Rev	ECO NO.	Revision History	Date	Originator Name
1		Initial Release	07-23-01	John Chang
A		Update to Production Release	12-17-01	John Chang
B		Update to Release 4 Configuration	04-08-02	S. Morisse

Unison RAU ATE Manual

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1 Purpose

The Unison RAU (Remote Antenna Unit) Automatic Test Equipment (ATE) is intended to align, test and debug Unison RAU assemblies (740510) after they are manufactured. This manual is intended to document the design and structure of the ATE hardware and software, with all other relevant topics to provide users with instructions on its usage and maintenance.

2 Hardware

2.1 Physical Description

The RAU ATE consists of a single rack of commercial of the shelf (COTS) test equipment, a LGC designed test fixture, a computer system, and test software. Table 1 contains a list of the included equipment and components. Figure 1 shows a rack layout drawing with locations of the major equipment. Figure 2 shows a block diagram and system interconnection drawing.

Table 1; List of Equipment

Qty.	Description	Manufacturer	Part Number	Options	Comments
1	Computer Workstation	Dell			Or equivalent
1	PCI GPIB Interface Card	National Inst.	777073-01		Installed in PC
1	Signal Generator	Agilent	8648C	1EA, 1CM	
1	Signal Generator	Agilent	8648C	1CM	
1	Spectrum Analyzer	Agilent	8594E	041, 140	
1	Power Supply	Agilent	3632A	Rack Mt.	
1	RAU Test Fixture	JFW	50SA-052		LGC Modified
5	GPIB Cable 2 Meter	National Inst.	763061-02		
1	RS232/RS485 converter	B&B Electro.	485SD9TB		Or Equivalent
1	RF Cable SMA (m)-SMA (m)	RF Connector	RFW5170-48		Or Equivalent
1	RF Cable SMA (m)-SMA (m)	RF Connector	RFW5170-36		Or Equivalent
1	RF Cable SMA (m)-SMA (m)	RF Connector	RFW5170-24		Or Equivalent
1	RF Cable SMA (m)-SMA (m)	RF Connector	RFW5170-18		Or Equivalent
1	RF Cable SMA (m)-SMA (m)	RF Connector	RFW5170-8		Or Equivalent
1	CAT5 Cable 3 feet				Or Equivalent
1	RS485 output serial cable	Custom made			
2	50 Ohm Terminator				
1	SMA RF Attenuator 6dB				
1	UNISON TB4e Cal Box	Custom made			
1	Rack Mount Cabinet				19 in. 40RU

RAU ATE Rack Layout

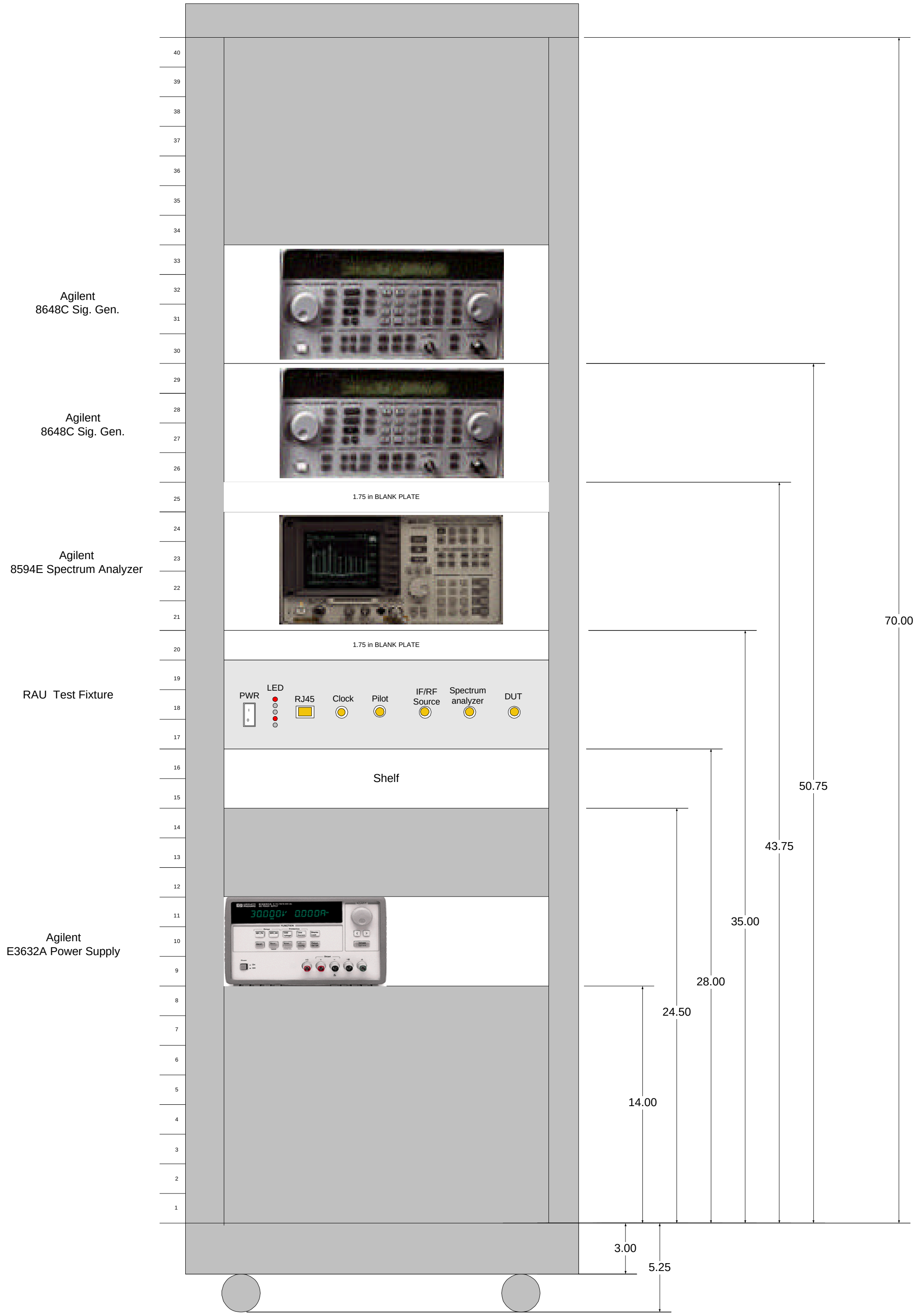


Figure 1; RAU ATE Rack Layout

RAU ATE Functional Block Diagram

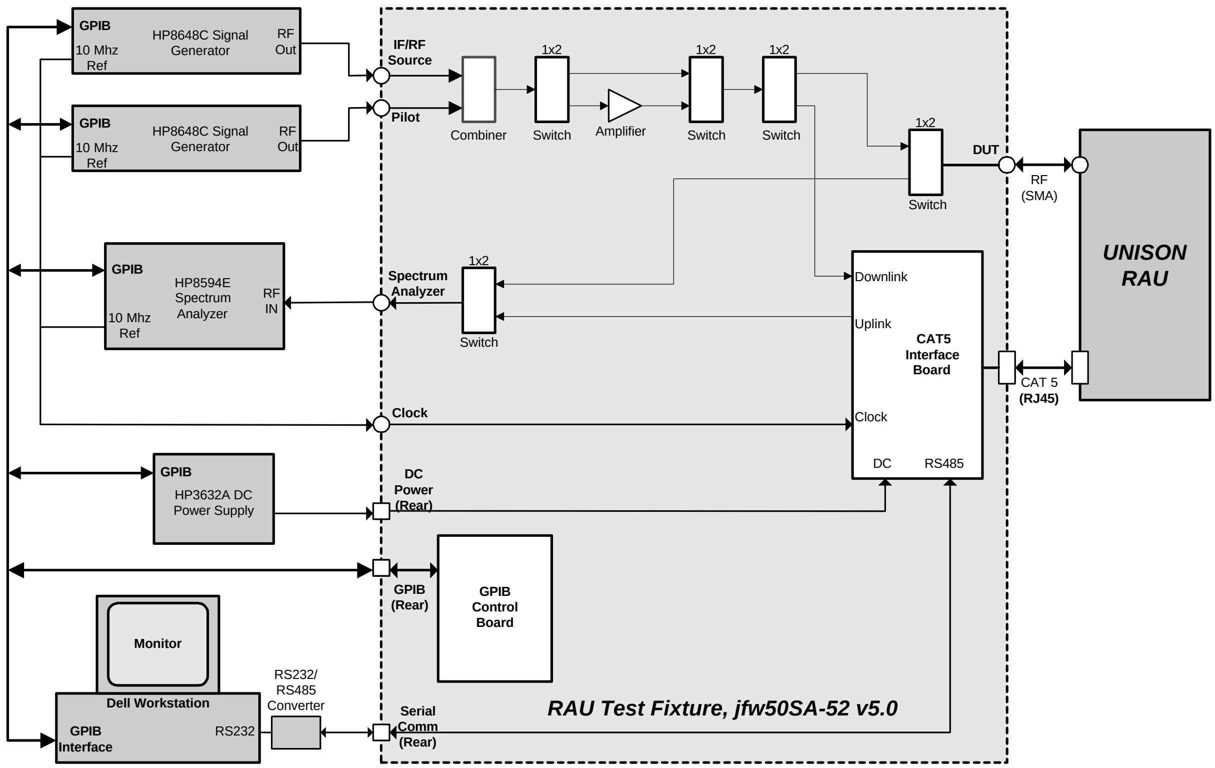


Figure 2; RAU ATE Interconnection and Block Diagram

2.2 Instrument GPIB Address and Initial State

The computer would control all ATE instrument functions over the GPIB interface while in test. However all of the instruments should be at “power on” state (Push power on button if the instrument is not on) before it performs the test since GPIB interface cannot control this. Each instrument GPIB address and communication can be verified by the “Measurement and Automation” software utility of NI if any question is raised. Refer to the instrument manual for additional information on how to setup and verify the instruments respectively.

Table 2; RAU ATE GPIB Address and Initial State

Instrument	*Description*	*State*	*GPIB Address*
Agilent8648C	SG1, IF/RF Signal	Power On	19
Agilent8648C	SG2, Pilot Signal	Power On	21
Agilent8594E	SA1, Spectrum Analyzer	Power On	18
Agilent3632A	DC Power Supply	Power On	5
Test Fixture (jfw50SA-052 v5.0)	Fixture1	Power On	4

3 Software

3.1 Overview

The users interact with the ATE via a Graphical User Interface (GUI) Test Executive (also called Main Panel). The Test Executive is responsible for soliciting operator inputs, scheduling tests, logging data to the database, and printing reports if requested. There are actually two types of tests in the program, **[Configuration Tests]** and **[Functional Tests]** which are grouped into two list tables. The top list table on main panel is for Configuration Tests and bottom one is for Functional Tests.

[Configuration Tests] are responsible for aligning various adjustable elements in the Unit Under Test (UUT, namely the RAU under test), compiling tables of calibration data, and sending this alignment and calibration information to the UUT to store in its EEPROM memory for future use.

[Functional Tests] are responsible for verifying electrical performance of the UUT to its specifications.

3.2 Test Scheduling

The test executive schedules tests according to a pre-defined or custom defined test sequence. The test sequence designates the test steps and what band to run for the UUT. Test sequences are compiled by the test engineer and can be stored as a sequence file to "re-run" in the future. Press the <Default Test> button on the main panel will load the default, pre-defined sequence that consists of all the tests and bands in the ***proper order*** to configure and function test the UUT. This is for typical test of production.
Attention!!! Except the default initial file consists of all necessary test steps that for typical testing task, there are other sequence files. For what test steps are included in each special scheduled ".ini" file and what purpose of using it , asking test engineer if there is need for such situation.

3.3 Data Logging

The test executive stores data in various database tables on the SQL server. See Section (TBD) for a description of the database. The data will not written into database until to some specific steps by the schedule sequence.

3.4 Printing Reports

The test executive has two types of reports: One is in MS Excel format that was called by the main panel normally minimized on the bottom, and a simple report from LabView. The Excel format can be printed as typical Excel file after the test is done, and the LabView report can be generated by selecting Report Option list on "No Print Out" "Print on Fails" or "Print All Results" then press the [Generate Report] button to print it on default printer.

3.5 Test Summaries

The following are descriptions for each of the configuration and functional tests:

3.5.1 Configuration Tests [with fail conditions in the program for debug purpose]

3.5.1.1 Pre-Sequence

The pre-sequence test first clears the manufacturing flag to set the RAU in test mode. It then tests the low input voltage operation, reading back all hardware numbers, verifying the firmware revision preloaded in the RAU to see if it is the latest release in the firmware vault or not. If not, it will prompt the operator to load the newest one (though it also has "skip" button to escape this upload). Then the RAU is required to warm up until it reaches normal operating temperature shown on a pop-up temperature display window. It will go on as soon as the temperature reaches the predefined value. It will check the general values such as current consumptions, voltage, etc. as well.

Fail conditions (total 6):

1. Temperature is not reached the defined value.
2. Failed firmware download.
3. The current (A/D reading) of power amplifier off (PAoff) out of range.
4. The current (A/D reading) of power amplifier on (Paon) out of range.
5. The DC voltage low (A/D reading) out of range.
6. The total current consumption (power supply reading) is out of range.

