

DOCSIS ATP 2.0

Phy-15.2

## **JUPITER 200 ATP PHY-15.2 TEST SCRIPT DATA SHEET**

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Carrier Power Flatness



A DOCSIS 2.0 ATP TEST SCRIPT DATA SHEET

# Jupiter 200 Phy-15.2

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## Jupiter 200 – Phy-15.2

### Introduction

This tests the flatness of the upstream for constant power without changes up to a burst length of 4.8 m-sec to test for flatness at turn on and the effect of low frequency hum modulation, and time to configure for power changes of less than one dB and greater than one dB. It also tests that reconfiguration times are met for changes of power, symbol rate, offset frequency, channel frequency, or modulation type changes.

– *DOCSIS 2.0 ATP*

### ATP-Stated Test Requirements

The RF specification requires that bursts are flat within 0.1 dB in the time domain as measured across a burst packet. In addition the modem must recover to a new programmed power level within +/- 0.1 dB in 5 u-sec for power changes of 1 dB or 10 u-sec for power changes greater than 1 dB not counting the effects of pulse shaping and amplitude modulation for formats like 16-QAM response. The CMTS MUST not try to change power, symbol rate, offset frequency, channel frequency, ranging or modulation type in a TDMA environment till the last burst has decreased to -30 dBc.

For S-CDMA consecutive bursts MUST be able to be transmitted when changes in output power per mini-slot, offset frequency, pre-equalizer coefficients and/or range offsets occur as long as the CMTS allows at least one frame between bursts. For symbol rate changes the CMMUST be able to transmit consecutive bursts as long as the CMTS waits the required time between bursts for Upstream Channel Descriptor, UCD, parameter changes plus a null data grant at least 1 m-sec or two S-CDMA frames unless the CMTS forces the CM to do a re-ranging (likely case since changes in symbol rate change the time to do the FEC encoding/decoding, possibly cause synchronization problems and equalization changes if the equalizer is on). This test will be done with the equalizer off since it is done in a better environment than real world and FEC off. For S-CDMA, no changes of the enable parameter or US ratio (numerator or denominator) will be done since it causes the S-CDMA system to redo initial ranging before it resumes normal operation.

Flatness can be measured on an oscilloscope using a packet with a long all 1's (CW) preamble. The measurement may be made at a splitter port on the upstream using an oscilloscope, internally synchronized to the burst envelope and measuring the envelope flatness across the burst. Alternatively, flatness may be measured on a vector signal analyzer (VSA) by plotting the magnitude of the recovered symbols using digital demodulation with all the bursts for maintenance and data

having the same length preamble and time between start of bursts. Since the power flatness (as separate from the fast changes due to MER) is a function of the output amplifier and its power supply, only TDMA is tested (not S-CDMA) to simplify the test. The short term effects of power supply sag after the power amplifier load is switched on and the long term effects of 60 and 120 hertz hum modulation are measured using either an oscilloscope and 1536 bit burst preambles at 160 kSym/s and a 300 u-sec burst at 2.56 MSym/s or a VSA with a 4.8 m-sec burst at 160 kSym/s or across a 75 u-sec preamble area of a burst at 2.56 MSym/s. To adequately see the modem recovering to +/- 0.1 dB within 5 u-sec, have a flat burst envelope long enough to see all the likely variation and not have a special test mode requirement two symbol rates will be used, 160 kSym/s and 2.56 MSym/s. The QPSK test envelope can be constructed with of a preamble with only ones to generate a CW signal, easy to measure for flatness, but requires a fast measurement before the CM/CMTS determines something wrong and the CM goes to another downstream frequency. The test frequency is set to 24 MHz, high enough to get several cycles of the carrier frequency inside a 2.56 MSym/s symbol. Alternatively the flatness can be measured on a VSA as long as the bursts all use the same preamble and are the same length between the start of one burst and the start of the next burst for ease of synchronization.

The measurements will be 1.) first a 4.8 msec long burst at 160 kSym/s with an output power 50 dBmV is tested for flatness, 2.) then a shorter approximately 300 u-sec long burst at 2.56 MSym/s with an output power of 50 dBmV with a step of 1 dB higher to 51 dBmV and 3.) repeat the 300 u-sec burst starting at an output power of 47 dBmV with a step of 3 dB to 50 dBmV. All measured bursts are 1536 bits long for oscilloscope testing, and somewhat shorter for testing on the VSA. For reconfiguration times for power, symbol, offset frequency, channel frequency, ranging or modulation changes an oscilloscope will be used to detect the changes and the VSA will be used to ensure that the changes that were detected in the time domain with the oscilloscope actually occurred. The bursts on which the packets changed will be identified with a simultaneous 1 dB power change.

