



**Site Master**

**Model S311D**

**Cable and Antenna Analyzer**

**MAINTENANCE MANUAL**

**SiteMaster** 

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**Anritsu**

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## 1. Introduction

This manual provides maintenance instructions for the Site Master Model S311D Cable and Antenna Analyzer. It describes the product and provides performance verification procedures, parts replacement procedures, and a replaceable parts list.

Throughout this manual, the term “VNA” may be used to denote Return Loss, SWR, Cable Loss and DTF modes. All other modes are referenced individually.

## 2. Description

The Site Master S311D is a Cable and Antenna Analyzer for measuring Return Loss, SWR, Cable Loss of cable and antenna systems from 25 MHz to 1600 MHz. Option 2 can be added to extend the lower frequency range to 2 MHz. Other options available with the S311D include Power Monitor (Option 5), High Accuracy Power Meter (Option 19) and GPS measurements (Option 31).

The following sections contain tests that can be used to verify the performance of the Site Master Model S311D.

## 3. Performance Verification

This section contains tests that can be used to verify the performance of the S311D. Before performing any of these tests, ensure that the S311D has had a minimum of 30 minute warm-up, and that all test equipment is warmed-up to manufacturers' specifications.

A blank performance verification test record is provided on page 14. Make a copy of the blank test record and use it to record measured values.

The following table lists the equipment required to perform the tests in this section.

**Table 1.** Required Equipment List

Instrument	Critical Specification	Recommended Manufacturer/Model
Synthesized Signal Source	Frequency: 0.1 Hz to 20 GHz	Anritsu Model MG3692A or B with options 2A, 4
Frequency Reference	Frequency: 10 MHz	Symmetricom Model RubiSource T&M
Adapter	N(m)-N(m), 50 Ohm	Anritsu Model 34NN50A
Adapter	Frequency: DC to 20 GHz K(m)-N(f), 50 Ohm	Anritsu Model 34RKNF50
50 Ohm Termination	Frequency: DC to 18 GHz	Anritsu Model 28N50-2 or equivalent
RF Coaxial Cable	N(m)-N(f), 50 Ohm	Anritsu Model 15NN50-1.5C or equivalent
Spectrum Analyzer	9 KHz to 21.2 GHz	Anritsu Model MS2665C or equivalent
Open/Short	DC to 18 GHz N(m)	Anritsu Model 22N50
Offset Termination	20 dB, 4 GHz	Anritsu Model SC5270
Offset Termination	6 dB, 4 GHz	Anritsu Model SC5237
Power Splitter (for Option 5)	Frequency: DC to 18 GHz	Aeroflex/Weinschel Model 1870A
RF Detector (for Option 5)	10 MHz to 20 GHz	Anritsu Model 560-7N50B
Power Meter (for Option 5)	Power Range: -70 to +20 dBm	Anritsu Dual Channel Model ML2438A
Power Sensor (for Option 5)	Frequency: 10 MHz to 18 GHz Power Range: -67 to +20 dB	Anritsu Model MA2442D or equivalent

## VNA Frequency Accuracy

The following test can be used to verify the CW frequency accuracy of the Site Master. Measurement calibration of the Site Master is not required for this test.

### a. Procedure:

1. Connect a 10 MHz Reference signal to the 10 MHz STD Ref In of the MS2665C.
2. Press and hold the **ESCAPE/CLEAR** key, then press the **ON/OFF** key to turn on the Site Master. (This sets the instrument to the factory preset state.)
3. Press the **FREQ/DIST** key, then press the F1 soft key and set F1 to 1000 MHz.
4. Press the F2 soft key, set F2 to 1000 MHz.
5. Press the **MEAS/DISP** key, then press the Fixed CW soft key to turn Fixed CW On.
6. Connect the RF cable from the Site Master Reflection Test Port to the RF Input on the MS2665C.
7. Set up the MS2665C as follows:
  - (a) Press the **Preset** key, then select **Preset All** (F1).
  - (b) Press the **Frequency** key.
  - (c) Press the **1** key and then the **GHz** key to change the Center Frequency to 1 GHz.
  - (d) Press the **Span** key.
  - (e) Set the frequency span to 750 kHz.
  - (f) Press the **RBW** key.
  - (g) Set the RBW to 10 kHz.
  - (h) Press the **VBW** key.
  - (i) Press the **Filter Off** soft key (F3) to turn the VB filter off.
  - (j) Press the **Amplitude** key.
  - (k) Set the reference level to 0 dBm.
  - (l) Press the **Log Scale** soft key (F5)
  - (m) Select **2 dB/Div** (F3) and the press the **return** soft key.

