

# GMII BFM – Quick Reference

This is a stripped-down version of GMII with only data lines.

For general information see UVVM Essential Mechanisms located in `uvvm_vvc_framework/doc`.

**gmii\_write** (data\_array, msg, gmii\_tx\_if, [action\_when\_transfer\_is\_done], [scope, [msg\_id\_panel, [config]]])

**Example:** `gmii_write(v_data_array(0 to v_numBytes-1), "Write v_numBytes bytes", gmii_tx_if, HOLD_LINE_AFTER_TRANSFER, C_SCOPE, shared_msg_id_panel, gmii_bfm_config);`

**Example:** `gmii_write((x"01", x"02", x"03", x"04"), "Write 4 bytes", gmii_tx_if);`

**gmii\_read** (data\_array, data\_len, msg, gmii\_rx\_if, [scope, [msg\_id\_panel, [config, [ext\_proc\_call]]]])

**Example:** `gmii_read(v_data_array, v_numBytes, "Read v_numBytes bytes", gmii_rx_if, C_SCOPE, shared_msg_id_panel, gmii_bfm_config, "gmii_expect()");`

**Example:** `gmii_read(v_data_array, v_numBytes, "Read v_numBytes bytes", gmii_rx_if);`

**gmii\_expect** (data\_exp, msg, gmii\_rx\_if, [alert\_level, [scope, [msg\_id\_panel, [config]]]])

**Example:** `gmii_expect(v_data_array(0 to v_numBytes-1), "Expect v_numBytes bytes", gmii_rx_if, ERROR, C_SCOPE, shared_msg_id_panel, gmii_bfm_config);`

**Example:** `gmii_expect((x"01", x"02", x"03", x"04"), "Expect 4 bytes", gmii_rx_if);`

**init\_gmii\_if\_signals** (VOID)

**Example:** `gmii_tx_if <= init_gmii_if_signals(VOID);`

**BFM**



*gmii\_bfm\_pkg.vhd*

#### BFM Configuration record 't\_gmii\_bfm\_config'

Record element	Type	C_GMII_BFM_CONFIG_DEFAULT
max_wait_cycles	integer	10
max_wait_cycles_severity	t_alert_level	ERROR
clock_period	time	-1 ns
clock_period_margin	time	0 ns
clock_margin_severity	t_alert_level	TB_ERROR
setup_time	time	-1 ns
hold_time	time	-1 ns
bfm_sync	t_bfm_sync	SYNC_ON_CLOCK_ONLY
match_strictness	t_match_strictness	MATCH_EXACT
id_for_bfm	t_msg_id	ID_BFM

#### Signal record 't\_gmii\_tx\_if'

Record element	Type
gtxclk	std_logic
txd	std_logic_vector(7 downto 0)
txen	std_logic

#### Signal record 't\_gmii\_rx\_if'

Record element	Type
rxclk	std_logic
rxdata	std_logic_vector(7 downto 0)
rxdv	std_logic

### BFM signal parameters

Name	Type	Description
gtxclk	std_logic	TX reference clock
txd	std_logic_vector	TX data lines (to DUT)
txen	std_logic	TX enable
rxclk	std_logic	RX reference clock
rxdata	std_logic_vector	RX data lines (from DUT)
rxdv	std_logic	RX data valid

### BFM non-signal parameters

Name	Type	Example(s)	Description
data_array data_exp	t_slv_array	(x"D0", x"D1", x"D2", x"D3")	An array of bytes containing the data to be written/read.  data_array(0) is written/read first, while data_array(data_array'high) is written/read last. For clarity, data_array is required to be ascending, for example defined by the test sequencer as follows: variable v_data_array : t_slv_array(0 to C_MAX_BYTES-1) (7 downto 0);
data_len	natural	v_data_len	The number of valid bytes in the data_array. Note that the data_array can be bigger and that is why the length is returned.
alert_level	t_alert_level	ERROR or TB_WARNING	Set the severity for the alert that may be asserted by the procedure.
msg	string	"Write bytes"	A custom message to be appended in the log/alert.
action_when_transfer_is_done	t_action_when_transfer_is_done	RELEASE_LINE_AFTER_TRANSFER	Whether to release (default) or hold the TXEN line after the procedure is finished. Useful when transmitting a packet of data through several procedures, e.g. from an Ethernet HVVC.
scope	string	"GMII_BFM"	A string describing the scope from which the log/alert originates. In a simple single sequencer typically "GMII_BFM". In a verification component typically "GMII_VVC".
msg_id_panel	t_msg_id_panel	shared_msg_id_panel	Optional msg_id_panel, controlling verbosity within a specified scope. Defaults to a common message ID panel defined in the UVVM-Util adaptations package.
config	t_gmii_bfm_config	C_GMII_BFM_CONFIG_DEFAULT	Configuration of BFM behaviour and restrictions. See section 0 for details.
ext_proc_call	string	"gmii_expect()"	External procedure call. Only use when called from another BFM procedure.

