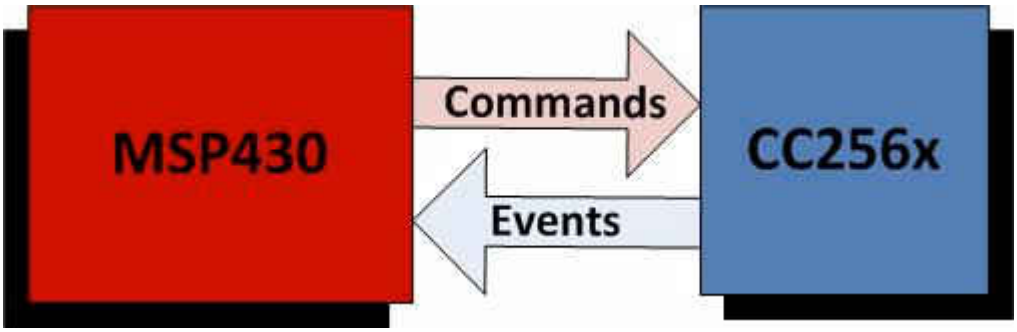
Application Note

CC256x versus HCI Commands

ABSTRACT

Bluetooth® systems consists of a host and a controller. The BT SIG has created a standard protocol for the host to communicate with the controller. This is called the Host Controller Interface (HCI) which is specified in the BT Core 4.1 specification Volume 2 Part E. The HCI provides a uniform command interface to a Controller. There are some commands which are not listed in the specifications and they are specific to the device itself. These commands are vendor-specific commands (VS) generally used for testing and debugging purposes. For further details on testing command sequences, refer to CC256x Testing Guide.

Figure 1-1. HCI Commands VS



As shown in the diagram above, the host (MSP430) sends HCI commands to the controller (CC256x). The controller then sends HCI events to the host as a response to the HCI commands. All HCI commands follows this format for all packets:

Table 1-1. HCI Packet Format

First Byte	Next Bytes
HCI Packet Type	HCI packet (variable length)

All HCI commands starts with a byte describing type of packet while the remaining bytes is dependent on the type of HCI packet.

Here is a list of important HCI packet types:

Table 1-2. HCI Packet Types

HCI Packet Type	Packet Type Indicator	Direction
HCI command packet	0x01	Host to baseband controller
HCI event packet	0x04	Baseband controller to host

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1 Command Packet

Most of the HCI packets consist of command packets. The host sends these command packets according to the structure detailed in the tables below and the controller sends responses through event packets back to the host. Command packets are used to configure many aspects of the Bluetooth system ranging from the link layer to the baseband layer.

You can also refer to the Core 4.1 Specification Volume 2, Part E, for the format of these HCI packets.

After the first byte,the remaining bytes depends on what type of packet it is. Of these two packet types, the structure of the HCI command packet is:

Table 1-1. Command Packet

First Last		
16 bit Opcode	8 bit Length	Parameters(0,1,3,...,N)

Note

Some commands do not have parameters, thus ends with 0x00 as the length.

Here is a description of the above HCI command packet structure:

Table 1-2. HCI Command Description

Fields	Descriptions
Opcode	16 bit unique Opcode for HCI command
Length	Length of parameters in bytes
Parameters	Specific parameters associated with each command

Taking the command HCI_Read_BD_ADDR, this is an example of a command packet consisting of outgoing data to the controller:

Table 1-3. Command Packet Example

Packet Type	Opcode	Opcode	Length
0x01	0x09	0x10	0x00

In this case, the length is zero so no parameters follows afterwards.

2 Event Packet

After the packet type (0x04) denoting an Event packet, this is the format for HCI events that are returned by the BT controller to the host:

Table 2-1. HCI Events

First Byte	Second Byte	Third Byte	N Byte
Event Code	Length	Param0	ParamN

There are many event packet types and each has a unique event code. The parameters for the command complete event (which has event code of 0x0E) is described as follows:

Table 2-2. Command Complete Event

Param 0 (Byte 1)	Param 1 (Byte 2)	Param 1 (Byte 3)	Param 2 (Byte 4)
Num_HCI_Command_Packets	Command_Opcode (LSB)	Command_Opcode (MSB)	Return_Parameter(s)

The Command Complete event is used by the Controller for most commands to transmit return status of a command and the other event parameters that are specified for the issued HCI command. The Num_HCI_Command_Packets parameter tells the number of HCI command packets which are allowed to be sent to the Controller from the Host.

This is an example of a returned event after the HCI_Read_BD_ADDR command is issued to the controller.

Table 2-3. Event Packet Example

Packet Type	Event Packet Code	Length	Num of HCI Commands	Command_Opcode (LSB)	Command_Opcode (MSB)	Status	BD_ADDR (LSB)					BD_ADDR(MSB)
0x04	0x0E	0x0A	0x01	0x09	0x10	0x00	0x11	0xD1	0xF8	0xA5	0x0D	0xBC

So from this example, the event packet tells us the event was successful (Status is 0x00) and the BT Device Address is "BC:0D:A5:F8:D1:11"

3 HCI Commands

3.1 HCI Commands List Format

Command Name (*Opcode*)

Description: *Command Description*

Table 3-1. Command Parameters

Command Name (Opcode) Parameter 0, ..., Parameter N

Command Parameter	Size (bytes)	Value	Description
Parameter Name	Size in bytes of parameter starting with first byte to be sent to BT device	Value 0 Value 1 Value N	Description 0 Description 1 Description N

Table 3-2. Return Parameters

Returned Value	Description	Size (bytes)	Events Generated
Param0 Param1 ParamN	Description0 Description1 DescriptionN	Size in bytes of returned value starting with first byte received from BT device	Name of event generated due to previous command sent Ex: *Command Complete Event*

Note

Parameter 0 is the first byte sent out, then Param 1,...,etc.

3.2 Support HCI Commands Detailed Description

3.2.1 HCI_VS_Write_BD_Addr (0xFC06)

Description:

This command writes the value for the BD_ADDR parameter.

Table 3-3. Command Parameters

HCI_VS_Write_BD_Addr (0xFC06) BD address

Command Parameter	Size (bytes)	Value	Description
BD address	6	0xXXXXXXXXXXXX	New BD_ADDR to be written to device.

Table 3-4. Return Parameters

Returned Value	Description	Size (bytes)	Events Generated
0x00 0x01 – 0xFF	Command succeeded. Command failed.	1	Command Complete

3.2.2 HCI_VS_Write_CODEC_Config (0xFD06)

Description:

This command configures the codec interface parameters and the PCM clock rate, which is relevant when the Bluetooth core generates the clock. This command must be used by the host to use the PCM interface.

Table 3-5. Command Parameters

HCI_VS_Write_CODEC_Config (0xFD06) Clock rate, Clock direction, Frame-sync frequency, Frame-sync duty cycle, Frame-sync edge, Frame-sync polarity, Reserved, Channel 1 data out size, Channel 1 data out offset, Channel 1 data out edge, Channel 1 data in size, Channel 1 data in offset, Channel 1 data in edge, Reserved, Channel 2 data out size, Channel 2 data out offset, Channel 2 data out edge, Channel 2 data in size, Channel 2 data in offset, Channel 2 data in edge, Reserved

Command Parameter	Size (bytes)	Value	Description
Clock rate	2	64-16,000	The PCM clock rate in KHz. Valid values are between 64K to 4096K (for master mode) or 64K to 16M (for slave mode). It influences other parameters such as wait cycles and frequency rate calculation and therefore must be configured even if an external clock is used.
Clock direction	1	0x00 0x01	PCM clock and Fsync direction is output (codec_IF is Master on PCM bus) and sampled on rising edge PCM clock and Fsync direction is input
Frame-sync frequency	4	100 Hz – 173 kHz	Frame-sync frequency in Hz
Frame-sync duty cycle	2	0x0000 0x0001-0xFFFF	50% of Fsync period (I2S Format) Number of cycles of PCM clock
Frame-sync edge	1	0x00 0x01	Driven/sampled at rising edge of the PCM clock Driven/sampled at falling edge of the PCM clock
Frame-sync polarity	1	0x00 0x01	Active high Active low
Reserved	1		
Channel 1 data out size	2	0x0001 – 0x0280	Sample size in bits for each codec Fsync The value is between 1 bit and 0x0280 bits. If data size is greater than 24 bits, the size must be divisible by 8 (for example, 1–24,32, 40, 48, etc.).
Channel 1 data out offset	2	0x0000 – 0x00FF	Number of PCM clock cycles between rising of frame sync and data start. NOTE:Please note that the offset of CH2 must be a minimum of CH1 DATA LENGHT + 1.This requirement is important also when CH2 is not used.
Channel 1 data out edge	1	0x00 0x01	Data driven at rising edge of the PCM clock Data driven at falling edge of the PCM clock
Channel 1 data in size	2	0x0001 – 0x0280	Sample size in bits for each codec Fsync The value is between 1 bit and 0x0280 bits. If data size is greater than 24 bits, the size must be divisible by 8 (for example, 1–24,32, 40, 48, etc.).