3.5.1.2 RAU Quick Test (Reference the appendix for the step and command)

The RAU Quick Test is a fast screening step in order to find hardware failure, such as bad attenuator, bad detector circuit, etc. to avoid spending more time on such bad RAU for a thorough test. It will go through each of digital controlled hardware part to turn it on/off, or tune it from small to large or vice-versa to see the value change so it consists many sub-steps. It firstly set up RAU DL channel to check the maximum gain with every controllable part turns to max gain. If it is too low, it means some parts in downlink channel must be wrong. Then the operator can choose <Continue> to see which part fails. Each sub-step has a prompt window to ask operator to <Continue>, <Retry>, or <Abort> if failed. By the way it can be a hardware debug tool to retest a single part for many times by choosing <Retry>. The UL channel test has similar way just after the DL is done. If no problem exists, the test sequence will directly go to next step. Otherwise it will list all failure results in a message window. Since this test is a screen tool instead of accurate measurement, a RAU passed this test does not mean it can pass the later function test. Normally if the RAU failed Quick Test, the operator should choose <Abort> at end message window of "Quick Test" to get out the test for further hardware debugging, unless there is special necessity to run the following steps.

Fail conditions (total 17, some step with multiple conditions, channel reference not counted):

1. Set reference gain of DL channel fails (**show red window to remind but not in final fail conditions** since there must be some hardware failure to trig this, just continue)
2. The delta of max/min of DL EQA/DGA attenuator out of range from nominal value.
3. The DL pilot detector out of range.
4. The delta of max/min of DL ADJ/VVA attenuator out of range from nominal value.
5. The delta of max/min of DL 10dB attenuator out of range from nominal value.
6. The delta of DL PA on/off out of range.
7. The DL power detector out of range.
8. The delta of max/min of DL slope control out of range.
9. The delta of DL long/short cable attenuator out of range (for low band [LB] only).
10. Set reference gain of UL channel fails (**show red window to remind but not in final fail conditions** since there must be some hardware failure to trig this, just continue)
11. The delta of max/min of UL DGA attenuator out of range from nominal value.
12. The delta of max/min of UL VVA attenuator, or pilot generator detector, or pilot detector out of range.
13. The delta of max/min of UL 10dB attenuator out of range from nominal value.
14. The delta of max/min of UL limiter out of range.
15. The delta of UL IF amplifier out of range (for high band [HB] only).
16. The delta of UL FD, either RF or detector output out of range.

3.5.1.3 Set DL (Down Link) Slope

In order to get better gain flatness value for test in Down Link (DL), ATE will set internal slope circuit of RAU for different DL slope settings while comparing the flatness. As soon as it finds the least ripple on the response, it sets the slope setting and record the DL slope value for later use.

Fail conditions (None).

3.5.1.4 Pilot Calibration Table – LB or HB

Set Pilot table DL is a very important step for RAU to compensate the cable loss in variable length automatically and correctly. Because the difference in hardware architecture, they are grouped as Low-Bands (LB) such as EGSM, GSM, CELL, IDEN and UMTS (Though it has higher frequency but with similar structure with LB) or High-Bands (HB) such as DCS and PCS. The methods of measurement are different so there are two such files "Pilot Calibration Table – HB" and "Pilot Calibration Table – LB" respectively in [Configuration Test] group. The predefined default test will choose it correctly but be caution while doing user selected, "non-default" tests. Mismatched use on Pilot Calibration Table step and the band will recur unknown result or program malfunction.

<u>Fail conditions (total 5 for LB, 2 for HB):</u>

1. <u>DGA gain can not be reached. (LB, HB)</u>
2. <u>The first line of long pilot table out of range. (LB, HB)</u>
3. <u>The last line of long pilot table out of range. (LB)</u>
4. <u>The first line of short pilot table out of range. (LB)</u>
5. <u>The gain cross point of long/short table out of range. (LB)</u>

3.5.1.5 Calibration Tone

This is another DL set step in which the output power of RAU reaches the designated level by pumping the signal generator, reading and recording the forward/reflected power from the detector on RAU.

<u>Fail conditions (total 3):</u>

1. <u>The gain cannot be reached.</u>
2. <u>The detector of cal tone out of range.</u>
3. <u>The ratio of reflected/forward from the power detector out of range.</u>

3.5.1.6 Set Gain

This step is an Up Link (UL) setting. The major role is to adjust RAU build-in attenuator for right UL gain of RAU then record the value of digital attenuator.

<u>Fail conditions (total 2):</u>

1. <u>The adjusted gain out of range (can not reach the gain, or step gain is over the limit)</u>
2. <u>The DGA count for setting the gain out of range.</u>

3.5.1.7 Set Pilot Level

This is another UL setting. By a given input signal, the program will adjust digital attenuator in order for pilot signal on RAU to reach some specific value, and record such parameters.

<u>Fail conditions (total 3):</u>

1. <u>The pilot level is out of range.</u>
2. <u>The VVA count for setting the level out of range.</u>
3. <u>The A/D reading of pilot generator detector out of range.</u>

3.5.1.8 Failure Detect Threshold

This is UL setting. By a given input signal, the program will check to see if the failure detector is activated, then record the level from both RF and FD detector output.

Fail conditions (total 2):

1. The RF output of FD out of range.
2. The detector count of FD out of range.

3.5.1.9 Set Limiter

This is another UL setting. By a given input signal, the program will adjust digital attenuator to read the level of two limiters and set the limiter values in RAU.

Fail conditions (None).

3.5.1.10 Calculate Alarm Setting

This is a calculation step from the results of above to set the alarm level on both up/down links on pilot and cal tone signals.

Fail conditions (None).

3.5.1.11 Set Band Bit Mask

In order to write the settings into EEPROM on some RAUs with multiple sub-bands, this step will check how many sub-bands they have, and define the bit mask for database access. It will check to see if any configuration step fails. ***Attention!!! By the algorithm, unless all of above configuration steps pass (including Quick Test and any other configuration test files available in "Config" subdirectory, even they are not loaded into the test), the band bit mask would not be programmed right. If "FF" is shown at address x1057 it means either some configuration step was missed, or any of the configuration step failed.***

Fail conditions: (total 1):

1. The band bit mask is not right comparing to the definition.

3.5.1.12 EEPROM Write

The EEPROM Write is performed for each band tested. This test sends the all configured data to the RAU EEPROM and saves the data into database and a flat file. The filename convention is <snNNNNNNNN_BBBB.txt>, where NNNNNNNN is the serial number (8 digits) and BBBB is the band name. For example <sn00000005_EGSM.txt> is the EEPROM file written into an EGSM RAU with serial number 00000005 and <sn00000009_DCS1.txt> is the EEPROM file written into a DCS RAU with serial number 00000009 for DCS1 sub-band parameters.
Attention!!! Not until this step is done, the configuration data will not be written into database and flat text file.

Fail conditions: (total 2):

1. Missing data.
2. Read back does not match the writing.

3.5.2 Functional Tests

3.5.2.1 DL Gain and Flatness

For each band the DL gain and flatness of RAU is verified to be within the specified limits by measuring the gain for 9 points across the designated frequency range against the specification, giving pass/fail result.

Fail conditions (total 3):

1. The maximum ripple out of range.
2. The maximum gain out of range.
3. The minimum gain out of range.

3.5.2.2 UL Gain and Flatness

Same thing as above but is for UL path.

3.5.2.3 DL IP3

For each band and for each port the DL IP3 is verified to be within the specified limits by injecting 2 signals offset by +/-300 KHz. from the center of the band and measuring the inter-modulation products generated. The IP3 point is calculated from the measured values, giving pass/fail result.

Fail conditions (total 1):

1. The IP3 value out of range.

3.5.2.4 UL IP3

Same thing as above but is for UL path.

3.5.2.5 DL P1dB

For each band the DL 1 dB compression point of RAU is verified to be within the specified limits by injecting a signal at the center of the band and incrementing its power until there is a 1 dB reduction in the gain, giving result.

Fail conditions (total 1):

1. The P1dB value out of range.

3.5.2.6 UL P1dB

Same thing as above but is for UL path.

3.5.2.7 DL Noise Figure

For each of band, test and calculate the noise figure for DL of RAU to see if it is within the specifications defined in the database, giving pass/fail result.

Fail conditions (total 1):

1. The noise figure out of range.

3.5.2.8 UL Noise Figure

Same thing as above but is for UL path.

3.5.2.9 DL Phase Noise

This is a function test to see the phase noise with a single tone at different frequency offset of 1k and 10kHz from center against the specifications, giving pass/fail result.

Fail conditions (total 2):

1. The 1k offset phase noise out of range.
2. The 10k offset phase noise out of range.

3.5.2.10 UL Phase Noise

Same test but only for UL path.

3.5.2.11 DL Spur Test

This is a function test to see the highest spurs off from center frequency against the specification if it is in the tolerance, giving pass/fail result.

Fail conditions (total 1):

1. The highest spur out of range.

3.5.2.12 UL Spur Test

Same test as above but only is for UL path.

3.5.2.13 DL LO Leakage

This test is to verify the Local Oscillator (LO) in RAU to see how much leak to the RF output against the specification for DL, giving the pass/fail result.

Fail conditions (total 1):

1. LO leakage out of range.

3.5.2.14 DL 10dB Attenuator On/Off

This is a function test for DL to see the output difference while internal DL 10dB attenuator is on then off against the specification, giving pass/fail result.

Fail conditions (total 1):

1. The 10dB attenuation out of range.

3.5.2.15 Post Sequence

Clean all of instruments, ports and power and set the manufacturing flag to put the RAU in normal operating mode. ***Attention!!! Not until Post Sequence is done, all of the test data will not be written into database.***

Fail conditions (total 1):

1. The manufacturing flag is not setting right.

3.6 Test Executive

Double clicking on the desktop icon called “Test Launch Panel V1” starts the Test Executive (Main Panel). After waiting sometime for loading all software modules, the panel window will be seen as in Figure 3.

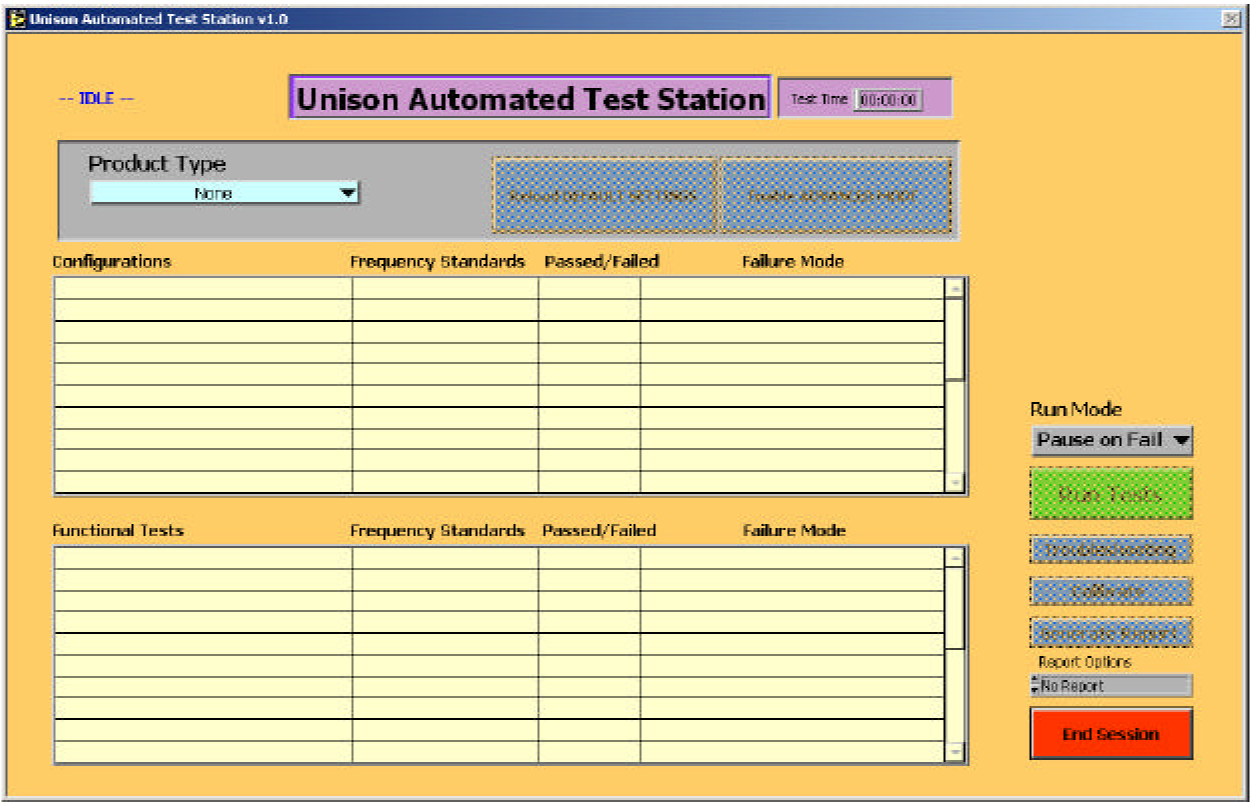


Figure 3; Test Executive Main Panel

The login prompt window in Figure 4 is then popped-up. The user should enter the user name provided by the system administrator.

