![DSPG Telecom logo]

DSPGenie Modem Transmission Tester
Automated modem transmission testing platform with 2-wire POTS interfaces

User's Guide

Rev.1.5.5

(Referring to version 4.1.5 of MTT DAA software)

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1 Introduction

The DSPGenie Modem Transmission Tester (MTT) is a multi-DSP based testing platform that allows for highly automated verification of the behaviour of telecommunication network equipment with various types of modems. Configured for use with two-wire DAA interfaces allow the DSPGenie MTT to be utilised in most PSTN and PSTN-like environments, where the POTS-type modems are expected.

The DSPGenie MTT uses onboard DSP resources to implement a range of low-speed modems used in text telephony, including those defined in the ITU-T V.18 recommendation:
- V.18
- V.21
- V.23
- Bell 103
- Baudot
- EDT
- DTMF text
- CTM

The DSP implementation also supports some special protocols

- DTMF signaling (keypad)

- DTMF security protocol SIA DC-05

- VCO mode for text modems.

The MTT utilises Rockwell/Conexant (Mentor) modems that support most of the standard ITU-T data modem protocols:
- V.21
- V.22
- V.22bis
- V.23
- Bell 103
- Bell 212
- V.32
- V.32bis
- V.32ext
- V.34
- V.90
- V.92

The automatic modulation negotiation (automode) is disabled in the MTT modems to guarantee that all data transmission tests are performed only with the modulation types specified by the user. The data compression V.42bis is also disabled for all data modem protocol.

2 DSPGenie Installation Guide

This section describes the installation and initial setup of the DSPGenie MTT and the optional remote control terminal.

Normally, connect a standard monitor, keyboard and mouse directly to the rear of the DSPGenie and run locally both the *server* and the *client* software that have already been pre-installed on the unit (see section 3).

If the unit is to be controlled this way, then the keyboard and mouse need to be connected *before* the unit is powered-up. The keyboard and mouse are connected using the supplied splitter cable (PS/2 mini-DIN type connections).

It is also possible to control the DSPGenie from the *client* application running on another PC connected remotely via a TCP/IP network. Owing to the server implementation, only one client can be connected to the *server*.
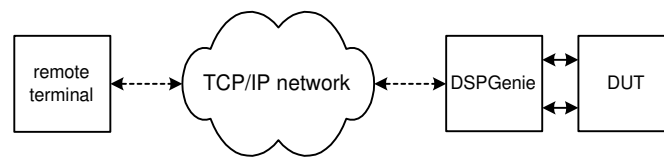
Figure 1: Client/server relationship.

If the DSPGenie unit is to be controlled *remotely* from the *client* application, it needs to be connected to the Local Area Network using the RJ-45 socket located on the rear of the unit.

> The IP address of the DSPGenie unit is pre-configured with a specific IP address**.** If this address is already being used by another device on the network then it is possible to change the IP address of the DSPGenie by connecting a keyboard, mouse and monitor and editing the TCP/IP properties in the LAN connection (right-click **My Network Places** and select **Properties**, then right click **Local Area Connection** and select **Properties**, then select **Internet Protocol (TCP/IP)** and click on the **P**roperties button).

2.1   Installing the software on remote control terminal

In order to set-up a remote control terminal, the *client* application needs to be installed on the client computer. Refer to a separate document *MTT DAA - installing remote client & IP address_notes.doc* for instructions on how to install and run this component.

3 Tester Operation

This DSPGenie MTT is pre-set and configured for 2-wire PSTN network as presented in Figure 2.
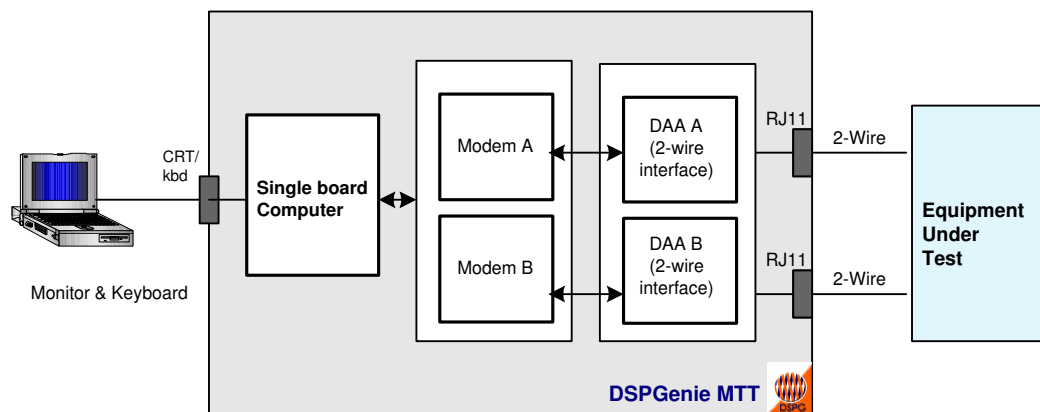
Figure 2: DSPGenie MTT with DAA interfaces

The DAA interface can be used in the lab conditions or with real PSTN networks. All the necessary network progress tones can be monitored and reported by the DSPGenie MTT.
The recognisable line conditions include:

- No dial tone
- Busy
- Ringing

The DSPGenie software suite consists of two packages: *client* application with LabView based Graphical User Interface and *server* application designed to perform the modem transmission tests when used in conjunction with the DSPGenie hardware.

The software allows the user to configure and set up each parameter of the testing procedures through the *client's* GUI. A single test or sequence of tests may be selected, and may be run completely automatically without any further user intervention.

The *server* application need be launched before the *client* application can be used.

After the *server* has been started using its shortcut located on the desktop, a small window will appear named 'server'. After a longer while the 'server' window will change its listening status indicator to green, confirming that *server* application is active and ready.

When the user has finished with the *client/server* MTT test suite, the client application should be closed by using **File > Quit** in the *client* main window. This ensures that also the *server* is correctly shut down on the DSPGenie unit.

4 Client software overview

4.1 Starting client application

After the *client* application has been started using its shortcut located on the desktop, the user is presented with DSPGenie MTT main screen**,** listing the available tests: **Test 1A: text modem**, **Test 2A: data modem** and **Test 3A: fax modem** (not available in the MTT version 4.1.5).

But before testing can commence, the user needs to connect to the *server* and confirm the configuration settings of the MTT unit.

Selecting Configure from the Tools menu does this.
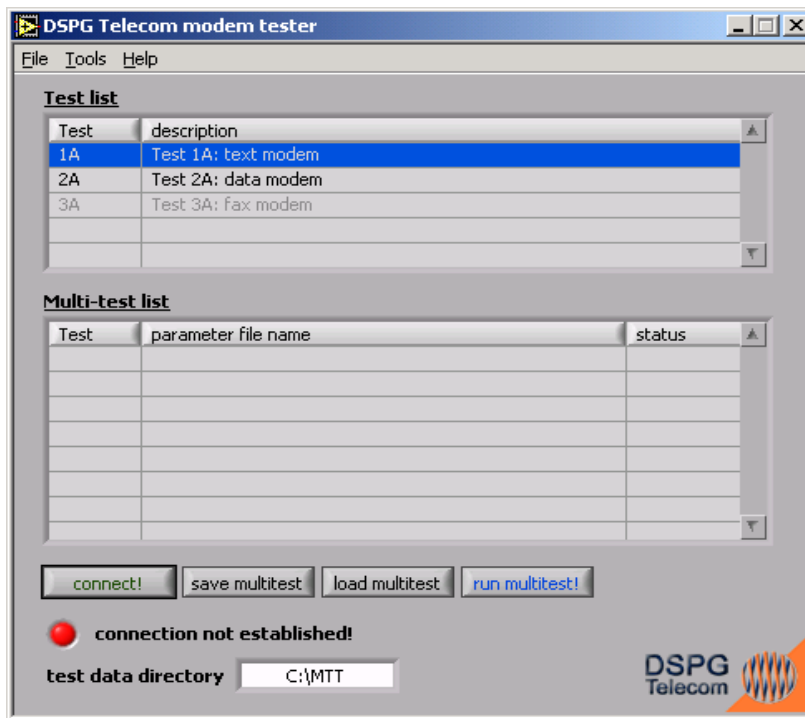
Figure 3: DSPGenie MTT main screen

4.2 Configuring the MTT unit

There are two tabs (Interface and General), which define categories that can be configured.

In the top right of the window there are three buttons: *Apply*, *Accept* and *Cancel*. At any time the user may press the *Cancel* button to return to the main interface and disregard any changes that have been made.

Additionally, clicking the *Apply* button causes the DSPGenie unit to be configured with the current parameters.

Clicking the button *Accept* will cause all the system configuration settings to be stored in the DSPGenie and will close the configuration window. The 'connection with server' status indicator should have also changed to green (*connection established).*

The user specified *test data directory* is used by the MTT to save the multi-test scripts and results – please refer to sections 4.5.3 and 5.

