Airoha IoT SDK for BT Audio Mass Production RACE Application Note

*** AB156x is only compatible with SDK v3.1.0 and above ***

Version: 1.10
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Document Revision History

Revision	Date	Description
1.0	19 January 2022	Initial release
1.1	04 July 2022	Added relay example for dual chip Fixed incorrect example of get audio channel RACE command Fixed incorrect format of Power OFF RACE command Fixed incorrect NV ID of Enter DUT mode function
1.2	20 October 2022	Added Airoha defined data format for USB interface Added MIC test commands to support multi-MIC/DCHS test purposes Added DUT/DTM mode commands which do not need to reset device
1.3	26 October 2022	Added description for ULL 1.0/ULL 2.0 pairing commands
1.4	10 March 2023	Added a screenshot of Bluetooth address on smart devices
1.5	24 March 2023	Modified description for ULL 2.0/LE Audio pairing commands
1.6	3 May 2023	Added support for AB1627 and renamed the documentation to Airoha IoT SDK for BT Audio Mass Production RACE Application Note.
1.7	31 July 2023	Revised description for enabling or disabling ANC command.
1.8	12 January 2024	Modified the content of Chapter 5.1 and added Chapter 5.9.
1.9	23 January 2024	Corrected the value about DMIC_2_R in Table 9-1.
1.10	20 February 2024	Added support for AB159x.

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Lists of Tables and Figures

1. Introduction

This application note describes Airoha device Mass Production RACE related information. The following topics are included to help users to establish Audio Mass Production environment.

1) Airoha device RACE definition
2) UART software flow control
3) ANC calibration flow
4) ANC RACE commands (ANC RACE commands are used to calibrate ANC.)

Relay RACE commands (Relay RACE commands are used to send RACE to partner for MCSync/dual chip ANC calibration.)

Sub-function RACE commands (Sub-function RACE commands is to support version check, model name check…etc.)

Mic test RACE commands (Mic test RACE commands are used to test mic functionality.)

*** For AB156x, The content of this application note is only applicable in AB156x SDK v3.1.0 and below. ***

2. RACE Command Packet

The Race Command (RCMD) packet is used to send commands to Airoha device from the Host (external MCU or PC tool) or receive events (indications or responses) from Airoha device. Any Airoha device can accept an RCMD with up to 1000 bytes of data excluding the RCMD header and length field. Each RCMD command is assigned two types of transported fields that are used to uniquely identify different format of commands. These two fields are called “Transported by H4” and “Transported by H5”.

2.1. RCMD Packet Format

2.1.1. RCMD Command Format (sent to Airoha device)

Command				
Channel	Type	Length	ID	Payload
1 byte	1 byte	2 bytes	2 bytes	Varied
0x05	0x5A or 0x5C	#1	RACE Command ID	#2

Table 2-1.RACE Command Format

#1 ID + Payload
#2 Command parameters
#3 Little Endian used for multi-bytes area

2.1.2. RCMD Receive Format (received from Airoha device)

Response				
Channel	Type	Length	ID	Payload
1 byte	1 byte	2 bytes	2 bytes	Varied
0x05	0x5B or 0x5D	#1	RACE Command ID	#2

Table 2-2.RACE Receive Format

The host sends RCMD Commands to Airoha device via UART. Airoha device responds with the individual ‘ID’ which represents the ID of the responding command.

2.2. Type List

Type ID	Description
0x5A	Command needs a response
0x5B	Response
0x5C	Command does not need a response
0x5D	Notification

Table 2-3.RACE Type List

3. UART Flow Control

Airoha device implements the UART software flow control which uses 0x11 and 0x13 as the control bytes. Encode/decode data according to the following tables if you are sending RACE via UART.

Sending raw data	Encoded data
0x11	0x77 0xEE
0x13	0x77 0xEC
0x77	0x77 0x88

Table 3-1. UART Flow Control Encoding Table

Receiving raw data	Decoded data
0x77 0xEE	0x11
0x77 0xEC	0x13
0x77 0x88	0x77

Table 3-2. UART Flow Control Decoding Table

4. USB Data Format

Airoha device supports the USB interface for sending RACE commands for MP/tuning purposes.

Byte 0	Byte 1	Byte 2	Byte 3-61
Report ID - 0x06: Out - 0x07: In	Length - Valid length of Data	Target Device - 0x00: Local - 0x80: Remote	Data - Race command

Table 4-1. USB Data Format

- Byte 0: Report ID

In HID specification, the first byte must be the report ID

Out Report ID: 0x06; IN Report ID: 0x07

- Byte 1: **Valid** length of data

The data of HID packet is padded to the maximum size by zero data of each HID report.

The USB module can know according to this byte how many bytes is valid and send the appropriate data to the race module.