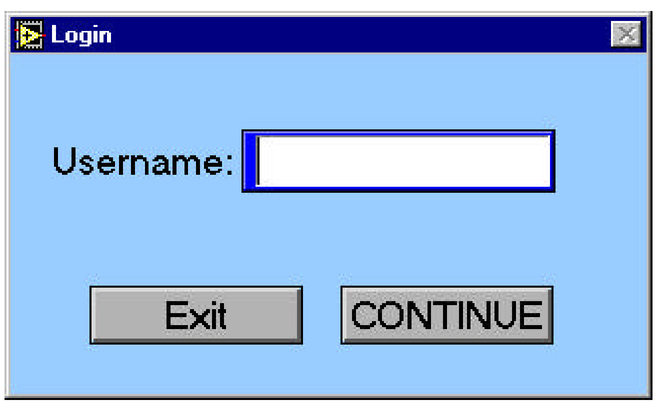


Figure 4; Login Display

The screen will then remain as shown in Figure 3. The user can now select the product type by clicking and holding the bar on “Product Type” drop down list. The user is then prompted to enter the software revision. Selecting right revision then clicking <Done> button as shown in Figure 5. will start loading relevant data from database to the test software and data sheet. The loading is considered done as soon as the status display on top left corner changes from “IDLE” to “Loading Spec”, then to “Preparing Data Sheet”, and finally back to “IDLE”.

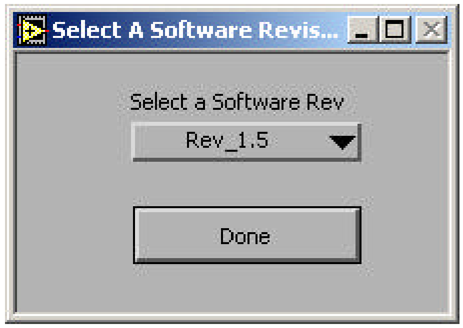


Figure 5; Software Revision Selection

After it is done, all default test steps for that product will be shown on the test window as like in Figure 6. ***Attention: Since loading database and Excel data sheet needs somehow a quite time, be patient and check the status on the left top corner changed from "Loading Specs" to "Preparing Datasheet" until to "IDLE".***

There are two types of run modes toggled with button labeled <Pause on Fail> and <Automatic> which means it can either stop at any failed step until the operator interacts, or keep test running all the way to the end without stop even with fails. At this point the users need only clicking on "Run Tests" to begin executing the default tests defined by the system administrator for normal test, or select to calibrate the system, or perform troubleshooting by pressing those buttons instead of <Run tests>. See paragraphs for more information on Calibration and Troubleshooting.

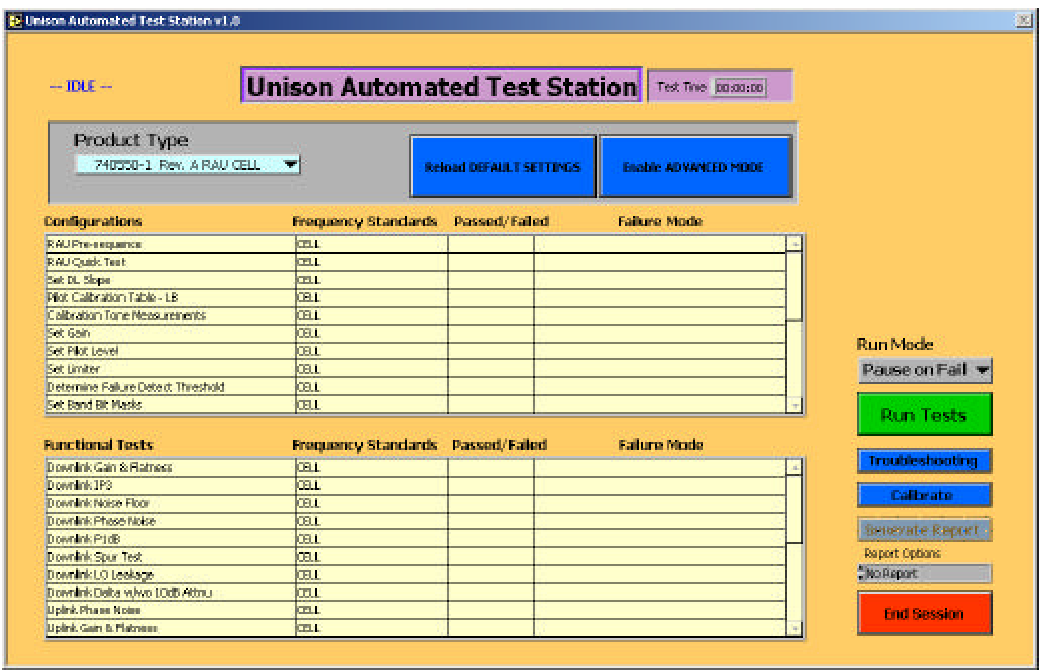


Figure 6; Ready to Begin Testing, or Calibrating, or Troubleshooting

3.6.1 Test Executive System Administrator Functions

The System Administrator can utilize the Advanced Mode of the Test Executive to modify or create test plans. Test plans are instructions (.ini files) to the Test Executive concerning which tests to run, in what order and for what frequency bands. These advanced mode functions should be used with caution and only by those fully cognizant of the production test requirements.

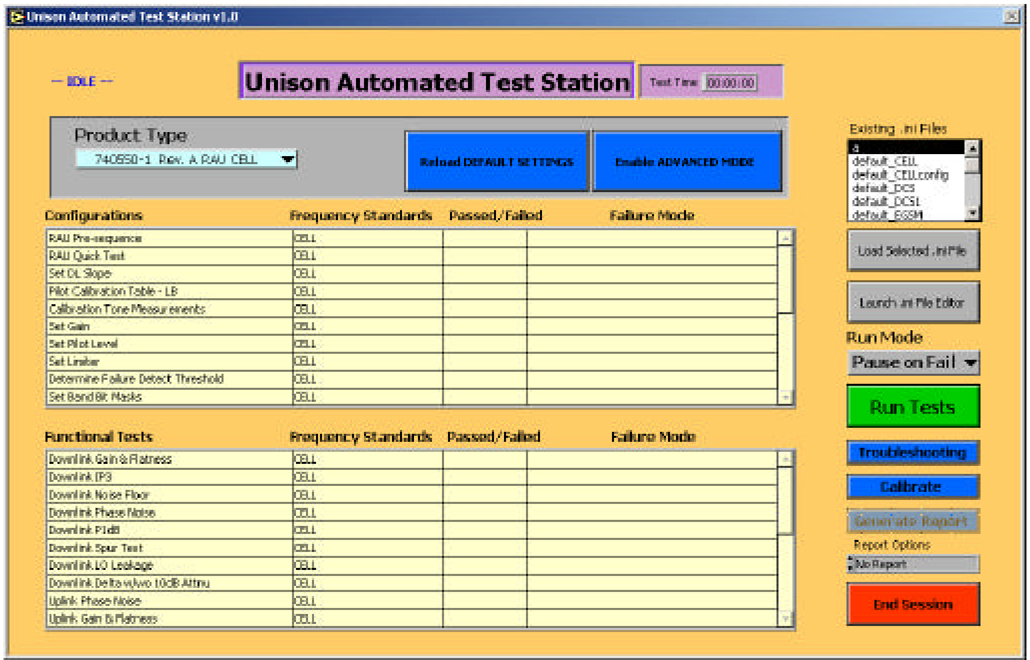


Figure 7; Advanced Mode

The first option is the capability to select and load existing default .ini files. After clicking on the advanced mode button the display will appear as shown in Figure 7. The user can highlight an existing .ini file and click on the <Load Selected File> button to change the tests and bands as defined in the stored file.

The second option is to modify or create new .ini file by clicking on the <Launch .ini file Editor> button. The .ini file editor should then appear as shown in Figure 8.

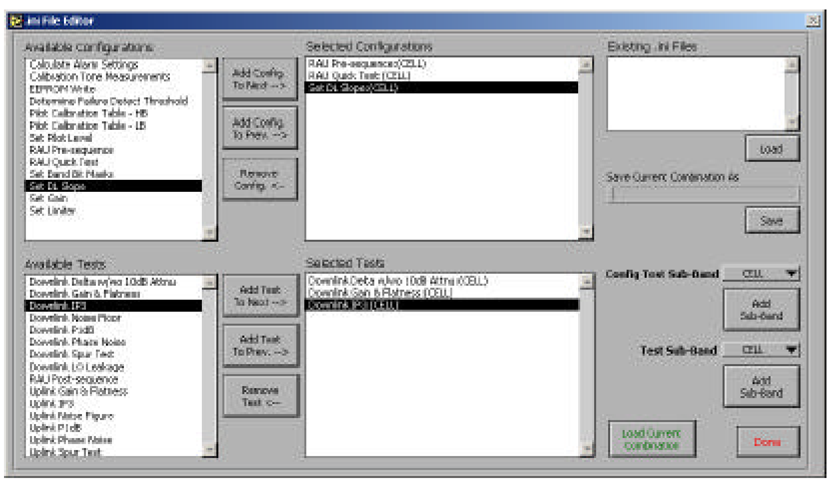


Figure 8; File Editor

Highlighting the test names at the left of the screen and pressing the appropriate “Add Test” button as needed select the tests. As tests are added, selecting the band and pressing the appropriate “Add Sub-Band” button can also select bands for that test.

When the test plan is defined as required, the user can save the plan by typing a name in and press the save button. This will make the new plan available to other users. The test plan can also be used temporarily by pressing the “Load Current Combination” button. Remember this will not save the test plan for use later.

After loading the current combination the display will appear as shown in Figure 9.

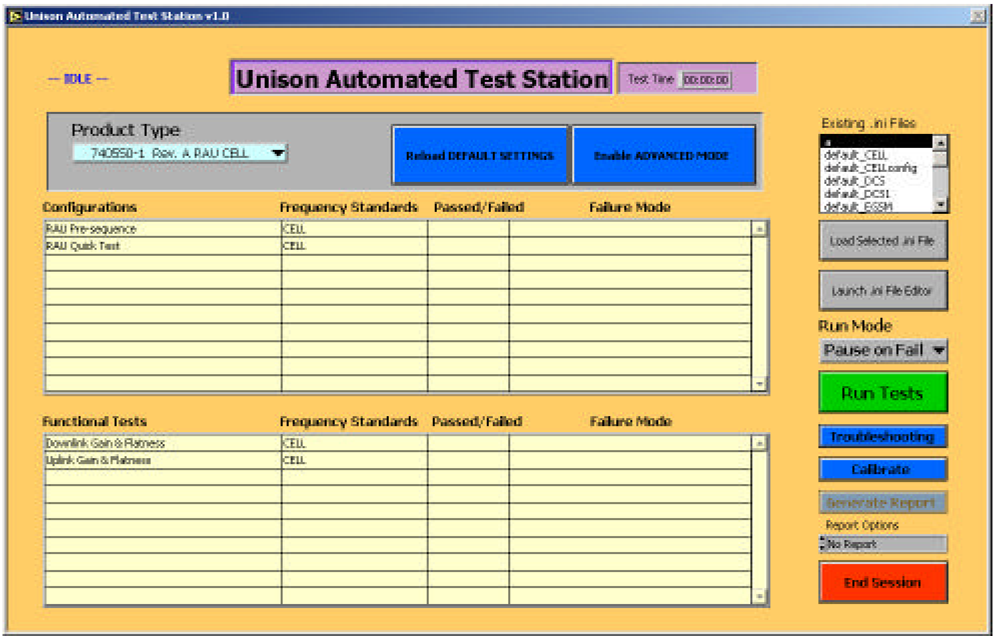


Figure 9; User Defined Test Plan

Clicking on <Run Tests> will now execute the desired tests as shown in the display.
Caution!!   Unless the user knows exactly what test sequence should be arranged (some input data on one step may rely on the output of other step. Error will occur if missing such data), or what impact it can have on the EEPROM write for such custom made sequence, do not use advanced mode to test RAU as a normal means.

After tests have completed, the user can select to open Excel datasheet then print the Excel formatted data, or selecting the report options then clicking "Generate Report" button to have LabView formatted data.

By pressing the "End Session" button the user can exit the test executive and the program will be terminated.

4 Calibration/Maintenance/Accuracy Verification

4.1 Calibration Overview

Calibration of the RAU ATE is accomplished in two parts: The first part is the standard periodic calibration of each of the COTS equipment according to the procedure and schedule defined in each of the instrument manuals (the periodic calibration procedure for the JFW Test Fixture is included in this document). The second part is the User Calibrations that are necessary to adjust the ATE measurements to accommodate the test fixture and cable losses inherent from the system. This user calibration is a semi-automatic procedure that runs on the ATE from the Main Panel. It prompts the user going through each of the setups and measures the required parameters.

4.2 User Calibration Procedure

User calibration is to be done **once per month**, or after any maintenance on the ATE such as replacing cable or impedance matching board in fixture, etc, which affects the RF signal path and response. All COTS equipment and the Test Fixture should have their calibration in affect verified by checking the dates on the stickers attached to each item. This calibration can run from main panel where a <Calibration> button is on the right hand of the window. As soon as the main panel loads up and wait for user input, the <Calibration> button can be clicked to pop-up the calibration window as in following Figure 10.

