AB1562 MCSync Reference Design User Guide

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1.0.0	01 May 2020	Initial version

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1. Introduction

The man-machine interface (MMI) layer is intended to offer a well-organized interface that makes control profile services such as HFP, A2DP, and AVRCP more intuitive. The MMI layer also provides a robust system environment which protects users from a negative experience (e.g., crash situation).

This guide is written to help users easily and completely understand MMI layer functionality.

1.1. Platform architecture

Figure 1. Software architecture shows that the software architecture is made up of several components which are also divided into three different groups: Airoha Defined Interface component; Bluetooth Defined Component; and Customer Defined Component. MMI is the only component in the Customer Defined component. It is also the topmost layer and is completely controlled by users. Moreover, MMI coordinates the interface and allows all profiles to operate together.

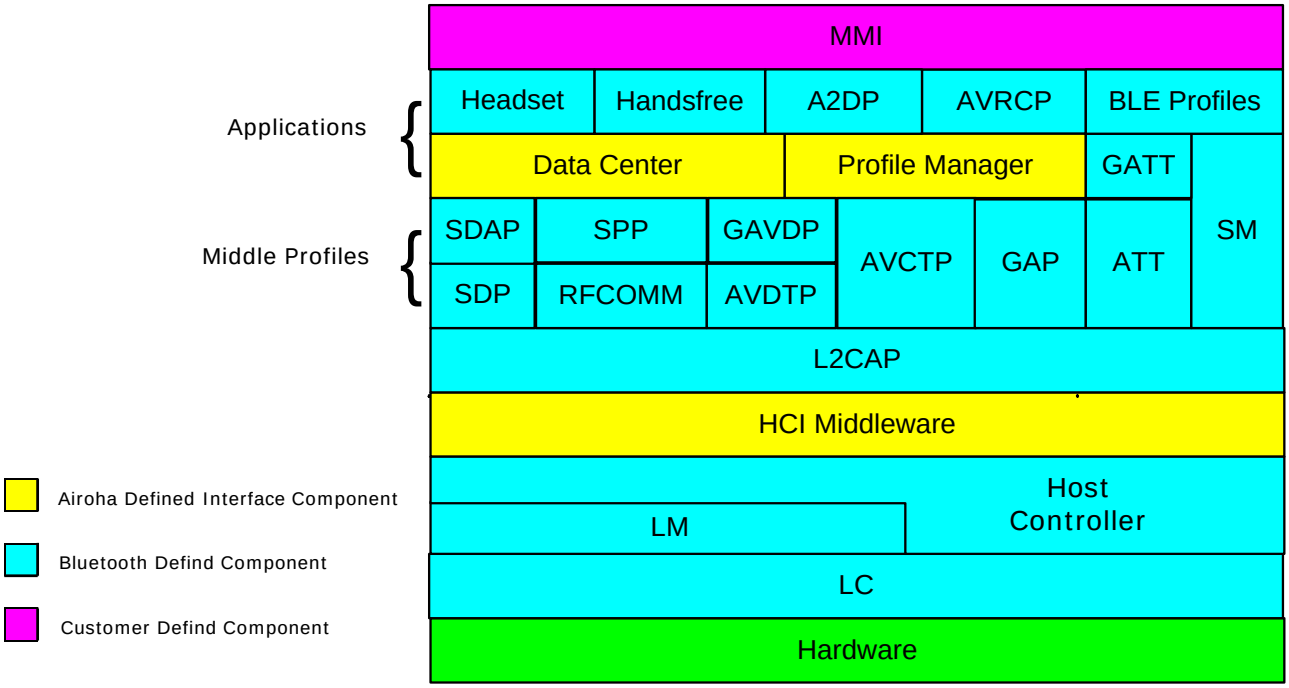

Figure 1. Software architecture

1.2. EVK components

When users start using the AB1562 MMI functionality, there are some signals they can recognize to verify whether the corresponding functionality is correctly operating. Besides, users must use some EVK components to also make use of the MMI functionalities. Therefore, this section introduces those components that are used to trigger MMI or show the MMI functionality.

There are four different colors to indicate the different EVK component groups as shown in Figure 2. EVK components.