## Setup

The Jupiter 200 Phy-15.2 Test Script utilizes Jupiter hardware as shown in Figure 1 of the **Jupiter 200 Phy Hardware Setup Data Sheet** document.

## Procedure

### Procedure 1 (constant-power power flatness)

As Stated by DOCSIS 2.0 ATP:	As Performed by Jupiter:	Deviation
1. CM AC power off.	The Test Script controls the AC Power Controller via Telnet or SNMP over Control Path 1 and powers off the CM.	None
2. CMTS power on. Wait for CMTS ready.	The CMTS is assumed to be on and ready at the start of the test.	Yes

As Stated by DOCSIS 2.0 ATP:	As Performed by Jupiter:	Deviation
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3. CM AC power on. Wait for CM ready.	The Test Script uses Telnet or SNMP over Control Path 1 to control the AC Power Controller and powers on the CM, verifying ready through Telnet or SNMP.	None
4. Using a standard burst registration packet, register the modem using QPSK at 160 kSym/s burst operation.	CMTS is configured for 25 MHz, 160 kSym/sec upstream. Modulation used is controlled by Modulation Profile Definition file.	None
5. Adjust the variable attenuator to force the CM to sign on at about 50 dBmV.	Upstream attenuator in Passive Impairment Interface is adjusted for 50 dBmV nominal power level from the modem.	None
6. After registration is complete, force the CM to wait till its power amplifier has shut down – about 2 msec.	Script takes at least this long to configure the packet generator.	None
7. (VSA Method) Using TDMA, a 160 kSym/s QPSK burst 3.8 ms long is sent to a CM from the SmartBits.	Packet length is configurable within the Environment File. Symbol rate and modulation were set earlier (step 4).	Packet length is variable.
8. On the VSA, detect the amplitude of the complex baseband samples using the VSA in digital demodulation mode, use root cosine filters alpha 0.25.	VSA is put into demodulation mode with RRC alpha=0.25.	None
9. Set the search area to cover the length of the longest burst plus the longest gap, not counting the initial ranging gap. Insert the preamble into the synchronization pattern on the VSA.	TDMA trigger is configured to provide capture of a few symbols of noise before the burst, plus the first portion of the actual burst. First symbol in the burst is determined by measuring EVM vs. symbol.	Different pulse-location method.
10. Display IQ data as Y axis in log dB, X axis in linear time.	VSA setup as log magnitude vs. time.	None
11. Collect data over the full 768 symbols.	As much of the burst as possible is captured.	None
12. Using the marker functions for RMS power set up to measure the power in groups of 38 symbols.	Number of symbols in bandpower markers is defined in the Environment File.	Measurement window is variable.

As Stated by DOCSIS 2.0 ATP:	As Performed by Jupiter:	Deviation
13. The power is measured in 16 groups of 38 symbols long across the envelope, which tests the envelope for hum modulation. Don't let the markers extend beyond the start or end of the envelope.	At least 608 (=16*38) symbols are measured.	None
14. Subtract the smallest measured power from the largest measured power to obtain the flatness of the burst.	Range of measured values is calculated by the controlling PC.	None.

Procedure 2 (1-dB recovery time power flatness)

15. (VSA Method) Set up SmartBits to send 64-byte packets to the cable modem under test.	Packet generator is set to 64-byte packets.	None.
16. Use the following burst profile for testing burst flatness with the VSA.	Modulation profile used is defined in the Modulation Profile Definition file.	None.
17. On the VSA, detect the amplitude of the complex baseband samples using the VSA in digital demodulation mode, use root cosine filters alpha 0.25.	VSA is put into demodulation mode with RRC alpha=0.25	None
18. Set the search area to cover the length of the longest burst plus the longest gap or about 300 u-sec. Insert the preamble into the synchronization pattern on the VSA.	TDMA trigger is configured to provide capture of a few symbols of noise before the burst, plus the first portion of the actual burst. First symbol in the burst is determined by measuring EVM vs. symbol.	Different pulse-location method.
19. Display IQ data as Y axis in log dB, X axis in linear time.	VSA setup as log magnitude vs. time.	None.
20. Measure CM burst flatness of the symbol height after the 1 dB change from 5 u-sec to the end of the 192 symbol preamble, using averaging between symbols to reduce the effect of MER on the individual symbols.	First 192 symbols are measured, and first 5 u-sec are discarded.	None.
21. Reconfiguration Time	This portion not measured by the Jupiter system	Yes.