- Byte 2: Target device

0x00: The local device

0x80: The remote device which is connected to the local device

- Byte 3~61: Data

Race command

5. ANC RACE Command

Payload ID

All ANC commands use the RACE command ID **0x0E06** and Payload ID in the payload. Table 5-1 shows the definitions for the Payload IDs.

Payload ID	
Description	**ID**
ANC On	**0x0A**
ANC Off	**0x0B**
Set ANC Gain	**0x0C**
Read ANC gain from NvKey	**0x0D**
Write ANC gain to NvKey	**0x0E**
Get ANC hybrid capability	**0x16**

Table 5-1.ANC RACE Payload ID

ANC Gain Index Mapping

Table 5-2 shows the Gain Index and the Gain Values for ANC.

Gain Index	Gain Value (dB)
0x0258(600)	**6**
…	**..**
0x0000	**0**
0xFFFF(-1)	**-0.01**
0xFFFE(-2)	**-0.02**
…	**Gain value = Gain index/100**
0xFF9C(-100)	**-1**
…	**…**
0xFA24(-1500)	**-15**
…	**…**
0xDCD8(-9000)	**-90**

Table 5-2.ANC Gain Index Mapping

5.1. ANC On

Hereinafter, 'Passthrough' will be abbreviated as 'PT'.

Command (0x055A)								
Length		ID		Payload				
2 bytes		2 bytes		5 bytes				
				Status	ID	Filter coefficient index	ANC mode	Sync mode
0x07	0x00	0x06	0x0E	0x00	0x0A	XX	00:Hybrid 01:FF only 02:FB only 04:AiroThru 06:Hybrid PT 07:PT FB 08:Adaptive PT 09:Vivid PT	00: Turn on agent ANC only 01:Turn on both agent and partner ANC 02: Turn on both agent and partner ANC through application layer

*** The "sync mode" parameter is supported to set value as 2 from SDK v3.8.0.***

Response (0x055B)									
Length		ID		Payload					
2 bytes		2 bytes		6 bytes					
				Status	ID	Filter coefficient index	ANC mode	Sync mode	reserved
0x08	0x00	0x06	0x0E	0x00: success Else: fail	0x0A	XX	00:Hybrid 01:FF only 02:FB only 04:AiroThru 06:Hybrid PT 07:PT FB 08:Adaptive PT 09:Vivid PT	00 or 01 or 02	XX

Filter coefficient index:
ANC: 0x01 ~ 0x04
AiroThru: 0x09 ~ 0x0B
Hybrid PT: 0x05 ~ 0x07
Vivid PT: 0x0C ~ 0x0E

5.2. ANC Off

Command (0x055A)						
Length		ID		Payload		
2 bytes		2 bytes		3 bytes		
0x05	0x00	0x06	0x0E	Status	ID	Sync mode
				0x00	0x0B	00: Turn on agent ANC only 01: Turn on both agent and partner ANC 02: Turn on both agent and partner ANC through application layer

*** The "sync mode" parameter is supported to set value as 2 from SDK v3.8.0.***

Response (0x055B)									
Length		ID		Payload					
2 bytes		2 bytes		6 bytes					
0x08	0x00	0x06	0x0E	Status	ID	Sync mode	Reserved		
				0x00: success Else: fail	0x0B	00 or 01 or 02	XX	XX	XX

5.3. Set ANC Gain

Command (0x055A)											
Length		ID		Payload							
2 bytes		2 bytes		10 bytes							
0x0C	0x00	0x06	0x0E	Status	ID	Gain FF L		Gain FB L		Gain FF R		Gain FB R	
				0x00	0x0C	XX	XX	XX	XX	XX	XX	XX	XX

Response (0x055B)											
Length		ID		Payload							
2 bytes		2 bytes		10 bytes							
0x0C	0x00	0x06	0x0E	Status	ID	Gain FF L		Gain FB L		Gain FF R		Gain FB R	
				0x00:success Else: fail	0x0C	XX	XX	XX	XX	XX	XX	XX	XX

5.4. Read ANC Gain from NvKey

Command (0x055A)					
Length		ID		Payload	
2 bytes		2 bytes		2 bytes	
0x04	0x00	0x06	0x0E	Status	ID
				0x00	0x0D

Response (0x055B)											
Length		ID		Payload							
2 bytes		2 bytes		10 bytes							
0x0C	0x00	0x06	0x0E	Status	ID	Gain FF L		Gain FB L		Gain FF R		Gain FB R	
				0x00: success Else: fail	0x0D	XX	XX	XX	XX	XX	XX	XX	XX

5.5. Write ANC Gain to NvKey

Command (0x055A)													
Length		ID		Payload									
2 bytes		2 bytes		10 bytes									
0x0C	0x00	0x06	0x0E	Status	ID	Gain FF L		Gain FB L		Gain FF R		Gain FB R	
				0x00	0x0E	XX	XX	XX	XX	XX	XX	XX	XX