1) The EVK components shown in red indicate the buttons on the EVK. From left to right, these buttons are REG, PIO2, PIO3, PIO4, PIO5, PIO7, and PIO8.

2) The EVK components shown in green indicate the LEDs. The LEDs are shown from left to right as LED0 and LED1. These LEDs have different colors.

3) The EVK component shown in yellow is the earphone jack. The earphone jack is used for listening to the voice prompt and ringtone that are related to a specific MMI functionality.

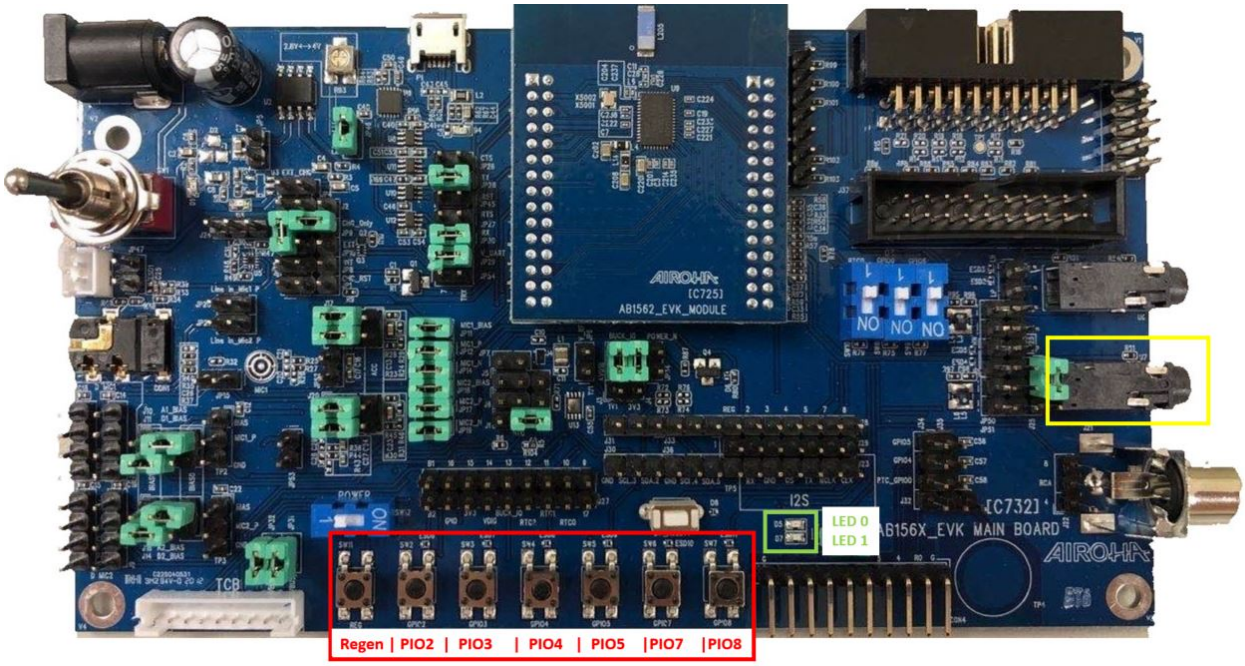

Figure 2. EVK components

2. MMI Functionality

This section shows the MMI layer functionality. Generally speaking, MMI functions can be partitioned into five main fields: system; connection; calling; volume; and music. A more in-depth description of each function fields is given in the function field sections.

Furthermore, the actions for the buttons must be defined in advance. The tap action is defined as a press of the button of no more than 700 milliseconds. Pressing the button for more than 700 milliseconds is defined as a "press".

The beep results must also be well defined. The length of the beeps are described as long, median, and short, and the beep's tonality refers to the falling and rising sounds. Every beep result includes a number which describes the number of times a beep will play.

In the following sections, the components must be used to trigger the functionality. The results indicate that the functionality is correctly triggered.

2.1. System

Regarding the system function field, the MMI functionalities related to the functions of the EVK itself are classified in this field, including how to turn on and off the AB1562 product, Active Noise Cancellation (ANC), AiroThru, and how to reset the device to factory settings.

2.1.1. Power

The user can turn the AB1562 product on and off.

