BirdTechnologies®

SiteHawk™ SK-4000 Analyzer

OPERATING INSTRUCTIONS

This is a preliminary manual. Specifications, limits, and text are subject to change without notice. The information within this manual was as complete as possible at the time of printing. Bird Electronic Corporation is not liable for errors.

Safety Precautions

The following are general safety precautions that are not necessarily related to any specific part or procedure, and do not necessarily appear elsewhere in this publication. These precautions must be thoroughly understood and apply to all phases of operation and maintenance.

WARNING

Keep Away From Live Circuits

Operating Personnel must at all times observe general safety precautions. Do not replace components or make adjustments to the inside of the test equipment with the high voltage supply turned on. To avoid casualties, always remove power.

WARNING

Shock Hazard

Do not attempt to remove the RF transmission line while RF power is present.

WARNING

Do Not Service Or Adjust Alone

Under no circumstances should any person reach into an enclosure for the purpose of service or adjustment of equipment except in the presence of someone who is capable of rendering aid.

WARNING

Safety Earth Ground

An uninterruptible earth safety ground must be supplied from the main power source to test instruments. Grounding one conductor of a two conductor power cable is not sufficient protection. Serious injury or death can occur if this grounding is not properly supplied.

WARNING

Resuscitation

Personnel working with or near high voltages should be familiar with modern methods of resuscitation.

WARNING

Remove Power

Observe general safety precautions. Do not open the instrument with the power on.

Safety Symbols

WARNING
Warning notes call attention to a procedure, which if not correctly performed, could result in personal injury.

CAUTION
Caution notes call attention to a procedure, which if not correctly performed, could result in damage to the instrument.

Note: *Calls attention to supplemental information.*

Caution Statements

The following equipment cautions appear in the text and are repeated here for emphasis.

CAUTION
Please do not open the instrument shell. Damage made be done to the electronic equipment inside.

CAUTION
If subjected to an ESD spike directly to the metal portion of the case the unit may go into an interrogative state. A power cycle of the unit may be required to return to normal operation.

CAUTION
Do not touch the cathode connector with bare hands, water, or emery cloth. Otherwise, damage may occur to the connectors surface.

Safety Statements

USAGE

ANY USE OF THIS INSTRUMENT IN A MANNER NOT
SPECIFIED BY THE MANUFACTURER MAY IMPAIR THE
INSTRUMENT'S SAFETY PROTECTION.

USO

EL USO DE ESTE INSTRUMENTO DE MANERA NO
ESPECIFICADA POR EL FABRICANTE, PUEDE ANULAR LA
PROTECCIÓN DE SEGURIDAD DEL INSTRUMENTO.

BENUTZUNG

WIRD DAS GERÄT AUF ANDERE WEISE VERWENDET ALS VOM
HERSTELLER BESCHRIEBEN, KANN DIE GERÄTESICHERHEIT
BEEINTRÄCHTIGT WERDEN.

UTILISATION

TOUTE UTILISATION DE CET INSTRUMENT QUI N'EST PAS
EXPLICITEMENT PRÉVUE PAR LE FABRICANT PEUT
ENDOMMAGER LE DISPOSITIF DE PROTECTION DE
L'INSTRUMENT.

IMPIEGO

QUALORA QUESTO STRUMENTO VENISSE UTILIZZATO IN
MODO DIVERSO DA COME SPECIFICATO DAL PRODUTTORE
LA PROZIONE DI SICUREZZA POTREBBE VENIRNE
COMPROMESSA.

SERVICE

SERVICING INSTRUCTIONS ARE FOR USE BY SERVICE - TRAINED PERSONNEL ONLY. TO AVOID DANGEROUS ELECTRIC SHOCK, DO NOT PERFORM ANY SERVICING UNLESS QUALIFIED TO DO SO.

SERVICIO

LAS INSTRUCCIONES DE SERVICIO SON PARA USO EXCLUSIVO DEL PERSONAL DE SERVICIO CAPACITADO. PARA EVITAR EL PELIGRO DE DESCARGAS ELÉCTRICAS, NO REALICE NINGÚN SERVICIO A MENOS QUE ESTÉ CAPACITADO PARA HACERIO.

WARTUNG

ANWEISUNGEN FÜR DIE WARTUNG DES GERÄTES GELTEN NUR FÜR GESCHULTES FACHPERSONAL.

ZUR VERMEIDUNG GEFÄHRLICHE, ELEKTRISCHE SCHOCKS, SIND WARTUNGSARBEITEN AUSSCHLIEßLICH VON QUALIFIZIERTEM SERVICEPERSONAL DURCHZUFÜHREN.

ENTRENTIEN

L'EMPLOI DES INSTRUCTIONS D'ENTRETIEN DOIT ÊTRE RÉSERVÉ AU PERSONNEL FORMÉ AUX OPÉRATIONS D'ENTRETIEN. POUR PRÉVENIR UN CHOC ÉLECTRIQUE DANGEREUX, NE PAS EFFECTUER D'ENTRETIEN SI L'ON N'A PAS ÉTÉ QUALIFIÉ POUR CE FAIRE.

ASSISTENZA TECNICA

LE ISTRUZIONI RELATIVE ALL'ASSISTENZA SONO PREVISTE ESCLUSIVAMENTE PER IL PERSONALE OPPORTUNAMENTE ADDESTRATO. PER EVITARE PERICOLOSE SCOSSE ELETTRICHE NON EFFETTUARRE ALCUNA RIPARAZIONE A MENO CHE QUALIFICATI A FARLA.

UNITS ARE EQUIPPED WITH RECHAREABLE BATTERIES.

THESE ARE TO BE REPLACED BY AUTHORIZED SERVICE PERSONNEL ONLY!!!

LAS UNIDADES VIENEN EQUIPADAS CON BATERIAS RECARGABLES.

¡¡¡Y SOLAMENTE EL PERSONAL DE SERVICIO AUTORIZADO PUEDE REEMPLAZARLAS!!!

GERÄTE SIND MIT WIEDER AUFLADBAREN BATTERIEN BESTÜCKT.

BATTERIEN SIND NUR VON QUALIFIZIERTEM SERICE PERSONAL AUSZUWECHSELN!!!

CES DISPOSITIFS SONT ÉQUIPÉS DE BATTERIES RECHARGEABLES.

SEUL LE PERSONNEL D'ENTRETIEN AUTORISÉ EST HABILITÉ À LES REMPLACER!

LE UNITÀ SONO DOTATE DI BATTERIE RICARICABILI,

CHE DEVONO DA COME SPECIFICATO DAL PRODUTTORE LA PROTEZIONE DI SICUREZZA POTREBBE VENIRNE COMPROMESSA.

