

HANDS-FREE AND HEADSET PROFILES

iWRAP APPLICATION NOTE

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Version 1.3

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VERSION HISTORY

Version	Comment
1.0	First version
1.1	HFP usage added
1.2	HSP usage added
1.3	iWRAP overview added

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1 Introduction

This application note discusses Bluetooth Hands-Free Profile (HFP) and Bluetooth Headset Profile (HSP) their advantages and how these profiles can be utilized. Also practical examples are given how the HFP and HSP are used with the iWRAP firmware.

1.1 Hands-Free profile

Hands-Free Profile describes how an audio gateway device can be used to place and receive calls for a hand-free device.

A common scenario would be a mobile phone used together with a wireless headset. The headset will connect to the mobile phone and can be used to place and receive phone calls. The HFP defines two roles, that of an Audio Gateway (HFP-AG) and a Hands-Free unit (HF):

- HFP Audio Gateway (HFP-AG) is the device that is the gateway of the audio, both for input and output, typically a mobile phone.
- Hands-Free Unit (HF) is the device acting as the Audio Gateway's remote audio input and output mechanism. It also provides some remote control means. Typically a wireless headset or a car kit.

Hands-Free control is the entity responsible for Hands-Free unit specific control signalling; this signalling is AT command based. Control channel works on top of RFCOMM connection and the audio channel on top of SCO or eSCO channel.



Figure 1: Typical HFP use case

Source: [1]

1.2 Headset profile

The HSP describes how a Bluetooth enabled headset should communicate with a computer or other Bluetooth enabled device such as a mobile phone.

The typical usage scenario is, of course, using a wireless headset to connect with your mobile phone.

The HSP defines two roles, that of an Headset Audio Gateway (HSP-AG) and a Headset (HS):

- Headset Audio Gateway (HSP-AG) is a device that is the gateway of the audio, both for input and output, typically a mobile phone or PC.
- Headset (HS) is a device acting as the Audio Gateway's remote audio input and output mechanism.

Headset control is the entity responsible for Headset unit specific control signalling. Control channel works on top of RFCOMM connection and the audio channel on top of SCO or eSCO channel.

One should know that HSP offers significantly less control possibilities then HFP. Therefore modern implementations prefer Hands-Free Profile to Headset Profile.



Figure 2: Typical HSP use case

Source: [2]

2 iWRAP firmware overview

iWRAP is an embedded firmware running entirely on the RISC processor of WT12, WT12 and WT32 modules. It implements the full *Bluetooth* protocol stack and many *Bluetooth* profiles as well. All software layers, including application software, run on the internal RISC processor in a protected user software execution environment known as a Virtual Machine (VM).

The host system can interface to iWRAP firmware through one or more physical interfaces, which are also shown in the figure below. The most common interfacing is done through the UART interface by using the ASCII commands that iWRAP firmware supports. With these ASCII commands, the host can access *Bluetooth* functionality without paying any attention to the complexity, which lies in the *Bluetooth* protocol stack. GPIO interface can be used for event monitoring and command execution. PCM, SPDIF, I2S or analog interfaces are available for audio. The available interfaces depend on the used hardware.

The user can write application code to the host processor to control iWRAP firmware using ASCII commands or GPIO events. In this way, it is easy to develop *Bluetooth* enabled applications.

On WT32 there is an extra DSP processor available for data/audio processing.

