WiLink™ 8.0 *Bluetooth*®
Vendor-Specific HCI Commands

User's Guide

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Contents

Overview

This document describes all supported vendor-specific (VS) host controller interface (HCI) commands in the WiLink™ 8.0 *Bluetooth*® firmware. Modifications and new VS commands are added to this document as the software versions are updated.

This document covers the relevant Bluetooth-enabled WiLink 8.0 family, including WL183xMOD, and WiLink 8Q (automotive) including WL183xQ and WL187xQ. For more information about WiLink 8Q, contact your local representative at Texas Instruments™.

WiLink 8.0	Description
WL1831MOD	Single band combo Wi-Fi®, Bluetooth and Bluetooth low energy module
WL1835MOD	Single band combo 2 × 2 MIMO Wi-Fi, Bluetooth and Bluetooth low energy module
WL1837MOD	Industrial dual band 2 × 2 MIMO Wi-Fi, Bluetooth and Bluetooth low energy module

1 Introduction

1.1 Configuration Requirements

HCI Tester tool is available for download in the TI Wireless Tools package release. This tool requires an XML file and a BTS file to control WiLink devices through the HCI interface.

- For WL18xxMOD devices, download the XML and BTS files from the TI Bluetooth Service Pack.
- For additional devices, download the XML and BTS files from the Git, following the guidelines described in the README file.

The XML file can be directly loaded into the command library, as described in the *HCITester User Guide*.

The BTS file, or initialization script, must be modified in order to work with HCITester. Follow the steps below to modify the BTS file for HCITester:

- Open HCITester tool and open the BTS file (File → Open)
- Create a new script (File → New) and copy the contents of the BTS file into the new tab.
- Replace the “0x00” value in the “Number of HCI Commands” parameter to “any” by selecting Edit → Replace → Replace All and configuring the parameters as shown in Figure 1.
- When the BTS file is modified and in a new script, save that script as the new initialization file in TXT format. This initialization file must be run prior to running any scripts on the module.
- Click Execution → Execute to run the initialization file.

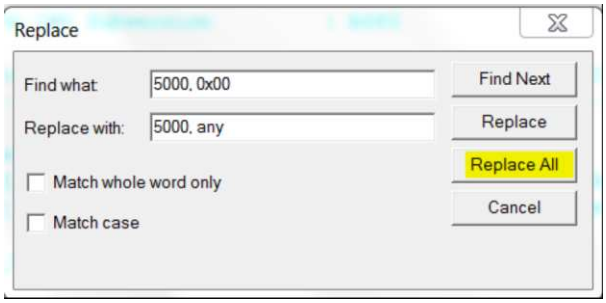

Figure 1. Editing the BTS File for Use in HCITester Tool

Review the *HCITester User’s Guide* for further details about navigating and setting up the HCITester tool.

1.2 HCI Packet Format

HCI packets are transmitted and received in bytes, least-significant byte (LSByte) first, using the packet format described in Table 1.

Table 1. HCI Packet Format

First Byte	Last Byte
Packet type indicator (1 byte)	HCI packet (variable length)

Table 2 lists the packet types.

Table 2. HCI Packet Types

HCI Packet Type	Packet Type Indicator	Direction
HCI command packet	0x01	Host to baseband controller
HCI ACL data packet	0x02	Both
HCI SCO data packet	0x03	Both
HCI event packet	0x04	Baseband controller to host
Reserved	0x08	Both
Reserved	0x09	Both
HCI ANT COMMAND	0x0A	Both

The following sections describe the HCI packets. For more information, see the Bluetooth specifications.

1.3 Command Packet

The following is quoted from Bluetooth Specification V1.1, Chapter 4.4.1, *HCI Command Packet*:

> "Each command is assigned a 2 byte Opcode used to uniquely identify different types of commands. The Opcode parameter is divided into two fields, called the Opcode Group Field (OGF) and Opcode Command Field (OCF). The OGF occupies the upper six bits of the opcode, while the OCF occupies the remaining 10 bits. The OGF of 0x3F is reserved for VS debug commands. The OGF of 0x3E is reserved for Bluetooth Logo Testing. The organization of the Opcodes allows additional information to be inferred without fully decoding the entire Opcode."