Response (0x055B)													
Length		ID		Payload									
2 bytes		2 bytes		10 bytes									
0x0C	0x00	0x06	0x0E	Status	ID	Gain FF L		Gain FB L		Gain FF R		Gain FB R	
				0x00: success Else: fail	0x0E	XX	XX	XX	XX	XX	XX	XX	XX

5.6. Get ANC Hybrid Capability

Command (0x055A)					
Length		ID		Payload	
2 bytes		2 bytes		2 bytes	
0x04	0x00	0x06	0x0E	Status	ID
				0x00	0x16

Response (0x055B)						
Length		ID		Payload		
2 bytes		2 bytes		3 bytes		
0x05	0x00	0x06	0x0E	Status	ID	Hybrid capability
				0x00: success Else: fail	0x16	0x01: support hybrid

5.7. Enter ANC MP Mode

Command (0x055A)					
Length		ID		Payload	
2 bytes		2 bytes		2 bytes	
0x04	0x00	0x06	0x0E	Status	ID
				0x00	0x10

Response (0x055B)					
Length		ID		Payload	
2 bytes		2 bytes		2 bytes	
0x04	0x00	0x06	0x0E	Status	ID
				0x00: success Else: fail	0x10

5.8. Leave ANC MP Mode

Command (0x055A)					
Length		ID		Payload	
2 bytes		2 bytes		2 bytes	
0x04	0x00	0x06	0x0E	Status	ID
				0x00	0x11

Response (0x055B)					
Length		ID		Payload	
2 bytes		2 bytes		2 bytes	
0x04	0x00	0x06	0x0E	Status	ID
				0x00: success Else: fail	0x11

5.9. Adaptive ANC On

Command (0x055A)								
Length		ID		Payload				
2 bytes		2 bytes		4 bytes				11 bytes
0x11	0x00	0x06	0x0E	Status	ID	Filter Coefficient Index	ANC Mode	Fixed Settings
				0x00	0x0A	xx	05:Adaptive ANC	01 00 0A 01 00 08 02 00 00 00 00

Response (0x055B)								
Length		ID		Payload				
2 bytes		2 bytes		4 bytes				5 bytes
0x0B	0x00	0x06	0x0E	Status	ID	Filter coefficient index	ANC mode	Fixed Settings
				0x00: success Else: fail	0x0A	XX	05:Adaptive ANC	01 00 0A 00 00

Filter coefficient index:
ANC: 0x01 ~ 0x04

6. Relay RACE command (For MCSync and Dual Chip)

6.1. Get Available Destination

Command (0x055A)				
Length		ID		Payload
2 bytes		2 bytes		N/A
0x02	0x00	0x00	0x0D	N/A

Response (0x055B)				
Length		ID		Payload
2 bytes		2 bytes		N bytes
XX	0x00	0x00	0x0D	Destination list
				Pairs of [dst type:1 byte][dst id: 1 byte] For example: 0x01020506 (type USB and type AWS peer)

*** dst type: 0 uart, 1 usb, 2 airapp, 5 AWS peer**

6.2. Relay Command to Partner

Command (0x055A)						
Length		ID		Payload		
2 bytes		2 bytes		N bytes		
XX	XX	0x01	0x0D	Dst type	Dst ID	Data to partner
				0x05	%AWS_peer_ID	

Response (0x055C)							
Length		ID		Payload			
2 bytes		2 bytes		N bytes			
XX	XX	0x01	0x0D	Status	Dst type	Dst ID	Data from partner
				0x00: success Else: fail	0x05	%AWS_peer_ID	

*** %AWS_peer_ID is queried by Get Available Destination command. Type is 0x05 (AWS_peer).**

Relay example: (for MCSync)
Step 1: Get the AWS peer destination ID.
055A0200000D
055B0400000D0506 => get AWS peer ID: **06**

Step 2: Use AWS peer destination ID to send ANC OFF command to partner.
Relay the ANC OFF command to partner.
055A0D00010D0506 055A0500060E000B00
Get **ANC OFF Response** from partner
055D1000010D0506 055B0800060E000B00000000

Relay Example: (for Dual Chip)
Step 1: Get the UART destination ID.
055A0200000D
055B0400000D0506 => UART ID: **0D**

Step 2: Use the UART destination ID to send the ANC OFF command to the Dual chip partner.
Relay the ANC OFF command to partner.
055A0D00010D000D 055A0500060E000B00
Get the **ANC OFF Response** from partner.
055D1000010D000D 055B0800060E000B00000000

