SENCORE

SA 1454

Signal Analyzer

USER'S MANUAL

FORM 7454

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WARNING 

PLEASE OBSERVE THESE SAFETY PRECAUTIONS

There is always a danger present when using electronic equipment.

Unexpected high voltages can be present at unusual locations in defective equipment and signal distribution systems. Become familiar with the equipment with which you are working and observe the following safety precautions.

- Every precaution has been taken in the design of your SA 1454 to insure that it is as safe as possible. However, safe operation depends on you the operator.
- Never exceed the limits of the SA 1454 as given in the specifications section or other special warnings provided in this manual.
- Always be sure your equipment is in good working order. Ensure that all points of connection are secure to the chassis, and that protective covers are in place and secured with fasteners.
- Remove test leads immediately following measurements to reduce the possibility of shock.
- Never work alone when working in hazardous conditions. Always have another person close by in case of an accident.
- Never assume that a cable shield is at earth ground potential. Both static and electrical voltages can be present on a cable's sheath. Do not connect the SA 1454 to a cable having a hot shield. Doing so may place lethal voltages on the SA 1454.
- Always follow standard safety procedures, such as, using your safety belt when working above the ground.

When in doubt be careful.

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1. SA 1454 Description

1.1 Introduction

The SA 1454 provides in a hand-held unit a full spectral display for finding and analyzing both analog and digital signal problems. A special Bars Scan spectral display provides "at a glance" the system spectral condition.

The SA 1454 features full tuning capabilities from 5–870 MHz for testing both forward and reverse path frequencies. It provides the capability to test all analog and digital signals including Annex B QAM 64/256, 8- and 16-VSB, as well as Annex A & C.

Data storage and printing capabilities are provided for system documentation and future data reference.

A built-in voltmeter indicates both DC level and square-wave AC present on the cable for systems that provide telephony and high-speed data.

The unit is a portable and light-weight design for field use. It weighs about 2.5 lbs and offers up to 6 hours of continuous battery use with normal charge-time of 2-4 hours. An easy to read backlit LCD display provides full spectral display and a quick bar-scan display of a selected channel plan. Individual RF levels with selectable analog and digital parameters are also available.

1.2 Features

- Full Spectral Display
- Bars Scan spectral display provides "at a glance" system spectral condition
- Set Frequency or Channel (Analog or Digital)
- Spectral Display controls for Frequency, Span, Reference Level, and dB/Division
- Moveable Frequency/Channel Marker on Spectral Display with Power Level readout at marker
- Measurement Units of dBmV, dBuV
- RF Level Measurements – Peak for Analog, Average Peak for Digital
- Frequency Range: 5–870 MHz
- Dynamic Range: >60dB
- Digital Measurements – BER* (Bit Error Rate), C/N (Carrier to Noise)
- Analog Measurements – C/N (Carrier to Noise), Audio/Visual Ratio for both carrier levels
- Audio Speaker Output (Analog TV Channels & FM Radio)
- FM Radio Carrier Levels and Audio Speaker Output

- DC and AC (square wave) measurements at RF input
- Buzzer function – Provides tone proportional to measured signal
- Auto-backlight-off and auto-off mode to preserve battery life
- Data storage and printing capabilities

*BER measurements on the SA 1454 are emulated. The SA 1454 does not incorporate a digital demodulator.

1.3 Specifications – SA 1454

Spectrum Analysis:
Frequency range: 5–870MHz
Dynamic range: >60dB
Resolution bandwidth: 100KHz
Reference level: –50dBmV to +65dBmV
+10dBuV to +125dBuV
Marker Frequency: 5-870MHz
Marker Analog or Digital: Automatic
Bar Scan: From 9 to 120 channels (selectable)

Analog Measurements:
Frequency band TV and Radio: 5–870Mhz
Frequency resolution: 62.5KHz
Input impedance: 75 Ohms
Measurement range:
-50dBmV to +65dBmV
+10dBuV to +125dBuV
Measurement resolution: 0.1dB
Accuracy @ 20˚ C:
Level measurement:
±1dB typ (2dB max)
A/V ratio:
±1.5dB typ (2dB max)
C/N ratio :
±2dB typ (4dB max)
Measurement. filter bandwidth:
100KHz @ -3dB
Channel plan memory:
6 memory positions
Standard: NTSC

Digital Measurement:

Frequency band: 47–870 MHz

Digital measurement:

Annex B QAM 64 / 256, 8-16 VSB, Annex A & C QAM 16 to 256

Power measurement range:

–35dBmV to +56dBmV

+25dBuV to +116dBuV

BER measurement:

Before RS BER up to 2x10-8 (emulated)

Digital signal quality test:

PASS-MARG-FAIL

Based on emulated BER measurement

Digital power limit indication:

Indicates that the signal power is too low or too high.

General Specifications:

Voltmeter function: AC (Square wave), DC 0 to 100V

Channel plan master copy function: Optional or via PC

Power:

Built-In NI-CD rechargeable battery

External power supply: 17–20 VAC 1A

AC Adapter: 120V

Battery duration at 25 degree C:

3-4 hours in analog mode

2-3 hours in digital mode

Size: H 11.8” x W 4.5” x D 2.4”

Weight: 2.5 lbs.

Download port: RS232 standard serial port

Display: 128 x 128 pixels, 2.5” square

General

Power Requirements: 120 V AC,

Rechargeable Battery Life: 2-4 Hrs Continuous
Battery Saver Auto Off: 5 min. nominal (defeatable)
Battery Charge Time: 4 Hrs.

Data Logging: 100 Sites

Size: 11.8" H x 4.5" W x 2.4" D

Weight: 2.5 lbs.

Environmental

Operating Temperature: 14°F to +122°F
Storage Temperature: –40°F to +150°F
Humidity: 0 to 90% (non-condensing)

Specifications Subject to Change Without Notice

1.4 Supplied Accessories

1. **AC Charger** 120 volt AC charger. Plugs into the SA 1454 to charge the battery or provide AC operation.
2. **Protective Carrying Case** Protective carrying case designed to prevent unit damage while used in the field.
3. **"Rubber Duck" Antenna** Connects to the 75-Ohm input of the SA 1454 to perform premises leakage testing.

1.5 Options

NOT Supplied with Unit, but available at additional cost

1. **Test Cable** 75-Ohm F-to-F male Test cable. Quality Test Cable with one "Fast F" male cable connector.
2. **F-81 replacement input connector** May be changed from the exterior. (Unscrew and discard the old connector. Screw in the new F-81.)
3. **DC Vehicle Charger** 12 Volt DC adapter. Plugs into the SA 1454 to charge the battery or provide DC operation. Sencore # PA298
4. **Dipole Antenna** Adjustable Dipole CLI Antenna. Used to perform Cumulative Leakage Measurements (CLI) for FCC documentation. Sencore # AN710
5. **Serial Printer** Portable Serial Printer. Use to print stored data from the SA 1454. Sencore # SP1453
6. **Serial Data Cable** Used to connect the SA 1454 to the serial printer or PC. Sencore # SC1453

1.6 SA 1454 Overview

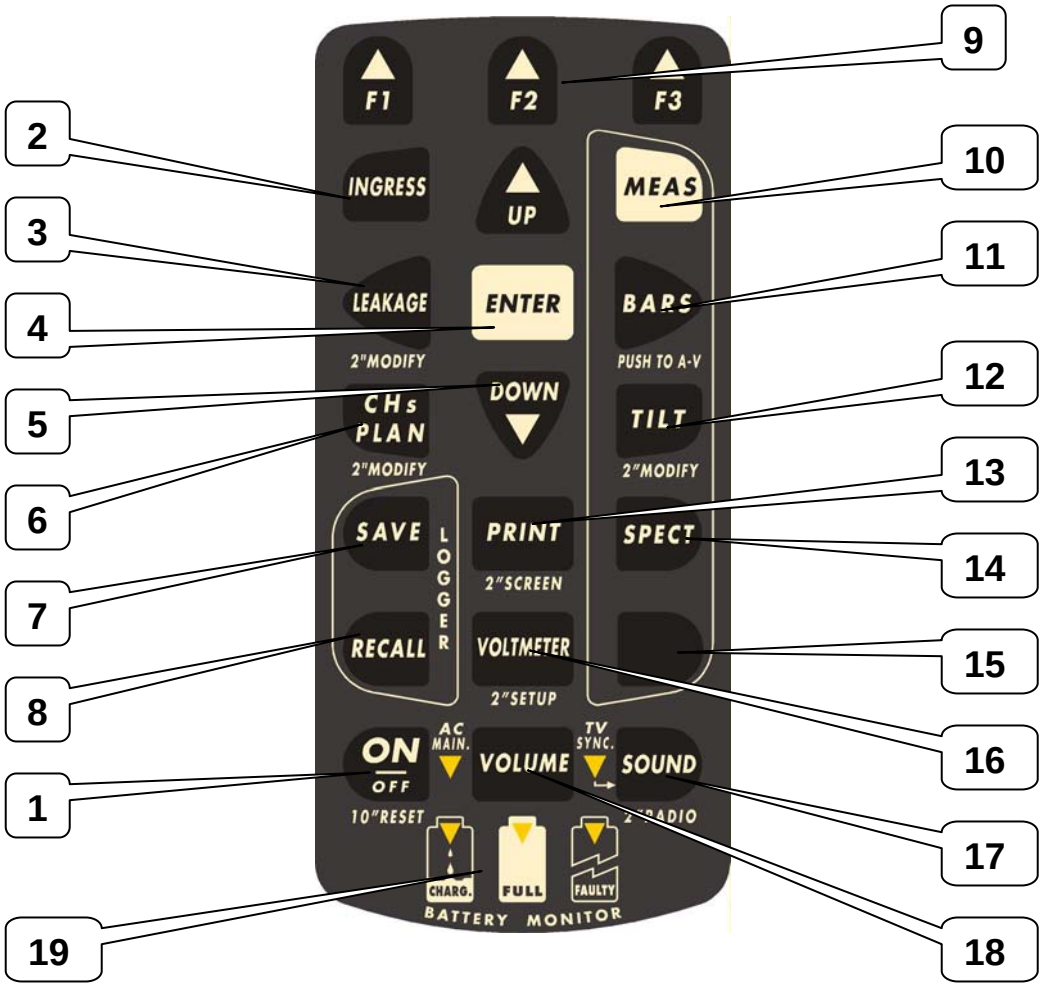

FIGURE 1 – FRONT PANEL CONTROLS

1.6.1 Inputs

RF Input – Input "F" connector. 75 ohms. Field replaceable with any standard F-81 fitting. Located at top of unit.

Charger Input – Charger input charge jack. (17 VAC at 1A max) Charges the internal battery or operates the meter from the charger or cigarette lighter adapter. Charges only when the unit is power off. Located at the bottom of unit.

1.6.2 Output

RS-232 Connector – RS-232 Output to Serial Printer or Serial Interface to PC. 9-pin D-sub connector located on side of unit.

1.6.3 Controls

1. **ON/OFF** – Turns the SA 1454 power On or Off. After the startup display, the meter will go back to the last function that was used before the meter was turned off. All settings are stored when the meter is turned off. Holding ON/OFF key for 10 seconds will reset the instrument.
2. **INGRESS –** Puts the unit in a mode to measure return path interference frequency and level induced into the cable system.
3. **LEAKAGE* –** Puts the unit in a mode to sense RF energy radiated from the cable system. Used in conjunction with dipole or rubber duck antenna, also known as egress or CLI. Holding the button for 2 seconds allows modification of the leakage setup parameters, such as leakage threshold and antenna characteristics.
4. **ENTER** – Enters the edit mode of a menu item where the asterisk is scrolled with the **UP ARROW** and **DOWN ARROW** keys.
5. **UP ARROW and DOWN ARROW** – Scrolls the asterisk within menus and changes values after a menu item has been set to "edit" by pressing **ENTER**.
6. **CHANNEL PLAN* –** Allows selection of the desired channel plan. Holding the button for 2 seconds allows modification of the channel plans.
7. **SAVE –** Allows saving the key parameters of every channel within a channel plan to a log file. After pressing SAVE you will select the correct channel plan and the key parameters you want logged, along with the log file number.
8. **RECALL –** Allows recalling a saved log file and viewing the results for each channel in the plan.
9. **F1 F2 F3** – Used to set start/stop frequencies and hold during ingress measurements.
10. **MEAS** – Selects the Measurement mode, you can then select individual channels within a channel plan. Reports key measurements for the selected channel, digital or analog, depending on the channel type.
11. **BARS –** Bar Scan. Allows display of the picture carrier level for each channel in the channel plan. Holding the button for 2 seconds will graphically show the audio/video carrier ratio.

12. **TILT* –** Sets the meter into the Tilt analysis mode for measuring calbe system frequency response. Holding the button for 2 seconds allows you to modify the tilt measurement parameters.
13. **PRINT*** – Enters the Print menu. You may print to a serial printer or an open Hyperterminal connection on a PC. Holding the button for 2 seconds will print the active screen to the serial printer.
14. **SPECT** – Sets the meter into Spectrum Analysis mode.
15. **Not Used**
16. **VOLTMETER* –** Displays the DC and square-wave AC present on the cable. Holding the button for 2 seconds will take you into the unit configuration menus.
17. **SOUND* -** Allows you to listen to the audio on analog TV channels. Pressing the button again will allow you to hear the TV sync. Holding the button for 2 seconds allows tuning of radio stations by frequency.
18. **VOLUME –** Allows you to set the key beep volume. It will also adjust the audio volume if Sound has been selected.
19. **BATTERY CHARGE INDICATORS –** Displays unit charging and battery status.

Buttons with an ***** have dual function.
Hold button down for approx 2-3 seconds for 2nd function.

2 Quick Setup Operation

The following will briefly describe the procedures to begin making cable system measurements. A detailed operation section will follow describing each of the settings and measurements in greater detail.

The first step before making any measurements is setting the channel plan. Start by pressing the **CHs PLAN** button. You can now select the appropriate channel plan. If you have not already programmed a channel plan you will need to hold down the **CHs PLAN** button for 2 seconds to modify or build a channel plan. All channels are assumed to be NTSC analog unless the channel plan is modified with the correct parameters for the digital channels. Once you have selected the correct channel plan, you may now move on to perform the measurements.

Throughout the operation of the unit, use the **UP /DOWN** arrow keys to move the asterisk * to different parameters in a given menu. Press **ENTER** and use the **UP /DOWN** arrow keys to modify these parameters. Press **ENTER** again to save the modification.

2.1 Channel Measurement

1. Press the **MEAS** button to enter the channel measurement screen.

2. With the asterisk * next to Channel, press **ENTER**, you may now press the **UP / Down** arrow keys to select the desired channel and press **ENTER**.

3. The screen will now display key parameters for the channel. Measurement parameters will be determined by whether the channel is analog or digital, as defined in the channel plan.

4. Use the **UP / DOWN** arrow keys to move the asterisk * to the Page line. Pressing **ENTER** will allow you to use the **UP /DOWN** arrow keys to select different pages of measurement information for the selected channel.

2.2 Spectrum Analysis

1. Press the **SPECT** button to enter the spectrum analysis screen. The center channel will be pre-defined based on the channel that was selected in the measurement screen.

2. Use the **UP /DOWN** arrow keys to move the asterisk * to different parameters of the spectrum analysis. Press **ENTER** and use the **UP**

/DOWN arrow keys to modify these parameters. Press **ENTER** again to save the modification.

3. Center Channel, Reference Level, Span, dB/Div, and Marker Freq. are the modifiable parameters in the spectrum analysis.

2.3 Spectrum Bar Scan View

1. Press the **BARS** button to enter the bar scan analysis screen. The center channel will be pre-defined based on the channel that was selected in the measurement screen. The bars represent the carrier level for each channel.

2. Use the **UP /DOWN** arrow keys to move the asterisk * to different parameters of the spectrum analysis. Press **ENTER** and use the **UP /DOWN** arrow keys to modify these parameters. Press **ENTER** again to save the modification.

3. Marker Channel, Reference Level, Channel Span, and dB/Div, and are the modifiable parameters in the bar scan analysis.

4. Pressing the BARS button for 2 seconds will display the bar scan in a mode that graphically represents A / V carrier ratio for each channel in the scan.

2.4 Tilt Measurement

1. Press the **TILT** button to enter the tilt (frequency response) analysis screen.

2. If you have not already defined the channel to include in the tilt analysis (up to 9 channels), press the **TILT** button for 2 seconds to enter the tilt setup menu.

3. In the tilt setup menu, use the **UP /DOWN** arrow keys to move the asterisk * and use the ENTER button to select the low and high channels. You may also select up to 7 intermediate channels to include in the tilt analysis.