*NOTE: If the Site Master has gone into the hold mode, press the **RUN/HOLD** key to return to normal mode.*

8. When a peak response appears on the Spectrum Analyzer, press the **Marker Peak Search** key on the Spectrum Analyzer. Verify that the marker peak readout value is 1000 MHz  $\pm$ 75 kHz.
9. On the Site Master, press the **MEAS/DISP** key then the Fixed CW soft key to turn Fixed CW off.

## VNA Return Loss Verification

The following test can be used to verify the accuracy of return loss measurements. Measurement calibration of the Site Master is required for this test.

### a. **Procedure:**

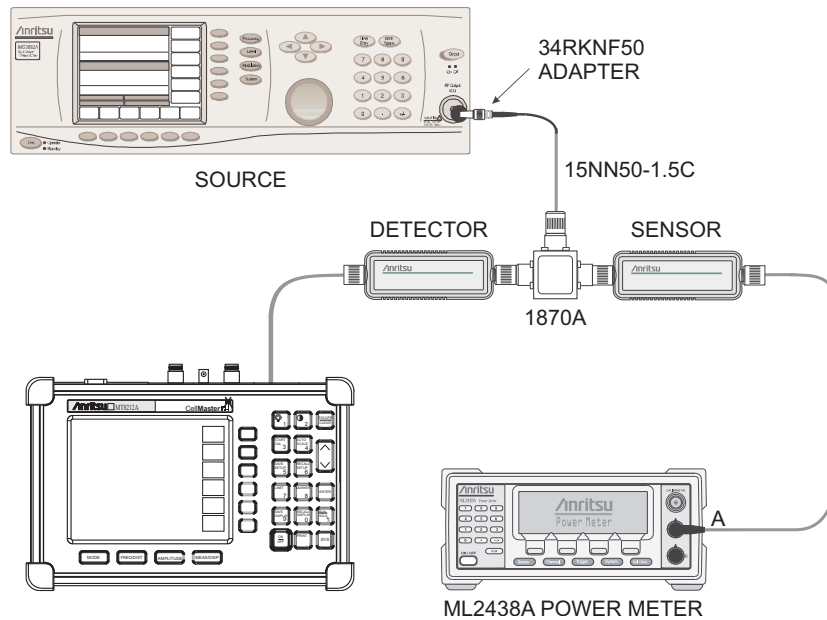
1. Press and hold the **ESCAPE/CLEAR** key, then press the **ON/OFF** key to turn on the Site Master. (This sets the instrument to the factory preset state.)
2. Press the **MODE** key.
3. Use the Up/Down arrow key to highlight Return Loss, then press **ENTER**.
4. Press the **START CAL** key.
5. Follow the instructions on the screen to perform a calibration using a 22N50 Open/Short and 28N50-2 or SM/PL Termination.
6. Connect the 20 dB offset to the Refl Test Port and verify that the reading is  $20 \text{ dB} \pm 1.7 \text{ dB}$ .
7. Connect the 6 dB offset to the Refl Test Port and verify that the reading is  $6 \text{ dB} \pm 1.2 \text{ dB}$ .

## Power Monitor Verification (Option 5)

The following test can be used to verify the accuracy of the power monitor function.

### a. Procedure:

1. Turn on the power meter and signal source.
2. Set the MG3692A output power level to 5 dBm.
3. Set the MG3692A output to 1 GHz CW.
4. Connect the power sensor to the power meter and calibrate the sensor.
5. On the power meter, press the Sensor key, the Cal Factor soft key, and then the FREQ soft key. Use the keypad to enter 1 GHz as the input signal frequency, which sets the power meter to the proper power sensor cal factor. Press the System key on the power meter to display the power reading.
6. Connect MG3692A, power meter, RF detector, Power Splitter and Power Sensor as shown in Figure 1.



