

An_S412D.EXE

Driver for Anritsu S412D LMR Master

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Overview

The AN_S412D.EXE driver is designed to operate with Anritsu S412D portable analyzers. Measurements are totally automated by the AN_S412D driver.

The cable used with these analyzers is a Female to Female Null Modem cable. A cable of this type is supplied with the analyzer and with Field Test 6 when the An_S412D is included.

Flow of Driver Operation

The flow diagram at the end of this section shows the measurement process of the Anritsu_SA driver.

Establish Communications

Communication with the analyzer is tested by sending a Enter Remote Mode command. When successful the analyzer responds with the model name and firmware version. After successful communication is established with the analyzer the baud rate is set to 38400 baud. When this is successfully completed the analyzer model name and firmware version is displayed in the driver window.

Error messages are displayed if communication with the analyzer can not be established. In this case, check the hardware and software interface to the analyzer and reinitialize the analyzer with a power off on cycle.

Initial Commands

After successful communication interface has been established and the analyzer name and version is displayed, the commands listed in the [Initial Commands] section are sent to the analyzer. An error message will be displayed if a problem is encountered with any of these commands. The error message will indicate the line in the [Initial Commands] section that is the most likely source of the problem.

Note: If line numbers are not consecutive in the section, this number displayed in the error is the number of the command in the section not the line number.

Measurement Loop

After the initial commands are successfully sent the measurement loop is entered. At this point the driver status window shows the word "Running".

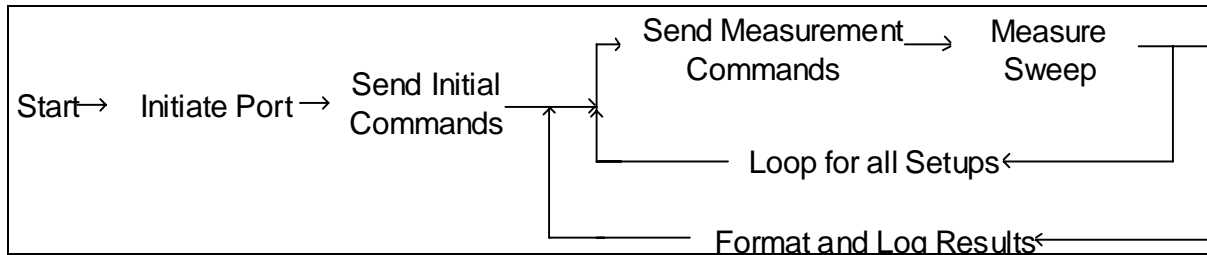
Commands in the first [Measurement Commands 1] section are sent to the analyzer then the analyzer is placed into local mode for a time

to complete the required measurement. The analyzer is then returned to remote mode and the sweep is down loaded into the computer. The appropriate measurements are taken from the sweep data and formatted into log file records. Then the next [Measurement Commands n] section is implemented.

When all [Measurement Commands n] sections have been implemented the complete log file record is sent from the driver to the main Field Test 6 program for display and logging in the measurement database.

Note: If a signal is not displayed on the analyzer screen by one of the measurement command sections it will not be measured and will not have a value in the measurement database.

This process repeats continuously until stopped by clicking the Stop control on the Receiver Window.



<name>.REC File Structure

The <name>.REC file is a text file that contains settings and commands that are the basis for controlling the measurement process in the S412D instrument. One <name>.REC file is copied into each new project directory and is then editable to design or modify the measurement process.

There are 5 types of sections in the <name>.REC file for the An_S412D.EXE driver.

[Compatibility] section is for the benefit of the driver, to determine state the driver compatibility of the file. It should not be modified.

[Global Settings] section contains parameters which are set in the driver software. These settings are acquired and set as the driver starts. The lines in the [Global Settings] section are of the form:

<Setting Name>=<Setting Value>

[Initial Commands] section contains initial commands and settings that are specific to the measurement mode of operation. These commands are sent to the S412D once, after initial communications is established with the instrument. The commands in the [Initial Commands] section are of the following form:

Line Number = <Command> <Parameter>

[Measurement Commands] section(s) contain commands that are sent to the S412D repeatedly to make the desired measurements. These sections are repeated and the results are logged and displayed until the user selects the STOP RECEIVER control.

Most of the Measurement Modes only require one [Measurement Commands] section. However, in the SA Measurement Mode multiple sections may be used to setup screens upon which signal strength measurements can be made. These sections are numbered with a following integer in the section name as follows.

