Mini-Circuits®

Mini-Circuits Smart Power Sensor
PWR-6G+/ 6GHS+
"Measurement Application"
User's Guide

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"Measurement Application" User's Guide

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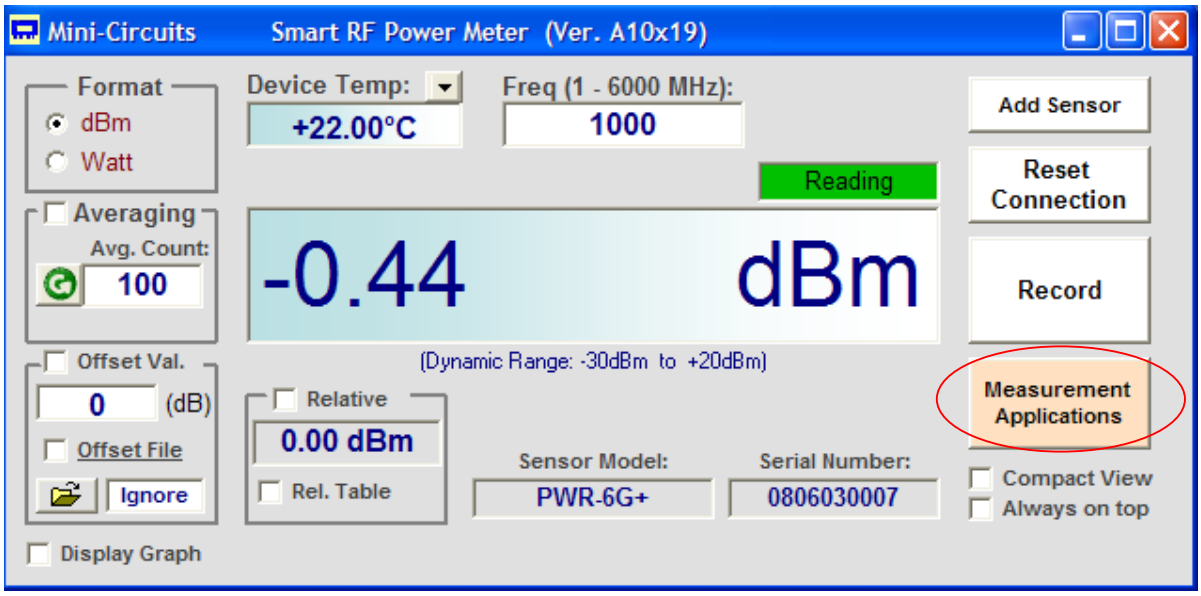
1.0 Introduction

This chapter describes the basics of what is the "Measurement Application".

- "Measurement Application" is a powerful function of the Power Meter Program. (see **Figure 1**).
- For information on the Mini-Circuits Smart Power Sensor & Power Meter Software consult User Guide : http://minicircuits.com/pages/pdfs/PWR-6G+_guide.pdf
- You can select a suitable measurement by choosing one of the ten measurement options seen in (**Figure 2**).
- You can create easily your own measurement project.
  - Set desired testing points (Frequency and Power),
  - Set the spec. limit of each point
  - Use either remote or local control of an external RF source.
  - Take reference measurements and measure any number of units
- You can use the "on-line Graph" feature to get another look at the D.U.T's performance.
- You can save or recall your project at any time with both the specified test parameters and the previously measured data available.

Figure 1: Smart RF Power Meter



Clicking on the Measurement Applications button will open the "Meas. Applications" window shown in **Figure 2.**

1.1 Mini-Circuits Smart RF Power Meter PWR-6G+ Features:

- RF source Power Measurements
- High Power Measurements (Up to +53 dBm by using Virtual Coupler)
- Continuous Power Monitoring(Low or High by using Virtual Coupler)
- Gain measurements
- 2-3 Port Devices Insertion Loss Measurements (optional Virtual Attenuator for increasing Dynamic Range)
- Return Loss Measurement Using Coupler.
- Creating a Virtual Coupler file (to extend a coupler's frequency range for use in various measurements)
- Creating a Virtual Attenuator file(to calibrate an attenuator to its nominal value for use as a safe attenuator in various measurements)
- Calibrating Thru - Path (creation of a file containing system loss/gain without the D.U.T to compensate for existing setup loss/gain or to use as an offset file).
- An On-Line Graph for visual representation in all measurements.
- Printing of all data readings.

2.0 Measurement Applications Features.

This chapter explains how to set the communication commands in order to control an external RF source and a brief description of the various measurement applications available.

Sensor serial number detects automatically by the Program.
You can open an existing Project (by clicking on the **Recall** key) but you can also start building a New Project. Select one specific option from Measurement Application list, then Click Next to approve your selection.
The **Setup** key will send to Setup Information screen (see **Figure 3**).

Figure 2 Meas. Application Screen

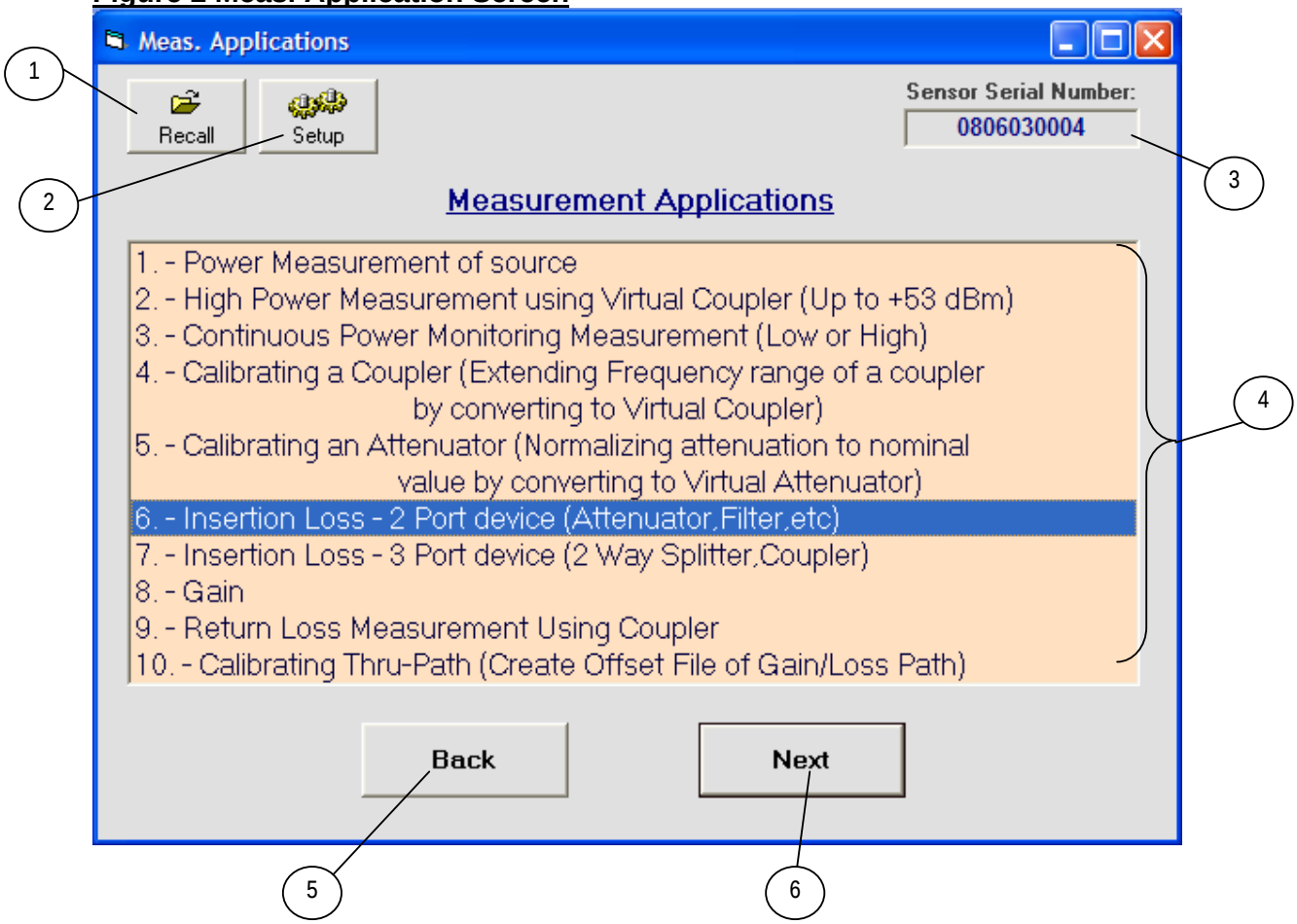


Table1: Measurement Applications item description.

Item	Item	Description
1	Recall	Load existing project. **See 3.3.1.3**(Page 13) for further explanation.
2	Setup	Define communication setup. **See 2.1** below for further explanation.
3	Sensor serial number	Sensor S/N. indicator detected automatically by the program
4	Measurement applications list	List of measurement options available **See 2.2**(Page 7).
5	Back	Return to smart RF power meter window
6	Next	Proceed to selected measurement window

2.1. Setting communication/commands in order to control an external source.[Setup]

Figure 3: Setting External Generator Control(example: Ethernet connection selected)

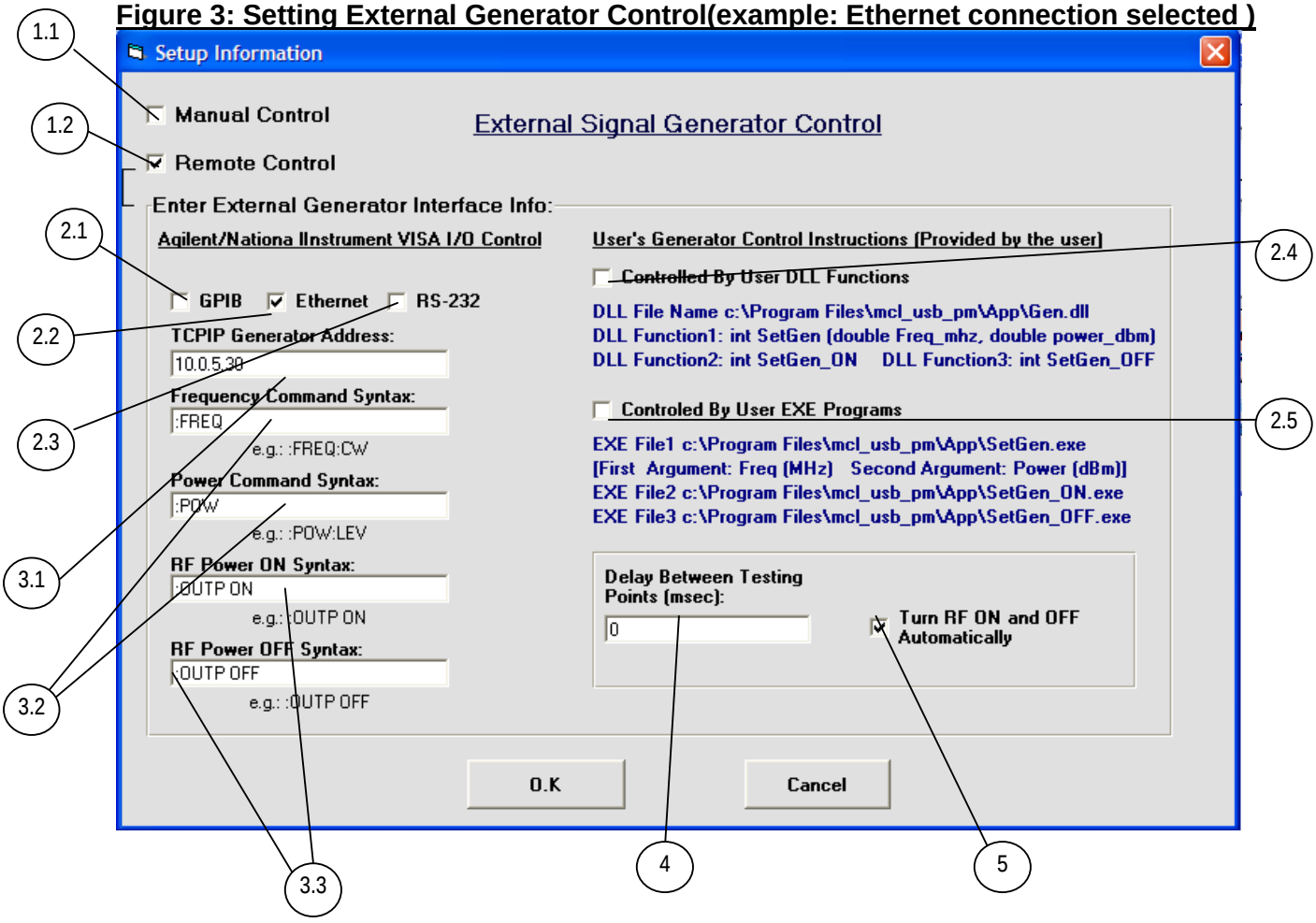


Table2: Setup information item description

Item	Option	Description
1.1	**Manual**	Manual control of the RF source power and frequency. All adjustments of power and frequency must be preformed by the user.
1.2	**Remote**	Remote control of the RF source. see **Items 2 - 5**
2.1	**GPIB**	Selects the named communications option for remote control of the RF source. Options 2.4 and 2.5 are generally used when the user does not use the one of the standard communication protocols offered in options 2.1,2.2 and 2.3.
2.2	**Ethernet**	
2.3	**RS232**	
2.4	**Customer DLL**	
2.5	**Customer EXE**	
3.1	**Generator Address**	The address of the RF source to be controlled. Title indicates automatically which communication protocol is currently in use.
3.2	**Frequency/Power command syntax**	The command syntax to prefix any changes in power and frequency settings of the RF source. Must be entered by the user according to the specific RF source in use if Remote is selected.
3.3	**RF Power ON/OFF Syntax**	The command syntax to start and stop RF transmission by the RF source. Must be entered by the user according to the specific RF source in use if Remote is selected.
4	**Delay Between Testing Points(msec)**	When Remote is selected sets the delay between setting the RF source state and beginning the measurement point.
5	**Turn RF ON and OFF Automatically**	Allows the program to start and stop the RF source's transmission when in Remote. If this option is not checked the User must manually start the RF source before beginning measurements and stop it afterwards.

2.2 A brief description of the selection list(Figure 2):

1. **Power Measurement of source**- Measures power output of the RF source.
2. **High Power Measurement using Virtual Coupler (Up to +53dBm)** - Measures a High Power Signal from your D.U.T/System, (the Virtual Coupler allows an expansion of the Dynamic Range of the Power Sensor).The power out measurement will be in dBm.
3. **Continuous Power Monitoring (Low or High)** - This option enables you to monitor the power out of your D.U.T/System/Module using a previously defined coupler (using **Calibrating a Coupler**). The power out measurement will be in dBm.
4. **Calibrating a Coupler (Extending frequency range of a coupler by converting to Virtual Coupler)** – Creating a Virtual Coupler file for use in future measurement applications. Virtual Coupler files are used in High Power and Continuous Power.

5. **Calibrating an Attenuator (Normalizing attenuation to nominal value by converting to Virtual Attenuator) -** Creating a Virtual Attenuator file for use in future Measurement Applications. Virtual Attenuator files can be used in all measurements as safe attenuator (to prevent excess power entering the sensor) after the D.U.T, or when using a filter as a Harmonic suppression filter. To compensate for system line attenuation use Calibration Thru- Path option.

6. **Insertion Loss -2 port device (Attenuator, Filter, etc)** –Measures the Insertion Loss of a two port D.U.T The Insertion Loss measurement will be in -dB. For amplifiers it is recommended to use the Gain measurement option.
7. **Insertion Loss -3 port device (2 Way Splitter, Coupler)** –Measures the Insertion Loss of a three port D.U.T The Insertion Loss measurement will be in -dB.

8. **Gain** –Measures the gain of your D.U.T/System/Module. The Gain measurement will be in dB. This is the recommended selection for testing Amplifiers.

9. **Return Loss Measurement Using Coupler**- Measures the Return Loss of a one or two port D.U.T The Return Loss measurement will be in -dB. Coupler used in Return Loss measurement is not a virtual coupler file.

10. **Calibration Thru - Path (Create offset file of Gain/Loss Path) –** Measures the system line gain/loss without the D.U.T This measurement is used to create a calibration offset file for future measurements or to compensate for existing setup loss/gain.

3.0 Measurement Application Sequence

This chapter describes the creation of a measurement project step by step and explains file management.

3.1 Start New Project

Step 1: Selecting the “Meas. Application” button on the Smart Power meter main screen (**Figure 1)** will transfer you to the Measurement Application first screen shown in **Figure 2**.

Step 2: You can select a specific measurement option (see **chapter 2.0**) by clicking on the appropriate measurement option and clicking on **Next** key**.** Selecting a measurement option will transfer you to the “Project Information” screen. See **Figure 4.**

Figure 4: Project Information screen

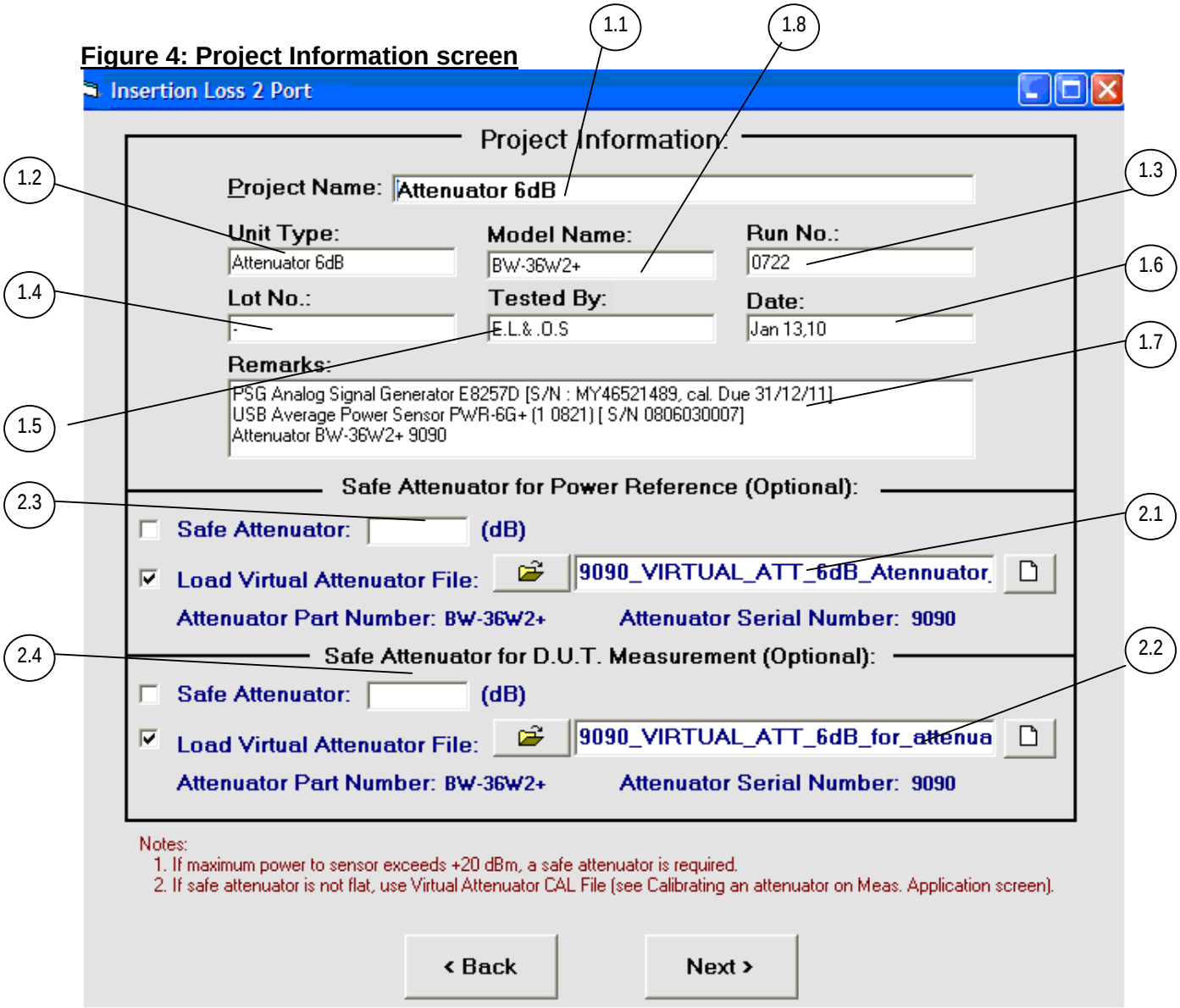


Table3: Project Information item description

Item	Field name	Description
1.1	Project Name	Specify your own Project Name
1.2	Unit Type	Specify D.U.T type
1.3	Run No	Specify Run No. (If exists)
1.4	Lot No	Specify Lot No. (If exists)
1.5	Test By	Tester Name
1.6	Date	Date project tests preformed
1.7	Remarks	Specify your Setup equipment (no character limit)
1.8	Model Name	D.U.T Model Name
2.1	Safe Attenuator for power reference	Virtual Attenuator or Coupler file for power reference (optional)
2.2	Safe Attenuator for D.U.T measurement	Virtual Attenuator or Coupler file for D.U.T measurement (optional)
2.3	Safe Attenuator for power reference	Manual entry of safe attenuator value for power reference
2.4	Safe Attenuator for D.U.T measurement	Manual entry of safe attenuator value for D.U.T measurement.

The **Back** key will navigate back to Meas. Application first screen (see **Figure 2**)
The **Next** key will navigate to Frequency Measurements Point screen (see **Figure 5**)

3.2 Building the set of measurement points (for all various measurements including Virtual Attenuators and Couplers)

Figure 5: Frequency Measurements Points screen (with Segment use example)

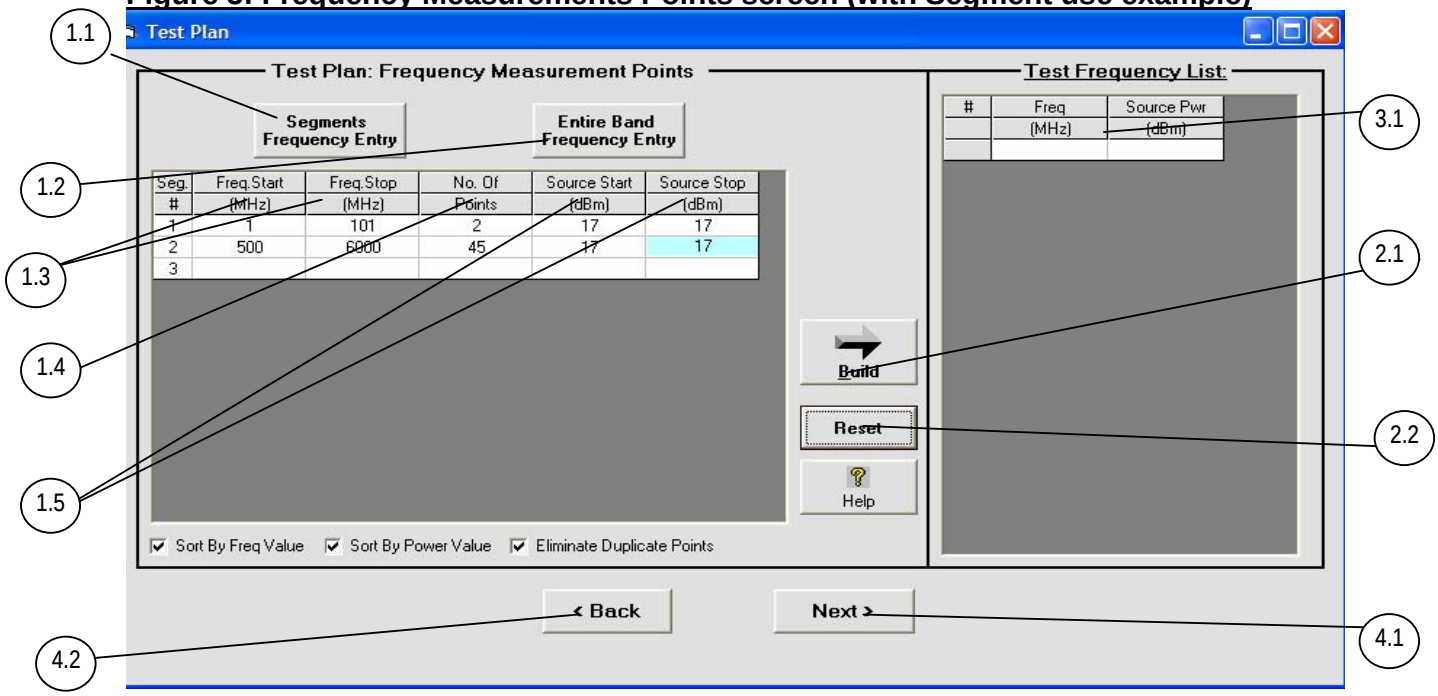
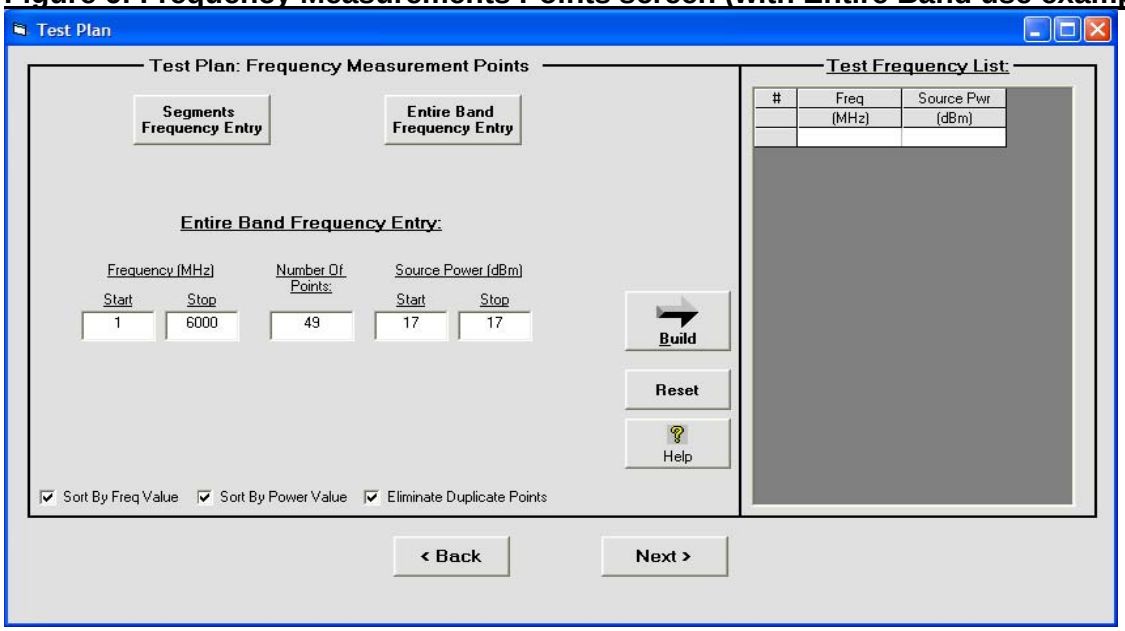


Table4: Frequency Measurement Points item description

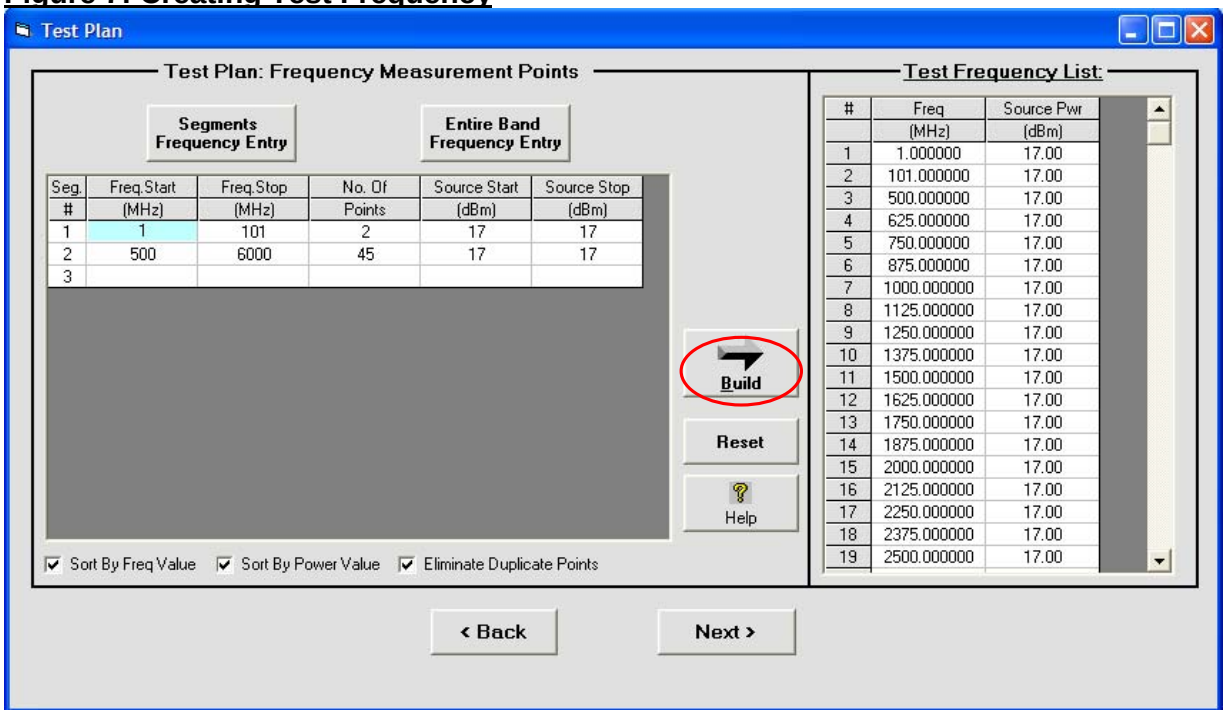
Item	Field name	Description
1.1	Segments Frequency Entry	Allows measurement points to be entered in a number of separate segments, each one with it's own parameters.
1.2	Entire Band Frequency Entry	Allows measurement points to be entered in a single measurement segment, with only one set of parameters. (see **Figure 6)**
1.3	Freq. Start/Stop	Initial and final measurement point frequencies in a given measurement segment (In MHz). All other points in the segment will be spaced evenly over the span between them.
1.4	No. of points	Total number of points in measurement segment including start and stop points.
1.5	Source Start/Stop	Required RF Source output at Initial and final measurements points in a given measurement segment (in dBm). All other points in the segment will be spaced evenly over the span between them.
2.1	Build	Select to generate a listing of the measurement points (Power and Freq.) (see **Figure 7**)
2.2	Reset	Delete all entries in the screen
3.1	Frequency list	Display of the actual measurement points (Power and Freq.) generated from the previous instructions.
4.1	Next	Proceed to the Measurements screen (in the case of D.U.T measurements) or the Measurements & Virtual Component creation (in case of Virtual Component file creation) (see **Figure 8)**
4.2	Back	Return to the project information screen (see **Figure 4**)

Figure 6: Frequency Measurements Points screen (with Entire Band use example)



See (**Table 4** and **Figure 5)** for explanation of items.

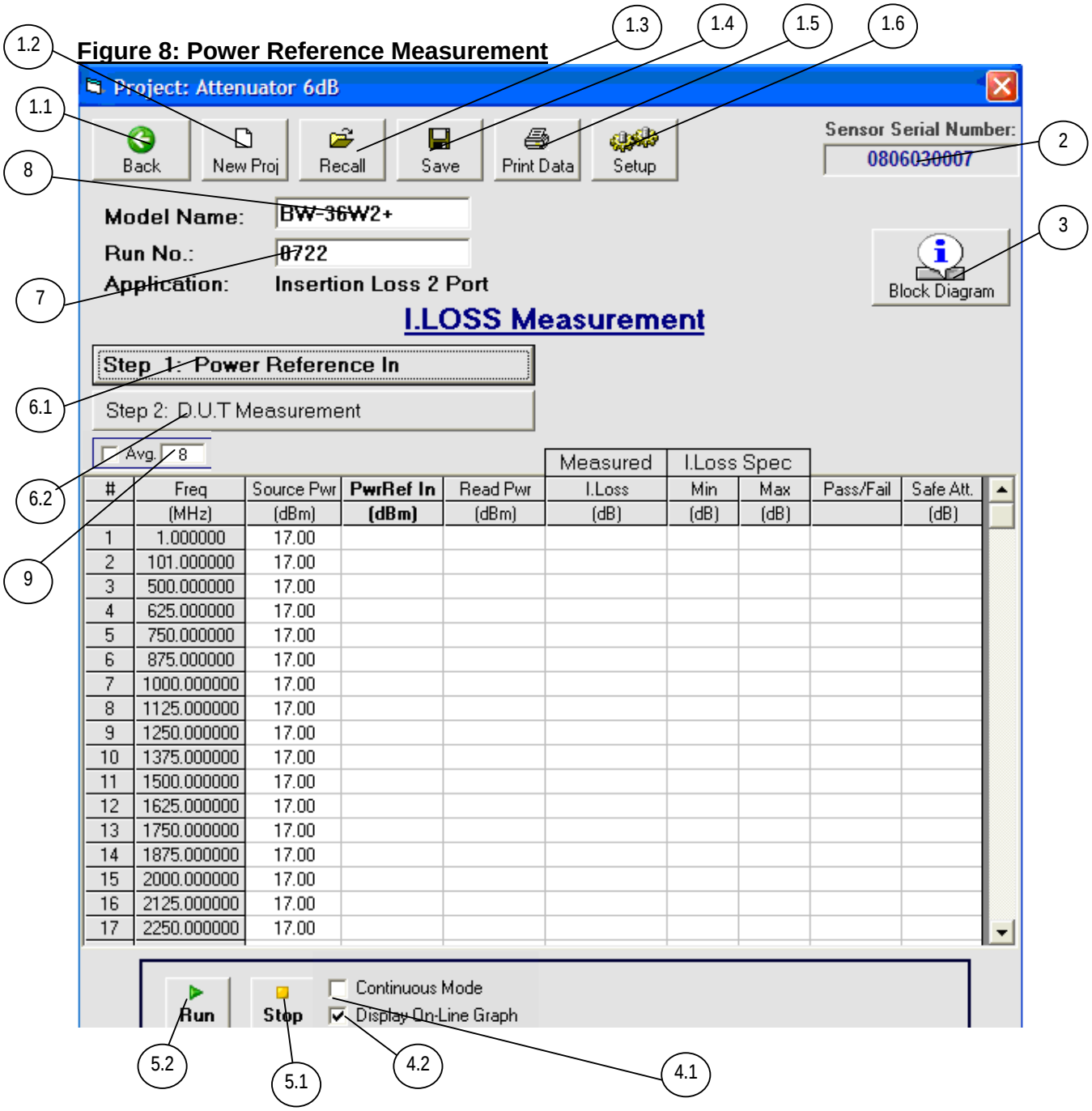
Figure 7: Creating Test Frequency



3.3 Power Reference Measurement

Power Reference measurement must be performed before any other measurement except Power Out (dBm) can be performed. This step will provide a reference for the relative measurement in dB. In this step we connect the Power Sensor to the RF Source's RF out line and start the measurement by clicking on the **Run** key (**see Figure 8**)

Figure 8: Power Reference Measurement



3.3.1 Power Reference Measurement First Step

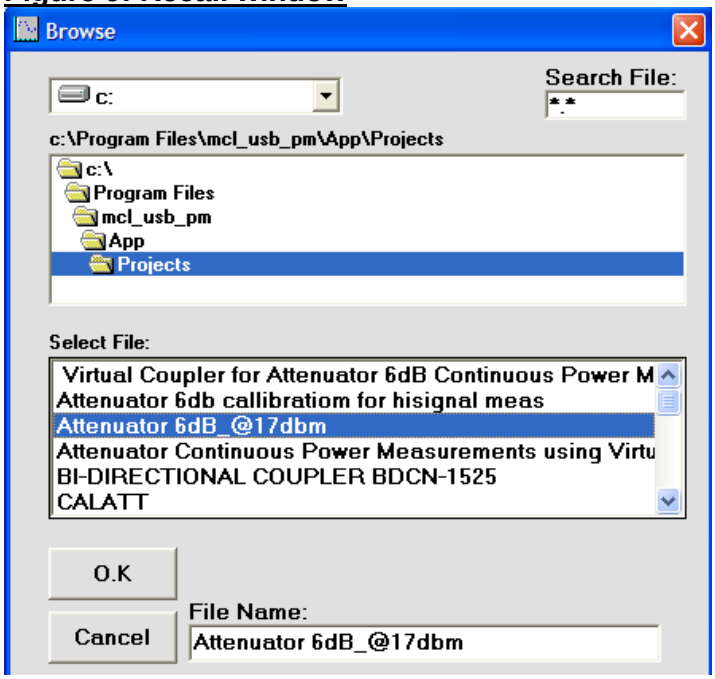
Table 5: Power Reference Measurement First Step Button Items review:

Item	Button/Field	Description
1.1	Back	Back to previous screen (see **Figure 9**)
1.2	New Proj.	Starting a new project , navigation to Meas. Application screen (see **Figure 2** on **page 5)**
1.3	Recall	Load existing project .See **paragraph 3.3.1.2** on **page 14** for further details.
1.4	Save	Save current project data .See **paragraph 3.3.1.2** on **page 15** for further details
1.5	Print Data	Printing current project data. See **section 3.6** on **page 22** for further details
1.6	Setup	See **chapter 2.1** on **page 6**
2	Sensor serial number	Sensor S/N. Indicator detected automatically by the program.
3	Block Diagram	Setup schematic suitable for current measurement step. See **section 3.7** on **page 25** for further details
4.1	Continuous Mode	Selecting this option causes the current measurement step to repeat in a loop until interrupted.
4.2	On-Line Graph	When selected activates an on line graphical data presentation (see detailed explanation below)
5.1	Stop	Stop measurement
5.2	Run	Begin measurement
6.1	Step1	Current measurement step
6.2	Step2	Next measurement step
7	Run No.	See **Table 2**
8	Model Name	See **Table 2**
9	Averaging	See explanation bellow

3.3.1.1 Averaging Increased averaging provides more accurate measurement results. However this increases the time required to perform the measurement.
The maximum number of averages possible is 32 .The default value is 8.

3.3.1.2 Recall function.

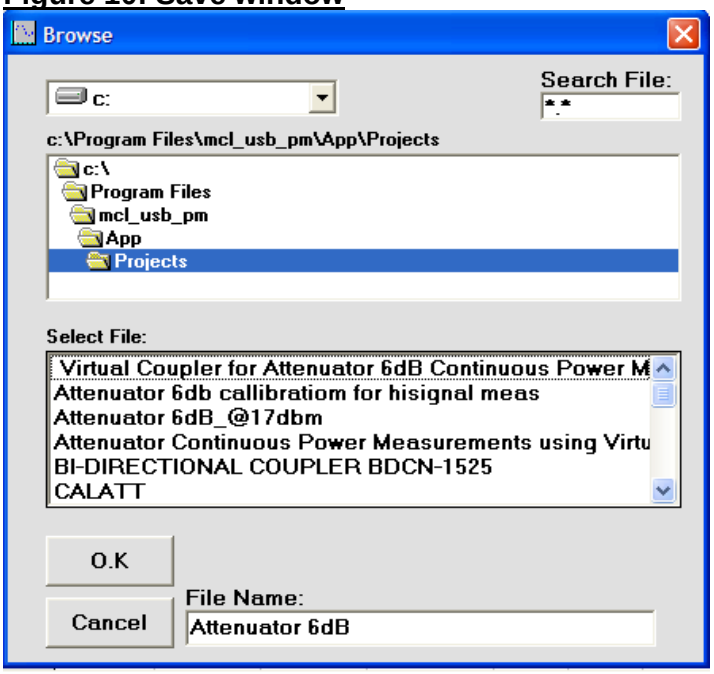
Figure 9: Recall window



- You can load a saved project by selecting from the list of saved projects (see **Figure 9**) and clicking **O.K** key.
- You can delete saved Project by selecting from the list and using keyboard's **Delete** button.
- Clicking the **Cancel** key will return you to the previous window.

3.3.1.3 Save function.

Figure 10: Save window



- You can save your project data by clicking the **Save** key. (see **Figure 10**)
- You can save the Project under a new name by typing the new name in the '**File Name'** field.
- You can delete a saved project by selecting the project from the list and using the keyboard's **Delete** button.
- Clicking the **Cancel** key will return you to the previous window.

3.3.2 Power Reference Measurement First Step Data Fields revew:

Figure 10: Power Reference Measurement First Step Data Fields review:

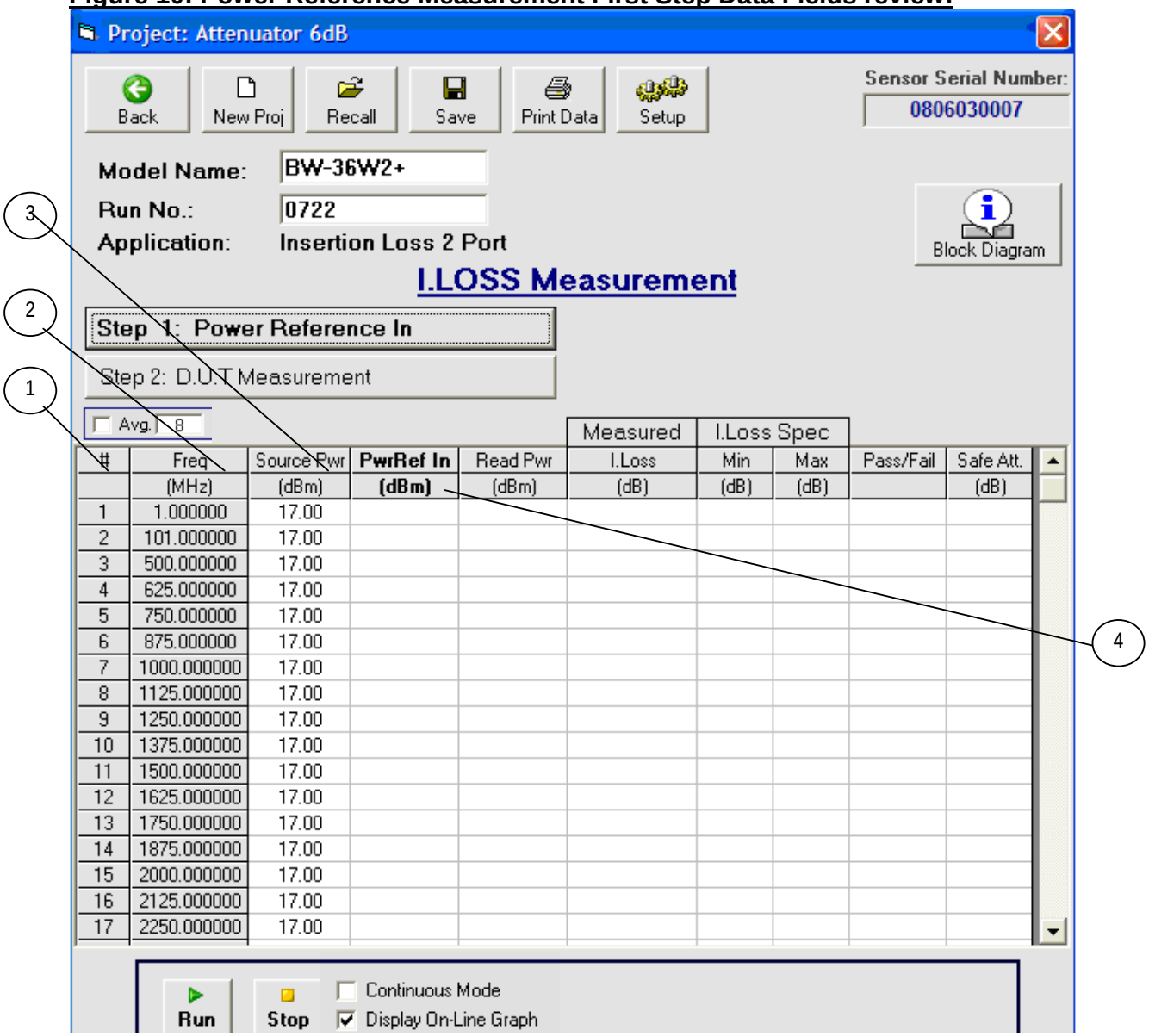


Table 6: Power Reference Measurement First Step Data Fields Items

Item	Data Field	Description
1	[#]	Measurement points settings are explained in **3.2 Building the set of measurement points** (see **Figure 11**)
2	Freq [MHz]	Frequency settings are explained in **3.2 Building the set of measurement points** (see **Figure 12**)
3	Source Pwr [dBm]	Source power settings are explained in **3.2 Building the Set of measurement points** (see **Figure 13**)
4	**Pwr.Ref In [dBm]**	**Bold Data**- Data measured in current step

3.4 D.U.T Measurements

When the Reference Measurement is complete we can proceed to testing components by selecting the option D.U.T Measurements. You can see that the **Block Diagram** setup schematic has also changed to Step 2 D.U.T Measurement after pressing the **Step 2** key.

3.4.1 D.U.T Measurements new Keys review:

Figure 12 D.U.T Measurements new Keys review

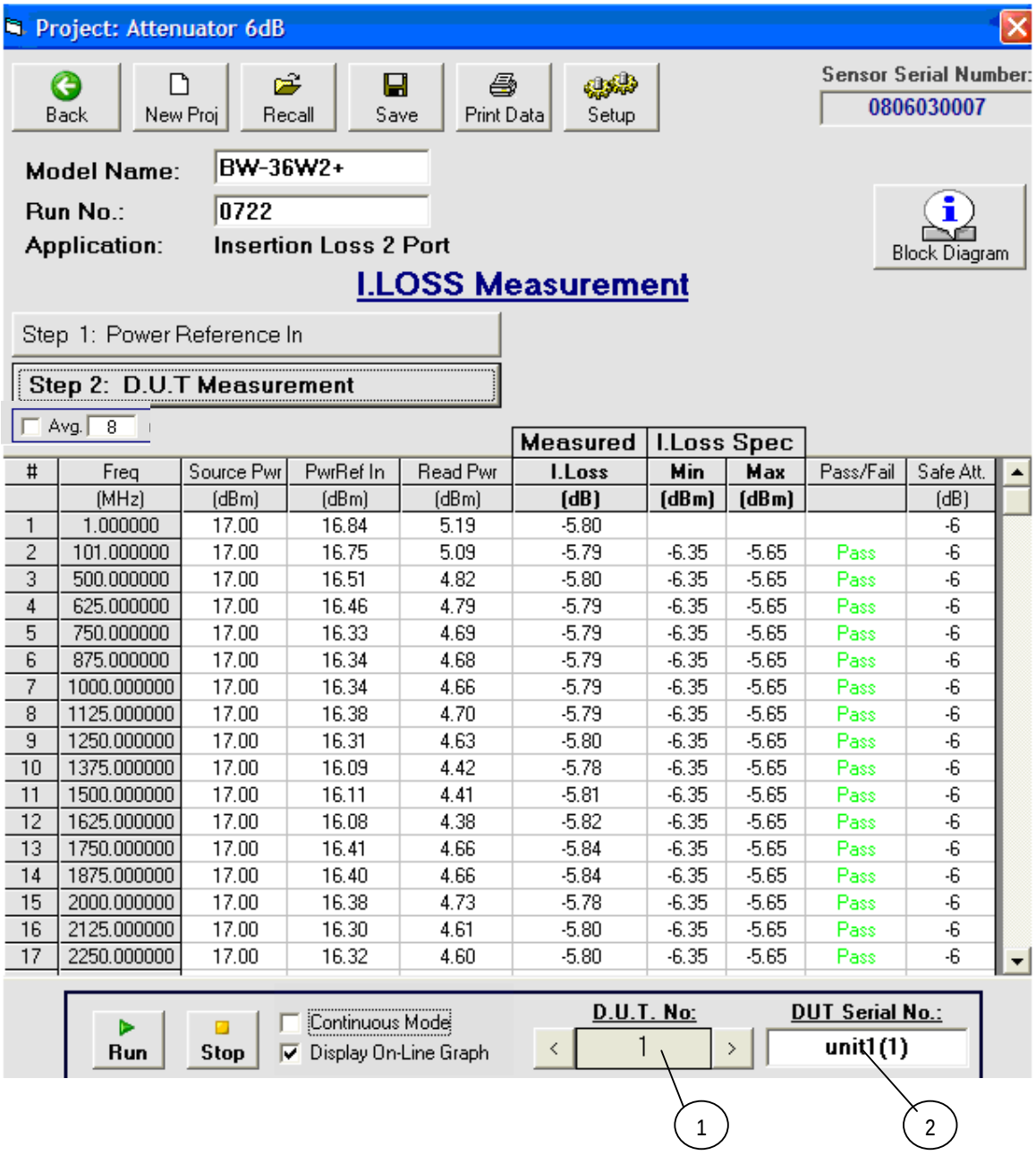


Table 7: D.U.T Measurements new Keys review

Item	Button name	Description
1	D.U.T No.	Allows you to scroll between results of all units measured. Number is the position of currently viewed D.U.T in the series
2	D.U.T Serial No.	Serial number of D.U.T currently displayed in data fields.

3.4.2 D.U.T Measurements new Data Fields review:

Figure 13 D.U.T Measurements new Data Fields review.

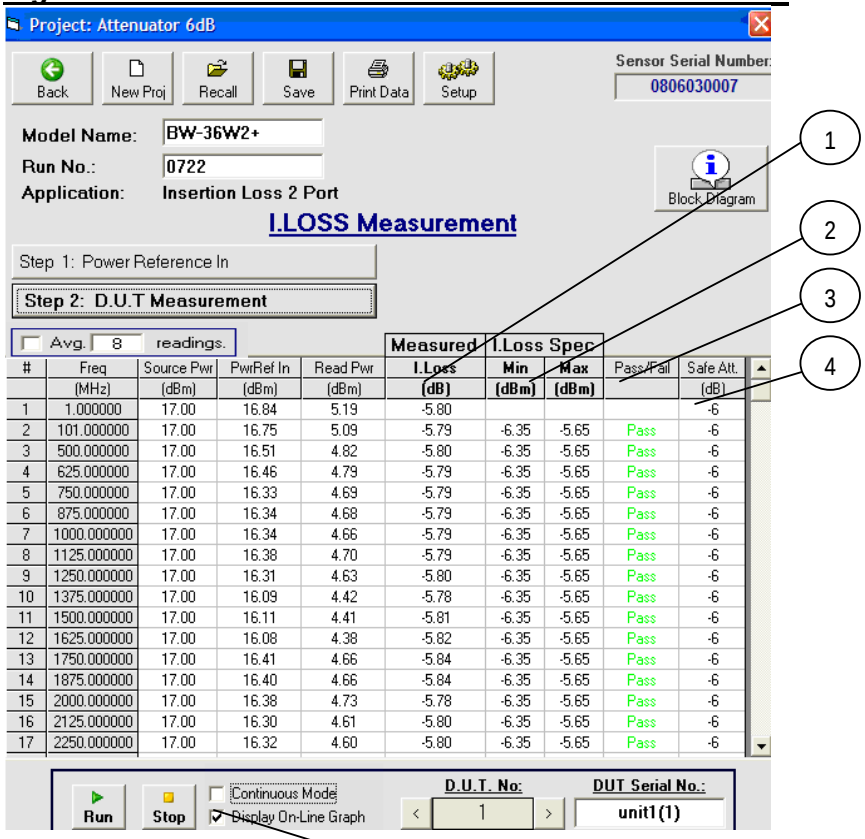


Figure 13a: On-Line Graph

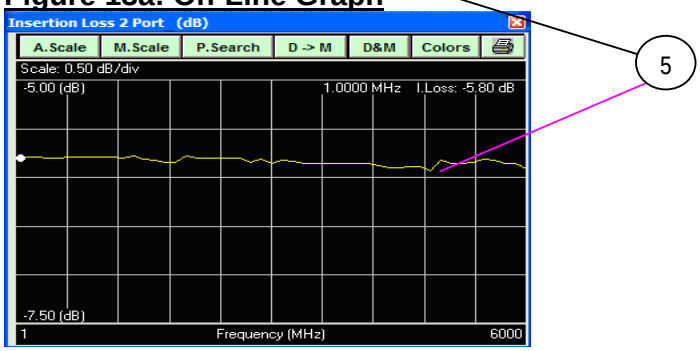


Table 8: D.U.T Measurements new data fields item description.

Item	Data Field [dBm]	Description
1	I. Loss	**Bold Data**- Measured data in this particular step
2	Spec I. Loss (Min. ,Max.) [dBm]	Spec I. Data .Will be entered manually by the user from T.Spec/Data Sheet's. see **3.4.2.2** on **page 21**
3	Pass/Fail result	Pass – Measured data is within the range specified. Fail – Measured data is outside the range specified.
4	Safe Att.	Virtual Safe Attenuator 6dB uploaded see **Table 3 Item 2.1**
5	Include On-Line Graph	See **Figure 15**

3.4.2.2 Spec. Definitions:

- To enable Spec. Definitions double click on any data field.
- The Edit Spec. Limit window (**Figure 15**) will pop up.
- Set Low/Up Spec. Limits, determine applicable points range(based on frequency range specified)
- Update data.

Figure 14: Spec. Definitions window

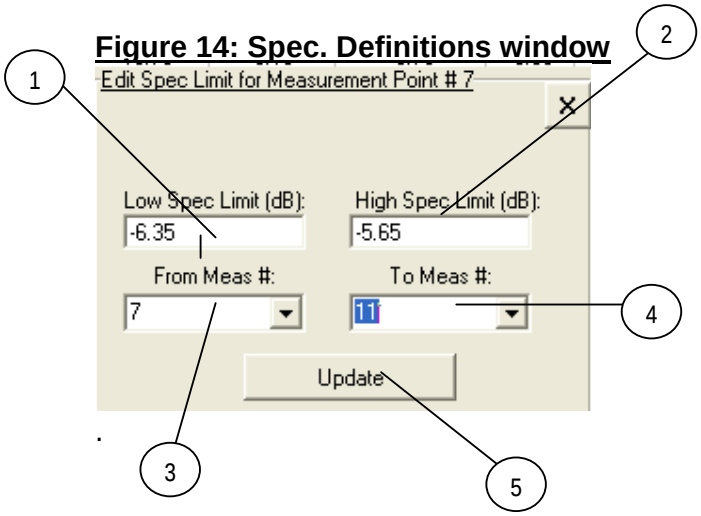


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Table 9: Spec. Definitions item description

Item	Field	Description
1	Low Spec Limit [dB]	Low Spec. Limit [dB]
2	High Spec Limit [dB]	High Spec. Limit [dB]
3	From Meas. #	First applicable point
4	To Meas. #	Last applicable point
5	Update	Update the Spec. with currently shown figures

3.5 On-Line Graph features

When the "Display On-Line Graph" check box is selected a small window will appear beside the measurement screen containing a graphical representation of the measurement table data (see **Figures 13a-15**).

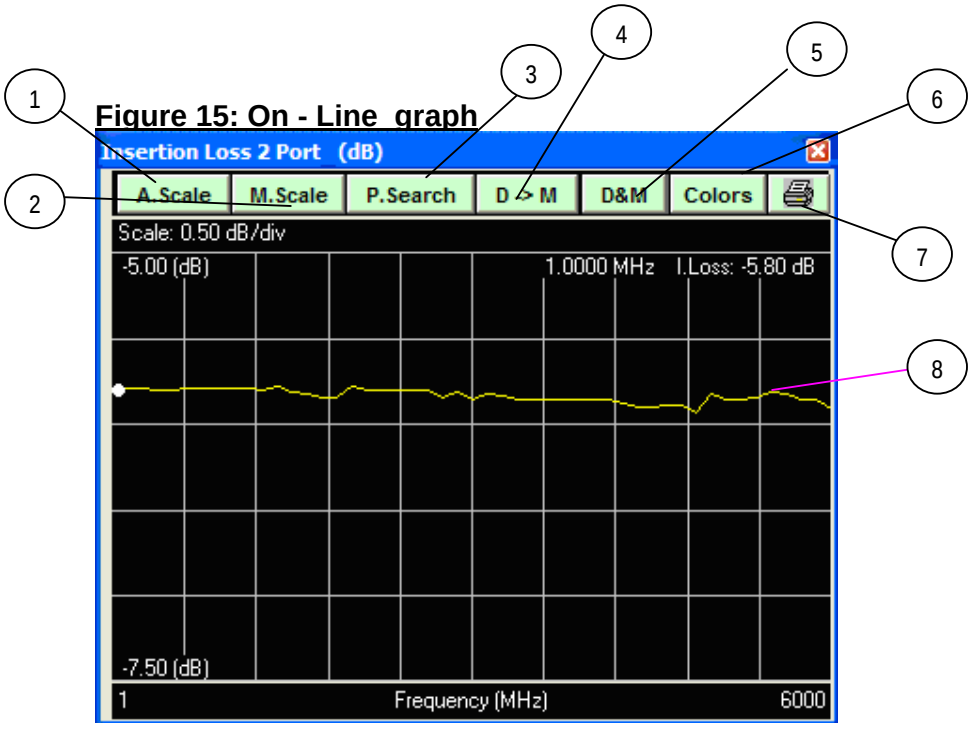


Figure 15: On - Line graph

Table 10: On-Line Graph Items Features

Item	Button	Description
1	A. Scale	Auto Scale – Resets the scale automatically to show all of the data trace.
2	M. Scale	Manual Scale – Allows the user to manually determine the Y axis scale.
3	P. Search	**Peak Search function** , sending marker to highest graph point
4	D->M	Save current data trace to memory.
5	D& M	Display both saved memory trace and current data trace.
6	Colors	Set the colors of the various graphical elements. Once changed, the new color choices will be saved automatically.
7	Printing	Print current graph
8	Marker	Marker Value is always shown on the right side of the window screen and you can set the marker by moving the mouse across the graph or by using the arrow keys with the On-Line-Graph window selected.

3.6 Printing Data Function.

Clicking on the printer icon located on the top of the screen (see **Figure 8, Item 5**) will open the 'Print Data Reports' window which allows the user to print measurement data and insert or change certain parameters before printing (see **Figure 16**).

Figure 16 : Printing Data Window

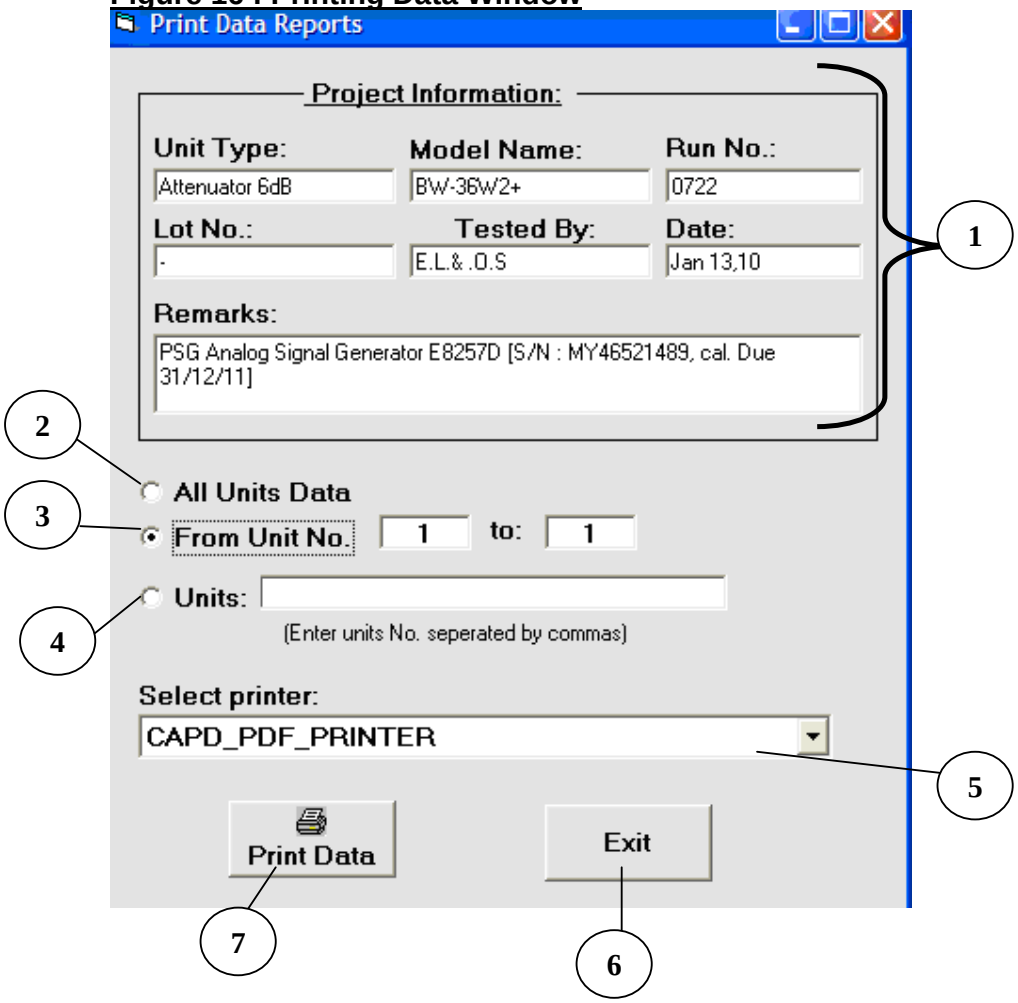
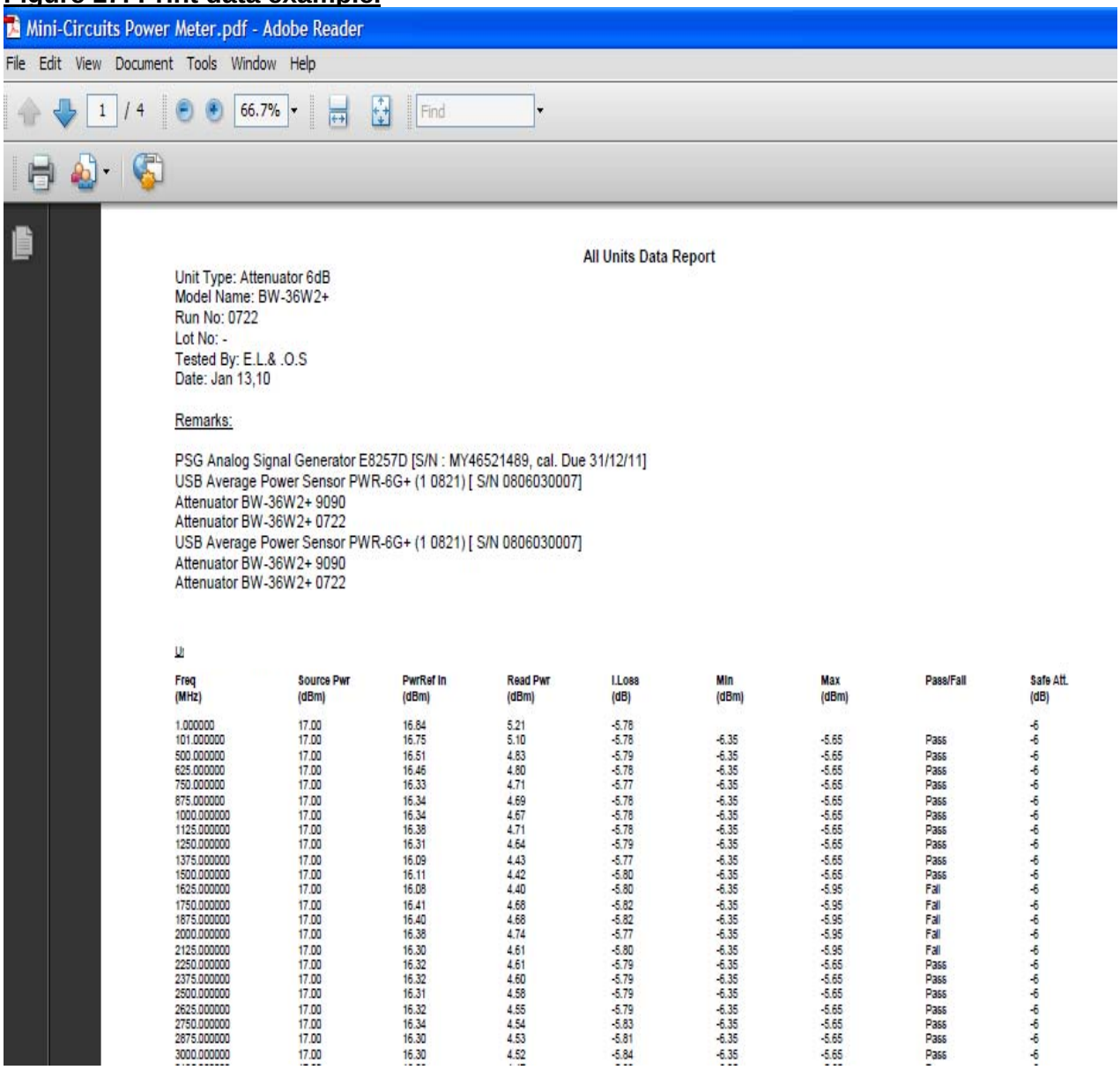


Table 11: Printing Data window Items

Item	Field/Button	Description
1	Project Information	See **table 3 Items 1.1-1.7** for descriptions. Project Information can be altered for specific print jobs but can not be saved from the Print Data Reports window.
2	All Units Data	Print the data for all available units.
3	From Unit No. X to Y	Print the data for units from Unit No. X to Unit No. Y, inclusive.
4	Units	Print the data for the units whose numbers appear in the field. Numbers represent single units and are to be separated by commas.
5	Select printer	Pick a specific printer from those available in system (PDF printer, physical printer, or other)
6	Exit	Close print window, returning to the project.
7	Print Data	Send data to selected printer (see **Figure 18** for format)

Figure 17: Print data example.



