



AB156x_V3/AB157x/AB158x Series Mass Production RACE Application Note

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

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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

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1. Introduction

This application note describes AB156x_V3/AB157x/AB158x series Mass Production RACE related information. The following topics are included to help users to establish Audio Mass Production environment.

- 1) AB156x_V3/AB157x/AB158x 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 AB156x_V3/AB157x/AB158x device from the Host (external MCU or PC tool) or receive events (indications or responses) from AB156x_V3/AB157x/AB158x device. Any AB156x_V3/AB157x/AB158x device is able to accept RCMD with up to 1000 bytes of data excluding the RCMD header and length field. Each RCMD command is assigned two types of transported 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 AB156x_V3/AB157x/AB158x)

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 AB156x_V3/AB157x/AB158x)

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

RCMD Commands are sent from the host to AB156x_V3/AB157x/AB158x via UART. AB156x_V3/AB157x/AB158x 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

AB156x_V3/AB157x/AB158x implements UART software flow control which uses 0x11 and 0x13 as control bytes. If sending RACE via UART, please encode/decode data according to the following tables.

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

AB156x_V3/AB157x/AB158x supports the USB interface to send 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 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.

According to this byte, the USB module can know how many bytes is valid and send 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

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

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

Filter coefficient index: ANC: 0x01 ~ 0x04
Airo through: 0x09 ~ 0x0B

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 off agent ANC only 01: Turn off both agent and partner ANC

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	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	
				0x00	0x0C	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	
				0x00:success Else: fail	0x0C	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

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: Getting the AWS peer destination ID

055A0200000D

055B0400000D0506 => get AWS peer ID: 06

Step 2: Using AWS peer destination ID to send ANC OFF command to partner

Relay ANC OFF command to partner

055A0D00010D0506 055A0500060E000B00

Get ANC OFF Response from partner

055D1000010D0506 055B0800060E000B00000000



Relay example: (for Dual Chip)

Step 1: Getting the UART destination ID

055A0200000D

055B0400000D0506 => UART ID: **0D**

Step 2: Using UART destination ID to send ANC OFF command to Dual chip partner

Relay **ANC OFF** command to partner

055A0D00010D000D 055A0500060E000B00

Get **ANC OFF Response** from partner

055D1000010D000D 055B0800060E000B00000000

7. ANC calibration flow

7.1. AB156x_V3/AB157x/AB158x Series Hybrid ANC diagram

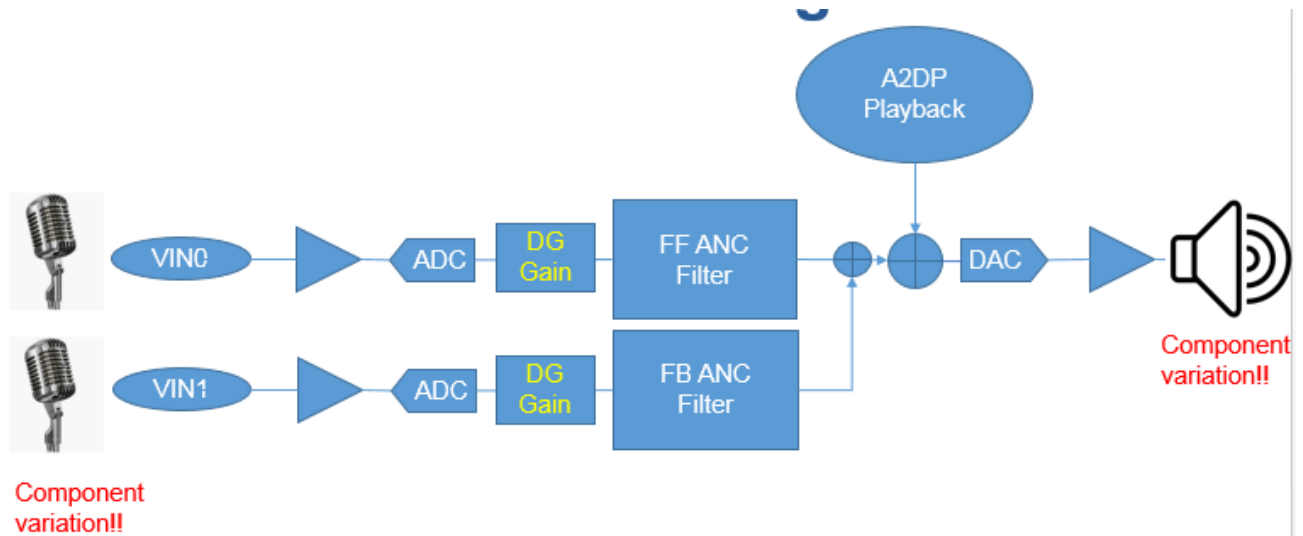


Figure 7-1. AB156x_V3/AB157x/AB158x Series Hybrid ANC diagram

7.2. FB/FF ANC gains

There are two gains to be calibrated during ANC test.