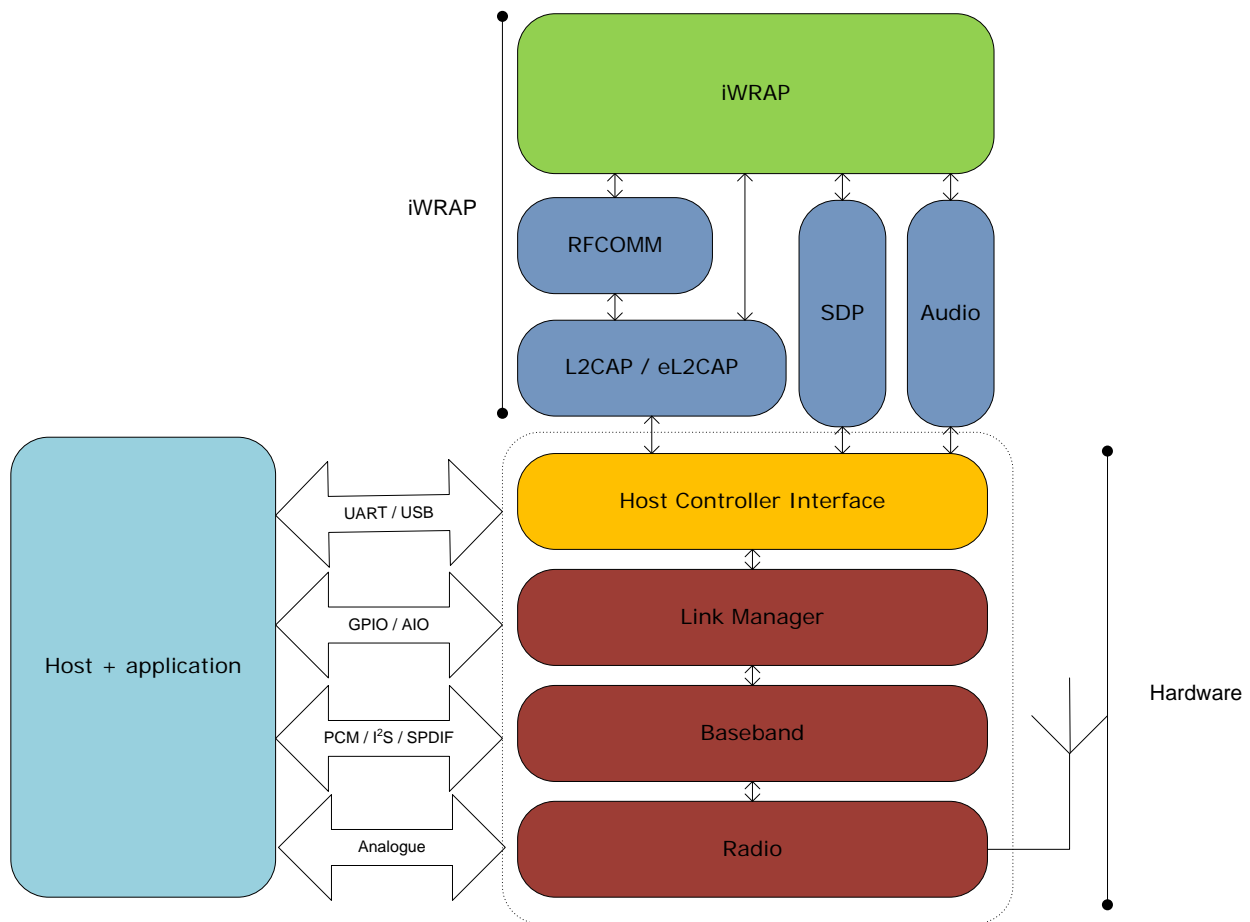


Figure 3: iWRAP Stack

In the figure above, a WRAP THOR *Bluetooth* module with iWRAP firmware could be connected to a host system for example through the UART interface. The options are:

- If the host system has a processor, software can be used to control iWRAP by using ASCII based commands or GPIO events.
- If there is no need to control iWRAP, or the host system does not need a processor, iWRAP can be configured to be totally transparent and autonomous, in which case it only accepts connections or automatically opens them.
- GPIO lines that WRAP THOR modules offer can also be used together with iWRAP to achieve additional functionality, such as Carrier Detect or DTR signaling.
- Audio interfaces can be used to transmit audio over a *Bluetooth* link.

3 Using HFP with iWRAP

This chapter instructs the HDP usage and configuration with the iWRAP firmware.

3.1 Configuration

3.1.1 Hands-Free Audio Gateway (HFP-AG)

HFP-AG is enabled with command “**SET PROFILE HFP-AG {service_name}**”

service_name

This parameter configures user friendly description of the device. Neither special characters nor white spaces are allowed. Service name **ON** enables the profile with the default name.

The Bluetooth Class-of-Device (CoD) needs to be also configured properly. Some device may not be able to discover and connect iWRAP unless it's properly set. For HFP devices the CoD needs to be 200408.

Finally a reset is needed to for the HFP-AG profile to become active.

Below is an example how to enable HFP-AG mode.

```
SET PROFILE HFP-AG ON
SET BT CLASS 200408
RESET
```

3.1.2 Hands-Free unit (HF)

HF mode is enabled with command "**SET PROFILE HFP {*service_name*}**"

service_name

This parameter configures user friendly description of the device. Neither special characters nor white spaces are allowed. Service name **ON** enables the profile with the default name.