7. ANC Calibration Flow

7.1. Airoha Device Hybrid ANC Diagram

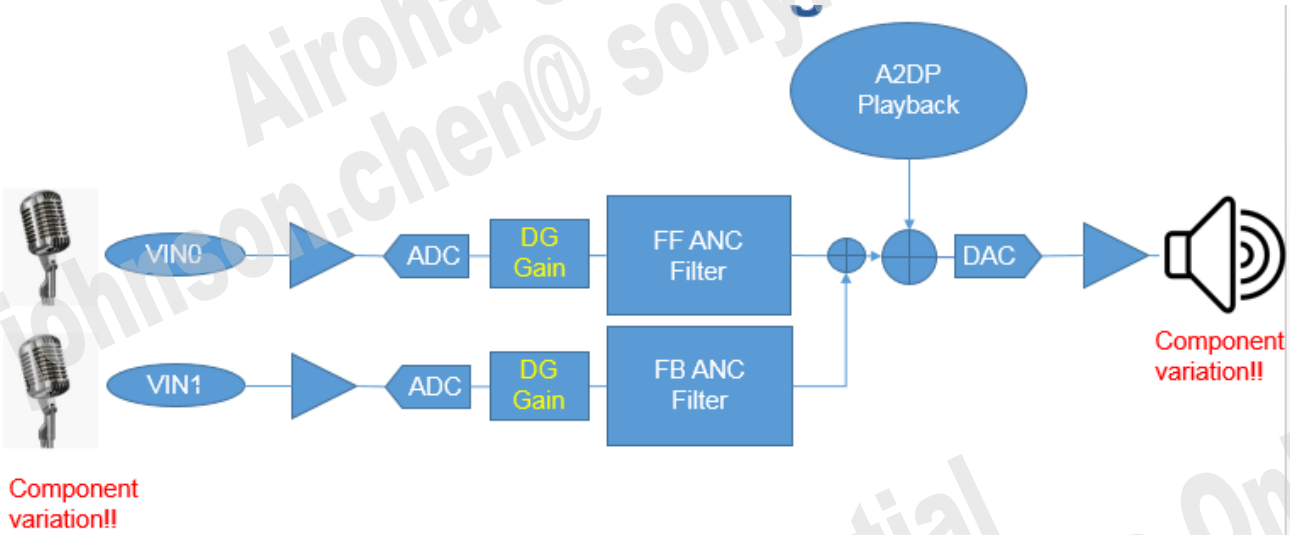

Figure 7-1. Airoha Device Hybrid ANC Diagram

7.2. FB/FF ANC Gains

There are two gains to be calibrated during the ANC test.

1) FB DG gain: The FB gain must be calibrated in the first stage under ANC FB mode.
2) FF DG gain: After FB gain is calibrated, the FF gain must be calibrated under ANC hybrid mode.

7.3. ANC Calibration Flow Chart

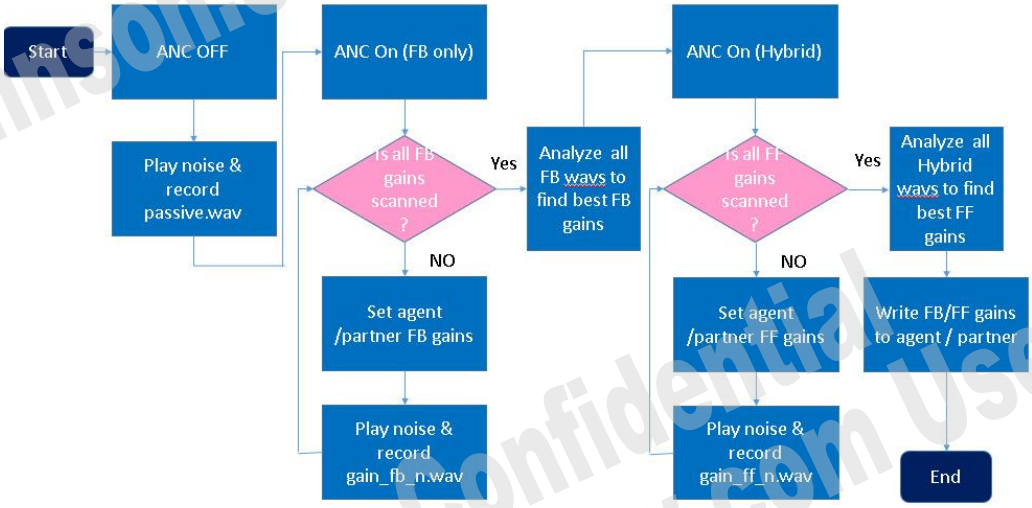

Figure 7-2. ANC Calibration Flow Chart

8. Sub Function RACE Command

8.1. Read NV Key

Command (0x055A)							
Length		ID		Payload			
2 bytes		2 bytes		4 bytes			
0x06	0x00	0x00	0x0A	NV_ID_B0	NV_ID_B1	Length_B0	Length_B1
				XX	XX	XX	XX

Command (0x055B)						
Length		ID		Payload		
2 bytes		2 bytes		N bytes		
XX	XX	0x00	0x0A	Length_B0	Length_B1	NV value (N-2 bytes)
				XX	XX	XX

