Appendix

A_3500A.EXE

STI Driver for Aeroflex 3500A Portable Test Set

To Index

Overview

The A_3500.EXE driver (STI Driver) is an extension of Field Test 6, designed to operate with the Aeroflex 3500 Communications Test Set (3500) to make signal strength measurements. The 3500 is controlled by the STI Driver through an RS-232 serial interface. The cable used is a straight through, F-F, 9 pin cable connected to the Aeroflex Comm Breakout Box for the 3500. The Breakout Box is supplied with the Aeroflex 3500.

Standards in this Manual

Words contained between the less-than and greater-than signs, < >, are variables that are set by the user. The exception is the application of < and > inside the .REC file where they enclose values used by the A_3500.EXE driver.

Note: Paragraphs contain important operational information about the Driver operation.

Measurement Overview

Measurements to be made by the 3500 and the STI Driver are controlled by <name>.REC and V6A_3500.INI files. These files contain:

- Settings used internally by the driver,
- commands which can be used to modify the initial conditions of the 3500, and
- frequencies at which measurements will be measured.

Measurement Process

The field test measurement process is continuous. The driver first reads the contents of the <name>.REC file and communication with the 3500 is established. Then any initial commands are sent to the 3500 to modify the initial settings in the Transmitter Test tiles and the following continuous measurement process is started.

1. A series of receiver frequencies are set in the 3500 and the measured signal parameters for each frequency is queried and received from the 3500.
2. All measurement values are then formatted and sent to the Field Test 6 main program for display and logging in the measurement database.

This process repeats until stopped by the user selecting the Stop Receiver command.

STI Driver Control Files

Two files are used by the STI Driver as a source for parameters to control the measurement process.

The <name>.REC file contains project specific information and is located in the <Current Project> directory. More details are in the <name>.REC Files section below.

The V6A_3500.INI file contains global information related to the operation of the 3500 hardware and is located in the C:\STI REC Files directory. More details are in the V6A_3500.INI File section below.

Aeroflex 3500 User Initialization

The initial setup of the 3500 must be performed by the user from the front panel before testing is initiated. This includes setting up the 3500 for either analog signal or P25 digital signal measurements as well as setting up the communications port, either RS-232 or Ethernet. To setup the 3500 communication port from the main SYSTEM screen select the controls below in the indicated sequence:

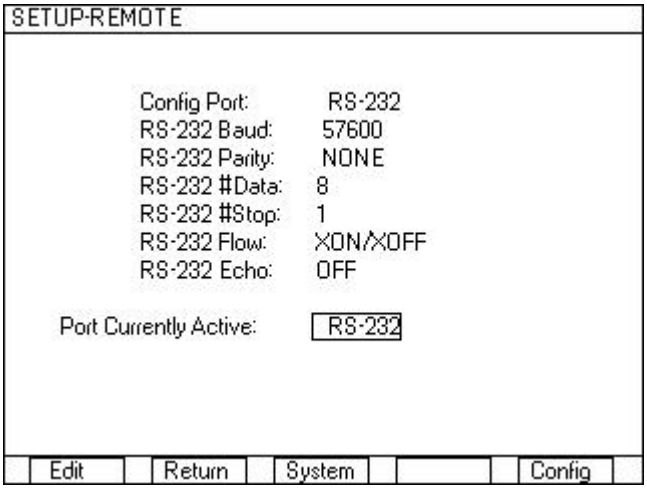
4 Benchtop then,

7 Setup then,

2 Remote.

RS-232 Setup

Setup the 3500 for communication through the RS-232 port in the SETUP-REMOTE screen by setting the RS-232 serial port options as indicated in the following screen image.



When the settings are complete select CONFIG soft control then the SYSTEM soft control to return to the SYSTEM screen. When the RS-232 interface is used the A_3500.EXE driver will search all available ports for a range of baud rates including 19.2, 38.4, 57.6, 115.2 kb.

Note: Try setting the 3500 at the next lower baud rate if you experience communication errors when using the RS-232 connection during testing.

