

Application Note

FOR

SMA Calibration Kit for VNA

LCAL06A, LCAL06B, LCAL06C and LCAL09A are precision SMA calibration kits which provide accurate and reliable Short-Open-Load-Thru (SOLT) or Load-Reflect-Match (LRM) calibration of a vector network analyzer (VNA). Each calibration kit is carefully fine tuned and measured to ensure the performance factory guaranteed specifications as described in its data sheet.

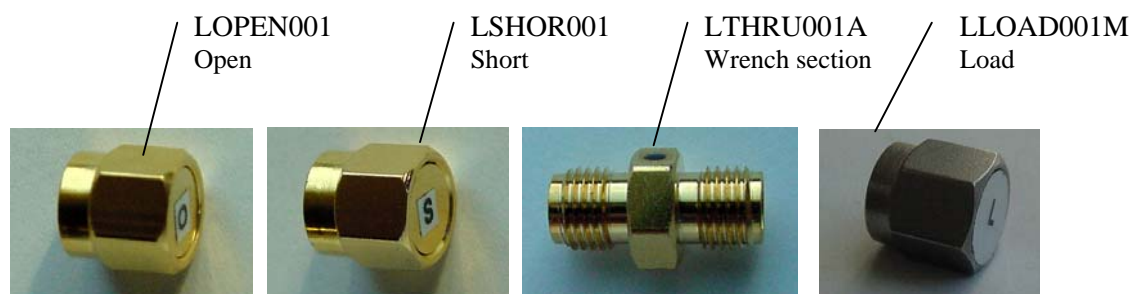
LCAL06A

A female calibration kit and used for DC ~ 6.0 GHz VNA test cable with male end connector.

It includes the following items:

- 1) Short – SMA Male (Part # LSHOR001).
This part needs to be used with Thru (Part # LTHRU001A) to form SMA Female Short.
- 2) Open – SMA Male (Part # LOPEN001).
This part needs to be used with Thru (Part # LTHRU001A) to form SMA Female Open.
- 3) Load – SMA Male (Part # LLOAD001M)
This part needs to be used with Thru (Part # LTHRU001A) to form SMA Female Load.
- 4) Thru (Part # LTHRU001A) – SMA Female/Female

Below is the example of a female kit LCAL06A:



LCAL06B

A male calibration kit and used for DC ~ 6.0 GHz VNA test cable with female end connector.

It includes the following items:

- 1) Short (Part # LSHOR001) – SMA Male
- 2) Open (Part # LOPEN001) – SMA Male
- 3) Load (Part # LLOAD001M) – SMA Male
- 4) Thru (Part # LTHRU001B) – SMA Male/Male

LCAL06C

A combo (female/male) calibration kit and used for DC ~ 6.0 GHz VNA test cable with either male or female end connectors.

It includes the following items:

- 1) Short (Part # LSHOR001)
 - a. SMA Male
 - b. SMA Female: *This part needs to be used with Thru (Part # LTHRU001A) to form SMA Female Short.*
- 2) Open (Part # LOPEN001)
 - a. SMA Male
 - b. SMA Female: *This part needs to be used with Thru (Part # LTHRU001A) to form SMA Female Open.*
- 3) Load (Part # LLOAD001M) – SMA Male
 - a. SMA Male
 - b. SMA Female: *This part needs to be used with Thru (Part # LTHRU001A) to form SMA Female Load.*
- 4) Thru (Part # LTHRU001A) – SMA Female/Female
- 5) Thru (Part # LTHRU001B) – SMA Male/Male

LCAL09A

A female calibration kit and used for DC ~ 9.0 GHz VNA test cable with either male or female end connectors.

It includes the following items:

- 1) Short – SMA Male (Part # L022).
This part needs to be used with Thru (Part # L020) to form SMA Female Short.
- 2) Open – SMA Male (Part # L023).
This part needs to be used with Thru (Part # L020) to form SMA Female Open.
- 3) Load – SMA Male (Part # L024)
This part needs to be used with Thru (Part # L020) to form SMA Female Load.
- 4) Thru (Part # L020) – SMA Female/Female

Connect Cal Kit to Test Cable

In order to maintain the performance of each kit and the accuracy of the calibration, a torque wrench with 5 ~ 6 lb-Inch is *required* to connect or disconnect the kit from a test cable at the cable side SMA mating connector. Never try to turn the kits which may cause the kits to be permanently damaged.