Table 3-5. Command Parameters (continued)

HCI_VS_Write_CODEC_Config (0xFD06) Clock rate, Clock direction, Frame-sync frequency, Frame-sync duty cycle, Frame-sync edge, Frame-sync polarity, Reserved, Channel 1 data out size, Channel 1 data out offset, Channel 1 data out edge, Channel 1 data in size, Channel 1 data in offset, Channel 1 data in edge, Reserved, Channel 2 data out size, Channel 2 data out offset, Channel 2 data out edge, Channel 2 data in size, Channel 2 data in offset, Channel 2 data in edge, Reserved

Command Parameter	Size (bytes)	Value	Description
Channel 1 data in offset	2	0x0000 – 0x00FF	Number of PCM clock cycles between rising of frame sync and data start
Channel 1 data in edge	1	0x000x01	Data sampled at rising edge of the PCM clock Data sampled at falling edge of the PCM clock
Fsynch Multiplier	1	0x00/0xFF 32/64	**This field is only relevant to CC256XB from SP 0.2 !!!** When setting the values 0x00 or 0xFF the command will act the same as previously, but when entering a value of 32/64 the Clock Rate will be: Clock Rate = Fsynch Multiplier X Frame Synch frequency , for example 44,100Hz X 32 = 1441,200Hz
Channel 2 data out size	2	0x0001 – 0x0280	Sample size in bits for each codec Fsync The value is between 1 bit and 0x0280 bits. If data size is greater than 24 bits, the size must be divisible by 8 (for example, 1–24,32, 40, 48, etc.).
Channel 2 data out offset	2	0x0000 – 0x00FF	Number of PCM clock cycles between rising of frame sync and data start. NOTE:Please note that the offset of CH2 must be a minimum of CH1 DATA LENGHT + 1.This requirement is important also when CH2 is not used.
Channel 2 data out edge	1	0x00 0x01	Data driven at rising edge of the PCM clock Data driven at falling edge of the PCM clock
Channel 2 data in size	2	0x0001 – 0x0280	Sample size in bits for each codec Fsync The value is between 1 bit and 0x0280 bits. If data size is greater than 24 bits, the size must be divisible by 8 (for example, 1–24,32, 40, 48, etc.).
Channel 2 data in offset	2	0x0000 – 0x00FF	Number of PCM clock cycles between rising of frame sync and data start
Channel 2 data in edge	1	0x000x01	Data sampled at rising edge of the PCM clock Data sampled at falling edge of the PCM clock
Reserved	1		

Table 3-6. Return Parameters

Returned Value	Description	Size (bytes)	Events Generated
0x00 0x01 – 0xFF	Command succeeded. Command failed.	1	Command Complete

3.2.3 HCI_VS_Write_CODEC_Config_Enhanced (0xFD07)

Description:

This command configures enhanced configuration of the codec interface. This command is optional and cannot be used when all default parameters are acceptable. When this command is used, it must come after HCI_VS_Write_CODEC_Config.

Table 3-7. Command Parameters

HCI_VS_Write_CODEC_Config_Enhanced (0xFD07) Clock shutdown, Clock start, Clock stop, Reserved, Channel 1 data in order, Channel 1 data out order, Channel 1 data out mode, Channel 1 data out duplication, Channel 1 TX_dup_value, Channel 1 data quant, Reserved, Channel 2 data in order, Channel 2 data out order, Channel 2 data out mode, Channel 2 data out duplication, Channel 2 TX_dup_value, Channel 2 data quant, Reserved

Command Parameter	Size	Value	Description
Clock shutdown	1	0x00 0x01	PCM clock shutdown feature is disabled. PCM clock shutdown feature is enabled. Time of start/stop is defined in the following two fields (used in master mode only).
Clock start	2	0x0000 – 0xFFFF	Number of PCM clock cycles relative to the PCM frame sync to start PCM clock (for example, start two clocks before frame sync)
Clock stop	2	0x0000 – 0xFFFF	Number of PCM clock cycles relative to the PCM frame sync to stop PCM clock (for example, stop 20 clocks after frame sync)
Reserved	1	0x00	Default: 0x00
Channel 1 data in order	1	Bit 0 = 0 Bit 0 = 1 Bit 1 = 0 Bit 1 = 1 Bit 2 = 0 Bit 2 = 1	Data driven MSB first Data driven LSB first Don’t swap bytes within the sample. Swap bytes within the sample in bit-wise mode when data size > 8 ([XYZ]->[ZYX]). Do not shift the sample. Shift the sample by (24|16-dout_size) bits from MSB to LSB (controls sample alignment inside internal register (23:0) in bit-wise mode only).

Table 3-7. Command Parameters (continued)

HCI_VS_Write_CODEC_Config_Enhanced (0xFD07) Clock shutdown, Clock start, Clock stop, Reserved, Channel 1 data in order, Channel 1 data out order, Channel 1 data out mode, Channel 1 data out duplication, Channel 1 TX_dup_value, Channel 1 data quant, Reserved, Channel 2 data in order, Channel 2 data out order, Channel 2 data out mode, Channel 2 data out duplication, Channel 2 TX_dup_value, Channel 2 data quant, Reserved

Command Parameter	Size	Value	Description
Channel 1 data out order	1	Bit 0 = 0 Bit 0 = 1 Bit 1 = 0 Bit 1 = 1 Bit 2 = 0 Bit 2 = 1	Data driven MSB first Data driven LSB first Don't swap bytes within the sample. Swap bytes within the sample in bit-wise mode when data size > 8 ([XYZ]->[ZYX]). Do not shift the sample. Shift the sample by (24|16-dout_size) bits from MSB to LSB (controls sample alignment inside internal register (23:0) in bit-wise mode only).
Channel 1 data out mode	1	0x00 0x01 0x02 0x03	Always 3-state (input) Always output Switch to 3-state (input) when idle Always 3-state (input)
Channel 1 data out duplication	1	0x00 0x01	Retransmit last sample when no data are available. 0x01 Transmit DUP_VALUE when no data are available.
Channel 1 TX_dup_value	4	0x00000000 – 0x00FFFFFF	Replacement value to transmit when no data is available
Channel 1 data quant	1	0x00 0x01	Bit-wise mode. Possible if data in and data out size are up to 24 bits. Byte-wise mode
Reserved	1		
Channel 2 data in order	1	Bit 0 = 0 Bit 0 = 1 Bit 1 = 0 Bit 1 = 1 Bit 2 = 0 Bit 2 = 1	Data driven MSB first Data driven LSB first Don't swap bytes within the sample. Swap bytes within the sample in bit-wise mode when data size > 8 ([XYZ]->[ZYX]). Do not shift the sample. Shift the sample by (24|16-dout_size) bits from MSB to LSB (controls sample alignment inside internal register (23:0) in bit-wise mode only).

Table 3-7. Command Parameters (continued)

HCI_VS_Write_CODEC_Config_Enhanced (0xFD07) Clock shutdown, Clock start, Clock stop, Reserved, Channel 1 data in order, Channel 1 data out order, Channel 1 data out mode, Channel 1 data out duplication, Channel 1 TX_dup_value, Channel 1 data quant, Reserved, Channel 2 data in order, Channel 2 data out order, Channel 2 data out mode, Channel 2 data out duplication, Channel 2 TX_dup_value, Channel 2 data quant, Reserved

Command Parameter	Size	Value	Description
Channel 2 data out order	1	Bit 0 = 0 Bit 0 = 1 Bit 1 = 0 Bit 1 = 1 Bit 2 = 0 Bit 2 = 1	Data driven MSB first Data driven LSB first Don't swap bytes within the sample. Swap bytes within the sample in bit-wise mode when data size > 8 ([XYZ]->[ZYX]). Do not shift the sample. Shift the sample by (24|16-dout_size) bits from MSB to LSB (controls sample alignment inside internal register (23:0) in bit-wise mode only).
Channel 2 data out mode	1	0x00 0x01 0x02 0x03	Always 3-state (input) Always output Switch to 3-state (input) when idle Always 3-state (input)
Channel 2 data out duplication	1	0x00 0x01	Retransmit last sample when no data are available. 0x01 Transmit DUP_VALUE when no data are available.
Channel 2 TX_dup_value	4	0x00000000 – 0x00FFFFFF	Replacement value to transmit when no data is available
Channel 2 data quant	1	0x00 0x01	Bit-wise mode. Possible if data in and data out size are up to 24 bits. Byte-wise mode
Reserved	1		

Table 3-8. Return Parameters

Returned Value	Description	Size (bytes)	Events Generated
0x00 0x01 – 0xFF	Command succeeded. Command failed.	1	Command Complete

3.2.4 HCI_VS_DRP_Read_BER_Meter_Result (0xFD13)

Description:

This command allows reading of the BER result produced by the internal software-based BER meter.