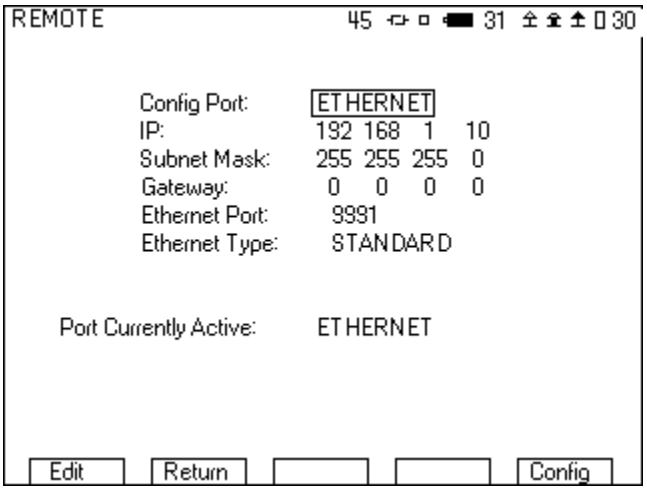
Note: The RS-232 connection to the 3500 is made with a straight through female to female DB9 cable.

Ethernet Setup

Setup the 3500 for communication through the Ethernet port in the SETUP-REMOTE screen by setting the Ethernet options as indicated in the image on the next page. The default IP port setting is 9991.

Note: The Ethernet connection must be made a network crossover cable unless you have a newer laptop with an adaptable Ethernet interface

Note: The IP address can be any set of 4 numbers.



When the settings are complete select CONFIG soft control then the SYSTEM soft control to return to the SYSTEM screen.

Transmitter Test Setup - Analog

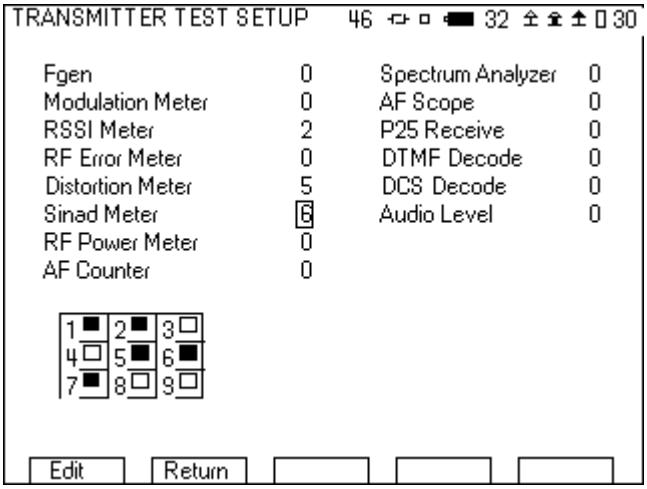
Follow these steps to setup the 3500A to make analog measurements of RSSI, signal distortion or SINAD. From the main SYSTEM screen select the following sequence of controls:

3 Transmitter Test.

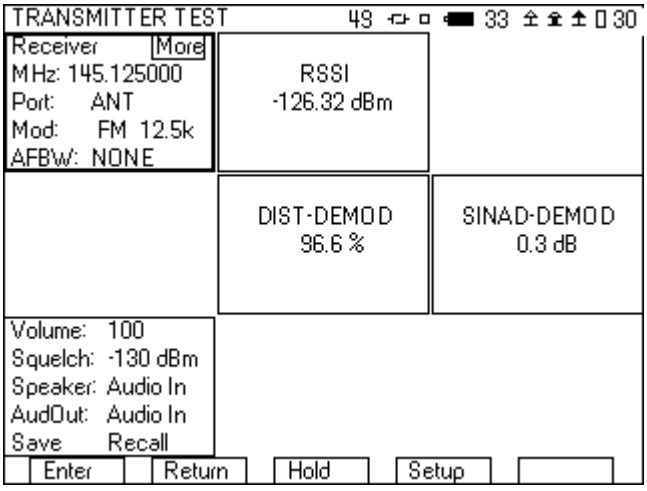
Then press the SETUP soft key.