The following lists the range assignment for opcodes in VS commands (OGF = 0x3F).

The command packet transfers standard and VS HCI commands from the host to the baseband controller. Table 3 shows the packet structure.

Table 3. HCI Command Packet Structure

First					Last
OCF	OGF	Length	Para0	Para1	– – – – – –

OCF:	10-bit opcode command field, range: 0x00–0x3F (0x3E reserved for Bluetooth logo testing and 0x3F reserved for VS debug commands)
OGF:	6-bit opcode group field
Length:	Length of all parameters in this packet measured in bytes (total length of parameters, not number of parameters)
Para0–ParaN:	Specific parameters are associated with each command. These parameters and the size of each parameter are defined for each command. The size of each parameter is an integer number of bytes.

1.4 Event Packet

The event packet transfers standard and VS HCI events from the baseband controller to the host. Table 4 describes the packet structure.

Table 4. HCI Event Packet Structure

First				Last
Event code	Length	Para0	Para1	– – – – – –

Event code:	Each event is assigned a 1-byte event code that uniquely identifies the event type. Range: 0x00–0xFF (The event code 0xFF is reserved for VS debug events. The event code 0xFE is reserved for Bluetooth logo testing.)
Length:	Length of all parameters in this packet measured in bytes (total length of parameters, not number of parameters)
Para0–ParaN:	Specific parameters are associated with each command. These parameters and the size of each parameter are defined for each command. The size of each parameter is an integer number of bytes.

2 Troubleshooting

If at any point a command is unsuccessful or the device hangs, perform the following debug steps:

1. Reset the Serial port.
   - In HCITester, click View → Options. Toggle the serial port number and return to the previous setting. Click Apply. This will reset the serial port.
2. If resetting the serial port does not work, power cycle the device and restart the software.

3 Terms and Abbreviations

Table 5 lists the terms and abbreviations used in this document.

Table 5. Terms and Abbreviations

Abbreviation or Term	Definition
ACK	Acknowledgment
ACL	Asynchronous connection-oriented link
BD	Bluetooth device
BER	Bit error rate
BT	Bluetooth
CODEC	Coder and decoder
CRC	Cyclic redundancy check
CVSD	Continuous variable slope delta modulation
DRP	Digital radio frequency (RF) processor
DUT	Device under test
eSCO	Extended SCO
FEC	Forward error correction code
FH	Frequency hopping
FHS	Frequency hop synchronization
FW	Firmware
HCI	Host controller interface
HEC	Header error check
HW	Hardware
LC	Link control or controller
LM	Link management or manager
LPS	Low-power scan
LMP	Link manager protocol
MAC	Medium access control
NAK	Negative acknowledge
OCF	Opcode command field (lower 10 bits of command)
OGF	Opcode group field (upper 6 bits of command)
OP	Open platform
PRBS	Pseudo-random binary sequence
PTCR	Patch trap control register
PCM	Pulse-code modulation
PER	Packet error rate
QoS	Quality of service
ROM	Read-only memory
VS	Vendor specific
SCO	Synchronous connection-oriented link

4 Detailed Description of Supported VS HCI Commands and Events

Unless otherwise specified in the descriptions of Section 4.1, Table 6 lists the possible return values for the commands.

Table 6. VS HCI Status Return Descriptions

Return Value	Description
0x00	Success
0x01	Unknown HCI command
0x03	Hardware failure
0x04	Page timeout
0x05	Authentication failure
0x06	PIN missing
0x07	Memory capacity exceeded
0x08	Connection timeout
0x09	Connection limit exceeded
0x0A	Synchronous connection limit to a device exceeded
0x0B	ACL connection limit exceeded
0x0C	Command disallowed
0x0D	Connection rejected due to limited resources
0x0E	Connection rejected due to security reasons
0x0F	Connection rejected due to unacceptable BD_ADDR
0x10	Connection accept timeout exceeded
0x11	Unsupported feature or parameter value
0x12	Invalid HCI command parameters
0x13	Remote user terminated connection
0x14	Remote device terminated connection due to low resources
0x15	Remote device connection due to power off
0x16	Connection terminated by local host
0x17	Repeated attempts
0x18	Pairing not allowed
0x19	Unknown LMP PDU
0x1A	Unsupported remote feature
0x1B	SCO offset rejected
0x1C	SCO interval rejected

