LS mode

Tone Detection: Press |F3| repeatedly to set modulation frequency: 270 Hz, 330 Hz, 1000 Hz, 2000 Hz, AUTO, CW. AUTO cycles channels every 18-20 seconds.

8.0   Optical Power Measurements

8.1   Mode for Optical Power Measurements

PM (PM1 or PM2)/TLTS: use the OPM test mode to measure any incoming optical signal level (CW, 270, 330, 1000, or 2000 Hz) between the wavelength range of 800 - 1700 nm. Then select a calibrated wavelength that matches the incoming source wavelength.

8.2   Optical Power Measurements

To use FX87 for optical power measurements, connect the fiber to the OPM port located on the right on the top panel of the device.

FX87 Top Panel, OPM Port

8.2.1   Setting ZERO Level

Set the ZERO level before the first use of FX87 for broadband power measurements. We also strongly advise to set the ZERO level before every new batch of measurements, and after measurement conditions have changed.

To set the ZERO level:

1. Press the **|MODE|** button to enter the optical power measurement mode (PM);

2. Press **|F3|** (MORE), then press **|F1|** (ZERO). The **ZERO** notification will show briefly on the display.

Setting the ZERO level

The FX87 is now ready to perform measurements.

8.3   Power Measurements

Clean the fiber before connecting it to the device.

The OPM is an InGaAs detector with a wavelength range from 800 to 1700nm. The displayed power readings can be absolute (dBm and watts) or relative (dB). To measure the optical power in a fiber, insert the test fiber on the OPM test port and press **|MODE|** until the **PM1** or **PM2** test mode appears at the upper left corner of the display (see below an example of PM1 measurement result).
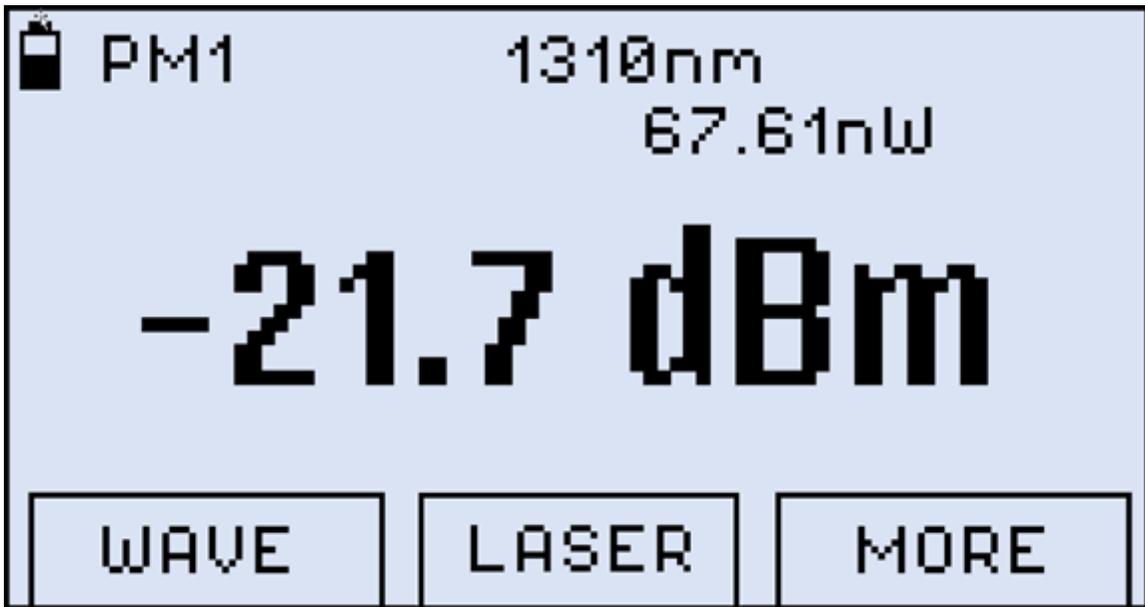
Results of PM measurement

⚠️ *The fiber under test must have only one wavelength. If there are several wavelengths, the measurement results will NOT be valid.*

To change the wavelength, press the **|F1|** button (WAVE). The resulting calibrated wavelength list is then shown below:
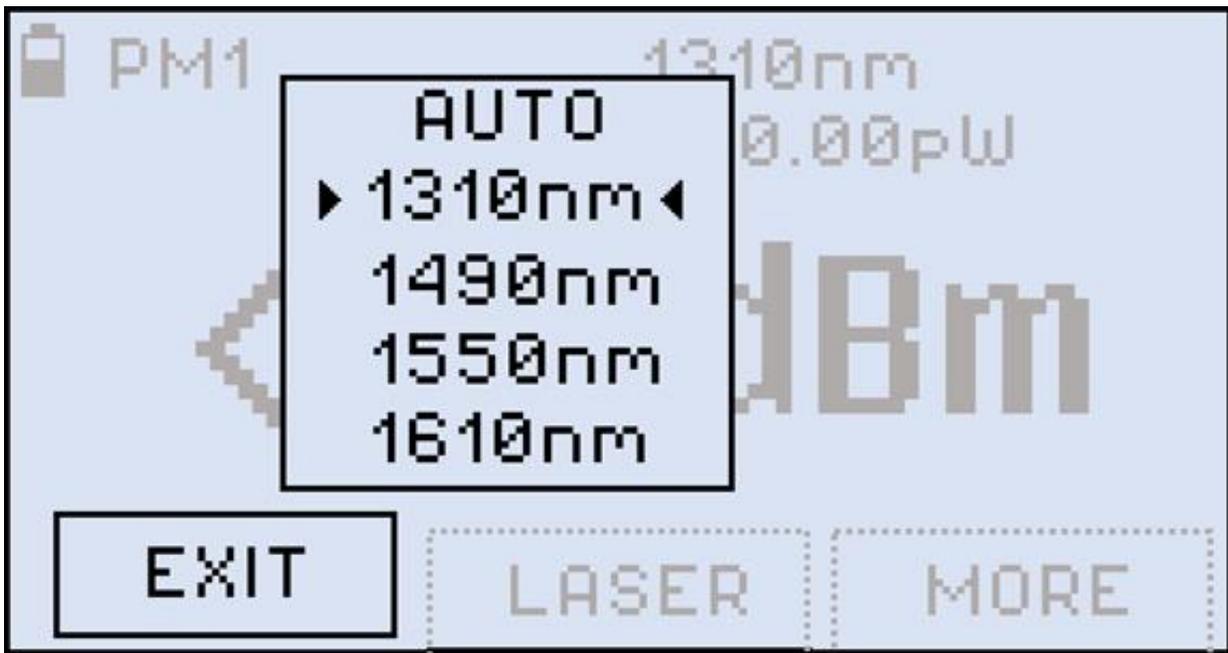
Selecting a wavelength for PM measurement

Select a wavelength by pressing the **|Up|** and **|Down|** buttons, then press the **|Shift/Enter|** button to confirm the choice. The new wavelength then appears in the top right corner of the display. To keep the previous wavelength effective, select a wavelength and then press the **|F1|** button (EXIT).

If the fiber under test carries a signal with WaveID details, select **[AUTO]**. Then FX87 determines the wavelength automatically.