About This Manual

This manual covers the operating and maintenance instructions for the following models:

SK-4000

Changes to this Manual

We have made every effort to ensure this manual is accurate. If you discover any errors, or if you have suggestions for improving this manual, please send your comments to our Solon, Ohio factory. This manual may be periodically updated. When inquiring about updates to this manual refer to the part number and revision on the title page.

Literature Contents

Start-up Instructions

The Start-up Instructions contains minimum operational steps and the order they should be performed. Use this manual for reference or if further explanation of any step is required.

Operations Manuals

Chapter Layout

Introduction — Describes the features of the Bird SiteHawk™, lists equipment supplied and optional equipment, and provides power-up instructions.

Measure Match Mode — Lists the steps to make match measurements, as well as providing instructions for all functions available in Measure Match mode.

Distance-to-Fault Measurements — The DTF measurement shows the location of any problems in the antenna system. This is shown in either feet or meters from the cable end connected to the SiteHawk.

PC Tool — Describes how to use the SiteHawk's PC Tool function and how to transfer readings from the SiteHawk to the computer and back again.

Utilities — Describes built-in instrument utility features and how to use them.

Maintenance — Lists routine maintenance tasks as well as troubleshooting for common problems. Specifications and parts information are also included.

Table of Contents

The SiteHawk SK-4000 Analyzer is a multifunction test instrument for use in installation and maintenance of wireless systems. The current product testing range between 85MHz-4GHz。

Antenna systems are tested by using a SiteHawk Analyzer to measure match conditions. Data points measured across a user-specified frequency band or distance range are graphed on a 1920 x 1080 pixel touch screen display area.

Safety considerations

CAUTION
Please do not open the instrument shell. Damage made be done to the electronic equipment inside.

CAUTION
If subjected to an ESD spike directly to the metal portion of the case the unit may go into an interrogative state. A power cycle of the unit may be required to return to normal operation.

Common Abbreviations	
DUT	Device Under Test
IF	Intermediate Frequency
CW	Continuous Wave
SWR	Standing Wave Ratio

Items Supplied

Figure 1   Hardware and Software Supplied

Item	Description
1	SiteHawk SK-4000 Analyzer
2	Hard Carry Case
3	AC Adapter
4	USB Interface Cable
5	Soft Carry Case
6	RF Cable, 1 meter long
7	USB Drive
8	Instruction Manual

Items Not Supplied (Selectable)

Figure 2   Hardware Not Supplied

Item	Description
1	Calibration Combination (Cal Combo).
2	N-type, Male to 7/16 DIN, Female adapter
3	External Battery Pack

SiteHawk SK-4000 Analyzer Specifications

Frequency Range	85 MHz to 4 GHz
Frequency Accuracy	±2.5×10-6
Frequency Resolution Setting	1kHz
Output Power	-10dBm

Reflect Amplitude Accuracy
    –15 dB — 0 dB
    –25 dB — –15 dB
    –35 dB — –25 dB
	
	0.4 dB
	1.5 dB
	4.0 dB

Tracei Noise Amplitude (IFBW 1kHz)	0.02 dB rms
SinglePoint Measure Time	0.25 ms
Measure Points	51 to 3201
Measure Bandwidth	100Hz to 30kHz
Temperature Stability	0.01 dB/°F 0.02 dB/°C
Return Loss Measurement Range Resolution	0 dB to - 60 dB 0.01 dB
VSWR Measurement Range Resolution	1.0 to 65.0 0.01
Cable Loss Measurement Range Resolution	0 dB to 30 dB 0.01 dB
DTF Range	0 to 5000 ft. 0 to 1500 m.
Test Port Connector Impedance	N-type, Female 50 ohms
Connector	Micro USB B, USB 2.0
Dimensions (L×W×H)	7.16x3.74x1.83 in. 182 x 95 x 46.5 mm
Weight	1.89 lbs. 0.9kg
Maximum Input Power	+23 dBm
Maximum Input Voltage	50V
Operates In Temperature	14° to 131° F –10° to +55° C
Storage Temperature	-40° to 176° F –40° to +80° C
Battery Charging Temperature	32° to 95° F 0 to +35° C
Altitude	Up to 5000 ft. Up to 1500 m

Humidity	95±5° max (non-condensing)
Pressure	84 to 106.7 kPa
Warm-Up Time	15 minutes
Power Measurement	No
Compatible Devices	None
Storage Capacity	Thousands of Traces and Setups
Immunity to Interfering Signals	+13 dBm
CE	TBD
Battery	TBD, TBD Hrs Typical Operating Time
Battery Charge Time	TBD Hrs for Full Charge

Measurement Capability

- Fast swept measurement.
- Seven user-selectable trace capture options: 51,101,201,401,801,1601 or 3201 data points per sweep.
- Adjustable pass/fail limit with visual indicator.
- 16GB of internal flash memory for storing thousands of traces and setups.
- X and Y scales and units are user adjustable.
- Six markers for either direct or difference measurements.
- Can also measure relative to limit line or recalled trace.
- Measurement hold to temporarily store a trace.
- Frequency can be set using either Start/Stop or Center/Span frequencies.
- Measurement can be Return Loss [dB], Cable Loss [dB], SWR [ratio],DTF SWR[ratio] or DTF Return Loss [dB].
- Measurement units can be Return Loss [dB] or SWR [ratio].

Connectors

Figure 3   Connector Diagram
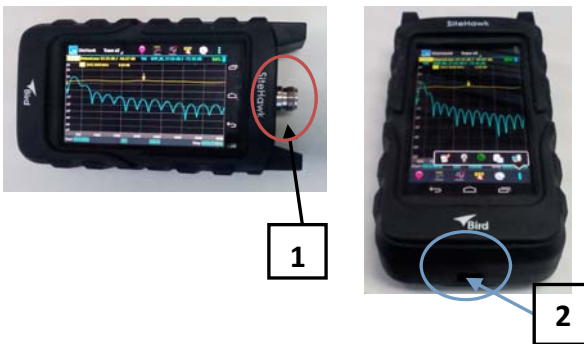
1	Antenna Test Port	Female N connector for connecting to the antenna. Use a phase-stable cable for best results.
2	USB 2.0 B Type	There is one Micro USB device port for connection to a USB Disk and Input for lithium-ion battery Charging power supplies.

Power

The SiteHawk SK-4000 Analyzer has an internal, rechargeable, lithium-ion battery pack.

- The unit will operate for a minimum of 4 hours of continuous usage.
- Recharging time, from a full discharge, is approximately 5 hours.

  Note: *When the unit is received the battery may not be fully charged. An AC adapter should be used when operating the unit for the first time.*

Powering On

1. Press Power Key for 5 seconds.

   Note: *Power on and waiting for 5 minute.*
2. Assemble the measuring components.