4.1 HCI VS Commands

The HCI VS commands consist of the following types:

- System configuration commands
- Audio and voice configuration commands
- RF and PHY configuration commands
- Debug commands
- Memory access commands

4.1.1 System Configuration Commands

This section describes the system configuration commands.

4.1.1.1 HCI_VS_Write_BD_Addr (0xFC06)

Command	Opcode	Command Parameters	Return Parameters
HCI_VS_Write_BD_Addr	0xFC06	New BD address	Status

Description:

This command writes the value for the BD_ADDR parameter.

Command Parameters:

New BD Address	Size: 6 bytes
Value	**Parameter Description**
XXXXXXXXXXXX	BD address of the device

Return Parameters:

Status	Size: 1 byte
Value	**Parameter Description**
0x00 0x01–0xFF	Command succeeded Command failed

Events Generated:

Command Complete Event

4.1.1.2 HCI_VS_Start_VS_Lock (0xFE37)

Command	Opcode	Command Parameters	Return Parameters
HCI_VS_Start_VS_Lock	0xFE37	Software major version Software minor version	Status

Description:

This command protects the Bluetooth firmware from downloading and running an inappropriate patch code. The command checks the version that is supplied as command parameters and compares the version to the internal software version. If there is a match, no change occurs. If there is no match, all successive VS commands are locked in the firmware (their execution is skipped and a Command Complete message with a SUCCESS error code is sent to the host).

The VS lock is released only by the Stop VS Lock command or by a hardware or software reset. If VS lock is on, all error messages are printed in the Bluetooth Logger only.

All protected segments of HCI scripts must be wrapped with the Start VS Lock and Stop VS Lock commands to protect the Bluetooth device from performing version-specific commands (for example, patch code unique to a specific firmware version).

Command Parameters:

Software Major Version	Size: 1 byte
Value	**Parameter Description**
0x00–0xFF	Major (upper) number of the software version (the X of the X.Y.Z)

Software minor version	Size: 1 byte
Value	**Parameter Description**
0x00–0xFF	Minor (lower) number of the software version (the Z of X.Y.Z)

Return Parameters:

Status	Size: 1 byte
Value	**Parameter Description**
0x00 0x01–0xFF	Command succeeded Command failed

Events Generated:

Command Complete Event

4.1.1.3 HCI_VS_Stop_VS_Lock (0xFE38)

Command	Opcode	Command Parameters	Return Parameters
HCI_VS_Stop_VS_Lock	0xFE38	None	Status

Description:

The Stop_VS_Lock command clears any lock by a previous command, terminates a protected script segment, and ensures that the next commands of a script are executed independently of the firmware software version.

All protected segments of HCI scripts must be wrapped with the Start_VS_Lock and Stop_VS_Lock commands to protect the Bluetooth device from performing version-specific commands (for example, patch code unique to a specific firmware version).

Command Parameters:

None

Return Parameters:

Status	Size: 1 byte
Value	**Parameter Description**
0x00 0x01–0xFF	Command succeeded Command failed

Events Generated:

Command Complete Event

4.1.1.4 HCI_VS_Update_UART_HCI_Baudrate (0xFF36)

Command	Opcode	Command Parameters	Return Parameters
HCI_VS_Update_UART_HCI_Baudrate	0xFF36	UART HCI baud rate value	Status

Description:

This command sets the UART HCI baud rate. The HCI baud rate changes after the status response.

NOTE: To continue using HCITester after the baud rate has been changed, the COM port settings must be adjusted to match the baud rate that was set.