> ⚠️ *If the [AUTO] option is selected for a signal without WaveID or a modulated signal, the wavelength value goes blank, and the measurement results are NOT valid.*

8.3.1 Setting Power Reference Level

To measure the fiber under test span loss, first set a reference level for each test wavelength. For that press the **|F3|** button (MORE), then **|F2|** (REF). The resulting screen is shown below:

Selecting a reference option for PM measurement

- **REF SET** command: sets the current power value as the reference level. To do that, make sure the cursor is at **REF SET** and press the **|Shift/Enter|** button. As a result, the value onscreen changes to **--.--dB** (see the Figure below). The reference level value is also saved to the device memory.
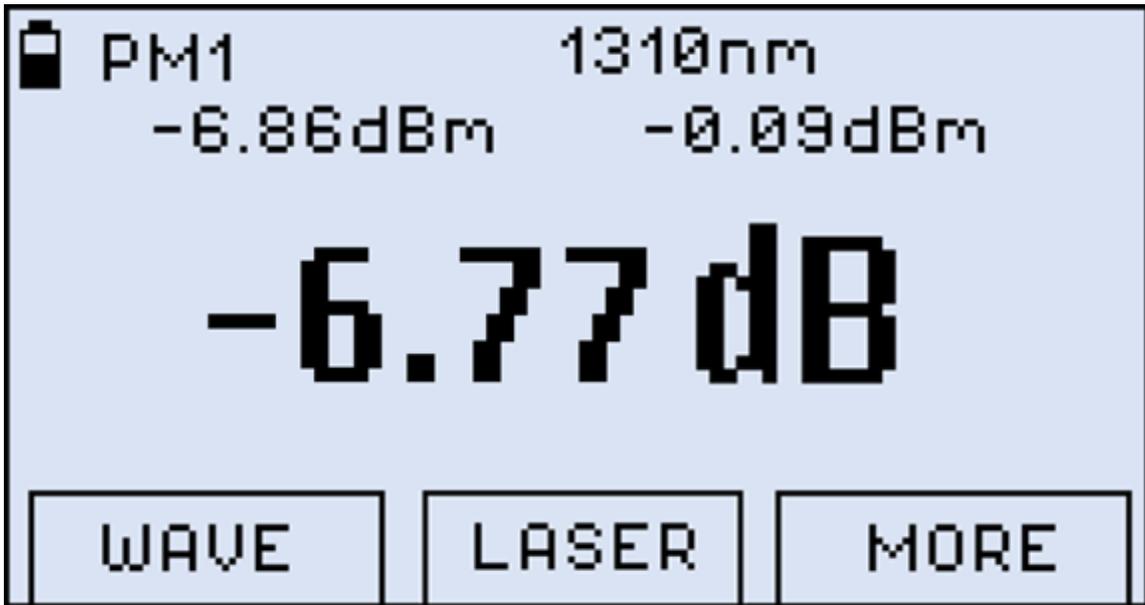
Current power value set as the reference level

*The current reference level value is shown at the second row on the left (**-6.86dBm** in the example above).*

- **REF MEM** command: the previously saved reference level is taken from the device memory and set as active.
- **REF OFF** command: makes the previously saved reference level inactive. The measurement result is then shown in **dBm**.


Broadband measurement taken against a reference level

- **REF +/-** command: adjusts the reference level finely by 0.01 increments with the help of the **|Up|** and **|Down|** buttons.

8.3.2 Saving Measurement Results

To save the result, press the **|Shift/Enter|** and **|Up|** buttons simultaneously. The result is then saved with the comment (note) from the previously saved result.

8.4   Using WaveID

8.4.1 FX87 Device and FX-8x OPM Connected from End to End
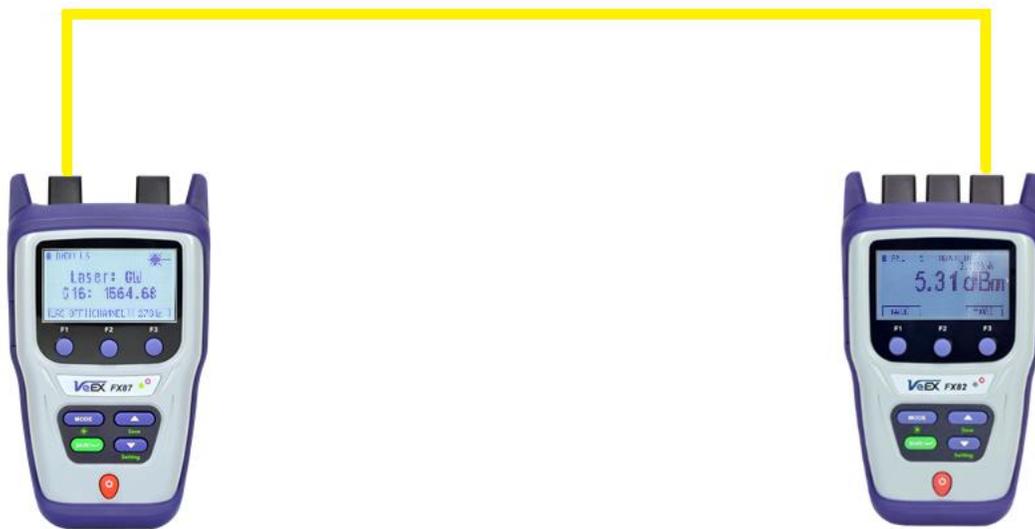
FX87 connected over fiber under test to FX-8x OPM

Set the FX-8x OPM **WAVE |F1|** function to **AUTO**, and choose from one of two FX87 transmit setups

1. Set the FX87 in **DWDM OLS** mode to transmit by pressing **LAS ON |F1|**, and press **CHANNEL |F2|,** and navigate to the desired DWDM channel using the **|Up|** and **|Down|** keys and press **|Shift/Enter|** to confirm the selection**.**

2. Set the FX87 in **PM1/PM2** (**OPM**) mode and press **LASER |F2|** and choose either **LAS ON |F1|** to turn on the laser for the current displayed wavelength by the **>…. <** or navigate to the desired DWDM channel using the **|Up|** and **|Down|** keys and press **|Shift/Enter|** to confirm the selection**.**

8.5 Using One Device for Optical Power Measurement (with Loopback Function)

Optical power in a cable can be measured with just one FX87 device. In this case the device employs both the light source and the power meter and is plugged in at one location, while on the other location the loop is closed with a patch cord (see the Figure below).
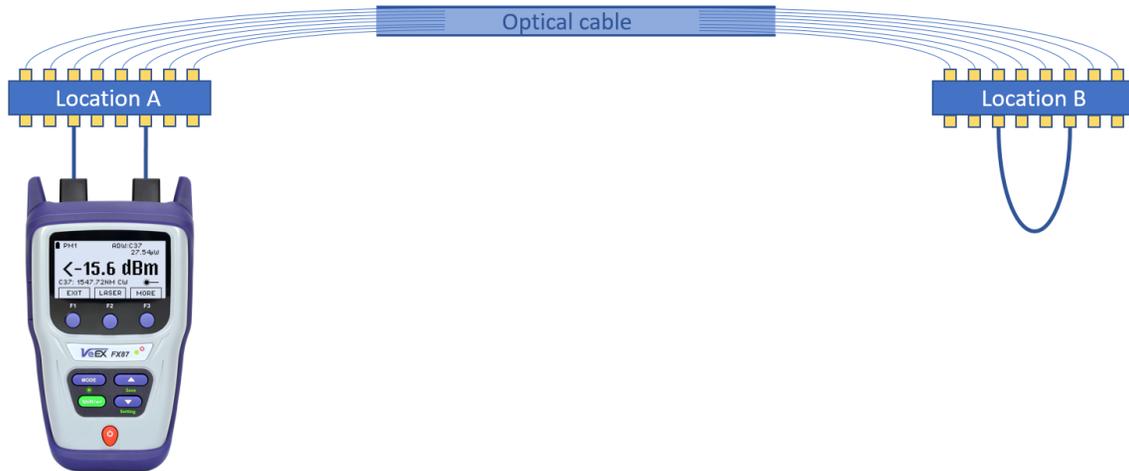
Using one device for optical power measurement (Loopback function)

> ⚠️ *The loop must be closed on Location B with a patch cord. If the Location B technician fails to do that, FX87 shows "0" power value in µW and the dBm value below the sensitivity limit.*

> ⚠️ *If FX87 is used both as a power meter and a light source, set the Light Source first.*

For such measurements the Loopback function may be useful. It immediately sets the wavelength for the power meter, making it the same as the Light Source wavelength.