All Units Data Report

Unit Type: Attenuator 6dB
Model Name: BW-36W2+
Run No: 0722
Lot No: -
Tested By: E.L.& .O.S
Date: Jan 13,10

Remarks:

PSG Analog Signal Generator E8257D [S/N : MY46521489, cal. Due 31/12/11]
USB Average Power Sensor PWR-6G+ (1 0821) [S/N 0806030007]
Attenuator BW-36W2+ 9090
Attenuator BW-36W2+ 0722
USB Average Power Sensor PWR-6G+ (1 0821) [S/N 0806030007]
Attenuator BW-36W2+ 9090
Attenuator BW-36W2+ 0722

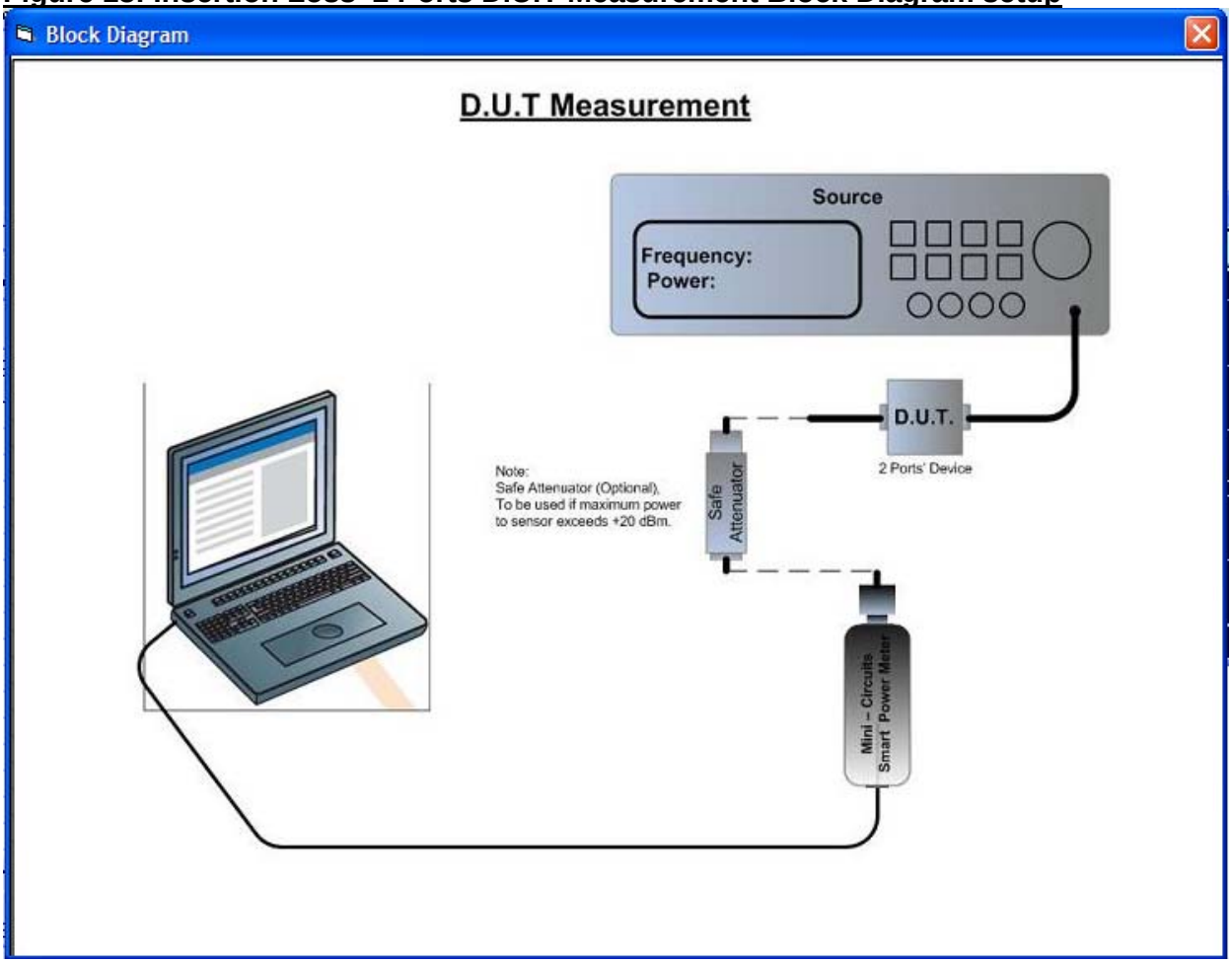
U

Freq (MHz)	Source Pwr (dBm)	PwrRef In (dBm)	Read Pwr (dBm)	I.Loss (dB)	Min (dBm)	Max (dBm)	Pass/Fail	Safe Att. (dB)
1.000000	17.00	16.84	5.21	-5.78				-6
101.000000	17.00	16.75	5.10	-5.78	-6.35	-5.65	Pass	-6
500.000000	17.00	16.51	4.63	-5.79	-6.35	-5.65	Pass	-6
625.000000	17.00	16.46	4.80	-5.78	-6.35	-5.65	Pass	-6
750.000000	17.00	16.33	4.71	-5.77	-6.35	-5.65	Pass	-6
875.000000	17.00	16.34	4.69	-5.78	-6.35	-5.65	Pass	-6
1000.000000	17.00	16.34	4.67	-5.78	-6.35	-5.65	Pass	-6
1125.000000	17.00	16.38	4.71	-5.78	-6.35	-5.65	Pass	-6
1250.000000	17.00	16.31	4.64	-5.79	-6.35	-5.65	Pass	-6
1375.000000	17.00	16.09	4.43	-5.77	-6.35	-5.65	Pass	-6
1500.000000	17.00	16.11	4.42	-5.80	-6.35	-5.65	Pass	-6
1625.000000	17.00	16.08	4.40	-5.80	-6.35	-5.95	Fail	-6
1750.000000	17.00	16.41	4.68	-5.82	-6.35	-5.95	Fail	-6
1875.000000	17.00	16.40	4.68	-5.82	-6.35	-5.95	Fail	-6
2000.000000	17.00	16.38	4.74	-5.77	-6.35	-5.95	Fail	-6
2125.000000	17.00	16.30	4.61	-5.80	-6.35	-5.95	Fail	-6
2250.000000	17.00	16.32	4.61	-5.79	-6.35	-5.65	Pass	-6
2375.000000	17.00	16.32	4.60	-5.79	-6.35	-5.65	Pass	-6
2500.000000	17.00	16.31	4.58	-5.79	-6.35	-5.65	Pass	-6
2625.000000	17.00	16.32	4.55	-5.79	-6.35	-5.65	Pass	-6
2750.000000	17.00	16.34	4.54	-5.83	-6.35	-5.65	Pass	-6
2875.000000	17.00	16.30	4.53	-5.81	-6.35	-5.65	Pass	-6
3000.000000	17.00	16.30	4.52	-5.84	-6.35	-5.65	Pass	-6

3.7 Block Diagram

Block Diagram represents the equipment setup configuration used in the measurement. All measurements start from a **Reference In** setup. When proceeding to the next step, first review and assemble the measurement step's setup (for example see **Insertion Loss 2 Ports D.U.T Measurement** in **Figure 18**)

Figure 18: Insertion Loss 2 Ports D.U.T Measurement Block Diagram setup

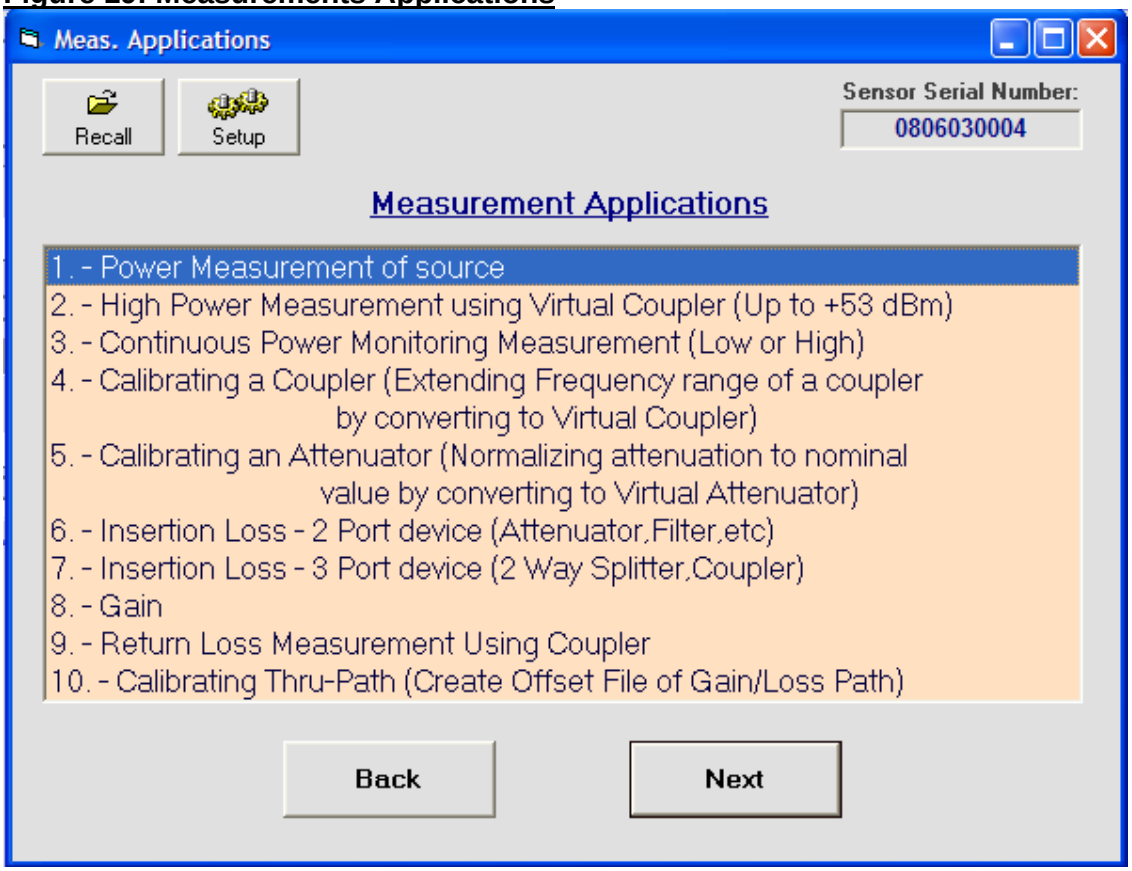


4.0 Application # 1- Power measurement of source.

This chapter describes the process of performing Power out measurements of an RF source. This measurement can be used to calibrate an RF source or verify its output. Data output is in [dBm] units.

- **Step 1.** Open a project from **Measurement Application** screen (see **Figure 19**)

Figure 19: Measurements Applications



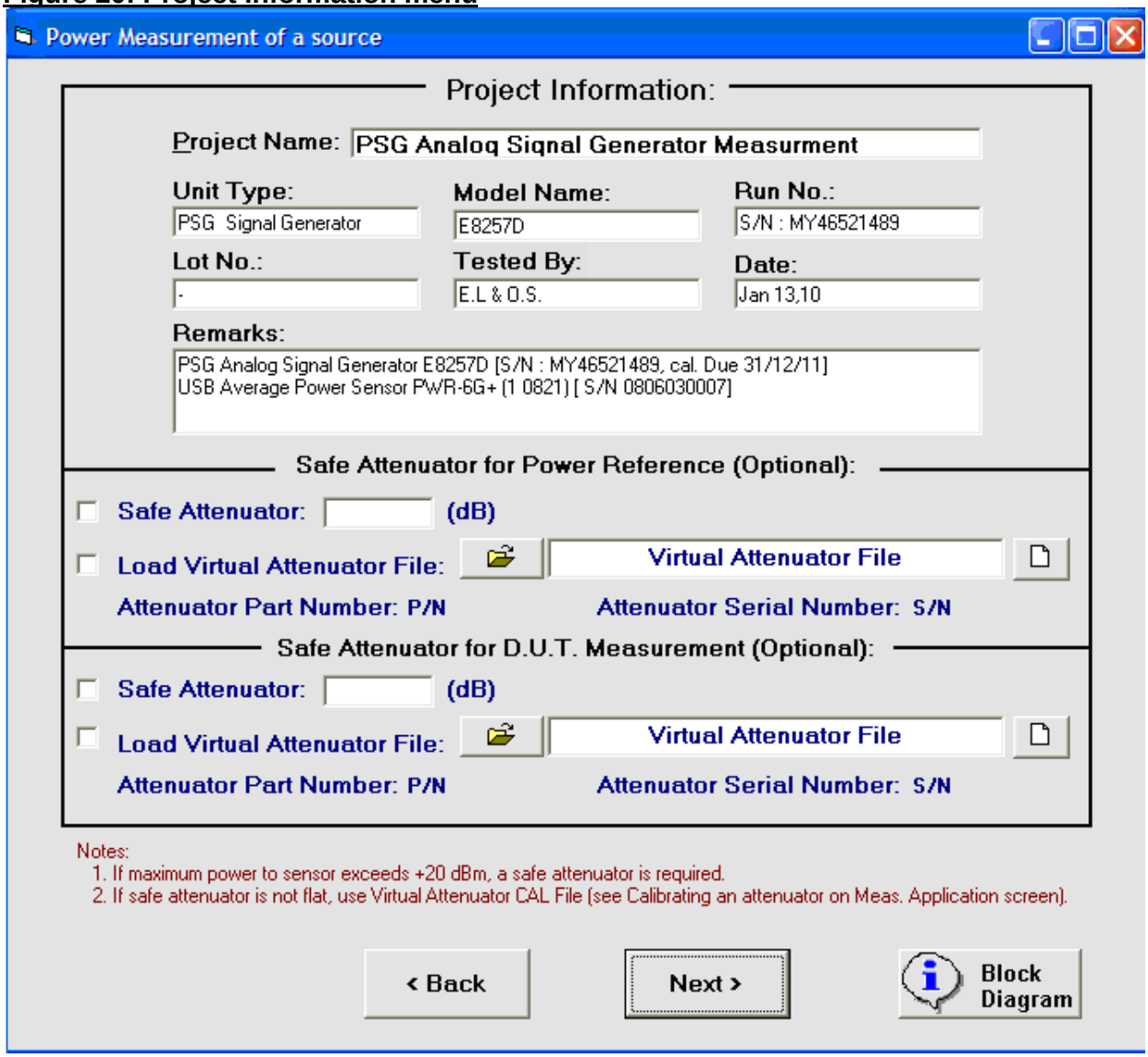
- **Step 2.** The **Project Information menu** will open (see **Figure 20**)**.**

- **Step 3.** Review and fill all necessary fields in the **Project Information menu** see detailed explanation Figure **4** and **Table 3** at **page 10.**

Note

1. If maximum power to sensor exceeds +20dBm, a safe attenuator is required
2. If safe attenuator is not flat, use Virtual Attenuator file. See creation of Virtual Attenuator **Chapter 8.**

Figure 20: Project Information menu

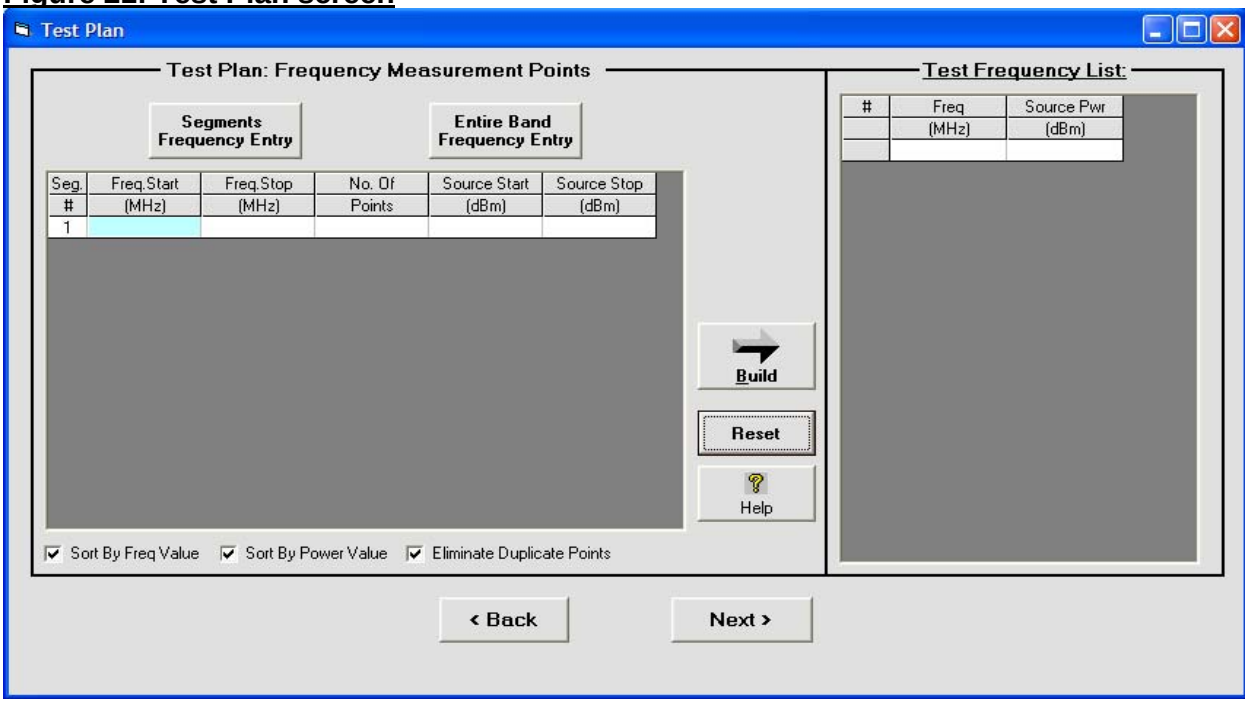


- **Step 4.** Press **Next** key.
  The **Test Plan** screen will open (see **Figure 21**).

- **Step 5.** You can choose one of two options to build the measurement points set (see **Chapter 3.2, Figures 5-6** on **pages 10-11**).

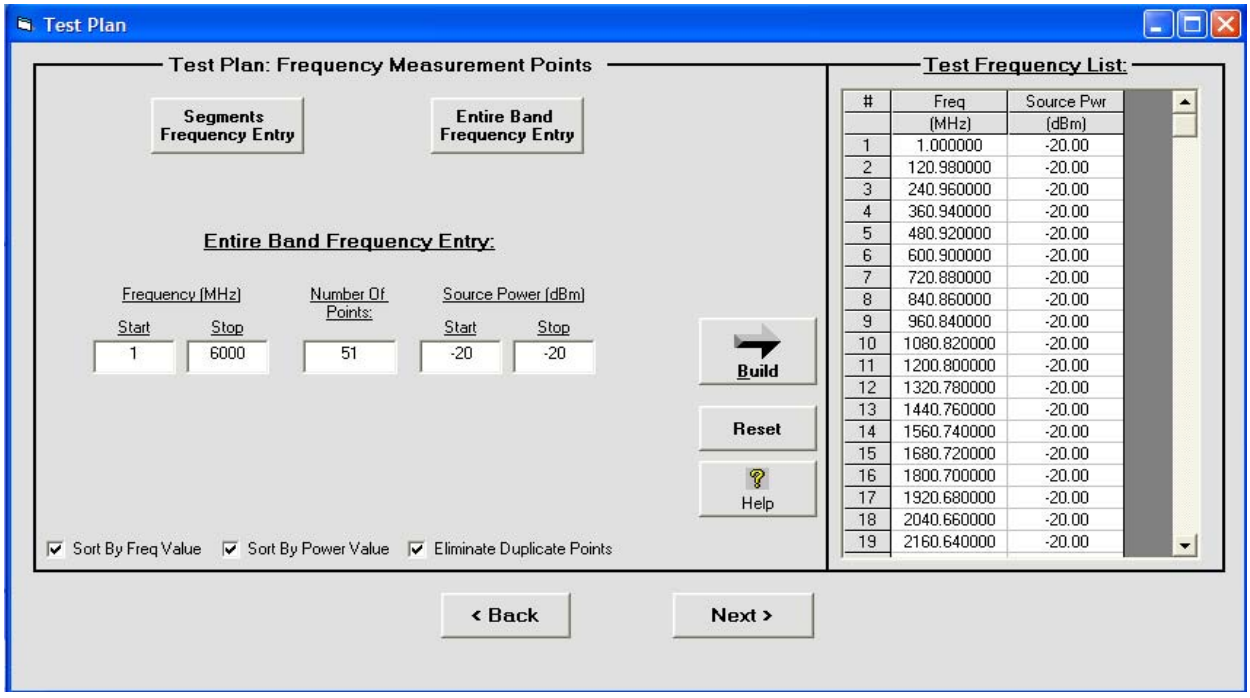
- **Step 6.** Create the measurement points and set input power (you can see an explanation and an example in **Figure 5** on **page 10**).

Figure 21: Test Plan screen



- **Step 7.** Press **Build** key to create a **Test Frequency List (**see **Figure 22**).

Figure 22 : creating Test Frequency List

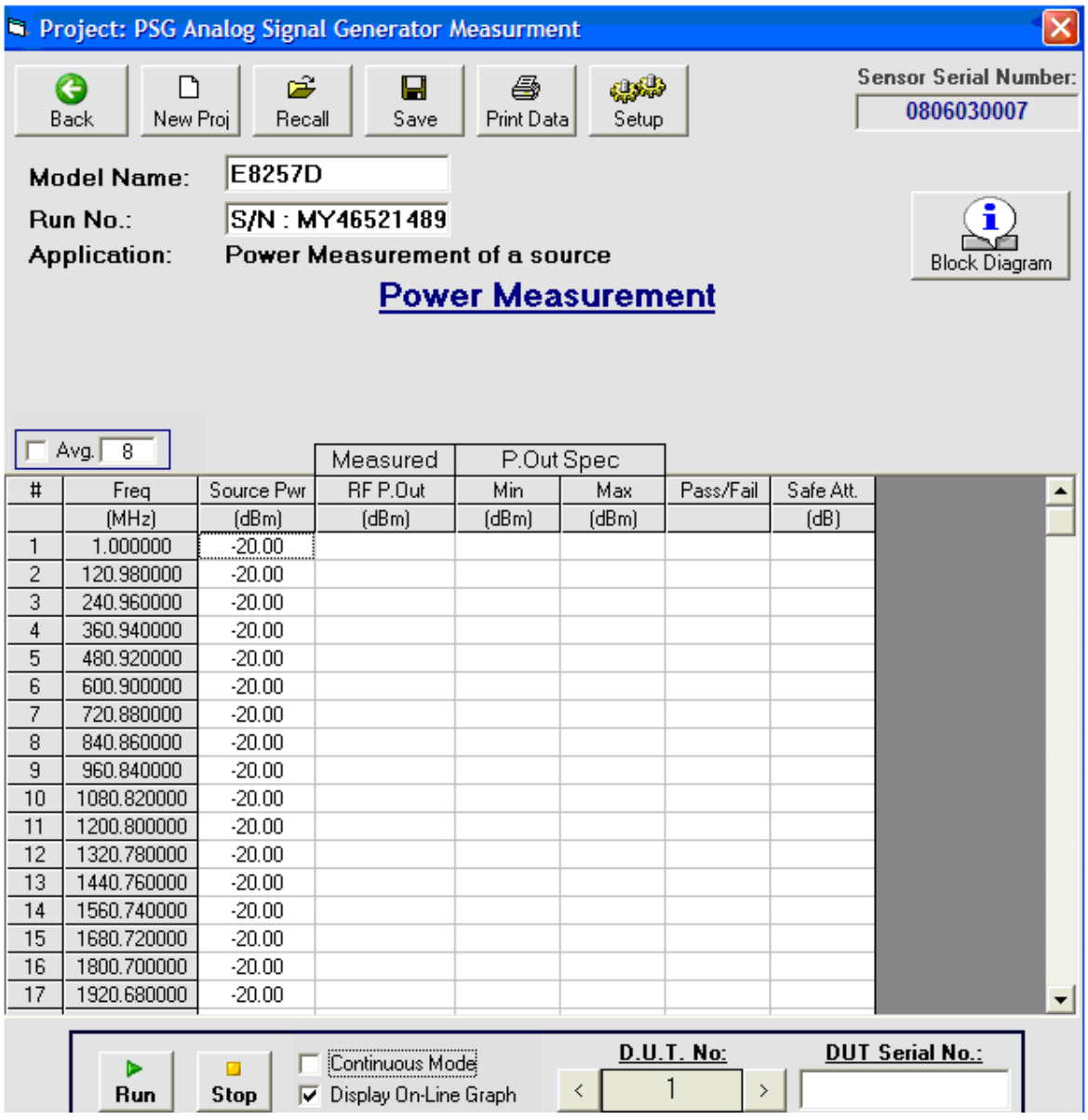


- **Step 8.** Press **Next** key.
  The **Power Measurements** screen will open. (see **Figure 21**).
  Validate desirable data transferred from the previous screen.
  During all following steps you can use **Recall** and **Save** keys at all stages (see **3.3.1.2 Recall** on **page 15, 3.3.1.3 Save** on **page 16** for explanation)

- **Step 9.** Open measurement's **Block Diagram** setup (see **Figure 24**).

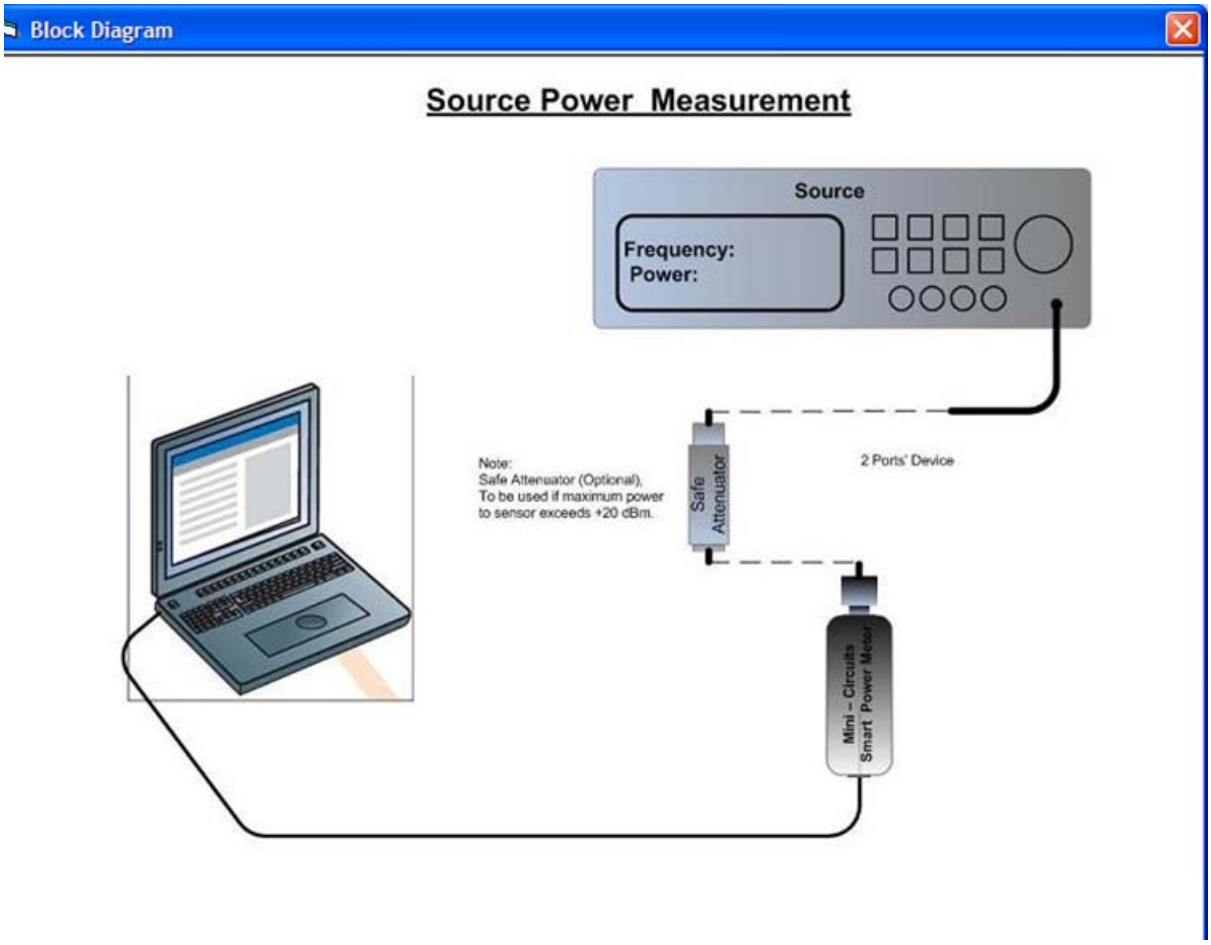
- **Step 10.** Assemble the **Power Measurements of a source** equipment setup.

Figure 23: The Power Measurements screen



- **Step 11.** Define/Confirm **Setup** settings (see **2.1. Setting communication/commands in order to control an external source.** on **page 5**)

Figure 24: Source Power Measurement's Block Diagram setup



- **Step 11.** Enter spec. data (If available).
  [see explanation **3.4.2.2 Spec. Definitions** on **page 21**].

- **Step 12.** You can enable **Continuous Mode** if necessary for your application.

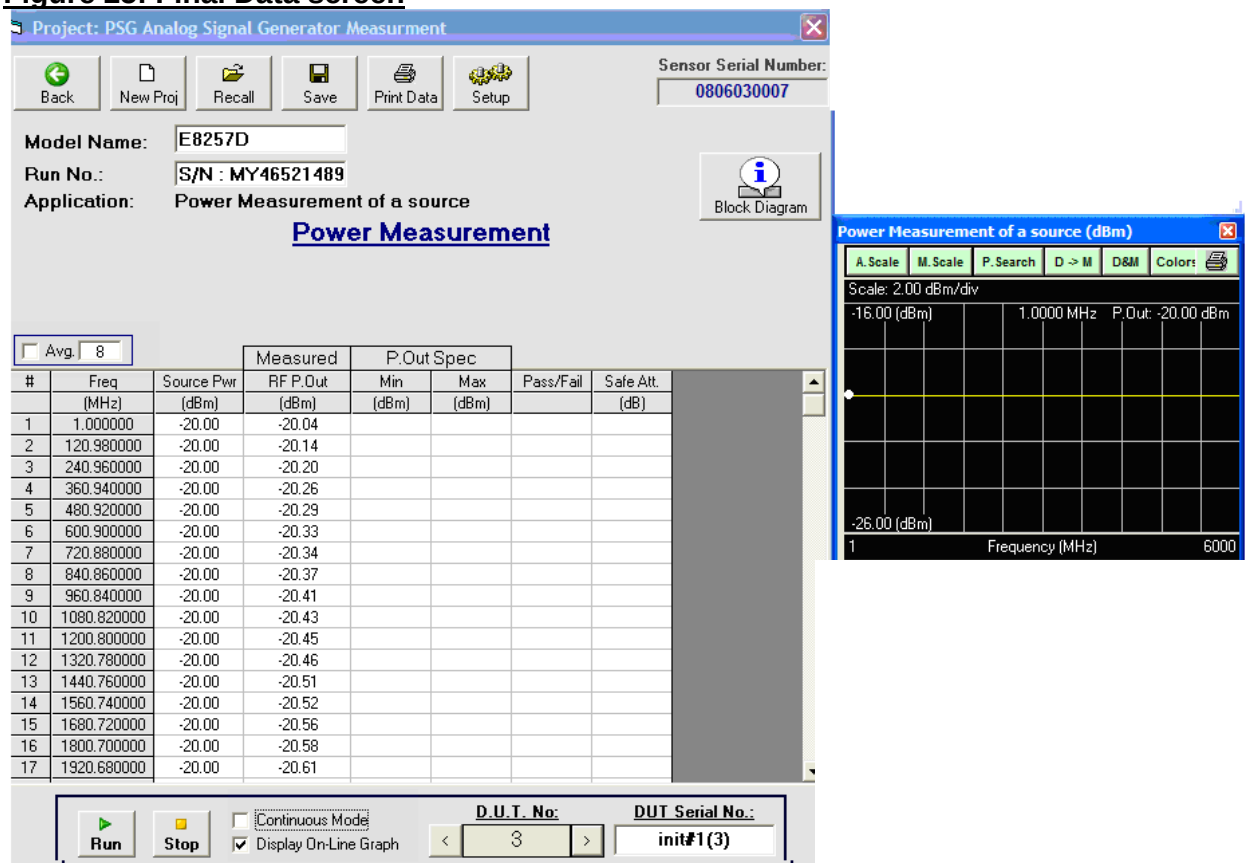
- **Step 13.** You can enable the **On-Line Graph** option.
  (see 3.5 **On-Line Graph features page 22**).

- **Step 14.** Enter **D.U.T Serial No:** (If available).

- **Step 15.** Press **Run** key to launch test. You can stop the test at any stage by pressing the **Stop** key. If **Continuous Mode** is not enabled test will finish after sweeping all segments. If **Continuous Mode** is enabled test will repeat until interrupted by **Stop** key.

- **Step 16.** If you have more than one D.U.T to test, repeat **Steps 12-15** for next test (see **Figure 25**).

Figure 25: Final Data screen



- **Step 17.** Save your project data (see **3.3.1.3 Save Function** on **page 16** for explanation).

- **Step 18.** You can print your test data (see **3.6 Printing Data Function** on **page 23** for explanation).

5.0. Application # 2- High Power Measurement using Virtual Coupler (Up to +53 dBm)

This chapter describes the process of performing High power measurements using a coupler. Before proceeding with this measurement you must generate a Virtual Coupler file described in **chapter 7.** High power measurements using a coupler allow you to extend the power sensor's dynamic range to measure signals of greater than +20dBm power. In some cases the coupler's coupling factor is insufficient protection and an additional safe attenuator may be needed to prevent damage to the sensor. If the Safe Attenuator is not flat use a Virtual Attenuator CAL file (see Virtual Attenuator in **chapter 8.)**.
Data output is in [dBm] units.

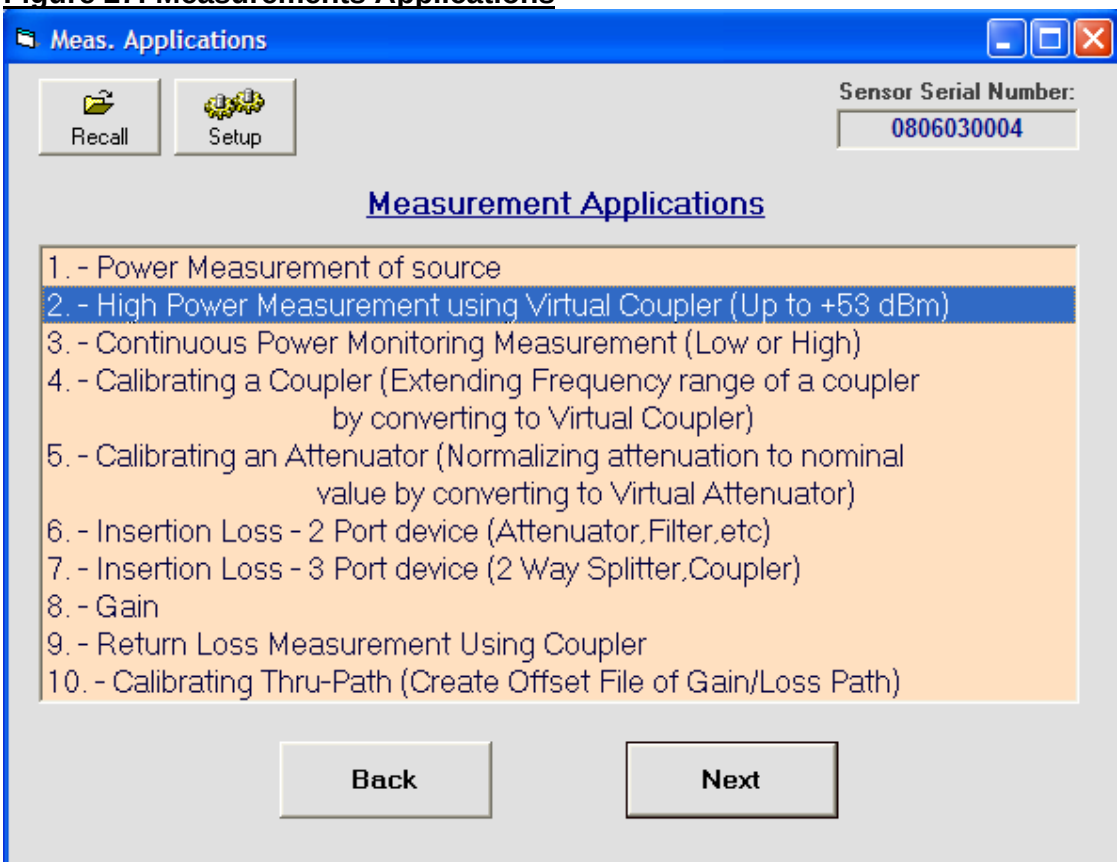
Note

1. Before proceedings with the measurement insure the power rating of your coupler is not exceeded by the signal strength entering it and that the actual signal entering the power sensor does not exceed +20dBm.

2. If the D.U.T will enter compression during the test consider using filters as Virtual Attenuators (see **chapter 8**, **page 60**) to suppress harmonics.

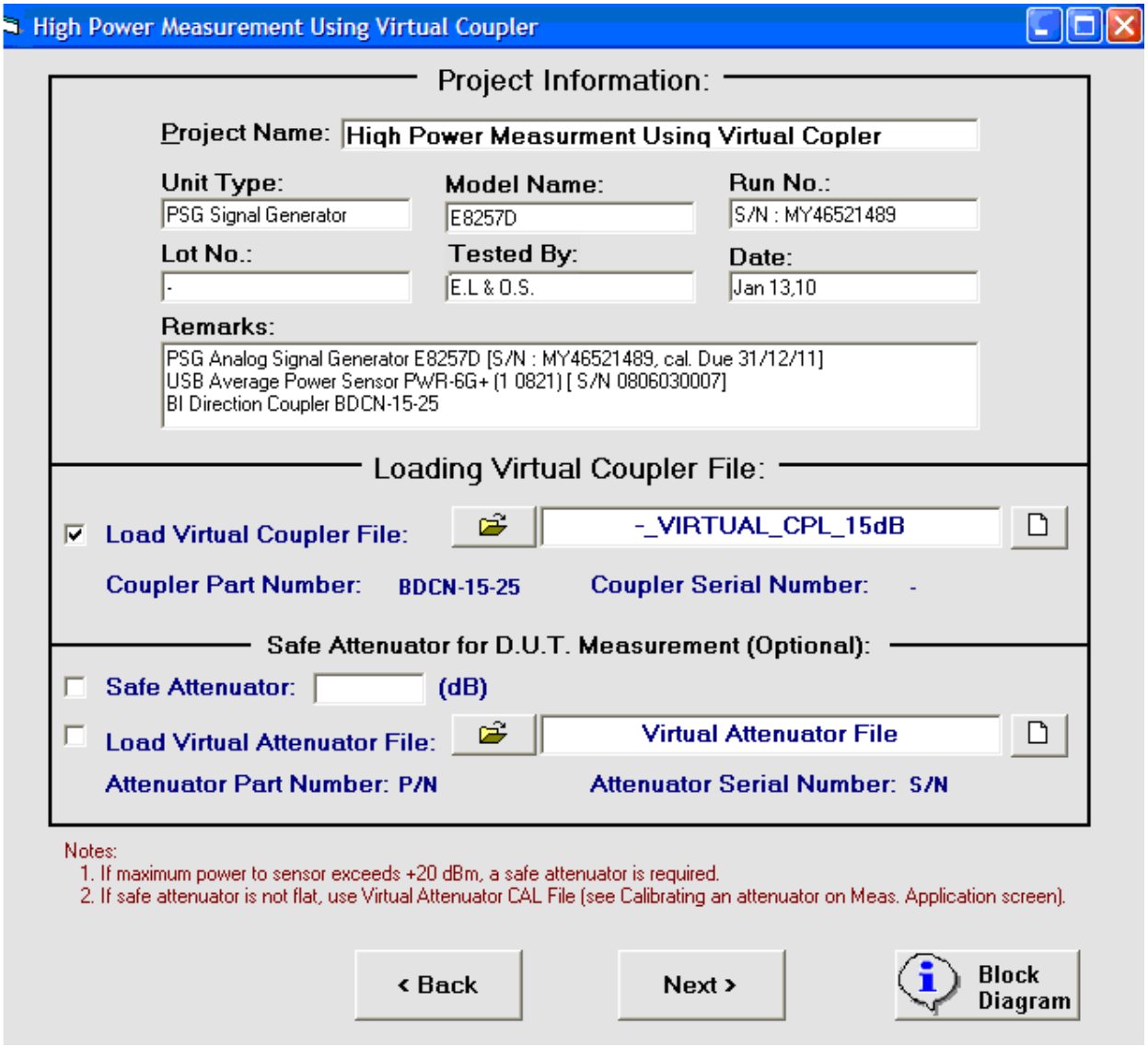
- **Step 1.** Open a project from **Measurement Application** screen (see **Figure 27**)**.**

Figure 27: Measurements Applications



- **Step 2.** The **Project Information menu** will open (see **Figure 28**).
- **Step 3.** Review and fill all necessary fields in the **Project Information menu** see detailed explanation **Figure 4** and **Table 3** at **page 10 .**

Figure 28: Project Information menu



- **Step 4.** Load previously created Virtual Coupler (see **chapter 7)[mandatory]** see **Figure 29** for an example of a Virtual Coupler file.

Note

High power measurements using a Virtual Coupler beyond the Coupler's rated frequency range will result in inaccurate measurements unless a suitable filter is used in order to suppress harmonics. In order to prevent errors due to the filter's insertion loss you must compensate for its loss while it's connected.
Create an Offset file using the Virtual Attenuator option (see **chapter 8**, **page 60**).
In the Project Information menu, Safe Attenuator section (see **Figure 28).**
Load the offset file created previously as a virtual attenuator. When measuring points outside the coupler's official frequency range connect the filter as shown and enable the Load Virtual **Attenuator File** option. For all other points remove the filter and disable the **Offset file**

Figure 29: Virtual Coupler ASCII file

-_VIRTUAL_CPL_15dB

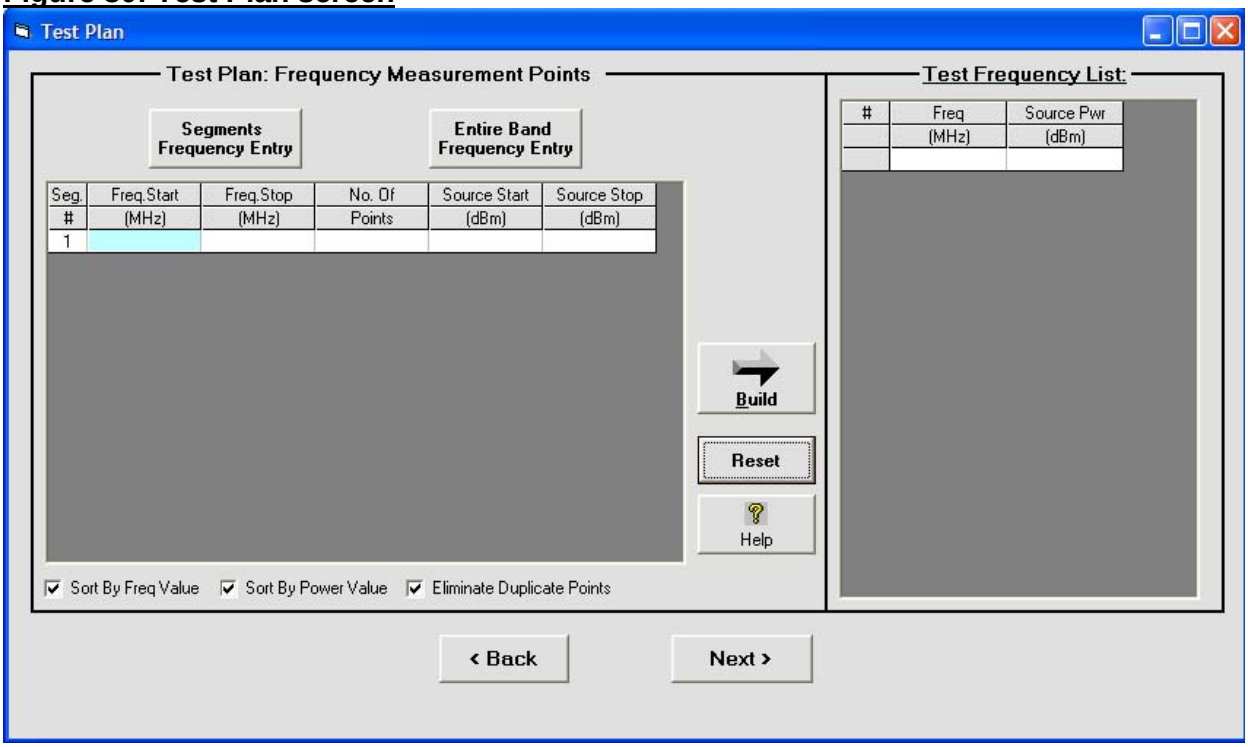
```
! Mini-Circuits
Virtual Coupling File for Coupler Part No: BDCN-15-25 Serial Number: -
! Created By: Power Meter Software
! Using Power Sensor: Part No: PWR-6G+ Serial Number: 0806030007
! Power Rating: 16
! Created On: Jan 21,10
!**Note: Virtual Coupling frequency is limited by the In/Out Return Loss of the
actual Coupler.
!
!              --------Actual--------      --------Virtual--------
!Frequency      I.LOSS         Coupling      I.LOSS         Coupling
!    (MHz)       (dB)           (dB)          (dB)           (dB)
   824.000000   -0.38          -15.22          0             -15
   844.000000   -0.34          -15.05          0             -15
   864.000000   -0.36          -14.90          0             -15
   884.000000   -0.41          -14.77          0             -15
   904.000000   -0.41          -14.59          0             -15
   924.000000   -0.35          -14.42          0             -15
   960.000000   -0.46          -14.27          0             -15
  1010.000000   -0.48          -13.95          0             -15
  1060.000000   -0.46          -13.74          0             -15
  1110.000000   -0.44          -13.50          0             -15
  1160.000000   -0.58          -13.36          0             -15
  1210.000000   -0.63          -13.03          0             -15
  1260.000000   -0.57          -12.87          0             -15
  1310.000000   -0.51          -12.67          0             -15
  1360.000000   -0.60          -12.54          0             -15
  1410.000000   -0.60          -12.22          0             -15
  1460.000000   -0.56          -12.09          0             -15
  1510.000000   -0.57          -12.05          0             -15
  1560.000000   -0.58          -11.96          0             -15
  1610.000000   -0.58          -11.89          0             -15
  1660.000000   -0.57          -11.97          0             -15
```

- **Step 6.** Press **Next** key.
  The **Test Plan** screen will open (see **Figure 30**).

- **Step 7.** You can choose one of two options to build the measurement points set (see **Chapter 3.2, Figures 5-6** on **pages 10-11**).

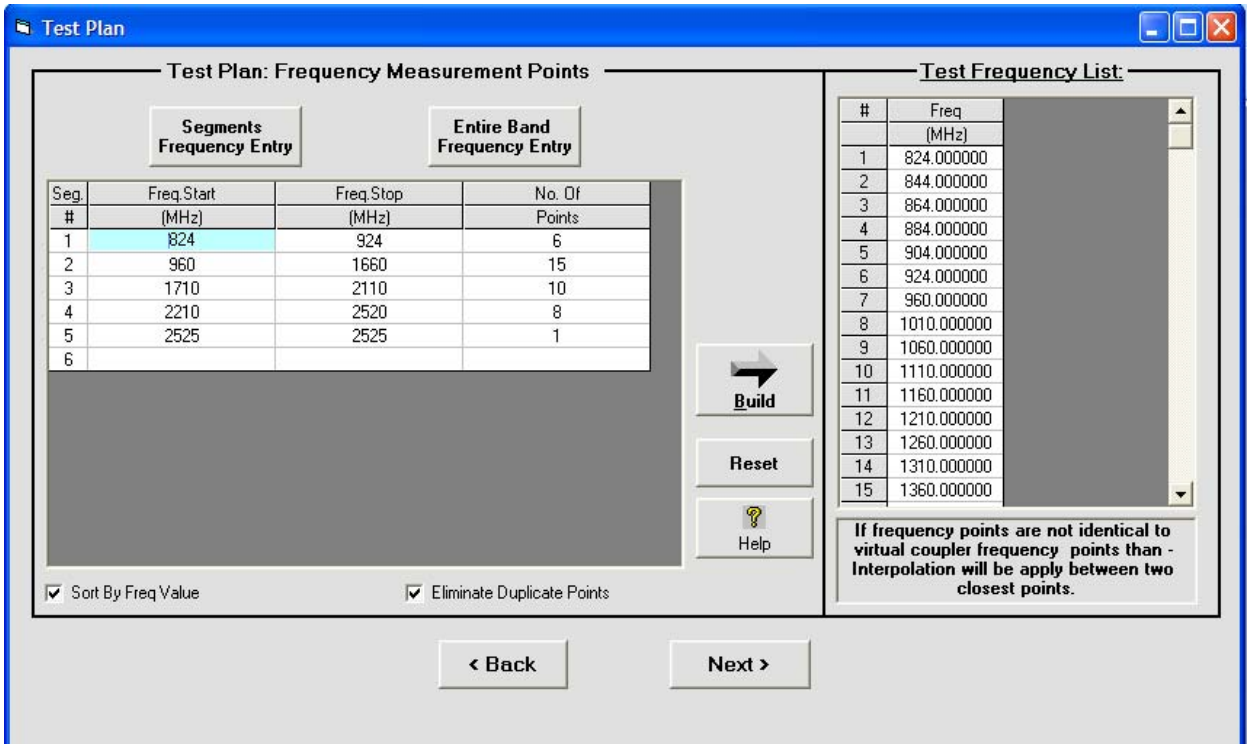
- **Step 8.** Create the measurement points and set input power (you can see an explanation and an example in **Figure 5** on **page 10**).

Figure 30: Test Plan screen



- **Step 9.** Press **Build** key to create a **Test Frequency List (**see **Figure 31**).

Figure 31: Test Frequency List

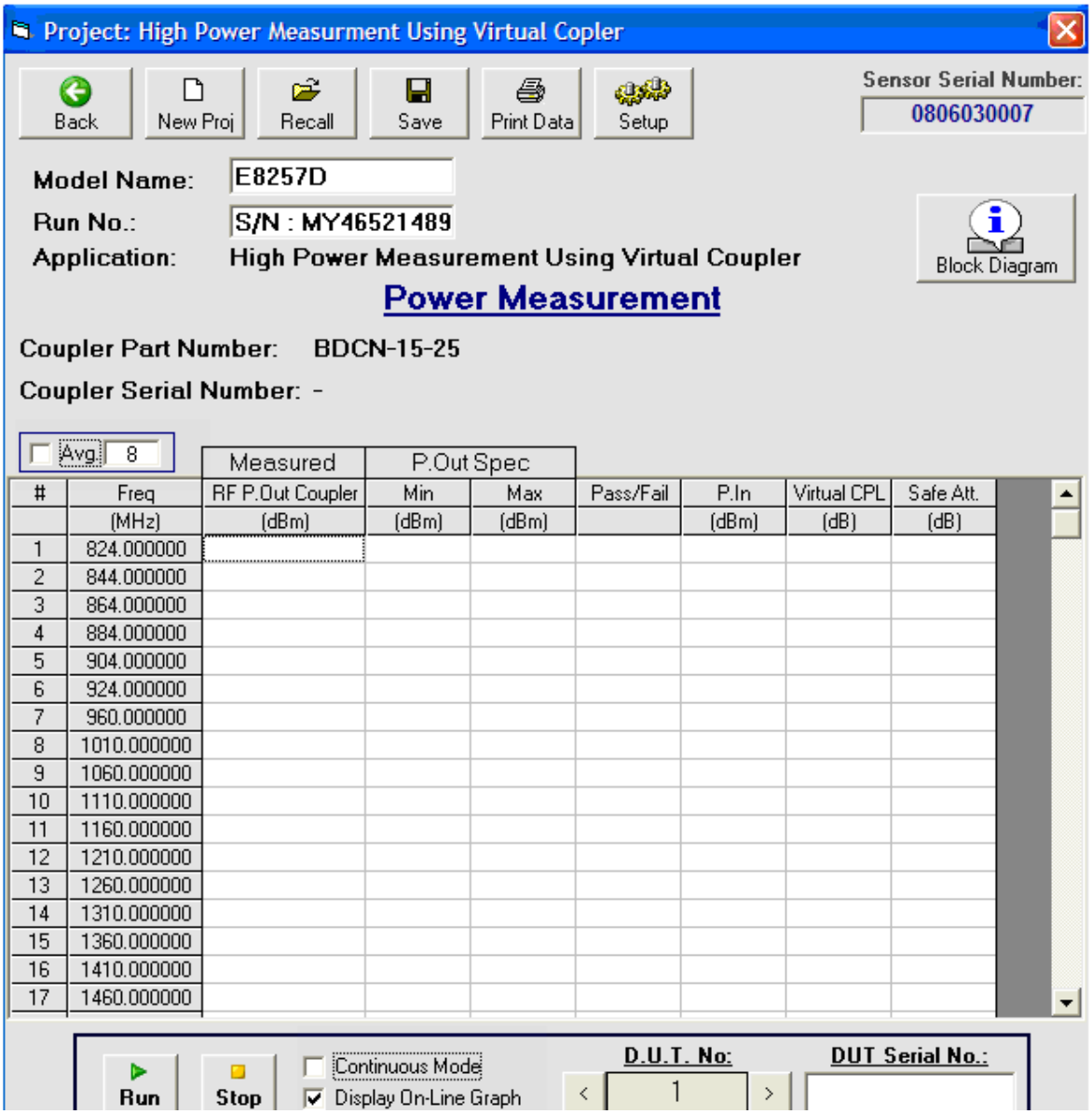


- **Step 10.** Press **Next** key.
  The **Power Measurement** screen will open (see **Figure 32**).
  Validate desirable data transferred from the previous screen.
  During all following steps you can use **Recall** and **Save** keys at all stages (see **3.3.1.2 Recall** on **page 15, 3.3.1.2 Save** on **page 16** for explanation)**.**

- **Step 11.** Open measurement **Block Diagram** setup (see **Figure 33**).

- **Step 12**. Assemble the High power measurements using Virtual Coupler equipment setup.

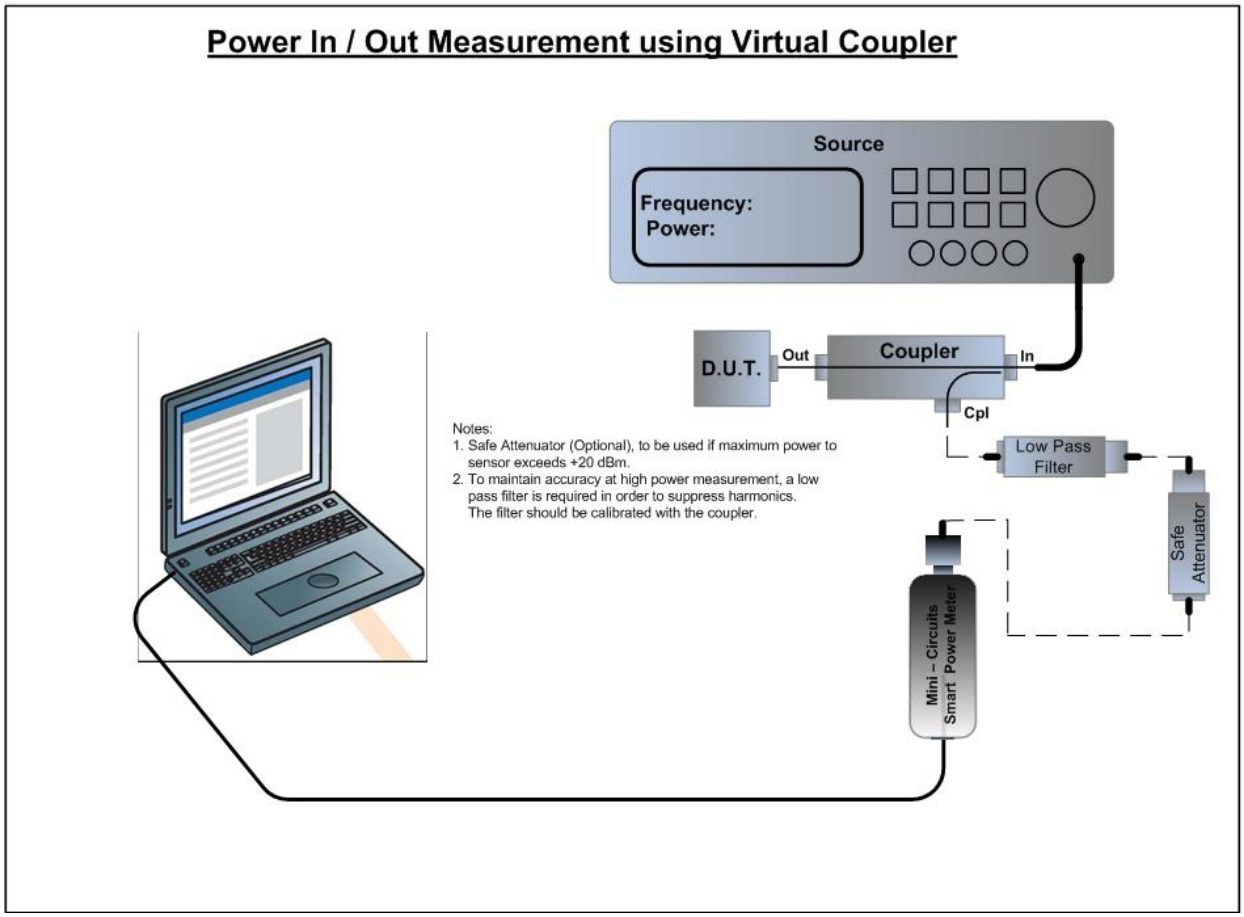
Figure 32: Power Measurement screen



- **Step 13.** Define/Confirm Setup settings (see **2.1. Setting communication/commands in order to control an external source** on **page 5**).

- **Step 14.** Enter spec. data (If available). [see explanation **3.4.2.2 Spec. Definitions** on **page 21**].

Figure 33:Power In/Out Measurement's Block Diagram setup



- **Step 15.** You can enable **Continuous Mode** if necessary for your application.

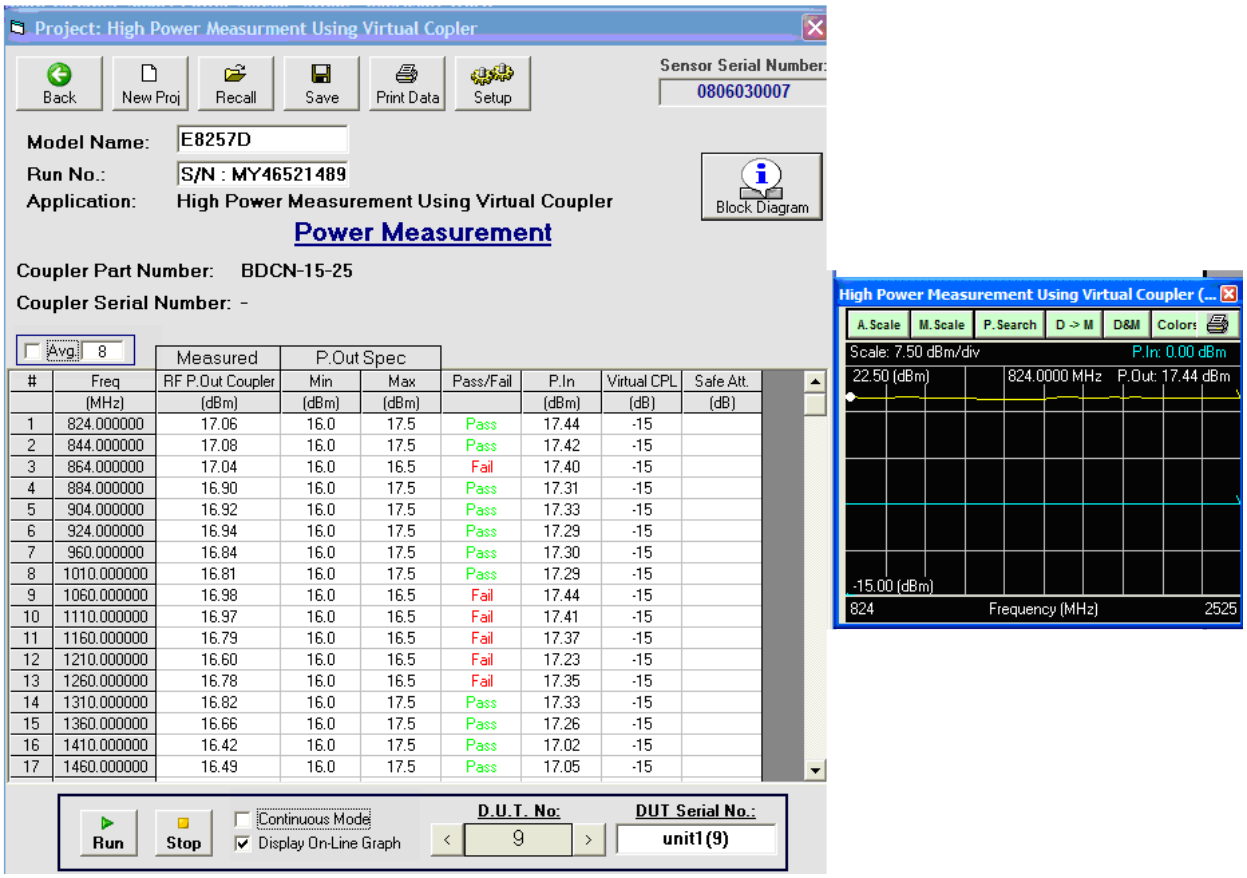
- **Step 16.** You can enable the **On-Line Graph** option.
  (see **3.5 On-Line Graph features** on **page 22**)

- **Step 17.** Enter **D.U.T Serial No:** (If available).

- **Step 18.** Press **Run** key to launch test. You can stop the test at any stage by pressing the **Stop** key. If **Continuous Mode** is not enabled test will finish after sweeping all segments. If **Continuous Mode** is enabled test will repeat until interrupted by **Stop** key.

- **Step 19.** If you have more than one D.U.T to test repeat **Steps 15-18** for next test
  (see **Figure 34**)

Figure 34: Final Data screen



- **Step 20.** Save your project data (see **3.3.1.3 Save Function** on **page 16** for explanation).

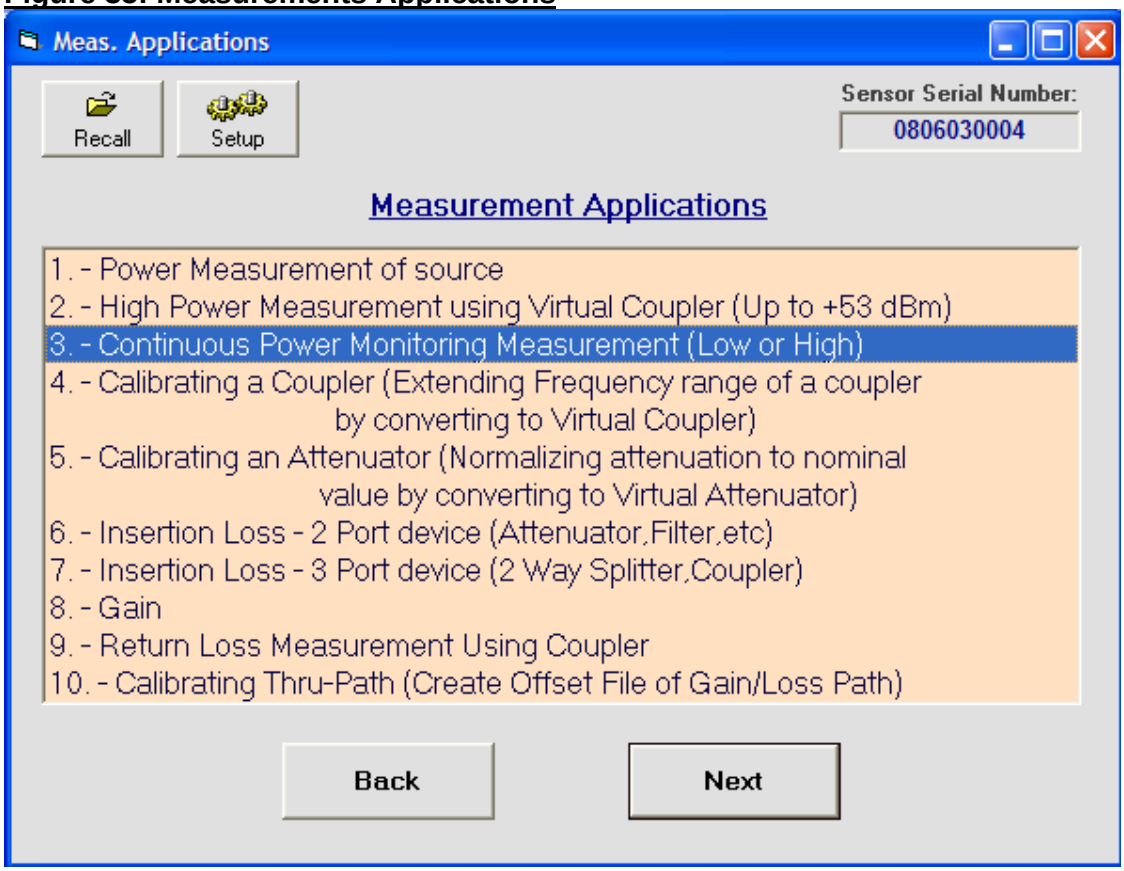
- **Step 21.** You can print your test data (see **3.6 Printing Data Function** on **page 23** for explanation).

6.0 Application # 3 - Continuous Power Monitoring Measurement (Low or High)

This chapter describes the process of setting up and using a continuous power monitoring setup using a virtual coupler. This setup allows you constant monitoring of power out from an RF source (at the coupler's coupling port) to a D.U.T without interrupting the power. Before proceeding with this measurement you must generate a Virtual Coupler file described in **chapter 7.** Data output of this measurement will be in [dBm] units.

Step 1. Open a project from **Measurement Application** screen (see **Figure 35).**

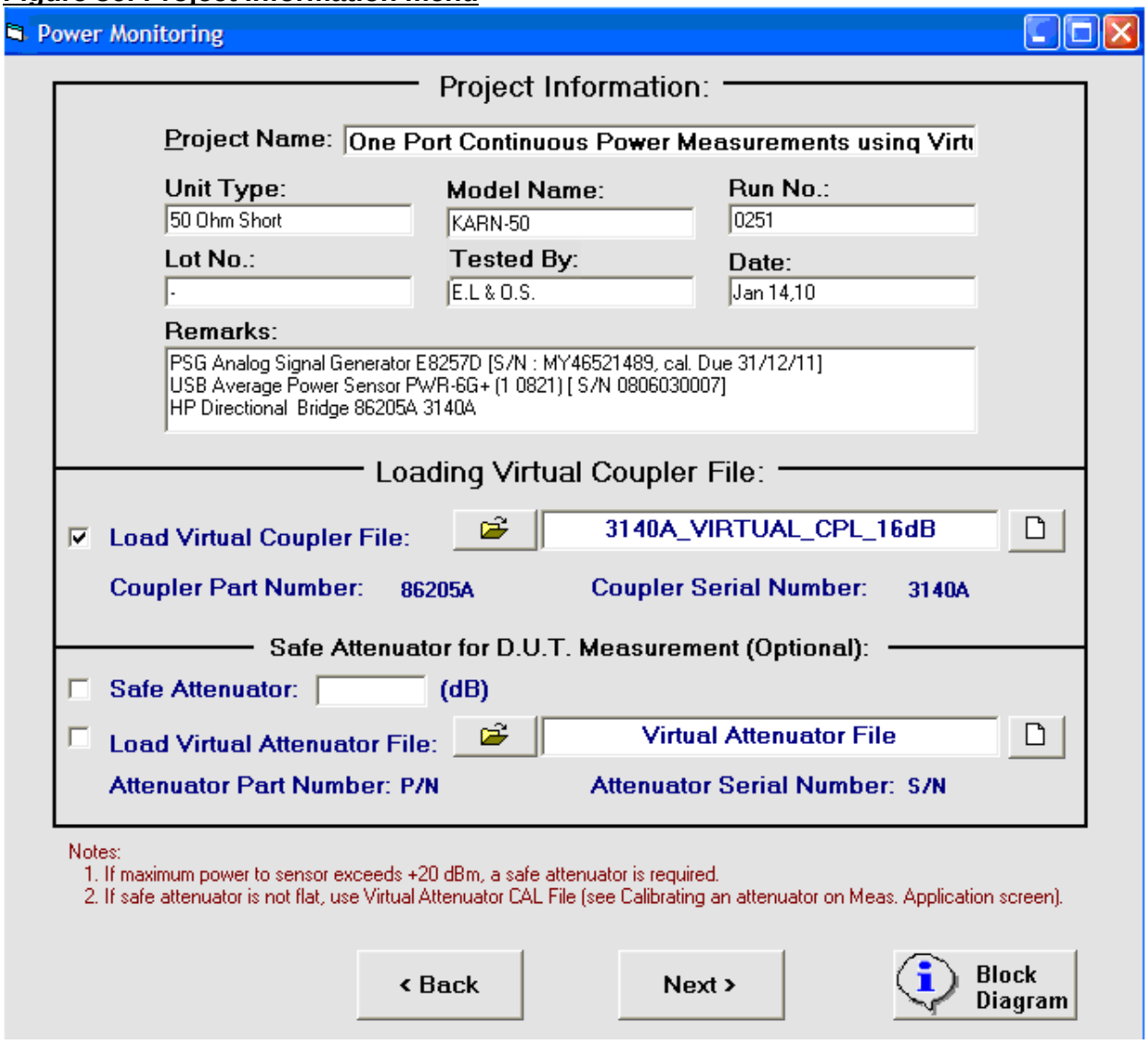
Figure 35: Measurements Applications



Note If the D.U.T will approach to compression during the test consider using filter as Virtual Attenuators (see **chapter 8**, **page 60**) to suppress harmonics.

