EM203 Optical Module Evaluation Platform

User's Manual

Hardware Version

Software Version

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1. Introduction

1.1. Description

The EM203 Optical Module EMI Test Platform is a test system for qualifying optical modules for Radiated Emissions EMC test compliance. The platform doubles as both a reference signal source for verifying the Radiated Emissions test chamber and a test fixture and variable power supply and state configuration unit for the optical module under test. The platform's modular design enables support for multiple optical module transceiver standards. The test platform is controlled via an easy-to-use command-line interface command set. The command set provides access to all internal optical module transceiver registers, internal temperature regulation, and operating voltage control.

Figure 1 Instruments for EM203 testing

1.2. Applications

- Optical Module Transceiver EMI Qualification Testing

2. Hardware

2.1. EM203 System Part list

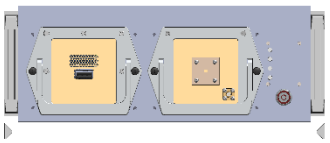
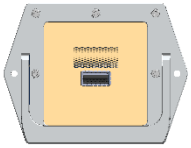
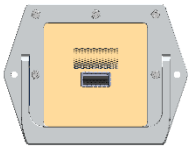
Item #	Qty.	Description	Model Number	Product Picture
1	1	Optical Module EMI Test Platform Front Panel Control	EM203	
2	1	RF Reference Source Unit – 26.5 GHz	EM203-RS1	
3	1	Optical Module Test Unit – QSFP-DD 400G	EM203-OM-QSFP1	
4	1	Optical Module Test Unit OSFP 400G	EM203-OM-OSFP1	

Table 1 List of parts for EM203 system setup

2.2. System Specs

2.2.1. EM203-Optical Module EMI Test Platform

Supported Data Rates	**QSFP-DD**		**OSFP**	
	400G	-	400G	-
Supported Device Class	**QSFP-DD**		**OSFP**	
	Class 1-8		Class 1-8	