The Bluetooth Class-of-Device (CoD) needs to be also configured properly. Some device may not be able to discover and connect iWRAP unless it's properly set. For HFP devices the CoD needs to be 200408.

Finally a reset is needed to for the HFP profile to become active.

Below is an example how to enable HFP mode.

```
SET PROFILE HFP ON
SET BT CLASS 200408
RESET
```

3.2 Service discovery

Bluetooth technology enables wireless service discovery, so you can find out the capabilities the remote device supports. Wireless service discovery uses the Bluetooth Service Discovery Profile (SDP).

With iWRAP the service discovery is performed with command: "**SDP {bd_addr} {uuid}**".

bd_addr

Bluetooth device address of the remote device.

uuid

Universally unique identifier. Refers to the Bluetooth profile one wants to discover. For HFP-AG the **uuid** is 111F and for HF 111E.

Below is an example how to perform a service discovery for HFP-AG device.

SDP 00:07:80:93:0c:aa 111F

SDP 00:07:80:93:0c:aa < I SERVICENAME S "**HF Voice Gateway**" > < I PROTOCOLDESCRIPTORLIST
< < U L2CAP > < U RFCOMM I **03** > > >

SDP

HF Voice Gateway

= Service name

03

= RFCOMM channel for HFP

Below is an example how to perform a service discovery for HF device.

SDP 00:07:80:81:66:6f 111E

SDP 00:07:80:81:66:6f < I SERVICENAME S "**Hands-Free**" > < I PROTOCOLDESCRIPTORLIST < < U
L2CAP > < U RFCOMM I **03** > > >

SDP

Hands-Free

= Service name

03

= RFCOMM channel for HFP

3.3 Connection establishment

3.3.1 HFP control channel

With HFP, first a control channel needs to be established. The control channel is used for AT command signalling between the HF and HFP-AG devices.

The HFP control channel is opened, typical to iWRAP, with a **CALL** command:

“CALL {*bd_addr*} 111F HFP” - When opening connection from HF device to HFP-AG device

“CALL {*bd_addr*} 111E HFP-AG” - When opening connection from HFP-AG device to HF device

bd_addr Bluetooth device address of the remote device.

Below is an example how to set up a HFP connection from HF to HFP-AG.

```
CALL 00:07:80:93:0c:aa 111F HFP
```

```
CALL 0
```

```
CONNECT 0 HFP 3
```

```
HFP 0 STATUS "service" 0
```

```
HFP 0 STATUS "call" 0
```

```
HFP 0 STATUS "callsetup" 0
```

```
HFP 0 STATUS "callheld" 0
```

```
HFP 0 STATUS "signal" 0
```

```
HFP 0 STATUS "roam" 0
```

```
HFP 0 STATUS "battchg" 5
```

```
HFP 0 READY
```

A typical indications of outgoing call and successful connection are received (CALL and CONNECT). After a successful connection the HFP-AG device sends various status reports to the HD device. These reports are output to the user as HFP status messages, which have a general format:

“HPF {*link_id*} STATUS {*status*} {*value*}”

link_id Numeric connection identifier

feature HFP status indicator

status Value of status indicator

Sometimes the HFP-AG devices may send manufacturer proprietary AT commands, which are not recognized by iWRAP. A different report is then output:

“HPF {*link_id*} UNKNOWN {*value*}”

link_id Numeric connection identifier

string String sent by HFP-AG device

Finally when the connection initialization is complete a message is displayed: **“HPF {*link_id*} READY”**. AT commands must not be sent before this event is received.

Below is an example how to set up a HFP connection from HFP-AG to HF.

```
CALL 00:07:80:81:66:6f 111E HFP-AG
```

```
CALL 0
```

```
CONNECT 0 HFP-AG 3
```

```
HFP-AG 0 READY
```

```
HFP-AG 0 VOLUME 4
```

In the example above HFP device reports its volume level to the HFP-AG. The volume level is indicated by message:

“HPF {*link_id*} VOLUME {*level*}”

link_id

Numeric connection identifier

level

HFP devices volume level. Range: 0 -15

3.3.1.1 HFP-AG implementation

For HFP-AG implementers it's worth mentioning that the network service status should be indicated to the HF device right after connection setup. By default iWRAP sets the network status to 0 telling the HFP-AG does not have network (GSM, PSTN etc.) connectivity. If there is no network connectivity many of the HF features such as making outgoing connections is not available. The network service status is indicated with command:

“STATUS service {*status*}”

status

Network service status

0 = Network is inactive

1 = Network is active

3.3.2 HFP audio channel

Once the HFP control channel has been set up an audio channel can be created. There are several ways how the audio channel can be established depending on the use case.