**Figure 1.** Power Monitor Verification Setup

7. On the Site Master, press and hold the **ESCAPE/CLEAR** key, then press the **ON/OFF** key to turn on the Site Master. (This sets the instrument to the factory preset state.)
8. Press the **MODE** key. Use the Up/Down arrow key to highlight Power Monitor and then press **ENTER**.
9. On the MG3692A press the Level key, then use the knob to adjust the power level so that the power meter reads -40 dBm.
10. Verify that the Site Master reading is  $-40 \text{ dBm} \pm 1.0 \text{ dB}$ .



11. Repeat steps 9 and 10 for the other power level settings shown in Table 2.

**Table 2** Power Monitor Test Levels

Power In @ 1 GHz	Specification
0 dBm	± 1 dB
-7 dBm	± 1 dB
-21 dBm	± 1 dB
-40 dBm	± 1 dB

## InstaCal Module Verification

This test verifies the performance of the Anritsu Site Master InstaCal Calibration Module. The InstaCal Module, part number ICN50, is an optional accessory for the S311D.

### a. Procedure

1. Press and hold the **ESCAPE/CLEAR** key, then press the **ON/OFF** key to turn on the Site Master. (This sets the instrument to the factory preset state.)
2. Press the **MODE** soft key.
3. Use the Up/Down arrow key to highlight **RETURN LOSS**, then press **ENTER**.
4. Press the **START CAL** key. The message “CONNECT OPEN or InstaCal TO RF Out PORT” will appear in the display.
5. Connect the InstaCal module to the RF Out port and press the **ENTER** key.

*NOTES: If this particular InstaCal module has been used to calibrate this Site Master before, the Site Master senses the familiar InstaCal module and automatically calibrates the unit using the OSL procedure.*

*If the Site Master senses that the characterization data for the InstaCal module connected to this Site Master is different than the one currently stored, it will display soft key options to keep or replace the InstaCal characterization data.*

*Selecting the YES soft key transfers all of the characterization data from this InstaCal module to the Site Master. The transfer may take up to three minutes. This option is preferred if this InstaCal module is to stay with this particular Site Master. Once completed, the data will not need to be transferred again for this combination of Site Master and InstaCal module.*

*Selecting the NO soft key will temporarily transfer only the portion of the characterization data necessary for this particular calibration. This transfer takes approximately 30 to 60 seconds, and will have to be repeated every time a calibration is done using this combination of Site Master and InstaCal module.*

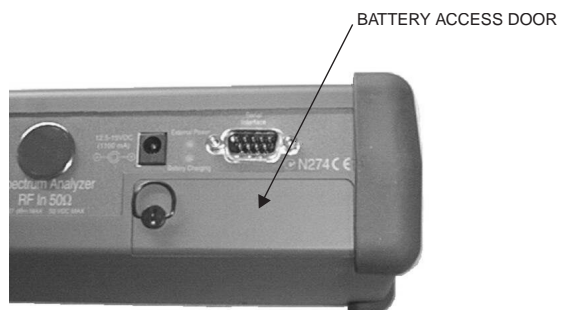
6. Verify that the calibration has been properly performed by checking that the **CAL ON!** message is displayed in the upper left corner of the display.
7. Remove the InstaCal module from the RF Out port and connect the 20 dB Offset to the RF Out port.
8. Measure the return loss of the 20 dB Offset. The level should be 20 dB, ±2 dB across the calibrated frequency range.
9. Remove the 20 dB Offset from the RF Out port and connect the 6 dB Offset to the RF Out port.
10. Measure the return loss of the 6 dB Offset. The level should be 6 dB, ±1.2 dB across the calibrated frequency range.

## 4. Battery Pack Removal and Replacement

This procedure provides instructions for removing and replacing the Site Master battery pack.

*NOTE: Many of the procedures in this section are generic, and apply to many similar instruments. Photos and illustrations used are representative and may show instruments other than the Site Master.*

1. With the Site Master standing upright on a stable surface, locate the battery access door (Figure 2).



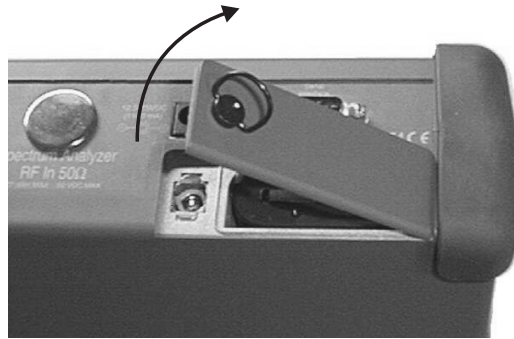
**Figure 2.** Battery Access Door Location