Table 2 system specs for the EM203 system

2.2.2. EM203-RS1 RF Reference Source Unit – 26.5 GHz

Output Frequency	26.5 GHz
Nominal Output Power	-40 dBm

Table 2 system specs for the EM203 system

2.2.3. EM203-OM-QSFP1 Optical Module Test Unit – QSFP-DD 400G

Form Factor	QSFP-DD
Max Power Consumption	40 W
Shielding Effectiveness	TBD

Table 4 system specs for the EM203 system

2.2.4. EM203-OM-OSFP1 Optical Module Test Unit – OSFP 400G

Form Factor	OSFP
Max Power Consumption	40 W
Shielding Effectiveness	TBD

Table 5 system specs for the EM203 system

2.3. Optical Module EMI Test Platform Front Panel Control

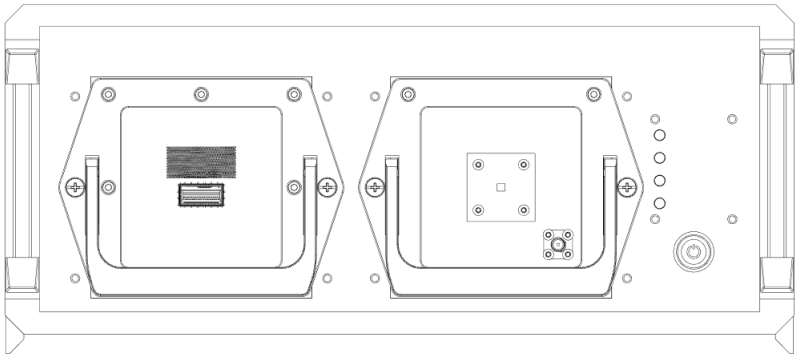


Figure 1 EM203 front panel

Figure 2 EM203 rear panel

2.4. RF Reference Source Unit - 26.5 GHz

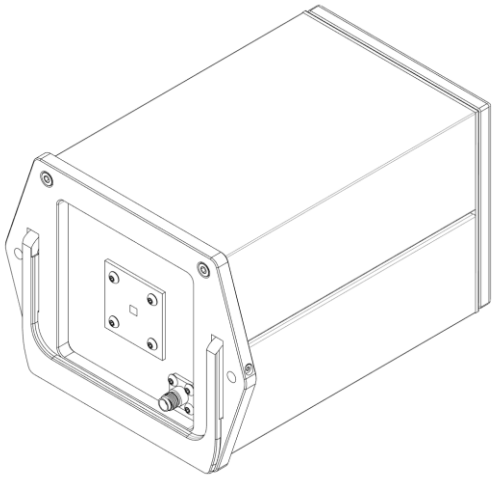


Figure 3 EM203 RF Reference Source Unit

2.5. Optical Module Test Unit - QSFP-DD 400G

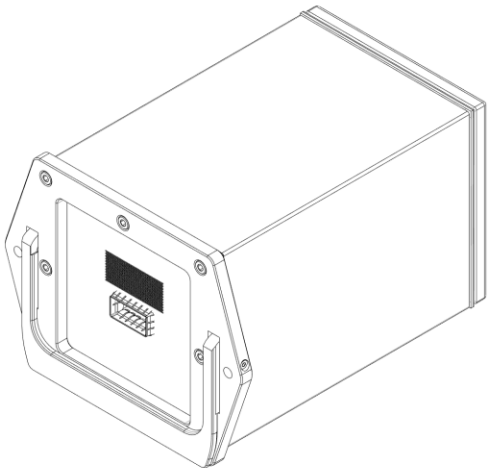


Figure 4 EM203 Optical Module Test Unit QSFP-DD 400G

2.6. Optical Module Test Unit - OSFP 400G

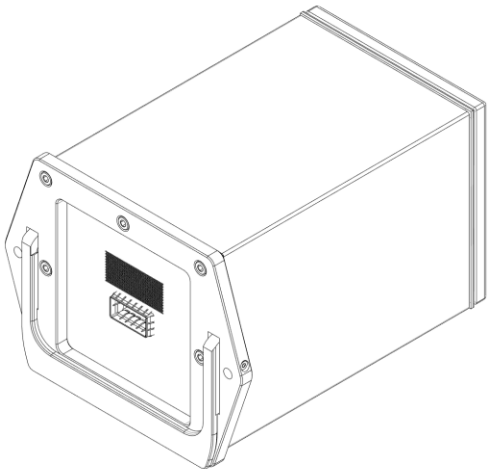


Figure 5 EM203 Optical Module Test Unit OSFP 400G

3. Software

The EM203 Optical Module EMI Test Platform is controlled via a command set, utilizing a command line interface. To utilize the command line interface commands, an application such as Tera-Term or Putty can be utilized.

The command set offers the user the ability to access an optical module's complete management interface register set. Commands exist that allow for system-level voltage, current, and temperature reading. Also, separate commands exist to control the Reference Signal source output.

3.1. Device Commands

3.1.1. Protocol

The device can be connected to a computer via the USB port. It will present itself to the computer as a virtual serial/COM port. When connecting to the virtual serial port, the baud rate does not matter.

The device uses a plain-text command-response protocol. It listens for commands from the host computer, and it returns a response for each command which will indicate success/failure of the command and/or any data that was requested.

Note: The protocol is case-sensitive. Commands and other text should be sent using the same capitalizations specified in this document. This restriction may be relaxed in the future.

3.1.2. Command Syntax

Each command consists of a name which identifies the command being issued, followed by zero or more arguments separated by spaces. The number and format of arguments to be sent is specific to each command. After the command name and arguments are sent, the command is terminated with a single semicolon (;) character.

Example: Issuing a command named S_FAN_CONTROL with two arguments: 1 and 60

```
S_FAN_CONTROL 1 60;
```

When the device receives and processes a command, it will send a response. The format of the responses varies depending on the command, but all responses are terminated with a single semicolon (;) character.

There is one standard response, Command_Not_Found; which is returned when the given command name is not a recognized command.

Note: In command usage examples, lines starting with > indicate a command string being sent, and lines starting with < indicate the response returned by the previous command. For example:

```
> S_FAN_CONTROL 1 60;
< Ack;
```

The > and < prefixes and the newlines between command and response are *not part of the protocol* and are only to improve the readability of examples.

3.1.3. Command List

3.1.3.1 System

S_FAN_CONTROL <index> <percent>; - Manually set the control for the fan specified by <index> to the specified percentage.

The percentage value is clamped between 0 and 100. Note that the device may enforce a minimum fan speed based on the system temperature.

Returns Set on success, and Not_Set if the given index is out of range.

Example:

> S_FAN_CONTROL 1 80;
< Set;

> S_FAN_CONTROL 10 25;
< Not_Set;

G_FAN_CONTROL <index>; - Get the current control value for the fan specified by <index>.

Returns the value as a decimal percentage, or zero if the given index is out of range.

Example:

> G_FAN_CONTROL 1;
< 60.0;

G_FAN_RPM <index>; - Measures the current rotation speed of the fan specified by <index>.

Returns the fan speed in revolutions per minute (RPM). If the given index is out of range, zero is returned.

