

Application Note

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TETRA MS AutoTest scripting for Aeroflex IFR 3900 series test sets



The AutoTest facility in the Aeroflex IFR 3900 series test sets allows the user to create and run automated test sequences for the TETRA MS system.

This application note guides the user as to how to create an AutoTest script to meet particular requirements, how to run the script, and how to save results. The script structure is illustrated in listings included at the end of the note.

For full details of configuring and operating AutoTest scripts, refer to the IFR 3901 Operating Manual. Chapter 5 provides general information on the AutoTest System, and Chapter 22 defines the specific commands for the TETRA MS System.

The example scripts listed in the appendices can be found on the 3900 App Notes pages at <http://www.aeroflex.com/tetra/3900scripts.zip>. When creating custom scripts, rather than starting 'from scratch' the user is encouraged to begin with one of the examples.

For the very latest specifications visit www.aeroflex.com

OVERVIEW

Creating an AutoTest script

A 3900 AutoTest script takes the form of a flat (unformatted) text file as created, for example, on a PC using Microsoft® Notepad.

Whichever editor you use, it is important not to apply any formatting (such as font selection). Note that the test set requires AutoTest script files to have the extender *.ats* so, when saving the file in Notepad, be sure to (a) specify the extender in *File name:* as *' .ats'*, and set *Save as type:* to *'All Files'*. If you leave *Save as type:* at the default value of *'Text Documents (*.txt)'*, then the file may be saved with the extender *' .ats.txt'* and, in that form, will not be recognized by the test set.

The file can be transferred to the test set on a USB memory stick or floppy disk, from which it can be imported via the UTILS menu (UTILS / File Management / AutoTest / Scripts / Import) (Fig 1)

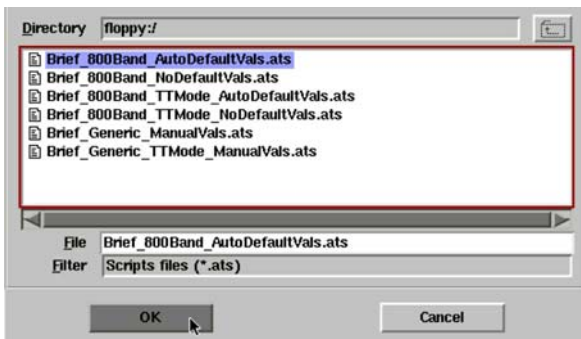


Fig 1: Importing an AutoTest script from floppy disk

Running a script

To run an AutoTest script, it is first necessary to load the 3900's AutoTest system. Press the CONFIG key twice, navigate via the ARROW keys to highlight *Systems / AutoTest*, and press SELECT. Inside AutoTest, press the *Load Script* softkey, and highlight and select the required script. (Fig 2)

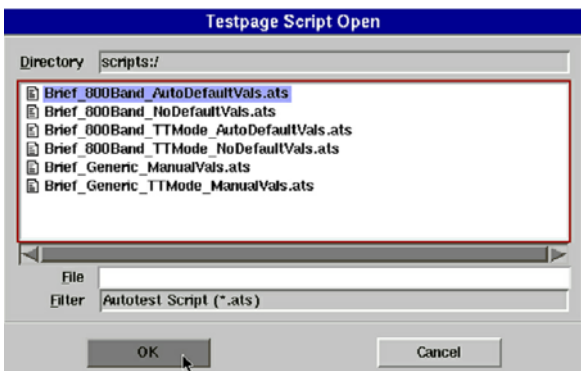


Fig 2: Importing an AutoTest script from floppy disk

Before running the script, you can use the On Error softkey to set how AutoTest behaves if a test fails - it can (a) Pause (i.e. the operator decides whether the run should continue or halt), (b) Abort (the run halts regardless), or (c) Ignore (the run, if at all possible, continue). Pause is most appropriate when the UUT is being tested by a skilled technician; Ignore is most appropriate for simple pre-screening applications.

The screen shows the progress of the test run and any operator action is prompted. (Fig 3)



Fig 3: Registration test - operator prompted to turn on the UUT

Storing results

The results of a test run can be saved to the test set's results directory. When the test has ended, select *Results / Store*, and enter a filename. Results files can be exported to USB memory or floppy disk via *UTILS / File Management / AutoTest / Results*. On a PC they can be read by Microsoft® WordPad or Word. If read by Microsoft® Notepad, the line terminators used by the 3901 make the text confusing to read.

Results files can also be imported to the test set from USB memory or floppy disk via *UTILS / File Management / AutoTest / Results*, and displayed in AutoTest via *Results / Recall*.