For example:
Read NV ID = 0xF500, Length = 0x0028
055A0600000A00F52800
Response, Length = 0x0028, NV value = 0x5941595500 …….
055B2C00000A2800594159550000000000000000000000000000006D6F64656C3100000000000000000000000000

8.2. Write NV Key

Command (0x055A)						
Length		ID		Payload		
2 bytes		2 bytes		N bytes		
0xXX	0xXX	0x01	0x0A	NV_ID_B0	NV_ID_B1	Payload
				XX	XX	NV values

Command (0x055B)				
Length		ID		Payload
2 bytes		2 bytes		1 byte
03	00	0x01	0x0A	Status
				0x00: success Else: fail

For example:
Write NV ID = 0x3A00, Value = 0x00
055A0500010A003A00
Response, Status = 00
055B0300010A00

8.3. Get Version

Command (0x055A)				
Length		ID		Payload
2 bytes		2 bytes		Role: 1 byte
0x03	0x00	0x07	0x1C	Agent: 0x00

Notification (0x055D)							
Length		ID		Payload			
2 bytes		2 bytes		N bytes			
XX	XX	0x07	0x1C	Status	Role (1 byte)	Length (1 byte)	version (N-3 bytes) in ASCII
				0x00: success Else: fail	0x00: agent	XX	XX

For example:
055A0300071C00
Notification, Length = **0x06**, NV value = **0x76312E302E30**
055D0B00071C0000067631 2E302E30

0x76312E302E30 in ASCI is “v1.0.0”.

8.4. Set PEQ Index

Command (0x055A)						
Length		ID		Payload		
2 bytes		2 bytes		Module (2 bytes)		PEQ index (1 byte)
0x05	0x00	0x00	0x09	0x00	0x00	index

Notification (0x055D)					
Length		ID		Payload	
2 bytes		2 bytes		N bytes	
0x05	0x00	0x00	0x09	Module (2 bytes)	Status
				0x00 0x00	0x00: success Else: fail

8.5. Power OFF

Command (0x055A)				
Length		ID		Payload
2 bytes		2 bytes		1 byte
0x03	0x00	0x11	0x11	0x01

Response (0x055B)				
Length		ID		Payload
2 bytes		2 bytes		1 bytes
0x03	0x00	0x11	0x11	Status
				0x00: success Else: fail

8.6. Get Battery Level

Command (0x055A)				
Length		ID		Payload
2 bytes		2 bytes		Role (1 byte)
0x03	0x00	0xD6	0x0C	Agent: 0x00

Notification (0x055D)						
Length		ID		Payload		
2 bytes		2 bytes		N bytes		
0x05	0x00	0xD6	0x0C	Status	Role (1 byte)	Battery level (1 byte)
				0x00: success Else: fail	0x00: agent	Unit: percentage

For example:
055A0300D60C00
055D0500D60C000050 Battery level is 80%.

8.7. Get BD Address

Command (0x055A)				
Length		ID		Payload
2 bytes		2 bytes		Role: 1 byte
0x03	0x00	0xD5	0x0C	Agent: 0x00

Response (0x055B)						
Length		ID		Payload		
2 bytes		2 bytes		N bytes		
0x05	0x00	0xD5	0x0C	Status	Role (1 byte)	BD address (6 bytes)
				0x00: success Else: fail	0x00: agent	

For example:
055A0300D50C00
055B0A00D50C0000665544332211 BD address is 0x112233445566.

055A0300D50C00
055B0A00D50C00007CE0E56ADB4D BD address is 0x4DDB6AE5E07C.

The MAC address is shown as the Bluetooth address on smart devices.

Figure 8-1. Bluetooth Address on Smart Devices.

8.8. Write MCSync Information

NV key 0x183D saves the MCSync setting. Use the Write NV RACE command to write it.

For example:
Agent BD address: 0x112233445566
Partner BD address: 0x998877665544
MCSync key: 0x01020304050607080910111213141516

Write to agent (0x40)
055A3400010A 3D18 40 0000 445566778899 FF 665544332211
0101020304050607080910111213141516**00000000000000000000000000000000**

Write to partner (0x20)
055A3400010A 3D18 20 0000 665544332211 FF 445566778899
0101020304050607080910111213141516**00000000000000000000000000000000**

Note: To keep values of other fields, read the NV back, replace the agent BDA, partner BDA, role, and MCSync key, and then write it back.

Note: Agent and partner must have the same MCSync key in one group but the different agent partner group must use a different MCSync key.

8.9. Read/Write Device Name

The device name is saved in the NV key 0xF203 in ASCII format. Use Read/Write NV RACE commands to access it.

8.10. Get Model Name

Model name is saved in the 21st to 40th bytes of NV key 0xF50C in ASCII format. Use Read NV RACE command to get it.

8.11. Get Audio Channel

Audio channel setting is saved in the 2nd byte of NV key 0xE0F1. Use Read NV RACE command to get it.

