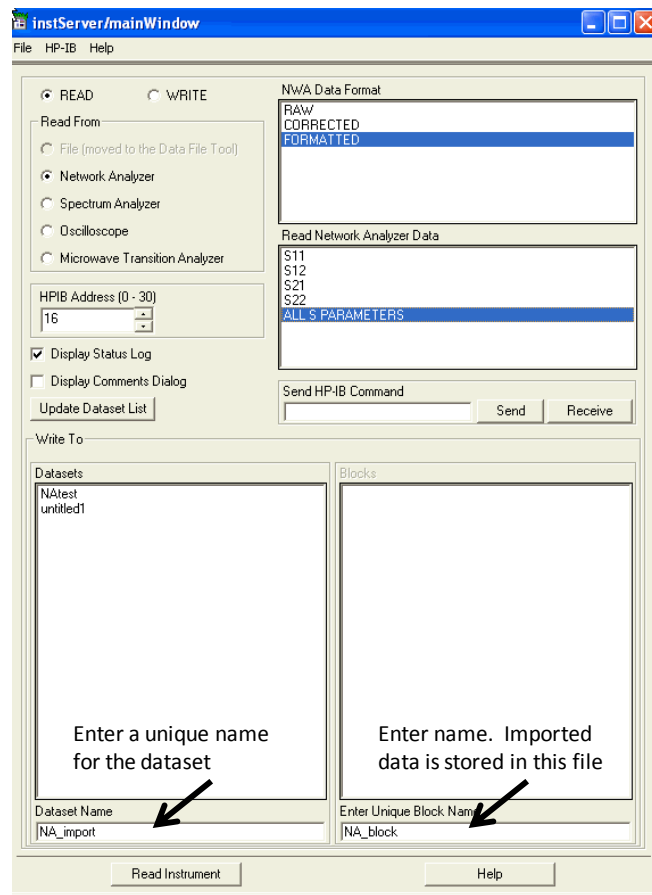


Instructions for Extracting Data from Instruments in the 5162D Microwave lab

Measurement data can be read from each of the instruments in electronic form and then imported into ADS to compare with simulated data. This document will outline the steps to do this for each instrument.

Accessing Data over the GPIB with ADS instrument server:

1. Open a project and a schematic window. Go to the Tool menu and select the instrument server. The instrument manager window, see below, can be used to import/export data files and read data from instruments. Formatted data is corrected through calibration and smoothed.



2. Initialize the GPIB card. Drag mouse over HP-IB on the tool bar and select Symbolic Name.
3. Type “hpib7” and click OK. This sets the computer’s GPIB address to 7.

4. Select type of instrument to read from, ie Network Analyzer, Oscilloscope...etc.
5. Set the GPIB address to match the instrument address. See individual instrument descriptions below on how to access the particular instrument's GPIB/GPIB address. Sometimes other instruments can conflict with each other so make sure the other instruments on the GPIB bus do not have conflicting addresses. If you are still having trouble getting data, try removing the other instruments from the bus.
6. Type in a dataset name, datablock name and click **Read Instrument**. If it worked you will see text filled in the blocks window. Be sure to verify that the correct data is accessed by plotting a sample in the ADS data display window.

Network Analyzer Measurements:

We have two types of analyzers in the 5162D Microwave lab, and they each have different procedures to extract the measured data.

8751A (5 Hz to 500 MHz):

This analyzer has a disk drive but does not have a GPIB card. Therefore data must be saved to a disk and manually reformatted into a touchstone file format (.s2p extension).

1. When you have data that you are ready to save, press the **MENU** hardkey in the **STIMULUS** group. Press the **TRIGGER MENU** softkey and then press the **SINGLE** softkey. This part is optional but I would suggest doing it, especially if your data is a bit unstable. This will stop the NA from taking measurement sweeps and hold the current data on the screen. The data can be saved with the steps below and then the NA can be switched back to **CONTINUOUS** in the same menu.
2. To save the data, press the **SAVE** hardkey.
3. If this is the first file you have saved, press the **FILE UTILITIES** softkey, then press the **FORMAT** softkey, so it reads [DOS] (not [LIF]). Make sure the **STOR DEV** softkey says [DISK]. Press the **RETURN** softkey
4. Press the **ASCII SAVE** softkey. The first time through you should check the option under the **DEFINE SAVE DATA** softkey. Only **TRACE ARY** should be ON.
5. Press the **DATA ONLY (ASCII)** softkey.
6. Enter in a file name with the scroll wheel and the softkeys. Press the **DONE** softkey to save.
7. Return the analyzer to continuous sweep mode.

