DOCSIS ATP 2.0

Phy-24.2

JUPITER 200 ATP PHY-24.2 TEST SCRIPT DATA SHEET

MER Test

A DOCSIS 2.0 ATP TEST SCRIPT DATA SHEET

Jupiter 200 Phy-24.2

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Jupiter 200 – Phy-24.2

"Measures the fidelity of the CM transmit waveforms across different modulations, symbol rates, and channel frequencies. In all cases the transmit equalizer is turned off." – ***DOCSIS 2.0 ATP***

Introduction

This test measures the Modulation Error Ratio (MER) due to modem transmitter implementation loss. The test is run in S-CDMA mode at modulation rates of 1280 kHz, 2560 kHz, and 5120 kHz, and in TDMA mode at modulation rates of 160 kHz, 320 kHz, 640 kHz, 1280 kHz, 2560 kHz and 5120 kHz. The test is run over a set of defined upstream frequencies and modulations and uses a Vector Signal Analyzer (VSA) with burst demodulation capabilities to measure the MER. For S-CDMA mode, the capabilities of a VSA with TDMA burst demodulation capabilities is extended through the use of post-processing to perform de-spreading and any necessary gain, phase or frequency adjustments.

Test Requirements

This test requires a packet generator to send packets to the CM under test. A VSA is configured to demodulate the upstream bursts and record the MER averaged from ten bursts. This test requires SNMP to set the upstream channel frequency, symbol rate, modulation type, S-CDMA mode enable and TCM encoding.
For S-CDMA mode, there is an additional requirement that the CM send a spreader-off burst to serve as a synchronization reference and then follow it with the desired spreader-on burst.
The CMTS must be configured for S-CDMA mode such that it schedules a spreader-off burst preceding each of the spreader-on bursts. As an interim prototype solution, the test is run using the TDMA burst demodulator function of the VSA where the spreader-off burst is demodulated and then it and the following spreader-on bursts are captured. The captured waveform is then uploaded to a workstation for post-processing in which the spreader-on bursts are de-spread and corrected for any phase, frequency and or gain offset.
The method of instructing a CMTS to send a spreader-off burst followed by a spreader-on burst requires a special test mode.

MER is measured at the following channel center frequencies (with modulation rate in kHz):
(5 + modulation_rate*0.000625) MHz,
10 MHz,

15 MHz,
30 MHz,
35 MHz,
(42 - modulation_rate*0.000625) MHz

Also MER is measured with the following modulations:
TDMA: QPSK, 8QAM, 16 QAM, 32QAM, 64QAM
S-CDMA: QPSK, 8QAM, 16QAM, 32QAM, 64QAM, 128QAM TCM

It is not necessary to exhaustively test all combinations of the above parameters. The table in the Results section of this document defines the 24 test cases covering the above parameters.

Setup

The Jupiter 200 Phy-24.2 Test Script utilizes Jupiter hardware as shown in Figure 1 of the **Jupiter 200 Phy Hardware Setup Data Sheet** document.

Procedure

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.	CMTS is assumed to be powered on and in a state that allows modems to log in.	CMTS is not reboot for each CM.
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. Set packet length to 1518 bytes		None
5. Configure CMTS for Test Case 1 in the Results Table.	Test cases used are defined in the Environment File associated with the test. The default Environment File contains all 24 ATP test cases.	None
6. Send packets from the packet generator to the CM at a rate of 10 packets per second.	Packet rate is chosen in the Environment File.	Possible

As Stated by DOCSIS 2.0 ATP:	As Performed by Jupiter:	Deviation
7. Use VSA to capture a data burst. If S-CDMA mode, Upload captured spreader-on burst to test controller. De-spread burst and determine demodulated burst parameters.	VSA is used to capture data. S-CDMA dispreading and MER calculation is handled in the PC by the Test Script.	None
8. Repeat Step 7 until 10 bursts have been captured and MER measurements averaged.	The number of measurements to make per test-case is defined in the Environment File associated with the test. The default Environment File is set to 10 measurements per test-case.	None
9. Record the average MER from the 10 bursts into the appropriate results table.	Average MER is reported by the script.	None
10. Configure CMTS for next test case and repeat from Step 6 until all 24 test cases have been covered.	An unlimited number of test-cases may be defined in the Environment File.	None
11. End of test.	End of test.	None

