



CASSINI RF/ Microwave ATE System Application Development by Example



ROOS INSTRUMENTS



LNA Tests

- DC Currents & Beta
- S11, S21, S12 & S22
- Noise Figure
- P1dB
- Intermodulation Distortion
- Harmonics



Search Measurements

- Dependent and Independent Variable
- Collect appropriate data
- Curve fit
- Find desired dependent condition
- Retrieve associated independent stimulus



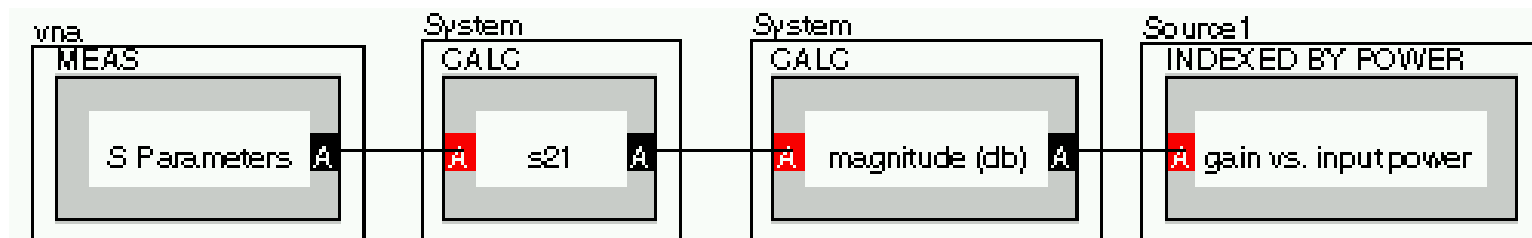
P1dB, Step 1 and 2

- Measure the small signal gain, in this case 10 dB
- Subtract 1 from the value to establish the "target compression gain" in this case 9 dB



P1dB Step 3

- Measure gain at a number of Source 1 input power levels, saving the measured gains, indexed by Source 1 Power.





P1dB Step 3 (Continued)

- The index value is actually not the Source 1 power value, It is the "N" as in the Nth value of the Source 1 power used

<i>Index, Gain</i>	
1,	10
2,	10
3,	10
4,	10
5,	10
6,	9.7
7,	9.2
8,	8.4
9,	7.5
10,	6.5
11,	5.5

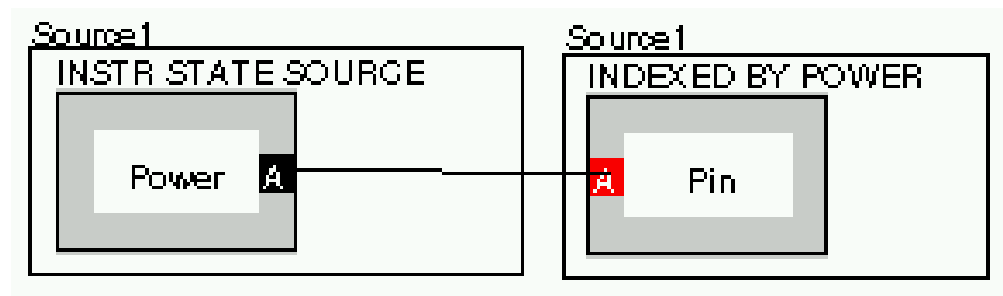


P1dB Step 4

- Save the second array, Source 1 power, also indexed by Source 1 Power

Index, Pin

1,	-30
2,	-29
3,	-28
4,	-27
5,	-26
6,	-25
7,	-24
8,	-23
9,	-22
10,	-21
11,	-20

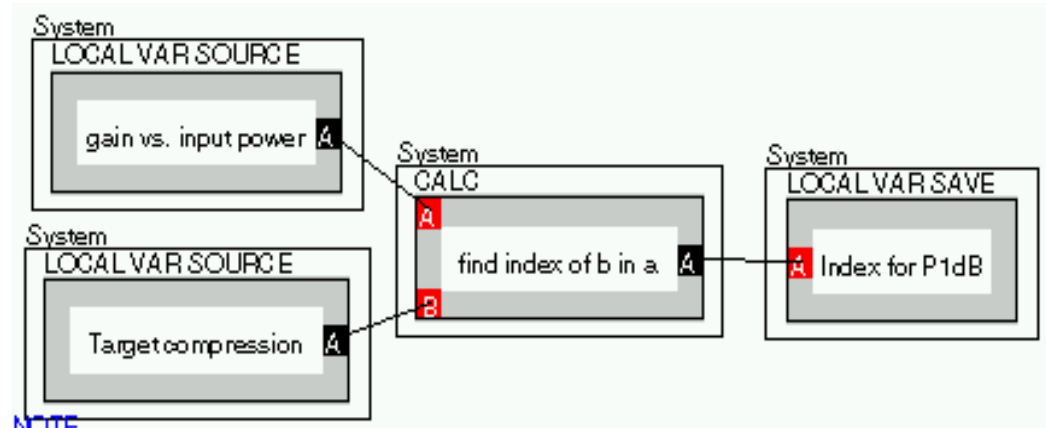




P1dB Step 5

- Find fractional index for P1dB (9 dB)
- This is an index of approximately 7.2

<i>Index, Gain</i>	
1,	10
2,	10
3,	10
4,	10
5,	10
6,	9.7
7,	9.2
8,	8.4
9,	7.5
10,	6.5
11,	5.5



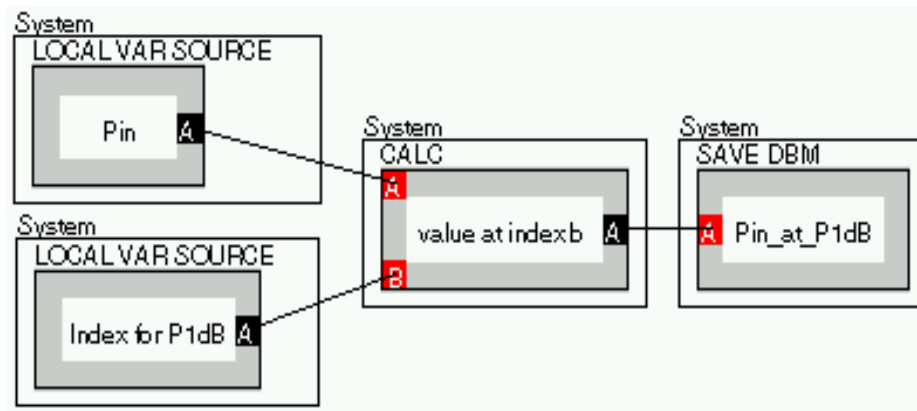


P1dB Step 6

- Extract Pin for that index. (~ -23.8 dBm)

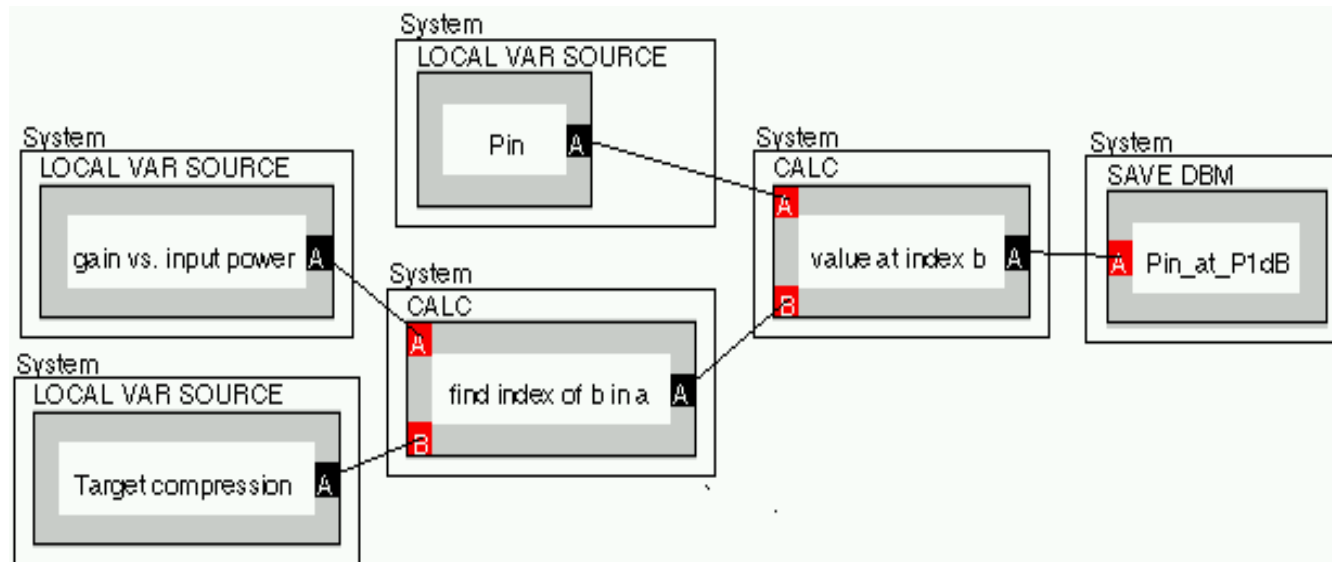
Index, Pin

1	-30
2	-29
3	-28
4	-27
5	-26
6	-25
7	-24
8	-23
9	-22
10	-21
11	-20





P1db Calculation





Measuring Noise Figure

- Set RF Source 1 to Device Input Freq.
- Set Receive Attenuation to 0 dB
- Set IF Filter Bandwidth to wide/4 MHz
- Set IF Gain for Hot Noise Measurement
System Automatically sets IF Gain 6 dB
Higher for Cold Noise Measurement



Noise Figure Measurement

The screenshot displays the GSMNF2_V software interface. At the top, a menu bar includes File, Edit, Test Plan, Tester, Limits, Options, Help, and Debug. Below the menu is a list of test plans in red text, with the last one highlighted in black: "Test: Noise Figure Max Gain@942_38_0_256". To the right of the test plan list are three green buttons: "Compile", "Run", and "Repeat".

The main interface is divided into several sections:

- Receiver:** IF GAIN is set to 38.
- Source1:** RF STATE is set to OFF.
- Source1:** FREQUENCY is set to 942.5 Mhz.
- System:** AVERAGES is set to 256.
- Testhead:** REC ATTENUATION is set to 0db.

Below these sections are two "StaticDigital" blocks, both set to "on":

- DB 1
- DB 2

At the bottom, there are two measurement blocks:

- noiseFigure MEAS:** Displays "Noise Figure" with a red 'A' icon.
- System SAVE LOG:** Displays "NF_max@942_38_0_256" with a red 'A' icon.

A line connects the 'A' icon in the noiseFigure MEAS block to the 'A' icon in the System SAVE LOG block, indicating a data link.



Expanded Noise Figure Measurement

- Set RF Source 1 to Device Input Freq.
- Set Receive Attenuation to 0 dB
- Set IF Filter Bandwidth to wide/4 MHz
- Set IF Gain for Hot Noise Measure
- Set IF Gain **+6,+12** or **+18** dB higher for Cold Noise Measurement



Expanded Noise Figure

Calculating Device Noise Figure

- $F_1 = F_{12} - (F_2 - 1)/G_1$
- F_1 = Device Noise Figure
- F_2 = Tester/Second Stage Noise Figure
- F_{12} = Measured Noise Figure
- G_1 = Device Noise Gain



Expanded Noise Figure

GSMNF2_V

File Edit Test Plan Tester Limits Options Help Debug

Test: Pout Mid Gain_-25_dBm_40_20
Test: S11 & S21 Max@925_40_10
Test: S11 & S21 Max@942.5_40_10
Test: S11 & S21 Max@960_40_10
Test: S22 only Max Gain
Test: Noise Figure Mid Gain@942_50_56_0_256 Expanded
Test: Noise Figure Mid Gain@942_50_0_256
Test: Noise Figure Max Gain@942_38_56_0_256 Expanded
Test: Noise Figure Max Gain@942_38_0_256
Test: Noise Figure Max Gain@942_38_38_0_256 Old