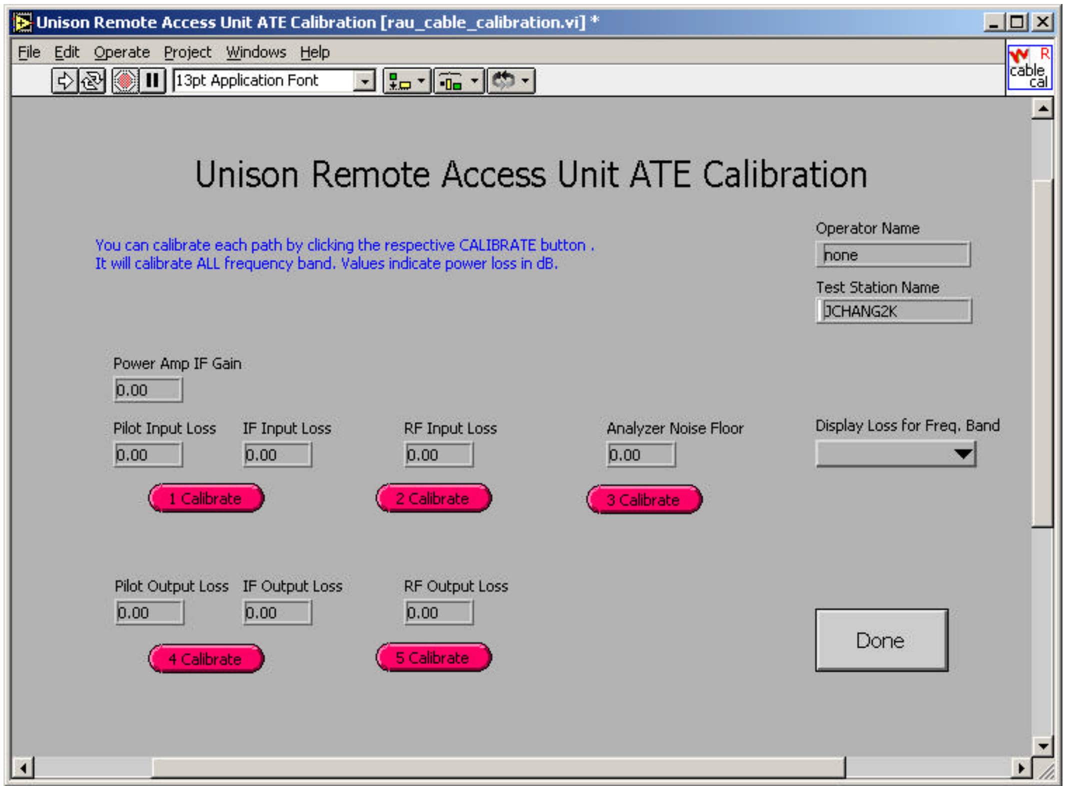


Figure 10; Calibration Pop-up Window

You can calibrate each path by clicking on the respective calibrate buttons such as <1 Calibrate>, etc. This can be done in any order, and can be re-do in the event of a mistake or failure. The immediate following screen will show how to connect the path with some steps need a cal box labeled “UNISON TB4e”. Follow the detailed instructions and pictures for calibrating each path after pressing the button. Each path will be calibrated for **all frequency bands,** which means it does not need to perform once more for different bands. It will show the warning window if the current value is too far from the previous value if in wrong connection, or malfunction in test fixture. Call test engineer if this situation happens after verifying every connection right and tried a few times but still with the problem. When each path completes, its button will turn green and the measured values can be examined. When all the paths are complete, press <DONE> for the program to store the data then return to Test Executive window.

4.3 Test Fixture Periodic Calibration

Once per year, or after any internal maintenance or repair action taken, the JFW Test Fixture (50SA-052) must be verified to be within operating limits.

4.3.1 Equipment Required

The following table lists the equipment required to perform this calibration.

Table 3; Test Fixture Calibration Equipment Required

Qty.	*Manufacturer*	*Model*	*Comment*
1	Agilent	8714ET	Network Analyzer, or Equivalent
2	RF Connector	RFW5170-24	SMA Cables
1	Any	SMA(f)-SMA(f)	Adapter
1	Dell	Any	Computer Workstation or Equivalent
1	National Instruments	PCI-GPIB	GPIB Interface
1	National Instruments	763061-2	GPIB Cable or Equivalent

4.3.2 *Procedure*

1) Remove the Test Fixture from the ATE and connect proper path in Table 4 such as in Figure 11.
2) Calibrate Network Analyzer with SMA adapter and cables to perform gain and input return loss measurements over frequency range specified in Table 4.
3) Using Table 4, activate each path by sending the specified command string over the GPIB to the Test Fixture. Reference JFW50SA-052 manual for the command set to switch the fixture by the path name.
4) Then measure the Insertion Loss for each path and the return loss for each port. Verifying the specifications according to Table 4.

Table 4; Test Fixture Performance Specifications

Path Name	Signal Input (Network Analyzer Transmit Port to)	Signal Output (Network Analyzer Receiving Port from)	Lower Freq. (MHz)	Upper Freq. (MHz)	Insertion Loss (Max)	Max VSWR (Port1)	Max VSWR (Port2)
IF DL path w/wo AMP	IF/RF Source Connector	RJ45 with TB4e Box DL Connector	50	2500	6 dB.	1.5:1	1.5:1
Pilot DL path w/wo AMP	Pilot Connector	RJ45 with TB4e Box Pilot Connector	50	2500	6 dB	1.5:1	1.5:1
RF UL path w/wo AMP	IF/RF Source Connector	DUT Connector	50	2500	5 dB	1.5:1	1.5:1
Pilot UL path w/wo AMP	Pilot Connector	DUT Connector	50	2500	5 dB	1.5:1	1.5:1
RF DL path	DUT Connector	Spectrum Analyzer Connector	50	2500	3.5 dB	1.5:1	1.5:1
IF UL path	RJ45 with TB4e Box UL Connector	Spectrum Analyzer Connector	50	2500	2.5 dB	1.5:1	1.5:1

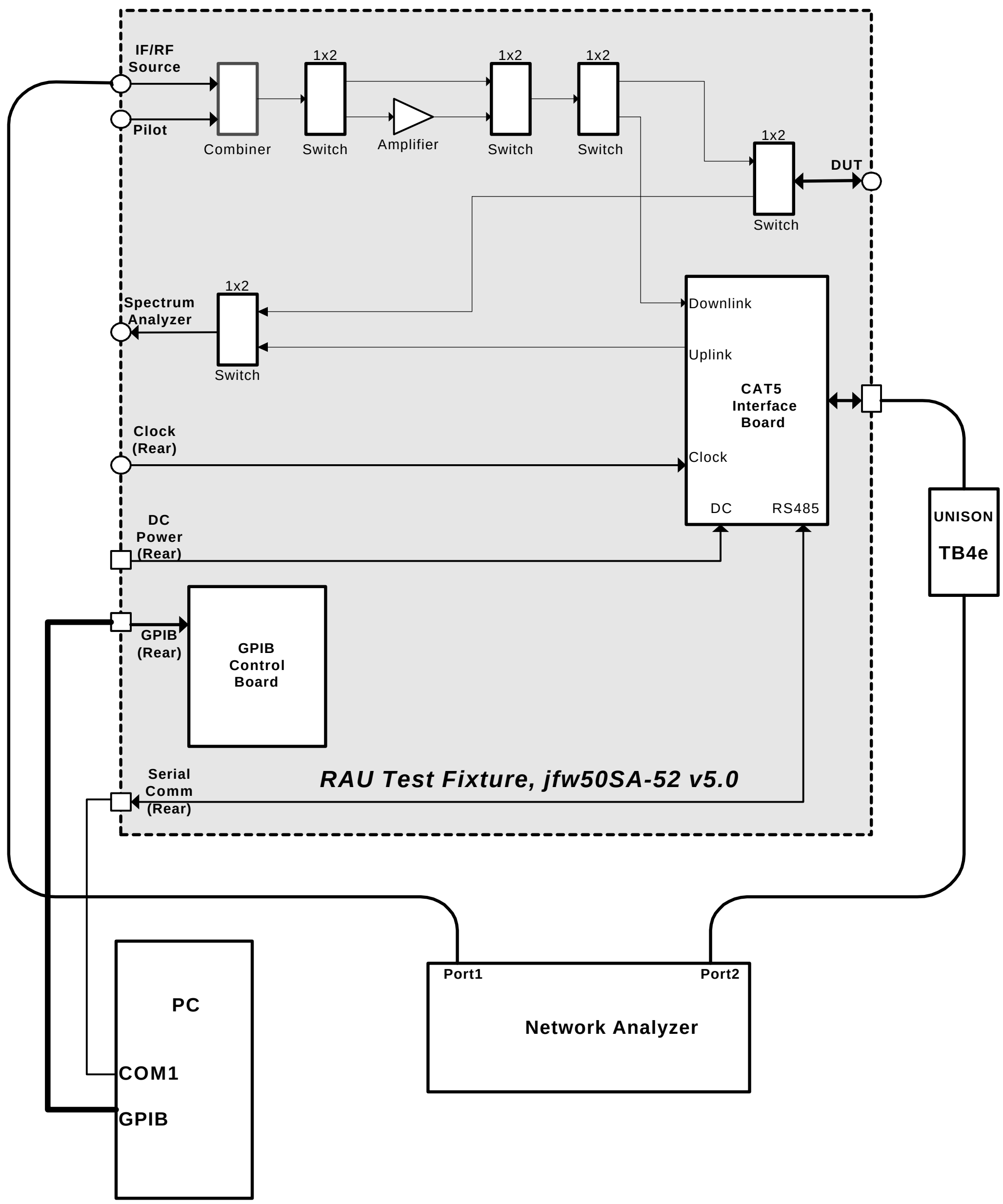


Figure 11; Test Fixture Calibration Connection Diagram

4.4 RF Cable and Connector Maintenance

The ATE RF cables can become damaged and worn out from regular usage, and should be periodically inspected for signs of wear and damage.

Dirty or damaged connectors are often the cause of measurement errors. Using the plastic protector caps and never rotating the connectors relative to one another during connect/disconnect cycles is the best way to keep connectors clean and in good condition. Before using the ATE, inspect the connector interfaces. Look for dirt, contaminants, dented or scratched outer conductor mating surfaces, and damaged center conductors.

Use a swab dipped in clean isopropyl alcohol to clean off the outer conductor mating surfaces and the ends of the center conductors. Be careful not to let the alcohol get on the insulator bead, as this may damage the bead. Be careful not to exert too much force on the center conductors. Use a swab that has a sharp enough corner to clean all areas of the connector interface. Don't forget to clean off the coupling nut threads.

Blow off the alcohol with clean compressed air. Re-inspect the connectors. If the outer conductor mating face of a connector has raised material that would keep it from making complete contact with another connector, it should be replaced.

4.5 Accuracy Verification

Except normal calibration, accuracy verification is another important step to make sure accuracy of the measurement is in tolerance. This procedure does not simply calibrate the instrument and path, rather, it measures the signal from reference plane (such as input/output terminals) to see the true signal level appeared comparing to the calculated result from nominal value under certain test conditions. For example, instead a 15dBm Cal Tone signal generated from RAU nominally, a calibrated 15dBm produced from a calibrated signal generator is injected into DL RF path to observe the output on a calibrated spectrum analyzer or a power meter. By the way, the signal finally measured, after subtracting the path loss called database, should be very close to 15dBm. This is the basic methodology verifying what true levels are in and out on both channels of front and after RAU.

The suggestion for accuracy verification is a couple of months for once, or any situation that the configuration of ATE has changed, instrument replaced, or obvious values that far from normal happened.

There are blank and filled (with current data for ATE#3, ATE#5, ATE#9 stations) Excel tables for such verification on appendix (?) and directory

F:\ATE_Software\tps\rau\Rev_1.5\calibration

The use of such table is very simple: Save the blank Excel table as a name then simply follow the step on the table, opening the troubleshooting panel from main panel, selecting DL or UL link, filling in the loss values then measuring the values by using calibrated SG/SA or power meter from each terminal indicated, then filling the value measured into the corresponding cell. Since all the specs and pass/fail conditions are with pre-defined equation, the result will shown as soon as all of necessary data are entered. If failing, thorough checking will be needed to see from font to end of the path, mainly on text fixture and cable losses, and the accuracy of calibration data.

5 Troubleshooting

5.1 Troubleshooting Basics

The first step should be to ensure the connections and setup of the ATE is as described in section 2.

Troubleshooting test failures from error messages requires understanding exactly which test and which band was running when the failure occurred as well as what that test was trying to accomplish. Section 3.5 describes each of the tests and should guide the operator to the appropriate starting place to begin troubleshooting.

The RAU block diagrams (Figure 12 for Low-Band and Figure 13 for Hi-Band) combined with the appropriate schematics will also help the user to troubleshoot the failure.

Some hints can be used to give some general troubleshooting guideline:

1. Pay attention on messages of Quick Test. If there is a message mentioning the delta value is out of range for that part, it means tuning that digital controlled attenuator has very little change or no change at all. Obvious this hardware has problem. The delta value would be shown on the in the window.

2. If pilot table has all same values on the detector column with down stepped DGA value, it means the detector is bad. It is bad, too if the partial values on top or bottom of table are same, or up to FF or down to 00 which are over the limits.

3. The pilot table for low band has a transition from long to short cable mode. If the error message showing long/short overlap problem, typically this is the long/short attenuator turning bad.

4. The message of "Can not reach the gain" typically is caused by either bad digital controlled attenuator, or the channel has bad parts before or after it. Measuring the signal with a good one to see the signal level before or after the attenuator.

5. Coupler is one of causes to affect pilot or power detector level that the detectors get signal from it. Check the level before coupler if the power detector level is low, if ok then check the detector.

6. Amplifier can be checked by digitally turned on and off the see how much the signal level change.

7. Pay attention on control digital signal, too. If sending command but seeing no change, check the control line to see the digital control level is really reaching the pin of that component. If not, check digital control circuit rather than RF path.

8. Reading the circuit block diagram with command marked on to be familiar with what command is controlling what component, then from channel path to see what possible effects may have.

9. If serial communication has problem to talk after a few tries, checking digital and CPU section up to flush memory rather than RF path. Make sure the right program is loaded into the memory since the serial communication depends on the program to run.

10. If signal of output is not right, select a break point in the circuit to measure the signal, then narrow down before that point if the signal already wrong. Do not scattering checking.