4. Press the **TILT** button to return to the tilt analysis screen and perform your measurement.

5. Use the **UP /DOWN** arrow keys to move the asterisk * to different parameters of the tilt analysis. Press **ENTER** and use the **UP /DOWN** arrow keys to modify these parameters. Press **ENTER** again to save the modification.

6. Marker Channel, Reference Level, and dB/Div, are the modifiable parameters in the tilt analysis.

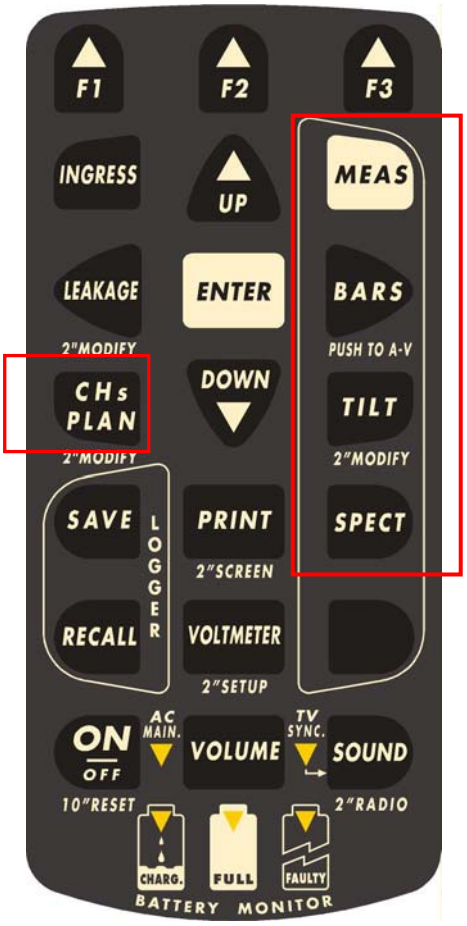

FIGURE 2 – MAIN MEASUREMENT BUTTONS

3 Detailed Operation

This section of the manual demonstrates all of the user features and capabilities of the SA 1454. The following will describe, in detail, all of the functions, measurements, and setup of the SA 1454.

3.1 Unit Configuration

Most operations are self evident from the front panel nomenclature, however a few Setup functions are less obvious since they are seldom used. All keys with the * symbol have a second setup function to their operation and are effective by holding down for approximately 2 seconds. The following describes the steps involved in configuring the unit's main parameters.

3.1.1 Configuration Menu

1. Press and hold the **VOLTMETER** button for approximately 2 seconds. This will bring up the Configuration Menu screen.

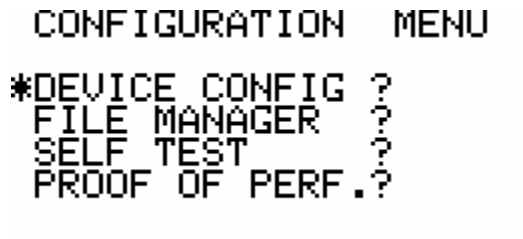

FIGURE 3 – CONFIGURATION MENU

2. Use the **UP /DOWN** arrow keys to move the asterisk * and the **ENTER** key to select the appropriate sub-menu.

3. The Device Configuration menu allows you to modify unit parameters such as, display contrast, Auto-off timeout, Backlight, Spectrum analysis mode, and C/N measurement. You may also modify the default unit of measure used throughout the meter for levels from dBmV to dBuV. Use the **UP /DOWN** arrow keys to move the asterisk * and the **ENTER** key to select the parameter to modify. Use the **UP / DOWN** arrow keys and the **ENTER** button to make changes to the parameter. This is the procedure for selecting and modifying parameters throughout the unit. Selecting Back will take you to the previous menu.

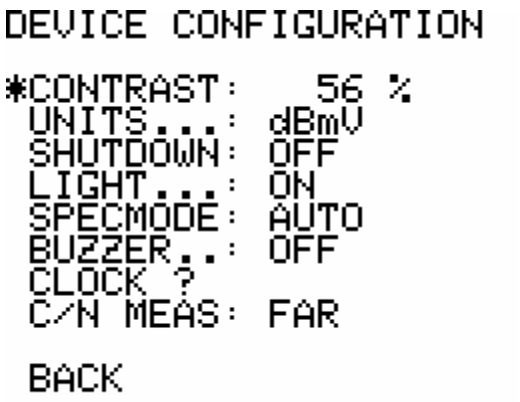

FIGURE 4 – DEVICE CONFIGURATION MENU

4. The File Manager menu allows you to delete log files that are no longer needed. First, select the file type (channel plan, datafile, ingress, spectrum, or leakage). Second, select the file name of the desired file type that you want to delete. Finally, select delete and the file will be removed.

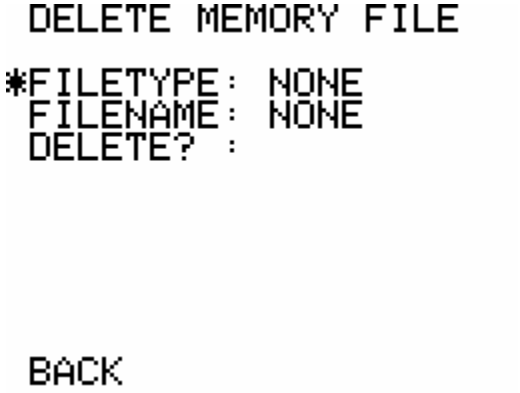

FIGURE 5 – DELETE MEMORY FILE MENU

5. The Self-Test menu will run a built-in-test program that will report back the status of the unit and version numbers.

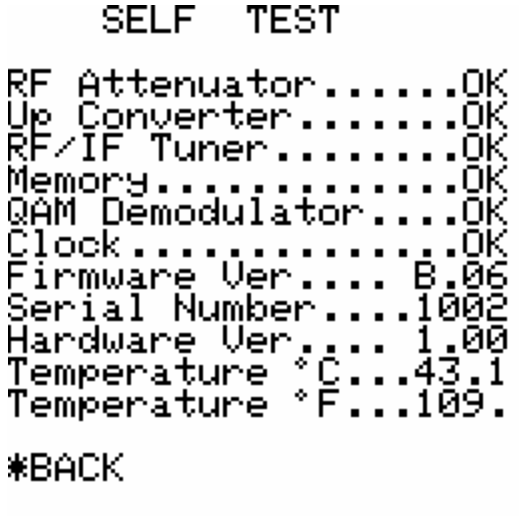

FIGURE 6 – SELF TEST

6. The Proof of Performance menu allows you to perform unattended testing of your cable system. First, select a start time. Then select the interval of how often you want it to log system parameters (15m, 30m, 45m, 1hr – 8hrs). You then have the option of enabling or disabling the digital MER and before RS BER measurements. Select Go, you will now be in a menu that prompts you to delete all data files to make room for the new logs that are generated from the proof of performance. The unit will now initiate the proof of performance and go into a sleep mode to conserve battery life.

FIGURE 7 – PROOF OF PERFORMANCE MENU

The unit will awaken during the measurement interval that you defined. Scan progress will be reported to the screen. The datafile name that the capture is stored to will also be displayed. Datafile names will start with "Log. 1" and increment up with each subsequent capture. These files may be accessed later using the **RECALL** button under the Logger function.

FIGURE 8 – PROOF OF PERFORMANCE SCAN AND STORE

3.1.2 Printing

The SA 1454 allows you to print Live (current channel-by-channel) captures and Stored data files from the Data Logger to a printer or Hyperterminal. A serial printer must be used if direct printing is desired. Printing to Hyperterminal (or other serial terminal emulation program) will be detailed below.

1. Connect the SA 1454 to serial Com port on your PC using a null-modem 9-pin RS-232 cable. If you are using a Com port on your PC terminal go on to step 2. If your are using a serial printer go directly to step 7.

2. Open Hyperterminal, usually under Start>Programs>Accessories> Communications on Windows operating systems. Give the connection a name, such as, SA 1454 Capture.

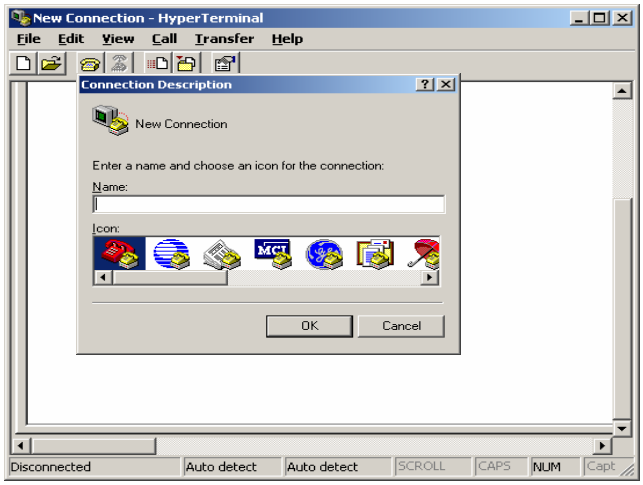

FIGURE 9 - HYPERTERMINAL

3. Choose Com 1 or Com 2.

FIGURE 10 – HYPERTERMINAL CONNECTION SETTINGS

4. Set the Port Settings: 8, None, 1, None

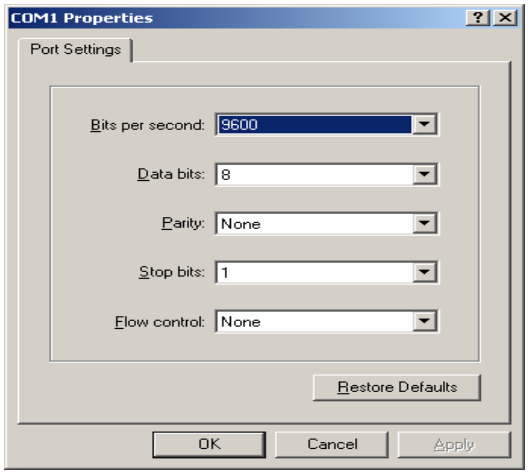

FIGURE 11 – HYPERTERMINAL PORT SETTINGS

5. In Hyperterminal, go to File>Properties. Click on settings tab and set emulation to VT100 and click OK.

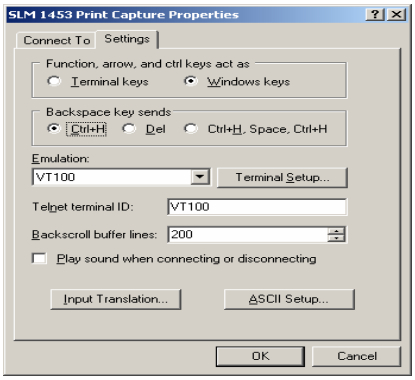

FIGURE 12 – HYPERTERMINAL EMULATION SETTINGS

6. You will now be able to display incoming data from the SA 1454 in the Hyperterminal window. If this is all that is desired, go on to step 7. However, it is usually valuable to capture this information to a file that may be manipulated and printed at a later time. To capture the data from Hyperterminal go to Transfer> Capture Text… in the Hyperterminal window. Name a file to capture the data to and proceed to Step 7. Step 8 will outline how to manipulate captured data.

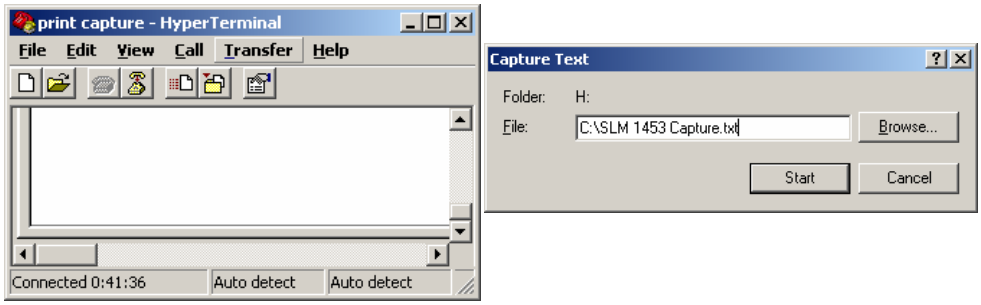

FIGURE 13 – HYPERTERMINAL CAPTURE TEXT

7. Press the **PRINT** button on the SA 1454 to enter the printing menu. You will be able to select Live or Stored to print either current information or stored datafiles. You must then select the appropriate channel plan for a Live print or the correct datafile for a Stored print. Finally, move the astericks * to Confirm and press **ENTER** to initiate the printing. Data will now be sent to the serial printer or the Hyperterminal program on a PC.

   Holding the PRINT button down for 2 seconds will initiate a print of the current screen you are viewing. For example, if you are viewing the spectrum, you may press and hold the PRINT button to send the spectrum display to the printer. This only works with a serial printer, sending this to Hyperterminal will not work correctly.

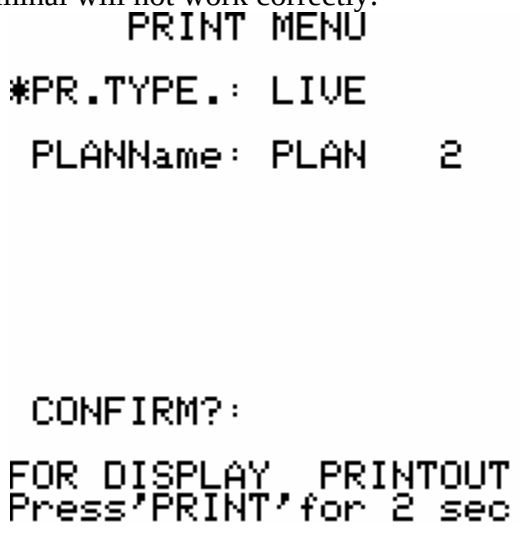

FIGURE 14 – PRINT MENU

8. Data files captured to a text file via Hyperterminal may be manipulated in several ways. The files may be opened with Notepad or other simple text editing programs. However, using Microsoft Excel offers the greatest possibilities for data organization. To import the text file into Excel:

- Open Excel
- Go to File> Open
- Set for text files of type: *.prn, *.txt, *.csv
- Browse and open the SA 1454 text file that you captured
- A text import wizard will start
- Ensure the “Delimited” button is selected
- Click Next

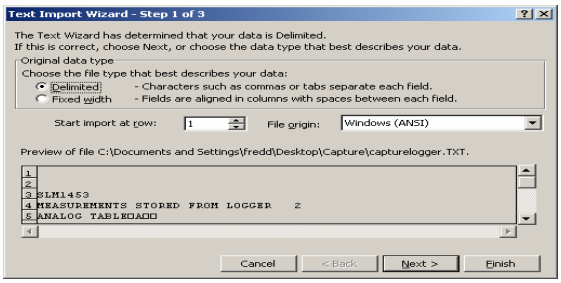

FIGURE 15 – EXCEL IMPORT WIZARD

- In Delimiters, click on Other
- Enter a “!” in the block next to Other
- Click Next
- Then Click Finish

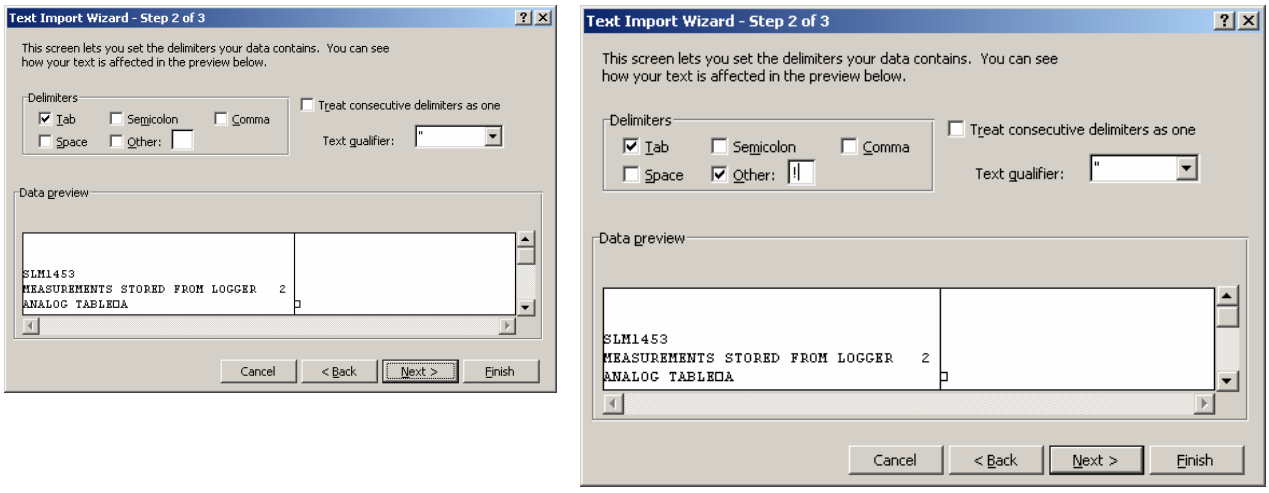

FIGURE 16 – EXCEL IMPORT WIZARD PART 2

- Imported data in Excel looks as follows:

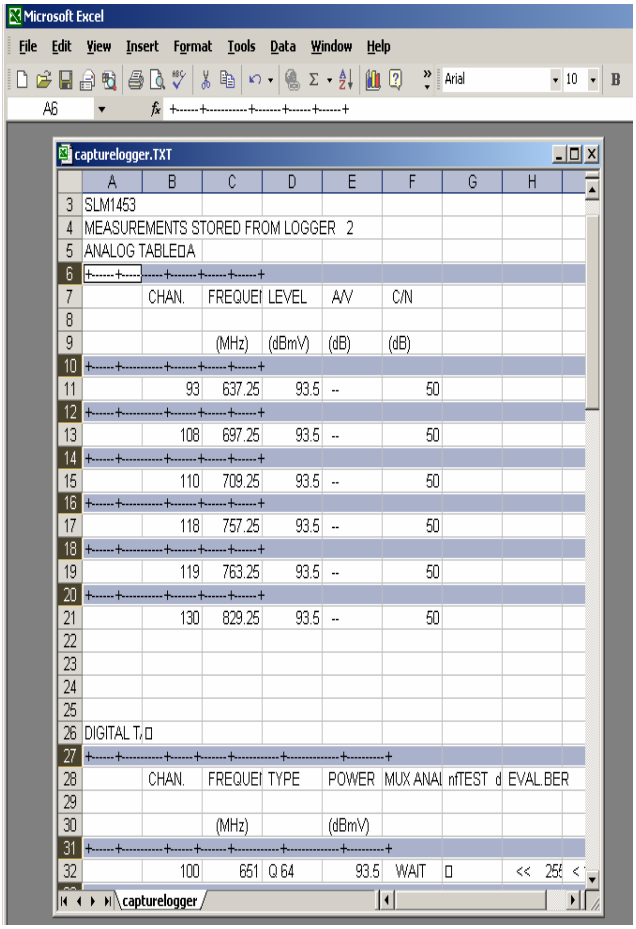

FIGURE 17 – EXCEL SPREADSHEET EXAMPLE

- You may delete extra lines in Excel by holding CTRL and clicking on each line with (+-----+-----+-----+), now select Edit> Delete (not the delete key). Adjust column widths and bold headings as desired.

