

# IEEE 1149.4 Mixed-Signal Test Bus Working Group Meeting Minutes

for  
February 22<sup>nd</sup>, 2005

9:00AM-11:00AM

## Meeting Agenda:

Time	Topic	Responsibility
9:00 AM	Introduction	Bambang Suparjo
9:05-11:00 AM	1. Review of Straw_Dog_2_0 Proposal. 2. Identification of Critical Issues for Next Actions.	Adam Ley
11:00 AM	Summary and Adjourn	Bambang Suparjo

## Meeting Attendees:

Name	Company
Pete Collins	JTAG Technology
Jake Karrfalt	ASC
Adam Ley	Asset-Intertech
Keith Lofstrom	Keith Lofstrom Integrated Circuits
Heiko Ehrenberg	Goepel
Ken Parker	Agilent Technologies
Rohit Kapur	Synopsys
Bambang Suparjo	Mentor Graphics

## Sending Regret:

- Adam Osseiran
- Steve Sunter
- Adam Cron

## 1. Introduction

Bambang moderated the teleconference. The meeting was based on Straw\_Dog\_2\_0 proposed by Adam Ley (Appendix A-C):

- a. Straw\_Dog\_2\_0, BSDL description of a simple 1149.4 device (Appendix A)
- b. MST Extension, where MST stands for Mixed-Signal Test (Appendix B)
- c. STD\_1149\_4\_2005 (Appendix C).

## 2. Review of Straw\_Dog\_2\_0

Adam Ley led the discussion and below are the extracted information from Adam Ley email (Appendix D) and the relevant information in Appendix A-C.

### 2.1 Semantic Checks for PROBE

PROBE will be a keyword for MST BSDL and as such needs to be an addition to the reserved words of BSDL and VHDL.

Semantic checks proposed for PROBE include:

- = it shall be present in the INSTRUCTION\_OPCODE attribute.
- = it shall be present in the REGISTER\_ACCESS attribute wherein it is associated with register BOUNDARY.

### 2.2 Semantic Checks for BOUNDARY\_REGISTER

Semantic checks proposed for BOUNDARY\_REGISTER include:

- = disable value for cells with function BIDIR associated with analog pins (including ATAP pins and any pins provided with ABMs) shall be 0.
- = disable result for cells with function BIDIR associated with analog pins (including ATAP pins and any pins provided with ABMs) shall be Z (??).
- = cells with function BIDIR associated with ATAP pins AT1 and AT2 shall share a single control cell between themselves and that control cell shall not be shared otherwise.
- = cells with function BIDIR associated with any pins provided with ABMs shall have a control cell that is not shared with any other.

### 2.3 Control Cells for TBIC and ABM

```
-- The following cells (4) are TBIC controls
-- num cell port function safe [ccell disval rslt]
"2 (BC_7, AT1, bidir, 0, 4, 0, Z), " &
"3 (BC_7, AT2, bidir, 0, 4, 0, Z), " &
"4 (BC_1, *, control, 0), " & -- required safe bits
"5 (BC_1, *, internal, 0), " & -- required safe bits

-- The following cells (4) control the Y analog signal
-- num cell port function safe [ccell disval rslt]
"6 (BC_7, Y, bidir, 0, 7, 0, Z), " &
```

```

"7 (BC_1, *, control, 0), " & -- required safe bits
"8 (BC_1, *, internal, 0), " & -- required safe bits
"9 (BC_1, *, internal, 0), " & -- required safe bits

-- The following cells (4) control the W analog signal
-- num cell port function safe [ccell disval rslt]
"10 (BC_7, W, bidir, 0, 11, 0, Z), " &
"11 (BC_1, *, control, 0), " & -- required safe bits
"12 (BC_1, *, internal, 0), " & -- required safe bits
"13 (BC_1, *, internal, 0)"; -- required safe bits