[Measurement Commands N] where N is a sequential integer.

Commands in the [Measurement Commands] section are of the form.

Line Number = <Command> [Parameter]

[Freq List] section contains a list of the measurements to be logged. There is a one-for-one relationship between the lines in the [Freq List] section and the fields in the measurement database. Lines in the [Freq List] section are of the form:

Line Number = <Channel Name>,<Parameter>
[,<SignalBottom>,<SignalTop>]

Where <Channel Names> are used by the Field Test 6 program to label the X axis of the Signals Display, to name the fields in the measurement database and to name files when generating analysis results, so they must satisfy Windows file naming restrictions.

<Parameter> is usually a frequency in MHz but is sometimes a descriptor that describes the type of measurement being made.

<SignalBottom> is an optional field that represents the value that will be at the bottom of the Signals bar graph for that item in the frequency list.

<SignalTop> is an optional field that represents the value that will be at the top of the Signals bar graph for that item in the frequency list.

<SignalBottom> and <SignalTop> parameters are used to display positive values such as BER, or distortion % on the same bar graph as negative RSSI values.

[Global Settings]

The [Global Settings] section may contain two commands.

Bucket Width = 10000

The Bucket Width setting is used only in the SA Measurement Mode (See Below). Frequency and Bucket Width parameters are used by An_S412D.EXE to assign amplitude readings to appropriate frequency channels and measurement database fields.

The driver actually adds the energy components of the downloaded screen pixels in the bucket width spectrum to compute the power of the signal in that spectrum.

The Bucket Width setting must account for frequency error in the source as well as instrument measurement error. Therefore it is not quite the same as channel width, although it may be set equal to the channel spacing.

Measurement Mode (SA,Chan,P25,NXDN) = <parameter>

There are 4 types of automated measurement modes that are possible with the An_S412D driver and the S423D instrument. These modes are indicated in the Measurement Mode command as SA, Chan, P25 and NXDN. <name>.REC files associated with each of these Measurement Modes are included with the driver installation in the C:\STI REC Files directory.

Spectrum Analyzer Measurements, SA

Spectrum analyzer measurements are made by setting the analyzer so a desired spectrum of signals are fully displayed on the screen. Then the entire sweep display is down loaded into the computer. The driver then selects the sweep pixels in the region defined by the channel center frequency and the channel width and adds the power represented by each pixel in the channel width.

This measurement always results in a measurement for every displayed frequency in the frequency list. However, when the signal is very low the recorded amplitude will be a noise level and when a nearby signal is very strong the recorded level may be a value on the skirt of the nearby signal.

As an example the included setup file S400_AB-CELL.REC sets up the instrument to very quickly measure the 42, A and B cellular control channels.

Channel Power Measurements, Chan

Channel occupied power measurements can be made for a few arbitrary signals. For example the occupied power measurement method can be used for measuring signal strength of signals with a spread energy spectrum.

The file S400_ChnlPwr.REC shows a way to measure the occupied power on each of two channels.

P25 Signal Strength and BER, P25

Signal strength and BER measurements are important to fully characterize signal coverage on P25 and NXDN digital signals. The S400_P25.REC file shows the way to control the S412D to make these measurements on P25 signals.

NXDN Signal Strength and BER, NXDN

Signal strength and BER measurements can also be made on NXDN digital channels. The file, S400_NXDN.REC shows how to do this.

[Initial Commands] and [Measurement Commands]

The contents of the [Initial Commands] and [Measurement Commands] sections are commands and parameters associated with specific settings in the S412D.

The Anritsu S412D programming interface is based upon binary commands sent to the analyzer. The AN_S412D.EXE driver has translated many of the common commands to an easier to understand form for entry into the <name>.REC test setup file. The commands do not apply all Measurement Modes so their application is noted for each command.

This section is listed in alphabetical order.

Attenuator Setting

Applicable Measurement Mode: SA, Chan, P25, NXDN

The command to set attenuator value is:

Line number = AT <value, dB>

Example: 1=AT 0DB

Bandwidth

Applicable Measurement Mode: Chan

The command to set the frequency width over which the power is measured is like:

Line Number = BW 12.5KHz

Bandwidth must be set before Center Frequency. See Center Frequency below.