3.2 Channel Plan

The key to performing any measurements with the SA 1454 is setting up a channel plan. All measurements are based on the selected channel plan. The channels available for selection in the Measurement menu are defined by the selected channel plan. This includes not only the channel numbers, but the modulation format (NTSC, QAM, VSB, etc.) and the symbol rate if applicable. Your first step in using the SA 1454 will be setting up a channel plan.

3.2.1 Selecting a Channel Plan

If you have already created a channel plan, it is very simple to select this plan and start making measurements. You will select a channel plan before continuing to take measurements.

1. Press the **CHs PLAN** button. You will now enter a menu that allows you to select and activate a stored channel plan.

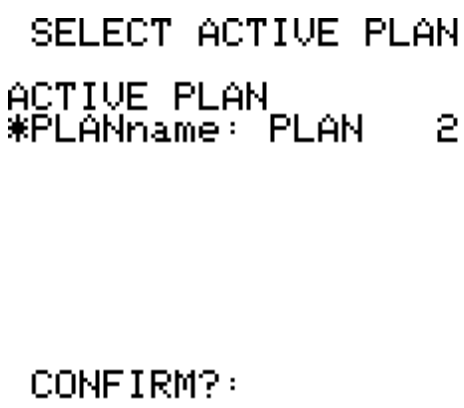

FIGURE 18 - SELECT ACTIVE CHANNEL PLAN MENU

2. Press **ENTER** with the asterisk * on the PLANname line and use the **UP /DOWN** arrow keys to select the desired plan. Press ENTER to activate the plan and then press **MEAS**, **TILT**, etc. to begin using the meter.

3.2.2 Building a Channel Plan

To build a new channel plan you must first press and hold the **CHs PLAN** button for 2 seconds to enter the Channel Plan menu. Building or modifying a channel plan involves four basic steps.

1. The first step is to select an existing channel plan as a source to copy from. This can either be a plan you have already created or one of the four default standard plans that come preloaded into the unit. The default plans are USA Cable, USA HRC, USA IRC, and USA Broadcast. The default plans serve as a starting point to build your plan and not to be used for performing measurements.

2. The second step is to select the plan name for your destination (this will be the name of the new plan you are creating). The default names for the destination are Plan 1-6.

3. The third step is to set the selection mode to either manual or auto. When the selection mode is set to manual you must manually add or remove channels from the channel plan. If you select auto, you must then select a threshold level. This setting will determine the minimum level (-30dBmV – 40dBmV) that a channel must meet to be included in the channel plan. Once confirm is selected, the meter will automatically scan your cable system (cable must be connected to meter) and add all of the channels that meet the defined threshold to the plan. Automatic mode is only applicable for analog channels.

4. The final step is to select Confirm. This will write to your new or modified channel plan and take you into the Edit Channel menu.

FIGURE 19 – SELECT FILE PLAN MENU

Once you have selected confirm in the Select File Plan menu, you will now be taken into the Edit Channel Plan menu. This menu will display your Source plan, Destination (new) plan, channel number, and channel parameters. You also have the ability to replace a channel (with new parameters), delete a channel, or disable all channels. Disabling all channels allows you to build up a plan from scratch (if you have a small number of channels) rather than deleting a large number of unused channels. These features are valid regardless of what selection mode you used in the previous menu (manual or auto).

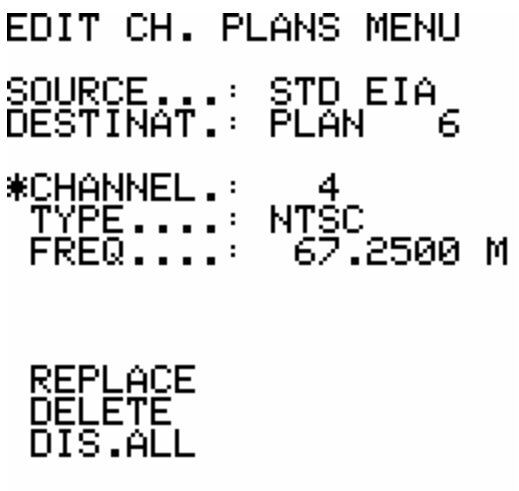

FIGURE 20 – EDIT CHANNEL PLAN MENU (ANALOG)

Editing your new channel plan is a straightforward operation. All channels are assumed to be standard NTSC and the frequency is based on the source plan. If one of the default standards was used, the channels and frequencies track with that standard. Channels in your system that are digital, require editing the new plan. The following steps describe how to edit your new plan.

1. Move the asterisk * to the Channel line and press **ENTER**. You will now be able to select which channel you want to modify. Press **ENTER** again when the desired channel is selected.

2. If you are deleting the channel you may now move directly to the Delete line and press ENTER. This channel is now removed from the plan.

3. If you need to change the type of channel, move to the Type line and press **ENTER**. You will now be able to select the modulation format for the selected channel. The types available for selection are: Disable, NTSC, CW, FM, Scrambled NTSC, 16-256 QAM A/B/C, 8VSB, 16VSB, QPSK, and DATA. Press **ENTER** again when the desired type is selected.

4. Move to the Freq line if the frequency needs to be changed from the default value.

5. The line below Freq in this menu will vary based on the modulation type selected. For NTSC, CW, FM, and disable there will be no line. If one of the digital modulations or Scrambled NTSC is selected, then there will be a line (Symbol Rate for the digital types and Level Offset for Scrambled NTSC).

- For digital channels, move to the Symbol Rate line and modify the symbol rate based on the parameters of the digital channel. Each modulation type has a default setting that is already programmed into the meter. If this setting matches your system parameters no changes are necessary.

Symbol Rate Defaults

Annex B
QAM 64 = 5.057 MSps
QAM 256 = 5.361 MSps
VSB
8-VSB = 5.381 MSps
16-VSB = 5.381 MSps
QPSK
1.280 MSps
DATA
6.000 MSps

Annex A&C
QAM 16 = 6.875MSps
QAM 32 = 6.875MSps
QAM 64 = 6.875MSps
QAM 128 = 6.875MSps
QAM 256 = 6.875MSps

- For Scrambled NTSC channels, move to the Level Offset line and modify the sync level as appropriate for your system.

6. Once changes have been made to a channel, you need to move the asterisk * to the Replace line and press ENTER. The changes you have made are now saved for that channel. Pressing ENTER on the Delete line will remove the channel from the plan. Pressing ENTER on the Dis. All line will disable all channels allowing you to build up a plan from scratch (if you have a small number of channels) rather than deleting a large number of unused channels.

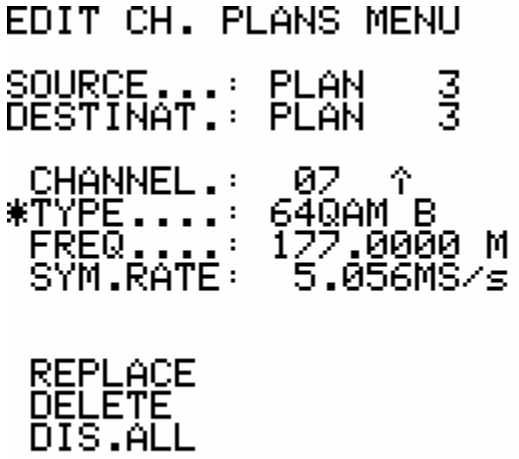

FIGURE 21 - EDIT CHANNEL PLAN MENU (DIGITAL)

Repeat steps 1-6 (as applicable) for every channel that needs to be edited in your plan. Keep in mind that all channels default to NTSC and need to be edited if they are digital in your cable system.

3.3 Measurement

Once you have built and selected a channel plan, you are now ready to begin using the meter. The Measurement screen is probably the single most import tool in the SA 1454, as it provides you with most of the basic channel measurements in one location.

To access the Measurement screen press the **MEAS** button. Below is a typical analog channel display. As with all screens on the SA 1454, move the asterisk * with the **UP / DOWN** arrow keys to the line you wish to change and press **ENTER**. Use the **UP / DOWN** arrow keys to change the value and press **ENTER** again to save and return to the asterisk *.

3.3.1 Analog Measurement

The following starts with measurements on analog channels with digital measurements to follow.

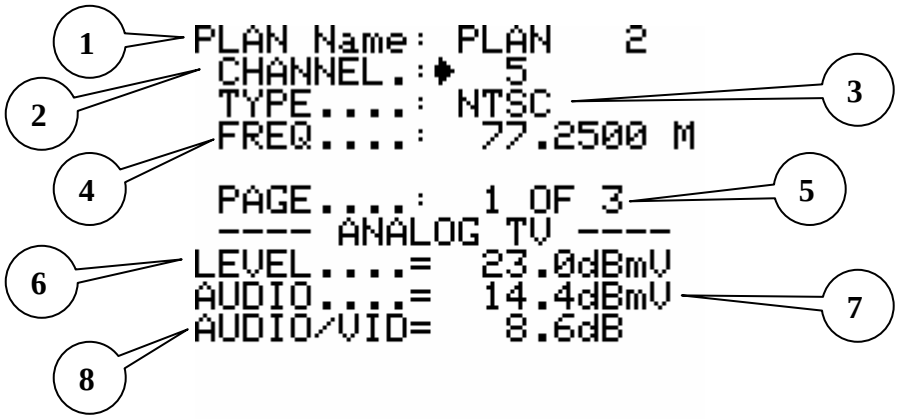

FIGURE 22 – MEASUREMENT SCREEN PAGE 1 (ANALOG)

1. Channel Plan – Displays the channel plan that you are currently using. Remember, to change the channel plan, press the CHs PLAN button and select the desired plan prior to going into the Measurement screen.

2. Channel – This line displays the channel under measurement. You may change channels in this line within the parameters of the channel plan.

3. Channel Type – Displays the type of channel that is under test (NTSC, QAM, 8-VSB, etc.). This is defined in the channel plan.

4. Frequency – Displays the frequency of the channel selected, defined by the channel plan.

5. Page Number – There are three pages to the analog measurement screen. You may select the page you desire on this line. Page one contains most of the information.

6. Level – The peak picture carrier level on analog channels and the average level on digital channels.

7. Audio – The audio carrier level on analog channels.

8. Audio / Video Level – The difference between the picture and audio carrier levels on analog channels.

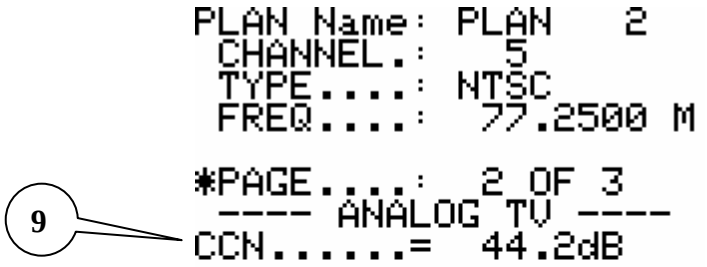

FIGURE 23 – MEASUREMENT SCREEN PAGE 2 (ANALOG)

9. Carrier to Noise Ratio – The ratio of the carrier to noise level on the selected channel.

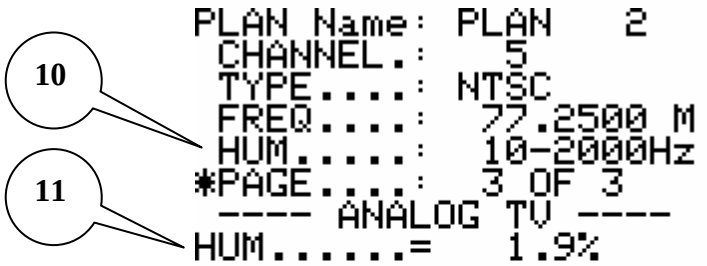

FIGURE 24 – MEASUREMENT SCREEN PAGE 3 (ANALOG)

10. Hum – The frequency at which the Hum measurement is taken. Definable values are 50, 60, 100, 120, and 10-2000 Hz. Hum is usually a product of power supply ripple from the AC line.

11. Hum Measurement - A percentage value indicating the amount of AC ripple on the cable system at the frequency defined in the Hum line.

3.3.2 Digital Measurement

The following are measurement screens for digital channels.

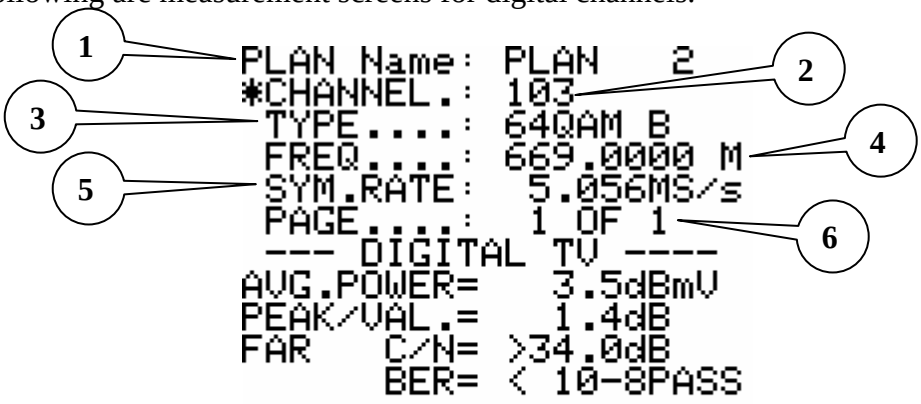

FIGURE 25 – MEASUREMENT SCREEN 1 (DIGITAL)

1. Channel Plan – Displays the channel plan that you are currently using. Remember, to change the channel plan, press the CHs PLAN button and select the desired plan prior to going into the Measurement screen.

2. Channel – This line displays the channel under measurement. You may change channels in this line within the parameters of the channel plan.

3. Channel Type – Displays the type of channel that is under test (NTSC, QAM, 8-VSB, etc.). This is defined in the channel plan.