4.2.1 Configuration: Interface

As this DSPGenie MTT version is pre-set for 2-wire PSTN networks, the only configuration available under the tab 'Interface' is a 2-wire DAA as shown in Figure 4. The TDM and PCM configuration are not available in the MTT version 4.1.5.
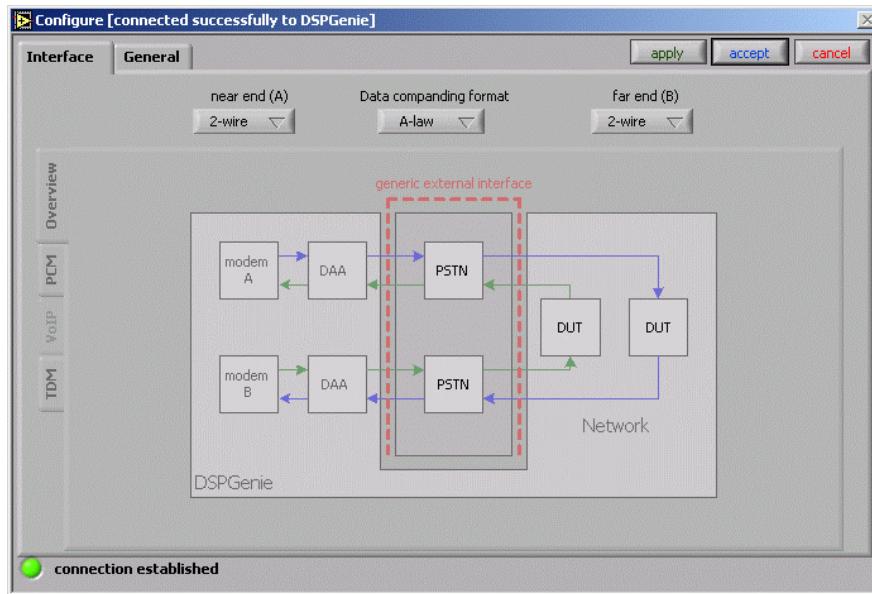
Figure 4: Configuration (Interface)

4.2.2 Configuration: General

Several parameters can be configured from the 'General' tab.

When the DSPGenie MTT is to be remotely controlled, the real *IP address* of the unit should be entered in the Server IP Address box instead of default 'localhost'. Please also refer to a separate document *MTT DAA - installing remote client & IP address_notes.doc* for additional comments.

The Server Port is fixed for each different test suite and should not be changed by the user. The TCP timeout should only be adjusted if the network has a large volume of other traffic and network errors are occurring.

Whether any parameter changes have been made or not, the *Accept* button needs to be pressed to confirm the settings and return to the main window.

4.3 Running a single test

After the MTT has been configured, the user is presented again with DSPGenie MTT main screen as shown Figure 3. The testing can now be initiated by simply *double-clicking* on the desired test line in the table.

4.3.1 Text modem settings

Selecting **Test 1A: text modem** will open a new window with a simplified block diagram of the MTT text modem configuration where the particular range of parameters for that *test case* can be selected, as depicted in Figure 5.
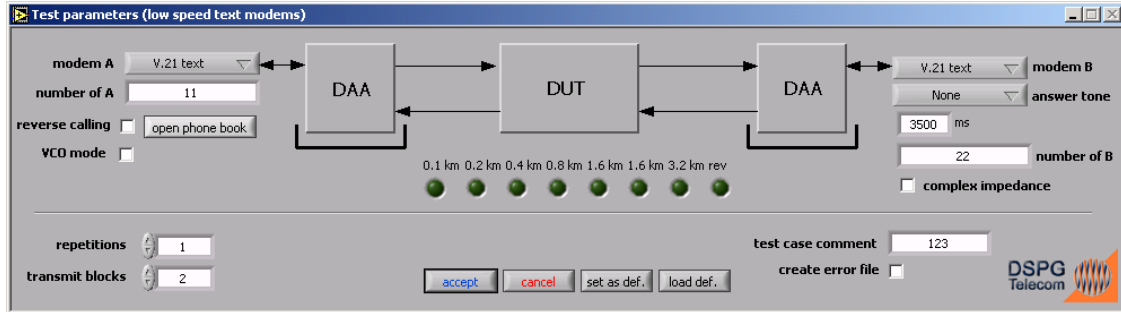
Figure 5: Text modem configuration window.

1) Modulation Selection: Modem A – Modem B

The user is able to select the text modulation type for Modem A (MA) and Modem B (MB) independently, though should take care to select compatible modulation types for both MA and MB.

The list of available text modems is given in Table 1below.

> V.18 automoding
> Baudot 45.5 bps
> Baudot 50 bps
> DTMF text
> EDT
> V.21
> V.23
> Bell 103
> CTM
> DTMF keypad
> DTMF SIA DC-05

Table 1: Text modem modulation types

2) Answer Tone

At the answering modem MB, it is possible to select the *type* (the default setting for text modems is **'none'**) as well as the *duration* (in ms) of the *answer tone* that the modem responds during connecting.

> None
> 2100 Hz
> 2225 Hz
> 2100 (PR)
> ANSam

Table 2: Modem B answer tones

3) Dialing Numbers

The "number of A" is the originating dialing number (used here just as a reference) and "number of B" is the destination-dialed number. These numbers can be either manually entered by the user or selected from the list of saved dialing numbers accessible by clicking on the open phone book button.

The Modem A should be always considered a calling party and the Modem B an answering party.

The normal mode of operation is for the MTT to make a call from 'West' to 'East' (as represented by the simplified block diagram of Figure 5). The number dialed by Modem A is the number of B as defined for that particular test case.

4) Open phone book

Clicking the open phone book button will take the user to the Phone Book window shown in Figure 6.
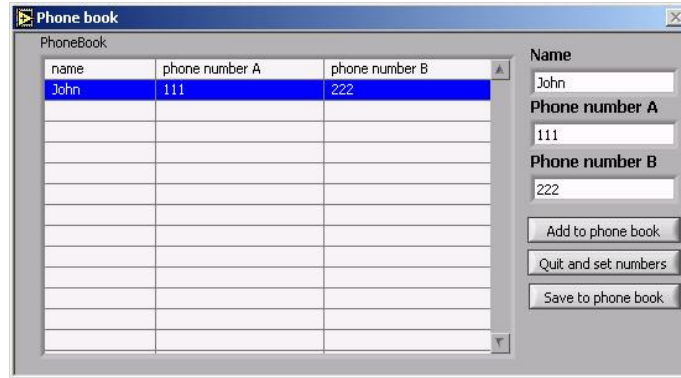
Figure 6: Phone Book Window

The user can edit it by adding a new entry or removing some existing entry (double-click on it), then save this phone book into the phonebook.txt.

The quit and set numbers option will close the phonebook window.

5) Reverse calling

If the user checks the reverse calling box, this will make calls in the reverse direction, i.e. from 'East' to 'West', effectively swapping the telephone lines.

The Modem A is still a calling party and the "number of B" has to be defined for the reverse destination.

6) Transmit Block

The text sequence used during the test consists of a number of default text blocks, each text block having 256 ASCII characters (2048 data bits). The standard "THE QUICK BROWN FOX…" text pattern is used here, sent continuously multiple times as required.

The transmit blocks parameter specifies the total number of blocks transmitted in both directions so that the even numbers should be used for the transmit blocks parameter.

7) Repetitions

The user can introduce the number of interactions that the selected *test case* will be repeated during the test.

8) Artificial telephone line

DSPGenie MTT can control an optional external artificial telephone line device (MSB Design model AL-2), connected via parallel port. The eight controls buttons/indicators located in the middle of the window allow the user to select different lengths.

9) VCO mode

The VCO mode check box is used to select an optional Voice Carry Over testing mode that can be used for Baudot, DTMF text, V21, V23, EDT, Bell103 and CTM text modems. In this mode, after modems has been connected, the selected text sequence is automatically transmitted three times, interleaved with two voice intervals of about 6 seconds duration.

10) Complex Impedance

The complex impedance check box is used to select 600 Ohm or complex impedance for DAA.

11) Test Case Comment

The user can entry some unique identification ID or comment into the test case comment box. This parameter will be added into the test case file as a parameter.

12) Create error file

If the user selects the error file checkbox, the MTT will create an optional error distribution file and then calculate and save relevant error values. This feature is available neither for the DTMF signal mode nor for the DTMF security mode.

After setting all the above test parameters, pressing the ***set as def*** button the user save them as default parameters. They will be ready to be loaded next time using the ***load def*** button.

Clicking *accept* will save this test case parameters into unique configuration file (please refer to section 5 for detail information) and then take the user to the testing window similar to the one presented in Figure 7.

4.3.2 Text modem testing

The testing sequence may now be executed by clicking the *start* button. The MTT will then automatically iterate through all the required tests repetitions. After each single test repetition has finished, the CER and BER are calculated by the MTT and reported back to the *client* application GUI. It is also reported the elapsed seconds, the number of bits transmitted, the time stamps and the summary of the modulation.
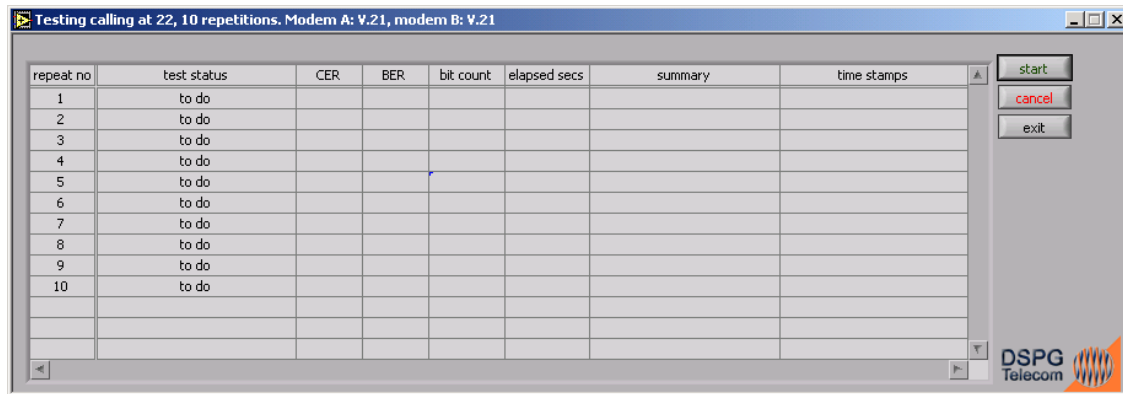
Figure 7: Example of testing window.