Center Frequency

Applicable Measurement Mode: Chan

The command to enter the center frequency of the channel being measured is:

Line Number = CF <frequency, MHz>

The instrument command to set center frequency also contains Bandwidth and Span. The Center Frequency command causes the binary command to be sent to the S412D. This means that Bandwidth and Span settings must be set in the <name>.REC file before the Center Frequency is set.

Note: The parameter <F> is a place holder for the currently measured frequency in the frequency list. Each instance of an <M> parameter

causes the current line in the frequency list to increment. See the Read Power command below for details.

Channel Trigger

Applicable Measurement Mode: Chan (Only in **local** mode)

The command to start the measurement and provide for notification when the measurement is complete is:

Line Number = ChannelTrigger [Repeats] (one word)

Issuing the ChannelTrigger command provides for more accurate timing of the measurement. The instrument sends a "Measurement Complete" message when the measurement is complete at which time the next command in the <name>.REC file will be sent.

The optional Repeats parameter can be used to repeat the channel trigger function so the nth measurement may be logged. This allows the S412D measurement process to stabilize before logging a measured value. If this is necessary, a value of 2 or 3 can be used.

Alternatives: ChanTrig, ChannelTrig

Display Mode

Applicable Measurement Mode: P25, NXDN

The DisplayMode command determines whether the display will show RSSI or BER values.

Line number = DisplayMode [RSSI or BER]

Example: 1=DisplayMode RSSI

Alternatives:

Enter Remote

Applicable Measurement Mode: Chan, P25, NXDN (**Local** mode only)

The command to enter remote mode during the measurement cycle is:

Line Number = EnterRemote (one word)

See Exit Remote below.

Exit Remote

Applicable Measurement Mode: Chan, P25, NXDN

The command to go to exit remote mode and enter local mode is:

Line Number = ExitRemote (one word)

The S412D is not able to make measurements when in remote mode. Therefore, after all settings are set the ExitRemote command must be sent to allow the measurement to start. The only two types of commands allowed while in local mode are the EnterRemote and Trigger type commands.

Native Anritsu Command

Applicable Measurement Mode: Any

Finally, if there is a need to send a command not included in this section binary values can be sent to the analyzer with the Native Binary, NB, command below.

Line number = NB <comma delimited ASCII values>

Example: 1=NB 118,3

This command will set the sweep average setting to 3 averages.

Note: Only Native Binary commands may be used that create an "Operation Complete" response. Any other response to an NB command will create an error. See the Anritsu Programming Manual for details on S412D commands.

Preamplifier On/Off

Applicable Measurement Mode: SA, Chan, P25, NXDN

The command to turn the preamplifier on or off is:

Line number = PA <On/Off>

Example: 1=PA OFF

Note: If the S412D does not have a preamplifier option this command may generate an error.

Read NXDN Query

Applicable Measurement Mode: NXDN

The ReadNXDN? Query sends a query command to the S412D to return the RSSI and BER measurement message. The command is:

Line number: = ReadNXDN? <M1>,<M2>

<Mn> is a place holder for a measurement. One measurement is returned by the ReadPower query. Each time <Mn> is encountered the current line in the [Freq List] is incremented. At the end of the [Freq List] the measurements are logged and the process starts over at the start of the list.

<M1> indicates the first field in the measurement message, RSSI, should be returned and <M2> indicates the second field in the message should be returned. Because <M1> appears first, the first field in the message, RSSI, will be logged first and the second field, BER, will be logged next.

Read P25 Query

Applicable Measurement Mode: P25

The ReadP25? Query sends a query command to the S412D to return the RSSI and BER measurement message. The command is:

Line number: = ReadP25? <M1>,<M2>

<Mn> is a place holder for a measurement. One measurement is returned by the ReadPower query. Each time <Mn> is encountered the current line in the [Freq List] is incremented. At the end of the [Freq List] the measurements are logged and the process starts over at the start of the list.

<M1> indicates the first field in the measurement message, RSSI, should be returned and <M2> indicates the second field in the message should be returned. Because <M1> appears first, the first field in the message, RSSI, will be logged first and the second field, BER, will be logged next.

Read Power Query

Applicable Measurement Mode: Chan

The query to read and log the integrated power over the bandwidth set by the Bandwidth command is:

Line Number = ReadPower? <M>

<M> is a place holder for a measurement. One measurement is returned by the ReadPower query. Each time a <M> is encountered the current line in the [Freq List] is incremented. At the end of the [Freq List] the measurements are logged and the process starts over at the start of the list.

