

User Guide

2300-480

VNA System Performance Verification Software

37000C, 37000D, 37000E Series Vector Network Analyzers

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Chapter 1 — General Information

1-1 Introduction

This manual supports the Anritsu 37000 Series VNA System Performance Verification Software, GPRG# 63420. This software is used with the Anritsu 37000 Series Vector Network Analyzers. The manual is organized into five chapters and three appendices, as shown below:

- [Chapter 1, “General Information”](#)
- [Chapter 2, “Configuring the System”](#)
- [Chapter 3, “Configuring the Program”](#)
- [Chapter 4, “Running the Program”](#)
- [Chapter 5, “Troubleshooting”](#)
- [Appendix A, “GPIB Interface and Instrument Settings”](#)
- [Appendix B, “Example of Test Results”](#)
- [Appendix C, “Allowable VNA Calibration Kit Verification Kit Combinations”](#)

1-2 Verification Software Overview

This section provides a brief overview of the Anritsu 2300-480 VNA System Performance Verification Software.

Software Medium

The Anritsu 2300-480 VNA System Performance Verification Software is provided on a PC-compatible CD-ROM disk.

Capability

The verification software provides for automating measurements of the test components contained in an Anritsu Verification Kit.

It compares the measurements made on your instrument with the test component data provided in each verification kit. This will aid in determining if the measurement values are consistent with system specifications.

Data Output

The test data and results are output in the form of four files to a folder (C:\mmdcsvc\63420.10x) on the hard drive of the computer controller. The default file names, depending on the type of test being performed, are:

- AIR.DAT
- BEATTY.DAT
- 20DB.DAT
- 4050DB.DAT

Note

The tabular data in each file is given at discrete frequencies at 1 GHz intervals, along with separate start and stop frequencies if the start and stop frequencies do not fall on 1 GHz spacing. The test results can be viewed or printed from the “Main menu” window.

1-3 Required Equipment

This section describes the required and recommended equipment for installing and running the Anritsu 2300-480 VNA System Performance Verification Software.

System Controller PC Minimum Requirements

- Intel Pentium III Microprocessor or equivalent (Intel Pentium IV recommended)
- 1 GByte RAM
- 20 MByte hard disk free space
- National Instruments GPIB Controller and associated driver installed
- Display with 1024 x 768 resolution
- CD-ROM drive
- 3.5 inch Floppy drive
- USB Port
- Microsoft Windows XP Operating System software, SP3

Note	This software application may not function on international versions of Windows that use double-byte character sets. It has not been tested on Microsoft Windows Vista and Windows 7 Operating System.
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GPIB Interface Hardware and Cable

Depending on the PC hardware used to perform the system performance verification, there are different requirements for the GPIB hardware configurations. This software supports the following GPIB interfaces:

- Notebook with PCMCIA slot – National Instruments Model PCMCIA-GPIB (Driver Version 1.2 and above)
- Desktop with PCI bus – National Instruments Model PCI-GPIB (Driver Version 1.2 and above)

Note	A GPIB Interface Cable – Anritsu 2100-2 is required when a Desktop PC controller is used.
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Regardless of which GPIB hardware is used, the GPIB adapter card must be configured as “GPIB0”.

Instrument

This software application can be used to verify the following Anritsu Vector Network Analyzers:

- 37200C Series Vector Network Analyzers
- 37300C Series Vector Network Analyzers
- 37200D Series Vector Network Analyzers
- 37300D Series Vector Network Analyzers
- 37200E Series Vector Network Analyzers
- 37300E Series Vector Network Analyzers

Calibration Kit

Depending on the VNA port connector type, one of the following Anritsu Calibration Kits is needed for system performance verification:

- 3650-1 or 3650A-1 3.5 mm Connector Calibration Kit (with Sliding Loads)
- 3651-1 GPC-7 Connector Calibration Kit (with Sliding Loads)
- 3652-1 or 3652A-1 K Connector Calibration Kit (with Sliding Loads)
- 3653 N Connector Calibration Kit
- 3654B, 3654C-1 or 3654D-1 V Connector Calibration Kit (with Sliding Loads)

Verification Kit

Depending on the VNA port connector type, one of the following Anritsu Verification Kit is needed for system performance verification:

- 3663 N Connector Verification Kit
- 3666 3.5 mm Connector Verification Kit
- 3667 GPC-7 Connector Verification Kit
- 3668 K Connector Verification Kit
- 3669B V Connector Verification Kit

Note

The VNA Port, Calibration Kit, and Verification Kit must be of the same connector type for valid system performance verification.

Coaxial Test Port Cables

A test port extension cable with length of 24 inch (61 cm) long is required to extend VNA Port 2 during system performance verification. The following cables are supported:

- 3670A50-2 GPC-7 Test Port Cable, 24 inches (61 cm)
- 3670K50-2 K(f) - K(m) Test Port Cable, 24 inches (61 cm)
- 3670NN50-2 N(m) to N(m) Test Port Cable, 24 inches (61 cm)
- 3670V50A-2 V(f) to V(m) Test Port Cable, 24 inches (61 cm)
- 3671K50-2 K(f) - K(m) Test Port Cable, 38 inches (96.5 cm)
- 3671V50B-2 V(f) - V(m) Test Port Cable, 38 inches (96.5 cm)

Printer

A printer is not required for operation as the verification results and data are stored in four files on the computer hard disk drive. These files are saved in ASCII format for easy viewing and printing.

Chapter 2 — Configuring the System

2-1 Introduction

This chapter describes how the various system elements are interconnected and provides the preliminary steps required for operation of the verification software.

2-2 Hardware Interconnection

Refer to [Figure 2-1](#) during the following setup procedure:

1. Connect one end of the GPIB interface cable to the computer's GPIB port.
2. Connect the other end of the cable to the instrument GPIB port labeled **IEEE488.2 GPIB**.
Do not connect the cable to the instrument GPIB port labeled **Dedicated GPIB**.
3. Install a phase equal insertible (PEI) adapter on Port 1 such that a female connector is available for use. This step does not apply to GPC-7 connectors, which are genderless.
4. Connect a Test Port cable to Port 2 such that a male connector is available for use.
5. For 3.5 mm, K, and V connector types, install a phase equal insertible (PEI) adapter to the open end of the Test Port cable.

