DOCSIS ATP 2.0

PHY-10.2

JUPITER 20 ATP PHY-10.2 TEST SCRIPT DATA SHEET

Upstream Frequency Range

A DOCSIS 2.0 ATP TEST SCRIPT DATA SHEET

Jupiter 200 PHY-10.2

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Jupiter 200 – PHY-10.2

"This test verifies the ability of the CM to transmit from 5 MHz (+bandwidth offset) to 42 MHz (-bandwidth offset) with the initial accuracy of +/- 50 parts per million. A second part of the test tracks ranging response frequency adjustments to completion and verifies that for each adjustment the measured upstream frequency is within +/- 10 Hz of the frequency adjustment applied to the measured frequency before the adjustment." – ***DOCSIS 2.0 ATP***

Introduction

Test 1 – Frequency Range and Accuracy, Symbol Rate, and Modulation Type:
The general sequence of actions described for the first test case is given next. Define a QPSK upstream channel at approximately 5.1 MHz with a symbol rate of 160 ksym/sec. This allows the upstream carrier to occupy the 5.0 MHz to 5.2 MHz band. Disconnect the upstream from the CMTS and connect it to the VSA/RFSA through an impedance matching device. The VSA/RFSA is set to receive the upstream burst. Capture the first ranging burst from the CM in the VSA/RFSA. The burst frequency is read. The specification calls for a +/- 50-ppm tolerance before ranging adjustments to the frequency offset. The test is repeated at 6 MHz, 7 MHz, 8 MHz, and all 1 MHz step increments up to 41 MHz. Then, 41.9 MHz is used as the last carrier frequency to allow for the channel bandwidth.

This test is repeated for all supported symbol rates, 320 ksym/sec, 640 ksym/sec, 1280 ksym/sec, 2560 ksym/sec and 5120 ksym/s. The center frequency offset is adjusted appropriately for each symbol rate. Finally, all the above tests are repeated using the following modulations. For S-CDMA cases, the three modulation rates, 1280, 2560 and 5120 kHz, are tested only and TCM On tests are performed only if the CMTS supports them.

TDMA: 8QAM, 16QAM, 32QAM, 64QAM
S-CDMA TCM Off: QPSK, 8QAM, 16QAM, 32QAM, 64QAM
S-CDMA TCM On: QPSK, 8QAM, 16QAM, 32QAM, 64QAM, 128QAM

Note that in S-CDMA cases, the first ranging message is transmitted using the Initial Maintenance ICU 3 burst type which is a spreader-off burst. Therefore the burst is processed as a normal TDMA burst in the VSA/RFSA.

The frequency change is accomplished by using CMTS control mechanisms to change the frequency in the UCD message for the upstream channel to which the CM is assigned. The CM upstream test point is monitored. Many RF MIBs are monitored as described below.

Test 2 – Offset frequency adjustment and accuracy: This test is carried out on a defined QPSK upstream channel at 30 MHz with a symbol rate of 1280 ksym/sec. The VSA/RFSA is set to receive the upstream burst. A downstream sniffer or a CMTS log function is needed to record all ranging responses to the CM. Start capturing downstream ranging responses. Power up the CM and capture all ranging burst from the CM until CM has successfully ranged. Stop capturing downstream ranging responses. The burst frequency is read from the vector signal analyzer for each ranging burst. Read the ranging response frequency offset adjustments corresponding to each burst. For each ranging response, add the offset frequency adjustment to the frequency measured from previous ranging request burst. The measured frequency for the next ranging request burst must be within +/- 10 Hz of this calculated frequency.

The test is repeated for an S-CDMA QPSK upstream channel at 20 MHz when TCM is off and modulation rate is 1280 KHz. In this case, the CMTS is configured to grant all the subsequent ranging messages as spreader-off bursts, similar to the first ranging message. Therefore, the bursts are processed as normal TDMA bursts in the VSA/RFSA.

The test need not be repeated on other frequencies.