4. Frequency – Displays the frequency of the channel selected, defined by the channel plan.

5. Symbol Rate – Symbol rate of the selected digital channel. This is defined when building a channel plan.

6. Page Number – There is only one page to the digital measurement screen.

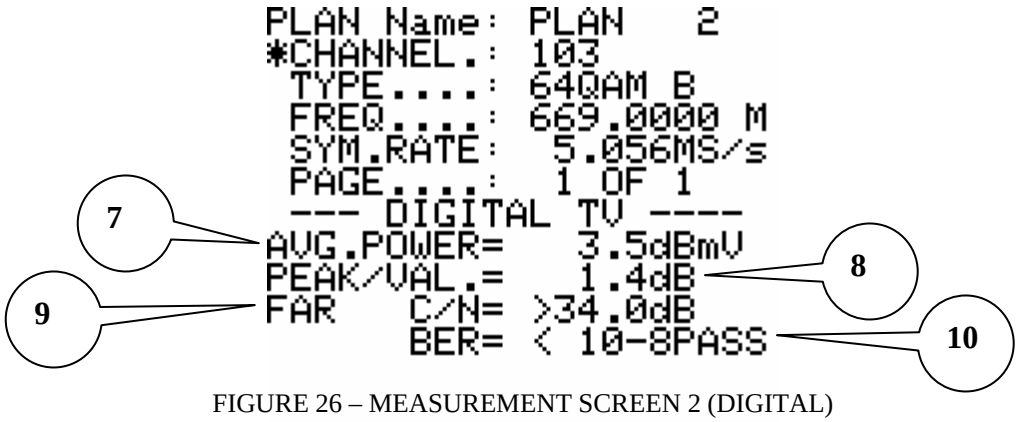

FIGURE 26 – MEASUREMENT SCREEN 2 (DIGITAL)

7. Average Power – Continually updated power value averaged while the measurement screen is active on a selected channel.

8. Peak to Valley – Measurement of the difference between the highest (peak) and lowest (valley) power level across the 6MHz channel spectrum.

9. C/N – Carrier to Noise measurement. Far indicates that the measurement is set to measure C/N using the lowest noise floor based on a sample of the 15 channels above and 15 channels below the measured channel. Near indicates that the measurement is set to measure C/N using the lowest noise floor based on a sample of the channel above and channel below the measured channel. The Near and Far setting may be defined in the device configuration (see figure 4).

10. BER – Bit Error Rate. Emulated indication of digital signal quality based on the theoretical number of errored bits divided by the number of non-errored bits. A number of 10-6 or lower is generally a PASS condition. The SA 1454 calculates this value based the C/N value and the modulation format. For example: you will need a higher C/N value with 256QAM to achieve the same theoretical BER as 64QAM.

3.4 Bar Scan

Pressing the **BARS** button will take you to the Bar Scan screen. The bar scan shows a snapshot of overall cable system performance by displaying a bar that represents the peak level of each channel in the defined span. There are several definable parameters that you may modify to change the view of the bar scan.

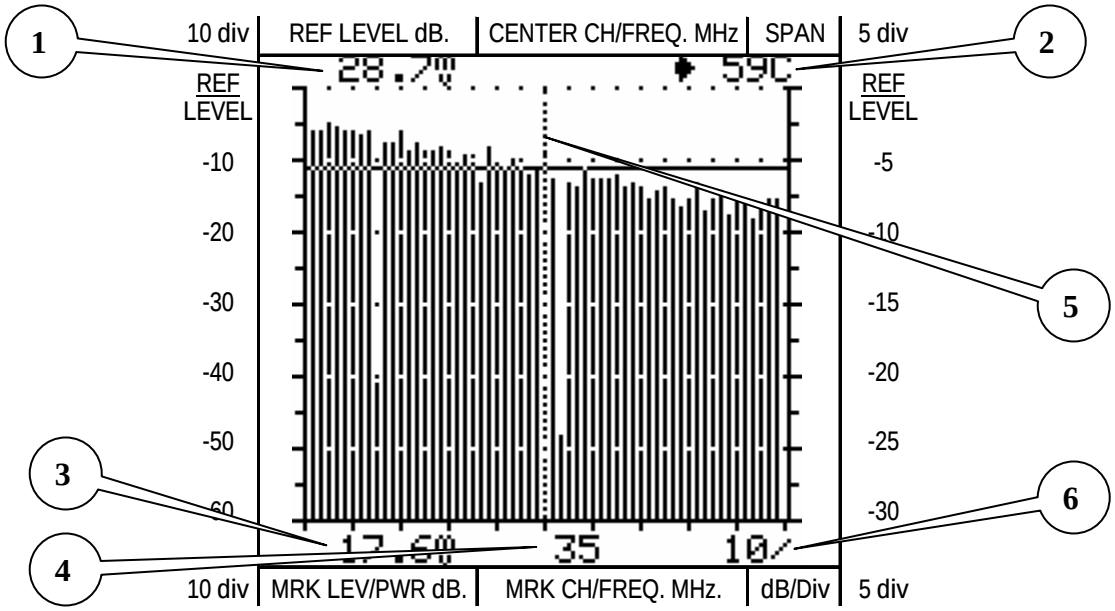

FIGURE 29 – BAR SCAN SCREEN

You may modify parameters in the bar scan screen by moving the asterisk * with the **UP / DOWN** arrow keys to the value you wish to change and pressing **ENTER**. Use the **UP / DOWN** arrow keys to change the value and press **ENTER** again to save and return to the asterisk *.

1. Reference Level – The reference level that defines how the scan is displayed. This value is auto-ranging, however, it may be modified from –60 to +65 dBmV.

2. Channel Span – The number of channels you want included in the scan. You may select a 9, 19, 29, 59, or 120 channel scan.

3. Marker Level – Displays the peak level of the marker channel selected.

4. Marker Channel – This value will originally be derived from the channel number last selected in the measurement screen. It will appear in the center of the span by default. The marker channel may be changed and the cursor will move in the scan accordingly.

5. Marker Channel Cursor – Graphically displays the marker channel's location within the scan.

6. dB / Division – Displays and allows you to set the dB per Division for displaying the bar scan. 1, 5, 10, and 20 are the available steps.

Pressing and holding the **BARS** button for 2 seconds will display the bar scan with a marker on each bar indicating the audio carrier level (on analog channels) in respect to the peak (picture carrier) level.

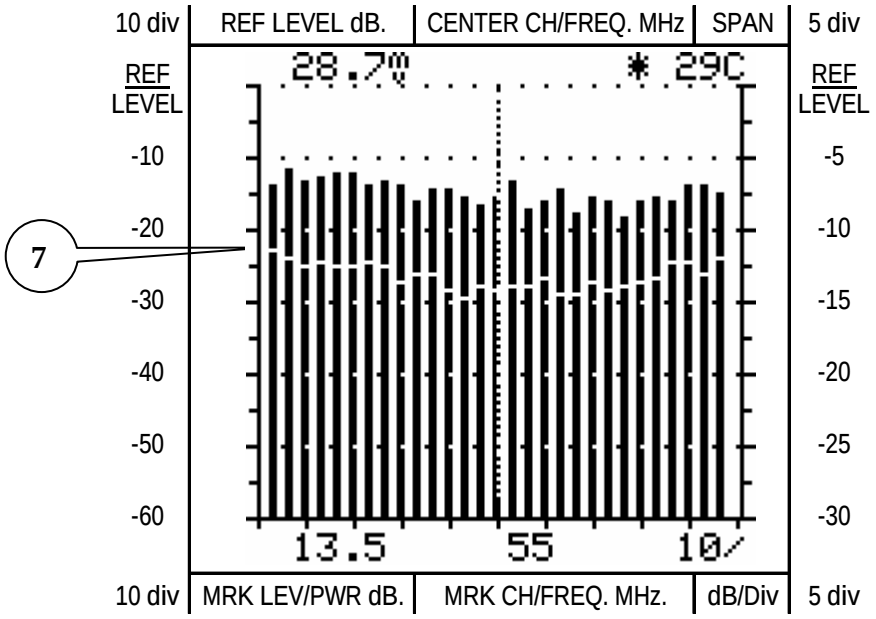

FIGURE 30 - BAR SCAN SCREEN WITH A-V INDICATION

7. Audio Carrier Indicator – Indicates the audio carrier level within a channel.

3.5 Tilt

Tilt is a measurement that will show you the overall frequency response of your cable system. By performing a tilt measurement you can graphically see the levels of a few chosen channels and determine the frequency roll-off of your system.

The first time you want to view the tilt of your system you will need to set up which channels you want to view. Press the **TILT** button for 2 seconds to enter the tilt setup menu and tag which channels you want included in the tilt measurement.

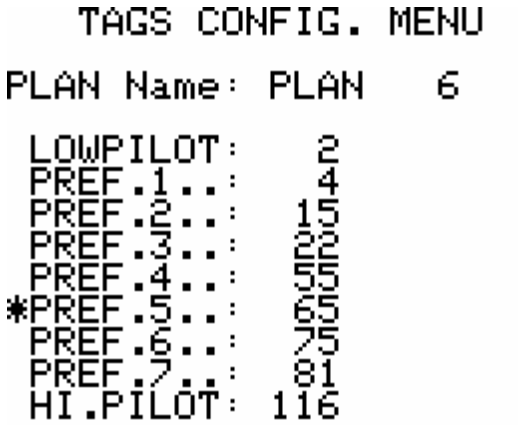

FIGURE 31 – TILT TAGS CONFIGURATION MENU

You may modify parameters in the tag configuration screen by moving the asterisk * with the **UP / DOWN** arrow keys to the value you wish to change and pressing **ENTER**. Use the **UP / DOWN** arrow keys to change the value and press **ENTER** again to save and return to the asterisk *.

You may tag up to nine channels to include in the tilt measurement. You must tag at least two channels (the low and high pilot). Channels must be in ascending order from the low to high pilot channels. Once you have tagged your channels, press the Tilt button again and you will be taken into the tilt measurement screen.

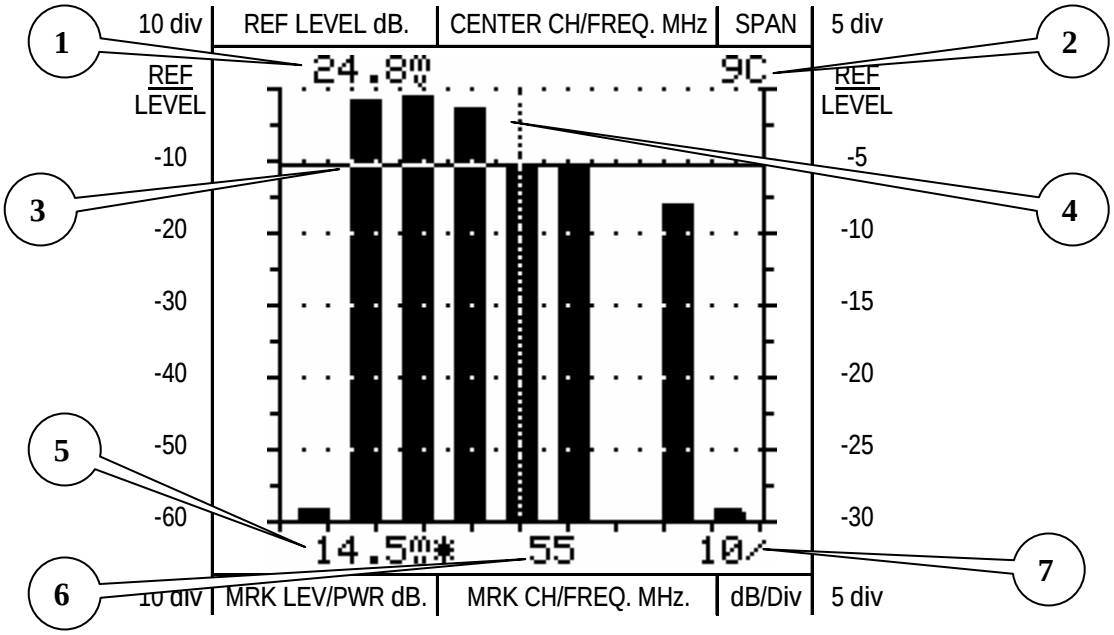

FIGURE 32 – TILT MEASUREMENT SCREEN

1. Reference Level - The reference level that defines how the spectrum is displayed. This value is auto-ranging, however, it may be modified from –60 to +65 dBmV.

2. Span – The span of the tilt spectrum. Fixed at nine channels.

3. Peak Level Cursor – Graphically displays the peak level of the marker channel.

4. Marker Channel Cursor - Graphically displays the marker channel's location within the spectrum.

5. Marker Level – Displays the peak level of the marker channel selected.

6. Marker Channel – This value will originally be the center channel tag. The marker channel may be changed between the tagged channels and the cursor will move in the tilt spectrum accordingly.

7. dB / Division – Displays and allows you to set the dB per Division for displaying the spectrum. 1, 5, 10, and 20 are the available steps.

3.6 Spectrum Analysis

The SA 1454 incorporates a feature not found in many current signal level meters, spectrum analysis. To view the spectrum screen press the **SPECT** button. After a few moments the spectrum will appear.

As with most screens on the SA 1454, you may modify parameters in the spectrum screen by moving the asterisk * with the **UP / DOWN** arrow keys to the value you wish to change and pressing **ENTER**. Use the **UP / DOWN** arrow keys to change the value and press **ENTER** again to save and return to the asterisk *.

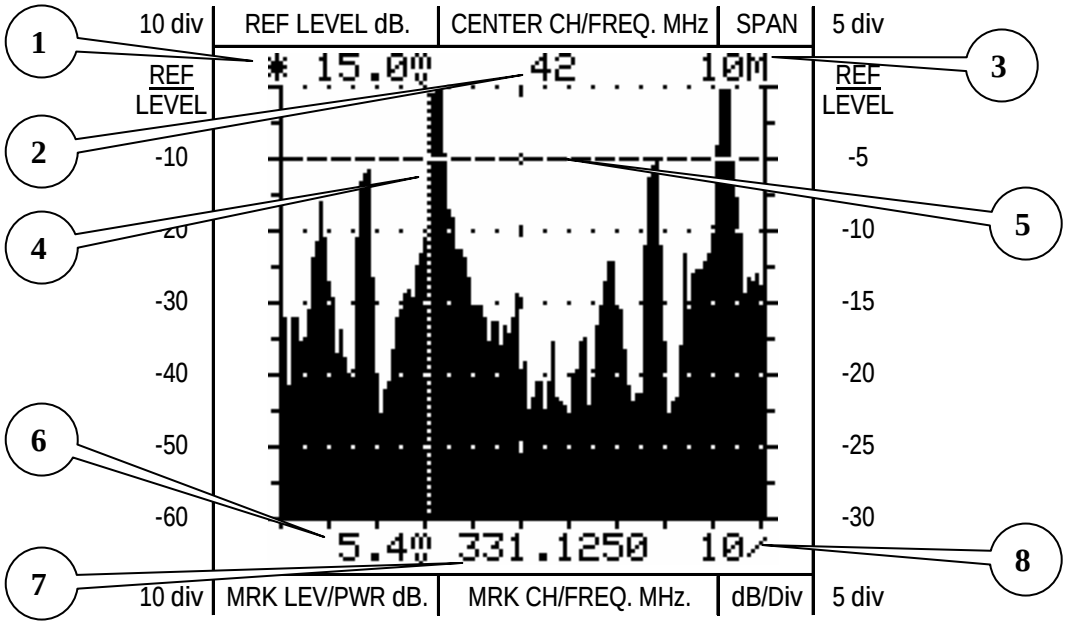

FIGURE 33 – SPECTRUM ANALYSIS SCREEN (10MHZ SPAN)

1. Reference Level - The reference level that defines how the spectrum is displayed. This value is auto-ranging, however, it may be modified from –60 to +65 dBmV.

2. Center Channel – The center channel of the spectrum originally derived from the last channel selected in the measurement screen. May be modified.

3. Span – The span of the spectrum. Modifiable in the following steps (MHz): 2, 5, 7, 10, 20, 50, 100, 200, 500, and Full (50-870)

4. Marker Frequency Cursor - Graphically displays the marker frequency's location within the spectrum.

5. Peak Level Cursor – Graphically displays the peak level of the marker frequency.

6. Marker Level – Displays the peak level of the marker frequency selected.

7. Marker Frequency – This value will originally be derived from the channel number last selected in the measurement screen. It will appear in the center of the spectrum by default. The marker frequency may be changed and the cursor will move in the spectrum accordingly.

8. dB / Division – Displays and allows you to set the dB per Division for displaying the spectrum. 1, 5, 10, and 20 are the available steps.