Reference Level

Applicable Measurement Mode: SA, Chan, P25, NXDN

The command to set the analyzer reference level is:

Line number = RL <value, dB>

Example: 1=RL -20Db

Resolution Bandwidth

Applicable Measurement Mode: SA

The command to set resolution bandwidth is:

Line number = RB <freq, KHz>

Example: 1=RB 10KHZ

Signal Standard

Applicable Measurement Mode: SA

The command to select the signal standard for spectrum analyzer mode is:

Line Number = SigStd <Index, decimal>

The command selects the S4112D signal standard used to set the measurement parameters in the S412D. Refer to the chapter Signal Standards in the S412D Programming Guide for a list of signal standards and their Index.

Span

Applicable Measurement Mode: Chan

The command to set the S412D screen span is like:

Line Number = SPAN 20KHZ

Span must be set before Center Frequency. See Center Frequency below.

Start Frequency

Applicable Measurement Mode: SA

The command to set the start frequency of an analyzer display is:

Line number = FA <freq, MHz>

Example: 1=FA 880.000MHz

Note: If FA is set equal to FB the analyzer will be in Zero Span mode.

Stop Frequency

Applicable Measurement Mode: SA

The command to set the right frequency of an analyzer display is:

Line number = FB <freq, MHz>

Example: 1=FB 880.640MHz

Note: If FA is set equal to FB the analyzer will be in Zero Span mode.

Test Pattern

Applicable Measurement Mode: P25, NXDN

The command to set the test pattern to be measured is:

Line number = TestPattern <Parameter>

<Parameter> for P25 measurements can be the following:

1011 for the standard P25 1011 Hz test pattern, or

153 for the 0.153 test pattern.

<Parameter> for NXDN measurements can be the following:

153 for the 0.153 test pattern.

Video Bandwidth

Applicable Measurement Mode: SA

The command to set video bandwidth is:

Line number = VB <freq, KHz>

Example: 1=VB 10KHz

S400_AB-CELL.REC Example

This sample S400_AB-Cell.REC file is setup to measure A and B cellular control channels. Two measurement setups are used, one for A and another for B channels. This file may be edited to make measurements in other frequency band(s).

'A and B control channels

[Compatibility]

File Version=5

Driver=V6An_S412D.EXE

File Version 6=True

[Global Settings]

Bucket Width=10000

Measurement Mode (SA,Chan,P25,NXDN)=SA

[Initial Commands]

1=SigStd 1 'Cellular AMPS Down Link

;1=NB 161,03,01 'Native example, SigStd AMPS Down Link

2=RB 3KHZ 'RESOLUTION BANDWIDTH

3=VB 3KHZ 'VIDEO BANDWIDTH

4=AT 0DB 'ATTENUATOR SETTING

5=RL -30DB 'REFERENCE LEVEL

10=PA ON 'Preamp OnTrueYes1/Off

[Measurement Commands 1]

1=FA 879.37MHZ 'START FREQUENCY

2=FB 880.00MHZ 'STOP FREQUENCY

[Measurement Commands 2]

1=FA 880.00MHZ 'START FREQUENCY

2=FB 880.64MHZ 'STOP FREQUENCY

[Freq List]

1=ch 313,879.390

2=ch 314,879.420

3=ch 315,879.450

4=ch 316,879.480

...

22=ch 334,880.020

23=ch 335,880.050

24=ch 336,880.080

...

40=ch 352,880.560

41=ch 353,880.590

42=ch 354,880.620

S400_ChnlPwr.REC

The S400_ChnlPwr.REC file below is setup to measure integrated signal power on two channels. The preamplifier is turned on. The SerialPortEcho and SingleSweep modes are turned on in order to enable the ChannelTrigger command during the measurement process.

```
'Setup for Channel RSSI Measurements

[Compatibility]
File Version=5
Driver=V6An_S412D.EXE
File Version 6=True

[Global Settings]
Measurement Mode (SA,Chan,P25,NXDN)=Chan

[Initial Commands]
1=RL -50DB           'REFERENCE LEVEL
2=AT 0DB            'ATTENUATOR SETTING
3=PA ON             'Preamp OnTrueYes1/Off
4=BW 12.5KHz       'Integration Bandwidth
5=SPAN 20KHz       'Analyzer span
6=SerialPortEcho True
7=SingleSweep True

[Measurement Commands]
;Note: BW and SPAN must be set prior to CF!
1=CF <F>           'Set Current Center Frequency
2=ExitRemote
3=ChannelTrigger
4=EnterRemote
5=ReadPower? <M>  'Read Channel Power Measurement

[Freq List]
1=RSSI-1,845.1250
2=RSSI-2,846.1250
```