Test Requirements

Test 1: This test requires control in the CMTS to set the upstream channel descriptor fields as required. The CMTS MIB objects to be controlled and/or monitored are:

docsIfUpstreamChannelTable
- docsIfUpChannelFrequency
- docsIfUpChannelWidth
- docsIfUpChannelModulationProfile
- docsIfUpChannelScdmaFrameSize
- docsIfUpChannelScdmaActiveCodes
- docsIfUpChannelScdmaCodesPerSlot

docsIfCmtsModulationTable
- docsIfCmtsModType
- docsIfCmtsModIndex
- docsIfCmtsModTcmErrorCorrectionOn
- docsIfCmtsModScdmaSpreaderEnable

ifTable
- ifSpeed

CM MIB objects are not used because the CM does not come online.

VSA/RFSA to measure upstream channel frequency.

Test 2: This test requires control in the CMTS to set the upstream channel descriptor fields as required. A means of collecting downstream ranging responses is needed. Either a downstream sniffer or a logging CMTS can be used for this purpose.

A VSA/RFSA is needed to measure upstream channel frequency.

Setup

The Jupiter 200 PHY-10.2 Test Script utilizes Jupiter hardware as shown in Figure 1 of the **Jupiter 110/200 PHY Hardware Setup Data Sheet** document.

Procedure

The test performs the following actions:

1. Load configuration from the selected test environment file (see Environment File Details section).
2. It performs initialization on the following pieces of hardware or software components:
    a. VSA/RFSA: Resets and sets averages to 1.
    b. CMTS: Compiles MIB for SNMP communication
    c. DHCP: Sets modem config file to system default
    d. TFTP: Configures parameters for communication with TFTP logs
    e. Cable Plant: Initializes all settings to default values in Hardware.INI
    f. RF Interface Unit: Configures paths to route CM upstream to VSA/RFSA
    g. Power Outlet: Initializes communication and reboots the CM.
    h. CM: Waits for modem to fully register with CMTS
    i. CMTS: Moves upstream to a TDMA channel.
    j. Packet Sniffer: If using it initializes communication with the Sniffer.
    k. Packet Generator: Opens communication with Packet Generator then configures ports and creates 1 stream (1518 bytes long). Packet Rate is set to 10 packets per second.
    l. TDMA Trigger: Initializes communications with hardware used to perform TDMA triggering.
3. Perform Test 1 (if selected). The following steps are repeated for every test point configured in the environment file for Test 1.
    a. Read modulation profile specified in the test point and load onto CMTS.
    b. Move the CM to specified modulation profile and channel type
    c. Set basic upstream parameters (upstream frequency and channel width).
    d. Setup TDMA trigger by performing:
        i. Wait for modem to register and pass traffic (ping packets).
        ii. Calculate the burst duration for an initial ranging burst using configured modulation profile.
        iii. Start Packet Generator.
        iv. Train TDMA Trigger.
        v. Setup trigger parameters on the VSA/RFSA.
        vi. Measure band power running a routine to optimize the reference level.
        vii. Stop Packet Generator
    e. Disable the Upstream signal to the CMTS. RF switch in cable plant switched upstream into a 75-Ohm load (termination).

f. Power cycle modem
g. For each upstream frequency configured for this test point perform the following:
    i. Set the desired upstream frequency on the CMTS
    ii. Set the desired upstream frequency on the TDMA Trigger.
    iii. Enter a loop where on each iteration of the loop the upstream frequency is measured by the VSA/RFSA. With each measurement check the demodulation's EVM. Continue loop until EVM is less than 10 or 10 iterations have occurred.
    iv. Report final measured frequency.

4. Perform Test 2 (if selected) by performing the following:
    a. Turn off the upstream Equalizer.
    b. For both TDMA and SCDMA (if selected) perform the following:
        i. Read modulation profile specified in the test point and load onto CMTS.
        ii. Move the CM to specified modulation profile and channel type
        iii. Set basic upstream parameters (upstream frequency and channel width).
        iv. Setup TDMA trigger by performing:
            1. Wait for modem to register and pass traffic (ping packets).
            2. Calculate the burst duration for an initial ranging burst using configured modulation profile.
            3. Start Packet Generator.
            4. Train TDMA Trigger.
            5. Setup trigger parameters on the VSA/RFSA.
            6. Measure band power running a routine to optimize the reference level.
            7. Stop Packet Generator
        v. Start Packet Generator
        vi. Make initial frequency measurement.
        vii. Stop Packet Generator
        viii. Set periodic ranging interval to 10 seconds to allow stable measurement time on the VSA/RFSA.
        ix. Start Packet Sniffer and record computer time on sniffer at start. Configure to capture DS RNG-RSP and SYNC messages.
        x. For the configured number of measurements, measure upstream frequency. Disregard measurement if EVM is greater than 10. For each measurement, record the exact trigger time of the burst.
        xi. Align captured RNG-RSP messages with demodulation measurements. For each demodulation measurement, sum all the frequency corrections from captured RNG-RSPs that occurred after the previous demodulation measurement.
        xii. Set periodic ranging interval back to default.
        xiii. Return to original modulation profile destroying the one created for this test point.
    c. Turn on the upstream Equalizer
5. Post Driver information for all hardware used.
6. Post modem software load information.