The Figure 8 presents an example of execution of a single test case using the CTM modem with 5 repetitions.

If necessary, the testing sequence can be interrupted by clicking the cancel button. This will result in return to the main MTT test selection window, with momentary loss of client/server connection.
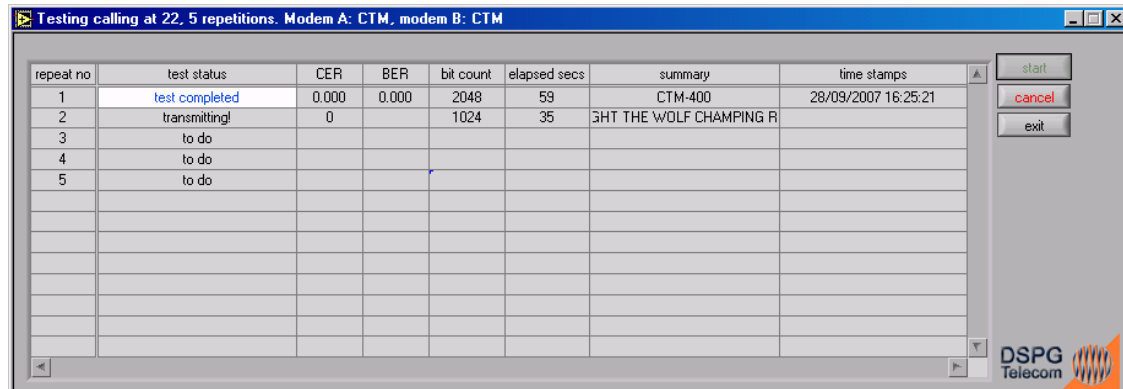
Figure 8: Text modem test sequence in progress

After all the repetitions of a single test case sequence have finished, the results are saved into a time-stamped folder within the \server\results directory.

Pressing the exit button will close the test window and return again to the main MTT test selection window (Figure 3).

4.3.3   Text modem results

After all the repetitions of a single test case sequence have finished, the results are saved into a time-stamped folder within the \server\results directory.

The modem's connection statistics and status information include the following fields (Please refer to section 5.2 for detailed information)

Date & Time	Date and time of the test case according to the OS setting
Comment	Information of the test case entries in Figure 5
Test Status	Test status reported including "test completed", "user cancelled"," can not connect", "test aborted"
CER	Character Error Rate
BER	Bit Error Rate
Total bits	Total Transmitted Bits
Elapsed seconds	The total test time in seconds including data transmission time, error calculation, and some overhead, etc.
Modulation-speed	Modulation and speed of this test
Dialing number A	A leg telephone number
Dialing number B	B leg telephone number
Reverse dialing	Report status of the reverse dialing
Artificial Line length	Selected artificial line (km)
Answer tone used	Frequency of the answer tone used in Hz
Complex Impedance	Report 600Ohm or complex impedance used

The *summary* field (Figure 8) provides all this information in a compact form; the user can scroll forth and back within this field to see all of it.

4.3.4   Data modem settings

Selecting **Test 2A: data modem** from the DSPGenie main screen will open a new window with a simplified block diagram of the MTT data modem configuration where a range of parameters for that test *case* can be selected (Figure 9).
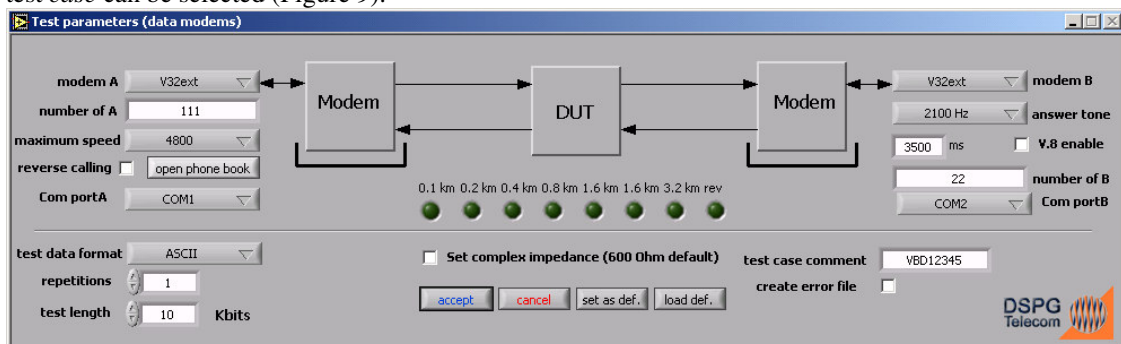
Figure 9: Data modem configuration

Many functions and parameters have the same meaning here as in the text modem configuration, i.e. number to dial, phone book, call reversal, test case comment, create error file, artificial line control,

set/load defaults, etc (Please refer to section 4.3.1). Apart from these parameters, additional settings have to be configured:

1) Serial PORT selection

The MTT normally uses the COM1 and the COM2 ports for its data modems, but some MTT hardware variants may default to other COM ports so the user has to make sure the correct COM port are selected.

2) Modulation Selection: Modem A – Modem B

The user is able to select and fix the data modulation type for *Modem A* and *Modem B* independently; the list is given in Table 3. The user should take care to select compatible modulation types for both the MA and MB as the automode is disabled for the MTT tests.

<div align="center">

V.21
V.22
V.22bis
V.23
V.32
V.32bis
V.32ext
V.34
V.90
V.92
Bell 103
Bell 212

</div>

Table 3: Data modem modulation types.

3) Modem Speed Selection

MTT offers several transmission speeds for testing.

4) Answer tone

It is possible to select the *type* (see Table 4) and the *duration* of the *answer tone* for the answering modem. For most of the applications it is sufficient to select the **default** option and duration of **3500 ms**.

<div align="center">

Default
2100 Hz
2225 Hz
2100 (PR)
ANSam (PR)
None

</div>

Table 4: Modem B answer tones

The MTT implementation consists on the following data modems that will be used for different answer tone selection as shown in the Table 5:

M1 Mentor data modem - an external V.90 modem including V.21, V.22, V.22bis, V.23, V.32, V.32bis, V.34, V.90, Bell103 and Bell212 will be used for the **default** answer tone selection

M2 CSM Rockwell data modem - an internal data modem including V.21, V.22, V.22bis, V.23, V.32, V.32bis, V.34, V.90, Bell103 and Bell212 will be used for the other answer tone selection (Table 4)

Item	Modulation	Default Hz	2100Hz	Other ANS	V.42bis /V.44	ECM	V.8
1	V.21	2100 V.25 M1	2100 V.25 M1	None, 2100PR M2	Disable	Disable	Disable
2	V.22	2100 V.25 M1	2100 V.25 M1	None, 2100PR M2	Disable	Disable	Disable
3	V.22bis	2100 V.25 M1	2100 V.25 M1	None, 2100PR M2	Disable	Disable	Disable
4	V.23	2100 V.25 M1	2100 V.25 M1	None 2100PR M2	Disable	Disable	Disable
5	V.32	2100 V.25 M1	2100 V.25 M1	None, 2100PR M2	Disable	Disable	Disable
6	V.32Bis	2100PR V.25 M1	N/A	N/A	Disable	Disable	Disable
7	V.32ext	2100 V.25 M1	2100 V.25 M2	N/A	Disable	Disable	Disable
8	V.34	AnSam (PR) V.8 M1	N/A	N/A	Disable	Enable	Enable
9	V.90	AnSam (PR) V.8 M1	N/A	N/A	Disable	Enable	Enable
10	V.92	AnSam (PR) V.8 M1	N/A	N/A	Disable	Enable	Enable
11	Bell103	2100 V.25 M1	N/A	N/A	Disable	Disable	Disable
12	Bell212	2100 V.25 M1	N/A	N/A	Disable	Disable	Disable

Table 5: Default of the answer tone, V.42bis and V.8 disable for the data modem.

5) Test Length

For data modems the user can specify the length of a binary data that will be send during a single test in each direction. Normally a standard pseudo-random 511-bit pattern is used, sent continuously multiple times as required.

6) V.8 Selection

The user can select enabled or disabled the V.8 option by checking the v.8 checkbox.

After setting all the test parameters, user has an option to save them as default (set as def.), ready to be loaded next time (load def).

Clicking **accept** will save this test case parameters into unique configuration file (please refer to section 5 for further information) and then take the user to a testing window similar to the one shown in Figure 10.

There may be a longer delay after accepting the data modem configuration for the first time while the *server* application is loading the firmware code.

4.3.5 Data modem testing

The testing sequence may now be executed by clicking the *start* button. The MTT will then automatically iterate through all the required tests repetitions. After each single test repetition has finished, the CER and BER are calculated by the MTT and reported back to the *client* application GUI. It is also reported the elapsed seconds, the number of bits transmitted, the time stamps and the summary of the modulation.

If necessary, the testing sequence can be interrupted by clicking the *cancel* button. This will result in return to the main MTT test selection window, with momentary loss of *client/server* connection.