Example:

> G_FAN_RPM 1;
< 2515;

G_TEMP_SENSORS; - Lists the temperature sensors provided by this device.

This list defines the sensor names that are supported by the G_TEMPERATURE command.

Returns the sensor names as a comma-separated list.

Example:

> G_TEMP_SENSORS;
< CPU, SFP;

G_TEMPERATURE <sensor>; - Measure the temperature using the sensor specified by <sensor>.

The specified sensor must be one of the names given by G_TEMP_SENSORS.

Returns the temperature measured from the sensor in degrees Celsius. If the sensor name is not recognized, returns Not_Available.

Example:

> G_TEMPERATURE CPU;
< 33.6;

> G_TEMPERATURE CHA;
< Not_Available;

3.1.3.2 Reference Signal Generator

S_REFERENCE_SIGNAL <state>; - Power up/down the signal generator.

The value of <state> must be On or Off to power up/down respectively.

Returns Set on success, and Not_Set if the state argument is invalid.

Example:

> S_REFERENCE_SIGNAL On;
< Set;

G_REFERENCE_SIGNAL; - Get the power state of the signal generator.

Returns On or Off indicating the last value set by S_REFERENCE_SIGNAL.

The power-on default value is Off.

Example:

> G_REFERENCE_SIGNAL;
< Off;

> S_REFERENCE_SIGNAL On;
< Set;

> G_REFERENCE_SIGNAL;
< On;

STATQ_REFERENCE_SIGNAL; - Check the status of the signal generator hardware.

Returns one of the following status codes:

Off - The signal generator is powered down.

Starting - The signal generator is powered up but not transmitting yet. This may be returned briefly after powering up the signal generator.

On - The signal generator is powered up and transmitting.

Example:

> STATQ_REFERENCE_SIGNAL;
< Off;

> S_REFERENCE_SIGNAL On;
< Set;

> STATQ_REFERENCE_SIGNAL;
< Starting;

... sometime later

> STATQ_REFERENCE_SIGNAL;
< On;

3.1.3.3 Optical Module

G_MODULE_PRESENT; - Read the ModPrsL signal to detect whether the module is present.

Returns Present if the ModPrsL signal is asserted low by a module, and Not_Present otherwise.

Example:

> G_MODULE_PRESENT;
< Present;

S_MODULE_LPMODE <state>; - Set the InitMode signal.

On - The module will initialize into “low power mode” / under host software control.

Off - The module will initialize into “high power mode” / under module hardware control.

This configuration is persistent across device reboots.

Returns Set on success, and Not_Set if the state argument is invalid.

Example:

> S_MODULE_LPMODE On;
< Set;

G_MODULE_LPMODE; - Get the state of the InitMode signal.

Returns the current configuration as set by S_MODULE_LPMODE.

Example:

> G_MODULE_LPMODE;
< On;

S_MODULE_POWER <state>; - Power up/down the optical module.

The value of <state> must be On or Off to power up/down respectively.

Returns Set on success, and Not_Set if the state argument is invalid.

Example:

> S_MODULE_POWER On;
< Set;

G_MODULE_POWER; - Get the power state of the optical module.

Returns On or Off indicating the last value set by S_MODULE_POWER.

The power-on default value is Off.

Example:

> G_MODULE_POWER;
< Off;

> S_MODULE_POWER On;
< Set;

> G_MODULE_POWER;
< On;

S_MODULE_RESET <state>; - Set the ResetL signal state.

On - Assert the ResetL signal low, holding the module in reset.

Off - Deassert the ResetL signal, initializing the module if it was reset.

Returns Set on success, and Not_Set if the state argument is invalid.

Example:

> S_MODULE_RESET On;
< Set;

G_MODULE_RESET; - Get the current state of the ResetL signal.

Returns the last value set by S_MODULE_RESET. Default value is Off.

Example:

> G_MODULE_RESET;
< Off;

MODULE_RESET; - Pulses the ResetL signal to initiate a module reset.

Returns Done to indicate success.

Example:

> MODULE_RESET;
< Done;

G_MODULE_INTERRUPT; - Reads the state of the module interrupt signal.

Returns Off under normal conditions, when IntL is high. If the IntL pin is asserted low by the module, this command will return On, indicating an interrupt flag is waiting to be read.

Example: L-Rx6 LOS interrupt. (See also: MODULE_READ)

> G_MODULE_INTERRUPT;
< On;

> MODULE_READ 3 8;
< 32,0,0,0,0,0,0,0

> G_MODULE_INTERRUPT;
< Off;

G_MODULE_ADDRESS; - Get the configured I2C address for the optical module's management interface.