Note The phase equal insertible (PEI) adapter provides tight pin depth tolerance that is required at the connector interface for performing system performance verification.

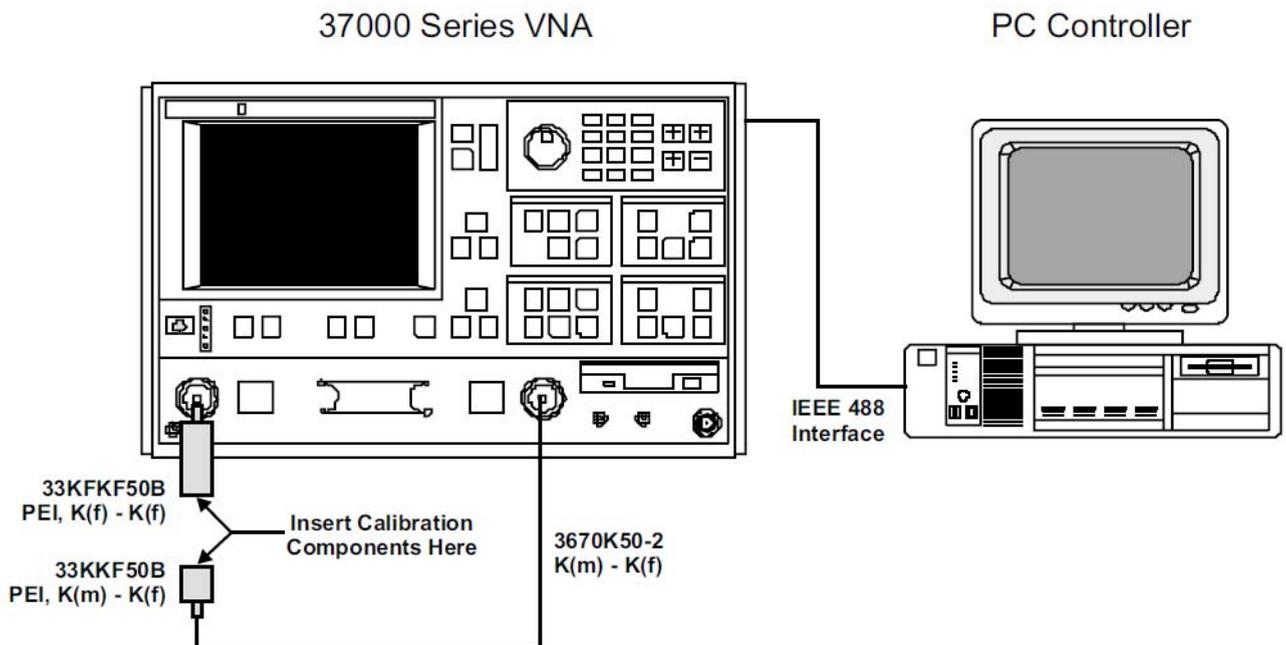


Figure 2-1. VNA Calibration and Measurement Setup

2-3 Software Installation

The setup program copies program files to the computer into the directory of your choice (you will be prompted for the destination directory). When the setup program is completed, the program may or may not want to restart Windows, depending on if there were any files in use (usually DLLs) at the time of the installation.

Procedure

1. Insert the Software Application CD-ROM disk into the computer's CD-ROM drive.
2. The installation program should run automatically. If the installation program does not start automatically, then navigate to the CD directory and double-click the file named **Startup.exe** to begin the installation process.
3. Follow the on-screen installation instructions.

Chapter 3 — Configuring the Program

3-1 Introduction

The performance verification software runs in a Windows environment as described below. Note that the actual appearance may vary slightly in relation to the operating system configuration.

3-2 Starting the Program

With the equipment and software configured as described in [Chapter 2](#), turn on the computer and allow it to boot up to Windows. Double click the 37000 Verification Software desktop icon as shown in [Figure 3-1](#).



Figure 3-1. Performance Verification Software Windows Desktop Icon

The program launcher menu is then displayed (shown in [Figure 3-2](#)).

Click **Verify a 37000 VNA** to start the verification program.



Figure 3-2. Program Launcher Menu

The program will then display an **About** dialog box with the version information (shown in [Figure 3-3](#)). Press the **Enter** key or click the **Ok** button to continue.

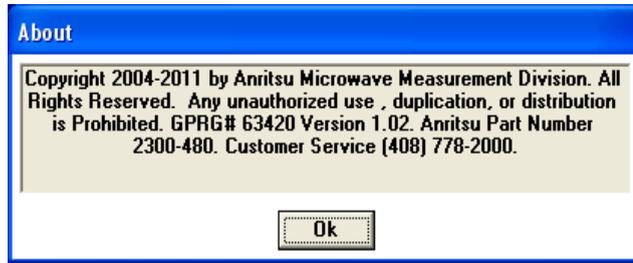


Figure 3-3. About Dialog Box

3-3 Program Initialization

A new dialog box, as shown in [Figure 3-4](#), prompts you to enter your name.

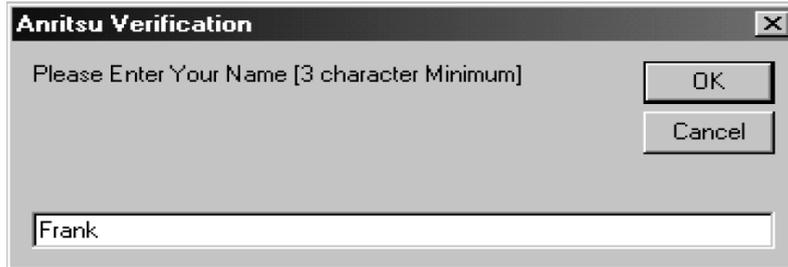


Figure 3-4. Name Request Text Box

After you enter your name, the program displays **GPIB Interface Check** dialog box ([Figure 3-5](#)) and starts to check for a GPIB adapter at the location GPIB0.