   Note: *Cable, connector, holder, these parts to connect DUT and Site-Hawk.*
3. Execute reflectometer calibration. See "Calibration" on page 7.

Powering Off

1. Press Power Key for three seconds.

   Note: *Pop up the device operation massage box.*
2. Select Power Off.

Sleep Mode

Press Power key.

   Note: *The display screen will be shut off though the SiteHawk SK-4000 Analyzer still be on.*

Measurement Port

N type projection measurement port of 50 ohm. This port is used to connect the DUT.

Calibration Accessories

Calibrating the SiteHawk SK-4000 Analyzer

Calibration Combination (Cal Combo) which contains:

- One 50 ohm load
- One Open standard
- One Short standard

> **Note:** *When using a test cable connected to the SiteHawk SK-4000 Analyzer, attach the Cal Combo to the end of the cable during calibration.*

> **Note:** *When using an extension cable, a phase stable cable is needed to ensure performance and accuracy.*

- Frequency Setting:
  85MHz~4GHz
- Sweep points setting:
  The max number is 3201 point (51point~3201point)
- IFBW choose key:
  Minimum bandwidth is 100Hz 30KHz~100Hz）
- Calibrate key
- Calibration Kit
- Open/Short/Load Calibration key
- Correction Key

1. Press the Calibrate key.
2. Connect the Cal Combo "Open" connector to the unit antenna port.
3. Press the Open softkey then wait for the unit to beep and display .
4. Connect the Cal Combo "Short" connector to the unit antenna port.
5. Press the Short softkey
6. Wait for the unit to beep and display.
7. Connect the Cal Combo "Load" connector to the unit antenna port.
8. Press the Load softkey
9. Wait for the unit to beep and display.

> **Note:** *During calibration, the color of the icon display is yellow.*

Note: *After calibration, the display will resemble Figure 4 on page 8.*

Figure 4   Calibration Display Screen
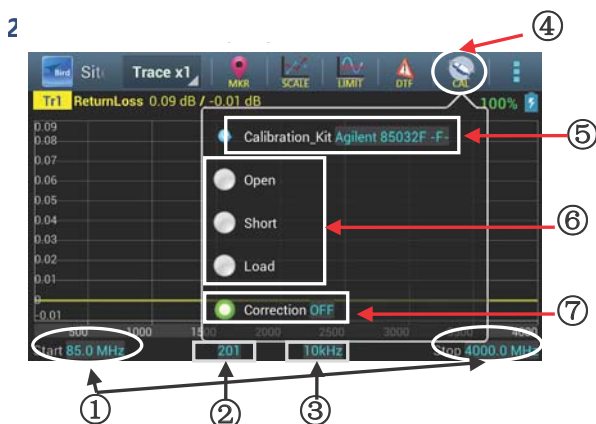
Calibration Combination Manage

The SiteHawk SK-4000 provides 14 sets of calibration kits. Including these, 8 sets are predefined Suite. The other sets are empty, which Calibration weight definition must be accurate standard parameters to improve the calibration accuracy.

When the predefined list of good suite can not meet the demand, the a custom calibration can be added.

The Custom Calibrate kits will be saved to the calibrate kits settings file int the program folder (save without additional operations).

Title Setting

1. Enter a Component name.
2. Press the Left part menu.

Calibration Criterion Edit

1. Press the Calibration menu.
2. Click the Calibration.
3. Components into Edit mode.
   - **Open mode:** Boundary capacitance is designated:
     $C = C0 + C1 f + C2 f 2 + C3 f 3$, f ： Frequency [Hz] C0···C3： Coeff
   - **Short Cut mode:** retention value is designated:
     $L = L0 + L1 f + L2 f2 + L3 f 3$, f ： Frequency [Hz] L0…L3： Coeff
   - **Standard mode:** All the Parameter is particular.
     One way Phase delay(s) resistance value (ohm) loss (Gohm/s)

8

Chapter 3   Measure Match Mode

Match measurement verifies and monitors the match conditions in the antenna system at various frequencies. The results are shown on an x-y graph. Frequency is shown on the x-axis and Return Loss, Cable Loss, or SWR is shown on the y-axis.

Before making a Match Measurement, be sure to have a Calibration Combination (Cal Combo), all necessary cables with adapters of the correct size and connector type.

Selecting the Measure Match Mode

1. Select ReturnLoss.
2. Select one of the following in the drop down menu:
   - ReturnLoss
   - CableLoss

Figure 5   Figure 3.1 Selecting the Measure Match Mode

Scanning Setting

Setting the Measurement Frequency

Frequencies can be set manually. Be sure to set the frequency to a value that is well beyond the normal range of the antenna.

Example - For a 450 MHz antenna, set the start frequency at 400 and the stop frequency at 500 MHz, for an 800 MHz antenna, set the start frequency at 700 and the stop frequency at 1,100 MHz.

Note: *Changing the frequency settings will automatically turn calibration off. Always set the frequency before calibrating the unit.*

Note: *If a frequency that is outside of the range of the Site Analyzer is entered, the Site Analyzer will override the entry and set the minimum or maximum frequency of the model.*

Setting a Custom Sweep Frequency

1. Select Other Config.
2. Select Setting.
3. Select each of the following:
   - Start
   - Stop
   - Center
   - Span
4. Enter a value for each setting.
5. Press Enter after entering each value.
6. Press the Screen to exit.

Figure 6   Setting a Custom Sweep Frequency

Selecting the Measurement Units

Select units before or after making a measurement. When making a match measurement, select one of three units for the Y (vertical) scale,

- SWR (ratio)
- Return Loss (dB)
- Cable Loss (dB)

1. Press the DTF key. (Figure 3.3)
2. Select units by pressing it
3. Open the units list menu by pressing a certain units.
4. Press the Screen to exit the configure screen.

Figure 7   Selecting the Measurement Units

Setting the Measurement Data Points

Select the number of data points to take during a measurement. There are seven data point options:

- 51 points
- 101 points
- 201 points
- 401 points
- 801 points
- 1601 points
- 3201 points

Increasing the number of data points increases the measurable distance in distance-to-fault measurements and increases the detail in Measure Match mode measurements. When saving a trace, the number of data points collected are saved.

A progress bar, just below the x-axis, will indicate the progress of the sweep.

When the number of measurement data points are changed, the current trace is erased and the Save softkey is disabled until the sweep finishes and the screen displays the first new trace.

1. Select Point key in status bar
2. Open the selection list.
3. Select a data point option.
4. Press the Screen to exit.