Value = {
    1: Left channel
    2: Right channel
}

For example:
055A0600000AF1E0E803
Response, Length = **0x0009**, NV value = **0x0001010214, Left channel**
055B0900000A0500001010214

8.12. Enable/Disable DUT Mode

DUT mode control is saved in the NV key 0x183A. Use Write NV RACE command to enable/disable it.

For example:
Write NV ID = **0x183A**, Value = **0x01** (0x00 for disable, 0x01 for enable)
055A0500010A3A1801
Response, Status = **00**
055B0300010A00

8.13. RF Test Commands for Entering 3.0 DUT Mode/4.0 DTM

There are three commands for entering 3.0 DUT mode and 4.0 DTM.

1) standby command
2) enter 3.0 DUT mode command
3) enter 4.0 DTM command

Send A then B for entering 3.0 DUT mode.
Send A then C for entering 4.0 DTM.

A. Standby

Command (0x055A)				
Length		ID		Payload
2 bytes		2 bytes		22 bytes
0x18	0x00	0x92	0x0F	0x41 54 2B 42 54 43 4D 49 54 3D 42 54 5F 53 54 41 4E 44 42 59 0D 0A

B. Enter 3.0 DUT Mode

Command (0x055A)				
Length		ID		Payload
2 bytes		2 bytes		23 bytes
0x19	0x00	0x92	0x0F	0x41 54 2B 45 42 54 45 52 3D 53 45 54 5F 44 55 54 5F 4F 4E 4C 59 0D 0A

C. Enter 4.0 DTM

Command (0x055A)				
Length		ID		Payload
2 bytes		2 bytes		12 bytes
0x0E	0x00	0x92	0x0F	0x41 54 2B 45 42 54 45 52 3D 30 0D 0A

8.14. Factory Reset

Command (0x055A)				
Length		ID		Payload
2 bytes		2 bytes		2 byte
0x04	0x00	0x01	0x11	0x9500

Response (0x055B)				
Length		ID		Payload
2 bytes		2 bytes		1 byte
0x03	0x00	0x01	0x11	0x00: success Else: fail

8.15. Write ULL1.0 Dongle & Headset Pairing Information

ULL1.0 dongle & headset pairing is saved by NV key 0xF318. Use the Write NV RACE command to write it.

For example:
Dongle BD address: 0x112233445566
Headset BD address: 0x998877665544

Write to Dongle
055A0A00010A 18F3 445566778899

Write to Headset
055A0A00010A 18F3 665544332211

8.16. Write ULL1.0 Dongle & MCSync Pairing Information

Flow:
Step 1. MCSync setting is saved by NV key 0x183D. Use the Write NV RACE command to write it.
Refer to 8.8 for more information.

Step 2. ULL1.0 dongle & MCSync pairing is saved by NV key 0xF318. Use the Write NV RACE command to write it.

For example:
Dongle BD address: 0x112233445566
MCSync Agent BD address: 0x998877665544

Write to Dongle
055A0A00010A 18F3 445566778899

Write to MCSync (earbuds)
055A0A00010A 18F3 665544332211

8.17. Write ULL2.0/LE Dongle & MCSync/Headset SIRK Key

To write the SIRK key:

Step 1. MCSync setting is saved by NV key 0x183D. Use the Write NV RACE command to write it. Refer to Section 8.8 for more details.
Step 2. ULL2.0/LE dongle & MCSync/Headset SIRK key is saved by NV key 0x1900. Make sure that the dongle and earbuds/headset have the same SIRK key. Use the Read NV RACE command to read NV back, replace the SIRK key, and then use the Write NV RACE command to write it back.
For example:
ULL2.0/LE Dongle, MCSync(earbuds), Headset:
Read NV ID = 0x1900, Length = 0x0012
055A0600000A00191200
Response, Length = 0x0012, NV value = 0x00000000000000000000000000000000XXXX
055B1600000A1200 00000000000000000000000000000000 XXXX (XXXX: Don't Change.)
Original SIRK Key: 0x00000000000000000000000000000000
Write NV ID = 0x1900, New SIRK Key = 0x0102030405060708091011121314151 6 (SIRK: 16bytes random num.)
Keep others field unchanged.
055A1600010A0019010203040506070809101112131415 16XXXX (XXXX: Do not Change.)

Note: The LE dongle and earbuds/headset must have the same SIRK key in one group, but the different LE dongle and earbuds/headset group should use a different SIRK key.

8.18. Un Pairing: Write MCSync Information

Flow:
Step 1. Un Pairing MCSync setting is saved by NV key 0x183D. Use the Write NV RACE command to write it.

For example:
Write to agent and partner
055A3400010A 3D18 40 0000 000000000000 FF 000000000000
01 00000000000000000000000000000000000000000000000000000000000000000000

Step 2. Use command: Factory Reset (refer to Section 8.14 for more information).