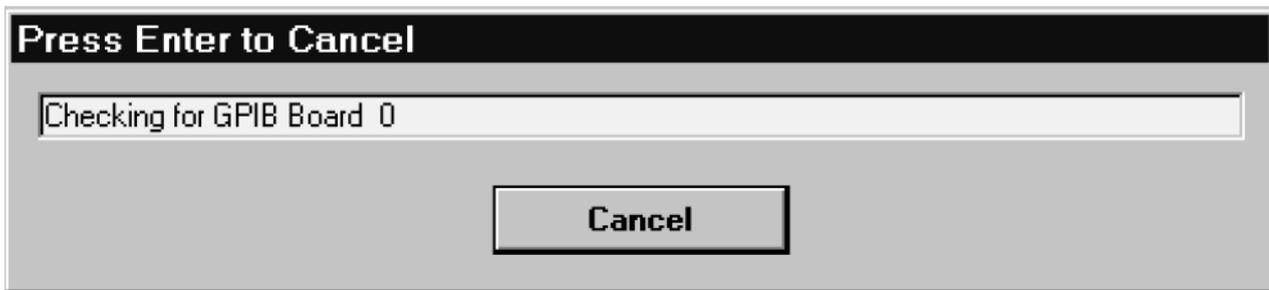


Figure 3-5. GPIB Interface Check Dialog Box

If the program finds a GPIB adapter at GPIB0, a dialog box (Figure 3-6) appears.



Figure 3-6. Found GPIB Dialog Box

If the program does not find a GPIB adapter at GPIB0, or if you click **No** in the dialog box above, the program will terminate. Click **Yes** to continue.

Next, the program starts searching the GPIB bus for an Anritsu 37000 Series VNA instrument and display the **VNA Search** dialog box as shown in Figure 3-7. If the program finds additional VNA instruments, the program will skip those instruments without any response required from you.

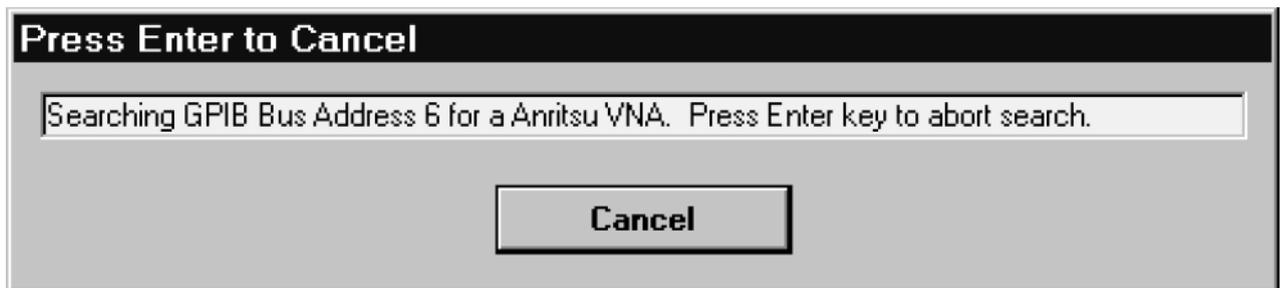


Figure 3-7. VNA Search Dialog Box

If the program finds a VNA, it displays a dialog box as shown in Figure 3-8 to ask for your confirmation to use the instrument for the verification. If there are multiple instruments on the GPIB, and this instrument is not the one you want to use, then you should click **No** so the program will look for another instrument on the GPIB.

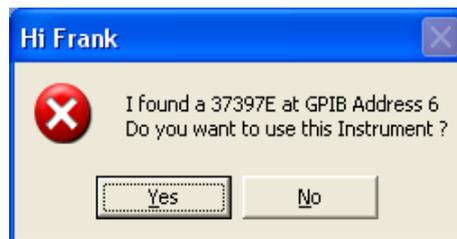


Figure 3-8. Instrument Confirmation Dialog Box

If you answer **No** to the above, the program will respond by searching for another instrument.

If the program did not find an instrument on the GPIB, the program displays a dialog box as shown in [Figure 3-9](#) to tell you that it did not find an Anritsu VNA and then exit the program.



Figure 3-9. Instrument Not Found Dialog Box

If there is an instrument on the GPIB and the program did not find it, then a problem exists somewhere in the system. Check the GPIB interface cables to make sure they are properly connected and check the GPIB system to verify that it is operating properly. If this does not alleviate the problem, there could be something wrong with the GPIB system or the instrument.

If you click **Yes** in the **Instrument Confirmation** dialog box, the program displays the **Calibration Kit Type** frame as shown in [Figure 3-10](#).

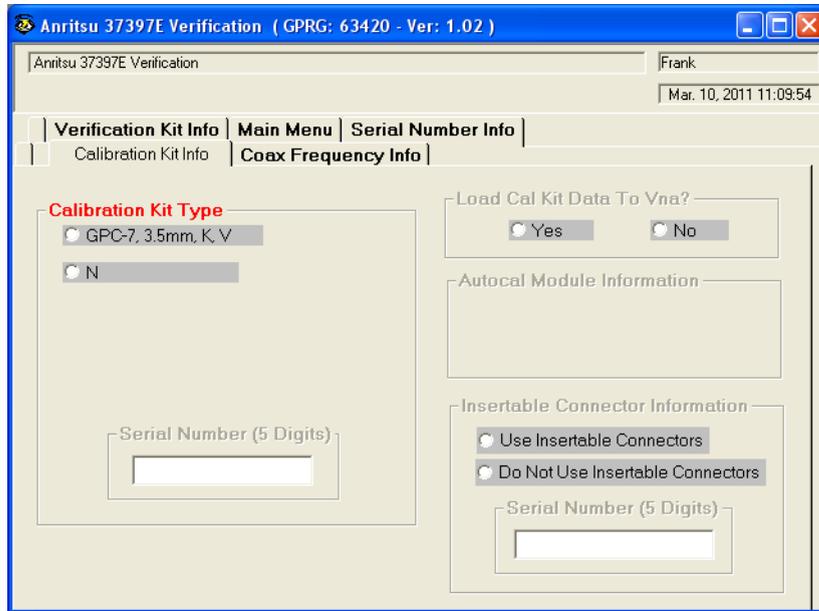


Figure 3-10. Calibration Kit Type Frame

In this section of the program, items that are determined by the program to be complete enough to continue to the next step will have the frame's text label change color from red to green to give you an indication to proceed.