Compile
Run
Repeat

MEASURE

Receiver IF GAIN 56
noiseFigure MEAS NfCold Noise A

MEASURE

Receiver IF GAIN 38
noiseFigure MEAS NfHot Noise A

noiseFigure MEAS Input ENR A

System CALC Noise Figure, cold, hot enr A

noiseFigure MEAS 2nd Stage Noise Figure A

noiseFigure MEAS Port Noise Gain A

System CALC Noise Gain, cold, hot, enr A

System CALC a / b A

System CALC a / b A

System CALC a - b A

System SAVE LOG NF_max_expand@942_38_56_0_256

Receiver IF GAIN 38

StaticDigital DB 1 on

System AVERAGES 256

Source1 RF STATE OFF

StaticDigital DB 2 on

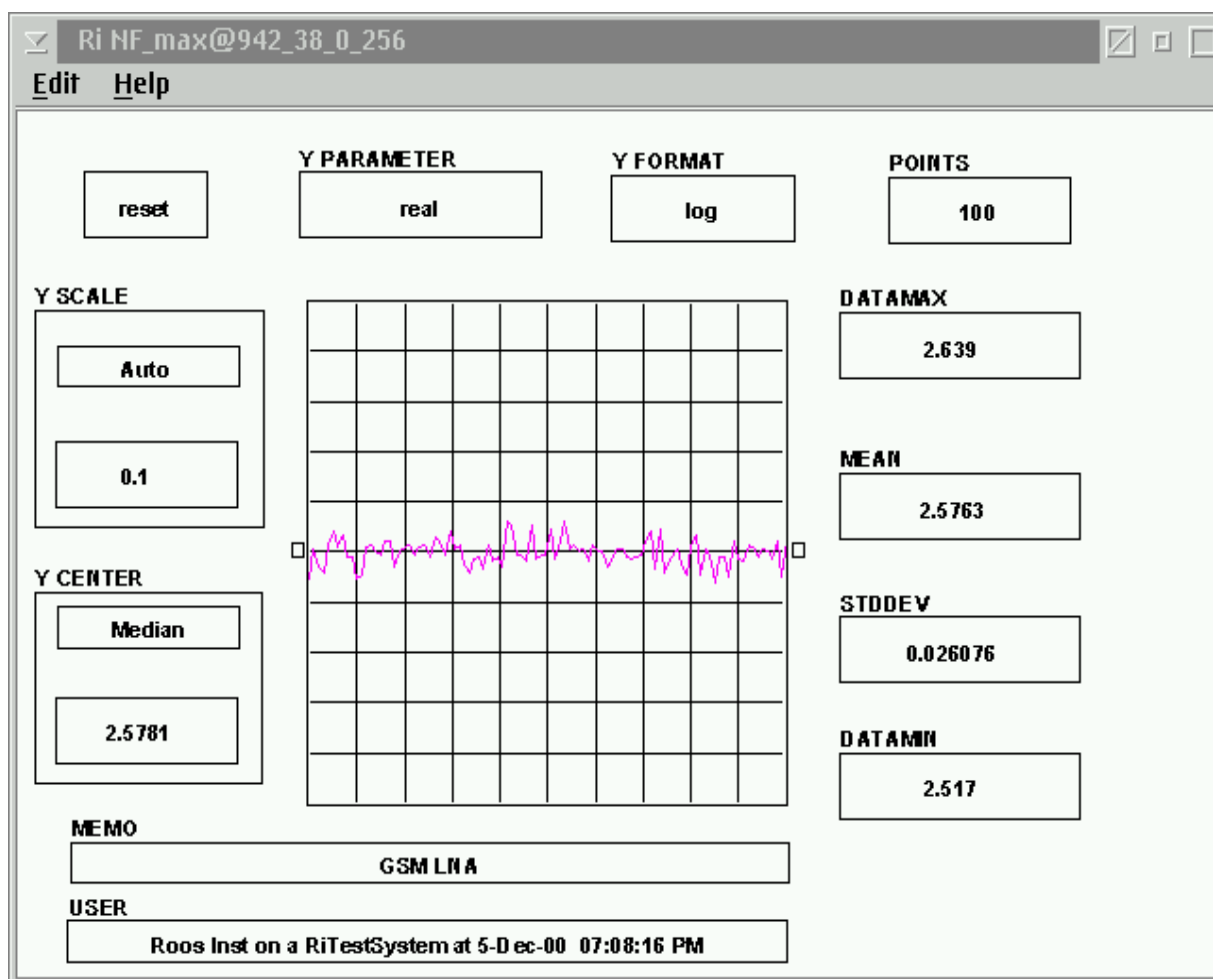
Testhead REC ATTENUATION 0db

Source1 FREQUENCY 942.5 Mhz

NOTE

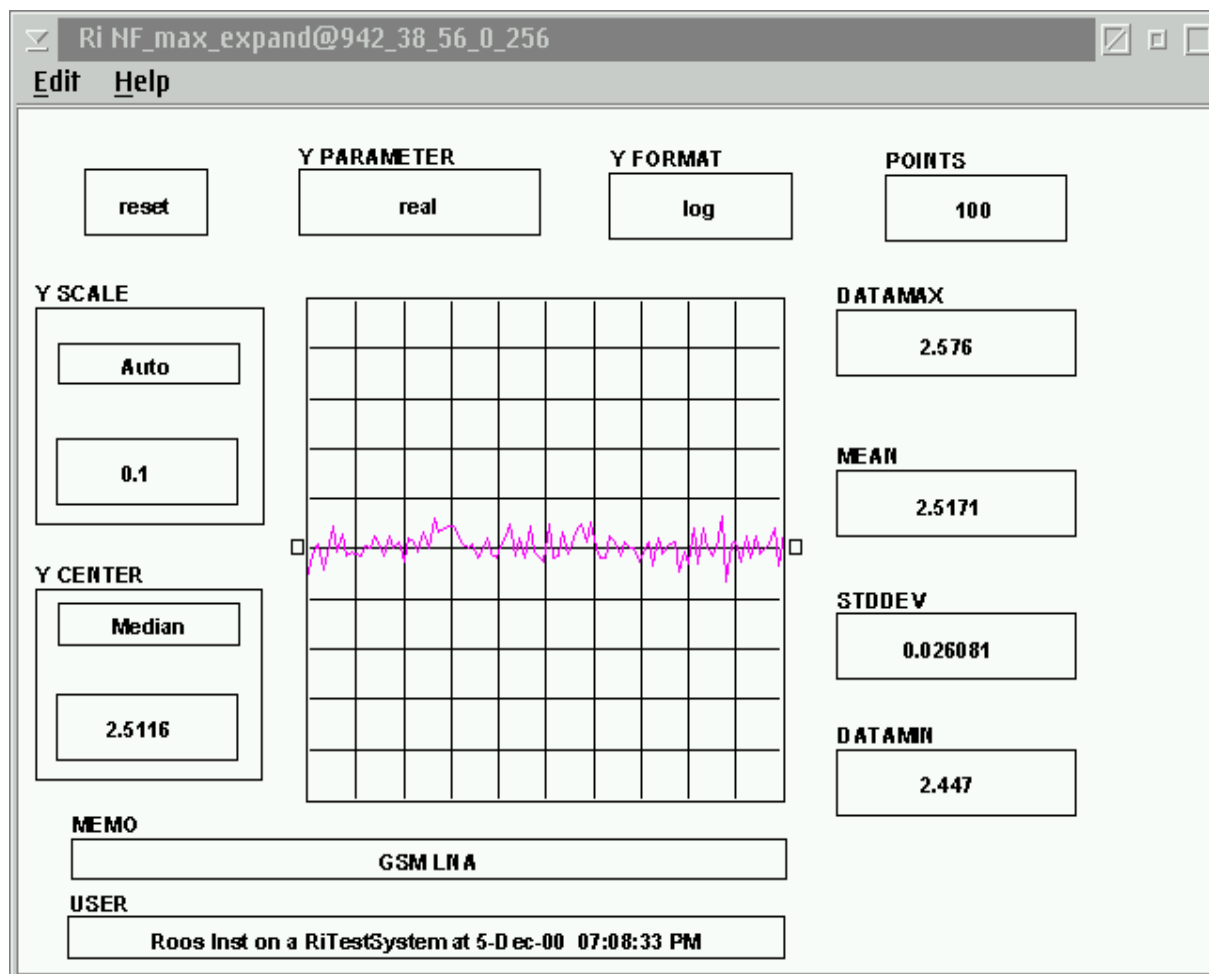


Noise Figure Measurement IF Gain +6 dB higher for Cold





Expanded Noise Figure IF Gain set for Hot & Cold





Example LNA Test Plan

CASSINI Simulator - Examine Test Plan

Test Plan Settings

Global Defaults

Disconnect Settings

Connect Sequence

Test Section: Current Tests

Conditional Statement

Section Defaults

Test: Igcq

Test: IDD

Test Section: RF Tests

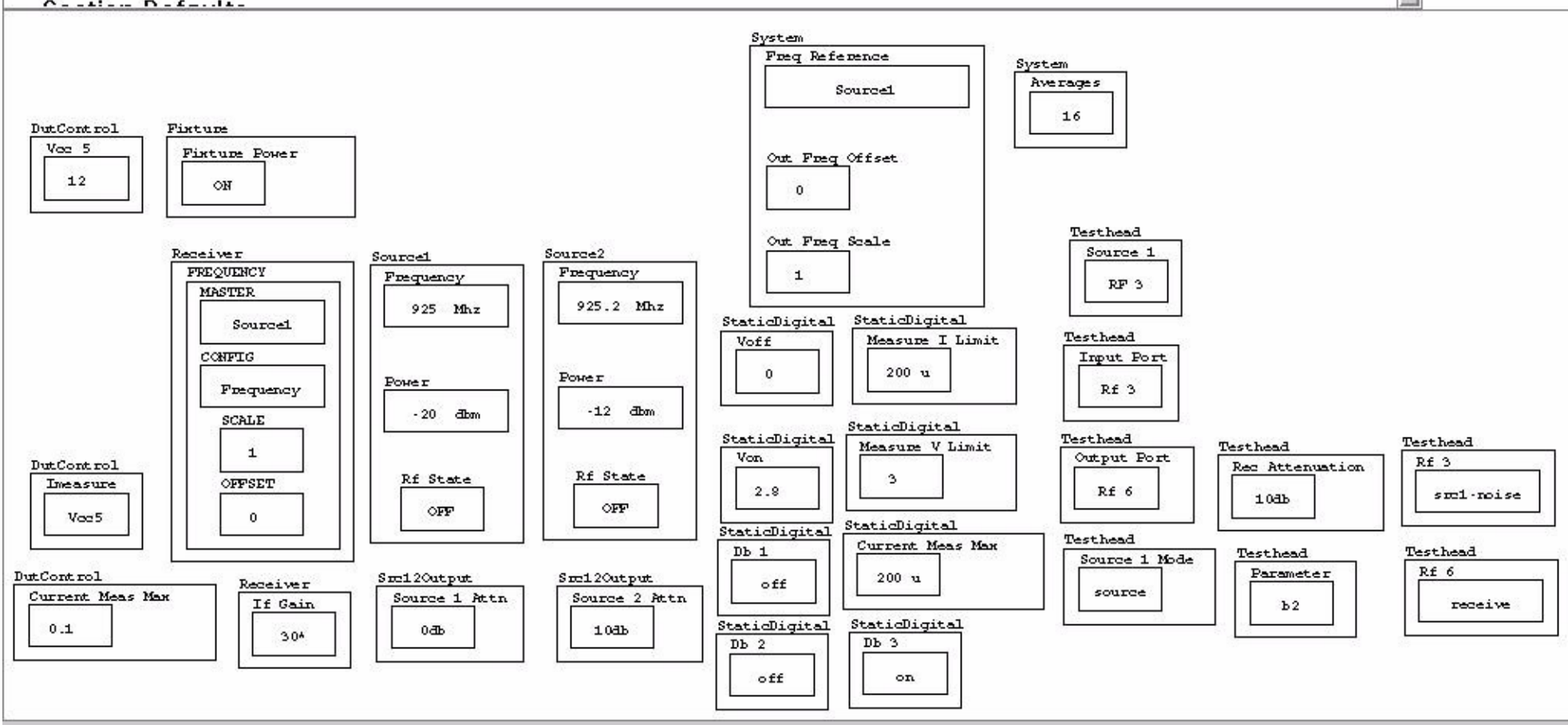
Conditional Statement

Section Defaults

Compile

Run

Repeat



LNA_example_revD

File Edit Test Plan Tester Limits Options Help Debug

Test Plan Settings

- Global Defaults
- Disconnect Settings**
- Connect Sequence

Test Section: Current Tests

- Conditional Statement
- Section Defaults
- Test: Igcq
- Test: IDD

Test Section: RF Tests

- Conditional Statement
- Section Defaults

Compile

Run

Repeat

Source1

Rf State

OFF

Source2

Rf State

OFF

StaticDigital

Db 2

off

StaticDigital

Db 3

off

DutControl

Vcc 5

0

NOTE

LNA_example_revD

File Edit Test Plan Tester Limits Options Help Debug

Test Plan Settings

- Global Defaults
- Disconnect Settings
- Connect Sequence**

Test Section: Current Tests

- Conditional Statement
- Section Defaults
- Test: Igcq
- Test: IDD

Test Section: RF Tests

- Conditional Statement
- Section Defaults

Compile

Run

Repeat

DutControl

Vcc 5
2.7

System

Sequence Delay
5000

StaticDigital

Db 2
on

StaticDigital

Db 3
on

Source1

Rf State
ON

Source2

Rf State
ON

NOTE

LNA_example_revD

File Edit Test Plan Tester Limits Options Help Debug

Test Plan Settings
Global Defaults
Disconnect Settings
Connect Sequence

Test Section: Current Tests
Conditional Statement
Section Defaults
Test: Igcq
Test: IDD

Test Section: RF Tests
Conditional Statement
Section Defaults

Compile
Run
Repeat

Receiver

Frequency
925 Mhz

Source1

Rf State
OFF

Source2

Rf State
OFF

NOTE

LNA_example_revD

File Edit Test Plan Tester Limits Options Help Debug

Test Plan Settings
Global Defaults
Disconnect Settings
Connect Sequence

Test Section: Current Tests
Conditional Statement
Section Defaults

Test: Igcq
Test: IDD

Test Section: RF Tests
Conditional Statement
Section Defaults

Compile
Run
Repeat

StaticDigital
Measure V Force
3

StaticDigital
Measure Mode
I meas

System
Averages
32

StaticDigital
Measure Pin
DB2

StaticDigital
Current Meas Max
200 u

StaticDigital
MEAS
Current A

System
Save Amps
A Igc

StaticDigital
Db 2
open

StaticDigital
Measure I Limit
200 u

LNA_example_revD

File Edit Test Plan Tester Limits Options Help Debug

Test Plan Settings
Global Defaults
Disconnect Settings
Connect Sequence

Test Section: Current Tests
Conditional Statement
Section Defaults
Test: Igccq
Test: IDD

Test Section: RF Tests
Conditional Statement
Section Defaults

Compile
Run
Repeat

```
graph TD
    subgraph System1 [System]
        Averages[Averages]
        Averages --- 64[64]
    end

    subgraph StaticDigital1 [StaticDigital]
        Db1[Db 1]
        Db1 --- off[off]
    end

    subgraph StaticDigital2 [StaticDigital]
        Db2[Db 2]
        Db2 --- on[on]
    end

    subgraph DutControl1 [DutControl]
        CurrentMeasMax[Current Meas Max]
        CurrentMeasMax --- 0.1[0.1]
        Imeasure[Imeasure]
        Imeasure --- Vcc5[Vcc5]
    end

    subgraph MEAS [DutControl MEAS]
        CurrentA[Current A]
    end

    subgraph System2 [System Save Amps]
        SaveAmps[Save Amps]
        SaveAmps --- IDD[A IDD]
    end

    CurrentA --- IDD
```


LNA_example_revD

File Edit Test Plan Tester Limits Options Help Debug

Conditional Statement
Section Defaults
Test: Igcq
Test: IDD

Test Section: RF Tests
Conditional Statement
Section Defaults
Test: Gain and Input Return Loss
Test: S22 only
Test: Gain Flatness
Test: Calc Gain Flatness
Test: Target Gain

Compile
Run
Repeat

Source1

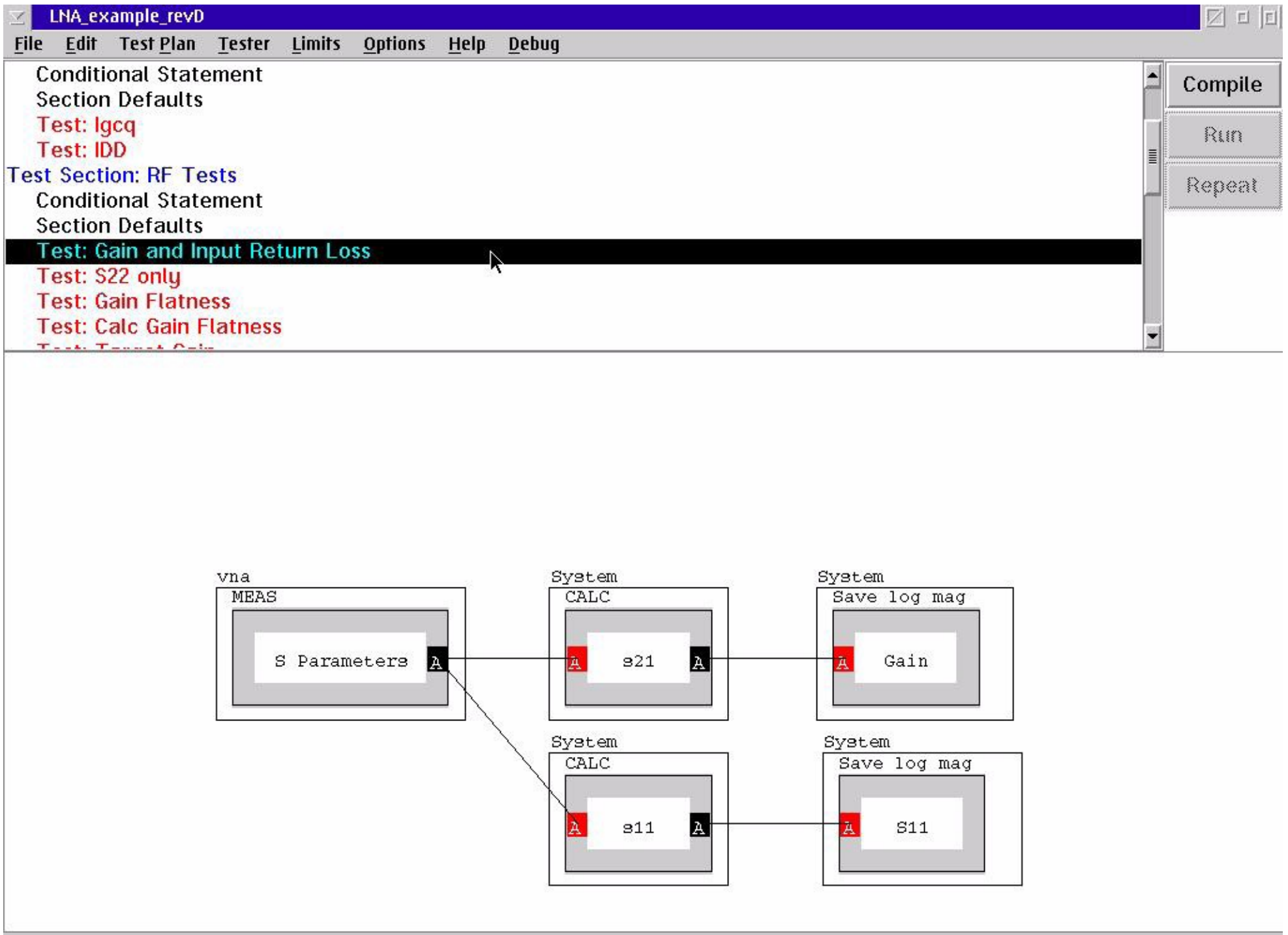
Rf State

ON

StaticDigital

Db 2

on



LNA_example_revD

File Edit Test Plan Tester Limits Options Help Debug

Conditional Statement
Section Defaults
Test: Igcq
Test: IDD

Test Section: RF Tests
Conditional Statement
Section Defaults
Test: Gain and Input Return Loss
Test: S22 only
Test: Gain Flatness
Test: Calc Gain Flatness
Test: Target Gain

Compile
Run
Repeat

Source1

Power

-12 dbm

Testhead

Source 1

Load

Testhead

Load State

source 1

Testhead

Input Port

Rf 6

Testhead

Output Port

Rf 6

vna

MEAS

S11 Only A

System

Save log mag

A S22_rev_path

LNA_example_revD

File Edit Test Plan Tester Limits Options Help Debug

Conditional Statement
Section Defaults
Test: Igcq
Test: IDD

Test Section: RF Tests
Conditional Statement
Section Defaults
Test: Gain and Input Return Loss
Test: S22 only
Test: Gain Flatness
Test: Calc Gain Flatness
Test: Target Gain