Table 1. Power

Functionality	Actions	Results	Requirements
Power on	Press key1 (Regen) for three seconds	LED0 rapidly flashes three times One long beep and the voice prompt says "Power On"	Power off state
Power off	Press key1 (Regen) for three seconds	LED1 rapidly flashes three times One long beep and the voice prompt says "Power Off"	Any state except for power off, or when detaching a link or the EEPROM is updating

2.1.2. Reset to factory

The user to recover the original AB1562 product settings, such as the device name. Only valid after power off. (Clean paired history, reset volume level, language, device name and PEQ to default setting.)

Table 2. Reset to factory

Functionality	Actions	Results	Requirements
Reset to factory	Tap key1 (Regen) -> wait 1 sec -> press key1 (Regen) + key3(PIO5)	One median beep	In the power off state

2.1.3. Language selection

The user could change the language of the system.

Table 3. Language selection

Functionality	Actions	Results	Requirements
Change the language of the system	Double-tap key3(PIO5) key	Double long beep and a voice prompt says “English voice prompt”	System is active

2.1.4. ANC

Ambient unwanted sound is significantly reduced when ANC is on. ANC uses aural overlap and destructive interference to attenuate surrounding noises.

Table 4. ANC

Functionality	Actions	Results	Requirements
ANC on	Triple-tap key5 (PIO4)	Two falling beeps	In power on, during pairing mode, connected, call active states
ANC off	Triple-tap key5 (PIO4)	Two falling beeps	In power on, during pairing mode, connected, call active states

2.1.5. AiroThru

When the AiroThru functionality is on, the user can hear the surrounding sound without removing their headphones. Essentially, users can still hear traffic, broadcasts, or chatting when they are listening to music or audio.

Table 5. AiroThru

Functionality	Actions	Results	Requirements
AiroThru on	Press key7 (PIO3) for three seconds	Rising beeps	In power on, paring mode, connected states
AiroThru off	Press key7 (PIO3) for three seconds	Rising beeps	In power on, paring mode, connected states

2.1.6. Google Fast Pair

The AB1562 device supports Google Fast Pair Service (GFPS) as a fast pair provider to allow fast pair seekers to find the device through a specific BLE advertisement that contains the model ID for the registered fast pair device.

Please refer to the following link for more information about Google Fast Pair:

https://developers.google.com/nearby/fast-pair/spec.

Note: The model ID and anti-spoofing key pair in the AB1562 official release firmware are for testing purposes only. For information about registering your device and getting the relevant Model ID and Anti-Spoofing keys, see the following link: https://developers.google.com/nearby/devices/.

Table 6. GAP

Functionality	Actions	Results	Requirements
Fast pair	Turn on device which has the GFPS feature enabled. The device goes into a discoverable state.	Android phones near the device show a notification with the model image. Tap the notification to pair with the device.	Android 6.0 or later. Network access is mandatory (e.g., 3G, 4G, Wi-Fi).

2.2. Connection

This section describes the MMI functionality related to being discoverable by other devices, connecting to other devices, cancelling the connection with other devices, and turning on the voice assistant on the device that is connecting to the AB1562 product.

2.2.1. Enter air-pairing mode

During air-pairing procedure, two MCSync devices will create a special connection. System decide role by BDA's (BD address) comparison. If the number of the address of the MCSync device is larger than the other side, its role will be agent. In contrast, the role will be partner.

Table 7. Enter air-pairing mode while power on

Functionality	Actions	Results	Requirements
Make two MCSync devices to be connected automatically	Press key1 (Regen) for six seconds and release key1 (Regen)	After a voice prompt "Power on", and then a short beep. LED1 continue flashing for 30 seconds.	In power off state

Note: The six second action includes the power on procedure. To be more specific, after pressing key1 (Regen) for four seconds, the user will first see the power on result. The user must continue pressing the key1 (Regen) for another two seconds to complete the six second action.

2.2.2. Enter pairing mode (AG)

This functionality is used to make the AB1562 product discoverable by other devices.

Table 8. Enter pairing mode

Functionality	Actions	Results	Requirements
Enter pairing mode	Press key3(PIO5) for two seconds	One long beep and the voice prompt says “Pairing”	Power off state

Note: The six second action includes the power on procedure. To be more specific, after pressing key1 (Regen) for three seconds, the user will first see the power on result. The user must continue pressing the key1 (Regen) for another three seconds to complete the six second action.