To use the Loopback function:

1. Set the Light Source as described in Section *7.0. FX87 as a Tunable Light* Source.

2. Enter one of the PM modes as described in Section *8.3. Power Measurements*. Then press the **|F1|** button (WAVE) and select LOOPBACK (see below):
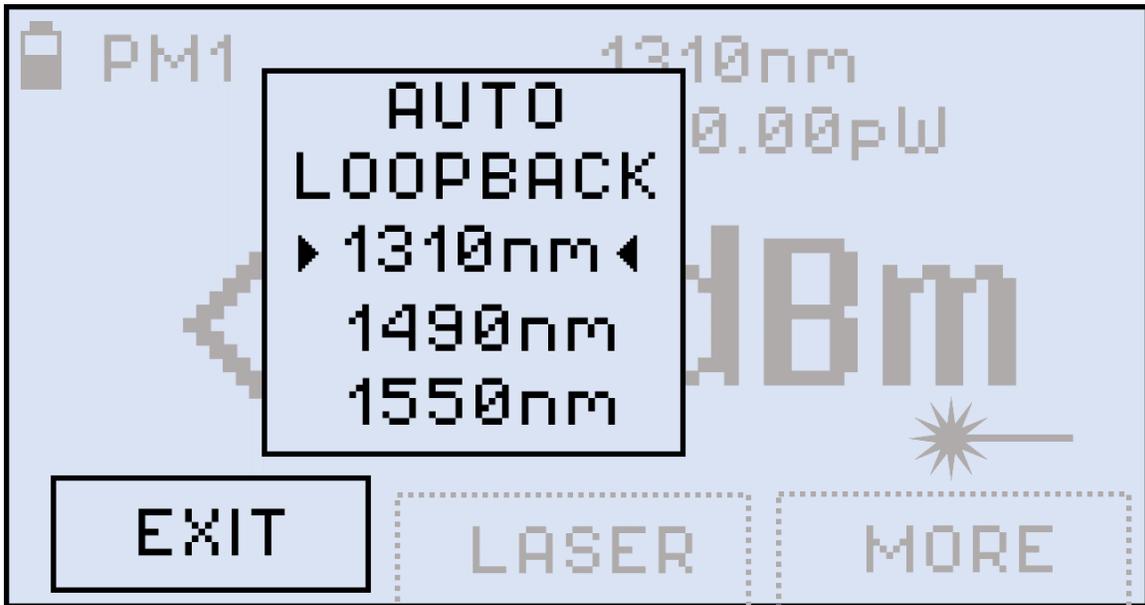
LOOPBACK option in the menu

After that the Power Meter channel is set the same as the Light Source wavelength, and the top line gets the same channel number as the bottom line (C37), as shown below:
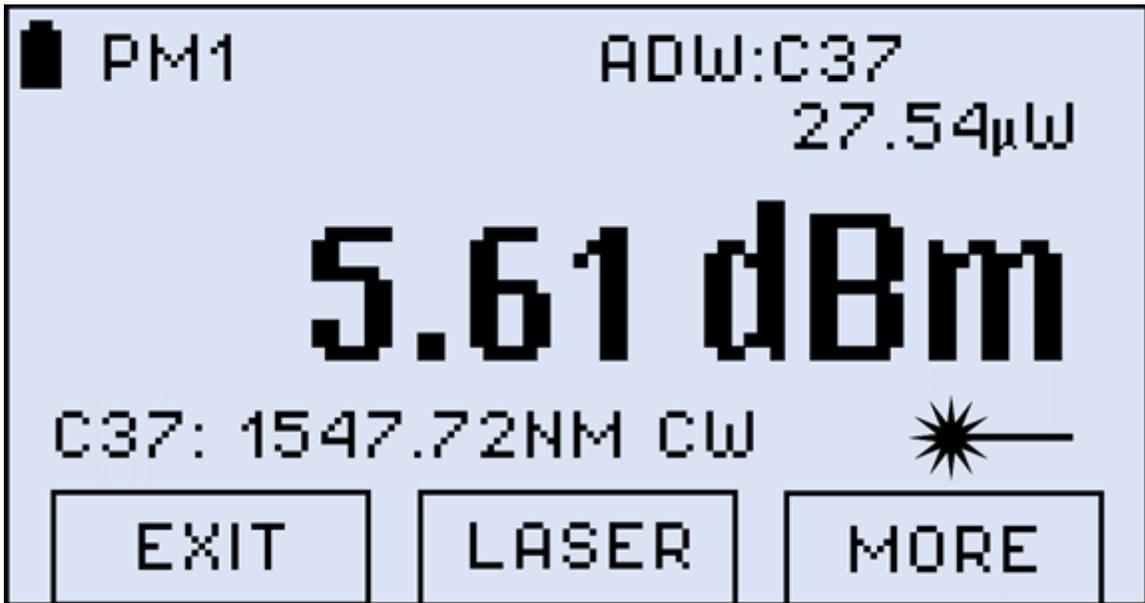

Power Meter channel is set the same as Light Source wavelength

The measured optical power value is immediately shown onscreen.

8.6 Viewing Measurement Results (Read Mode)

To view measurement results, press the **|MODE|** button until the **READ** mode appears at the upper left corner of the display. Scroll up or down the records with the help of the **|Up|** and **|Down|** buttons or go page up and page down by pressing **|F1|** and **|F2|**.
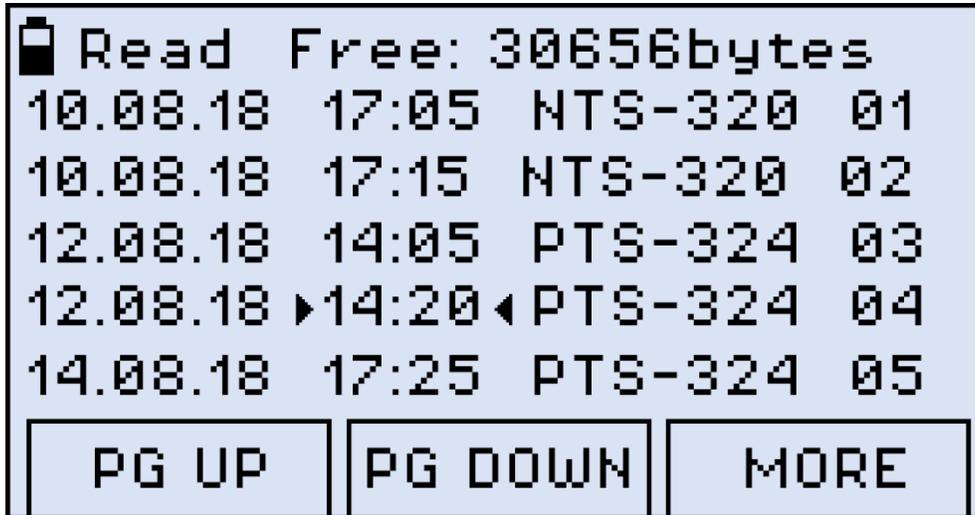
Read mode

8.7 Editing Notes to Measurement Results

By default, every measurement is appended with the 'COMMENT###' note, where ### is the number incremented by "1" with every measurement. This is convenient when measuring several fibers within one batch or one splitter.

The note can be edited as described below, then the updated text applies to the next measurement.