```

- a. Safe values for cells 2, 3, 6 and 10 can be 0, 1, or X; change them to X since no specific value is require (x is ambiguous by definition). Deleted: and
- b. The disval for cells 2, 3, 6, and 10 must be 0.
- c. The disable result for cells 2, 3, 6, and 10 must be Z.
- d. The safe val for cells 4, 7 and 11 must be 0 to disable associated controlled ports but the control cell value can be 0 or 1 to disable or enable the ports, respectively. Deleted: and
- e. The safe val for cells 5, 8, 9, 12 and 13 must be 0 to preserve conventional 1149.1 operation and that no other value should be required by any tool that operates strictly in the 1149.1 context (without awareness of 1149.4 functions/features). Deleted: c  
Deleted: and
- f. Cells 4, 7 and 10 are not limited to BC\_1 cell type only and also cells 2 and 3 (AT1 and AT2) are not limited to BC\_7 cell type. Deleted: d  
Deleted: can use either
- g. For TBIC, both cell 2 and cell 3 can have a common control cell but each ABM needs its own control cell e.g. for pin Y, cell 7 controls cell6 and for pin W, cell 11 controls cell10. Deleted: or BC\_2 boundary scan cell types  
Deleted: e

## 2.4 MST Extension

```

-- Extension declarations are made in the user package named
-- "STD_1149_4_2005"

-- Extension definitions

attribute MST_Component_Conformance of Straw_Dog_2_0 : entity is
"STD_1149_4_1999";

attribute MST_ATAP_AT1 of Straw_Dog_2_0 : entity is "AT1";
attribute MST_ATAP_AT2 of Straw_Dog_2_0 : entity is "AT2";

attribute MST_TBIC_Base of Straw_Dog_2_0 : entity is
-- D1 D2 Co Ca
"2, 3, 4, 5";

attribute MST_ABM_List of Straw_Dog_2_0 : entity is

```

```
-- port partition D Co B1 B2
"W ( 1, 10, 11, 12, 13), " &
"Y ( 1, 6, 7, 8, 9)";
```

- a. In RTF (Appendix B), page 1, all occurrences of "{}" pairs should be replaced with "[]" pairs.
- b. In RTF (Appendix B), page 2, attribute MSG\_TBIC\_Add\_Partition\_Count is not needed; delete it.
- c. In STRAW\_DOG\_2\_0 and in RTF, for attribute MST\_TBIC\_Base, change cell the order to "Ca, Co, D1, D2" to match table 2; and reference tables 1, and 2. Tables 4 and 5 are for partition case.
- d. In STRAW\_DOG\_2\_0 and in RTF, for attribute MST\_ABM\_List, change item order to "port (partition: C, D, B1, B2)"; and reference tables 6, 7, and 8.

Deleted: ,

Deleted: , 4, and 5

## 2.5 Other issues

- a. Need KITCHEN\_SINK example... (that includes all possible attributes).
- b. How might the syntax be evolved to deal with chips that have multiple ATAPs?
- c. Should the syntax require the partitions to be explicitly named/ referenced?
- d. Syntax needs to permit ABMs to be associated with internal nodes (which do not appear in the port list); probably want to explicitly declare the list of internal signals that are so treated...
- e. Syntax/ semantics needs to permit ABMs to be associated with linkage ports (such as GND and VDD)

## 3. Identification of Critical Issues for Next Actions.

There was no critical issue but Adam Ley will provide the ABSDL update.

## 4. Summary and Adjourn

Bambang summarized the meeting and the teleconference was adjourned at 11:00 AM.

## Appendix A – Straw\_Dog\_2\_0

```
-- Straw Dog 2.0 BSDL description of a simple 1149.4 device
-- This is an 1149.1-compatible BSDL that does encode 1149.4 features.
```