Table 3-9. Command Parameters

HCI_VS_DRP_Read_BER_Meter_Result (0xFD13)

Command Parameter	Size (bytes)	Value	Description
None	0	N/A	N/A

Table 3-10. Return Parameters

Returned Value	Description	Size (bytes)	Events Generated
0x00 0x01 – 0xFF	Command succeeded. Command failed.	1	Command Complete
0xXX	Finished at least one test	1	

Table 3-10. Return Parameters (continued)

Returned Value	Description	Size (bytes)	Events Generated
0xXXXX	Number of packets received	2	
0xXXXXXXXX	Total bits counted	4	
0xXXXXXXXX	Number of errors found	4	

3.2.5 HCI_VS_DRPb_Tester_Con_RX (0xFD17)

Description:

This command gets the Bluetooth channel index and ADPLL mode and sets the device to continuous reception at the selected frequency.

Table 3-11. Command Parameters

HCI_VS_DRPb_Tester_Con_RX (0xFD17) Frequency, ADPLL loop mode

Command Parameter	Size (bytes)	Value	Description

Frequency	1	0 - 78	Selects *Bluetooth* frequency channel for transmission. Frequency channel index (k), range 0 – 78 (decimal)
			`Freq = 2402 + 2k, for k = 0, 1, 2 … 39`
			`Freq = 2403 + 2(k-40), for k = 40, 41…78`

ADPLL loop mode	1	0x00 0x01	Open Loop - Used during Scanning Modes, i.e. Inquiry Scan and Page Scan Close Loop - Used during Connection Modes, i.e. Active and Sniff Mode

Table 3-12. Return Parameters

Returned Value	Description	Size (bytes)	Events Generated
0x00 0x01 – 0xFF	Command succeeded. Command failed.	1	Command Complete

3.2.6 HCI_VS_LE_Enable (0xFD5B)

Description:

This command enables the Bluetooth Low Energy (BLE) function in the controller.

Table 3-13. Command Parameters

HCI_VS_LE_Enable (0xFD5B) Enable/Disable, Load LE code

Command Parameter	Size (bytes)	Value	Description
Disable Enable	1	0x00 0x01	Disable Enable
Load LE code	1	0x00 0x01	Do not load code Load code

Table 3-14. Return Parameters

Returned Value	Description	Size (bytes)	Events Generated
0x00 0x01 – 0xFF	Command succeeded. Command failed.	1	Command Complete

3.2.7 HCI_VS_Set_LE_Test_Mode_Parameters (0xFD77)

Description:

This command configures the test mode parameters for the type of packets to transmit.

Table 3-15. Command Parameters

HCI_VS_Set_LE_Test_Mode_Parameters (0xFD77) TX Power Level, RX Mode, Packets to transmit, Access code, BER Test Enable, BER Test Pattern, BER Test Packet Length, BER FA Threshold, Trace Enable, Reference CRC

Command Parameter	Size (bytes)	Value	Description
TX Power Level	1	0x01	Fixed BLE Power Level See HCI_VS_DRPb_Set_Power_Vector
RX Mode	1	0x00 0x01 0x02 0x03	Normal Wide Window Continuous RX Wide Window and power saving
Packets to transmit	2	0x0000 N	Unlimited N number of packets to transmit
Access code	4	0xXXXXXXXX	An access code to sync and transmit Default:0x71764129
BER Test Enable	1	0x00 0x01	Disable BER Enable BER
BER Test Pattern	1	0x00 0x01 0x02 0x03 0x04 0x05 0x06 0x07	PRBS 9 FOFO ZOZO PRBS 15 All 1 All 0 OFOF OZOZ
BER Test Packet Length	1	N	N Number of payload bytes to be received in the BER test
BER FA Threshold	1	0xXX	A threshold for FA detection Default: 20
Trace Enable	1	0x00 0x01	Disable trace during BER test Enable trace during BER test
Reference CRC	4	0xXXXX	Reference CRC value for the packet. Default: 0x0000

Table 3-16. Returned Parameters

Returned Value	Description	Size (bytes)	Events Generated
0x00 0x01 – 0xFF	Command succeeded. Command failed.	1	Command Complete

3.2.8 HCI_VS_DRPb_Enable_RF_Calibration (0xFD80)

Description:

This command enables an RF calibration run immediately or periodically. It defines the calibration procedures required to run each time the periodic calibration is run. In standby mode, when enabling the periodic run, the calibration should start the run immediately.

Table 3-17. Command Parameters

HCI_VS_DRPb_Enable_RF_Calibration (0xFD80) Periodic mode, Calibration procedures, Override temp condition

Command Parameter	Size (bytes)	Value	Description
Periodic mode	1	0x00 0x01 - 0xFD 0xFE 0xFF	Activate the calibration one time Activate the calibration each Value × 10 seconds periodically Do not change Stop the periodic calibration
Calibration procedures	4	0xXXXXXXXX	Default: 0xFFFFFFFF
Override temp condition	1	0x00 0x01	Activate the calibrations only if the temperature has changed. Activate the calibrations at every periodic calibration.

Table 3-18. Return Parameters

Returned Value	Description	Size (bytes)	Events Generated
0x00 0x01 – 0xFF	Command succeeded. Command failed.	1	Command Complete

3.2.9 HCI_VS_DRPb_Tester_Con_TX (0xFD84)

Note

Refer to the CC256x Testing Guide for further details on how to use this command.

Description:

This command tests the RF transceiver in continuous transmission mode. The transmitter is activated by configuring the transmission parameters such as pattern, modulation, and frequency.

Table 3-19. Command Parameters

HCI_VS_DRPb_Tester_Con_TX(0xFD84) Modulation, Test pattern, Frequency, Power level, Generator initialization value, EDR generator mask

Command Parameter	Size (bytes)	Value	Description
Modulation	1	0x00 0x01 0x02 0x03 0x04	CW - *Test pattern (second parameter, below) MUST be set to "All 1" or "All 0"* GFSK (BR) π/4-DQPSK (2-EDR) 8DPSK (3-EDR) BLE
Test pattern	1	0x00 0x01 0x02 0x03 0x04 0x05 0x06	PN9 PN15 5555 (0101 0101 0101 0101b) All 1 All 0 FOFO (1111 0000 1111 0000b) FF00

Frequency	1	0 - 78	Selects *Bluetooth* frequency channel for transmission. Frequency channel index (k), range 0 – 78 (decimal)
			`Freq = 2402 + 2k, for k = 0, 1, 2 … 39`
			`Freq = 2403 + 2(k-40), for k = 40, 41…78`

Table 3-19. Command Parameters (continued)

HCI_VS_DRPb_Tester_Con_TX(0xFD84) Modulation, Test pattern, Frequency, Power level, Generator initialization value, EDR generator mask

Command Parameter	Size (bytes)	Value	Description
Power level	1	0x0F - 0x08	0x0F(15): Level with Max Output Power (GFSK, EDR2 or EDR3)0x08(8): Level with Min Output Power (GFSK, EDR2 or EDR3)0x01(1): Level with BLE Output Power (BLE) • *Refer to HCI_VS_DRPb_Set_Power_Vector for the corresponding Output Power.*
Reserved	4	0xXXXXXXXX	0x00000000 (Default)
Reserved	4	0xXXXXXXXX	0x00000000 (Default)

Table 3-20. Return Parameters

Returned Value	Description	Size (bytes)	Events Generated
0x00 0x01 – 0xFF	Command succeeded. Command failed.	1	Command Complete

3.2.10 HCI_VS_DRPb_Tester_Packet_TX_RX (0xFD85)

Description:

This command starts sending/receiving packets using packet transmission parameters such as frequency channel, packet type, and packet length. It is used for Packet TX/RX.