- **Step 2.** The **Project Information menu** will open (see **Figure 36**).
- **Step 3.** Review and fill all necessary fields in the **Project Information menu** see detailed explanation Figure **4** and **Table 3** at **pages 8-9**.

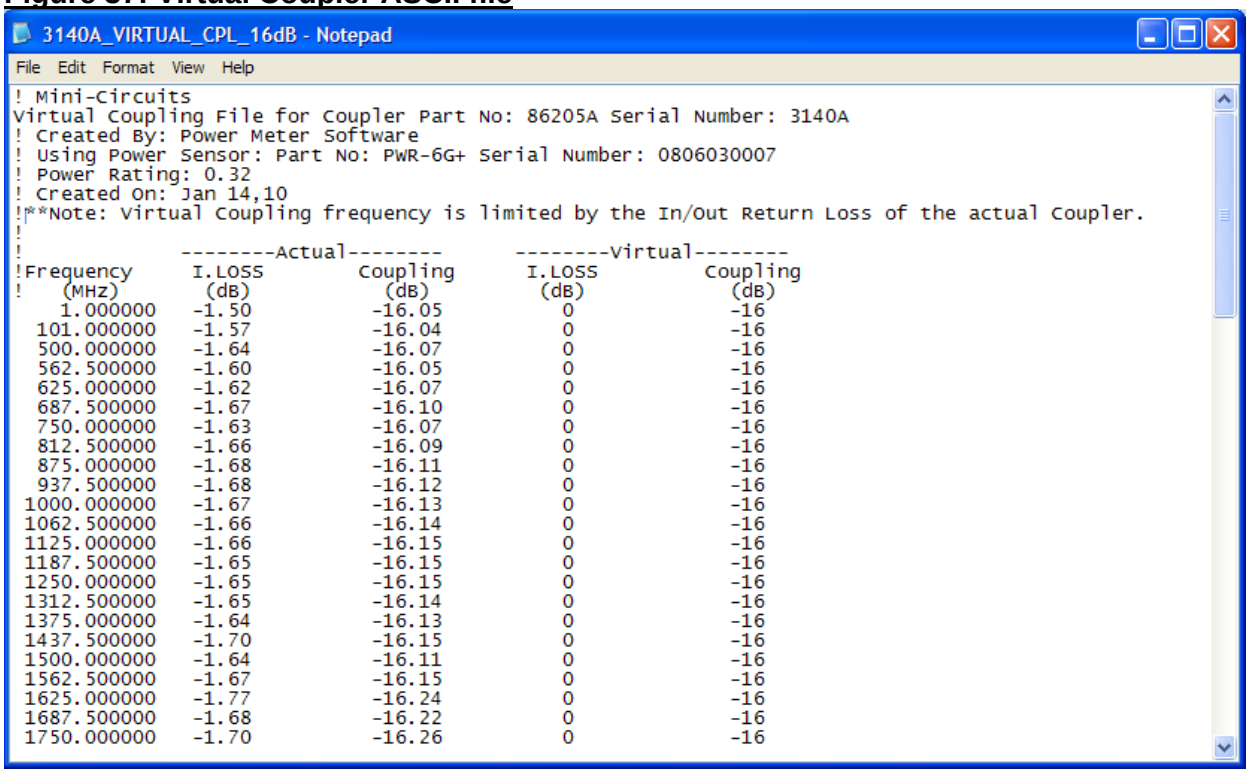
Figure 36: Project Information menu



- **Step 4.** Load previously created Virtual Coupler (see **chapter 7**) **[mandatory]** **(**see **Figure 37** for an example of a Virtual Coupler file)

.

Figure 37: Virtual Coupler ASCII file



3140A_VIRTUAL_CPL_16dB - Notepad

File Edit Format View Help

```
! Mini-Circuits
Virtual Coupling File for Coupler Part No: 86205A Serial Number: 3140A
! Created By: Power Meter Software
! Using Power Sensor: Part No: PWR-6G+ Serial Number: 0806030007
! Power Rating: 0.32
! Created On: Jan 14,10
!**Note: Virtual Coupling frequency is limited by the In/Out Return Loss of the actual Coupler.
!
!             --------Actual--------      --------Virtual--------
!Frequency     I.LOSS        Coupling      I.LOSS        Coupling
!   (MHz)       (dB)          (dB)          (dB)          (dB)
    1.000000   -1.50          -16.05          0           -16
  101.000000   -1.57          -16.04          0           -16
  500.000000   -1.64          -16.07          0           -16
  562.500000   -1.60          -16.05          0           -16
  625.000000   -1.62          -16.07          0           -16
  687.500000   -1.67          -16.10          0           -16
  750.000000   -1.63          -16.07          0           -16
  812.500000   -1.66          -16.09          0           -16
  875.000000   -1.68          -16.11          0           -16
  937.500000   -1.68          -16.12          0           -16
 1000.000000   -1.67          -16.13          0           -16
 1062.500000   -1.66          -16.14          0           -16
 1125.000000   -1.66          -16.15          0           -16
 1187.500000   -1.65          -16.15          0           -16
 1250.000000   -1.65          -16.15          0           -16
 1312.500000   -1.65          -16.14          0           -16
 1375.000000   -1.64          -16.13          0           -16
 1437.500000   -1.70          -16.15          0           -16
 1500.000000   -1.64          -16.11          0           -16
 1562.500000   -1.67          -16.15          0           -16
 1625.000000   -1.77          -16.24          0           -16
 1687.500000   -1.68          -16.22          0           -16
 1750.000000   -1.70          -16.26          0           -16
```

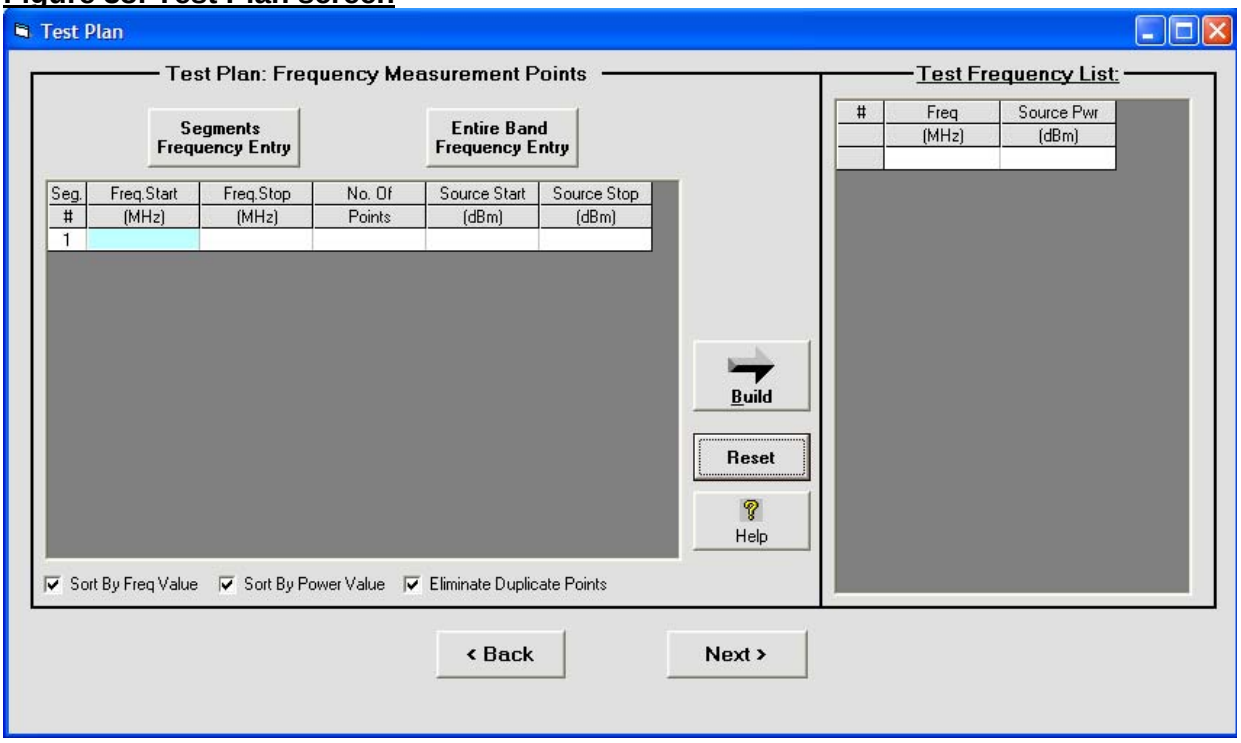
- **Step 5.** Load previously created Virtual Attenuator (see **chapter 8**)[**Optional**]

- **Step 6.** Press **Next** key.
  The **Test Plan** screen will open (see **Figure 38**).

- **Step 7.** You can choose one of two options to build the measurement points set (see **Chapter 3.2, Figures 5-6** on **pages 10-11**).

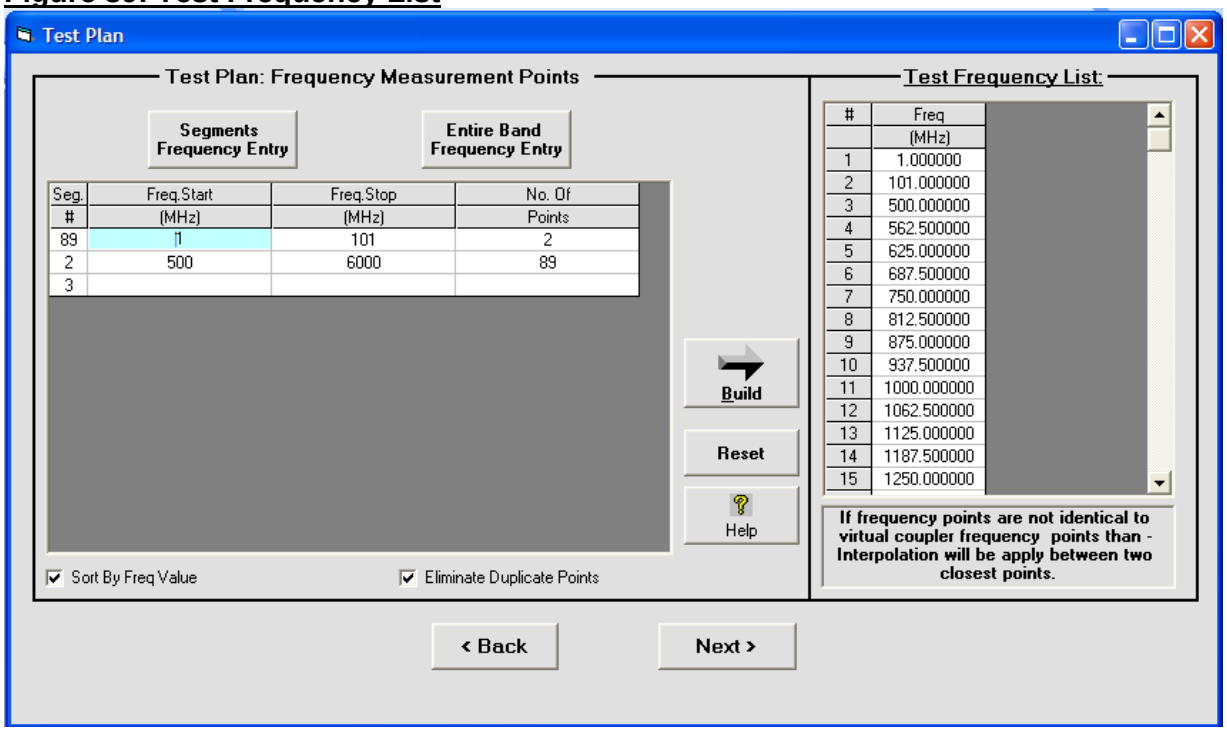
- **Step 8.** Create the measurement points and set input power (you can see an explanation and example in **Figure 5** on **page 10**).

Figure 38: Test Plan screen



- **Step 9.** Press **Build** key to create a **Test Frequency List (**see **Figure 39**).

Figure 39: Test Frequency List

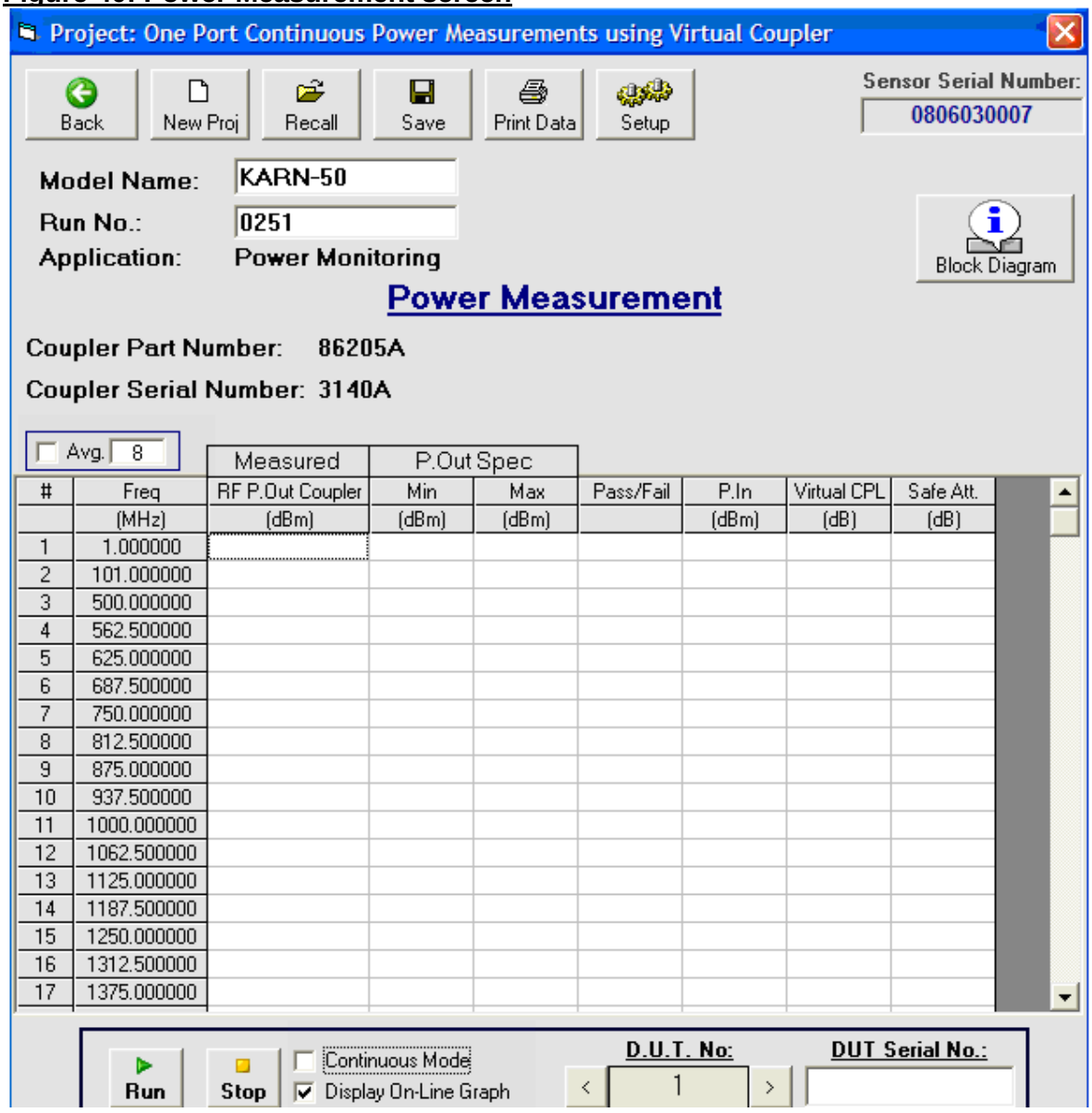


- **Step 10.** Press **Next** key. The **Power Measurements** screen will open.
  (see **Figure 40**) Validate desirable data transferred from the previous screen.
  During all following steps you can use **Recall** and **Save** keys at all stages
  (see **3.3.1.2 Recall** on **page 15, 3.3.1.3 Save** on **page 16** for explanation).

- **Step 11.** Open measurement's **Block Diagram** setup (see **Figure 41**).

- **Step 12.** Assemble the **Continuous Power Monitoring Measurement (Low or High)** equipment setup.

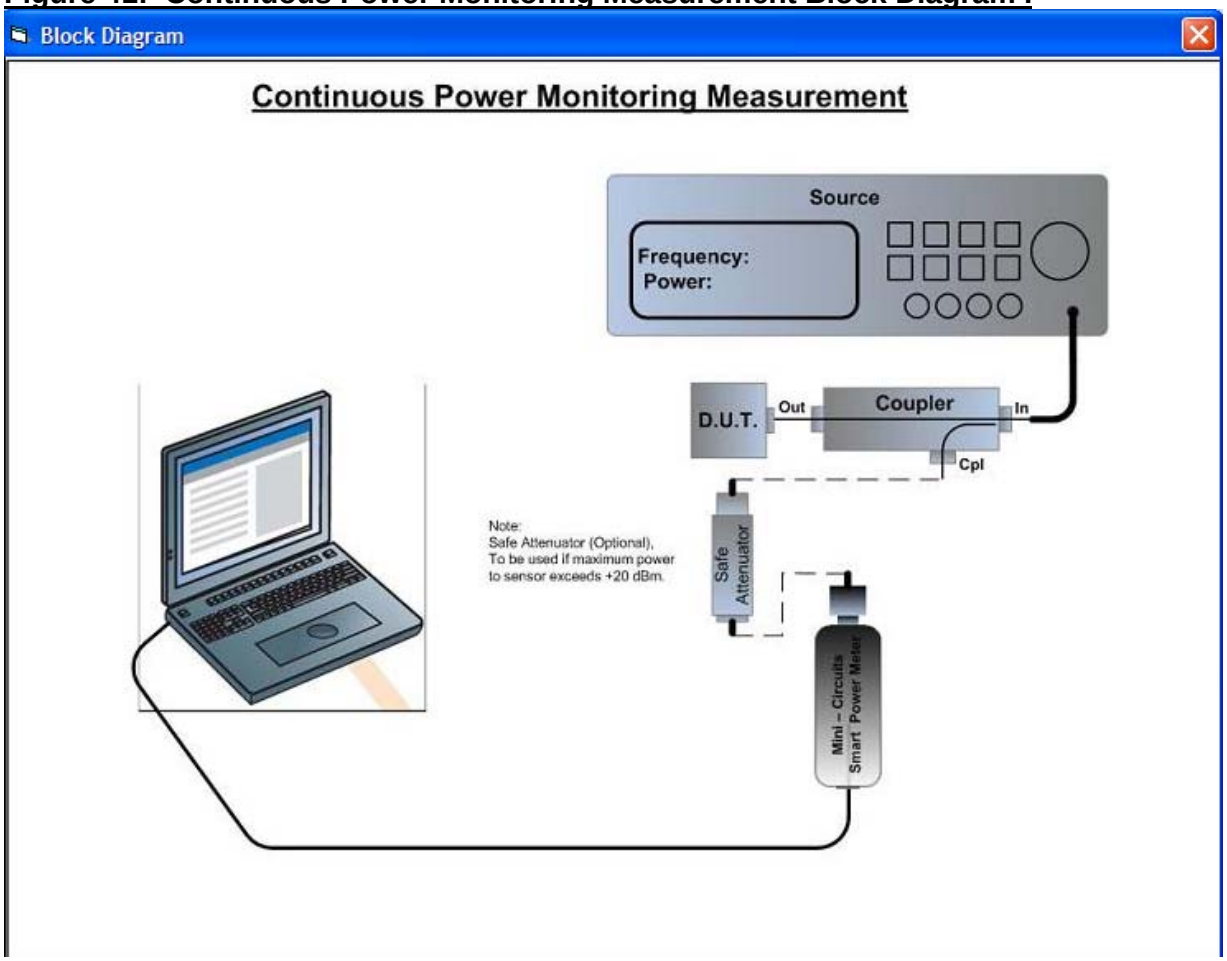
Figure 40: Power Measurement screen



- **Step 13.** Define/Confirm **Setup** settings (see **2.1. Setting communication/commands in order to control an external source.** on **page 5**).

- **Step 14.** Enter spec. data (If available).
  [see explanation **3.4.2.2 Spec. Definitions** on **page 21**].

Figure 41: Continuous Power Monitoring Measurement Block Diagram .



- **Step 15.** You can enable the **On-Line Graph** option.
  (see **3.5 On-Line Graph features** on **page 22**).

Note

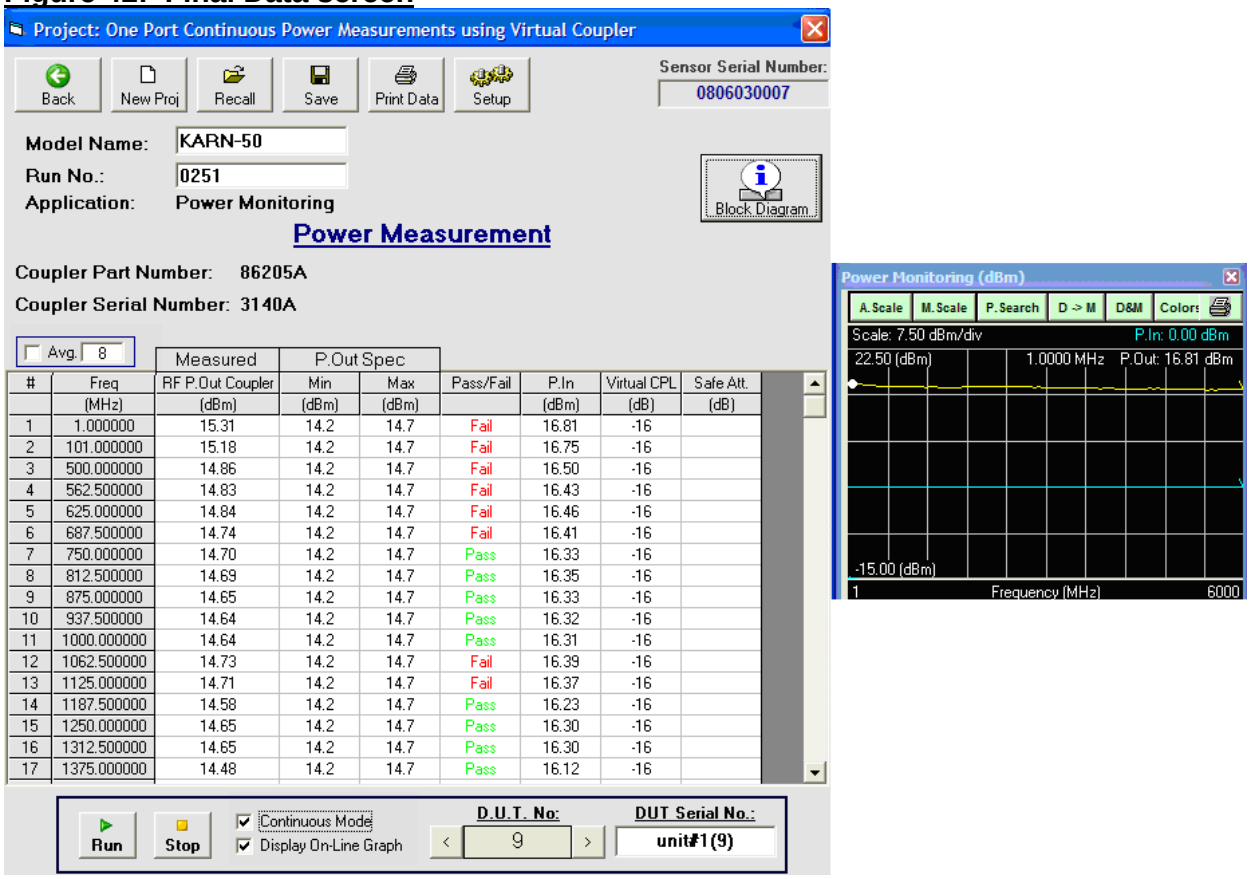
Insure final signal power at coupling port exceeds -30dBm to allowing accurate reading by Power Sensor.

- **Step 16.** Enter **D.U.T Serial No:** (If available).

- **Step 17.** Press **Run** key to launch test. You can stop the test at any stage by pressing the **Stop** key. If **Continuous Mode** is not enabled test will finish after sweeping all segments. If **Continuous Mode** is enabled test will repeat until interrupted by **Stop** key.

- **Step 18.** If you have more than one D.U.T to test repeat **Steps 15-17** for next test (see **Figure 42**).

Figure 42: Final Data screen



- **Step 19.** Save your project data (see **3.3.1.3 Save Function** on **page 16** for explanation).

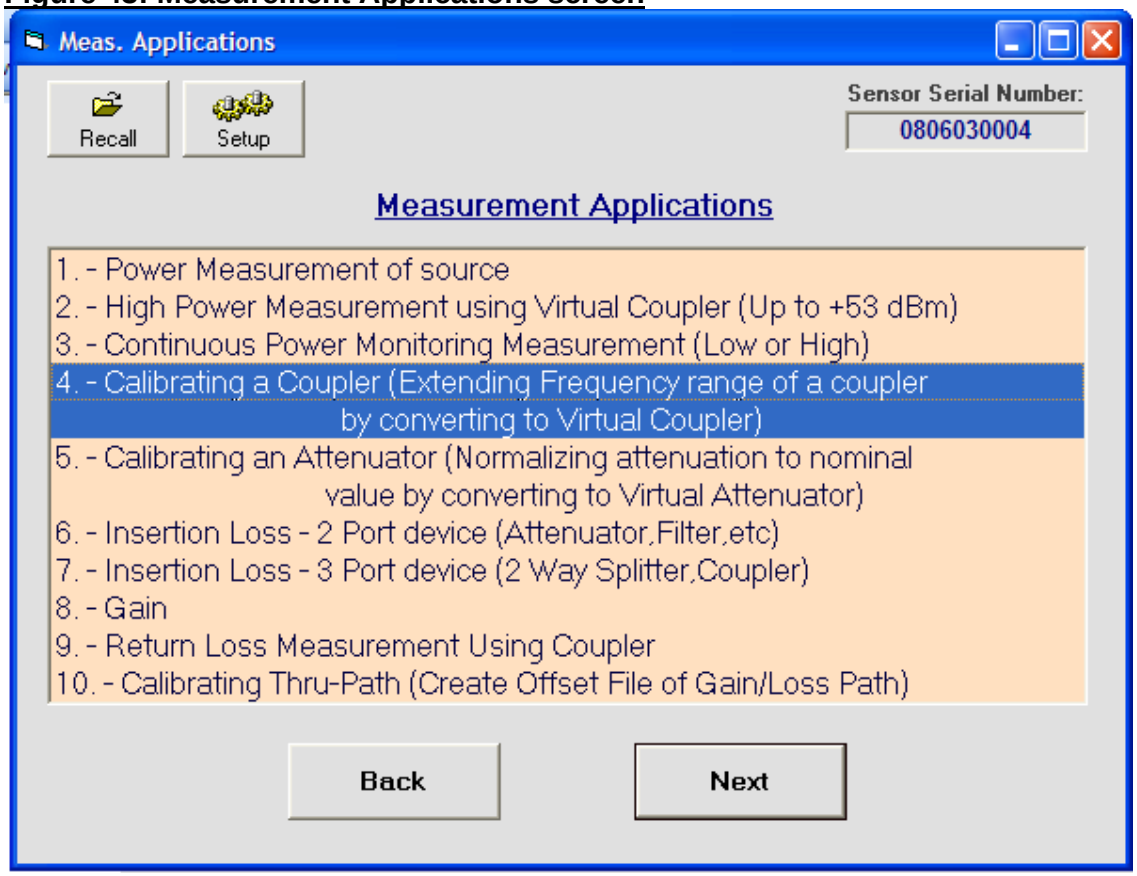
- **Step 20.** You can print your test data (see **3.6 Printing Data Function** on **page 23** for explanation).

7.0 Application # 4- Calibrating a Coupler (Extending Frequency range of a coupler by converting to Virtual Coupler).

This chapter describes the process of calibrating a coupler and creating a Virtual Coupler – allowing the extension of the coupler's frequency range beyond its rated specifications to the limits established by its Return Loss values and the user's required accuracy. Virtual couplers are required for Continuous Power monitoring (**chapter 6**) and High power measurements (**chapter 5**). Before you can calibrate a coupler you must establish a Reference Power measurement described in **3.3** on **page 11**.

- **Step 1.** Open a project from the **Measurement Applications** screen (see **Figure 43**).

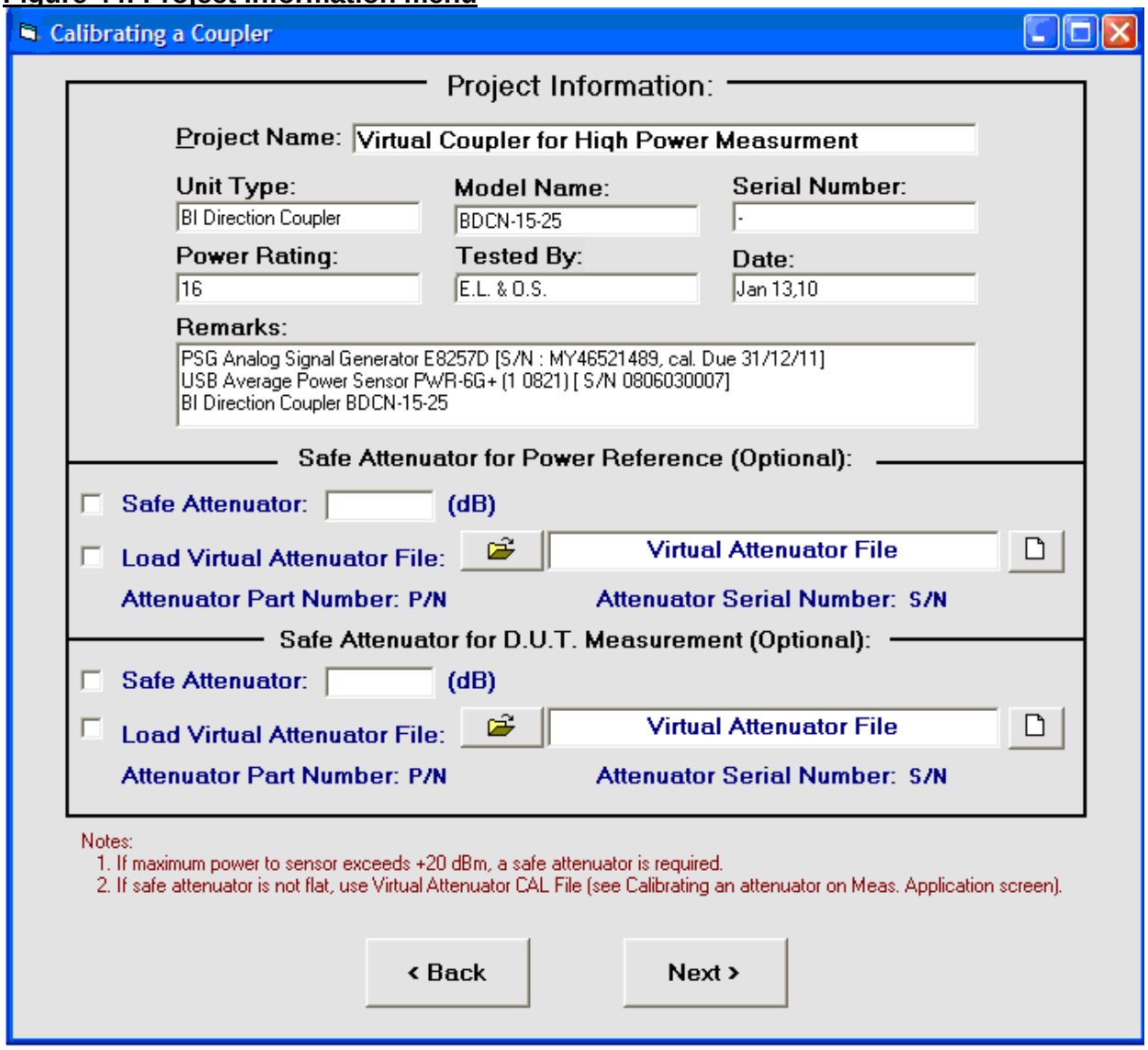
Figure 43: Measurement Applications screen



- **Step 2.** The **Project Information menu** will open (see **Figure 44**).

- **Step 3.** Review and fill all necessary fields in the **Project Information menu** see detailed explanation Figure **4** and **Table 3** at **page 10.**

Figure 44: Project Information menu



- **Step 4.** Load previously created Virtual Attenuator (see **chapter 8**) [**Optional**].

- **Step 5.** Press **Next** key. The **Test Plan** screen will open (see **Figure 45**).

- **Step 6.** You can choose one of two options to build the measurement points set (see **Chapter 3.2, Figures 5-6** on **pages 10-11**).

- **Step 7.** Create the measurement points and set input power (you can see an explanation and an example in **Figure 5** on **page 10**).

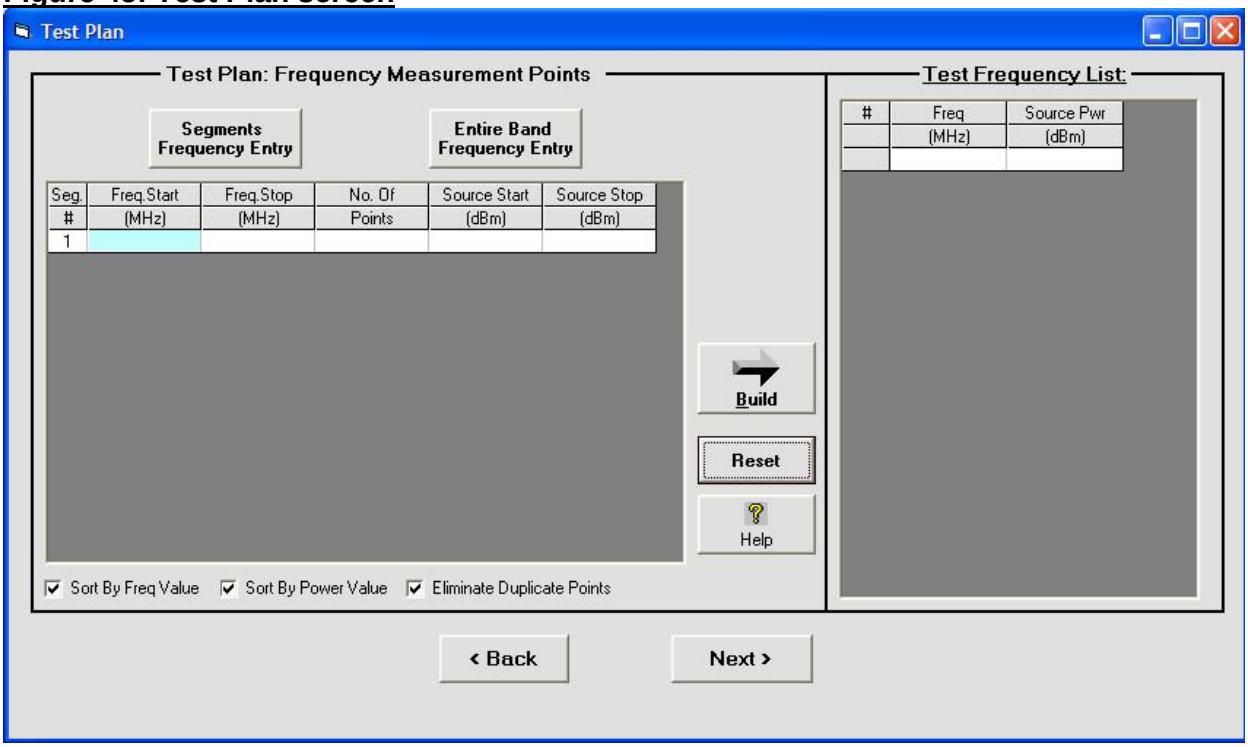
Note

1. Build a Virtual Coupler for a specific
(Source power from Virtual Coupler will be used in Measurement Application see **chapters 6-7**).

2. Choose as high power as available in Measurement Applications (see **chapters 6-7**) that does not reach the maximum limit of power sensor.
That will guaranty minimum distortion dynamic range available for measurement.
.

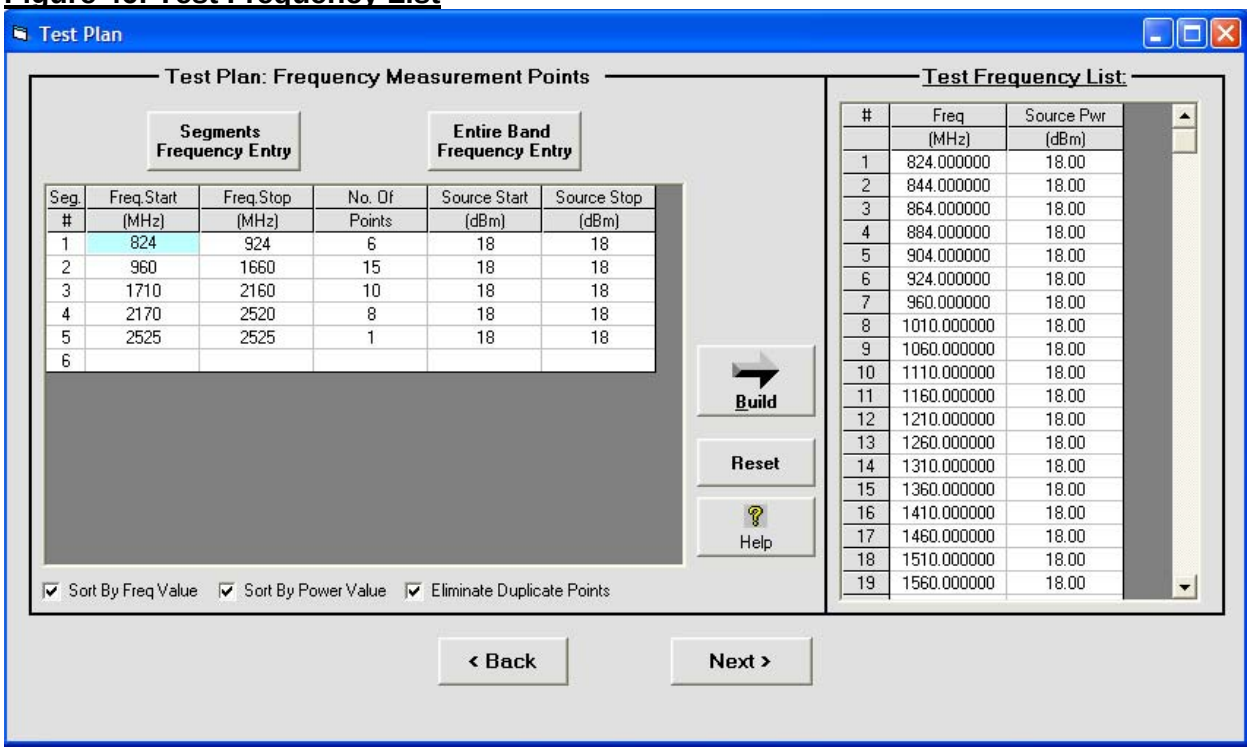
.

Figure 45: Test Plan screen



- **Step 8.** Press **Build** key to create a **Test Frequency List** (see **Figure 46**).

Figure 46: Test Frequency List



- **Step 9.** Press **Next** key .The **Coupler Measurement** screen will open. (see **Figure 47**) Validate desirable data transferred from the previous screen. During all following steps you can use **Recall** and **Save** keys at all stages (see **3.3.1.2 Recall** on **page 15, 3.3.3.2 Save** on **page 16** for explanation)**.**

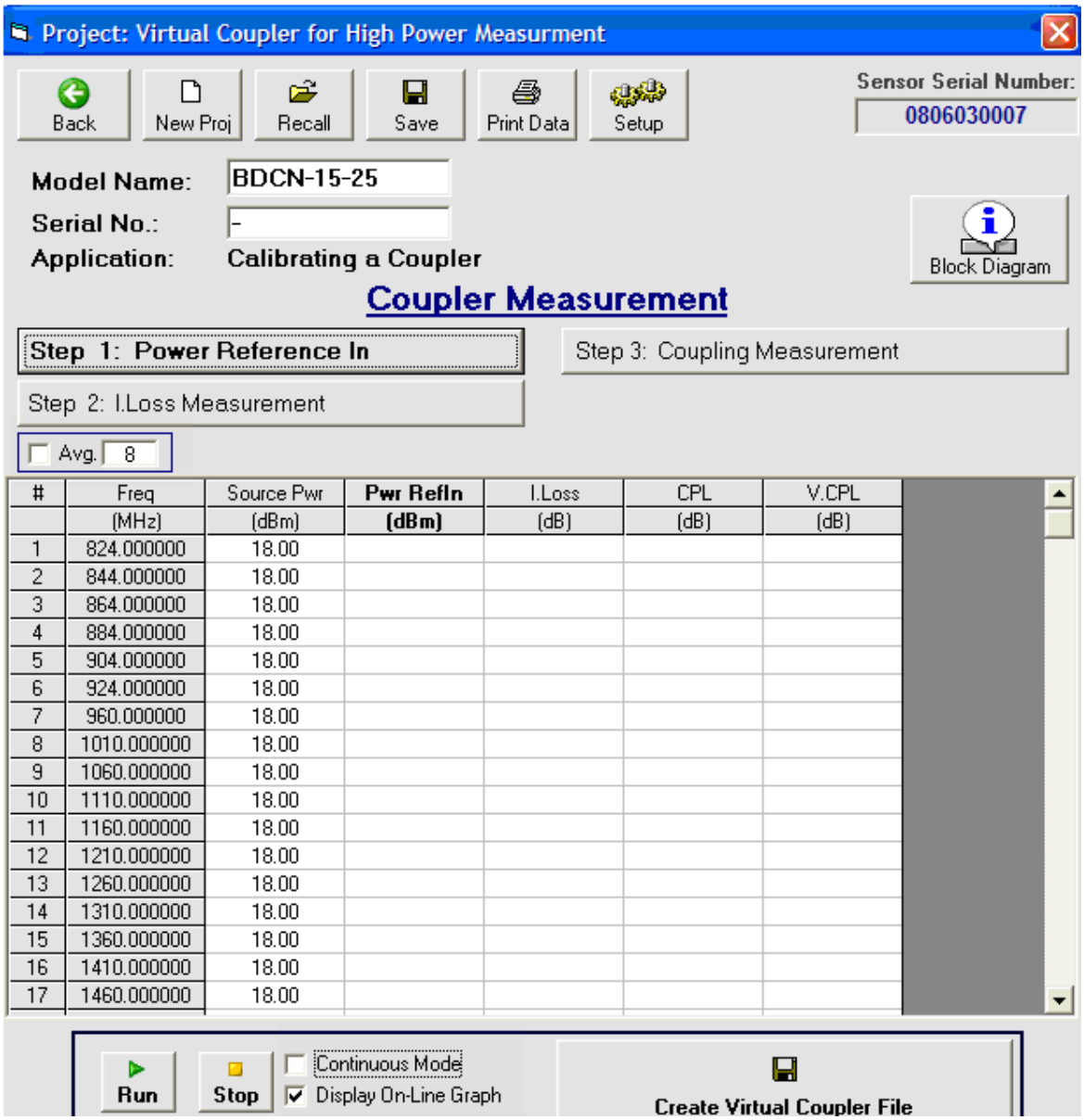
- **Step 10.** Press **Step 1: Power Reference In** key.

- **Step 11**. Open **Power Reference In** measurement's **Block Diagram** setup (see **Figure 48**).

- **Step 12.** Assemble the **Power Reference In** equipment setup.

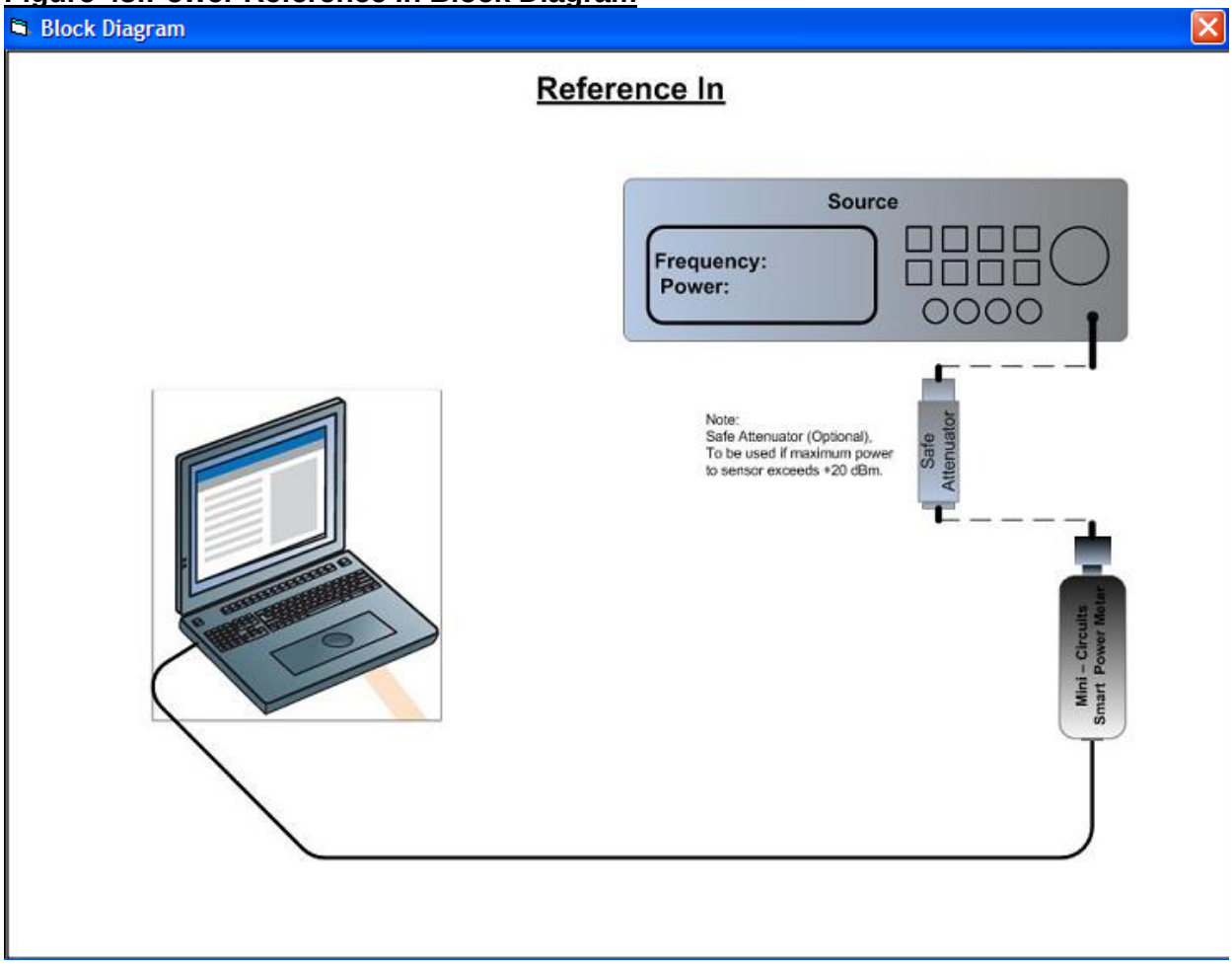
- **Step 13.** Define/Confirm **Setup** settings (see **2.1. Setting communication/commands in order to control an external source.** on **page 5**).

Figure 47: Coupler Measurement screen



- **Step 14.** Press **Run** key to launch test. You can stop the test at any stage by pressing the **Stop** key. If **Continuous Mode** is not enabled test will finish after sweeping all segments. If **Continuous Mode** is enabled test will repeat until interrupted by **Stop** key.

Figure 48:Power Reference In Block Diagram



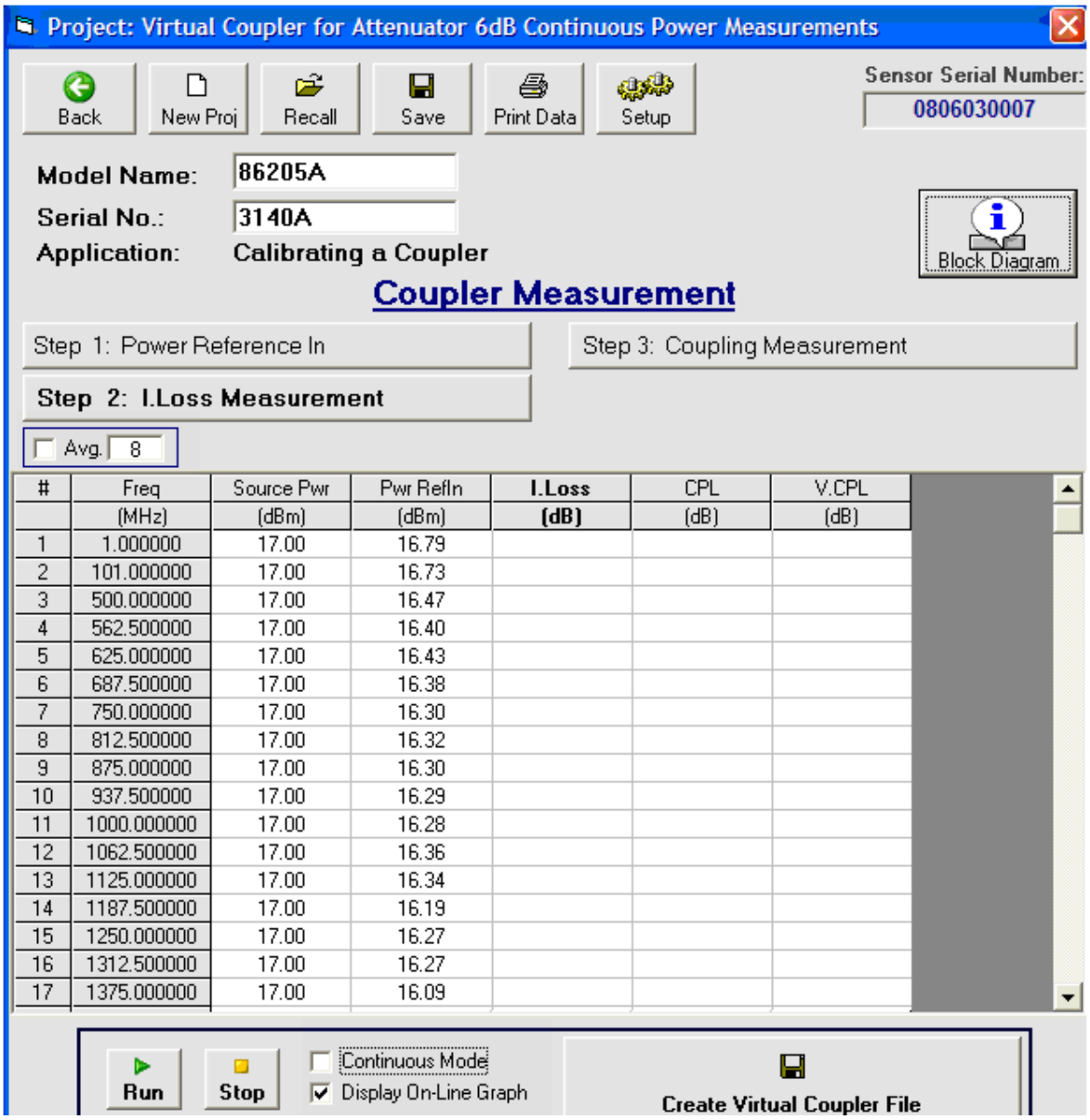
- **Step 15.** Press **Step 2: I Loss Measurements** key.

  The **I Loss Measurements** screen will open (see **Figure 48**).

- **Step 16.** Open **I Loss** measurement's **Block Diagram** setup (see **Figure 49**).

- **Step 17.** Assemble the **I Loss Measurement** equipment setup.

Figure 48: I. Loss Measurement screen

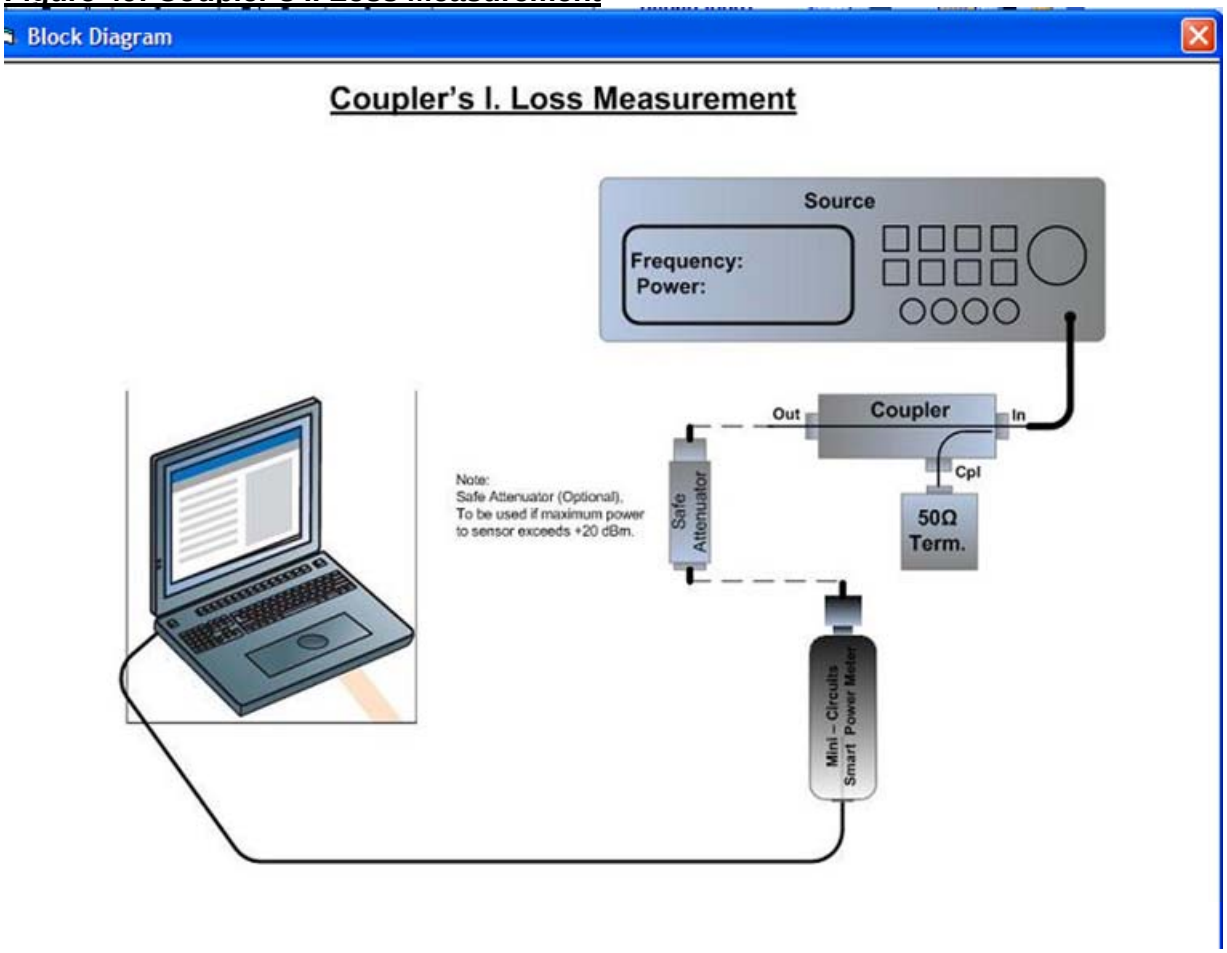


#	Freq (MHz)	Source Pwr (dBm)	Pwr RefIn (dBm)	I.Loss (dB)	CPL (dB)	V.CPL (dB)
1	1.000000	17.00	16.79			
2	101.000000	17.00	16.73			
3	500.000000	17.00	16.47			
4	562.500000	17.00	16.40			
5	625.000000	17.00	16.43			
6	687.500000	17.00	16.38			
7	750.000000	17.00	16.30			
8	812.500000	17.00	16.32			
9	875.000000	17.00	16.30			
10	937.500000	17.00	16.29			
11	1000.000000	17.00	16.28			
12	1062.500000	17.00	16.36			
13	1125.000000	17.00	16.34			
14	1187.500000	17.00	16.19			
15	1250.000000	17.00	16.27			
16	1312.500000	17.00	16.27			
17	1375.000000	17.00	16.09			

Note

Insure that of your source power does not exceed +20dBm. (In this step I. Loss will be minimal and source power will be close to power entering to the Power Sensor. See **Figure 49**)
If power does exceed +20dBm use a Safe Attenuator (see **chapter 8.**)

Figure 49: Coupler's I. Loss Measurement

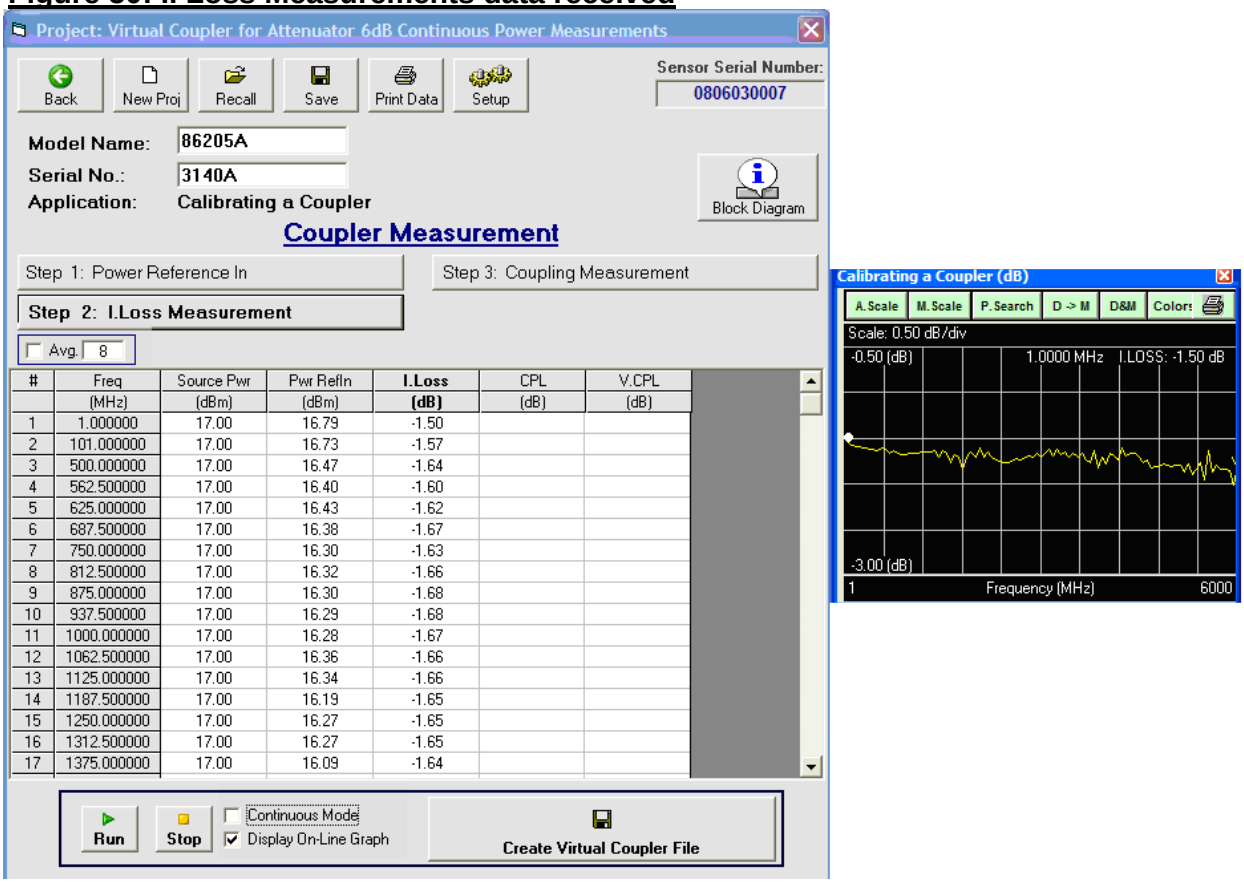


- **Step 18.** Press **Run** key to launch test. You can stop the test at any stage by pressing the **Stop** key. If **Continuous Mode** is not enabled test will finish after sweeping all segments. If **Continuous Mode** is enabled test will repeat until interrupted by **Stop** key.

  .

- **Step 19. I. Loss Measurements data** received (see **Figure 50**).

Figure 50: I. Loss Measurements data received



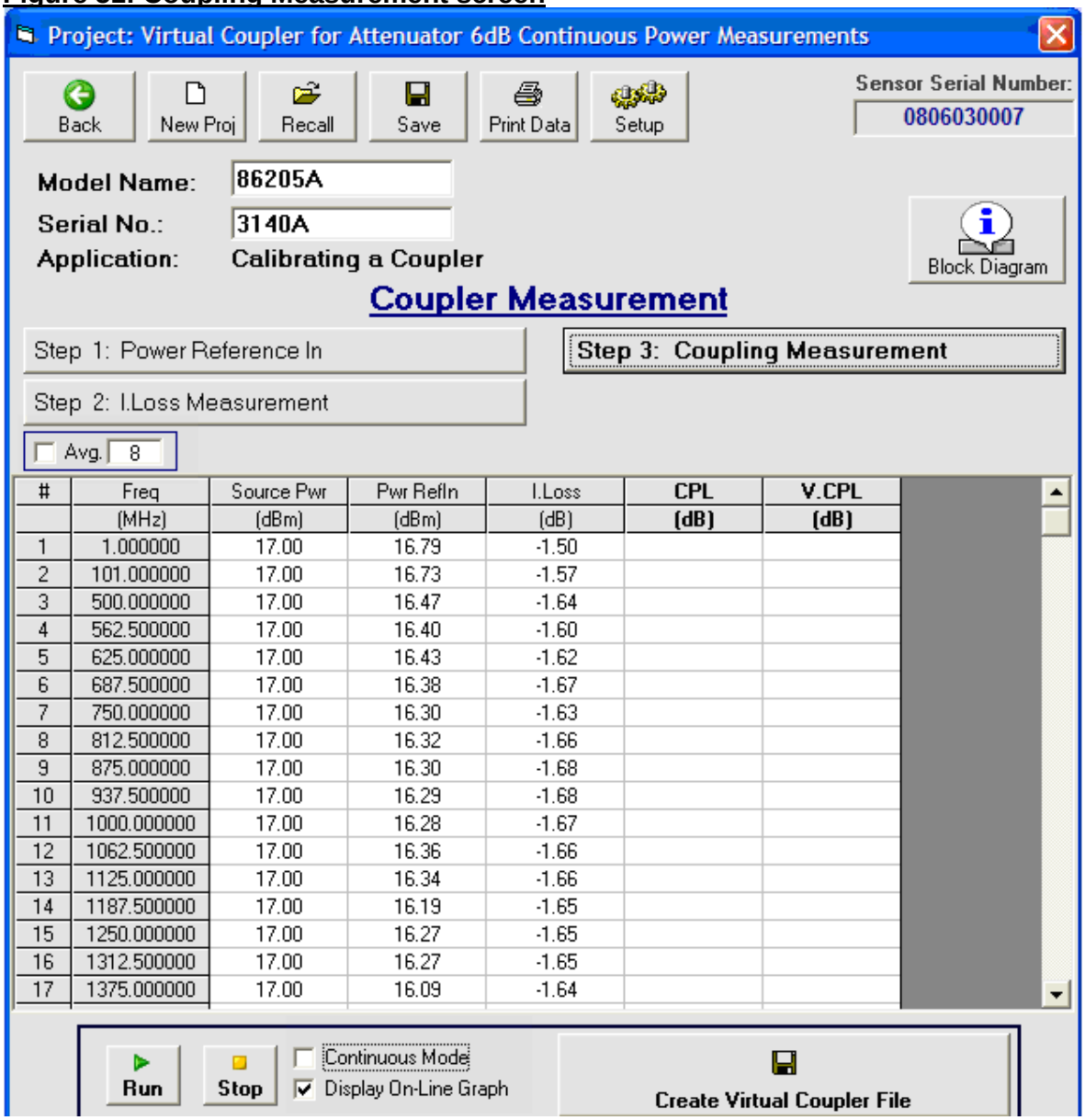
- **Step 20.** Press **Step 3: Coupling Measurement** key.

  The **Coupling Measurement** screen will open (see **Figure 51**).

- **Step 21.** Open **Coupling Measurement's Block Diagram** setup (see **Figure 52**).

- **Step 22.** Assemble the **Coupler Measurement** equipment setup.