Environment File Details

Using this file as shown below with all items set to TRUE will conduct the test in its entirety as described above in the **Procedure** section. Some comments have been added and denoted with "//" preceding the comments. Any test sections set to FALSE will be skipped when the test is executed. The environment file shown below sets all listed test cases (channel types, modulations, channel widths, frequencies). DAQTron's Test Sequencer, described in the **DAQTron Jupiter 110/200 Operator's Guide**, is used to cycle through various environment files.

Phy-24.2.env

```
[Phy-24.2]
Modulation Profile Definition File=C:\DAQTron\2.2 Development\2.0 Source
Code\Phy\Phy-24.2\Support Files\Modulation Profile Definitions.txt
                                    //* Location of Modulation Profiles used
                                    //* in the test cases listed below.  If left blank,
                                    //* will search default locations
# Measurements/Case=10
Tune TDMA Symbol Rates=True         //* If true, symbol rate is tuned +-250 ppm of
                                    //* nominal rate to maximize MER
VSA Trace File=                     //* If a file path/name is entered here, the raw
                                    //* complex constellation points from the VSA will
                                    //* be saved in this file
Periodic Ranging Interval (sec)=29  //* Rate for periodic ranging opportunities (IUC 4),
```

```
                                        //* in addition to those generated by the MER
                                        //* test mode, to be provided
Packet Rate to test at (pps)=10         //* Packet rate to use during testing

[Test Case 1]
Test Description="ATP Test Point 1"     //* User-defined name
Channel Type="scdma (3)"                //* "tdma (1)", "atdma (2)", "scdma (3)"
Channel Width="1600 kHz"                //* "200 kHz", "400 kHz", "800 kHz",
                                        //*  "1600 kHz", "3200 kHz", "6400 kHz"
Modulation Profile="S-CDMA QPSK"        //* Profile name defined in Modulation
                                        //* Profile Definition File listed above
Frequency=5800000
Enable=True                         //* True enables test point, False skips test point
Symbols To Use=100                  //* Number of symbols to measure MER over

[Test Case 2]
Test Description="ATP Test Point 2"
Channel Type="scdma (3)"
Channel Width="6400 kHz"
Modulation Profile="S-CDMA 64-QAM"
Frequency=8200000
Enable=True
Symbols To Use=400

[Test Case 3]
Test Description="ATP Test Point 3"
Channel Type="scdma (3)"
Channel Width="3200 kHz"
Modulation Profile="S-CDMA 8-QAM"
Frequency=10000000
Enable=True
Symbols To Use=200

[Test Case 4]
Test Description="ATP Test Point 4"
Channel Type="scdma (3)"
Channel Width="6400 kHz"
Modulation Profile="S-CDMA 64-QAM"
Frequency=10000000
Enable=True
Symbols To Use=400

[Test Case 5]
Test Description="ATP Test Point 5"
Channel Type="scdma (3)"
Channel Width="1600 kHz"
Modulation Profile="S-CDMA 128-QAM"
Frequency=15000000
Enable=True
Symbols To Use=800

[Test Case 6]
```

```
Test Description="ATP Test Point 6"
Channel Type="scdma (3)"
Channel Width="6400 kHz"
Modulation Profile="S-CDMA 32-QAM"
Frequency=15000000
Enable=True
Symbols To Use=400

[Test Case 7]
Test Description="ATP Test Point 7"
Channel Type="scdma (3)"
Channel Width="3200 kHz"