Compile
Run
Repeat

Source1
Frequency
925 Mhz

Source1
Frequency
942.5 Mhz

Source1
Frequency
960 Mhz

vna
MEAS
S Parameters A

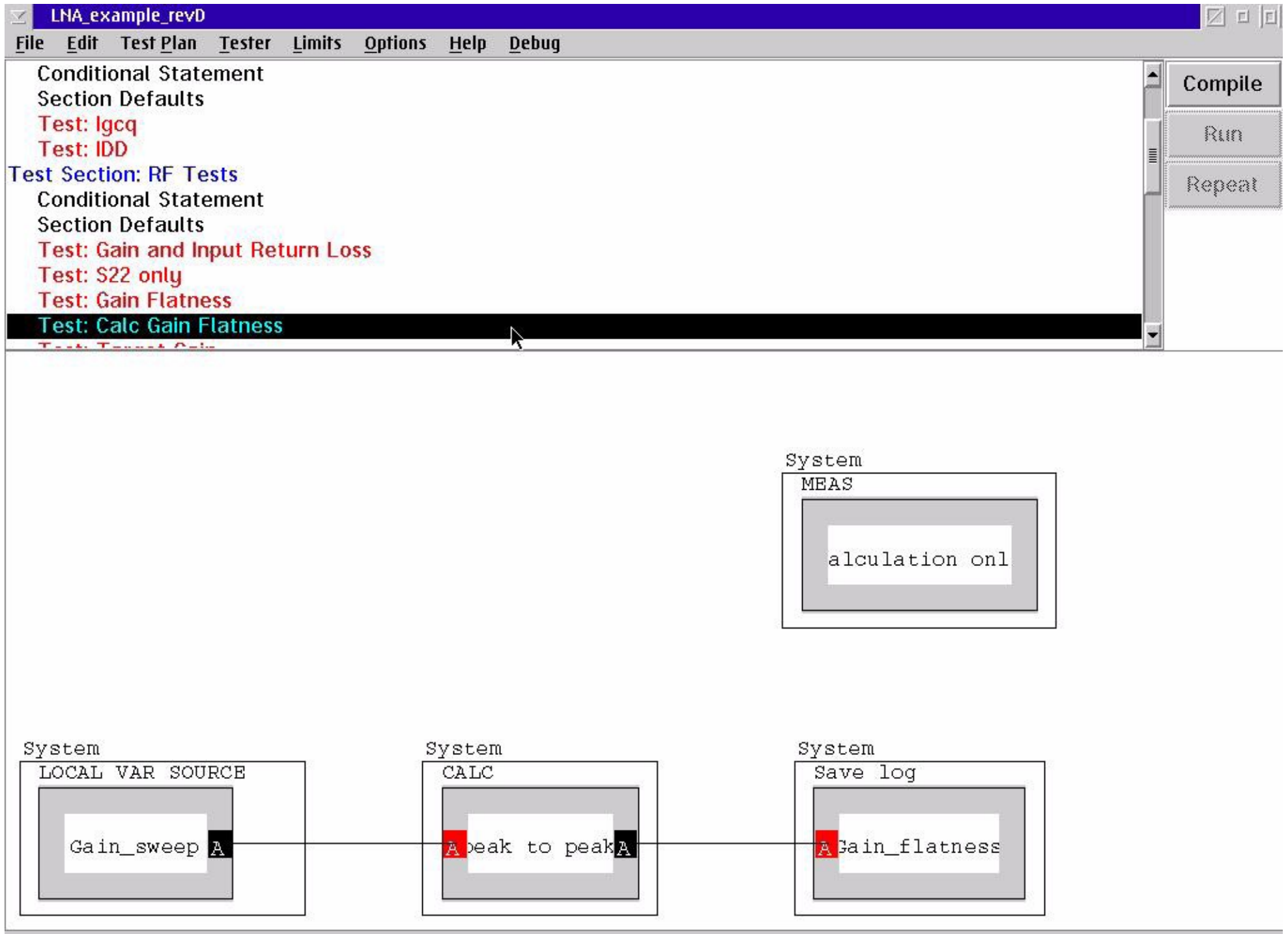
System
CALC
s21 A

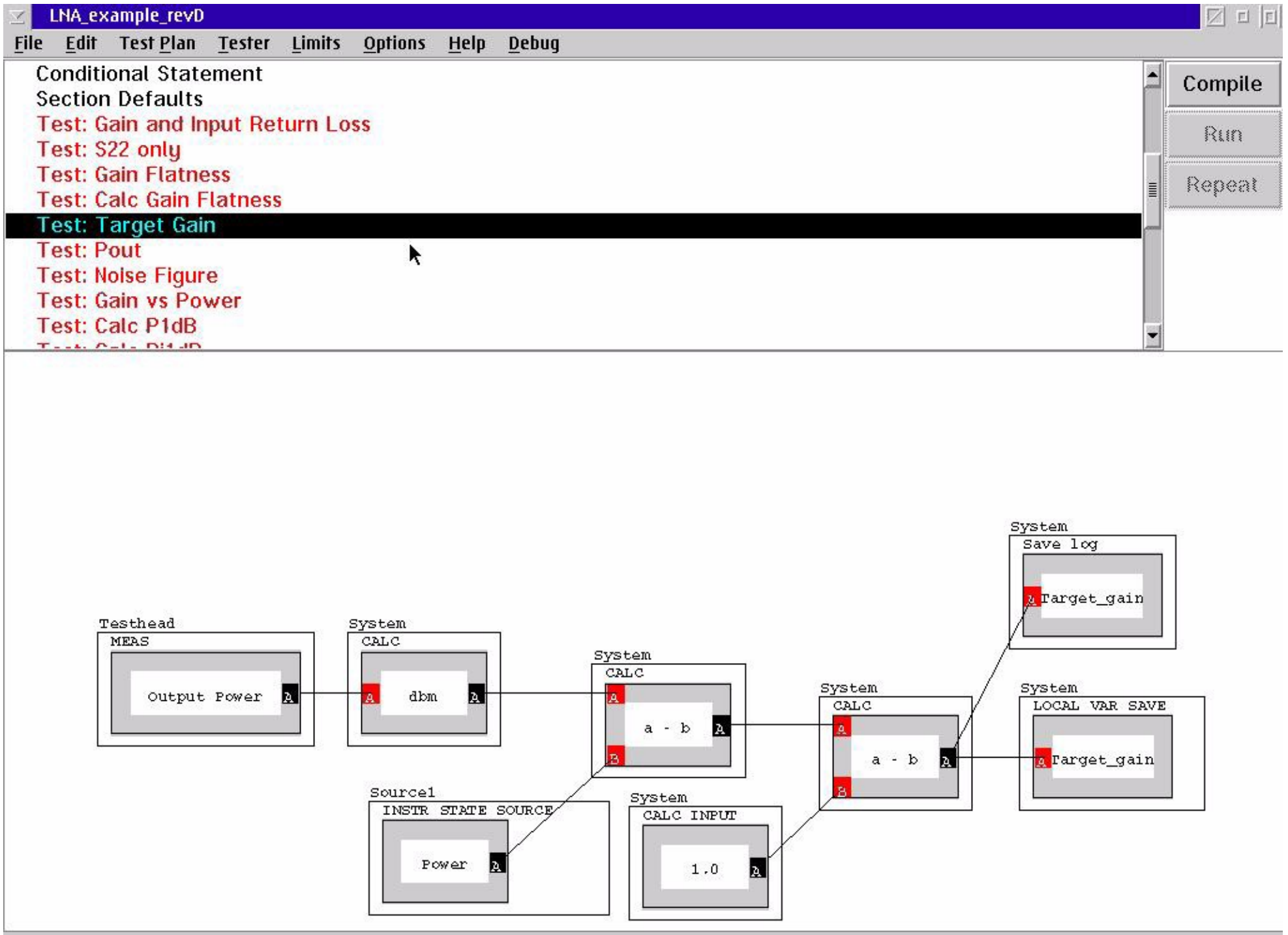
System
CALC
magnitude (db) A

System
LOCAL VAR SAVE
Gain_sweep A

System
Save log
Gain_sweep A

```
graph LR; S1[Source1: 925 Mhz] --- VNA[vna: MEAS S Parameters]; S2[Source1: 942.5 Mhz] --- VNA; S3[Source1: 960 Mhz] --- VNA; VNA --- S21[System: CALC s21]; S21 --- Mag[System: CALC magnitude (db)]; Mag --- LVS[System: LOCAL VAR SAVE Gain_sweep]; Mag --- SL[System: Save log Gain_sweep];
```





LNA_example_revD

File Edit Test Plan Tester Limits Options Help Debug

Conditional Statement
Section Defaults
Test: Gain and Input Return Loss
Test: S22 only
Test: Gain Flatness
Test: Calc Gain Flatness
Test: Target Gain
Test: Pout
Test: Noise Figure
Test: Gain vs Power
Test: Calc P1dB
Test: Calc P1dB

Compile
Run
Repeat

Source1
Power
-12 dbm

Testhead
MEAS
Output Power A

System
CALC
A dbm A

System
LOCAL VAR SAVE
A Pout

```
graph LR; Source1[Source1: Power -12 dbm] --> Testhead[Testhead: MEAS Output Power A]; Testhead --> System1[System: CALC A dbm A]; System1 --> System2[System: LOCAL VAR SAVE A Pout];
```


LNA_example_revD

File Edit Test Plan Tester Limits Options Help Debug

Conditional Statement
Section Defaults
Test: Gain and Input Return Loss
Test: S22 only
Test: Gain Flatness
Test: Calc Gain Flatness
Test: Target Gain
Test: Pout
Test: Noise Figure
Test: Gain vs Power
Test: Calc P1dB
Test: Calc P1dB

Compile
Run
Repeat

Receiver
If Gain
50

Source1
Rf State
OFF

System
Averages
128

Testhead
Rec Attenuation
0db

noiseFigure
MEAS
Noise Figure A

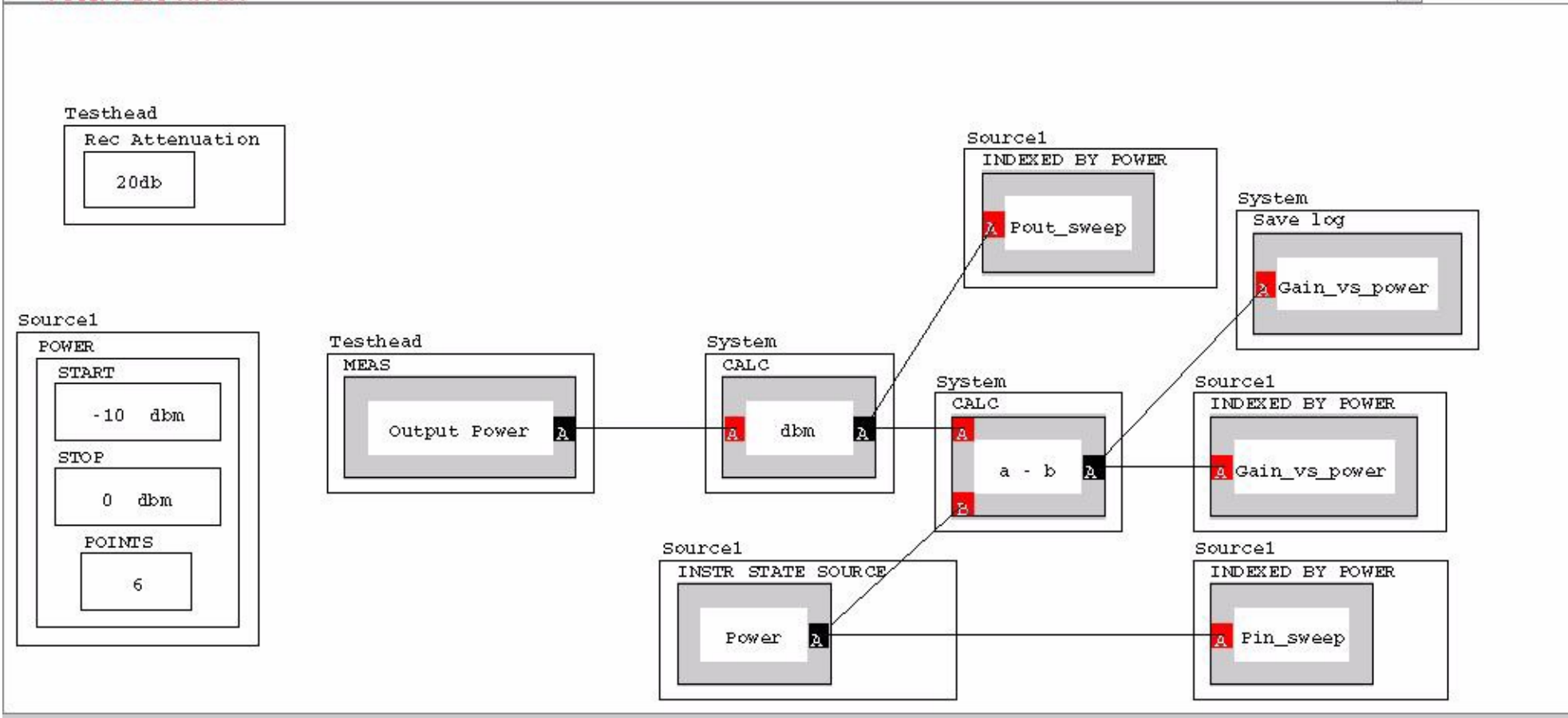
System
Save log
A NF

LNA_example_revD

File Edit Test Plan Tester Limits Options Help Debug

Conditional Statement
 Section Defaults
 Test: Gain and Input Return Loss
 Test: S22 only
 Test: Gain Flatness
 Test: Calc Gain Flatness
 Test: Target Gain
 Test: Pout
 Test: Noise Figure
Test: Gain vs Power
 Test: Calc P1dB
 Test: Calc P1dB

Compile
 Run
 Repeat

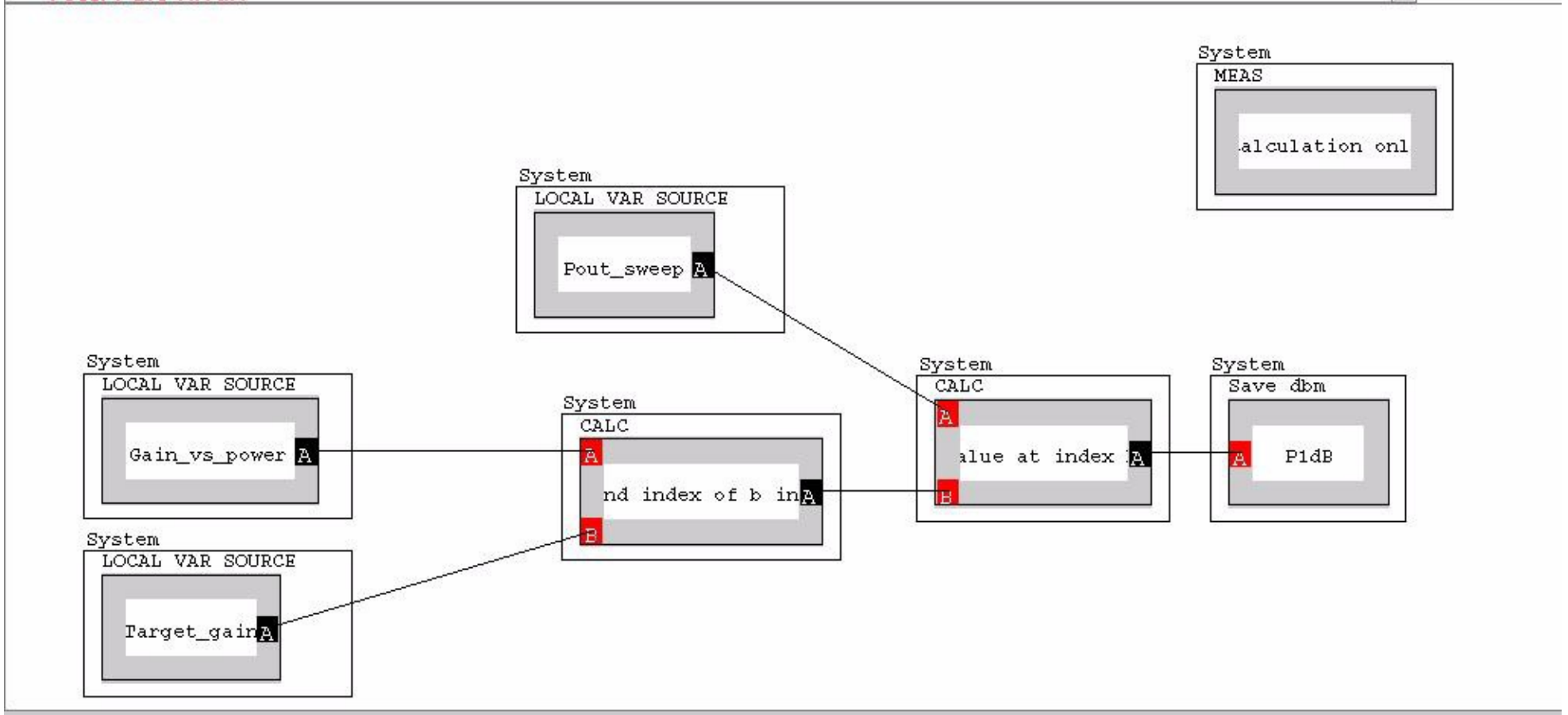


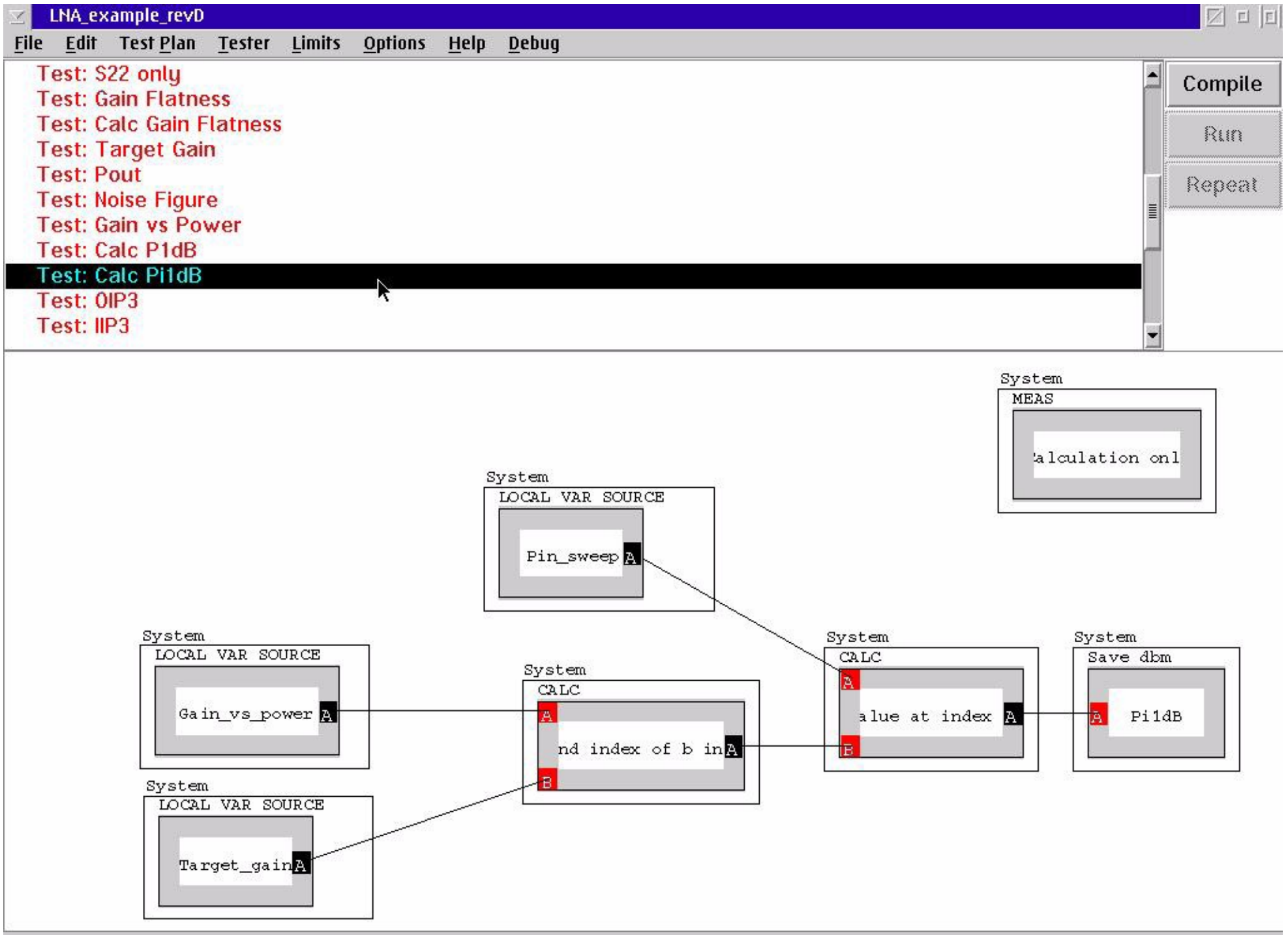
LNA_example_revD

File Edit Test Plan Tester Limits Options Help Debug

Conditional Statement
 Section Defaults
 Test: Gain and Input Return Loss
 Test: S22 only
 Test: Gain Flatness
 Test: Calc Gain Flatness
 Test: Target Gain
 Test: Pout
 Test: Noise Figure
 Test: Gain vs Power
Test: Calc P1dB
 Test: Calc P1dB

Compile
 Run
 Repeat



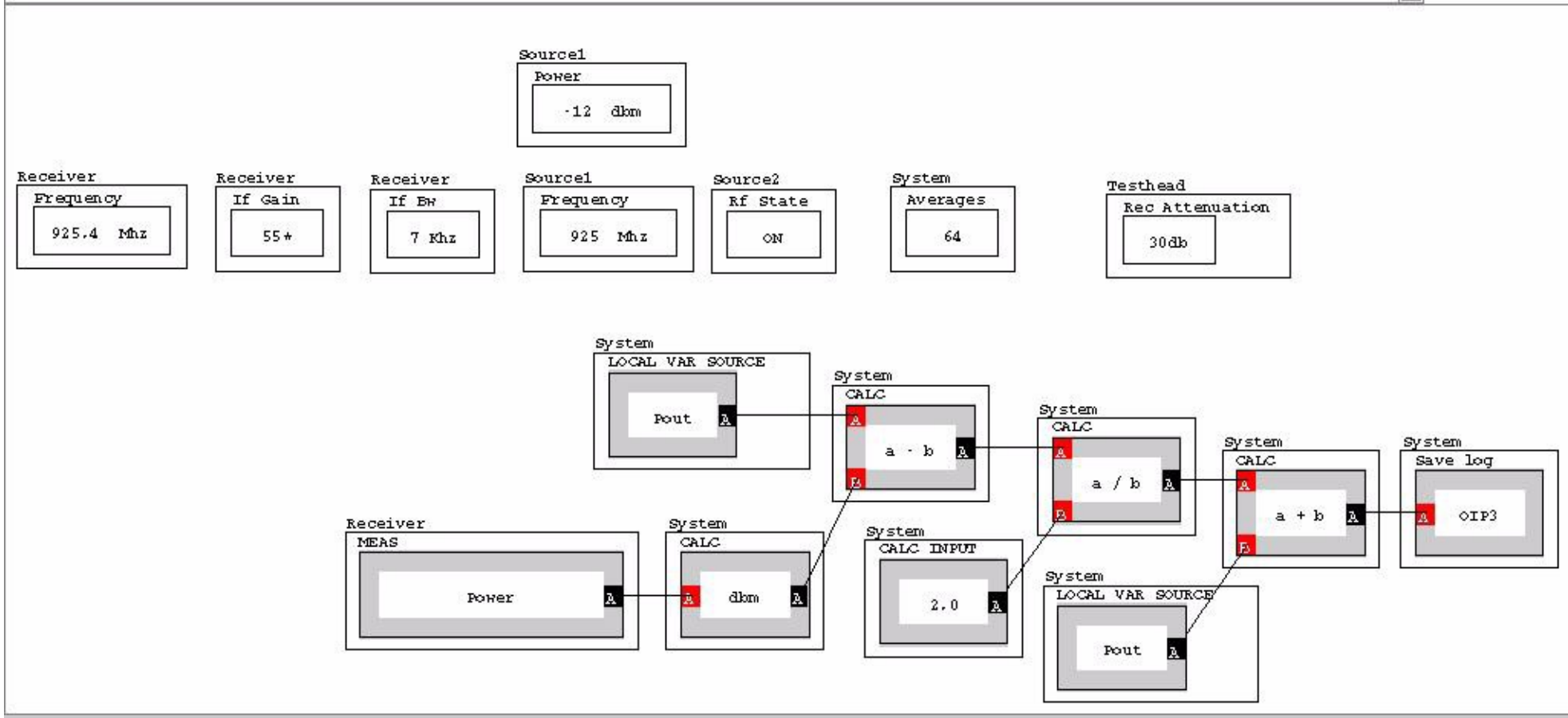


LNA_example_revD

File Edit Test Plan Tester Limits Options Help Debug

Test: S22 only
 Test: Gain Flatness
 Test: Calc Gain Flatness
 Test: Target Gain
 Test: Pout
 Test: Noise Figure
 Test: Gain vs Power
 Test: Calc P1dB
 Test: Calc P1dB
Test: OIP3
 Test: IIP3