If the next item is a text box that needs to be filled in, the program will automatically move the cursor to that text box.

If the next item is a multiple choice item, the program enables the choice's frame box and turns the label of the box red to draw your attention. After you make a selection, the program continues in this fashion until enough information has been entered to perform a calibration.

Note

At that point, the **Setup Calibration of VNA** button will appear so you can start the actual calibration of the instrument. You will have a chance to confirm the information that was input before proceeding with the calibration. Also, at any time up until the confirmation of the information input, you can go back to any stage of the setup and change items you wish to change by selecting the appropriate tab and making the changes.

Please note that changing some choices may cause other information to have to be re-entered. For example, if you select a different calibration kit type, you will also have to re-enter the information about the calibration kit.

The calibration kit has a coefficients disk or USB memory device. Insert the disk into the instrument's disk drive, or insert the USB memory device into the instrument's front panel USB port.

After the serial number of the calibration kit is entered, the **Load Cal Kit Coefficient** title will change to RED color as shown in [Figure 3-11](#). Click **Yes**, and then follow the on-screen instructions on the PC to load the calibration kit coefficients into the VNA.

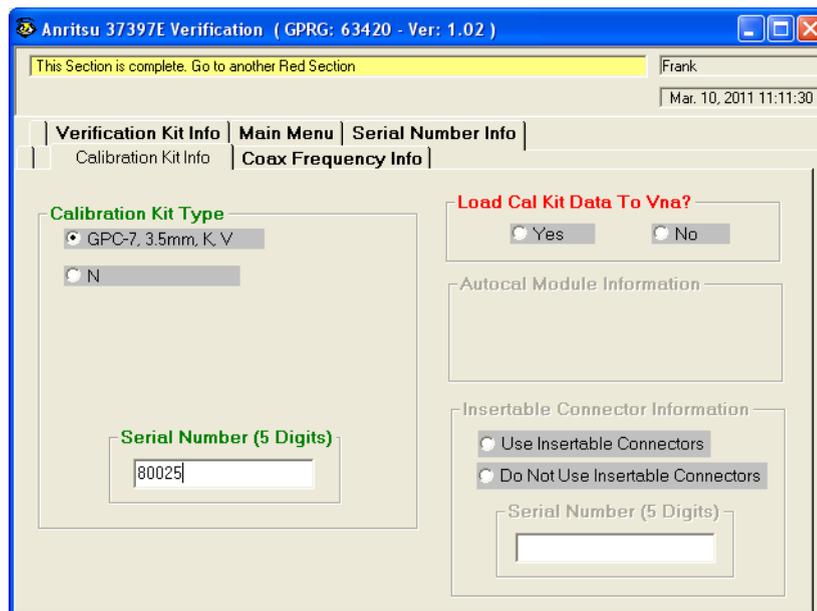


Figure 3-11. Calibration Kit Type Frame

The next step is gathering the verification kit information. The program displays the Verification Kit type frame as shown in [Figure 3-12](#). Some items will be disabled depending on the choices that were made in earlier menus.

At this point, insert the 3.5-inch data disk from the verification kit into the PC floppy drive.

Note Anritsu 366x Series Lightning Verification Kits provide the characterization data on a 3.5 inch floppy disk only. The contents of the data disk can be transferred to a data folder on a USB memory device, if desired.

Pick the verification kit type, select the calibration kit model, enter the verification kit serial number, and select the Drive or Path of the verification kit data.

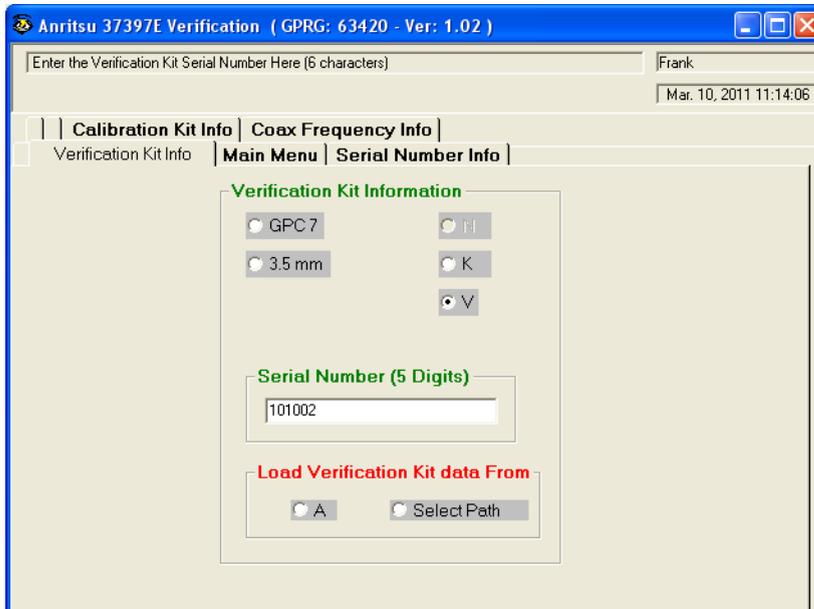


Figure 3-12. Verification Kit Type Frame

Once the verification kit data has been checked, the **Setup Calibration of VNA** button will appear as shown in [Figure 3-13](#).