Notice how much different the following figure looks compared to the first spectrum analysis screen. (10MHz span versus Full span)

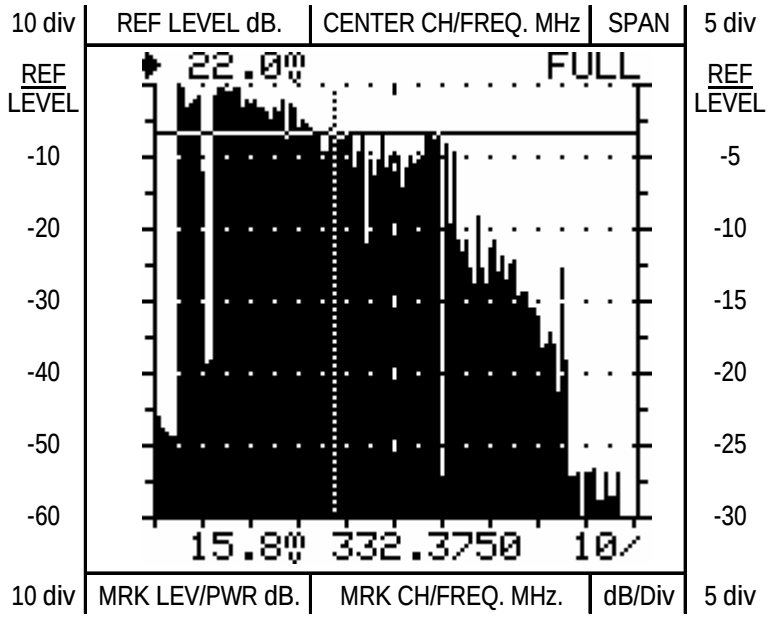

FIGURE 34 – SPECTRUM ANALYSIS SCREEN (FULL SPAN)

3.7 Sound Output

The SA 1454 has a built-in speaker and the ability to output analog audio. Pressing the **SOUND** button will allow you to hear the audio on an analog channel selected in the measurement screen. Pressing the **SOUND** button a second time will allow you to hear the AM demodulated video sync pulse (59.94 Hz buzz) indicating there is video present on the selected analog channel. You will also see a light next to the **SOUND** button indicating TV Sync.

3.8 Volume

Pressing the **VOLUME** button allows you to adjust the volume of the speaker output. This includes Beep volume, Sound volume, and Leakage volume. After pressing **VOLUME**, you will then need to use the **UP / DOWN** arrow keys to adjust the volume level.

3.9 On / Off

The operation of the **ON / OFF** button is self-evident. To power on the unit, press and release the **ON / OFF** button. To turn the unit off, press the **ON / OFF** button until you hear a beep (about 2 seconds) and release. Pressing the **ON / OFF** button for 10 seconds will initiate a reset (reboot) of the unit in the unlikely event it should lock-up.

3.10 Voltmeter

Pressing the VOLTMETER button will take you into the voltmeter screen and display square wave AC and DC voltages present on the cable drop. Pressing the VOLTMETER button for 2 seconds will take you into the unit configuration menus described earlier in section 3.1.

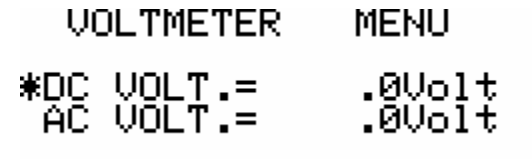

FIGURE 35 – VOLTMETER MENU

3.11 Ingress

Ingress testing is the process of determining if any unwanted frequencies are being radiated into the cable system from the premises. Testing for ingress should occur at the ground block or tap, testing into the premises with the cable system disconnected. All televisions, set-top boxes, and other equipment should be on. However, cable modems should be disconnected due to their operating frequencies.

Press the **INGRESS** button to enter the ingress spectrum screen. Prior to reading measurements on the ingress spectrum, some setup is required. Press the **F1** button to set the start frequency. Press **ENTER** and use the **UP / DOWN** arrow keys to modify the start frequency (5.000 – 47.375 MHz range). Now press the **F3** button to set the stop frequency. Press **ENTER** and use the **UP / DOWN** arrow keys to modify the stop

frequency (7.125 – 65.000 MHz range). The **F2** button allows you to enable or disable hold. Hold determines whether the spectrum is completely redrawn with each sweep or if previous information is held and added to with each sweep.

As with most screens on the SA 1454, you may modify parameters in the ingress spectrum screen by moving the asterisk * with the **UP / DOWN** arrow keys to the value you wish to change and pressing **ENTER**. Use the **UP / DOWN** arrow keys to change the value and press **ENTER** again to save and return to the asterisk *.

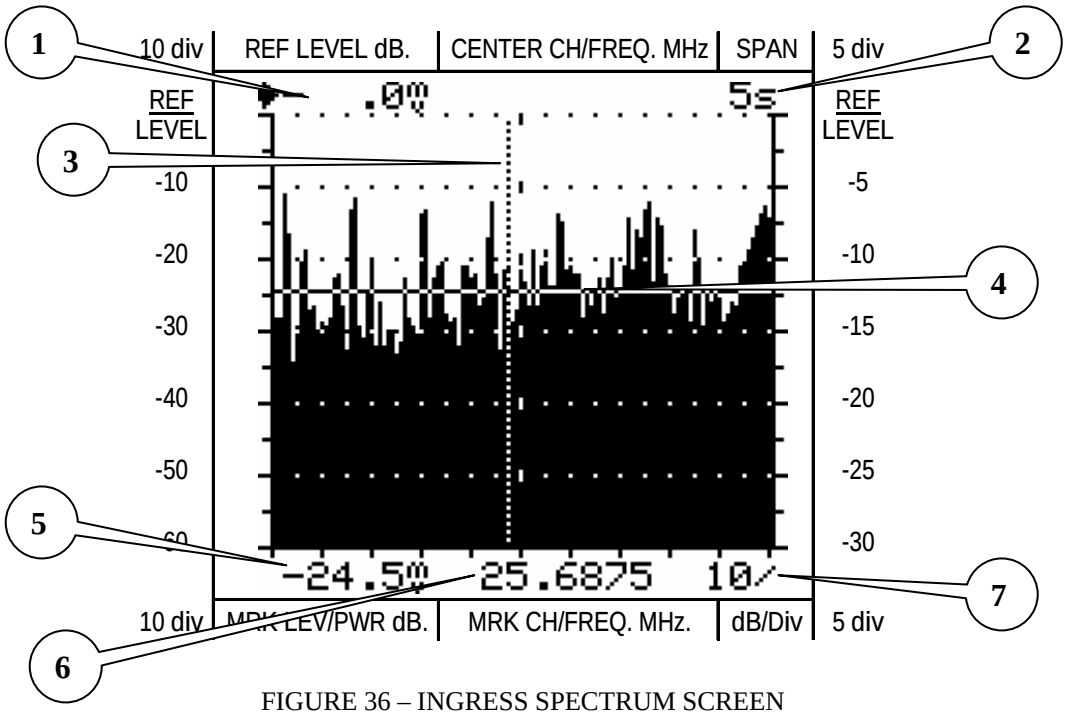

FIGURE 36 – INGRESS SPECTRUM SCREEN

1. Reference Level - The reference level that defines how the ingress spectrum is displayed. This value is auto-ranging, however, it may be modified from –60 to +65 dBmV.

2. Redraw Speed – The speed at which the ingress spectrum is redrawn. Modifiable in the following steps (seconds): 50ms, 0.1, 0.3, 0.5, 1, 2, 5, 10, 20, and 50. Smaller durations give more of a real-time display, however, a longer duration will capture infrequent spikes.

3. Marker Frequency Cursor - Graphically displays the marker frequency's location within the spectrum.

4. Peak Level Cursor – Graphically displays the peak level of the marker frequency.

5. Marker Level – Displays the peak level of the marker frequency selected.

6. Marker Frequency – It will appear in the center of the ingress spectrum by default. The marker frequency may be changed and the cursor will move in the spectrum accordingly.

7. dB / Division – Displays and allows you to set the dB per Division for displaying the ingress spectrum. 1, 5, 10, and 20 are the available steps.

3.12 Leakage

The SA 1454 is capable of performing leakage measurements on your cable system. To begin taking measurements press and hold the **LEAKAGE** button to enter the parameters you will be using to perform your leakage tests. Once these parameters have been set they are saved and you only need to modify them again if your measurement parameters change.

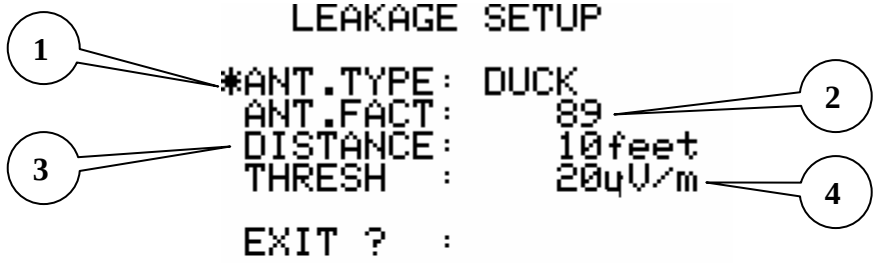

FIGURE 37 – LEAKAGE SETUP

1. Antenna Type – The type of antenna you are using to perform leakage measurements. Choices are Duck (provided with the unit), Monopole, and Dipole.

2. Antenna Factor – The reception factor for the selected antenna. Factory defaults are 100 for Dipole, 90 for Monopole, and 75 for Duck. These values are user modifiable for your individual antenna. The correct value for your antenna should be verified by performing a field shop test.

3. Distance – The distance from the system that you are performing the leakage test. 10ft. is the FCC standard, however, this setting is user modifiable for performing tests at various distances. 1 - 999ft. may be selected.

4. Threshold – The level at which an audible alarm on the unit is sounded to indicate leakage. The audible sound will vary in pitch based on the amount of leakage present. 20uV/meter is the default setting and it is modifiable from 0 – 65000 uV/m.

Once these parameters are set, go to the exit line and press ENTER to return to the LEAKAGE screen.

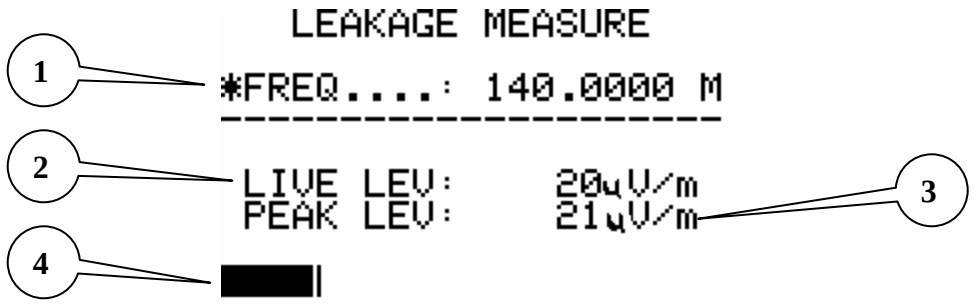

FIGURE 38 – LEAKAGE MEASUREMENT SCREEN

1. Measurement Frequency – Modifiable from 115.0 – 140.0 MHz. Value should be set based on the frequency of your test generator located at the head-end.

2. Live Level – Continuously updated leakage level received by the meter.

3. Peak Level – The highest leakage level received by the meter since the test began.

4. Level Bar – Gives you a graphical representation of the leakage current and peak levels.

There is also an audible tone associated with leakage level present at this time. The audible sound will vary in pitch based on the amount of leakage present. The volume may be adjusted by following the procedures described in section 3.9.

3.13 Data Logging

The SA 1454 features a data logging and recall function. You have the ability to save measurement logs, spectrum analysis snapshots, ingress spectrum snapshots, and leakage measurements. When a log has been saved it may be recalled for viewing at a later time.

3.13.1 Saving a Data Log

To save a data log you must first be in the screen you want to save. For example, if you want to save measurement logs you must be in the measurement screen. If you want to

save a spectrum snapshot you must be in the spectrum analysis screen and so on. To save a particular log press the **SAVE** button while you are in the screen of interest.

Measurement Log Save

Press the **SAVE** button while you are in the measurement screen. You will now be taken into the Logger Store Menu. The Log file you are creating will save the following information on every channel in the selected channel plan and be available for recall at a later time.

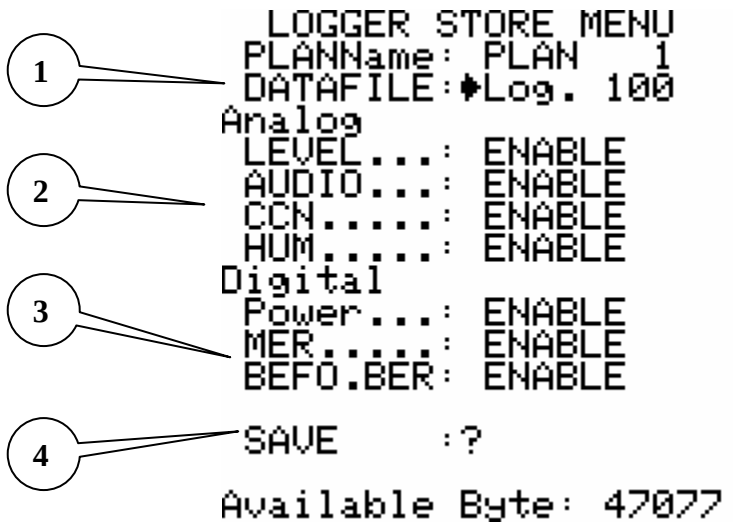

FIGURE 39 – LOGGER STORE MENU

The Plan that you are logging is derived from the plan that has been selected and used in the measurement screen.

1. DATAFILE – The log file used for logging measurement information may be selected (up to 100 different logs / sites). You may choose Log. 1 – Log. 100 and recall this information at a later time.

2. Analog Measurements – These are the measurements that will be logged on analog channels. All tests are enabled.

3. Digital Measurements - These are the measurements that will be logged on digital channels. The MER and Before BER tests may be enabled or disabled.

4. SAVE – After you have selected the Log file number and enabled / disabled the appropriate digital tests, go to the save line and press **ENTER** to save the measurements to file. The save process will take a few minutes while the unit scans and records information from all of the channels in the channel plan.

Spectrum Log Save

Press the **SAVE** button while you are in the spectrum analysis screen. A sub-menu will pop up in the spectrum screen allowing you to choose a spectrum file to save a snapshot of the spectrum analysis screen to. You will then be able to recall this snapshot at a later time.

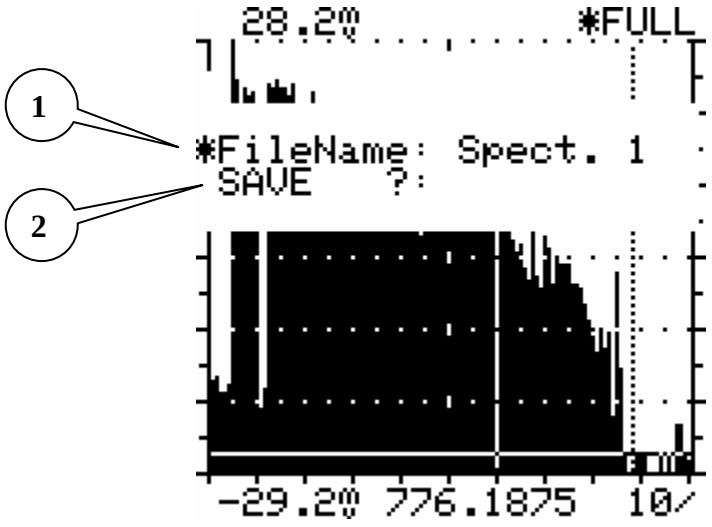

FIGURE 40 – SPECTRUM LOG SAVE

1. FileName – The log file used for logging a spectrum snapshot may be selected (up to 10 different snapshots / sites). You may choose Spect. 1 – Spect. 10 and recall this snapshot at a later time.

2. SAVE – After you have selected the Spectrum file number, go to the save line and press **ENTER** to save the snapshot to file.

Ingress Log Save

Press the **SAVE** button while you are in the ingress spectrum screen. A sub-menu will pop up in the ingress spectrum screen allowing you to choose an ingress file to save a snapshot of the ingress spectrum screen to. You will then be able to recall this snapshot at a later time.

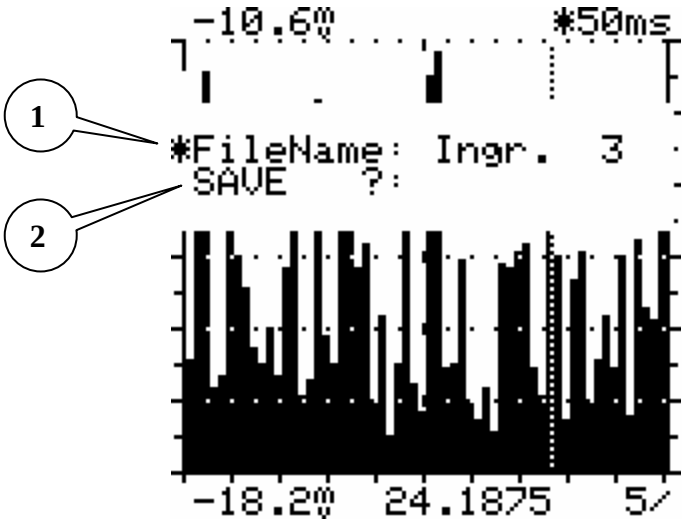

FIGURE 41 – INGRESS LOG SAVE

1. FileName – The log file used for logging an ingress spectrum snapshot may be selected (up to 10 different snapshots / sites). You may choose Ingr. 1 – Ingr. 10 and recall this snapshot at a later time.