In the TRANSMITTER TEST SETUP screen is a list of possible tiles to display in the TRANSMITTER TEST screen. Edit the settings as shown below for the tiles in the list:

RSSI Meter	2
Distortion Meter	5
SINAD Meter	6
(All other tiles)	0



Then select the RETURN soft key to return to the TRANSMITTER TEST screen. The functional tiles in this screen should look similar to the image below.



Note: Be sure that the modulation type and bandwidth in the Receiver tile are set properly for the signal under test. For example modulation = FM and bandwidth = 12.5 kHz.

The 3500 is now ready to be controlled by the A_3500.EXE driver to make analog measurements of signal strength, signal distortion and/or audio SINAD. Use one of the following <name>.REC files to make the corresponding measurements:

3500_RSSI.REC to make RSSI measurements.

3500_RSSI-Distortion.REC to make RSSI and Distortion measurements.

3500_RSSI-SINAD.REC to make RSSI, SINAD and Distortion measurements.

Transmitter Test Setup – P25 Digital

Follow these steps to setup the 3500A to make RSSI, BER or Modulation Fidelity measurements on a P25 digital signal. To make BER measurements a standard P25 1011 Hz test signal must be broadcast.

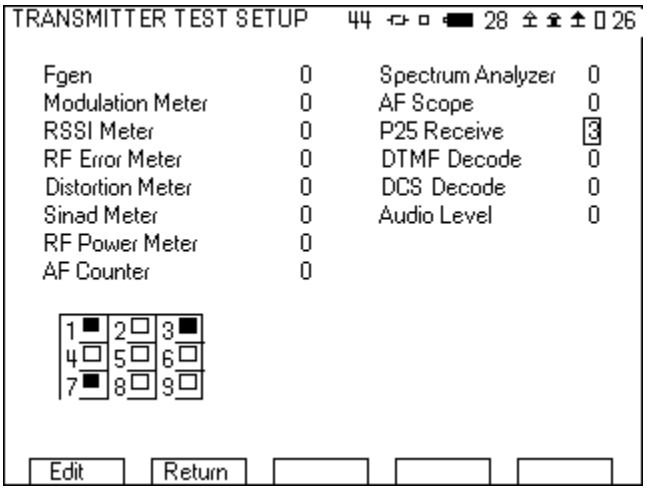
From the System screen select the following controls:

3 Transmitter Test

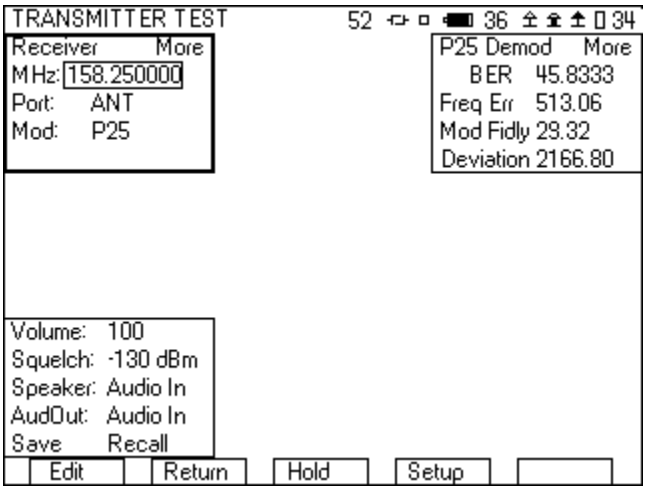
Then press the Setup soft key.

In the TRANSMITTER TEST SETUP screen is a list of possible tiles to display in the TRANSMITTER TEST screen. Edit the settings as shown below for the tiles in the list:

P25 Receive 3



Then select the RETURN soft key to return to the TRANSMITTER TEST screen. The functional tiles in this screen should look similar to the image below.



