

AOTF Driver Communication Protocol

Generic Version

1. System Block Diagram

The host computer controls the driver via a USB interface to output RF signals with specified parameters. The system block diagram is shown in Figure 1.

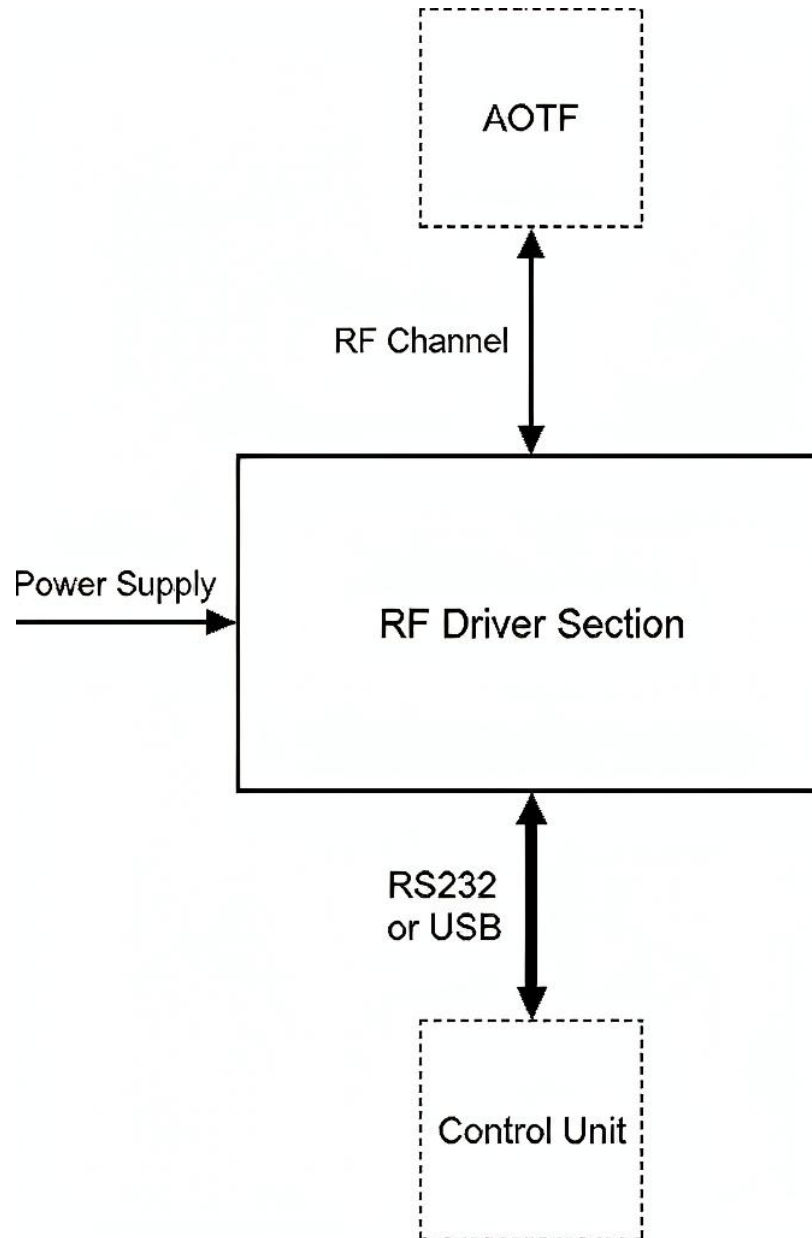


Figure 1 System Block Diagram

Control terminal (RS232/USB) ↔ RF driver section ↔ AOTF (RF channel). Power is supplied to the RF driver section.

2. Protocol Format

The control program currently supports two operating modes: single-frequency "sending" and scanning "scanning".

- Single-frequency mode: requires frequency and amplitude parameters.
- Scanning mode: requires start frequency, stop frequency, amplitude, and frequency step parameters.

The detailed data-frame formats are described below.

2.1 Operating Mode Control

The control commands include Power Off, Pause, and Resume. The Power-Off command is valid in both single-frequency and scanning modes; Pause and Resume are valid only in scanning mode.

Field	Size	Description
Data Frame Header	4 bytes	Fixed: A5 5A 5A A5
Send Count	1 byte	Number of transmissions
Mode	1 byte	Control mode (0x00)
Command Word	1 byte	0x00=Power Off, 0x01=Pause, 0x02=Resume
Frame Tail	4 bytes	Fixed: 5A A5 A5 5A

Note: The command-word values above are representative. Refer to the specific driver firmware version for exact encodings.

2.2 Single-Frequency Mode

Field	Size	Description
Data Frame Header	4 bytes	Fixed: A5 5A 5A A5
Send Count	1 byte	Number of transmissions
Mode	1 byte	Single-frequency mode (0x01)
Frequency	4 bytes	Output frequency (see Section 4.1)
Amplitude	2 bytes	Output amplitude (see Section 4.2)
Frame Tail	4 bytes	Fixed: 5A A5 A5 5A

2.3 Scanning Mode

Field	Size	Description
Data Frame Header	4 bytes	Fixed: A5 5A 5A A5
Send Count	1 byte	Number of transmissions
Mode	1 byte	Scanning mode (0x03)
Start Frequency	4 bytes	Scan start frequency
Stop Frequency	4 bytes	Scan stop frequency
Amplitude	2 bytes	Output amplitude

Frequency Step	1 byte	Step size lookup (see Section 2.4)
Async Scan Interval	4 bytes	Time interval = data × 20 ns
Loop Flag	1 byte	0x01=loop, 0x00=single sweep
Frame Tail	4 bytes	Fixed: 5A A5 A5 5A

2.4 Frequency Step Lookup Table

In scanning mode, the frequency-step parameter occupies one byte. The actual step value is obtained from the following lookup table:

Code	0	1	2	3	4	5	6	7	8	9	A	B	C	D
Step	15 kHz z	30 kHz z	61 kHz z	122 kHz z	244 kHz z	488 kHz z	976 kHz z	1.95 3 MHz	3.90 6 MHz	7.81 2 MHz	15.62 5 MHz	31.2 5 MHz	62.5 MH z	125 MH z

3. Other Parameters

- Frame header: A5 5A 5A A5; Frame tail: 5A A5 A5 5A
- Default serial port: COM1; Baud rate: 9600 bps
- Driver control program written in VC 6.0

4. Frequency and Amplitude Calculation

The following formulas apply to the frequency and amplitude fields in the protocol data frames.

4.1 Frequency Calculation

All frequency parameters (except the frequency-step byte) are 4-byte unsigned integers.

$$FTW = \text{round}((f_{out} \times 2^{32}) / f_{sysclk})$$

Where FTW is the frequency tuning word in the protocol, f_{sysclk} is the system clock (1 GHz = 10^9 Hz), and f_{out} is the desired output frequency.

Example: $f_{out} = 50$ MHz $\rightarrow$ FTW = 0x0CCCCCCC.

4.2 Amplitude Calculation

Amplitude is a 2-byte unsigned integer.

$$ASF = \text{round}(\text{Amplitude scale} \times 2^{12} - 1)$$

Where ASF is the amplitude scale factor in the protocol, and Amplitude scale is the attenuation coefficient (0 – 4, precise to 0.01). 0 corresponds to minimum output power; 4 corresponds to maximum output power.

Example: Amplitude scale = 4 → ASF = 0x3FFF.

4.3 Asynchronous Scanning Time Interval

The asynchronous scanning time interval is a 4-byte unsigned integer.

$$TI = Async\ Scan\ Interval\ Data \times 20\ ns$$

Where TI is the time interval between frequency steps. The data range is $1 - 5 \times 10^7$, giving a minimum interval of 20 ns and a maximum of 1 s.

4.4 Loop Control (Asynchronous Only)

The loop flag is a 1-byte field valid only for asynchronous scanning. Synchronous scanning speed is determined by the external sync signal frequency.

- 0x01: Loop scanning. After reaching the stop frequency, the sweep restarts from the start frequency and repeats until a Power-Off command is received.
- 0x00: Single sweep. After reaching the stop frequency, the output remains at the stop frequency.

SIMTRUM provides a reference VC test program. Users may develop their own driver control software according to this protocol and integrate it into their systems.