8.19. Un Pairing: Write ULL1.0 Dongle & Headset Information

Flow:
Step 1. Un Pairing ULL1.0 dongle & headset is saved by NV key 0xF318. Use the Write NV RACE command to write it.

For example:
Write to Dongle
055A0A00010A 18F3 000000000000

Write to Headset
055A0A00010A 18F3 000000000000

Step 2. Use command: Factory Reset (refer to Section 8.14 for more information).

8.20. Un Pairing: Write ULL1.0 Dongle & MCSync Information

Flow:
Step 1. Un Pairing MCSync setting is saved by NV key 0x183D. Use the Write NV RACE command to write it. Refer to Section 8.18 for more information.

Step 2. Un Pairing ULL1.0 dongle & MCSync is saved by NV key 0xF318. Use the Write NV RACE command to write it.

For example:
Write to Dongle
055A0A00010A 18F3 000000000000

Write to MCSync (earbuds)
055A0A00010A 18F3 000000000000

3. Use command: Factory Reset (refer to Factory Reset for more information).

8.21. Unpairing: Write ULL2.0/LE Dongle & MCSync/Headset SIRK Key

To unpair:
Step 1. Un Pairing MCSync setting is saved by NV key 0x183D. Use the Write NV RACE command to write it. Refer to Section 8.18 for more details.

Step 2. Un Pairing ULL2.0/LE dongle & MCSync/Headset, SIRK key is saved by NV key 0x1900. Use the Read NV RACE command to read NV back, replace SIRK key so that each device has a different SIRK key, and then use the Write NV RACE command to write it back.

For example:
Original SIRK Key: 0x01010101010101010101010101010101

ULL2.0/LE Dongle, MCSync(earbuds), Headset:
Read NV ID = 0x1900, Length = 0x0012
055A0600000A00191200
Response, Length = 0x0012, NV value = 0x01010101010101010101010101010101XXXX
055B1600000A1200 01010101010101010101010101010101 XXXX (XXXX: Do not Change.)
Original SIRK Key: 0x01010101010101010101010101010101
Write NV ID = 0x1900, New SIRK Key = 0x02020202020202020202020202020202 (SIRK: 16bytes random num.)
Make **each device write a different SIRK key**. Keep others fields unchanged.
055A1600010A00190202020202020202020202020202020202XXXX (XXXX: Don't Change.)

Note: Let the LE dongle and earbuds/headset have a different SIRK key.

Step 3. Use command: Factory Reset (refer to Section 8.14 for more information).

9. Mic test RACE Command

9.1. MIC Swap

Command (0x055A)				
Length		ID		Payload
2 bytes		2 bytes		1 byte
0x03	0x00	0x0C	0x0E	MIC0 (0x00) MIC1 (0x01) MIC2 (0x02) MIC3 (0x03) MIC4 (0x04) MIC5 (0x05) Not Used (0xFF)

Response (0x055B)				
Length		ID		Payload
2 bytes		2 bytes		1 byte
0x03	0x00	0x0C	0x0E	0x00: success Else: fail

9.2. AECNR On/Off

Command (0x055A)				
Length		ID		Payload
2 bytes		2 bytes		1 byte
0x03	0x00	0x0D	0x0E	0x00 (Off) 0x01 (On)

Response (0x055B)				
Length		ID		Payload
2 bytes		2 bytes		1 byte
0x03	0x00	0x0D	0x0E	0x00: success Else: fail

9.3. RACE_DSP_REALTIME_OPEN_ALL_MIC_EXTEND

Command (0x055A)									
Length		ID		Payload					
2 bytes		2 bytes		6 bytes					
0x08	0x00	0x20	0x0E	MIC0 index	MIC1 index	MIC2 index	MIC3 index	MIC4 index	MIC5 index
				The values of MIC indexes are listed in Table 9-1.					

Response (0x055b)				
Length		ID		Payload
2 Bytes		2 Bytes		1 Byte
0x03	0x00	0x20	0x0e	0x00: Success Else: Fail

Use this command to enable microphones if some microphones are not use for speech process.

Input Device	Index	Input Device	Index	Input Device	Index	Input Device	Index	Input Device	Index
AMIC_0_L	0x00	DMIC_0_L	0x08	I2S_M_0_L	0x10	I2S_S_0	0x80		
AMIC_0_R	0x01	DMIC_0_R	0x09	I2S_M_0_R	0x20	I2S_S_0	0x90		
AMIC_1_L	0x02	DMIC_1_L	0x0A	I2S_M_1_L	0x30	I2S_S_1	0xA0	Not_Use	0xFF
AMIC_1_R	0x03	DMIC_1_R	0x0B	I2S_M_1_R	0x40	I2S_S_1	0xB0		
AMIC_2_L	0x04	DMIC_2_L	0x0C	I2S_M_2_L	0x50	I2S_S_2	0xC0		
AMIC_2_R	0x05	DMIC_2_R	0x0D	I2S_M_2_R	0x60	I2S_S_2	0xD0		

Table 9-1. Indexes of All Types of Microphones

After configuring microphones by this command, send MIC swap command to enable MIC0, MIC1, MIC2 … or MIC5.