1. Press the **|F3| (MORE)** button, and then **|F1| (NOTE)** button. The screen shown below then appears.
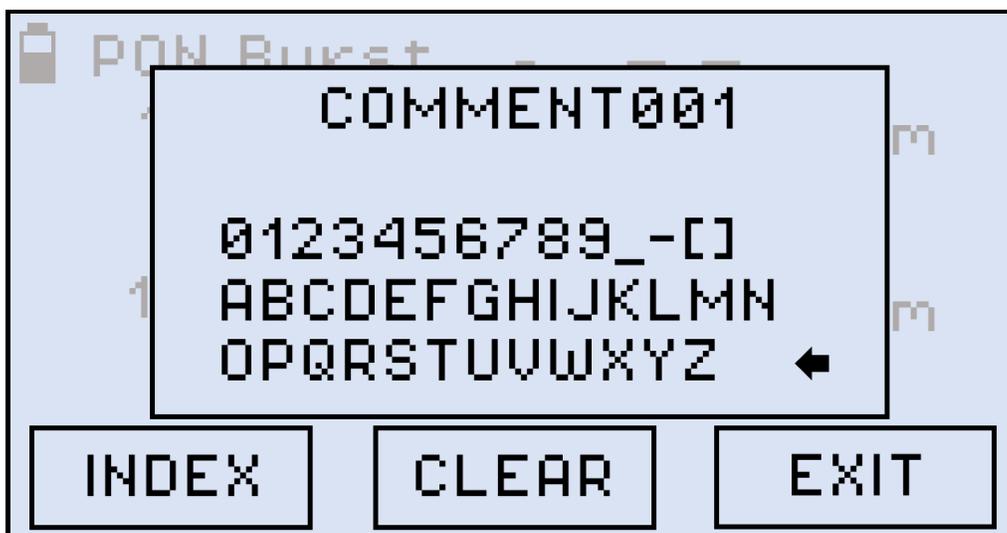
Editing comments to future measurement results

2. Press **|INDEX|** until the cursor in the top line starts flashing, then use the **|Up|** and **|Down|** buttons to select the index number position.
3. Press **|COMMENT|** again to go to the list of symbols in the lower section. The active symbol then gets highlighted. Use the **|Up|** and **|Down|** buttons to select another symbol if necessary.
4. Press the **|Shift/Enter|** button to insert the selected symbol from the list into the selected position on the top line. The comment can include up to 10 symbols total, with 7 symbols for the comment text and 3 numbers for the comment number.
5. Press **|CLEAR|** to reset the index position to "000" when **|INDEX|** is selected or erase the whole note when **|COMMENT|** is selected.
6. To erase a symbol in the note, place the cursor after that symbol, then select the left arrow (◀) and execute the command by pressing the **|Shift/Enter|** button.
7. To save the note for the next measurement and exit the **NOTE** mode, press the **|F3| (EXIT)** button.

To save the current measurement results with the current note:

Press the **|Shift/Enter|+|Up|** button combination **(Save)**. The **Saved** notification is then briefly shown onscreen, and current measurement results with the current note are saved in the device memory.

Once the note is saved with measurement results, it cannot be edited.

9.0　Downloading Measurement Results to PC

To transfer test results and create a measurement report, first install the **LTSync** PC software available for download on VeEX customer portal. New users will have to fill in a registration details about customer information and device usage and to be approved by administrator.

Upon entering login credentials, the website will flash and navigate to VeEX customer portal page. Go to the *Functions* sidepane and look for *Secured Releases*->*Fiberizer Tab->Fiberizer LTSync*.

VeEX Customer Portal Software Releases Webpage

For detailed operations with the applications, please refer to their corresponding manuals. More information on Fiberizer Cloud and LTSync can be found at the VeEX website (www.veexinc.com).

9.1　Installing the FX8x USB Driver

A digitally signed Windows USB driver is required for connecting to the FX8x series. The driver is embedded in the **LTSync** software and will install automatically in the background when the software is installed. If for any reason, the USB driver installation fails, it may be necessary to install the driver manually. In such event, please follow the procedure below.

> ⚠️ *If the operator has used FX-4x series and FX-8x series optical power meter with LTSync to download results on the current PC system in the past, then this step can be **ignored**.*

For the PC to operate with the FX87 device, first install the FX8x USB driver. The procedure below is the same for any FX8x device.

To install the USB driver:

1. Plug in a compatible VeEX power meter to the PC via the supplied USB-to-microUSB cable.
2. Launch the Windows Device Manager and check the FX8x item in the **Other devices** list. The FX8x item is shown with the exclamation mark sign (see an example below) meaning that the driver for the device is not installed.
3. Download the driver from the VeEX web site at www.veexinc.com.
4. In the Windows Device Manager right-click the FX8x item, then select **Update driver**.
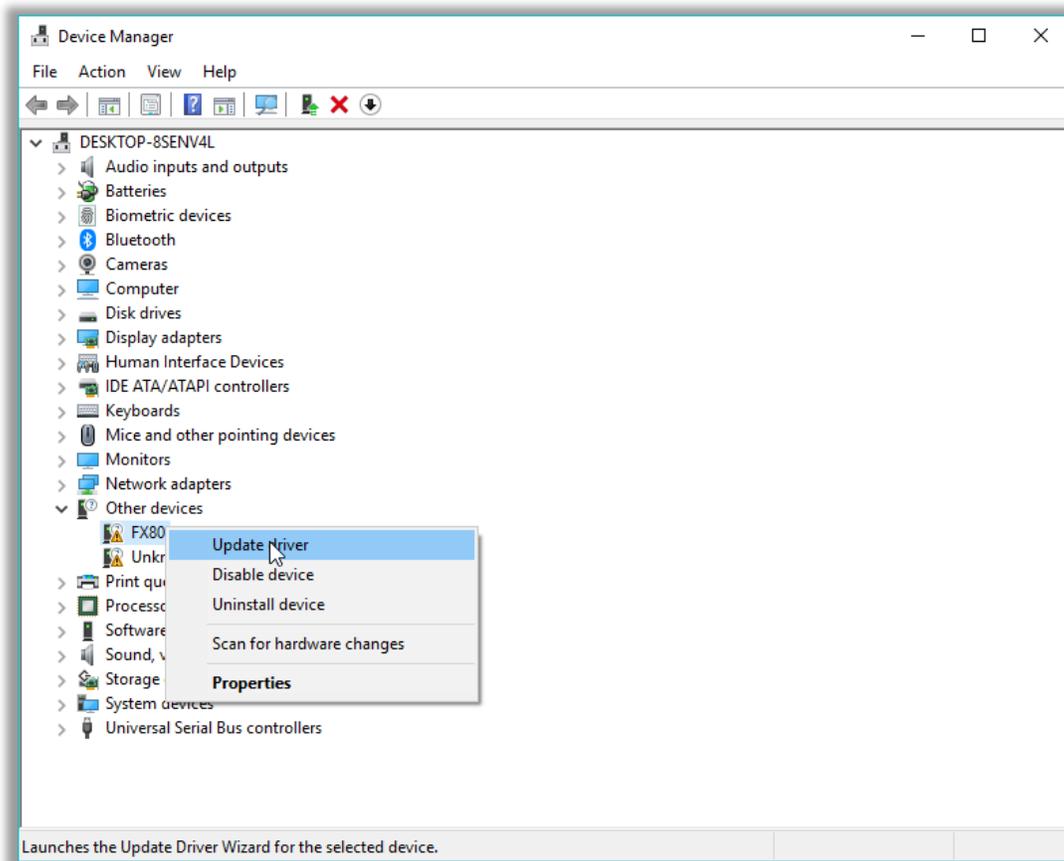
Installing the driver for FX8x