2.2.3. Reconnect while power on

During the power on procedure, the user makes the AB1562 product connect to another device previously connected to the AB1562 product.

Table 9. Reconnect while power on

Functionality	Actions	Results	Requirements
Reconnect while power on	Press key1 (Regen) until you hear “Power-On” and release immediately	Four rising beeps, and a voice prompt says "Connected"	Power off state

Note: The voice prompt immediately says “Connected” when the AB1562 product successfully connects to the other device.

2.2.4. Reconnect to AG actively

The user makes the AB1562 product connect to another device previously connected to the AB1562 product.

Table 10. Reconnect actively

Functionality	Actions	Results	Requirements
Reconnect actively	Tap key1 (Regen)	One short beep	In power on, pairing mode, connected states

Note: The voice prompt immediately says “Connected” when the AB1562 product successfully connects to the other device.

2.2.5. Call off connection

The user makes the AB1562 product disconnect from another device.

Table 11. Call off connection

Functionality	Actions	Results	Requirements
Call off connection	Triple-tap key7 (PIO3)	Rising beeps, and a voice prompt says "Disconnected"	In connected, incoming/outgoing call, call active states

Note: If the AB1562 product successfully cancels the connection, the user immediately hears four falling beeps and the voice prompt say “Disconnected”.

2.2.6. Voice recognition

The user turns on the voice assistant on the device connected to the AB1562 product.

Table 12. Voice recognition

Functionality	Actions	Results	Requirements
Voice recognition	Triple-tap key1 (Regen)	One median beep	In connected states

2.3. Calling

This section shows the MMI functionality related to calling. These functions include how to accept/end/reject/hold a call, cancel an outgoing call, redial the most recently dialed phone number, transfer the sound to a connected device or to the AB1562 product, and manage a three-way call.

2.3.1. Accept call

The user can accept an incoming call.

Table 13. Accept call

Functionality	Actions	Results	Requirements
Accept call	Tap key1 (Regen)	One median beep	An incoming call is active

Note: When the call is successfully accepted, LED1 periodically flashes for two seconds.

2.3.2. End call

The users can end an active call.

Table 14. End call

Functionality	Actions	Results	Requirements
End call	Tap key1 (Regen)	One median beep, four falling beeps, and the voice prompt says “Call ended”	A call is active

2.3.3. Last number redial

The user can redial the most recently dialed number.

Table 15. Last number redial

Functionality	Actions	Results	Requirements

Functionality	Actions	Results	Requirements
Last number redial	Double-tap key1 (Regen)	One long beep and a voice prompt says “Redialing”	In connected states

2.3.4. Cancel outgoing call

The user can cancel an outgoing call.

Table 16. Cancel outgoing call

Functionality	Actions	Results	Requirements
Cancel outgoing call	Tap key1 (Regen)	One long beep and a voice prompt says “Call cancelled”	An outgoing call is active

2.3.5. Reject call

The user can reject an incoming call.

Table 17. Reject call

Functionality	Actions	Results	Requirements
Reject call	Double-tap key1 (Regen)	One long beep and a voice prompt says “Call rejected”	A call is incoming

2.3.6. Hold call

The user can hold an active call.

Table 18. Hold call

Functionality	Actions	Results	Requirements
Hold call	Double-tap key1 (Regen)	NA	A call is active

2.4. Volume

This section shows the MMI functions related increasing or decreasing the volume of the speaker and microphone, and how to mute or unmute the microphone.

2.4.1. Speaker volume

Users can adjust the sound level of the speaker.

Table 19. Speaker volume

Functionality	Actions	Results	Requirements
Speaker volume up	Continuously press key5 (PIO4)	One short beep	In connected, incoming/outgoing, call active states
Speaker volume down	Continuously press key6 (PIO2)	One short beep	In connected, incoming/outgoing,

Functionality	Actions	Results	Requirements
			call active states

Note: The speaker here is applicable to HFP, A2DP, depending on the scenario.

Note: When the volume reaches the maximum level, the user hears two short beeps and the voice prompt says “Volume maximum” through the earphone.

2.4.2. Mic mute

The user can mute or unmute the microphone.