Command Parameters:

UART HCI Baud Rate Value	Size: 4 bytes
Value	**Parameter Description**
0x00000001–0x003D0900	New UART baud rate (in bits/sec)

Return Parameters:

Status	Size: 1 byte
Value	**Parameter Description**
0x00 0x01–0xFF	Command succeeded Command failed

Events Generated:

Command Complete Event

4.1.1.5 HCI_VS_Sleep_Mode_Configurations (0xFD0C)

Command	Opcode	Command Parameters	Return Parameters
HCI_VS_Sleep_Mode_Configurations	0xFD0C	Reserved Deep sleep enable Deep sleep mode Reserved Reserved Reserved Reserved Reserved	Status

Description:

This command configures the sleep mode to use.

NOTE: Before this command is sent, deep sleep is disabled.

Default Values: Deep sleep is disabled by default.

Command Parameters:

Reserved	Size: 1 byte
Value	**Parameter Description**
0x00	Reserved

Deep Sleep Enable	Size: 1 byte
Value	**Parameter Description**
0x00 0x01	Deep sleep is disabled. Deep sleep is enabled.

Deep Sleep Mode	Size: 1 byte
Value	**Parameter Description**
0x00 0x01–0xFE 0xFF	HCILL Reserved Retains previous value / Do not change.

Reserved	Size: 1 byte
Value	**Parameter Description**
0xFF	Reserved. Do not change.

Reserved	Size: 1 byte
Value	**Parameter Description**
0xFF	Reserved. Do not change.

Reserved	Size: 1 byte
Value	**Parameter Description**
0xFF	Reserved. Do not change.

Reserved	Size: 1 byte
Value	**Parameter Description**
0xFF	Reserved. Do not change.

Reserved	Size: 2 bytes
Value	**Parameter Description**
0x00	Default value 0x00 must be used.

Return Parameters:

Status	Size: 1 byte
Value	**Parameter Description**
0x00 0x01–0xFF	Command succeeded Command failed

Events Generated:

Command Complete Event

4.1.1.6 HCI_VS_HCILL_Parameters (0xFD2B)

Command	Opcode	Command Parameters	Return Parameters
HCI_VS_ HCILL_Parameters	0xFD2B	inactivity_timeout retransmit_timeout rts_pulse_width	Status

Description:

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

Default Parameters:

Inactivity_Timeout : 100 ms

Retransmit_Timeout: 500 ms

RTS_Pulse_Width: 1 µs

Command Parameters:

inactivity_timeout	Size: 2 bytes
Value	**Parameter Description**
0x0000–0xFFFF	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 frame = 1.25 ms).

retransmit_timeout	Size: 2 bytes
Value	**Parameter Description**
0x0000–0xFFFF	Time from sending WAKEUP_IND packet, to a retransmission of this packet. If this value is 0, no retransmission occurs. Unit is frames (1 frame = 1.25 ms).

rts_pulse_width	Size: 1 byte
Value	**Parameter Description**
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.

Return Parameters:

Status	Size: 1 byte
Value	**Parameter Description**
0x00 0x01–0xFF	Command succeeded Command failed

Events Generated:

Command Complete Event

4.1.1.7 HCI_VS_Start_AVPR_VS_Lock (0xFE49)

Command	Opcode	Command Parameters	Return Parameters
HCI_VS_Start_AVPR_VS_Lock	0xFE49	Major version number Minor version number	Status

Description:

This command protects the AVPR firmware from downloading and running an inappropriate patch code. The command checks the version that is supplied as command parameters and compares the version to the internal software version. If there is a match, no change occurs. If there is no match, all successive VS commands are locked in the firmware (their execution is skipped and a Command Complete message with a SUCCESS error code is sent to the host).

The VS lock is released only by the Stop VS Lock command or by a hardware or software reset. If VS lock is on, all error messages are printed in the Bluetooth Logger only.

All protected segments of HCI scripts must be wrapped with the Start VS Lock and Stop VS Lock commands to protect the Bluetooth device from performing version-specific commands (for example, patch code unique to a specific firmware version).