PROGRAMMING

Script elements

As illustrated in Fig 4, an AutoTest script is made up of the commands that allow:

- the appropriate system to be loaded into AutoTest (more on this later),
- system parameters to be set up,
- functional and parametric testing against programmable limits.

Although most scripts will follow a simple beginning-to-end sequence, the language allows for looping around and, if required, for using different parameter values in each pass. For example:

```
repeat 4
  set_rf_gen_level {-70} {-80} {-90} {-100}
  test_power_level_avg
end
```

tests the power level from the UUT at four sig gen levels: -70, -80, -90 and -100 dBm.

Bit Error Rate testing

Since AutoTest is restricted to the TETRA MS system (and not TETRA MST1), bit error rate (BER) testing in AutoTest requires the use of TETRA Test (TT) Mode. Currently however, not all mobiles support TT Mode. When using TT Mode, the modified form of AutoTest's registration command:

```
test_registration test_mode
```

should be employed. With this, once the mobile has registered, the 3901 will automatically confirm TT operation.

When in TT Mode, you can test bit error rate using commands such as:

```
test_rx_meas_ber -112.0 class0 class1 class2
test_rx_meas_rber -112.0 mer class0 class1
```

Loading a system into AutoTest

For it to operate, the 3900 test set must be loaded with a system such as TETRA MS, TETRA BS T1, etc. As can be seen from the CONFIG / Systems menu, AutoTest itself is classed as one of those systems. However, when you load the AutoTest system, AutoTest itself does not have a system loaded into it.

The AutoTest command for loading TETRA MS has three versions:

```
system "TETRA MS" default
system "TETRA MS"
system "TETRA MS" manual
```

and each has its own properties.

1. If the script uses

```
system "TETRA MS" default
```

then, every time the script is run, TETRA MS is loaded and all its parameters are automatically set to the AutoTest Default Values listed in the 3900 Operating Manual, Chapter 22.

2. If the script uses

```
system "TETRA MS"
```

then:

- on the first run, AutoTest loads TETRA MS and all its parameters are automatically set to the AutoTest Default Values.
- on subsequent runs, AutoTest will not load TETRA MS and the script will start with all its parameters set as they currently stand (i.e. however they were left after the previous run).

3. If the script uses

```
system "TETRA MS" manual
```

then, every time the script is run, TETRA MS is loaded and all its parameters are automatically set to the values saved when TETRA MS was last used manually (i.e. outside AutoTest).

The significance of the three commands is as follows:

1. **system "TETRA MS" default** is the most straightforward. Knowing that every run will start with all parameters set to known defaults, the writer simply has to include a relatively small number of setup statements to suit the requirements of the Unit Under Test (UUT).

Loading a system adds several seconds to the run time. However, if the time penalty of loading TETRA MS on every run is not a critical issue, the relative simplicity of using `system "TETRA MS" default` can be attractive, to R & D experimenters looking for a quick way of creating automated test sequences. For example code, see Appendix 1, Example 1.

2. Since the TETRA MS system is loaded only once, using **system "TETRA MS"** significantly reduces overall run time. However, the script must include statements not only to modify AutoTest defaults to suit the UUT, but also to re-set any parameters that are modified during a run. Fortunately, the additional run time of the extra setup statements is negligible compared with the time saved by loading the TETRA MS system only once. **So, if you plan to run the same script two or more times consecutively, then `system "TETRA MS"` is the correct choice.** See Example 2.

3. It should be noticed that scripts using either of the above two `system` commands effectively have all their parameters hard-coded, thus making them specific to the UUT type. The third command, **system "TETRA MS" manual**, provides for the creation of 'generic' (non UUT-specific) scripts. Such scripts assume the operator has already set the UUT-specific parameters (such as frequency plan, traffic channel, country code, network code, etc) before switching the test set into AutoTest. Although the number of parameters may be significant, the operator's workload (and the consequent risk of error) can be minimized by setting up the 3900's store-and-recall facility with the parameters for each UUT type.

As with `system "TETRA MS" default`, `system "TETRA MS" manual` has the time overhead of always loading the TETRA MS system. However, the ability to use a single script on mobiles that are set up for different channels, etc, may have an overriding attraction to, say, a repair organization. See Example 3.