Table 20. Mic mute

Functionality	Actions	Results	Requirements
Mic mute toggle	Double-tap key3 (PIO5)	Two short beeps and the voice prompt says “Mute on/off”	Only during an active call

Note: When the microphone is muted, the voice prompt says “Mute on” and will periodically repeat saying “Mute on” until the microphone is unmuted.

2.5. Music

This section shows the MMI functionality for music control, including the method for playing music, pausing music, and setting music forward or backward.

Note: The music referred to here is for both A2DP.

Note: A2DP music cannot exist at the same time.

2.5.1. Music play

The user can play music.

Table 21. Music play

Functionality	Actions	Results	Requirements
Music play	Tap key3 (PIO5)	NA	In connected states

Note: The user can immediately hear the song from earphones when the music successfully plays.

2.5.2. Music pause

The user can pause the currently playing music.

Table 22. Music pause

Functionality	Actions	Results	Requirements
Music pause	Tap key3 (PIO5)	NA	In connected states

Note: The user immediately hears the music pause when the music successfully pauses.

2.5.3. Music forward

This functionality provides the ability to play the next audio file.

Table 23. Music forward

Functionality	Actions	Results	Requirements
Music forward	Double-tap key5 (PIO4)	One short beep	In connected states

2.5.4. Music backward

The user can play the audio file that is stored before the currently playing audio file.

Table 24. Music backward

Functionality	Actions	Results	Requirements
Music backward	Double-tap key6 (PIO2)	One short beep	In connected states

3. MMI Event

This section shows the events that are not triggered by pressing the button, but are instead triggered by other devices or the AB1562 product itself. These events are divided into three types: connection, battery, and time out.

3.1. Connection

This section shows all events related to connections, such as successfully air-pairing, pairing, pairing successful, being connectable and being connected.

Table 25. Connection event

Event	Results
Pairing successful (AG)	Four rising beeps, and a voice prompt says “Connected”
Connectable (AG)	LED0 and LED1 alternately and periodically flash for 600 milliseconds every five seconds
Discoverable (AG)	AG could find device’s name on Bluetooth list
Connected (AG)	LED1 periodically flashes for 600 milliseconds every five seconds, four rising beeps, and a voice prompt say “connected”

Note: If the AB1562 product is connectable, it can only be connected to but it is not discovered.

Note: The connected event here is for situations in which it is both fully connected and not connected.

Note: All MMI events are the same for both MCSync devices, no matter whether you are a single device and two devices.

3.1.1. Air-pairing (Agent/Partner)

Airoha designed the air-pairing feature to allow two MCSync devices to share a special connection if different BDAs written to each device. Both MCSync devices must enter air-pairing state, a mutual inquiry and inquiry scan process is performed based on the same LIAC (Limited Inquiry Access Code). This process is completed in a few seconds if they find each other, and when air-pairing is successful, if the number of the BDA of the devices is larger than the other side, its role will operate in the agent role. The other device will be in the partner role. In addition, if the device has a default role, no matter agent or partner role, the device role can change after the air-pairing process. For example, one device is in the agent role, but the BDA number is lower than the other device, the role of the first device changes after the air-pairing process.

Table 26. Air-pairing result

Event	Results
Air-pairing (Agent/Partner)	If air-pairing process is successful, Agent and partner MCSync devices flashes five times on LED1 rapidly.

3.2. Battery

This section shows the battery events including low battery and charging.

Table 27. Battery event

Event	Results
Low battery	LED0 periodically flashes for two seconds
Charging	LED0 is always on during charging

3.3. Time out

There are three different time out mechanisms for the AB1562 product: connectable time out; pairing mode time out; and auto power off. This section shows each of these time out mechanisms.

Table 28. Time out event

Event	Results
Connectable time out	Connectable state is disabled after 10 minutes
Pairing mode time out	The pairing mode times out after 5 minutes when the AB1562 product is not connected or discoverable state is removed
Auto power off	The AB1562 product turns off after 30 minutes of inactivity

3.4. Charger case interaction

There is usually a charger case for charging and storing MCSync devices. This section shows how MCSync devices interact with the charger case.