S400_P25.REC

The S400_P25.REC file below is setup to measure signal strength and BER on two P25 channels. The preamplifier is turned on. Two measurements are being sequentially requested from the instrument and the 2nd one is logged. The BER bars on the Signals Display will display from 0 to 50%.

```
'P25 RSSI and BER Measurements
```

```
[Compatibility]
```

```
File Version=5
```

```
Driver=V6An_S412D.EXE
```

```
File Version 6=True
```

```
[Global Settings]
```

```
Measurement Mode (SA,Chan,P25,NXDN)=P25
```

```
[Initial Commands]
```

```
1=DisplayMode RSSI
```

```
2=RL -40DB 'REFERENCE LEVEL
```

```
3=AT 0DB 'ATTENUATOR SETTING
```

```
4=Scale 10 'P25 only
```

```
5=PA ON 'Preamp OnTrueYes1/Off
```

```
7=TestPattern 1011
```

```
[Measurement Commands 1]
```

```
1=CF <F> 'Current Center frequency
```

```
2=ExitRemote
```

```
3=ChTrig 2
```

```
4=EnterRemote
```

```
5=ReadP25? <M1>,<M2> 'Get P25 RSSI(1) and BER(2)
```

```
[Freq List]
```

```
1=P25-RSSI-1,845.125
```

```
2=P25-BER-1,BER,0,50
```

```
3=P25-RSSI-2,846.125
```

```
4=P25-BER-3,BER,0,50
```

S400_NXDN.REC

The S400_NXDN.REC file below is setup to measure signal strength and BER on two channels. The preamplifier is turned on. Three measurements are being sequentially requested from the instrument and the 3rd one is logged. The BER bars on the Signals Display will display from 0 to 50%.

```
'NXDN; RSSI and BER Measurements
```

```
[Compatibility]
```

```
File Version=5
```

```
Driver=V6An_S412D.EXE
```

```
File Version 6=True
```

```
[Global Settings]
```

```
Measurement Mode (SA,Chan,P25,NXDN)=P25
```

```
[Initial Commands]
```

```
1=DisplayMode RSSI
```

```
2=RL -40DB 'REFERENCE LEVEL
```

```
3=AT 0DB 'ATTENUATOR SETTING
```

```
4=Scale 10 '10 dB/Div
```

```
5=PA ON 'Preamp OnTrueYes1/Off
```

```
6=Bandwidth 12.5KHz
```

```
7=TestPattern 0.153
```

```
[Measurement Commands 1]
```

```
1=CF <F> 'Current Center frequency
```

```
2=ExitRemote
```

```
3=ChannelTrig 3 'Use the 3rd measurement
```

```
4=EnterRemote
```

```
5=ReadNXDN? <M1>,<M2> 'Get P25 RSSI and BER
```

```
[Freq List]
```

```
1=P25-RSSI-1,845.125
```

```
2=P25-BER-1,BER,0,50 'Signals display range from 0 to 50%
```

```
3=P25-RSSI-2,846.125
```

```
4=P25-BER-3,BER,0,50
```

An_S412D.INI File

When the receiver driver is started for the first time the An_S412D.INI file is initialized with serial port communications settings. Below is the contents of this after proper initialization.

```
[Serial Port Settings]
Forced Port Search=
Baud Sequence=9600,38400
Port=COM1
Baud=38400
Settings=n,8,1
Handshake= 0
```

Analyzer Serial Cable

The serial cable for Anritsu S412D analyzer is wired as a null modem with the following wiring connections. This cable is included with the analyzer and is supplied with the An_S412D.EXE driver option.

Female Computer DB9			Female Analyzer DB9		
Pin	Function		Pin	Function	
1	DCD	<-->	4	DTR	
2	Rx	<-->	3	Tx	
3	Tx	<-->	2	Rx	
4	DTR	<-->	1	DCD	
5	Gnd	<-->	5	Gnd	
6	DSR	NC	6	DSR	NC
7	RTS	<-->	8	CTS	
8	CTS	<-->	7	RTS	
9	Ring	NC	9	Ring	NC