Product Specification

Spec#: **5000**
Description: **Embedded OSA Modules**
Customer: **GouMax Standard OSA Module**

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Revision History

Rev.	Date	Revision History	Originated by	Signed by
1.0	09/22/2017	Initial release	Mark Geng	Jay Hsieh

1. Product Description

This specification describes and defines GouMax's OSA devices with applications to test and measurement equipment. The OSA product is designed and produced using GouMax's proprietary micro-optics and tunable technology. It measures optical spectrum of optical signals injected into the OSA device over the defined operating wavelength range. From the measured spectrum, critical channel parameters, such as channel power, wavelength, or OSNR, can be analyzed. GouMax OSA-family products support various zones of wavelength range, such as C-band, L-band, O-Band, S-Band, C+L-band, full band from 1050 nm to 1650 nm and any other customer specified wavelength range.

GouMax's OSA module consists of a bandpass tunable optical filter, a photodetector and low noise, high-dynamic range electronics, as schematically shown in Figure 1-1. When a wide band spectrum is incident to the tunable filter, it allows a narrow band of input light centered at a given wavelength to pass through the filter. By altering the central wavelength of pass band of the tunable filter, the whole input spectrum can be scanned and spectrum information of incident signal is detected sequentially. The photodetector converts the light passing through the filter into electrical current that is then digitized. The data processing unit analyzes the data and then outputs the spectrum to the customers.

Typical applications:

1) Tranceiver analyzer: To measure the transmitter's total power, wavelength and SMSR (side-mode suppression ratio)
2) DWDM channel analyzer: To measure channel power, wavelength and noise floor.
3) General purpose hand-held optical spectrum analyzer.

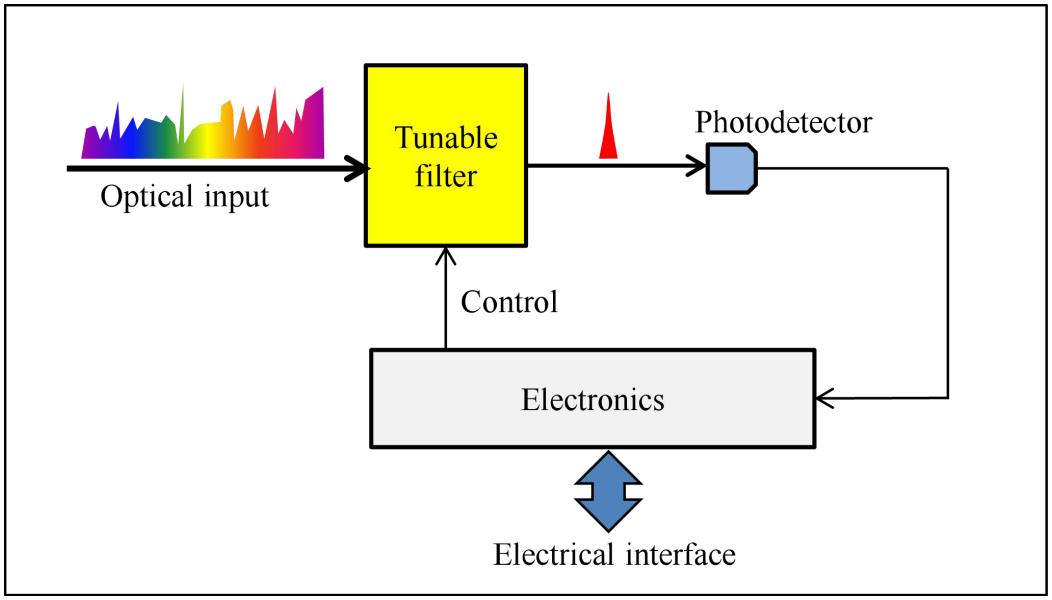

Figure 1-1: Schematic diagram of working process of OSA device

2. Specifications

The following specifications define GouMax's embedded OSA modules. The OSA device can be integrated into customer's package for portable optical spectrum analyzer.