Modulation Profile="S-CDMA 64-QAM"
Frequency=30000000
Enable=True
Symbols To Use=400

[Test Case 8]
Test Description="ATP Test Point 8"
Channel Type="scdma (3)"
Channel Width="6400 kHz"
Modulation Profile="S-CDMA 16-QAM"
Frequency=30000000
Enable=True
Symbols To Use=200

[Test Case 9]
Test Description="ATP Test Point 9"
Channel Type="scdma (3)"
Channel Width="1600 kHz"
Modulation Profile="S-CDMA 128-QAM"
Frequency=35000000
Enable=True
Symbols To Use=800

[Test Case 10]
Test Description="ATP Test Point 10"
Channel Type="scdma (3)"
Channel Width="6400 kHz"
Modulation Profile="S-CDMA 16-QAM"
Frequency=35000000
Enable=True
Symbols To Use=200

[Test Case 11]
Test Description="ATP Test Point 11"
Channel Type="scdma (3)"
Channel Width="6400 kHz"
Modulation Profile="S-CDMA QPSK"
Frequency=38800000
Enable=True
Symbols To Use=100

[Test Case 12]
```

```
Test Description="ATP Test Point 12"
Channel Type="scdma (3)"
Channel Width="1600 kHz"
Modulation Profile="S-CDMA 128-QAM"
Frequency=41200000
Enable=True
Symbols To Use=800

[Test Case 13]
Test Description="ATP Test Point 13"
Channel Type="atdma (2)"
Channel Width="200 kHz"
Modulation Profile="A-TDMA QPSK"
Frequency=5100000
Enable=TRUE
Symbols To Use=100

[Test Case 14]
Test Description="ATP Test Point 14"
Channel Type="atdma (2)"
Channel Width="6400 kHz"
Modulation Profile="A-TDMA 64-QAM"
Frequency=8200000
Enable=TRUE
Symbols To Use=400

[Test Case 15]
Test Description="ATP Test Point 15"
Channel Type="atdma (2)"
Channel Width="400 kHz"
Modulation Profile="A-TDMA 8-QAM"
Frequency=10000000
Enable=TRUE
Symbols To Use=200

[Test Case 16]
Test Description="ATP Test Point 16"
Channel Type="atdma (2)"
Channel Width="6400 kHz"
Modulation Profile="A-TDMA 32-QAM"
Frequency=10000000
Enable=TRUE
Symbols To Use=400

[Test Case 17]
Test Description="ATP Test Point 17"
Channel Type="atdma (2)"
Channel Width="800 kHz"
Modulation Profile="A-TDMA 16-QAM"
Frequency=15000000
Enable=TRUE
Symbols To Use=200

[Test Case 18]
```

```
Test Description="ATP Test Point 18"
Channel Type="atdma (2)"
Channel Width="6400 kHz"
Modulation Profile="A-TDMA QPSK"
Frequency=15000000
Enable=TRUE
Symbols To Use=100

[Test Case 19]
Test Description="ATP Test Point 19"
Channel Type="atdma (2)"
Channel Width="1600 kHz"
Modulation Profile="A-TDMA 32-QAM"
Frequency=30000000
Enable=TRUE
Symbols To Use=400

[Test Case 20]
Test Description="ATP Test Point 20"
Channel Type="atdma (2)"
Channel Width="6400 kHz"
Modulation Profile="A-TDMA 32-QAM"
Frequency=30000000
Enable=TRUE
Symbols To Use=400

[Test Case 21]
Test Description="ATP Test Point 21"
Channel Type="atdma (2)"
Channel Width="3200 kHz"
Modulation Profile="A-TDMA 64-QAM"
Frequency=35000000
Enable=TRUE
Symbols To Use=400

[Test Case 22]
Test Description="ATP Test Point 22"
Channel Type="atdma (2)"
Channel Width="6400 kHz"
Modulation Profile="A-TDMA 16-QAM"
Frequency=35000000
Enable=TRUE
Symbols To Use=200

[Test Case 23]
Test Description="ATP Test Point 23"
Channel Type="atdma (2)"
Channel Width="6400 kHz"
Modulation Profile="A-TDMA QPSK"
Frequency=38800000
Enable=TRUE
Symbols To Use=100

[Test Case 24]
```

```
Test Description="ATP Test Point 24"
Channel Type="atdma (2)"
Channel Width="200 kHz"
Modulation Profile="A-TDMA 64-QAM"
Frequency=41900000
Enable=TRUE
Symbols To Use=400
```

Limit File Details

The limit file shown below for Phy-24.2 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**.