Pressing the **exit** button will close the test window and return again to the main MTT test selection window (Figure 3).
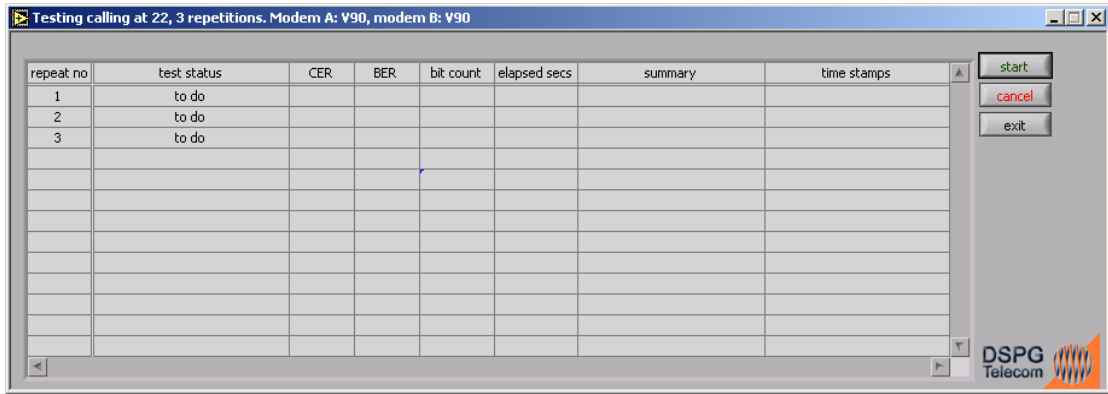
Figure 10: Data modem testing window.

The Figure 11 below presents an example of test screen view during V.90 data modem testing.
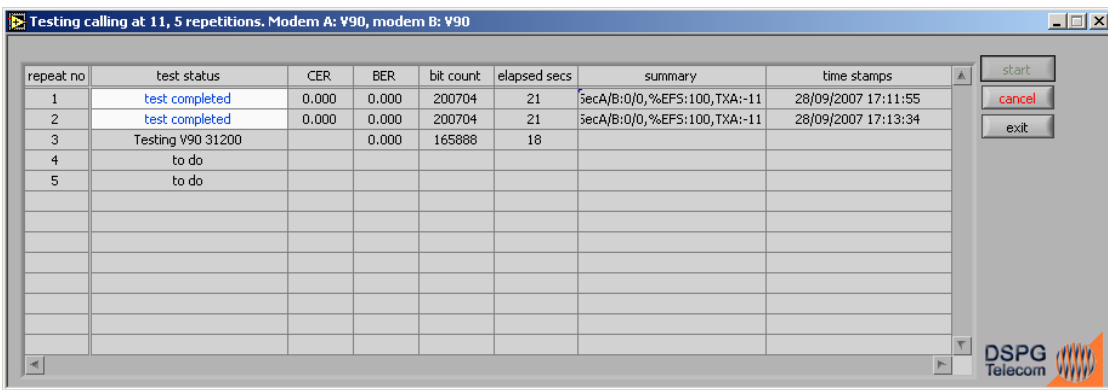
Figure 11: Data modem test sequence in progress

4.3.6   Data modem results

After all the repetitions of a single test case sequence have finished, the results are saved into a time-stamped folder within the \server\results directory.

The modem's connection statistics and status information include the following fields (Please refer to section 5.2 for detailed information)

Date & Time	Date and time of the test case according to the OS setting
Comment	Information of the test case entries in Figure 5or Figure 9.
Test Status	Test status reported including "test completed", "user cancelled"," can not connect", "test aborted"
CER	Character Error Rate
BER	Bit Error Rate
Total bits	Total Transmitted Bits
Elapsed seconds	The total test time in seconds including data transmission time, error calculation, and some overhead, etc.
Modulation-speed	Modulation and speed of this test
Bit error A/B	Bit error A and B in both directions
Block error A/B	Block error number in both directions
Block number	Total block numbers transmitted

Error seconds	Number of errored seconds in which any one-second interval containing at least one bit error
%EFS	(Elapsed seconds - error seconds)/elapsed second
Transmit level A	Modem A transmitted level dB
Receive level B	Modem B received level dB
SNR	Signal to noise ratio
Round trip delay	Modem reported round trip delay ms
Local & remote retrain	Numbers of local and remote retrain
Disconnect reason	Code of modem-disconnected reason
Dialing number A	A leg telephone number
Dialing number B	B leg telephone number
Reverse dialing	Report status of the reverse dialing
Artificial Line length	Selected artificial line (km)
Answer tone used	Frequency of the answer tone used in Hz
Complex Impedance	Report 600Ohm or complex impedance used

The *summary* field (Figure 11) provides all this information in a compact form; the user can scroll forth and back within this field to see all of it.

4.4 Viewing previous results

It is possible to view results from previous tests by *right-clicking* the main test table on the desired test, and then selecting *view previous results* from the context menu, as shown in Figure 12.
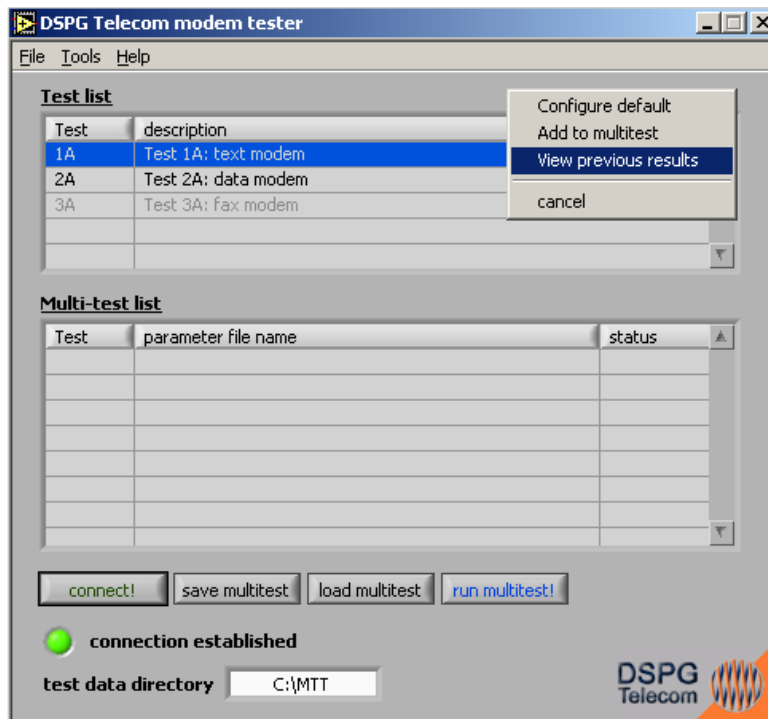
Figure 12: Viewing previous results

The *client* application will query the DSPGenie unit (*server*), and a listing of all the saved results will be displayed (similar to Figure 13).
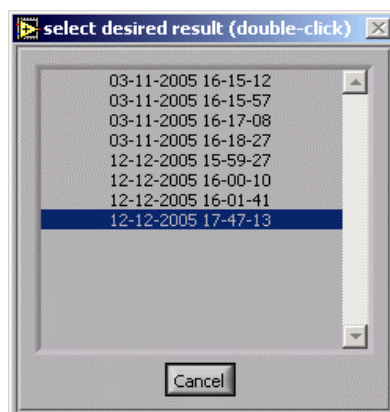
Figure 13: List all previous results of testing

Double-clicking on the desired test will open a window similar to shown in Figure 8, but lacking the buttons to start or stop testing.

4.5 Multi-test mode

One of the strengths of the DSPGenie MTT is the ability to pre-configure and run many or all of the test cases with just a few mouse-clicks, using the multi-test mode.

4.5.1 Adding a new test case

Right clicking on the test list table brings up a context menu, which includes options to *add to multi-test* (see Figure 12). Selecting it will open the modem configuration and parameter selection window (Figure 5 or Figure 9) and the user can choose all required parameters.

Clicking on the *accept* button will then cause the particular parameter settings to be stored into a new test case configuration file and adding it to the multi-test list. Each new test case will be saved with a unique filename within the test case library: the MTT internal subdirectory **\server\testconfig.**

Repeating this process allows building a multi-test list (test script) with various modem types and various parameters selected by the user.

4.5.2 Deleting a test case

Double-click on a selected test line within the multi-test list removes this test case from the list.

Right-click on the multi-test list brings up a context menu, which includes option to clear all queued tests. Selecting it will delete all test cases from the list.

4.5.3 Saving and loading the multi-test script

Once all the desired tests have been placed and queued into the multi-test window, the multi-test list can be saved for future use. Pressing the *save multitest* button will save the current script into the internal subdirectory **\server\saved_MTM**.

If user would like to re-use a test script in the future, just pressing the load multitest button, a list of the pre-saved test scripts will present as shown the Figure 14. When a user makes double-click on one of the test script, the list of the test cases of this test script will be presented in the multi-test list window.

For user's reference, after starting the multi-test, the multitest script will be also automatically saved into the **test data directory**.
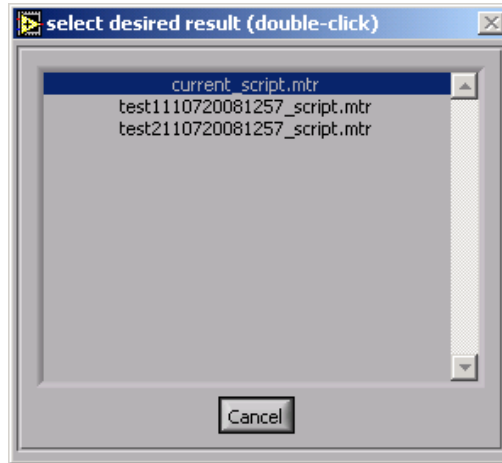
Figure 14: List of pre-saved test scripts.