2.1 Specifications

Table 2-1: Specifications for single-band OSA module

Parameters		Unit	Specification
Operating Wavelength Range		nm	40 nm within 1250 and 1650 nm For example: C-band 1527 ~ 1567 nm
Input Power Range		dBm	-50 ~ 15
Maximum Input Power		dBm	30
Wavelength Resolution (FWHM)	Type A[1]	nm	0.18
	Type B[2]	nm	0.11
Absolute Wavelength Accuracy[3]		pm	± 50
Wavelength Repeatability[3]		pm	± 10
Absolute Power Accuracy[3,4]		dB	± 0.5
Relative Power Accuracy[3,4]		dB	± 0.4
Power Repeatability[4]		dB	± 0.1
PDL		dB	< 0.3
Noise Floor		dBm	-55
Optical Rejection Ratio	At 0.4 nm offset	dB	> 30
	At 1.6 nm offset		> 50
Optical Return Loss		dB	> 30
Response Time		s	< 1
Power Consumption		W	< 2.0

Notes:

1. Typical FWHM is 0.15 nm.
2. Typical FWHM is 0.10 nm.
3. Specs guarantee for input power range only from −40 ~ −10 dBm.
   For the input power between -50 ~ -40 dBm, absolute wavelength accuracy is ± 90 pm and absolute power accuracy is ± 0.9 dB.
4. Do not include PDL.

Table 2-2: Specifications for dual-band OSA module

Parameters		Unit	Specification
Operating Wavelength Range		nm	90 nm within 1250 and 1650 nm For example: C+L-band 1527 ~ 1617 nm
Input Power Range		dBm	-50 ~ 15
Maximum Input Power		dBm	30
Wavelength Resolution (FWHM)	Type A[1]	nm	0.35
	Type B[2]	nm	0.22
Absolute Wavelength Accuracy[3]		pm	± 50
Wavelength Repeatability[3]		pm	± 10
Absolute Power Accuracy[3,4]		dB	± 0.5
Relative Power Accuracy[3,4]		dB	± 0.4
Power Repeatability[4]		dB	± 0.1
PDL		dB	< 0.3
Noise Floor		dBm	-55
Optical Rejection Ratio	At 0.4 nm offset	dB	> 15 (for type-A), >30 (for Type-B)
	At 1.6 nm offset		> 50
Optical Return Loss		dB	> 30
Response Time		s	< 1
Power Consumption		W	< 2.0

Notes:

1. Typical FWHM is 0.32 nm.
2. Typical FWHM is 0.21 nm.
3. Specs guarantee for input power range only from −40 ~ −10 dBm.
   For the input power between -50 ~ -40 dBm, absolute wavelength accuracy is ± 90 pm and absolute power accuracy is ± 0.9 dB.
4. Do not include PDL.

Table 2-3: Specifications for Full-band OSA module

Parameters		Unit	Specification
Operating Wavelength Range		nm	1250 ~ 1650
Input Power Range		dBm	-50 ~ 15
Maximum Input Power		dBm	30
Wavelength Resolution (FWHM)	Type A[1]	nm	3.0
	Type B[2]	nm	1.5
Absolute Wavelength Accuracy[3]		nm	± 0.3
Wavelength Repeatability[3]		nm	± 0.1
Absolute Power Accuracy[3,4]		dB	± 0.8
Relative Power Accuracy[3,4]		dB	± 0.6
Power Repeatability[4]		dB	± 0.1
PDL		dB	< 0.5
Noise Floor		dBm	-55
Optical Rejection Ratio		dB	> 40 (AT adjacent and non-adjacent CWDM channels)
Optical Return Loss		dB	> 30
Response Time		s	< 1
Power Consumption		W	< 2.0

Notes:

1. Typical FWHM is 3.0 nm.
2. Typical FWHM is 2.0 nm.
3. Specs guarantee for input power range only from −40 ~ −10 dBm.
   For the input power between -50 ~ -40 dBm, absolute wavelength accuracy is ± 0.5 nm and absolute power accuracy is ± 1.6 dB.
4. Do not include PDL.