2. SAVE – After you have selected the Ingress file number, go to the save line and press **ENTER** to save the snapshot to file.

Leakage Log Save

Press the **SAVE** button while you are in the leakage measurement screen. A sub-menu will pop up in the leakage screen allowing you to choose a leakage file to save a snapshot of the leakage measurement to. You will then be able to recall this leakage measurement at a later time.

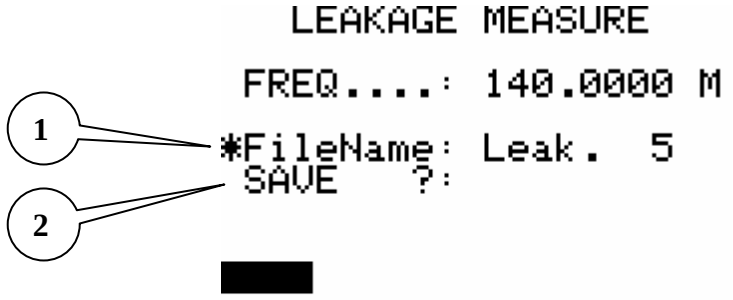

FIGURE 42 – LEAKAGE LOG SAVE

1. FileName – The log file used for logging a leakage measurement may be selected (up to 10 different logs / sites). You may choose Leak. 1 – Leak. 10 and recall this log at a later time.

2. SAVE – After you have selected the Leakage file number, go to the save line and press **ENTER** to save the snapshot to file.

3.13.2 Recalling a Data Log

Once you have saved a log you may recall it for viewing the captured information. Start by pressing the **RECALL** button in the screen of the log you want to recall (Measurement, Spectrum, Ingress, or Leakage).

For Spectrum, Ingress, and Leakage the procedure will be nearly identical to saving a log. Simply press **RECALL** in the Spectrum, Ingress, or Leakage screen and a pop-up menu will appear. Select the file you wish to display and go to the Recall line and press **ENTER**. The appropriate snapshot/measurement will now be displayed.

Recalling a measurement log is slightly more involved. First go to the measurement screen and press **RECALL**. A Logger Recall menu will now appear.

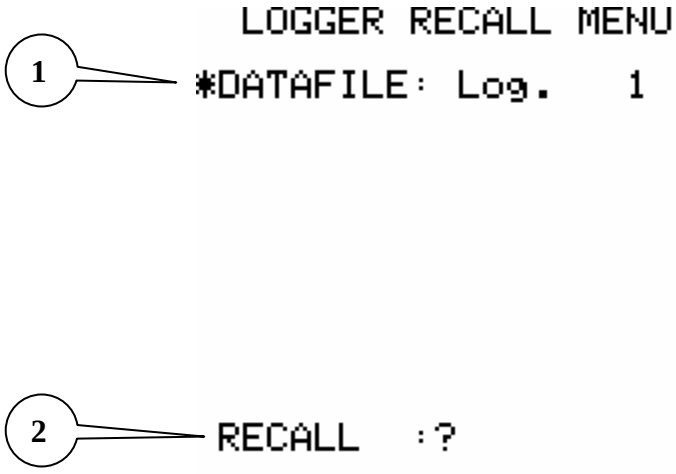

FIGURE 43 – MEASUREMENT LOG RECALL MENU

1. DATAFILE – Select the Log file number that you wish to recall/display.

2. RECALL – Go to the recall line and press **ENTER** to display the selected Log file.

The measurement log will now be opened and displayed. You will notice that it looks very similar to the measurement screen. To view the measurements for different channels in the log, simply scroll to the Channel line and press **ENTER**. Now use the **UP / DOWN** arrow keys to select the desired channel and press **ENTER** again.

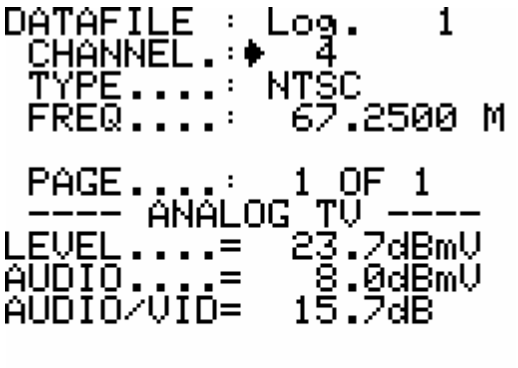

FIGURE 44 – MEASUREMENT LOG RECALL DATA

4 Battery Charging and Startup

Upon receipt, your SA 1454 will need to be charged overnight before the unit will be ready for a full day's operation. In the meantime, you may operate the SA 1454 from the charger in order to get more familiar with its operation and keypad controls.

4.1 Battery Indicators

The SA 1454 has three indicators to explain the condition of the internal battery. The first indicator will show the battery is in charge mode and a green light will appear on the front panel.

The second indicator will appear when the unit reaches a full charge. Another green light will appear in the "full" display of battery at the bottom of the unit.

The last indicator shows when there is a problem with either the charging of the unit or if the internal battery has a problem.

While the SA 1454 has a continuous 3-6 hour battery life you should expect this time to vary under some circumstances. Intermittent use, "ON" and "OFF", will extend the total operating battery life. Temperature will also affect the battery life; cold temperatures will reduce the operating time by as much as 40%

4.2 Recharging the Battery

When the battery requires charging, use only the charger supplied with your SA 1454. Applying more than 18 volts will damage your unit. Connect the charger to the charge input jack and plug the charger into an AC receptacle. When not charging your SA 1454, you should remove the charger from the AC receptacle.

4.3 Turning ON the SA 1454

Pressing the **ON** button turns on the SA 1454. When the **ON** button is pressed the display will turn on. Once the SA 1454 is switched on, the unit will remain on for approximately 5 minutes before it automatically shuts off, if no other keys are pressed. The 5-minute time-out will be reset each time a key is pressed. This feature may also be disabled in the setup menu. Any time the SA 1454 is left on, without any keys being pressed, the unit will turn itself off after 5 minutes (unless auto-off is disabled) to conserve the battery. The operator can defeat the Auto-shut-off feature. The unit may be turned off when you have finished your usage by pressing the “OFF” key.

4.4 The RF Input Connection

The input to the SA 1454 is the "F" connector located on the top of the instrument. Since this connector will typically see a lot of wear it is field replaceable. Simply unscrew the "F" connector from the meter and replace it with a Sencore Model 26G322 or similar F-81 barrel. The input to the SA 1454 is 75 Ohms unbalanced, just like the other cable system components. You may connect any RG-59 or RG-6 type CATV drop cable directly to the SA 1454. Other connections may be made to system components by using a Sencore Model 39G189 cable or any good quality jumper cable fitted with "F" connectors. Care should always be taken to be sure that a good Test Jumper is used. A good instrument will still give the wrong readings with a defective jumper cable and make troubleshooting impossible. The input of your SA 1454 is protected from DC and AC (<1 KHz) voltages up to 100 V peak. Thus, the typical power found on system distribution cables will not affect the operation of the SA 1454.

5 General Application Information

5.1 Introduction

The application section is intended to give you a "hands on" introduction to using the SA 1454. Procedures described here are general in terms and will require adaptation to your specific circumstance. You should also refer to your company procedures. A listing of the FCC minimum requirements and recommended targets for the Subscriber Drop are listed in the table below.

SIGNAL PARAMETER	FCC REQUIRED LEVEL	GOOD PRACTICE
Minimum carrier level	0 dBmV	3 dBmV
Maximum carrier level	< Overload	10 dBmV
Level difference between adjacent channels	3 dB	1 dB
Level difference between all channels	10 dB	7 dB
Minimum A / V ratio	6.5 dB	13 dB
Maximum A / V ratio	17 dB	15 dB
Minimum FM station level	N/A	–20 dBmV
Maximum FM station level	N/A	–10 dBmV
Level difference between adjacent FM stations	N/A	3 dB
C/N (all Channels)	>43dB	46 dB
Tap Isolation	18 dB	20 dB

FIGURE 45 – FCC REQUIREMENTS

In the best circumstance an installation should be straightforward and require little troubleshooting or testing, however, assuring the quality of a drop installation is a simple and quick task with the SA 1454. Assuring the quality during the installation will prevent

a second truck roll for the subsequent repair and eliminate dissatisfaction for the subscriber.

5.2 The Installation

The first step to a good installation is to be sure that you are starting with a known good signal level. When you climb the pole or open the pedestal to begin the installation take your SA 1454 with you so that you can first measure the signal level at the TAP. While you probably do not have a system schematic with TAP output levels indicated, you really do not need one. With a little rough math and simple assumptions you can estimate the signal levels that you will need at the TAP to insure a good installation.

5.3 Cable Loss

Before you start the installation, the loss of the cable to be used for the drop should be estimated. Remember that the cable loss is dependent on the frequency of the signals it transports. Since the greatest loss occurs at the highest frequency used, we normally talk about a cable's loss only at that frequency. For instance, 6dB of cable means the loss at our highest channel is 6dB. Each manufacturer of drop cable specifies the loss of a particular type of cable at some frequency per 100 feet of that cable.

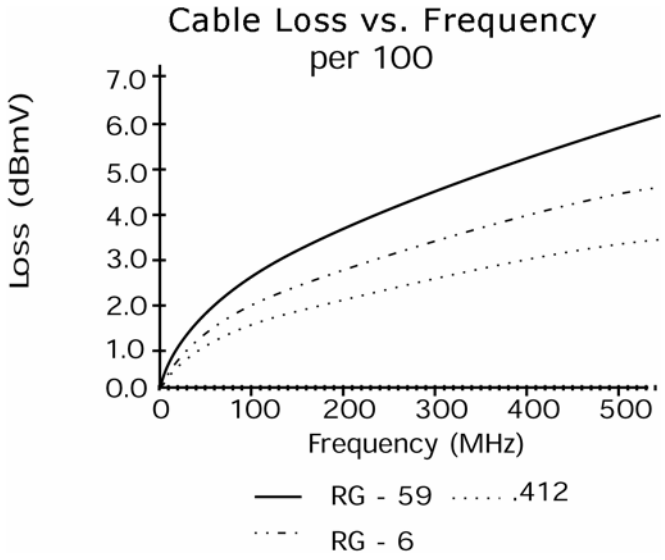

FIGURE 46 – CABLE LOSS VS. FREQUENCY

From the manufacturer's specification we can determine the specific loss for our application by the formula:

L1 = L2 * Square root of F1 / Square root of F2
Where,

L1 = Loss at our desired frequency
L2 = Manufacturers stated loss
F1 = Frequency at which we want to determine loss
F2 = Frequency at manufacturers stated loss

Thus, if we were working on a system specified to 800 MHz and using a cable rated at 6dB loss per 100 feet at 550 MHz it would have a loss of:

L1 = 6 dB * square root 800MHz / square root 550MHZ

L1 = 7.2 dB per 100 feet @ 800MHz

Estimate the distance from the TAP to the TV set. The loss will be the distance times the loss per 100 feet divided by 100.

L = D * L1 / 100

For a distance of 150 feet: D = 150

L = 150 * 7.2 dB / 100

L = 10.8 dB

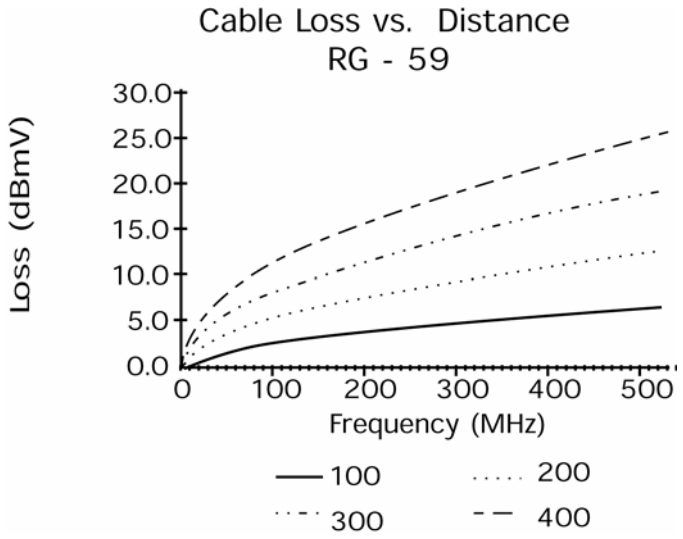

FIGURE 47 – CABLE LOSS VS. DISTANCE

5.4 Drop Losses

To this loss we also add the other loss in our drop installation. The insertion loss of our Ground Block: ~.5 dB and the loss of any splitters used to provide second outlets ~3.0 dB for a two-way splitter. Thus our total loss will be:

$L_T = L + L_{GB} + L_S = 10.8 + .5 + 3.0$

$L_T = 14.3$ dB

Where,

L_T = Total Loss of the Drop

L = Cable Loss

L_S = Splitter Loss

L_{GB}= Ground Block Loss

With this in mind, we know that we need a minimum of 0dBmV at the subscribers set and therefore must have a minimum of 14.3dB + 0dBmV or +14.3 dBmV. To provide a sufficient safety margin a minimum level of +16.0 dBmV should be present at our TAP. While you are connected to the TAP you should also measure the lowest channel, highest channel and a couple of key channels in the spectrum, just to be sure there is no problem with the TAP. Remember from the FCC chart in Figure 45 that we must provide all channels within a 10 dBmV window with adjacent channels within 3 dB. Refer to Figure 45 for the other requirements.

You will only have to make the L1 loss calculation once to determine the loss of your drop cable per 100 feet. You will continue to use that value for L1 unless you change drop cable or extend the bandwidth of your system. Do your calculations on the ground before you climb. Some typical cable losses are listed in Figure 48:

Cable Characteristics: Nominal Attenuation per 100 feet

CABLE	Ch.2	Ch.6	Ch.7	Ch.13	Ch.30	Ch.40	Ch.50	Ch.60	Ch.70
RG59/U	2.6	3.5	4.9	5.4	8.8	9.2	9.7	10.3	11.0
RG59/U Foam	2.3	2.7	3.8	4.2	6.6	6.8	7.1	7.3	7.7
RG 6 Foam	1.7	1.9	2.8	3.0	5.2	5.6	5.9	6.2	6.5
RG11/U	1.4	1.7	2.2	3.2	5.3	5.5	5.7	6.1	6.2
RG11/U Foam	1.1	1.4	1.6	2.3	4.0	4.1	4.2	4.4	4.6
.412	.74	1.0	1.4	1.5	2.6	2.7	2.9	3.1	3.3
.500	.52	.67	.72	1.1	1.8	2.1	2.4	2.7	3.0

FIGURE 48 – CABLE CHARACTERISTICS CHART

5.5 Drop Signal Levels

If you have a sufficient level at the output of your TAP you are ready to continue your installation. If you do not have sufficient level you can change the TAP to the appropriate value (you may need to get approval from your supervisor or an engineer). Taps are available in most common values. If your level is 3 dB low at the current tap, you need a tap value, which is 3 dB smaller. It is usually best to select the next lower value tap when the exact value falls between those available. Once the drop is installed you should check the levels at the back of the set or the input to the set-top converter. At this test point you should expect a minimum level of 0 dBmV, which we used in our calculation, plus the safety margin and any TAP value variation required from rounding off to the nearest available TAP value. Remember that we must provide the subscriber with a signal between 0 dBmV and +10 dBmV. If the level looks good on our highest channel we should then check the low end of the spectrum and any key channels in between. Remember that our levels will vary with the frequency as the loss increases with the frequency. If you measure all the channels you will see the tilt of the system established at the last Line Extender minus the cable loss from the AMP through the cable to the TAP and through the drop to the Wall Plate. Note, the amount of tilt will change from drop to drop as the distance from the last AMP or Line Extender varies. The FCC requires a minimum of 0 dBmV and a maximum of +10 dBmV, this provides sufficient signal level above the noise floor for a "snow free" picture and prevents "overload" of the TV set and or converter, which would cause 2nd/3rd order or inter-modulation distortions.