3.3.2.1 HFP-AG receives an incoming connection

A typical scenario is that the HFP-AG device receives an incoming phone call and indicates this to the HF device. HF device then accepts or rejects the incoming call. The example below shows how this is accomplished.

On the HFP-AG device **RING** command is used to indicate an incoming phone call to the HD device.

RING

CONNECT 1 SCO	(Indicates that SCO connection was established)
HFP-AG 0 RINGING	(Indicates that the HF device is ringing)
HFP-AG 0 CONNECT	(Indicates that the HF device answered the phone call)

Below is a trace of the same situation as seen on the HF device.

HFP 0 STATUS "callsetup" 1	(Indicates a callsetup change to active)
HFP 0 RING	(Indicates that HFP link 0 is ringing)
RING 1 00:07:80:93:0c:aa SCO	(Indicates an incoming SCO connection with link_id 1)
ANSWER	
HFP 0 STATUS "call" 1	(Indicates a call change to active)
HFP 0 STATUS "callsetup" 0	(Indicates a callsetup change to inactive)

ANSWER command can be used to answer the incoming call on the HF device.

3.3.2.2 HF device makes an outgoing call request

A 2nd typical scenario is that the HF device makes an outgoing phone call. The examples below show how this is accomplished.

On the HD device outgoing connection can be established with two different commands:

"ATD{number};"	- Asks HFP-AG to dial to number .
"AT+BLDN"	- Asks HFP-AG to dial to last dialled number.

Here's an example trace from HF device.

ATD777;	(Dial to 777)
HFP 0 OK	(OK indication from HFP-AG)
HFP 0 STATUS "callsetup" 2	(Indicates a callsetup change)
RING 1 00:07:80:93:0c:aa SCO	(Indicates an incoming SCO connection with link_id 1)
HFP 0 STATUS "callsetup" 3	(Indicates a callsetup change)
HFP 0 STATUS "call" 1	(Indicates a call status change to active)
HFP 0 STATUS "callsetup" 0	(Indicates a callsetup change to inactive)

Below is a trace of the same situation as seen on the HFP-AG device.

HFP-AG 0 DIAL NUM 777	(Dial request to 777 from HF device)
CONNECT 1 SCO	(SCO connection indication)
HFP-AG 0 CALLING	(HFP-AG status change to calling state)
CONNECT	(CONNECT command to indicate that network call was successful)
HFP-AG 0 CONNECT	(HFP-AG status change to connected)

3.3.2.3 HFP-AG makes an outgoing call

A 3rd typical scenario is that the HFP-AG device makes an outgoing phone call and this is indicated to the HF device. The examples below show how this is accomplished.

Here's an example trace from HFP-AG device.

DIALING	(Indicates to HF that outgoing call is made)
CONNECT 1 SCO	(SCO connection indication)
HFP-AG 0 CALLING	(HFP-AG status change to calling state)
CONNECT	(CONNECT command to indicate that network call was successful)
HFP-AG 0 CONNECT	(HFP-AG status change to connected)

The same situation as seen on the HF device.

HFP 0 STATUS "callsetup" 2	(Indicates a callsetup change)
RING 1 00:07:80:93:0c:aa SCO	(Indicates an incoming SCO connection with link_id 1)
HFP 0 STATUS "callsetup" 3	(Indicates a callsetup change)
HFP 0 STATUS "call" 1	(Indicates a call status change to active)
HFP 0 STATUS "callsetup" 0	(Indicates a callsetup change to inactive)

3.3.2.4 Forcing SCO connection open

It's also possible simply to open the SCO connection without any status updates. This can be done with command:

"SCO OPEN {link_id}"

link_id

Numeric connection identifier of an RFCOMM connection to which to open the SCO connection.