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

7.3. ANC calibration flow chart

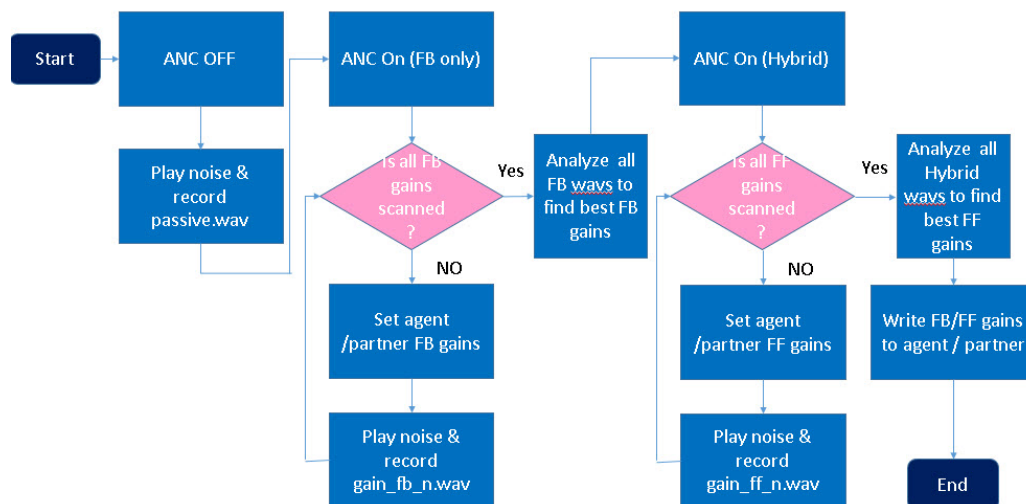


Figure 7-2. ANC calibration flow chart

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

055A060000A00F52800

Response, Length = 0x0028, NV value = 0x5941595500

055B2C0000A280059415955000000000000000000000000006D6F64656C3100000000
00000000000000000000

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

055D0B00071C00000676312E302E30

0x76312E302E30 in ASCII 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.

8.8. Write MCSync information

MCSync setting is saved by NV key 0x182F. Please 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 2F18 40 0000 445566778899 FF 665544332211

01010203040506070809101112131415160000000000000000000000000000

Write to partner (0x20)

055A3400010A 182F 20 0000 665544332211 FF 445566778899

[illegible]

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

Note: The 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. Please 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. Please 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. Please 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

055B0900000A05000001010214

## 8.12. Enable/Disable DUT mode

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

For example:

Write NV ID = **0x183A**, Value = **0x01** (0x00 for disable, 0x01 for enable)



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**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.

- A. standby command
- B. enter 3.0 DUT mode command
- C. enter 4.0 DTM command

For entering 3.0 DUT mode, send A then B.

For entering 4.0 DTM, send A then C

#### 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<br>42 54 5F 53 54 41 4E 44 42 59 0D<br>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<br>45 54 5F 44 55 54 5F 4F 4E 4C 59<br>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<br>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<br>Else: fail |

## 8.15. Write USB-HID dongle & headset pairing information

USB-HID dongle & headset pairing is saved by NV key 0xF318. Please use the Write NV RACE command to write it.

For example:

Dongle BD address: 0x**112233445566**

Headset BD address: 0x**998877665544**

Write to Dongle

055A0A00010A 18F3 **445566778899**

Write to Headset

055A0A00010A 18F3 **665544332211**

## 8.16. Write USB-HID dongle & MCSync pairing information

Flow:

1. MCSync setting is saved by NV key 0x182F. Please use the Write NV RACE command to write it.

Please refer to 8.8 Write MCSync information

2. USB-HID dongle & MCSync pairing is saved by NV key 0xF318. Please use the Write NV RACE command to write it.

For example:

Dongle BD address: 0x**112233445566**

MCSync Agent BD address: 0x**998877665544**

Write to Dongle

055A0A00010A 18F3 **445566778899**

Write to MCSync (earbuds)

055A0A00010A 18F3 **665544332211**

## 8.17. Write USB-HID LE dongle & MCSync SIRQ key

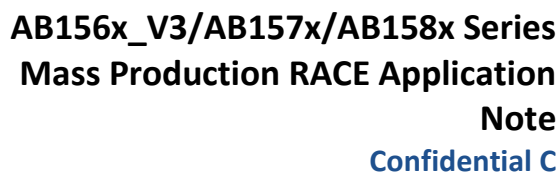
Flow:

1. MCSync setting is saved by NV key 0x182F. Please use the Write NV RACE command to write it.

Please refer to 8.8 Write MCSync information for more details.

2. USB-HID LE dongle & MCSync SIRQ key is saved by NV key 0x1900. Please use the Write NV RACE command to write it.





055A1600010A0019010203040506070809101112131415160000

055A1600010A0019010203040506070809101112131415160201

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

[illegible]

1. Un Pairing MCSync setting is saved by NV key 0x182F. Please use the Write NV RACE command to write it. Please refer to 8.18 Un Pairing: Write MCSync information for more details.

