ERAVANT
FORMERLY SAGE MILLIMETER, INC.

Frequency Synthesizer User's Manual

(Model Number: SOT-01210313200-SF-B6)

Rev. 1.0

Eravant

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Table of Contents

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Introduction

Model SOT-01210313200-SF-B6 is a low phase noise frequency synthesizer module designed and manufactured for standard test instrumentation, communication, and Radar systems as a local oscillator. The module covers a frequency range of 0.1 to 10 GHz with an exceptional low harmonics and spurious emissions as well as superior low phase noise performance. The model is externally referenced with internal reference backup. The frequency resolution of the module is up to 0.1 Hz. The phase noise of the oscillator is dependent on the quality of the reference source. The oscillator has a maximum spurious of -65 dBc. The oscillator has a built-in voltage regulator to further improve the signal quality and provide over voltage protection. The normal operating state of the oscillator is external referenced. This module can be directly controlled with digital signals through Micro-D connector (RS-232 protocol) for system development and integration. Eravant provides a GUI for performance evaluation and rapid system development as well.

This manual intends to give the step by step instructions for SOT operations by using provided generic GUI (Graphic User Interface) program.

GUI (Graphic User Interface) Instruction

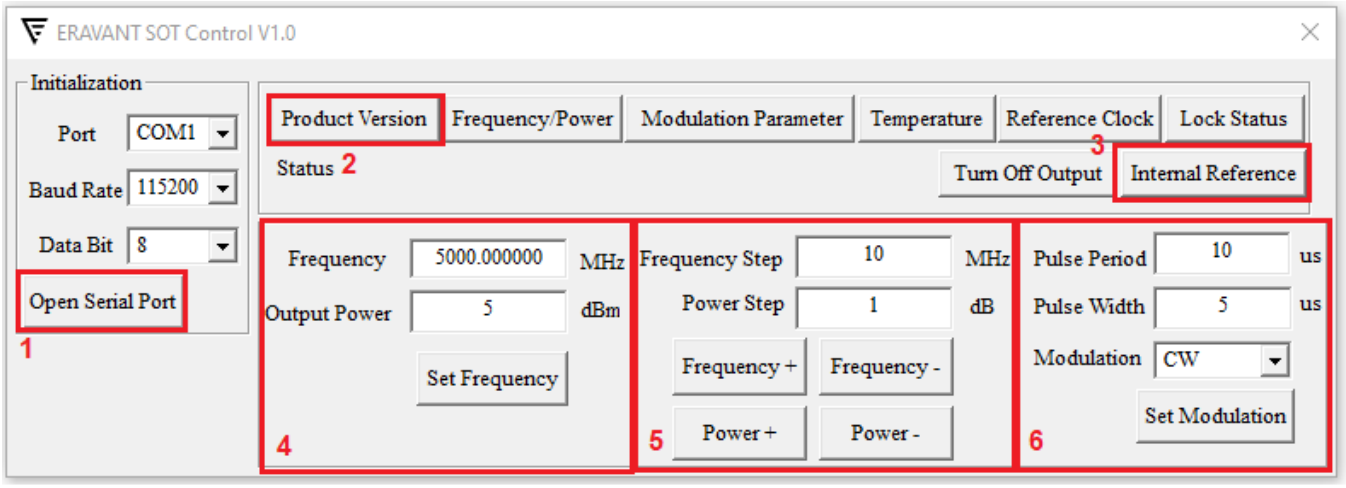

Fig. 1 Eravant SOT Control GUI for SOT-01210313200-SF-B6

Eravant provides a generic GUI program for user to exam, familiar with and control its SOT series synthesizer, which implements the single frequency and pulse waveforms generation. To realize the frequency sweeping, the customer needs to control the device through the Micro-D connector by following the RS-232 serial communication protocol. A personal computer, a well-regulated DC power supply with +12 V_{DC}/2A power capacity and a custom-built cable are required to operating the synthesizer.