5.2 Troubleshooting Panel

There is a software utility to facilitate the troubleshooting in main panel. Simple click the "Troubleshoot" button on right of main panel will call it up as seen on Figure 14 or Figure 15, up to Hi-band or Low-band selected in main panel. (*The hardware/firmware of Hi-band RAU has some difference from Low-band so there are different panels*). Generally, it is a graphical interfaced, interactive control panel in which the operator can adjust each of digital controlled hardware component individually and see the output of different detectors.

The usage for this troubleshoot panel is simple. After choosing the right band and DL/UL, manually set the signal generators and spectrum analyzer to the right frequencies shown on the panel, the operator can click corresponding button either turning on/off , or call a slide tuner to make adjustment to observe the change of detector. By the way, the problem can be found if the detector has no change, or the output on SA is not right.

The prerequisite to use this very well is to understand the circuit well. The block diagrams are good reference to see the signal channel, and what adjustment will affect what value.

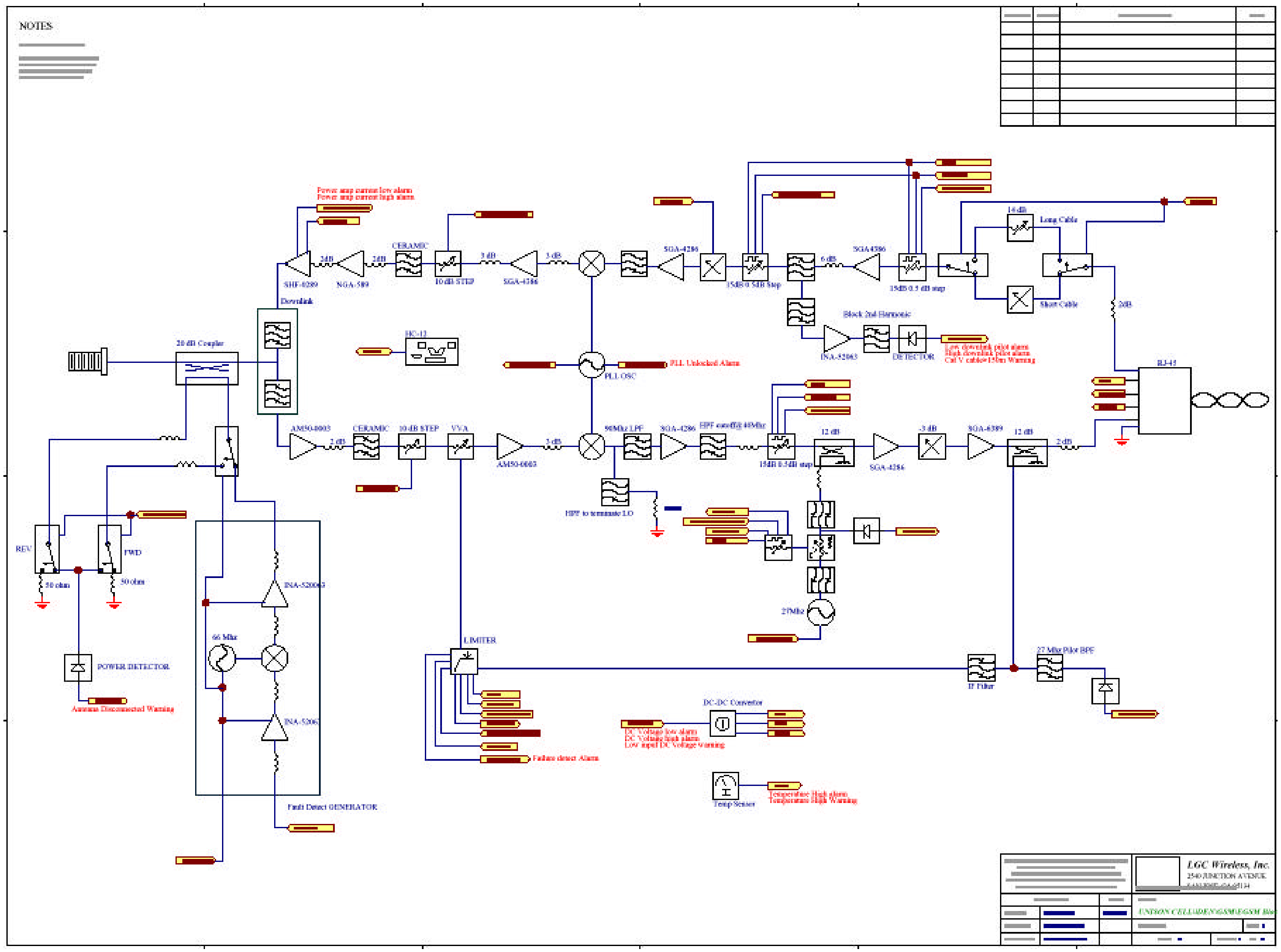


Figure 12; Low Band RAU Block Diagram

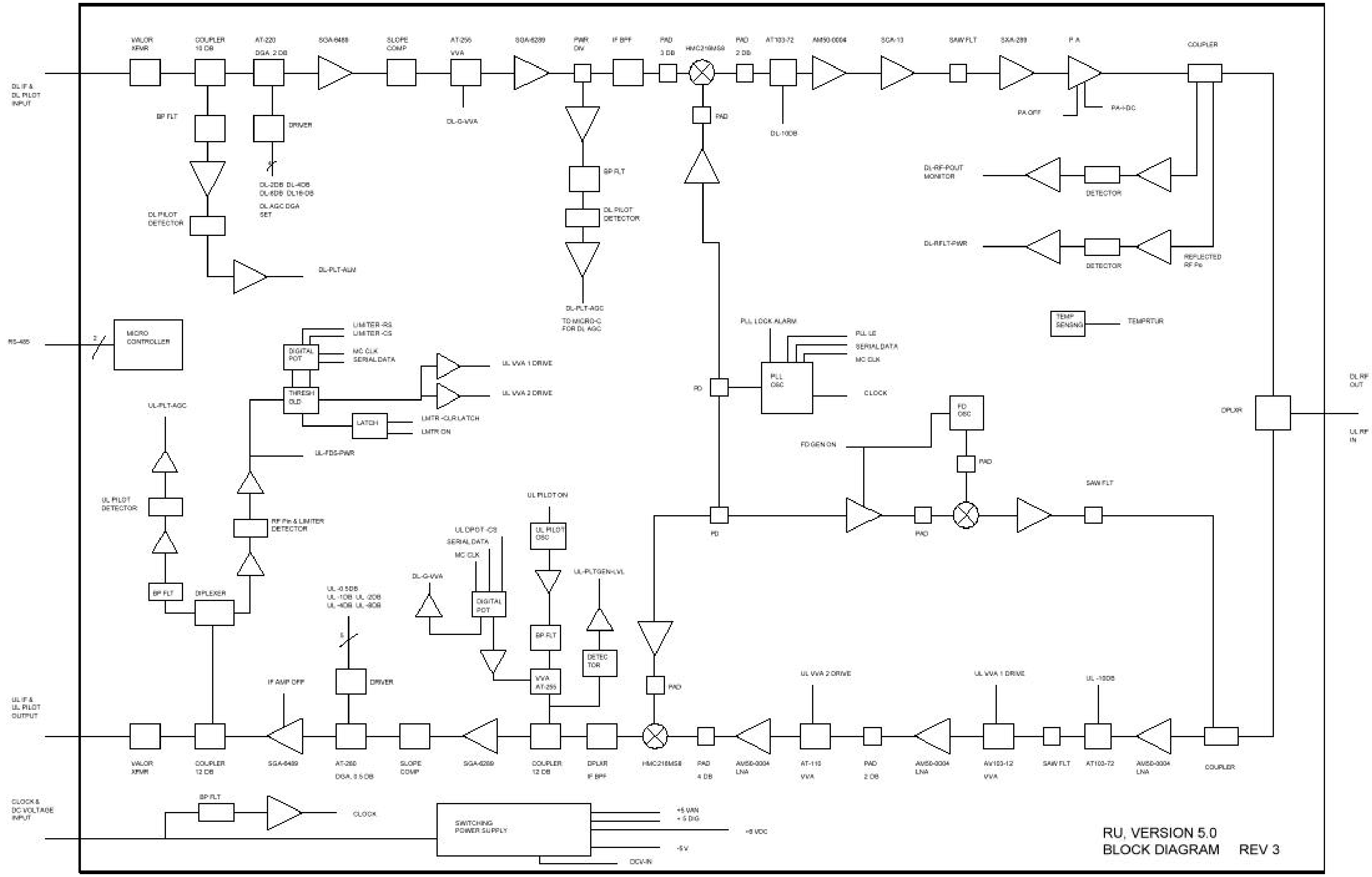


Figure 13; High Band RAU Block Diagram

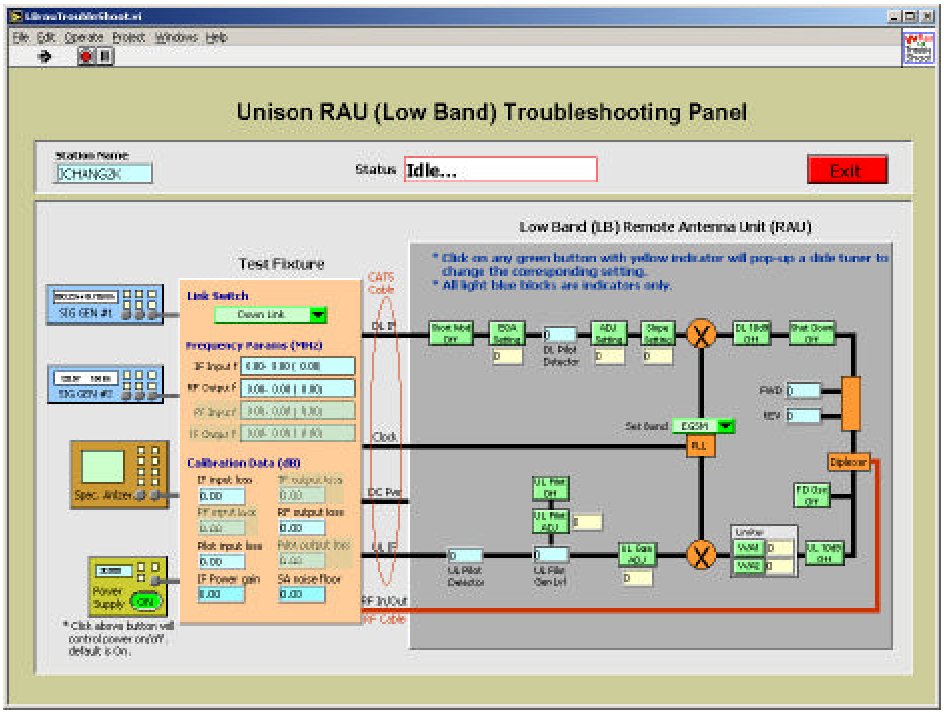


Figure 14; The Low-Band Troubleshooting Panel

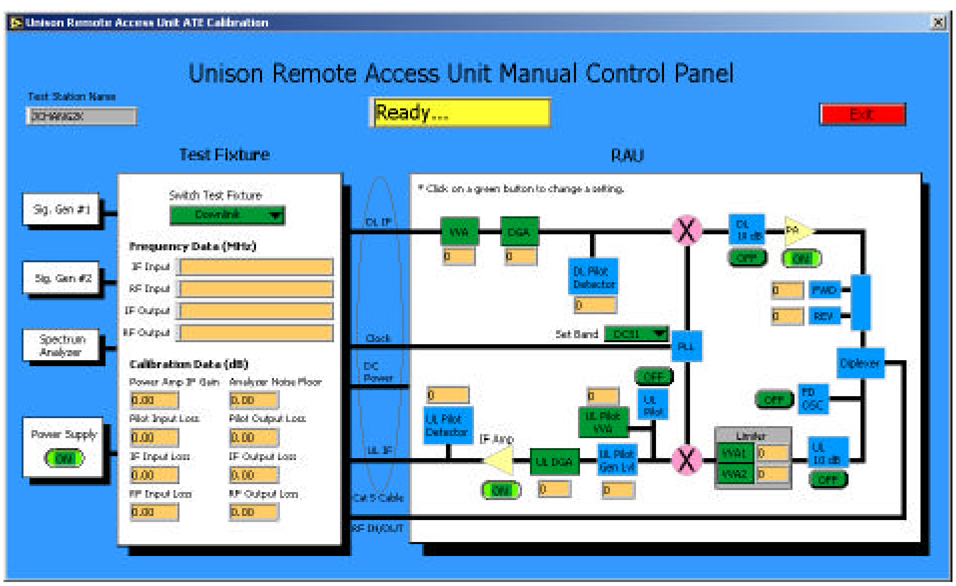


Figure 15; The Hi-Band Troubleshooting Panel

6 Software Installation and Setup Procedures

6.1 Requirements

- A PC with a National Instrument PCI-GPIB card installed.
- IEEE-488.2 driver installed
- Labview 5.1.1 IDE installed with SQL Toolkit.
- Network \\Main\ATE_Software directory is mapped to F: Drive in local Windows (see network administrator for path)

6.2 ODBC Configuration

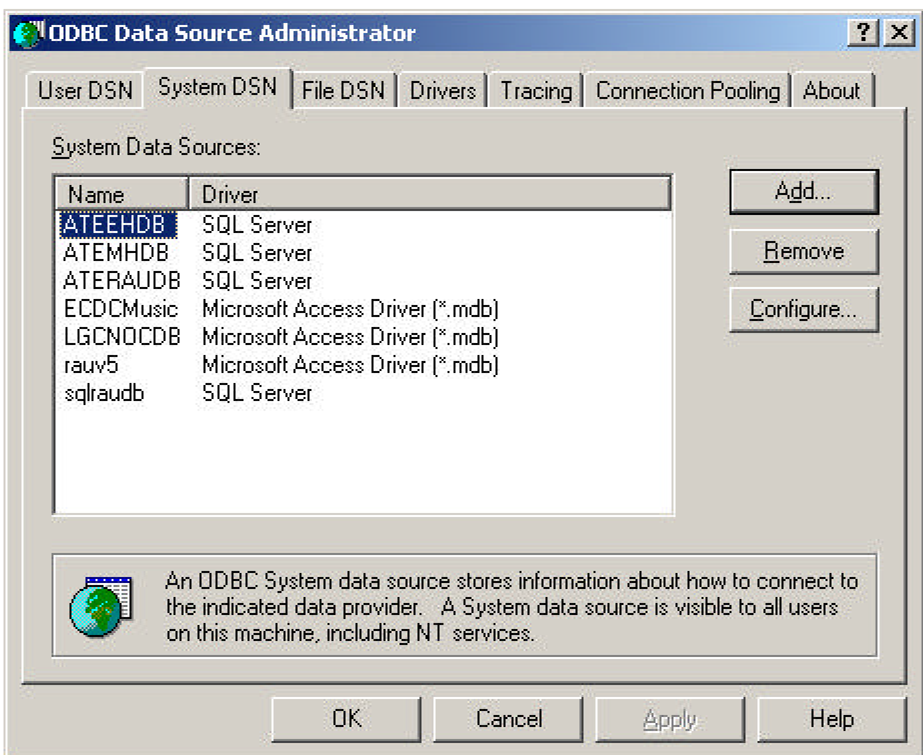
6.3 Basics

The ATE software requires three individual databases to work. Their Date Source Names (DSN) are ATEMHDB, ATEEHDB and ATERAUDB.