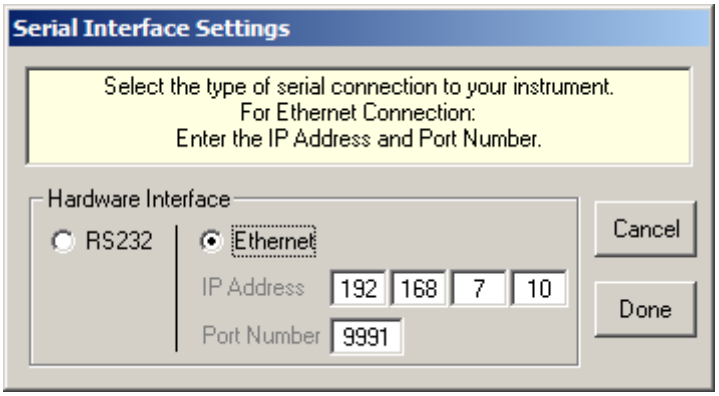
Note: Be sure that the modulation type is set to P25 for the P25 test.

The 3500 is now ready to be controlled by the A_3500.EXE driver to make P25 digital measurements of signal strength, BER and/or Modulation Fidelity.

Use the 3500_P25.REC file described below for P25 measurements:

A_3500.EXE Communication Setup

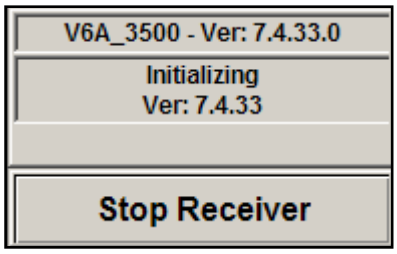
When the A_3500.EXE driver is started for the first time and after any communication failure the dialog box below will be presented.



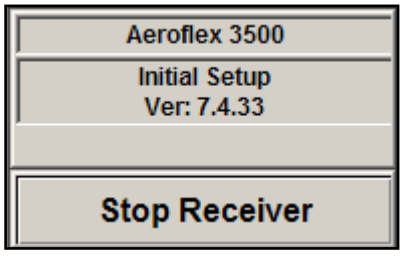
Select the appropriate Hardware Interface option and if Ethernet is selected, enter the same IP address as is entered into the 3500 IP address. The Port Number for the 3500 is 9991 as shown above.

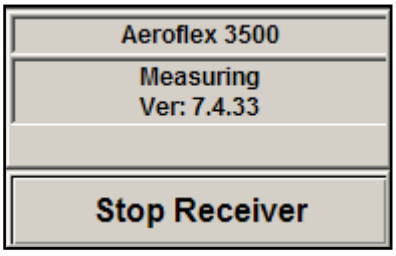
When the settings are completed select Done to start the receiver operation.

3500 Initialization and Startup



As the driver reports its progress as it initializes and starts. During the Initializing stage the .REC and .INI files are read and the communication port is initialized. Next, the Receiver Initial Commands in the .REC file are sent to the instrument. Finally, the Instrument Measurement Commands are sent and measurements process is started. The commands in the Receiver Measurement Commands section are repeated in a continuous loop until the user selects the Stop Receiver control.





<name>.REC Files

<Name>.REC files for the A_3500.EXE driver are ASCII files that are the source for parameters and 3500 RCI commands that control the project specific measurement operation of the 3500 and STI Driver. There are <name>.REC files for several different measurement requirements. All of the files contain four sections including:

- [Compatibility]
- [Global Settings]
- [Receiver Initial Commands]
- [Receiver Measurement Commands]
- [Freq List]

[Compatibility]

The [Compatibility] section contains the name of the receiver driver with which this .REC file is compatible. The required entries are:

Driver=A_3500.exe

File Version 6=True

These entries are used by Field Test 6 and must not be changed.

[Global Settings]

There are no Global Settings parameters at the present time for the A_3500.EXE driver.

[Receiver Initial Commands]

The [Initial Commands] section contains a list of RCI commands to setup the 3500 to make the required measurements. The commands in this section are sent once at the start of the test session. Each command must be preceded with a line number. The format of parameter setting commands in the [Init Section] is as follows:

<Line Number>=<RCI Command> <Parameter>

Commands in this section are sent in order of their line numbers.