Returns the 8-bit address formatted in decimal.

The power-on default value is A0 hex (160 decimal).

Example:

> G_MODULE_ADDRESS;
< 160;

S_MODULE_ADDRESS <addr>; - Set the I2C address of the optical module's management interface.

The <addr> argument should be the 8-bit address formatted as decimal.

The write control byte and read control byte for the management interface will be derived from this value by setting the least significant bit to 0 and 1 respectively.

Returns Set on success, and Not_Set if the address argument is invalid.

Example:

> S_MODULE_ADDRESS 84;
< Set;

> G_MODULE_ADDRESS;
< 84;

MODULE_WRITE <reg> <bytes>; - Performs a sequential write operation of up to eight (8) bytes starting at the specified register address <reg>.

Arguments:

<reg> - The starting address of the write, in decimal.

<bytes> - A byte string containing the bytes to write.

Returns Ack if all bytes have been successfully written, and Nack otherwise.

Examples:

Set the upper page to 01h:

> MODULE_WRITE 127 1;
< Ack;

Password entry: Write the string “abcd” to the password entry area.

> MODULE_WRITE 123 65,66,67,68;
< Ack;

MODULE_READ <reg> <count>; - Performs a sequential read operation of up to eight (8) bytes starting at the specified register address <reg>.

Arguments:

<reg> - The starting address of the read, in decimal.

<count> - The number of bytes to read.

Returns a byte string containing the bytes read. If the device did not respond, Nack is returned instead.

Examples:

Read the internal temperature sensor:

> MODULE_READ 26 2;
< 55,138;

I2C_WRITE <bytes>; - Performs an I2C write transaction.

Arguments:

<bytes> - A byte string containing the bytes to write.

Returns Ack if all bytes have been successfully written, and Nack otherwise.

I2C_READ <count>; - Performs an I2C read transaction.

Arguments:

<count> - The number of bytes to read.

Returns a byte string containing the bytes read. If the device did not respond, Nack is returned instead.

I2C_WRITE_READ <bytes> <count>; - Performs an I2C write transaction followed by a repeated start and a read transaction.

Arguments:

<bytes> - A byte string containing the bytes to write. numbers.

<count> - The number of bytes to read following the write.

Returns a byte string containing the bytes read, if the write and read were performed successfully. If the device returns a NACK, then Nack is returned instead.

4. System Operation

The purpose of this section is to guide the user through the operation of the EM203 system.

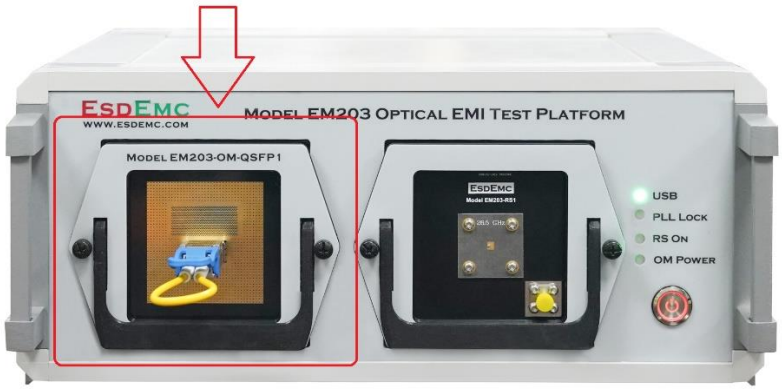
4.1. Preparation and Check Power

The EM203 system is powered by a 60Hz 120V receptacle connect power supply cable. Other mains voltages and frequencies are supported. After properly connecting the power supply cable, turn on the unit by pressing the front panel Power button. If the unit is properly powered-on, the Power button will be illuminated Red, and an audible 'beep' will be heard.