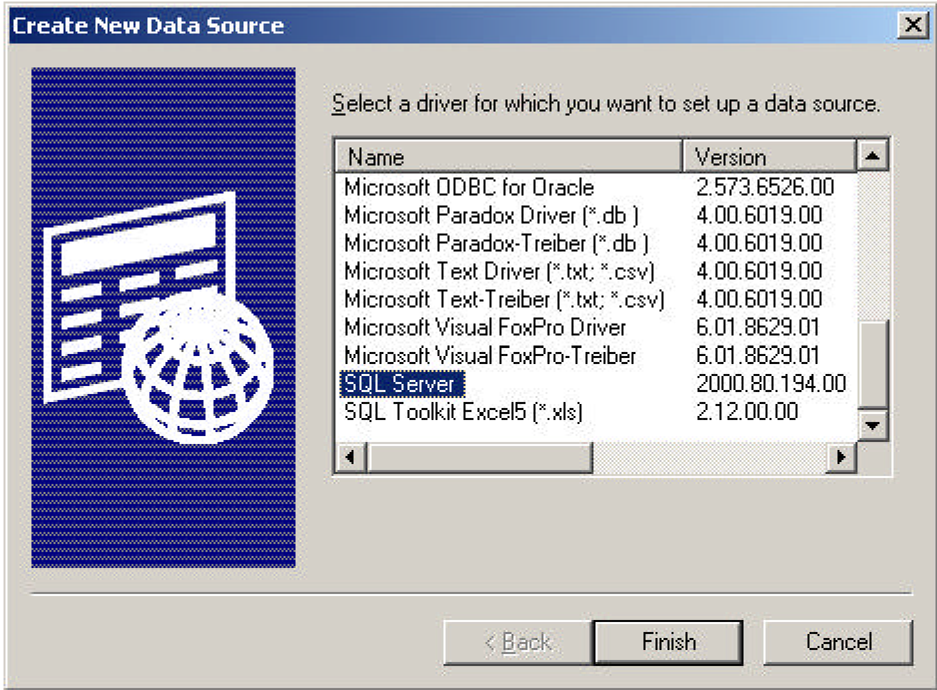
Note: See network administrator for parameters setup in this section.

6.4 Setting up DSN

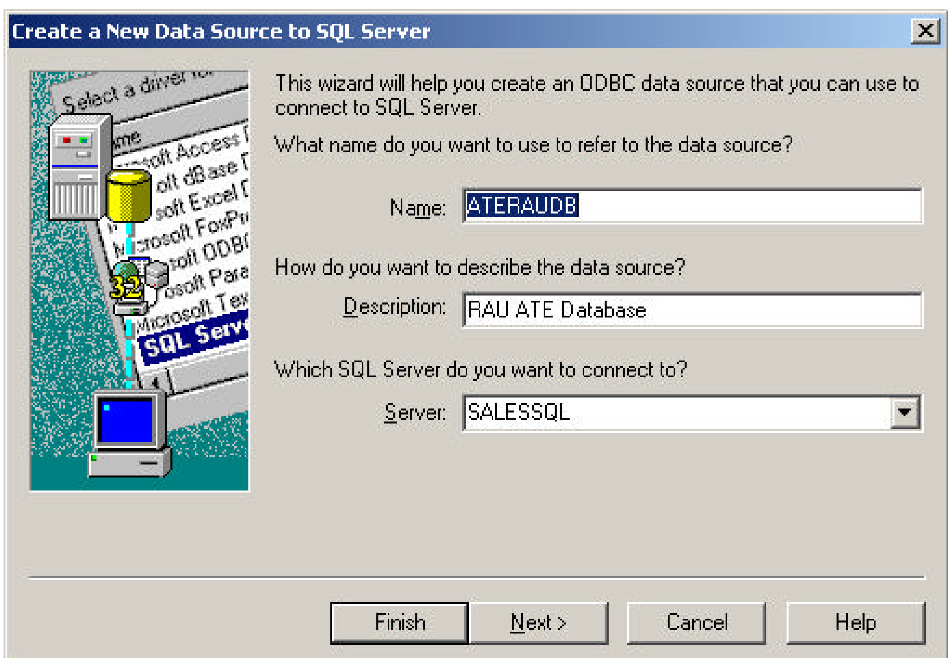
Open the Data Source Administrator under Control Panel.



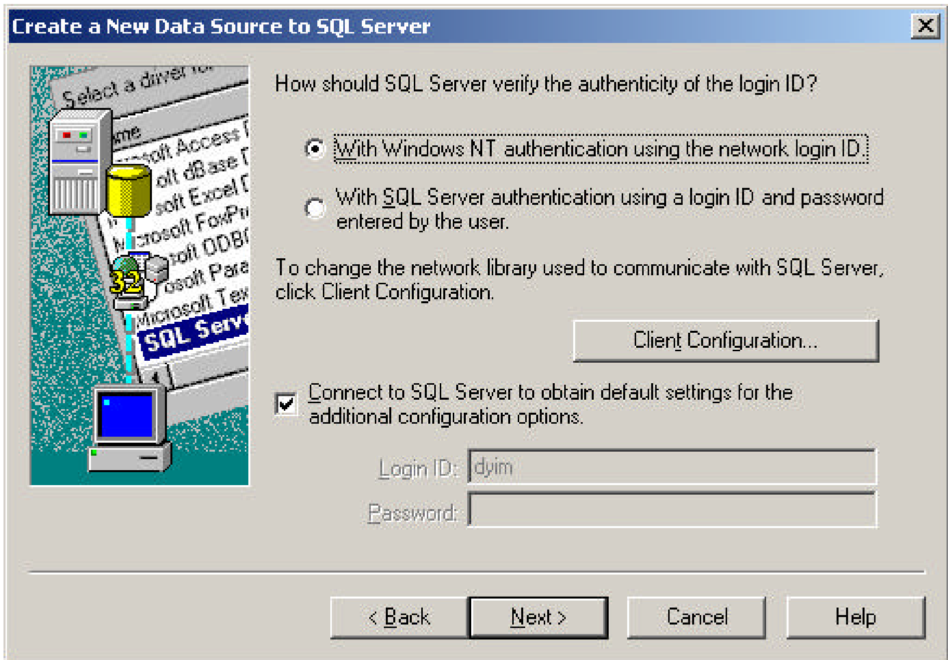
Click on Add and pick SQL Server and click on Finish.



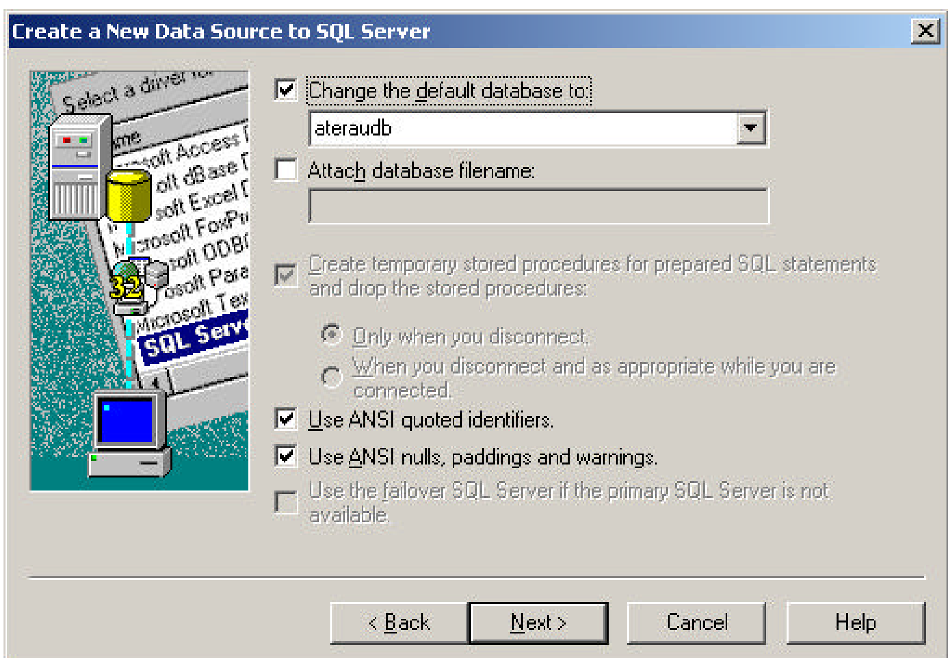
In the “Name” box, typing in the DSN, e.g. ATERAUDB. Then pick the Server (it should be given by the IS department). Description is optional.



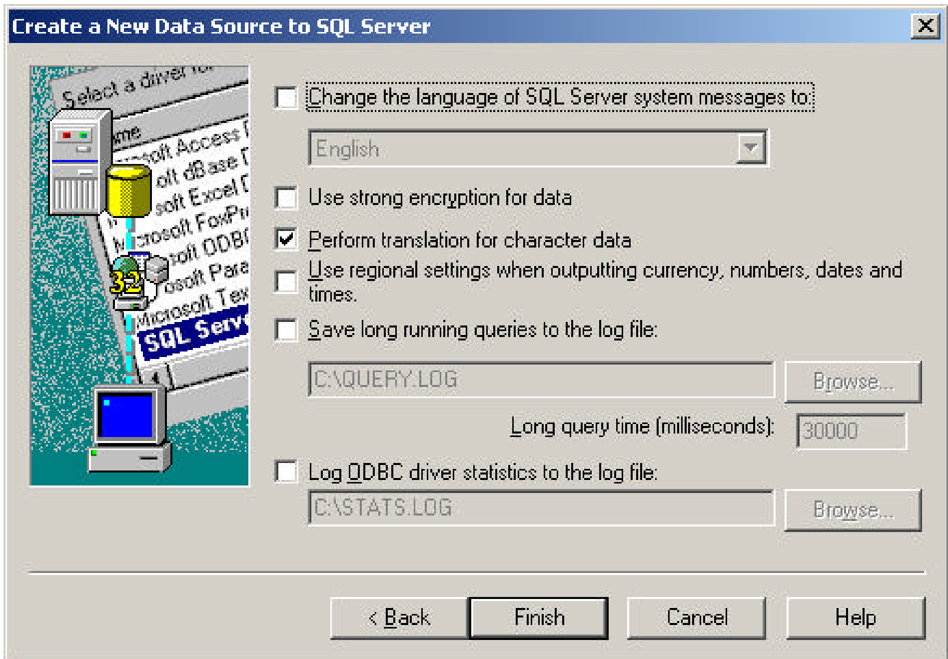
Use default values and click next.



Check Change the default database to and pick the one you are setting the DSN for, in this case, ATERAUDB.



Click Finish.

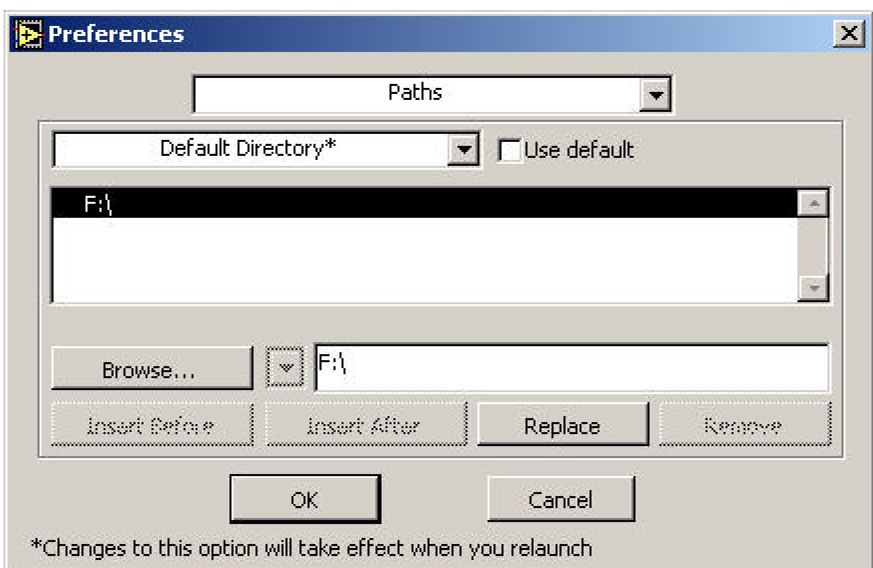


Repeat these steps for the other 2 database items.