Example trace from HFP-AG

SCO OPEN 0
CONNECT 1 SCO

3.4 Connection termination

3.4.1 HFP audio channel

The simplest way to terminate the audio (SCO) connection is to use “**HANGUP**” command. It can be issued on both HF and HFP-AG device to indicate that the call was terminated.

Termination of the call from HF device

HANGUP

NO CARRIER 1 ERROR 113 HCI_ERROR_OETC_USER (Indication that HFP-AG terminated SCO)

HFP 0 STATUS "call" 0 (Call status change to inactive)

Termination of the call from HFP-AG device

HANGUP

HFP-AG 0 NO CARRIER (NO CARRIER indication)

NO CARRIER 1 ERROR 0 (SCO connection termination)

It also possible to forcibly close the SCO connection with the iWRAP's normal “**CLOSE {link_id}**” command.

Closing the SCO connection from HF device. HFP-AG keeps the network call active in this case.

CLOSE 1

NO CARRIER 1 ERROR 0

3.4.2 HFP control channel

The HFP control channel is simply be closed with iWRAP command “**CLOSE {link_id}**”

link_id Numeric connection identified

HFP control channel termination.

CLOSE 0

NO CARRIER 0 ERROR 0

3.5 General HFP information

This chapter contains general information and tips about the iWRAP and HFP profile for the implementers.

3.5.1 HFP commands

HF and HFP-AG support various commands to perform certain actions such as answer and terminate calls. These commands are described in this chapter.

Command	Function	Explanation
ANSWER	Answer to call	callsetup 0, call 1
DISCONNECT	Hang-up call	callsetup 0, call 0
HANGUP	Hang-up call	callsetup 0, call 0
REJECT	Reject call	callsetup 0, call 0
DMTF {code}	Set status and send it to Hands Free. status 0 means no GSM connectivity and status 1 means active GSM connection.	AT+CIND
{raw AT command}	Sends the raw AT command to the headset	-

Table 1: Supported HF device commands

Command	Function	Explanation
ANSWER	Answer to call	callsetup 0, call 1
DISCONNECT	Hang-up call	callsetup 0, call 0
ERROR	Send ERROR result to HF device	error
HANGUP	Hang-up call	callsetup 0, call 0
REJECT	Reject call	callsetup 0, call 0
OK	Send OK result to HF device	OK
DIALING	Notifies the HF that the AG is dialing an outgoing call, for example if the user dials a number on the phone. Issuing this command establishes SCO connection.	callsetup 2 followed by callsetup 3
CONNECT	Notifies the HF that the aforementioned call was accepted by the remote party.	call 1 followed by callsetup 0
RING [count] [number] [name]	Notify HF device for incoming call. Optional parameter [count] indicates the amount of ring indications. Optional parameter [number] displays the number from where the call is coming from. [name] is an optional parameter describing the caller name.	callsetup 1, ring, AT+CLIP ring is sent [count] times, if [number] or [name] is given, AT+CLIP is sent
STATUS {status}	Set status and send it to Hands Free. status 0 means no GSM connectivity and status 1 means active GSM connection.	AT+CIND
{raw AT command}	Sends the raw AT command to the HF device	-

Table 2: Supported HFP-AG device commands

3.5.2 HFP events

HF and HFP-AG output various events to indicate the user of status changes. These events are described in this chapter.

Event	Explanation
HFP {link_id} STATUS "{feature}" {status}	Status of feature feature HFP-AG feature: service = Network status call = call status call_setup = call setup call_held = call hold status signal = signal status roam = roaming status batt_chg = battery status status Status identifier
HFP {link_id} READY	Service Level Connection open, HFP ready link_id Numeric connection identifier
HFP {link_id} NETWORK "{name}"	Network operator name link_id Numeric connection identifier name Network operator name string
HFP {link_id} OK	OK response from HFP-AG link_id Numeric connection identifier
HFP {link_id} RING	Incoming call link_id Numeric connection identifier
HFP {link_id} CALLERID "{number}" "{alpha}" {type}	Caller ID link_id Numeric connection identifier number Phone number alpha Optional string type alphanumeric representation of number

	<i>type</i> The phone number format in hex
HFP {<i>link_id</i>} UNKNOWN {<i>data</i>}	Unrecognized AT command <i>link_id</i> Numeric connection identifier <i>data</i> Raw input data

Table 3: HF device's events

The possible HFP-AG status reports mentioned in the example are described below:

Event	Explanation
HFP-AG { <i>link_id</i> } READY	Service Level Connection open, HFP ready <i>link_id</i> Numeric connection identifier
HFP-AG { <i>link_id</i> } VOLUME { <i>level</i> }	Volume level information <i>link_id</i> Numeric connection identifier <i>level</i> Volume level information
HFP-AG { <i>link_id</i> } MIC { <i>level</i> }	Headset microphone gain information <i>link_id</i> Numeric connection identifier <i>level</i> Volume level information
HFP-AG { <i>link_id</i> } RINGING	Incoming call / headset ringing <i>link_id</i> Numeric connection identifier
HFP-AG { <i>link_id</i> } CONNECT	HFP connection / call active <i>link_id</i> Numeric connection identifier
HFP-AG { <i>link_id</i> } NO CARRIER	Call ended <i>link_id</i> Numeric connection identifier
HFP-AG { <i>link_id</i> } DIAL POS { <i>pos</i> }	Dial a number from memory position <i>link_id</i> Numeric connection identifier <i>pos</i> Memory position number
HFP-AG { <i>link_id</i> } DIAL NUM { <i>num</i> }	Dial a number <i>link_id</i> Numeric connection identifier <i>num</i> Number to dial
HFP-AG { <i>link_id</i> } UNKNOWN { <i>data</i> }	Unrecognized AT command <i>link_id</i> Numeric connection identifier <i>Data</i> Raw input data

Table 4: HFP-AG device's events

- **“%s %d CALLING\r\n”**
Outgoing call
- **“%s %d BUSY\r\n”**

3.5.3 Available AT-commands

The AT commands and indications that are available for the Bluetooth Hands-Free profile are listed below.

ATA

Standard call answer AT command.

ATDdd...dd;

Standard AT command intended for placing a call to a phone number. Only voice calls are covered in this specification.

ATD>nnn...;

Extension of the standard ATD command, intended for memory dialing. Only voice calls are covered in this specification.

AT+CCWA

Standard “Call Waiting notification” AT command. Within the AT+CCWA=[<n>[,<mode>[,<class>]]]command, only enabling/disabling of the Call Waiting notification unsolicited result code +CCWA , using the <n> parameter, is covered in this specification.

AT+CHLD

Standard call hold and multiparty handling AT command.

AT+CHUP

Standard hang-up AT command. Execution command causes the AG to terminate the currently active call. This command shall have no impact on the state of any held call.

AT+CIND

Standard indicator update AT command.

+CIND

Standard list of current phone indicators.

AT+CLCC

Standard list current calls command.

+CLCC

Standard list current calls result code

AT+COPS

The AT+COPS=3,0 shall be sent by the HF to the AG prior to sending the AT+COPS? command. AT+COPS=3,0 sets the format of the network operator string to the long format alphanumeric.

AT+CMEE

Standard AT command used to enable the use of result code.

AT+CLIP

Standard “Calling Line Identification notification” activation AT command. It enables/disables the Calling Line Identification notification unsolicited result code +CLIP.

+CLIP

Standard “Calling Line Identification notification” unsolicited result code.

AT+CMER

Standard event reporting activation/deactivation AT command.

+CIEV

Standard “indicator events reporting” unsolicited result code.

AT+VTS

Standard DTMF generation AT command. Only the AT+VTS=<DTMF> command format is covered in this specification.

AT+CNUM

AT+CNUM (Retrieve Subscriber Number Information)

+CNUM

Standard Response used for sending the “Subscriber Number Information” from AG to HF.

AT+BINP

Command used for requesting some specific data input from the AG4. On reception of this command the AG shall perform the proper actions such that the requested information is sent back to the HF using the +BINP response.

AT+BLDN

Bluetooth Last Dialed Number

AT+BVRA

Bluetooth Voice Recognition Activation

+BVRA

Bluetooth Voice Recognition Activation. Unsolicited result code used to notify the HF when the voice recognition function in the AG is activated/deactivated autonomously from the AG.

AT+BRSF

(Bluetooth Retrieve Supported Features. Notifies the AG of the supported features available in the HF, and requests information about the supported features in the AG. The supported features shall be represented as a decimal value.

+BRSF

*Bluetooth Retrieve Supported Features).*Result code sent by the AG in response to the AT+BRSF command, used to notify the HF what features are supported in the AG. The supported features shall be represented as a decimal value.