2. Lift up the access door handle and rotate it 90 degrees counterclockwise, as illustrated in Figure 3.



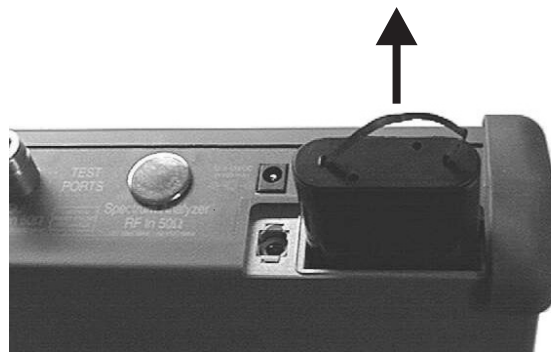
**Figure 3.** Rotate the Battery Access Door Handle

3. Lift the door and remove, as illustrated in Figure 4.



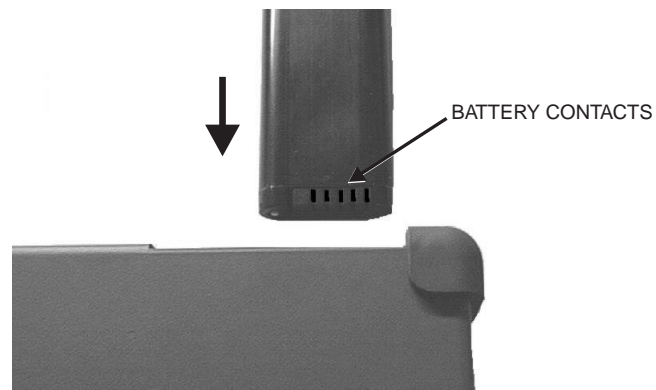
**Figure 4.** Removing the Battery Access Door

4. Grasp the battery lanyard and pull the battery straight up and out of the unit, as illustrated in Figure 5.



**Figure 5.** Removing the Battery

5. Replacement is the opposite of removal. Note the orientation of the battery contacts, and be sure to insert the new battery with the contacts facing the rear of the unit (Figure 6).



**Figure 6.** Battery Orientation

## 5. Battery Information

The following information relates to the care and handling of the Site Master battery, and NiMH batteries in general.

- The Nickel Metal Hydride (NiMH) battery supplied with the Site Master is shipped in a discharged state. Before using the Site Master, the internal battery must first be charged for three hours, either in the Site Master or in the optional battery charger (Anritsu part number: 2000-1029).
- Use only Anritsu approved battery packs.
- Recharge the battery only in the Site Master or in an Anritsu approved charger.
- With a new NiMH battery, full performance is achieved after three to five complete charge and discharge cycles.
- When the Site Master or the charger is not in use, disconnect it from the power source.
- Do not charge batteries for longer than 24 hours; overcharging may shorten battery life.
- If left unused a fully charged battery will discharge itself over time.
- Temperature extremes will affect the ability of the battery to charge: allow the battery to cool down or warm up as necessary before use or charging.
- Discharge a NiMH battery from time to time to improve battery performance and battery life.
- The battery can be charged and discharged hundreds of times, but it will eventually wear out.
- The battery may need to be replaced when the operating time between charging becomes noticeably shorter than normal.
- Never use a damaged or worn out charger or battery.
- Storing the battery in extreme hot or cold places will reduce the capacity and lifetime of the battery.
- Never short-circuit the battery terminals.
- Do not drop, mutilate or attempt to disassemble the battery.
- Do not dispose of batteries in a fire!
- Batteries must be recycled or disposed of properly. Do not place batteries in household garbage.
- Always use the battery for its intended purpose only.