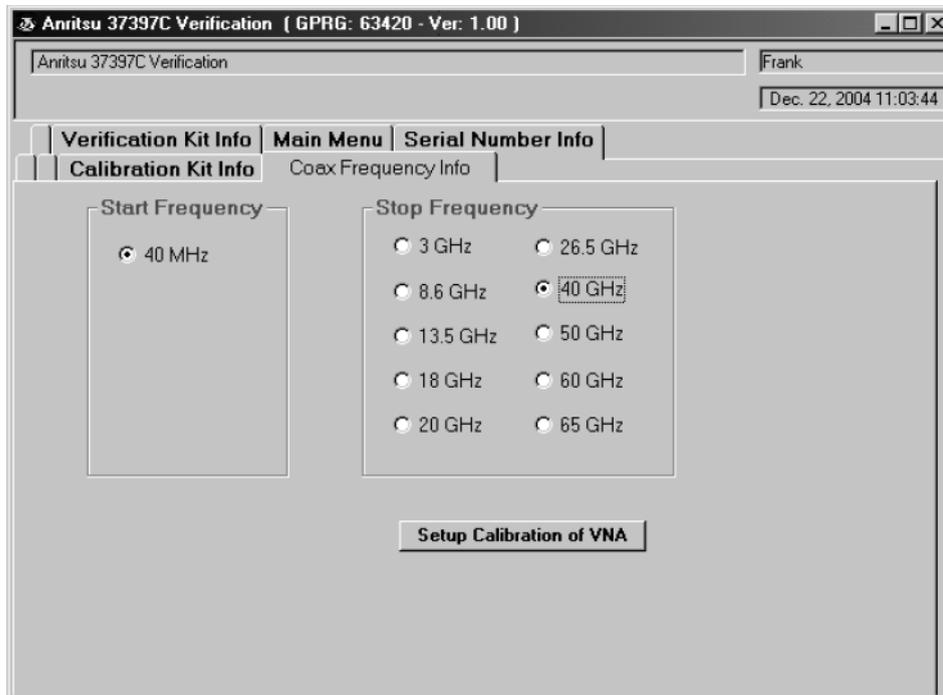


Figure 3-13. VNA Setup Information Frame

When you click the **Setup Calibration of VNA** button, a dialog box as shown in [Figure 3-14](#) appear to request your confirmation that the information entered is correct. If you click **No**, the program returns to the setup menu so that you can check or change items.

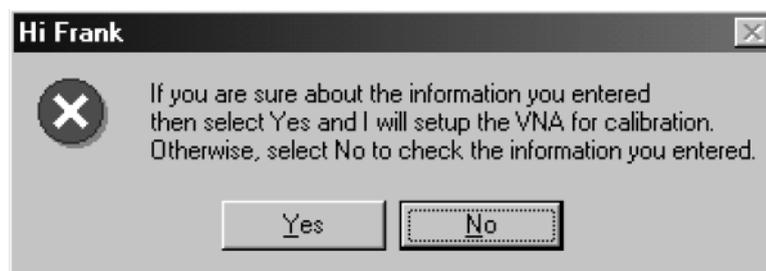


Figure 3-14. Calibration Setup Information Confirmation Dialog Box

If you click **Yes**, the program will setup the VNA according to the input supplied.

Next, a new dialog box as shown in [Figure 3-15](#) provides calibration instructions.

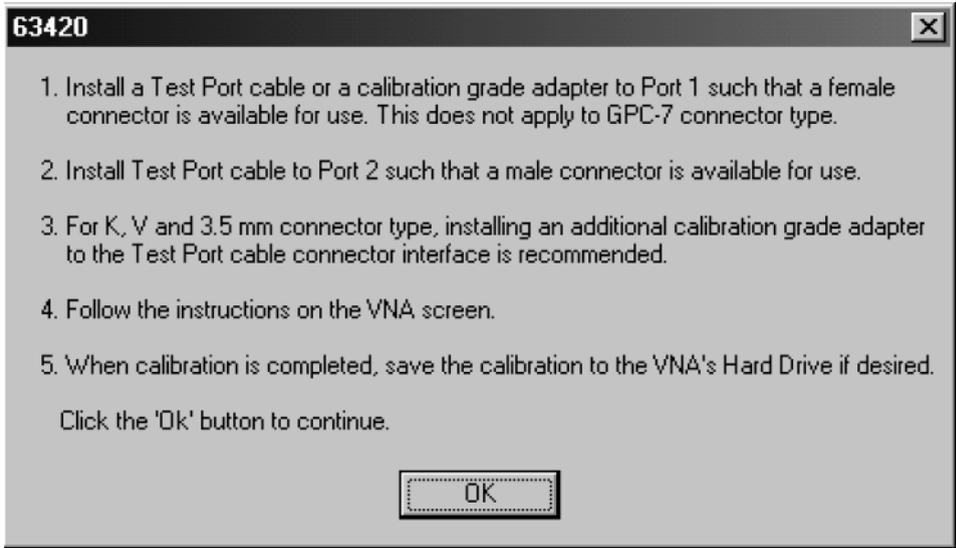


Figure 3-15. VNA Calibration Instruction Dialog Box

After the VNA has been calibrated, clicking the **OK** button in the above dialog box causes the program to set up the VNA for running the tests on the verification devices and display the Main Menu as shown in [Figure 3-16](#).

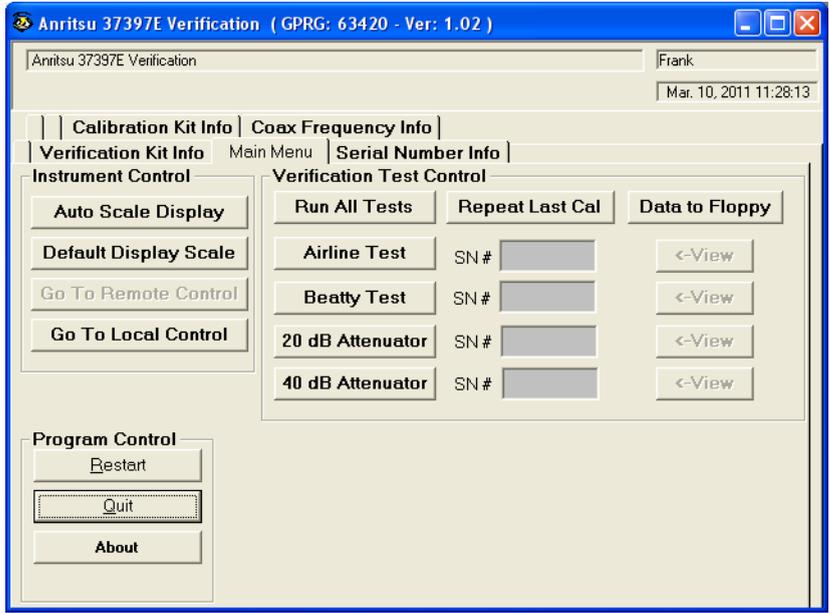


Figure 3-16. Main Menu

Program initialization is now complete.

Chapter 4 — Running the Program

4-1 Introduction

This chapter provides information about the Main Menu of the performance verification software and how it relates to the verification kit device measurements.