4.5.4   Running the multi-test

The multi-testing can be initiated by clicking the **run multi-test** button. After this no more user interaction is required, and the DSPGenie will proceed with the scheduled tests.

Once testing has commenced, the DSPGenie MTT loops through all the queued tests, for each of these a testing window will open up (similar to Figure 7or Figure 10) and then test cases individually executed.

4.5.5   Save multitest results

The multi-test results are into a user specified *test data directory*. Please refer to section 5 for detailed information about the results.
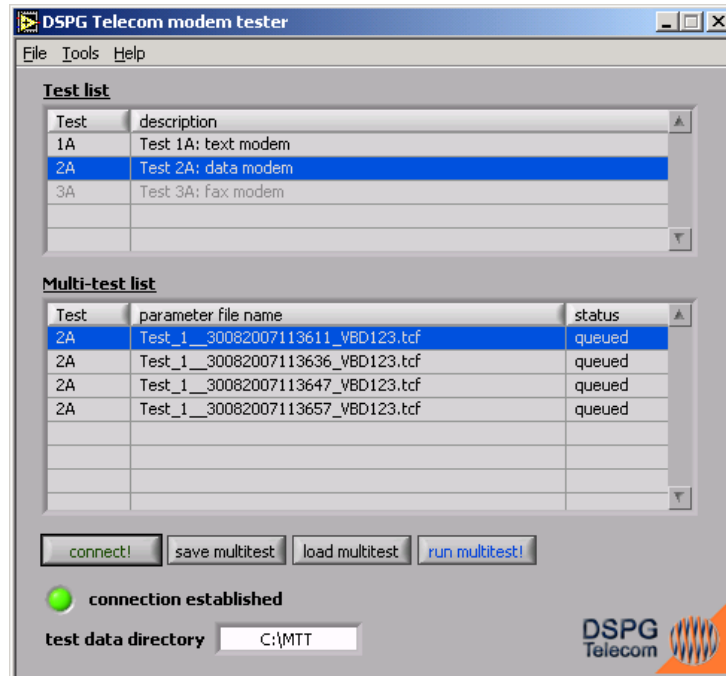
Figure 15: Multi-test mode ready to run.

4.5.6   Create a test script in off-line

Users can edit and create a new test script using edit software in off-line as following procedures:

      1. Test scrip format user must follow the data format in section 5

2. User can add a new test case into the test script library (available in the server\saved_MTM subdirectory) or delete the test cases from the current test script.

3. Save the test script and copy it into MTT test script library.

When naming the off-line created scripts it is useful, but not necessary, to provide the date-time stamp. Only the suffix and filename extension **_script.mtr** are important in the script file names.

4.5.7   Create a test case in off-line

This is an optional feature for advanced users. User can modify or create a new test case using a edit software.

1. Edit the case file to change the parameters of the test case (see detail of the parameters)

2. Save this test case as a different name

3. Copy edited test case file into the MTT test case library …\server\testconfig for use.

When naming the off-line created test case files it is useful, but not necessary, to provide the date-time stamp. Only the prefix (**Test_0__** or **Test_1__),** test case ID suffix (e.g. **_VBDk1**) and filename extension **.tcf** are important in the test case file names.

The following two tables show the list of parameters of the test case files for both text and data modem as well as the format of the filename.

Test case for text modem

The test case filename for text modems have the following format: Test_0_xxxxxx.tcf

|	
[configuration]	
param_repetitions=1	numbers of test repetition
param_modemA_type=5	1=V18, 2=Baudot, 25=Baudot50, 3=DTMF text, 4=EDT, 5=V21, 6=V23, 7=Bell103, 8=CTM, 91=DTMF keypad, 92=DTMF security DC-05
param_modem_answerTone=0	0=none 1=2100Hz 2=2225Hz 3=2100 reverse 4=AnsSam
answer tone duration=3500	duration of the answer tone in ms
param_testSequence=0	do not change for text modem
param_modemB_type=5	same param_modemA_type
param_EchoA_type	do not use for 2-wire
param_EchoB_type=00	do not use for 2-wire
param_EchoA_Td=00	do not use for 2-wire
param_EchoB_Td=00	do not use for 2-wire
param_longhaul_delayD1=	do not use for 2-wire
param_longhaul_delayD2=00	do not use for 2-wire
param_testlength=1	number of test blocks
artificial_line=0	1=0.1 km 2=0.2 km 3=0.3 km 4=0.4 km 5=0.5 km 6=0.6 km 7=0.7 km 8=0.8 km 16=1.6 km 32 =3.2 km 48=4.8 km 112 = 6.4 km
call_flag=0	0=normal dialing 1=reverse dialing
enableerrorfile=0	0=disable to create a error file 1= enable to create error filr
vco_flag=0	0=normal 1= vco mode
complex_flag=0	0=DAA 600ohm, 1=DAA complex
param_number_to_dial=1112345	A leg number (reference only)
param_number_to_dial_B=2212345	B leg number to dial out

param_config_name=VBD123	user entered the test case ID/comments
param_modem_output=0.000000	do not use for 2-wire
param_EchoA_ERL=0.000000	do not use for 2-wire
param_EchoB_ERL=0.000000	do not use for 2-wire

Test case for data modem

The test case filename for data modems have the following format: Test_1_xxxxxx.tcf

[configuration]	
param_repetitions=1	numbers of test repetition
param_modemA_type=5	0=v21 1=v22 2=b22bis 3=v23 9=v32 10=v32bis 11 v34 12 = v90 56 = v92 64 = bell103 69 = bell212 70 v32ext
param_modem_answerTone=0	0=default 1=2100Hz 2=2225Hz 3=2100 reverse 4=AnsSam 5=NONE
answer tone duration=0	duration of the answer tone in ms
param_testSequence=0	0=binary 1= ascii
param_modemB_type=5	same param_modemA_type
param_EchoA_type=0	do not use for 2-wire
param_EchoB_type=0	do not use for 2-wire
param_EchoA_Td=0	do not use for 2-wire
param_EchoB_Td=0	do not use for 2-wire
param_longhaul_delayD1=0	do not use for 2-wire
param_longhaul_delayD2=0	do not use for 2-wire
param_testlength=1	number of kB
artificial_line=0	1=0.1 km 2=0.2 km 3=0.3 km 4=0.4 km 5=0.5 km 6=0.6 km 7=0.7 km 8=0.8 km 16=1.6 km 32 =3.2 km 48=4.8 km 112 = 6.4 km
call_flag=00	0=normal dialing 1=reverse dialing
enableerrorfile=0	0=disable to create a error file 1= enable to create error file
vco_flag=0	0=normal 1= vco mode
complex_flag=0	0=DAA 600ohm, 1=DAA complex (used for M2 only)
param_number_to_dial=1112345	A number
param_number_to_dial_B=2212345	B number
param_config_name=123	test case ID/comment
param_modem_output=0.000000	do not use for 2-wire
param_EchoA_ERL=0.000000	do not use for 2-wire
param_EchoB_ERL=0.000000	do not use for 2-wire

5 DSPGenie MTT Data Structure Definitions

This chapter provides definitions used in the technical documentation of the DSPGenie Modem Transmission Tester (MTT v4.1.5).

Many of the results storage definitions provided here correspond only to the Multi-Test mode; the relevant result files are available in the user specified folder - ***test data directory***.

5.1 General Definitions

Test case - A test case is considered to be the lowest level executable element and comprises the definition of parameters such as the dial number A and the dial number B, modems, the repetitions and test case ID, etc (please refer to section 4.5.7 for more details).

Test Script - A test script is considered to be a collection of test cases that can be executed in a single multi-test run.

Unique test case ID - Any single test case should be consistently referenced by means of a user-definable alphanumeric test ID (10 character field). The user can entry the test case ID into the *test case comment* box in the modem configuration window.

Results - Test results are considered to be the raw results generated by test script execution. Test results are created at the time of execution and are read-only (i.e. never subsequently changed).

5.2 Technical Definitions

Date & Time - Date and time of the test case according to the OS setting.

Comment - Information of the test case entry in Figure 5 or Figure 9.

Status - Test status report including "test completed", "user cancelled", "can not connect", "test aborted".

BER - (Bit Error Rate or Ratio) the ratio of the number of bits incorrectly received to the total number of bits sent during in a transmission. It is defined "Total bit error numbers/ Total bits transmitted."

CER – (Character Error Rate or Ratio) the ratio of the number of characters incorrectly received to the total number of characters sent during in a transmission. It is defined "Total character error numbers/ Total character transmitted."

Total Bits – Total transmitted bits of a single test.

Elapsed seconds – The total time from the start to the end of the test. It includes data transmission time, error calculation time, service time between the server and the client, time of writing the error file to the hard disk, etc.

Modulation-speed – It is displayed the type of modulation (V.21, V.22, V.22bis, V.23, V.32, V.32bis, V.32ext, V.34, V.90, V92, Bell103, Bell212, Baudot, EDT, CTM, DTMF) and speed of this modulation.

Bit Error A – bit error numbers of the data transmitted from modem A to modem B.

Bit Error B – bit error numbers of the data transmitted from modem B to modem A.

Block error A– number of blocks which at least have one bit or character error occurs when the blocks are transferred from modem A to modem B.

Block error B– number of blocks which at least have one bit or character error occurs when the blocks are transferred from modem B to modem A.
Block number – Total block numbers transmitted. It is defined as "total bits/ block size"

Block size
Data modem: The block size is 2048 bits.
Text modem: The block size is 256 characters (256 x 8 = 2048 data bits).