AT+NREC (*Noise Reduction and Echo Canceling*)

Command issued to disable any Echo Canceling and Noise Reduction functions embedded in the AG.

Only support for execution command is mandated. Neither the read nor test commands are mandatory.

AT+VGM

Gain of Microphone. Command issued by the HF to report its current microphone gain level setting to the AG. <gain> is a decimal numeric constant, relating to a particular (implementation dependent) volume level controlled by the HF. This command does not change the microphone gain of the AG; it simply indicates the current value of the microphone gain in the HF.

AT+VGS (Gain of Speaker)

Command issued by the HF to report its current speaker gain level setting to the AG. <gain> is a decimal numeric constant, relating to a particular (implementation dependent) volume level controlled by the HF. This command does not change the speaker gain of the AG; it simply indicates the current value of the speaker volume in the HF.

+VGM (Gain of Microphone)

Unsolicited result code issued by the AG to set the microphone gain of the HF. <gain> is a decimal numeric constant, relating to a particular (implementation dependent) volume level controlled by the HF.

+VGS (Gain of Speaker)

Unsolicited result code issued by the AG to set the speaker gain of the HF. <gain> is a decimal numeric constant, relating to a particular (implementation dependent) volume level controlled by the HF.

++BSIR (Bluetooth Setting of In-band Ring tone)

Unsolicited result code issued by the AG to indicate to the HF that the in-band ring tone setting has been locally changed. The HF may react accordingly by changing its own alert method.

AT+BTRH (Bluetooth Response and Hold Feature)

Command issued by the HF for the “Response and Hold” feature in the AG. This specification defines the use of the set and read command. The AT+BTRH? command shall be used by the HF to query the current “Response and Hold” state of the AG.

+BTRH (Bluetooth Response and Hold Feature)

Result code used to notify the HF when-ever the incoming call is either put on hold or accepted or rejected. The AG shall also respond back with this response for the AT+BTRH? command from the HF.

3.5.4 Power saving

iWRAP offers two power saving options. Sniff mode, which can be used to save power for active Bluetooth connections and deep sleep mode which puts the internal processor into a reduced duty cycle mode. Please refer to iWRAP user guide for more information about sniff and deep sleep modes.

One should also know that when Bluetooth connections are in active mode i.e. no power saving in use the master device uses 3-4 times less power than a slave device. Therefore for battery powered applications it might be useful to configure the device as a master rather than a slave.

3.5.5 Ring tones

iWRAP supports the use of ring tones with HFP profile. The ring tone is played if HF device in the case when the HFP-AG does not provide a so called in-band ring tone. The user can manually play the ring tone with **PLAY** command or alternatively iWRAP can be instructed to play the ring tone automatically with **SET CONTROL RINGONE** command.

refer to iWRAP user guide for more information about **PLAY** and **SET CONTROL RINGONE** commands.

3.5.6 Echo cancellation and noise reduction

Cambridge Silicon Radio's Clear Voice Capture (CVC) is a modular suite of algorithms for enhancing voice communication products, including acoustic echo cancellation and noise suppression that can be applied in a granular fashion to suit the application and the processing resources available. Rather than suppressing noise like many competing technologies, CVC separates out the voice signals of interest using proprietary signal extraction techniques.

CVC runs on the Bluegiga's DSP-equipped WT32 Bluetooth module. It's seamlessly integrated into iWRAP firmware suite and will be active whenever SCO (audio) connections are used.

Learn more:

<http://www.csr.com/products/cvc.htm>

4 Using HSP with iWRAP

This chapter instructs the Headset profile usage and configuration with the iWRAP firmware.

4.1 Configuration

4.1.1 Headset Audio Gateway (HSP-AG)

HFP-AG is enabled with command “**SET PROFILE HSP-AG ON**”.

The Bluetooth Class-of-Device (CoD) needs to be also configured properly. Some device may not be able to discover and connect iWRAP unless it's properly set. For HSP devices the CoD needs to be 200404.

Finally a reset is needed to for the HSP-AG profile to become active.

Below is an example how to enable HSP-AG mode.

```
SET PROFILE HSP-AG ON  
SET BT CLASS 200404  
RESET
```

4.1.2 Headset unit (HS)

HF mode is enabled with command **"SET PROFILE HSP ON"**

The Bluetooth Class-of-Device (CoD) needs to be also configured properly. Some device may not be able to discover and connect iWRAP unless it's properly set. For HSP devices the CoD needs to be 200404.