5. Select **Browse my computer for driver software**, define the path where the downloaded driver is to be saved, and then click **Next**. The driver installation begins. A new window appears when the driver has been updated successfully.
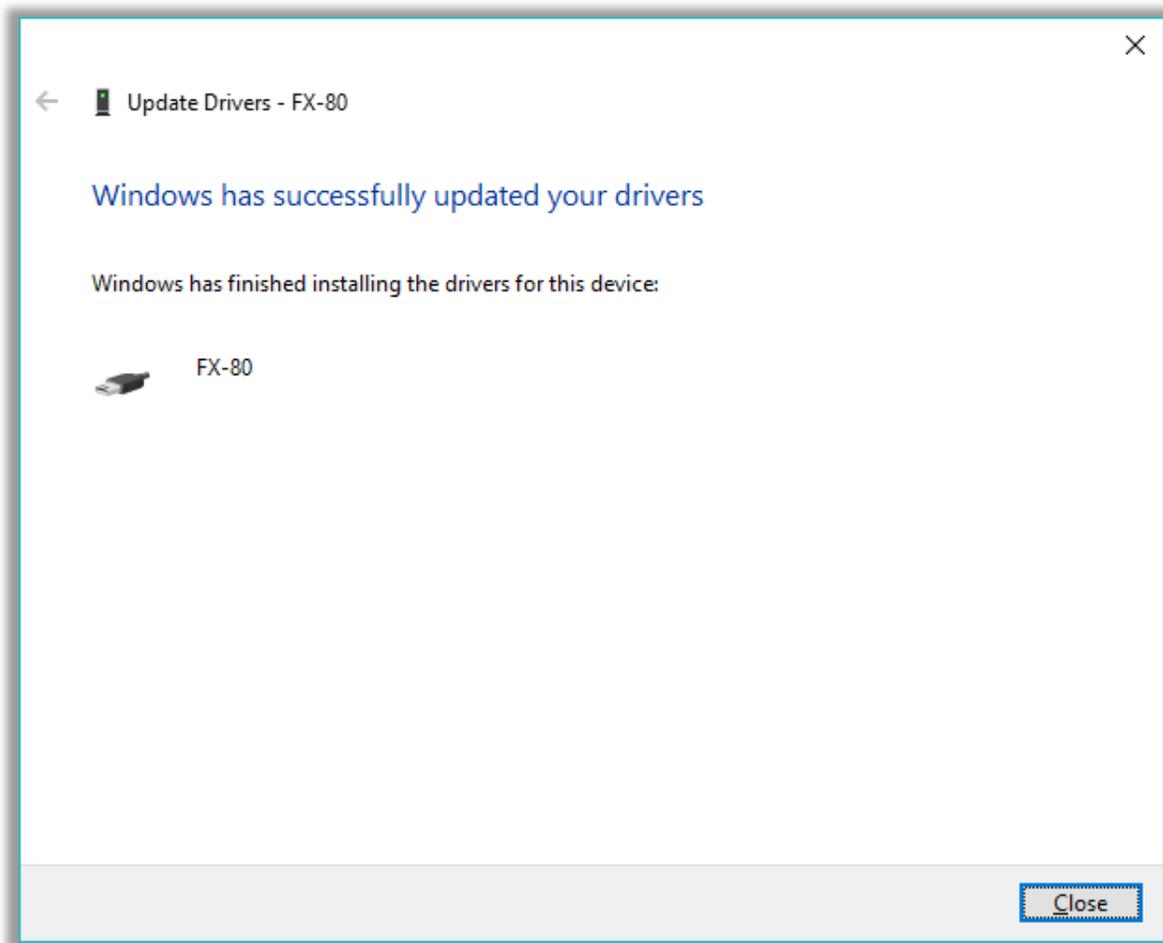
The driver for FX8x successfully installed

9.2 Transferring Measurement Results to PC

To access measurement results to create a report, first transfer results to a PC so they can be uploaded to Fiberizer Cloud. This can be done using the provided micro-USB cable provided and via Bluetooth connection.

⚠️ *To transfer the measurement results via the micro-USB cable, install the USB driver (see Section 9.1. Installing the FX8x USB Driver). For Bluetooth transfer, no driver is needed.*

9.2.1 Transfer Results Using Micro-USB Cable

To transfer measurement results to the PC using the micro-USB cable, connect the provided cable to a compatible power meter and to the PC. The figure below shows that a device is connected and the unique product ID.
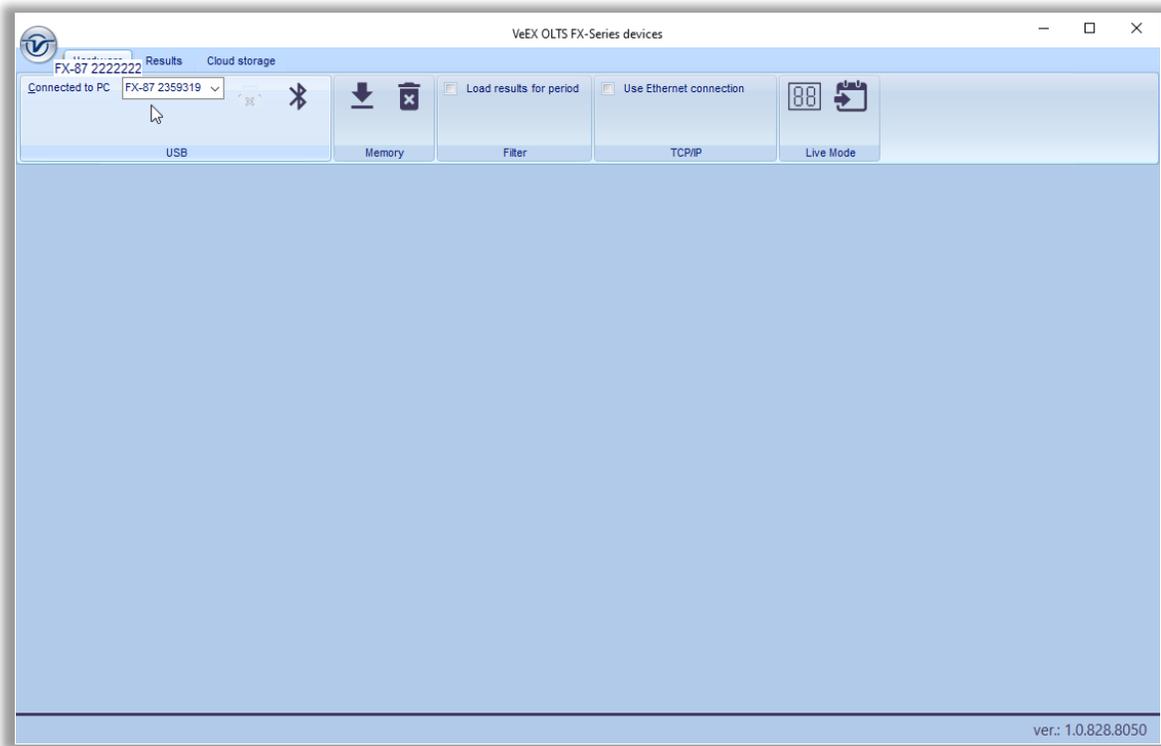
FX87 is connected to PC in LTSync, its serial number is recognized by the program