Figure 8   Setting the Number of Measurement Data Points

Setting the Scale

1. Select Scale.
2. Press the Left Icon.
3. Select one of the following the the drop down menu:
   - **For Manual Operation:**
     Press the TOP and BOTTOM key to enter a certain value
   - **For Auto Scale:**
     Auto to choose a best scale

Figure 9   Setting the Scale
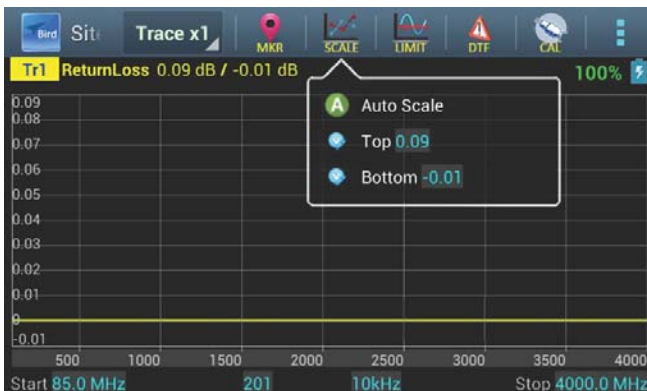
Tracing Mode Setting

1. Press the Test Icon to choose the specific line.

    Note: *The active Tracing line is High light.*

Choose one of the following:

- The Max_Value Set
    a. Double Click to Active.
    b. Enter a maximum value.

- The Min_Value Set
    a. Double Click to Active.
    b. Enter a minimum value.

- Tracing Count Seting

    Note: *SiteHawk has four trace lines.*

    a. Press the left Icon.
    b. Choose a specific line.

    Note: *Every trace line has a independent name, which can't be changed.Trace Name include the number, like as:Tr1,Tr2,Tr3,Tr4.*

    Note: *Every Trace has a default setting (appendix), such as: measurement parameters, format, scale, color and so on, this parameter can be reset by user.*

Figure 10   Tracing Setting Screen

Set and Activate Acceptance Limits

The limit line helps see failures. It appears as a horizontal line at the value selected.

An acceptance limit line can be set to help visualize what part of the measurement trace is not acceptable. The part of the trace that is not acceptable will display in red. To view the limit line, the limit test must be ON. This feature is available only in the Measure Match mode and the Fault Location mode.

1. Enable the Measure Match Mode. See "Selecting the Measure Match Mode" on page 13.
2. Set the frequency. See "Setting the Measurement Frequency" on page 9.
3. Calibrate the SiteHawk SK-4000 Analyzer. See "Calibration" on page 7.
4. Follow the numbered steps in "General Operation" on page 23 to turn ON the limit test and set the limit line value.

Interpreting the Measurement

The graph below shows a typical Match Measurement for an antenna system.

Figure 11   Graph

The graph contains the following elements:

- Trajectory of vertical axis vertical grid scale display activity data values.
- Horizontal grid scale display incentive axis data values (frequency, time or distance).
- Baseline position on behalf of the reference trajectory position.
- The measured value of the cursor on behalf of the activity on the trajectory difference.
- Track number is used to locate in a window.
- When scanning duration of more than 1 second, the current incentive position indicator will appear.

Cable Loss Measurement

Ensure that the cable being tested is unterminated (not connected to anything at the far end).

> **Note:** *Ensure that the cable does not have power greater than +23 dBm.*

> **Note:** *Ensure the frequency band of the system is known.*

Performing a Cable Loss Measurement

1. Press CableLoss.

Figure 12   Set Up for Cable Loss Measurement

2. Set the frequency start and stop to a range that is well beyond the normal range of the antenna. "Setting the Measurement Frequency" on page 9.

   > ***Example -*** *For a 450 MHz antenna, set the start frequency at 400 and the stop frequency at 500 MHz. For an 800 MHz antenna, set the start frequency at 700 and the stop frequency at 1,100 MHz.*

3. Connect a phase stable cable to the SiteHawk Analyzer antenna test port.
4. Connect a Cal Combo to the other end of the cable.
5. Calibrate the SiteHawk Analyzer. See "Calibration" on page 7.
6. Remove the Cal Combo unit from the cable.
7. Connect the phase stable cable to one end of the cable under test.
8. Connect the Short connection on the Cal Combo unit to the other end of the cable being tested.
9. Wait at least 10 seconds to allow the trace to update.
10. Hold the trace on the screen. See "Trigger" on page 21.
11. Place a triangle-style marker (mark 1) at the minimum loss point within the frequency band on the trace. See "Makers" on page 24.

12. Place a triangle-style marker (mark 2) at the maximum loss point within the frequency band on the trace. See "Makers" on page 24.

13. Save and label the trace, if appropriate. See "Save Operation" on page 33.

Interpreting a Cable Loss Measurement

The graph below shows a typical cable loss measurement. Note that the scale is greatly reduced to show the cable's variation across frequency.

Figure 13   Cable Loss Measurement Screen
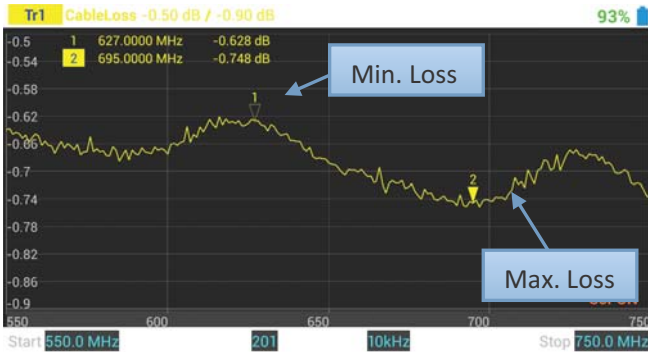
1. Take the average of M1 and M2.

> **Note:** *This is the average cable loss across the frequency band.*

2. Compare the loss with the manufacturer's specified loss for a cable of this length.

> **Note:** *If they do not correspond, retake the measurement, then check the cable for problems.*

> **Note:** *Cable Loss for a good cable should be flat across the frequency band.*

16

Fault location identifies the position of impedance discontinuities (reflections) within the antenna system. The measurement results are displayed on an x-y graph. Distance from the SiteHawk Analyzer is shown on the x-axis, while relative magnitude of the discontinuity is shown on the y-axis.