Figure 51: Coupling Measurement screen



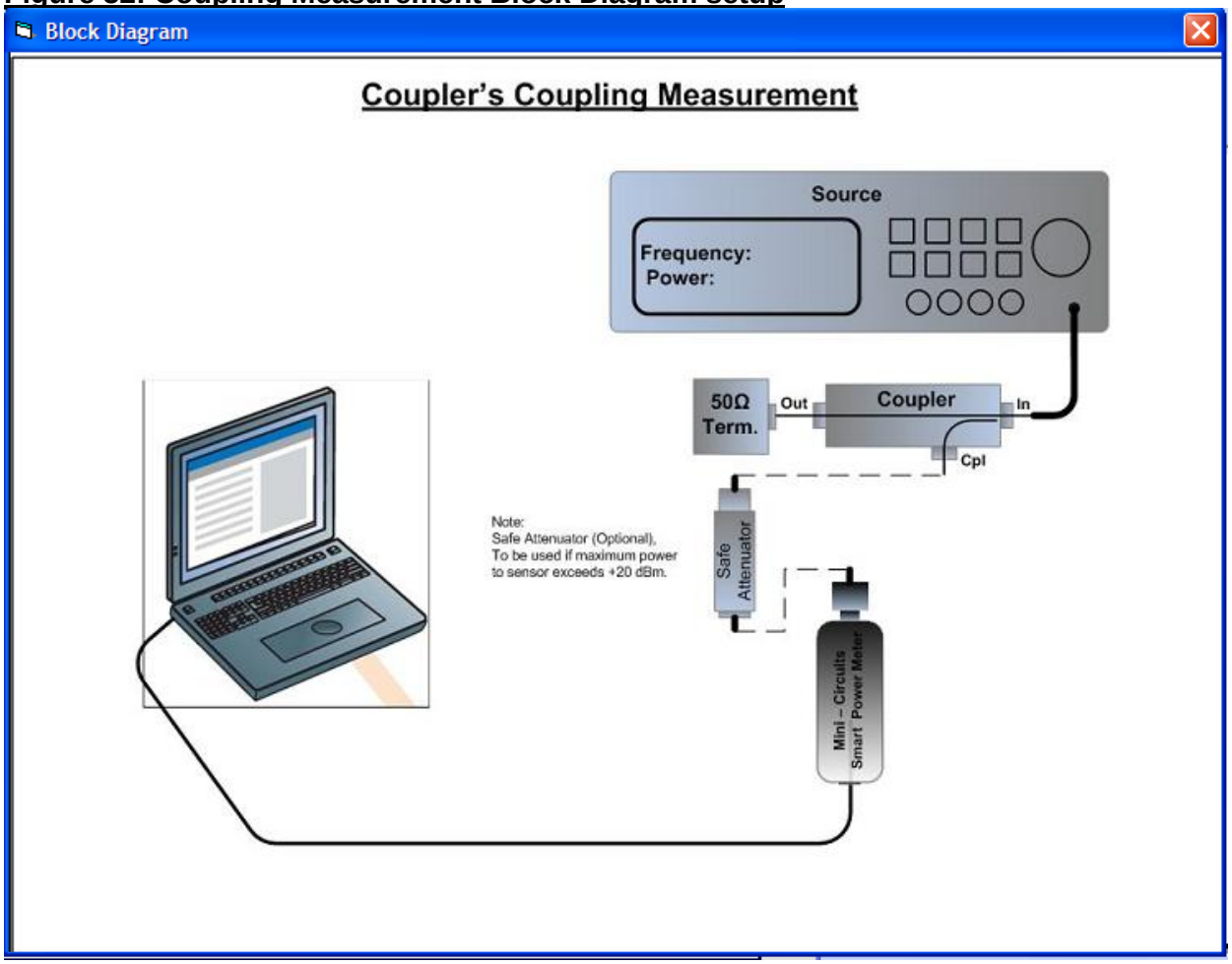
#	Freq (MHz)	Source Pwr (dBm)	Pwr RefIn (dBm)	I.Loss (dB)	CPL (dB)	V.CPL (dB)
1	1.000000	17.00	16.79	-1.50		
2	101.000000	17.00	16.73	-1.57		
3	500.000000	17.00	16.47	-1.64		
4	562.500000	17.00	16.40	-1.60		
5	625.000000	17.00	16.43	-1.62		
6	687.500000	17.00	16.38	-1.67		
7	750.000000	17.00	16.30	-1.63		
8	812.500000	17.00	16.32	-1.66		
9	875.000000	17.00	16.30	-1.68		
10	937.500000	17.00	16.29	-1.68		
11	1000.000000	17.00	16.28	-1.67		
12	1062.500000	17.00	16.36	-1.66		
13	1125.000000	17.00	16.34	-1.66		
14	1187.500000	17.00	16.19	-1.65		
15	1250.000000	17.00	16.27	-1.65		
16	1312.500000	17.00	16.27	-1.65		
17	1375.000000	17.00	16.09	-1.64		

Note

Insure final signal power at coupling port exceeds -30dBm to allowing accurate reading by Power Sensor (see Figure 52).

.

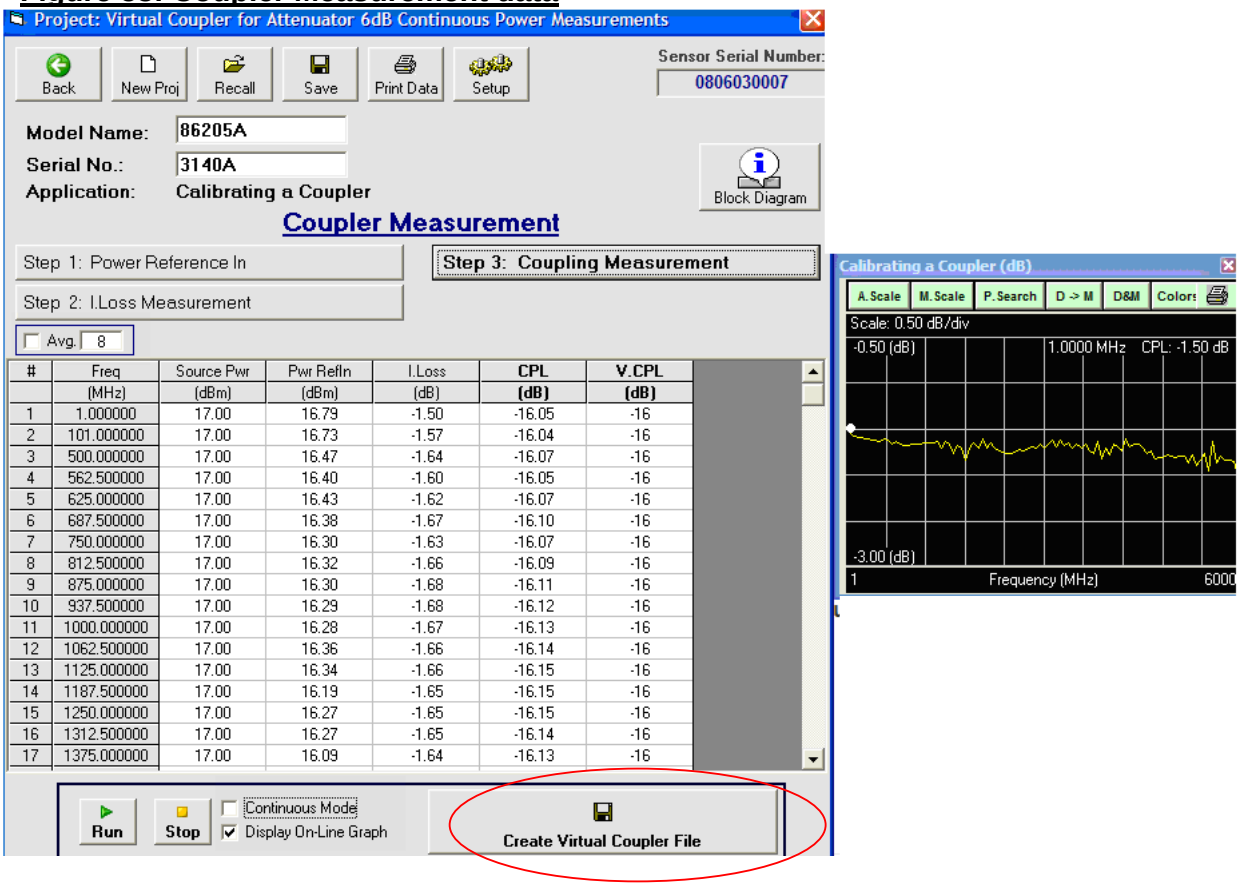
Figure 52: Coupling Measurement Block Diagram setup



- **Step 23.** Press **Run** key to launch test. You can stop the test at any stage by pressing the **Stop** key. If **Continuous Mode** is not enabled test will finish after sweeping all segments. If **Continuous Mode** is enabled test will repeat until interrupted by **Stop** key.

- **Step 24.** Final **Coupler Measurement** data received **(**see **Figure 53**).

Figure 53: Coupler Measurement data



- **Step 25.** Save your project data (see **3.3.1.3 Save Function** on **page 16** for explanation).

- **Step 26**. Press **Create Virtual Coupler File** key to create a Virtual Coupler. (see a sample **Virtual Coupler** created as an **ASCII File** in **Figure 54**).

- **Step 27.** You can print your test data (see **3.6 Printing Data Function** on **page 23** for explanation).

Figure 54: Virtual Coupler ASCII file

3140A_VIRTUAL_CPL_16dB - Notepad

File Edit Format View Help

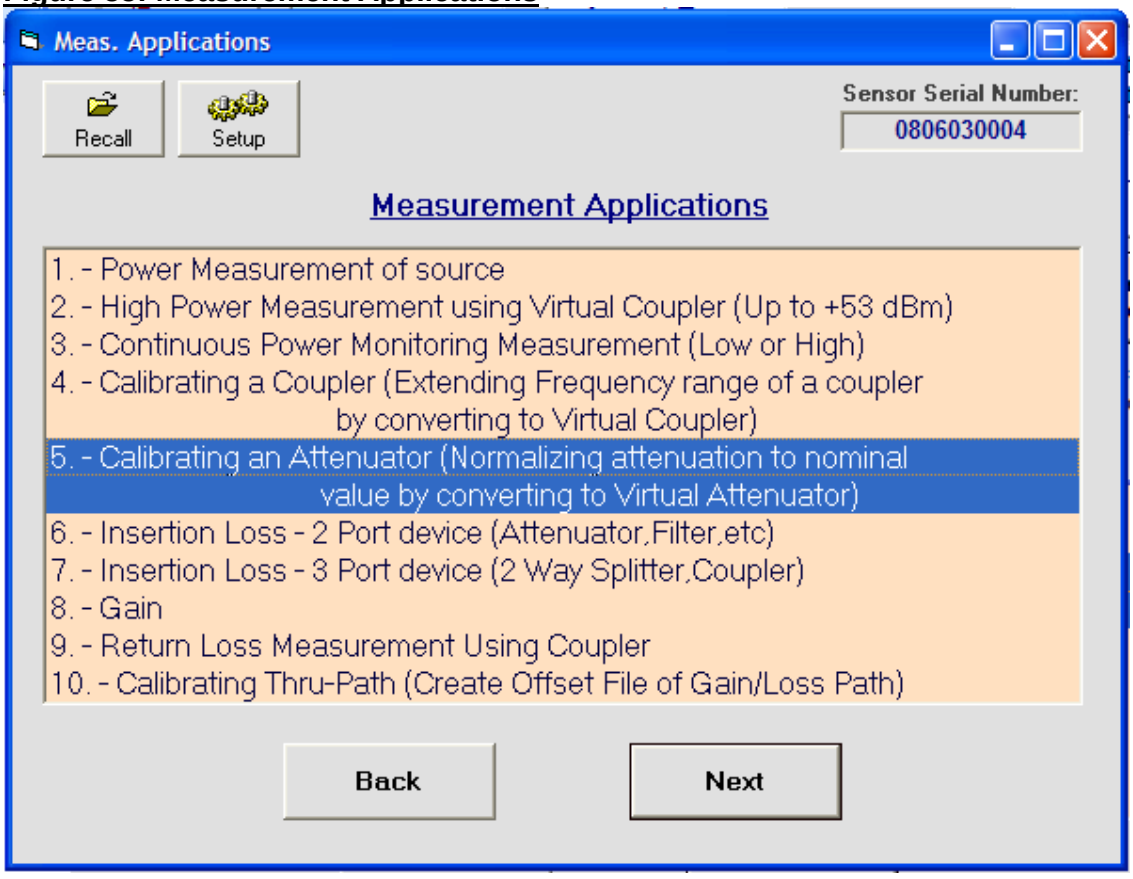
```
! Mini-Circuits
Virtual Coupling File for Coupler Part No: 86205A Serial Number: 3140A
! Created By: Power Meter Software
! Using Power Sensor: Part No: PWR-6G+ Serial Number: 0806030007
! Power Rating: 0.32
! Created On: Jan 14,10
!**Note: Virtual Coupling frequency is limited by the In/Out Return Loss of the actual Coupler.
!
!              --------Actual--------      --------Virtual--------
!Frequency      I.LOSS         Coupling      I.LOSS         Coupling
!    (MHz)       (dB)           (dB)          (dB)           (dB)
    1.000000   -1.50          -16.05          0             -16
  101.000000   -1.57          -16.04          0             -16
  500.000000   -1.64          -16.07          0             -16
  562.500000   -1.60          -16.05          0             -16
  625.000000   -1.62          -16.07          0             -16
  687.500000   -1.67          -16.10          0             -16
  750.000000   -1.63          -16.07          0             -16
  812.500000   -1.66          -16.09          0             -16
  875.000000   -1.68          -16.11          0             -16
  937.500000   -1.68          -16.12          0             -16
 1000.000000   -1.67          -16.13          0             -16
 1062.500000   -1.66          -16.14          0             -16
 1125.000000   -1.66          -16.15          0             -16
 1187.500000   -1.65          -16.15          0             -16
 1250.000000   -1.65          -16.15          0             -16
 1312.500000   -1.65          -16.14          0             -16
 1375.000000   -1.64          -16.13          0             -16
 1437.500000   -1.70          -16.15          0             -16
 1500.000000   -1.64          -16.11          0             -16
 1562.500000   -1.67          -16.15          0             -16
 1625.000000   -1.77          -16.24          0             -16
 1687.500000   -1.68          -16.22          0             -16
 1750.000000   -1.70          -16.26          0             -16
```

8.0 Application # 5- Calibrating an Attenuator.

This chapter describes the process of calibrating an attenuator or filter and creating a Virtual Attenuator file allowing the use of a safe attenuator or harmonic suppression filter in future measurements without reducing measurement accuracy. Safe attenuators are needed for any measurement involving power over +20dBm to prevent damage to the power sensor**.** Harmonic suppression filters are used when D.U.T is in compression or in combination with a Virtual Coupler. Before you can calibrate an Attenuator you must establish a Reference Power measurement described in **3.3** on **page 11.**

- **Step 1.** Open a project from the **Measurement Applications** screen (see **Figure 55**).

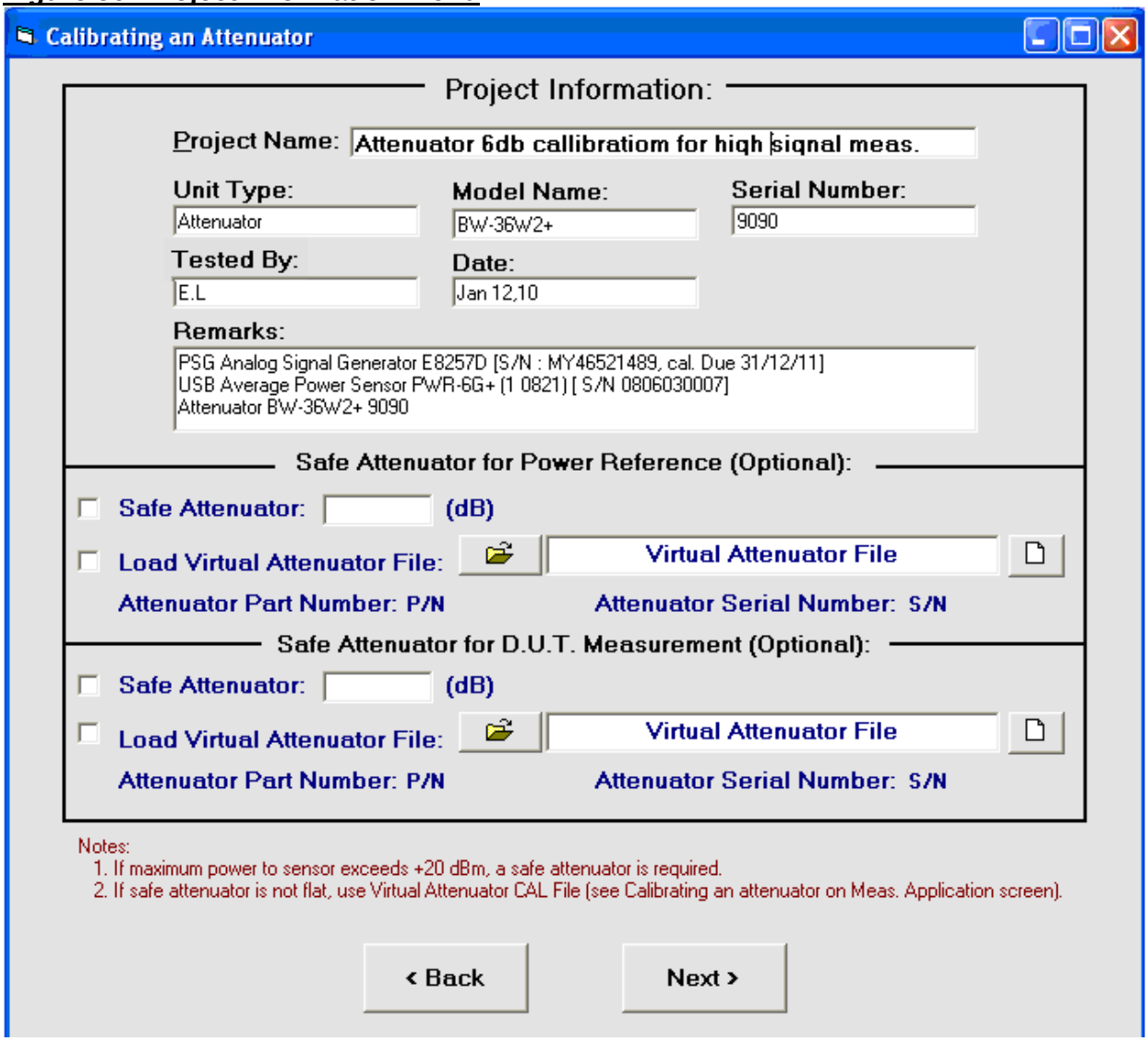
Figure 55: Measurement Applications



- **Step 2.** The **Project Information menu** will open (see **Figure 56**)**.**

- **Step 3.** Review and fill all necessary fields in the **Project Information menu** see detailed explanation Figure **4** and **Table 3** at **page 9**.

Figure 56: Project Information menu



- **Step 4.** Press **Next** key The **Test Plan** screen will open (see **Figure57**).

- **Step 5.** You can choose one of two options to build the measurement points set (see **Chapter 3.2, Figures 5-6** on **pages 10-11**).

- **Step 6.** Create the measurement points and set input power (you can see an explanation and an example in **Figure 5** on **page 10**).

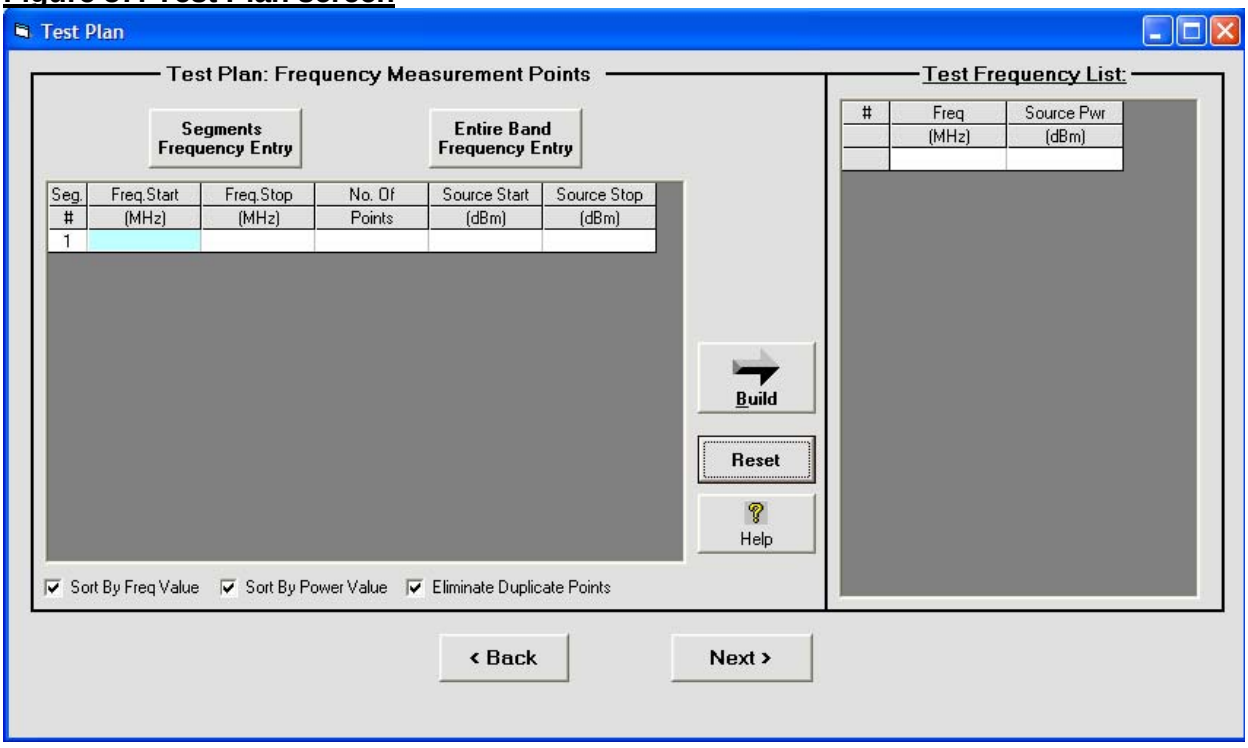
Note

Choose as high power as available in Measurement Applications that does not reach the maximum limit of power sensor, or the compression level of the measurement setup components.
This will guaranty minimum distortion in the dynamic range available for measurement.

.

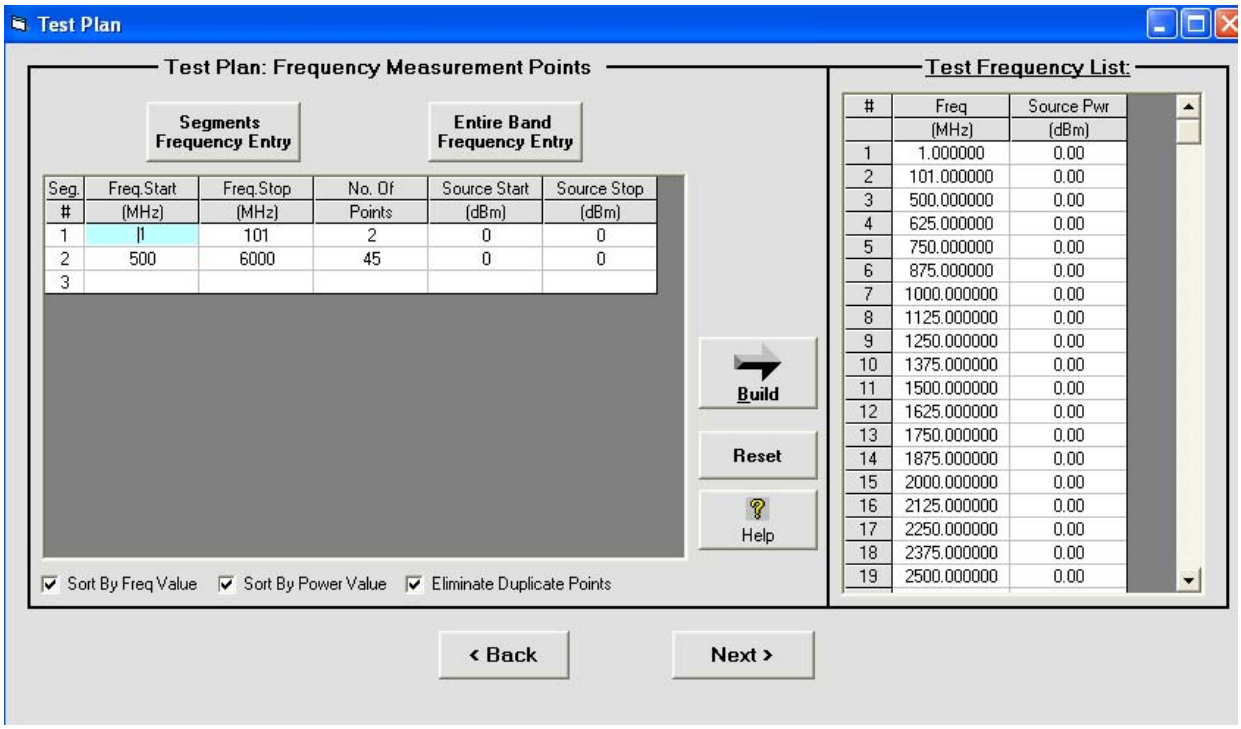
.

Figure 57: Test Plan screen



- **Step 7**. Press **Build** key to create a **Test Frequency List** (see **Figure 58**).

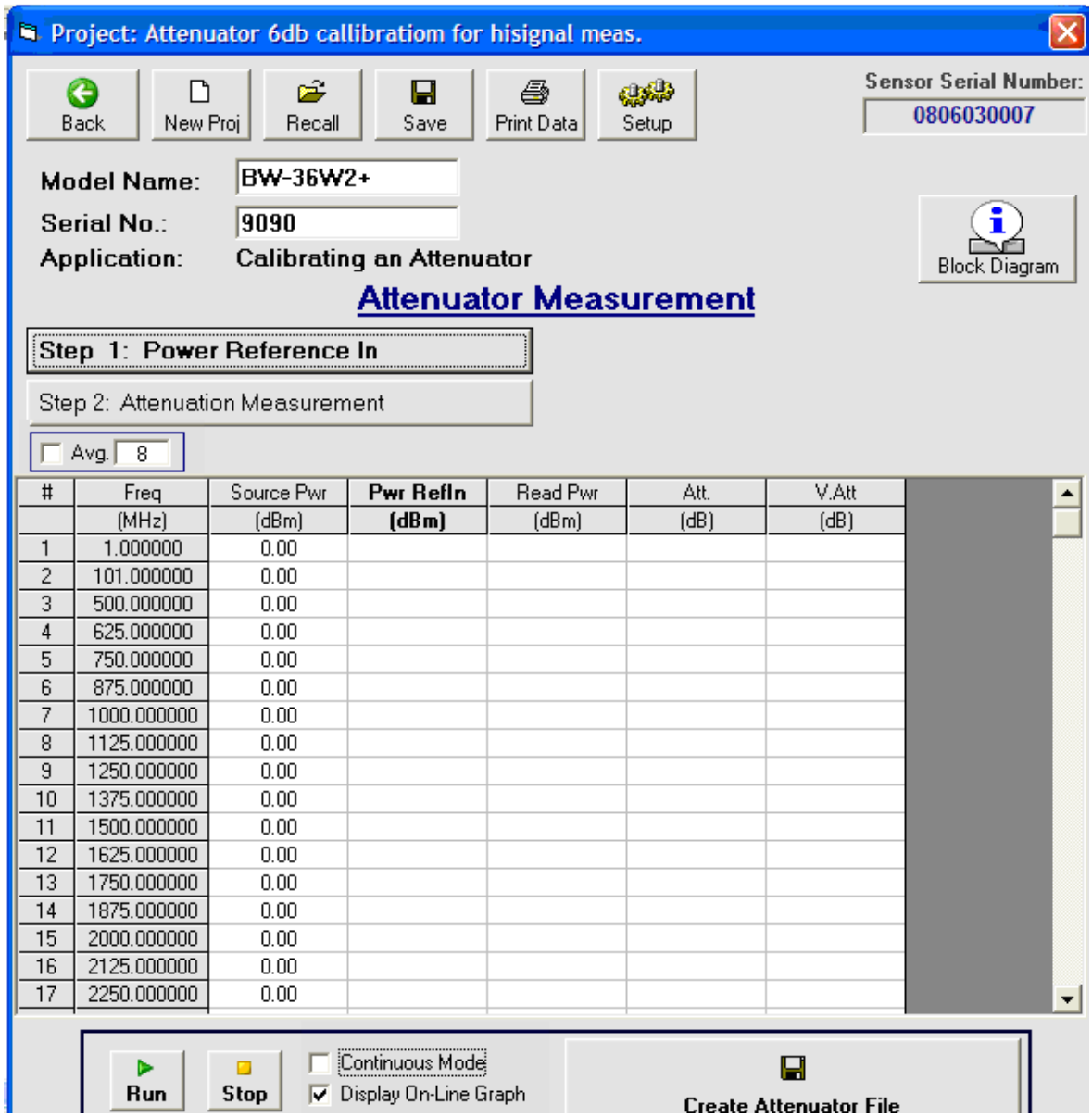
Figure 58: creating Test Frequency List



- **Step 8.** Press **Next** key.
  The **Attenuator Measurement** screen will open. (see **Figure 59**).
  Validate desirable data transferred from the previous screen.
  During all following steps you can use **Recall** and **Save** keys at all stages (see **3.3.1.2 Recall** on **page 15 , 3.3.1.3 Save** on **page 16** for explanation)**.**

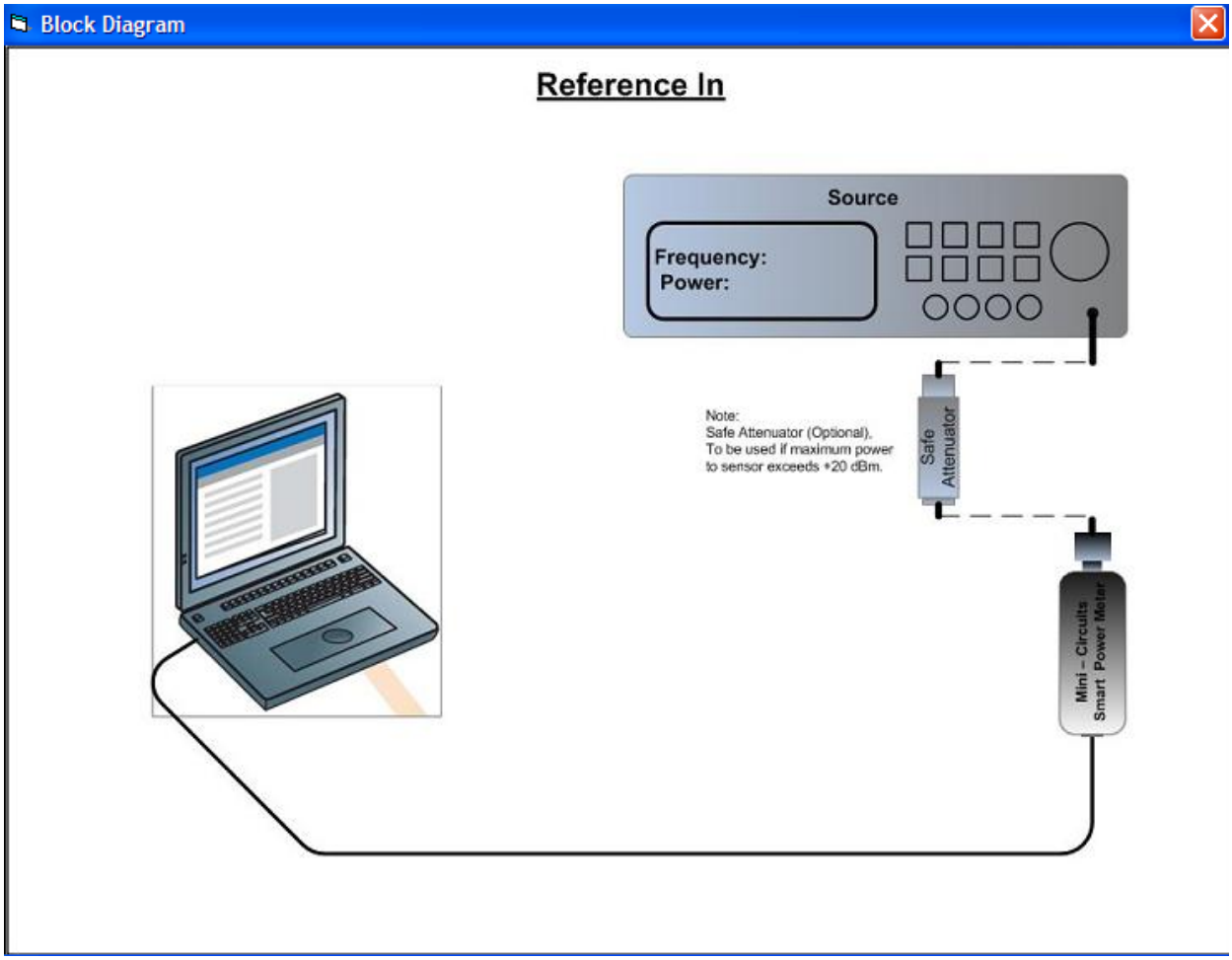
- **Step 9.** Press **Step 1: Power Reference In** key.

Figure 59: Attenuator Measurement screen



- **Step 10.** Open **Power Reference In** measurement's **Block Diagram** setup (see **Figure 60**).
- **Step 11.** Assemble the **Power Reference In** equipment setup.
- **Step 12.** Define/Confirm **Setup** settings (see 2.1**. Setting communication/commands in order to control an external source.** on **page 5**).

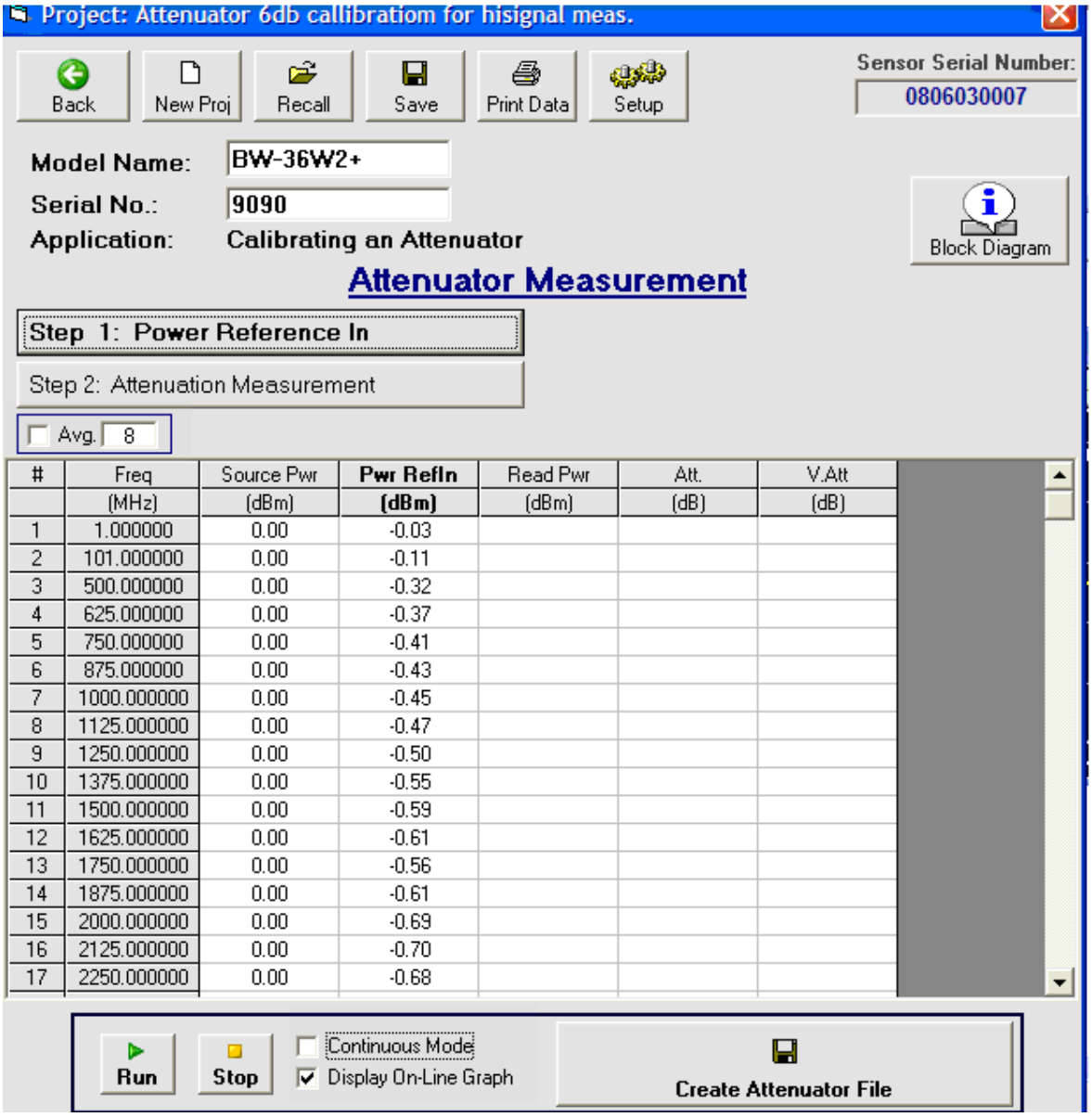
Figure 60: Power Reference In Block Diagram .



- **Step 13.** Press **Run** key to launch test. You can stop the test at any stage by pressing the **Stop** key. If **Continuous Mode** is not enabled test will finish after sweeping all segments. If **Continuous Mode** is enabled test will repeat until interrupted by **Stop** key.

- **Step 14** See results in **Figure 61.**

Figure 61: Attenuator Measurement screen



#	Freq (MHz)	Source Pwr (dBm)	**Pwr RefIn (dBm)**	Read Pwr (dBm)	Att. (dB)	V.Att (dB)
1	1.000000	0.00	-0.03			
2	101.000000	0.00	-0.11			
3	500.000000	0.00	-0.32			
4	625.000000	0.00	-0.37			
5	750.000000	0.00	-0.41			
6	875.000000	0.00	-0.43			
7	1000.000000	0.00	-0.45			
8	1125.000000	0.00	-0.47			
9	1250.000000	0.00	-0.50			
10	1375.000000	0.00	-0.55			
11	1500.000000	0.00	-0.59			
12	1625.000000	0.00	-0.61			
13	1750.000000	0.00	-0.56			
14	1875.000000	0.00	-0.61			
15	2000.000000	0.00	-0.69			
16	2125.000000	0.00	-0.70			
17	2250.000000	0.00	-0.68			

- **Step 15. Press** **Step 2: Attenuation Measurement** key.

  The **Attenuation Measurement** screen will open (see **Figure 62**).

- **Step 16.** Open **Attenuation Measurement's Block Diagram** setup (see **Figure 63**).

- **Step 17.** Assemble the Attenuation measurement equipment setup.

- **Step 18.** Press **Run** key to launch test. You can stop the test at any stage by pressing the **Stop** key. If **Continuous Mode** is not enabled test will finish after sweeping all segments. If **Continuous Mode** is enabled test will repeat until interrupted by **Stop** key.

Figure 62: Attenuator Measurement screen

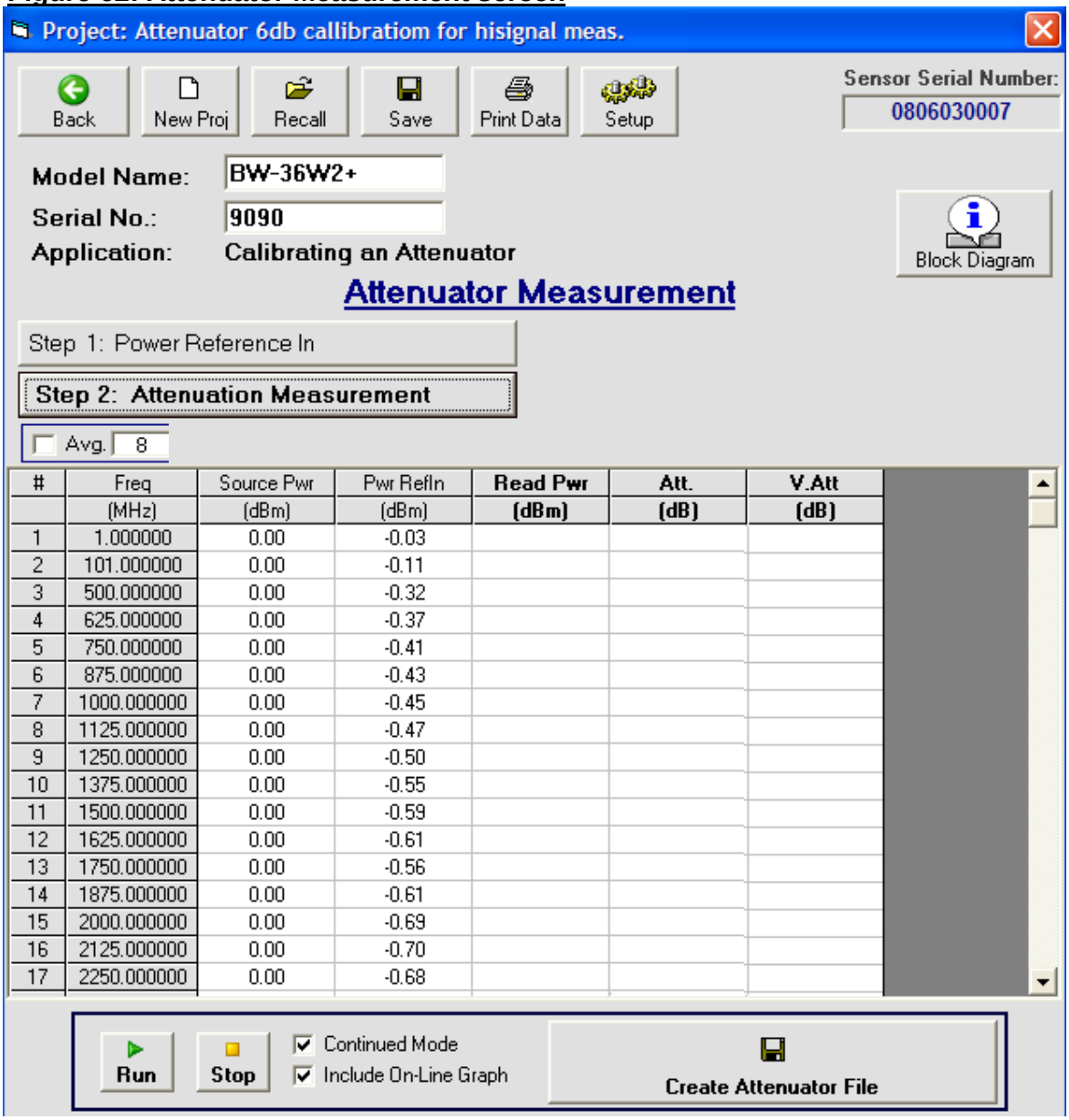
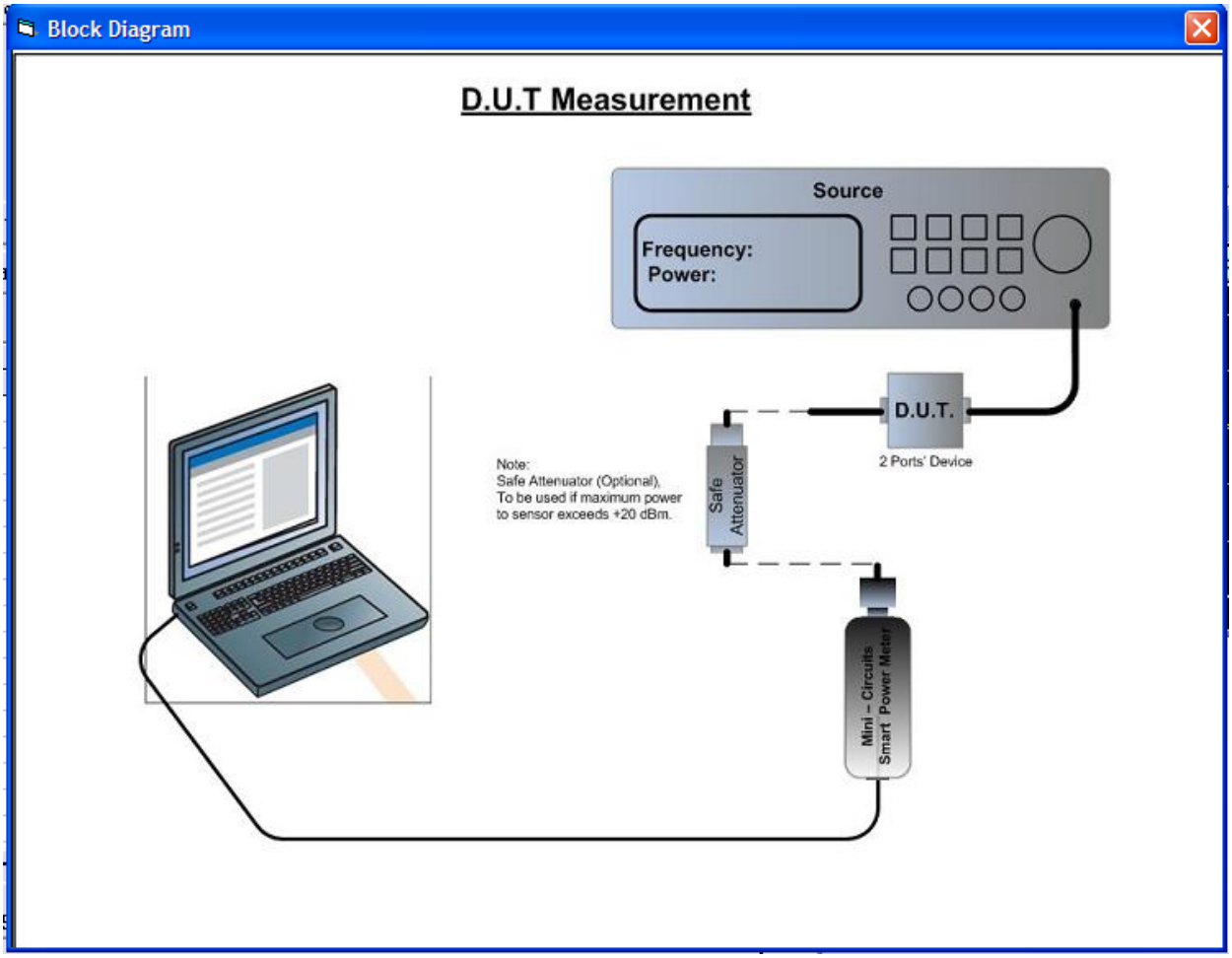


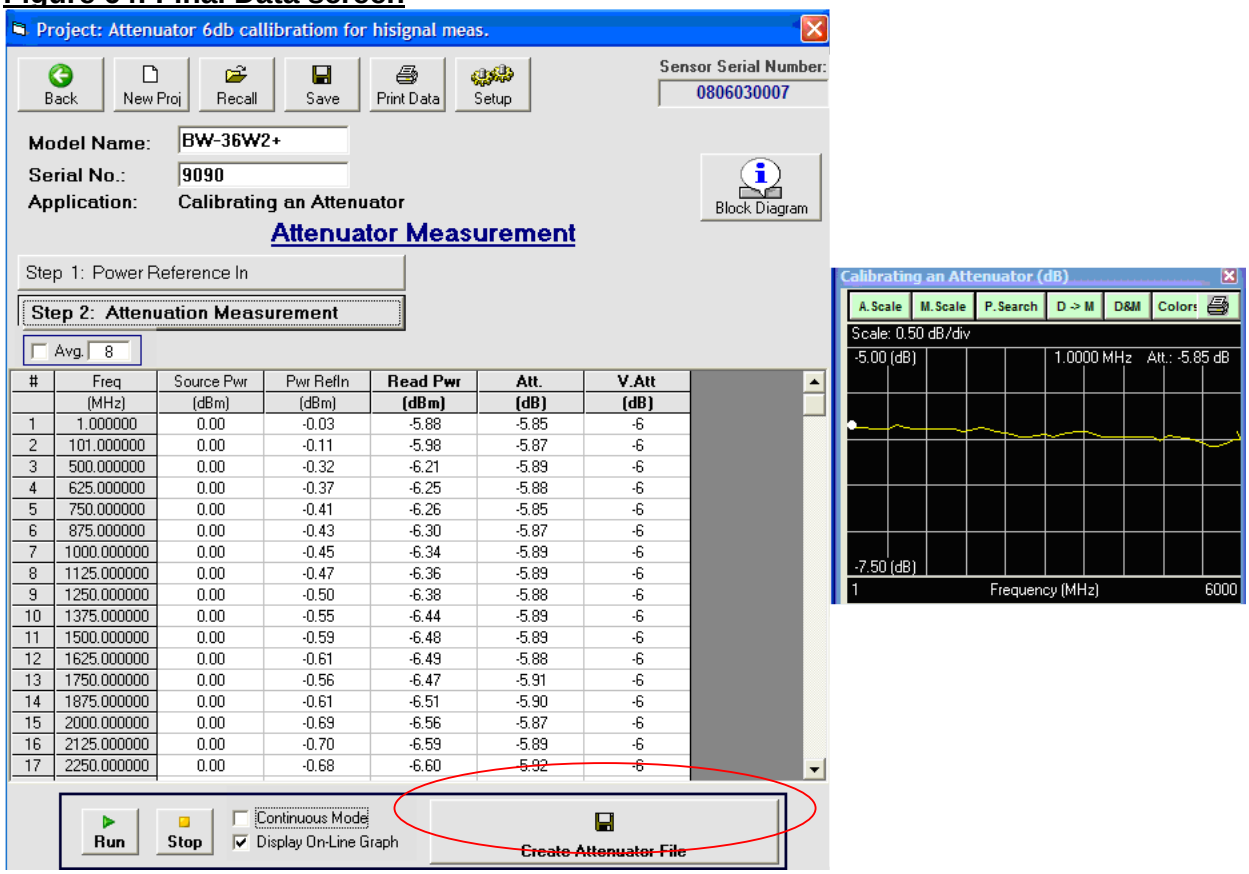
Figure 63: D.U.T measurement Block Diagram.



- **Step 19.** You can enable **On-Line Graph** option.
  (see 3.5 **On-Line Graph features page 22**).

- **Step 20 Final Attenuation** data received (see **Figure 64**).

Figure 64: Final Data screen

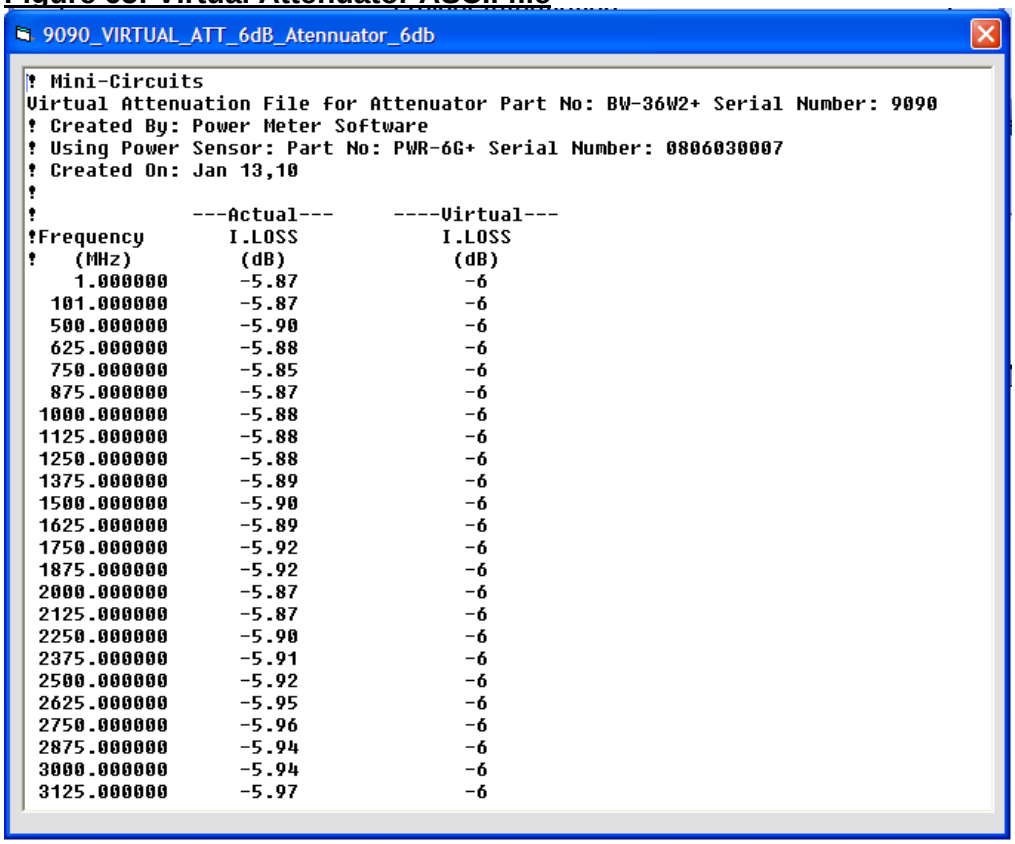


- **Step 21.** Save your project data (see **3.3.1.3 Save Function** on **page 16** for explanation).

- **Step 22.** You can print your test data (see **3.6 Printing Data Function** on **page 23** for an explanation)

- **Step 23**. Press **Create Attenuator File** key to create Virtual Attenuator. (see a sample **Virtual Attenuator** created as an **ASCII file** in **Figure 65**).

Figure 65: Virtual Attenuator ASCII file



9090_VIRTUAL_ATT_6dB_Atennuator_6db

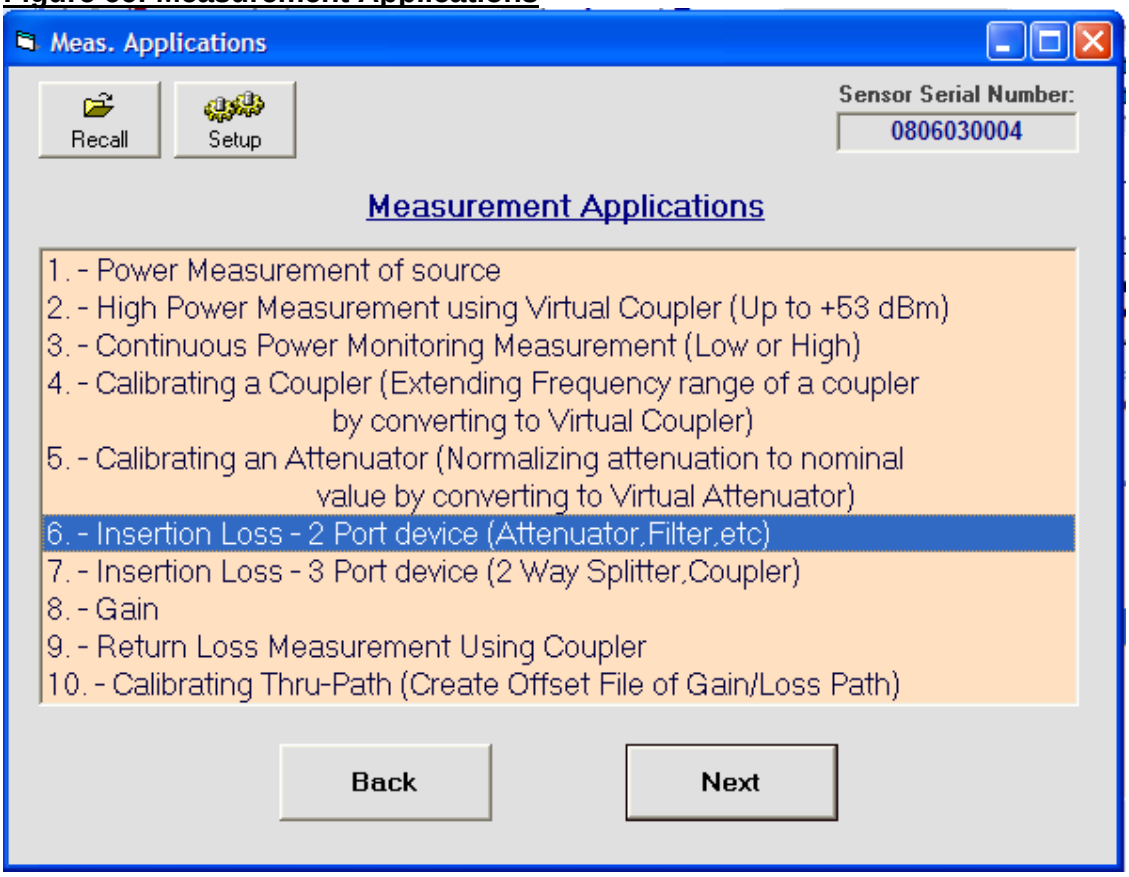
```
! Mini-Circuits
Virtual Attenuation File for Attenuator Part No: BW-36W2+ Serial Number: 9090
! Created By: Power Meter Software
! Using Power Sensor: Part No: PWR-6G+ Serial Number: 0806030007
! Created On: Jan 13,10
!
!             ---Actual---     ----Virtual---
!Frequency       I.LOSS            I.LOSS
!   (MHz)         (dB)              (dB)
    1.000000      -5.87              -6
  101.000000      -5.87              -6
  500.000000      -5.90              -6
  625.000000      -5.88              -6
  750.000000      -5.85              -6
  875.000000      -5.87              -6
 1000.000000      -5.88              -6
 1125.000000      -5.88              -6
 1250.000000      -5.88              -6
 1375.000000      -5.89              -6
 1500.000000      -5.90              -6
 1625.000000      -5.89              -6
 1750.000000      -5.92              -6
 1875.000000      -5.92              -6
 2000.000000      -5.87              -6
 2125.000000      -5.87              -6
 2250.000000      -5.90              -6
 2375.000000      -5.91              -6
 2500.000000      -5.92              -6
 2625.000000      -5.95              -6
 2750.000000      -5.96              -6
 2875.000000      -5.94              -6
 3000.000000      -5.94              -6
 3125.000000      -5.97              -6
```

9.0 Application # 6- Insertion Loss – 2 Port device (Attenuator, Filter, etc).

This chapter describes the process of measuring the insertion loss of a two port device (for example a filter or attenuator). Before you can begin measurements you must establish a Reference Power measurement described in **3.3** on **page 11.** If the measurements are preformed with high power (above +20dBm) you will need safe attenuator at the power sensor input to prevent damage. If the Safe Attenuator is not flat use a Virtual Attenuator CAL file (see Virtual Attenuator in **chapter 8.)** Data output of this measurement will be in [-dB] units.

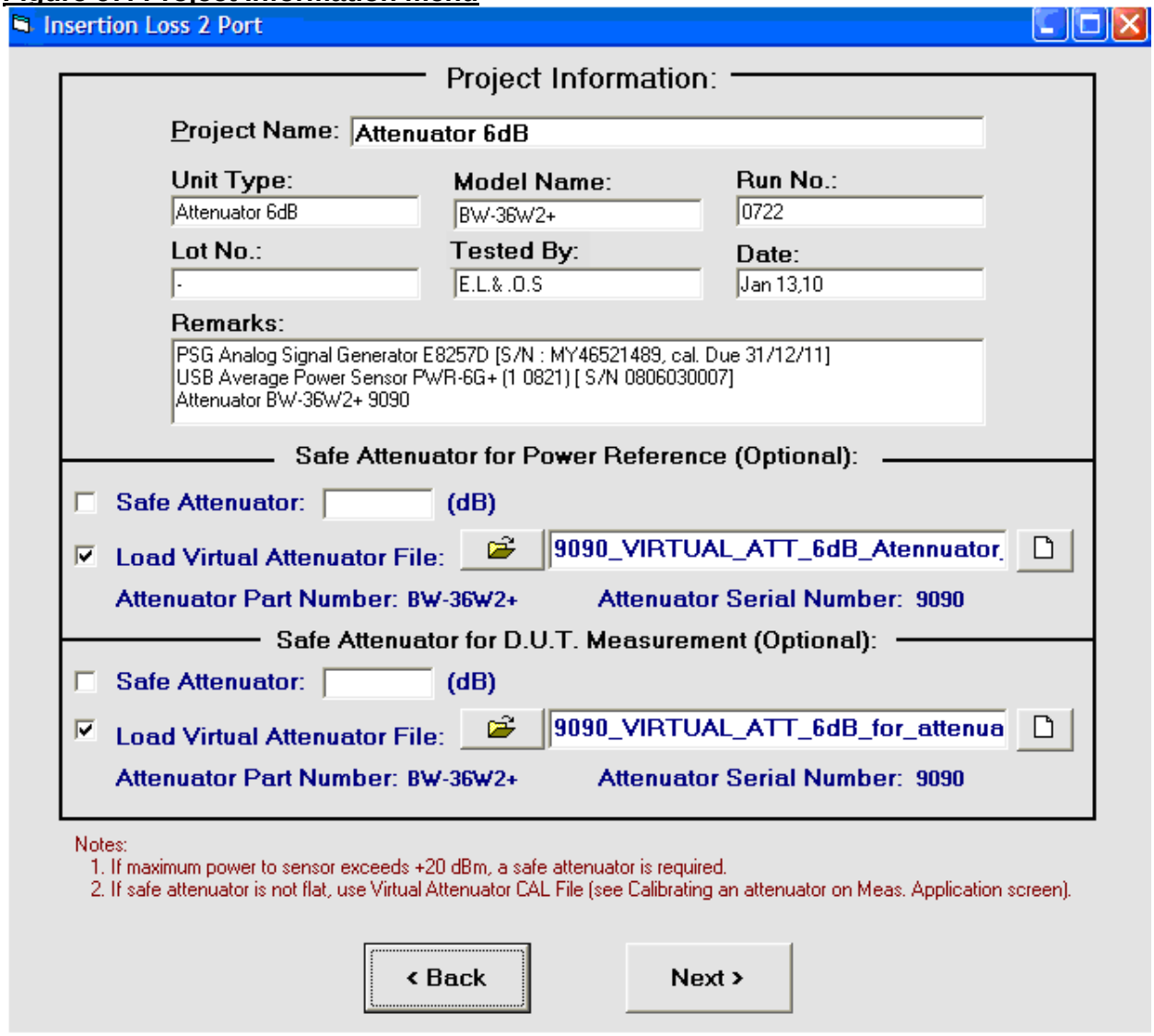
- **Step 1.** Open a project from the **Measurement Applications** screen (see **Figure 66**)

Figure 66: Measurement Applications



- **Step 2.** The **Project Information menu** will open (see **Figure 67**).
- **Step 3.** Review and fill all necessary fields in the **Project Information menu** see detailed explanation **Figure 4** and **Table 3** at **pages 9-10.**

Figure 67: Project Information menu



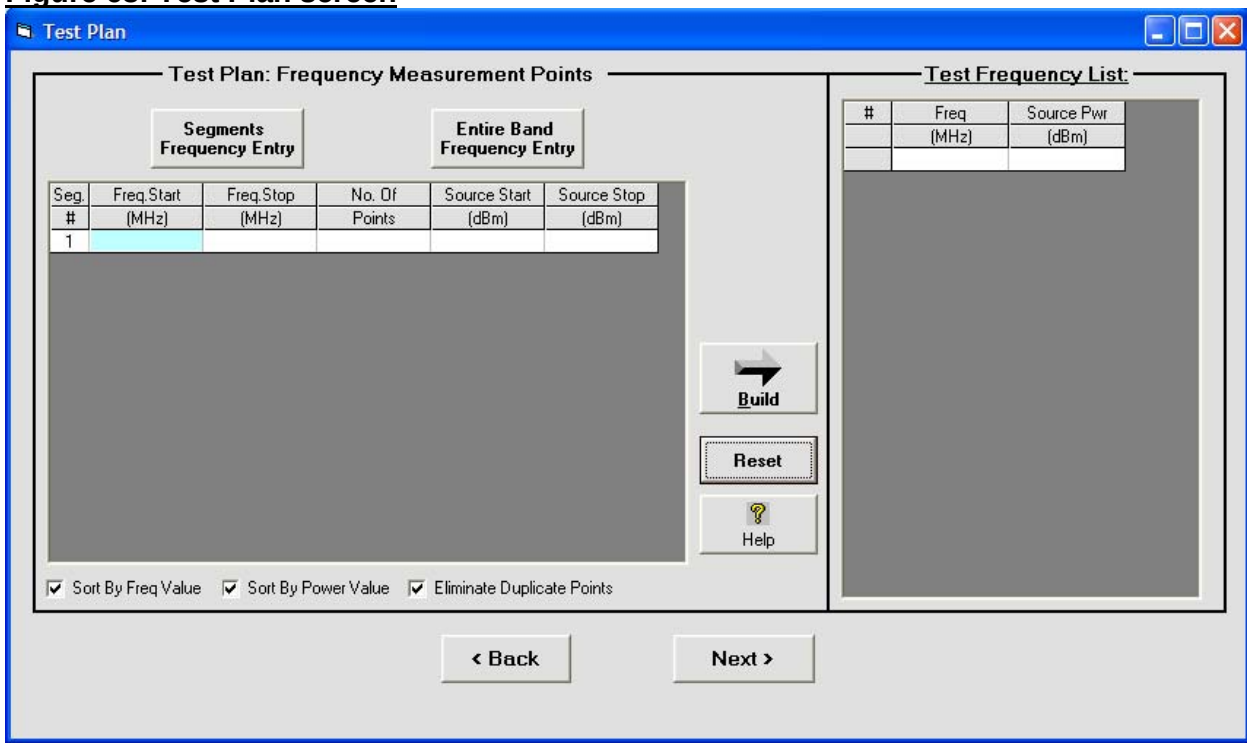
Note 1. If maximum power to sensor exceeds +20dBm, a safe attenuator is required
2. If safe attenuator is not flat, use Virtual Attenuator file. See creation of Virtual Attenuator **Chapter 8**

- **Step 4.** Press **Next** key.
  The **Test Plan** screen will open (see **Figure 68**).

- **Step 5.** You can choose one of two options to build the measurement points set (see **Chapter 3.2, Figures 5-6** on **pages 10-11**).

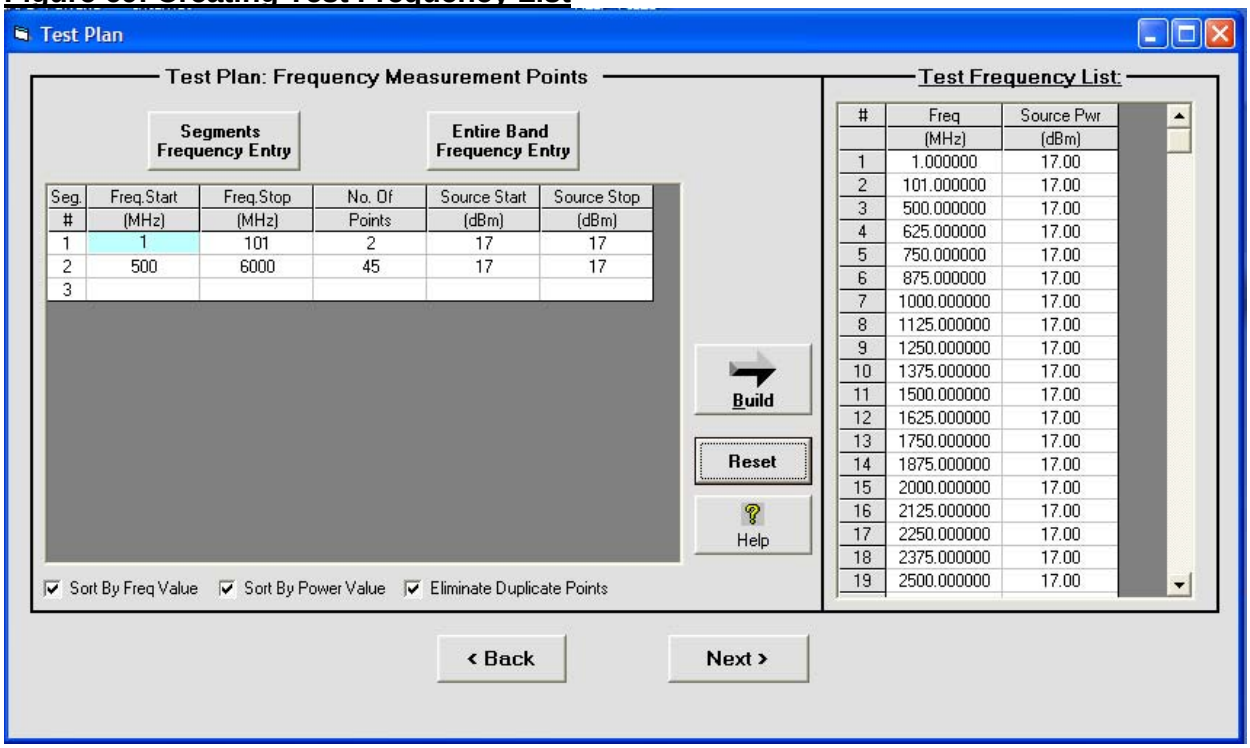
- **Step 6.** Create the measurement points and set input power (you can see an explanation and an example in **Figure 5** on **page 9**).