4-2 Running the Program

While the program is executing a command from the Main Menu (Figure 4-1), the buttons will be disabled until the currently executing command is finished. This is necessary due to the event driven nature of Windows. Also, while a command is being executed, informational messages may be displayed on the screen.

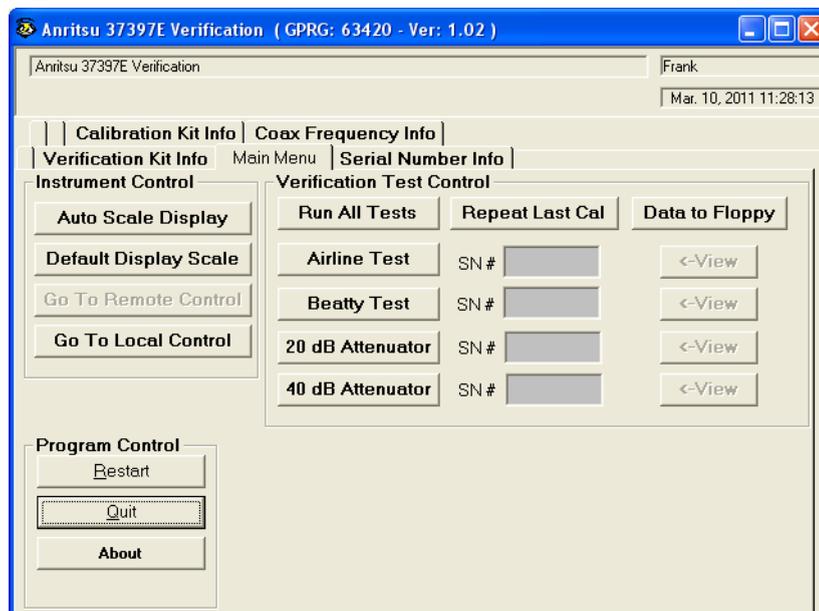


Figure 4-1. Main Menu

If a device passes, the serial number text turns **GREEN**. If a device fails, the serial number turns **RED**. If a test for a device was canceled before a pass-fail status could be established, the serial number text turns **WHITE**. If a device has not been tested, there will be no entry for the serial number. However, a device's serial number may be entered before testing by double clicking a device serial number text box.

The test results, pass or fail, are displayed in a dialog box as shown in Figure 4-2 and in the **Verification Test Control** frame.



Figure 4-2. Device Passed Information Dialog Box

Initially, if a device failed, the program displays the number of points that failed and asks if you would like to recheck those points as shown in [Figure 4-3](#).

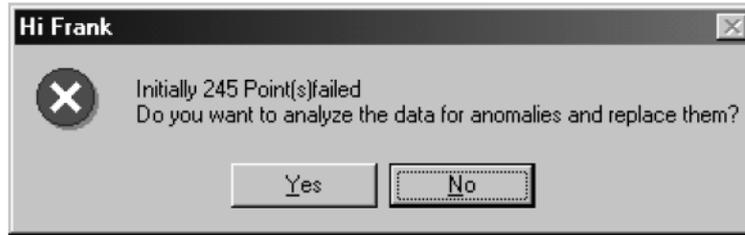


Figure 4-3. Result Recheck Dialog Box

If **Yes**, the points will be rechecked. If they now pass, the device is considered good and will be passed; otherwise, if the points cannot be resolved, the device has failed.

4-3 Commands

The Main Menu consists of three frames:

- [Program Control Frame](#)
- [Instrument Control Frame](#)
- [Verification Test Control Frame](#)

Each frame contains buttons to control various program operations.

Program Control Frame

Quit

Clicking **Quit** will bring up a confirmation dialog.

Clicking **Yes** will exit the program; clicking **No** will return to the previous screen.

Restart

This button allows you to change the instrument to test, the frequency range, or the selected verification kit. Clicking **Yes** will cause the program to return to the configuration stage.

About

Displays version information, copyright, other legal notices, and company contact information.

Instrument Control Frame

Auto Scale Display

This button automatically scales each channel on the Anritsu Vector Network Analyzer. It is the same as selecting a front panel **Channel** button, and then pushing the front panel **Auto Scale** button for each channel.

Note When the program detects that the Vector Network Analyzer has finished a sweep, the program will auto scale all four channels before continuing.

Default Display Scale

This button sets all four channels to a scale of 15 (dB or Unit)/Div and the reference value to 0. This will allow you to see if the device is remotely or properly connected.

Go To Remote Control

This button is only available after you have clicked the **Go To Local Control** button. When you push this button, the program takes control of the Vector Network Analyzer (VNA) and restores the VNA to the same state it was in after the instrument was calibrated.

Go To Local Control

This button allows you access to the front panel buttons while the program is running. The instrument is in Local Lock Out unless this button is pushed. Local Lock Out prevents an inadvertent front panel button presses from affecting the proper operation of the program.

Verification Test Control Frame

Run All Tests

This button will run all of the tests (Airline, Beatty, 20 dB Attenuator, 50 dB Attenuator [or 40 dB Attenuator for V connectors]) in order. You will be prompted for information as required.

Airline Test

This button will run an airline test only and then display the results.

Beatty Test

This button will run a beatty test only and then display the results.

20 dB Attenuator

This button will run a 20 dB attenuator test only and then display the results.

50 dB Attenuator or 40 dB Attenuator

This button will run a 50 dB attenuator test or a 40 dB attenuator test only, and then display the results.

Data to Floppy

This button will write the data files of the last set of tests that were run to the same floppy disk drive in which the verification kit disk is located. You will be prompted to remove and reinsert the verification kit disk at the proper time. Until all tests have finished, the program will not write data to the verification kit disk even if the disk is not write-protected.

Repeat Last Cal

This button will recalibrate the VNA according to the **current** calibration. This provides a way to quickly recalibrate the VNA without having to reset the program parameters in case of the original calibration being flawed.

View

These buttons allow you to view or print the test results without the use of an external program.

4-4 Running a Test

This section presents the typical test scenario.

Note In this section, the testing of a 20 dB attenuator device is used as an example. If any other device is tested, the program will respond in a similar manner, except the word **20 dB Attenuator** will be replaced with the name of the device (for example, **50 dB Attenuator**) as appropriate.