The 3500 does not acknowledge the receipt of a parameter setting command. As a result most parameter setting commands are paired with a query command which the A_3500.EXE driver uses to confirm the proper setting of each parameter. The query command has the following format:

<Line Number>=<RCI Command>? <Parameter>

The query command includes the expected parameter enclosed within < and >. If the value returned by the 3500 is different than the parameter enclosed in < and > then an error will be displayed. For example the following line:

1=:rec:rfamp_mode? <2>

will send the Aeroflex Remote Command Interface (RCI) query

:rec:rfamp_mode?

to the 3500 to get the current mode of the RF Amp. It compares the result to the value of 2 (ON). If the value returned by the 3500 is different than 2 then an error will be displayed and the driver will stop.

The following commands will set the 3500 parameters as follows:

:agc:rfamp_mode 2	Turns the RF preamp ON.
:agc:port 1	Connects the Receiver to the Antenna port.
:rec:extpad 0	Sets compensation for external attenuation to 0 dB.
:rssi:average 5	Causes the 3500 to average 5 RSSI readings.

[Receiver Measurement Commands]

The commands in the [Receiver Measurement Commands] section control the signal measurement process. Commands are executed in this section once for each frequency in the [Freq List] to cause the following actions:

1. The 3500 receiver frequency is set.
2. The driver waits for a number of milliseconds seconds (1500).
3. The 3500 receiver frequency is queried and checked.
4. One or more measurement(s), such as RSSI, SINAD, Distortion or BER, is queried from the 3500.

After the above steps are performed for each frequency in the [Freq List] section the results are formatted and sent to the main Field Test 6 program for display and logging in the measurement database.

The parameters <F> and <M> cause special actions in the driver. When the <F> parameter is encountered replaced by the currently active frequency in the [Freq List] section.

The <M> parameter is a place holder for the measurement being requested causes the driver to accept the measurement and send it to the main program for display and logging.

The command Wait 1500 causes the driver to wait for 1.5 seconds, allowing the 3500 to complete the measurement(s) before it is queried for the measurement result(s).

[Freq List]

The [Freq List] section contains a listing of the measurement names and frequency values. There is a one-to-one correspondence between the frequency list and the fields in the Field Test 6 Measurement Database and the bars on the Field Test 6 Signals display.

A realistic limit on the number of frequencies that can be measured is determined by the time required to make a complete set of measurements. It will take approximately 2 seconds to make a set of measurements on a single frequency.

Note: The measured values are internally averaged by the 3500. Attempting to shorten the Wait time less than 1.5 seconds may cause some residual from the previous measurement to be retained in the current measurement.

The format of the lines in the [Freq List] section is:

<Line Number>=<Measurement Name>,<Parameter>,
[Signal Bottom, Signal Top]

Line Number defines the order in which the frequency list is used.

Measurement Name is used to name the corresponding field in the Measurement Database and is also used to name files. As a result these must conform to windows file naming conventions and must not be duplicated.

Parameter, when the measurement is signal power, the Parameter field must contain the channel frequency in MHz and is used by the driver to set the tuned frequency of 3500 receiver. For other types of measurements the field represents the measurement type, SINAD, DIST, or BER.

Signal Bottom and Signal Top are optional settings to set the bottom and top of the Signals display so the corresponding bar shows meaningful values for measurements that are different than signal strength in dBm. For example the normal SINAD range is from 0 to about 30 dB, BER from 0 to about 50% and distortion from 0 to 100%.

The Signal Bottom and Signal Top fields are optional and if left out the measurement bar will have the range indicated on the left axis of the Signals display.

Note: Right clicking on a bar in the signals display will cause its digital value, along with the values of the bars next to it, to be displayed.

Relationship between [Freq List] and Measurements <M>

Each time a measurement query command is accompanied by an <M> field and a measurement is provided for the currently active line

in the [Freq List]. For example, the first <M> field will provide a measurement for the first line in the [Freq List]. The second <M> for the second line etc. When all of the commands in the [Receiver Measurement Commands] section are completed they start again with a new frequency. This process continues until measurements are provided for each of the lines in the [Freq List].