For example:
Step 1. Enable AMIC_0_R/AMIC_0_L/DMIC_1_L/DMIC_1_R/I2S_M_2_R/ Not Use
055A 0800 200E 01 00 0A 0B 60 FF
055B 0300 200E 00

Step 2. Switch to MIC1 for AMIC_0_L test
055A 0300 0C0E 01
055B 0300 0C0E 00

Step 3. Switch to MIC2 for DMIC_1_L test
055A 0300 0C0E 02
055B 0300 0C0E 00

Step 4.Switch to MIC0 for AMIC_0_R test
055A 0300 0C0E 00
055B 0300 0C0E 00

10. Analog Gain Calibration Flow

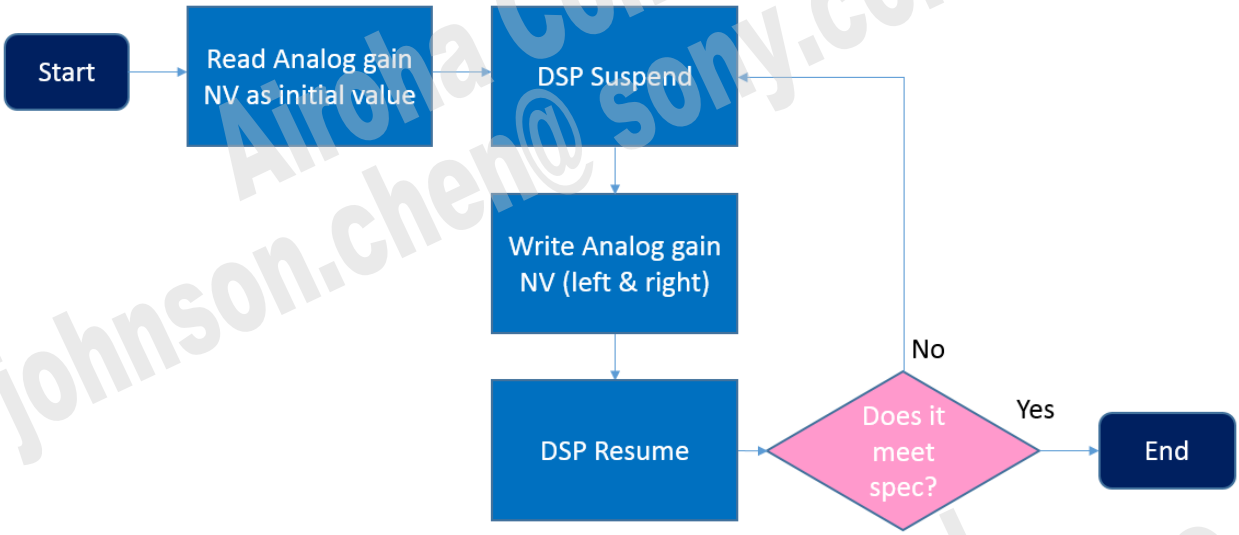

Figure 10-1. Analog Gain Calibration Flow Chart

10.1. Read/Write Analog Gain

The analog gain setting is saved by NV key 0xE00A. Use the Read/Write NV RACE command to access it.

In NV key 0xE00A, the 3rd and 4th bytes composes left analog gain and the 7th and 8th bytes composes right analog gain in unit of 0.01 db.

For example:
Analog gain left: 0x0190 (400 in decimal. i.e. 4db)
Analog gain right: 0xFF38 (-200 in decimal. i.e. -2db)

Write NV ID = 0xE00A, Value = 0x00009001……
055A3C00010A0AE0000090019001 38FF08070807B004B00408070807000000000000000000000000000000807080708070807080708070807080708070807080708070807
Response, Status = 00
055B0300010A00

10.2. DSP Suspend RACE Command

Command (0x055A)				
Length		ID		Payload
2 bytes		2 bytes		0 byte
0x02	0x00	0x01	0x0E	

Command (0x055B)				
Length		ID		Payload
2 bytes		2 bytes		1 byte
0x03	0x00	0x01	0x0E	Status
				00: success Else: fail

For example:
055A0200010E
055B0300010E00

10.3. DSP Resume RACE Command

Command (0x055A)				
Length		ID		Payload
2 bytes		2 bytes		0 byte
0x02	0x00	0x02	0x0E	

Command (0x055B)				
Length		ID		Payload
2 bytes		2 bytes		1 byte
0x03	0x00	0x02	0x0E	Status
				00: success Else: fail

For example:
055A0200020E
055B0300020E00