This file contains the 18 limits for the 24 ATP specified test cases. According to the RFI, MER is a function of frequency and channel-width only.

Phy-24.2.lmt

```
MER 5.1 MHz 200 kHz,c0%r,GE,23
MER 5.8 MHz 1600 kHz,c0%r,GE,23
MER 8.2 MHz 6400 kHz,c0%r,GE,20
MER 10.0 MHz 400 kHz,c0%r,GE,27
MER 10.0 MHz 3200 kHz,c0%r,GE,27
MER 10.0 MHz 6400 kHz,c0%r,GE,24
MER 15.0 MHz 800 kHz,c0%r,GE,30
MER 15.0 MHz 1600 kHz,c0%r,GE,30
MER 15.0 MHz 6400 kHz,c0%r,GE,27
MER 30.0 MHz 1600 kHz,c0%r,GE,30
MER 30.0 MHz 3200 kHz,c0%r,GE,30
MER 30.0 MHz 6400 kHz,c0%r,GE,27
MER 35.0 MHz 1600 kHz,c0%r,GE,27
MER 35.0 MHz 3200 kHz,c0%r,GE,27
MER 35.0 MHz 6400 kHz,c0%r,GE,24
MER 38.8 MHz 6400 kHz,c0%r,GE,20
MER 41.2 MHz 1600 kHz,c0%r,GE,23
MER 41.9 MHz 200 kHz,c0%r,GE,23
```

Test Results

The Test Results tab in the Phy-24.2 Data Viewer displays a tab for Tabular reports and another tab for Graphical Reports. The Progress tab shown below displays test progress.

Figure 1. Progress Tab for Jupiter 200 Phy-24.2.

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.