Before making a fault location measurement, ensure that the following items and information are present:

- Calibration Combination (Cal Combo) calibration unit
- All necessary cables and adapters of the correct size and connector type
- The velocity of propagation for the cable type being measured (obtain from the cable manufacturer)
- Number of data points to use in making the distance to fault measurement (user choice)

Selecting Fault Location Mode

1. Press DTF_SWR.
2. Select DTF_SWR.

Figure 14   DTF Mode Select
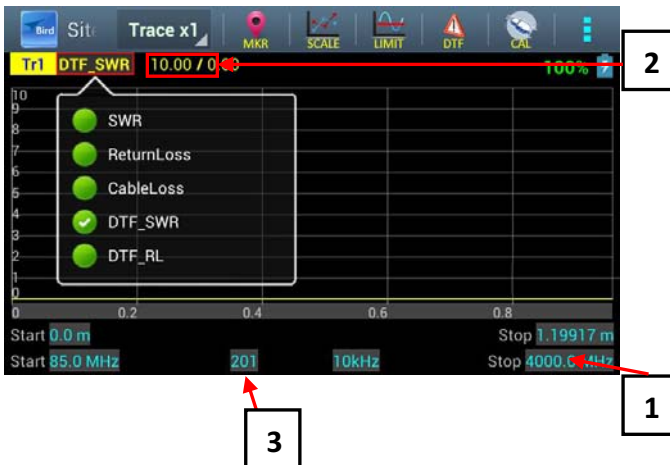
Setting the Frequency Span and Max Distance

Frequency Span

Frequency span and the relative propagation rate determines the maximum distance testing fault location test.The following will introduce the related system parameters set.

Narrowing the frequency span increases the measurable distance.

> **Note:** *Changing the frequency span or the max distance will automatically turn calibration off. Always set the frequency span or max distance before calibrating the unit.*

Max Distance

The maximum distance measured is determined by the frequency span, the velocity of propagation of the cable (Vp), and the number of data points to measure.

> **Note:** *If a maximum distance less than the total length of the cable system is selected, the trace might show a spike that is not really a fault, but rather an echo from the portion of the cable that is beyond the maximum length. Such a spike is known as an alias. To avoid aliasing, always set the maximum distance to a value that is a few feet or meters greater than the entire length of the cable system.*

Data Points

Increasing the number of data points increases the measurable distance. When changing the number of data points measured, the software automatically recomputes the new maximum measurable distance. If a maximum distance is entered manually, be sure to select the data points before entering the max distance.

> **Note:** *Changing data points will turn calibration off.*

Setting the Frequency Span

> **Note:** *At DTF mode, the basic data transform frequency -domain to time-domain by IFFT. The velocity of the testing trace has been know, such as coaxial-cable, time interval will be recalculation as distance.*

> **Note:** *At DTF_SWR or DTF_RL mode, Users can set the measure range by the fuzzy distance limit.Fuzzy distance should be set at frequency measure stage:*

$$\Delta T \; = \; \frac{1}{\Delta F} \; = \; \frac{N - 1}{F_{max} - F_{min}}$$

Note: N = Test points
F_{min} = Start frequency
F_{max} = End frequnecy
The fuzzy distance be recalculated as the max distance for DTF test.

$$DTF_{max} \; = \; \frac{C \cdot V_p \cdot \Delta T}{2} \; = \; \frac{C \cdot V_p \cdot (N - 1)}{2 \cdot (F_{max} - F_{min})}$$

Note: C = Speed of light
V_p = Start frequency

Example - *For a cable with a dielectric constant of 1, the velocity percentage is 100% and 201 data points are chosen, then the Site-Hawk Analyzer should be set to a frequency span of 0.1 MHz (85MHz to 85.1MHz). The maximum distance of fault will be 299,792.458 meters.*

1. Determine the frequency span.
2. Choose how many data points are to be measured.
3. Choose a velocity propagation percentage that is closest to the cable .
4. Press the 3-4-5-6 part on Fig4.2
5. Do one of the following:
    - After entering the Start value, press Enter.
    - After entering the Stop value, press Enter.
    - After entering the Point value, press Enter.

Figure 15   Setting the Frequency Span

Setting the Distance and Units

The trace can display the entire length (distance) of the cable system being measured or a smaller portion of the length for better detail.

If it is suspected that there might be a fault at a known distance along a cable, set the display to show only that area by using the start and stop points. Think of this as zooming in on a section of the cable. Both the start point (where to begin the trace display) and the stop point (where to end the trace display) can be set.

Unit

1. Select DTF.
2. Unit Select units settings.

> **Note:** *The system default unit m, optional units ns, ft.*

Start

1. Select the input box.
2. Set starting values.

End

1. Select the input box.
2. Set ending values.

Windows

1. Select the Window.
2. Select the corresponding window style.

> **Note:** *The default is Normal, Minimum case DTF display only part of the problem is a curve, display the Maximum case is DTF the whole curve.*

Velocity

1. Select Velocity.
2. Set speed value.

Cable Loss

1. Select CableLoss.
2. Set cable loss values.

Cable List

1. Select CableList.
2. Set cable type.
3. Select a certain cable type.

> **Note:** *Each type has the fixed value*。

Trigger

The Device has the following trigger modes:

- **Continuous** - End the scan cycle channel after each occurrence, scanning behavior
- **Keep -** Stop Scanning.

Trigger mode

1. Select the right side of the menu bar:
2. Click the switch trigger set CONTINUE.

Test for Fault Location

1. Connect the SiteHawk Analyzer to the cable being tested.

   > **Note:** *If the SiteHawk Analyzer is calibrated with a phase stable cable connected to its antenna port, do not remove the cable. Connect it to the cable to be tested.*

2. Wait at least 10 seconds for the sweep to update.
3. When a trace is on the screen, do any of the following:
   - Hold the trace. See "Trigger" on page 21.
   - Add markers to the trace. See "Makers" on page 24.
   - Save the trace. See "Saving and Recalling Traces" on page 28.

Interpreting the Fault Location Measurement

The graph below shows a typical Fault Location measurement for an antenna system. The table lists typical component return losses.

Figure 16   Fault Location Measurement Screen
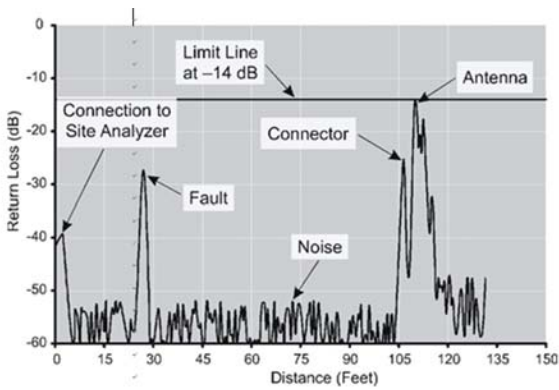
Typical Component Return Loss	
Antenna at Resonance	-14 dB
Connector	-25 dB
Jumper	-35 dB
Lightning Protector	-25dB
Transmission Line	-30dB

Each connector or jumper will show as a spike. If it is larger than the typical value, check the connector for damage.

Spikes where there are no components represent faults. Note the distance and check the line at that point for damage.

The largest spike is usually due to the antenna. Typically the trace after the antenna can be ignored.

If a selected cable length that is less than the total length of the cable system, the trace might show a spike that is not really a fault, but rather an echo from the remaining portion of the cable that is beyond the length chosen. Such a spike is known as an alias.