When the **Run All Tests** or other button is pressed, the program can respond in one of two ways:

- If no device has previously been tested, the program prompts you for the serial number of the device to be tested.
- If the device has previously been tested, the program prompts to determine if the test is to be run on the same or a different device.

Clicking **Yes** displays the dialog to input the serial number for the new device. Clicking **No** displays the device's connection dialog as shown in [Figure 4-4](#).

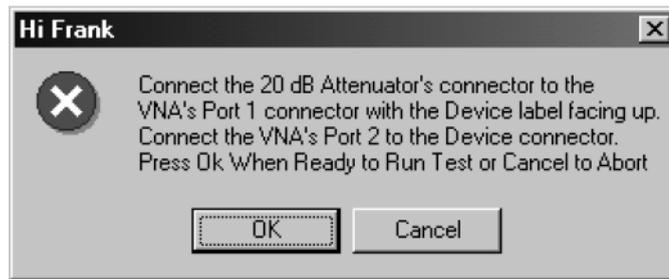


Figure 4-4. Device Installation Instruction Dialog Box

When you click the **OK** button, an **Abort Test** dialog box is displayed showing the test progress. At this point, if you choose to abort the test, the measurement data will be discarded. The program will not stop after the first sweep since the VNA will automatically do two sweeps.

The instrument will finish the current sweep, and then return to the Main Menu. When the test is finished, the program will get the test data from the VNA, read in the data from the verification kit disk, calculate the uncertainties, inform you if the device passed or failed, then write the measurements to the data files. If the device failed, the program will display the number of points that failed the test and prompt you to retest the specific failed points.

Note that the larger the number of failed points, the longer it will take to recheck them. If there are a large number of failed points, then rechecking those points might be skipped; there is probably something else wrong, such as bad or worn connectors or devices.

After all tests are run, the program then writes the measurements to the data files. The data files are located in C:\mmdcsvc\63420.10x folder. The respective file names are as follows:

- 20db.dat
- 4050db.dat
- airline.dat
- beatty.dat

Note These files will be overwritten if new tests are run. Copy them to a different location on the hard disk if backup copies of these files are required.

After saving the data, the program will return to the Main Menu.

Chapter 5 — Troubleshooting

5-1 Introduction

This chapter provides information on how to troubleshoot common problems during system verification.

5-2 Difficulty Running the Program

If you have difficulty getting the program to run properly:

1. Check your GPIB interconnection cables and addresses.
2. Check to see if National Instruments GPIB software is installed in Windows, if it is properly configured, and if it passes the National Instruments hardware and software tests.
3. This version of the verification software must be installed with the install program on the CD-ROM. The program will not run if it is just copied from the CD-ROM to the hard disk.
4. Ensure that, after launching the performance verification software, the verification kit data disk is installed in drive A (or PC's floppy drive) and that it contains the following files:

AIRLINE.S21, AIRLINE.S11, AIRLINE.S12, AIRLINE.S22
BEATTY.S21, BEATTY.S11, BEATTY.S12, BEATTY.S22
DB20.S21, DB20.S11, DB20.S12, DB20.S12, DB20.S22
DB4050.S21, DB4050.S11, DB4050.S12, DB4040.S22

If, after checking the above, you are still having difficulty, contact your local Anritsu Service Center for further assistance.

5-3 Difficulty Meeting System Specifications

If the verification software appears to run properly, but the results are not within the measurement limits associated with the verification kit:

1. Check both the verification kit and calibration kit devices for signs of physical damage. Make sure that the connectors are clean.
2. Ensure that the serial number of the verification kit data disk (or USB memory device) matches that shown on the verification kit.
3. Repeat the process with a fresh calibration. Save the results of both measurements as an aid in troubleshooting in case you require assistance from an Anritsu Service Center.
4. When installing calibration devices and when measuring verification devices, pay particular attention to proper alignment and torque. Torque the connectors using the torque wrench supplied with the calibration kit.

If you still have difficulty after following the above steps, contact your local Anritsu Service Center for further assistance.

Appendix A — GPIB Interface and Instrument Settings

A-1 GPIB Interface Settings

The following are the recommended settings:

- Primary Address = 0
- Secondary Address = None or 0
- Timeout Setting = 10 seconds
- Terminate Read on EOS = No or Unchecked
- Set EOI with EOS on Writes = Yes or Checked
- Type of compare on EOS = 8 bit
- EOS Byte = 0Ah or decimal 10
- Send EOI at end of Write = Yes or Checked
- System Controller = Yes or Checked
- Assert REN when SC = Yes or Checked
- Enable Auto Serial Polling = No or Unchecked
- Enable CIC protocol = No or Unchecked
- Bus Timing = 2 seconds
- Parallel Poll Duration = Default

The following settings may vary depending on the GPIB Interface type and Operating System selected:

- Use this GPIB Interface = Yes or Checked
- Board Type = your board type (PCI, PCMCIA, etc.)
- Base I/O Address = consult the GPIB interface manual
- DMA Channel = consult the GPIB interface manual
- Interrupt Level = consult the GPIB interface manual

A-2 Instrument Settings

The following are the recommended settings:

- Primary Address = 6
- Secondary Address = None or 0
- Timeout Setting = 10 seconds
- Serial Poll Timeout = 1 second
- Terminate Read on EOS = No or Unchecked
- Set EOI with EOS on Writes = Yes or Checked
- Type of compare on EOS = 8 bit
- EOS Byte = 0Ah or decimal 10
- Send EOI at end of Write = Yes or Checked
- Enable Repeat Addressing = No or Unchecked

Appendix B — Example of Test Results

B-1 Example of Test Results

Anritsu Verification Version 1.00
 VNA Model : 37369A VNA Serial Number : 024701
 Calibration Kit Model Number : 3652-1 Calibration Kit Serial Number : 70072
 Verification Kit Model Number : 3668 Verification Kit Serial Number : 80079
 Date :12/07/2004 11:14:41 AM Operator : Frank
 20 dB Attenuator Serial Number : 981201