-- Still suitable for use with 1149.1 Interconnect Testing software.

```
entity Straw_Dog_2_0 is
generic (PHYSICAL_PIN_MAP : string := "dip");

port(TCK, TDI, TMS: in bit;
      TDO: out bit;          -- TAP pins
      AT1, AT2: inout bit;  -- ATAP pins (bidir)
      A, B: in bit;         -- Digital pins
      W, Y: inout bit;      -- Analog pins
      NC1, NC2: linkage bit;
      GND, VCC: linkage bit);

use STD_1149_1_2001.all; -- Get Std 1149.1-2001 attrs and defns
use STD_1149_4_2005.all; -- Get MST attributes and definitions

attribute COMPONENT_CONFORMANCE of Straw_Dog_2_0 : entity is
  "STD_1149_1_2001";

attribute PIN_MAP of Straw_Dog_2_0 : entity is PHYSICAL_PIN_MAP;

constant dip:PIN_MAP_STRING:=
  "TCK:6, TDI:5, TMS:8, " &
  "TDO:9, " &
  "AT1:11, AT2:10, " &
  "A:1, B:2, " &
  "W:13, Y:12, " &
  "NC1:3, NC2:4, " &
  "GND:7, VCC:14";

attribute TAP_SCAN_IN of TDI : signal is true;
attribute TAP_SCAN_MODE of TMS : signal is true;
attribute TAP_SCAN_OUT of TDO : signal is true;
attribute TAP_SCAN_CLOCK of TCK : signal is (20.0e6, BOTH);

attribute INSTRUCTION_LENGTH of Straw_Dog_2_0 : entity is 2;

attribute INSTRUCTION_OPCODE of Straw_Dog_2_0 : entity is
  "EXTEST (00), " &
  "PRELOAD (01), " &
  "SAMPLE (01), " &
  "PROBE (10), " &
  "BYPASS (11)";

attribute INSTRUCTION_CAPTURE of Straw_Dog_2_0 : entity is "01";

attribute REGISTER_ACCESS of Straw_Dog_2_0 : entity is
  "BOUNDARY (EXTEST, PRELOAD, SAMPLE, PROBE), " &
  "BYPASS (BYPASS)";

attribute BOUNDARY_LENGTH of Straw_Dog_2_0 : entity is 14;

attribute BOUNDARY_REGISTER of Straw_Dog_2_0 : entity is
  -- The following cells (2) are for the digital pins
  -- num cell port function safe [ccell disval rslt]
  "0 (BC_1, A, input, x), " &
  "1 (BC_1, B, input, x), " &
```

```

-- The following cells (4) are TBIC controls
-- num cell port function safe [ccell disval rslt]
"2 (BC_7, AT1, bidir, 0, 4, 0, Z), " &
"3 (BC_7, AT2, bidir, 0, 4, 0, Z), " &
"4 (BC_1, *, control, 0), " & -- required safe bits
"5 (BC_1, *, internal, 0), " & -- required safe bits

-- The following cells (4) control the Y analog signal
-- num cell port function safe [ccell disval rslt]
"6 (BC_7, Y, bidir, 0, 7, 0, Z), " &
"7 (BC_1, *, control, 0), " & -- required safe bits
"8 (BC_1, *, internal, 0), " & -- required safe bits
"9 (BC_1, *, internal, 0), " & -- required safe bits

-- The following cells (4) control the W analog signal
-- num cell port function safe [ccell disval rslt]
"10 (BC_7, W, bidir, 0, 11, 0, Z), " &
"11 (BC_1, *, control, 0), " & -- required safe bits
"12 (BC_1, *, internal, 0), " & -- required safe bits
"13 (BC_1, *, internal, 0)"; -- required safe bits

-- Now add extensions for 1149.4

-- Extension declarations are made in the user package named
-- "STD_1149_4_2005"

-- Extension definitions

attribute MST_Component_Conformance of Straw_Dog_2_0 : entity is
"STD_1149_4_1999";

attribute MST_ATAP_AT1 of Straw_Dog_2_0 : entity is "AT1";
attribute MST_ATAP_AT2 of Straw_Dog_2_0 : entity is "AT2";

attribute MST_TBIC_Base of Straw_Dog_2_0 : entity is
-- D1 D2 Co Ca
"2, 3, 4, 5";

attribute MST_ABM_List of Straw_Dog_2_0 : entity is
-- port partition D Co B1 B2
"W ( 1, 10, 11, 12, 13), " &
"Y ( 1, 6, 7, 8, 9)";

end Straw_Dog_2_0;

```

## Appendix B – MST Extension

```

<MST Extension> ::=

  <MST component conformance statement>
  <MST ATAP identification statement>
  <MST TBIC base statement>
  { <MST TBIC additional partition count statement>
    <MST TBIC additional partition list statement> }

```

<MST ABM list statement>

---

<MST component conformance statement> ::=  
    **attribute MST\_Component\_Conformance of** <component name> : **entity is**  
    <MST conformance string>;