- Reformat the data into a touchstone format (.s2p) using Excel. To do this open the text file in excel. In the text file import wizard select space delimited. Then the data can be reformatted and the header deleted. You can copy and “paste special,” only the values into a new spreadsheet. The new file can be saved as a tab delimited text file. The extension is not critical but the industry standard is .sNp, where N is the number of ports.

A sample of the saved output file from the NA is below:

```
"8751A REV5.02"
"DATE: Sep 5 2004"
```

```
"CHANNEL: 1"
"MEASURE TYPE: S11"
"FORMAT TYPE: LOG MAG"
"NUMBER of POINTS: 4"
"SWEEP TIME: 81.24 ms"
"SWEEP TYPE: LIN FREQ"
"SOURCE POWER: 0 dBm"
"IF BANDWIDTH: 4 kHz"
```

```
"Frequency"      "Data Real"    "Data Imag"
1.0000000000E+05  9.674495E-01  1.734867E-01
2.5995000000E+06  9.853629E-01  1.146573E-02
5.0990000000E+06  9.859161E-01  2.727407E-03
7.5985000000E+06  9.851523E-01 -3.554109E-03
```

You can convert the real and imaginary data to magnitude in dB and Phase in degrees using excel or leave it alone.

The Touchstone format accommodates both formats. An example of a few lines of a touchstone file is below:

```
!2-port S-parameter file, three frequency points
# GHZ S RI R 50.0
!freq ReS11 ImS11 ReS21 ImS21 ReS12 ImS12 ReS22 ImS22
1.0000 0.3926 -0.1211 -0.0003 -0.0021 -0.0003 -0.0021 0.3926 -0.1211
2.0000 0.3517 -0.3054 -0.0096 -0.0298 -0.0096 -0.0298 0.3517 -0.3054
10.000 0.3419 0.3336 -0.0134 0.0379 -0.0134 0.0379 0.3419 0.3336
```

Lines beginning with exclamation points are comments and do not need to be included.

The line beginning with # is the option line and it describes the format of the file. A description of the possible option line cases is below. Each data line starts with a frequency point then a set of network parameter data pairs. For example a one port file will have one pair and a two port will have four.

```
# <frequency unit> <parameter> <format> R <n>
```

frequency unit specifies the unit of frequency. Legal values are

GHz, MHz, KHz, Hz. The default value is GHz.

parameter specifies what kind of network parameter data is contained in the file. Legal values are:

S for Scattering parameters,
Y for Admittance parameters,
Z for Impedance parameters,
H for Hybrid-h parameters,
G for Hybrid-g parameters.
The default value is S

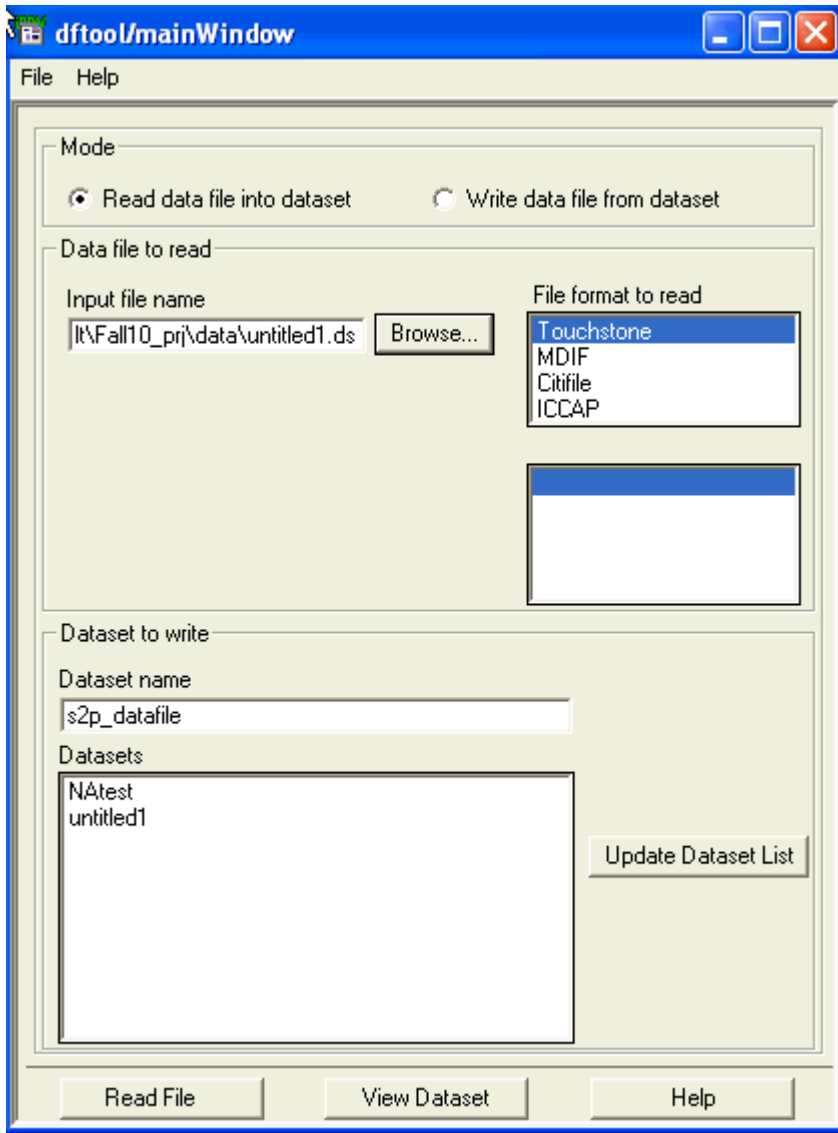
format specifies the format of the network parameter data pairs. Legal values are:

DB for dB-angle ($\text{dB} = 20 \cdot \log_{10}|\text{magnitude}|$)
MA for magnitude-angle,
RI for real-imaginary.
Angles are given in degrees. Note that this format does not apply to noise parameters. (Refer to the “Adding Noise Parameters” section at the end of this document). The default value is MA.

R n specifies the reference resistance in ohms, where n is a positive number of ohms (the real impedance to which the parameters are normalized). The default reference resistance is 50 ohms.

For a more detailed explanation of the touchstone file format see http://www.eda.org/pub/ibis/connector/touchstone_spec11.pdf

9. After reformatting the file can be imported into ADS with the data file tool. Save the s2p file in the ADS data directory for your project. Open the data display and select Tools > data file. This opens the dftool window (below). Browse for your .s2p file.



10. Type in a dataset name to save to and click **Read File** at the bottom of the window. This file should show up as a data set in any of the table or plot features of the data display.

8719C (50 MHz to 13.5GHz) and 8720B (130 MHz to 20 GHz):

These two analyzers do not have disk drives, but they do have GPIB. The data can be read with a computer with a GPIB card using ADS or Agilent VEE.

1. See the first section on accessing data with ADS.
2. To find the GPIB address of the NA, press the **LOCAL** hardkey in the INSTRUMENT STATE group. Press the **SET ADDRESSES** softkey, then press **ADDRESS: INSTRUMENT** softkey. Enter this address into the ADS instrument manager.

3. You can stop the NA from taking new measurement sweeps by following step one in the 8751A section.
4. Select Read from Network Analyzer.
5. Select FORMATTED for NWA Data Format.
6. Select ALL S PARAMETERS or just one.
7. Type in a dataset name to save as, then click Read Instrument. If it worked correctly you will see faint writing appear in the Blocks window on the right. Plot the data on a Data Display window to be sure the correct data is in the dataset.

Spectrum Analyzer Measurements:

8592B (9 kHz to 22 GHz):

Just like 8719C, this SA can be accessed with ADS over GPIB.

1. See the first section on accessing data with ADS.
2. To find the GPIB address of the SA, press the **CONFIG** hardkey in the INSTRUMENT STATE group. Then, for the 9592B SA you need to press the **MORE** softkey. Press the **ANALYZER ADDRESSES** softkey. Enter this address into the ADS instrument manager.
3. You can stop the SA from taking new measurement sweeps by pressing the **TRIG** hardkey in the CONTROL group. Then press the **SINGLE SWEEP** or **SWEEP** softkey. Remember to switch back to continuous mode to take new measurements.
4. Select Read from Spectrum Analyzer.
5. Select TRACE A.
6. Type in a dataset name to save as, then click Read Instrument. This will take the same data that the screen shows, so you might want to adjust the frequency span, resolution bandwidth...etc. before pressing this button. If it worked correctly you will see faint writing appear in the Blocks window on the right. Plot the data on a Data Display window to be sure the correct data is in the dataset

Oscilloscope Measurements:

All Tektronix Scopes:

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The Tek scopes do not seem to be compatible with ADS communicating over GPIB. The data must be saved to disk with the scopes with disk drives or the data can be printed with the HPGL plotter. Excel can be used to plot data from disk. To save to disk follow below.

1. Press the **WAVEFORM** hardkey in the SAVE/RECALL box.
2. Press the **Save Format** softkey on the bottom side of the screen. Then select **Spreadsheet**.
3. Press the **Save Wfm Ch1** softkey on the bottom of the screen then press the **To File** softkey.
4. Press the **Save to Selected File** key to save. Note the file name can be changed with the **File Utilities** key.
5. This file can be read and plotted by excel.