Command Parameters:

Major Version	Size: 1 byte
Value	**Parameter description**
0x00–0xFF	Major version

Minor Version	Size: 1 byte
Value	**Parameter description**
0x00–0xFF	Minor version

Return Parameters:

Status	Size: 1 byte
Value	**Parameter description**
0x00 0x01–0xFF	Command succeeded Command failed

Events Generated:

Command Complete Event

4.1.1.8 HCI_VS_ Fast_Clock_Configuration_btip (0xFD1C)

Command	Opcode	Command Parameters	Return Parameters
HCI_VS_ Fast_Clock_Configuration_btip	0xFD1C	XTAL Enable Settling time Reserved Reserved Reserved Reserved Reserved Slow Clock Accuracy Reserved Reserved Reserved Reserved Reserved Reserved	Status

Description:

This command configures the clock sources parameters for both fast and slow clock: settling time, clock type, and related deep-sleep parameters.

If the device has more than two fast clock sources (primary and secondary), this command is sent twice with the appropriate parameters of each clock source.

Command Parameters:

XTAL Enable	Size: 1 byte
Value	**Parameter Description**
0x00 0x01 0xFF (default)	XTAL (OSC cell) is disabled, external clock configuration is used. XTAL (OSC cell) is enabled. Notice: Use this value only for debug purposes. in case XTAL is used the device automatically detects the XTAL and turn on the XTAL cell. Retain default value; do not change. Uses the device automatic clock type detection.

Settling Time	Size: 4 bytes
Value	**Parameter Description**
0x0000–0x003F 0xFFFF	Time (in microseconds) from device clock request assertion until a valid clock can be assumed on device clock input. This parameter is driven from the clock source wake up time. During device initialization, this value is updated to 5000. For power consumption optimization it is recommended to update the settling time to reflect the external clock wake up time. Default = 5000 µs or 0x1388. Retain previous value; do not change.

Reserved	Size: 1 byte
Value	**Parameter Description**
0xFF	Reserved. Do not change without consulting TI.

Reserved	Size: 1 byte
Value	**Parameter Description**
0xFF	Reserved. Do not change.

Slow Clock Accuracy	Size: 1 byte
Value	**Parameter Description**
0x00–0xFA (0–250 ppm)	Provides the slow clock accuracy in ppm: in case the clock source accuracy is better than 250 ppm, the device can optimize wake-up time in low power modes. (Default = 250 ppm)

Reserved	Size: 1 byte
Value	**Parameter Description**
0x00	Reserved. Do not change without consulting TI.

Reserved	Size: 1 byte
Value	**Parameter Description**
0	Reserved.

Reserved	Size: 1 byte
Value	**Parameter Description**
0	Reserved.

Reserved	Size: 1 byte
Value	**Parameter Description**
0xFF	Reserved.

Reserved	Size: 1 byte
Value	**Parameter Description**
0xFF	Reserved.

Reserved	Size: 1 byte
Value	**Parameter Description**
0	Reserved.

Return Parameters:

Status	Size: 1 byte
Value	**Parameter Description**
0x00 0x01–0xFF	Command succeeded Command failed

Events Generated:

Command Complete Event

4.1.1.9 HCI_VS_Configure_DDIP (0xFD55)

Command	Opcode	Command Parameters	Return Parameters
HCI_VS_Configure_DDIP	0xFD55	BE access percentage Guaranteed access percentage Poll period Reserved Reserved Reserved Master burst after RX limit Reserved Reserved	Status

Description:

This command configures the bandwidth allocation between ACL (best effort or guaranteed connection) and Inquiry/Page/Bluetooth low energy scans. The host protocol stack can define the behavior of the controller and control the performance of the device during the activities above.

NOTE: The HCI_VS_Configure_DDIP command should run once at the end of the initialization script.

Command parameters:

Best Effort Access Percentage	Size: 1 byte
Value	**Parameter Description**
0x00–0x64 (0–100%)	Percentage allocated for best-effort ACL during page, inquiry and continuous Bluetooth low energy scans. Default = 25%.