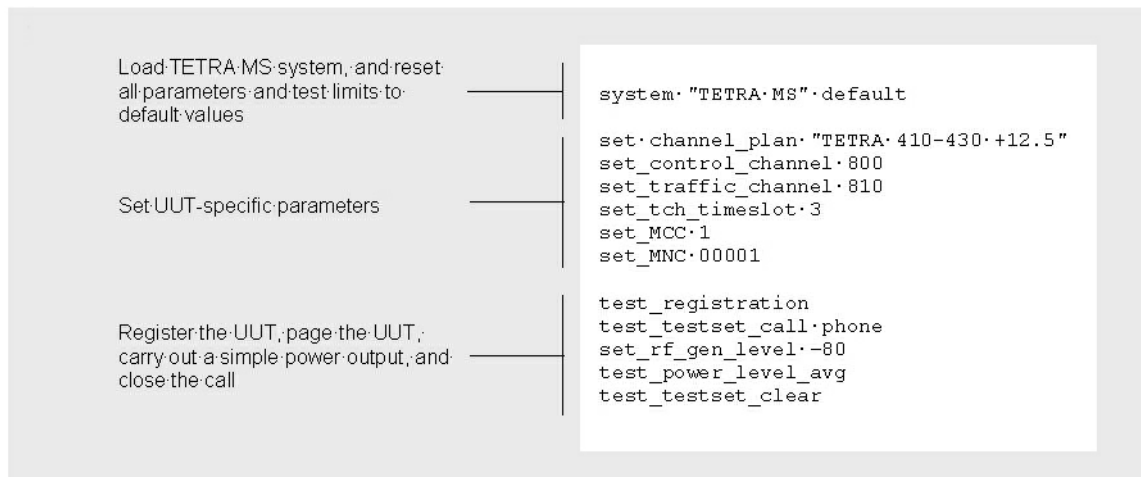


Fig 4: Example script structure

Appendix 1: Example AutoTest scripts

Each of the following three examples follow the same pattern of testing: the mobile is registered with the 3901 test set, a call is placed, a few parameteric tests are carried out, and the call is closed.

Examples 1 and 2 are each dedicated to a particular Channel Plan, Mobile Country Code and Mobile Network Code. It will be necessary to adjust these values to suit the mobile under test. All that is necessary to do is edit the values given in the Setup UUT-SPECIFIC parameters: section.

By contrast, Example 3 is generic, requiring the operator to set up those parameters manually in the 3901's TETRA MS mode prior to invoking AutoTest. In addition, Example 3 illustrates the use of TT Mode to enable BER tests to be made. If the mobile in question does not support TT Mode, then the BER and RBER tests should be removed and the test_registration statement should be modified in line with Examples 1 and 2.

Soft copies of the latest versions can be found on the 3900 App Notes pages at <http://www.aeroflex.com/tetra/3900scripts.zip>.

Example 1

This example uses **system "TETRA MS" default** to guarantee all parameters revert to default values at the start of every test run - but at the cost of running time. It is dedicated to a particular channel, MCC and MNC.

Summary		Comment
Type:	UUT-specific	Hard coded channels, MCC, MNC, etc.
Foolproof:	Yes	Operator has no influence on parameters.
Run time:	Slow	TETRA MS system reloaded on every run.
Notes:	Script starts with default values on every run.	

```
# Simple_800Band_AutoDefaultVals.ats
# March 2005

# 3900 AUTOTEST script to register a mobile
# (in test mode), place a call from the
# mobile, measure TX parameters, and close
# the call from the testset.

# This script assumes the values specified
# in 'Setup UUT-SPECIFIC parameters', below.

# #####
# LOAD TETRA MS AND SET UP SYSTEM PARAMETERS
# #####

# Load TETRA MS system, using default
# parameters on every run:

system "TETRA MS" default

# Setup TEST-SPECIFIC parameters:

set_registration_timeout 60
set_group_attach_wait 1

# Setup UUT-SPECIFIC parameters:

set_channel_plan "TETRA 805-870 +12.5"
set_control_channel 2040
set_traffic_channel 2140
set_tch_timeslot 3
```

```
set_MCC 1
set_MNC 00001

# #####
# RUN TESTS
# #####

# Register mobile:

set_rf_gen_level -75.0
test_registration

# Mobile-originated call:

test_mobile_call phone

# Tx tests:

test_burst_timing_wc
test_power_level_avg
test_power_profile
test_freq_error_wc
test_vector_error_rms_max
test_vector_error_peak_max
test_residual_carrier_max

# Close call from test set:

test_testset_clear
```

Example 2

This example uses **system "TETRA MS"** to minimize overall run time. As in Example 1, this script is dedicated to a particular channel, MCC and MNC.