Error Seconds - number of errored seconds in which any one-second interval containing at least one bit error.

%EFS – it is defined as (Elapsed seconds - error seconds)/elapsed seconds.

Transmit level A – Modem A transmitted level dB.

Receive level B – Modem B received level dB

SNR – Signal to noise ratio

Round trip delay – the elapsed time for transit of the signal over a closed circuit. The modem reported the round trip delay calculated according to the following equations:

$RTD = (N/X) –3.5$ (for V.34, V90)
$RTD = (N/2.4) –29$ (for V.32bis – Only Mentor Modems supported this feature)

Where:
RTD is the round trip delay in ms.
N is the decimal value of the 16-bit word achieved by the combination of the hex values of the two fields "kk" and "kl" (reported using "AT&V2").
X is the sample rate found in the field "da" (reported using "AT&V2").

Local & remote retrain – number of retrains which occurred during the connection for the local modem and remote modem.

Disconnect reason - Code of modem-disconnected reason. The value can be decoded using the following table.

Value	Disconnect Reason
0	Normal hang-up, no error occurred.
1	Reserved
2	Reserved
3	Call waiting caused disconnect
4	Physical carrier loss
5	No error connection at the other end
6	No response to feature negotiation
7	This modem is async only; the other modem is sync only.
8	No framing technique in common
9	No protocol in common
10	Bad response to feature negotiation
11	No sync information from the remote modem
12	Normal hang-up initiated by the remote modem
13	Retransmission
14	Protocol violation occurred
15	Lost DTR
16	Received GSTN cleardown
17	Inactivity timeout
18	Speed not supported
19	Long space disconnect
20	Key abort disconnect

21	Clears previous disconnect reason
22	No connection established
23	Disconnect after three retrains

Table 6: Disconnected reason code.

Dialling A-Number - This is defined as the number on the telephone wall socket from which the call is initiated. This number is not used by the MTT, but is recorded in the results for reference purposes.

Dialling B-Number - This is always the number that is dialled by the MTT in order to make a call for a particular test case. It is not necessarily the number on the "wall socket" because it may contain a steering code that routes the call through the network in a particular way.

Reverse dialling - The normal mode of operation is for the MTT to make a call from West to East. The dialled number is the B-number as defined for that particular test case. Reverse dialling is defined as making a call in the reverse direction (i.e. from East to West).

This mode of operation allows the user to define a single test script that includes separate test cases for calls in both directions (e.g. across an asymmetric network) without changing the physical telephone lines.

Artificial Line length – It is displayed the length Km selected by user. DSPGenie MTT can control an optional external artificial telephone line (MSB Design model AL-2), connected via parallel port.

Answer tone used - Frequency of the answer tone used (Hz). The following table displays the possible answer tones.

<div align="center">

Default
2100Hz
2225Hz
2100(PR)
ANSam
None

</div>

Complex Impedance - Report 600 Ω or complex impedance for DAA.

5.3   Data storage structure

This section describes in detail the principles of data storage used in the DSPGenie MTT.

User defines the structure of the test results directory including root directory and sub-directories using "*test data directory*" box in the client window. All data storage is located in the MTT server hard disk.

During each test session the user has to specify the full directory path including subdirectories that are related to a particular test session during which various test parameters are set via GUI or script and run using automated Multi-Test facility.

During automated multi-tests session DSPGenie MTT internally creates unique files related to particular test session as listed below:

File1: ddmmyyyyxxx_config.cfg This is a configuration file that stores DSPGenie MTT tester internal configuration for a particular test session. There is only one such file per test session and is created automatically, since it is related to the hardware set-up.

File2: ddmmyyyyxxx _script.mtr This is the test script file that stores list of the all test cases (see example 1). There is only one such file per test session and can be created via GUI or off-line

by script. Each test case includes the parameters as specified in the following sections. The value of each parameter created automatically during the test session is stored in the results file.

File3: ddmmyyyyxxx _result.txt This is a test result file that stores test results of each test case in the CSV format. There is only one such file per test session. The file structure is shown in the example 3. It can be imported into an Excel file as shown the example 4.

File4: ddmmyyyyxxx _testCBER.err This file stores the BER per block for high speed modem and the CER per block for text modems to provide a statistical distribution of errors during a specified test case. It can be imported into an Excel file as shown the example 5.

NOTE: This file is optional, user needs to click the *create error file* box in the modem configuration window to create this file.

Example 1: List of the test cases for a test script [ddmmyyyyxxx _script.mtr]

A test script is considered to be a collection of test cases that can be executed in a single multi-test run.

The internal format of the test script file can be explained on the following example:

Test group	Test cases name	Status
1A	Test_0_ddmmyyyyhhmmss_zzzzzz.tcf	queued
1A	Test_0_ddmmyyyyhhmmss_zzzzzz.tcf	queued
1A	Test_0_ddmmyyyyhhmmss_zzzzzz.tcf	queued
1A	Test_0_ddmmyyyyhhmmss_zzzzzz.tcf	queued
2A	Test_1_ddmmyyyyhhmmss_zzzzzz.tcf	queued
2A	Test_1_ddmmyyyyhhmmss_zzzzzz.tcf	queued
2A	Test_1_ddmmyyyyhhmmss_zzzzzz.tcf	queued
2A	Test_1_ddmmyyyyhhmmss_zzzzzz.tcf	queued

Where:
dd – numeric representation of the day, range (1-31)
mm – numeric representation of the month, range (1-12)
yyyy – numeric representation of the year, range (2000-2099)
hhmmss – time stamp (hours, minutes, seconds)
zzzzzz – the test case ID specified by the user (up to 10 characters)
Test_0 – in the name of the test case identity the text modem.
Test_1– in the name of the test case identity the data modem.
1A – denotes text modem test group ('Test_0__' test case files).
2A – denotes data modem test group ('Test_1__' test case files).
3A – reserved for fax modem test group ('Test_2__' test case files).
queued – default status when saving the script.

Example 2: Test parameters used for each test case [for MTT internal use only]

A test case is considered to be the lowest level executable element and comprises the definition of A and B end numbers, modems, etc. Test case also includes the repetitions used with the same settings and same test case ID.

The **test case configuration** files are saved automatically when the *accept* button is pressed in the test configuration window. All test cases files are saved in the MTT internal subdirectory **\server\testconfig.** Their file names are created in the form shown below:

Test_0__ddmmyyyyhhmmss_zzzzzz.tcf

Test_1__ddmmyyyyhhmmss_zzzzzz.tcf

Any single test case should be consistently referenced by means of a user-definable alphanumeric test ID (10 character field). The user can entry the **test case ID** into the *test case comment* box in the modem

configuration window. An example of a test case file name: **Test_1__7122007173512_VBDk1.tcf** (VBDk1 - test case ID).

param_repetitions=1	numbers of test repetition
param_modemA_type=5	modem type 1=v18, 2=baudot, 25=baudot50 3=dtmf test 4=edt, 5=v21,6=v23,7=bell103 8=CTM 91=DTMF keypad 92=DTMF security DC-05
param_modem_answerTone=0	0=none 1=2100Hz 2=2225Hz 3=2100 reverse 4=AnsSam
answer tone duration=0	duration of the answer tone in ms
param_testSequence=0	do not use for 2-wire
param_modemB_type=5	same param_modemA_type
param_maxspeed=8	
param_comA=0	Select serial portA
param_comB=0	Select serial portA
param_testlength=1	number of test blocks
artificial_line=0	1=0.1 km 2=0.2 km 3=0.3 km 4=0.4 km 5=0.5 km 6=0.6 km 7=0.7 km 8=0.8 km 16=1.6 km 32 =3.2 km 48=4.8 km 112 = 6.4 km
reverse_dial_flag=0	0=normal dialing 1=reverse dialing
enableerrorfile=0	0=disable to create a error file 1= enable to create error filr
vco_flag=0	0=normal 1= vco mode
v8_flag=0	0=v.8 is disabled, 1=v.8 is enabled
complex_flag=0	0=DAA 600ohm, 1=DAA complex
param_number_to_dial=1112345	A number
param_number_to_dial_B=2212345	B number
param_config_name=VBD12345	user entry comments
param_modem_output=0.000000	do not use for 2-wire

Example 3: Results file in the CSV format [ddmmyyyyxxx _result.txt]

```
VBD05/07/2007 15:49:13
date and time,status,CER,BER,total bits,elapsed seconds,modulation-
speed,bit error A/B,block error A/B,block number,error seconds,% EFS,
transmit level A,receive level B,SNR,round trip delay,local&remote
retrain,disconnect reason,dial numberA,dial number B,reverse
dialling,line length km, answer tone, complex impedance

05/07/2007 15:49:14,test completed,0.000,0.000,10240,48,V21-
300,BitErrA/B:0/0,blockErrA/B:0/0,block:5,ErrSecA/B:0/0,%EFS:100,TXA:-
16dB,RXB:-20dB,SNR:N,RTD:N,L&R
retrain:0/0,disconnect:4,11,22,No,0,2100,0
05/07/2007 15:51:14,test completed,0.000,0.000,10240,8,V22-
1200,BitErrA/B:0/0,blockErrA/B:0/0,block:5,ErrSecA/B:0/0,%EFS:100,TXA:
-16dB,RXB:-23dB,SNR:N,RTD:N,L&R
retrain:0/0,disconnect:12,11,22,No,0,2100,0
05/07/2007 15:52:24,test completed,0.000,0.000,10240,6,V22B-
2400,BitErrA/B:0/0,blockErrA/B:0/0,block:5,ErrSecA/B:0/0,%EFS:100,TXA:
-16dB, RXB:-26dB,SNR:N,RTD:N,L&R
retrain:0/0,disconnect:12,11,22,No,0,2100,0
```

```
05/07/2007 15:58:33,test completed,0.000,0.000,10240,6,V34-
33600,BitErrA/B:0/0,blockErrA/B:0/0,block:5,ErrSecA/B:0/0,%EFS:100,TXA
:-16dB,RXB:-24dB,SNR:28,RTD:17,L&R
retrain:0/0,disconnect:12,11,22,No,0,default,0
05/07/2007 15:59:40,test completed,0.000,0.000,10240,5,V90-
33600,BitErrA/B:0/0,blockErrA/B:0/0,block:5,ErrSecA/B:0/0,%EFS:100,TXA
:-16dB,RXB:-23dB,SNR:29,RTD:17,L&R
retrain:0/0,disconnect:12,11,22,No,0,default,0
```

Example 4: Excel Results

Test No	Date and time	Comment	Status	CER	BER	Total Bits	Elapsed seconds
1	26-04-07 00:00:00	VDB101	Test completed	0.0	0.0	10240	4

Modulation-Speed	Bit Errors A/B	Block Error A/B	Block Number	Errored Seconds	%EFS	Artificial Line length
V90-33600	0/0	0/0	5	0/0	100%	0

Table 7: Sample Excel sheet generated from the CSV results file.