Guaranteed Access Percentage1	Size: 1 byte
Value	**Parameter Description**
0x00–0x64 (0–100%)	Percentage allocated for guaranteed ACL during page, inquiry, and continuous Bluetooth low energy scans. Default = 80%.

Poll Period	Size: 1 byte
Value	**Parameter Description**
0x02–0xFF	The controller (when acting as a slave of the connection) tries to reduce the poll period during DDIP activities by sending quality of service request to its master. This parameter controls the requested poll period. Default = 0x06.

Reserved	Size: 1 byte
Value	**Parameter Description**
Default = 0x07	Reserved (must be 7)

Reserved	Size: 1 byte
Value	**Parameter Description**
Default = 0x2	Reserved (must be 0x2)

Reserved	Size: 1 byte
Value	**Parameter Description**
0x01	Reserved

Master Burst After RX Limit	Size: 1 byte
Value	**Parameter Description**
0x00–0xFF	A number of frames, after reception of data by master, it tries to send ACK (before giving up and allowing another connection to be scheduled). Default = 0x01.

Reserved	Size: 1 byte
Value	**Parameter Description**
0xFF	Reserved

Reserved	Size: 1 byte
Value	**Parameter Description**
0xFF	Reserved

Return Parameters:

Status	Size: 1 byte
Value	**Parameter Description**
0x00 0x01–0xFF	Command succeeded Command failed

Events Generated:

Command Complete Event

4.1.1.10 HCI_VS_Clock_Set_Timeout (0xFE24)

Command	Opcode	Command Parameters	Return Parameters
HCI_VS_Clock_Set_Timeout	0xFE24	Timer mode Time	Status

Description:

The Clock_Set_Timeout command enables the device controller to wake up the host. After the allotted time expires, the device sends a notification of an event to the host to wake it up. It is only used in rare cases where the host does not have a timer.

NOTE: This command is not relevant for WiLink 8Q devices.

Command Parameters:

Timer Mode	Size: 1 byte
Value	**Parameter Description**
0x01 0x10	Start timer once Start periodic timer

Time	Size: 4 bytes
Value	**Parameter Description**
0x0000–0xFFFF	Specify the time in milliseconds.

Return Parameters:

Status	Size: 1 byte
Value	**Parameter Description**
0x00 0x01–0xFF	Command succeeded Command failed

Events Generated:

Command Complete Event

4.1.2 Audio and Voice Configuration Commands

This section describes the audio and voice configuration commands.

4.1.2.1 HCI_VS_Write_CODEC_Config (0xFD06)

Command	Opcode	Command Parameters	Return Parameters
Write_codec_config	0xFD06	PCM clock rate PCM 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	Status

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.

Default Values	Hardware Default	HCI Tester Command	Equivalent Hex
PCM clock rate	N/A	2048 kHz	0x0800
PCM direction	1 (input)	0 (output)	0x00
Frame-sync frequency	N/A	8000 Hz	0x00001F40
Frame-sync duty cycle	N/A	1	0x0001
Frame-sync edge	0 (rising edge)	0 (rising edge)	0x00
Frame-sync polarity	0 (active high)	0 (active high)	0x00
Reserved	N/A	0	0x00
Channel 1 data out size	0	16 bits	0x0010
Channel 1 data out offset	0	1	0x0001
Channel 1 data out edge	0 (rising edge)	0 (rising edge)	0x00
Channel 1 data in size	0	16 bits	0x0010
Channel 1 data in offset	0	1	0x0001
Channel 1 data in edge	0 (rising edge)	1 (falling edge)	0x01

Default Values	Hardware Default	HCI Tester Command	Equivalent Hex
Reserved	N/A	0	0x00
Channel 1 data out size	0	16	0x0010
Channel 2 data out offset	0	17	0x0011
Channel 2 data out edge	0 (rising edge)	0 (rising edge)	0x00
Channel 2 data in size	0	16	0x0010
Channel 2 data in offset	0	17	0x0011
Channel 2 data in edge	0 (rising edge)	1 (falling edge)	0x01
Reserved	N/A	0	0x00

Command Parameters:

PCM Clock Rate	Size: 2 bytes
Value	**Parameter Description**
0x0040–0x3E80 (64Kbits–16Mbits)	The PCM clock rate is between 64k to 4096k (for master mode) or 64K to 16M (for slave mode). The rate influences other parameters, such as wait cycles and frequency rate calculation and therefore must be configured even if an external clock is used.