As shown in Fig. 1, the steps to use the GUI to generate CW and pulse waveforms can be summarized as below,

1. Power on the synthesizer and connect the synthesizer to PC through serial port. Click on "**Open Serial Port**" on the GUI, which is the indicated as block 1 in Fig. 1.
2. Click on "**Product ID**" (Block 2) on the GUI. If the synthesizer is successfully connected to the PC, the product version will be shown in the "**Status**" box.
3. The customer needs to select the internal/external reference used for the synthesizer. Click on the button in block 3 on the GUI. If the GUI shows "**Internal Reference**", it means the synthesizer is using an external reference. The internal reference will be used when this button is click on.
4. Input the operating frequency into "**Frequency**" box and power level into "**Output Power**" box in block 4 on the GUI. Then click on "**Set Frequency**", the single frequency setup command will be sent to the synthesizer and executed.
5. The buttons and boxes in block 5 on the GUI enable the customer to change the output frequency and power level with fixed steps.
6. This synthesizer provides the pulse waveform as well and the relevant button and boxes are listed in block 6 on the GUI. Input the required pulse information into "**Pulse Period**" and "**Pulse Width**" boxer, select the "**Internal Pulse**" in the "**Modulation**" drop-down box, and click on "**Set Modulation**". The synthesizer will generate the pulse waveform with required parameters.

Serial Communication Protocol

1. Asynchronous Serial Port Configuration

Baud Rate	Start Bit	Data Frame	Parity Bit	Stop Bit
115200bps	1 bit	8 bits	NA	1 bit

2. Command Format

Format	Number of Bytes	Description
Header	1	Command begins with 0xaa
Module Number	1	0x55, broadcasting
Command Index	1	Refer to command summary

Data Length	1	Number of data bytes
Data	Variable Length	MSB first
Parity	1	XOR output of all other bytes

3. Command Summary

Command Index	Data Length	Data	Note	Data Transmission
0x00	1 byte	1. 0x01 Product Version; 2. 0x02 Frequency and Power; 3. 0x03 Modulation Type and Parameter; 4. 0x04 Temperature; 5. 0x05 Reference Clock; 6. 0x06 Lock and Output Status; 7. 0x80 ON/OFF State; 8. 0x81 RESERVED; 9. 0xf0 RESERVED.	Check Status	PC->SOT
0x02	8 bytes	6 bytes (Frequency, step 1 Hz) 2 bytes (Attenuation, step 0.1 dBm, and add up 1500)	Frequency and Attenuation	PC->SOT
0x05	8 bytes	6 bytes (Frequency, step 0.1 Hz) 2 bytes (Attenuation, step 0.1 dBm, and add up 1500)	Frequency and Attenuation	PC->SOT
0x08	1 bytes	1. 0x01 Use Internal Reference; 2. 0x00 Use External Reference.	Select Reference Clock	PC->SOT
0x09	1 bytes	1. 0x01 Output ON 2. 0x00 Output OFF	Output Switch	PC->SOT
0x11	9 bytes	1. 1 byte (0x00, CW) 8 bytes RESERVED; 2. 1 byte (0x01, Internal Pulse) 4 bytes (Pulse Period, unit ns)	Modulation Configuration	PC->SOT

		4 bytes (Pulse Width, unit ns) 3. 1 byte (0x02, External Pulse) 4 bytes (Pulse Period, unit ns, INVALID) 4 bytes (Pulse Width, unit ns, INVALID)		
0x12	2 bytes	RESERVED	RESERVED	RESERVED
0x13	2 bytes	RESERVED	RESERVED	RESERVED
0x21	16 bytes	RESERVED	RESERVED	RESERVED
0x22	14 bytes	RESERVED	RESERVED	RESERVED
0x23:	12 bytes	RESERVED	RESERVED	RESERVED
0x24:	10 bytes	RESERVED	RESERVED	RESERVED
0x25	4 bytes	RESERVED	RESERVED	RESERVED
0x29	16 bytes	RESERVED	RESERVED	RESERVED
0x2a	14 bytes	RESERVED	RESERVED	RESERVED
0x2b	12 bytes	RESERVED	RESERVED	RESERVED
0x2c	10 bytes	RESERVED	RESERVED	RESERVED
0x2d	4 bytes	RESERVED	RESERVED	RESERVED
0x31	34 bytes	8 bytes (Start Frequency, unit 0.1 mHz) 8 bytes (Stop Frequency, unit 0.1 mHz) 8 bytes (Frequency Step, unit 0.1 mHz) 2 bytes (Start Power, unit 0.1 dB) 2 bytes (Stop Power, unit 0.1 dB) 2 bytes (Power Step, unit 0.1 dB)	Frequency Sweeping Setup	PC->SOT

		4 bytes (Dwell Time, unit ns)		
0x33	22 bytes	RESERVED	RESERVED	RESERVED
0x34	16 bytes	RESERVED	RESERVED	RESERVED
0x35	4 bytes	1 byte (0x00 Disable Sweeping; 0x01 Enable Sweeping) 1 byte (0x00, Enable Frequency Ascending; 0x01, Enable Frequency Descending; 0x10, Enable Power Ascending; 0x11, Enable Power Descending) 2 bytes RESERVED	Enable Sweeping	PC->SOT
0X80	4 bytes	1 byte (0x00, GPIO OFF; 0x01 GPIO ON)	Internal Module ON/OFF Switch	PC->SOT
0x81	5 bytes	RESERVED	RESERVED	RESERVED
0x82	8 bytes	RESERVED	RESERVED	RESERVED
0x83:	6 bytes	RESERVED	RESERVED	RESERVED
0x84:	4 bytes	RESERVED	RESERVED	RESERVED
0x91	12 bytes	RESERVED	RESERVED	RESERVED
0x92	10 bytes	RESERVED	RESERVED	RESERVED
0x93:	8 bytes	RESERVED	RESERVED	RESERVED
0x94:	6 bytes	RESERVED	RESERVED	RESERVED
0x95		RESERVED	RESERVED	RESERVED
0x96	6 bytes	RESERVED	RESERVED	RESERVED
0xa1	8 bytes	RESERVED	RESERVED	RESERVED
0xa2	6 bytes	RESERVED	RESERVED	RESERVED
0xa3	4 bytes	RESERVED	RESERVED	RESERVED

0xa4	2 bytes	RESERVED	RESERVED	RESERVED
0XA5	13 bytes	RESERVED	RESERVED	RESERVED
0XA6	11 bytes	RESERVED	RESERVED	RESERVED
0XA7	9 bytes	RESERVED	RESERVED	RESERVED
0XA8	7 bytes	RESERVED	RESERVED	RESERVED
0XB1		RESERVED	RESERVED	RESERVED
0XB2		RESERVED	RESERVED	RESERVED
0XB3		RESERVED	RESERVED	RESERVED
0XB4		RESERVED	RESERVED	RESERVED
0xB5		RESERVED	RESERVED	RESERVED
0xB6		RESERVED	RESERVED	RESERVED
0XB8		RESERVED	RESERVED	RESERVED
0XB9		RESERVED	RESERVED	RESERVED
0XBa		RESERVED	RESERVED	RESERVED
0XBb		RESERVED	RESERVED	RESERVED
0XBc		RESERVED	RESERVED	RESERVED
0XBD		RESERVED	RESERVED	RESERVED
0x10	8 bytes	2 bytes (Production Date) 2 bytes (Project Number) 2 bytes (Product ID) 2 bytes (Software Version)	Check Product Version	SOT->PC
0x11	11 bytes	1 byte (0x01) 8 bytes (Frequency, unit 0.1 mHz) 2 bytes (Attenuation, unit 0.1 dB and add up 1500)	Check Frequency and Power	SOT->PC

0x12	9 bytes	1. 1 byte (0x00, CW) 8 bytes RESERVED 2. 1 byte (0x01, Pulse) 4 bytes (Pulse Period, unit ns) 4 bytes (Pulse Width, unit ns)	Check Modulation Type and Parameters	SOT->PC
0x13	2 bytes	RESERVED		SOT->PC
0x14	1 byte	4. 0x01 Using Internal Reference Clock 4. 0x00 Using External Reference Clock	Check Reference Clock	SOT->PC
0x15	1 byte	Bit 0 (0, Out of Lock; 1, Locked) Bit 1 to Bit 6, RESERVED Bit 7 (0, Output Disabled; 1, Output Enabled)	Check Lock and Output Status	SOT->PC
others	RESERVED	RESERVED	RESERVED	RESERVED

4. Serial Communication Process

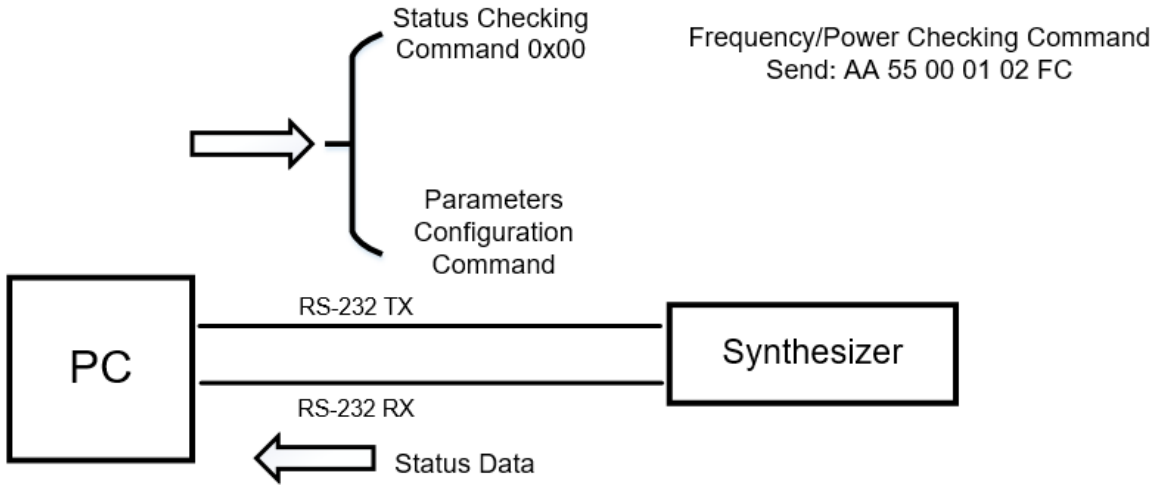

Fig. 2 Communication between PC and synthesizer

When PC sends parameter setup command through RS-232 TX pin to the synthesizer, the synthesizer will calculate the parameters and generate waveforms as required. When PC sends status check command to the synthesizer, the synthesizer will read the requested status data and send a command back to the PC through RS-232 RX pin. The communication between PC and synthesizer is illustrated in Fig. 2. Note that all the commands sent by both PC and synthesizer follow the same command format.

To operate the synthesizer, there are three steps,

1. Power on the synthesizer. The default operating frequency is 10 GHz, power level is 0 dBm, and output is disabled.
2. Enable the synthesizer output. PC sends command below to the synthesizer,
   AA 55 09 01 01 F6
   where AA (Header) 55(Module Number) 09(Command Index) 01(Command Length) 01(Data) F6(Parity).
3. Configure the operating frequency and power level. For example, if the synthesizer is configured to generate CW waveform with frequency of 1 GHz and power of 0 dBm, frequency unit 1 Hz, PC sends command below to the synthesizer,
   AA 55 02 08 00 00 3B 9A CA 00 05 DC 47
   Besides continuous wave, the synthesizer can generate pulse waveform as well. The command to generate an internal pulse with 0.1 ms period and 0.05 ms pulse width is shown below,
   AA 55 11 09 01 00 01 86 A0 00 00 C3 50 52

Index