Table 3-21. Command Parameters

HCI_VS_DRPb_Tester_Packet_TX_RX (0xFD85) Frequency mode, TX single-frequency index, RX single-frequency, ACL packet type, ACL packet data pattern, Reserved, ACL packet data length, Power level, Disable whitening, PRBS9 initialization value

Command Parameter	Size (bytes)	Value	Description
Frequency mode	1	0x00 0x03	Hopping Single frequency

TX single-frequency	1	0 - 78	Selects *Bluetooth* frequency channel for transmission. Frequency channel index (k), range 0 – 78 (decimal)
			`Freq = 2402 + 2k, for k = 0, 1, 2 … 39`
			`Freq = 2403 + 2(k-40), for k = 40, 41…78`

RX single-frequency	1	0 - 78, 0xFF	Selects *Bluetooth* frequency channel for transmission. Frequency channel index (k), range 0 – 78 (decimal)
			`Freq = 2402 + 2k, for k = 0, 1, 2 … 39`
			`Freq = 2403 + 2(k-40), for k = 40, 41…78`
			`0xFF - Disable RX (packet TX only)`

ACL packet type	1	0x000x010x020x030x040x050x060x070x080x090x0A0x0B	DM1DH1DM3DH3DM5DH52-DH12-DH32-DH53-DH13-DH33-DH5

Table 3-21. Command Parameters (continued)

HCI_VS_DRPb_Tester_Packet_TX_RX (0xFD85) Frequency mode, TX single-frequency index, RX single-frequency, ACL packet type, ACL packet data pattern, Reserved, ACL packet data length, Power level, Disable whitening, PRBS9 initialization value

Command Parameter	Size (bytes)	Value	Description
ACL packet data pattern	1	0x00 0x01 0x02 0x03 0x04 0x05	All 0 All 1 5555 (0101 0101 0101 0101b) FOFO (1111 0000 1111 0000b) Ordered PRBS9 random
Reserved	1	0xXX	Reserved (Default: 0x00)
ACL packet data length	2	0-17 0-27 0-121 0-183 0-224 0-339 0-54 0-367 0–679 0-83 0–552 0-1021	DM1 DH1 DM3 DH3 DM5 DH5 2-DH1 2-DH3 2-DH5 3-DH1 3-DH3 3-DH5
Power level	1	0 - 15	15 = Max Output Power, 0 = Min Output Power
Disable whitening	1	0x00 0x01	Enable whitening Disable whitening
PRBS9 initialization value	2	0x0000 - 0x01FF	Used only in PRBS9 patterns to initialize PRBS9 data

Table 3-22. Return Parameters

Returned Value	Description	Size (bytes)	Events Generated
0x00 0x01 – 0xFF	Command succeeded. Command failed.	1	Command Complete

3.2.11 HCI_VS_DRPb_Reset (0xFD88)

Description:

This command resets the BT radio to initial state. This command may be used to stop the Continuous_TX transmission initiated via HCI_VS_DRPb_Con_TX.

Table 3-23. Command Parameters

HCI_VS_DRPb_Reset (0xFD88)

Command Parameter	Size (bytes)	Value	Description
None	0	N/A	N/A

Table 3-24. Return Parameters

Returned Value	Description	Size (bytes)	Events Generated
0x00 0x01 – 0xFF	Command succeeded. Command failed.	1	Command Complete

3.2.12 HCI_VS_DRPb_BER_Meter_Start (0xFD8B)

Description:

This command activates the internal software-based BER meter used in Production Line Test (PLT). The VS command controls the reception frequency and the packet/connection parameters. It turns on a continuous RX and triggers the BER meter into operation.

Table 3-25. Command Parameters

HCI_VS_DRPb_BER_Meter_Start (0xFD8B) Frequency, BD address, LT address, ACL packet type, ACL packet data length, Number of packets, PRBS9 initialization value, Poll period

Command Parameter	Size (bytes)	Value	Description

Frequency	1	0 - 78	Selects *Bluetooth* frequency channel for transmission. Frequency channel index (k), range 0 – 78 (decimal)
			`Freq = 2402 + 2k, for k = 0, 1, 2 … 39`
			`Freq = 2403 + 2(k-40), for k = 40, 41…78`

Reserved	1	0xXX	Default: 0x00
BD address	6	0xXXXXXXXXXXXX	BD address of the device being tested by its internal BER meter
LT address	1	0x00-0x05	Address of the device within a specific Piconet Default: 0x01
ACL packet type	1	0x00 0x01 0x02 0x03 0x04 0x05 0x06 0x07 0x09	DM1 DH1 DM3 DH3 DM5 DH5 2-DH1 2-DH3 3-DH1
ACL packet data length	2	0-17 0-27 0-121 0-183 0-224 0-339 0-54 0-367 0-83	DM1 DH1 DM3 DH3 DM5 DH5 2-DH1 2-DH3 3-DH1
Number of packets	2	0x0000 - 0xFFFF	Number of packets from 0 to 65,535
PRBS9 initialization value	2	0x0000 - 0x01FF	Value from which the PRBS pattern generator must start
Poll period	1	0x00 - 0xFF	Poll period in number of Bluetooth frames Default:0x01

Table 3-26. Return Parameters

Returned Value	Description	Size (bytes)	Events Generated
0x00 0x01 – 0xFF	Command succeeded. Command failed.	1	Command Complete

3.2.13 HCI VS LE Read Ber Test Results (0xFDAE)

Description:

This command returns the test results from the received packets. This is used in BLE SIG RF PHY Receiver Testing.

Command Parameters: None.

Table 3-27. Return Parameters

Returned Value	Description	Size (bytes)	Events Generated
0x00 0x01 – 0xFF	Command succeeded. Command failed.	1	Command Complete
Number of BER in Type received	Htype_Bad_Bits	4	
Number of BER in Length received	Hlength_Bad_Bits	4	
Number of BER in payload received (Part 1)	Ppart1_Bad_Bits	4	
Number of BER in payload received (Part 2)	Ppart2_Bad_Bits	4	
Number of BER in payload received (Part 3)	Ppart3_Bad_Bits	4	
Number of BER in payload received (Part 4)	Ppart4_Bad_Bits	4	
Number of BER in CRC received	CRC_Bad_Bits	4	
Number of SYNC events received	BER_Sync	4	
Number of Packet with Bad Type	Htype_Bad_Packets	2	
Number of Packet with Bad Length	Hlength_Bad_Packets	2	
Number of Packet with Bad CRC	CRC_Bad_Packets	2	
Number of FA Events	FA_Events	2	
Reserved		2	
Reserved		2	
Reserved		2	
Reserved		2	
Reserved		2	
Reserved		2	
Reserved		2	
Reserved		2	
Reserved		2	
Reserved		2	
Reserved		2	
Number of packets with good CRC	Total_Good_Packets	2	

3.2.14 HCI_VS_Read_RSSI (0xFDFC)

Description:

This command returns the RSSI value without the Golden Range threshold for a specified connection handle.

Table 3-28. Command Parameters

HCI_VS_Read_RSSI (0xFDFC), Handle

Command Parameter	Size (bytes)	Value	Description
Handle	2	0xXXXX	Connection Handle

Table 3-29. Return Parameters

Returned Value	Description	Size (bytes)	Events Generated
0x00 0x01 – 0xFF	Command succeeded. Command failed.	1	Command Complete
0xXXXX	Connection Handle	2	

Table 3-29. Return Parameters (continued)

Returned Value	Description	Size (bytes)	Events Generated
0xXX	RSSI (signed 8 bit)	1	

3.2.15 HCI_VS_Write_SCO_Configuration (0xFE10)

Description:

The command configure SCO/eSCO voice path to either PCM or HCI. Once this command is issued, it is valid for all the following SCO/eSCO channels going to be created. It is used to determine the following parameters: SCO connection type - Host or CODEC TX packet length that will be used for flow control calculations. TX buffer max latency that will determine the value of Latency_Thr that determines how much time data can be in the TX buffer before it is flushed out. This parameter is applicable only if flow control is disabled. If flow control is enabled, then the host is in charge to regulate the data flow to keep the latency within limits. Once this command is used, the next 'Read Buffer Size Command' will return the new buffer size and an appropriate number of buffers.

Command Default Values:

- Connection type = HCI connection (1)
- TX buffer size = Don't change
- TX buffer maximum latency = 511 bytes
- Accept packet with bad CRC = Don't change

Table 3-30. Command Parameters

HCI_VS_Write_SCO_Configuration (0xFE10), Connection type, TX Buffer Size, TX buffer max latency and Accept packet with bad CRC

Command Parameter	Size (bytes)	Value	Description
Connection type	1	0 1 0xFF	Codec Host Don't change
TX Buffer Size	1	0x0 30-255 bytes	Keep Current Packet Size New packet size in bytes
TX buffer max latency	2	0x00 1-720 bytes	Keep current max latency New max latency in bytes.
Accept packet with bad CRC	1	0x00 0x01 0xFF	Reject packet with bad CRC Accept packet with bad CRC Don't change

Table 3-31. Return Parameters

Returned Value	Description	Size (bytes)	Events Generated
0x00 0x01 – 0xFF	Command succeeded. Command failed.	1	Command Complete
0x00 0x01-0xFF	Illegal value New TX Buffer size New buffer size in bytes.	1	Command Complete
0x00-0xFF	Number of available buffers.	1	Command Complete

3.2.16 HCI_VS_Set_Pcm_Loopback_Enable (0xFE28)

Description:

This command enables PCM loopback between the PCM input data to the PCM output data.