PCM Direction	Size: 1 byte
Value	**Parameter Description**
0x00 0x01	PCM clock and Fsync direction is output (codec_IF is master on PCM bus) and sampled on the rising edge. PCM clock and Fsync direction is input (codec_IF is slave on PCM bus).

Frame-Sync Frequency	Size: 4 bytes
Value	**Parameter Description**
0x00000064–0x0002A3C8	Frame-sync frequency in Hz (Range 100 Hz–173 kHz). Default = 8000 Hz or 0x00001F40.

Frame-Sync Duty Cycle	Size: 2 bytes
Value	**Parameter Description**
0x0000 0x0001–0xFFFF	50% of Fsync period Number of cycles of PCM clock

Frame-Sync Edge	Size: 1 byte
Value	**Parameter Description**
0x00 0x01	Driven/sampled at rising edge of the PCM clock Driven/sampled at falling edge of the PCM clock

Frame-Sync Polarity	Size: 1 byte
Value	**Parameter Description**
0x00 0x01	Active high Active low

Reserved	Size: 1 byte
Value	**Parameter Description**
0x00	Reserved for future use. Must be set to 0.

Channel X data out size	Size: 2 bytes
Value	**Parameter Description**
0x0001–0x0280	Sample size in bits for each codec Fsync The value is between 1 bit and 640 bits. If data size is greater than 24 bits, the size must be divisible by 8 (for example, 1–24, 32, 40, 48, and so on). Default = 16 bits or 0x0010.

Channel X Data Out Offset	Size: 2 bytes
Value	**Parameter Description**
0x0000–0x00FF	Number of PCM clock cycles between rising of frame sync and data start. NOTE: The offset of CH2 must be a minimum of CH1 DATA LENGTH + 1. This requirement is also important when CH2 is not used.

Channel X Data Out Edge	Size: 1 byte
Value	**Parameter Description**
0x00 0x01	Data driven at rising edge of the PCM clock Data driven at falling edge of the PCM clock

Channel X Data In Size	Size: 2 bytes
Value	**Parameter Description**
0x0001–0x0280	Sample size in bits for each codec Fsync The value is between 1 bit and 640 bits. If data size is greater than 24 bits, the size must be divisible by 8 (for example, 1–24, 32, 40, 48, and so on).

Channel X Data In Offset	Size: 2 bytes
Value	**Parameter Description**
0x0000–0x00FF	Number of PCM clock cycles between rising of frame sync and data start

Channel X Data In Edge	Size: 1 byte
Value	**Parameter Description**
0x00 0x01	Data sampled at rising edge of the PCM clock Data sampled at falling edge of the PCM clock

Reserved	Size: 1 byte
Value	**Parameter Description**
0x00	Reserved for future use. Must be set to 0.

Return Parameters:

Status	Size: 1 byte
Value	**Parameter Description**
0x00 0x01–0xFF	Command succeeded Command failed

Events Generated:

Command Complete Event

4.1.2.2 HCI_VS_Write_CODEC_Config_Enhanced (0xFD07)

Command	Opcode	Command Parameters	Return Parameters
HCI_VS_Write_CODEC_Config_Enhanced	0xFD07	PCM clock shutdown PCM clock start PCM 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	Status

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 follow Write_codec_config.