Example 5: Excel Results and graph of error distribution file

Block TestcaseID	1	2	3	4	5	6	7	…	25	26	…	50	…
zzzzzz	0	0	0	0.5	0	0.1	0	…	0.3	0.3	…	0	…
zzzzzz	0.2	0	0	0.1	0.2	0.1	0	…	0	0	…	0.1	…
…	0	0.4	0	0	0.1	0	0	…	0	0.5	…	0	…
zzzzzz	0	0	0	0.4	0	0	0.8	…	0.1	0	…	0.7	…
…	…	…	…	…	…	…	…	…	…	…	…	…	…

Table 8: Sample Excel sheet generated from the error file [ddmmyyyyxxx _testCBER.err]

The left column is the test case ID (the repetitions will have the same case ID).
The top row is the sequential block number. The numbers in the table are BER or CER values for each data block within each test case.

Each row will be then presented by one graph. The name of graph will be the following:

Test0testcaseID.xls for the text modem
Test1testcaseID.xls for the data modem

E.g. in the graph below for the bit block number 2 the Bit Error Ratio (BER) is 0.5.
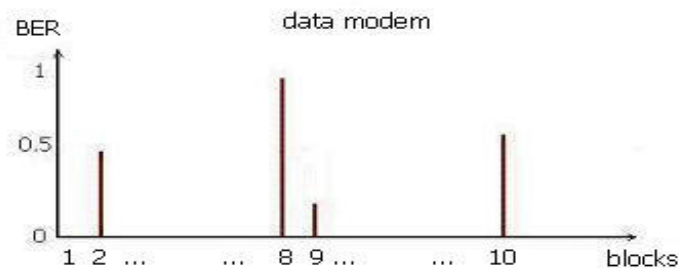
Figure 16: Data Modem: Bit Error Rate against the block numbers.

E.g. in the graph below for the character block number 2 (see below) the Character Error Ratio (CER) is 0.25 (25% of characters in the block are in error)
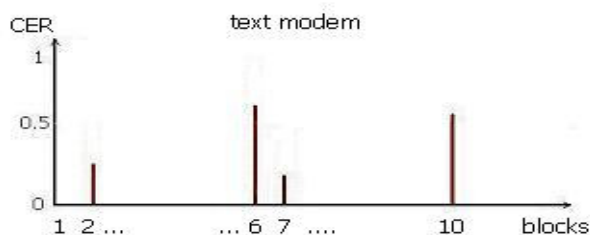

Figure 17: Text Modem: character Error Rate against the block numbers.

6 The Interfaces

6.1 Dual 2-wire Analogue interface (DAA)

The DSPGenie MTT platform offers a dual 2-wire Analogue POTS interface.

Based on an industry standard DAA module, this interface is able to originate and terminate calls and also offers On-Hook reception for non-obtrusive line monitoring applications.

- Dual channel transformer-less 2-to-4 wire conversion
- Full duplex voice and data transmission
- 600ohm resistive or European (CTR21) complex line impedance and network balance (option)
- Parallel apparatus activity detection and On-Hook reception (non-obtrusive monitoring mode)
- DTMF generation/detection
- Call progress tones detection: dial tone, line engage, ring-back, silence; also: 'no answer' time-out
- Built-in over-voltage/over-current protection
- CTR21/French requirements line current limiter (option)
- 17 Vrms ringing voltage sensitivity
- Receive gain (4-Wire to 2-Wire)   nom. 0 dB
- Transmit gain Off-Hook (2-Wire to 4-Wire)   nom. 0 dB
- Transmit gain On-Hook (2-Wire to 4-Wire)   nom. 0 dB
- Frequency response   (300 – 3400Hz)   (+/-0.5) dB
- Trans-hybrid loss   (300 – 3400Hz)   typ. 25 dB
- Return loss at 2-Wire (300 – 3400Hz)   typ. 24 dB
- Idle channel noise   (A-law)   typ. -70 dBm0p
- Single frequency distortion (1015Hz, 0 dBm0) max. -46 dB

The interface configuration and control is done by the DSPGenie MTT *server* application.

The line impedance and network balance option (600ohm resistive or European CTR21) is pre-set at factory according to user's preference, as is the CTR21 current limiter option.

Parallel apparatus activity detection and On-Hook reception (high impedance) can be utilized in some specific applications for non-obtrusive monitoring (and recording/analyzing) of signals on 2-wire lines.

6.1.1   2-wire interface sockets

Two standard RJ12 FCC-68 Modular sockets are mounted at the DSPGenie front panel marked as '2-wire I/O' - socket 'A' and 'B'. Their pin-out and signal definition is listed below.

> Pin 1: NC
> Pin 2: NC
> Pin 3: Tip
> Pin 4: Ring
> Pin 5: NC
> Pin 6: NC

This wiring of the RJ12 sockets is compliant with the US/international standard. For the UK market an adapter is needed, with cross-connected pins 3 - 2 and 4 - 5.

6.2   Dual Analogue Monitoring interface

The DSPGenie MTT platform offers as standard two analogue monitoring outputs, which are providing audio signals corresponding directly to the digital signals present at the inputs of modems.

These analogue monitoring outputs allow the user to listen to the received signals in *real-time*, giving valuable additional information.

- Dual unbalanced analogue outputs
- Low impedance output stages (22 ohm typ.)   Can drive directly 300 ohm loads
- 0dBm0 level   Equivalent of 0.375 Vrms at the outputs (nom.)
- Output gain (D-to-A)   -6.3 dB nom
- Overload level   1.5 Vpp
- Frequency response   (300 – 3000Hz)   (+/-0.25) dB
- Single frequency distortion (1015Hz, 0 dBm0)   Max. -36 dB
- Idle channel noise (D-to-A)   Max. -70 dB0p

The analogue monitoring interface configuration and internal connection is done automatically by the DSPGenie MTT control application.

The Modem A Rx signal can be monitored via the analogue output 'A', and the Modem B Rx signal can be monitored via the analogue output 'B'.

6.2.1   Monitoring interface connectors

Standard phono (RCA) type sockets are used at the DSPGenie front panel marked as 'Analogue I/O' - interface 'A' Out and interface 'B' Out.

The usual contact arrangement is followed here: the centre contact is an active signal; the outer contact is an analogue ground (and a cable screen).

The outer contact (an analogue ground) in all phono sockets is isolated from the metal front panel to reduce noise pick-up and avoid ground loops.

7 MTT Software Update Procedures

To update the MTT software, the user should follow one of the outlined procedures depending on the upgraded box.

OLD MTT TESTER

The old MTT tester uses Microsoft MS 2000 Operating System and upgrade of the software should be as follows.

1. **MTT Server**
   1.1. Copy the **MTT updated server executable** and **the initialize file** to the server subdirectory.
   1.2. Right-click on the MTT server executable to create the new shortcut for the server.
2. **MTT Client**
   2.1. Copy both the **MTT updated client executable** and the **initialize file** to the client directory.
   2.2. Right-click on the MTT client executable to create the new shortcut for the client.

NEW MTT TESTER

The new MTT tester uses Microsoft XP Operating System and different drivers from the old Tester and upgrade of the software should be as follows.

1. **MTT Server**
   1.1. Copy the **MTT updated server executable** and **the initialize file** to the server subdirectory.
   1.2. Copy the previous MTT server shortcut and rename it. For example, copy the shortcut named "MTT Server V4.1.4 DAA" and renames the shortcut as "MTT server V4.1.5 DAA".
   1.3. Right-click on the shortcut named "MTT server V4.1.5 DAA" and select the "Properties" option.
   1.4. Select the "Shortcut" tab as it is shown in the **Figure 18**
   1.5. Modify the MTT server executable in the "**Target**" text box. For example, "C:\…\\AllowIO\AllowIo.exe" "modem tester server v4.1.5 DAA.exe" /a.
   1.6. Modify the program path in the "**Start in**" text box for the MTT server executable if it is different from the previous version.
   1.7. Press the "**Apply**" button and then the "**OK**" button to set the new MTT server shortcut.