2. Un Pairing USB-HID dongle & MCSync is saved by NV key 0xF318. Please 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. Please use command: Factory Reset (refer to [Factory Reset](#) for more information).

## 8.21. Un Pairing: Write USB-HID LE dongle & MCSync SIRK key

Flow:

1. Un Pairing MCSync setting is saved by NV key 0x182F. Please use the Write NV RACE command to write it. Please refer to 8.18 Un Pairing: Write MCSync information for more details.

2. Un Pairing USB-HID LE dongle & MCSync, SIRK key is saved by NV key 0x1900. Please use the Write NV RACE command to write it.

For example:

Original SIRK Key: 0x01010101010101010101010101010101

MCSync (earbuds1):

Write NV ID = 0x1900, Value1 = 0x02020202020202020202020202020202

055A1600010A00190202020202020202020202020202020000

MCSync (earbuds2):

Write NV ID = 0x1900, Value1 = 0x03030303030303030303030303030303

055A1600010A00190303030303030303030303030303030201

LE Dongle:

Write NV ID = 0x1900, Value1 = 0x04040404040404040404040404040404

055A1600010A00190404040404040404040404040404040201

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

3. Please use command: Factory Reset (refer to [Factory Reset](#) 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)<br>MIC1 (0x01)<br>MIC2 (0x02)<br>MIC3 (0x03)<br>MIC4 (0x04)<br>MIC5 (0x05)<br>Not Used (0xFF) |

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

### 9.2. AECNR on/off

| Command (0x055A) |      |         |      |                         |
|------------------|------|---------|------|-------------------------|
| Length           |      | ID      |      | Payload                 |
| 2 bytes          |      | 2 bytes |      | 1 byte                  |
| 0x03             | 0x00 | 0x0D    | 0x0E | 0x00 (Off)<br>0x01 (On) |

| Response (0x055B) |      |         |      |                             |
|-------------------|------|---------|------|-----------------------------|
| Length            |      | ID      |      | Payload                     |
| 2 bytes           |      | 2 bytes |      | 1 byte                      |
| 0x03              | 0x00 | 0x0D    | 0x0E | 0x00: success<br>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<br>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     | 0x0F  | 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:

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**

2.Switch to MIC1 for **AMIC\_0\_L** test

**055A 0300 0C0E 01**



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055B 0300 0C0E 00

3.Swich to MIC2 for **DMIC\_1\_L** test

**055A 0300 0C0E 02**

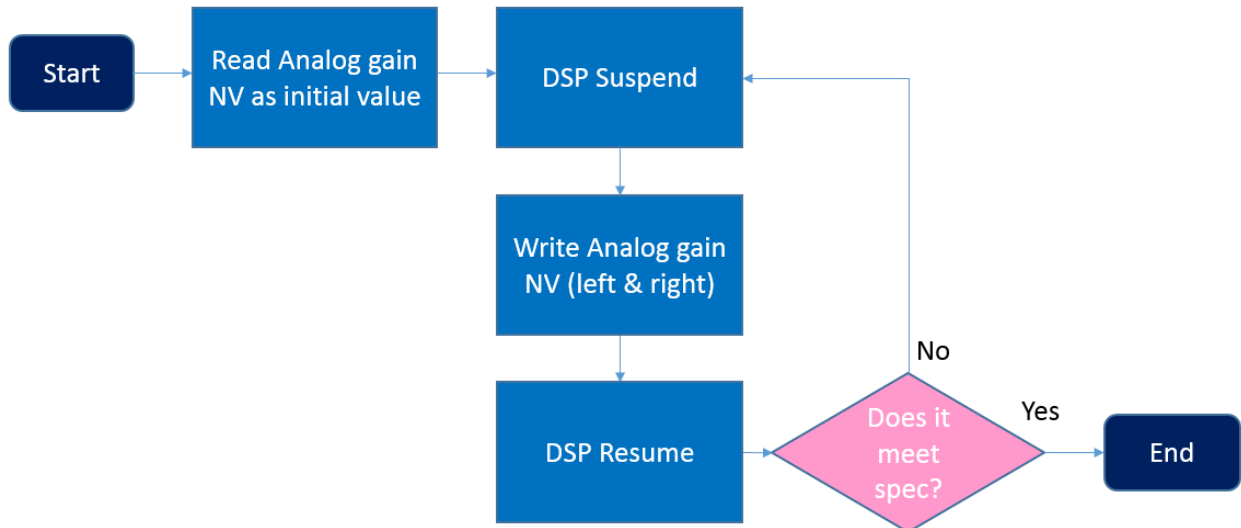
055B 0300 0C0E 00

4.Swich 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. Please use the Read/Write NV RACE command to access it.

In NV key 0xE00A, the 3<sup>rd</sup> and 4<sup>th</sup> bytes composes left analog gain and the 7<sup>th</sup> and 8<sup>th</sup> 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.....

055A3C00010A0AE000009001900138FF08070807B004B0040807080700000000000000000000  
000008070807080708070807080708070807080708070807

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**