<MST conformance string> ::= " <MST conformance identification> "

<MST conformance identification> ::= **STD\_1149\_4\_1999**

---

<MST ATAP identification statement> ::=  
    **attribute MST\_ATAP\_AT1 of** <component name> : **entity is** <port ID  
string>;  
    **attribute MST\_ATAP\_AT2 of** <component name> : **entity is** <port ID  
string>;  
    { **attribute MST\_ATAP\_AT1N of** <component name> : **entity is** <port ID  
string>;  
      **attribute MST\_ATAP\_AT2N of** <component name> : **entity is** <port ID  
string>; }

<port ID string> ::= " <port ID> "

---

<MST TBIC base statement> ::=  
    **attribute MST\_TBIC\_Base of** <component name> : **entity is**  
    <MST TBIC base string>

<MST TBIC base string> ::= " <MST TBIC base description> "

<MST TBIC base description> ::=  
    <MST TBIC base D1 cell number>,  
    <MST TBIC base D2 cell number>,  
    <MST TBIC base Ca cell number>,  
    <MST TBIC base Co cell number>  
    { , <MST TBICN base D1 cell number>,  
      <MST TBICN base D2 cell number>,  
      <MST TBICN base Ca cell number>,  
      <MST TBICN base Co cell number> }

<MST TBIC base D1 cell number> ::= <integer>  
<MST TBIC base D2 cell number> ::= <integer>  
<MST TBIC base Ca cell number> ::= <integer>  
<MST TBIC base Co cell number> ::= <integer>  
<MST TBICN base D1 cell number> ::= <integer>  
<MST TBICN base D2 cell number> ::= <integer>  
<MST TBICN base Ca cell number> ::= <integer>  
<MST TBICN base Co cell number> ::= <integer>

---

<MST TBIC additional partition count statement> ::=

```

attribute MST_TBIC_Add_Partition_Count of <component name> : entity
is
    <MST TBIC additional partition count string>;

<MST TBIC additional partition count string> ::=
    " <MST TBIC additional partition count> "

<MST TBIC additional partition count> ::= <integer>



---



<MST TBIC additional partition list statement> ::=
attribute MST_TBIC_Add_Partition_List of <component name> : entity is
    <MST TBIC additional partition list string>;

<MST TBIC additional partition list string> ::=
    " <MST TBIC additional partition list> "

<MST TBIC additional partition list> ::=
    <MST TBIC additional partition entry>
    {, <MST TBIC additional partition entry> }

<MST TBIC additional partition entry> ::=
    <MST TBIC additional partition number>
    ( <MST TBIC additional partition cells> )

<MST TBIC additional partition number> ::= <integer>
<MST TBIC additional partition cells> ::=
    <MST TBIC additional partition D1 cell number>,
    <MST TBIC additional partition D2 cell number>
    {, <MST TBICN additional partition D1 cell number>,
    <MST TBICN additional partition D2 cell number> }

<MST TBIC additional partition D1 cell number> ::= <integer>
<MST TBIC additional partition D2 cell number> ::= <integer>
<MST TBICN additional partition D1 cell number> ::= <integer>
<MST TBICN additional partition D2 cell number> ::= <integer>



---



<MST ABM list statement> ::=
attribute MST_ABM_List of <component name> : entity is
    <MST ABM list string>;

<MST ABM list string> ::= " <MST ABM list> "

<MST ABM list> ::= <MST ABM entry> {, <MST ABM entry> }

<MST ABM entry> ::= <port ID> ( <MST ABM description> )

<MST ABM description> ::=
    <MST TBIC partition number>,
    <MST ABM D cell number>,
    <MST ABM C cell number>,
    <MST ABM B1 cell number>,
    <MST ABM B2 cell number>

<MST TBIC partition number> ::= <integer>

```

```
<MST ABM D cell number> ::= <integer>
<MST ABM C cell number> ::= <integer>
<MST ABM B1 cell number> ::= <integer>
<MST ABM B2 cell number> ::= <integer>
```