Procedure 3 (3-dB recovery time power flatness)

As Stated by DOCSIS 2.0 ATP:	As Performed by Jupiter:	Deviation
22. Use the same burst profile and VSA setup as was used for the 1 dB change	Same VSA setup is used. Modulation Profile Definition specific to procedure 3 is loaded from the Modulation Profile Definition file.	None.
23. Measure the CM burst flatness of the symbol height after the 3 dB change from 49 dBmV to 51 dBmV. Measure the burst flatness from 10 u-sec after the burst starts to the end of the 192 symbol preamble, using averaging between symbols to eliminate MER on the individual symbols	First 192 symbols are measured, and first 10 u-sec are discarded. Power increase from 48 to 51 dBmV.	None.
24. Reconfiguration Time	This portion not measured by the Jupiter system	Yes.

Procedure 4 (Reconfiguration time after frequency offset)

- Not measured by Jupiter system

Procedure 5 (Reconfiguration time after channel frequency change)

- Not measured by Jupiter system

Procedure 5 (Reconfiguration time after ranging)

- Not measured by Jupiter system

Procedure 6 (Reconfiguration time after modulation change)

- Not measured by Jupiter system

## Environment File Details

Using the Phy-15.2 we set the values to be used for the test. The environment file shown below sets up one test case. The Phy-15.2 test script will run the test using the Upstream Frequency and Modulation specified in the environment file and will automatically run the test using the 5 channel widths of 3200, 1600, 800, 400 and 200. DAQTron's Test Sequencer, described in the **DAQTron Jupiter 110/200 Operator's Guide**, is used to cycle through various test cases.

### [Phy-15.2]

```
Modulation Profile Definition File=C:\DAQTron\Jupiter\Phy-15.2
ModulationProfileDefinitions.txt    \** location of modulation profile definitions
                                     \** if blank, will use default location

Perform Procedure 1=True              \** Enable/disable Procedure 1
Procedure 1 - # Symbols to Average Over=38 \** Averaging window size
Procedure 1 - Packet Length=150       \** Packet length (bytes) to use

Perform Procedure 2=False
Procedure 2 - # Symbols to Average Over=38

Perform Procedure 3=False
Procedure 3 - # Symbols to Average Over=38
```

## Limit File Details

The limit file shown below for Phy-15.2 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**.

The Phy-15.2 limit file tests to ensure that the Burst Flatness is less-than-or-equal-to 0.1dB, and for Procedures 2 & 3, that the modem power level changes by the amount expected.

### Phy-15.2.lmt

```

Procedure 1 BurstFlatness,c0%r,LE,0.1
Procedure 2 BurstFlatness,c0%r,LE,0.1
Procedure 2 deltaPower,c0%r,WII,0.7,1.3
Procedure 3 BurstFlatness,c0%r,LE,0.1
Procedure 3 deltaPower,c0%r,WII,2.5,3.5
    
```

## Test Results

Using Data Viewer to view the Phy-15.2 test results, there are two tables. The progress tab that lists the steps executed by the test script and the Test Results table where Pass/Fail criteria are applied.