> **Note:** *To avoid aliasing, always set the measurement distance to a value that is a few feet or meters greater than the entire length of the cable system.*

A large spike (fault) near the SiteHawk Analyzer will mask other faults farther away. When a large spike near the Site Analyzer is found, fix it and then repeat the Fault Location measurement.

Chapter 5   General Operation

Limit Lines

The limit line helps to set off those parts of a trace that are outside of the acceptance (limit) values. It appears as a horizontal line at the limit line value.

An acceptance limit line can be set to help visualize what part of the measurement trace is not acceptable. The part of the trace that is not acceptable will display in red. To view the limit line, the limit test must be ON.

> **Note:** *This feature is available only in the Measure Match mode and the Fault Location mode.*

1. Click on Set Limit.
2. Set the following parameters:

Limit

Click to open or close the limit line.

Style

1. Enter setting limit line.
2. Set Max and Min.

> **Note:** *The default Max is the position of the limit line place at 10dB part, Min type is the position of the limit line place at 10dB part.*

Value

Select to enter the position value.

Step

Select to enter limit step value.

Move Up

Select to move limit line up.
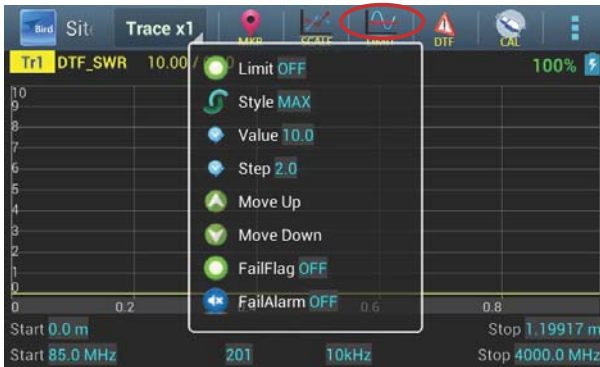
Move Down

Select to move limit line down.

FailFlag

Select open or close for the test status.

FailAlarm

Select open or close at the limit test failure alarm prompt.

Figure 17   Setting a Limit Line

Makers

Up to six markers can be used and activated to visually indicate the trace value at specific frequency points. All markers follow the current trace only. The Site-Hawk analyzer displays the frequency and signal value for each marker at the bottom of the screen. Each marker is displayed as a triangle pointer or a vertical line through the trace. The difference (delta) in frequency between two markers can also be displayed. Markers indicate SWR to 0.01, and Return Loss or Cable Loss to 0.1 dB.

When both a recalled trace and the current measurement trace is both displayed at the same time, there is an additional marker option, single mode and dual mode.

In single mode, the markers function normally (indicating the frequency and value at the marker).

In dual marker mode, select a marker using the Mark softkey.

At the bottom of the screen, the site analyzer will display the marker number, the frequency, and the value of the current trace at the marker.

> **Note:** *The difference in frequency and value between the current trace and the recalled trace is also displayed. The difference in frequency is always 0.00 (zero). Only the first three markers (M1, M2, M3) are available in dual mode.*

Activate Markers and Set Marker Style

1. Select Marker to open marker setting list.
2. Set any of the following parameters:

Add

Add a marker (1~6).

Delete

Delete a maker.

Position

Sets the position of an active marker.

Step

Moves the position of the marker.

Move Left/Move Right

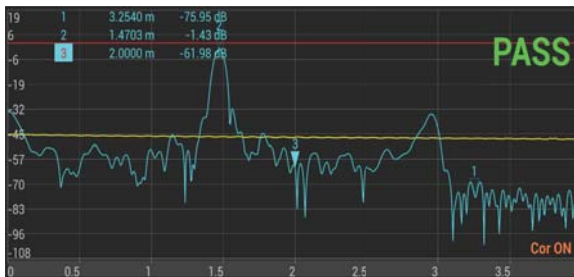Moves an active maker right or left.

Search Max/Min

Search a maximum or minimum point along the tracing line

3.   Press the Screen to return.

*Figure 18   Activate Marker and Set Style*

(a)

(b)

Using Delta Markers

In the delta marker mode, only active markers will be Hight light. The delta marker feature displays the difference (delta) in both frequency and value between the selected marker and each active marker. If the limit line is active, the difference between the selected marker and the limit line will be evident. The frequency difference between the selected marker and the limit line will always be the frequency of the marker. All markers follow the current trace only.

1. Cycle through the active markers.
2. Press the Delta Flag to the active markers and limit line (if active).

Figure 19   Delta Markers
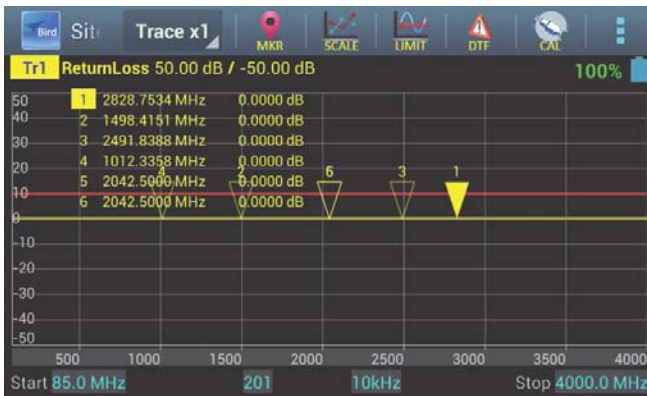
Maker Add

Select Add.

> **Note:** *The new standard will be added as active cursor display in the incentive shaft intermediate.*

Maker Deletion

Select Delete to remove the maker.

Setting the Position of a Cursor

1. Select to choose a specific cursor maker.
2. Enter the value the of the active maker.

Maker Activation

1. Select the left Icon of a specific line.
2. Press a specific Delta Icon to active the maker.
   - The active Maker is highlighted.
   - The inactive Maker is empty.

> **Note:** *Users can press the Delta Icon to active the Maker.*
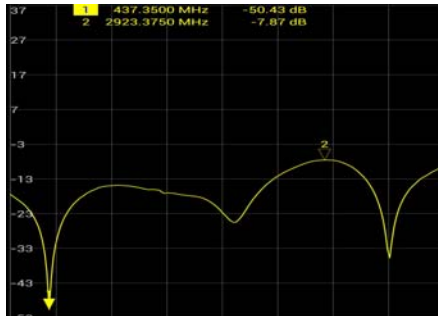
Limited Search

> **Note:** *Cursor maker search mode allowed to display these value：*
>   - *Maximum*
>   - *Minimum*

1. Press the Left Icon.
2. Display The Second Menu.
   - Choose the Search Max or Search.
   - Min Key to find the Certain Value.

Figure 20   Limited Search

Delta Marker Function

DeltaMaker function is used to calculate the frequency band. Activate it after selecting the reference maker. Once the reference maker is selected, activate the Delta Maker as the figure below.

Move Delta function used to move the select maker to the next maker position.

Figure 21   Markers Station Calculate Function
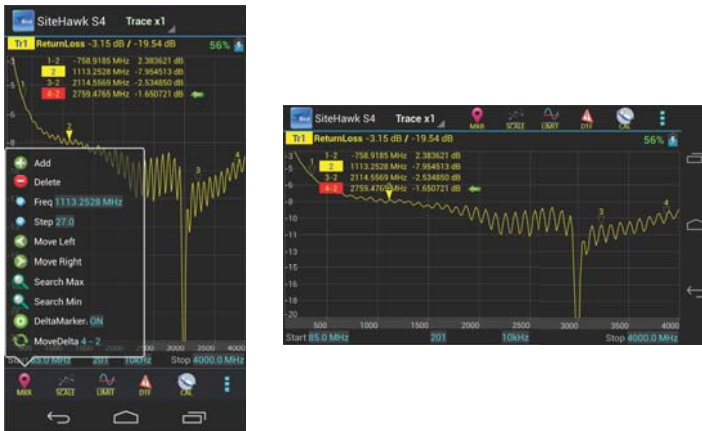
1. Press the Left Icon.
2. Display The Second Menu.

> **Note:** *Before you activate Delta Maker Function, you should select the reference frequency first.*

   a. Delta Maker default states is OFF.

   b. Click Delta Maker to turn the status to ON.

   c. Click Move Delta key to move to select the next makers.

Saving and Recalling Traces

Traces and instrument setups can be saved and recalled from either the unit's internal memory or on an external USB thumb drive. The SiteHawk Analyzer identifies saved files by the frequency range used, a time-date stamp, and the number of data measurement points.

Saving a Trace

1. Press the left Icon.
2. Select Data Memory.

> **Note:** *Data will be saved to the memory.*

Recalling a Saved Trace

> **Note:** *The recalled trace is drawn using the same display type as the trace currently being measured.*

Ensure that the unit is in either Measure Match mode or Fault Location mode to recall a saved trace.

- **Data path by dividing the memory trace**
  Show track the status bar: D/M
- **Data path smultiplied by the memory trace**
  Show track the status bar: D*M
- **Data path minus the memory trace**
  Show track the status bar: D-M
- **Data path and memory trace**
  Show track the status bar: D+M

1. Press DataMath
2. Open operation function.
3. Select the file.

> **Note:** *In the data storage box for the current data path and memory estimation operation type selection of desired.*

Viewing a Recalled Trace

When a saved trace is recalled, it is displayed along with the trace currently being measured (two traces on the screen). With a current and recalled trace, the display behaves as follows:

- The frequency range will change to the settings of the recalled trace.
- Recalled traces adopt the display type of the current trace.
- The resolution of the recalled trace does not affect the resolution of the current trace.
- Markers always follow the current trace, not the recalled trace.
- When comparing the current trace to a recalled trace, each data point on the current trace is compared to only the first data point on the recalled trace (at the frequency of the marker).
- The status box at the top of the screen displays the resolution and display type of the current trace on the top line and the label text of the recalled trace on the bottom line.

Others

Instrument Default

Instrument default key can be used to reset device. See "" on page 37.
Press the key if the user really want to reset, please press OK

Exit

Exit application.

System Information

Software version

- Hardware version and Device Serial Number
- System>about

System Setting

Contains the following parameters:

- Tracing line color setting
- Font size setting
- Line Width Setting
- Check or cancel Full screen
- Language Change

Chapter 6 Data Save and Export

SiteHawk SK-4000 Status

SiteHawk SK-4000 status, calibration result, and tracing data can be saved to the instrument, and can be recalled back to the SiteHawk program.

The parameters about this instrument setting include: motivation, scale, trace, cursor and analysis. These parameters are saved in the status files.

SiteHawk SK-4000 Status Save

Save Instrument Status

1. Click the icon on the right side.
2. Choose save type.
3. Choose the save file type.
4. Name the file.
5. Choose the save path.
6. Press the Icon.

Save Tracing Data in CSV File

SiteHawk can track data of single trace and then save the file as CSV file. The CSV file contains a comma separated list of data. The current format and response trajectory under the incentive value is stored in the CSV file.

> **Note:** *Only one way (activities) trajectory data is saved to a file.*

Trajectory data is in the following format to the *.CSV file:

```
F[0],        Data1,        Data2
F[1],        Data1,        Data2
             . . .
F[N],        Data1,        Data2
```

> **Note:** *F[n] = Frequency about point N.*
> *Data1 = Trace response value, Real part*
> *Data2 = 0,Imaginary part*

CSV Flies Save

Save trace data, activating the trace first.
1. Select Save file.
2. Choose save type first.
3. Choose the save file type.

Tracing Data SIP File

SiteHawk S- can save the parameters to the S1p file. The SIP file contains the frequency value and S-parameter.

*.s1p files are used to store a single port parameter.

Only one path of data is saved to the file.

The file contains a comment, title and track data lines. Comment on"!" Mark the start of the title, and began to "#" mark.

For single port measurement *.s1p file:

The Touchstone file contains the notes, the title and track data lines. Comment on"!" Mark the start of the title, and began to "#" mark.

```
! Comments
# Hz S FMT R Z0
F[1]  {S₁₁}'  {S₁₁}"
F[2]  {S₁₁}'  {S₁₁}"
        . . .
F[N]  {S₁₁}'  {S₁₁}"
```

Note: *Hz——frequency measurement unit (kHz、 MHz、 GHz)；*
FMT—— Data Format：
RI——Real part and Imaginary part
MA——Linear Amp and Phase
DB——Log Amp （dB） and Phase
Z0——reference impedance
F[n]——Frequency about point N.
{...}'—— {(RI) |(MA) |(DB)}
{...}"——{(RI) |(MA) |(DB)}

SIP File Save

Save the Data Path

1. Click Save SIP.
2. Choose a path.
3. Type the file name in the pop-up dialog box.

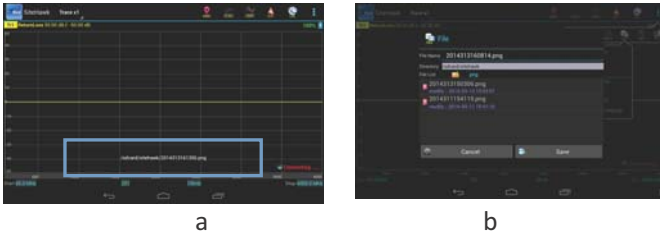### Option to save the file dialog box in the SIP file format

1. Click the save SIP regional choice format required in the standard format list.
2. Click the finish.

Screen Printing

Printing the screen and save the picture as the PNG mode

Figure 22   PNG Picture and Saved position

a   b

Save Operation

1. Save the current date.
2. Click on the Save Screen Picture.
3. Select the save file path.

> **Note:** *The default named "XXXXX.png", where "XXXXX" is the current date and time.*
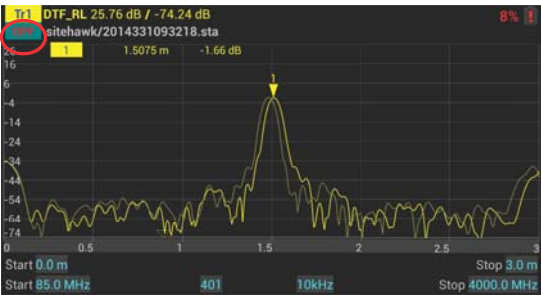
Load Status Function

The user can recall sta or csv data display with the running data at the same time.