This means that the number of <M>'s in the [Receiver Measurement Commands] section must come out even when the end of the [Freq List] is reached. If there are N, <M> fields there must be k * N lines in the [Freq List]. For example if there are two <M> fields there must be an even number of lines in the [Freq List] section.

See the sections below from the 3500_P25.REC file as an example.

```
[Receiver Measurement Commands]
1=:rec:freq <F>
2=:p25:rx:reset_acq
3=Wait 1000
4=:rec:freq? <F>
5=:p25:rx:pwr:val? 0 <M>
6=:p25:rx:ber:val? 2 <M>
7=:p25:rx:mod_fid:val? 1 <M>

[Freq List]
;Format is LineNum=Name,Frequency
1=Ch1_RSSI,869.90
2=Ch1_BER,BER,0,50
3=Ch1_MFD,MFD,0,100
4=Ch2_RSSI,871.125
5=Ch2_BER,BER,0,50
6=Ch2_MFD,MFD,0,100
```

Note that an RSSI measurement is the first line in the [Freq List] and is the current line when the <F> field is encountered to set the channel frequency. It is also the first measurement, line 5, in the [Receiver Measurement Commands] section. As <M> fields are encountered in Lines 5, 6 and 7 the current line in the [Freq List] is increment by one. When the commands in the [Receiver Measurement Commands] section are completed the process starts over. Line 4 in the [Freq List] becomes the current line and the <F> field in the [Receiver Measurement Commands] section sets the channel frequency to the value for that line, 871.125, and the three measurements represented by <M> fields, are then assigned to lines 4, 5, and 6 in the [Freq List].

3500_RSSI.REC File Example

Following is the contents of the 3500_Example.REC file. It is setup to measure signal amplitude on 7 weather channels.

The semicolon (;)may be used at the beginning of a line to comment out that line. This can be used to eliminate a command line or to create a line for notes. The apostrophe (') is used to separate a command from a trailing note on the same line.

```
[Compatibility]
Driver=A_3500.exe
File Version 6=True

[Global Settings]
;(There are no applicable Global Settings.)

[Receiver Initial Commands]
;Format is LineNum=3500 command[ parameter] OR [? and <parameter>]
1=:agc:rfamp_mode 2            'Turn on preamplifier
2=:agc:rfamp_mode? <2>         'Confirm setting
3=:rec:port 1                  'Connect to Antenna port
4=:rec:port? <1>               'Confirm setting
5=:rec:extpad 0                'No external attenuator
6=:rec:extpad? <0>             'Confirm setting
7=:demod:type 4                'Set Demodulation type to FM
8=:demod:type? <4>             'Confirm setting
9=:rssi:average 5              'Average 5 readings.

[Receiver Measurement Commands]
1=:rec:freq <F>                'Set Frequency
2=:rssi:reading:clear          'Clear measurement memory
3=Wait 1500                    'Wait 1.5 seconds
4=:rec:freq? <F>               'Check Frequency
5=:rssi:reading:val? <M>       'Query RSSI value and assign to current
                               'line in [Freq List]

[Freq List]
;Format is LineNum=Name,Frequency
1=WX1,162.550
2=WX2,162.400
3=WX3,162.475
4=WX4,162.425
5=WX5,162.450
6=WX6,162.500
7=WX7,162.525
```