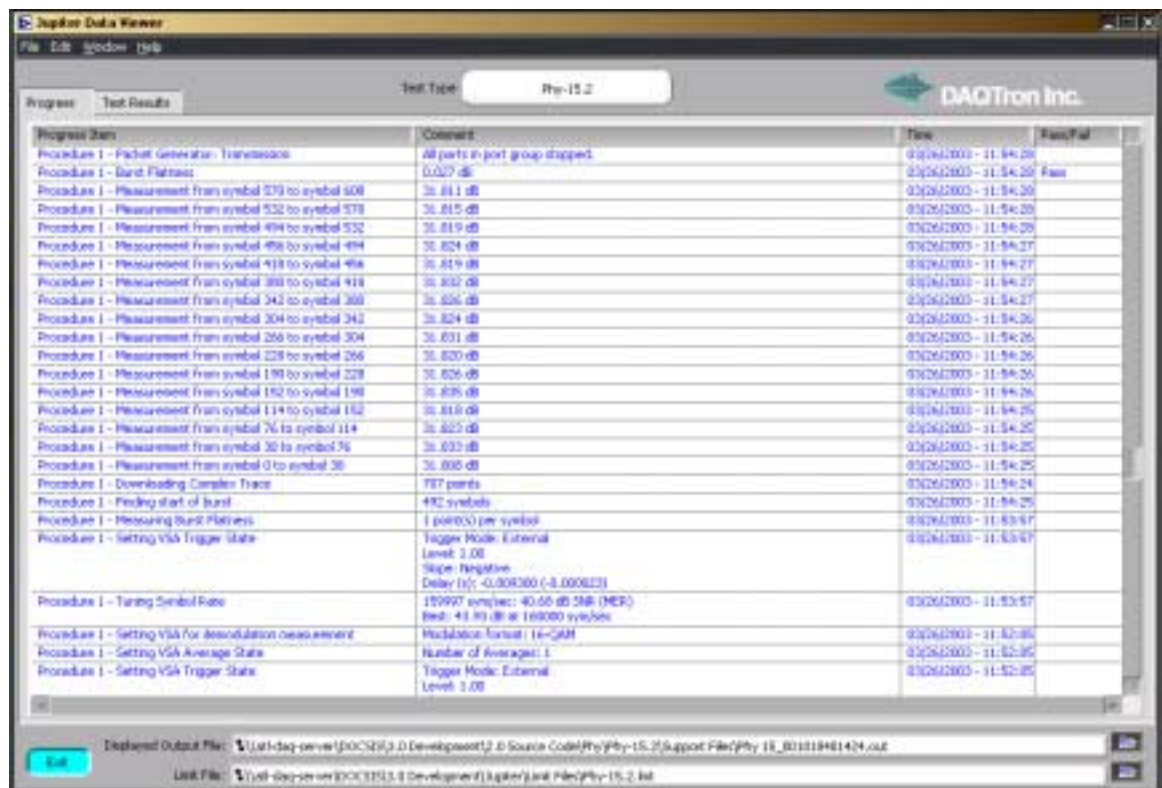


Figure 1. Progress Tab for Jupiter 200 Phy-15.2.

# Tabular Report

The Tabular report lists the **PICS**, **Measurement**, **Comment**, **Pass/Fail** and **Limit** applied to the measurement. The filter pull-down menu above the table allows you to view all data, only the data that passed the test or only the data that failed the test.

PICS	Measurement	Comment	Pass/Fail	Limit
20093	Procedure 1 - Burst Flatness	0.027 dB	Fail	<@0.027 dB less than or equal to 6.1
2045T	Procedure 2 - Burst Flatness	0.041 dB	Fail	<@0.041 dB less than or equal to 6.1
	Procedure 2 - Power Level Change	0.91 dB	Pass	<@0.91 dB between (including) 2.7 and 3.3
2045T	Procedure 3 - Burst Flatness	0.043 dB	Pass	<@0.043 dB less than or equal to 6.1
	Procedure 3 - Power Level Change	3.12 dB	Pass	<@3.12 dB between (including) 2.8 and 3.5

Figure 2. Tabular Results for Jupiter 200 Phy-15.2.

## Graphical Reports

The graphical results tab will show the Phy-15.2 test results in a graphical format. Burst profiles for each procedure may be inspected with the pull-down menu above the graph.