Compile
 Run
 Repeat

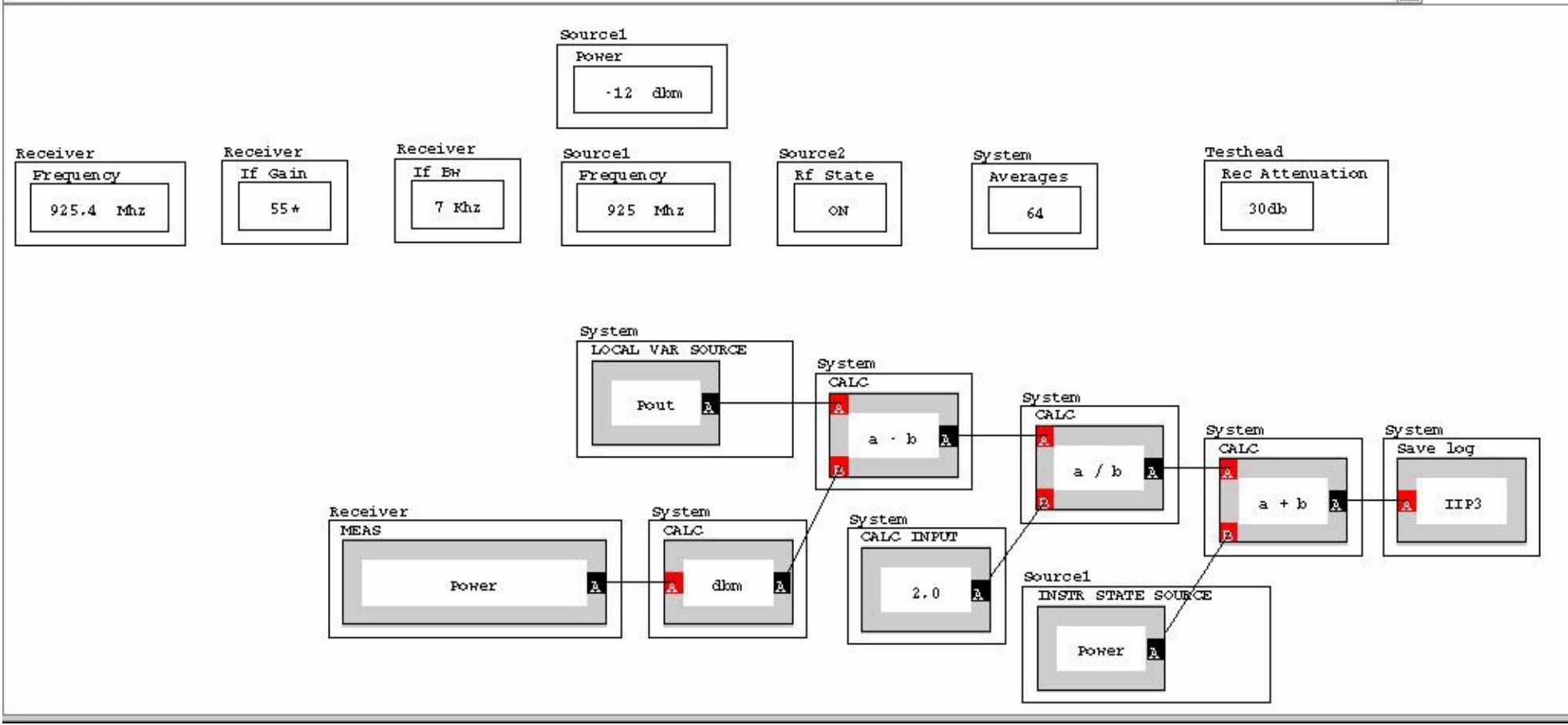


LNA_example_revD

File Edit Test Plan Tester Limits Options Help Debug

Test: S22 only
 Test: Gain Flatness
 Test: Calc Gain Flatness
 Test: Target Gain
 Test: Pout
 Test: Noise Figure
 Test: Gain vs Power
 Test: Calc P1dB
 Test: Calc P1dB
 Test: OIP3
Test: IIP3

Compile
 Run
 Repeat





Writing a LNA Test Plan - Lab D

- Get into Groups of Three
- Each will take turns performing the lab
- One types, one reads, one uses mouse



LNA Test Plan Lab

Develop 3rd Harmonic

- RF Input Level = -5 dBm
- RF Input Frequency = 960 MHz
- 3rd Harmonic Spec. Approx. -35 dBc
- Device Gain Approx. +10 dB
- Calc 3rd Harmonic in dBc
- Extra Credit:
 - Find 3rd Harmonic at +5 dBm Out



PA Tests

- DC Current & PAE
- S11, S21, S12 & S22
- Noise Figure
- P1dB
- Intermodulation Distortion
- Harmonics
- ACPR @ Specified Output Power



PA Test Plan Measurements

- Gain
- P1dB
- Fixed Pout
- IM3
- Leakage Current
- ACPR/ACLR
- Efficiency



PA Test Considerations

- Set Up DMSG in Global Defaults
- Use SRC12/Aux Pwr not Aux SRC/Pwr for sweep
- SRC12/Aux Pwr is Actually Attenuation
- Use RMS Power for Modulated Tones
- Characterize Noise BW of IF Filters for Modulation Type
- Use DB Line for Leakage Current Measurement

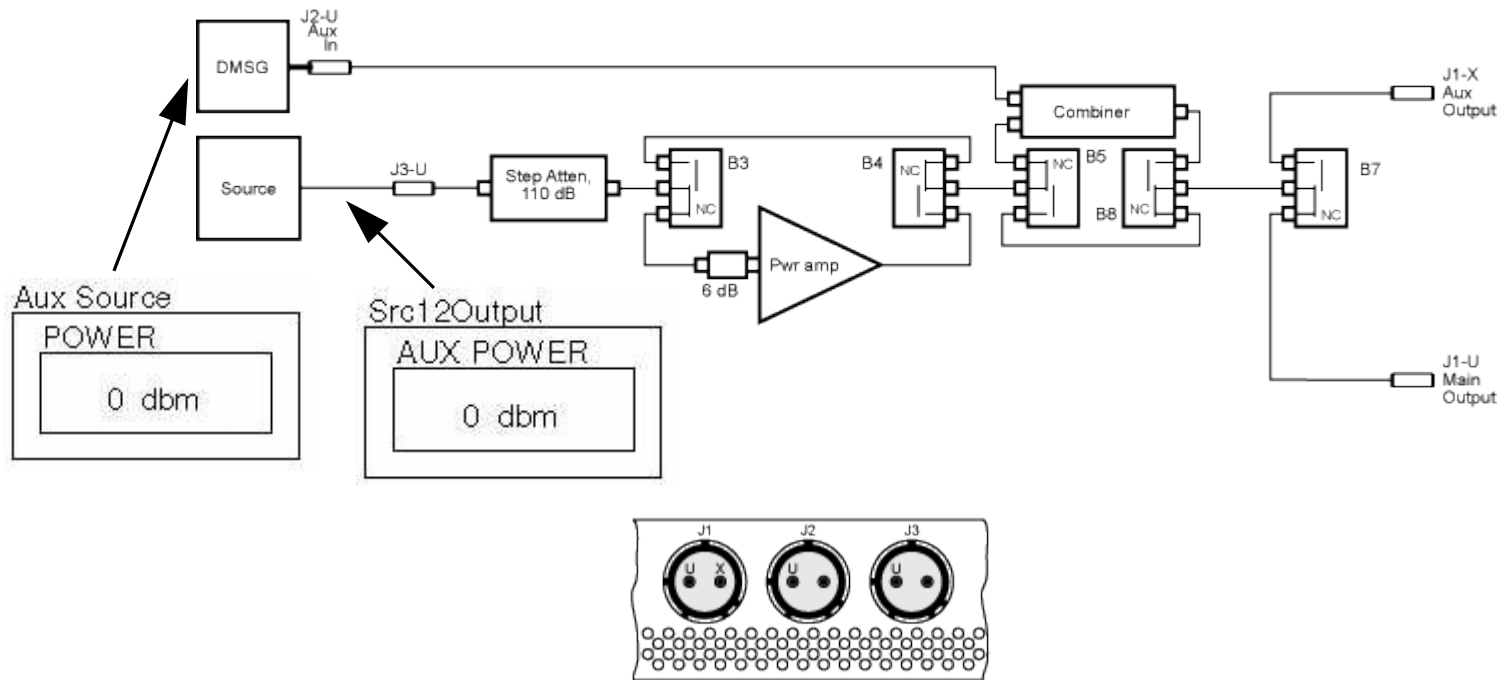


Aux Attenuator Path

Roos Instruments, Inc - Cassini
Block Diagram, Source/Amp Attenuator
RI8555A

2007-2-6

Copyright Roos Instruments, Inc.
Subject to change without notice



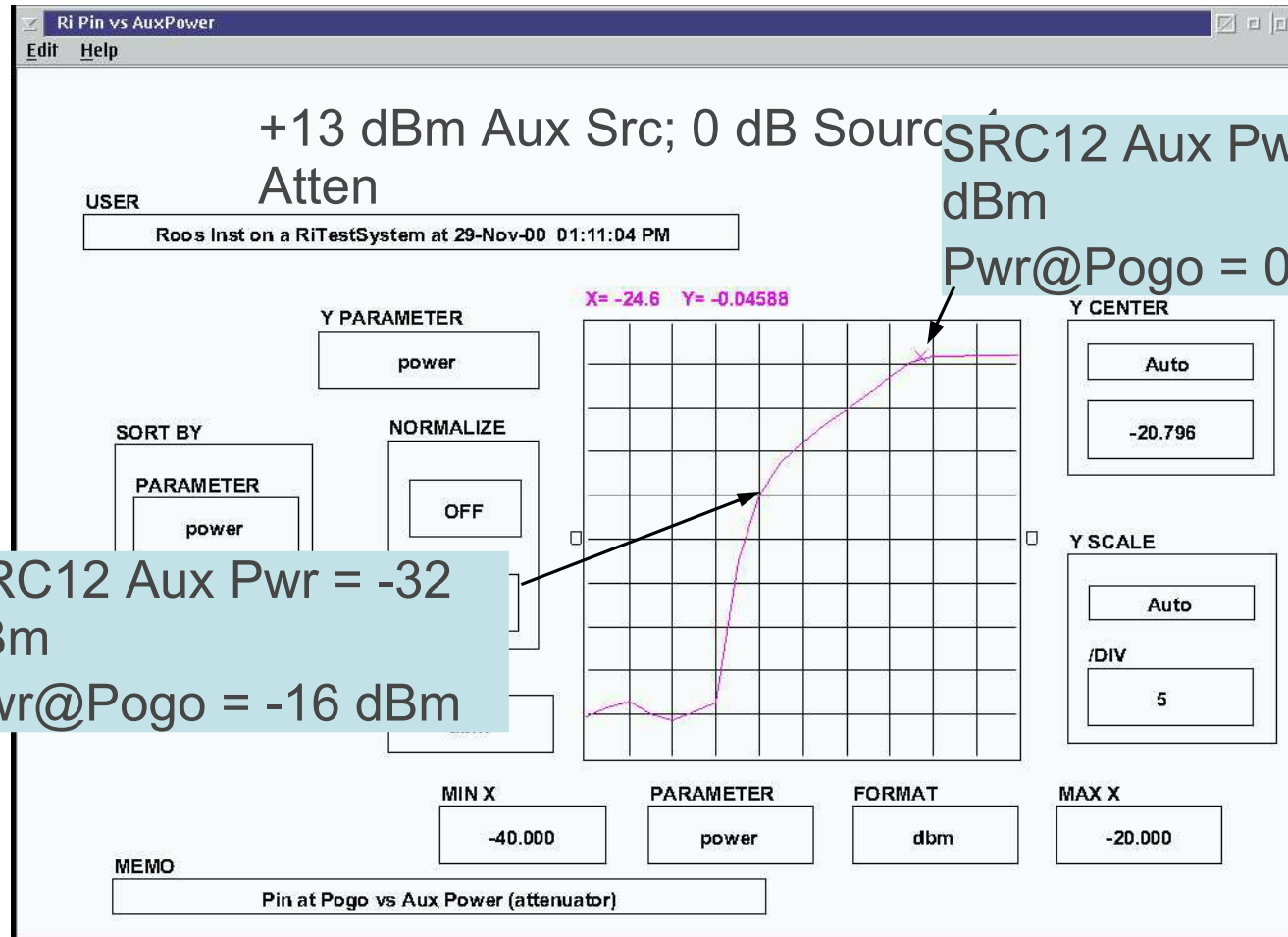


Src12 Aux Power

- Attenuator not Power
- Logarithmic Attenuation
- Approximately 13 dB Path Loss in 0 dB Attenuation State (DMSG to Pogo Ring)
- Effective Settings: SRC12/AuxPwr
 - -24 dBm = 13 dB path loss = 0 dB atten
 - -32 dBm = 29 dB path loss = 16 dB atten



Available vs. Src12/AuxPower



SRC12 Aux Pwr = -32 dBm
Pwr@Pogo = -16 dBm

SRC12 Aux Pwr = -24 dBm
Pwr@Pogo = 0 dBm



Aux Source Capabilities

- Anritsu MG3671B; +13 dBm max.
- Aux Src Only: 0 dBm @ Pogo
- With SRC1 Amp: Approximately +20 dBm @ Pogo
- CDMA, TDMA, PDC, GSM, TETRA, DECT



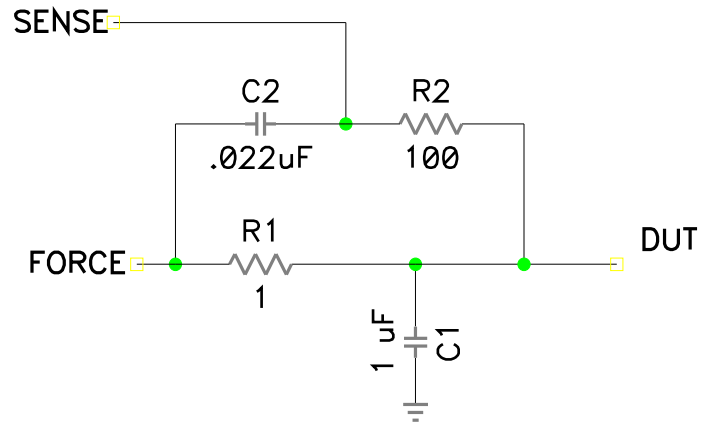
VI Loading

- Power VIs designed for $<0.1\mu\text{F}$
- 3 μSec settling, Faster than bench
- Some PA eval boards have higher values
- Design Dut boards appropriately
- If Dut must have $>1\mu\text{F}$ cap use following method



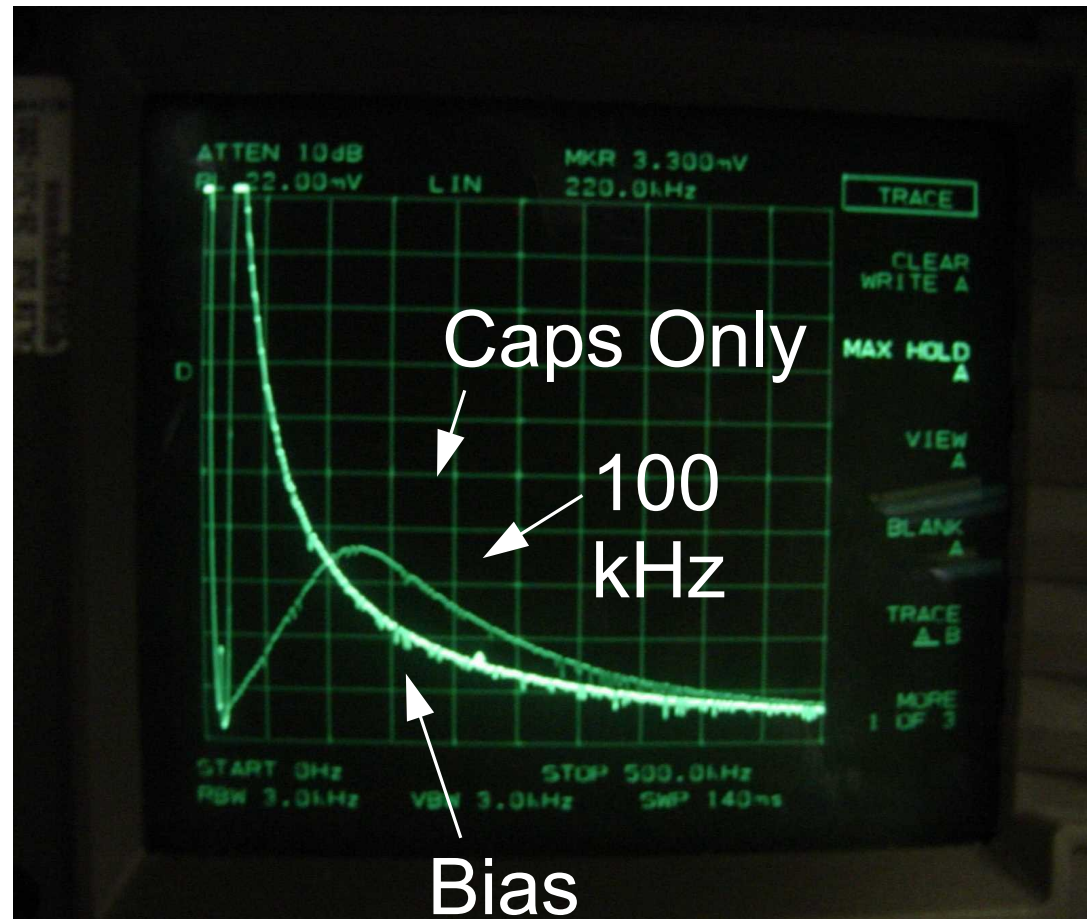
Loading Circuit

- C1 must be Ceramic (low R)
- R1, high watt; isolates Cap from VI





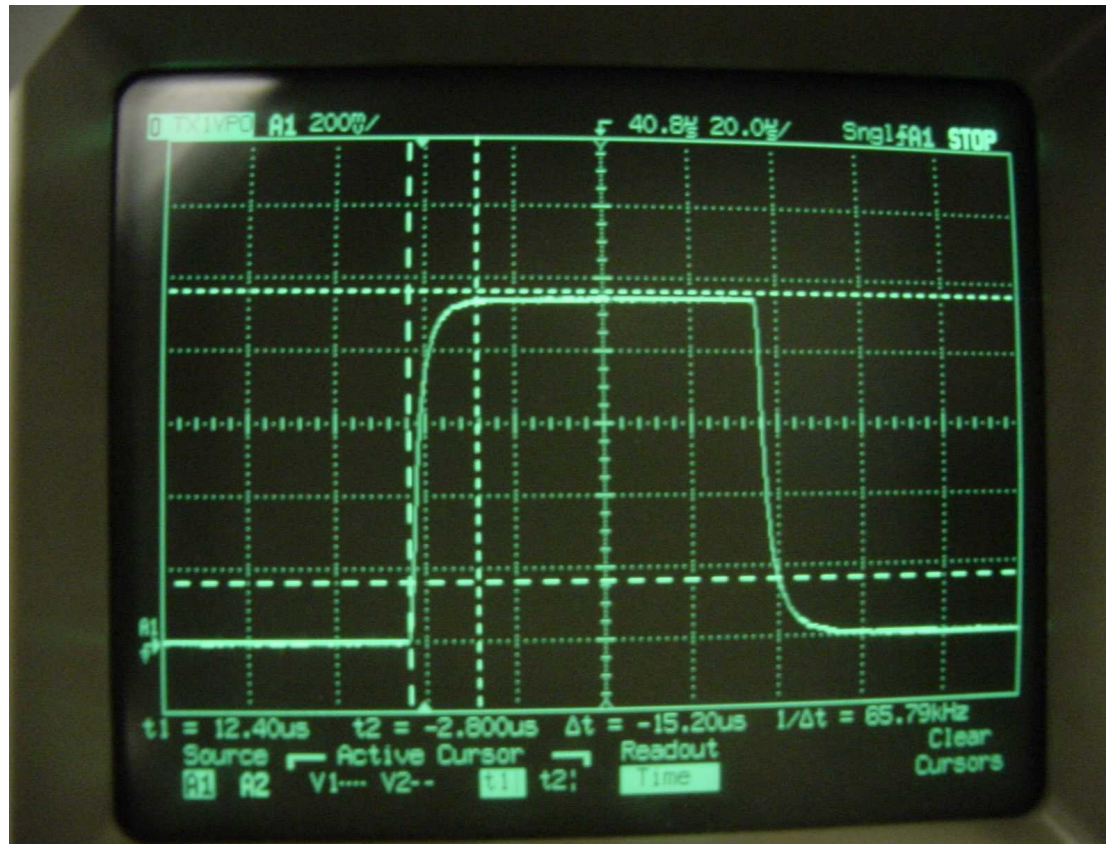
Circuit Frequency Response





Circuit Time Response

- 15 uSec Settling



ROOS INSTRUMENTS



Switching DC Supplies

- RI Supplies "Break before Make"
- Supplies for Special Measurements
- Power VI; High Current
- DB; Leakage Current
- Concerns:
 - Device Memory
 - Decoupling Capacitance
 - Test Order