Freq GHz	S21 Magnitude					S21 Phase				
	STD (dB)	MEAS (dB)	DIFF S-M	UNC +/-	Pass Fail	STD DEG	MEAS DEG	DIFF S-M	UNC +/-	Pass Fail
.04	.0064	-.0083	.0147	.3015		-3.6567	-3.6024	-.0543	1.1438	
1.00	-.0460	-.0383	-.0077	.3016		-90.3637	-90.3360	-.0276	1.3242	
2.00	-.0561	-.0594	.0033	.3017		179.4692	179.4530	.0162	1.5191	
3.00	-.0635	-.0657	.0023	.3018		89.3142	89.3134	.0009	1.7188	
4.00	-.0719	-.0713	-.0006	.3019		-.8616	-.8938	.0322	1.9218	
5.00	-.0787	-.0759	-.0028	.3021		-91.0497	-91.1154	.0657	2.1271	
6.00	-.0875	-.0866	-.0009	.3022		178.7762	178.7597	.0166	2.3342	
7.00	-.0918	-.0893	-.0026	.3024		88.6008	88.6360	-.0352	2.5426	
8.00	-.0981	-.0966	-.0015	.3025		-1.5451	-1.5991	.0540	2.7519	
9.00	-.1021	-.1084	.0063	.3027		-91.6919	-91.6728	-.0190	2.9621	
10.00	-.1081	-.1066	-.0015	.3028		178.1845	178.1203	.0642	3.1729	
11.00	-.1206	-.1100	-.0105	.3030		88.0248	87.9991	.0257	3.3842	
12.00	-.1174	-.1182	.0007	.3032		-2.1386	-2.1649	.0263	3.5960	
13.00	-.1174	-.1146	-.0028	.3034		-92.2295	-92.3164	.0869	3.8081	
14.00	-.1270	-.1336	.0066	.3036		177.6046	177.5089	.0957	4.0205	
15.00	-.1332	-.1288	-.0044	.3038		87.5049	87.3663	.1385	4.2331	
16.00	-.1354	-.1364	.0010	.3041		-2.6787	-2.7697	.0909	4.4460	
17.00	-.1489	-.1449	-.0039	.3043		-92.7963	-92.8902	.0938	4.6590	
18.00	-.1420	-.1457	.0037	.3045		177.0205	176.9549	.0656	4.8723	
19.00	-.1355	-.1402	.0047	.3048		86.9476	86.7952	.1524	5.0856	
20.00	-.1505	-.1520	.0015	.3051		-3.2361	-3.3667	.1307	5.2991	
21.00	-.1534	-.1611	.0077	.3053		-93.3526	-93.4848	.1322	5.5127	
22.00	-.1602	-.1578	-.0024	.3056		176.4560	176.3690	.0870	5.7264	
23.00	-.1607	-.1572	-.0035	.3059		86.3053	86.2190	.0863	5.9402	
24.00	-.1577	-.1681	.0104	.3062		-3.7958	-3.9098	.1140	6.1541	
25.00	-.1642	-.1655	.0013	.3065		-93.9103	-94.0715	.1612	6.3680	
26.00	-.1703	-.1754	.0051	.3068		175.9621	175.8341	.1280	6.5820	
27.00	-.1778	-.1780	.0003	.3071		85.8176	85.6873	.1303	6.7961	
28.00	-.1808	-.1825	.0017	.3075		-4.3342	-4.4424	.1083	7.0102	
29.00	-.1715	-.1857	.0141	.3078		-94.5021	-94.5904	.0883	7.2243	
30.00	-.1729	-.1886	.0156	.3082		175.3451	175.3000	.0451	7.4385	
31.00	-.1753	-.1762	.0009	.3085		85.2193	85.1734	.0459	7.6528	
32.00	-.1817	-.1954	.0136	.3089		-4.8864	-4.9691	.0827	7.8670	
33.00	-.1780	-.1995	.0215	.3093		-95.1347	-95.0736	-.0611	8.0813	
34.00	-.1853	-.1999	.0145	.3096		174.8648	174.7591	.1056	8.2957	
35.00	-.1793	-.2076	.0282	.3100		84.7083	84.6613	.0470	8.5101	
36.00	-.1929	-.2060	.0131	.3104		-5.4312	-5.4987	.0676	8.7245	
37.00	-.1984	-.2047	.0062	.3109		-95.5216	-95.6563	.1348	8.9389	
38.00	-.1943	-.2113	.0170	.3113		174.3021	174.2672	.0349	9.1533	
39.00	-.2066	-.2225	.0159	.3117		84.1578	84.1281	.0297	9.3678	
40.00	-.1989	-.2126	.0137	.3121		-6.0143	-6.0295	.0151	9.5823	

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Figure B-1. Example of Test Results

Appendix C — Allowable VNA Calibration Kit Verification Kit Combinations

C-1 Cross-reference Table

The cross-reference table is to be used as a guide in determining if you can perform verifications on a specific instrument model with a given calibration and verification kit. One way to use the table is to first select the instrument to be used in the test from the far left column. Next, select the verification kit to be used in the test from the top row. Scan to the box where the instrument and verification kit intersects. If there is a calibration kit listed in that box, then the combination of selected VNA, verification kit, and calibration kit can be verified. If there is not a calibration kit listed in that box, then the combination of equipment selected cannot be verified.

Table C-1. Allowable Calibration Kit - Verification Kit - Instrument Combinations

Coaxial Verification/Calibration Kit Pairs					
Models	3663 (N)	3666 (3.5 mm)	3667 (GPC-7)	3668 (K)	3669B (V)
37x17C	3653 (N)	3650-1 (3.5 mm) 3650A-1 (3.5 mm)	3651-1 (GPC-7)	3652-1 (K) 3652A-1 (K)	-
37x47C					-
37x69C					-
37x77C					3654B (V) 3654C-1 (V) 3654D-1 (V)
37x97C					3654B (V) 3654C-1 (V) 3654D-1 (V)
37x47D	-	-	-		-
37x69D	-	-	-		-
37x77D	-	-	-		3654B (V) 3654C-1 (V) 3654D-1 (V)
37x97D	-	-	-		3654B (V) 3654C-1 (V) 3654D-1 (V)
37x47E	-	-	-		-
37x69E	-	-	-		-
37x97E	-	-	-		3654B (V) 3654C-1 (V) 3654D-1 (V)

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