Table 3-32. Command Parameters

HCI_VS_Set_PCM_Loopback_Enable (0xFE28), PCM loopback enable

Command Parameter	Size (bytes)	Value	Description
PCM loopback enable	1	0x00 0x01	Stop PCM loopback operation Start PCM loopback operation.

Table 3-33. Return Parameters

Returned Value	Description	Size (bytes)	Events Generated
0x00 0x01 – 0xFF	Command succeeded. Command failed.	1	Command Complete

3.2.17 HCI_VS_Read_Hardware_Register (0xFF00)

Description:

This command returns the value of a specific hardware register.

Table 3-34. Command Parameters

HCI_VS_Read_Hardware_Register (0xFF00), Register address

Command Parameter	Size (bytes)	Value	Description
Register address	4	0xXXXXXXXX	Address of register

Table 3-35. Return Parameters

Returned Value	Description	Size (bytes)	Events Generated
0x00 0x01 – 0xFF	Command succeeded. Command failed.	1	Command Complete
0xXXXX	Value of register	2	Command Complete

3.2.18 HCI_VS_Write_Hardware_Register (0xFF01)

Description:

This command assigns a value into a hardware register.

Table 3-36. Command Parameters

HCI_VS_Read_Hardware_Register (0xFF00), Register address, Register value

Command Parameter	Size (bytes)	Value	Description
Register address	4	0xXXXXXXXX	Address of register
Register value	2	0xXXXX	Value to assign

Table 3-37. Return Parameters

Returned Value	Description	Size (bytes)	Events Generated
0x00 0x01 – 0xFF	Command succeeded. Command failed.	1	Command Complete

3.2.19 HCI_VS_Update_UART_HCI_Baudrate (0xFF36)

Description:

This command sets the UART HCI baud rate. All baud rates up to 4 Mbps are valid.

Table 3-38. Command Parameters

HCI_VS_Update_UART_HCI_Baudrate (0xFF36) Baud rate

Command Parameter	Size (bytes)	Value	Description
Baud rate	4	0xXXXXXXXX	Max Baud Rate: 4 Mbps

Table 3-39. Return Parameters

Returned Value	Description	Size (bytes)	Events Generated
0x00 0x01 – 0xFF	Command succeeded. Command failed.	1	Command Complete

3.2.20 HCI_VS_Set_Supported_Features (0xFF26)

Description:

This command changes the supported features of the device.

Table 3-40. Command Parameters

HCI_VS_Set_Supported_Features (0xFF26) Byte, Bit, Support

Command Parameter	Size (bytes)	Value	Parameter Description
Byte	1	0 1 2 3 4 5 6 7	Byte 0 Byte 1 Byte 2 Byte 3 Byte 4 Byte 5 Byte 6 Byte 7
Bit	1	0 – 7 0xXX	Single bit Whole byte value
Support	1	0 1 0xFF	Not supported Supported Change whole byte

Table 3-41. Return Parameters

Returned Value	Description	Size (bytes)	Events Generated
0x00 0x01 – 0xFF	Command succeeded. Command failed.	1	Command Complete

Example:

If you want to disable Sniff Mode,for Sniff mode Byte is 0 and Bit is 7. The bytes/bits are defined according to the "FEATURE MASK DEFINITION"(in Part C) of the Bluetooth specification.

```
Send_HCI_VS_Set_Supported_Features 0xFF26, 0x00, 0x07, 0x00
Wait_HCI_Command_Complete_VS_Set_Supported_Features_Event 5000, 0x00, 0xff26, 0x00
```

3.2.21 HCI_VS_HCILL_Parameters (0xFD2B)

Description:

This command controls the behavior of the HCILL deep-sleep protocol.

Table 3-42. Command Parameters

HCI_VS_HCILL_Parameters (0xFD2B) inactivity_timeout, retransmit_timeout, rts_pulse_width

Command Parameter	Size (bytes)	Value	Parameter Description
inactivity_timeout	2	0x00-0xFFFF	Time from UART inactivity to sending sleep_ind packet. If this value is 0, the device does not send sleep_ind packet. Unit is frames (1.25 ms).
retransmit_timeout	2	0x00-0xFFFF	Time from sending WAKEUP_IND packet, to a retransmission of this packet. If this value is 0, no retransmission occurs. Unit is frames (1.25 ms).
rts_pulse_width	1	0x00-0xFF	Each WAKEUP_IND packet can be accompanied by a short pulse on the RTS pin. This parameter controls the minimum width of this pulse. If this value is 0, no pulse is sent. Unit is Micro seconds.

Table 3-43. Return Parameters

Returned Value	Description	Size (bytes)	Events Generated
0x00 0x01 – 0xFF	Command succeeded. Command failed.	1	Command Complete

3.2.22 HCI_VS_Sleep_Mode_Configurations (0xFD0C)

Description:

This command configures the sleep mode to be used.

Note

Before this command is sent, deep sleep is disabled.

Table 3-44. Command Parameters

HCI_VS_Sleep_Mode_Configurations (0xFD0C) Reserved, Deep sleep enable, Deep sleep mode, Output I/O select, Output pull enable, Input pull enable, Input I/O select, Reserved

Command Parameter	Size (bytes)	Value	Parameter Description
Reserved	1	0x00 0x01	Reserved. Reserved.
Deep sleep enable	1	0x00 0x01	Deep sleep is disabled. Deep sleep is enabled.
Deep sleep mode	1	0x0 0x1 0x2 0x3 0x4 0x5 0x6 0x7 0x8 0x9 0xFF	HCILLReservedReservedReservedReservedH5SPISDIO command deep sleep protocols (explicit protocol)SDIO clocks deep sleep protocols (implicit protocol) UART_Break Indication lets device enter deep sleep Do not change.
Output I/O to select	1	0 1 0x02 -0xFE 0xFF	Reserved (do not use)BT_FUNC1 serves as UART_WAKEUP Reserved (do not use) Do not change.
Output pull enable	1	0x0 0x1 0xFF	Output pull (on selected output I/O) is disabled. Output pull (on selected output I/O) is enabled. Do not change.
Input pull enable	1	0x0 0x1 0xFF	Input pull (on selected output I/O) is disabled. Input pull (on selected output I/O) is enabled. Do not change.
Input I/O select	1	0-1 2 0x03 -0xFE 0xFF	Reserved (do not use)BT_FUNC2 serves as BT_WAKEUP Reserved (do not use) Do not change.
Reserved	2	0x00	Default value 0x00 must be used.

Table 3-45. Return Parameters

Returned Value	Description	Size (bytes)	Events Generated
0x00 0x01 – 0xFF	Command succeeded. Command failed.	1	Command Complete

3.2.23 HCI_VS_Get_System_Status (0xFE1F)

Description:

This command returns the current system parameters.

Command Parameters:

HCI_VS_Get_System_Status (0xFE1F) None.

Table 3-46. Return Parameters

Return Parameter	Size (bytes)	Value	Parameter Description
Status	1	0x00 0x01-0xFF	Command succeeded. Command failed.
Software version Major	1	0-0xFF	Major value of the software version being used.
Software version Internal	1	0-0xFF	Internal value of the software version being used.
Chip revision	1	0-0xFF	Defines which hardware revision is used.
Chip mode	1	0 1 2 3 4 5	Reserved for TI internal use TI mode Reserved for TI internal use Reserved for TI internal use Reserved for TI internal use Reserved for TI internal use.
FREF	2	0-0xFFFF	FREF in use (KHz)
Slow clock used	1	0 1	Internal slow clock used External slow clock used
Process type detected	1	0 1 2	Weak process detected Nominal process detected Strong process detected
Deep-sleep mode	1	0 1 2 3-8	Deep sleep disabled Reserved HCILL deep sleep enabled For future use
Whitening mode	1	0 1	Whitening enabled Whitening disabled
CDC mode	1	0 1	CDC disabled CDC enabled
Self-test	1	0 1	Self-test failed Self-test passed
Hopping mode	1	0 1	Frequency hopping Single-frequency TX and RX
UART baud rate	4	0-0xFFFFFFFF	UART baud rate (bps)
Temperature index	1	0 1 2 3 4	Hot Room Cold Warm Cool
Temperature detected	1	0x00-0x7F 0xFF-0x08	Positive Value Negative Value
I2C status	1	0 1 2 3-15	I2C is enabled.E2PROM is connected. CODEC is connected. For future use
FREF/TCXO clock	2	0	not in use.
PLL sharing running mode	1	0	not in use.