To get the measurement results onscreen, click the **Download** button ⬇. Results will appear in a table, as shown in the figure below.
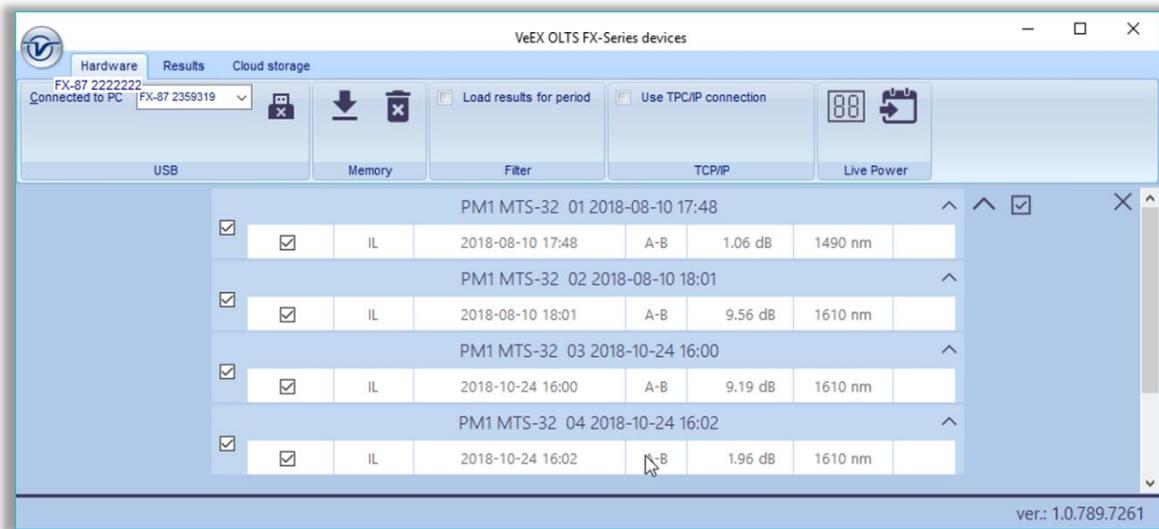
Measurement results are presented as a table

To prepare measurement results for a report, enter the pertinent information into the fields in the **Attributes** section (see, for example, the Figure above).

The displayed results can be filtered by the test group and/or wavelength by selecting the desired results to be worked with, in the main viewing area (see, for example, the Figure above).

To download results of a certain period, go to the **Hardware** tab and select the **[Load results for period]** checkbox. This brings (see the Figure below).
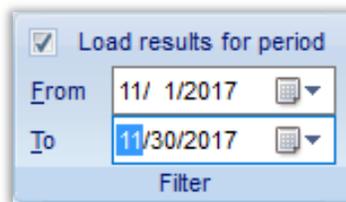
Filtering measurement results by time

To delete a row of results, select its checkbox, then click the **[Delete row]** button (⊟⊗, see it, for example, in the Figure above). Several rows of test results can be selected and deleted at the same time.

To move a row to another group, highlight the row by clicking it, after which the border around the row will turn orange. Drag-and-drop this row to another group if needed. Alternatively, highlight the row, click the **[Move row]** button (⊟⊤, see it, for example, in the Figure above), then highlight the desired group.

Only one row at a time can be moved.

A row can be moved to another group only if there is no measurement with that wavelength in the group.

To save the measurement results to the PC, click the **[Save to PC]** button (, see it, for example, in the Figure above).

To erase all test results from the FX87 memory, go to the **Hardware** tab and click the **[Erase all memory]** button).

9.2.2 Transfer Results Using Bluetooth

To transfer measurement results to the PC using Bluetooth, change **|MODE|** until **Read** screen is shown. The Bluetooth symbol ( ) should appear on the upper right-hand corner. Initiate pairing through the host device's operating system settings (Windows PC), before opening LTSync application.
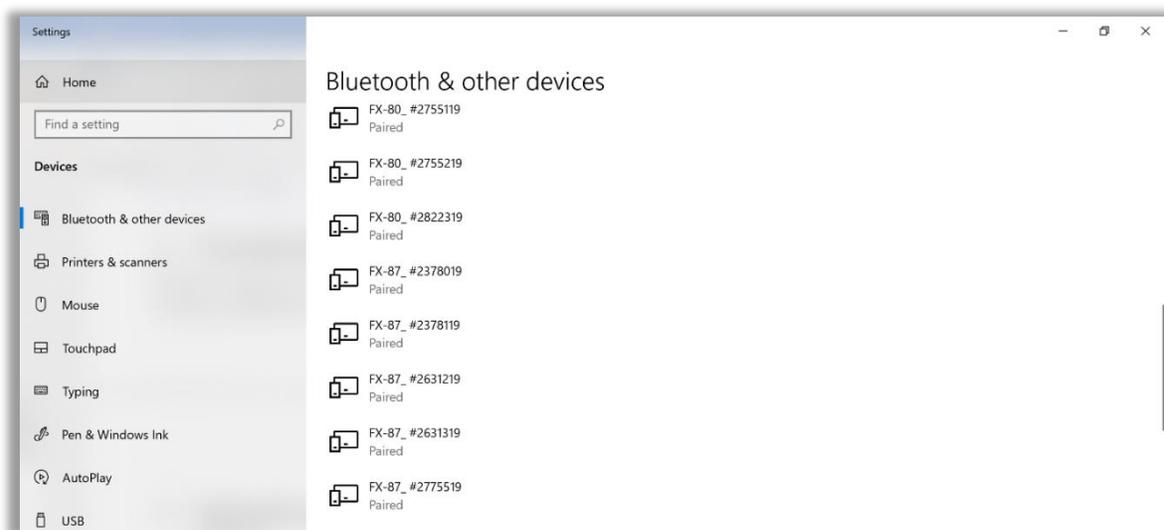
FX87 is paired to Windows PC Settings, data transfer to LTSync is ready to initiate

Then open the LTSync application with the FX87 device nearby, click on the Bluetooth symbol and wait until Bluetooth is highlighted in orange.

To get the measurement results onscreen, click the Download button . Results will appear in a table, as shown in the figure below.
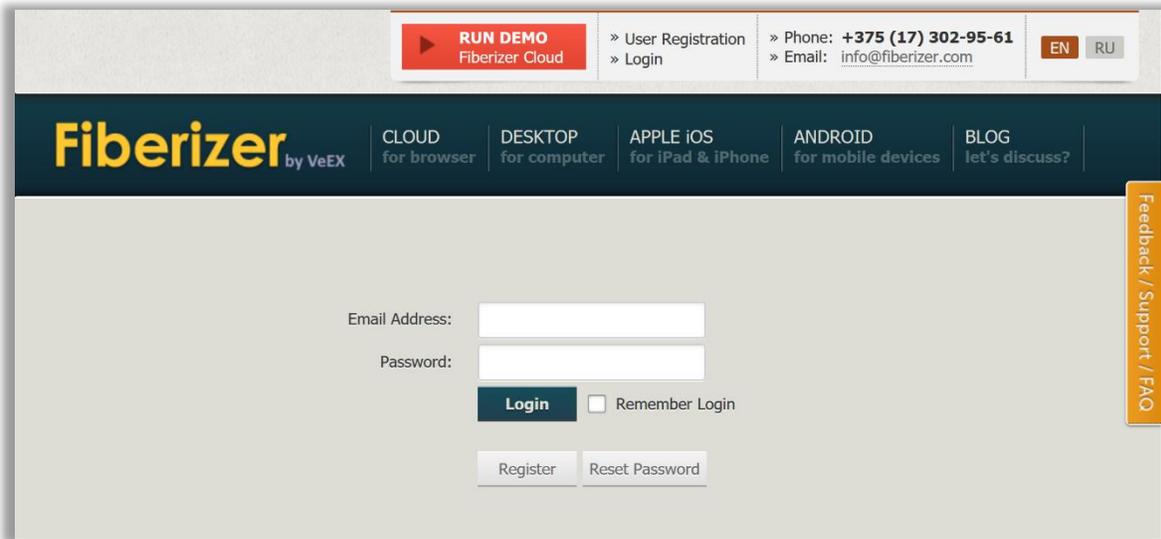
FX87 successful BT data transfer download