6.4 Labview Setting

6.4.1 Default Path

Open Labview, click on Edit->Preferences. Select Paths in the top drop down box and Default Directory under it. Uncheck Use Default, type in F:\ and click Replace.

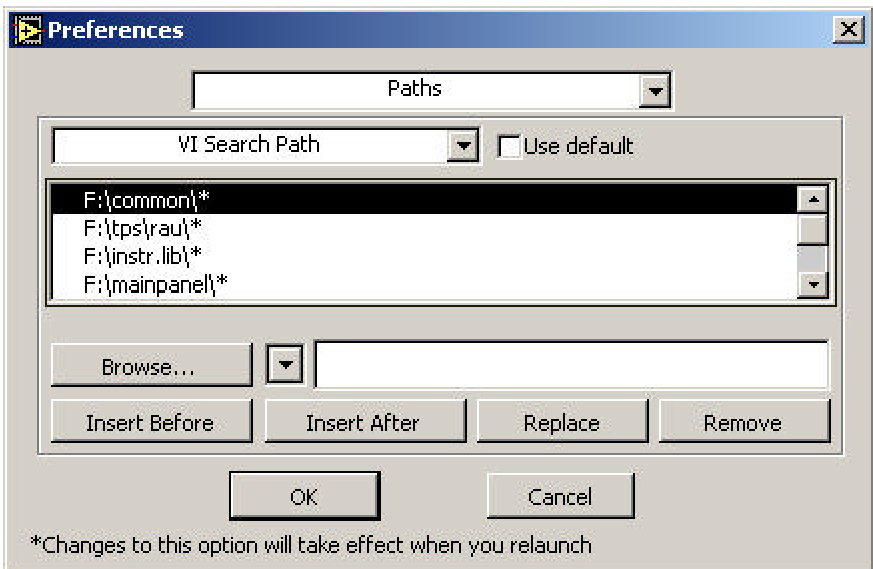


6.4.2 Vi's Search Directroies

After setting the Default Path, select VI Search Path. Uncheck Use default and make sure the list looks like the followings:-

- <topvi>*
- <foundvi>*
- <vilib>*
- F:\instr.lib*
- F:\common*
- F:\tps\mh*
- F:\tps\eh*
- F:\tps\rau*
- F:\mainpanel*

Then, restart LabView.



7 RAU Database Tables

7.1 Static Tables

Static Tables contain setup and configuration data that does not normally change or get appended to during ATE usage.

7.1.1 Band Settings Table

The Band Settings Table defines the configuration parameters default values that are band specific. In addition it defines the data block name and relative position in the block when the value is programmed into EEPROM

7.1.2 Band Specs Table

The Band Specs Table defines the frequency parameters for each band.

7.1.3 Main Band Spec Table

7.1.4 Configuration Table

The ATE configuration table defines the ATE GPIB addresses, COM port used.

7.1.5 EEPROM Location Table

The EEPROM location table defines the EEPROM Address locations for each of the data blocks.

7.1.6 General Spec Table

The General Spec Table contains the pass/fail limits as well as other constants used in performing the tests including all path names necessary for firmware, EEPROM access.

7.1.7 Main Band Settings

The Main Band Settings Table defines the configuration parameters default values that are not band specific. In addition it defines the data block name and relative position in the block when the value is programmed in EEPROM.

7.1.8 Product Table

The Product Table defines the band code, product type and part number.

7.1.9 Revision Table

The Revision Table contains the part number and revision of the product.

7.2 Dynamic Tables

Dynamic Tables have records appended to them as the ATE is used, or have their contends modified.

7.2.1 Calibration Table

AET Calibration data

7.2.2 Calibration Backup

The Calibration Table always contains the latest calibration Data for each ATE. The Calibration backup table contains all previous calibration data in the same fields as the Calibration table.

7.2.3 Gain Curve Calibration Table

The Gain Curve Calibration Table contains calibration data for the swept response of each path and band.

7.2.4 Gain Curve Calibration Backup

The Gain Curve Calibration Table always contains the latest calibration Data for each ATE. The Gain Curve Calibration backup table contains all previous calibration data in the same fields as the Calibration table.

7.2.5 Band Configuration Results

Contains band specific configuration results.

7.2.6 Test Results Table

Contains functional test results.

8 JFW Test Fixture Instruction

The JFW50SA-052 test fixture is a GPIB controlled combination of RF switches, amplifier and impedance matching circuit to change test path such as DL or UL, turn on/off amplifier if required, route serial communication signal from RS485 of PC and DC power to RAU through RJ45 connector. It has some modification from the original design of jfw. Please refer its own manual for basic functions and command set if special path switching is needed while in diagnosis.

If the a few RAU fails repeatedly on slope, gain/flatness tests, trying test the gold RAU to see the result. It is strongly suspected the fixture has malfunction if all fail. Asking test engineer if this occurs.

If serial communication has error message shown on panel, check the gold RAU to see what happens. Asking test engineer if they are all fail. Pay attention on connections of back of fixture where 2 wire RS485 cable is not fallen off. Besides check and make sure the DC power plugs are connected to the right place in rear of fixture.

Appendix 1: Excel Data Sheet

The Excel format datasheet is typically minimized on the bottom of window while being called by LabView. It has many sheets with band name on it. An "All" page has all the common data, such as temperature, current, voltage, config bit mask and all Quick Test results on it. The other sheets with band names have the all other parameter data. The examples are as followings. **Since the data sheet has interaction with LabView program frequently, manually opening it and operating on datasheet may trig problem**. If the Excel sheet window overlapped on test window but can not see the contents, it needs to reboot PC after closing test program and sheet.

"All" sheet:

UUT Part Number:	7405510	**Date/Time:**	12/6/2001 16:28
UUT Revision:	0A	**Operator Name:**	TL
Test S/W Part Number:	D-740540-0-09	**Test Time:**	0:13:04
Test S/W Revision:	Rev_1.5	**ATE:**	ATE-003
UUT Firmware Revision:	10522	**All Tests Pass:**	TRUE
UUT Serial Number:	13		

Config Test Name	Description	Units	Lower Limit	Measured	Upper Limit	Status
Pre_sequence	Total DC Current	A	0.2	0.24	0.6	**PASS**
	Test Temperature	Degree C	22	26.17	45	**PASS**
	Current Read for PA Off	Counts	0	1	50	**PASS**
	Current Read for PA On	Counts	160	169	175	**PASS**
	DCV for Low Input	Counts	92	111	160	**PASS**
	DCV Min Error for Low Input	Counts	N/A	111	N/A	**N/A**
	DCV Max Error for Low Input	Counts	N/A	126	N/A	**N/A**
	DCV Warning for Low Input	Counts	N/A	3	N/A	**N/A**
	PAI Max Error for High	Counts	N/A	153	N/A	**N/A**
	PAI Min Error for High	Counts	N/A	156	N/A	**N/A**
	PAI Max Error for Low	Counts	N/A	174	N/A	**N/A**
	PAI Min Error for Low	Counts	N/A	177	N/A	**N/A**
Set Bit Masks	Config Bands Bit Mask	Counts	N/A	254	N/A	**N/A**
	Sub Bands Bit Mask	Counts	N/A	254	N/A	**N/A**

Quick Test (Link Direction)	Description	Units	Lower Limit	Measured	Upper Limit	Status
DL	Delta of EQA/DGA Attenuator Test	dB	10	15.16	22	**PASS**
DL	Delta of Pilot Attenuator Test	dB	50	68	200	**PASS**
DL	Delta of ADJ/VVA Attenuator Test	dB	10	15.13	22	**PASS**
DL	Delta of Attenuator Test	dB	5	9.44	15	**PASS**
DL	Delta of Power Amp Test	dB	35	53.65	65	**PASS**
DL	Delta of Powe Detector Test	dB	1	5	20	**PASS**
DL	Delta of Slope Test	dB	1.5	2.14	4	**PASS**
DL	Delta of Long/Short Mode Test	dB	9	12.99	19	**PASS**
UL	Delta of DGA Test	dB	10	15.34	22	**PASS**
UL	Delta of VVA Test	dB	10	16.04	22	**PASS**
UL	Delta of Pilot Attenuator Test	dB	5	24	220	**PASS**
UL	Delta of Pilot Gen Test	dB	5	24	220	**PASS**
UL	Delta of Attenuator Test	dB	5	9.33	15	**PASS**
UL	Delta of Limiter Test	dB	25	38.78	85	**PASS**
UL	Delta of FD Test	dB	65	74.76	100	**PASS**
UL	Delta of FD detector Test	dB	30	113	200	**PASS**
UL	Delta of IF Amp Test	dB	30	#N/A	80	**#N/A**

“Band Sheet”:

UUT Part Number:	7405510	**Date/Time:**	12/6/2001 16:28
UUT Revision:	0A	**Operator Name:**	TL
Test S/W Part Number:	D-740540-0-09	**Test Time:**	0:13:04
Test S/W Revision:	Rev 1.5	**ATE:**	ATE-003
UUT Firmware Revision:	10522	**All Tests Pass:**	TRUE
UUT Serial Number:	13		

Config Test Name	**Description**	**Units**	**Lower Limit**	**Measured**	**Upper Limit**	**Status**
Set DL Slope	Slope Compensation Value	Counts	N/A	128	N/A	N/A
Pilot Calibration Table-LB	Max Gain Value of DL	dB	N/A	34.5	N/A	N/A
	VVA Value for Max Gain of DL	Counts	N/A	3	N/A	N/A
	Test Typical Gain of DL	dB	N/A	28.54	N/A	N/A
	DGA Value for Test Gain of DL	Counts	N/A	15	N/A	N/A
	VVA Value for Test Gain of DL	Counts	N/A	14	N/A	N/A
	Pilot of Max Cable Length Error for DL	Counts	N/A	1	N/A	N/A
	DGA value for Max Gain of DL	Counts	N/A	14	N/A	N/A
	Pilot Table Length of DL	Counts	N/A	14	N/A	N/A
	Short Mode Pilot Table Length of DL	Counts	N/A	8	N/A	N/A
	Gain Adjust Value of DL	dB	N/A	14	N/A	N/A
	Short To Long Mode EQA value of DL	Counts	N/A	23	N/A	N/A
	Long To Short Mode EQA Value of DL	Counts	N/A	8	N/A	N/A
	Gain Typical Difference of DL	dB	N/A	-0.04	N/A	N/A
	Pilot Table	**Address**	**EQA Value**	**Pilot Detect Value**	**Slope Comp. Value**	
		10BC	9	9	9	
		10BF	9	9	9	
		10C2	9	9	9	
		10C5	9	9	9	
		10C8	9	9	9	
		10CB	9	9	9	
		10CE	9	9	9	
		10D1	9	9	9	
		10D4	9	9	9	
		10D7	9	9	9	
		10DA	9	9	9	
		10DD	9	9	9	
		10E0	9	9	9	
		10E3	9	9	9	
		10E6	9	9	9	
		10E9	9	9	9	
		10EC	9	9	9	
		10EF	NOT_RUN	NOT_RUN	NOT_RUN	
		10F2	NOT_RUN	NOT_RUN	NOT_RUN	
		10F5	NOT_RUN	NOT_RUN	NOT_RUN	
Calibration Tone	CalToneDetRF_DL	dBm	32	72	254	**PASS**
	RF Reflect Power Error of DL	Counts	N/A	20	N/A	N/A
	Reflect RF/Forward RF ratio	%	N/A	25	50	**PASS**
	Path Power Min of DL	dBm	N/A	15	N/A	N/A
Set Gain	DGA Value for Gain of UL	Counts	N/A	7	N/A	N/A
	Gain Typical of UL	dB	N/A	30.14	N/A	N/A
Pilot Level	Pilot Level of UL	dBm	N/A	-19.9	N/A	N/A
	VVA Value for Pilot of UL	Counts	13	88	212	**PASS**
	Pilot Generator Target Level of UL	dBm	13	101	242	**PASS**
	Pilot Target Level of UL	dBm	N/A	67	N/A	N/A
Failure Detect Threshold	Failure Detect Error of UL	Counts	N/A	37	N/A	N/A
Alarms	Pilot Error SFByte of DL	Counts	N/A	105	N/A	N/A
	Cal Tone Error SF Byte of DL	Counts	N/A	66	N/A	N/A
	Pilot Error SF Byte of UL	Counts	N/A	105	N/A	N/A
Set Limiter	VVA Value for Limiter1	Counts	N/A	83	N/A	N/A
	VVA Value for Limiter2	Counts	N/A	231	N/A	N/A

Function Test Name	**Description**	**Units**	**Lower Limit**	**Measured**	**Upper Limit**	**Status**
DL Delta of 10dB Attn. On/Off	Delta for 10dB Attn. On/Off of DL	dB	7	9.44	12	**PASS**
DL Noise Figure	Noise Floor of DL	dB	N/A	-121.2	-112	**PASS**
DL Gain and Flatness	Typical Gain of DL	dB	25	28.23	33	**PASS**
	Gain Ripple of DL	dB	N/A	0.37	4.5	**PASS**
DL IP3	IP3 Value of DL	dBm	35	41.95	N/A	**PASS**
DL P1dB	P1dB Value of DL	dBm	22	25.74	N/A	**PASS**
DL LO Leackage	LO Leakage of DL	dBm	N/A	-84.63	-39	**PASS**
DL Phase Noise	Phase Noise 1k off for DL	dB	75	81.96	N/A	**PASS**
	Phase Noise 10k off for DL	dB	95	98.12	N/A	**PASS**
DL Spur Test	Spurs Value of DL	dB	N/A	-69.75	-40	**PASS**
UL Noise Figure	Noise Figure of UL	dB	N/A	7.78	10.5	**PASS**
UL Gain and Flatness	Typical Gain of UL	dB	27	30.14	33	**PASS**
	Gain Ripple of UL	dB	N/A	1.2	4	**PASS**
UL IP3	IP3 Value for UL	dBm	19	28.34	N/A	**PASS**
UL P1dB	P1dB Value for UL	dBm	9	14.29	N/A	**PASS**
UL Phase Noise	Phase Noise 1k off for UL	dB	75	81.11	N/A	**PASS**
	Phase Noise 10k off for UL	dB	95	98.81	N/A	**PASS**
UL Spur Test	Spurs Value of UL	dB	N/A	-73.27	-40	**PASS**

Appendix 2: Quick Test Procedure Steps

The Quick Test procedure is the list of steps in the Quick Test single step in the program. It shows each of step what instrument will be controlled and what settings they use, besides the commands sent to RAU associated with that step. Because of the difference of LB and HB hardware structure, there are 4 tables for LB/DL, LB/UL and HB/DL, HB/UL respectively. Reference the explanation in Quick Test paragraph.