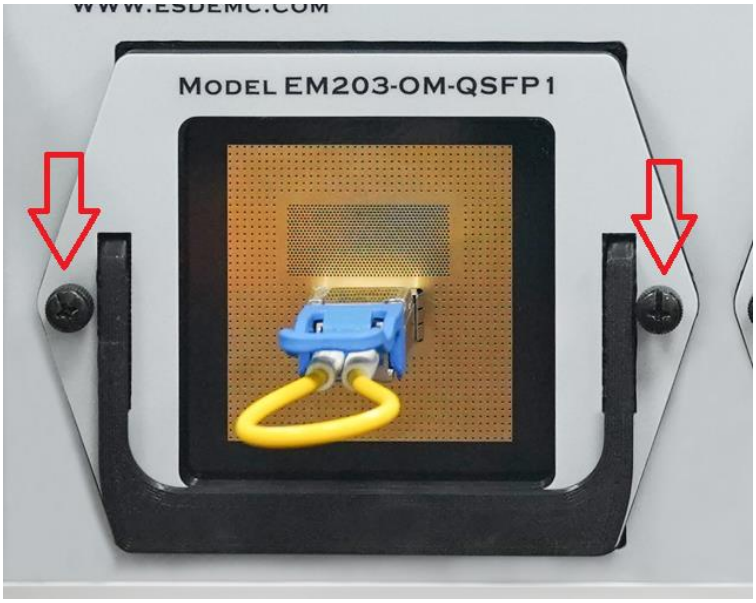
4.2. Optical Module Insertion

It is highly recommended that the optical modules are not plugged into the EM203-Optical Module Test Unit while the EM203 system is powered on. This may lead to electrical overstress damage to the optical module device.

There are two available slots for module insertion. The Optical Module is only compatible with the EM203 system's left slot. This slot is cooled with a fan, and is designed for the Optical Module only.



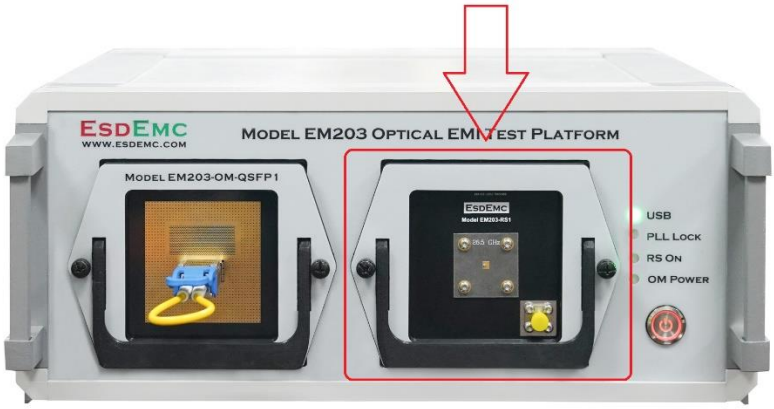
After inserting the Optical Module, ensure that the thumb screws (shown below) are fully threaded in before powering-on the EM203 system.



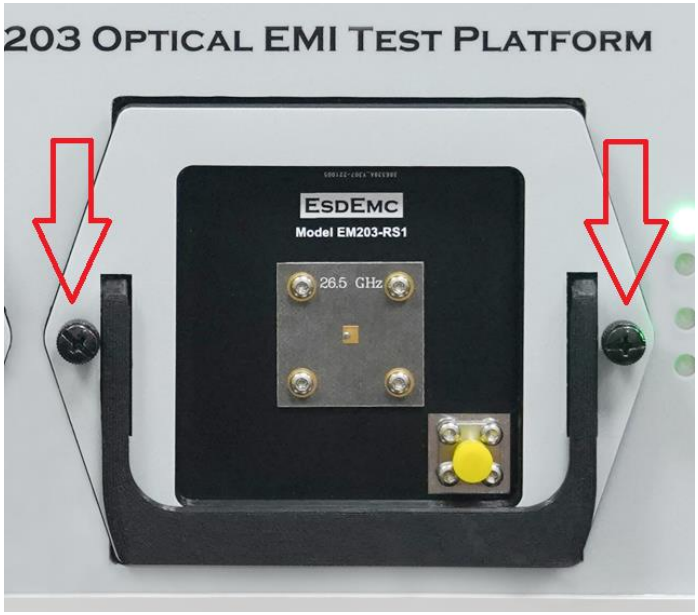
4.3. RF Module Insertion

It is highly recommended that the RF modules are not plugged into the EM203 system while it is powered on. This may lead to electrical overstress damage to the RF module device.

Only insert the RF module into the system's right slot, as highlighted in the blow image.



After inserting the RF Module, ensure that the thumb screws (shown below) are fully threaded in before powering-on the EM203 system.



4.4. Reference Signal Source Port Termination

When not utilizing the EM203-RF Reference Source Unit's conducted output port, a user should terminate this port with a properly rated 50 Ω load.

4.5. Optical Module Cooling

When the optical module is powered on, proper fan speed should be configured to maintain ambient temperatures such that the optical module is help within its standard's acceptable internal temperature range.

4.6. Sub-Module Replacement

Each modular unit can be replaced at will by the user of the EM203 system. Ensure that the system is powered off prior to removing any modular unit from the EM203 device.