9.3 Uploading Measurement Results to Fiberizer Cloud

Fiberizer Cloud account can be accessed within the **LTSync** program. To do this, go to the **Cloud storage** tab and click the **[Log in to Fiberizer Cloud]** button 🔲), then enter credentials in the resulting form.
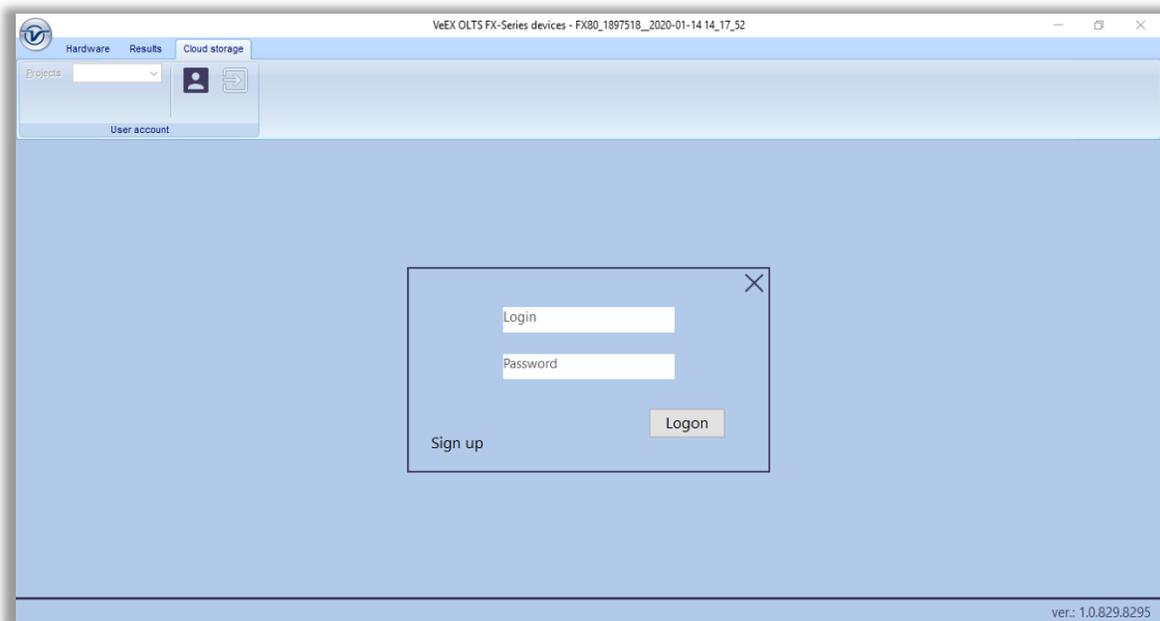

LTSync Fiberizer Cloud Login Profile

Fiberizer Main website registration window after clicking "Sign Up"

If no Fiberizer Cloud account exists, click the **[User Register in Fiberizer Cloud]** button (📋),
then register there.

To upload measurement results to Fiberizer Cloud, go to the **Results** tab and click the **[Upload
to Fiberizer Cloud]** button (☁). Then **LTSync** creates a folder in the Fiberizer Cloud account
named after the connected device (for example, **FX8x 2378019**) and uploads measurement
results into this folder.
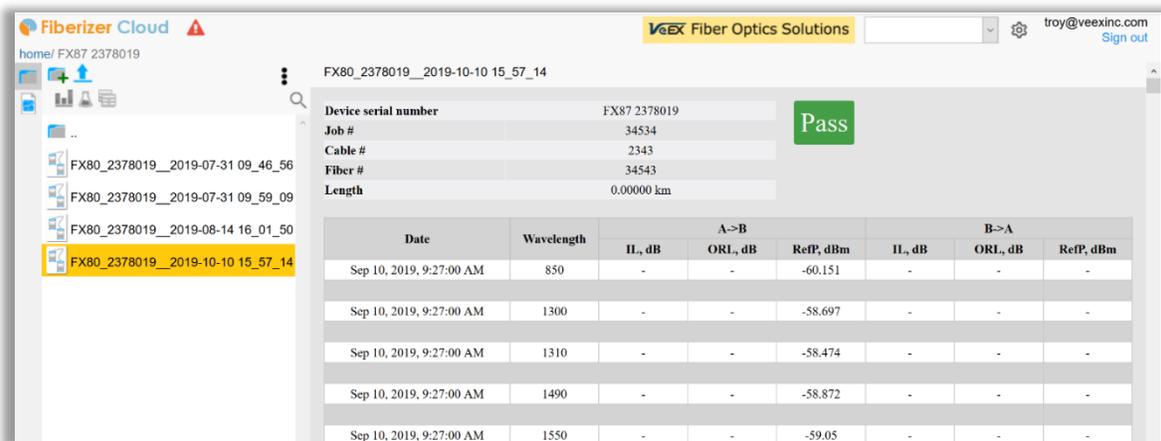
Measurement results uploaded to Fiberizer Cloud

To log out from the Fiberizer Cloud account, go to the **Cloud storage** tab and click the **[Log out
from Fiberizer Cloud]** button (↪).

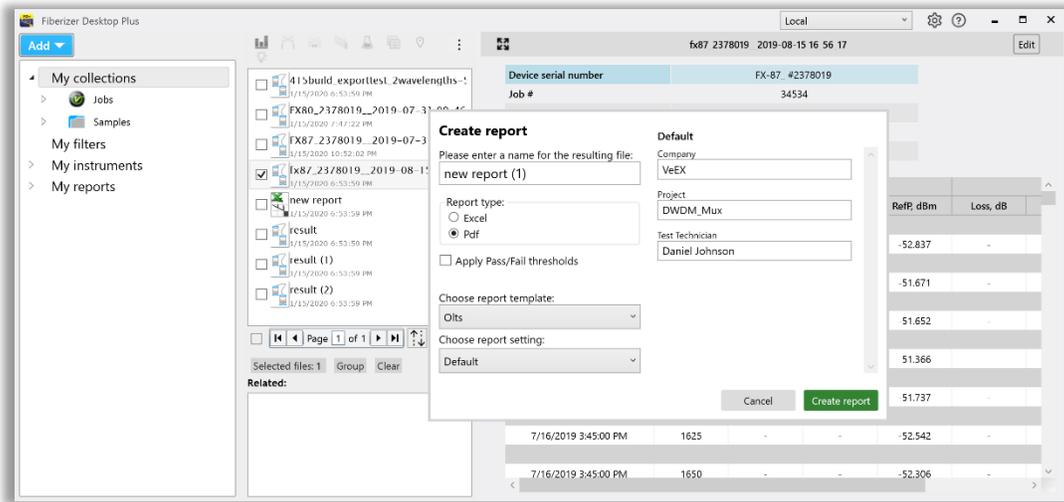# 9.4 Uploading Measurement Results to Fiberizer Desktop Plus

Refer to Section 9.0. Downloading Measurement Results to PC for the VeEX Customer Portal Software Releases Webpage instructions to download the latest Fiberizer Desktop Plus version.