Environment File Details

The environment file for PHY-10.2 provides a lot of flexibility for configuring not only how the script runs, but also which test points to measure. There are two main sections of the file, each detailed below. The 'General' section is used to specify global script configuration. There can be any number of 'Test Point' sections. These sections contain information that is specific to a particular test point. The name of each test point section is in the form: "Phy 10.2 Test Point X" where X is a unique number that is greater than or equal to 1.

See italicized text below for more information on each variable.

PHY-10.2.env

Frequency Format - (All in MHz and seperated with ",,")

A. Individual Frequency: 10

B. Start Frequency - Stop Frequency Note: Frequency Step Assumed to be 1 MHz

C. Start Frequency - Stop Frequency (Frequency Step)

[General]

Test 1 = TRUE

If TRUE performs Test 1, if FALSE skips it.

Test 2 = TRUE

If TRUE performs Test 2, if FALSE skips it.

[Test 2]

Test 2 TDMA = TRUE

If TRUE performs the TDMA part of Test 2, if FALSE skips it.

Test 2 SCDMA = TRUE

If TRUE performs the SCDMA part of Test 2, if FALSE skips it.

Test 2 TDMA Modulation = ATDMA QPSK

Specifies which modulation profile to use for the TDMA test. See operator's manual for more information regarding modulation profiles.

Test 2 SCDMA Modulation = SCDMA QPSK

Specifies which modulation profile to use for the SCDMA test. See operator's manual for more information regarding modulation profiles.

Test 2 Max Symbols = 700

Limits the number of symbols that will be used to perform frequency measurement. Reducing this number will speed the measurement which will increase the chances of measuring every ranging burst. However, the lower this measurement, the larger error in each individual frequency measurement.

Test 2 Measurements = 10

The number of ranging bursts to measure. Reducing this increases test time. This number needs to be large enough to insure that a power correction has occurred.

[PHY-10.2 Test 1 - Test Point 1]

Any number of Test Point sections can exist. The format of the name of each section is: "Phy 10.2 Test Point X" where X is a number greater than or equal to one. Each section must have a unique name.

Modulation Profile = ATDMA QPSK

Specifies which modulation profile to use for the test point. See operator's manual for more information regarding modulation profiles.

Channel Width = 200 kHz

The channel width to use for this test point. Acceptable values are: '200 kHz', '400 kHz', '800 kHz', '1600 kHz'. and '3200 kHz'.

Frequencies (MHz)= 5.1,,6-41,,41.9

The frequencies to measure for this test point. See earlier discussion of frequency format for more details.