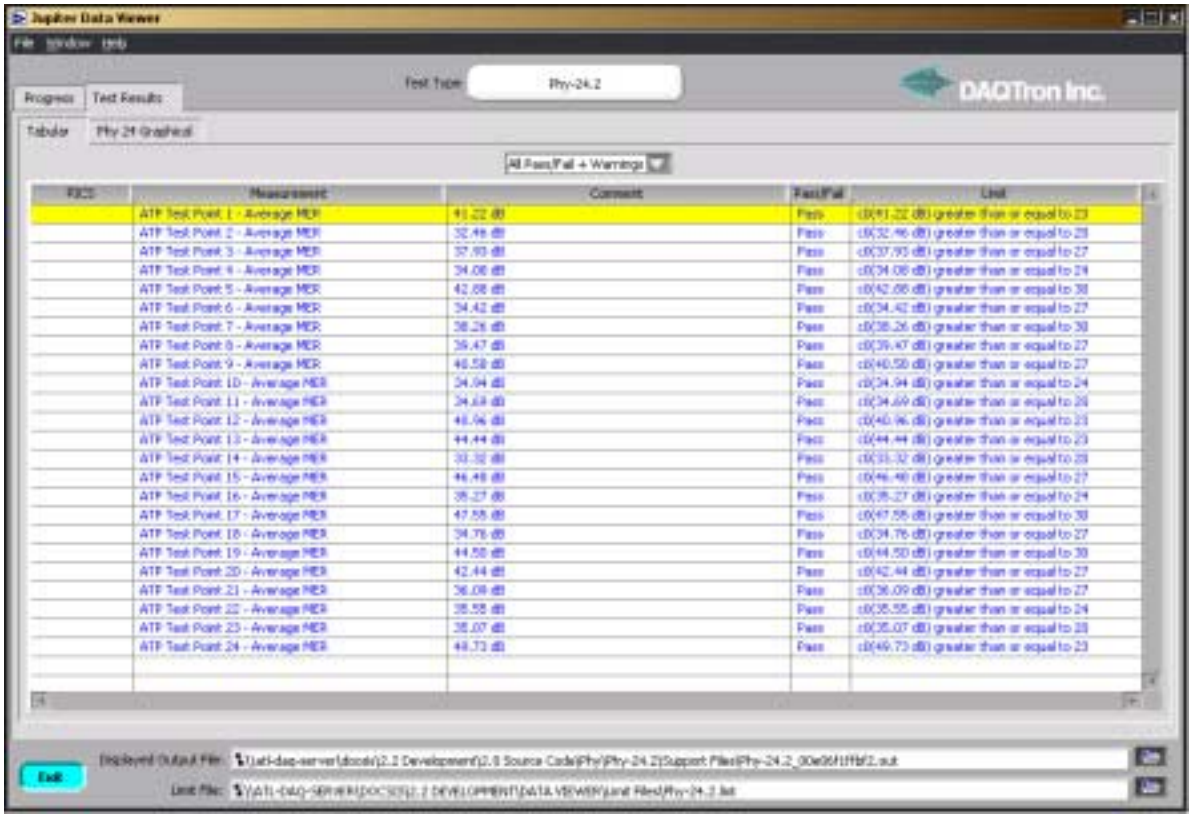

Figure 2. Tabular Results for Jupiter 200 Phy-24.2.

Graphical Reports

The graphical results tab will show numerical test results in a graphical format. Two graphs are shown on the Phy-24 graphical results tab. The left graph shows MER vs. symbol, and the right graph shows a constellation plot with both measured and nominal (ideal) constellation points. A pull-down menu above the graphs allows switching between different test points. The Ctrl-up and Ctrl-down combination-keys may be used to quickly step through the test points.