2.2 Environmental Conditions

Table 2-4: Environmental specifications

Parameters	Units	Specifications
Operating Temperature	℃	-5 ~ +65
Storage Temperature	℃	-40 ~ +85
Operating Relative Humidity	%	5 ~ 85 (non-condensing)
Storage Relative Humidity	%	5 ~ 95

2.3 Fiber Specifications

Table 2-5: Fiber specifications

Parameters	Units	Specifications
Fiber Type	-	SMF-28 900 μm
Fiber Length	m	1.0 ± 0.2
Optical Connector Type	-	LC/UPC (or customer specify)

2.4 Parameter Definitions

- **Operating Wavelength Range** specifies the spectral region between the minimum and maximum wavelengths over which the OSA device can operate and measure spectrum.
- **Input Power Range** specifies the power range of narrow-band signals over which the OSA device can operate and measure spectrum. When measuring DWDM signals, it is the channel input power range.
- **Maximum Input Power** is the maximally allowed value of total optical input power to the OSA device.
- **Wavelength Resolution** is specified by the Full Width at Half Maximum (FWHM) of the tunable filter. It is also called the 3-dB bandwidth.
- **Absolute Wavelength Accuracy** is the maximum wavelength error when measuring laser signals over operating wavelength range. The wavelength error is calculated as the difference of the measured wavelength values between the OSA device and the calibrated wavelength meter.
- **Wavelength Repeatability** is the maximum variation of wavelength measurements over operating wavelength range within 24 hours at any fixed measurement condition.
- **Absolute Power Accuracy** is the maximum power error when measuring laser signals over operating wavelength range and input power range. The power error is

calculated as the difference of the measured powers between OSA device and the calibrated power meter.

- **Relative Power Accuracy** is calculated as the maximum difference between the maximum and the minimum power errors over operating wavelength range from any single scans.
- **Power Repeatability** is the maximum variation of power measurements over operating wavelength range within 24 hours at any fixed measurement condition.
- **Polarization Dependent Loss (PDL)** is the maximum power difference of power measurements between any two polarization states.
- **Optical Rejection Ratio** (ORR) is defined as the isolation of the filter at a given location offset away from the center of the filter profile, as schematically shown in Figure 2-1.

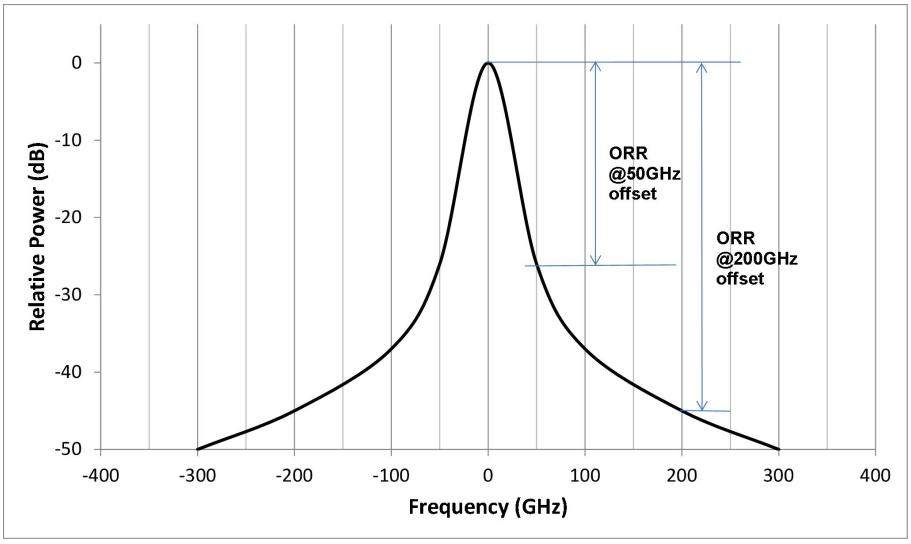

Figure 2-1: Definition of optical rejection ration

- **Noise Floor** is defined as electronics background noise when there is no light input from the fiber port to the device.
- **Optical Return Loss** is the ratio between the reflected power from the device and the input power to the device.
- **Operating Temperature** specifies the minimum and maximum ambient temperatures within which the device can operate and meet its specifications.
- **Storage Temperature** specifies the minimum and maximum ambient temperatures within which the device can be stored without damage, and the device can meet its specifications when working over operating temperature range.
- **Response Time** is the total time span from host command issuing to the end of reporting data to host.
- **Power Consumption** is defined as peak electrical power when the device operates.