3.2.24 HCI_VS_Read_Patch_Version (0xFF22)

Description:

This command gets all internal details and version numbers of the loaded patches.

All reserved bits and bytes must be 0.

PTCR = Patch trap control register

The following fields contain a unique identification for the patch package and its correlation to the base software version that runs on the device, regardless of whether it is a ROM or a FLASH version:

- Main release major number (1 byte)
- Main release minor number (1 byte)
- Patch trap package ID (1 byte)
- Patch trap package build number (1 byte)

The value of PTCR is set by the post patch load handler, at the end of patch load. Only the enabled patch functions (a bit mask of 12 lowest bits) must be 1, according to the patch package contents.

Note

After hardware reset, the PTCR is 0 and the patch is erased; thus, the patch version is also 0. Only after a patch is loaded does the HCI_VS_Read_Patch_Version command return nonzero values. The HCI_RESET behavior flow has been improved to only reset the link manager and link controller in accordance with the Bluetooth specification. It is not required to re-execute the service pack after HCI_RESET has been performed.

Command Parameters:

HCI_VS_Read_Patch_Version (0xFF22) None.

Table 3-47. Return Parameters

Return Parameter	Size (bytes)	Value	Parameter Description
Status	1	0x00 0x01-0xFF	Command succeeded. Command failed.
Enabled Mask	6	0–1	Bit mask of active patch traps. Every bit holds the value of the corresponding patch of only) the possible 12 traps. The value is read from the PTCR (Patch Trap Control Register). For every bit: 0 = Patch disabled; 1 = Patch enabled.
ReleaseMajor	1	For example, in a patch for software version 3.16, you will get 0x03.	Main release major number. The upper byte of the base software version to which the patch package refers.
ReleaseMinor	1	For example, in a patch for software version 3.16, you will get 0x10.	Main release minor number. The lower byte of the base software version to which the patch package refers.
PackageID	1	For example, in patch package 2, you will get 0x02.	Patch trap package ID. Unique number for the patch package. A patch package contains up to 12 different patch traps.
Build Number	1	For example, in patch package 2 in release (build no.) 4, you will get 0x04.	Patch trap package build number. Unique number for patch package build number. This is a serial number in the patch package.

3.2.25 HCI_VS_DRPb_Set_Power_Vector (0xFD82)

Description:

The new transmit power control algorithm is based on the capability to construct power control word for any required power level, based on predetermined ACW and interpolating the required control.

This VS command allows definition of the desired power vector for each modulation scheme, and determination of whether a specific power requires activation of an external PA (in Class1 case).

Note

Each power level (dBm) must be a multiple of 2. For example: for 10 dBm, the value of 10 × 2 (or decimal value of 20) must be used. When configuring power tables, a command must be sent for each modulation type. In addition, after configuring the power vectors, the RF calibration must be initialized

Note

Power level 1 of the GFSK Power Vector is used for BLE power.

Power Level Explanation:

1. There are only 8 power levels used in the CC256x.
2. Each power level is separated by 5 dBm.
3. The default Max TX Power defined in the SP is 12dBm and corresponds to Power Level 15. Therefore, default Power Level 14 is 7dBm, Power Level 13 = 2dBm, and so on.
4. The Max TX Power Level can be configured using the “BHET” tool. And thus, the rest of the power levels will change as well. But the number of power levels and power level separation does not change.

Table 3-48. GFSK Power Vector Example

Power Level	dBm	Value in bts file
15	12	0x18
14	7	0x0e
13	2	0x04
12	-3	0xfa
11	-8	0xf0
10	-13	0xe6
9	-18	0xdc
8	-23	0xd2
7	-23	0xd2
6	-23	0xd2
5	-23	0xd2
4	-23	0xd2
3	-23	0xd2
2	-23	0xd2
1	12	0x18
0	-50	0x9c

Table 3-49. Command Parameters

HCI_VS_DRPb_Set_Power_Vector (0xFD82) Modulation type, Level n power (n = 0 – 15), tx_power_edr_epc_idx, External PA mode.

Command Parameter	Size (bytes)	Value	Description
Modulation type	1	0x00 0x01 0x02	GFSK EDR2 EDR3
Level n power (n = 0 – 15)	1	–64 to 16 0xFF	Required RF power for each of the upper 15 power levels (in dBm) Do not change.
tx_power_edr_epc_idx	1	0xFF	Do not change.
External PA mode	2	Bit 1 Bit 15 0xFFFF	1: External PA on @Power level 1; 0: Off 1: External PA on @Power level 15; 0: Off Do not change.

Procedure For power level vector update:

1. Set the modulation type for which to update the power level vector.
2. Set the desired power for each of the upper 15 power levels (in dBm).
3. Set the external PA mode (on/off) for each of the 16 power levels (bit wise).
4. Replace the existing power vector commands (x3) in the service pack with updated commands.

The following script shows the commands required to run the example:

```
#Set BT BR (GFSK) LP Vectors Values (note the need to multiply the output power in dBm by '2')
Send_HCI_VS_DRPb_Set_Power_Vector 0xFD82, 0x00, 0x9c, 0x18, 0xd2, 0xd2, 0xd2, 0xd2, 0xd2, 0xd2,
0xd2, 0xdc, 0xe6, 0xf0, 0xfa, 0x04, 0x0e, 0x18, 0xff, 0x0000
Wait_HCI_Command_Complete_VS_DRPb_Set_Power_Vector_Event 5000, 0x00, 0xfd82, 0x00

#Set BT BR EDR 2MB LP Vectors Values (note the need to multiply the output power in dBm by '2')
Send_HCI_VS_DRPb_Set_Power_Vector 0xFD82, 0x01, 0x9c, 0xce, 0xce, 0xce, 0xce, 0xce, 0xce,
0xce, 0xd8, 0xe2, 0xec, 0xf6, 0x00, 0x0a, 0x14, 0xff, 0x0000
Wait_HCI_Command_Complete_VS_DRPb_Set_Power_Vector_Event 5000, 0x00, 0xfd82, 0x00

#Set BT BR EDR 3MB LP Vectors Values (note the need to multiply the output power in dBm by '2')
Send_HCI_VS_DRPb_Set_Power_Vector 0xFD82, 0x02, 0x9c, 0xce, 0xce, 0xce, 0xce, 0xce, 0xce,
0xce, 0xd8, 0xe2, 0xec, 0xf6, 0x00, 0x0a, 0x14, 0xff, 0x0000
Wait_HCI_Command_Complete_VS_DRPb_Set_Power_Vector_Event 5000, 0x00, 0xfd82, 0x00

#Set max power level index to be used with a peer device that does not support power control (per
LP/HP and per modulation)
Send_HCI_VS_DRPb_Set_Class2_Single_Power 0xFD87, 0x0d, 0x0e, 0x0e
Wait_HCI_Command_Complete_VS_DRPb_Set_Class2_Single_Power_Event 5000, 0x00, 0xfd87, 0x00

#Run TPC (Transmission Power Control) calibration
Send_HCI_VS_DRPb_Enable_RF_Calibration 0xFD80, 0x00, 0x00000800, 0x01
Wait_HCI_Command_Complete_VS_DRPb_Enable_RF_Calibration_Event 5000, 0x00, 0xfd80, 0x00
```

Table 3-50. Return Parameters

Returned Value	Description	Size (bytes)	Events Generated
0x00 0x01 – 0xFF	Command succeeded. Command failed.	1	Command Complete

3.2.26 HCI_VS_DRPb_Set_Class2_Single_Power (0xFD87)

Description:

Some Bluetooth devices do not support the power control feature, which allows increasing or decreasing the transmitted power level of the other devices in the connection. This command lets the user set the power level to be used during such a connection, so that the fixed power does not compress the other receiver. This is done by selecting from the 16 available power levels. The device then transmits at this level all the time. This single power can be set per modulation scheme.

Table 3-51. Command Parameters

HCI_VS_DRPb_Set_Power_Vector (0xFD82) GFSK single power level Status, EDR2 single power level, EDR3 single power level.

Command Parameter	Size (bytes)	Value	Description
GFSK single power level Status	1	0 to 150xFF	Sets the GFSK power level to be used without power control Don't change.
EDR2 single power level	1	0 to 150xFF	Sets the EDR2 power level to be used without power control Don't change.
EDR3 single power level	1	0 to 150xFF	Sets the EDR3 power level to be used without power control.