Switching Mechanism

- DB 4 x 8 Matrix
 - Von
 - Voff
 - Open
 - Parametric Measure
- VI
 - On
 - Off



Make before Break

- Connect Two Supplies at a Time
- DB Compliance
 - Mode Switching
 - Current Limit Applies
- VI Compliance
 - Drop Voltage to Limit Current
- Pre and Post Measure Group



Leakage Current Measurements

OSCAR_C14_FM_SRC2

File Edit Test Plan Tester Limits Options Help Debug

<DISABLED>Conditional Statement
<DISABLED>Section Defaults
<DISABLED>Test: Total Chip Leakage
Test Section: Junk (Unoptimized)
Conditional Statement
Section Defaults
Test: Total Chip Leakage
Test Section: DC Quiescent Tests (Unoptimized)
Conditional Statement
Section Defaults

PRE MEAS

StaticDigital MEASURE V FORCE 3.4	StaticDigital MEASURE PIN DB4	PowerVI V 1 OUTPUT OFF	System SEQUENCE DELAY 20000
---	-------------------------------------	------------------------------	-----------------------------------

StaticDigital
MEAS
Current A

System
SAVE AMPS
Chlp_Leakage_Off

StaticDigital MEASURE I LIMIT 20 u	StaticDigital CURRENT MEAS MAX 20 u
--	---

PRE MEAS

PowerVI V 1 OUTPUT ON	StaticDigital MEASURE PIN None	StaticDigital MEASURE V FORCE 0	StaticDigital MEASURE MODE Imeas
-----------------------------	--------------------------------------	---------------------------------------	--

Compile
Run
Repeat

NOTE



Pulsed DC Measurements

The screenshot shows a software window titled "GSM Pulse" with a menu bar (File, Edit, Test Plan, Tester, Limits, Options, Help, Debug). The left sidebar lists "Test Plan Settings" (Global Defaults, Disconnect Settings, Connect Sequence) and "Test Section: GSM Pulse Tests; Pulse DC" (Conditional Statement, Section Defaults, **Test: Pulsed DC Current**, Test: Measure RF power in 20 GSM pulses and average, Test: Average Power During GSM Pulse). On the right, there are buttons for "Compile", "Run", and "Repeat".

The main area displays measurement configurations:

- PRE MEAS**:
 - PowerVI: POWER V 1 (value: 3)
 - System: SEQUENCE DELAY (value: 200)
- POST MEAS**:
 - PowerVI: POWER V 1 (value: 0)
- MEASUREMENTS**:
 - PowerVI MEAS: Current A (value: A)
 - System SAVE AMPS: Current after 200 uSec (value: A)
 - System CURRENT MEAS MAX: 1
 - System IMEASURE: V1
 - System AVERAGES: 1

ROOS NOTE



Pulsed RF Measurements

GSM Pulse
File Edit Test Plan Tester Limits Options Help Debug

Test Plan Settings
Global Defaults
Disconnect Settings
Connect Sequence

Test Section: GSM Pulse Tests; Pulse DC
Conditional Statement
Section Defaults
Test: Pulsed DC Current
Test: Measure RF power in 20 GSM pulses and average
Test: Average Power During GSM Pulse

System AVERAGES
8

System REPEAT
20

PRE MEAS

PowerVI POWER V 1 3	System SEQUENCE DELAY 25
-------------------------------	------------------------------------

POST MEAS

DutControl VCC 5 0	System SEQUENCE DELAY 25	PowerVI POWER V 1 0	System SEQUENCE DELAY 1200
------------------------------	------------------------------------	-------------------------------	--------------------------------------

Receiver MEAS
Power

System LOCAL VAR SAVE
Power during GSM Pulse

RO NOTE



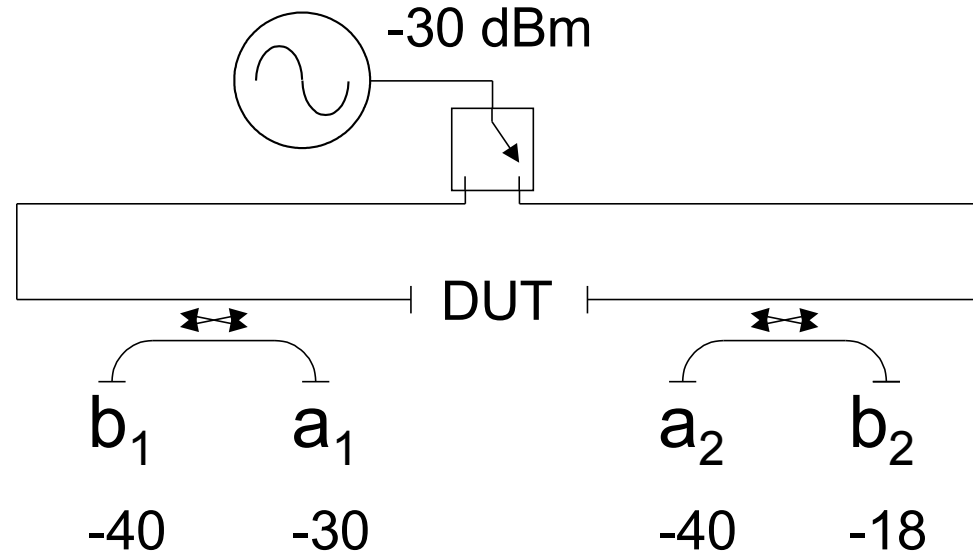
High Dynamic Range Devices

- Wave variation > 30 dB (approx.)
- Waves are a1, a2, b1, b2



Typical Device; LNA

- S21 12 dB
- S11 10 dB
- S12 15 dB
- S22 10 dB

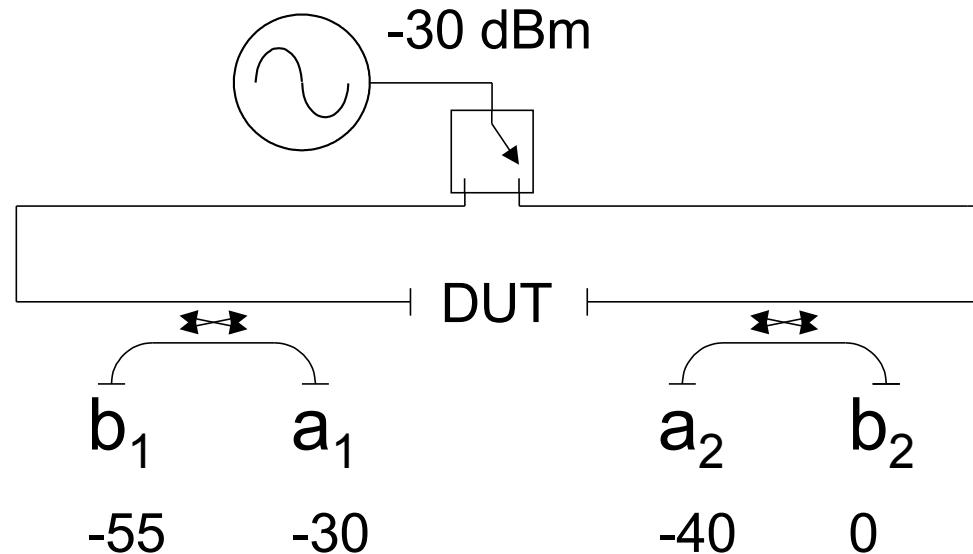


Total Variation 22 dB



High Dynamic Range Device; PA

- S21 30 dB
- S11 10 dB
- S12 25 dB
- S22 10 dB



Total Variation 55 dB



Example HD Devices

- Multi-stage amplifier
- PA
- Limiter
- Filter
- Log Amplifier
- GPS Amplifier



Tester Methods; VNA

- Measures all four waves
- Same Conditions
 - IF Gain
 - Receive Attenuation
- All waves are used to calculate each S-parameter
- Low dynamic range parameters will be influenced by non-optimized ones



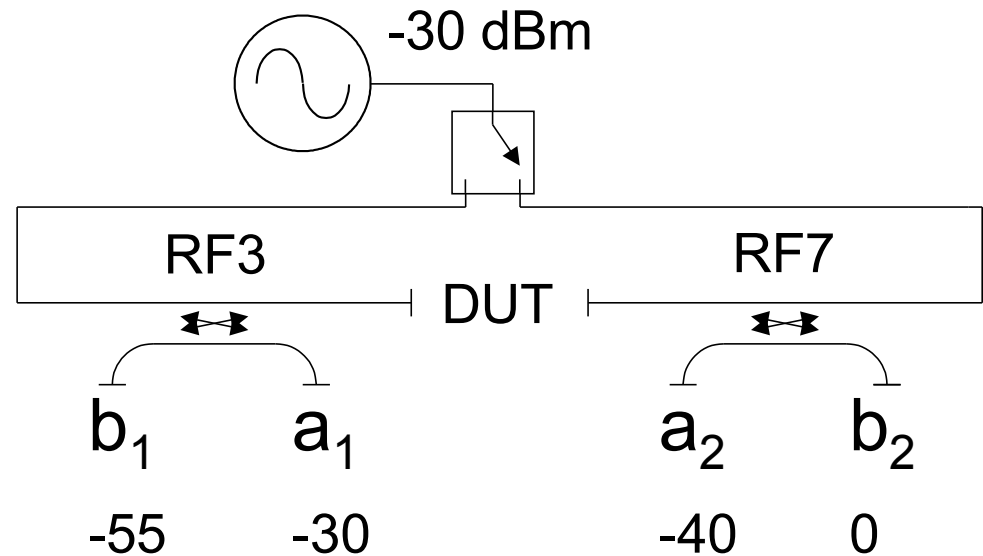
HDD Strategy

- Group according to power variation
- Separate S21 from S12
- Reduce to relevant waves; i.e. S11 only
 - Valid for high dynamic range device
 - If S12 is small; output will not influence input