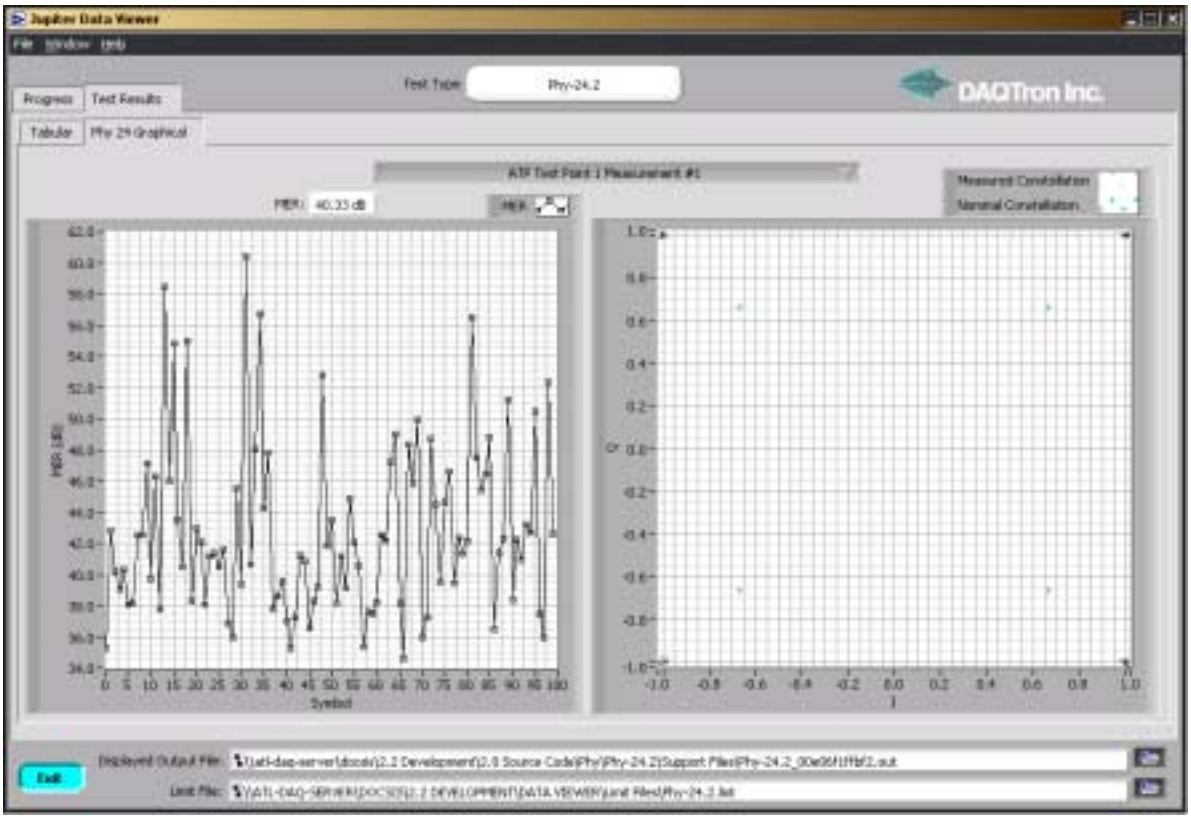

Figure 3. Graphical Results for Jupiter 200 Phy-24.2.

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.

1. This test must be run on a CMTS that implements the CableLabs Test Mode 108 (MER mode).

2. When viewing graphical results (constellation plot) in Data Viewer for QPSK cases, the results may be scaled to fit the QPSK1 grid points instead of the QPSK0 grid points. This is a Data Viewer artifact, and does not affect the MER calculation.

3. When viewing graphical results (constellation plot) in Data Viewer, note that the nominal/ideal constellation locations include both the QPSK0 and QPSK1 preamble locations in addition to the other constellation symbols belonging to the modulation used. Symbols that show up at these points are used for the MER calculation.

4. MER values are sensitive to the number of symbols used for the calculation (see the Environment File above). A larger number of symbols tends to yield lower (due to symbol rate differences between the modem and the VSA) but more repeatable MERs, whereas a smaller number of symbols tends to yield larger but less repeatable MERs. The numbers in the default Environment File were chosen based upon a limited number of modems available during script development, and may be tweaked to optimize results with your modem. Note that most VSA's have a minimum number of points that are required to lock onto the burst. See your VSA's documentation for more information.

5. Note that packets generated for the test are 1518 bytes long, and the script does not check that the number of symbols specified in the Environment File is less than the number of symbols transmitted by the modem. Also note that the number of symbols available for measurement is limited by your VSA. Finally, note that for SCDMA cases, the number of symbols specified is only the symbols for the measurement, and does not include the MER mode spreader-off burst (periodic ranging packet) and the time between the MER mode spreader-off burst and the spreader-on burst. This additional time, however, reduces the number of symbols available on the VSA for MER measurements.

6. The script is robust, and additional test cases may be added to the Environment File that are not in the ATP at the operator's discretion.

7. The Terayon Bluewave CMTS (3200 and 3500 models), running software revision 2.0.0.0.21 ("2k21"), does not reply to the periodic ranging messages (IUC4) generated by the modem before each packet when using the MER test mode. Modems being tested will experience T3 timeouts because these replies are not sent. Periodic ranging messages generated by the modem that are not associated with the MER test mode (e.g., regular opportunities) are handled correctly. If your modem experiences problems with T3 timeouts, reduce the packet rate and periodic ranging interval in the Environment File. This should only be an issue with the S-CDMA cases, as the A-TDMA cases do not use the MER test mode.

Expected Test Times

For all 24 ATP specified test cases of Phy-24.2, DAQTron's fully-automated Test Script test time averages approximately 1 hour and 40 minutes.

PIC Coverage

From SP-PICSv2.0-W03-020325

PICid	Feature	Status
200650.1	The measured MER MUST meet the following limits for all modulations:): Case 1a (measured at the F connector for modulation rates 2.56 MHz and below): MER 30 dB over 15 to 30 MHz carrier frequency; MER 27 dB over 10 MHz to 15 MHz and 30 MHz to 35 MHz carrier frequency.	Directly Measured
200650.2	The measured MER MUST meet the following limits for all modulations: Case 1b (measured at the F connector for modulation rate 5.12 MHz): MER 27 dB over 15 to 30 MHz carrier frequency; MER 24 dB over 10 MHz to 15 MHz and 30 MHz to 35 MHz carrier frequency.	Directly Measured
200651	MER should be measured on a modulation analyzer with adaptive receive equalization disabled	Directly Measured
200656	fc - 5Rs/8 Hz to fc + 5Rs/8 Hz: Group Delay Variation MUST NOT be greater than 100 nsec	Not Measured