Fiberizer Desktop Plus software allows users to upload measurement files from oxlts, sor, etc formats and perform advanced post-processing results: managing and merging results, generate pdfs/excel files, and other functionalities explained more in detail in its dedicated manual.
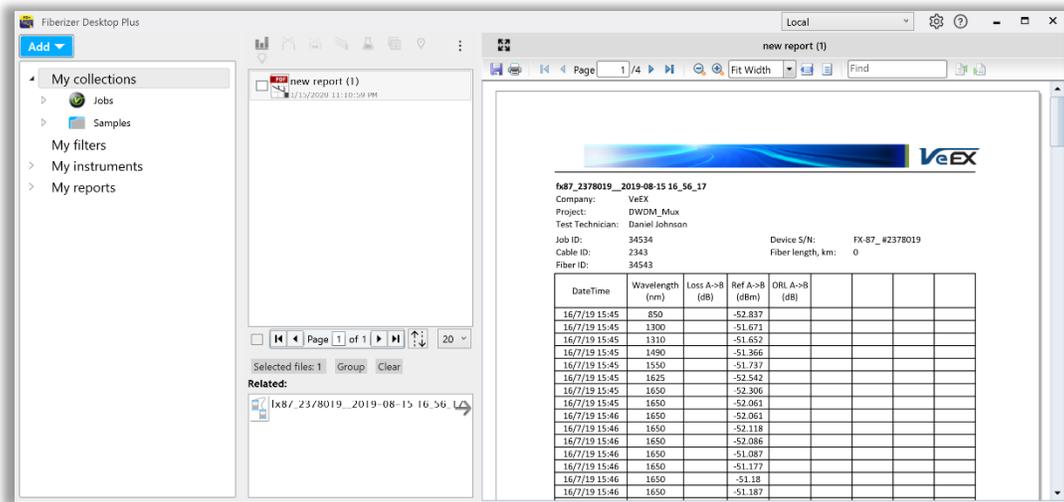
The screenshots below show the procedure to upload measurement files to Fiberizer Desktop repository window and generate pdf/excel reports.

Measurement results uploaded to Fiberizer Desktop Plus – File Upload

PDF/Excel Report Generation

PDF Report Generated

10.0 Warranty

VeEX Limited Warranty

The following terms and conditions govern the Limited Warranty for hardware ("Hardware"), Firmware and software ("Software") products (collectively, "Products") provided by VeEX, Inc. or its affiliates ("VeEX") that is the contracting party. This Limited Warranty extends only to the original purchaser of a Product ("Customer") and is effective as of the date of purchase of such Product. For future purchases, please consult this page for current warranty information, as this Limited Warranty may be updated by VeEX from time to time. To insure you receive up-to-date information and notices, please register your Product with VeEX.

Limited Warranty Start Date

VeEX Products may come with a 90-day, 1-year, 2-year, or other limited hardware warranty (the "Warranty Period") based on product, configuration and customer contract. The Warranty Period for battery pack, LCD, LCD touch panel, LCD protective cover, and accessories (including but not limited to patch cords, AC adaptor, SFP, USB adaptors, carrying case, carrying pouch) is limited to one (1) year from the Start Date, as defined below.

"Start Date" as used in this policy means the date when the VeEX Product downloaded or is shipped from VeEX's facilities or from an authorized VeEX reseller to the Customer.

Limited Hardware Warranty

To determine the warranty that came with your Hardware product(s), or the warranty renewal or extension that you purchased, see your packing slip, invoice, receipt or other sales documentation. Any Software embedded in the VeEX hardware is subject to the Limited Software Warranty set forth below.

VeEX warrants that for the applicable Warranty Period, the VeEX Hardware purchased by Customer shall be free of defects in material and workmanship under normal authorized use consistent with the Product instructions. In the event that VeEX receives notice during the Warranty Period that any Hardware does not conform to this Limited Warranty, Customer's sole and exclusive remedy, and VeEX's sole and exclusive liability, shall be for VeEX, at its sole option, to: (1) repair the Hardware at no charge, using new or refurbished replacement parts in accordance with VeEX's Return Policy; (2) exchange the Hardware with new or refurbished Hardware; or (3) refund the purchase price of the Hardware, provided that Customer returns the Hardware with acceptable evidence of purchase within 30 days from the date of VeEX's request, freight prepaid. VeEX's obligations hereunder are conditioned upon Customer's return of the Hardware to VeEX in accordance with the terms of this Limited Warranty. VeEX will use commercially reasonable efforts to ship any replacement Hardware within thirty (30) working days after VeEX's receipt of the non-conforming Hardware. Actual delivery times may vary depending on Customer location.

This limited hardware warranty does not cover:

- Software, including, without limitation, third-party software
- Non VeEX products and accessories
- Repairs made by Customer or any other party without VeEX's prior written authorization
- Problems that result, directly or indirectly, from external causes such as accident, abuse, misuse or problems with electrical power
- Usage that is not in accordance with product instructions

- Failure to follow the product instructions or failure to perform preventive maintenance
- Using accessories, parts or components not supplied by VeEX
- Commercial hardware products that use, or in which have been installed, products or components that have not been provided by VeEX.
- Products with missing or altered service tags or serial numbers
- Products for which VeEX has not received payment
- Normal wear and tear

Customer is solely responsible for assessing the suitability of the Product for use in particular applications and backing up its programs and data to protect against loss or corruption. VeEX's warranty obligations do not include installation support. No one is authorized to make any statement or representation altering the terms of this Limited Warranty.

Limited Software Warranty

Subject to the terms of VeEX's End User License Agreement, VeEX warrants for a period of 90 days from the Start Date that: (i) the media on which the Software is delivered will be free of defects in material and workmanship under normal authorized use consistent with the Product instructions; and (ii) the Software will perform substantially in accordance with VeEX's standard specifications. VeEX does not warrant that the Software will operate uninterrupted or error-free. In the event that VeEX receives notice during the warranty period for (the "Error"), Customer's sole and exclusive remedy, and VeEX's sole and exclusive liability, shall be: (1) for VeEX to replace the defective media; or (2) to provide Customer with a replacement copy of the Software containing any correction or modification needed to remedy the Error; or (3), at its sole option, to use commercially reasonable efforts to correct any substantial nonconformity of the Software reported to VeEX's authorized service or support representative by Customer during the warranty period. Customer's sole and exclusive remedy for VeEX's failure to correct the Error will be the refund of the purchase price of the Software, provided that the Software is returned to VeEX by the Customer along with proof of purchase within thirty (30) days of the request by the Customer, freight prepaid. VeEX shall not be obligated to remedy any Error which cannot be adequately reproduced by VeEX.

During the Warranty Period, VeEX will provide, without charge to the customer, all fixes, patches and enhancements to the purchased software, firmware and software options. VeEX does not warrant that all software or firmware defects will be corrected. New enhancements attached to a software option require the option to be purchased (at the time of order or the time of upgrade) in order to benefit from such enhancements.

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Hardware Replacement Process

Any defective Hardware can only be replaced in accordance with VeEX's Return Policy. Transportation costs, if any, incurred in connection with the return of a defective Hardware to an VeEX repair center shall be borne by Customer. If VeEX determines, at its sole discretion, that the allegedly defective Hardware is not covered by VeEX's Limited Warranty, the cost of repair by VeEX, including all shipping expenses, shall be paid by Customer. Customer is responsible for backing up and saving any data, software, firmware or other information embedded in or saved on any returned Hardware, and VeEX will not restore, save or return any such data, software, firmware or other information with any repaired or replaced Hardware. This Limited Warranty only covers Hardware manufactured by an authorized VeEX manufacturer and sold by VeEX's distributors and resellers.

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11.0 About VeEX

VeEX Inc., an innovative, customer-focused communications test and measurement company, develops next-generation test and monitoring solutions for telecommunication networks and services. With a blend of advanced technologies and vast technical expertise, VeEX has developed products that diligently address all stages of network deployment, maintenance, and field service turn-up and integrate service verification features across DSL, fiber optics, CATV/DOCSIS, mobile backhaul and fronthaul (CPRI/OBSAI), next-generation transport network, fiber channel, carrier and metro Ethernet technologies, WLAN, and synchronization.

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