3. Mechanics

Figure 3-1 shows the mechanical drawings of the OSA module for Type A. The locations of electrical connector and optical connector are shown, and mounting-hole locations are given. Product photo is shown in Figure 3-2.

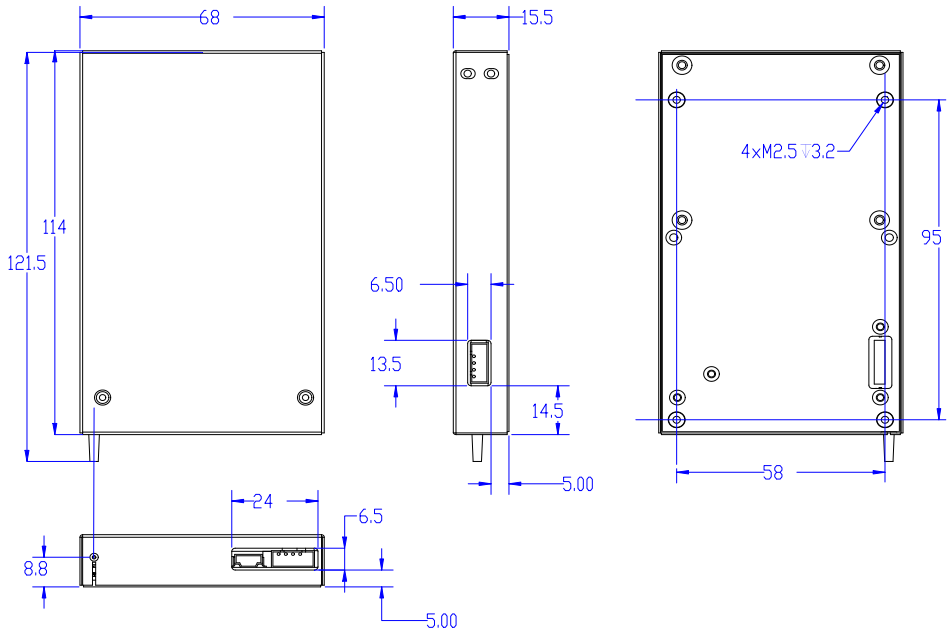

Figure 3-1: OSA module of Type A

Figure 3-2: Photo of Single C-band OSA module

Figure 3-3 shows the mechanical drawings of the OSA module for Type B. The locations of electrical connector and optical connector are shown, and mounting-hole locations are given. A 3D diagram is shown in Figure 3-4.