Define the calibration kit parameters for SOLT calibration

The following instruction is used as an example

- Agilent E8357A
- A new CalKit file named “demo”
- A female Calibration Kit LCAL06A with the following measured parameters.

	Offset	C0	C1	C2	C3	Offset Loss (Gohm/S)
Short	55.7 ps (16.70 mm)					4.8
Open	55.7 ps (16.70 mm)	45	6	-2.5	0	4.8
Load	0					4.8
Thru	55.70 ps (16.70 mm)					4.8

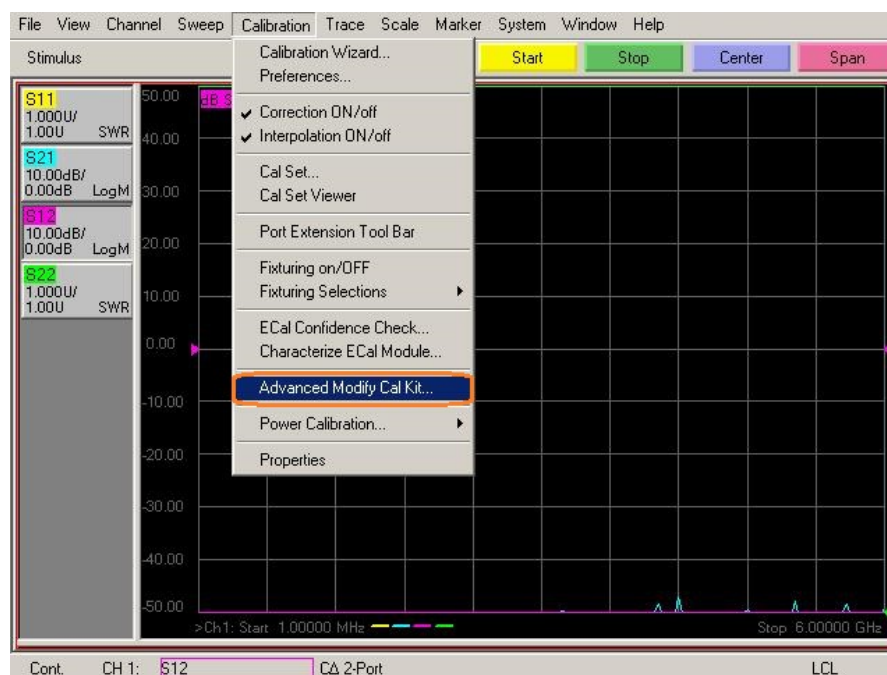
Legend:

Yellow rounded rectangular means the user needs to select or type;

Blue rounded rectangular means the user needs to pay extra attention.