High Dynamic Range Device; PA

- S21 30 dB
- S11 10 dB
- S12 25 dB
- S22 10 dB

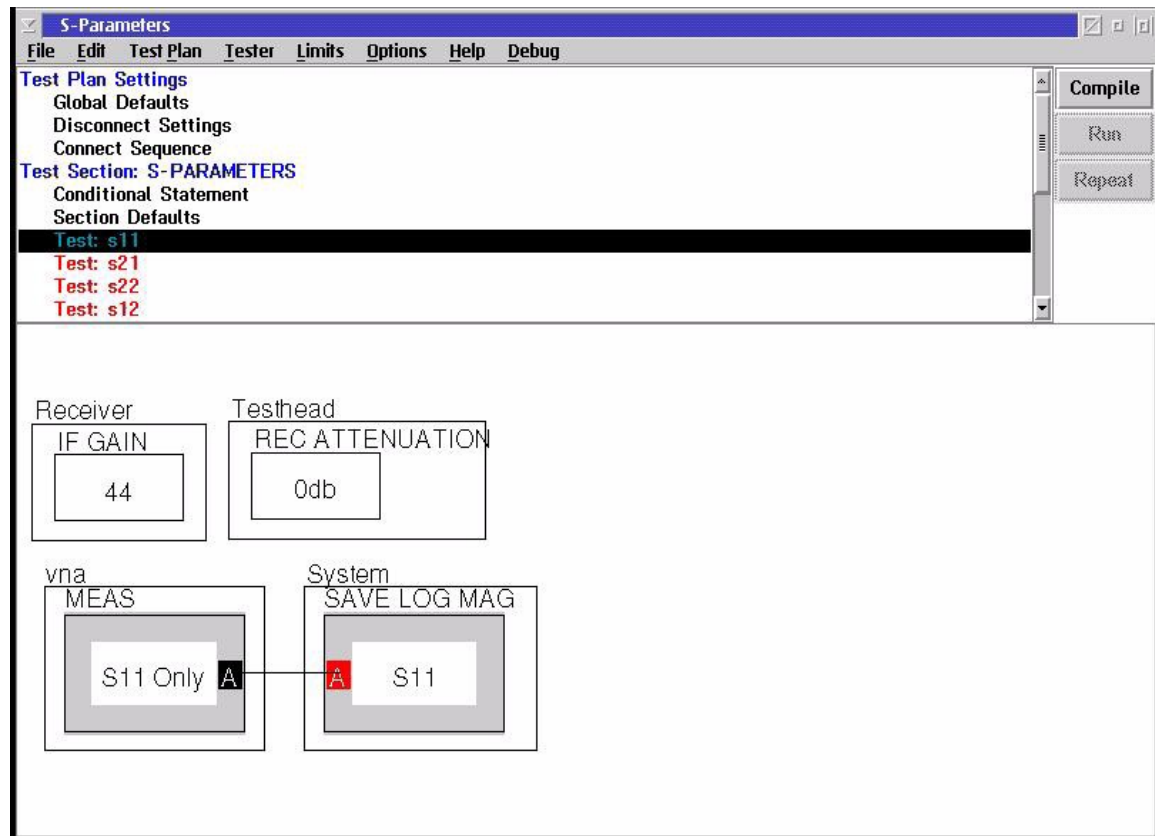


Total Variation 55 dB



S11

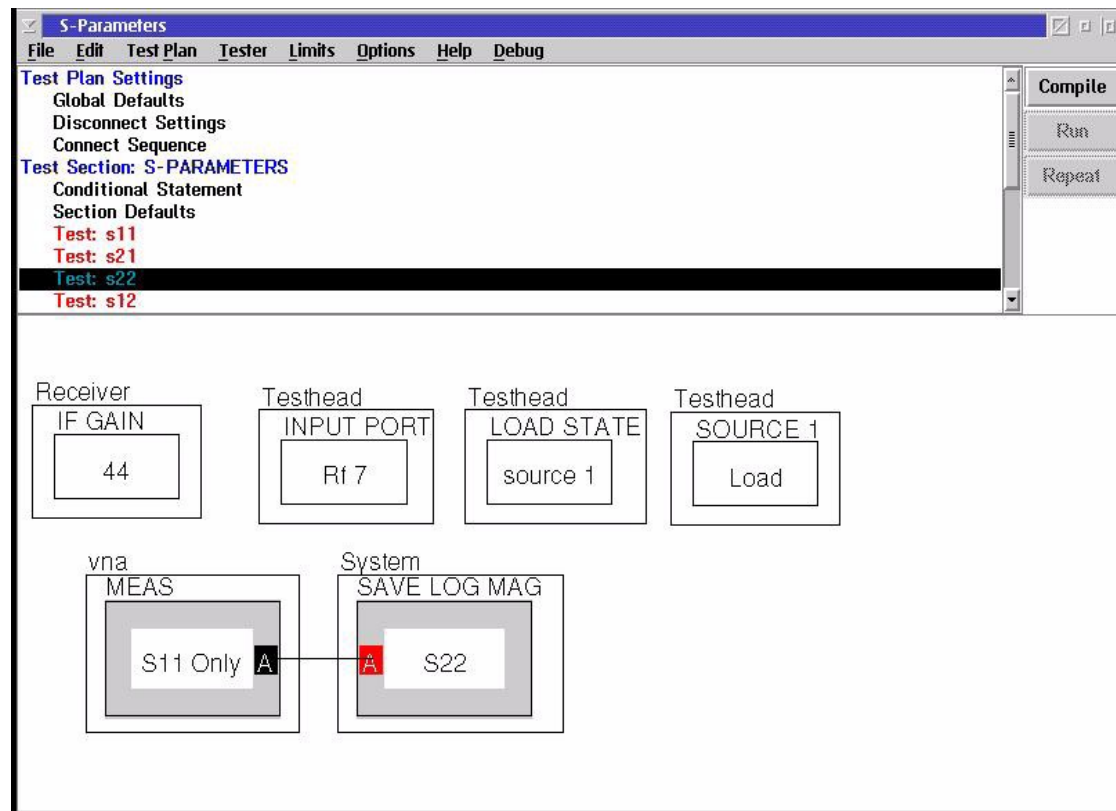
- S11 Only





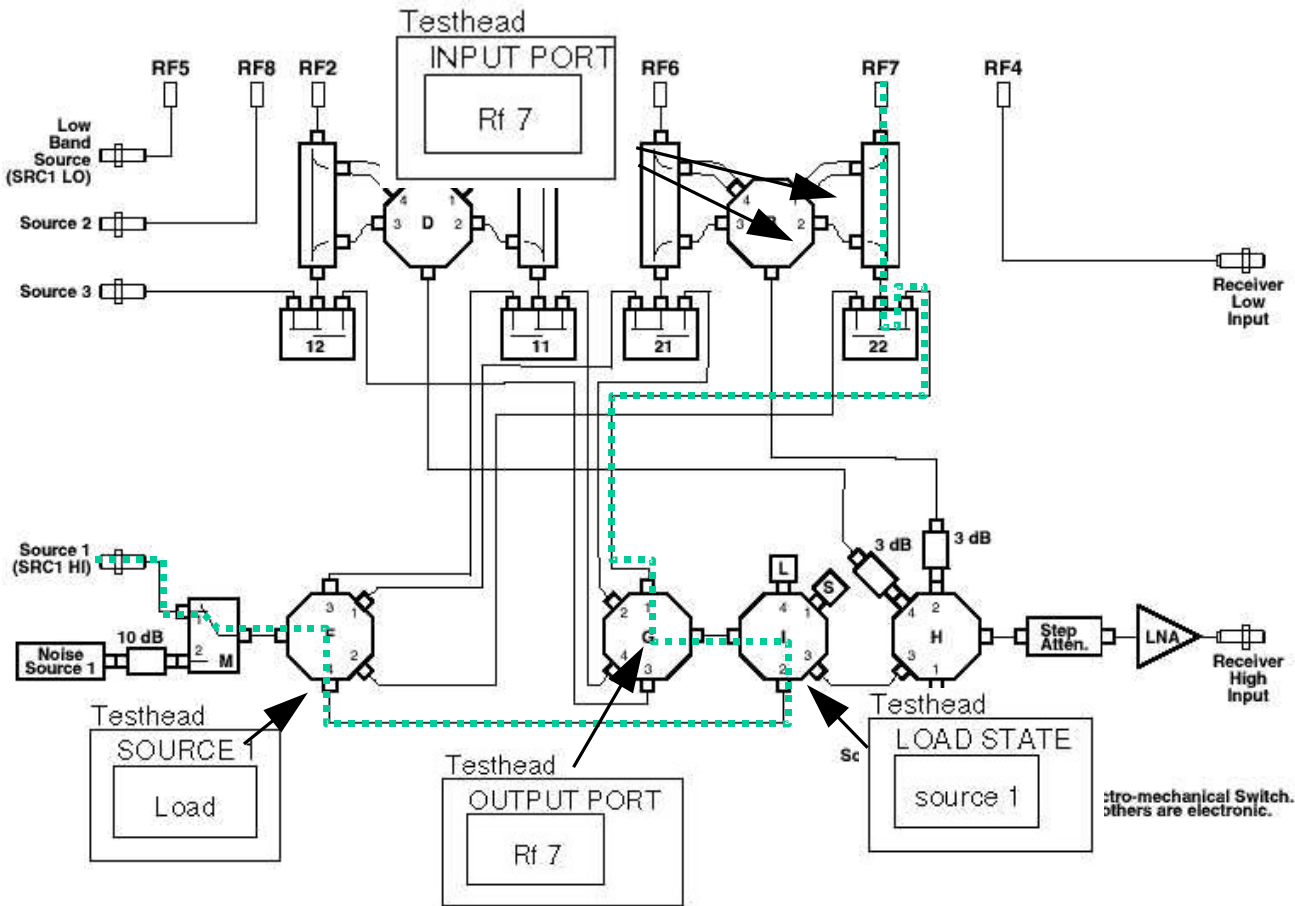
S22

- Back Door





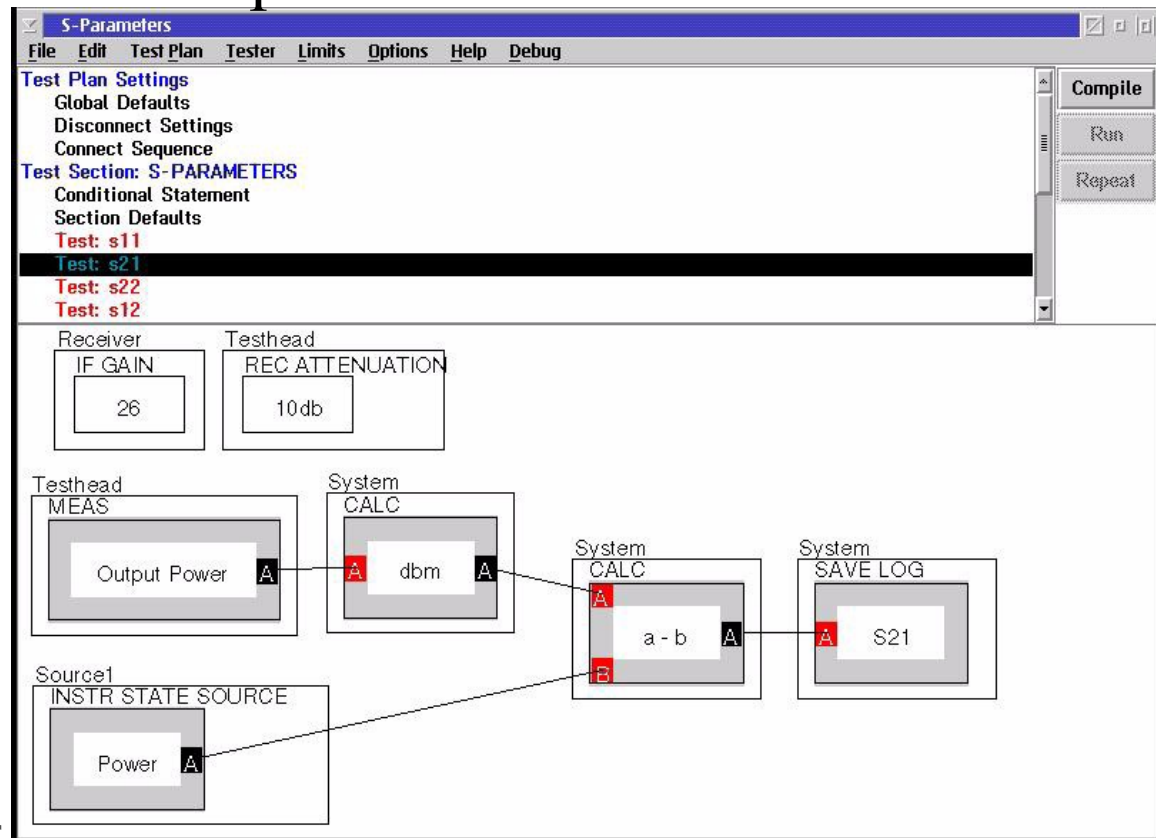
Back Door Path





S21

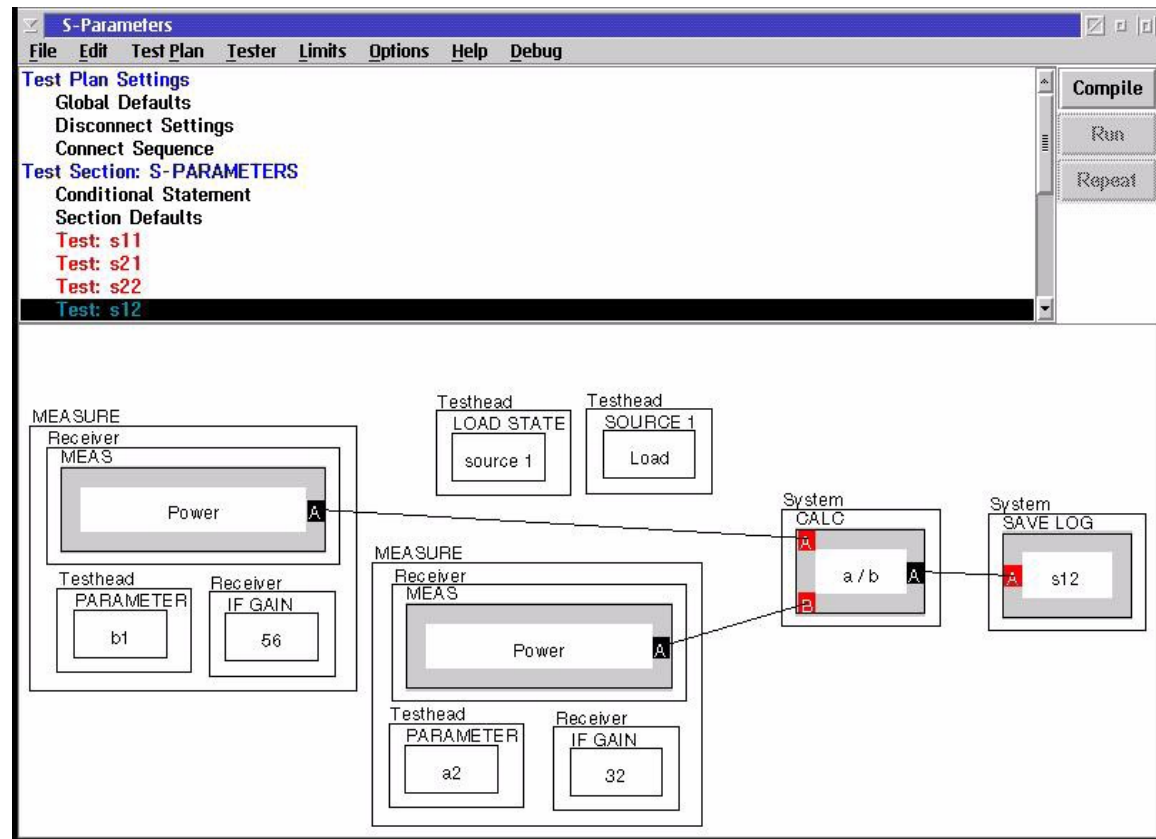
- Only Meas Pout
- Vector Correct for output match





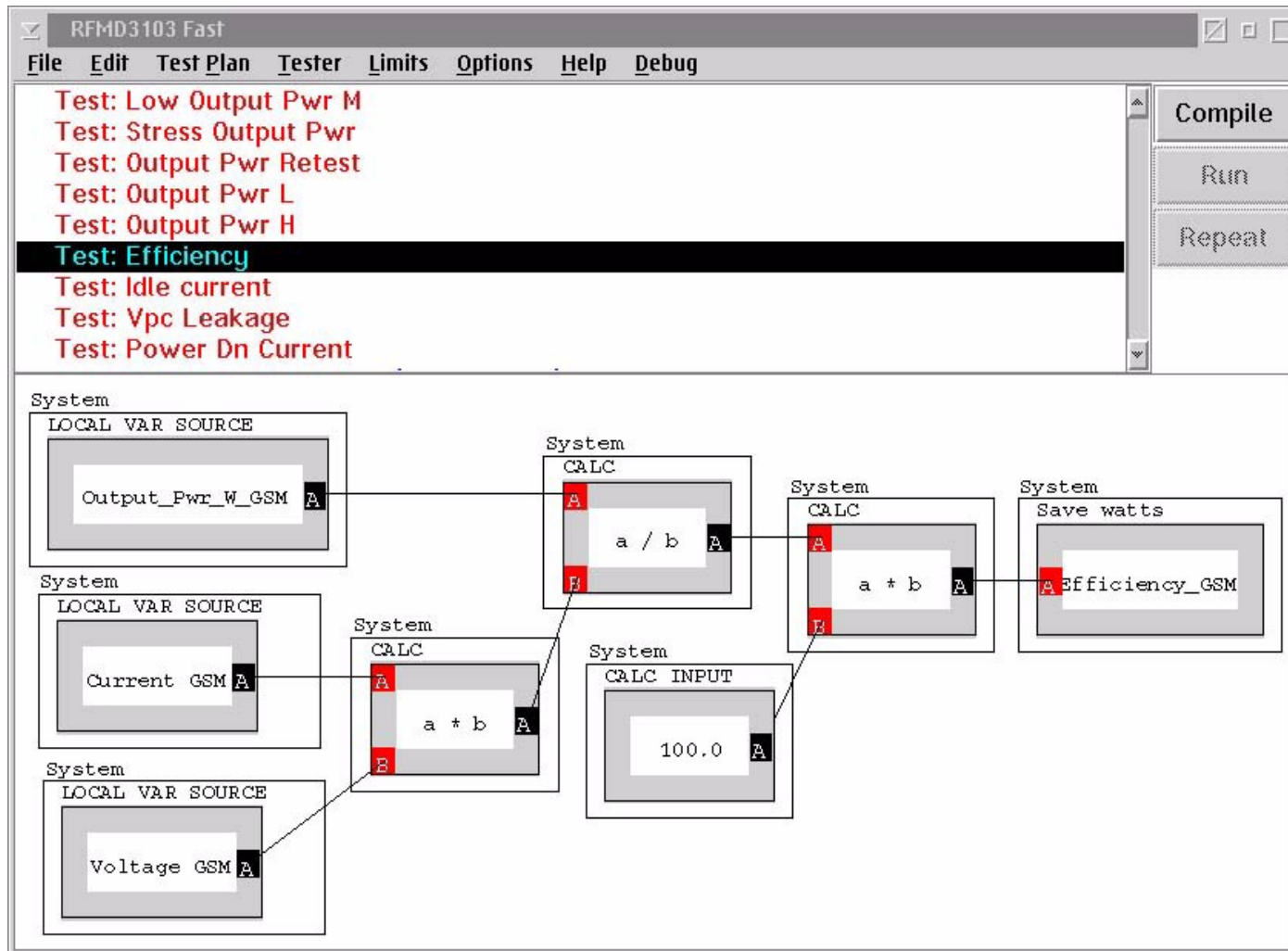
S12

- b1, a2
- back door





PAE: Power Added Efficiency



ROOS INSTRUMENTS



Measure Second Harmonic

RFMD3100_F_offset_b

File Edit Test Plan Tester Limits Options Help Debug

Test: Adjacent High HP
Test: Alternate High HP
Test: Alternate High LP
Test Section: 824 MHz AMPS Harmonic Measurements
Conditional Statement
Section Defaults
Test: 2nd Harmonic FE1
Test: 3rd Harmonic FE1
Test Section: 849 MHz CDMA HP Find Pout

Compile
Run
Repeat

PowerVI
Power V 1
3.7

Receiver
FREQUENCY
MASTER
Source2
CONFIG
Frequency
SCALE
2
OFFSET
0

Source2
Rf State
ON

Sm12Output
Aux Power
-50 dbm

Sm12Output
AUX POWER
824_AMPS_AuxPwrSet_31

System
LOCAL VAR SOURCE
Output Power 824 AMPS FE1

Receiver
MEAS
Power

System
CALC
dbm

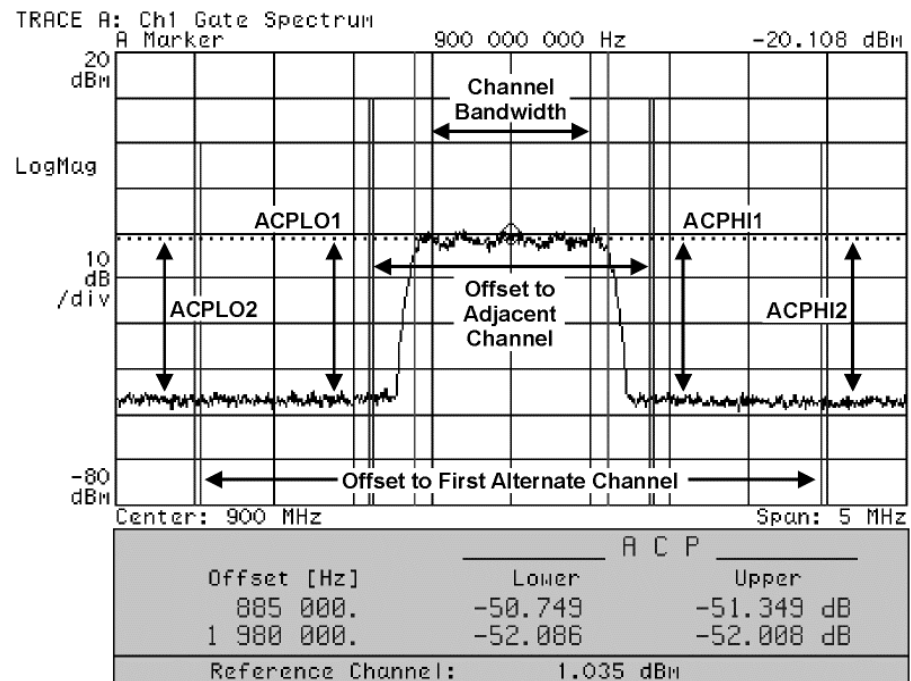
System
CALC
a - b

System
Save log
824 AMPS 2nd Harmonic



ACPR, ACLR

- "Multi-Tone IP3"
- Must Use RMS
- Power in Specified Bandwidth
- Every Standard is Different





Measure ACPR using Receiver Frequency Offset Button

RFMD3100_F_offset_b

File Edit Test Plan Tester Limits Options Help Debug

Test Section: 824 MHz CDMA ACPr Measurements HP/LP, added Rec Freq offset

Conditional Statement

Section Defaults

Test: Alternate Low LP

Test: Alternate Low HP

Test: Adjacent Low HP

Test: Adjacent Low LP

Test: Adjacent High LP

Test: Adjacent High HP

Compile

Run

Repeat

Receiver

Freq Offset

-1.98 Mhz

System

LOCAL VAR SOURCE

824_CDMA_L_Channel_Power

System

CALC

a - b

System

Save log

824 CDMA LP ALTL

Receiver

MEAS

Power

System

CALC

a + b

System

CALC

dlog

System

CALC INPUT

3.0

If Bw

7 KHz

Src12output

AUX POWER

824_CDMA_LP_AuxPwrSet_16

StaticDigital

Db 1

on

RC



Sweep Power to Find Gain Slope

Use Lock Step to Control Receiver Attenuation

RFMD3103 Fast_c

File Edit Test Plan Tester Limits Options Help Debug

Test Section: Gain Slope GSM (Unoptimized)

Conditional Statement

Section Defaults

Test: Gain Slope L

Test: Gain Slope H

Test: Calculation Low Power Log

Test: Calculation High Power Log

Test: Calculation High Power Linear

Test Section: GSM Tests (Unoptimized)

LOCK STEP CONFIGS

PowerVI Power V 3 1.08	Testhead Rec Attenuation 20db
PowerVI Power V 3 1.09	Testhead Rec Attenuation 20db
PowerVI Power V 3 1.1	Testhead Rec Attenuation 30db
PowerVI Power V 3 1.12	Testhead Rec Attenuation 30db
PowerVI Power V 3 1.14	Testhead Rec Attenuation 30db

If Gain
44

PRE MEAS

PowerVI Power V 3 A	System Sequence Delay 0
---------------------------	-------------------------------