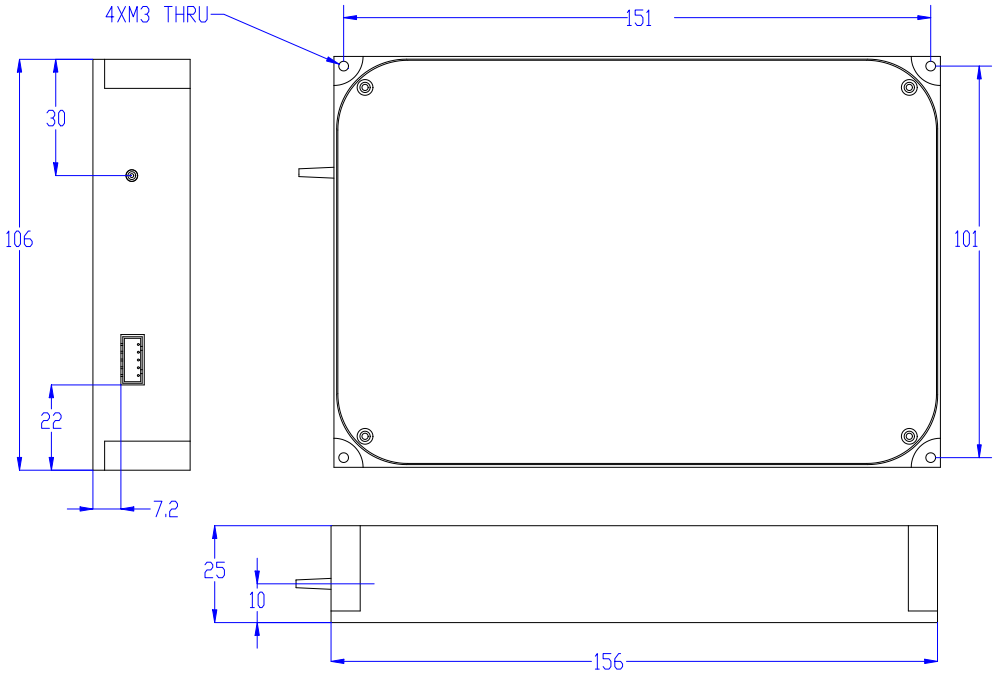

Figure 3-3: OSA module of Type B

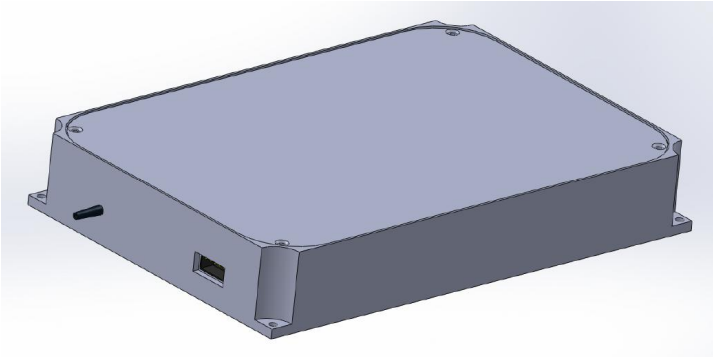

Figure 3-4: 3D diagram of Type B OSA module

4. Electrical Specifications

4.1 Power Supply

Power supply of OSA device is 5V DC. Table 4-1 lists specification of power supply.

Table 4-1: Voltage and current specifications

Electrical Parameters	Specification
Voltage Supply	+5.0 V DC
Voltage Tolerance	± 10%
Typical Current	0.3 A
Maximum Current	0.4 A

4.2 Electrical Connector and Pin Assignment

5-Pin UART connector on OSA module is:
Pin header on OSA module: HRS DF3-5P-2DS(01)
Mating connector: HRS DF3-5S-2C

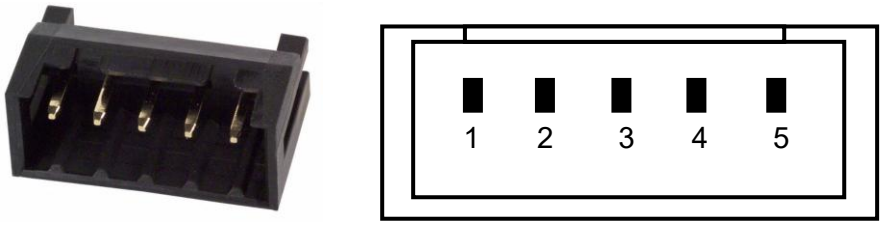

Figure 4-1: UART connector and Pin locations

Table 4-2: Pin assignment

Pin Number	Pin Definition
1	/Reset
2	+5V DC
3	Rx (OSA module)
4	Tx (OSA module)
5	Ground

5. Communication Protocol

GouMax's OSA provides both UART and USB2.0 communications.

This section describes OSA serial port (UART/USB) scan data commands for a single C-band OSA.