**WARNING:** *This equipment is supplied with a rechargeable battery that could potentially leak hazardous compounds into the environment. These hazardous compounds present a risk of injury or loss due to exposure. Anritsu Company recommends removing the battery for long-term storage of the instrument and storing the battery in a leak-proof, plastic container. Follow the environmental storage requirements specified in the product data sheet.*

## Battery Testing Procedure

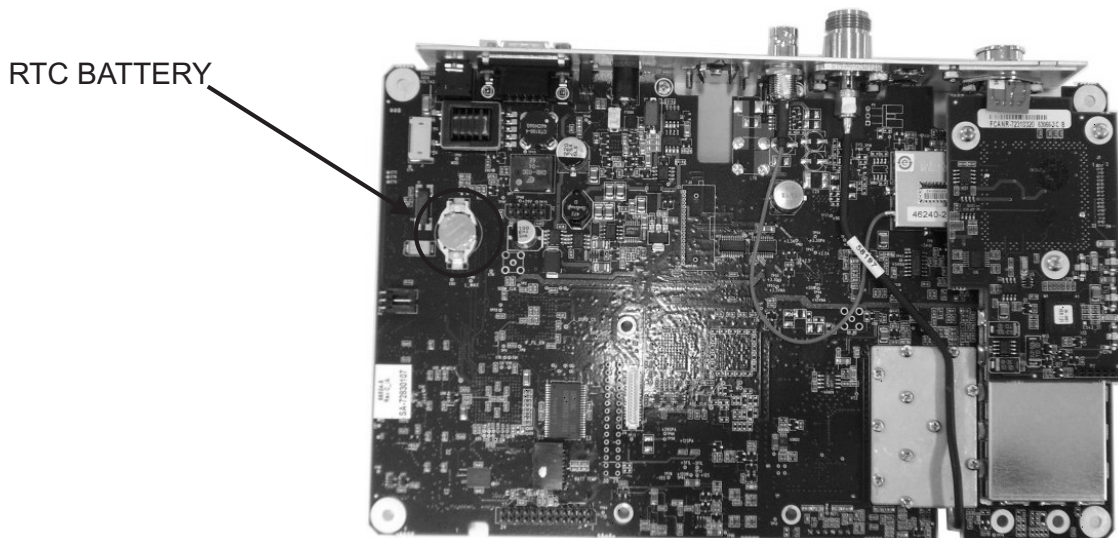
1. With the Site Master off and the battery installed, connect the Universal AC Adapter to the 12.5-15VDC (1350 mA) connector. The External Power LED and the Battery Charging LED will light.

*NOTES: If the Battery Charging LED does not light, the battery may be too low to immediately start full charging. Leaving the unit connected to AC power for several hours may bring the battery up to a level where full charging can begin. Turn the unit off and back on to see if the Battery Charging LED lights indicating a full charge cycle has begun. Charging is inhibited below 0°C and above 45°C. If the unit is too hot, the battery will not start charging until the unit temperature has reached 43°C.*

2. Disconnect the AC-DC Adapter when the Battery Charging LED turns off, indicating the battery is fully charged.
3. Press and hold the **ESCAPE/CLEAR** key, then press the **ON/OFF** key to turn on the Site Master. This sets the instrument to the factory preset state. Press **ENTER** when prompted to continue.
4. Press the **SYS** key, followed by the STATUS soft key. Verify that the indicated battery charge is  $\geq 80\%$ . If the value is 80% or above, press the **ESCAPE/CLEAR** key and continue with this procedure. If the value is lower than 80%, a discharge/charge cycle may be needed to improve the battery capacity. Completely discharge the battery, as described in Steps 5 and 6 below, and then recharge the battery as described in Steps 1 and 2. If the battery capacity does not increase after a discharge/charge cycle, replace the battery.
5. Press the **START CAL** key (to keep the Site Master from going into HOLD mode) and make note of the test start time.
6. When the Site Master display fades and the Site Master switches itself off, make note of the test stop time.
7. The total test time (Step 5 to Step 6) should be  $\geq 1.5$  hours. If the battery charge is near 80% and the total battery test time is  $< 70$  minutes, replace the battery.

## RTC Battery Information

The date and time are saved using a +3V coin-style battery mounted on the main PCB (Figure 7). This Real Time Clock battery has a finite lifespan. When sufficiently discharged, the message RTC Invalid will appear during the boot-up self test. If this message appears, replace the RTC battery. After replacing the battery, re-enter the date, time, and year (using the **Sys** key menu) to remove the RTC Invalid message.



*Figure 7. RTC Battery Location*

## 6. Removal and Replacement Procedures

This section contains procedures detailing the removal and replacement of assemblies within the Site Master. The following table list the replaceable assemblies.