POST MEAS

PowerVI Power V 3 0

PowerVI
INSTR STATE SOURCE
PowerV3

Receiver
MEAS
Power

System
CALC
dbm

System
CALC
voltage

System
CALC INPUT
1.414

System
LOCAL VAR SAVE
V_Gn_Slp_GSM

System
LOCAL VAR SAVE
F_dB_Gn_Slp_GSM

System
CALC
a + b

System
LOCAL VAR SAVE
F_VGn_Slp_GSM

Buttons: Compile, Run, Repeat



PA Test Plan

- Examine Example PA Test Plan

Test Plan Settings

Global Defaults

Disconnect Settings

Connect Sequence

Test Section: DC Test

Conditional Statement

Section Defaults

Test: Leakage Test

Test Section: Quiescent Current

Conditional Statement

Section Defaults

Test: Quiescent Current

Compile

Run

Repeat

Receiver

FREQUENCY

MASTER

Aux Source

CONFIG

Frequency

SCALE

1

OFFSET

0

System

Freq Reference

Aux Source

Out Freq Offset

0

Out Freq Scale

1

Testhead

Rf 3

src1-noise

Testhead

Input Port

Rf 3

Aux Source

Frequency

880 Mhz

Power

10 dbm

Testhead

RF 7

receive

Testhead

Output Port

Rf 7

Aux Source

Modulation

CDMA

Testhead

Source 1 Mode

source

Testhead

Source 1

RF 3

System

Averages

16

Testhead

Parameter

b2

Testhead

Rec Attenuation

30db

src12Output

Source Output Mode

Aux to src 1

Receiver

If Gain

40*

src12Output

Source 1 Attn

10db

PowerVI

Power V 1

3

Power I 1

1

V 1 Output

OFF

StaticDigital

Voff

0

StaticDigital

Von

3

StaticDigital

Db 1

open

StaticDigital

Db 2

off

PA_Lab_RevA

File Edit Test Plan Tester Limits Options Help Debug

Test Plan Settings
Global Defaults
Disconnect Settings
Connect Sequence
Test Section: DC Test
Conditional Statement
Section Defaults
Test: Leakage Test
Test Section: Quiescent Current
Conditional Statement
Section Defaults
Test: Quiescent Current

Compile
Run
Repeat

Src12Output

Aux Power

-32 dbm

NOTE

PA_Lab_RevA

File Edit Test Plan Tester Limits Options Help Debug

Test Plan Settings

- Global Defaults
- Disconnect Settings
- Connect Sequence**

Test Section: DC Test

- Conditional Statement
- Section Defaults
- Test: Leakage Test**

Test Section: Quiescent Current

- Conditional Statement
- Section Defaults
- Test: Quiescent Current**

Compile

Run

Repeat

NOTE

PA_Lab_RevA

File Edit Test Plan Tester Limits Options Help Debug

Test Plan Settings
Global Defaults
Disconnect Settings
Connect Sequence

Test Section: DC Test
Conditional Statement
Section Defaults

Test: Leakage Test

Test Section: Quiescent Current
Conditional Statement
Section Defaults

Compile
Run
Repeat

StaticDigital
Measure Mode
I meas

StaticDigital
Measure V Force
3

StaticDigital
Measure Pin
DB1

StaticDigital
Current Meas Max
100 u

StaticDigital
Measure I Limit
100 u

StaticDigital
MEAS
Current

System
Save Amps
Leakage Current

```
graph TD; subgraph "StaticDigital"; direction TB; S1["Measure Mode  
I meas"]; S2["Measure V Force  
3"]; S3["Measure Pin  
DB1"]; S4["Current Meas Max  
100 u"]; S5["Measure I Limit  
100 u"]; end; subgraph "System"; direction TB; subgraph "MEAS"; C["Current"]; end; subgraph "Save Amps"; LC["Leakage Current"]; end; C --- LC; end;
```

PA_Lab_RevA

File Edit Test Plan Tester Limits Options Help Debug

Test Section: Quiescent Current
Conditional Statement
Section Defaults
Test: Quiescent Current

Test Section: CDMA Power Sweep
Conditional Statement
Section Defaults
Test: Sweep Aux Power CDMA
Test: Find Aux Power in for 30dBm out

Test Section: PDC DC and ACP Test
Conditional Statement
Section Defaults

StaticDigital

Db 2

on

Compile

Run

Repeat

PA_Lab_RevA

File Edit Test Plan Tester Limits Options Help Debug

Test Section: Quiescent Current
Conditional Statement
Section Defaults
Test: Quiescent Current
Test Section: CDMA Power Sweep
Conditional Statement
Section Defaults
Test: Sweep Aux Power CDMA
Test: Find Aux Power in for 30dBm out
Test Section: PDC DC and ACP Test
Conditional Statement
Section Defaults

Compile
Run
Repeat

PowerVI

MEAS

Current A

System

Save Ampe

A Quiescent Current

CURRENT MEAS MAX

0.1

IMEASURE

V1

PowerVI

Power I 1

0.1

The screenshot shows a software interface for a test plan. The top part is a menu bar with 'File', 'Edit', 'Test Plan', 'Tester', 'Limits', 'Options', 'Help', and 'Debug'. Below the menu bar is a list of test sections. The 'Test: Quiescent Current' section is highlighted in black. To the right of the test plan list are three buttons: 'Compile', 'Run', and 'Repeat'. The bottom part of the window shows a circuit diagram. On the left, there is a 'PowerVI' block containing a 'MEAS' sub-block with a 'Current A' component. Below this are two input fields: 'CURRENT MEAS MAX' with a value of '0.1' and 'IMEASURE' with a value of 'V1'. On the right, there is a 'System' block containing a 'Save Ampe' sub-block with a 'A Quiescent Current' component. A line connects the 'Current A' component to the 'A Quiescent Current' component. At the bottom left, there is another 'PowerVI' block containing a 'Power I 1' sub-block with a value of '0.1'.

PA_Lab_RevA

File Edit Test Plan Tester Limits Options Help Debug

Test Section: CDMA Power Sweep
Conditional Statement
Section Defaults
Test: Sweep Aux Power CDMA
Test: Find Aux Power in for 30dBm out

Test Section: PDC DC and ACP Test
Conditional Statement
Section Defaults
Test: Power Current
Test: Pin
Test: Target Power (Test is optional, Pout is should be 8dBm from sweep)
Test: PAF

StaticDigital

Db 2

on

Compile

Run

Repeat

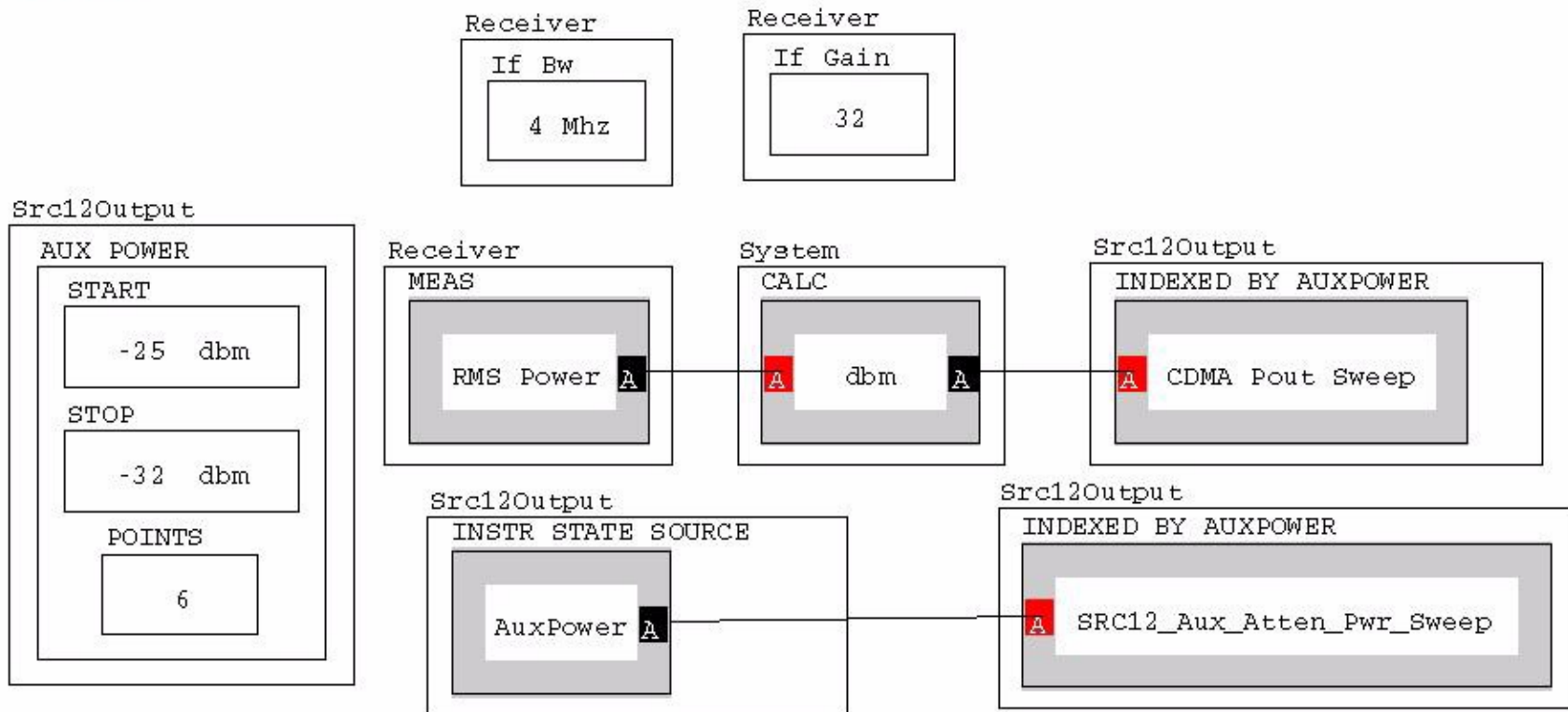
PA_Lab_RevA

File Edit Test Plan Tester Limits Options Help Debug

Test Section: CDMA Power Sweep
 Conditional Statement
 Section Defaults
Test: Sweep Aux Power CDMA
 Test: Find Aux Power in for 30dBm out

Test Section: PDC DC and ACP Test
 Conditional Statement
 Section Defaults
 Test: Power Current
 Test: Pin
 Test: Target Power (Test is optional, Pout is should be 8dBm from sweep)
 Test: PAF

Compile
 Run
 Repeat



PA_Lab_RevA

File Edit Test Plan Tester Limits Options Help Debug

Test Section: PDC DC and ACP Test

- Conditional Statement
- Section Defaults
- Test: Power Current**
- Test: Pin
- Test: Target Power (Test is optional, Pout is should be 8dBm from sweep)
- Test: PAE
- Test: ACPr 1 Hi
- Test: ACPr 1 Lo
- Test: ACPr 2 Hi
- Test: ACPr 2 Lo

Compile

Run

Repeat

PowerVI

MEAS

Current

1

CURRENT MEAS MAX

1

IMASURE

VI

System

Save Amps

Power Current

2

System

LOCAL VAR SAVE

Power Current

2

PowerVI

Power I 1

1

PowerVI

INSTR STATE SOURCE

PowerVI

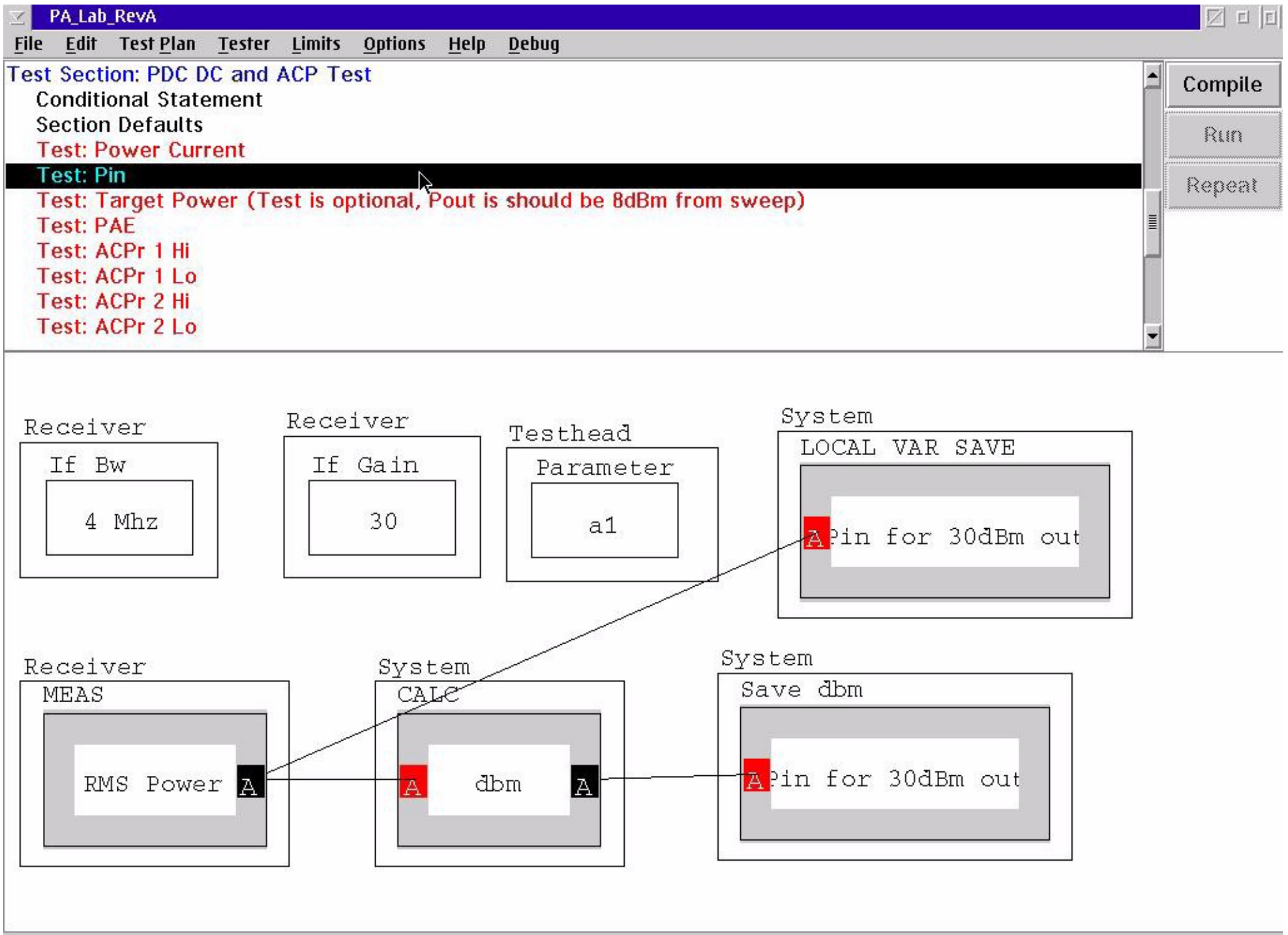
A

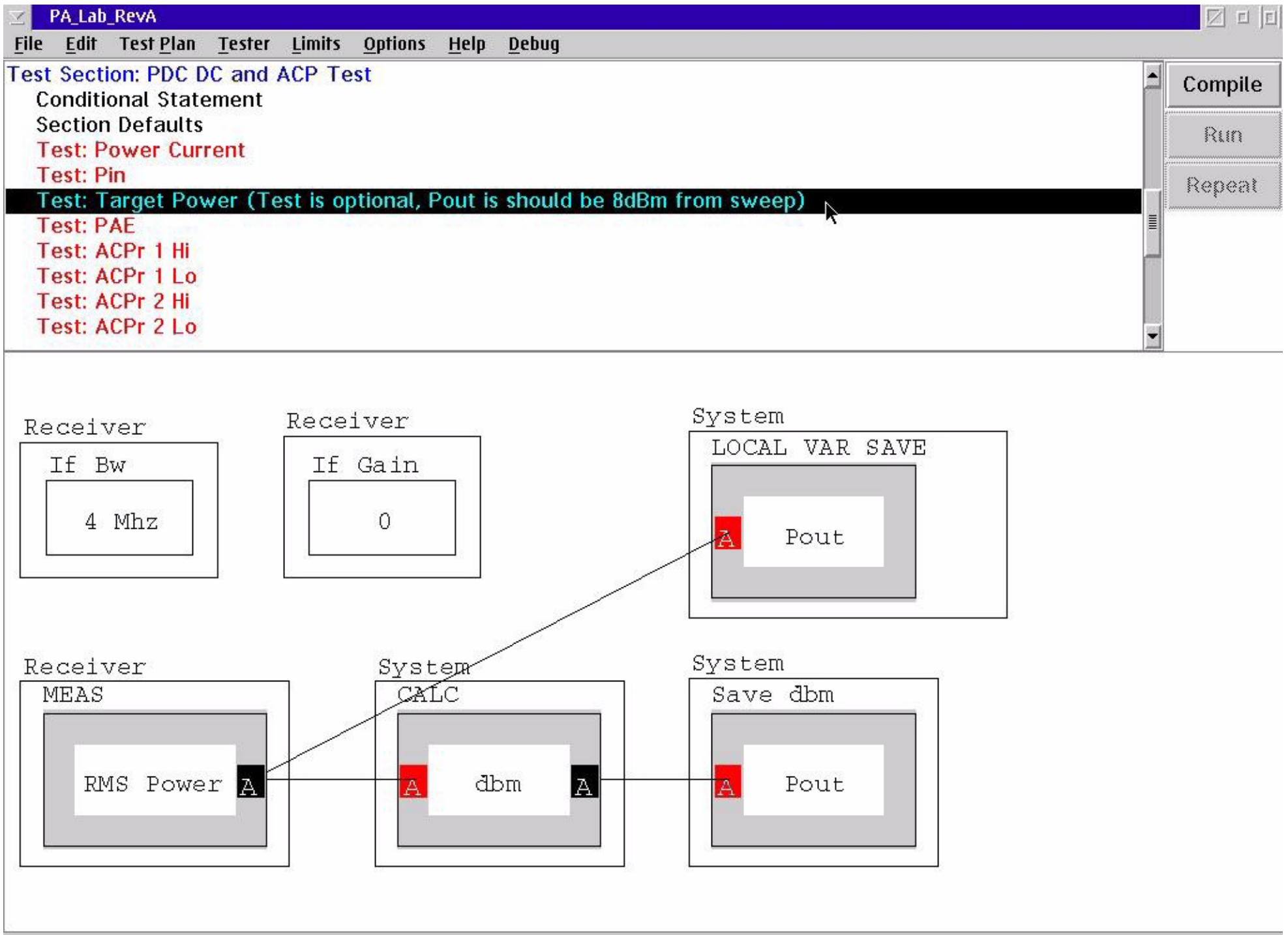
System

LOCAL VAR SAVE

Power Voltage

A





PA_Lab_RevA

File Edit Test Plan Tester Limits Options Help Debug

Test Section: PDC DC and ACP Test

Conditional Statement

Section Defaults

Test: Power Current

Test: Pin

Test: Target Power (Test is optional, Pout is should be 8dBm from sweep)