Finally a reset is needed to for the HSP profile to become active.

Below is an example how to enable HSP mode.

```
SET PROFILE HSP ON  
SET BT CLASS 200404  
RESET
```

4.2 Service discovery

Bluetooth technology enables wireless service discovery, so you can find out the capabilities the remote device supports. Wireless service discovery uses the Bluetooth Service Discovery Profile (SDP).

With iWRAP the service discovery is performed with command: “**SDP {bd_addr} {uuid}**”.

bd_addr

Bluetooth device address of the remote device.

uuid

Universally unique identifier. Refers to the Bluetooth profile one wants to discover. For HSP-AG the **uuid** is 1112 and for HS 1108.

Below is an example how to perform a service discovery for HSP-AG device.

SDP 00:07:80:81:66:6f 1108

```
SDP 00:07:80:81:66:6f < I SERVICENAME S "Headset" > < I PROTOCOLDESCRIPTORLIST < < U L2CAP > < U RFCOMM I 04 > > >
```

SDP

Headset

= Service name

04

= RFCOMM channel for HSP

Below is an example how to perform a service discovery for HS device.

SDP 00:07:80:93:0c:aa 1112

```
SDP 00:07:80:93:0c:aa < I SERVICENAME S "Voice Gateway" > < I PROTOCOLDESCRIPTORLIST < < U L2CAP > < U RFCOMM I 04 > > >
```

SDP

Voice Gateway

= Service name

04

= RFCOMM channel for HSP

4.3 Connection establishment

4.3.1 HSP control channel

With HSP, first a control channel needs to be established. The control channel is used for AT command signalling between the HF and HFP-AG devices.

The HSP control channel is opened, typical to iWRAP, with a **CALL** command:

"CALL {*bd_addr*} 1112 HSP" - When opening connection from HS device to HSP-AG device

"CALL {*bd_addr*} 1108 HSP-AG" - When opening connection from HSP -AG device to HS device

bd_addr Bluetooth device address of the remote device.

Below is an example how to set up a HSP connection from HS to HSP-AG.

```
CALL 00:07:80:93:0c:aa 1112 HSP
```

```
CALL 0
```

```
CONNECT 0 HSP 4
```

A typical indications of outgoing call and successful connection are received (CALL and CONNECT).

Below is an example how to set up a HSP connection from HSP-AG to HS.

```
CALL 00:07:80:81:66:6f 1108 HSP-AG
```

```
CALL 0
```

```
CONNECT 0 HSP 4
```

```
CONNECT 1 SCO
```

HSP-AG immediately opens SCO connection, which is indicated with "**CONNECT {*link_id*} SCO**" event.

4.3.2 HSP audio channel

Once the HSP control channel has been set up an audio channel can be created. Headset profile is much simpler than Hands-Free profile and therefore the connection establishment is also simpler.

There are two commands to manage the audio channel. The headset unit has a command **BUTTON**, which opens the audio channel and the Headset audio gateway uses command:

SCO OPEN {*link_id*}

link_id Numeric connection identified

Opening the audio channel from HS device.

BUTTON

RING 1 00:07:80:93:0c:aa SCO

Opening the audio channel from HSP-AG device.

SCO OPEN 0

CONNECT 1 SCO

4.4 Connection termination

4.4.1 HSP audio channel

The only way to terminate the audio (SCO) connection is to use command:

CLOSE {*link_id*}

link_id Numeric connection identified

Termination of the audio connection from HS device

CLOSE 1

NO CARRIER 1 ERROR 0

Termination of the audio connection from HSP-AG device

CLOSE 1

NO CARRIER 1 ERROR 0

4.4.2 HSP control channel

The HSP control channel is simply be closed with iWRAP command “**CLOSE {*link_id*}**”

link_id Numeric connection identified

HSP control channel termination.

CLOSE 0

NO CARRIER 0 ERROR 0

5 References

- [1] The Bluetooth SIG, Hands-Free Profile overview, URL:
<http://www.bluetooth.com/Bluetooth/Technology/Works/HFP.htm>

- [2] The Bluetooth SIG, Headset Profile overview, URL:
<http://www.bluetooth.com/Bluetooth/Technology/Works/HSP.htm>

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