Table 3-52. Return Parameters

Returned Value	Description	Size (bytes)	Events Generated
0x00 0x01 – 0xFF	Command succeeded. Command failed.	1	Command Complete

3.2.27 HCI_VS_LE_Output_Power (0xFDDD)

Description:

This command is used for setting LE power.

Note

By default it is set to power level 1

Table 3-53. Command Parameters

HCI_VS_LE_Output_Power (0xFDDD), Power Level Index.

Command Parameter	Size (bytes)	Value	Description
Power Level Index	1	1 to 15	Value indicating the Power level to be used for transmit output power of BLE

Table 3-54. Return Parameters

Returned Value	Description	Size (bytes)	Events Generated
0x00 0x01 – 0xFF	Command succeeded. Command failed.	1	Command Complete

3.2.28 HCI_VS_A3DP_Codec_Configuration (0xFD8E)

Description:

This command configures the PCM source type, SBC encoder, and SARC parameters. This command must not be called during streaming, meaning no stream has started using the start stream command.

The command can refer to a specific stream, or to both active streams in a multiple SNK scenario. Note that, in addition to that API call, the controller PCM codec must also be configured using the following commands:

- HCI_VS_Write_CODEC_Config
- HCI_VS_Write_CODEC_Config_Enhanced

Table 3-55. Command Parameters

HCI_VS_A3DP_Codec_Configuration (0xFD8E) Audio Source, PCM input sample frequency, PCM number of channels, SBC input sample frequency, SBC channel mode, SBC number of blocks, SBC number of subbands, SBC allocation method, SBC bit pool low boundary, SBC recommended bit pull, SBC dynamic bit pull enable, Reserved, Reserved

Command Parameter	Size (bytes)	Value	Description
Audio Source	1	0x0 - 0x1	Determines the audio source of the A2DP stream.0 – Audio source is the host through the PCM bus.1 – Audio source is the internal controller FM.
PCM input sample	1	0x1 – 0x9	The PCM sample frequency rate of the input PCM bus. This parameter is valid only when the audio source is the host. When this parameter is different from the SBC input sample frequency parameter the SARC will be used for sample rate conversion.0x01 – 8000 Hz0x02 – 11025 Hz0x03 – 12000 Hz0x04 – 16000 Hz0x05 – 22050 Hz0x06 – 24000 Hz0x07 – 32000 Hz0x08 – 44100 Hz0x09 – 48000 Hz
PCM number of channels	1	0x1 – 0x2	The number of channels (1 or 2) of the PCM input. This parameter is valid only when the audio source is the host.

Table 3-55. Command Parameters (continued)

HCI_VS_A3DP_Codec_Configuration (0xFD8E) Audio Source, PCM input sample frequency, PCM number of channels, SBC input sample frequency, SBC channel mode, SBC number of blocks, SBC number of subbands, SBC allocation method, SBC bit pool low boundary, SBC recommended bit pull, SBC dynamic bit pull enable, Reserved, Reserved

Command Parameter	Size (bytes)	Value	Description
SBC input sample frequency	1	0x0 - 0x3	The sample frequency rate of the PCM input to SBC encoder. Note that when this parameter is different from the PCM input sample frequency, the SARC is used for sample rate conversion.0x0 – 16000 Hz0x1 – 32000 Hz0x2 – 44100 Hz0x3 – 48000 Hz
SBC channel mode	1	0x0 - 0x3	Describes the channel mode used to encode a stream.0x0 – MONO0x1 – DUAL_CHNL0x2 – STEREO0x3 – JOINT_STEREO
SBC block length	1	0x4, 0x8, 0xC, 0x10	SBC block length. (4, 8, 12, 16)
SBC number of subbands	1	0x4, 0x8	Number of SBC subbands. (4, 8)
SBC allocation method	1	0x0 - 0x1	SBC allocation method (SNR, Loudness)0 – Loudness1 – SNR
SBC bit pool low boundary	1	0x00 - 0x39	The lower boundary of the negotiated bit pool range.
SBC recommended bit pull	1	0x00 - 0x39	The host can recommend a specific bit pool value from the bit pool rate. The recommended bit pool value is also used as the high boundary in dynamic bit pool.
SBC dynamic bit pull enable	1	0x0 – 0x1	Determines whether a dynamic bit pool mechanism should be used for performance/quality adjustment0 – Disable1 – Enable
Reserved	4		For future use
Reserved	4		For future use

Table 3-56. Return Parameters

Returned Value	Description	Size (bytes)	Events Generated
0x00 0x01 – 0xFF	Command succeeded. Command failed.	1	Command Complete

3.2.29 HCI_VS_AVPR_Enable (0xFD92)

Description:

This command is used to enable the AVPR features:

- A3PD SRC, WBS, FM converter.
- A3PD SNK, WBS, FM converter.

It is recommended that the AVPR would be disabled once not used, for current consumption reduction. The default AVPR state is disabled.

Table 3-57. Command Parameters

HCI_VS_AVPR_Enable (0xFD92) Enable/disable AVPR, A3DP Role, Upload code, Reserved

Command Parameter	Size (bytes)	Value	Description
Enable/disable AVPR	1	0x0 - 0x1	Enable/disable the AVPR clock. Enable also reloads the AVPR code.1 - Enable0 - Disable

Table 3-57. Command Parameters (continued)

HCI_VS_AVPR_Enable (0xFD92) Enable/disable AVPR, A3DP Role, Upload code, Reserved

Command Parameter	Size (bytes)	Value	Description
A3DP Role	1	0x0 - 0x1	0 – A3DP functional as source1 – A3DP functional as sink
Upload code	1	0x0 – 0x1	0 – Do not load A3DP code.1 – Load A3DP code.
Reserved	2		For future use

Table 3-58. Return Parameters

Returned Value	Description	Size (bytes)	Events Generated
0x00 0x01 – 0xFF	Command succeeded. Command failed.	1	Command Complete

3.2.30 HCI_VS_A3DP_Open_Stream (0xFD8C)

Description:

This command must be called when the A2DP SNK has moved to open state and has established the transport A2DP channel to open an A3DP entity in the controller. It contains the protocol parameters needed for L2CAP and AVDTP packet construction. SBC and SARC parameters are applied using the HCI_VS_A3DP_CODEC_CONFIGURATION command.

Table 3-59. Command Parameters

HCI_VS_A3DP_Open_Stream (0xFD8C) Connection handle, L2CAP CID, L2CAP MTU, AVDTP Version Parameter, AVDTP Payload Parameter, Reserved, Reserved

Command Parameter	Size (bytes)	Value	Description
Connection handle	1	0x1 - 0x7	The ACL connection handle
L2CAP CID	2	0x0040 – 0xFFFF	L2CAP channel ID of the AVDTP data stream. Refers to the L2CAP channel ID of the remote device.
L2CAP MTU	2	0x0030 – 0xFFFF	L2CAP max packet length
AVDTP Version Parameter	1	0x00 – 0x03	AVDTP protocol header Version Parameter
AVDTP Payload Parameter	1	0x30 – 0xFF	AVDTP protocol header Payload Parameter
Reserved	4		For future use
Reserved	4		For future use

Table 3-60. Return Parameters

Returned Value	Description	Size (bytes)	Events Generated
0x00 0x01 – 0xFF	Command succeeded. Command failed.	1	Command Complete

3.2.31 HCI_VS_A3DP_Close_Stream (0xFD8D)

Description:

This command must be called when the A2DP SNK has moved to Idle state and has closed the transport A2DP channel. If a stream is started by the start stream command, it must be stopped by the stop stream command before it is closed.

Table 3-61. Command Parameters

HCI_VS_A3DP_Close_Stream (0xFD8D) Connection handle, Reserved

Command Parameter	Size (bytes)	Value	Description
Connection handle	1	0x0 0x1- 0x7	close all streams The ACL connection handle

Table 3-61. Command Parameters (continued)

HCI_VS_A3DP_Close_Stream (0xFD8D) Connection handle, Reserved

Command Parameter	Size (bytes)	Value	Description
Reserved	4		For future use

Table 3-62. Return Parameters

Returned Value	Description	Size (bytes)	Events Generated
0x00 0x01 – 0xFF	Command succeeded. Command failed.	1	Command Complete

3.2.32 HCI_VS_A3DP_Start_Stream (0xFD8F)

Description:

This command starts the A2DP data streaming to the remote device. The host should initiate PCM audio data right after this API call. When no PCM data is accepted at the controller after this command call, no data will be sent to the peer device.