3500_Dist.REC File Example

The 3500_Dist.REC file is setup to make measurements of RSSI and Distortion on a set of frequencies.

```
[Compatibility]
Driver=A_3500.exe
File Version 6=True

[Global Settings]

[Receiver Initial Commands]
1=:agc:rfamp_mode 2              'Turn on preamplifier
2=:agc:rfamp_mode? <2>           'Confirm setting
3=:rec:port 1                    'Connect to Antenna port
4=:rec:port? <1>                 'Confirm setting
5=:rec:extpad 0                  'No external attenuator
6=:rec:extpad? <0>               'Confirm setting
7=:demod:state 1                 'Activate analog demodulation
8=:demod:state? <1>              'Confirm setting
9=:demod:type 4                  'Set Demodulation to FM
10=Wait 3000                     'Wait 3 sec for settings to complete
11=:demod:type? <4>              'Confirm Demodulation type
12=:demod:afbw 0                 'Set Audio filters to none
13=:demod:afbw? <0>              'Confirm setting
14=:rssi:average 5               'Average 5 RSSI readings

;Distortion Setup
15=:distortion:demod:state               'Activate distortion measurements
16=:distortion:demod:state? <1>                  'Confirm setting
17=:distortion:demod:average 2           'Average 2 demodulation readings
18=:distortion:demod:average? <2>        'Confirm setting

[Receiver Measurement Commands]
1=:rec:freq <F>                          'Set frequency
2=:rssi:reading:clear                    'Clear RSSI measurement memory.
3=:distortion:demod:reading:clear        'Clear Distortion measurement memory.
4=Wait 1500                              'Wait 1.5 seconds to make measurements
5=:rec:freq? <F>                         'Check frequency
6=:rssi:reading:val? <M>                 'First measurement, RSSI
7=:distortion:demod:reading:avg? <M>     'Second measurement, Distortion

[Freq List]
;Format is LineNum=Name,Frequency
1=Ch1_RSSI,889.90                'First <M> measurement
2=Ch1_DIST,DIST,0,100            'Second <M> measurement
3=Ch2_RSSI,894.00                'First <M> measurement
4=Ch2_DIST,DIST,0,100            'Second <M> measurement
```

3500_SINAD_Dist.REC File Example

The 3500_SINAD_Dist.REC file is setup to make RSSI, SINAD and Distortion measurements on two frequencies.

Note: The SINAD measurement requires a 1 KHz audio test tone transmitted over the radio signal.

```
'Setup for measuring RSSI, Distortion and SINAD
[Compatibility]
Driver=A_3500.exe
File Version 6=True

[Global Settings]

[Receiver Initial Commands]
;Receiver Setup
10=:agc:rfamp_mode 2
12=:agc:rfamp_mode? <2>
14=:rec:port 1
16=:rec:port? <1>
18=:rec:extpad 0
20=:rec:extpad? <0>
22=:demod:state 1
24=:demod:state? <1>
26=:demod:type 4
28=Wait 3000
30=:demod:type? <4>
32=:demod:afbw 0
34=:demod:afbw? <0>

;SINAD Setup
40=:sinad:demod:state
42=:sinad:demod:state? <1>
44=:sinad:demod:average 2
46=:sinad:demod:average? <2>

;Distortion Setup
50=:distortion:demod:state              '##
52=:distortion:demod:state? <1>                 '##
54=:distortion:demod:average 2          '##
56=:distortion:demod:average? <2>       '##

[Receiver Measurement Commands]
1=:rec:freq <F>
2=:rssi:reading:clear
3=:sinad:demod:reading:clear
4=:distortion:demod:reading:clear       '##
5=Wait 1500
```

```
6=:rec:freq? <F>
7=:rssi:reading:val? <M>
8=:sinad:demod:reading:val? <M>
9=:distortion:demod:reading:val? <M>    '##

[Freq List]
;Format is LineNum=Name,Frequency
1=Ch1_RSSI,889.90
2=Ch1_SINAD,SINAD,0,50
3=Ch1_DIST,DIST,0,100                   '##
4=Ch2_RSSI,894.00
5=Ch2_SINAD,SINAD,0,50
6=Ch2_DIST,DIST,0,100                   '##
```

Note: RSSI and SINAD can be measured without the Distortion measurement by commending out or removing the lines with the '## following the line.

3500_P25.REC File Example

The 3500_P25.REC file is setup to make RSSI and BER measurements on a P25 signal. Note that the measurement tiles on the 3500 must be setup according to the directions in the Transmitter Test Setup – P25 Digital section above.