# BFM details

## 1 BFM procedure details and examples

Procedure	Description
<b>gmii_write()</b>	<b>gmii_write (data_array, msg, gmii_tx_if, [action_when_transfer_is_done], [scope, [msg_id_panel, [config]]])</b>  The gmii_write() procedure writes data to the DUT. The length and data are defined by the "data_array" argument, which is a t_slv_array. data_array(0) is written first, while data_array(data_array'high) is written last. The default value for action_when_transfer_is_done is RELEASE_LINE_AFTER_TRANSFER which drives TXEN low at the end of the procedure. However, if HOLD_LINE_AFTER_TRANSFER is used, the TXEN will be held high at the end of the procedure.
<b>gmii_read()</b>	<b>gmii_read (data_array, data_len, msg, gmii_rx_if, [scope, [msg_id_panel, [config, ext_proc_call]]])</b>  The gmii_read() procedure reads data from the DUT. The received data is stored in the data_array output, which is a t_slv_array. The number of valid bytes in the data_array is stored in data_len. data_array(0) is read first, while data_array(data_array'high) is read last.
<b>gmii_expect()</b>	<b>gmii_expect (data_exp, msg, gmii_rx_if, [alert_level, [scope, [msg_id_panel, [config]]]])</b>  Calls the gmii_read() procedure, then compares the received data with data_exp.
<b>init_gmii_if_signals()</b>	<b>init_gmii_if_signals (VOID)</b>  This function initializes the GMII interface. All the BFM outputs are set to zeros ('0')

## 2 BFM Configuration record

Type name: t\_gmii\_bfm\_config

Record element	Type	C_GMII_BFM_CONFIG_DEFAULT	Description
max_wait_cycles	integer	10	Used for setting the maximum cycles to wait before an alert is issued when waiting for signals from the DUT.
max_wait_cycles_severity	t_alert_level	ERROR	Severity if max_wait_cycles expires.
clock_period	time	-1 ns	Period of the clock signal.
clock_period_margin	time	0 ns	Input clock period margin to specified clock_period.
clock_margin_severity	t_alert_level	TB_ERROR	The above margin will have this severity.
setup_time	time	-1 ns	Setup time for generated signals. Suggested value is clock_period/4. An alert is reported if setup_time exceed clock_period/2.
hold_time	time	-1 ns	Hold time for generated signals. Suggested value is clock_period/4. An alert is reported if hold_time exceed clock_period/2.
bfm_sync	t_bfm_sync	SYNC_ON_CLOCK_ONLY	When set to SYNC_ON_CLOCK_ONLY the BFM will enter on the first falling edge, estimate the clock period, synchronise the output signals and exit ¼ clock period after a succeeding rising edge. When set to SYNC_WITH_SETUP_AND_HOLD the BFM will use the configured setup_time, hold_time and clock_period to synchronise output signals with clock edges.
match_strictness	t_match_strictness	MATCH_EXACT	Matching strictness for std_logic values in check procedures. MATCH_EXACT requires both values to be the same. Note that the expected value can contain the don't care operator '-'. MATCH_STD allows comparisons between 'H' and '1', 'L' and '0' and '-' in both values.
id_for_bfm	t_msg_id	ID_BFM	The message ID used as a general message ID in the BFM.

## 3 Compilation

The GMII BFM may only be compiled with VHDL 2008. It is dependent on the UVVM Utility Library (UVVM-Util), which is only compatible with VHDL 2008. See the separate UVVM-Util documentation for more info. After UVVM-Util has been compiled gmii\_bfm\_pkg.vhd can be compiled into any desired library. See UVVM Essential Mechanisms located in uvvm\_vvc\_framework/doc for information about compile scripts.

### 3.1 Simulator compatibility and setup

See README.md for a list of supported simulators. For required simulator setup see UVVM-Util Quick reference.

## 4 Local BFM overloads

A good approach for better readability and maintainability is to make simple, local overloads for the BFM procedures in the TB process. This allows calling the BFM procedures with the key parameters only

e.g.

```
gmii_write(v_data_array(0 to 1), "msg");
```

rather than

```
gmii_write(v_data_array(0 to 1), "msg", gmii_tx_if, C_SCOPE, shared_msg_id_panel, C_GMII_BFM_CONFIG_DEFAULT);
```

By defining the local overload as e.g.:

```
procedure gmii_write(  
    constant data_array : in t_slv_array;  
    constant msg        : in string) is  
begin  
    gmii_write(data_array,          -- keep as is  
               msg,                -- keep as is  
               gmii_tx_if,         -- Signal must be visible in local process scope  
               C_SCOPE,            -- Just use the default  
               shared_msg_id_panel, -- Use global, shared msg_id_panel  
               C_GMII_BFM_CONFIG_LOCAL); -- Use locally defined configuration or C_GMII_BFM_CONFIG_DEFAULT  
end;
```

Using a local overload like this also allows the following – if wanted:

- Set up defaults for constants. May be different for two overloads of the same BFM
- Apply dedicated message ID panel to allow dedicated verbosity control

### IMPORTANT

This is a simplified Bus Functional Model (BFM) for GMII. The given BFM complies with the basic GMII protocol and thus allows a normal access towards a GMII interface. This BFM is not a GMII protocol checker. For a more advanced BFM please contact Bitvis AS at [support@bitvis.no](mailto:support@bitvis.no)