Notes:

- "Scan" command starts a new scan and returns spectrum data.
- "Read" command returns spectrum data, which was scanned from last "Scan" command.
- "Checksum" is an unsigned 16-bits number of the summation of all bytes from Field 1 to the byte before "checksum" word. "Checksum" does not include "Head" byte "0xAA".

5.1 UART serial port setting

UART serial port setting is shown in Table 5-1.

Table 5-1: UART serial port setting

Item	Setting
Baud Rate	460800
Data Bits	8
Parity	None
Stop Bits	1
Flow Control	None

5.2 Host Start OSA Scan Command

Table 5-2: OSA Scan command

Field	Parameter	OSA Scan Command
0	Head byte	0xAA (One byte head)
1	Command Word_1	0x5343
2	Command Word_2	0x4342
3	Length word	0x0005 (Words in Field 4 ~8)
4	Decimation Factor	0x0001 (Minimum = 1)
5	Scan Start Freq. high-16 bits	High 16-bits of 32-bits integer
6	Scan Start Freq. low-16 bits	Low 16-bits of 32-bits integer
7	Scan End Freq. high-16 bits	High 16-bits of 32-bits integer

8	Scan End Freq. low-16 bits	Low 16-bits of 32-bits integer
9	Checksum word	Unsigned 16-bit integer

Note: In command, Scan Start Freq. and Scan End Freq. are 32-bits integer number in GHz.

Table 5-3: OSA module response to OSA scan command

Field	Parameter	Response to OSA Scan Command
0	Head byte	0xAA (One byte head)
1	Command Word_1	0x5343
2	Command Word_2	0x4342
3	Length word	16-bit integer (Words in Field 4~10)
4	Error word	16-bit Error Code (00 for No error)
5	Scan Start Freq. high-16 bits	High 16-bits of 32-bits float data
6	Scan Start Freq. low-16 bits	Low 16-bits of 32-bits float data
7	Scan End Freq. high-16 bits	High 16-bits of 32-bits float data
8	Scan End Freq. low-16 bits	Low 16-bits of 32-bits float data
9	Data Length Word	16-bits (Number of word in Field 10)
10	Spectrum Data words	16-bits signed integer of Q-8 data
11	Checksum word	Unsigned 16-bit integer

Note: In return data, Scan Start Freq. and Scan End Freq. are 32-bits floating point number in GHz.

5.3 Host Read OSA Information

Table 5-4: Read OSA Info

Field	Parameter	Read OSA Data
0	Head byte	0xAA (One byte head)
1	Command Word_1	0x534E
2	Command Word_2	0x4656
3	Length word	0x0001 (Word in Field 4)
4	Reserved word	0x0000
5	Checksum word	Unsigned 16-bit integer

Table 5-5: OSA module response to read OSA Info command

Field	Parameter	Response to OSA Data
0	Head byte	0xAA (One byte head)
1	Command Word_1	0x534E
2	Command Word_2	0x4656
3	Length word	16-bit integer (Words in Field 4~10)
4	Error word	16-bit Error Code (00 for No error)
5	OSA PN words (10 word)	PN max. length 20 bytes ASCII codes
6	OSA SN words (10 word)	SN max. length 20 bytes ASCII codes
7	Manufacture words (5 words)	10 bytes ASCII codes
8	OSA FW version (4 words)	8 bytes ASCII codes
9	OSA HW version (6 words)	12 bytes ASCII codes
10	OSA temperature (1 word)	16 bits signed integer as 10xT degree.
11	Checksum word	Unsigned 16-bit integer

Notes:

(1) PN, SN and version numbers are in ASCII format.

(2) PN/SN fields have maximum length 20 bytes. If PN/SN length is less than 20 bytes, 0 is appended.

(3) Manufacturing date has 10 bytes ASCII codes as MM-DD-YYYY.

(4) OSA temperature is a signed 16 bits integer for 10xT. For example, number 342 = 34.2°C, and number -21 = -2.1°C.

6. RoHS Compliance

The product is RoHS 6 compliant.