Summary		Comment
Type:	UUT-specific	Hard coded channels, MCC, MNC, etc.
Foolproof:	Yes	Operator has no influence on parameters.
Run time:	Fast	TETRA MS system loaded only on first run after loading the script.
Notes:	Script starts with default values on first run. Script writer has to reset only those parameters that change during a run.	

```
# Simple_800Band_NoDefaultVals.ats
# March 2005

# 3900 AUTOTEST script to register a mobile,
# place a call from the mobile, measure TX
# parameters, and close the call from the
# testset.

# This script assumes the values specified
# in 'Setup UUT-SPECIFIC parameters', below.

# #####
# LOAD TETRA MS AND SET UP SYSTEM PARAMETERS:
# #####

# If this is the first run since loading this
# script, then load TETRA MS using default
# parameters:

system "TETRA MS"

# Restore any parameters that are altered
# during the test run:

set_rf_gen_level -75.0

# Setup TEST-SPECIFIC parameters:
```

```

set_registration_timeout 60
set_group_attach_wait 1

# Setup UUT-SPECIFIC parameters:

set_channel_plan "TETRA 805-870 +12.5"
set_control_channel 2040
set_traffic_channel 2050
set_tch timeslot 3
set_MCC 400
set_MNC 3

```

```

# #####
# RUN TESTS:
# #####

# Register mobile:

test_registration

# Mobile-originated call:

test_mobile_call phone

# Tx tests:

test_burst_timing_wc
test_power_level_avg
test_power_profile
test_freq_error_wc
test_vector_error_rms_max
test_vector_error_peak_max
test_residual_carrier_max

# Close call from test set:

test_testset_clear

```

Example 3

The previous examples, by setting-up all parameters prior to testing the UUT, are dedicated to testing on a particular channel, MCC, MNC, etc. By contrast, this example uses **system "TETRA MS" Manual** as a means of generating a generic script. However, it assumes that the operator manually sets up the test set appropriate to this UUT before selecting AutoTest and running the script.

Summary		Comment
Type:	Generic	Operator sets parameters with normal 3900 manual screens immediately before selecting AutoTest.
Foolproof:	No	
Run time:	Slow	TETRA MS system reloaded on every run.
Notes:	Script starts with (operator pre-set) values on every run.	

```

# Simple_Generic_TTMode_ManualVals.ats
# March 2005

# 3900 AUTOTEST script to register a mobile
# (in test mode), place a call from the
# mobile, measure TX and Rx parameters, and
# close the call from the testset.

# This script assumes:
# 1. The UUT supports TT mode.
# 2. The operator manually sets-up the test
# set appropriate to the UUT before
# selecting AutoTest, loading this script
# and running it.

```

```

# #####
# LOAD TETRA MS AND SET UP SYSTEM PARAMETERS:
# #####

# On every run, load TETRA MS system using
# values as saved when TETRA MS was last used
# manually (i.e. outside AutoTest):

system "TETRA MS" manual

# Setup TEST-SPECIFIC parameters:

set_registration_timeout 60
set_group_attach_wait 1

# #####
# RUN TESTS:
# #####

# Register mobile, confirm in TT mode:

test_registration test_mode

# Mobile-originated call:

test_mobile_call phone

# Tx tests:

test_burst_timing_wc
test_power_level_avg
test_power_profile
test_freq_error_wc
test_vector_error_rms_max
test_vector_error_peak_max
test_residual_carrier_max

# Rx tests:

test_rx_meas_ber -112.0 class0 class1 class2
test_rx_meas_rber -112.0 mer class0 class1

# Close call from test set:

test_testset_clear

```

Appendix 2: Code to set TETRA MS AutoTest Defaults

The following code sets all TETRA MS AutoTest parameters to the AutoTest Default values listed in Chapter 22 of the 3900 Operating Manual. By pasting all or part of this code into your test scripts, and selectively adjusting values, you can minimize the effort involved in the setting up of test parameters. Soft copy of the latest version can be found on the 3900 App Notes pages at <http://www.aeroflex.com/tetra/3900scripts.zip>.

Commands are grouped in functional blocks, resulting in some (such as `set_ptt_timeout` and `set_traffic_channel`) appearing more than once.