Figure 68: Test Plan screen



- **Step 7.** Press **Build** key to create a **Test Frequency List (**see **Figure 69**).

Figure 69: Creating Test Frequency List



- **Step 8.** Press **Next** key. The **I.LOSS Measurement** screen will open. (see **Figure 70**) Validate desirable data transferred from the previous screen. During all following steps you can use **Recall and Save** keys at all stages (see **3.3.1.2 Recall** on **page 15 , 3.3.1.3 Save** on **page 16** for explanation).

- **Step 9.** Press **Step 1: Power Reference In** key.

- **Step 10.** Open **Power Reference In** measurement's **Block Diagram** setup (see **Figure 71**).

- **Step 11.** Assemble the **Power Reference In** equipment setup.

- **Step 12.** Define/Confirm **Setup** settings (see 2.1**. Setting communication/commands in order to control an external source.** on **page 5**).

Figure 70: I.LOSS Measurement screen

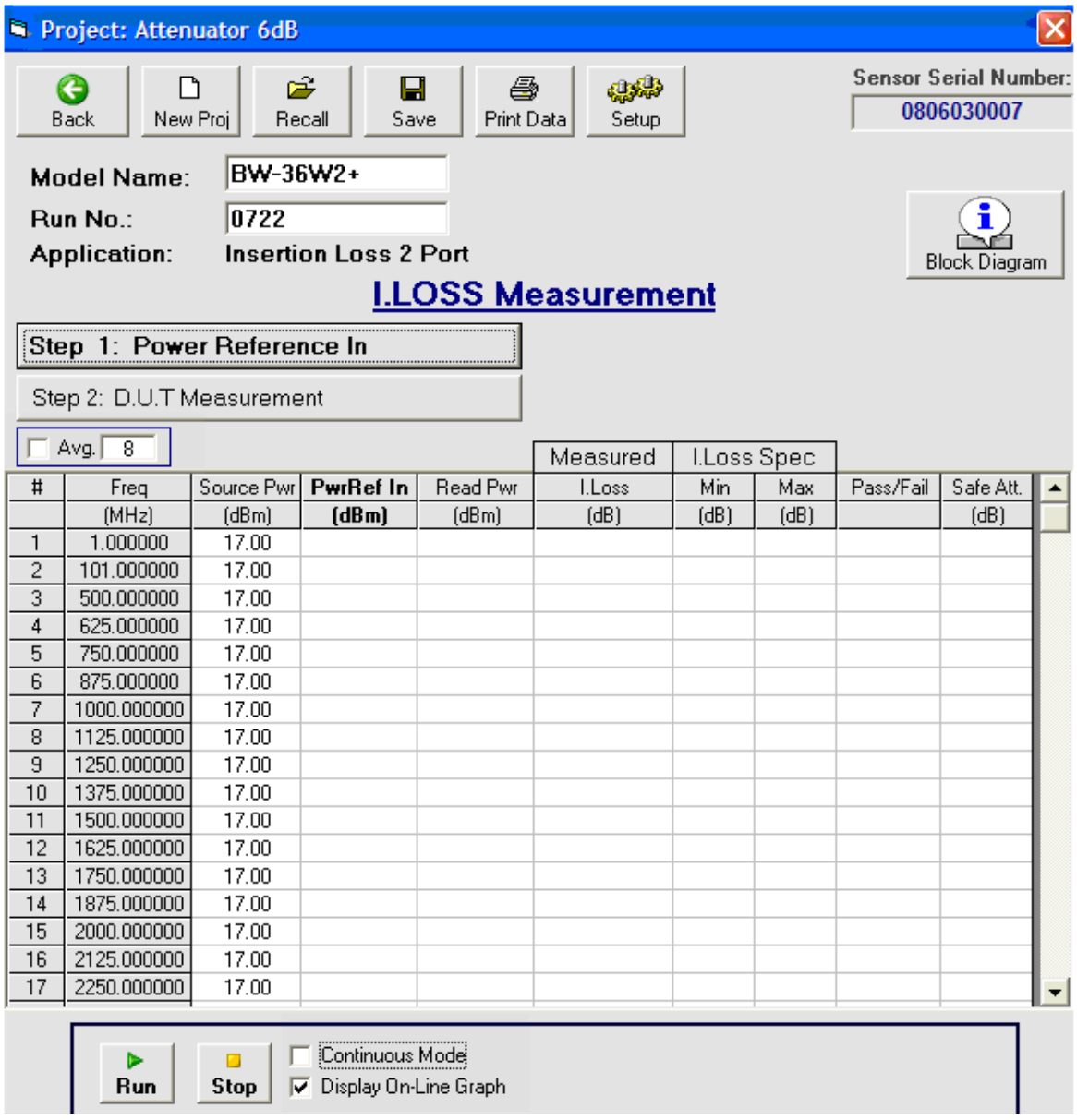
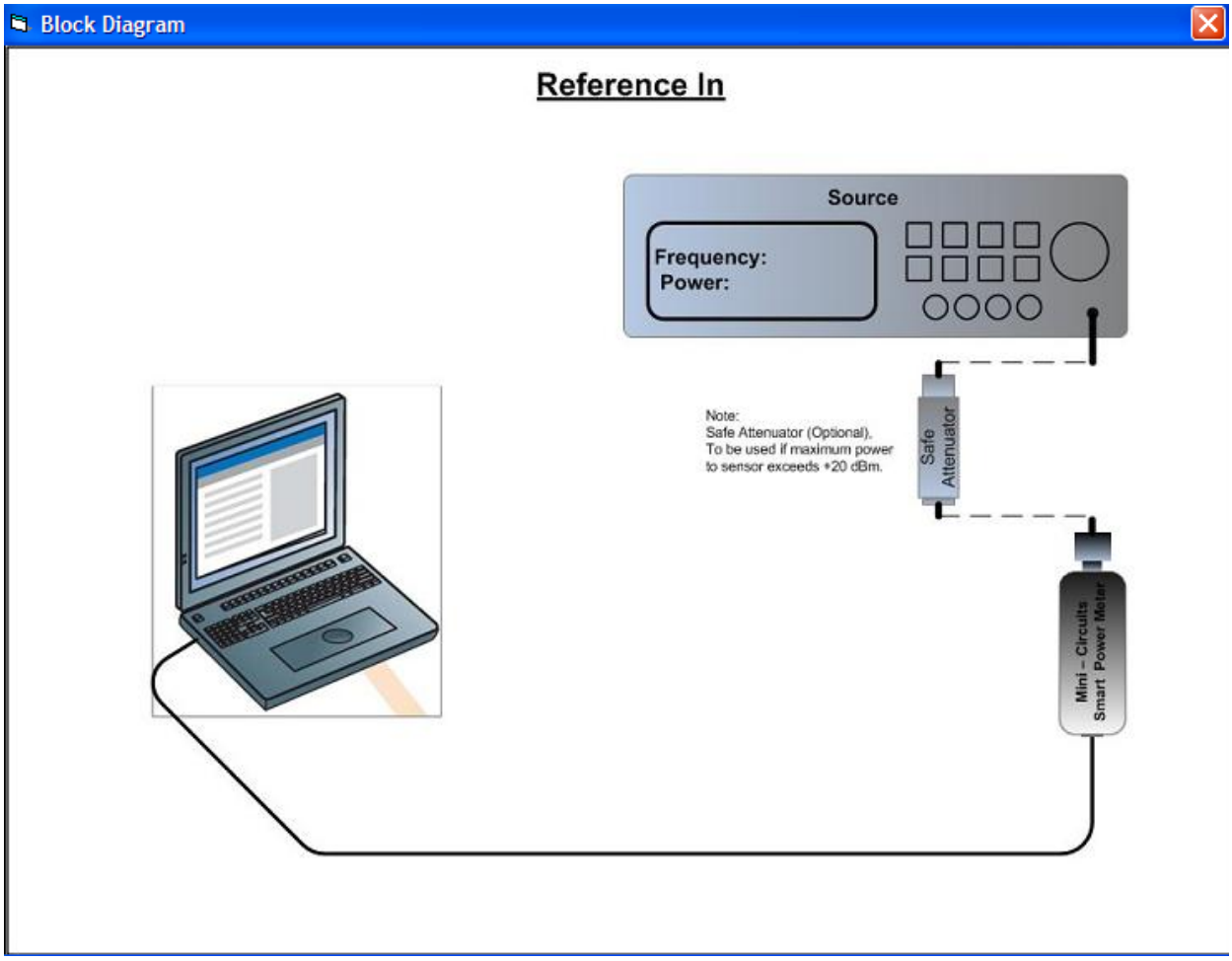
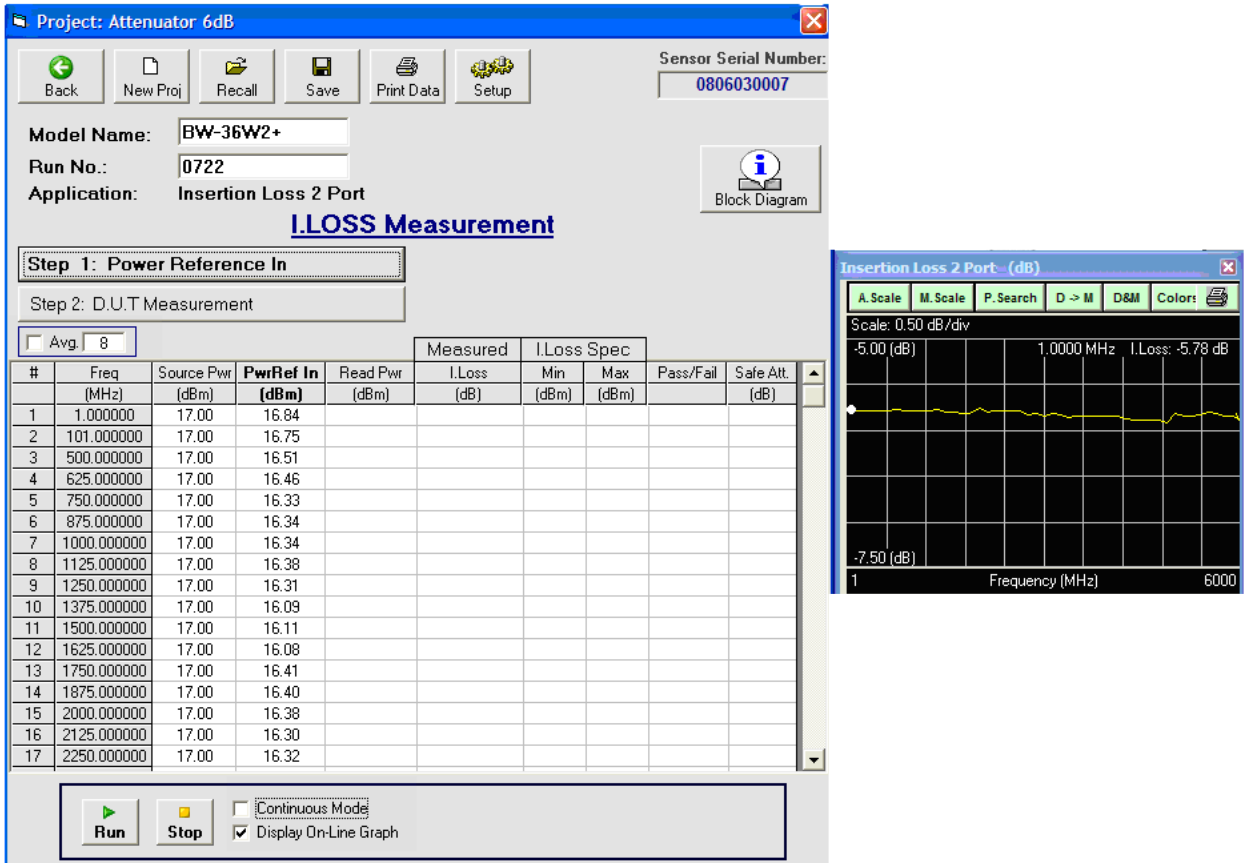


Figure 71: Power Reference In Block Diagram



- **Step 13.** Press **Run key** to launch test. You can stop the test at any stage by pressing the **Stop** key. If **Continuous Mode** is not enabled test will finish after sweeping all segments. If **Continuous Mode** is enabled test will repeat until interrupted by **Stop** key.
  .
- **Step 14** See results in **Figure 72.**

Figure 72: Power Reference In



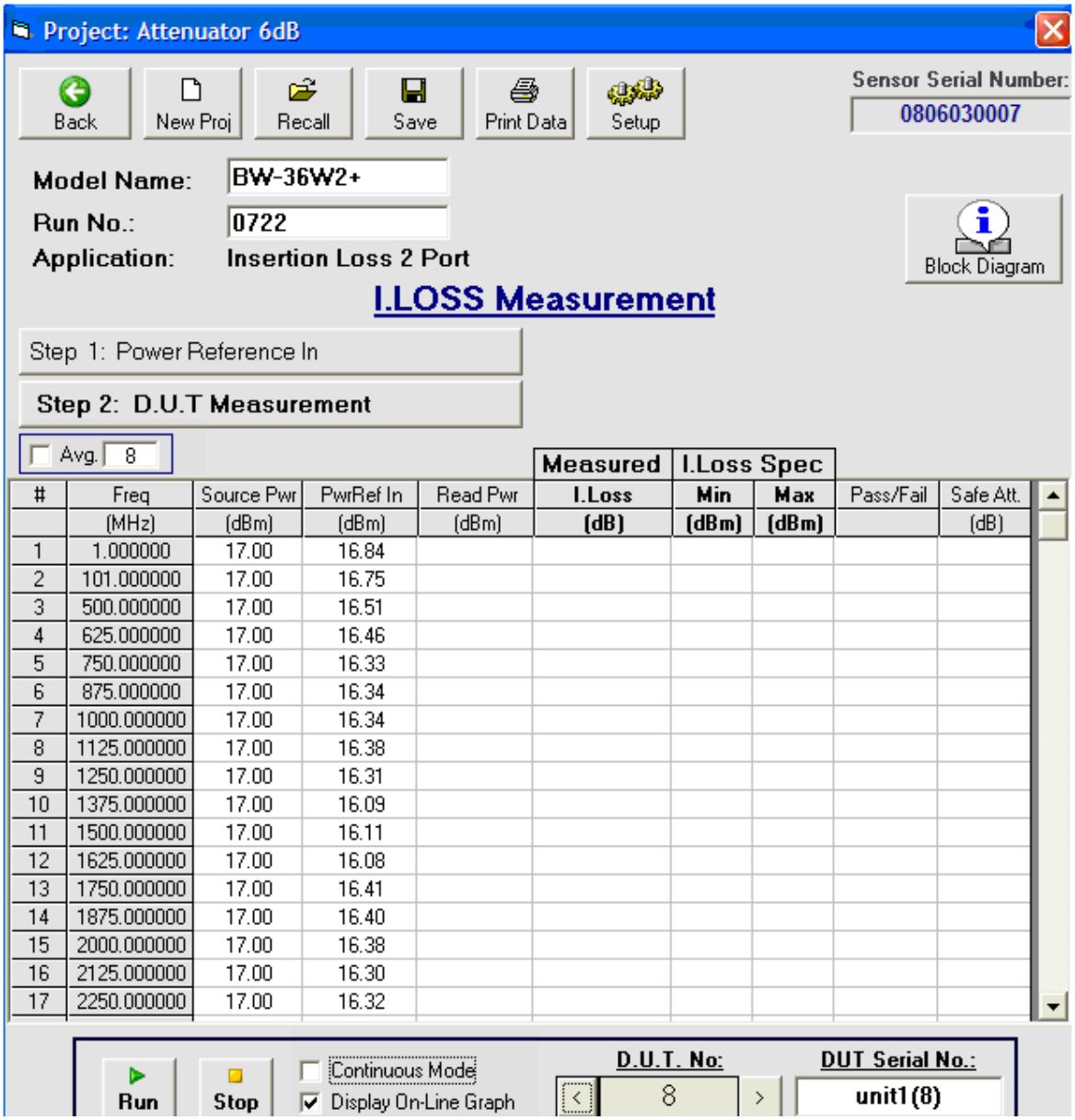
- **Step 15.** Press **Step 2: D.U.T Measurement** key.

  The **D.U.T Measurement** screen will open (see **Figure 73**).

- **Step 16.** Open **D.U.T Measurement's Block Diagram** setup **(**see **Figure 74)**.

- **Step 17.** Assemble the **D.U.T Measurement** equipment setup.

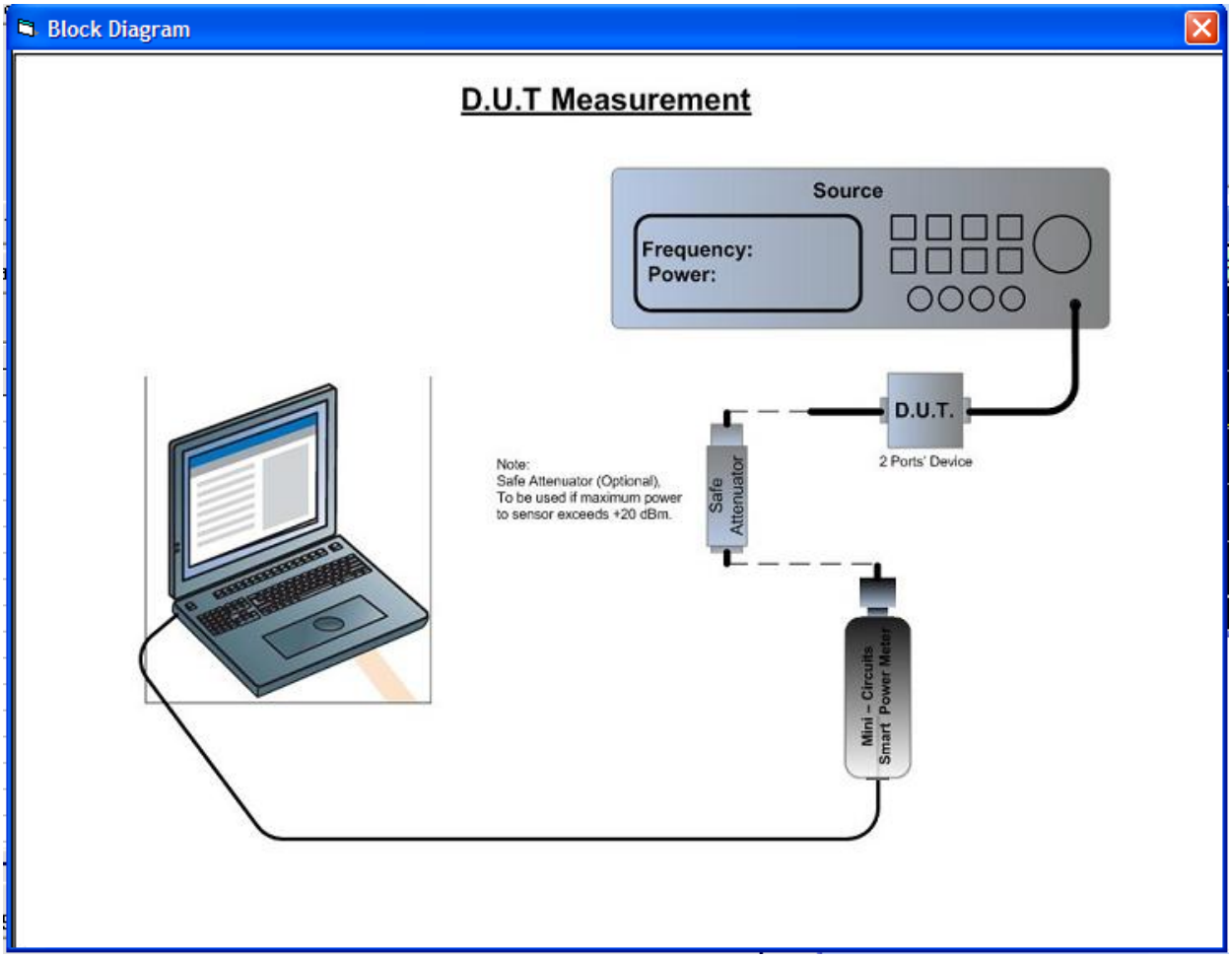
Figure 73: D.U.T Measurement screen



- **Step 18.** Enter spec. data (If available).
  [see explanation **3.4.2.2 Spec. Definitions** on **page 21**].

- **Step 19.** You can enable **Continuous Mode** if necessary for your application.

Figure 74: D.U.T measurement Block Diagram .



- **Step 20.** You can enable the **On-Line Graph** option.
  (see 3.5 **On-Line Graph features page 22**).

- **Step 21.** Enter **D.U.T Serial No.**: (If available).

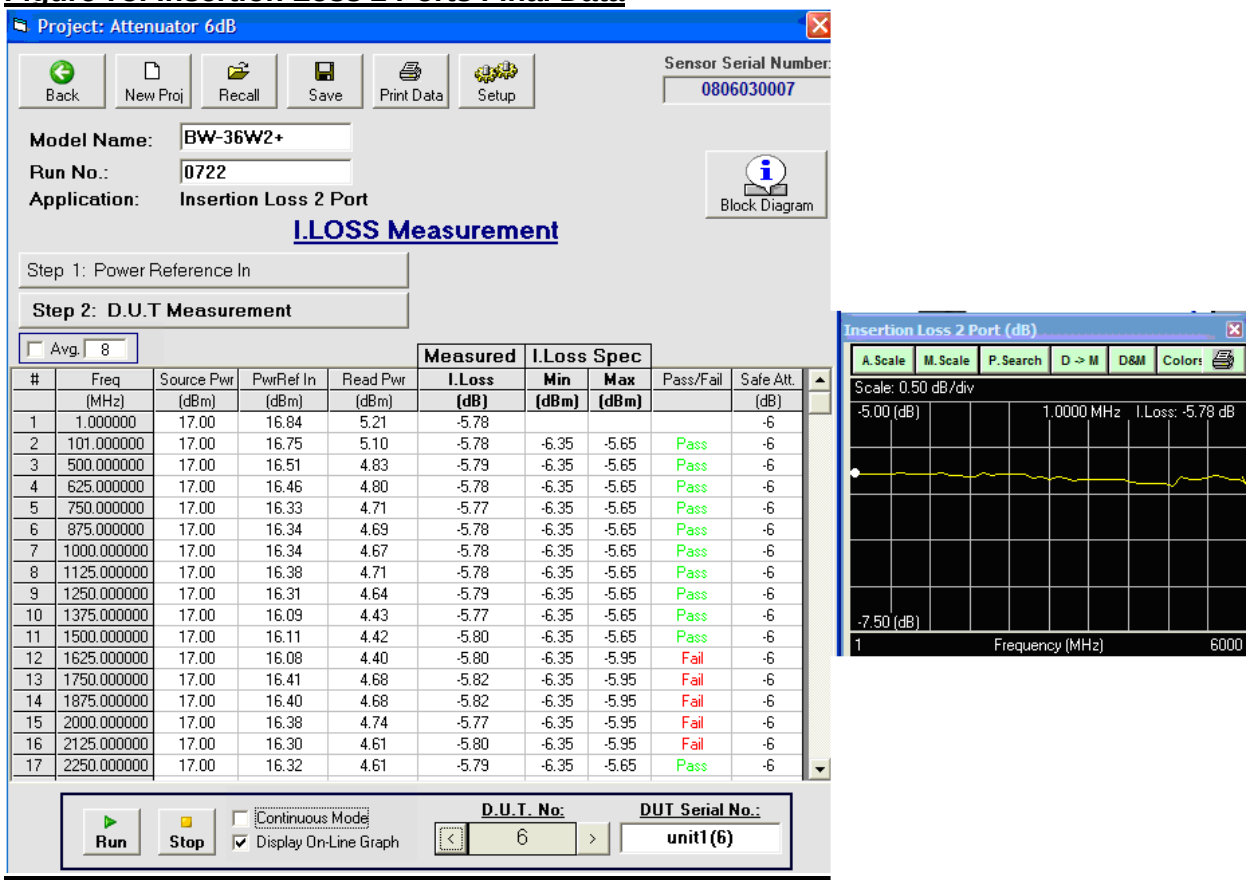
- **Step 22.** Press **Run** key to launch test. You can stop the test at any stage by pressing the **Stop** key. If **Continuous Mode** is not enabled test will finish after sweeping all segments. If **Continuous Mode** is enabled test will repeat until interrupted by **Stop** key.

- **Step 23.** If you have more than one D.U.T to test repeat **Steps 19-22** for next test.

- **Step 24.** You can enable **On-Line Graph** option. (see **3.5 On-Line Graph features** on **page 22**).

- **Step 25. Final D.U.T Data** received (see **Figure 75**).

Figure 75: Insertion Loss 2 Ports Final Data



- **Step 26.** Save your project data (see **3.3.1.3 Save Function** on **page 16** for explanation).

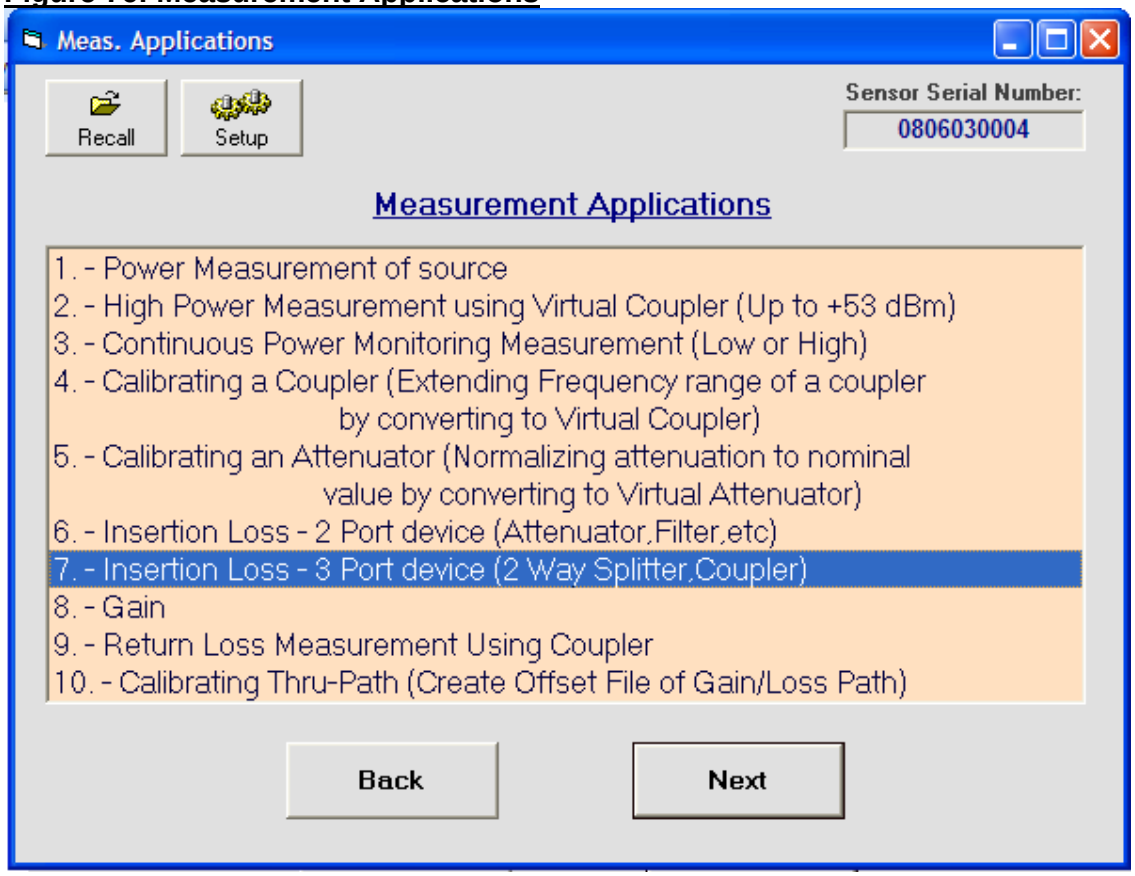
- **Step 27.** You can print your test data (see **3.6 Printing Data Function** on **page 23** for explanation).

10.0 Application # 7- Insertion Loss 3 Port Device (2 Way Splitter, Coupler).

This chapter describes the process of measuring the insertion loss of a three port device (for example a directional coupler or 2-way power splitter). Before you can begin measurements you must establish a Reference Power measurement described in **3.3** on **page 11.** If the measurements are preformed with high power (above +20dBm) you will need a safe attenuator at the power sensor input to prevent damage. If the Safe Attenuator is not flat use a Virtual Attenuator CAL file (see Virtual Attenuator in **chapter 8.)**
Data output of this measurement will be in [-dB]

- Open a project from the **Measurement Applications** screen (see **Figure 76**).

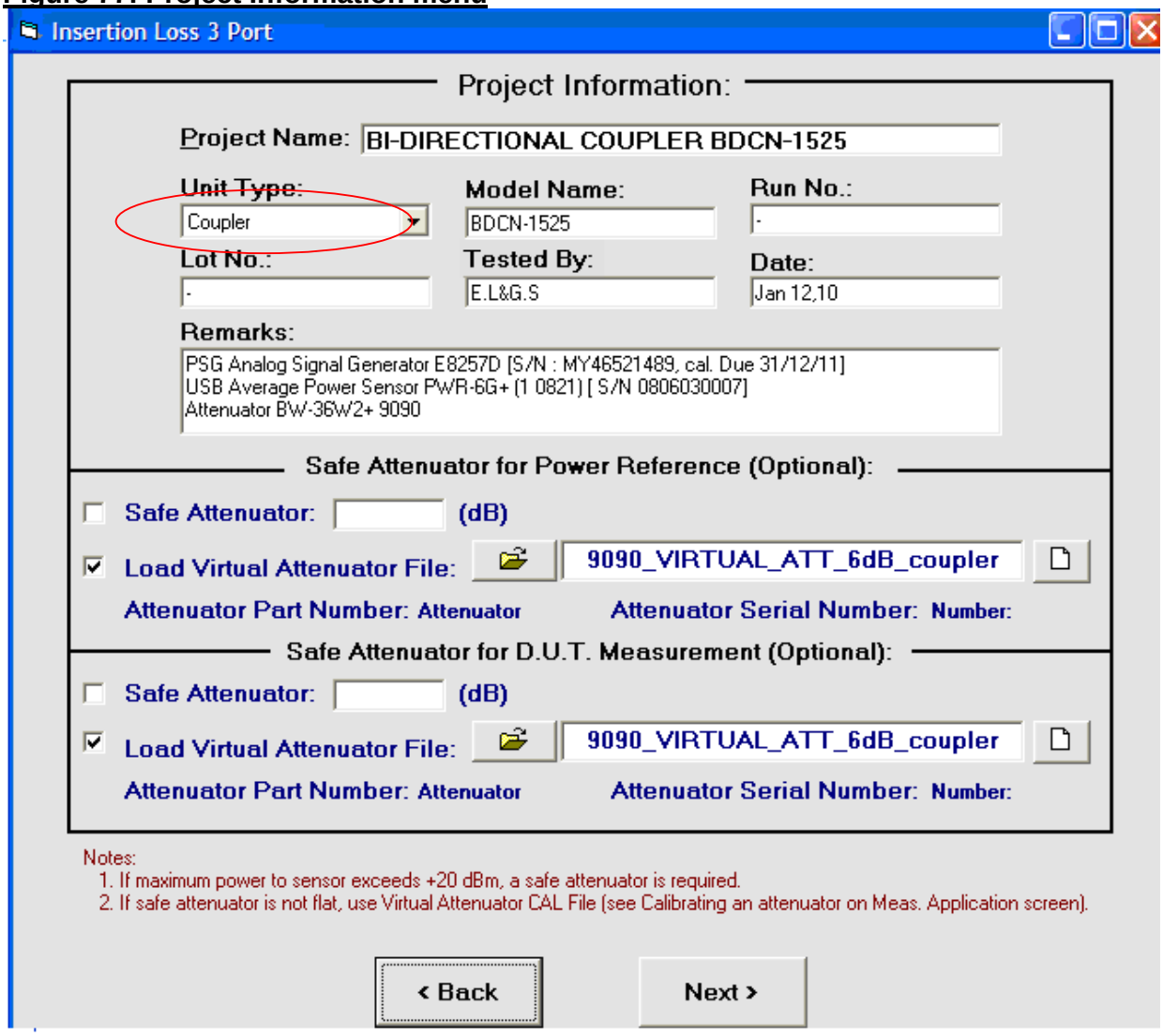
Figure 76: Measurement Applications



10.1 Coupler Measurements.

- **Step 1.** The **Project Information menu** is now open (see **Figure 77**).
- **Step 2.** Select **Unit Type**: **Coupler** in the **Project Information menu**.
- **Step 3.** Review and fill all necessary fields in the **Project Information menu** see detailed explanation **Figure 4** and **Table 3** at **pages 9-10.**

Figure 77: Project Information menu



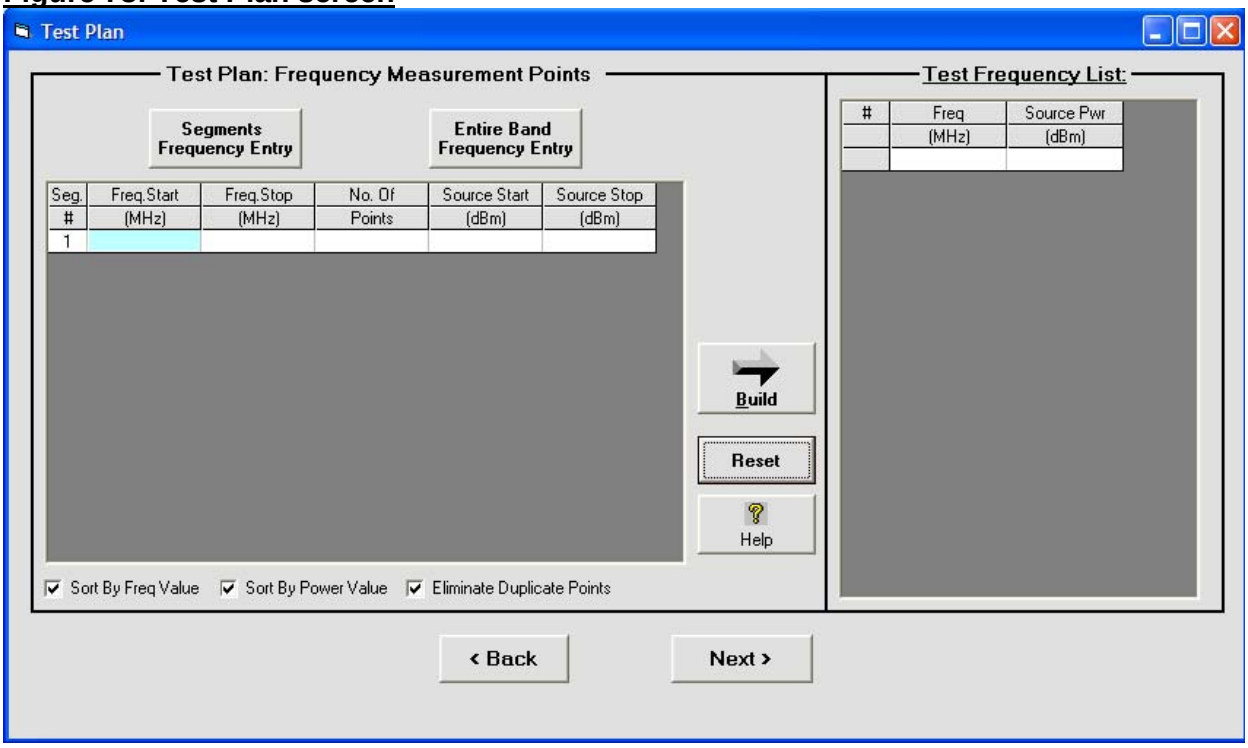
Note 1.If maximum power to sensor exceeds +20dBm, a safe attenuator is required
2. If safe attenuator is not flat, use Virtual Attenuator file. See creation of Virtual Attenuator **Chapter 8**.

- **Step 4.** Press **Next** key. The **Test Plan** screen will open (see **Figure 78**).

- **Step 5.** You can choose one of two options to build the measurement points set (see **Chapter 3.2, Figures 5-6** on **page 9**).

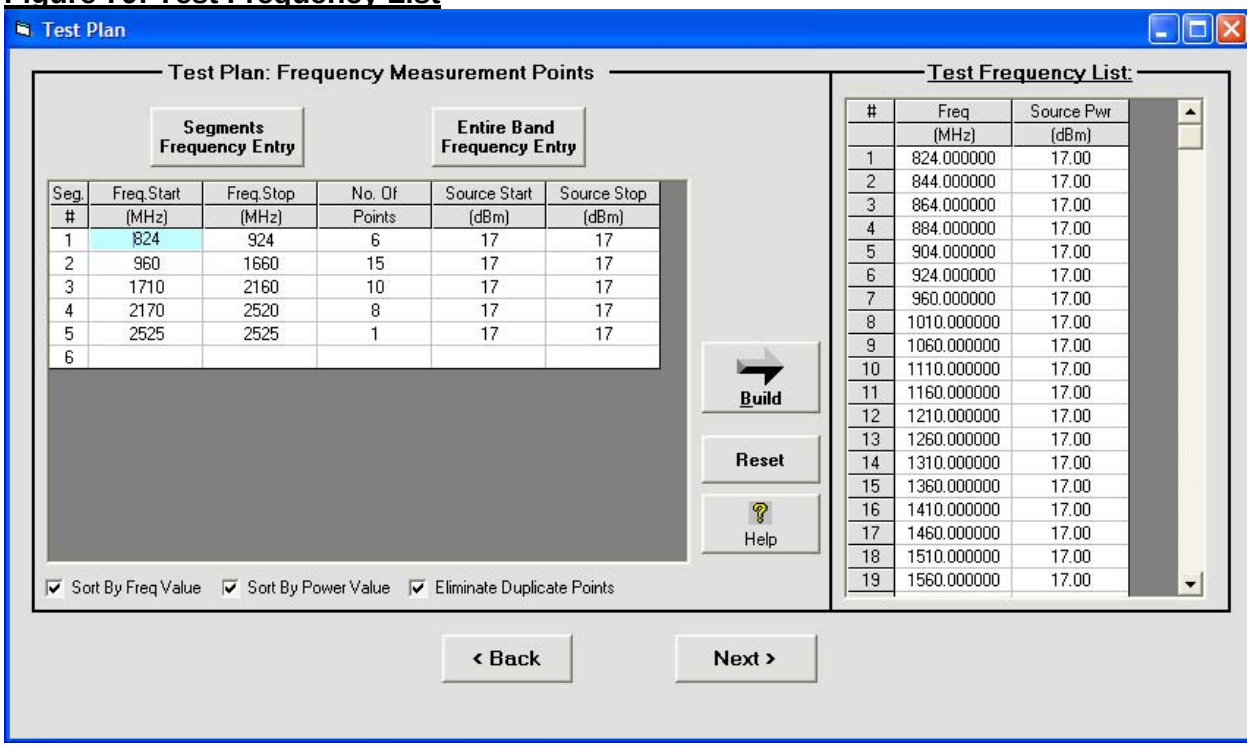
- **Step 6.** Create the measurement points and set input power (you can see an explanation and example in **Figure 5** on **pages 10-11**).

Figure 78: Test Plan screen



- **Step 7.** Press **Build** key to create a **Test Frequency List** (see **Figure 79**).

Figure 79: Test Frequency List



- **Step 8.** Press **Next** key.
  The **Insertion Loss -Coupler screen** will open. (see **Figure 80**)
  Validate desirable data transferred from the previous screen.
  During all following steps you can use **Recall** and **Save** keys at all stages (see **3.3.1.2 Recall** on **page 15, 3.3.1.3 Save** on **page 16** for explanation).

- **Step 9.** Press **Step 1: Power Reference In** key.

- **Step 10.** Open **Power Reference In** measurement's **Block Diagram** setup (see **Figure 81**).

- **Step 11.** Assemble the **Power Reference In** equipment setup.

- **Step 12.** Define/Confirm **Setup** settings
  (see 2.1**. Setting communication/commands in order to control an external source.** on **page 5**).

Figure 80: Insertion Loss -Coupler screen

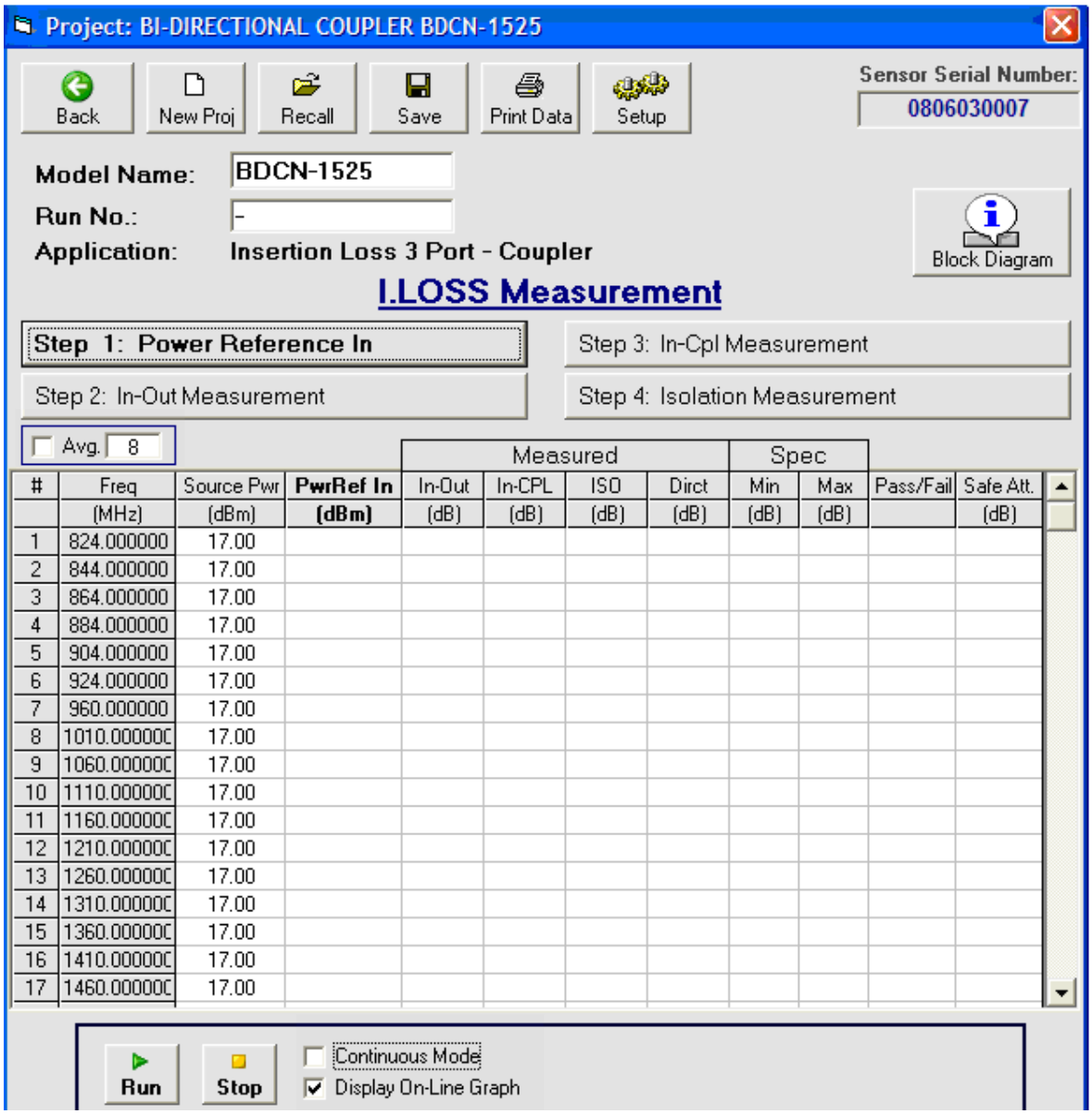
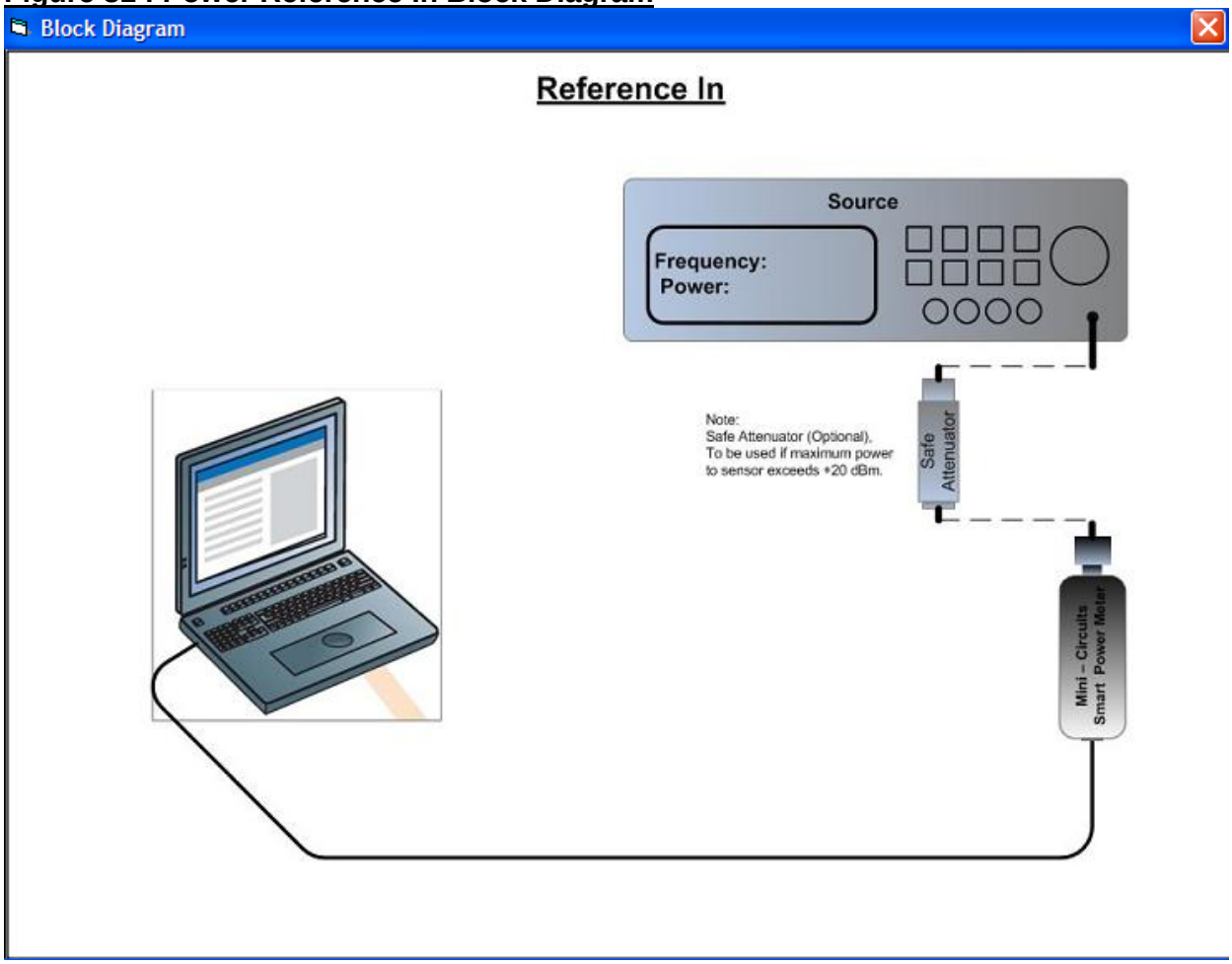


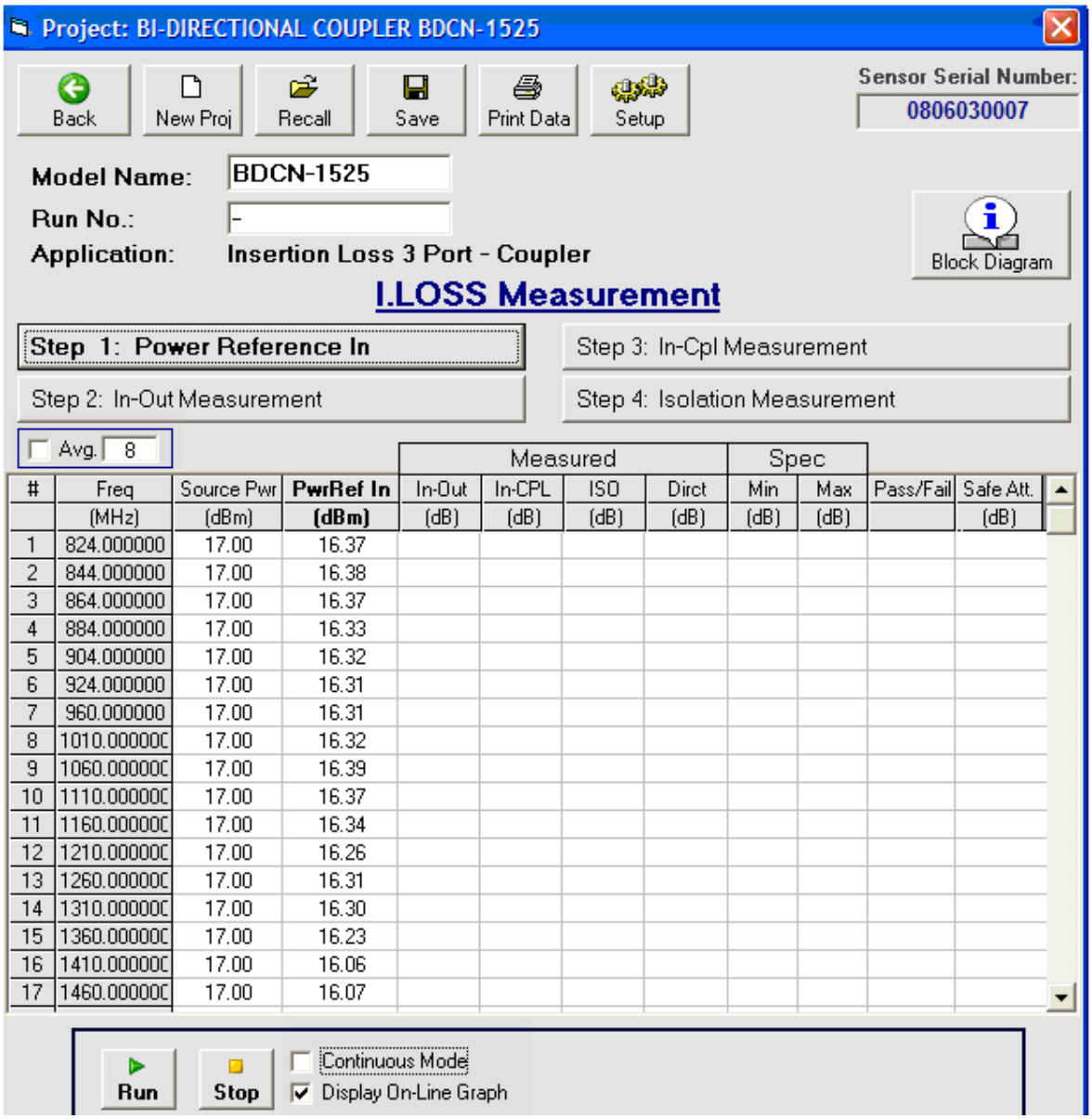
Figure 81 : Power Reference In Block Diagram



- **Step 13.** Press **Run** key to launch test. You can stop the test at any stage by pressing the **Stop** key. If **Continuous Mode** is not enabled test will finish after sweeping all segments. If **Continuous Mode** is enabled test will repeat until interrupted by **Stop** key.

- **Step14.** See **Power Reference In** results **(Figure 82).**

Figure 82: Power Reference In



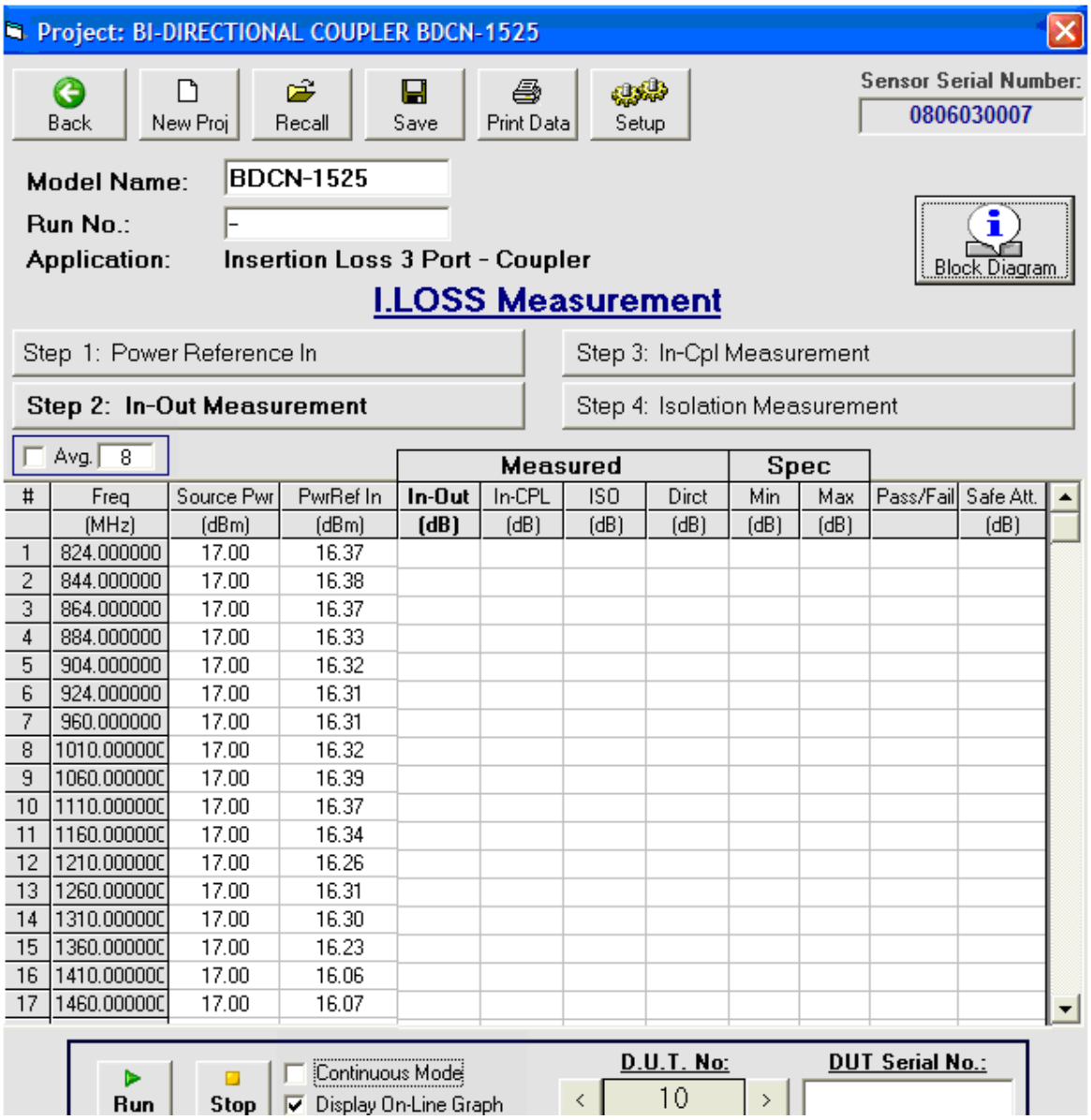
- **Step 15.** Press **Step 2: In Out Measurement** key.

  The Coupler's **In Out Measurement** screen will open (see **Figure 83**).

- **Step 16.** Open **In Out Measurement's Block Diagram** setup (see **Figure 84**).

- **Step 17.** Assemble the Coupler's **In Out Measurement** equipment setup**.**

Figure 83: In Out Measurement



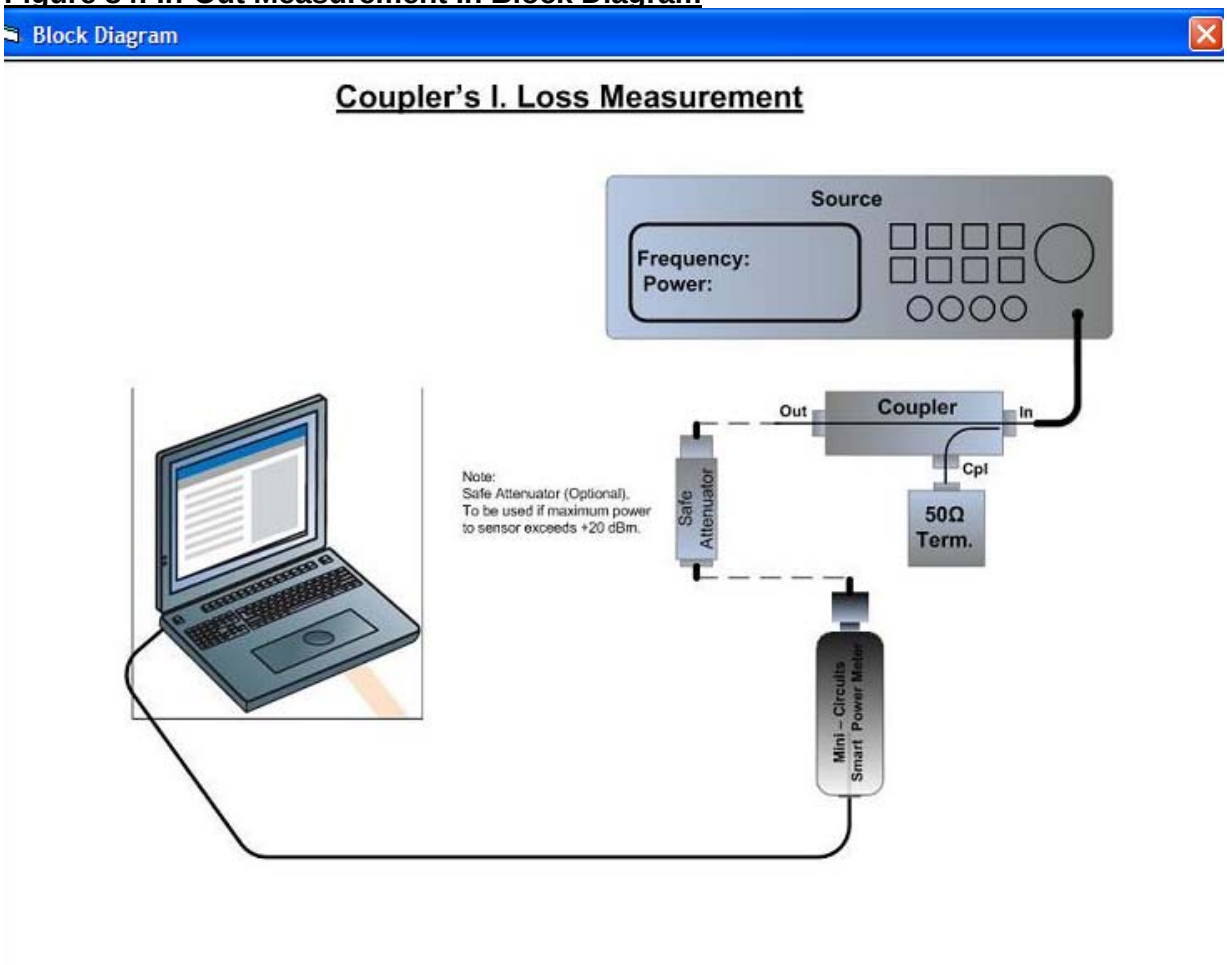
- **Step 18.** Enter spec. data (If available).
  [see explanation **3.4.2.2 Spec. Definitions** on **page 21**].

- **Step 19.** You can enable **Continuous Mode** if necessary for your application.

Note

Insure that of your source power does not exceed +20dBm. (In this step I. Loss will be minimal and source power will be close to power entering to the Power Sensor. See Figure **84**).
If power does exceed +20dBm use a Safe Attenuator (see **chapter 8.**)

Figure 84: In-Out Measurement In Block Diagram



- **Step 20.** You can enable the **On-Line Graph** option.
  (see **3.5 On-Line Graph features** on **page 22**)**.**

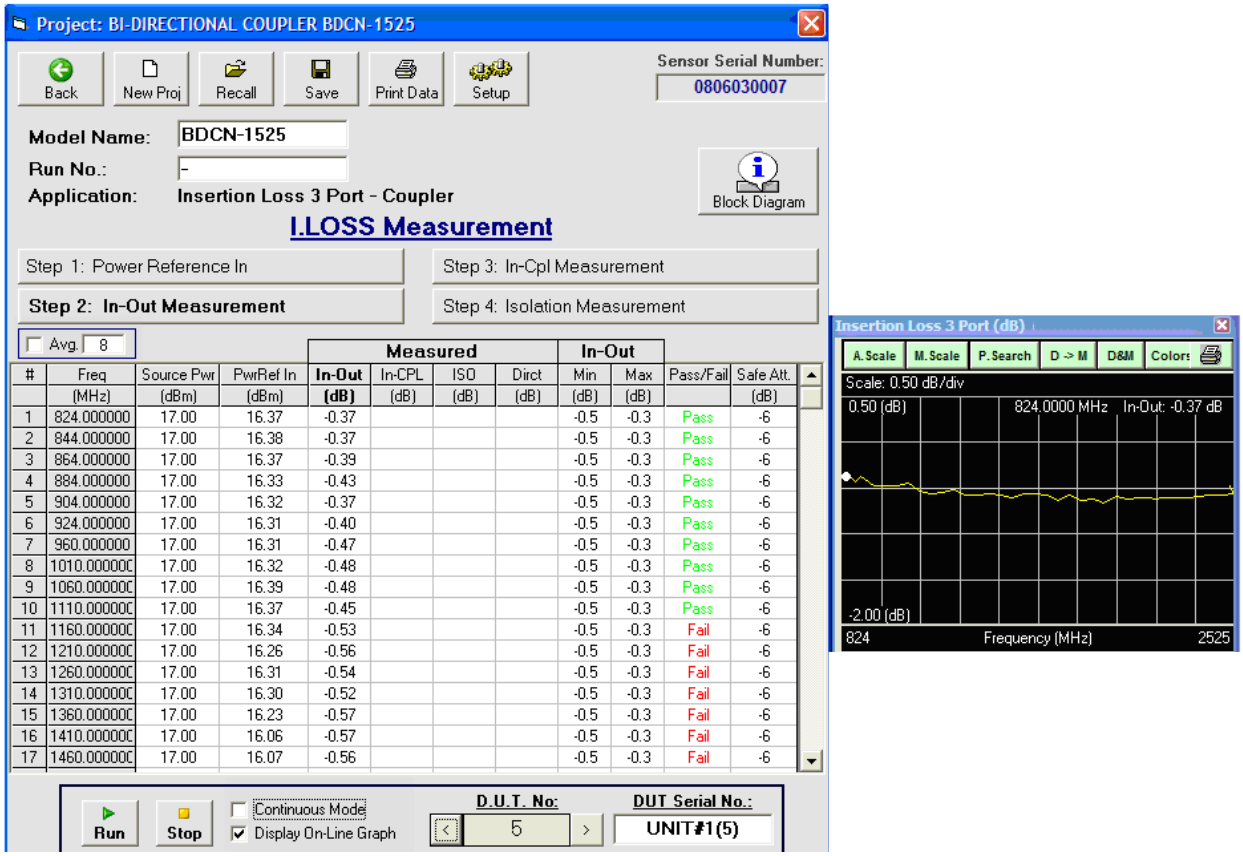
- **Step 21.** Enter **D.U.T Serial No.**: (If available).

- **Step 22.** Press **Run** key to launch test. You can stop the test at any stage by pressing the **Stop** key. If **Continuous Mode** is not enabled test will finish after sweeping all segments. If **Continuous Mode** is enabled test will repeat until interrupted by **Stop** key.

- **Step 23.** If you have more than one D.U.T to test repeat **Steps 19-22** for next test.

- **Step 24. In Out Measurement data** received
  (see **Figure 85**).

