PAUMAX OY·AINA WIRELESS INC

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COMMUNICATION PROTOCOL
AINA WIRELESS

Enhancing Remote-Speaker-Microphone (RSM) performance over Bluetooth

Version A.14

Paumax Oy Y-tunnus: 2395666-2
VAT ID: FI23956662

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1. Scope

This document defines wireless device control protocol. The protocol aims to provide secured control link from wireless device to application with high level acknowledgement, minimal latency and minimal radio air time. The communication includes Classic Bluetooth (BT) for audio transport and Bluetooth Low Energy (BLE) for control link. Optionally button information can also be offered over SPP-link (separate from HFP) over Bluetooth classic, if BLE communication is not available. The control link can be encrypted using BLE provided AES128 encryption and link latency can be optimized by tuning sniff interval parameter down to about 7.5ms maximum response time.

2. Features and functionality

The RSM device, when BLE communication is enabled in phone and application, operates as a BLE peripheral device and provides custom *Characteristics* for a phone's application. The application subscribes to receive *Notifications* from the RSM to enable instant message delivery, such as Push-to-Talk (PTT) keying and writes characteristics in order to control RSM features, such as speaker amplifier and led states.
In addition to BLE control, normal HFP audio link control is available as in any hands free device.

3. SPP Communication

An RSM device acts as an SPP server, and allows one way communication to a compatible phone. Once phone has connected to device, RSM will send messages over SPP when button pressed goes down, and when it comes up. Following messages are defined:

- 1st PTT: "+PTT=P" for button going down and "+PTT=R" for button coming up.
- 2nd PTT: "+PTTS=P" for button going down and "+PTTS=R" for button coming up.
- Emergency button: "+PTTE=P" for button going down and "+PTTE=R" for button coming up.

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- Left Soft button (<): "+PTTB1=P" for button going down and "+PTTB1=R" for button coming up.
- Right Soft button (>): "+PTTB2=P" for button going down and "+PTTB2=R" for button coming up.
- Volume Up button: "+VGS=U" when button press is detected.
- Volume Down button: "+VGS=D" when button press is detected.

4. BLE Service and characteristics

BLE connection allows two-way communication with compatible phone. Buttons and other state information is available for phone and phone can set certain features on/off as required. RSM will use a unique generated service identification number.

SERVICE 128b UUID: 127FACE1-CB21-11E5-93D0-0002A5D5C51B

4.1. Button mask

This characteristic shows RSM button press status. It is defined as 8bit unsigned integer, with following bit definitions:

bit 0: PTT	(0x01)
bit 1: PTTE	(0x02)
bit 2: PTTS	(0x04)
bit 3: PTTB1	(0x08)
bit 4: PTTB2	(0x10)
bit 5: MFB	(0x20)
bit 6: *reserved*	(0x40)
bit 7: HEARTBEAT	(0x80)

READ/NOTIFY 16b UUID: 0xBEEF

Button status bits reflect the current pressed state of the buttons. Displaying the button status will not disable its normal operation, pressing PTTB1 will put the device into covert mode regardless what the subscriber will do with the button status information received here. Heartbeat bit will toggle every ~500ms when any button is pressed.

4.2. Heartbeat mask

This characteristic shows button press time and is defined as 8bit unsigned integer and it will count from 0 to 255 and then roll over to 0. Counter is incremented every ~500ms, and will zero when no buttons are pressed.