## Appendix C - STD\_1149\_4\_2005

Package STD\_1149\_4\_2005 is

```
    use STD_1149_1_2001.all;

    attribute MST_Component_Conformance : BSDL_Extension;
    attribute MST_ATAP_AT1      : BSDL_Extension;
    attribute MST_ATAP_AT2      : BSDL_Extension;
    attribute MST_ATAP_AT1N     : BSDL_Extension;
    attribute MST_ATAP_AT2N     : BSDL_Extension;
    attribute MST_TBIC_Base     : BSDL_Extension;
    attribute MST_TBIC_Add_Partition_Count : BSDL_Extension;
    attribute MST_TBIC_Add_Partition_List : BSDL_Extension;
    attribute MST_ABM_List      : BSDL_Extension;

end STD_1149_4_2005;
```

Package Body STD\_1149\_4\_2005 is

```
    use STD_1149_1_2001.all;

end STD_1149_4_2005;
```

## Appendix D – Email from Adam Ley

**From:** owner-stds-1149-4wg@LISTSERV.IEEE.ORG [mailto:owner-stds-1149-4wg@LISTSERV.IEEE.ORG] **On Behalf Of** Adam Ley  
**Sent:** Tuesday, February 22, 2005 11:51 AM  
**To:** stds-1149-4wg@IEEE.ORG  
**Subject:** my notes from Meeting/Teleconference on ABSDL Development Feb. 22, 2005 9-11AM PST - straw\_dog\_2\_0

Hello, all.

Here's a quick summary of my notes taken during our meeting earlier today. Please let me know if I missed anything or got anything wrong...

PROBE will be a keyword for MST BSDL and as such needs to be an addition to the reserved words of BSDL and VHDL

semantics checks proposed for PROBE include:

= it shall be present in the INSTRUCTION\_OPCODE attribute

= it shall be present in the REGISTER\_ACCESS attribute wherein it is associated with register BOUNDARY

in STRAW\_DOG\_2\_0, safe values for cells 2, 3, and 6 can be 0, 1, or X; change them to x since no specific value is require (x is ambiguous by definition)

semantic checks proposed for BOUNDARY\_REGISTER include:

= disable value for cells with function BIDIR associated with analog pins (including ATAP pins and any pins provided with ABMs) shall be 0

= disable result for cells with function BIDIR associated with analog pins (including ATAP pins and any pins provided with ABMs) shall be Z (??)

= cells with function BIDIR associated with ATAP pins AT1 and AT2 shall share a single control cell between themselves and that control cell shall not be shared otherwise

= cells with function BIDIR associated with any pins provided with ABMs shall have a control cell that is not shared with any other

in STRAW\_DOG\_2\_0, note that disval for cells 2, 3, 6, and 10 must be 0

in STRAW\_DOG\_2\_0, note that disable result for cells 2, 3, 6, and 10 must be Z

in STRAW\_DOG\_2\_0, note that safe val for cells 4 and 7 must be 0 to disable associated controlled ports but the control cell value can be 0 or 1 to disable or enable the ports, respectively

in STRAW\_DOG\_2\_0, note that safe val for cells 5 and 8 must be 0 to preserve conventional 1149.1 operation and that no other value should be required by any tool that operates strictly in the 1149.1 context (without awareness of 1149.4 functions/ features)

in RTF, page 1, all occurrences of "{}" pairs should be replaced with "[]" pairs

in RTF, page 2, attribute MSG\_TBIC\_Add\_Partition\_Count is not needed; delete it

in STRAW\_DOG\_2\_0 and in RTF, for attribute MST\_TBIC\_Base, change cell order to "Co, Ca, D1, D2" to match table 2; and reference tables 2, 4, and 5

in STRAW\_DOG\_2\_0 and in RTF, for attribute MST\_ABM\_List, change item order to "port (partition: C, D, B1, B2)"; and reference tables 6, 7, and 8

need KITCHEN\_SINK example... (that includes all possible attributes)

how might the syntax be evolved to deal with chips that have multiple ATAPs?

should the syntax require the partitions to be explicitly named/ referenced?

syntax needs to permit ABMs to be associated with internal nodes (which do no appear in the port list); probably want to explicitly declare the list of internal signals that are so treated...

syntax/ semantics needs to permit ABMs to be associated with linkage ports (such as GND and VDD)

Best Regards,  
Adam