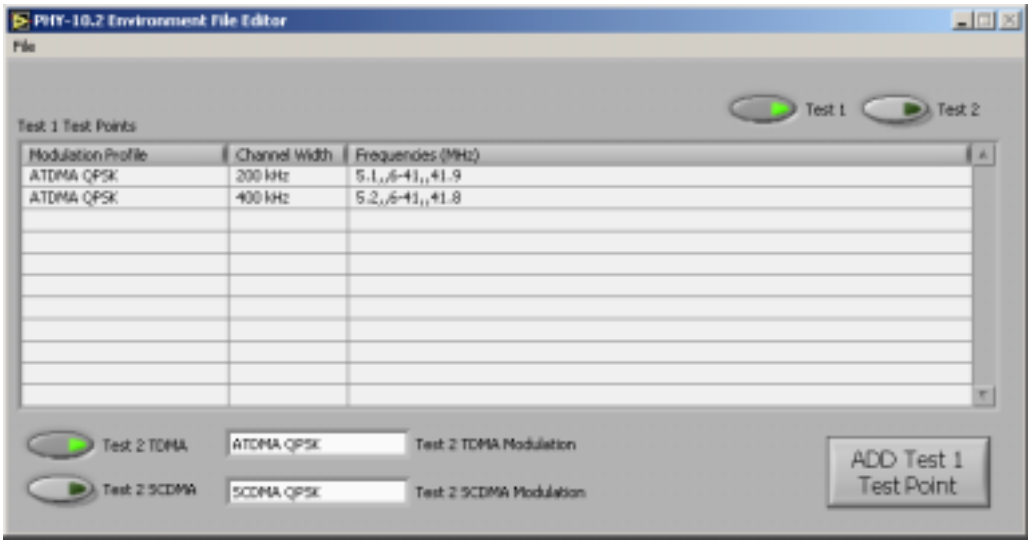
Environment File Editor

The environment file editor shown below provides a user-friendly way to edit the PHY-10.2 environment files. The operator can load from existing files and save results to new or current files. Multiple test points can be deleted by first holding down the shift key and selecting the desired test points to be deleted. Once selected, hitting the Delete key on the keyboard will remove them from the list.

The table summarizes the selected test points. Double clicking on a row will bring up a window that allows the operator to edit values. This same window is opened when the 'Add Test Point' value is selected.

At the top of the panel are two additional controls. These will control whether or not Test 1 and Test 2 is run.

At the bottom of the panel are controls that configure Test 2 parameters.



Limit File Details

The limit file shown below for PHY-10.2 allows user control of test pass/fail criteria without requiring access to the actual test script. One application of this limit file would be to set up 'marginal' criteria for passing, or in other words to allow for a comfort margin in modem performance before submission for certification testing. Acronyms for data format and conditions are as specified in the **DAQTron Jupiter 110/200 Operator's Guide**.

PHY-10.2.lmt

```
SetupInformation,C1%T,EQ,OK
ErrorPosted,C0%T,EQ,No Error
FrequencyError,C1%R,LE,50
FrequencyAdjustment,C1%R,LE,10
NoRangingBursts,C0%T,NE,No Ranging Bursts Acquired
```

Test Results

The Test Results tab in the PHY-10.2 Data Viewer displays a tab for Tabular reports and another tab for Graphical Reports.

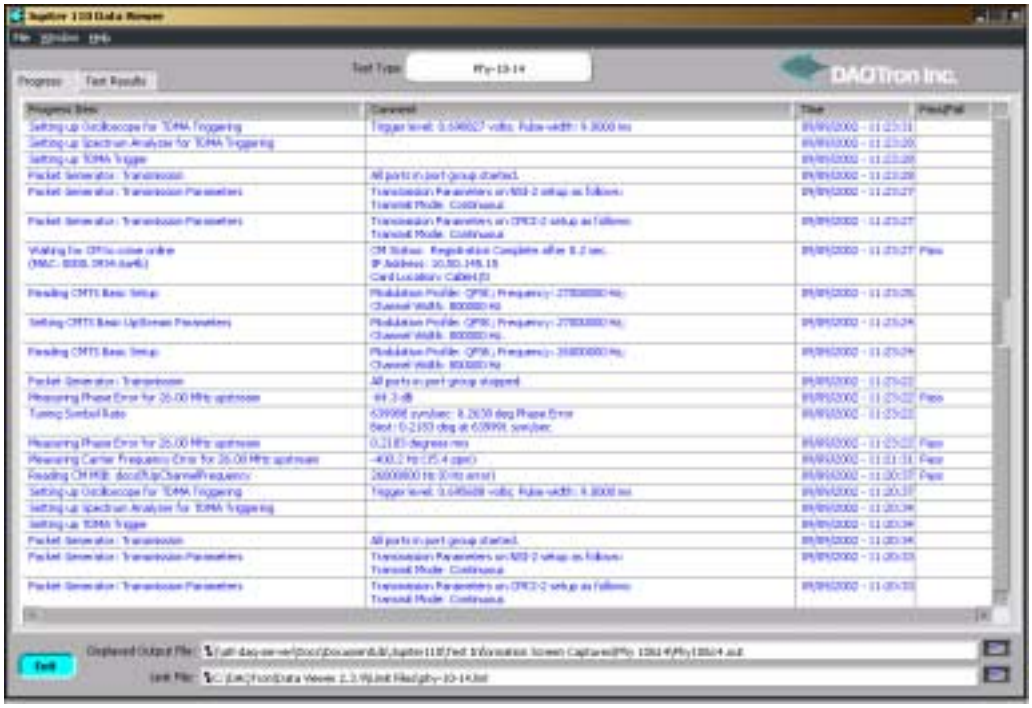


Figure 1. Progress Tab for Jupiter 200 PHY-10.2.