READ/NOTIFY 16b UUID: 0xF00D

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4.3. LED mask

This characteristic allows the control of RSM leds and audio devices. It is an 8bit unsigned integer, with following bit definitions:

bit 0: RED LED ON/OFF	(0x01)
bit 1: GREEN LED ON/OFF	(0x02)
bit 2: BLUE LED ON/OFF	(0x04)
bit 3: LED DISABLE ON/OFF	(0x08)
bit 4: AMPLIFIER ON/OFF	(0x10)
bit 5: AMPLIFIER OVERRIDE ON/OFF	(0x20)
bit 6: MICROPHONE MUTE	(0x40)
bit 7: MICROPHONE DISABLE ON/OFF	(0x80)

READ/WRITE/NOTIFY 16b UUID: 0xDEAD

Amplifier on/off and Microphone on/off bits will reflect the current state in RSM classic Bluetooth connection, thus you can only turn them off if they are turned on by normal HFP usage or by yourself through this characteristic. Led bits only reflect the state set through here. Turning leds on here will set the led on/off and the normal state leds are mixed in. With led disable the normal state patterns are disabled. Amplifier override will disallow the firmware to enable/disable the amplifier through normal means, allowing control only through bit 4. Microphone mute will turn on device normal mute on with corresponding indications and possible control over device ui. Microphone disable will disable the microphone regardless of the mute state or device ui (should mute be turned on during disable the indications are show as normal, but turning mute off will still not enable microphone). Any change in the characteristic will be notified to subscribed listeners.

4.4. Status mask

FOR INFORMATION ONLY, NOT FOR PRODUCTION USE! (EXCEPT BLE BIT)

This characteristic allows the control of various RSM features and states. It is an 8bit unsigned integer, with following bit definitions:

bit 0: POWER ON/OFF	(0x01)
bit 1: CLASSIC PAIRING STATE	(0x02)
bit 2: CLASSIC SPP STATE	(0x04)
bit 3: CLASSIC RECONNECT ATTEMPT	(0x08)
bit 4: WIRED HS MODE	(0x10)
bit 5: WIRED HS SPEAKER ONLY	(0x20)
bit 6: COVERT MODE	(0x40)
bit 7: BLE ENABLE	(0x80)

READ/WRITE 16b UUID: 0xDEAF

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All bit statuses will reflect the current state at the device, so when device autonomously enables pairing state, the bit 1 will be set to 1 in the characteristic (and phone notified, if it has subscribed to 0xDEAF). Pairing state initiated though here will end as per normal pairing timeout (2 minutes) if no pairing has been made. Reconnection attempt will end after 5minutes as per normal timeout. WIRED HS bit will show if RSM is using a headset instead of the internal speaker/microphone. If this bit is set, AMPLIFIER ON/OFF and MICROPHONE ON/OFF will affect the headset amplifier and microphone (if available). With bit 5 (in combination with bit 4, and an actual HS connected) RSM can be set to use HS speakers and internal microphone. COVERT mode will show and allow to enable/disable the normal covert mode of the RSM device. Bit 7 for BLE ENABLE can be pulled down after connection, which will disable BLE functionality of the device until next restart.

4.5. SW version characteristic

This characteristic will allow to read the RSM internal SW version for both the classic and LE software. The characteristic is hexadecimally encoded ASCII with 6bytes of data in the following format "***YYWWAaYYWWBb***" where **A** marks classic sw major version and **a** revision and **B** marks le sw version and **b** revision. Revision will be 0 for nonrevised release and a,b,c… etc. for revised weekly version.

READ 16b UUID: 0xC0FF

6. BLE advertisement data (TBD)

BLE advertisement data will include manufacturer specific data (field 0xff), with following content:

***Company identifier**: Aina-Wireless inc. BT identifier (CIC) 0x02CB.*

***Data**: alphanumerical string containing the subscriber name of the HFP AG the RSM is connected to at the moment. The string will be limited to 6 last characters of the subscriber number, each number hex encoded as 2 numbers per byte.*

7. Device FW updates

7.1. Bluetooth classic

Bluetooth classic firmware can be updated over USB cable from PC with appropriate software. RSM device must be set in to DFU mode by pressing both soft buttons simultaneously for 10 seconds. Device will show green led once in DFU mode. Please see the Aina FW upgrade guide -document.

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7.2. BLE

BLE will enter DFU mode by holding emergency button down when turning device on. BLE FW can be updated over the air (OTA) with BLE communication using appropriate software on PC or cell phone (which supports BLE communication). Please see the Aina FW upgrade guide -document.

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