Table 3-63. Command Parameters

HCI_VS_A3DP_Start_Stream (0xFD8F) Connection handle, Reserved

Command Parameter	Size (bytes)	Value	Description
Connection handle	1	0x1 - 0x7	The ACL connection handle
Reserved	4		For future use

Table 3-64. Return Parameters

Returned Value	Description	Size (bytes)	Events Generated
0x00 0x01 – 0xFF	Command succeeded. Command failed.	1	Command Complete

3.2.33 HCI_VS_A3DP_Stop_Stream (0xFD90)

Description:

This command stops the SBC data streaming to the remote device. An input parameter determines whether the current internal buffers should be transmitted to the remotes device(s) and then flushed (soft flush), or should be flushed immediately (hard flush). That option may be needed if the stream was stopped between songs for reconfiguration, so that the song ending should be heard by the user and not flushed. A VS event is generated at the completion of the operation, if requested.

Table 3-65. Command Parameters

HCI_VS_A3DP_Stop_Stream (0xFD90) Connection handle, Flush flag, Generate stop event, Reserved

Command Parameter	Size (bytes)	Value	Description
Connection handle	1	0x0 0x1 - 0x7	Stop all streams The ACL connection handle
Flush flag	1	0x0 - 0x1	Determines whether the current internal buffers should be transmitted to the remote device, or should be flushed immediately. Values:<bt>0 – Transmit internal buffers before flush (soft flush).1 – Immediate flush of buffers (hard flush)
Generate stop event	1	0x0 - 0x1	Determines whether a stop stream event is generated as soon as stream is stopped. To be used in soft flush.
Reserved	4		For future use

Table 3-66. Return Parameters

Returned Value	Description	Size (bytes)	Events Generated
0x00 0x01 – 0xFF	Command succeeded. Command failed.	1	Command Complete

3.2.34 HCI_VS_A3DP_Sink_Codec_Configuration (0xFD9C)

Description:

This command configures the SBC decoder parameters. This command must not be called during streaming, meaning no stream has started using the start stream command. The command refers to stream.
Note that in addition to that API calls, the controller PCM codec must also be configured using the HCI_VS_Write_CODEC_Config and HCI_VS_Write_CODEC_Config_Enhanced commands.

Table 3-67. Command Parameters

HCI_VS_A3DP_Sink_Codec_Configuration (0xFD9C) PCM number of channels, SBC input sample frequency, SBC channel mode, SBC number of blocks, SBC number of sub-bands, SBC allocation method, Reserved, Reserved, Reserved

Command Parameter	Size (bytes)	Value	Description
PCM number of channels	1	0x0 - 0x2	The number of channels (1 or 2) of the PCM output
SBC input sample frequency	1	0x1 – 0x3	The sample frequency rate of the PCM input to SBC decoder. Note that this parameter must be identical to the PCM output sample.0x0 – 16000 Hz0x01 – 32000 Hz0x02 – 44100 Hz0x03 – 48000 Hz
SBC channel mode	1	0x0 – 0x3	Describes the channel mode used to encode a stream0x0 – MONO0x1 – DUAL_CHNL0x2 – STEREO0x3 – JOINT_STEREO
SBC number of blocks	1	0x4, 0x8, 0xC, 0x10	Number of SBC decoder blocks. (4, 8, 12, 16)
SBC number of sub-bands	1	0x4 - 0x8	Number of SBC decoder sub-band (4, 8)
SBC allocation method	1	0x0 - 0x1	SBC allocation method (SNR, loudness)0 – Loudness1 – SNR
Reserved	4		For future use
Reserved	4		For future use
Reserved	4		For future use

Table 3-68. Return Parameters

Returned Value	Description	Size (bytes)	Events Generated
0x00 0x01 – 0xFF	Command succeeded. Command failed.	1	Command Complete

3.2.35 HCI_VS_A3DP_Sink_Open_Stream (0xFD9A)

Description:

This command must be called when the A2DP SRC has moved to open state and has established the transport A2DP channel to open an A3DP entity in the controller. It contains the protocol parameters needed for L2CAP. SBC parameters are applied using the HCI_VS_A3DP_SNK_CODEC_CONFIGURATION command.

Table 3-69. Command Parameters

HCI_VS_A3DP_Sink_Open_Stream (0xFD9A) Connection handle, L2CAP CID, Reserved, Reserved

Command Parameter	Size (bytes)	Value	Description
Connection handle	1	0x1 - 0x7	The ACL connection handle

Table 3-69. Command Parameters (continued)

HCI_VS_A3DP_Sink_Open_Stream (0xFD9A) Connection handle, L2CAP CID, Reserved, Reserved

Command Parameter	Size (bytes)	Value	Description
L2CAP CID	2	0x0040 – 0xFFFF	L2CAP channel ID of the AVDTP data stream. Refers to the L2CAP channel ID of the remote device.
Reserved	4		For future use
Reserved	4		For future use

Table 3-70. Return Parameters

Returned Value	Description	Size (bytes)	Events Generated
0x00 0x01 – 0xFF	Command succeeded. Command failed.	1	Command Complete

3.2.36 HCI_VS_A3DP_Sink_Close_Stream (0xFD9B)

Description:

This command must be called when the A2DP SRC has moved to Idle state and has closed the transport A2DP channel. If a stream is started by the start stream command, it should be stopped by the stop stream command before it is closed.

Table 3-71. Command Parameters

HCI_VS_A3DP_Sink_Close_Stream (0xFD9B) Reserved

Command Parameter	Size (bytes)	Value	Description
Reserved	4		For future use

Table 3-72. Return Parameters

Returned Value	Description	Size (bytes)	Events Generated
0x00 0x01 – 0xFF	Command succeeded. Command failed.	1	Command Complete

3.2.37 HCI_VS_A3DP_Sink_Start_Stream (0xFD9D)

Description:

This command starts the A2DP data streaming from the source device.

Table 3-73. Command Parameters

HCI_VS_A3DP_Sink_Start_Stream (0xFD9D) Reserved

Command Parameter	Size (bytes)	Value	Description
Reserved	4		For future use

Table 3-74. Return Parameters

Returned Value	Description	Size (bytes)	Events Generated
0x00 0x01 – 0xFF	Command succeeded. Command failed.	1	Command Complete

3.2.38 HCI_VS_A3DP_Sink_Stop_Stream (0xFD9E)

Description:

This command stops the SBC data streaming and flush the buffer (IPC RX buffer, AVPR DMEM).

Table 3-75. Command Parameters

HCI_VS_A3DP_Sink_Stop_Stream (0xFD9E) Reserved

Command Parameter	Size (bytes)	Value	Description
Reserved	4		For future use

Table 3-76. Return Parameters

Returned Value	Description	Size (bytes)	Events Generated
0x00 0x01 – 0xFF	Command succeeded. Command failed.	1	Command Complete

3.2.39 HCI_VS_WBS_Associate (0xFD78)

Description:

This command is used to associate the requested ACL handle with Wide Band Speech configuration.

Table 3-77. Command Parameters

HCI_VS_WBS_Associate (0xFD78) ACL handle.

Command Parameter	Size (bytes)	Value	Description
ACL handle	2	0x1 – 0x7	The ACL connection handle

Table 3-78. Return Parameters

Returned Value	Description	Size (bytes)	Events Generated
0x00 0x01 – 0xFF	Command succeeded. Command failed.	1	Command Complete

3.2.40 HCI_VS_WBS_Disassociate (0xFD79)

Description:

This command is used to disassociate Wide Band Speech configuration from any ACL handle.

Command Parameters:

HCI_VS_WBS_Disassociate (0xFD79) None.

Table 3-79. Return Parameters

Returned Value	Description	Size (bytes)	Events Generated
0x00 0x01 – 0xFF	Command succeeded. Command failed.	1	Command Complete

4 General Hardware Errors

Table 4-1. General Hardware Error Codes

General Hardware Error Codes	Decimal Value	Hex Value
UART_HCI_NO_ERRS	0	0x00
UART_HCI_ERR_NO_BUFFERS_COMMAND	1	0x01
UART_HCI_ERR_NO_BUFFERS_ACL_DATA	2	0x02
UART_HCI_ERR_NO_BUFFERS_SCO_DATA	3	0x03
UART_HCI_ERR_NO_BUFFERS_EVENT	4	0x04
UART_HCI_ERR_NO_BUFFERS	5	0x05
UART_HCI_ERR_BAD_TYPE	6	0x06
UART_HCI_ERR_BAD_LEN	7	0x07
UART_HCI_ERR_LOCAL_RESET	8	0x08
UART_HCI_ERR_OVERRUN	9	0x09
UART_HCI_ERR_PARITY	10	0x0A
UART_HCI_ERR_FRAMING	11	0x0B
UART_HCI_ERR_BREAK	12	0x0C
HCI_HW_ERR_FAULT_RADIO_EVENT	13	0x0D

5 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

DATE	REVISION	NOTES
September 2022	*	Initial Release

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