If your levels are significantly different than those predicted, there is a fault in the Installation. To locate this fault we will use the SA 1454 to troubleshoot our installation, starting back through the drop. DIVIDE and CONQUER. Move back to the ground block output to check levels. If they are good, the problem is between the ground block and the wall plate. If not, move to the cable at the input of the ground block. Keep dividing the problem area into half until you get down to the one faulty component. Don't forget our assumptions and estimate of loss as you go through the drop components so that you can predict a good signal level reading. If you are using a splitter to provide multiple outlets, be sure that a terminator, TV, or converter terminates each leg. An open leg on a splitter will cause standing waves and erroneous readings on the other leg.

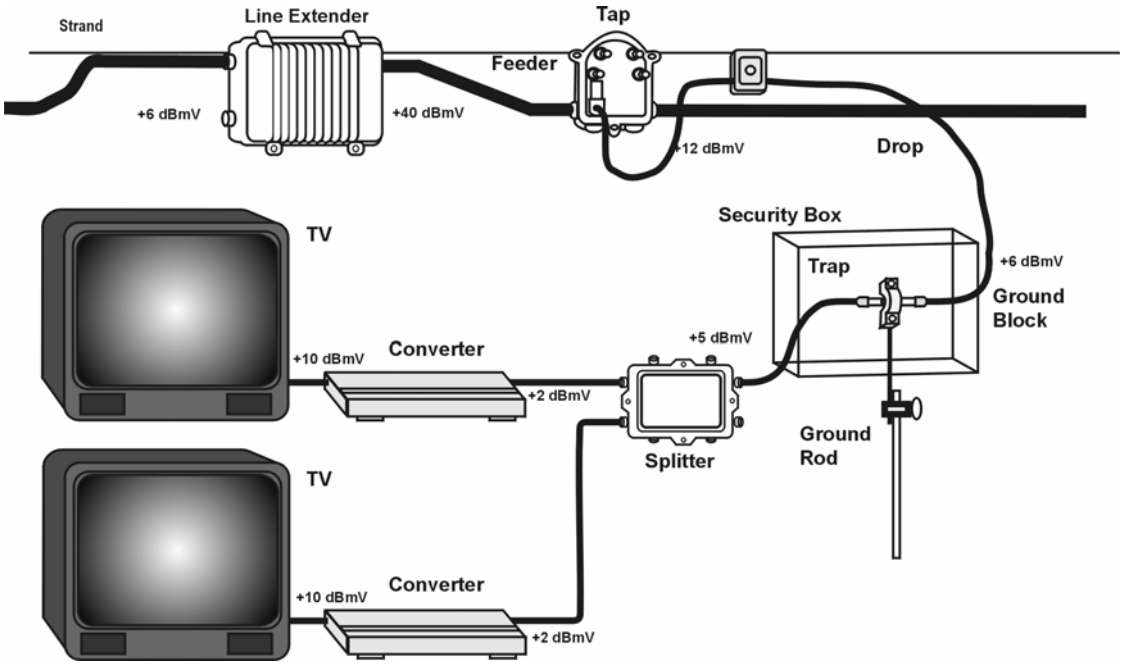

FIGURE 49 – TYPICAL INSTALLATION LEVELS

If you have had a problem to troubleshoot in an installation be sure to double-check all of your connections for proper tightness, tags and weather boots, etc. It is very easy to forget these items once you have solved the major fault.

5.6 dBmV & dBμV

The common unit of measure in the U.S., and many other countries is the dBmV or decibels above 1 mV across 75Ω. 0 dBmV equals a signal level of 1 mV across a 75Ω load. The dBμV (dB micro volt) is a similar unit of measure, except that it is referenced for 1 μV across a 75Ω load. Thus, 0 dBmV = +60 dBμV. The SA 1454 may be set up to use either unit of measure. See the SETUP section of this manual for SETUP procedures. See Appendix B for more information on measuring in dBmV and discussion on relative measurements in dB.

In the U.S., we measure the video carrier level in dBmV. Decibels above 1 mV across 75 ohms. In many PAL systems the preferred unit of measure is dBμV. Decibels above 1 μV across 75 ohms. It is quite easy to convert a dBmV reading to a dBμV by adding 60 dBμV to the reading in dBmV.

Delta = 20 Log (1 mV/1 μV) = 60

For example +10 dBmV becomes +70 dBμV and –20 dBmV becomes +40 dBμV. dBμV is used in a few systems outside the U.S. Systems in the UK and Asia are the main

exceptions. Naturally a dB is a dB the world over, 3 dB above 1 mV is +3 dBmV and 3 dB above 60 dBμV is 63 dBμV. Our standard formula:

dB = 20 Log (V1/V2), remains true in all systems, only the unit of measure changes.

5.7 Finishing the Job

Now that you are sure the signal level to the subscriber is correct, you should double-check the operation of the television set(s), the converter and the traps, if used. Operate the TV on all channels, viewing the picture quality and listening to the audio, especially those channels adjacent to trapped channels. A faulty trap will not only insufficiently block the trapped channel, but may also trap part of the adjacent channel. You can use your SA 1454 to measure the level of the adjacent video and audio carriers. The FCC requires the audio carriers to be 13 to 17 dBmV down from their respective video carrier. System transmission of the audio carrier should have little effect on this ratio. A problem is usually caused by a faulty trap.

Don't forget to check the remote control for the set-top converter and the power-on and power-off operation. The least little problem will mean a second truck roll and an unhappy subscriber. Be sure. Do it right the first time. The SA 1454 will help you make more installations and more importantly make them all *good* installations.

Appendix A

Channel Plans

Cable Channel Frequency Plans on FCC Digital, FCC (USA Cable), HRC (USA HRC), IRC USA IRC), 50-870 Mhz (USA Broadcast).

Based on Joint EIA/NCTA Engineering Committee approval (EIA IS-6 Interim Standard). Frequencies include Aeronautical FCC designated Offset Frequencies (Designated by an *****). HRC carriers are computed with a 6.000300 MHz +/– 1 Hz Comb Generator accuracy. VHF and UHF channels are per the FCC designations.

Sub-Band VHF Cable TV Channels, 5-50 Mhz

Channel #	FCC	HRC	IRC	VHF /UHF
T-7	7.00	---	---	---
T-8	13.00	---	---	---
T-9	19.00	---	---	---
T-10	25.00	---	---	---
T-11	31.00	---	---	---
T-12	37.00	---	---	---
T-13	43.00	---	---	---

Low-High VHF EIA/NCTA TV Channels

Channel #	FCC Digital	FCC	HRC	IRC	VHF /UHF
1	---	---	72.0036	73.2500	---
2	57.00	55.25	54.0027	55.2500	55.25
3	63.00	61.25	60.0030	61.2500	61.25
4	69.00	67.25	66.0033	67.2500	67.25
5	79.00	77.25	78.0039	79.2500	77.25
6	85.00	83.25	84.0042	85.2500	83.25
7	177.00	175.25	174.0080	175.2500	175.25
8	183.00	181.25	180.0090	181.2500	181.25
9	189.00	187.25	186.0093	187.2500	187.25
10	195.00	193.25	192.0096	193.2500	193.25
11	201.00	199.25	198.0099	199.2500	199.25
12	207.00	205.25	204.0102	205.2500	205.25
13	213.00	211.25	210.0105	211.2500	211.25

Channel Plans

Mid-band Cable Channels and UHF Broadcast Channels, 120 to 170 MHz

Channel #	Digital FCC	FCC	HRC	IRC	VHF /UHF
14	123.00	*121.2625	120.0060	*121.2625	471.25
15	129.00	*127.2625	126.0063	*127.2625	477.25
16	135.00	*133.2625	132.0066	*133.2625	483.25
17	141.00	139.2500	138.0069	139.2500	489.25
18	147.00	145.2500	144.0072	145.2500	495.25
19	152.00	151.2500	150.0075	151.2500	501.25
20	159.00	157.2500	156.0078	157.2500	507.25
21	165.00	163.2500	162.0081	163.2500	513.25
22	171.00	169.2500	168.0084	169.2500	519.25

* Aeronautical Offset Freq. Allocation

Super-band Cable TV Channels and UHF Broadcast Channels

Channel #	Digital FCC	FCC	HRC	IRC	VHF /UHF
23	219.00	217.2500	216.0108	217.2500	525.25
24	225.00	223.2500	222.0111	223.2500	531.25
25	231.00	*229.2625	228.0114	*229.2625	537.25
26	237.00	*235.2625	234.0117	*235.2625	543.25
27	243.00	*241.2625	240.0120	*241.2625	549.25
28	249.00	*247.2625	246.0123	*247.2625	555.25
29	255.00	*253.2625	252.0126	*253.2625	561.25
30	261.00	*259.2625	258.0129	*259.2625	567.25
31	267.00	*265.2625	264.0132	*265.2625	573.25
32	273.00	*271.2625	270.0135	*271.2625	579.25
33	279.00	*277.2625	276.0138	*277.2625	585.25
34	285.00	*283.2625	282.0141	*283.2625	591.25
35	291.00	*289.2625	288.0144	*289.2625	597.25
36	297.00	*295.2625	294.0147	*295.2625	603.25

* Aeronautical Offset Freq. Allocation

Hyper-band Cable Channels and UHF Broadcast Channels

Channel #	Digital FCC	FCC	HRC	IRC	VHF /UHF
37	303.00	*301.2625	300.0150	*301.2625	609.25
38	309.00	*307.2625	306.0153	*307.2625	615.25
39	315.00	*313.2625	312.0156	*313.2625	621.25
40	321.00	*319.2625	318.0159	*319.2625	627.25
41	327.00	*325.2625	324.0162	*325.2625	633.25
42	333.00	*331.2750 (+25k)	330.0165	*331.2750 (+25K)	639.25
43	339.00	*337.2625	336.0168	*337.2625	645.25
44	345.00	*343.2625	342.0171	*343.2625	651.25
45	351.00	*349.2625	348.0174	*349.2625	657.25
46	357.00	*355.2625	354.0177	*355.2625	663.25
47	363.00	*361.2625	360.0180	*363.2625	669.25
48	369.00	*367.2625	366.0183	*367.2625	675.25
49	375.00	*373.2625	372.0186	*373.2625	681.25
50	381.00	*379.2625	378.0189	*379.2625	687.25
51	387.00	*385.2625	384.0192	*385.2625	693.25
52	393.00	*391.2625	390.0195	*391.2625	699.25
53	399.00	*397.2625	396.0198	*397.2625	705.25
54	405.00	403.25	402.0201	403.2500	711.25
55	411.00	409.25	408.0204	409.2500	717.25
56	417.00	415.25	414.0207	415.2500	723.25
57	423.00	421.25	420.0210	421.2500	729.25
58	429.00	427.25	426.0213	427.2500	735.25
59	435.00	433.25	432.0216	433.2500	741.25
60	441.00	439.25	438.0219	439.2500	747.25
61	447.00	445.25	444.0222	445.2500	753.25
62	453.00	451.25	450.0225	451.2500	759.25
63	459.00	457.25	456.0228	457.2500	765.25
64	465.00	463.25	462.0231	463.2500	771.25
65	471.00	469.25	468.0234	469.2500	777.25
66	477.00	475.25	474.0237	475.2500	783.25
67	483.00	481.25	480.0240	481.2500	789.25
68	489.00	487.25	486.0243	487.2500	795.25
69	495.00	493.25	492.0246	493.2500	801.25
70	501.00	499.25	498.0249	499.2500	---
71	507.00	505.25	504.0252	505.2500	---
72	513.00	511.25	510.0255	511.2500	---
73	519.00	517.25	516.0258	517.2500	---
74	525.00	523.25	522.0261	523.2500	---

Channel #	Digital FCC	FCC	HRC	IRC	VHF /UHF
75	531.00	529.25	528.0264	529.2500	---
76	537.00	535.25	534.0267	535.2500	---
77	543.00	541.25	540.0270	541.2500	---
78	549.00	547.25	546.0273	547.2500	---
79	555.00	553.25	552.0276	553.2500	---
80	561.00	559.25	558.0279	559.2500	---
81	567.00	565.25	564.0282	565.2500	---
82	573.00	571.25	570.0285	571.2500	---
83	579.00	577.25	576.0288	577.2500	---
84	585.00	583.25	582.0291	583.2500	---
85	591.00	589.25	588.0294	589.2500	---
86	597.00	595.25	594.0297	595.2500	---
87	603.00	601.25	600.0300	601.2500	---
88	609.00	607.25	606.0303	607.2500	---
89	615.00	613.25	612.0306	613.2500	---
90	621.00	619.25	618.0309	619.2500	---
91	627.00	625.25	624.0312	625.2500	---
92	633.00	631.25	630.0315	631.2500	---
93	639.00	637.25	636.0318	637.2500	---
94	645.00	643.25	642.0321	643.2500	---

* Aeronautical Offset Freq. Allocation

FM Mid-band Cable Channels

Channel #	Digital FCC	FCC	HRC	IRC	VHF /UHF
95	93.00	91.25	90.0045	91.2500	---
96	99.00	97.25	96.0048	97.2500	---
97	105.00	103.25	102.0051	103.2500	---
98	111.00	*109.2750 (+25K)	108.0054	109.2750	---
99	117.00	*115.2750 (+25K)	114.0057	115.2750	---

* Aeronautical Offset Freq. Allocation

Hyper-band and UHF Broadcast Channels (cont.)

Channel #	Digital FCC	FCC	HRC	IRC	VHF /UHF
100	651.00	649.25	648.0324	649.25	---
101	657.00	655.25	654.0327	655.25	---
102	663.00	661.25	660.0330	661.25	---
103	669.00	667.25	666.0333	667.25	---
104	675.00	673.25	672.0336	673.25	---
105	681.00	679.25	678.0339	679.25	---
106	687.00	685.25	684.0342	685.25	---
107	693.00	691.25	690.0345	691.25	---
108	699.00	697.25	696.0348	697.25	---
109	705.00	703.25	702.0351	703.25	---
110	711.00	709.25	708.0354	709.25	---
111	717.00	715.25	714.0357	715.25	---
112	723.00	721.25	720.0360	721.25	---
113	729.00	727.25	726.0363	727.25	---
114	735.00	733.25	732.0366	733.25	---
115	741.00	739.25	738.0369	739.25	---
116	747.00	745.25	744.0372	745.25	---
117	753.00	751.25	750.0375	751.25	---
118	759.00	757.25	756.0378	757.25	---
119	765.00	763.25	762.0381	763.25	---
120	771.00	769.25	768.0384	769.25	---
121	777.00	775.25	744.0387	775.25	---
122	783.00	781.25	780.0390	781.25	---
123	789.00	787.25	786.0393	787.25	---
124	795.00	793.25	792.0396	793.25	---
125	801.00	799.25	798.0399	799.25	---
126	807.00	805.25	804.0402	805.25	---
127	812.00	811.25	810.0405	811.25	---
128	819.00	817.25	816.0408	817.25	---
129	825.00	823.25	822.0411	823.25	---
130	831.00	829.25	828.0414	829.25	---
131	837.00	835.25	834.0417	835.25	---
132	843.00	841.25	840.0420	841.25	---
133	849.00	847.25	846.0423	847.25	---
134	855.00	853.25	852.0426	853.25	---
135	861.00	859.25	858.0429	859.25	---
136	867.00	865.25	864.0432	865.25	---

Appendix B

What Is A dB?

Many technicians who use Signal Level Meters aren't sure what a dB really is and how it relates to signal strengths. In short, a decibel is a simple way of expressing the ratio of output power to input power as a simple number. Decibels (dBs) were developed to simplify figuring gains and losses of a system. Once the gain of a stage is converted to dB, only simple addition and subtraction is necessary to find the total gain of a system, or portion of the system.

In order to find the total gain of a distribution system without using dBs, it is necessary to multiply the gain of each amplifier stage and then divide the total gain by the total losses. As a short example, let's assume that we have the portion of the system drawn below:

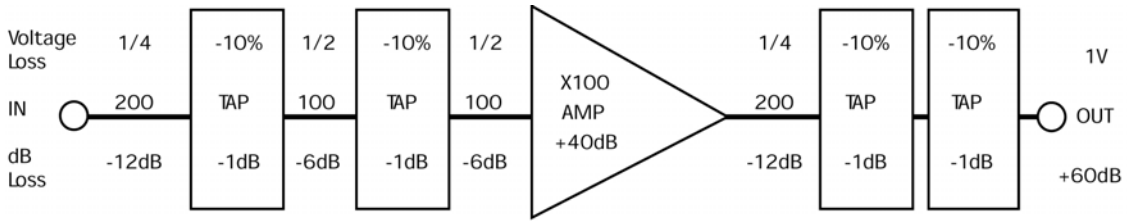

FIGURE 50 – SYSTEM LOSS AND GAIN CALCULATIONS

In our example the cable looses 1/2 of it's applied voltage every 100 ft. (6 dB). The TAPs all have an insertion loss of 10% (1 dB). When 1 V is applied to the input you can calculate the voltage at each component as noted in the figure.