Figure 85: In-Out Measurements



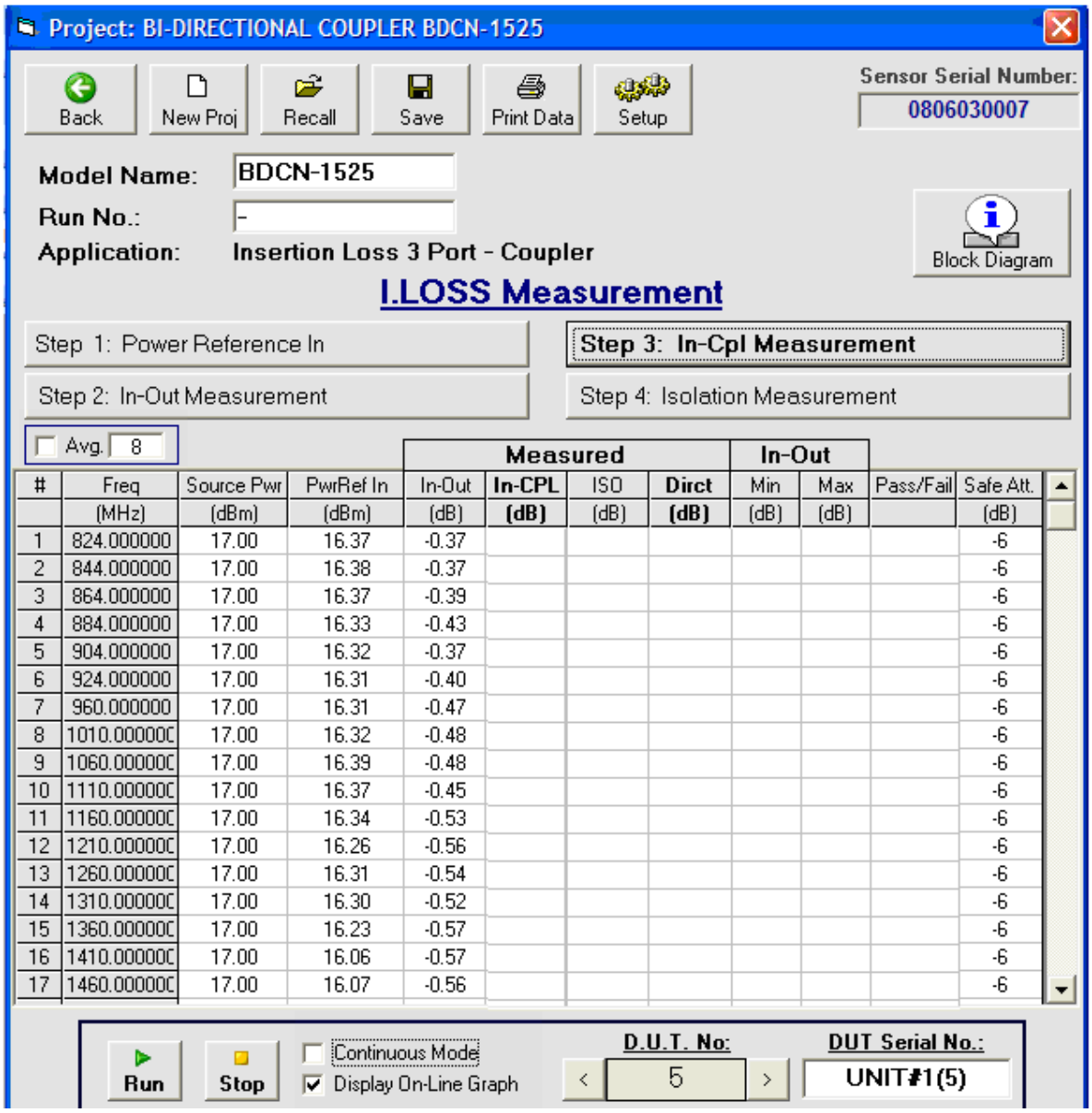
- **Step 25.** Press **Step 3: In-Cpl Measurement** key.

  The Coupler's **In-Cpl Measurement screen** will open (see **Figure 86**).

- **Step 26.** Open **In-Cpl Measurement's Block Diagram** setup (see **Figure 87**).

- **Step 27.** Assemble the Coupler's **In - Cpl Measurement** equipment setup**.**

Figure 86: In-Cpl Measurement

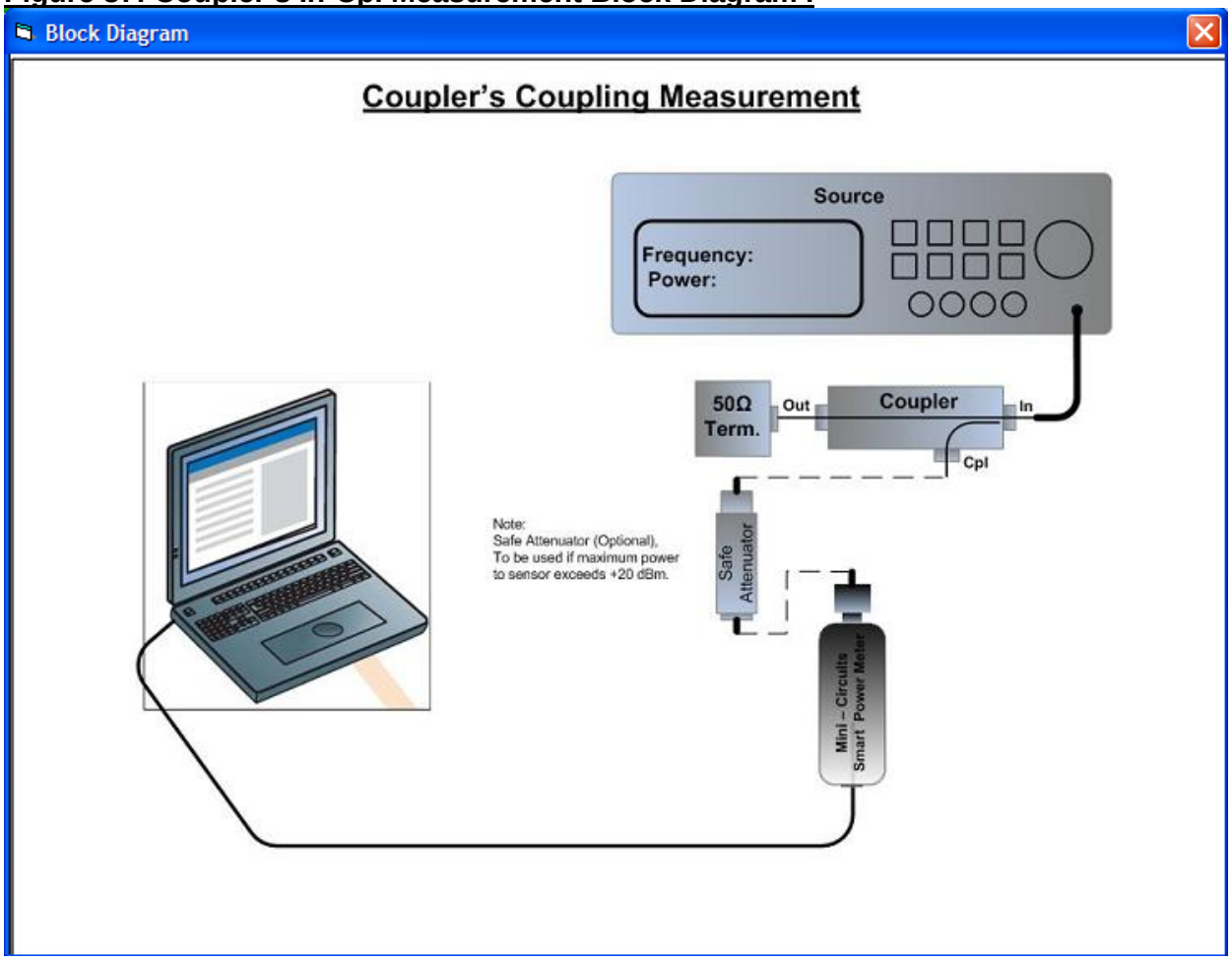


- **Step 28.** Enter spec. data (If available).
  [see explanation **3.4.2.2 Spec. Definitions** on **page 21**].

- **Step 29.** You can enable **Continuous Mode** if necessary for your application.

Note Insure final signal power at coupling port exceeds -30dBm to allowing accurate reading by Power Sensor.

Figure 87: Coupler's In-Cpl Measurement Block Diagram .



- **Step 30.** You can enable the **On-Line Graph** option.
  (see **3.5 On-Line Graph features page 22**).

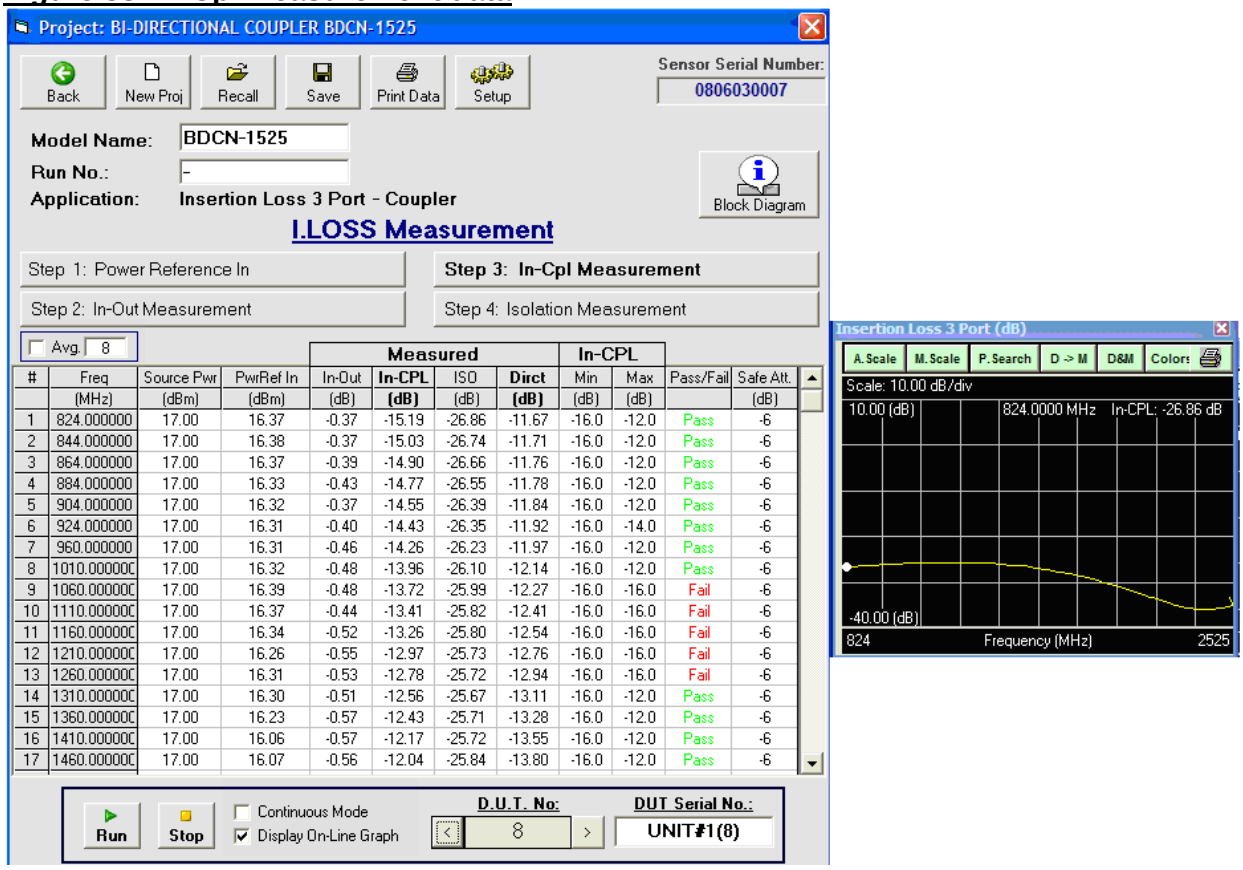
- **Step 31.** Enter **D.U.T Serial No.**: (If available).

- **Step 32.** Press **Run** key to launch test. You can stop the test at any stage by pressing the **Stop** key. If **Continuous Mode** is not enabled test will finish after sweeping all segments. If **Continuous Mode** is enabled test will repeat until interrupted by **Stop** key.

- **Step 33.** If you have more than one D.U.T to test repeat **Steps 29-32** for next test.

- **Step 34. In - Cpl Measurement** data received (see **Figure 88**).

Figure 88: In Cpl Measurement data



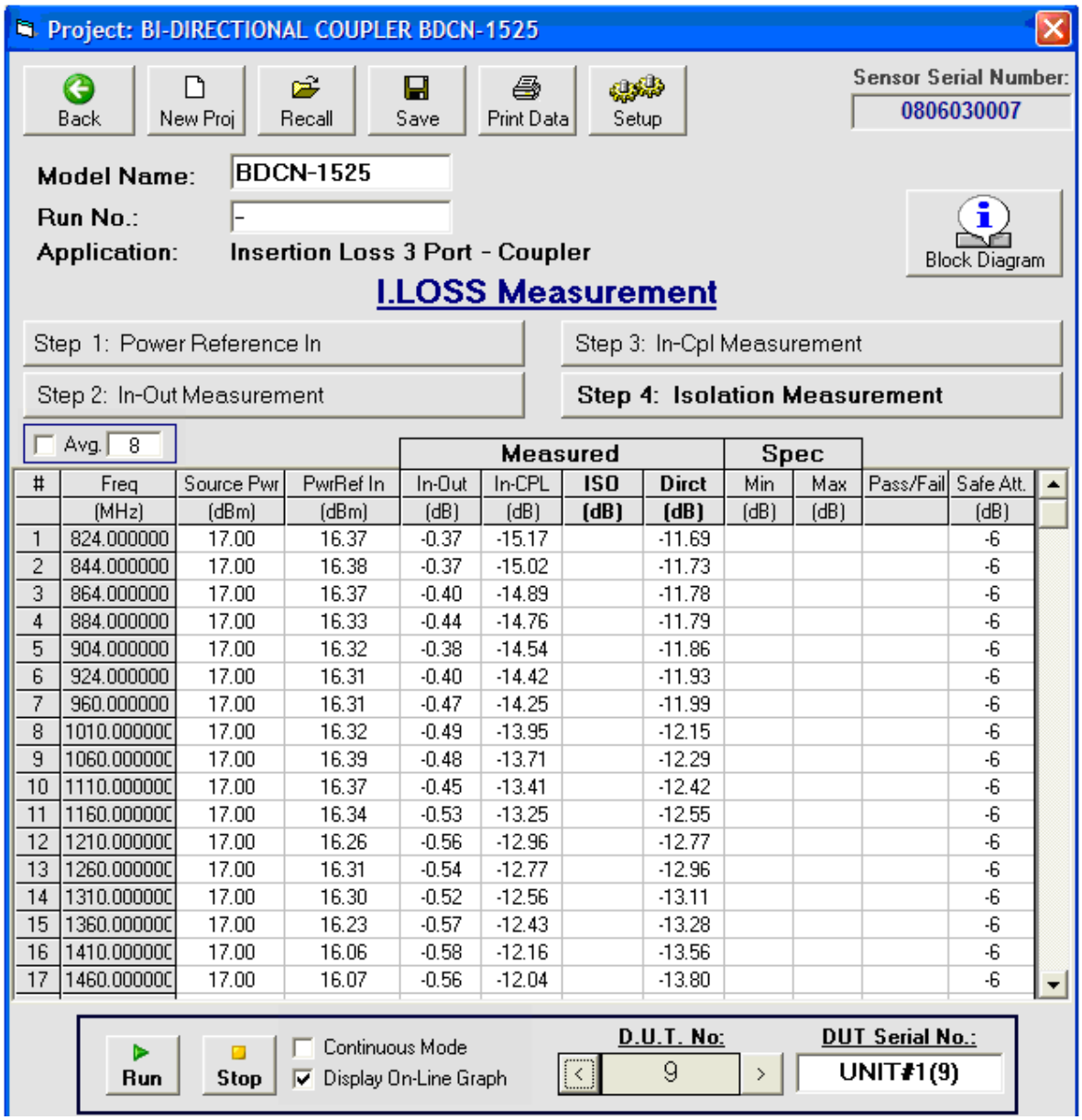
- **Step 35.** Press **Step 4: Isolation Measurement** key.

  The Coupler's **Isolation Measurement screen** will open (see **Figure 89**).

- **Step 36.** Open **Isolation Measurement's Block Diagram** (see **Figure 90**).

- **Step 37.** Assemble the Coupler's **Isolation Measurement setup.**

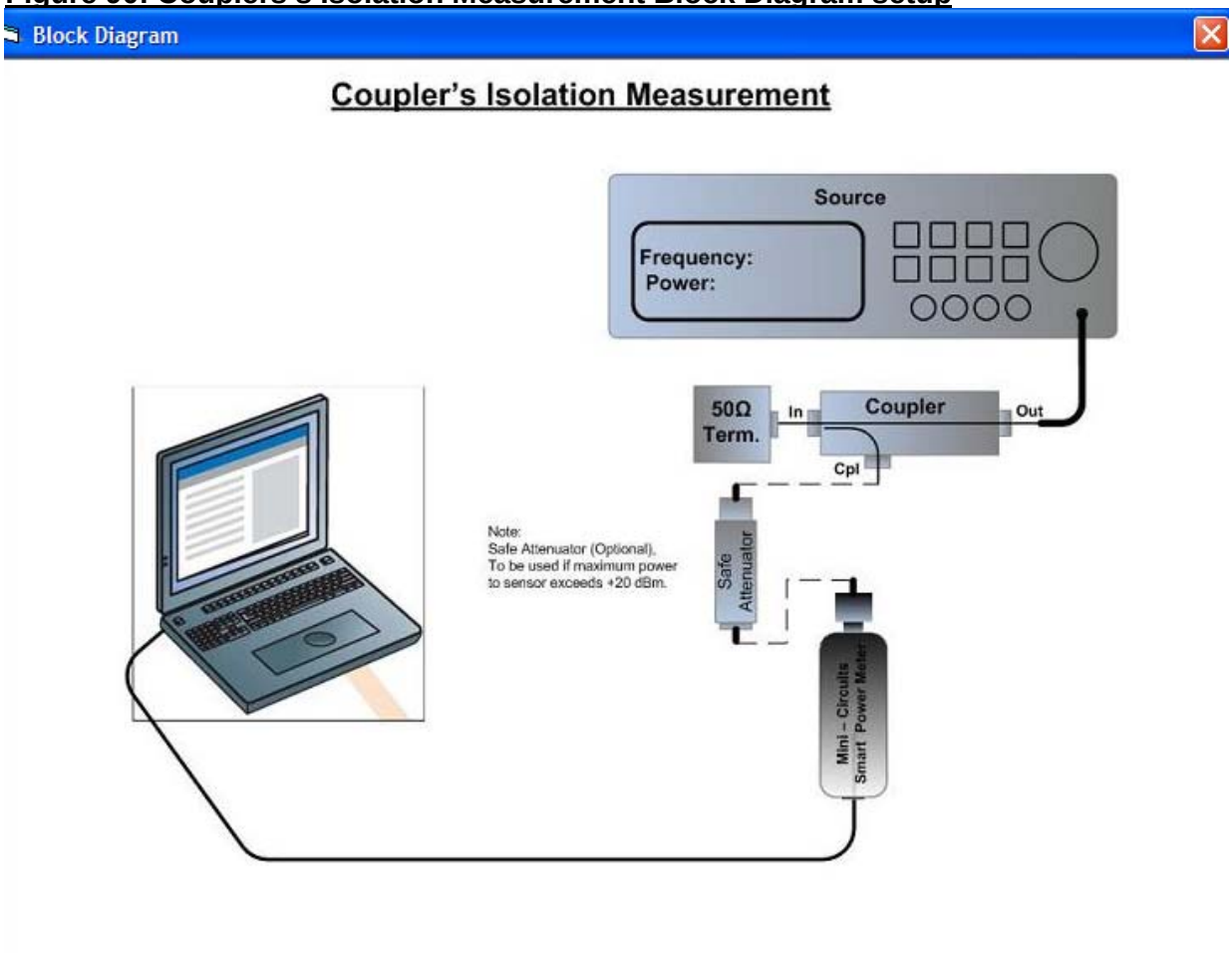
Figure 89: Isolation Measurement



- **Step 38.** Enter spec. data (If available).
  [see explanation **3.4.2.2 Spec. Definitions** on **page 21**].

- **Step 39.** You can enable **Continuous Mode** if necessary for your application.

Figure 90: Couplers's Isolation Measurement Block Diagram setup



- **Step 40.** You can enable the **On-Line Graph** option.
  (see **3.5 On-Line Graph features page 22**).

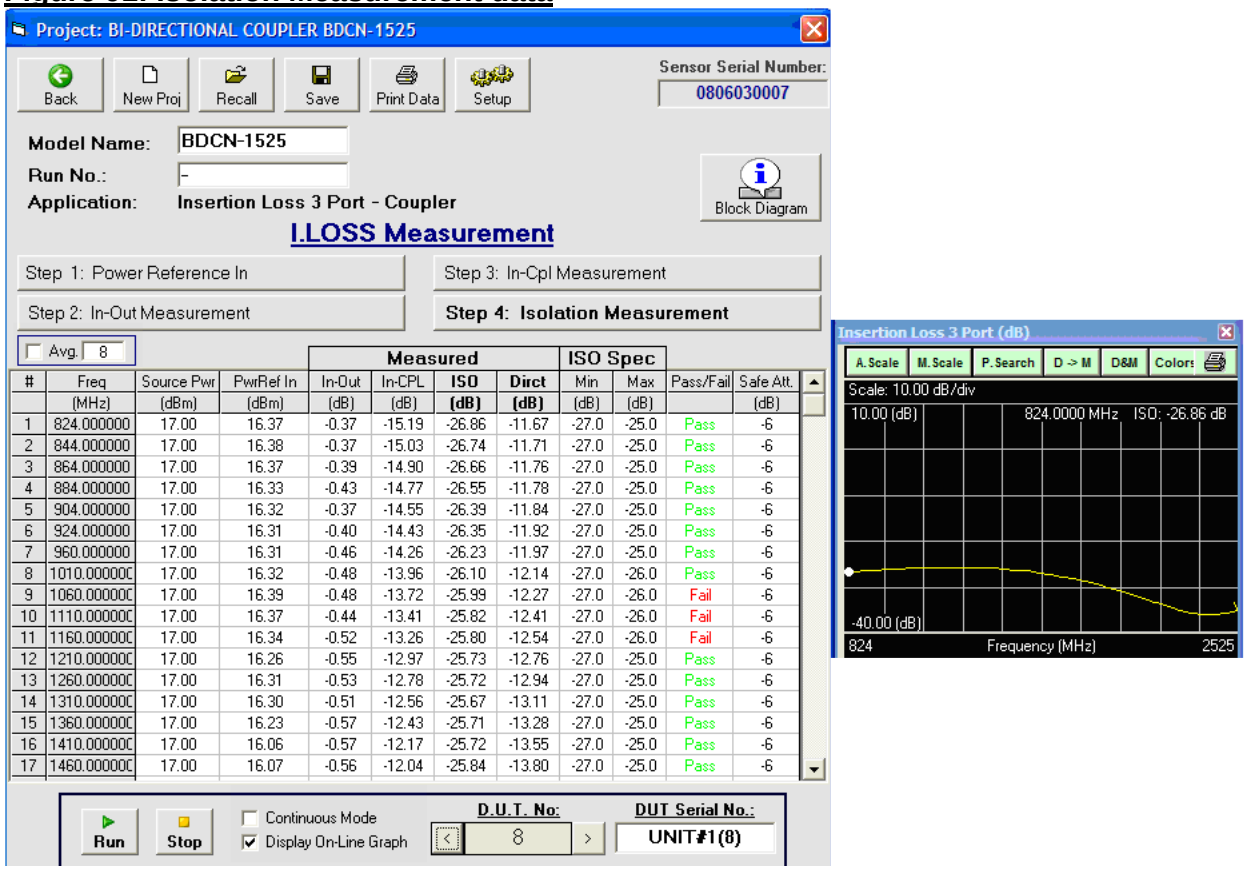
- **Step 41.** Enter **D.U.T Serial No.**: (If available).

- **Step 42.** Press **Run** key to launch test. You can stop the test at any stage by pressing the **Stop** key. If **Continuous Mode** is not enabled test will finish after sweeping all segments. If **Continuous Mode** is enabled test will repeat until interrupted by **Stop** key.

- **Step 43.** If you have more than one D.U.T to test repeat **Steps 39-42** for next test.

- **Step 44. Isolation Measurement** data received (see **Figure 91**).

Figure 91: Isolation Measurement data



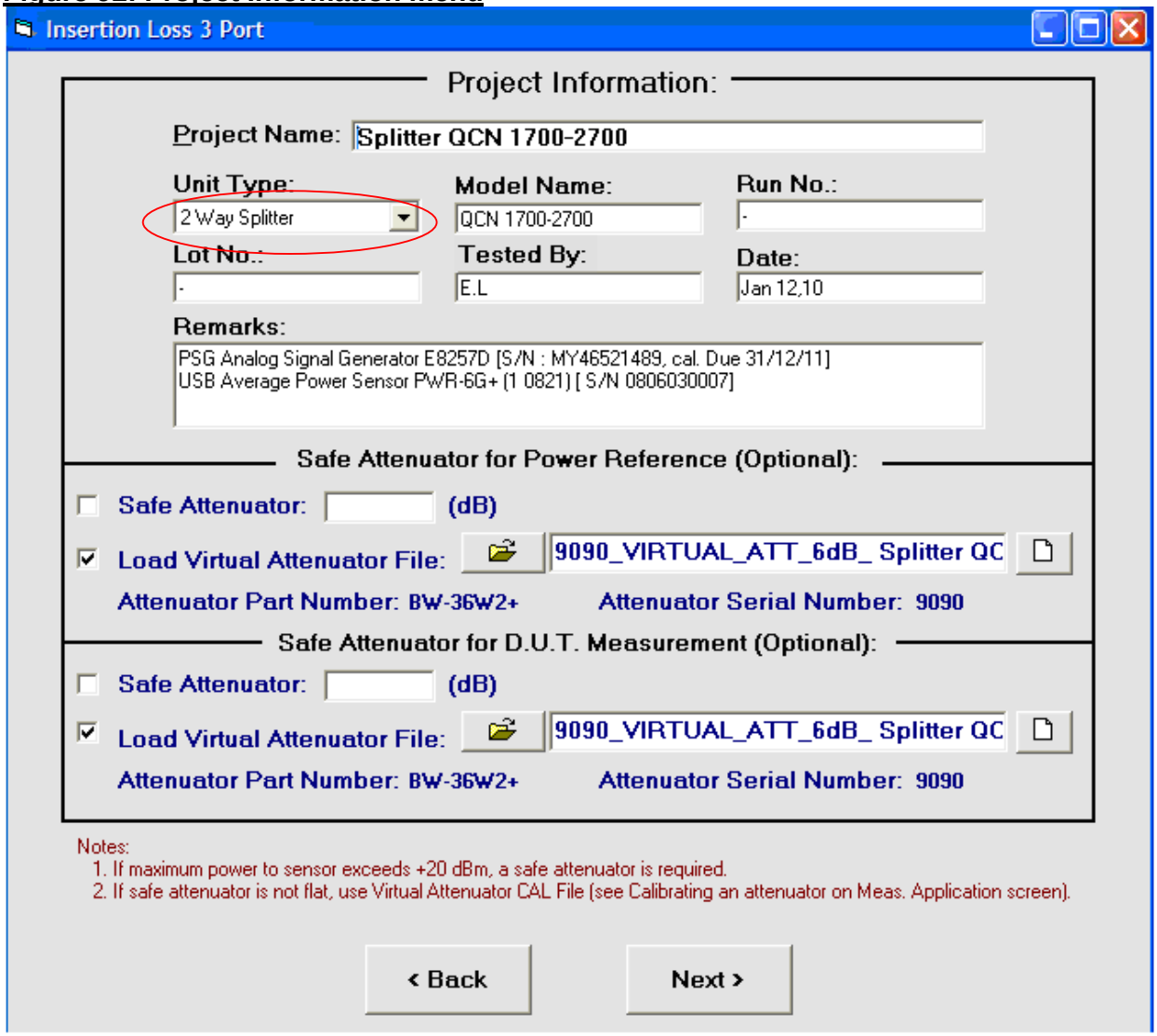
- **Step 45.** Save your project data (see **3.3.1.3 Save Function** on **page 16** for explanation).

- **Step 46.** You can print your test data (see **3.6 Printing Data Function** on **page 23** explanation).

10.2 2-Way Splitter/Combiner Measurements:

- **Step 1.** The Project Information Menu is now open (see **Figure 92**).
- **Step 2.** Select **Unit Type**: **2 Way Splitter** in the **Project Information menu**.
- **Step 3.** Review and fill all necessary fields in the **Project Information menu.** see detailed explanation **Figure 4** and **Table 3** at **pages 9-10.**

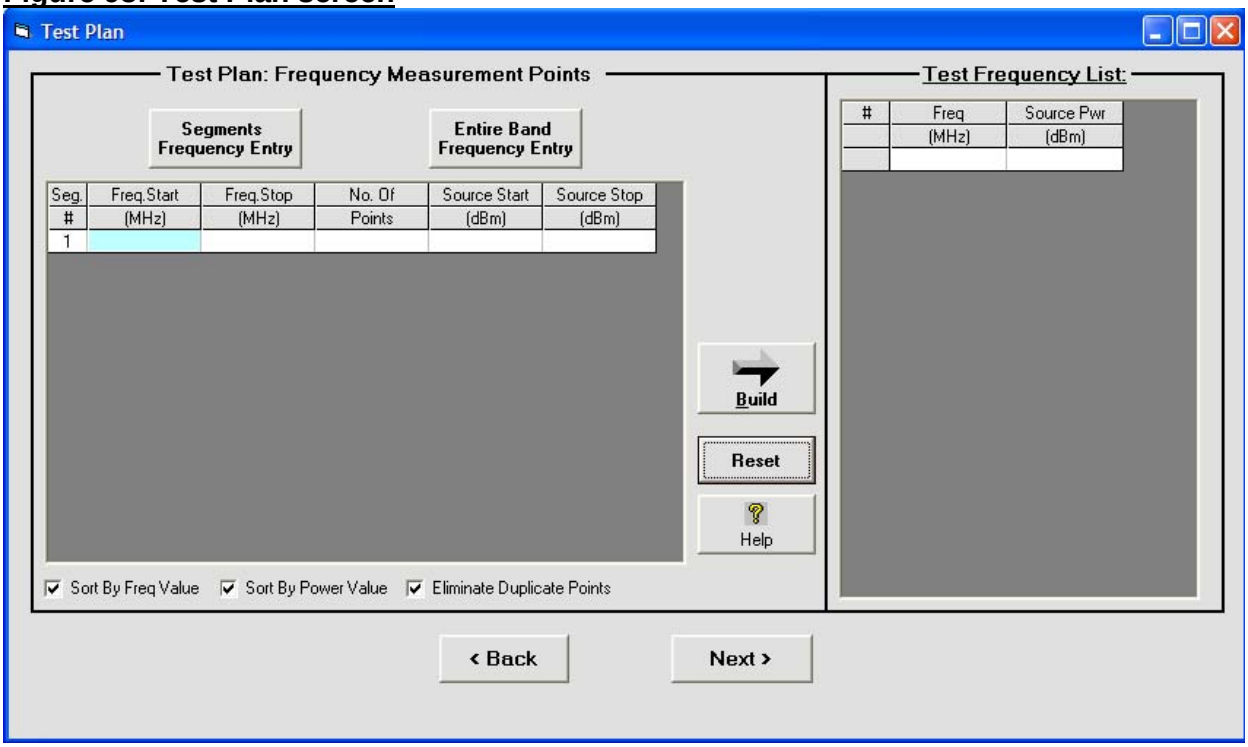
Figure 92: Project Information menu



Note
1. If maximum power to sensor exceeds +20dBm, a safe attenuator is required
2. If safe attenuator is not flat, use Virtual Attenuator file. See creation of Virtual Attenuator **Chapter 8**.

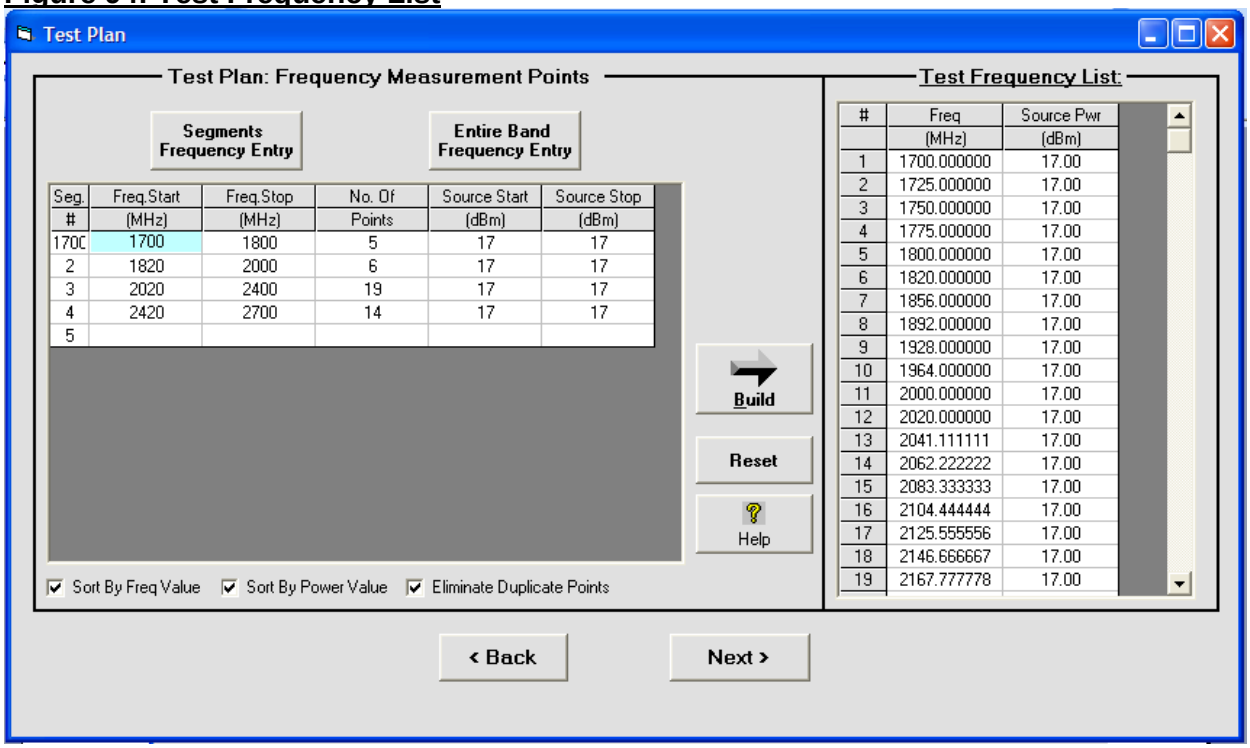
- **Step 4.** Press **Next** key. The **Test Plan** screen will open (see **Figure 93**).
- **Step 5.** You can choose one of two options to build the measurement points set (see **Chapter 3.2, Figures 5-6** on **pages 9-10**).
- **Step 6.** Create the measurement points and set input power (you can see an explanation and example in **Figure 5** on **page 10**).

Figure 93: Test Plan screen



- **Step 7.** Press **Build** key to create a **Test Frequency List (**see **Figure 94**).

Figure 94: Test Frequency List



- **Step 8.** Press **Next** key.
  The **Insertion Loss 3 Ports-2 Way Splitter screen** will open. (see **Figure 95**).
  Validate desirable data transferred from the previous screen.
  During all following steps you can use **Recall** and **Save** keys at all stages (see **3.3.1.2 Recall** on **page 15, 3.3.1.2 Save** on **page 16** for explanation).

- **Step 9.** Press **Step 1: Power Reference In** key.

- **Step 10.** Open **Power Reference In** measurement's **Block Diagram** setup (see **Figure 96**).

- **Step 11.** Assemble the **Power Reference In** equipment setup.

- **Step 12.** Define/Confirm **Setup** settings
  (see **2.1. Setting communication/commands in order to control an external source.** on **page 5**)

Figure 95: Insertion Loss 3 Ports - 2 Way Splitter screen

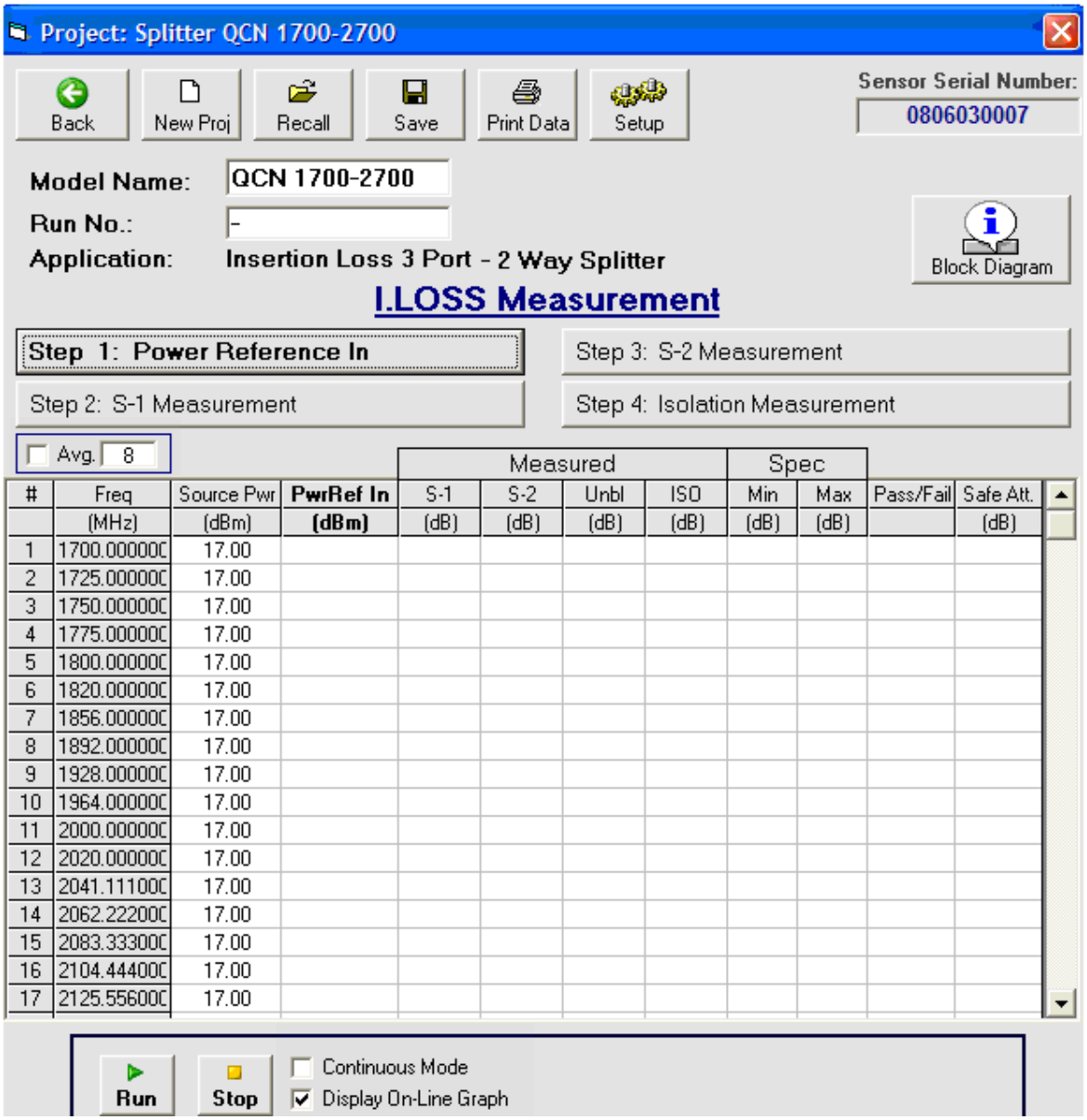
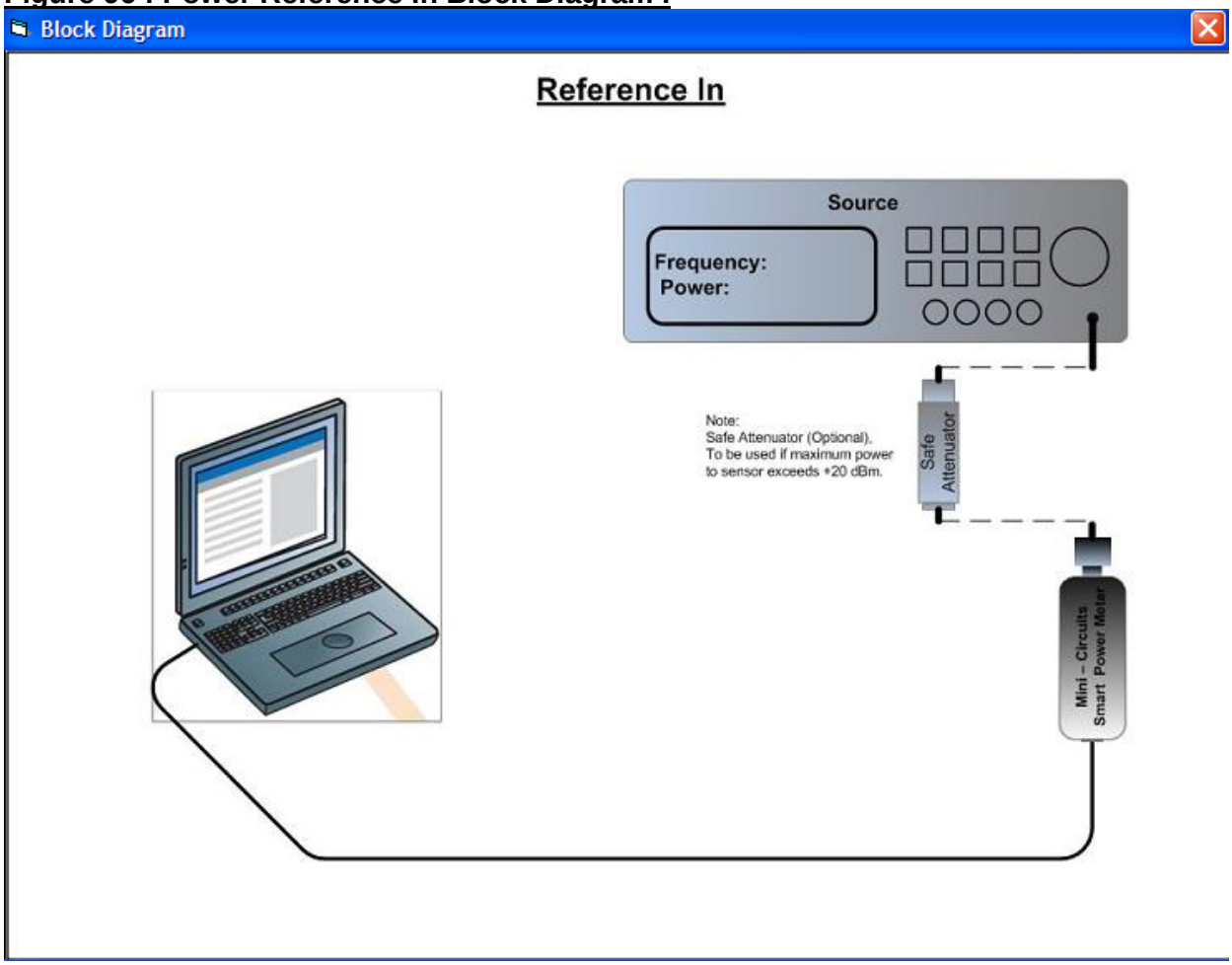


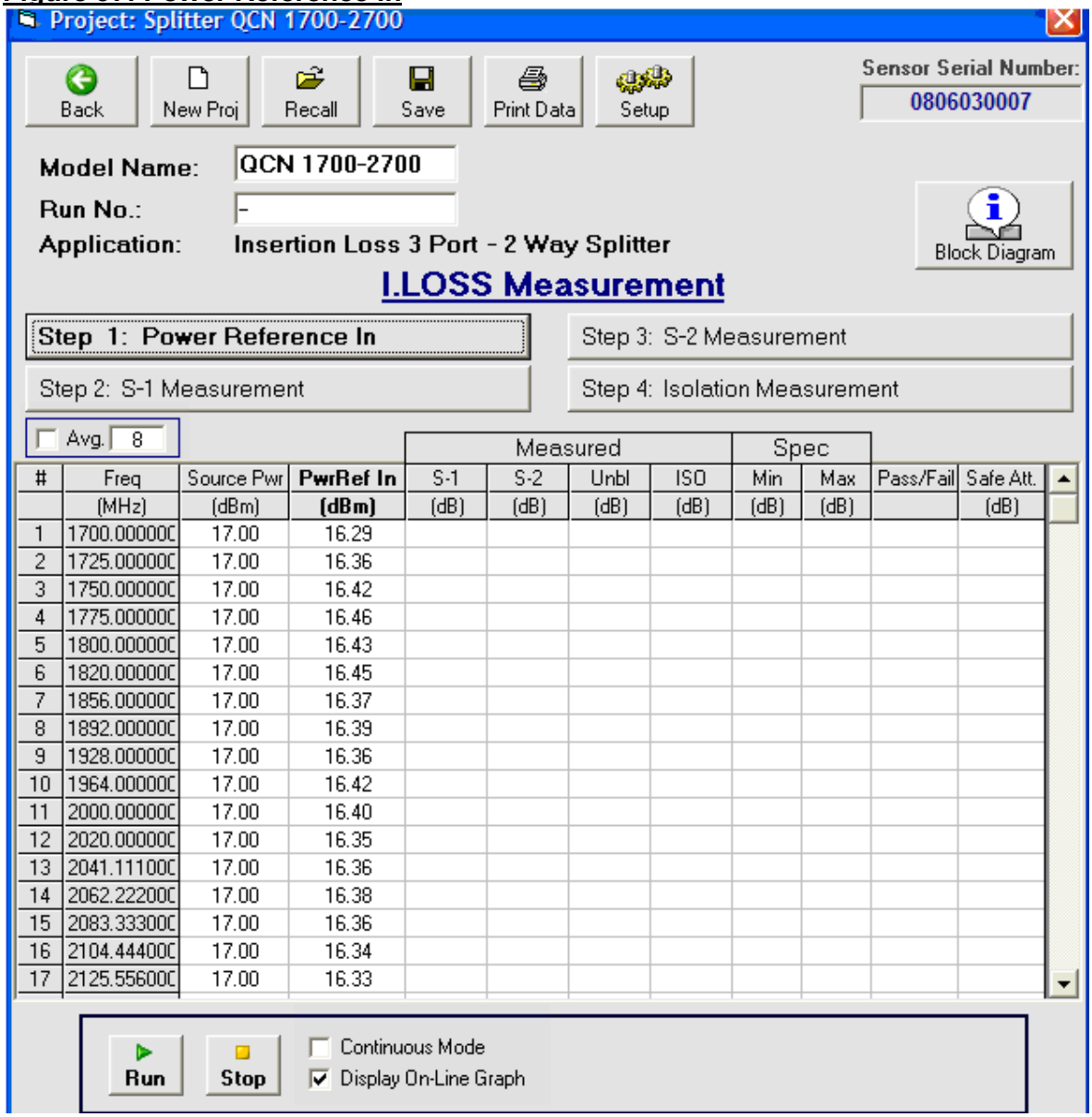
Figure 96 : Power Reference In Block Diagram .



- **Step 13.** Press **Run** key to launch test. You can stop the test at any stage by pressing the **Stop** key. If **Continuous Mode** is not enabled test will finish after sweeping all segments. If **Continuous Mode** is enabled test will repeat until interrupted by **Stop** key.

- **Step14.** See results**: Figure 97: Power Reference In.**

Figure 97: Power Reference In



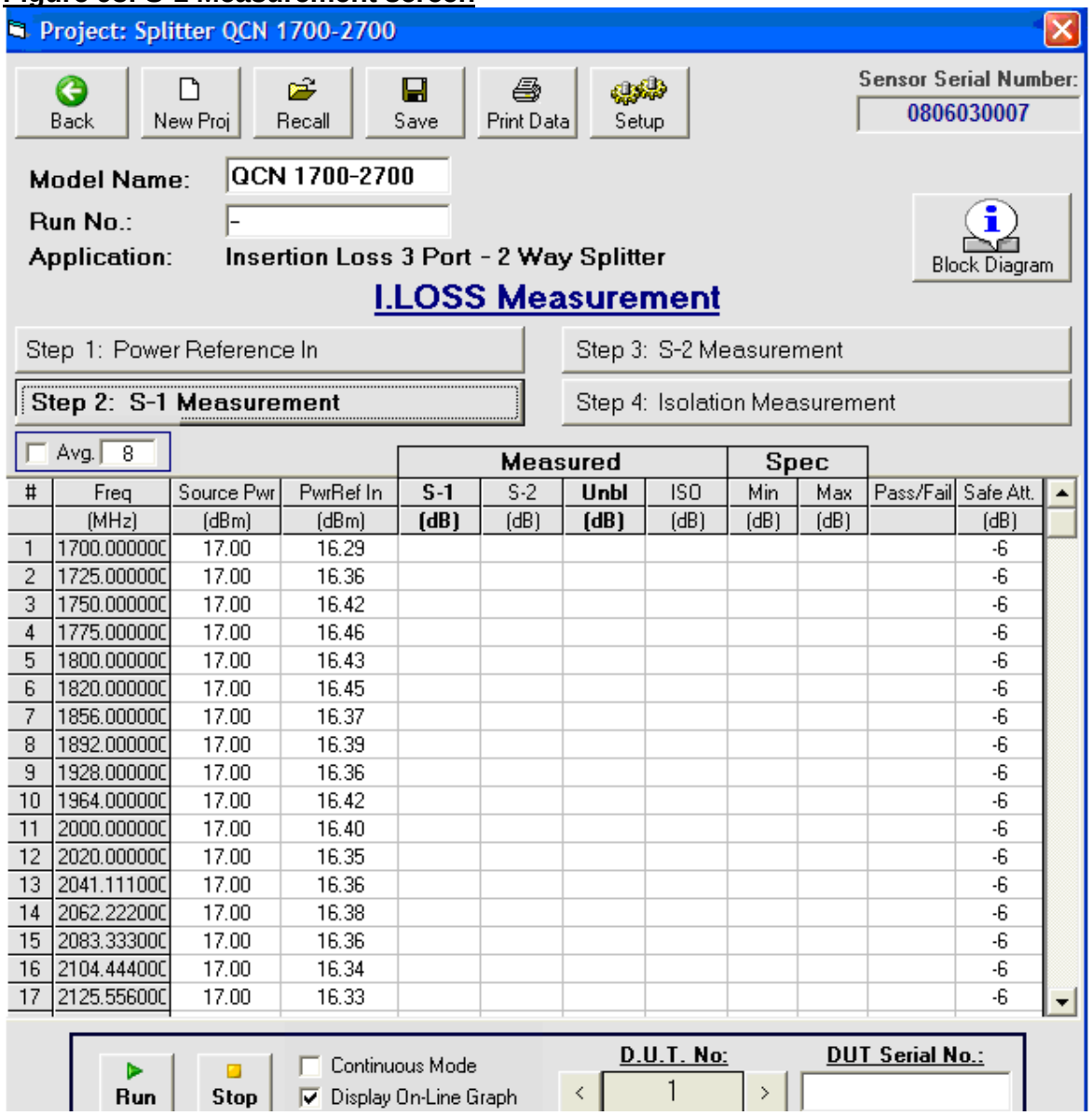
- **Step 15.** Press **Step 2: S-1 Measurement** key.

  The 2 Way Splitter's **S-1 Measurement** screen will open (see **Figure 98**).

- **Step 16.** Open **S-1 Measurement's Block Diagram** setup (see **Figure 99**).

- **Step 17.** Assemble the 2 Way Splitter's **S-1 Measurement** setup**.**

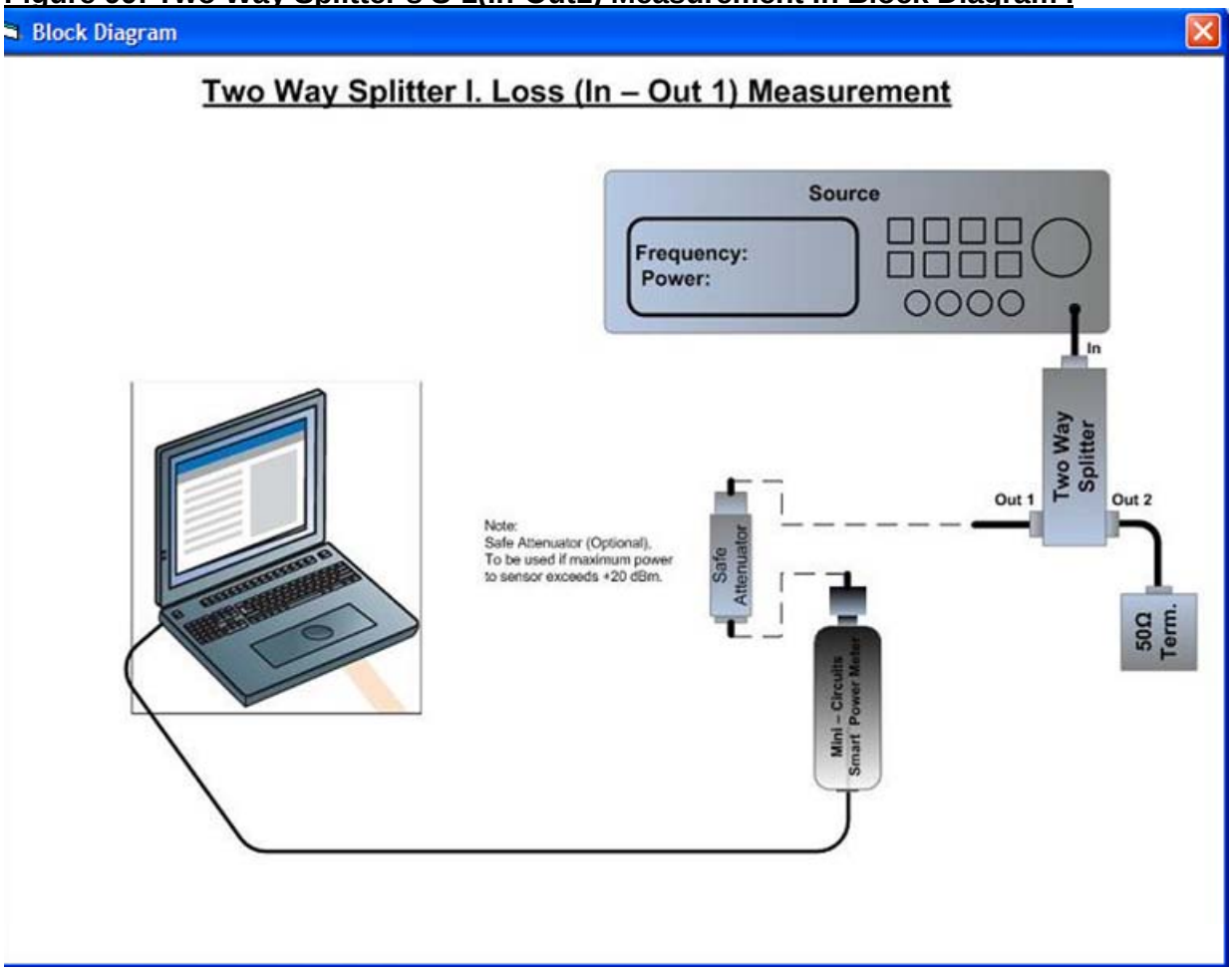
Figure 98: S-1 Measurement screen



- **Step 18.** Enter spec. data (If available).
  [see explanation **3.4.2.2 Spec. Definitions** on **page 21**].

- **Step 19.** You can enable **Continuous Mode** if necessary for your application.

Figure 99: Two Way Splitter's S-1(In-Out1) Measurement In Block Diagram .



- **Step 20.** You can enable the **On-Line Graph** option.
  (see **3.5 On-Line Graph features page 22**).

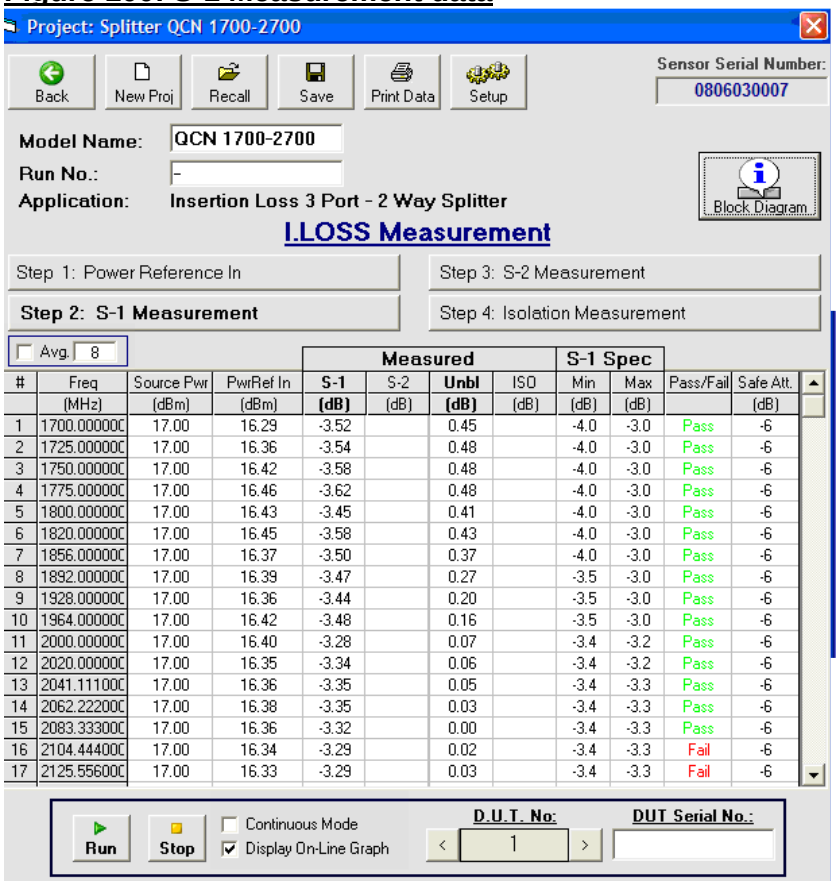
- **Step 21.** Enter **D.U.T Serial No.**: (If available).

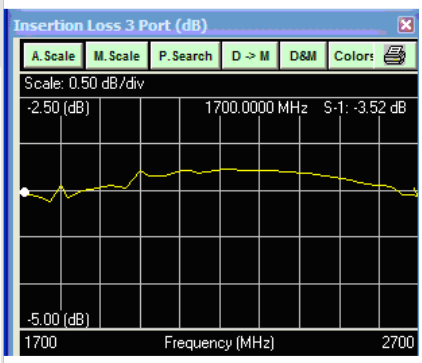
- **Step 22.** Press **Run** key to launch test. You can stop the test at any stage by pressing the **Stop** key. If **Continuous Mode** is not enabled test will finish after sweeping all segments. If **Continuous Mode** is enabled test will repeat until interrupted by **Stop** key.

- **Step 23.** If you have more than one D.U.T to test repeat **Steps 19-22** for next test.

- **Step 24.** 2 Way Splitter's **S-1 Measurement** data received (see **Figure 100**).

Figure 100: S-1 Measurement data





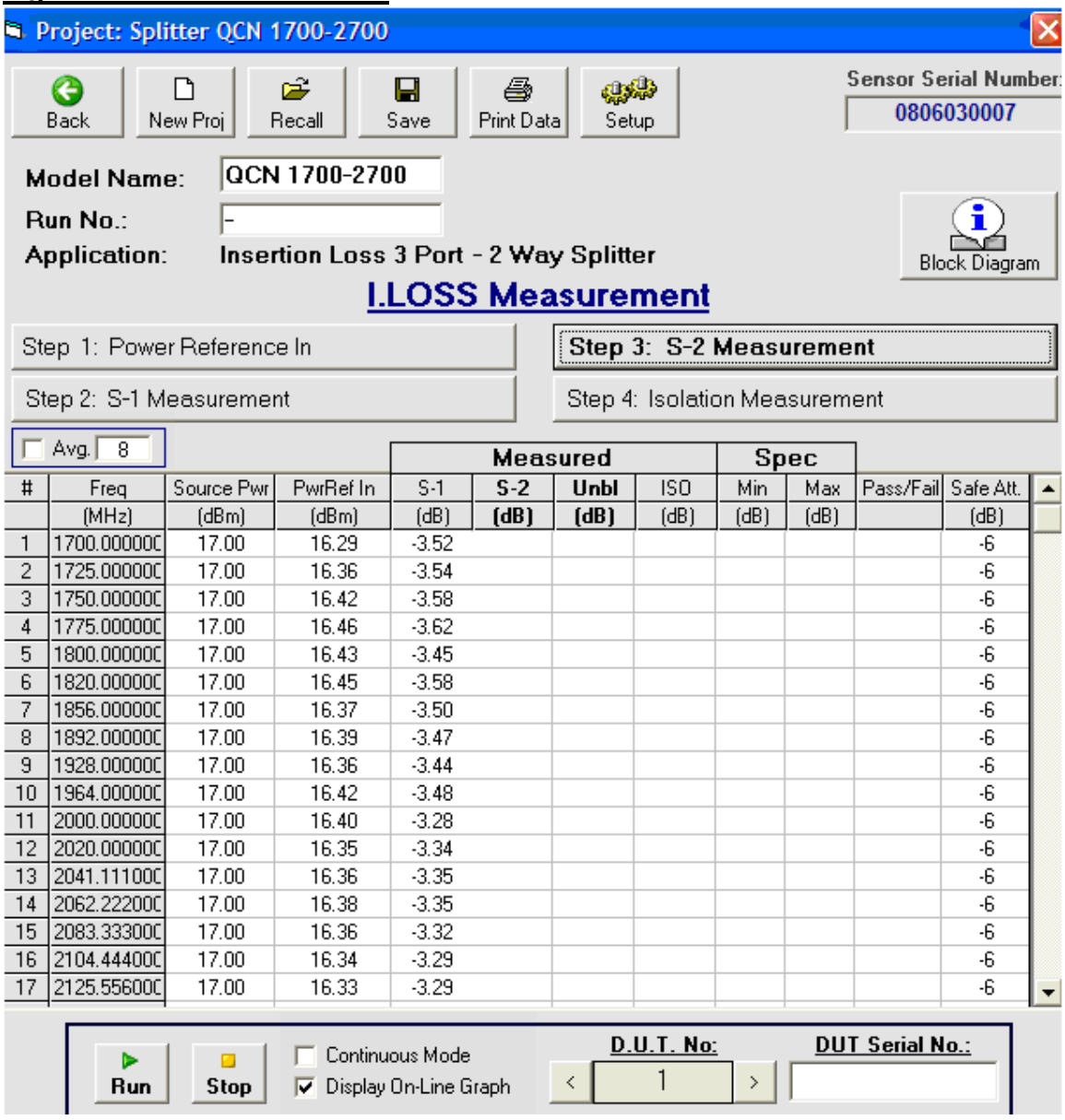
- **Step 25.** Press **Step 3: S-2 Measurement** key.

  The 2 Way Splitter's **S-2 Measurement screen** will open (see **Figure 101**).

- **Step 26.** Open **S-2 Measurement's Block Diagram** setup (see **Figure 102**).

- **Step 27.** Assemble the 2 Way Splitter's **S-2 Measurement setup.**

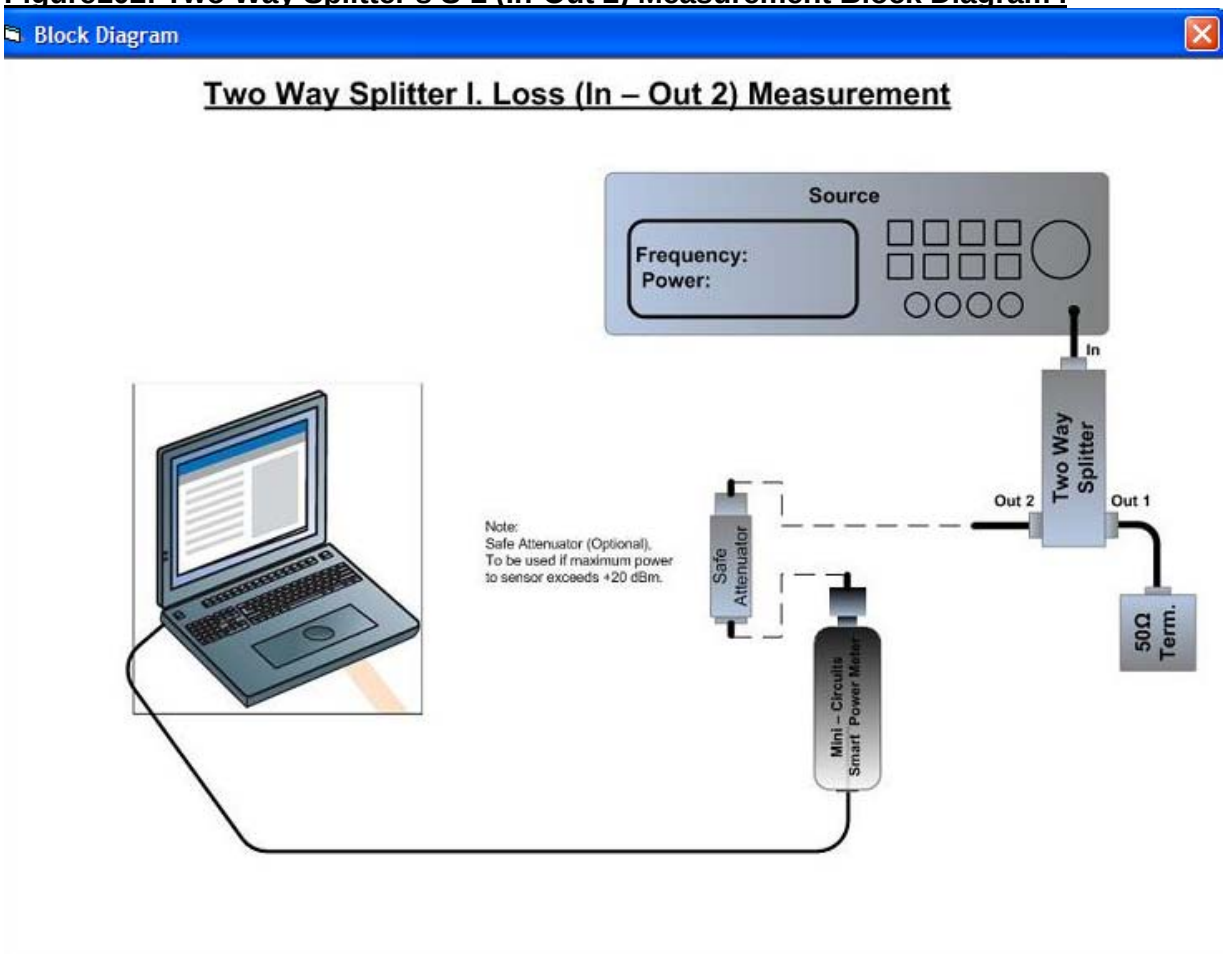
Figure 101: S-2 Measurement



- **Step 28.** Enter spec. data (If available).
  [see explanation **3.4.2.2 Spec. Definitions** on **page 21**].

- **Step 29.** You can enable **Continuous Mode** if necessary for your application.

Figure102: Two Way Splitter's S-2 (In-Out 2) Measurement Block Diagram .



- **Step 30.** You can enable the **On-Line Graph** option.
  (see **3.5 On-Line Graph features page 22**).