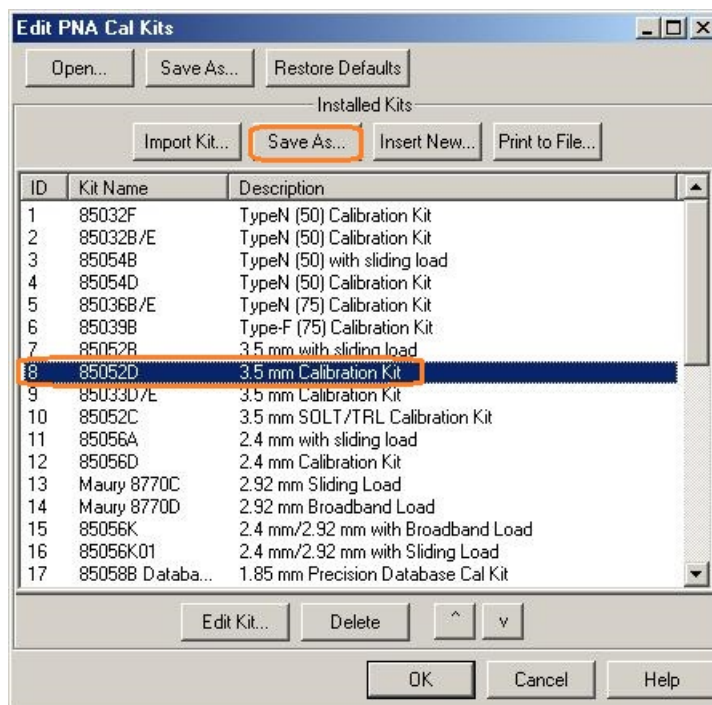
1. Prep Network Analyzer

- 1) Turn on a network analyzer such as Agilent 8753 ES for at least 2 hours.
- 2) Load predefined settings like port power.
- 3) Then Select “Advanced Modify Cal Kit...”

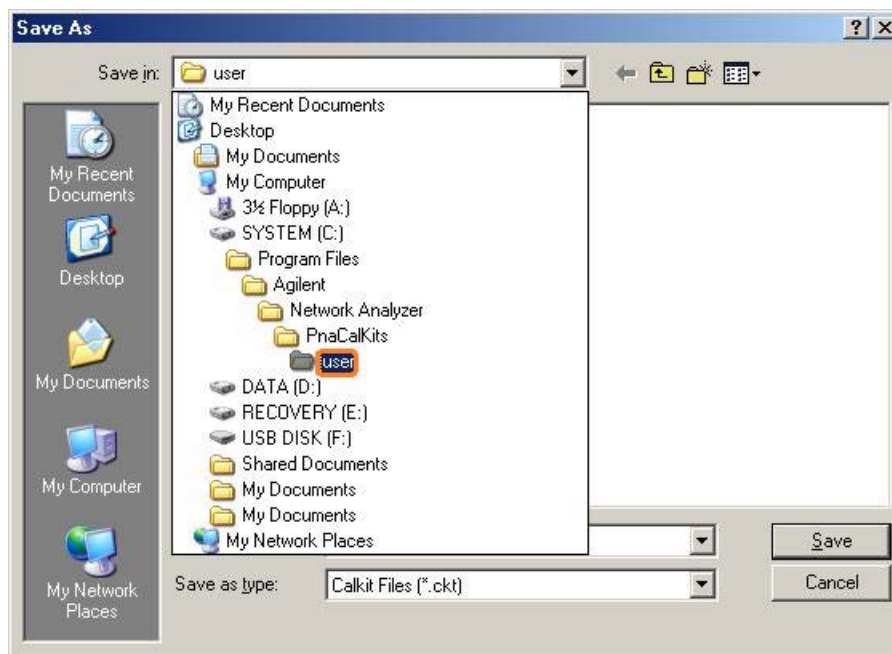


2. Create a baseline Calibration Kit File

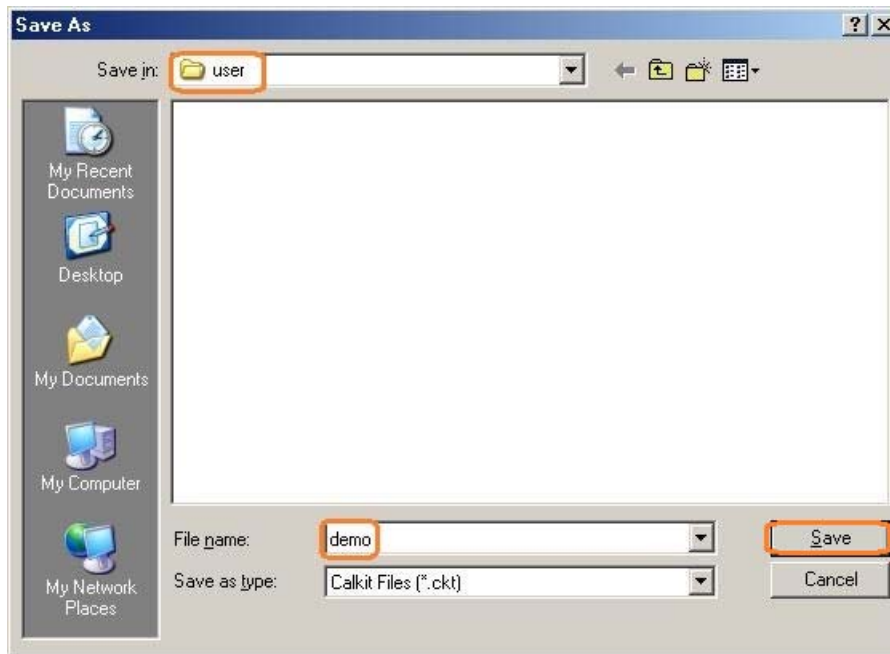
- 1) Open a factory calibration kit file such as Agilent 85052D, and select “Save As...”.



- 2) Save to Cal Kit user directory:

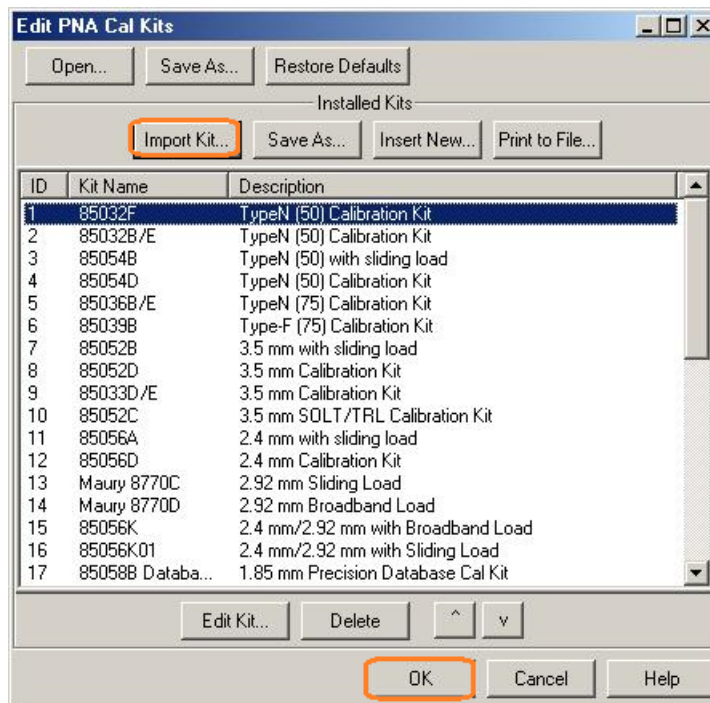


A unique file name shall be used. This example uses “demo” as the file name:



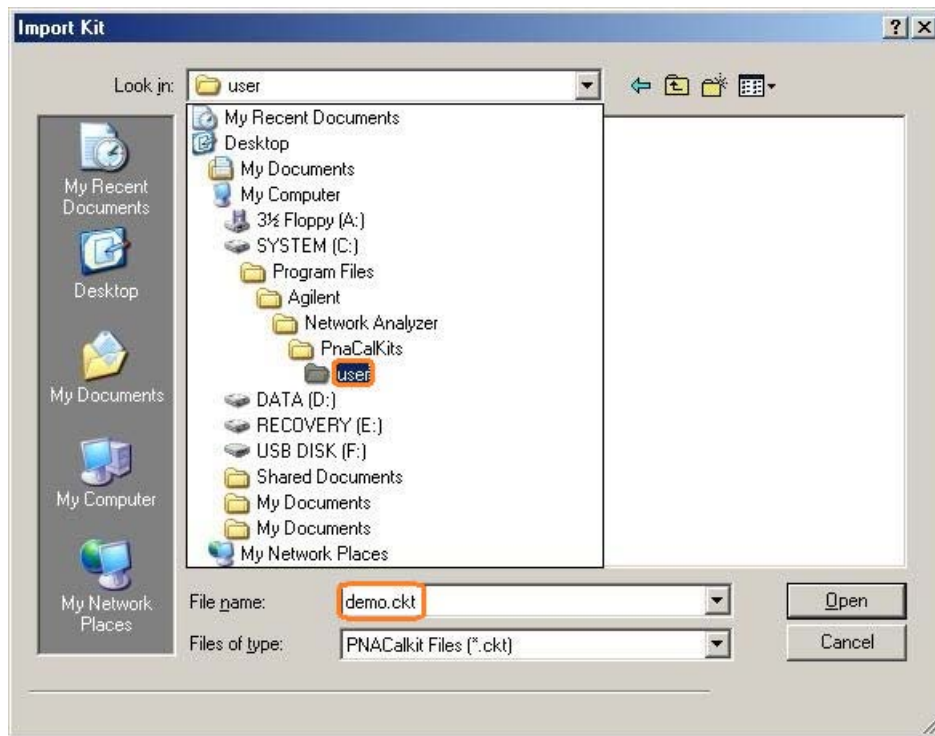
3) Import this newly created Calkit file:

a. Select “Import Kit...”, then “OK” button:

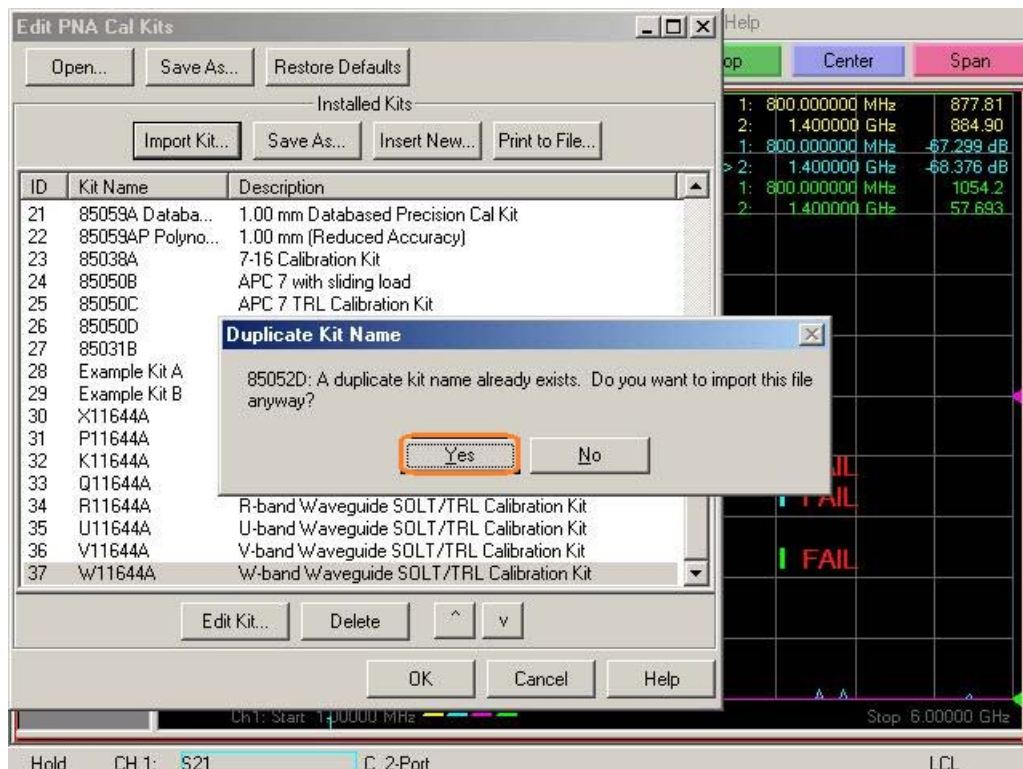


b.

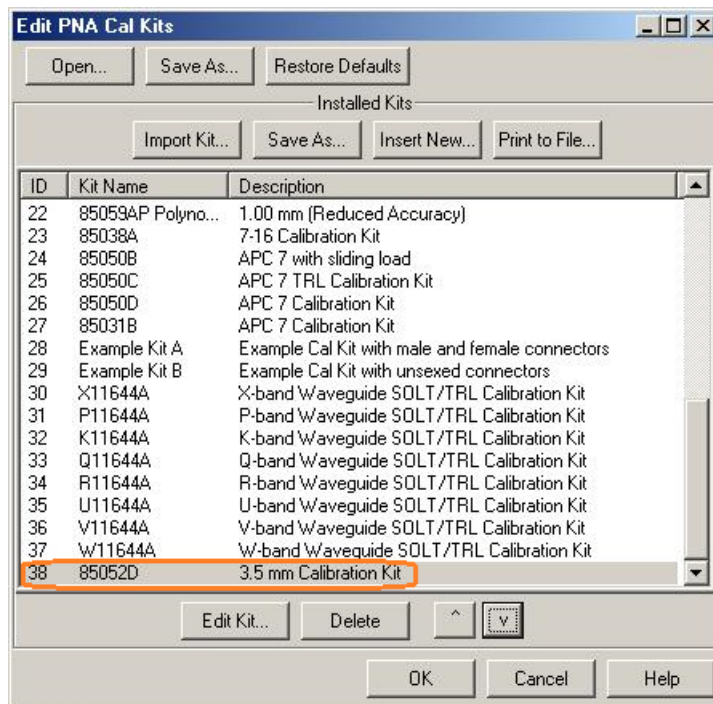
b. Select the newly created CalKit file from “User” folder, then select “Open”.



c. Select “Yes” on the warning screen:



Now the new CalKit file is ready to be edited.



3. Edit The Cal Kit File

For a female kits, all the female components Short, Open, Load and Thru shall be modified. See the highlighted field below. For a male kit, all male components shall be modified.

Edit Kit

Identification
 Kit Number: 38 Kit Name: 85052D
 Kit Description: 3.5 mm Calibration Kit

Connectors
 Description: APC 3.5 male Add or Edit...
 Family: APC 3.5 Change Family...

Class Assignments
 SOLT Edit...

ID	Standard	Description
2	OPEN -M-	3.5 mm male open
15	OPEN -F-	3.5 mm female open
1	SHORT -M-	3.5 mm male short
7	SHORT -F-	3.5 mm female short
3	BROADBAND LOA...	3.5 mm male broadband load
14	BROADBAND LOA...	3.5 mm female broadband load
4	THRU	Insertable thru standard

Add... Edit... Delete Delete All

OK Cancel Help

- 1) **Short:** Modify the **Offset Delay** and **Loss** to the values specified in the table comes with the kit:

Shorts

Identification
 Standard ID: 7 Label: SHORT -F-
 Short Description: 3.5 mm female short

Frequency Range
 Min: 0 MHz Max: 999000 MHz

Connector
 APC 3.5 female

Short Characteristics
 L0: 2.0765 H(e-12) L2: 2.1705 H(e-33)/Hz^2
 L1: -108.54 H(e-24)/Hz L3: -0.01 H(e-42)/Hz^3

Delay Characteristics
 Delay: 55.7 pSec Loss: 4.8 Gohms/s
 Z0: 50 ohms

Clear OK Cancel Apply Help

- 2) **Open:** Modify the **Offset Delay, Loss** and **fringe capacitances** per the specified values in the table come with the kit.

Note: The default units for C0, C1, C2 and C3 are as shown in the screenshot below. Ensure the unit for capacitances matches your unique equipment.

Opens

Identification
 Standard ID: 15 Label: OPEN .F-
 Open Description: 3.5 mm female open

Frequency Range
 Min: 0 MHz
 Max: 999000 MHz

Connector
 APC 3.5 female

Open Characteristics
 C0: 45 F[e-15] C2: -2.5 F[e-36]/Hz²
 C1: 6 F[e-27]/Hz C3: 0 F[e-45]/Hz³

Delay Characteristics
 Delay: 55.7 pSec Loss: 4.8 Gohms/s
 Z0: 50 ohms

Clear OK Cancel Apply Help

- 3) **Load:** Modify the **Offset Delay** and **Loss** per the specified values in the table come with the kit.

Loads

Identification
 Standard ID: 14 Label: BROADBAND LOAD -F-
 Load Description: 3.5 mm female broadband load

Frequency Range
 Min: 0 MHz
 Max: 999000 MHz

Connector
 APC 3.5 female

Load Type
 Fixed Load Arbitrary Impedance
 Sliding Load Offset Load

Complex Impedance
 Real: 50
 Imag: 0

Delay Characteristics
 Delay: 0 pSec Loss: 4.8 Gohms/s
 Z0: 50 ohms

Offset Load Definition
 First Offset Standard: THRU
 Second Offset Standard: THRU
 Load Standard: OPEN -F-

Clear OK Cancel Apply Help

- 4) **Thru:** Modify the **Offset Delay** and **Loss** per the specified values in the table come with the kit.

Thru/Line/Adapter

Identification
 Standard ID: 4 Label: THRU
 Thru Description: Insertable thru standard

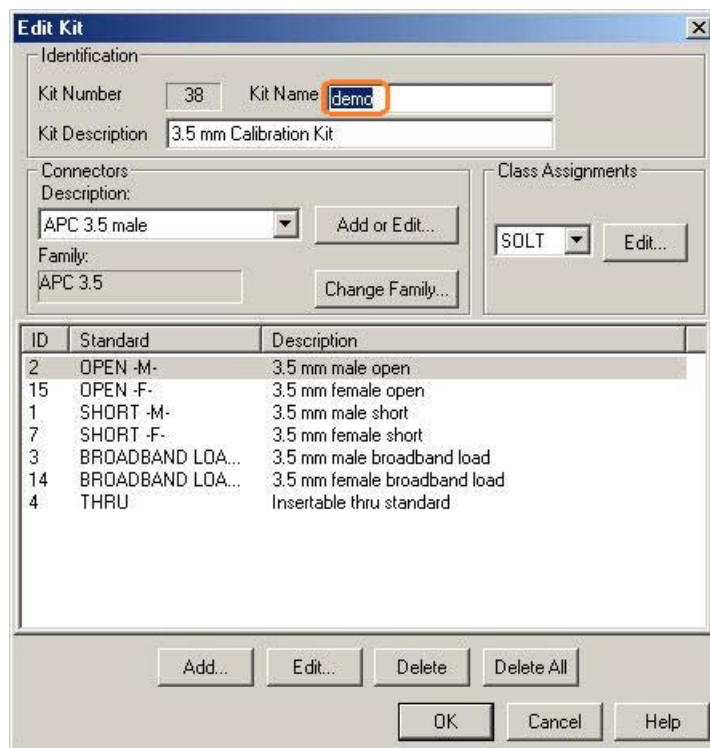
Frequency Range
 Min: 0 MHz
 Max: 999000 MHz

Delay Characteristics
 Delay: 55.7 pSec Loss: 4.8 Gohms/s
 Z0: 50 ohms

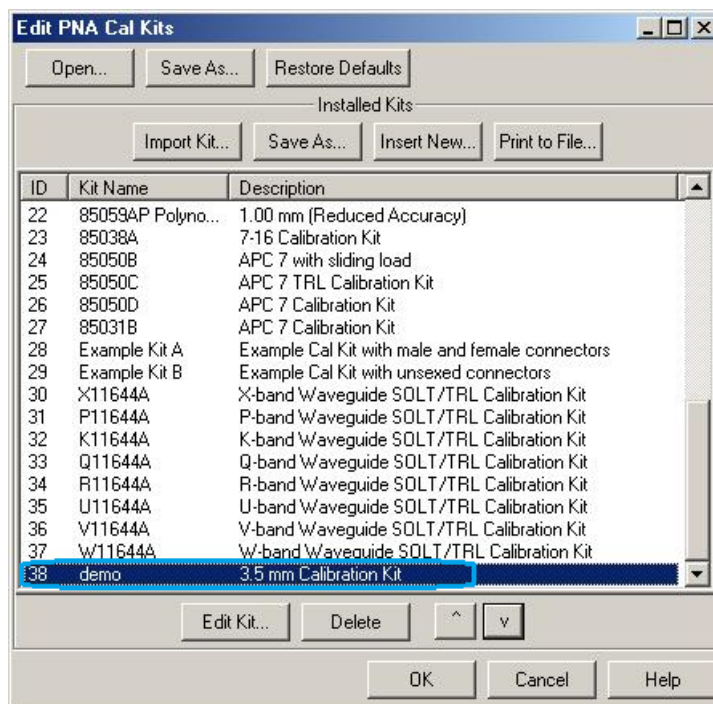
Connectors
 Port: APC 3.5 female Port: APC 3.5 male

Clear OK Cancel Apply Help

- 5) **Kit Name:** Modify the **Kit Name** field to a unique identifier, and then select “OK”.



- 6) Now the Cal Kit file is completed and ready for calibration.



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