After 200 ft. the voltage will be 1V x 1/2 x 1/2 = 1/4 V = 250 mV

At the TAP output a 10% loss is equal to a 90% efficiency, thus the output will be 250 mV x 90% = 250 mV x 0.90 = 225 mV.

Continuing the calculations will show the output voltage will be 1.01 V.

Voltage Calculation:

E = 1V x 1/ 4 x 0.9 x 1/ 2 x 0.9 x 1/ 2 x 100 1/ 4 x 0.9 x 0.9 = 1V

You can go through the system multiplying the gains and dividing the losses or using the Decibel (dB) system simply add and subtract the dBs for each component to determine the signal level at any point in the system. A loss of 1/2 the voltage is 6 dB and a 10% loss of voltage is 1 dB (check these with the formulas which follow). Thus we simply add the gains and subtract the losses from our 1 V equivalent of +60 dBmV. The total losses are 40 dB with a gain of 40 dB. Thus, our output will be the same as our input level: 60 dBmV or 1 V.

dB Calculation: E = +60dBmV – 12 – 1 – 6 – 1 – 6 + 40 – 12 – 1 – 1 = +60dBmV

By having the gains or losses of individual stages represented in dBs, as in Figure 50, you simply add them together to find the total gain. Thus in our example the attenuation of the cable is 6 dB/100 feet and the 1 volt input level is equal to +60dBmV (discussed later). Thus after 100 feet the signal level is 54 dBmV, after 200 feet the level is 48 dBmV and so on.

By definition a dB is 10 times the logarithm of the ratio of output power divided by input power:
$dB = 10 \log (P_{out}/P_{in})$ In MATV and CATV work we are most concerned about signal voltages. The input/output ratio of voltages is expressed in dBs by multiplying the logarithm of the ratio of voltages by 20 instead of 10:
$dB = 20 \log (V_{out}/V_{in})$ This is proven by substituting E^2/R for P_{in} and P_{out} in the original equation. Thus, our equation becomes:
$dB = 10 \log (E_{out}^2/R / E_{in}^2/R)$ To simplify this equation the R in the numerator and denominator cancel each other and the Square can be moved out of the log factor becoming simply 2 x the 10, changing the multiplier to 20. In these systems, a standard level of signal is required at the input to the television receiver for good picture quality. This standard is 1000 microvolts or 1 mV across 75 ohms, which is properly called 0 dBmV. The term dBmV is not a ratio. It is an absolute voltage level used as a reference point from which you can add and subtract other voltage levels expressed in dBmV. Gain or loss in a system or component is expressed in dBs, as in our earlier example. A specific voltage level is expressed in dBmV; that is: dB above (or below) the 1 mV standard. For example 10 dB may be the gain or loss of a component, but +10 dBmV is a specific voltage level (3.2 mV across 75 Ohms). Below are tables of equivalent levels and equivalent ratios, which come from these formulas, that may be useful:

Levels		***Ratios***	
Voltage	**dBmV**	**Voltage Change**	**dB Change**
1 μV	–60 dBmV		
10 μV	–40 dBmV	0.707	–3.0dB
100 μV	–20 dBmV	1.0	0.0dB
1 mV	0 dBmV	1.414	+3.0dB
10 mV	+20 dBmV	2.0	+6.0dB
100 mV	+40 dBmV	3.0	+9.5dB
1 V	+60 dBmV	5.0	+14.0dB
		10.0	+20.0dB

FIGURE 51 – DB COMPARISON

Appendix C

Glossary

Adjacent Channels – Two television channels having video carriers 6 MHz apart, or two FM channels having carriers occupying neighboring channel allocations.

AGC (Automatic Gain Control) – A circuit, which monitors the high pilot and automatically controls amplifier gain and keeps the output level constant with changing input levels. Main control over the High frequencies.

ASC (Automatic Slope Control) – A circuit, which monitors the low pilot and automatically controls the amplifier slope and keeps the output level constant with changing input levels. Main control over the low frequencies.

Amplifier – A device used to increase the power and voltage level of a signal.

Attenuator – A passive device used to reduce signal strength.

Band Separator – A device used to split 2 or more frequency bands into separate leads.

Bridger – An amplifier, which is connected directly to the main trunk amplifier and "splits off" the signal for a distribution system.

Broadband – A device, which is capable of handling one or more channels.

CATV (Community Antenna Television) – An RF distribution system that distributes television broadcast programs, original programs, premium programming and other services using a network of coaxial cable.

Channel – In television, a portion of the RF spectrum 6 MHz wide that carries the audio and video carriers of the television signal.

Chrominance Signal – The portion of the NTSC color television composite video signal containing the color information.

Clipping – Cutting off the peaks of a signal.

Closed Circuit – A system in which television signals are transmitted over cable or telephone lines without being broadcast through the air.

Coaxial Cable – A concentric cable consisting of a center conductor, a dielectric, and a shield. Coax used for most MATV and CATV work has a characteristic impedance of 75 ohms.

Co-Channel – Type of interference caused by receiving the desired signal as well as a weaker signal than is on the same frequency or close to the same frequency as the desired signal.

Composite Video Signal – The complete video signal including the picture (luminance) signal, the blanking and sync pulses, and the color (chrominance).

Contrast – The range of dark and light values in a picture, or the ratio between minimum and maximum brightness.

Converter – A device used in RF distribution systems to convert from one frequency to another. May also control channel access.

dB – A relative ratio of two absolute values.

dBmV – An absolute signal level where 0 dBmV is equal to 1000 uV across 75 ohms.

Diplex Filter – A filter used to separate the low and high frequency bands on a cable into two separate signal paths.

Directional Coupler – A device used in RF distribution systems that has one input and provides two or more isolated outputs. One of the outputs often provides a lower output than the other.

Distortion – Any difference between the wave shape of the original signal and the wave shape after the signal has passed through the distribution system.

Drop – The coaxial cable running between a distribution tap and a subscriber's television receiver; including drop cable, ground block, splitters, traps and wall plates. Sometime to include the terminal device (converter).

Egress – A condition often called "signal leakage" in which signals carried by the distribution system radiate into the air.

Equalizer – A device used on RF distribution systems to compensate for cable or amplifier losses and provide a flat overall frequency response.

Feeder Line – The coaxial cable in a distribution system, which runs between Bridgers, line extenders and taps.

Gain – A measure of amplification of a device, usually expressed in dB and at the highest frequency of operation.

Ghosting – A signal interference condition producing positive or negative pictures displaced in time from the desired picture, caused by multi-path signal reception. Ghost pictures also result from cable ringing.

Ground Block – Connector, which passes the RF signal through with minimum loss while providing a means of attaching a ground wire to the drop cable; typically near the entry to the home. Grounding is accomplished by either a special ground rod or connection to the Water system (see local code for required grounding methods).

Guard Band – A portion of the frequency spectrum, often just below and above a channel, which is kept free of signals to prevent interferences.

Head End – The equipment located at the start of a CATV system. The place where the signals are processed and combined prior to distribution.

Hi-Band – VHF channels 7 to 13.

Hum Modulation – A condition where one or more horizontal bars roll upward through the television picture causing a noticeable change in brightness or contrast.

Impedance – The opposition to the transfer of energy. The impedance of coaxial cable is dependent on physical structure.

Ingress – A condition where unwanted RF signals leak into a distribution system.

Insertion Loss – Also called "feed thru loss". This is the loss that occurs as signals pass through a passive device. Insertion loss occurs in all devices, which do not amplify the signal.

Isolation – The amount of separation or loss between two terminals of a device, or between two components.

Line Amplifier – A broadband amplifier used to compensate for loss in a distribution system.

Line Extender - A type of amplifier used in the feeder system of a distribution system to raise signal levels and create positive tilt prior to TAPs.

Lo-Band – VHF channels 2 to 6.

Loss – Power that is dissipated without doing useful work.

Trunk – The major link of a distribution system between the head end and a major subscriber area.

MATV (Master Antenna Television System) – A distribution system which is usually contained within a single building and receives its signals from an antenna or CATV system.

Matching Transformer – A device, often called a balun, which converts between a 75 ohm impedance and a 300 ohm impedance.

Messenger Strand – A heavy wire or cable that supports the signal-carrying coaxial cable.

Match – The condition, which exists when the maximum power is transferred from one device to another. Maximum power is transferred when the characteristic impedance of both devices are the same.

Mismatch – The condition where maximum power is not transferred from one device to another. The power, which is not transferred, is reflected.

Mixer – A device, which will "mix" the input signals together producing the two original signals and their sum and difference frequencies.

Noise – Any unwanted signal, which affects a wide or narrow band of frequencies.

Noise Figure – A comparison of the inherent noise of an amplifier to that of an ideal amplifier, which introduces no noise or distortion.

Off-Air – Any channel, which can be received by a conventional antenna system, including VHF and UHF, broadcast stations.

Passive – A circuit or device, which does not produce gain or use tubes, transistors, or integrated circuits. (i.e. TAPs and Splitters)

Preamplifier – An amplifier, which is often mounted on the antenna mast and is used to amplify very weak signals received by an antenna. The system noise figure is established by the preamp.

Processor – A device used in the Headend which receives a channel, reduces it to an IF, and either reproduces the signal on the same channel or converts it to another channel.

Radiation – RF energy, which is emitted, or leaks from a distribution system and travels through space. These signals often cause interference with other communication services.

Receiver – The part of a communications system, which converts electrical waves into visible or audible form.

Return Path – The signal path in a distribution system, which is used to get information back to the head end, usually on the sub-band frequencies of 5 to 50 MHz.

Ringing – A signal interference condition caused by impedance mismatch. Signal reflections produced by the mismatch result in ghost pictures.

Signal-To-Noise Ratio (S/N) – The ratio of desired signal level to the undesired noise level, expressed in dB.

Signal Strength – The intensity of an RF signal measured in volts (V), millivolts (mV), microvolts (μV), or dBmV.

Snow – A large quantity of random noise in a television picture, which results from a poor C/N (carrier to noise) ratio.

Splitter – A device used to supply a signal to a number of individually isolated outputs.

Tap – A device inserted into a feeder line, which allows a specific amount of signal to be removed from the feeder line and isolates the TAP port from the main through line.

Terminator – A resistive device, which matches a cable, or the unused output of an active or passive system component to its characteristic impedance. Proper termination is required to prevent unused outputs from causing reflections back down the line.

Tilt – A linearized change in the frequency response of the CATV system caused primarily by the frequency dependent cable loss. Tilt is quantified by comparing the difference between the level of the highest channel's video carrier and that of the lowest channel.

Trap – A circuit, often called a filter, which is used to attenuate undesired signals while not affecting desired signals. Typically a single channel trap to remove a single premium service, which the subscriber is not signed up for.

Trunk – The main signal path through the CATV system, which transports signals from the headend out to the neighborhood. Built to handle maximum channel capacity, maximize distance capability, minimize noise and distortion and preserve the quality of the headend signals. Drops are NEVER connected directly to the Trunk.

Two-Way System – A distribution system that delivers signals to the subscriber (down stream) and back to the head end (upstream).

UHF (Ultra High Frequency) – Off-air television channels 14 to 83.

VHF (Very High Frequency) – Off-air television channels 2 to 13.

Visual Carrier – The portion of a television signal, which carries the video portion of the picture.

Appendix D

Dipole Antenna Lengths

The length of the dipole antenna element is inversely proportional to the frequency or the desired RF carrier. Note the Frequency or channel you wish to measure and use the corresponding dipole antenna length. The quoted dipole element length is for each side of the dipole in inches. The total end-to-end length would be two times the element length.

Channel	Frequency	Element Length (Inches)		Channel	Frequency	Element Length (Inches)
2	55.25	50.8		26	247.25	11.4
3	61.25	45.8		27	253.25	11.1
4	67.25	41.8		28	259.25	10.8
5	77.25	36.3		29	265.25	10.6
6	83.25	33.7		30	271.25	10.4
				31	277.25	10.1
95	91.25	30.8		32	283.25	9.9
96	97.25	28.9		33	289.25	9.7
97	103.25	27.2		34	295.25	9.5
98	109.25	25.7		35	301.25	9.3
99	115.25	24.4		36	307.25	9.1
				37	313.25	9.0
14	121.25	23.2		38	319.25	8.8
15	127.25	22.1		39	325.25	8.6
16	133.25	21.1		40	331.25	8.5
17	139.25	20.2		41	337.25	8.3
18	145.25	19.3		42	343.25	8.2
19	151.25	18.6		43	349.25	8.0
20	157.25	17.9		44	355.25	7.9
21	163.25	17.2		45	361.25	7.8
22	169.25	16.6		46	367.25	7.6
				47	373.25	7.5
7	175.25	16.0		48	379.25	7.4
8	181.25	15.5		49	385.25	7.3
9	187.25	15.0		50	391.25	7.2
10	193.25	14.5		51	397.25	7.1
11	199.25	14.1		52	403.25	7.0
12	205.25	13.7		53	409.25	6.9
13	211.25	13.3		54	415.25	6.8
14	217.25	12.9		55	421.25	9.7
15	223.25	12.6		56	427.25	6.6
				57	433.25	6.5
23	229.25	12.2		58	439.25	6.4
24	235.25	11.9		59	445.25	6.3
25	241.25	11.6		60	451.25	6.2

FIGURE 52 – DIPOLE ANTENNA SEGMENT LENGTHS

Channel	Frequency	Element Length (Inches)	Channel	Frequency	Element Length (Inches)
61	457.25	6.1	78	559.25	5.0
62	463.25	6.1	79	565.25	5.0
63	469.25	6.0	80	571.25	4.9
64	475.25	5.9	81	577.25	4.9
65	481.25	5.8	82	583.25	4.8
66	487.25	5.8	83	589.25	4.8
67	493.25	5.7	84	595.25	4.7
68	499.25	5.6	85	601.25	4.7
69	505.25	5.6	86	607.25	4.6
70	511.25	5.5	87	613.25	4.6
71	517.25	5.4	88	619.25	4.5
72	523.25	5.4	89	625.25	4.5
73	529.25	5.3	90	631.25	4.4
74	535.25	5.2	91	637.25	4.4
75	541.25	5.2	92	643.25	4.4
76	547.25	5.1	93	649.25	4.3
77	553.25	5.1	94	655.25	4.3

FIGURE 53 – DIPOLE ANTENNA SEGMENT LENGTHS (CON'T)

Warranty Information

Your SA 1454 has been built to the highest quality standards in the industry. Your instrument is fully protected with a one year warranty and Sencore's 100% Made Right Lifetime Guarantee in the unlikely event that a defect was overlooked. Details of this warranty are covered in a separate document shipped with your instrument.

Service

The Sencore Factory Service Department provides all "in and out of warranty" service and complete calibration services for all Sencore instruments. No local service centers are authorized to repair Sencore instruments. Factory service insures you the highest quality work, the latest circuit improvements, factory parts and the fastest turnaround time possible. Most service repairs are completed within 72 hours of their receipt.

Returning an Instrument for Service

Save the original packing materials for reuse should you ever need to ship your SA 1454 to the Sencore Factory Service Department for repair or re-calibration. If the original packing material is not available, please follow the following procedure steps 1 thru 3.

1. Use a corrugated shipping container that has a tested strength of 50 lbs. and internal dimensions of at least 17"x11"x 9".
2. Pack the unit inside a plastic bag to protect it.
3. Cushion the unit with a minimum of 3 inches of padding on each side of the instrument, more as required to completely fill the shipping carton. Pack the carton tightly enough to prevent the unit from shifting during shipment.
4. Seal all seams in the container with durable shipping tape.
5. Be sure to enclose the following information: Owner's Name, Owner's Address (ship to), Billing Information, Purchase Order (if required), Contact Name and Phone Number, Service Desired or Problem.
   Call 1-800-SENCORE (1-800-736-2673) for a Return Authorization Number.
6. Ship the packaged unit to the address listed below. We recommend Federal Express.

Sencore Factory Service
3200 Sencore Drive
Sioux Falls, SD 57107

PARTS

Parts may be ordered from the Service Department. Parts not shown in the parts list may be ordered by description. Sencore reserves the right to inspect defective parts before warranty replacements are issued. If you have a question or a problem that we can help you with, please call or fax :

Toll Free: 1-800-SENCORE (736-2673)
Fax: 605-339-7032

The following information is for your records and may be helpful when calling the service department:

Purchase Date _____ Serial Number _____ Run Number _____

SENCORE
3200 Sencore Drive, Sioux Falls, SD 57107
www.sencore.com
1-800-SENCORE (736-2673)
1-605-339-0100

NOTES: