Serene ANC LU Host Commands

Version 2.0

Contents

1   Introduction

This document lists the commands supported by LightX-U (LU) chip via the SPI interface. The host SoC can use these commands to control the chip functionality and features.
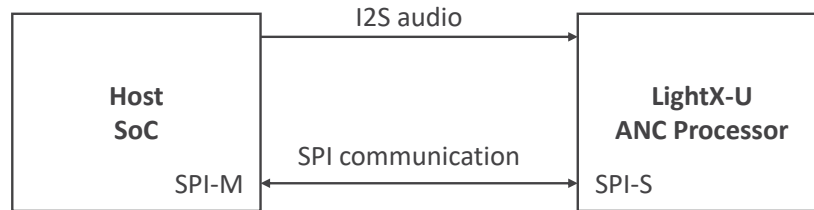

Figure 1-1. Interface between the host SoC and LightX-U ANC processor

2   List of Commands

The following table lists the individual commands supported over the host interface.

Table 2-1. List of LU commands

#	Command	Parameters	Response	Remarks
1	Shut down	-	status	Host sends this command to shut down the LU chip. For power on, use the reset pin.
2	Set LU mode	`mode`	status	`mode` can be NC (Active Noise Cancellation), Awareness (aka transparency) or Passive (ANC/Awareness off)
3	Get LU mode	-	mode	NC/Awareness/Passive
4	Start FB production cal	-	status	Start production Feedback ANC calibration. This command is initiated by the test PC via HID during production. This command takes about 30 s.
5	Start FF production cal	-	status	Start production Feedforward ANC calibration. This command is initiated by the test PC via HID during production. This command takes about 30 s.
6	Get production cal status	-	busy/idle	The host polls this status to know when the production cal has completed.
7	Get production cal values	`ancvar`	168 Bytes	Returns the value of one of 32 different ANC variables. `ancvar` is an integer in the range 0-31. The response contains 168 bytes representing 42 single-precision floating point numbers.
8	Set preset EQ	`preset`	status	Switch to one of five preprogrammed sets of EQ filters
9	Get preset EQ		preset	Index of the currently used preset (1 to 5)
10	Configure user EQ biquad	`set, band, type,`	status	Specify the filter for one biquad (#band 1-10) in one user EQ set (#set 1-4). Type can be

		frequency, gain, Q		peaking/lowshelf/highshelf/highpass/lowpass. Type, frequency, gain and Q specify the coefficients.
11	Set user EQ	preset	status	Switch to one of four user EQ filter sets
12	Get preset EQ		preset	Index of the currently used user EQ (1 to 4)

3 Command Structure

The general structure of the LU commands and responses is described in the "AIS Command Messaging Specification.pdf" document. The commands listed above will follow the same structure.

3.1 Set LU Mode

Parameters: mode

- NC (ANC on): 0
- Awareness: 1
- Passive: 2

Response: status

Avserve command: direct.param.set 0xAA 0x00200000 <mode>

SPI byte sequence:

Byte Offset	Start Bit	Field	Size (bits)	Value
0	0	Source	8	0x40
1	0	Dest	8	0x0C
2	0	Opcode	6	3
2	6	Reserved	1	0
2	7	BufferFlag	1	0
3	0	Status	6	0
3	6	Type	2	2'b01
4	0	Param0	32	0x00200000
8	0	Param1	32	0x0000000<mode>

Description:

Set the current mode that is active.

3.2 Get LU Mode

Parameters: None

Response: mode

- NC (ANC on): 0
- Awareness: 1
- Passive: 2

Avserve command: direct.param.get 0xAA 0x00200000

SPI byte sequence:

Byte Offset	Start Bit	Field	Size (bits)	Value
0	0	Source	8	0x40
1	0	Dest	8	0x0C
2	0	Opcode	6	4
2	6	Reserved	1	0
2	7	BufferFlag	1	0
3	0	Status	6	0
3	6	Type	2	2'b01
4	0	Param0	32	0x00200000
8	0	Param1	32	0x00000000

Description:

Get the current mode that is active.

3.3   Start Feedback Production Cal

Parameters: enable/disable

- 1: Enable FB cal
- 0: Disable FB cal

Response: status

Avserve command: direct.param.set 0xAA 0x05200000 <1|0>

SPI byte sequence:

Byte Offset	Start Bit	Field	Size (bits)	Value
0	0	Source	8	0x40
1	0	Dest	8	0x0C
2	0	Opcode	6	3
2	6	Reserved	1	0
2	7	BufferFlag	1	0
3	0	Status	6	0
3	6	Type	2	2'b01
4	0	Param0	32	0x05200000
8	0	Param1	32	0x00000000<1|0>

Description:

Start the Feedback ANC calibration. Must be completed prior to starting a Feedforward calibration.

3.4   Start Feedforward Production Cal

Parameters: enable/disable

- 1: Enable FF cal
- 0: Disable FF cal

Response: status

Avserve command: direct.param.set 0xAA 0x05200000 1

SPI byte sequence:

Byte Offset	Start Bit	Field	Size (bits)	Value
0	0	Source	8	0x40
1	0	Dest	8	0x0C
2	0	Opcode	6	3
2	6	Reserved	1	0
2	7	BufferFlag	1	0
3	0	Status	6	0
3	6	Type	2	2'b01
4	0	Param0	32	0x06200000
8	0	Param1	32	0x00000000<1|0>

Description:

Start the feed forward calibration. Assumes the Feedback ANC has already been calibrated.

3.5   Get Production Cal Status

Parameters: None

Response: is_cal_done

- 1 : done
- 0: not done

Avserve command: direct.param.get 0xAA 0x08200000

SPI byte sequence:

Byte Offset	Start Bit	Field	Size (bits)	Value
0	0	Source	8	0x40
1	0	Dest	8	0x0C
2	0	Opcode	6	4
2	6	Reserved	1	0
2	7	BufferFlag	1	0
3	0	Status	6	0
3	6	Type	2	2'b01
4	0	Param0	32	0x08200000
8	0	Param1	32	0x000000000

Description:

Used for determining when a calibration is busy. The calibration app will poll this value to wait for the calibration to complete before moving to the next step in the app.

3.6   Get Production Cal Values

Parameters: ancvar, num_bytes (256 max)

- 0: TNM_L
- 1: TNM_R
- 2: TUM_L
- 3: TUM_R

Response: ANC data array values

Avserve command: sys.direct.read 0xAA 0x0C20000<ancvar>

SPI byte sequence:

Byte Offset	Start Bit	Field	Size (bits)	Value
0	0	Source	8	0x40
1	0	Dest	8	0x0C
2	0	Opcode	6	1
2	6	Reserved	1	0
2	7	BufferFlag	1	1
3	0	Status	6	0
3	6	Type	2	2'b00
4	0	Param0	32	0x0C2000<ancvar>
8	0	Param1	32	0x00000<num_bytes>

Description:

The Transfer Function Estimate data is 616 bytes. The read commands can only transfer 256 bytes at a time. The Transfer Function Estimate Read Address command is used for setting the beginning of the read in words (e.g., the second block of 256 bytes will be read if the read address is set to 64).

3.7 Set Transfer Function Estimate Read Address

Parameters: Read Address in words

Response: status

Avserve command: direct.param.set 0xAA 0x0E200000 <addr_val>

SPI byte sequence:

Byte Offset	Start Bit	Field	Size (bits)	Value
0	0	Source	8	0x40
1	0	Dest	8	0x0C
2	0	Opcode	6	3
2	6	Reserved	1	0
2	7	BufferFlag	1	0
3	0	Status	6	0
3	6	Type	2	2'b01
4	0	Param0	32	0x0E200000
8	0	Param1	32	0x000000<addr_val>

Description:

Used as part of the Get Production Cal Values operation. Valid start addresses for transfer function estimate data is 0, 64, and 128 (0, 256, 512 bytes to read the 616 bytes in bursts of 256)

3.8   Get Transfer Function Estimate Length

Parameters: None

Response: Number of complex values in a Transfer Function Estimate

Avserve command: direct.param.set 0xAA 0x0D200000

SPI byte sequence:

Byte Offset	Start Bit	Field	Size (bits)	Value
0	0	Source	8	0x40
1	0	Dest	8	0x0C
2	0	Opcode	6	4
2	6	Reserved	1	0
2	7	BufferFlag	1	0
3	0	Status	6	0
3	6	Type	2	2'b01
4	0	Param0	32	0x0D200000
8	0	Param1	32	0x00000000

Description:

Used as part of the Get Production Cal Values operation. Returns the number of complex values in a Transfer Function Estimate. This value is static.

3.9 Set Preset EQ

Parameters: preset

Response: status

Avserve command: direct.param.set 0xAA 0x09200000 <preset_idx>

SPI byte sequence:

Byte Offset	Start Bit	Field	Size (bits)	Value
0	0	Source	8	0x40
1	0	Dest	8	0x0C
2	0	Opcode	6	3
2	6	Reserved	1	0
2	7	BufferFlag	1	0
3	0	Status	6	0
3	6	Type	2	2'b01
4	0	Param0	32	0x09200000
8	0	Param1	32	0x000000<preset_idx>

Description:

Switch to one of five preprogrammed sets of EQ filters

3.10 Get Preset EQ

Parameters: None

Response: Index of active Preset EQ

Avserve command: direct.param.get 0xAA 0x09200000

SPI byte sequence:

Byte Offset	Start Bit	Field	Size (bits)	Value
0	0	Source	8	0x40
1	0	Dest	8	0x0C
2	0	Opcode	6	4
2	6	Reserved	1	0
2	7	BufferFlag	1	0
3	0	Status	6	0
3	6	Type	2	2'b01
4	0	Param0	32	0x09200000
8	0	Param1	32	0x00000000

Description:

Get the index of the current Preset EQ.

3.11 Configure User EQ Biquad

Parameters: band, set, type, frequency, gain, Q

Band: byte

Set: byte

Frequency: IEEE754 float

Gain: IEEE754 Float

Q: IEEE754 Float

Type: byte

- 0: Unity
- 1: Peaking
- 2: Low Shelf
- 3: High Shelf
- 4: Lowpass
- 5: Highpass

Response: status

Avserve command: sys.direct.write 0xAA 0x0B20<band_idx_byte><set_idx_byte> frequency gain Q type

SPI byte sequence:

Byte Offset	Start Bit	Field	Size (bits)	Value
0	0	Source	8	0x40
1	0	Dest	8	0x0C
2	0	Opcode	6	2
2	6	Reserved	1	0
2	7	BufferFlag	1	1
3	0	Status	6	0
3	6	Type	2	2'b01
4	0	Param0	32	0x0B20<band_idx_byte><set_idx_byte>
8	0	Param1	32	0x0000000D
12	0	Payload	13*8	<frequency><gain><Q><type>

Description:

Configure the User EQ at <band_idx_byte> and <set_idx_byte> with a filter defined by the frequency, gain, Q and type

3.12 Set User EQ

Parameters: user EQ index

Response: status

Avserve command: direct.param.set 0xAA 0x0A200000 <user_idx>

SPI byte sequence:

Byte Offset	Start Bit	Field	Size (bits)	Value
0	0	Source	8	0x40
1	0	Dest	8	0x0C
2	0	Opcode	6	3
2	6	Reserved	1	0
2	7	BufferFlag	1	0
3	0	Status	6	0
3	6	Type	2	2'b01
4	0	Param0	32	0x0A200000
8	0	Param1	32	0x000000<user_idx>

Description:

Switch to one of four user EQ filter sets.

3.13 Get User EQ

Parameters: None

Response: Index of active User EQ

Avserve command: direct.param.get 0xAA 0x0A200000

SPI byte sequence:

Byte Offset	Start Bit	Field	Size (bits)	Value
0	0	Source	8	0x40
1	0	Dest	8	0x0C
2	0	Opcode	6	4
2	6	Reserved	1	0
2	7	BufferFlag	1	0
3	0	Status	6	0
3	6	Type	2	2'b01
4	0	Param0	32	0x0A200000
8	0	Param1	32	0x00000000

Description:

Get the index of the current User EQ.

4   Version History

Version	Date	Changes
1	April 1, 2025	Initial version
2	May 16, 2025	Add commands for preset and user EQ. Specify command structure and SPI byte sequences.