For the purposes of this application note, (+++) indicates that a long command has been wrapped around. In reality, AutoTest commands cannot be continued onto another line.

```
# Name: 3900_TETRA_MS_All_Defaults.txt
# Date: May 2005
```

```
# The following code sets all TETRA MS
# AutoTest parameters to the AutoTest
# Default
# values listed in Chapter 22 of the 3900
# Operating Manual.
```

```
# It is not a complete test script.
# However,
# it is intended as a typing shortcut, to be
# pasted, all or in part, into users' own
# scripts with values altered as required.
```

```
#####
# Setting default parameters ...
#####
```

```
# Default GENERAL parameters:
```

```
set_rf_ana_control_mode expected
set_rf_ana_port tr
set_rf_ana_level_offset_enable off
set_rf_ana_level_offset_value 0.0
set_rf_ana_expected_level +30.0
```

```
set_rf_gen_level -75.0
set_rf_gen_port tr
set_rf_gen_level_offset_enable off
set_rf_gen_level_offset_value 0.0
```

```
set_timing_offset_enable off
set_timing_offset_value 0.0
```

```
# Default IN CALL parameters:
```

```
set_idle_channel message facch
set_rf_ana_control_mode open
```

```
# Default POWER LEVEL test parameters:
```

```
set_power_class 4
set_power_class_usage reported
set_power_level_limits +2.0 -2.0 +2.5 -2.5
set_power_samples 20
set_ptt_timeout 20
```

```
# Default POWER PROFILE test parameters:
```

```
set_power_profile_limits -70.0 -36.0 +6.0
+3.0
set_ptt_timeout 20
```

```
# Default BURST TIMING test parameters:
```

```
set_burst_timing_limit 0.25
set_burst_timing_samples 20
set_ptt_timeout 20
```

```
# Default FREQUENCY ERROR test parameters:
```

```
set_freq_error_limit 100
set_freq_error_samples 20
set_ptt_timeout 20
```

```
# Default VECTOR ERROR RMS test parameters:
```

```
set_vector_error_rms_limit 10.0
set_vector_error_rms_samples 20
set_ptt_timeout 20
```

```
# Default VECTOR ERROR PEAK test parameters:
```

```
set_vector_error_peak_limit 30.0
set_vector_error_peak_samples 20
set_ptt_timeout 20
```

```
# Default RESIDUAL CARRIER test parameters:
```

```
set_residual_carrier_limit 5.0
set_residual_carrier_samples 20
set_ptt_timeout 20
```

```
# Default RX MEAS - BER test parameters:
```

```
set_BER_class0_limits 4.27 4.88 4.27
set_BER_class0_samples 15000
set_BER_class1_limits 0.23 0.23 0.23
set_BER_class1_samples 15000
set_BER_class2_limits 0.23 0.23 0.23
set_BER_class2_samples 15000
set_rx_class A
set_rx_class_usage reported
set_level_change_wait 2
```

```
# Default RX MEAS - RBER test parameters:
```

```
set_MER_limits 0.045 0.045 0.045
set_MER_samples 300
set_RBER_class0_limits 4.27 4.88 4.27
set_RBER_class0_samples 15000
set_RBER_class1_limits 0.23 0.23 0.23
set_RBER_class1_samples 15000
set_rx_class A
set_rx_class_usage reported
set_level_change_wait 2
```

```
# Default REGISTRATION test parameters:
```

```
set_access_param -45
set_base_advanced_link not_supported
set_base_air_interface_encryption not_
available
set_base_circuit_mode_data_service
(+++) not_supported
set_base_migration supported
set_base_minimum_mode_service never_used
set_base_power_off_deregistration required
set_base_power_on_registration required
set_base_priority_cell yes
set_base_reserved not_available
set_base_system_wide_services normal_mode
set_base_tetra_packet_data_service
(+++) not_available
set_base_tetra_voice_service supported
set_BCC 01
set_channel_plan "TETRA 380-400 +12.5"
set_control_channel 3600
set_group_attach_wait 25
set_GSSI 1
set_GSSI_usage reported
```

```
set_LA 00001
set_max_tx_level 30
set_MCC 001
set_min_rx_level_access -125
set_MNC 00001
set_registration_timeout 30
set_SSI 00000001
set_SSI_usage reported

# Default PLACE CALLS FROM TEST SET
# test parameters:

set_emergency_call_params individual simplex
(+++) direct 742200
set_group_call_params 00 742200
set_phone_call_params 00 "01438742200" inc
set_place_call_timeout 20
set_place_call_typecheck yes
set_private_call_params simplex hook 00
742200
set_tch_timeslot 3
set_traffic_channel 3700
set_user_call_params individual duplex hook
00
(+++) 16777186 "742200" inc

# Default PLACE CALLS FROM MOBILE test
# parameters:

set_place_call_timeout 20
set_place_call_typecheck yes
set_tch_timeslot 3
set_traffic_channel 3700

# Default CALL CLEARDOWN FROM TEST SET test
# parameters:

# ... there are no parameters to set

# Default CALL CLEARDOWN FROM MOBILE test
# parameters:

set_clear_call_timeout 20

# Default DEREGISTRATION test parameters:

set_deregistration_timeout 20

# Default SPEECH QUALITY / TONE / SILENCE
# test parameters:

set_audio_test_timeout 20
set_ptt_timeout 20

# #####
# ... finished setting default parameters.
# #####
```

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