Tabular Report

The Tabular report lists the **PICS**, **Measurement**, **Comment**, **Pass/Fail** and **Limit** applied to the measurement. Also, there are filter and Print buttons. The filter button allows you to view all data, only the data that passed the test or only the data that failed the test.

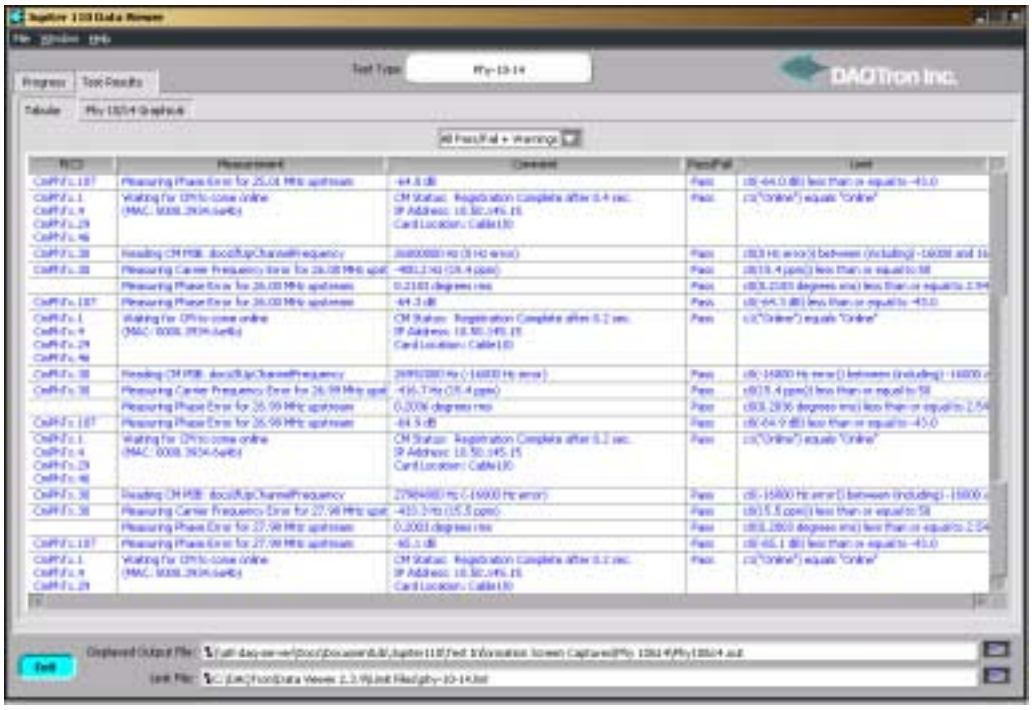


Figure 2. Tabular Results for Jupiter 200 PHY-10.2.

Known Issues: ATP Deviations, Assumptions and Caveats

The following list contains all the current issues. The issues can be with the ATP, 3rd Party Hardware, or DAQTron's implementation:

For Test 2, the ATP states that all ranging bursts should be collected by the VSA/RFSA and analyzed for carrier frequency. This poses a problem because the largest Insertion Interval that can be configured is two seconds. Based on certain parameters, it can take longer than 2 seconds for a demodulation measurement to occur. This means that ranging bursts are missed, which would invalidate the results. In order to achieve this same affect, DAQTron's implementation allows the modem to fully register and then captures periodic ranging requests which can be configured at a slower rate. Therefore every captured RNG-RES has a corresponding ranging burst demodulated on the VSA/RFSA. Enough samples need to be acquired to insure that a frequency correction has been made by the CMTS. If, for some reason, the VSA/RFSA misses a ranging burst, the frequency corrections from multiple RNG-RES packets will be summed together.

Expected Test Times

PHY-10.2 averages about 5 seconds per frequency in a particular test point. Each test point takes 2-3 minutes to setup and configure.