1. Select Load status key.
2. Select the sta data to compare with the running data.

> **Note:** *Data compare looks like the follow figure, if you want to closed the sta date.*

3. Press the OFF key witch below the Tr1.

Figure 23   Recall Sta Data and Running Data

Data transfer function

User can transfer the data from SK-4000 to USB disk by a OTG cable (special, supplied), at the same time the SK-4000 can call data from USB directly.

Figure 24   Data Transfer by USB Disk

Cleaning

Clean the SiteHawk SK-4000 Analyzer only with a soft cloth dampened with mild detergent and water. Do not use any other type of cleaning solution.

CAUTION
Do not touch the cathode connector with bare hands, water, or emery cloth. Otherwise, damage may occur to the connectors surface.

- Clean the connector using a cotton swab dipped into an isopropyl alcohol solution.
- Before using connectors, to make sure that it is dry.
- Before connected with the anode of coaxial connector calibrated the wrench.

Charging the Battery

The internal battery pack will automatically recharge when the SiteHawk Analyzer is plugged in.

Recharging time, from a full discharge, is approximately 5 hours.

Device Check

Instrument Calibration should only be performed by a certified service producers or authority.

It is recommended that an Instrument Calibration is done every three years.

Storage

Store the SiteHawk Analyzer in an enclosed case and in an environment where the temperature remains between -15℃ to 55℃ with a maximum humidity of 80%(25℃).

The device should work at the temperatures between -10 ℃ to 50 ℃ with relative humidity of up to 80%(25 ℃).

Ensure that the equipment stored away from dust, acidic and alkaline taste, explosive gas, and other causes of corrosion.
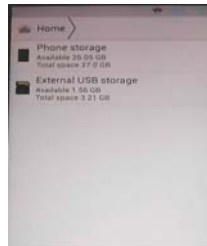
Firmware Update

1. Go to www.XXXX.com.
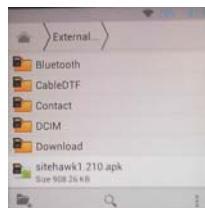2. Download the .apk update file.
3. Turn on the SiteHawk Analyzer.
4. Connect the SiteHawk to the PC via USB.

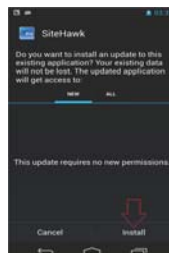
5. Select "File Manager".
6. Select "External USB storage".

7. Select SiteHawk.apk.

8. Install SiteHawk.apk in the unit.

Appendix

Description	Default Setting	Setting Range
Touchstone Data Format	RI - Real-Imaginary	Reflectometer
Allocation of Channels	1	Reflectometer
Active Channel Number	1	Reflectometer
Marker Value Identification Capacity (Stimulus)	8 digits	Reflectometer
Marker Value Identification Capacity (Response)	5 digits	Reflectometer
Vertical Divisions	10	Channel
Traces per Channel	1	Channel
Active Trace Number	1	Channel
Number of Sweep Points	201	q
Stimulus Start Frequency	85 MHz	Channel
Stimulus Stop	4 GHz	Channel
Frequency		
Stimulus IF Bandwidth	1 kHz	Channel
Sweep Range Setting	Start / Stop	Channel
Trigger Mode	Continuous	Reflectometer
Table of Calibration	Coefficients Empty	Reflectometer
Error Correction	ON	Reflectometer
Trace Scale	10 dB/division	Trace
Reference Level Value	0 dB	Trace
Reference Level Position	5 Div	Trace
Phase Offset	0°	Trace
Trace Display Format	Return Loss (dB)	Trace
Maximum Distance	1.49 m	Trace
Time Domain Kaiser Window	Normal	Channel
Number of Markers	0	Trace

Limited Warranty

All products manufactured by Seller are warranted to be free from defects in material and workmanship for a period of one year, unless otherwise specified, from date of shipment and to conform to applicable specifications, drawings, blueprints and/or samples. Seller's sole obligation under these warranties shall be to issue credit, repair or replace any item or part thereof which is proved to be other than as warranted; no allowance shall be made for any labor charges of Buyer for replacement of parts, adjustment or repairs, or any other work, unless such charges are authorized in advance by Seller.

If Seller's products are claimed to be defective in material or workmanship or not to conform to specifications, drawings, blueprints and/or samples, Seller shall, upon prompt notice thereof, either examine the products where they are located or issue shipping instructions for return to Seller (transportation-charges prepaid by Buyer). In the event any of our products are proved to be other than as warranted, transportation costs (cheapest way) to and from Seller's plant, will be borne by Seller and reimbursement or credit will be made for amounts so expended by Buyer. Every such claim for breach of these warranties shall be deemed to be waived by Buyer unless made in writing within ten days from the date of discovery of the defect.

The above warranties shall not extend to any products or parts thereof which have been subjected to any misuse or neglect, damaged by accident, rendered defective by reason of improper installation or by the performance of repairs or alterations outside of our plant, and shall not apply to any goods or parts thereof furnished by Buyer or acquired from others at Buyer's request and/or to Buyer's specifications. Routine (regularly required) calibration is not covered under this limited warranty. In addition, Seller's warranties do not extend to the failure of tubes, transistors, fuses and batteries, or to other equipment and parts manufactured by others except to the extent of the original manufacturer's warranty to Seller.

The obligations under the foregoing warranties are limited to the precise terms thereof. These warranties provide exclusive remedies, expressly in lieu of all other remedies including claims for special or consequential damages. SELLER NEITHER MAKES NOR ASSUMES ANY OTHER WARRANTY WHATSOEVER, WHETHER EXPRESS, STATUTORY, OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS, AND NO PERSON IS AUTHORIZED TO ASSUME FOR SELLER ANY OBLIGATION OR LIABILITY NOT STRICTLY IN ACCORDANCE WITH THE FOREGOING.