**Table 3.** *List of Replaceable Assemblies*

Part Number	Description
ND67961	S311D Main PCB Assembly (w/o Option 31)
ND67963	S311D Main PCB Assembly (with Option 31)
ND66432	Option 5 PCB
3-633-26	Coin Battery for RTC
15-123	LCD Display
46649-6	Keypad Membrane
67199-3	Keypad PCB
48231-1	Battery Door
790-523	Speaker
633-27	Rechargeable Battery
61440-1	Case Top
58214	Case Bottom
46655	Corner Bumper
40-187-R	AC Adapter

### Important Information Regarding Service of Anritsu Equipment

Only qualified service personnel should attempt to perform repairs on this instrument. During the warranty period, opening of the case by non-Anritsu Service personnel will void the warranty. Extreme care must be used when handling internal assemblies. Careless handling will cause damage.

Unless authorized by the factory, no attempts should be made to repair a defective assembly (discharged RTC batteries on the main PCB may be replaced). Exchange assemblies determined to be damaged by improper handling will not be accepted for credit.

### Exchange Assemblies

The Main PCB Assembly and Option 5 PCB (listed in Table 3) are factory-repairable exchange assemblies, which should be returned to Anritsu promptly for credit. AC adapters, batteries, LCDs, keypad parts, and non-electrical parts are not exchange assemblies and need not be returned to Anritsu. If the Main PCB has failed, order the correct replacement as shown on Table 3. Return the failed main PCB (without the Option 5 PCB) to Anritsu for credit. After replacement, no recalibrations are required.

If only Option 5 is found to be defective, the Option 5 PCB should be removed from the main PCB as described below and returned to Anritsu. Do not return the main PCB if there is a problem only with Option 5. After replacement of the Option 5 PCB, no recalibrations are required.

### ESD Precautions

Service personnel should be aware of the potential for ESD damage and take all necessary precautions. Technicians should exercise practices outlined within industry standards like JEDEC-625 (EIA-625), MIL-HDBK-263, and MIL-STD-1686, which pertain to ESD and ESDS devices, equipment, and practices.

Assemblies in this instrument contain static-sensitive components. Improper handling of these assemblies may result in damage to the assemblies. Always observe static-sensitive component handling precautions.

## Opening the Case

*NOTE: Many of the procedures in this section are generic, and apply to many similar instruments. Photos and illustrations used are representative and may show instruments other than the Site Master.*

1. Place the Site Master face up on a stable work surface.
2. Remove the four rubber corner bumpers by carefully lifting and sliding the bumpers off of the case corners (Figure 8).



**Figure 8.** Removing the Corner Bumpers

3. With the bumpers removed, the access holes for the case screws are revealed. Use a Phillips screwdriver to remove the four screws securing the two halves of the Site Master case together.

### CAUTION

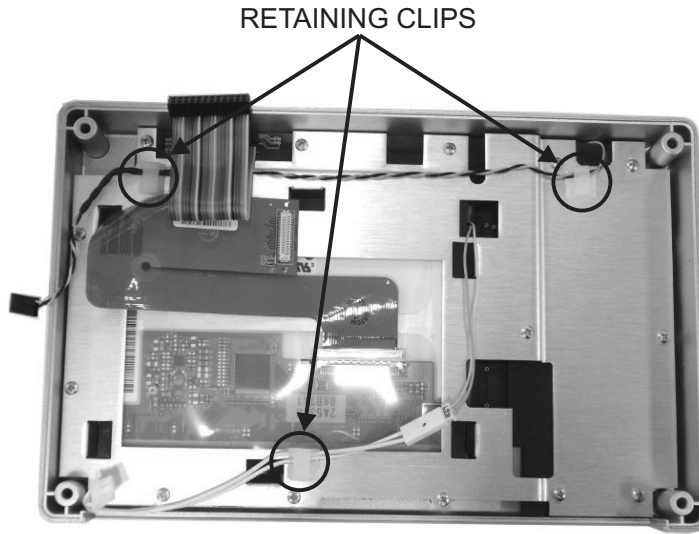
*Do not force or pull the two halves of the case apart completely, as there are delicate cables attached between the two halves that must be disconnected first.*

4. Separate the front and rear of the case by about two inches and gently unplug the four cables that connect to the main PCB.
5. Separate the front and rear of the case

For all assemblies in the S311D, installation is the reverse of removal.