Down Link Quick Test for LB:

Downlink Quick Test (LB)		*Low Limit*	*Meas. (Delta)*	*Up Limit*	*Commd.*	*Remark*
Set up RAU	Set RAU to **Long Cable Mode**	-	-	-	**f 0**	
(DL, Long Mode, No Attenuation, PA on, Slope in middle, All EQA, ADJ to no attenuation)	Select **Band to EGSM**				**b21**	
	Set **DL 10dB Attnu. Off**				**d0**	
	Set **DL PA On** (Disable Shutdown)				**o0**	
	Set Slope **SlopeCompValue = 80**				**s680**	
	Tune to Min Attnu. **GainAdj_DL=00**				**s000**	
	Tune to Min Attnu **DGAGainTest_DL=00**				**s100**	
	Input **-20 dBm @ 117.5 Mhz**					
	Measure RF **Ouput @ 0dB, 942.5MHz**	-15	~-7	-1		*Normal State Ref.*
Test EQA Tuning	**EQA = 1F**				**s01F**	
	Delta Tolarance by Nominal	10	15	20		Nominal:15dB Attnu
	Measure RF **Ouput @ 0dB, 942.5MHz**		~-22.5			
					s000	*Restore*
Test Pilot Detector	input Pilot Sig. **-5 dBm @ 165 Mhz**					
	Read DL Pilot Level		xFF		**s0** (Read a3)	
	Tune **EQA = 1F**				**s01F**	
	Read DL Pilot Level	x2		x19	Read a3 above	
	input Pilot Sig. **-20 dBm @ 165 Mhz**					
	Read DL Pilot Level				**s0** (Read a3)	
	Turn Off Pilot Gen				**s000**	*Restore*
Test ADJ Tuning	**ADJ = 1F**				**s11F**	
	Delta Tolarance by Nominal	10	15	20		Nominal:15dB Attnu
	Measure RF **Ouput @ 0dB, 942.5MHz**	-25.5	~-22.5	-19.5		
					s100	*Restore*
Test 10dB Attnu.	Set **10dB Attnu. On**				**d1**	
	Delta Tolarance by Nominal	5	10	15		Nominal:10dB Attnu
	Measure RF **Ouput @ 0dB, 942.5MHz**	-20	~-17	-14		
					d0	*Restore*
Test PA	Set **PA Off**				**o1**	
	Delta Tolarance by Nominal	35/20(U)	40/30(U)	45/35(U)		Nominal 40dB Gain
	Measure RF **Ouput @ 0dB, 942.5MHz**	-48	~-45	-42		(UMTS 30dB)
					o0	*Restore*
Test Power Detector	Read DL FW/RE power		0F/00		**a2** (Rd a1/0,1)	
	Set **EQA = 1F**				**s01F**	
	Read DL FW/RE power				**a2** (Rd a1/0,1)	
	Delta Tolarance by Nominal	1	10	10		
					s000	*Restore*
Test Slope	Set **Slope = 00**				**s600**	
	Delta Tolarance by Nominal	1	2.5	4		Nominal +/- 2dB tilt
	Measure RF **Ouput @ 0dB, 942.5MHz**	-9	~-7	-5		
					s680	*Restore*
Test Long/Short Mode	Change to **Short Mode**				**f1**	
	Delta Tolarance by Nominal	9	14	19		Nominal:14dB Attnu
	Measure RF **Ouput @ 0dB, 942.5MHz**	-22	~-19.5	-17		
					f0	*Restore*

Up Link Quick Test for LB:

Uplink Quick Test (LB)		***Low Limit***	***Meas. (Delta)***	***Up Limit***	***Commd.***	***Remark***
Set up RAU	Set **UL 10dB attenuator off**	-	-	-	**u0**	
(UL, No Attenuation, No limiting, Pilot Enable off, FD off, Gain Adj. and VVA to no attenuation)	Set **Limiter 1 off**				**s400**	
	Set **Limiter 2 off**				**s500**	
	Set **Pilot Enable off**				**t0**	
	Set **FD off**				**g0**	
	Set **UL Gain Adjust to min attenuation**				**s200**	
	Set **UL VVA to min attenuation**				**s300**	
	Input **-20dBm@897.5Mhz**					
	Measure **IF output@0dBm, 72.5Mhz**	-19	~-16	-13		*Normal State Ref.*
Test UL Gain Adj.	Set **GainAdj_UL = 1F**				**s21F**	
	Delta Tolarance by Nominal	12	(-15+/-3)	18		Nominal:15dB Attnu
	Measure **IF output@0dBm, 72.5Mhz**	-34	~-31	-28		
					s200	*Restore*
Test VVA, Pilot Det. & Pilot Gen Det.	Set **Pilot On**				**t1**	
	Measure **IF output@0dBm, 27Mhz**	-20	~-17	-14		Reference
	Read UL Gen/Pilot Level		FF/FF		**a2**(Rd a2/a5)	
	Set **VVA to Min**				**s3FF**	
	Delta Tolarance by Nominal	12	(-15+/-3)	18		Nominal:15dB Attnu
	Measure **IF output@0dBm, 27Mhz**	-36	~-33	-30		
	Read UL Gen/Pilot Level		20/2A		**a2**(Rd a2/a5)	
					s300,t0	*Restore*
Test Attenuator	Set **10dB Attnu. On**				**u1**	
	Delta Tolarance by Nominal	7	(-10+/-3)	13		Nominal:10dB Attnu
	Measure **IF output@0dBm, 72.5Mhz**	-28	~-25	-22		
					u0	*Restore*
Test Limiters	Set **Limiter 1, 2 to Max**				**s5FF,s4FF**	
	Delta Tolarance by Nominal		(-50+/-3)			No Nominal Value
	Measure **IF output@0dBm, 72.5Mhz**	-68	~-65	-62		
					s400,s500	*Restore*
Test FD	Measure **IF output@0dBm, 66Mhz**		~-78			Reference
	Read FD Detector		05		**a2**(Read a5)	
	Enable FD				**g1**	
	Measure **IF output@0dBm, 66Mhz**	-15	~-12	-9		
	Read FD Detector		16		**a2**(Read a5)	
					g0	*Restore*

1. All SA span is 1MHz.

Down Link Quick Test for HB:

Downlink Quick Test (HB)		*Low Limit*	*Meas. (Delta)*	*Up Limit*	*Commd.*	*Remark*
Set up RAU			-	-	-	
(DL, No Attenuation, PA on, Slope in middle, All DGA, VVA to no attenuation)	Select **Band to DCS**					**b51**
	Set **DL 10dB Attnu. Off**					**d0**
	Set **DL PA On**					**o1**
	Set Slope **SlopeCompValue = 80**					**s680**
	Tune to Max Gain. **DGA_DL=0F**					**s00F**
	Tune to Max Gain **VVA_DL=FF**					**s1FF**
	Input **-20 dBm @ 156.25 Mhz**					
	Measure RF **Ouput @ 0dB,**	*Normal State*	-15	~-4.5	-1	
Test DGA Tuning & Pilot Det.	**DGA_DL=00**					**s000**
	Delta Tolarance by Nominal	Nominal:30dB	25	30	35	
	Measure RF **Ouput @ 0dB,**			~-34		
		Restore				**s00F**
Test Pilot Detector	input Pilot Sig. **-5 dBm @ 105 Mhz**					
	Read DL Pilot Level			xFF		**a3** (Read a3)
	Tune DGA **= 00**					**s000**
	Read DL Pilot Level		x32		x82	**a3** (Read a3)
	input Pilot Sig. **-20 dBm @ 165 Mhz**					
	Read DL Pilot Level					**a3** (Read a3)
	Turn Off Pilot Gen	*Restore*				**s00F**
Test VVA Tuning	**DGA_DL=00**					**s100**
	Delta Tolarance by Nominal	Nominal:30dB	25	30	35	
	Measure RF **Ouput @ 0dB,**		-37	~-34	-31	
		Restore				**s1FF**
Test 10dB Attnu.	Set **10dB Attnu. On**					**d1**
	Delta Tolarance by Nominal	Nominal:10dB	5	10	15	
	Measure RF **Ouput @ 0dB,**		-16	~-13	-10	
		Restore				**d0**
Test PA	Set **PA Off**					**o0**
	Delta Tolarance by Nominal	Nominal:30dB	25	30	35	
	Measure RF **Ouput @ 0dB,**		-37	~-34	-31	
		Restore				**o1**
Test Power Detector	Read DL FW/RE power			x0A/01		**a3**(Rd a4/0,1)
	Set **DGA = 00**					**s000**
	Read DL FW/RE power			x00/00		**a3**(Rd a4/0,1)
	Delta Tolarance by Nominal	Nominal:10dB	1		10	
		Restore				**s1FF**
Test Slope	Set **Slope = 00**					**s600**
	Delta Tolarance by Nominal	Nominal +/-	1	2.5	4	
	Measure RF **Ouput @ 0dB,**		-6	~-4	-2	
		Restore				**s680**

Up Link Quick Test for HB:

Uplink Quick Test (HB)		*Low Limit*	*Meas. (Delta)*	*Up Limit*	*Commd.*	*Remark*
Set up RAU	Set **UL 10dB attenuator off**	-	-	-	**u0**	
(UL, No Attenuation, No limiting, Pilot Enable off, FD off, Gain Adj. and VVA to no attenuation)	Set **PA on**	-	-	-	**f1**	
	Set **Limiter 1 off**				**s400**	
	Set **Limiter 2 off**				**s500**	
	Set **Pilot Enable off**				**t0**	
	Set **FD off**				**g0**	
	Set **DGA_UL to min attenuation**				**s21F**	
	Set **VVA _UL to min attenuation**				**s3FF**	
	Input **-20dBm@1728.75Mhz**					
	Measure **IF output@0dBm, 61.25Mhz**	-20	~-17	-14		*Normal State Ref.*

Test UL Gain Adj.	Set **DGA_UL = 00**				**s200**	
	Delta Tolarance by Nominal	-18	(-15+/-3)	-12		Nominal:15dB Attnu
	Measure **IF output@0dBm, 61.25Mhz**	-35	~-32	-29		
					s21F	*Restore*

Test VVA, Pilot Det. & Pilot Gen Det.	Set **Pilot On**				**t1**	
	Measure **IF output@0dBm, 27Mhz**	-22	~-19	-16		Reference
	Read UL Gen/Pilot Level		FF/FF		**a3**(Read a5/a6)	
	Set **VVA to Min**				**s300**	
	Delta Tolarance by Nominal	-35	(-30+/-5)	-25		Nominal: 30dB Attnu.
	Measure **IF output@0dBm, 27Mhz**	-56	~-53	-50		
	Read UL Gen/Pilot Level		04/03		**a3**(Read a5/a6)	
					s3FF,t0	*Restore*

Test Attenuator	Set **10dB Attnu. On**				**u1**	
	Delta Tolarance by Nominal	-13	(-10+/-3)	-7		Nominal:10dB Attnu
	Measure **IF output@0dBm, 61.25Mhz**	-30	~-27	-24		
					u0	*Restore*

Test Limiters	Set **Limiter 1, 2 to Max**				**s5FF,s4FF**	
	Delta Tolarance by Nominal		(-50+/-4)			No Nominal Value
	Measure **IF output@0dBm, 61.25Mhz**	-74	~-70	-66		
					s400,s500	*Restore*

Test FD	Measure **IF output@0dBm, 66Mhz**	-81	~-78	-75		Reference
	Read FD Detector		75		**a3**(Read a7)	
	Enable FD				**g1**	
	Measure **IF output@0dBm, 66Mhz**	-14	~-11	-8		
	Read FD Detector		FF		**a3**(Read a7)	
					g0	*Restore*

1. All SA span is 1MHz.