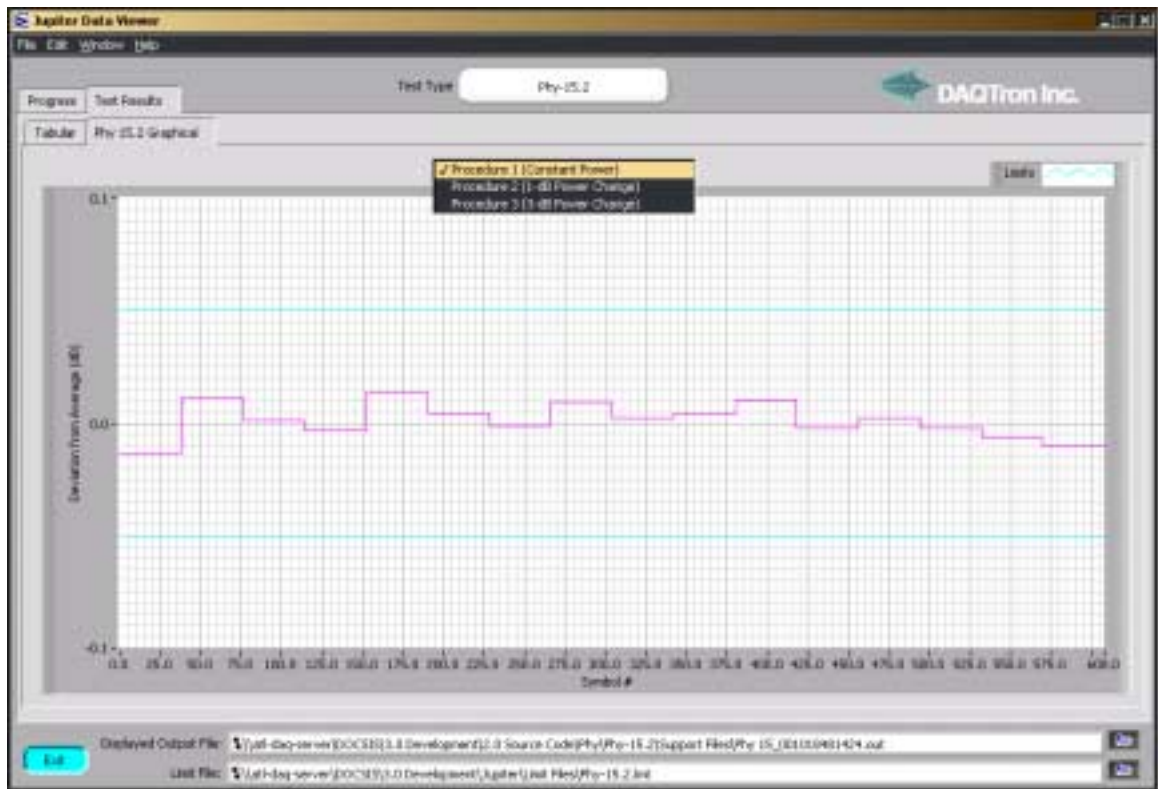


Figure 3. Upstream Results for Jupiter 200 Phy-15.2.

## Known Issues: ATP Deviations, Assumptions and Caveats

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

- The Terayon BW-3500 CMTS with software load 2.0.0.0.31 will schedule a second periodic ranging opportunity for a CM that has just had its power level adjusted immediately after commanding the modem to make an adjustment. This second ranging opportunity comes too quickly to catch the first packet at the new power level out of the modem. Hence Procedures 2 & 3 should not be run on the Terayon BW-3500 CMTS, as they will not measure the correct packets.
- Only Procedures 1-3 are implemented by DAQTron. The remaining procedures require knowledge that is not available to the Jupiter system.
- It is VERY IMPORTANT that the modem does not generate traffic during Procedures 2 & 3 except as generated by the test. These Procedures must capture a very specific packet, and this packet may be lost if the modem is required to generate any additional network

traffic during this test. Unacceptable sources of network traffic include SNMP queries of the modem or SNMP agents with "discovery" capabilities, ARPs or Ping packets.

## Expected Test Times

For each test case of Phy-15.2, DAQTron's fully-automated Test Script test time averages approximately 20 minutes for Procedures 1-3.

## PICS Coverage

From SP-PICSV2.0-W03-020325

PICS Item	Feature	Quality
200539	The output transmit power MUST be maintained constant within a TDMA burst to within less than 0.1 dB (excluding the amount theoretically present due to pulse shaping and amplitude modulation in the case of 8 QAM, 16 QAM, 32 QAM, 64 QAM in TDMA)	Direct
200457	The Output Power of the CM MUST be settled to within $\pm 0.1$ dB of its final output power level a) within 5 $\mu$ sec from the beginning of a change of 1 dB or less, and b) within 10 $\mu$ sec from the beginning of a change of greater than 1 dB	Direct