## Removal of the LCD and Keypad Assemblies

1. Remove the wire harnesses from under the plastic retaining clips of the metal backing plate (Figure 9).



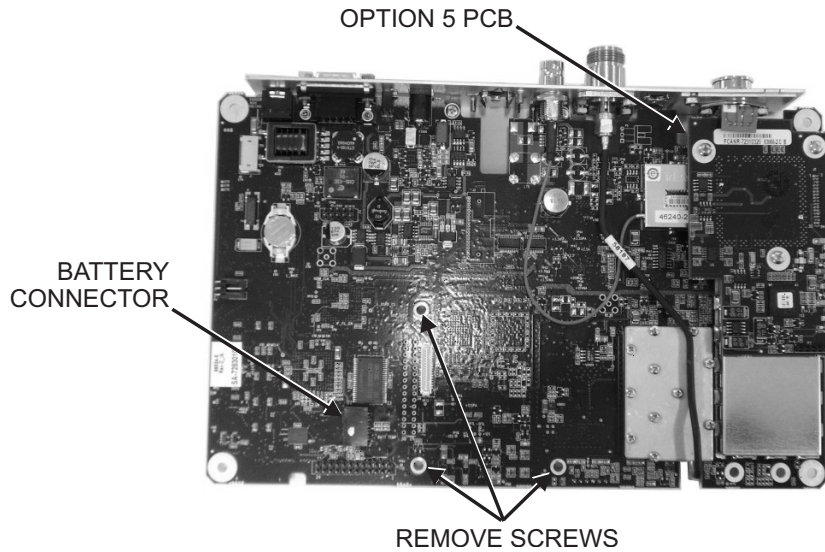
*Figure 9. Retaining Clips*

2. Remove the 14 screws that secure the backing plate to the case.
3. Lift off the backing plate, carefully feeding the wire harnesses through the holes. The LCD may remain attached to the backing plate by the friction of the rubber gasket.
4. Disconnect the flexible PCB from the LCD circuit board by pulling outward at each end of the connector with tweezers or a pointed tool. Do not pull on the wires.
5. Lift the LCD away from the backing plate.
6. Lift off the rubber cushion, the keypad PCB and the keypad membrane.



## Removal of the Main PCB

1. Remove the three screws indicated from the main PCB and disconnect the battery cable (Figure 10).



*Figure 10. Main PCB*

2. Lift the main PCB out of the case.

## Removal of the Option 5 PCB

1. The Option 5 PCB must be removed from the Main PCB if either the Main PCB or Option 5 has failed.
2. Unplug the 4-pin connector on the Option 5 PCB that connects to the front panel.
3. Remove the three screws securing the Option 5 PCB to the Main PCB.

The Option 5 PCB can be transferred to a replacement Main PCB. Recalibration is not required after the replacement of the Option 5 PCB.

## 7. Customer Service

To locate the nearest Anritsu Customer Service Center, please refer to the Anritsu web page:

<http://www.anritsu.com/Contact.asp>

## 8. Test Records

This section provides test records that can be used to record the performance of the S311D. We recommend that you make a copy of the following test record pages and document the measurements each time a Performance Verification is performed. Continuing to document this process each time it is performed provides a detailed history of the instrument's performance.

<b>S311D</b>	<b>Serial Number:</b>	<b>Date:</b>
<b>Firmware Revision:</b>		<b>Operator:</b>
<b>Options:</b>		

### Frequency Accuracy

Frequency	Measured Value	Specification
1000 MHz (CW Mode On)	kHz	$\pm 75$ kHz

### Return Loss Verification

Return Loss	Measured Value	Specification
6 dB	dB	$6 \text{ dB} \pm 1.2 \text{ dB}$
20 dB	dB	$20 \text{ dB} \pm 1.7 \text{ dB}$

### Option 5 Power Monitor Power Measurement Accuracy

Power In @ 1 GHz	Measured Value	Specification
0 dBm	dBm	$\pm 1 \text{ dB}$
-7 dBm	dBm	$\pm 1 \text{ dB}$
-21 dBm	dBm	$\pm 1 \text{ dB}$
-40 dBm	dBm	$\pm 1 \text{ dB}$



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