Table 32. Charger case interactions and reactions

Precondition	Interaction	Reaction
Both MCSync devices are out of the charger case.	Put both MCSync devices into the charger case.	Both MCSync devices turn off and show the charging LED indicator.
	Put one of the MCSync devices into the charger case.	The MCSync device inside the charger case turns off and shows the charging LED indicator. The other MCSync device can still operate alone.
Both MCSync devices are in the charger case	Remove both MCSync devices from the charger case.	Both MCSync devices automatically turn on and start the reconnection process.
	Remove one of the MCSync devices from the charger case.	The MCSync device which is removed from the charger case can operate alone.

4. Key Mapping Table

This section shows a mapping table of the keys, actions, LEDs, voice prompts, ring tones and any related comments for a specific function. For example, for the 'Power on' function, search for 'Power on' in the 'Functionality' column in Table 29. Key mapping table. The Key, Action, LED, Voice prompt, Ring tone, and comments that are associated with the 'Power on' function (i.e. Regen; Press for three seconds; LED1 rapidly flashes three times; Say "Power-On"; One long beep; and 'In the power off state') are shown in the adjacent cells on the same row.

Table 29. Key mapping table

Key	Functionality	Action	LED	Voice prompt	Ring tone	Comment
key1 (Regen)	Power on	Press for three seconds	LED0 rapidly flashes three times	Say "Power-On"	One long beep	In the power off state
	Enter air-pairing state	Press until you hear "Power-On" and keep pressing	LED0 flashes until exiting air-pairing state	N/A	One short beep	In the power off state
	Reconnect while power on	Press until you hear "Power-On" and release immediately	NA	Say "Connected"	One median beep and four rising beeps	In the power off state
	Last number redial	Double-tap	NA	Say "Redialing"	One long beep	In the connected state
	Power off	Press for three seconds	LED1 rapidly flashes three times	Say "Power-Off"	One long beep	Any state except for power off, or when detaching a link, or the EEPROM is updating
	Accept call	Tap	NA	NA	One median beep	An incoming call is active
	End call	Tap	NA	Say "Call ended"	One median beep and four falling beeps	A call is active
	Reconnect actively	Tap	NA	NA	One short beep	In the power on, pairing mode, or connected states
	Cancel outgoing call	Tap	NA	Say "Call cancelled"	One long beep	An outgoing call is active
	Reject call	Double-tap	NA	Say "Call rejected"	One long beep	An incoming call is active

Key	Functionality	Action	LED	Voice prompt	Ring tone	Comment
	Voice recognition	Triple-tap	NA	NA	One short beep	In the connected state
	Hold call	Double-tap	NA	NA	NA	A call is active
key3(PIO5)	Music play	Tap	NA	NA	NA	Cannot control BT in the MP3 state
	Music pause	Tap	NA	NA	NA	Cannot control BT in the MP3 state
	Mic mute toggle	Double-tap	NA	Say “Mute on/off”	Two short beeps	Only during an active call
	Enter pairing mode	Press for two seconds	NA	Say “Pairing”	One median beep	In the power off state
	Change language	Double-Tap	NA	Say “English Voice Prompt	NA	Valid in standby mode.
	Trigger RHO	Triple-tap	NA	NA	NA	In the MCSync connected state
key1 (Regen)+ key3(PIO5)	Reset to factory	Tap key1 (Regen) -> wait 1 sec -> press key1 (Regen) + key3(PIO5)	NA	NA	One median beep	Only valid after power off. (Clean paired history, reset volume level, language, device name and PEQ to default setting.)
key5 (PIO4)	Speaker volume up	Continuously press	NA	NA	One short beep	In the connected, incoming/outgoing, or call active states
	Music forward	Double-tap	NA	NA	One short beep	Cannot control BT in the MP3 state
	ANC On/Off	Triple-Tap	NA	NA	Two falling beeps	
key6 (PIO2)	Speaker volume down	Continuously press	NA	NA	One short beep	In the connected, incoming/outgoing, or call active states
	Music backward	Double-tap	NA	NA	One short beep	Cannot control BT in the MP3 state
key7 (PIO3)	Disconnect from AG	Triple-tap	NA	Say “Disconnected”	One median beep	In the connected, incoming/outgoing call, or call active states
	AiroThru	Press for three seconds	NA	NA	One short beep	All states except for call active state