2. **MTT Client**
   2.1. Copy both the **MTT updated client executable** and the **initialize file** to the client directory.
   2.2. Copy the previous MTT client shortcut and rename it. For example, copy the shortcut named "MTT client V4.1.4 DAA" and renames the shortcut as "MTT client V4.1.5 DAA".
   2.3. Right-click on the shortcut named "MTT client V4.1.5 DAA" and select the "Properties" option.
   2.4. Select the "Shortcut" tab as it is shown in the **Figure 18**.
   2.5. Modify the MTT client executable in the "**Target**" text box. For example, "C:\…\\AllowIO\AllowIo.exe" "modem tester client v4.1.5 DAA.exe" /a.
   2.6. Modify the path in the "**Start in**" text box for the MTT client executable if it is different from the previous version.
   2.7. Press the "**Apply**" button and then the "**OK**" button to set the new MTT client shortcut.
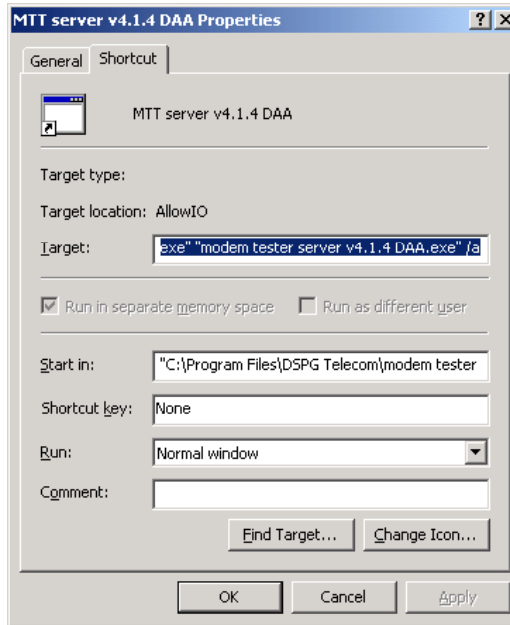
Figure 18: MTT server v4.1.5 DAA Properties Window.

8 General specifications

Model: DSPGenie MTT

Housing:	Mini-portable 3U
Dimensions:	180 x 320 x 375 mm (H x W x D), including the handle. (7.1 x 12.6 x 14.8 inches)
Weight:	6kg (13 pounds) approx. in a standard configuration

Power supply:

Auto-ranging SPSU: 85 to 264 V AC, 47 to 63 Hz

Power Factor Correction, meets EN61000-3-2

Inrush current: 32A peak at 230 V AC

Power consumption: 24 watts (typical) in a standard configuration

Operating temperature range: +10 to +40°C

Storage temperature range: -10 to +70°C

9 History of the MTT Modifications

Software Version	Software modification	Manual version/ Author	Date of software released
MTT V4.0.1	The first version that supported the data structure of the test script and test cases	Vr 1.3 / Dalan Wang	1/10/2007
MTT V4.1.2	V.8 and complex impedance can be selected as parameters	Vr 1.3/Dalan Wang No change	18/12/2007
MTT V4.1.3	The problem of V32ext calling long DTMF digits was fixed. When use default of the answer tone, Mentor modem is used for V32ext When 2100 Hz of the answer tone is selected the CSM modem is used for V32ext	Vr 1.3/Dalan Wang No change	18/01/2008
MTT V4.1.4	EDT to V18 problem was fixed V.18 to V.23 problem was fixed Add round trip delay calculation for V32bis and V34 V.42bis was disable for all modulations of the Mentor modems Complex impedance is reported in the result file Grey the selection of the complex impedance when the Mentor modems are selected	Vr 1.4 – Vr1.5/Dalan Wang & Rodrigo Castiñeira Adding the table of selection of the hardware. Update the list of the parameters for the test cases Update the GUI Adding Software Update procedures	1/07/2008
MTT V4.1.5	Error Correction and data compression are disabled for data modems V.21,V.22,V.23,V.32,V.32bis,V.32ext, Bell103 and Bell212 Error Correction and Data Compression are enabled for V.34,V.90 and V.92 The limit of the answer tone duration is increased for CSM modem to max 5 sec V.23 problem with termination in noisy line condition in Mentor modem was fixed	Vr 1.5.4/Dalan Wang Table 5 was updated Test results are shown in appendix	28/08/2008

Table 9: History of the MTT Modifications.

10 Appendix

Version Software	**MTT 4.1.5**
Test Date	**19/08/2008 – 26/08/2008**

10.1 Low speed Text Modems

Test No.	Modem	Test bits	Character error rate	Elapsed seconds	Comment
1	V.21-V.21	20480	0	134	passed
2	V.23-V.23	20480	0	256	passed
3	V.23-V.18	20480	0	257	passed
4	EDT-EDT	20480	0	326	passed
5	V.18-EDT	20480	0	327	passed
7	Baudot-Baudot	20480	0	568	passed
8	B103-B103	20480	0	134	passed
9	DTMF Text	4096	0	542	passed
10	DTMF signal	288	0	13	passed
11	DTMF security	128	0	13	passed

Table 10: Low speed text modems.

10.2 High speed Data modems

Test No	Modulation/ Speed	Modem type	Test Bits	Error rate	Elapsed seconds	Error correction & data compression	Answer tone	RTD
1	V21-300	Mentor	20K	0	90	Both None	default	N/A
2	V21-300	Zoom	20K	0	91	Both None	default	N/A
3	V21-300	CSM	20K	0	84	Both None	None 3.5 s	N/A
4	V22-1200	Mentor	20K	0	22	Both None	default	N/A
5	V22-1200	Zoom	20K	0	22	Both None	default	N/A
6	V22-1200	CSM	20K	0	24	Both None	None 3.5 s	N/A
7	V22bis-2400	Mentor	20K	0	11	Both None	default	N/A
8	V22bis-2400	Zoom	20K	0	11	Both None	default	N/A

9	V22bis-2400	CSM	20K	0	16	Both None	None 3.5 s	N/A
10	V23-75/1200	Mentor	20K	0	189	Both None	default	N/A
11	V23-75/1200	Zoom	20K	0	191	Both None	default	N/A
12	V23-75/1200	CSM	20K	0	182	Both None	None 3.5 s	N/A
13	V32-9600	Mentor	20K	0	3	Both None	default	N/A
14	V32-9600	Zoom	20K	0	3	Both None	default	N/A
15	V32-9600	CSM	20K	0	8	Both None	2100 PR 3.5 s	N/A

Table 11

Test No	Modulation & Speed	Modem type	Test Bits	Error rate	Elapsed seconds	Error correction & data compression	Answer tone	RTD	TNE delay ms
16	V32bis-14400	Mentor	20K	0	2	Both None	default	1	0
17	V32bis-14400	Zoom	20K	0	2	Both None	default	N/A	0
18	V32ext-14400	CSM	20K	0	7	Both None	2100Hz 3.5 s	N/A	0
19	V34-33600	Mentor	20K	0	1	LAPM V.42bis	default	1	0
20	V34-33600	Mentor	20K	0	1	LAPM V.42bis	default	4	3
21	V34-33600	Mentor	20K	0	1	LAPM V.42bis	default	7	6
22	V34-33600	Mentor	20K	0	1	LAPM V.42bis	default	10	9
23	V34-33600	Zoom	20K	0	1	LAPM V.44	default	N/A	0
24	V34-33600	Zoom	20K	0	1	LAPM V.44	default	0	3
25	V34-33600	Zoom	20K	0	1	LAPM V.44	default	3	6

26	V34-33600	Zoom	20K	0	1	LAPM V.44	default	6	9
27	V34-33600	Zoom	20K	0	1	LAPM V.44	default	9	12
28	V90-33600	Mentor	20K	0	1	LAPM V.42bis	default	4	3
29	V90-33600	Zoom	20K	0	1	LAPM V.44	default	0	3
30	Bell103-300	Mentor	20K	0	89	Both None	default	N/A	0
31	Bell103-300	Zoom	20K	0	91	Both None	default	N/A	0
32	Bell212-1200	Mentor	20K	0	22	Both None	default	N/A	0
33	Bell212-1200	Zoom	20K	0	22	Both None	default	N/A	0

Table 12

Notes:
Mentor|: 56K mentor data modem
Zoom: V.90 Zoom data modem
CSM: CSM Rockwell data modem

10.3 Test set-up conditions

1. Transmit level for all types of modems was set at –10dBm
2. All tests were performed using TNE set at 0 km transmission line
3. The error correction and data compression are disabled for V.21, V.22, V.23, V.32 , V.32bis, Bell 103 and Bell 212
4. The error correction and data compression are enabled for V.34 and V.90
5. Mentor modem uses V.42bis data compression and Zoom uses V.44 data compression
6. The Mentor modem supports RTD for V32bis, V.34 and V.90.
7. The Zoom modem supports RTD for V.34 and V.90.
8. There are a fixed offset of the RTD for Mentor modem and Zoom modem
   a. The offset of RTD for Mentor modem = 1 ms
   b. The offset of RTD for Zoom modem = -3 ms

9. Elapsed Seconds reported by Mentor, Zoom and CSM modems operating at the same modulation and speed differs from each other for the following reason:
   a. . The elapsed seconds include the transmission time and the MTT overheads such as buffer handling time and the differences in buffer length.
   b. The fixed overhead for handling CSM modem is e.g. 4s for transmitting 20 kb of data. The main contributing factor is the buffer length of CSM

modem that is 16 bytes for all modulations compared to 256 bytes for Zoom and Mentor (high speed data). That buffer size difference is reflected in elapsed time that is much higher for CSM modem.

c. The Mentor and Zoom modems use only 8 bytes buffer for Low Speed Data such as V.21 and V.23 modulations. In that case elapsed time for Mentor, Zoom and CSM modems is comparable.

END OF APPENDIX