Note: BER measurements require a standard 1011 Hz P25 digital test tone to be transmitted over the radio signal.

```
'Setup for measuring RSSI, BER and Modulation Fidelity
[Compatibility]
Driver=A_3500.exe
File Version 6=True

[Global Settings]

[Receiver Initial Commands]
1=:agc:rfamp_mode 2                 'Preamp on
2=:agc:rfamp_mode? <2>              'Confirm setting
3=:rec:port 1                       'Connect to antenna port
4=:rec:port? <1>                    'Confirm setting
5=:rec:extpad 0                     'No external attenuator
6=:rec:extpad? <0>                  'Confirm setting

7=:p25:rx:average:ber 1             'Average one BER reading
8=:p25:rx:average:ber? <1>          'Confirm setting
9=:p25:rx:average:pwr 2                     'Average 2 RSSI readings
10=:p25:rx:average:pwr? <2>         'Confirm setting
11=:p25:rx:average:mod_fid 2        'Average 2 Modulation Fidelity readings
12=:p25:rx:average:mod_fid? <2>     'Confirm setting

[Receiver Measurement Commands]
1=:rec:freq <F>                 'Set frequency
2=:p25:rx:reset_acq             'Reset measurement memory
3=Wait 1000                     'Wait 1 second
4=:rec:freq? <F>                'Confirm frequency setting
5=:p25:rx:pwr:val? 0 <M>        'RSSI Average value
6=:p25:rx:ber:val? 2 <M>        'BER Min value
7=:p25:rx:mod_fid:val? 1 <M>    'Modulation Fidelity Max value

[Freq List]
;Format is LineNum=Name,Frequency
1=Ch1_RSSI,869.90               'First measurement
2=Ch1_BER,BER,0,50              'Second measurement
3=Ch1_MFD,MFD,0,100             'Third measurement
4=Ch2_RSSI,871.125              'First measurement
5=Ch2_BER,BER,0,50              'Second measurement
6=Ch2_MFD,MFD,0,100             'Third measurement
```

V6A_3500.INI File

Below is the contents of the V6A_3500.INI file with default values. This file contains characteristics related to communication with the 3500. **Settings in this file are either maintained by the STI Driver or only need to be changed if related RCI commands change in the future.**

```
[Global Settings]
Company Name=Aeroflex
Response Timeout=5000
Net Timeout=2000
ID Timeout=2000
RS232 Message Termination=13,10
Net Message Termination=10
Init Message Time Out=10000

[Serial Port Settings]
Forced Port Search=
Baud Sequence=19200,38400,57600,115200
Port=
Baud=57600
Settings=n,8,1
Handshake= 1
Net Address=192.168.1.10
Net Port=9991
Select Hardware=True
Hardware=Net
```

Cables and Connections

The serial connection to the 3500 is made through the Aeroflex Comm Breakout Box which is connected to the Remote connector on top of the 3500. The Aeroflex part number of the Comm Breakout Box is 51190/7005-6242-900 or its replacement.

RS-232 Connection

The RS-232 connection between the 3500 Comm Breakout Box and the laptop computer is a through a straight, female to female DB-9 cable.

Ethernet Connection

The Ethernet connection directly between the 3500 Comm Breakout Box and the laptop must be an RJ-45 network crossover cable or crossover adaptor.

When connecting from the STI-9400 computer to the 3500 Comm Breakout Box through a network switch the cable is a standard RJ-45 network cable.

Customer Support

Survey Technologies is available for consultation regarding system operation during the initial warranty period at 503 848-8500. Often questions can be resolved by a phone call.

When the questions about system operation are more complex, a zipped copy of status and history files will assist us to quickly diagnose the problem. The Project Copy utility program will zip up these files into a single Support File that you can attach to your Email.

Follow these directions to create a Support File to Email to us.

- Select the Project Copy icon on your desk top or go through the Start menu to Programs then Survey Technologies Inc.
- In Project Copy, select a location for the Support File. Desktop is suggested as a convenient location.
- Click the support button and select the project from the list that has the problem.
- Select the Apply button. Progress bars will indicate the progress of the Support File creation. The name of the Support File will be:

  <Project Name>-Spt.Zip
- Attach this Support File to an Email and send it to support@surveytech.com .
- Delete the Support File after you have emailed it to us as it is no longer useful.

We will analyze the problem you observe and respond with a recommended course of action as quickly as possible.