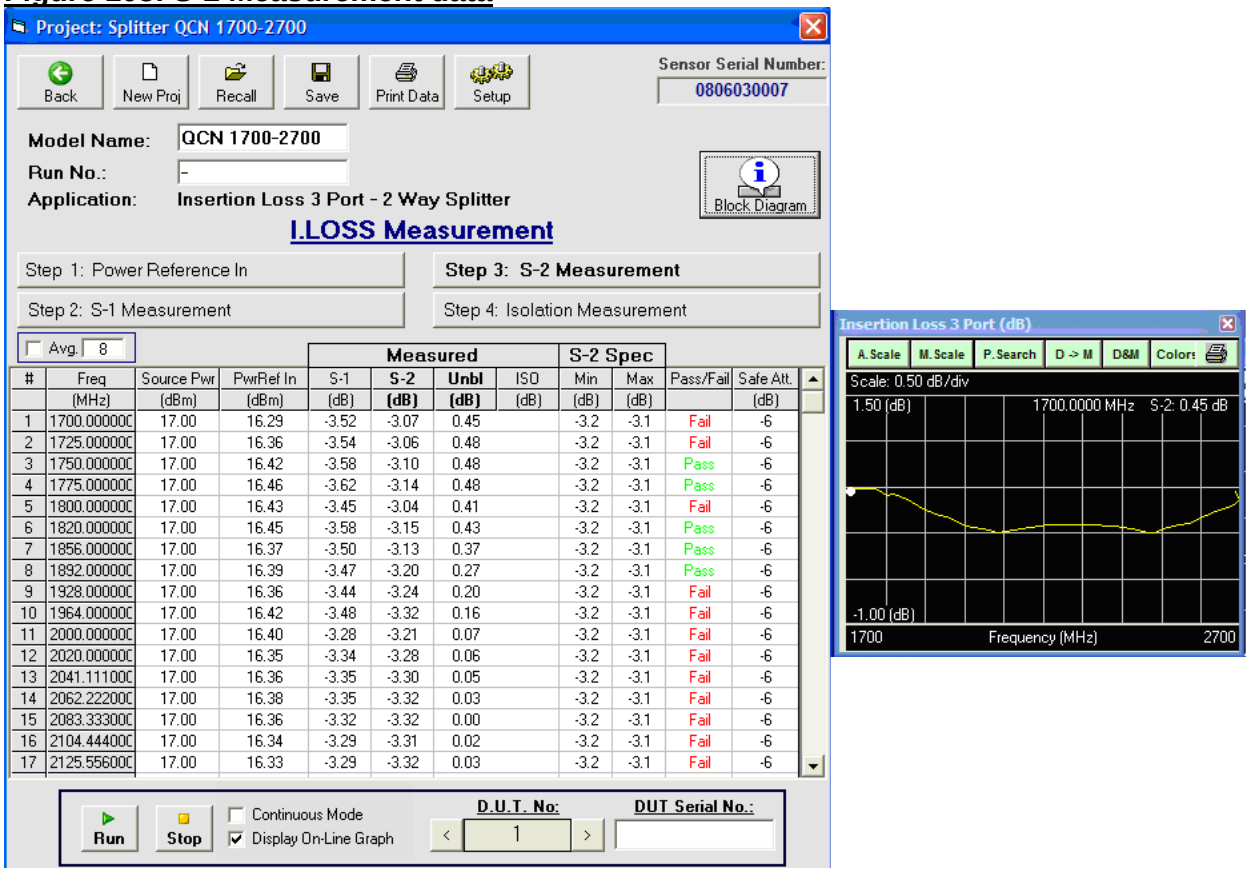
- **Step 31.** Enter **D.U.T Serial No.**: (If available).

- **Step 32.** Press **Run** key to launch test. You can stop the test at any stage by pressing the **Stop** key. If **Continuous Mode** is not enabled test will finish after sweeping all segments. If **Continuous Mode** is enabled test will repeat until interrupted by **Stop** key.

- **Step 33.** If you have more than one D.U.T to test repeat **Steps 29-32** for next test.

- **Step 34.** 2 Way Splitter's **S-2 Measurement** data received (see **Figure 103)**.

Figure 103: S-2 Measurement data



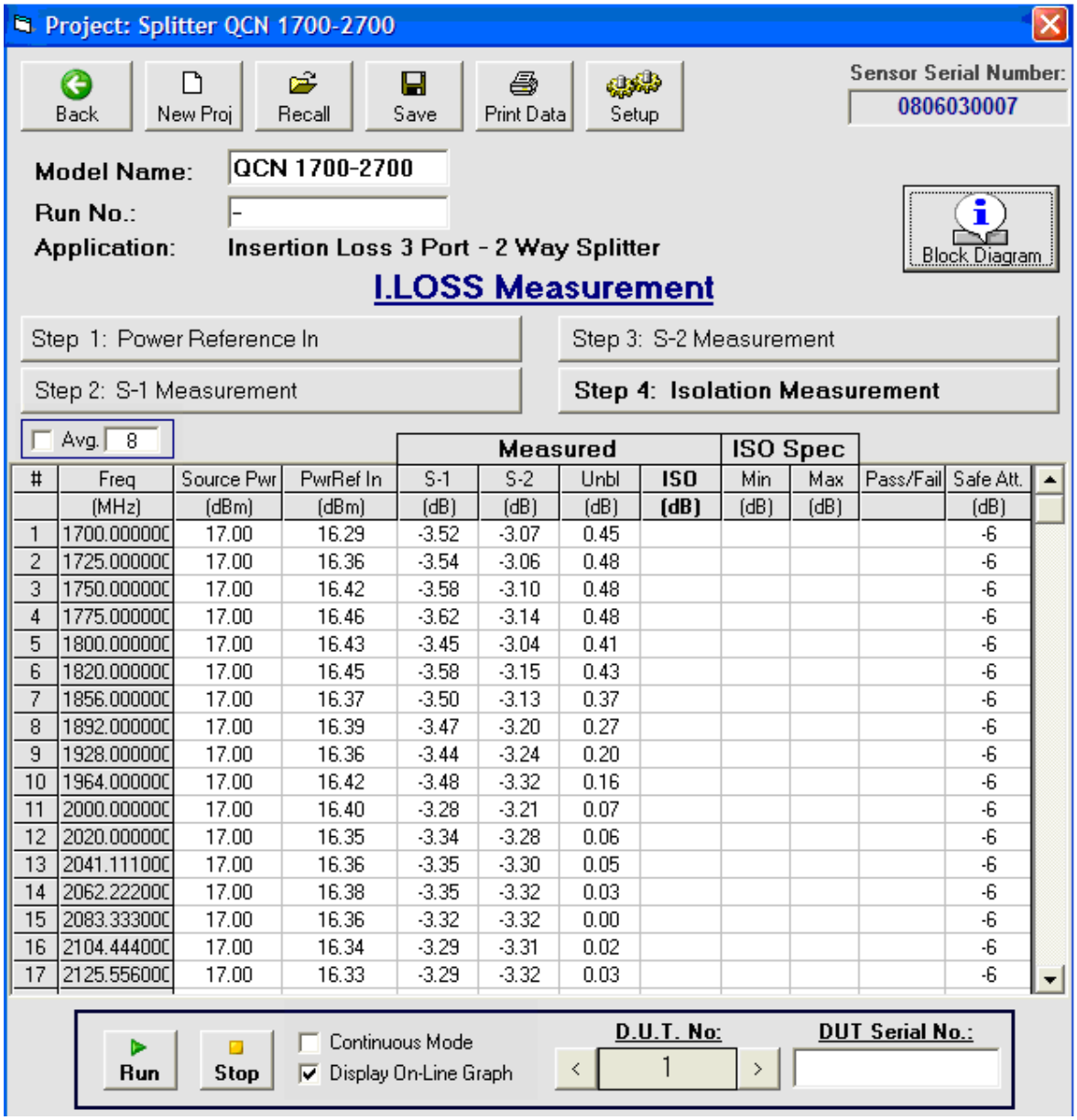
- **Step 35.** Press **Step 4: Isolation Measurement** key.

  The 2 Way Splitter's **Isolation Measurement screen** will open (see **Figure 104**).

- **Step 36.** Open **Isolation Measurement's** Block **Diagram** setup (see **Figure 105**).

- **Step 37.** Assemble the 2 Way Splitter's **Isolation Measurement** equipment setup.

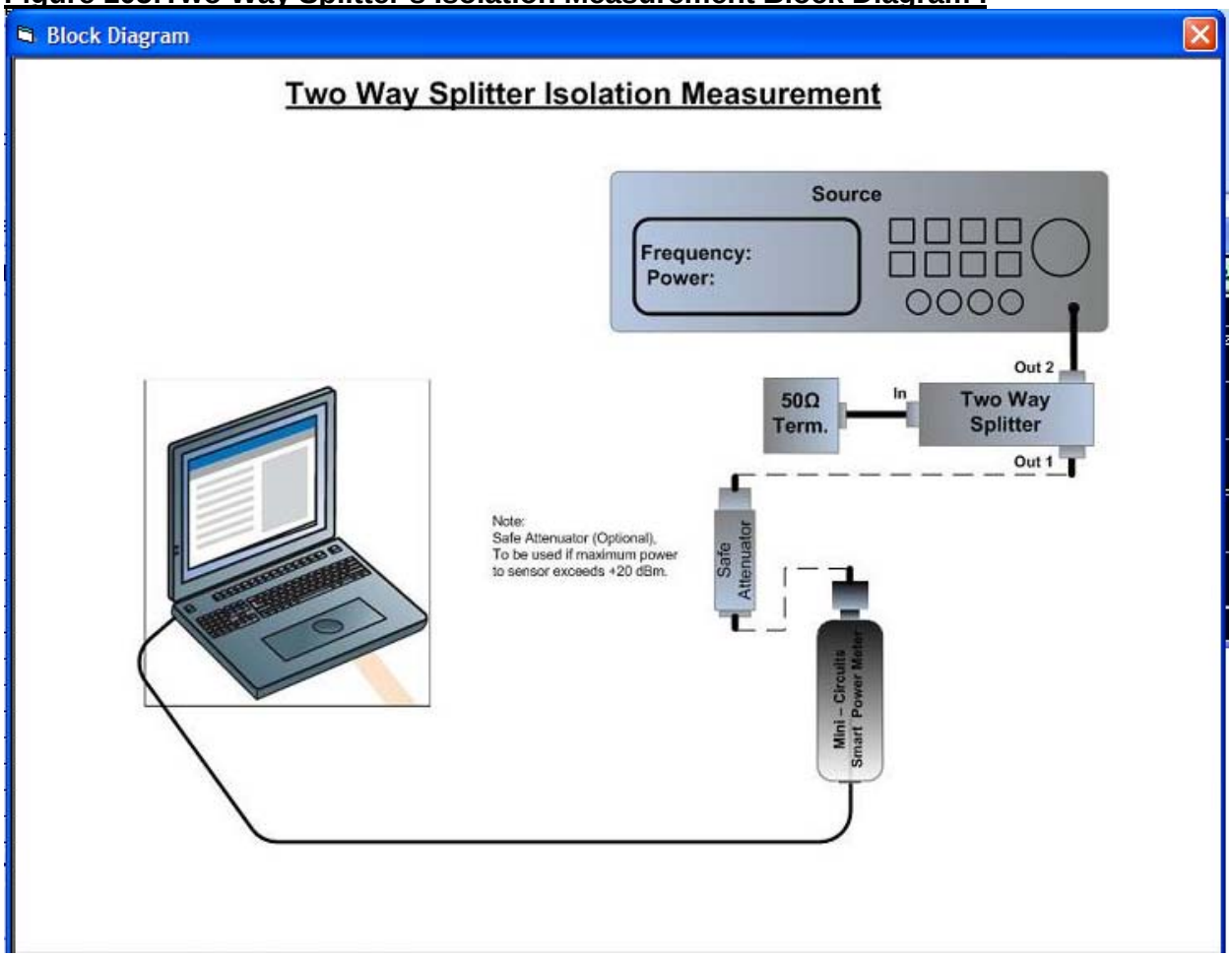
Figure 104: Isolation Measurement



- **Step 38.** Enter spec. data (If available).
  [see explanation **3.4.2.2 Spec. Definitions** on **page 21**].

- **Step 39.** You can enable **Continuous Mode** if necessary for your application.

Figure 105:Two Way Splitter's Isolation Measurement Block Diagram .



- **Step 40.** You can enable the **On-Line Graph** option.
  (see **3.5 On-Line Graph features page 22**).

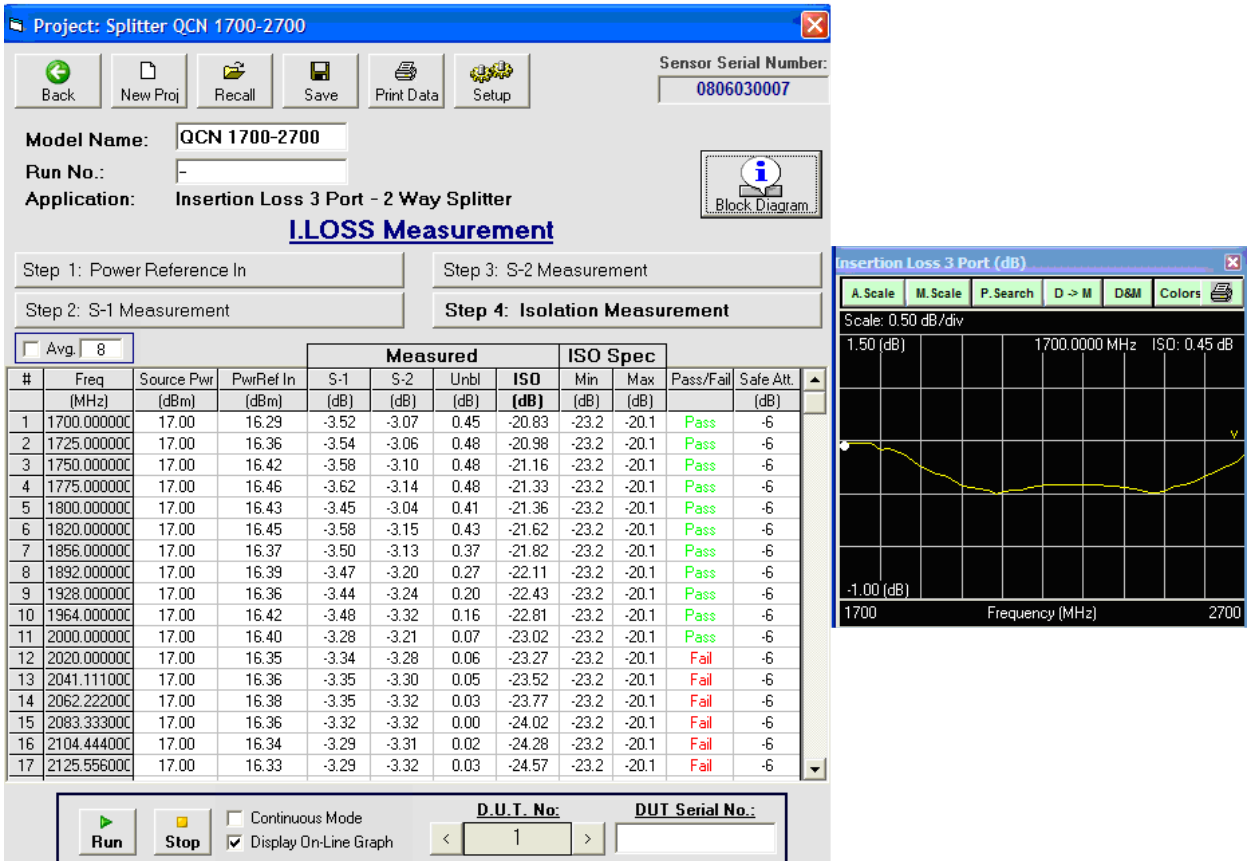
- **Step 41.** Enter **D.U.T Serial No.**: (If available).

- **Step 42.** Press **Run** key to launch test. You can stop the test at any stage by pressing the **Stop** key. If **Continuous Mode** is not enabled test will finish after sweeping all segments. If **Continuous Mode** is enabled test will repeat until interrupted by **Stop** key.

- **Step 43.** If you have more than one D.U.T to test repeat **Steps 39-42** for next test.

- **Step 44.** 2 Way Splitter's **Isolation Measurement** data received (see **Figure 106**).

Figure 106: Isolation Measurement



- **Step 45.** Save your project data (see **3.3.1.3 Save Function** on **page 16** for explanation).

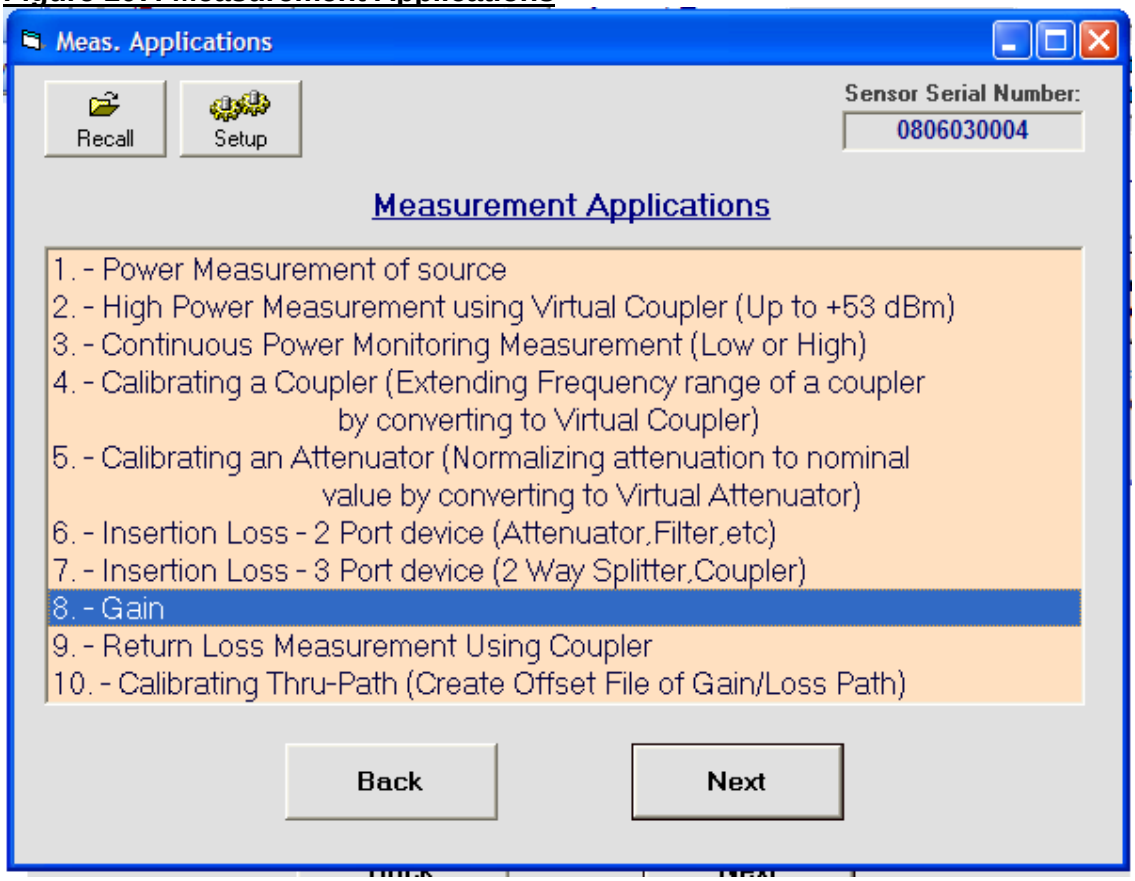
- **Step 46.** You can print your test data (see **3.6 Printing Data Function** on **page 23** explanation).

11.0 Application # 8- Gain.

This chapter describes the process of measuring the Gain of a device. Before you can begin measurements you must establish a Reference Power measurement described in **3.3** on **page 13.** If the device's power output is expected to approach or exceed +20dBm you will need a safe attenuator at the power sensor input to prevent damage. If the Safe Attenuator is not flat use a Virtual Attenuator CAL file (see Virtual Attenuator in **chapter 8.)** Data output of this measurement will be in [dB]

- **Step 1.** Open a project from **Measurement Applications** screen (see **Figure 107**).

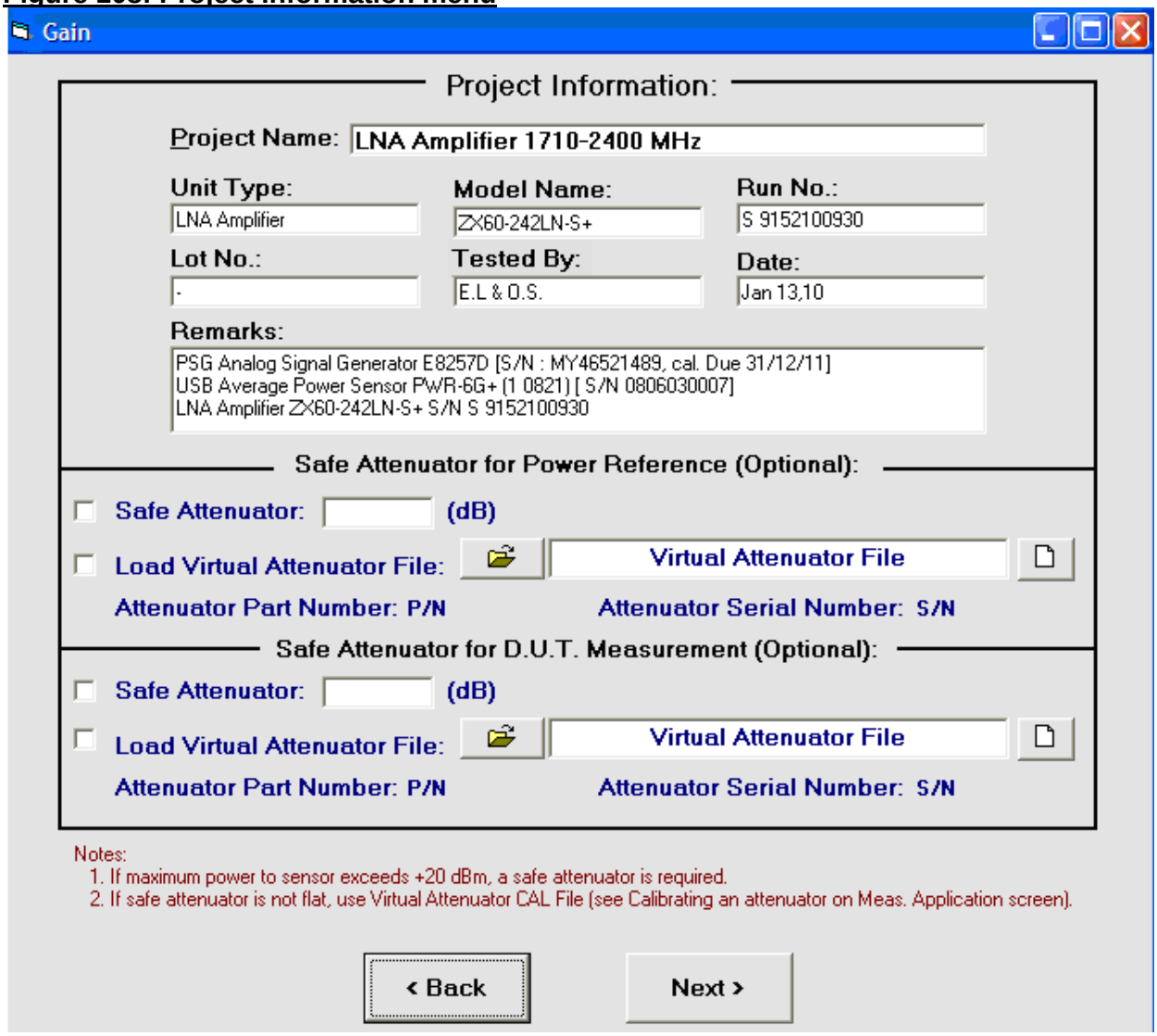
Figure 107: Measurement Applications



Note If the D.U.T will enter compression during the test consider using filters as Virtual Attenuators (see **chapter 8**, **page 60**) to suppress harmonics.

- **Step 2.** The **Project Information menu** will open (see **Figure 108**).
- **Step 3.** Review and fill all necessary fields in the **Project Information menu** see detailed explanation **Figure 4** and **Table 3** at **pages 8-9.**

Figure 108: Project Information menu



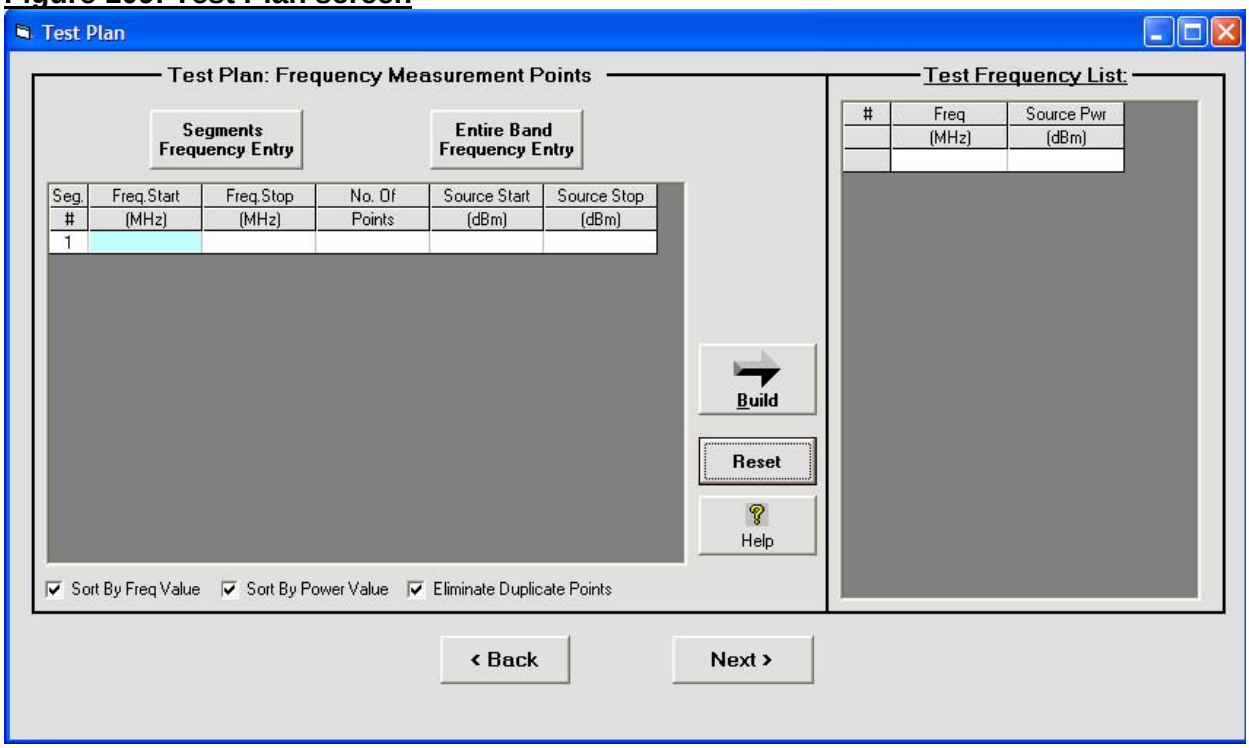
Note 1.If maximum power to sensor exceeds +20dBm, a safe attenuator is required
2. If safe attenuator is not flat, use Virtual Attenuator file. See creation of Virtual Attenuator **Chapter 8**.

- **Step 4.** Press **Next** key.
  The **Test Plan** screen will open (see **Figure 109**).

- **Step 5.** You can choose one of two options to build the measurement points set (see **Chapter 3.2, Figures 5-6** on **pages 9-10**).

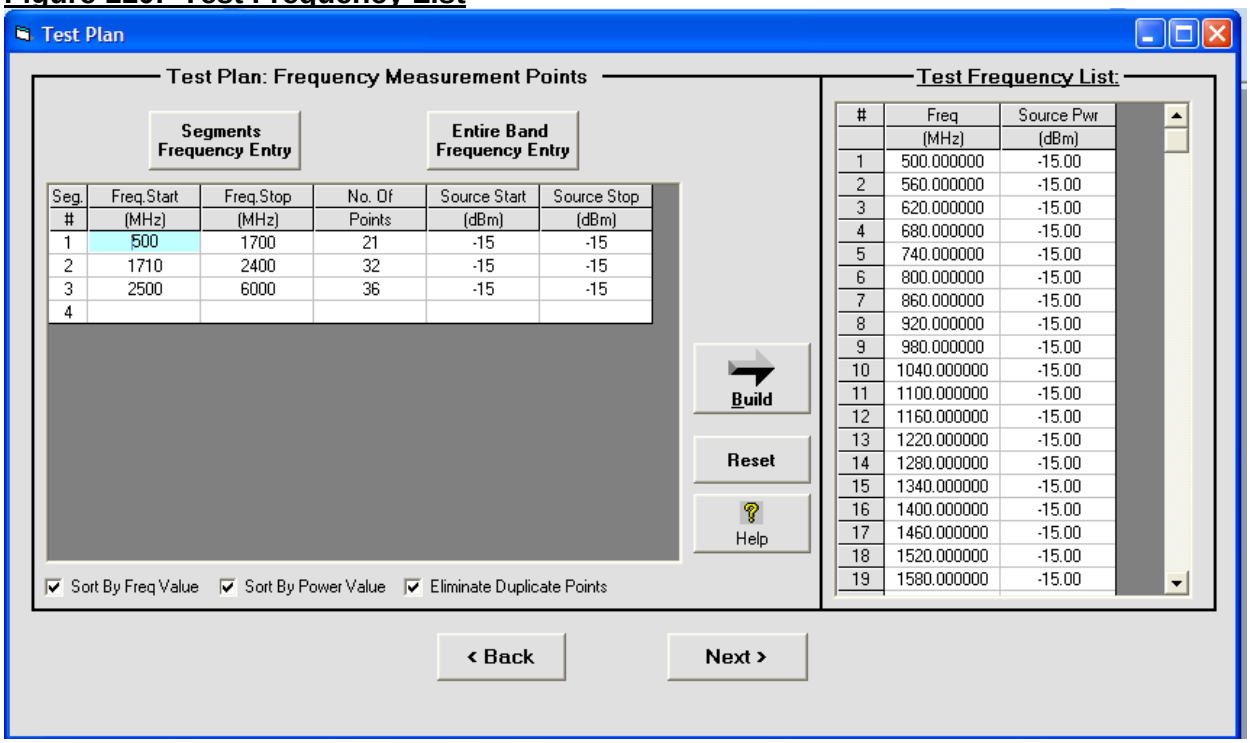
- **Step 6.** Create the measurement points and set input power (you can see an explanation and an example in **Figure 5** on **pages 10-11**).

Figure 109: Test Plan screen



- **Step 7.** Press **Build** key to create a **Test Frequency List** (see **Figure 110**).

Figure 110: Test Frequency List



- **Step 8.** Press **Next** key. The **Gain Measurement** screen will open. (see **Figure 111**)
  Validate desirable data transferred from the previous screen.
  During all following steps you can use **Recall** and **Save** keys at all stages (see **3.3.1.2 Recall** on **page 15, 3.3.1.3 Save** on **page 16** for explanation)

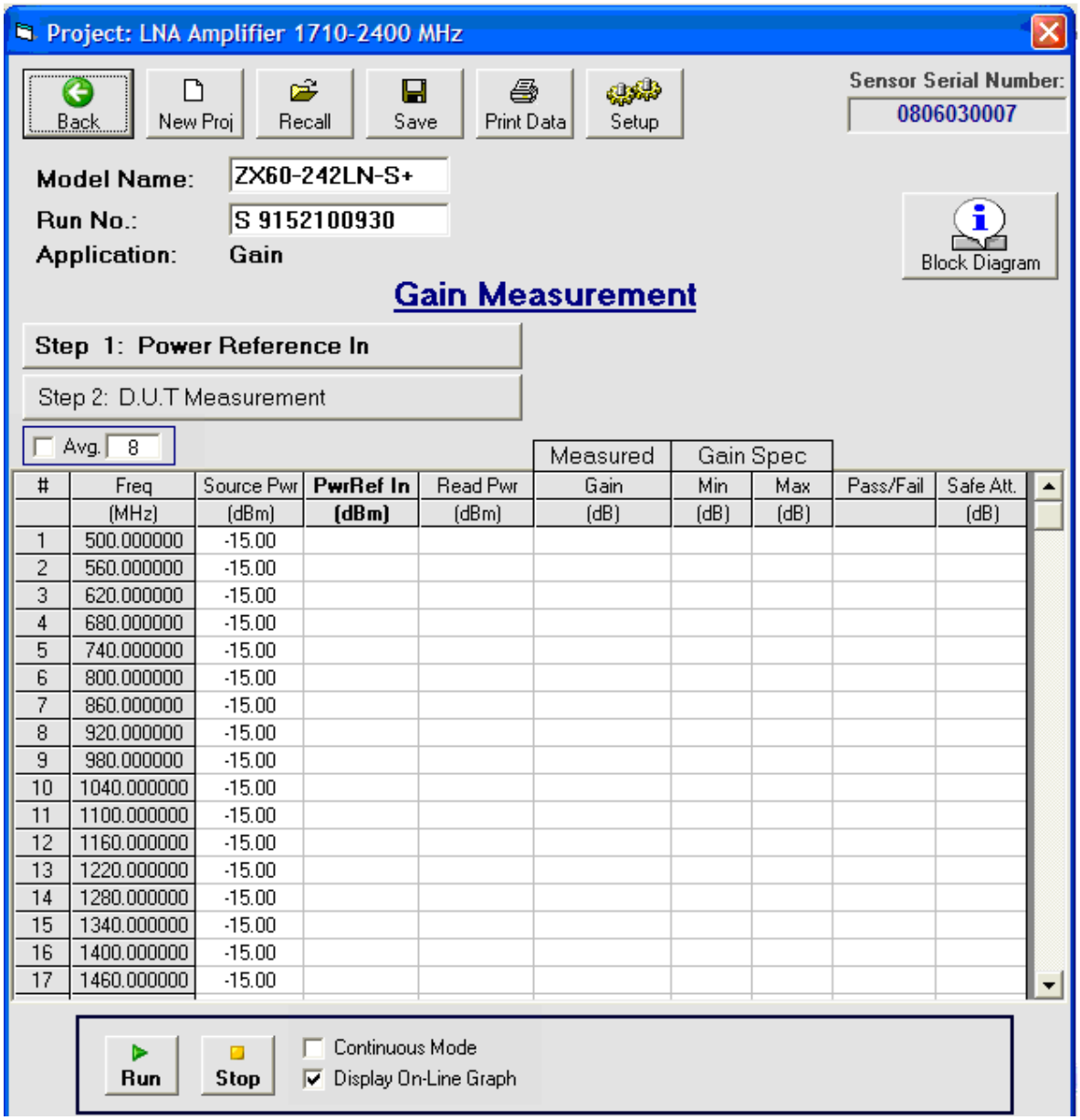
- **Step 9.** Press **Step 1: Power Reference In** key.

- **Step 10.** Open **Power Reference In** measurement **Block Diagram** setup (see **Figure 112**).

- **Step 11.** Assemble the **Power Reference In** equipment setup.

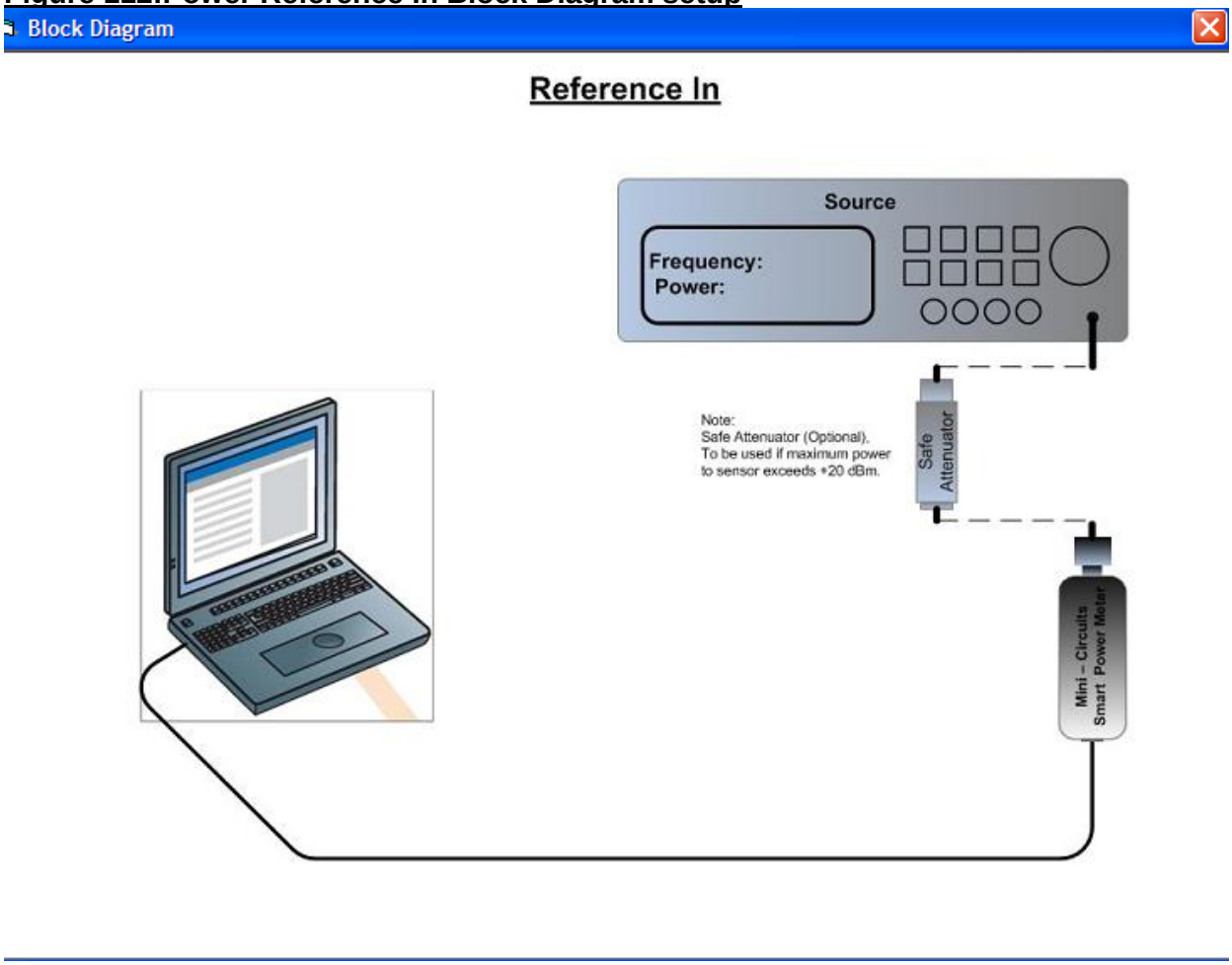
- **Step 12.** Define/Confirm **Setup** settings (see **2.1. Setting communication/commands in order to control an external source.** on **page 5**).

Figure 111: Power Reference In Measurement screen



#	Freq (MHz)	Source Pwr (dBm)	PwrRef In (dBm)	Read Pwr (dBm)	Measured Gain (dB)	Gain Spec Min (dB)	Gain Spec Max (dB)	Pass/Fail	Safe Att. (dB)
1	500.000000	-15.00							
2	560.000000	-15.00							
3	620.000000	-15.00							
4	680.000000	-15.00							
5	740.000000	-15.00							
6	800.000000	-15.00							
7	860.000000	-15.00							
8	920.000000	-15.00							
9	980.000000	-15.00							
10	1040.000000	-15.00							
11	1100.000000	-15.00							
12	1160.000000	-15.00							
13	1220.000000	-15.00							
14	1280.000000	-15.00							
15	1340.000000	-15.00							
16	1400.000000	-15.00							
17	1460.000000	-15.00							

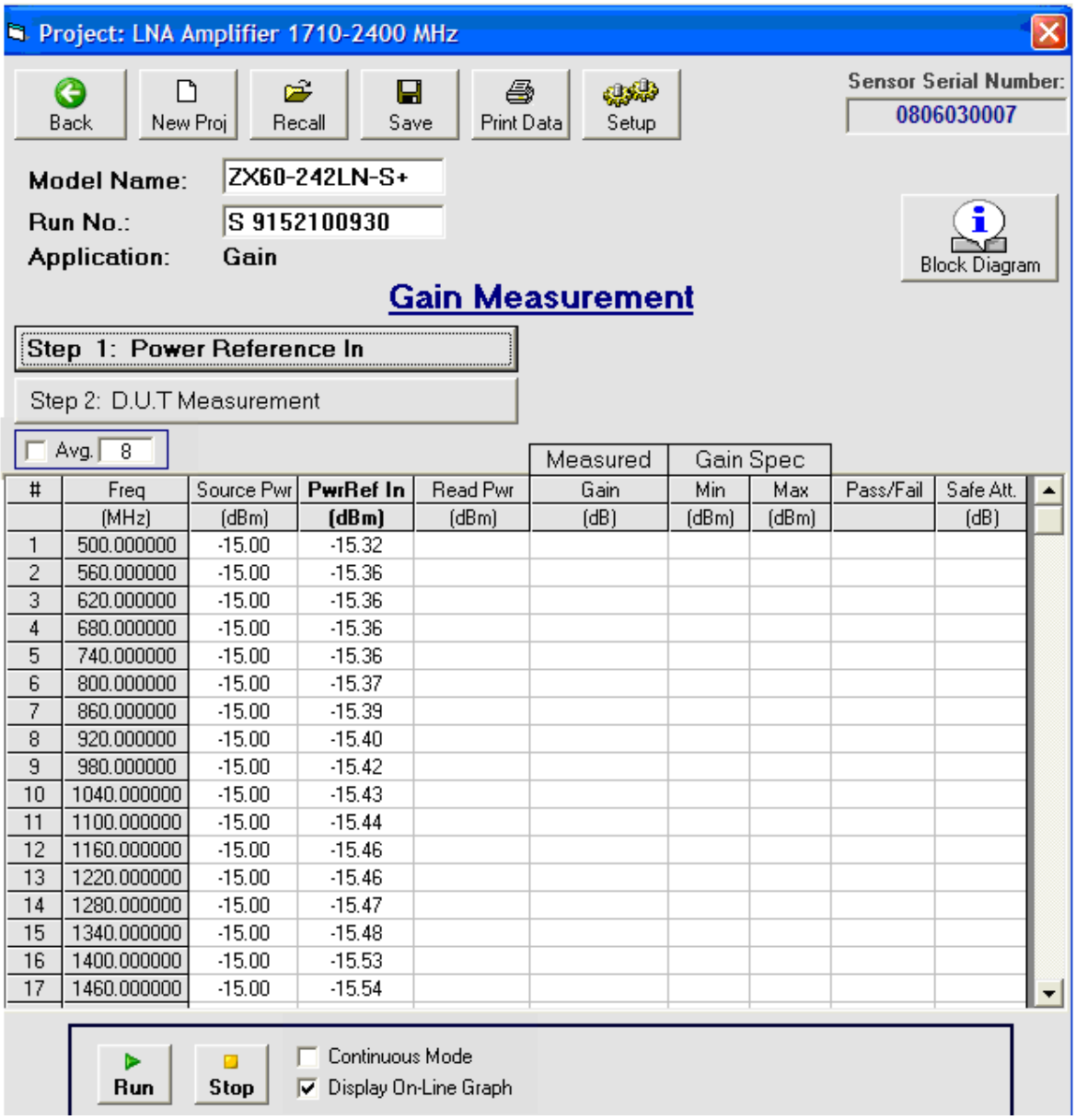
Figure 112:Power Reference In Block Diagram setup



- **Step 13.** Press **Run** key to launch test. You can stop the test at any stage by pressing the **Stop** key. If **Continuous Mode** is not enabled test will finish after sweeping all segments. If **Continuous Mode** is enabled test will repeat until interrupted by **Stop** key.

- **Step 14.** See results**: Figure 113: Power Reference In.**

Figure 113: Power Reference In



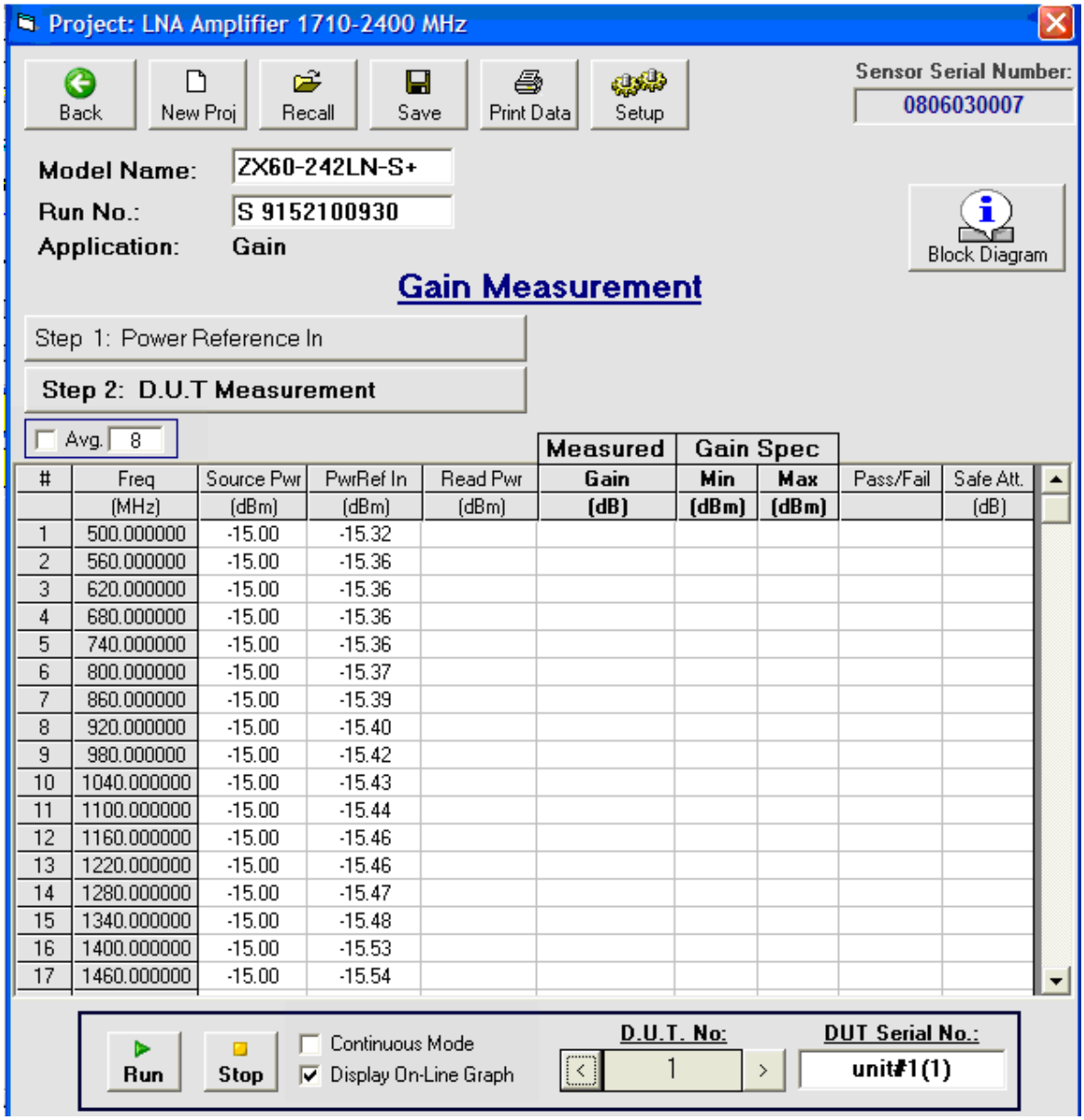
- **Step 15.** Press **Step 2: D.U.T. Measurement** key.

  The Gain's **D.U.T Measurement** screen will open (see **Figure 114**).

- **Step 16.** Open **D.U.T Measurement's Block Diagram** setup (see **Figure 115**)

- **Step 17.** Assemble the Gain's **D.U.T Measurement** equipment setup**.**

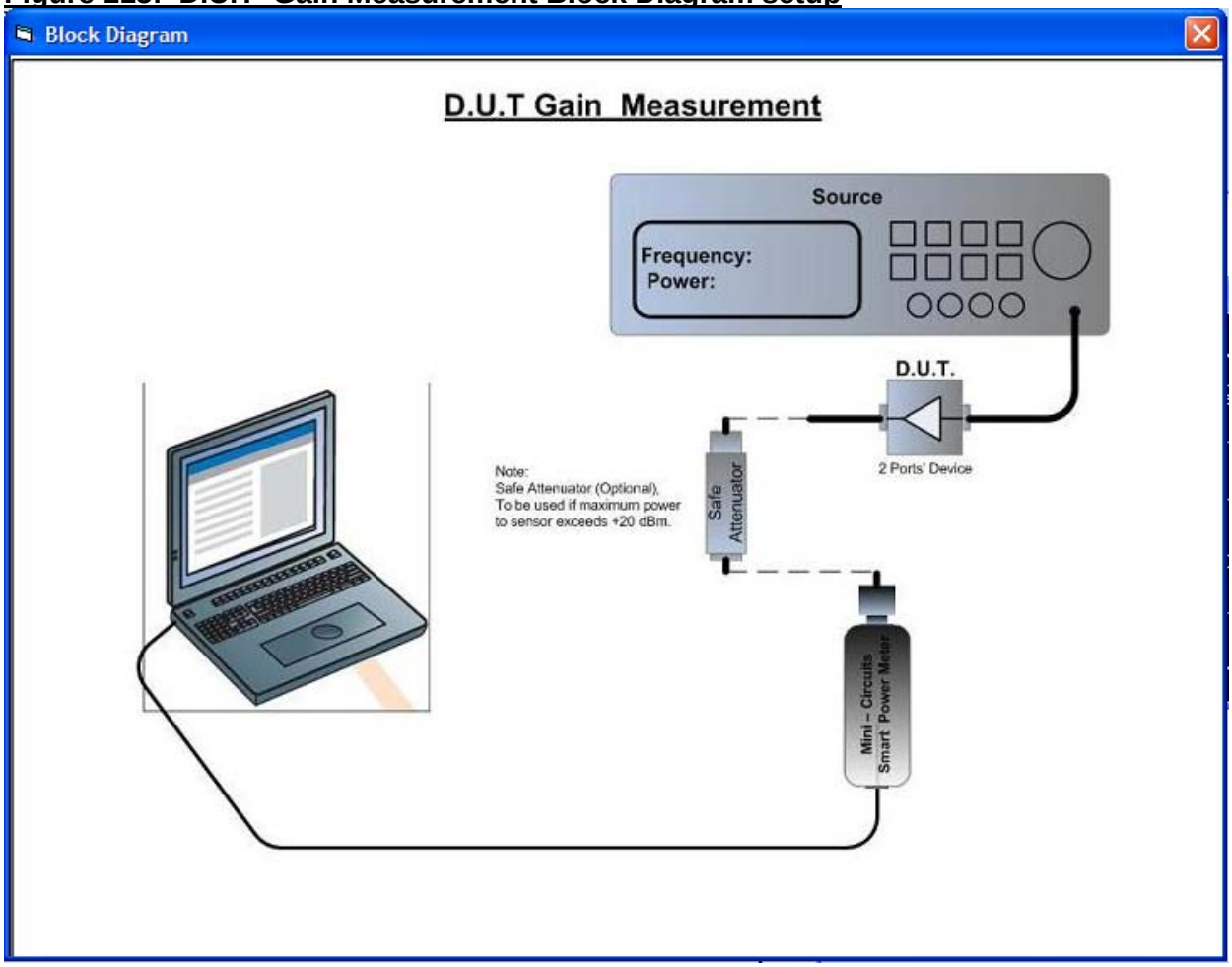
Figure 114: D.U.T Measurement screen



- **Step 18.** Enter spec. data (If available).
  [see explanation **3.4.2.2 Spec. Definitions** on **page 21**].

- **Step 19.** You can enable **Continuous Mode** if necessary for your application.

Figure 115: D.U.T Gain Measurement Block Diagram setup



- **Step 20.** You can enable the **On-Line Graph** option. (see **3.5 On-Line Graph features page 22**).

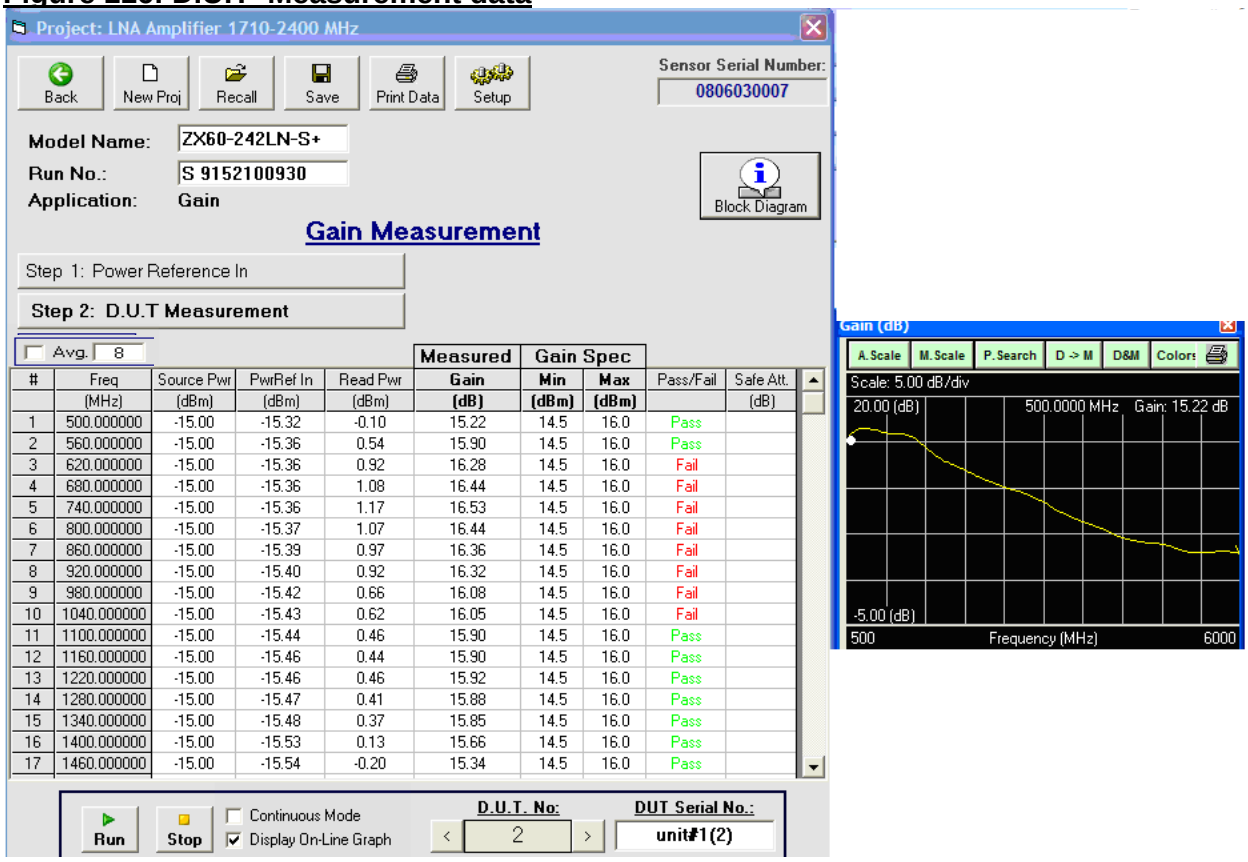
- **Step 21.** Enter **D.U.T Serial No:** (If available)

- **Step 22.** Press **Run** key to launch test. You can stop the test at any stage by pressing the **Stop** key. If **Continuous Mode** is not enabled test will finish after sweeping all segments. If **Continuous Mode** is enabled test will repeat until interrupted by **Stop** key.

- **Step 23.** If you have more than one D.U.T to test repeat **Steps 19-22** for next test.

- **Step 24. D.U.T Measurement** data received (see **Figure 116**).

Figure 116: D.U.T Measurement data



- **Step 25.** Save your project data (see **3.3.1.3 Save Function page** on **16** for explanation).

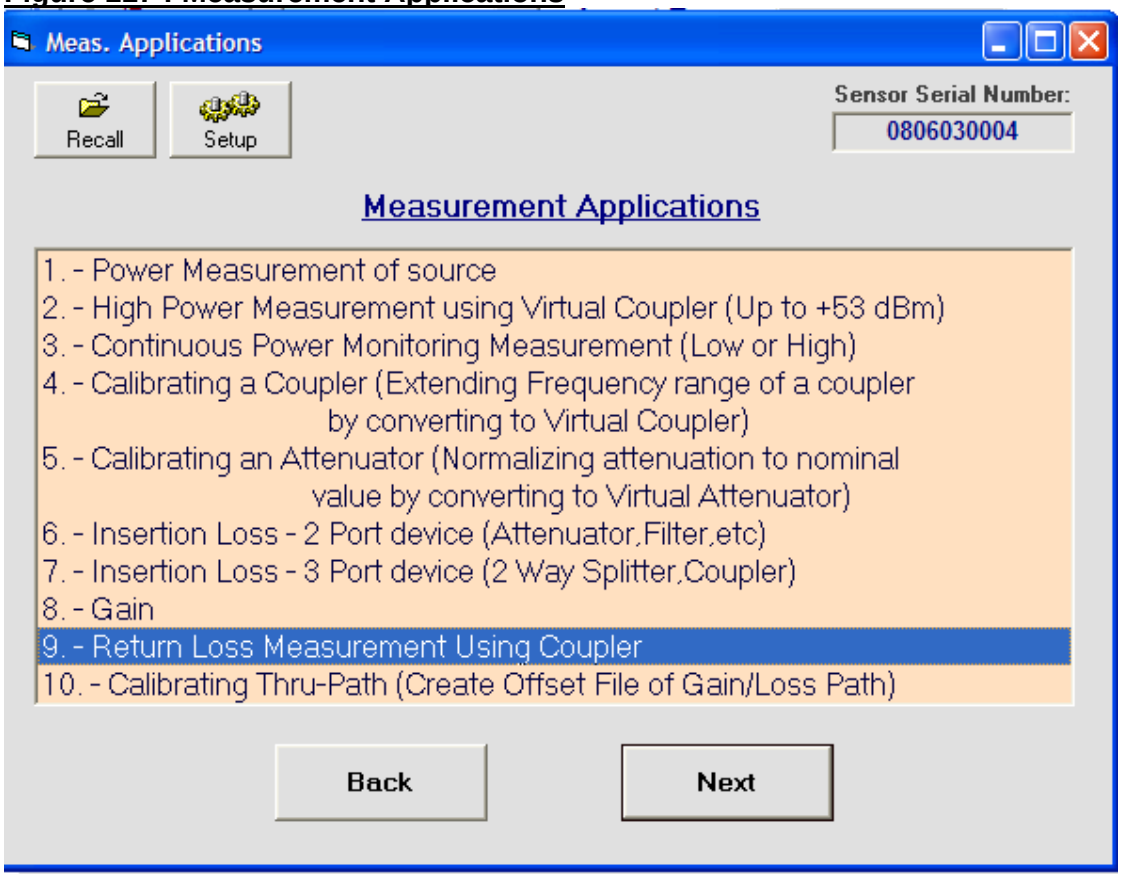
- **Step 26.** You can print your test data (see **3.6 Printing Data Function** on **page 23** for explanation).

12.0 Application # 9- Return Loss Measurement Using Coupler.

This chapter describes the process of measuring the return loss of a one or more port device using a coupler (Virtual Coupler option is not used). Before you can begin measurements you must establish a Reference Power measurement described in **3.3** on **page 11.** Please note that the power sensor is unable to reliably detect signals below -30dBm absolute and plan input power accordingly. Data output of this measurement will be in [-dB]

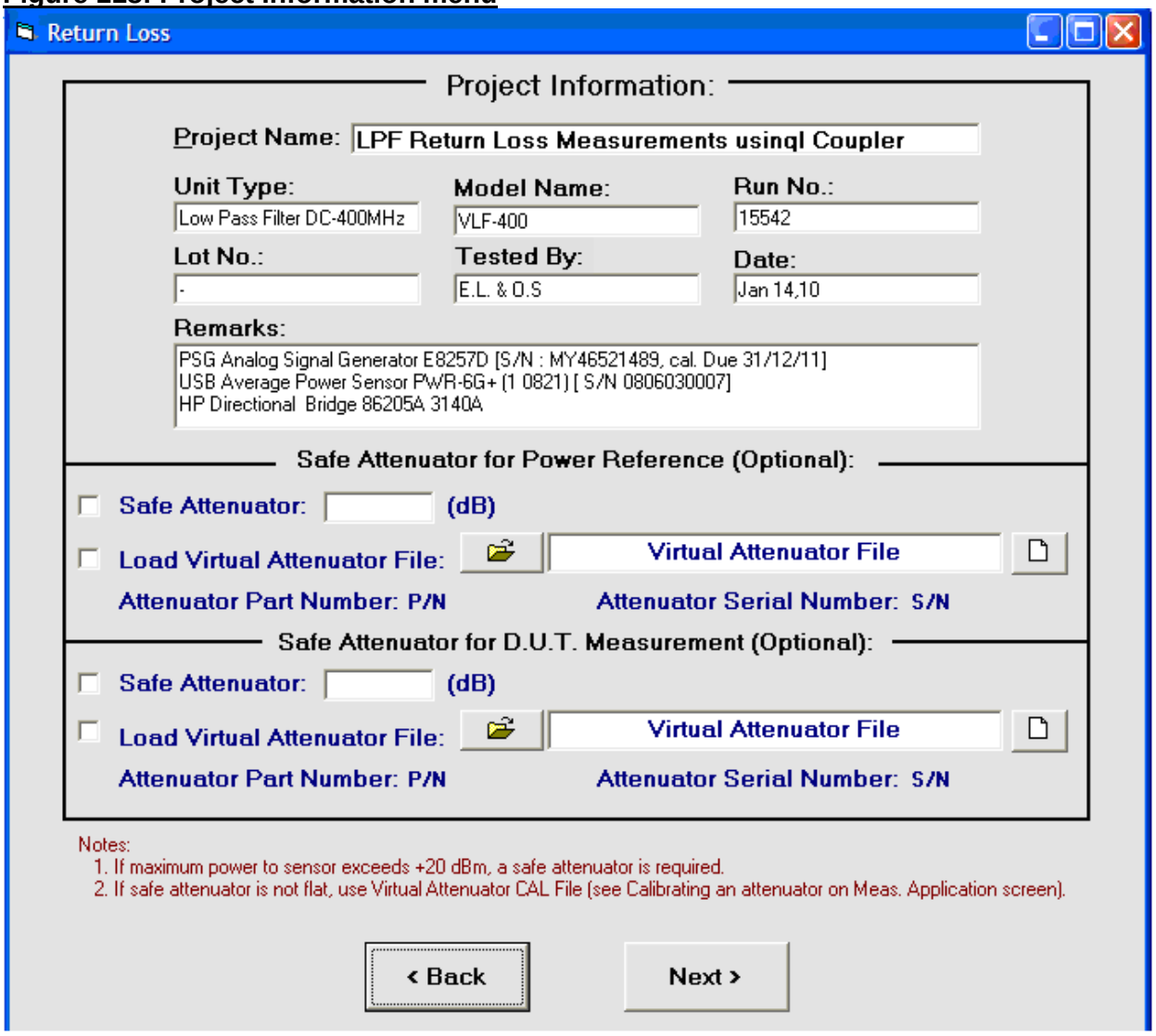
- **Step 1.** Open a project from the **Measurement Applications** screen (see **Figure 117**)

Figure 117 : Measurement Applications



- **Step 2.** The **Project Information menu** will open (see **Figure 118**).
- **Step 3.** Review and fill all necessary fields in the **Project Information menu** see detailed explanation **Figure 4** and **Table 3** at **pages 8-9**.

Figure 118: Project Information menu



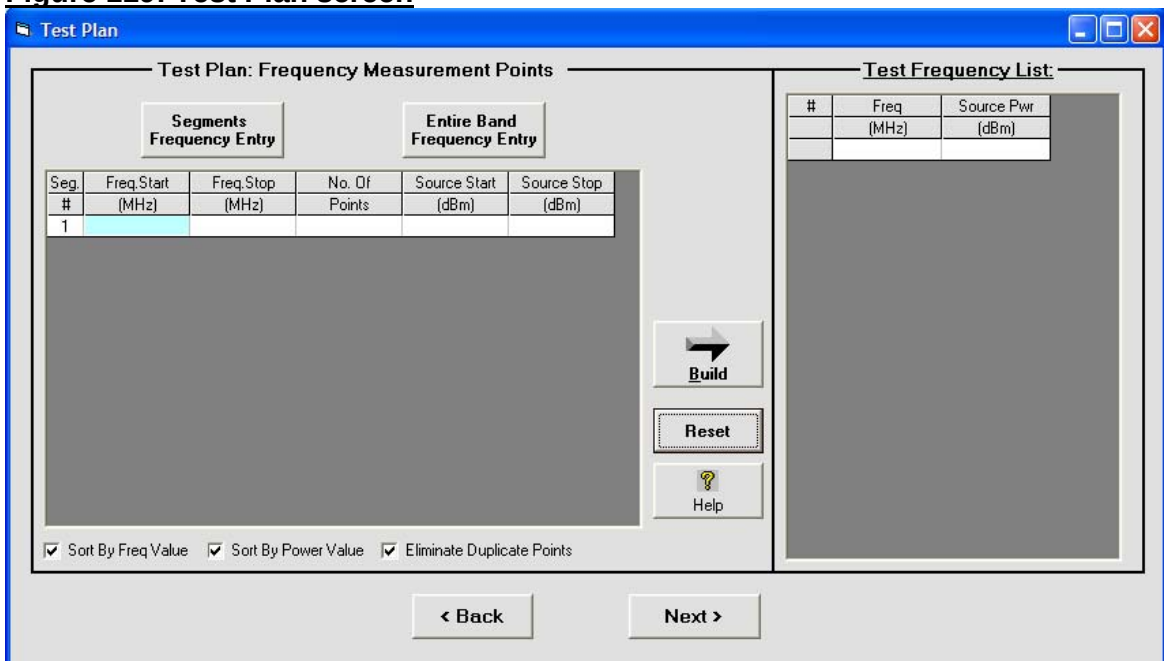
Note 1.If maximum power to sensor exceeds +20dBm, a safe attenuator is required
2. If safe attenuator is not flat, use Virtual Attenuator file. See creation of Virtual Attenuator **Chapter 8**.

- **Step 4.** Press **Next** key. The **Test Plan** screen will open (see **Figure 119**)

- **Step 5.** You can choose one of two options to build the measurement points set (see **Chapter 3.2, Figures 5-6** on **pages 9-10**).

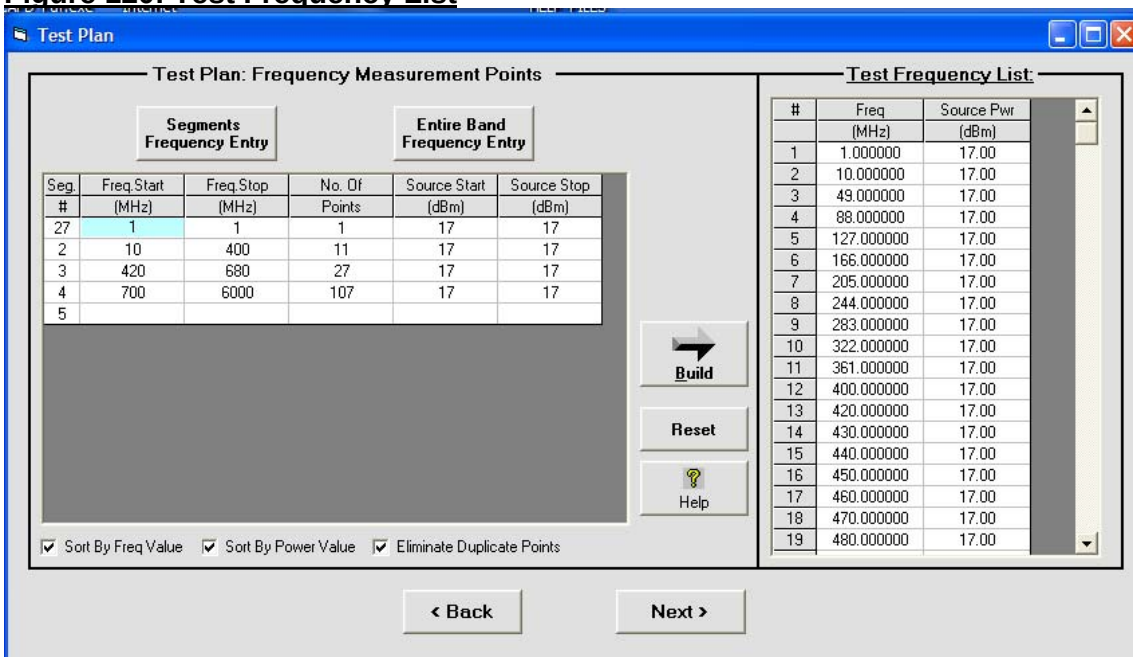
- **Step 6.** Create the measurement points and set input power (you can see an explanation and example in **Figure 5** on **pages 10-11**).

Figure 119: Test Plan screen



- **Step 7.** Press **Build** key to create a **Test Frequency List** (see **Figure 120**).

Figure 120: Test Frequency List



- **Step 8.** Press **Next** key The **R. Loss Measurement screen** will open. (see **Figure 121**) Validate desirable data transferred from the previous screen. During all following steps you can use **Recall** and **Save** keys at all stages (see **3.3.1.2 Recall** on **page 15, 3.3.1.3 Save** on **page 16** for explanation)

- **Step 9.** Press **Step 1: Return Loss Reference** key.

- **Step 10.** Open **Return Loss Reference** measurement's **Block Diagram** setup (see **Figure 122**).

- **Step 11.** Assemble the **Return Loss Reference** equipment setup.

- **Step 12.** Define/Confirm **Setup** settings (see **2.1. Setting communication/commands in order to control an external source.** on **page 5**)

Figure 121: Return Loss Reference screen

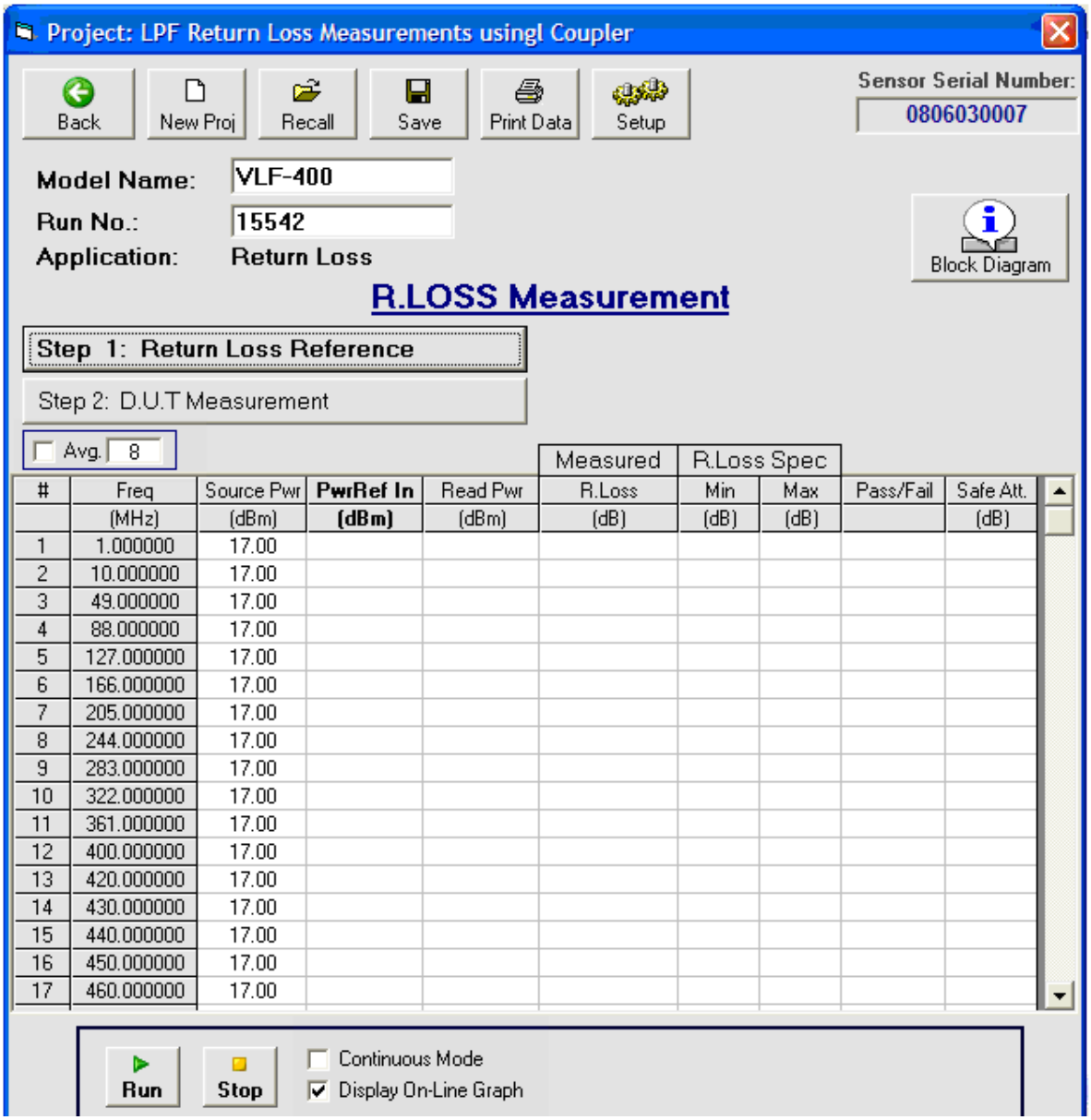
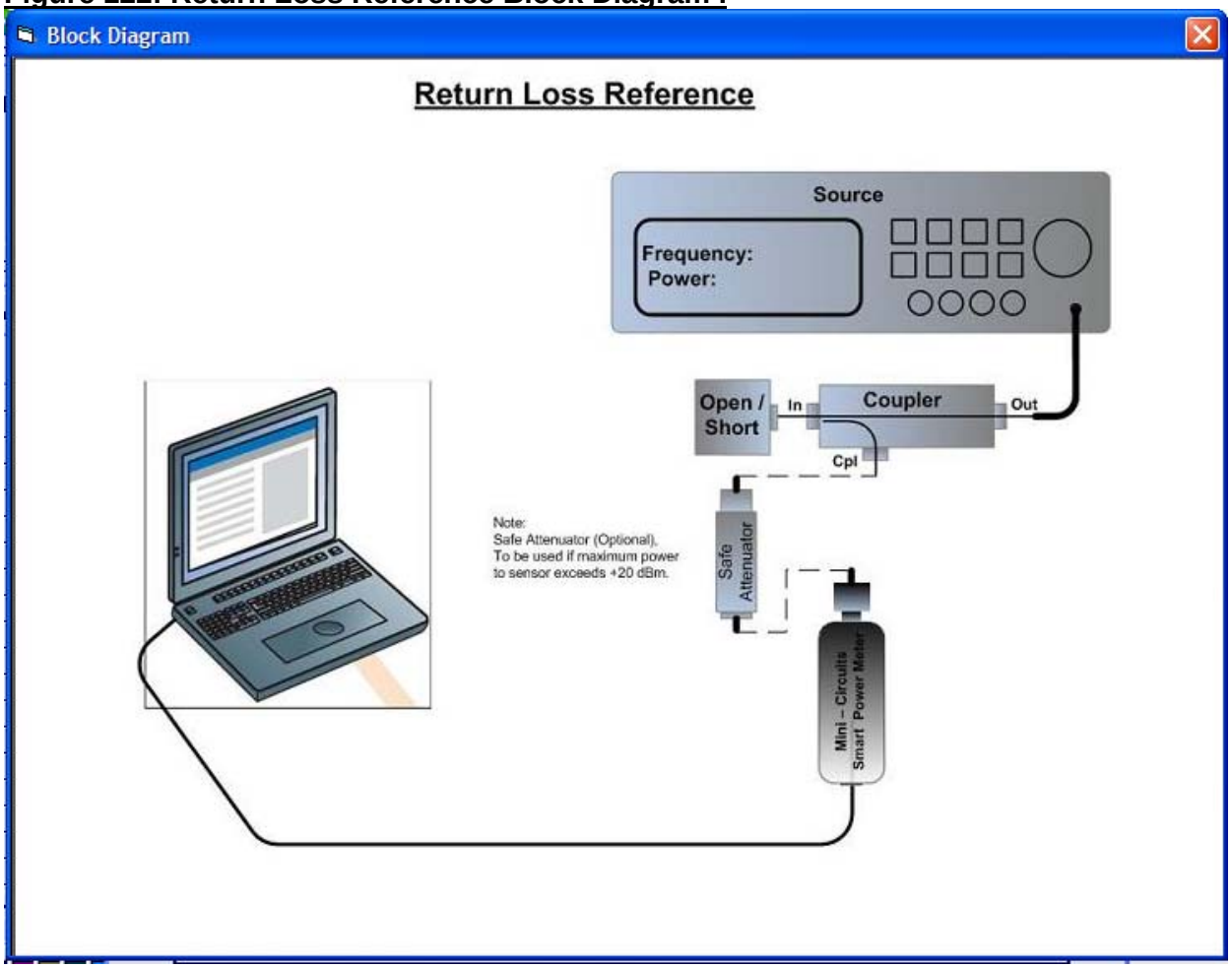


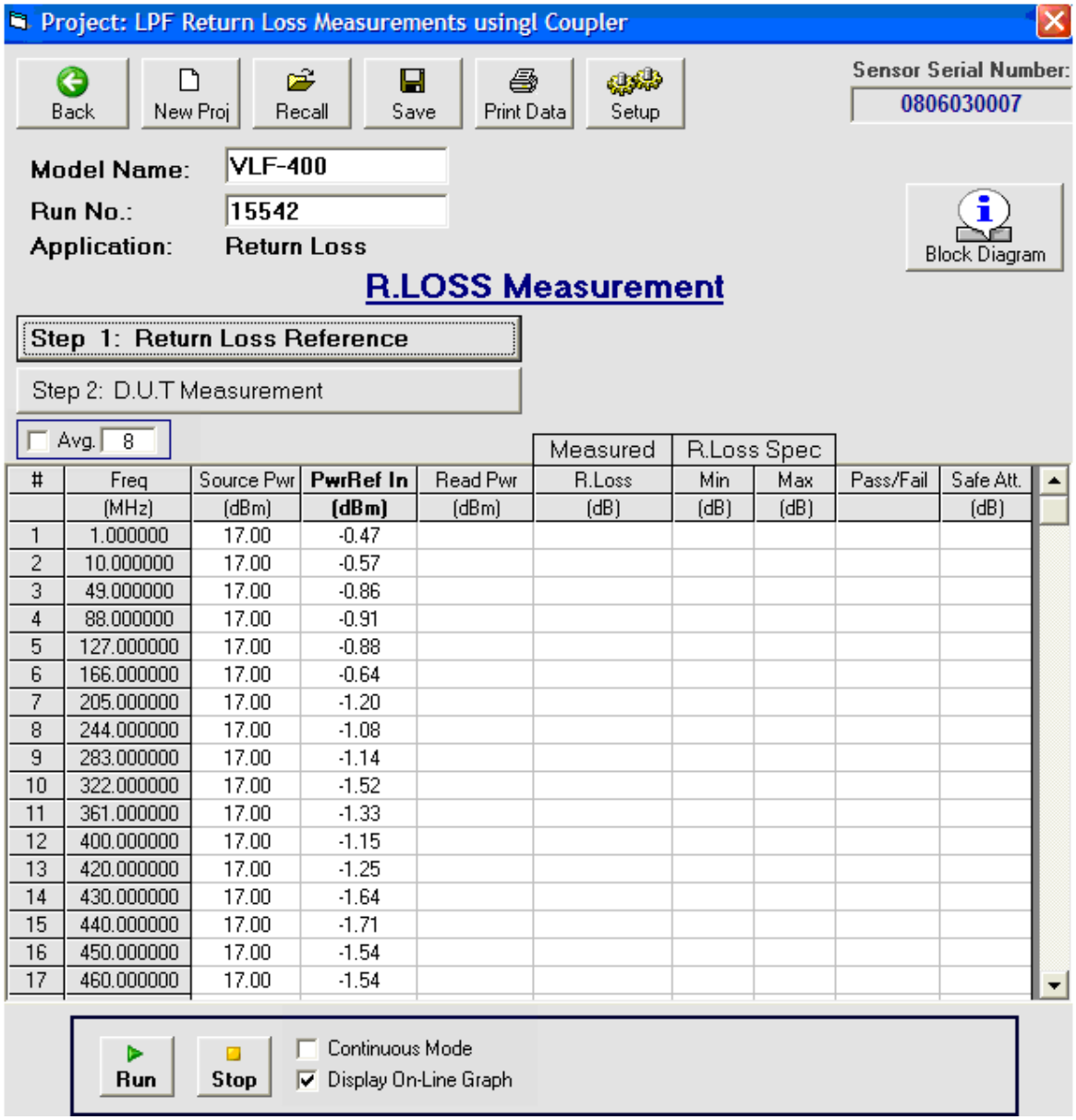
Figure 122: Return Loss Reference Block Diagram .



- **Step 13.** Press **Run** key to launch test. You can stop the test at any stage by pressing the **Stop** key. If **Continuous Mode** is not enabled test will finish after sweeping all segments. If **Continuous Mode** is enabled test will repeat until interrupted by **Stop** key.

- **Step 14.** See results **Figure 123**: **Return Loss Reference.**

Figure 123: Return Loss Reference.



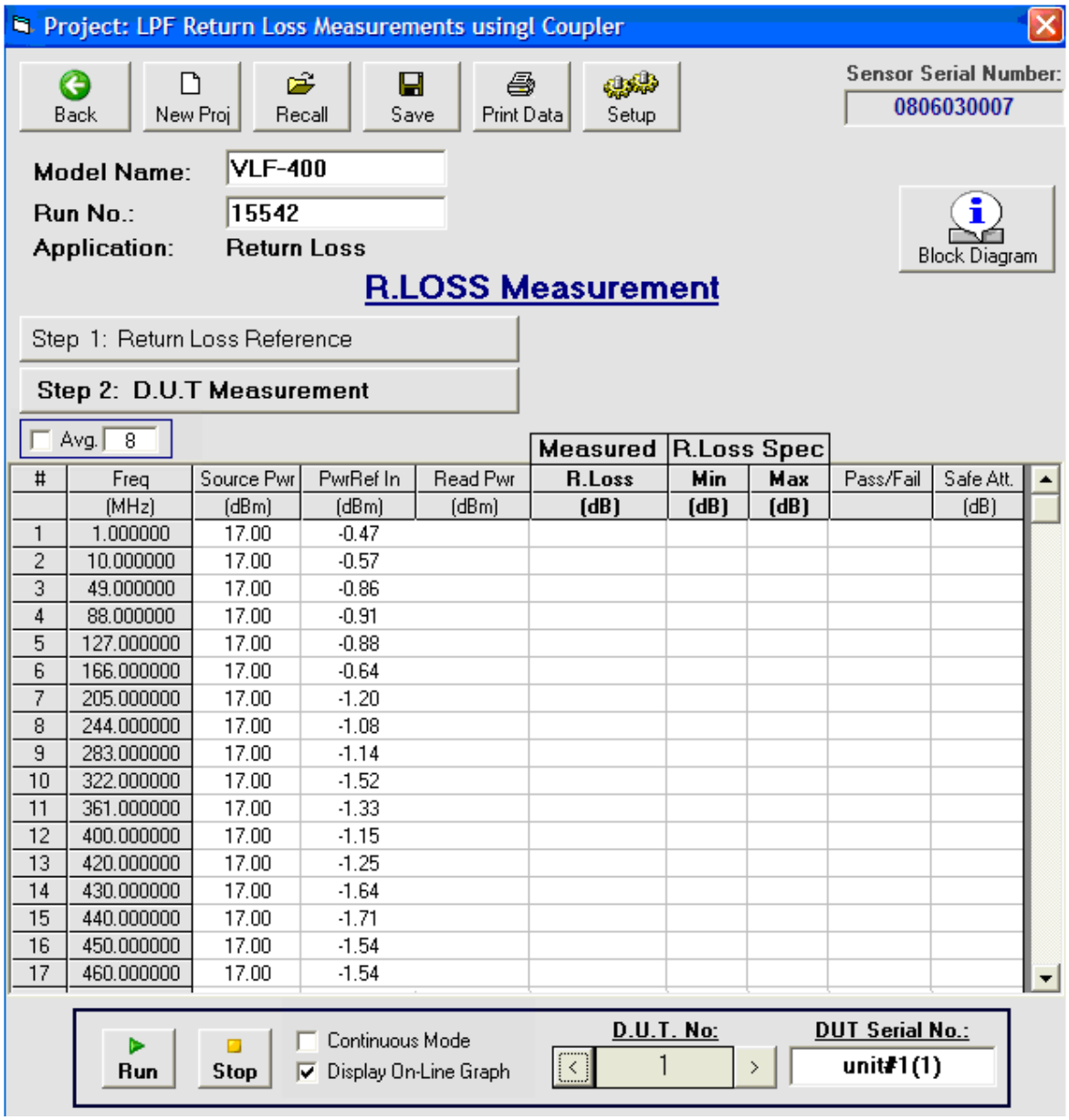
- **Step 15.** Press **Step 2: D.U.T. Measurement** key.

  The **D.U.T Measurement** screen will open (see **Figure 124**).

- **Step 16.** Open **D.U.T Measurement's Block Diagram** setup (see **Figure 125**).

- **Step 17.** Assemble the R. Loss's **D.U.T Measurement** equipment setup.

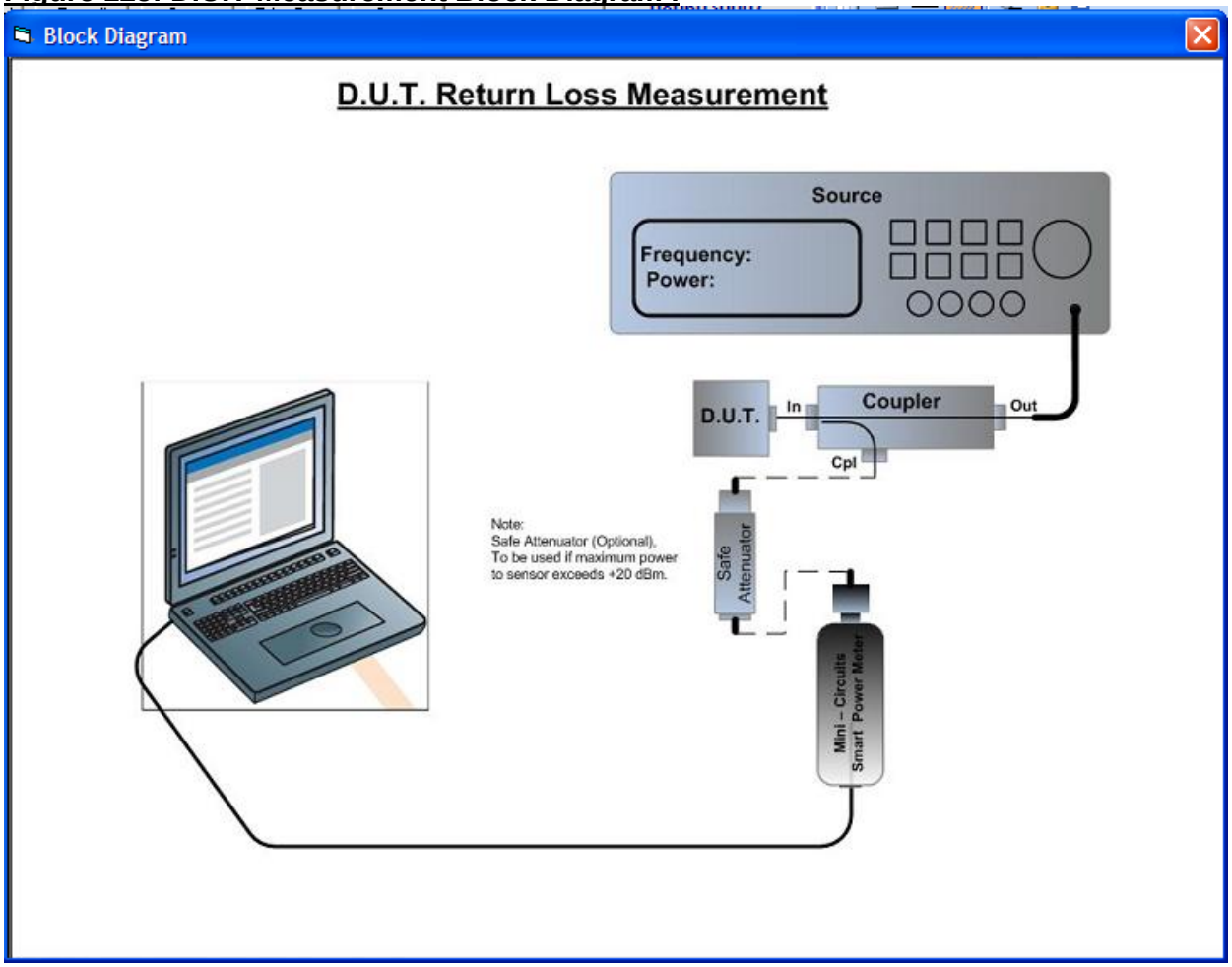
Figure 124 : D.U.T Measurement



- **Step 18.** Enter spec. data (If available).
  [see explanation **3.4.2.2 Spec. Definitions** on **page 21**].

- **Step 19.** You can enable **Continuous Mode** if necessary for your application.

Figure 125: D.U.T Measurement Block Diagram .



- **Step 20.** You can enable the **On-Line Graph** option.
  (see **3.5 On-Line Graph features page 22**).

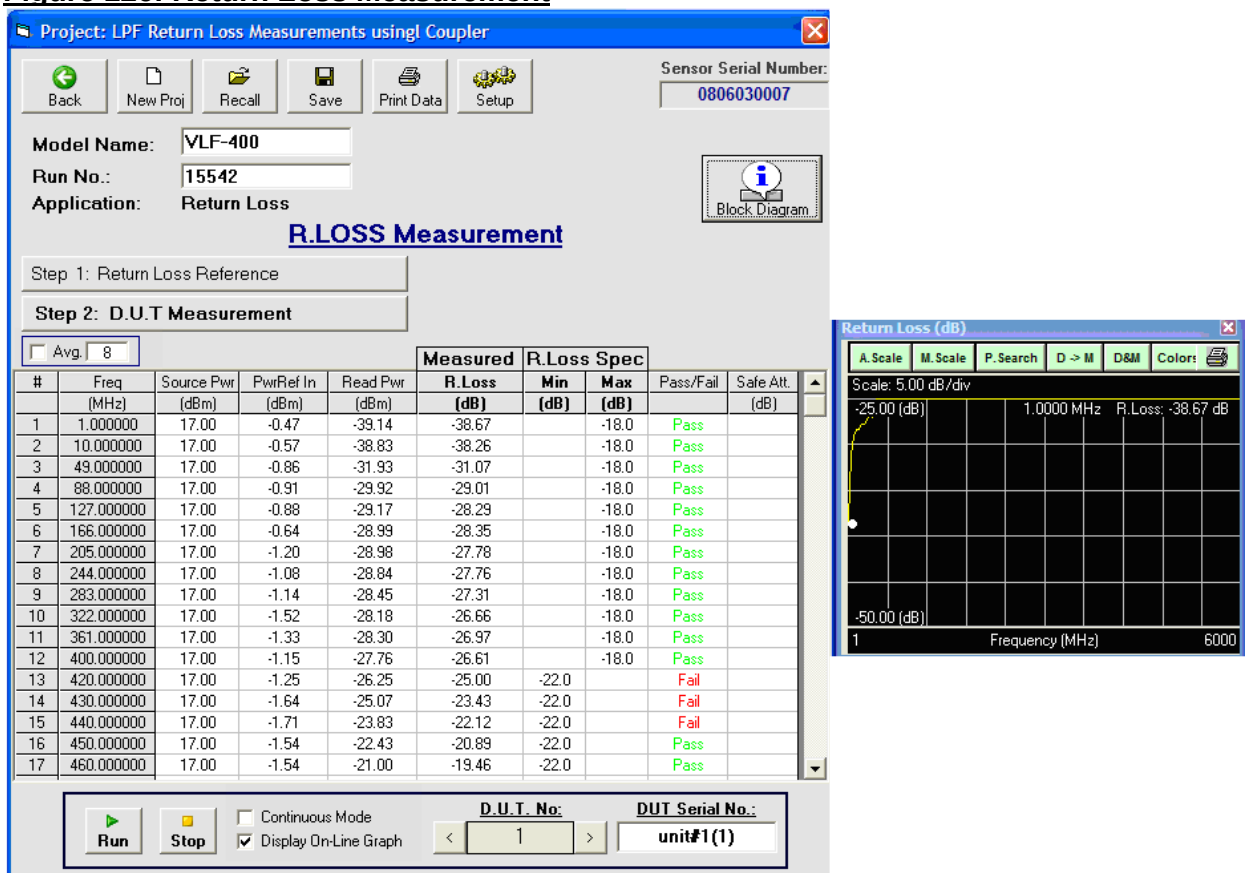
- **Step 21.** Enter **D.U.T Serial No:** (If available).

- **Step 22.** Press **Run** key to launch test. You can stop the test at any stage by pressing the Stop key. If **Continuous Mode** is not enabled test will finish after sweeping all segments. If **Continuous Mode** is enabled test will repeat until interrupted by **Stop** key.

- **Step 23.** If you have more than one D.U.T to test repeat **Steps 19-22** for next test.

- **Step 24. Return Loss Measurement** received (see **Figure 126**).

Figure 126: Return Loss Measurement



- **Step 25.** Save your project data (see **3.3.1.3 Save Function** on **page 16** for explanation).

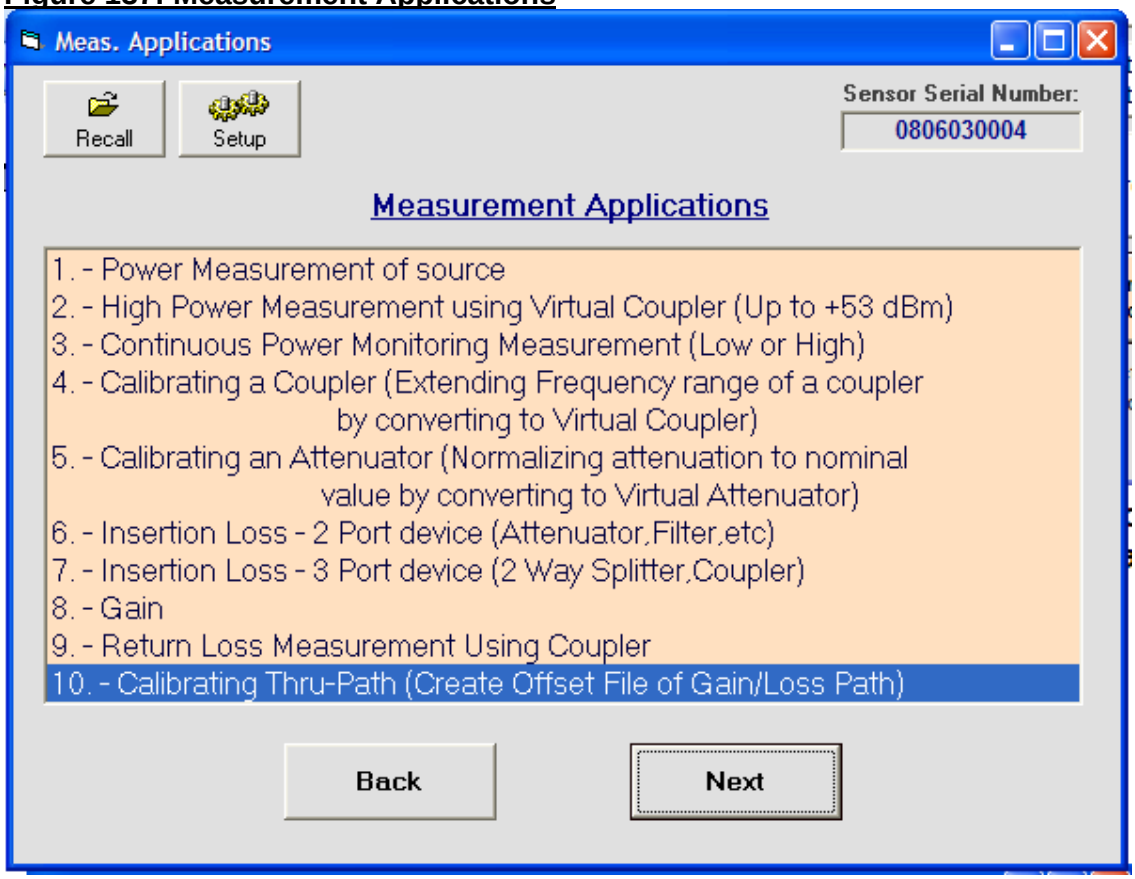
- **Step 26.** You can print your test data (see **3.6 Printing Data Function** on **page 23** explanation).

13.0 Application # 10- Calibrating Thru -Path (create Offset file of Gain/Loss Path)

This chapter describes the process of creating a calibration offset file containing the system loss/gain without the D.U.T .The file can be used as either an offset file to compensate for existing setup loss/gain.

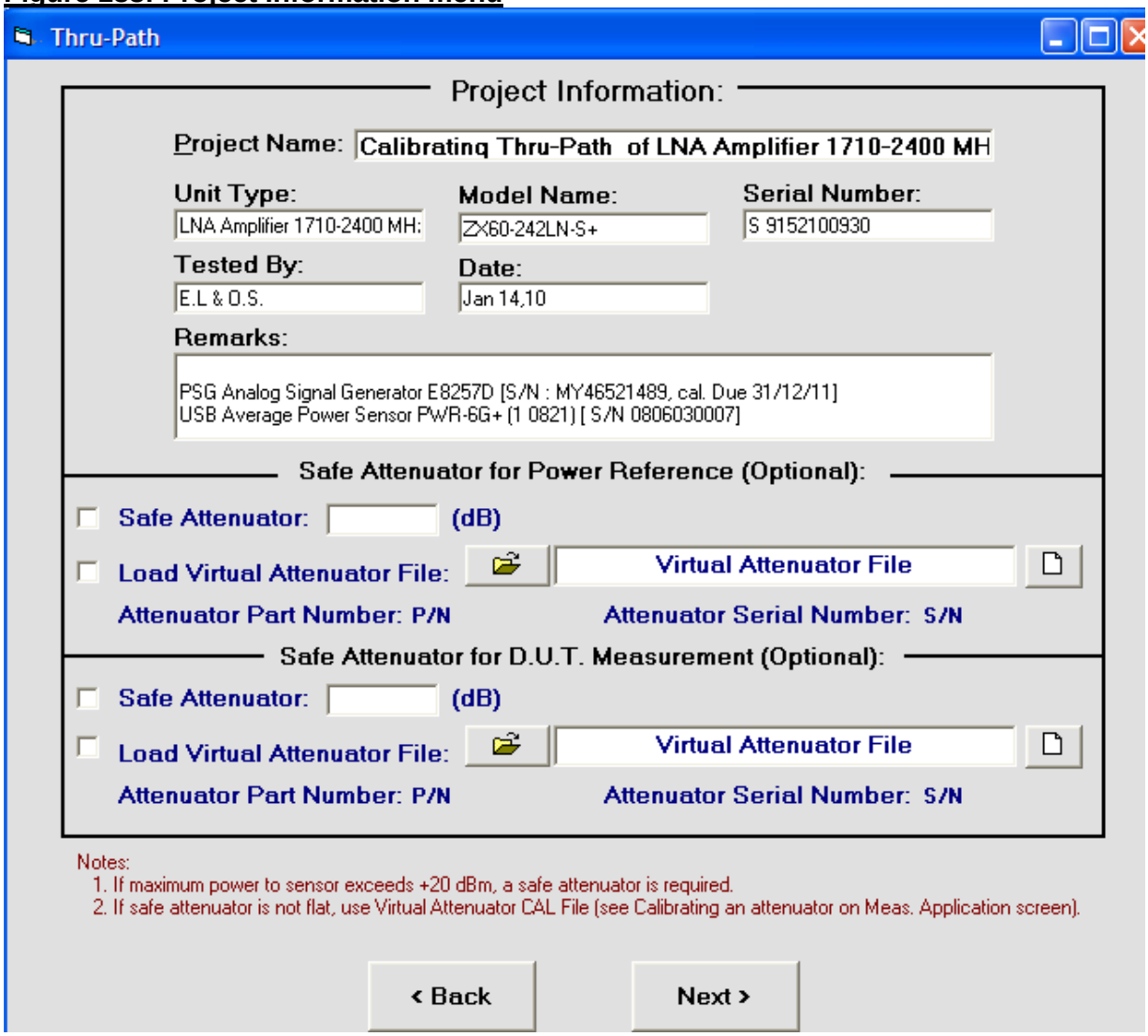
- **Step 1.** Open a project from the **Measurement Applications** screen (see **Figure 137**)

Figure 137: Measurement Applications



- **Step 2.** The **Project Information menu** will open (see **Figure 138**).
- **Step 3.** Review and fill all necessary fields in the **Project Information menu** see detailed explanation **Figure 4** and **Table 3** at **pages 9-10**.

Figure 138: Project Information menu



Note

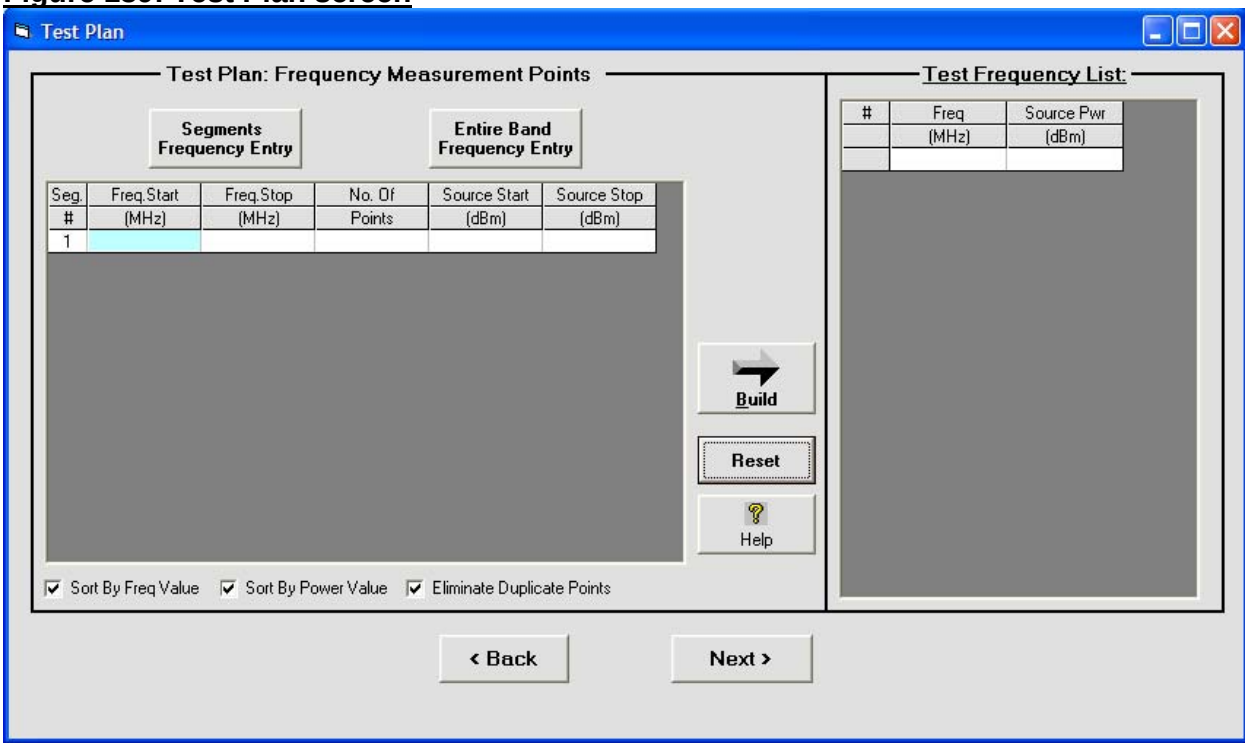
1. If maximum power to sensor exceeds +20dBm, a safe attenuator is required
2. If safe attenuator is not flat, use Virtual Attenuator file. See creation of Virtual Attenuator **Chapter 8.**

- **Step 4.** Press **Next** key.
  The **Test Plan** screen will open (see **Figure 139**).

- **Step 5.** You can choose one of two options to build the measurement points set (see **Chapter 3.2, Figures 5-6** on **page 10**).

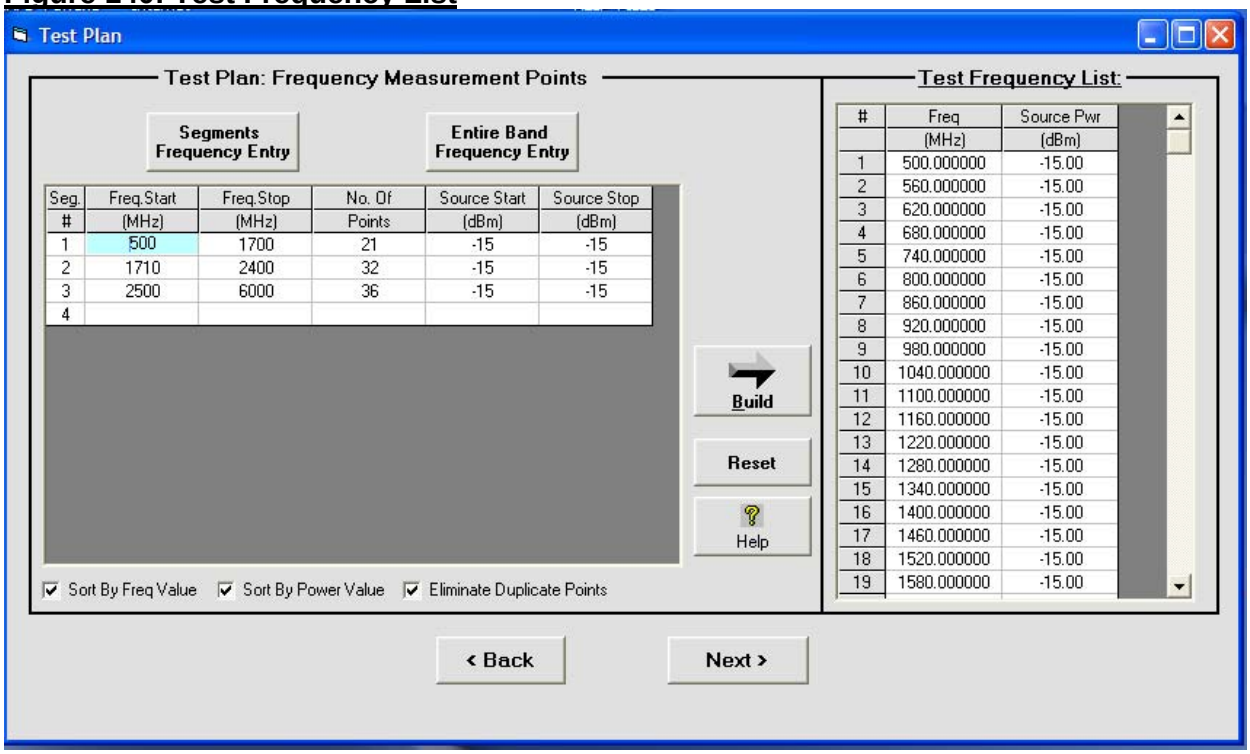
- **Step 6.** Create the measurement points and set input power (you can see an explanation and example in **Figure 5** on **pages 10-11**).

Figure 139: Test Plan screen



- **Step 7.** Press **Build** key to create a **Test Frequency List** (see **Figure 140**).

Figure 140: Test Frequency List



- **Step 8.** Press **Next** key .The **Thru- Path screen** will open. (see **Figure 141**)
  Validate desirable data transferred from the previous screen.
  During all following steps you can use **Recall** and **Save** keys at all stages (see **3.3.1.2 Recall** on **page 15, 3.3.1.3 Save** on **page 16** for explanation)

- **Step 9.** Press **Step 1: Power Reference In** key.

- **Step 10.** Open **Power Reference In** measurement's **Block Diagram** setup (see **Figure 142**)

- **Step 11.** Assemble the **Power Reference In** equipment setup.

- **Step 12.** Define/Confirm **Setup** settings (see **2.1. Setting communication/commands in order to control an external source.** on **page 5**).

Figure 141: Power Reference In

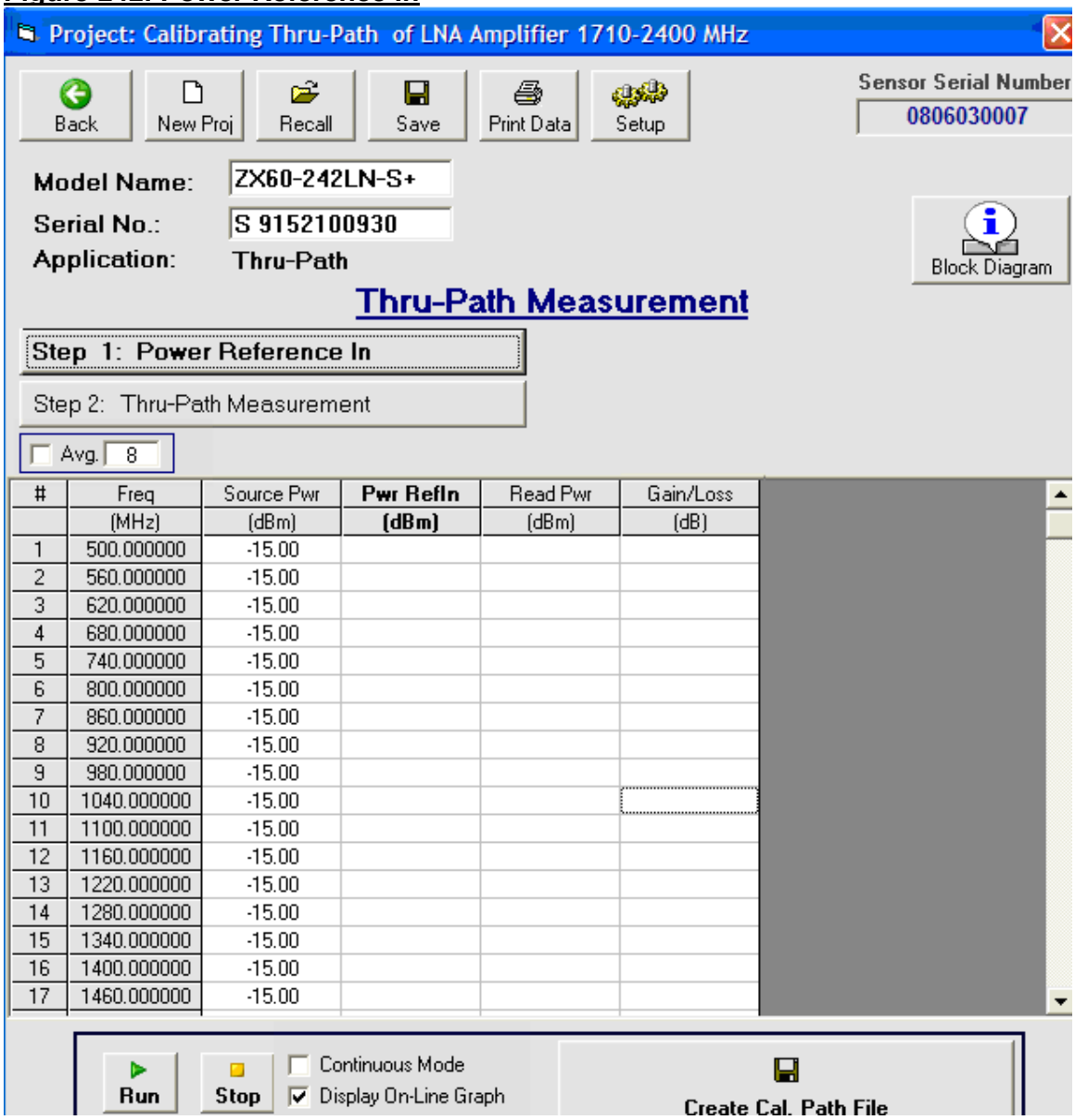
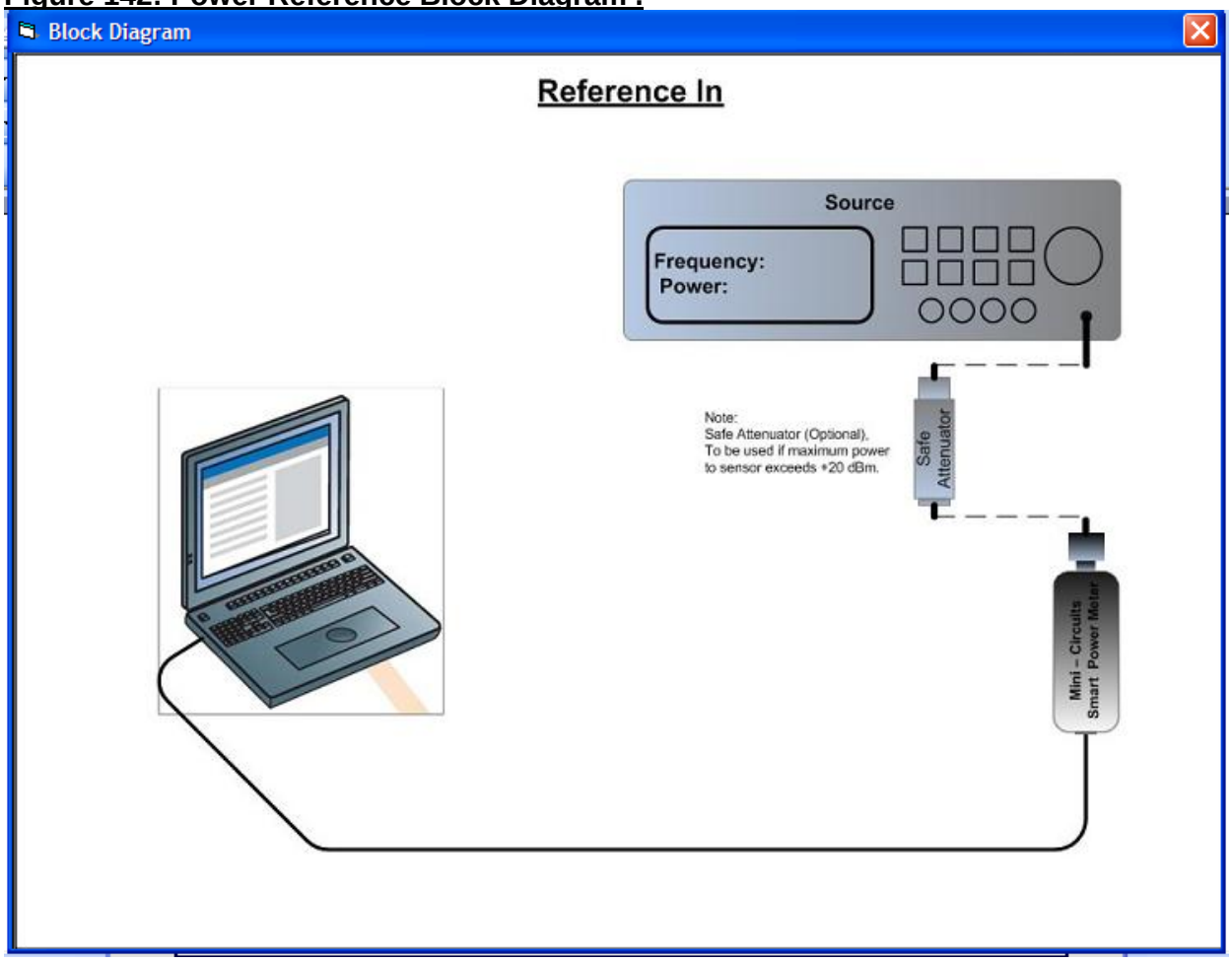


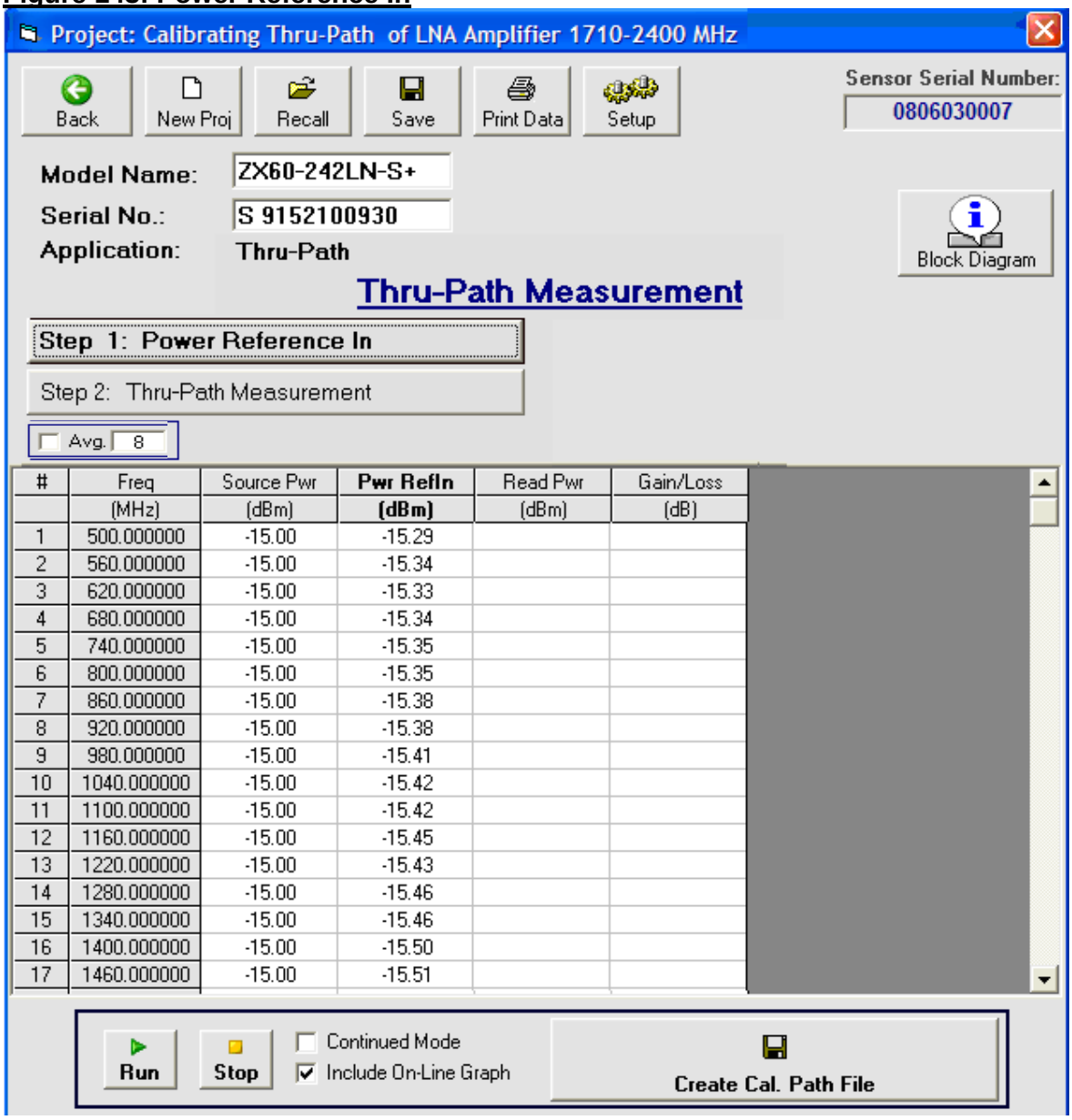
Figure 142: Power Reference Block Diagram .



- **Step 13.** Press **Run** key to launch test. You can stop the test at any stage by pressing the **Stop** key. If **Continuous Mode** is not enabled test will finish after sweeping all segments. If **Continuous Mode** is enabled test will repeat until interrupted by **Stop** key.

- **Step 14.** See results**: Figure 143, Power Reference In**.

Figure 143: Power Reference In



- **Step 15.** Press **Step 2: Path-Thru Measurement** key.

  The **Thru- Path Measurement** screen will open (see **Figure 144**).

- **Step 16.** Open **Thru- Path Measurement's Block Diagram** setup (see **Figure 145**).

- **Step 17.** Assemble the **Thru- Path Measurement** equipment setup**.**

Figure 144: Thru- Path Measurement screen

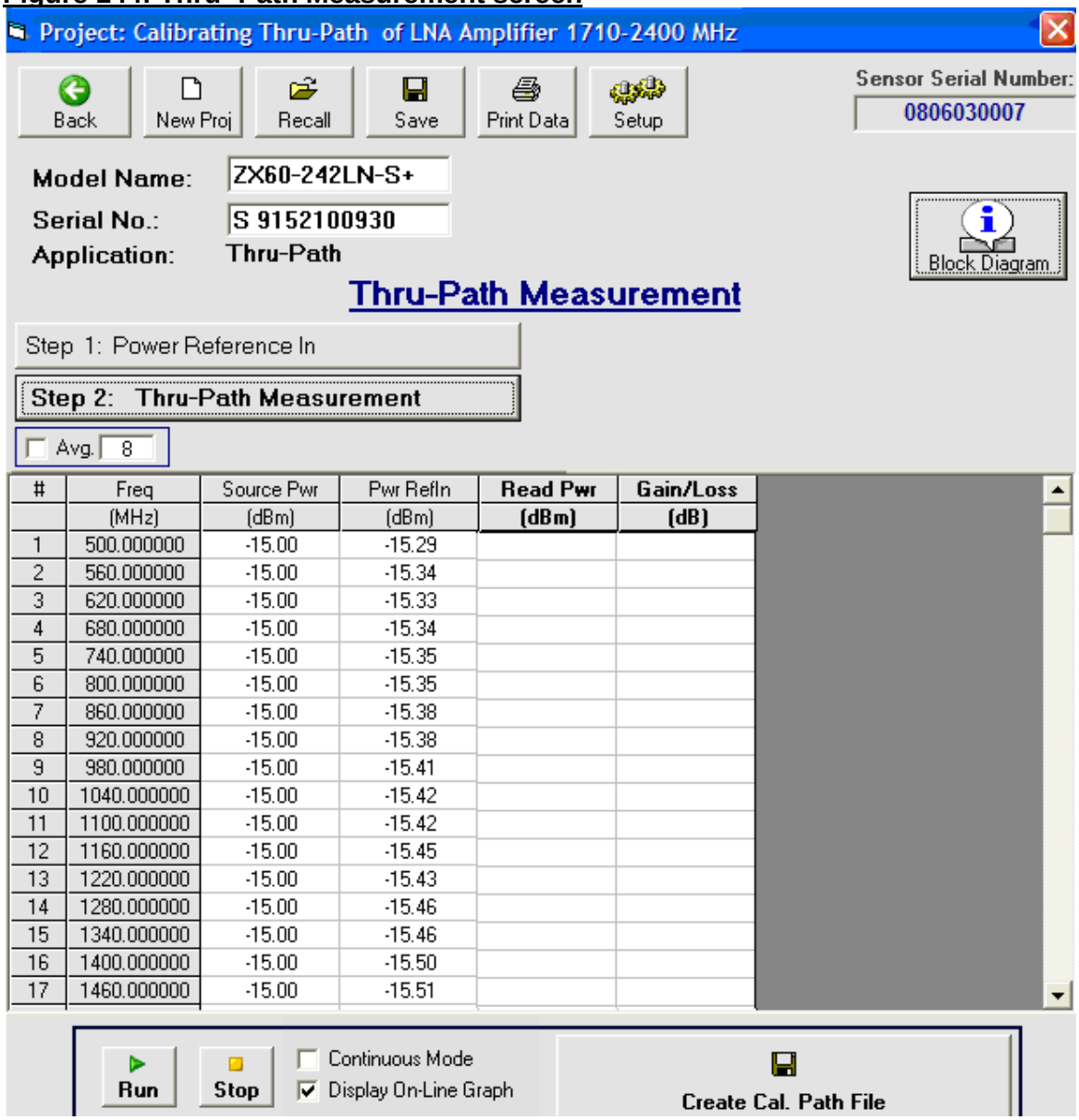
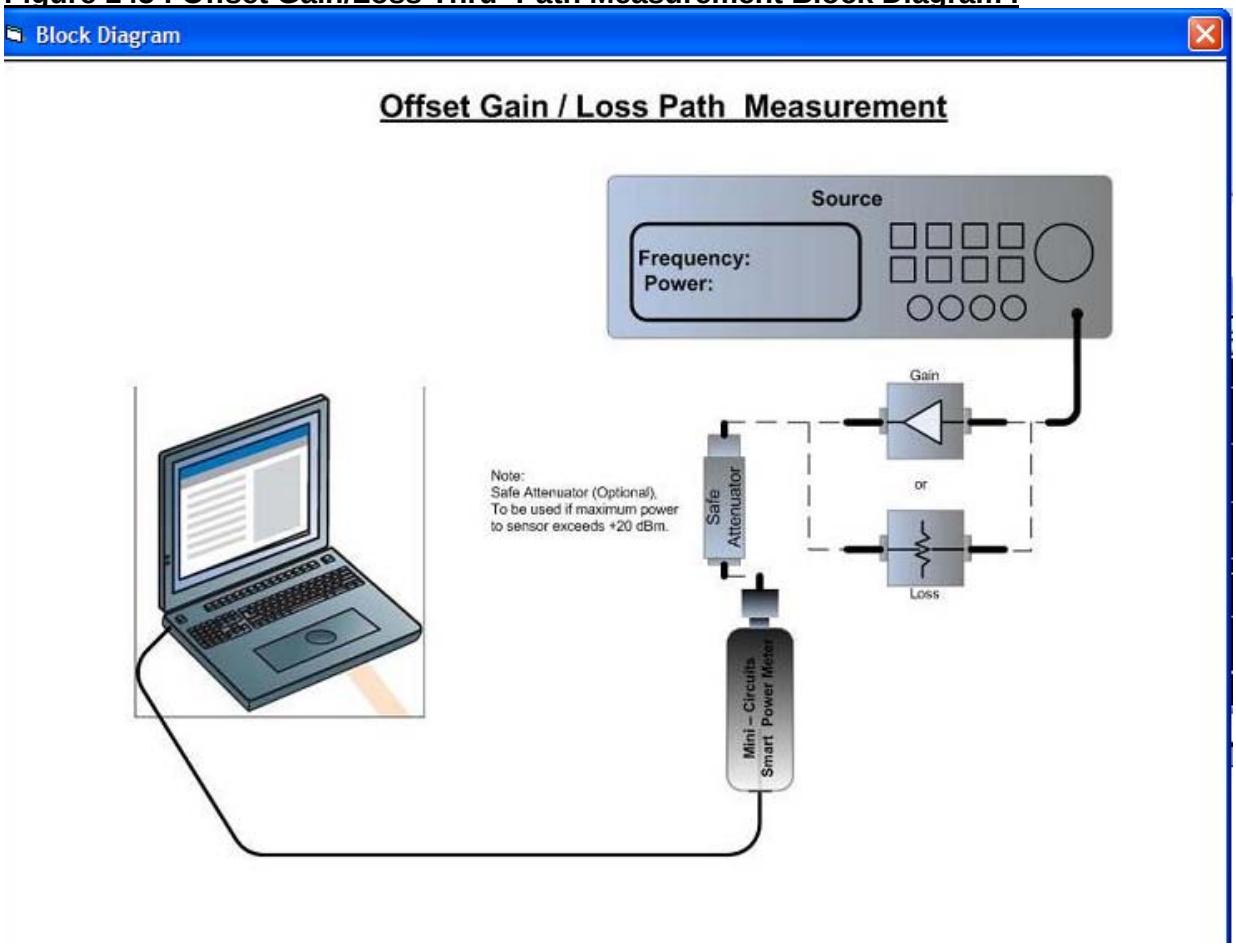


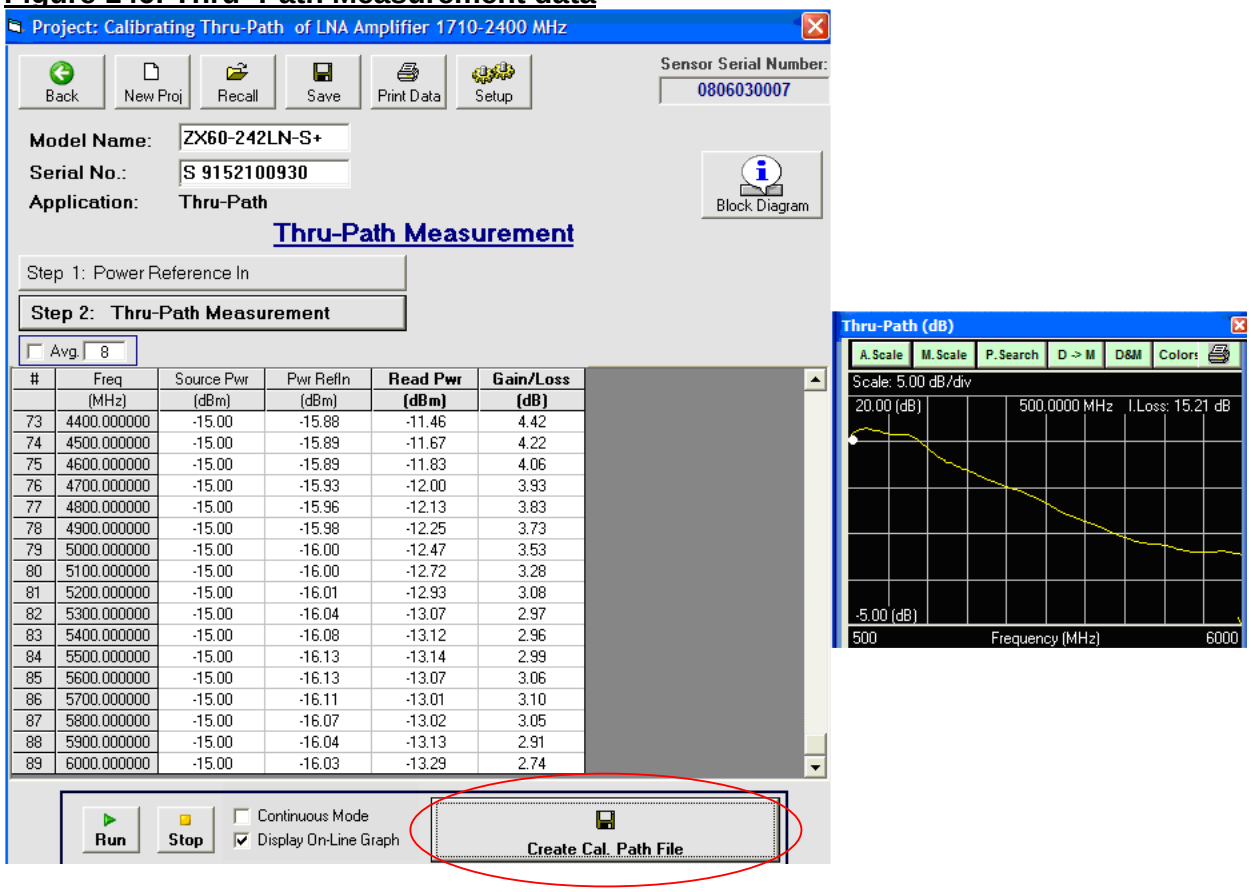
Figure 145 : Offset Gain/Loss Thru- Path Measurement Block Diagram .



- **Step 18.** Press **Run** to launch test. You can stop the test at any stage by pressing the **Stop** key. If **Continuous Mode** is not enabled test will finish after sweeping all segments. If **Continuous Mode** is enabled test will repeat until interrupted by **Stop** key.

- **Step 19. Thru- Path Measurement** data received (see **Figure 146**).

Figure 146: Thru- Path Measurement data



- **Step 20.** Save your project data (see **3.3.1.3 Save Function** on **page 16** for explanation)
- **Step 21.** You can print your test data (see **3.6 Printing Data Function** on **page 23** for explanation).

- **Step 22**. Press **Create Cal. Path. File** key to create **Path-Thru** offset file.

14.0 The Operation of Signal Generator

Measuring units using “Measurement Applications” requires using a signal generator.
Two basic options are available:

1. Operate the generator manually.
2. Let the program Remote control the generator.

The big advantage of selecting option 2 is that you can set many testing points
While in manual mode it will be much more reasonable to measure very few points.
Selecting option 1 – will cause the program to tell the user to make the necessary change request to the generator in each testing step.

14.1 Generator – Remote Control

There are two options to remote control the signal generator. One way is to use The VISA IO Library objects (GPIB, Ethernet or RS232) and the other way is to build your own generator interface programs (DLL or EXE file)
If you choose to work with the VISA IO then, installation of the VISA IO is required. The VISA IO software can be downloaded from Agilent or NI web sites.

Agilent-VISA:
http://www.home.agilent.com/agilent/product.jspx?nid=-34466.816598.00&cc=US&lc=eng
NI-VISA:
http://joule.ni.com/nidu/cds/view/p/id/1370/lang/en

if you choose to work with your own “home made” Signal Generator interface then the way to do it is to build a small simple DLL file or to build executable programs to control your signal generator.

DLL option:
Build “Gen.DLL” file and locate it in “c:\Program Files\mcl_usb_pm\App” folder
The DLL file should include 3 functions:

1. int SetGen (double Freq_mhz, double power_dbm)
   (this function should set the Frequency and power accordingly)
2. int SetGen_ON
3. int SetGen_OFF

Selecting DLL option will cause the Meas. Application to search for these functions in the DLL.

Execute files option:
Build the following 3 program files and locate them in “c:\Program Files\mcl_usb_pm\App” folder

1. SetGen.exe
   (Program to control Frequency and Power, the program should accept 2

Arguments. The first argument is the Frequency in MHz and the second argument is the Power in dBm.

2. SetGen_ON.exe (program that turn on the Generator)
3. SetGen_OFF.exe (program that turn off the Generator)

In addition to the Remote control information there is one important parameter "Delay between Testing Points (msec)" – this parameter describes the delay in milliseconds that comes right after setting the generator and before taking the next measurement. This delay is important, to let the system stabilize before taking the measurement. Another parameter is a check box to check if to let the measurement program control turning ON and OFF of the RF power generator.

All relevant information regarding the Remote control and setup need to be set in the Setup Screen (**figure 17**). Access to the Setup Screen is available from the main measurement screen by clicking on the Setup Button.

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