Test: PAE

Test: ACPr 1 Hi

Test: ACPr 1 Lo

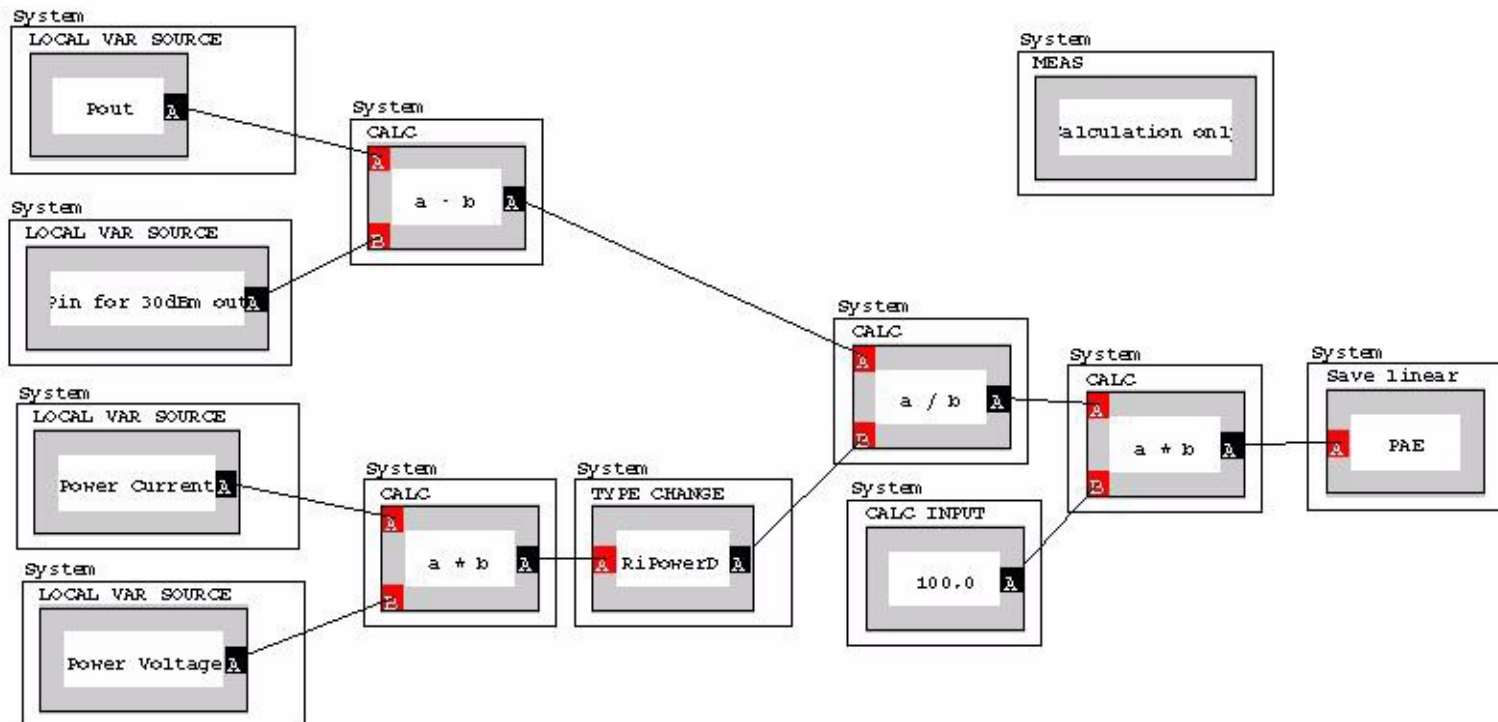
Test: ACPr 2 Hi

Test: ACPr 2 Lo

Compile

Run

Repeat



PA_Lab_RevA

File Edit Test Plan Tester Limits Options Help Debug

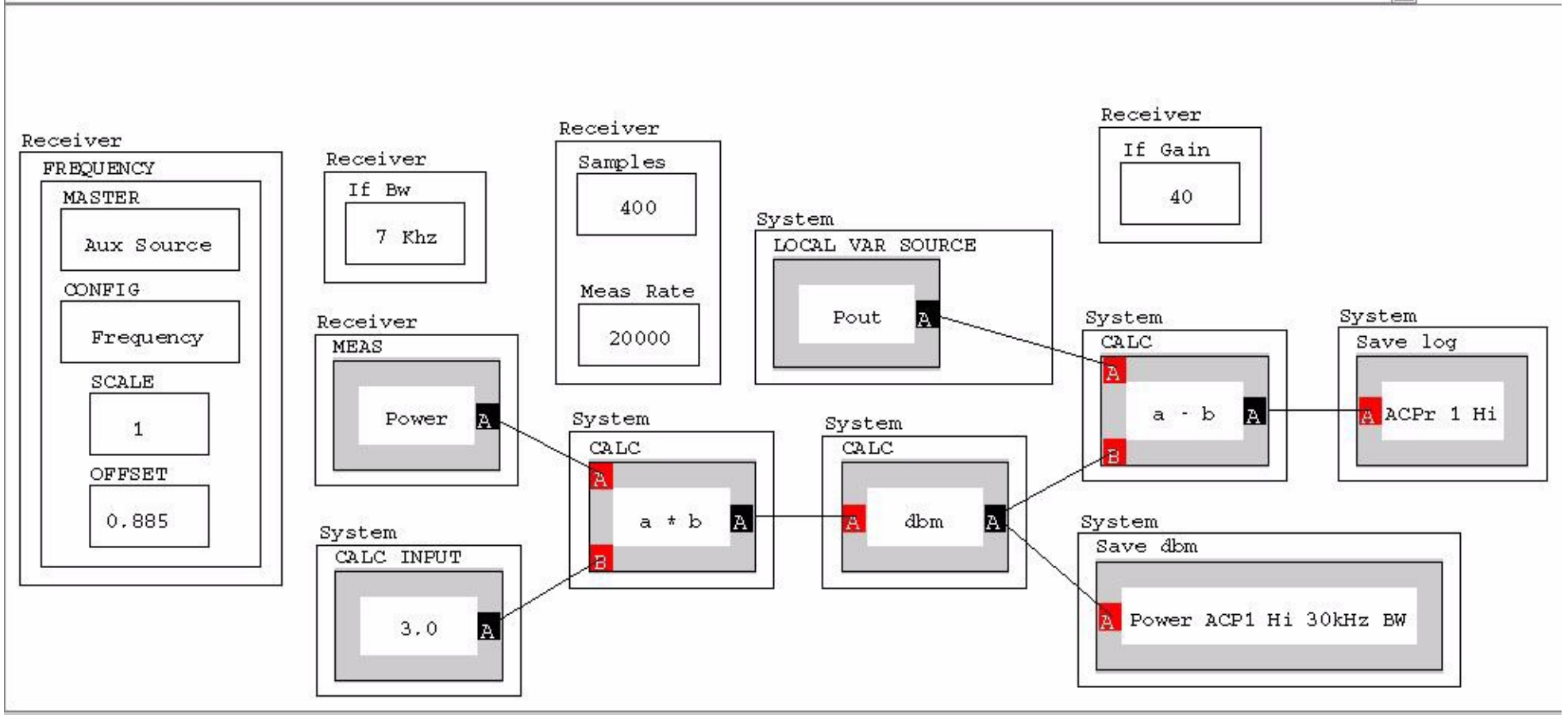
Test Section: PDC DC and ACP Test

- Conditional Statement
- Section Defaults
- Test: Power Current
- Test: Pin
- Test: Target Power (Test is optional, Pout is should be 8dBm from sweep)
- Test: PAE
- Test: ACPr 1 Hi**
- Test: ACPr 1 Lo
- Test: ACPr 2 Hi
- Test: ACPr 2 Lo

Compile

Run

Repeat



PA_Lab_RevA

File Edit Test Plan Tester Limits Options Help Debug

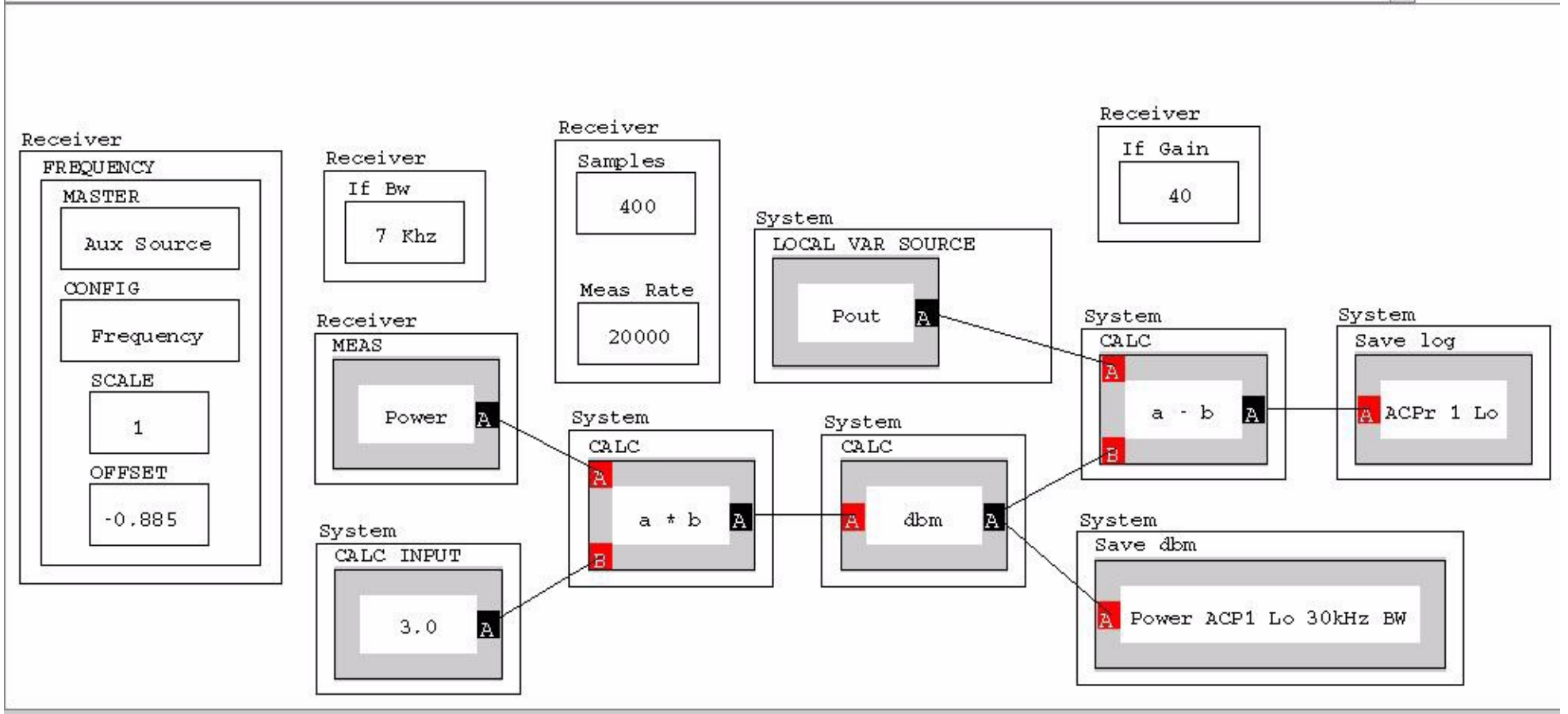
Test Section: PDC DC and ACP Test

- Conditional Statement
- Section Defaults
- Test: Power Current
- Test: Pin
- Test: Target Power (Test is optional, Pout is should be 8dBm from sweep)
- Test: PAE
- Test: ACPr 1 Hi
- Test: ACPr 1 Lo**
- Test: ACPr 2 Hi
- Test: ACPr 2 Lo

Compile

Run

Repeat



PA_Lab_RevA

File Edit Test Plan Tester Limits Options Help Debug

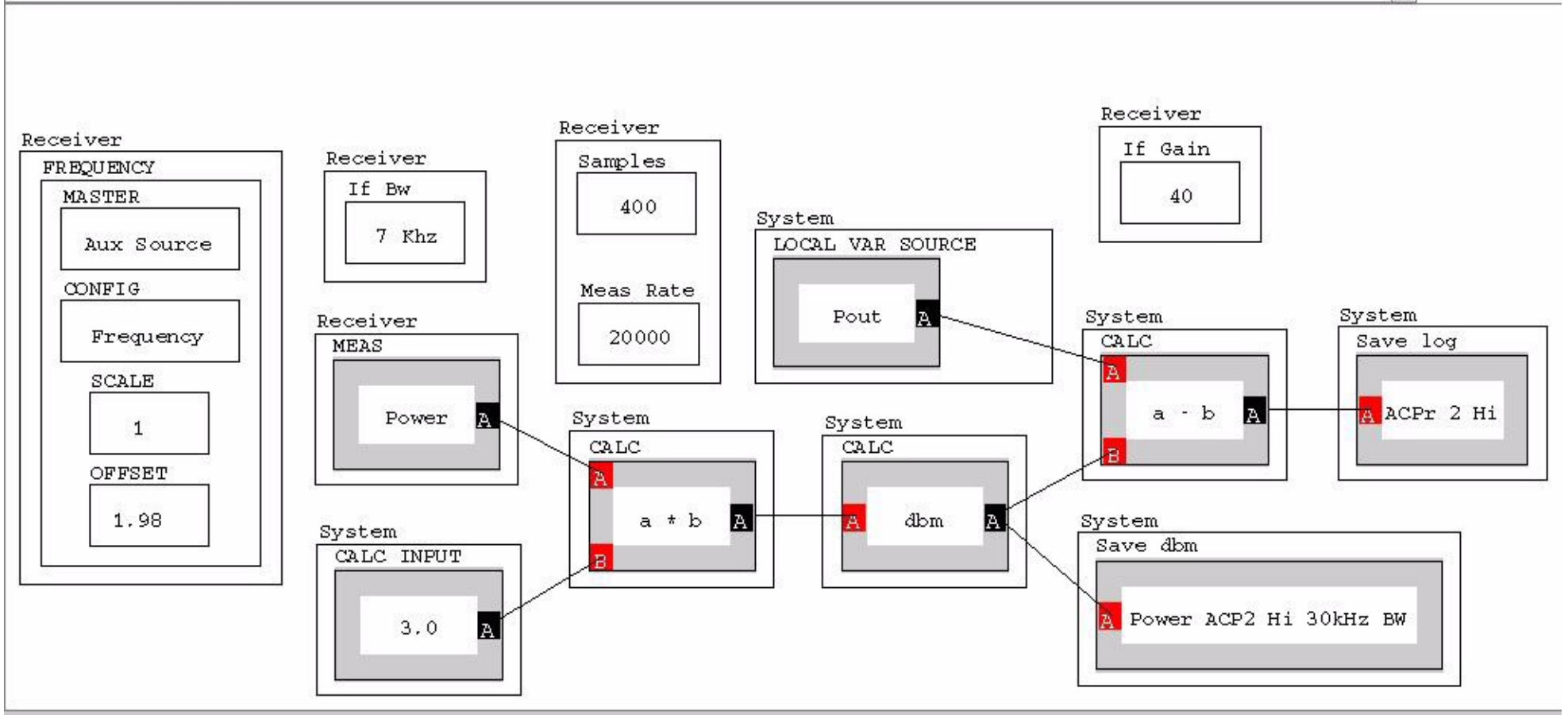
Test Section: PDC DC and ACP Test

- Conditional Statement
- Section Defaults
- Test: Power Current
- Test: Pin
- Test: Target Power (Test is optional, Pout is should be 8dBm from sweep)
- Test: PAE
- Test: ACPr 1 Hi
- Test: ACPr 1 Lo
- Test: ACPr 2 Hi**
- Test: ACPr 2 Lo

Compile

Run

Repeat



PA_Lab_RevA

File Edit Test Plan Tester Limits Options Help Debug

Test Section: PDC DC and ACP Test

Conditional Statement

Section Defaults

Test: Power Current

Test: Pin

Test: Target Power (Test is optional, Pout is should be 8dBm from sweep)

Test: PAE

Test: ACPr 1 Hi

Test: ACPr 1 Lo

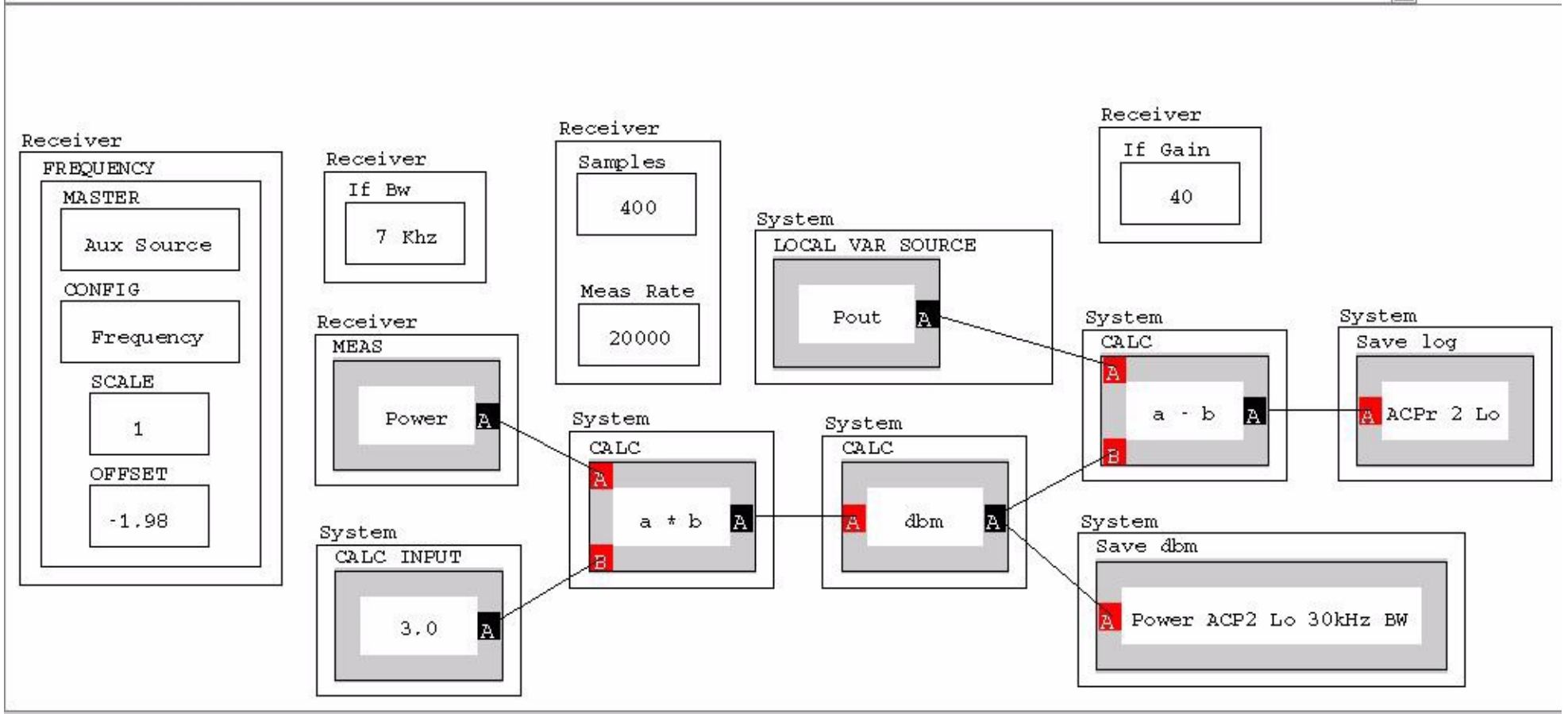
Test: ACPr 2 Hi

Test: ACPr 2 Lo

Compile

Run

Repeat





Example Applications - Lab E

- Get into Groups of Three
- Each will take turns performing the lab
- One drives, one reads, one uses pointer



PA Test Plan Lab: ACPR Test

- Use Aux Source
- Measure Leakage
- Search and Fix Pout
- Measure CDMA ACPR
 - 1.23 MHz Channel
 - 885 kHz, 1980 kHz Offset; 30 kHz BW



PA Test Plan Lab: NADC ACPR

- Create NADC Measurement
 - 25 kHz Ch.; 30 kHz Offset 25 kHz BW
- Channel is Flat
- Significant Power exists outside the channel
- Pout Does Not Equal Channel Power