Default Values	Hardware Default	HCI Tester Command
PCM clock shutdown	0 (disable)	0 (disable)
PCM clock start	0	0
PCM clock stop	0	0
Reserved	N/A	0
Channel 1 data in order	0 (most-significant bit [MSB] first)	0 (MSB first)
Channel 1 data out order	0 (MSB first)	0 (MSB first)
Channel 1 data out mode	2 (input when idle)(1)	2 (input when idle)
Channel 1 data out duplication	0 (last sample)	0 (last sample)
Channel 1 TX_dup_value	0	0
Channel 1 data quant	0	0
Reserved	N/A	0
Channel 2 data in order	0 (MSB first)	0 (MSB first)
Channel 2 data out order	0 (MSB first)	0 (MSB first)
Channel 2 data out mode	2 (input when idle)(1)	2 (input when idle)
Channel 2 data out duplication	0 (last sample)	0 (last sample)
Channel 2 TX_dup_value	0	0
Channel data quant	0	0
Reserved	N/A	0

(1) Set by software during initialization

PCM Clock Shutdown	Size: 1 byte
Value	**Parameter Description**
0x00 0x01	PCM clock shutdown feature is disabled. PCM clock shutdown feature is enabled. Time of start and stop is defined in the following two fields (used in master mode only).

PCM Clock Start	Size: 2 bytes
Value	**Parameter Description**
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)

PCM Clock Stop	Size: 2 bytes
Value	**Parameter Description**
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)

Channel X Data In Order	Size: 1 byte
Value	**Parameter Description**
Bit 0 = 0 Bit 0 = 1	Data driven MSB first Data driven least-significant bit (LSB) first
Bit 1 = 0 Bit 1 = 1	Don't swap bytes within the sample. Swap bytes within the sample in bit-wise mode when data size > 8 ([XYZ] → [ZYX]).
Bit 2 = 0 Bit 2 = 1	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 X Data Out Order	Size: 1 byte
Value	**Parameter Description**
Bit 0 = 0 Bit 0 = 1	Data driven MSB first Data driven LSB first
Bit 1 = 0 Bit 1 = 1	Do not swap bytes within the sample. Swap bytes within the sample in bit-wise mode when data size > 8 ([XYZ] → [ZYX]).
Bit 2 = 0 Bit 2 = 1	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 X Data Out Mode	Size: 1 byte
Value	**Parameter Description**
0x00 0x01 0x02	Always 3-state (input) Always output Switch to 3-state (input) when idle

Channel X Data Out duplication	Size: 1 byte
Value	**Parameter Description**
0x00 0x01	Retransmit last sample when no data are available. Transmit DUP_VALUE when no data are available.

Channel X TX_dup_value	Size: 4 bytes
Value	**Parameter Description**
0x00000000–0x00FFFFFF	Replacement value to transmit when no data is available

Channel X Data Quant	Size: 1 byte
Value	**Parameter Description**
0x00 0x01	In bit-wise mode, the basic data unit is the entire sample (8 – 24 bits). In byte-wise mode, the basic data unit is 1 byte. Bit-wise mode. Possible if data in and data out size are up to 24 bits. Byte-wise mode

Reserved	Size: 4 bytes
Value	**Parameter Description**
0x00	Reserved. Must be set to 0.

Return Parameters:

Status	Size: 1 byte
Value	**Parameter Description**
0x00 0x01–0xFF	Command succeeded Command failed

Events Generated:

Command Complete Event

4.1.2.3 HCI_VS_Set_PCM_Loopback_Configuration (0xFD04)

Command	Opcode	Command Parameters	Return Parameters
HCI_VS_Set_PCM_Loopback_Configuration	0xFD04	PCM loopback delay	Status

Description:

This command configures the default

PCM loopback delay on the bus between the PCM input data and the PCM output data. The new delay affects the next PCM loopback channel enabled. If a PCM loopback channel is already activated, disable it, and then enable it again to use the new delay.

Command Parameters:

PCM Loopback Delay	Size: 2 bytes
Value	**Parameter Description**
0x0001–0x0544	This value defines the delay in sample units (number of frame syncs) between the input sample to the device and the output of the same sample from the device. Supports 0–1348 frame syncs.

Return Parameters:

Status	Size: 1 byte
Value	**Parameter Description**
0x00 0x01–0xFF	Command succeeded Command failed

Events Generated:

Command Complete Event

4.1.2.4 HCI_VS_Set_PCM_Loopback_Enable (0xFE28)

Command	Opcode	Command Parameters	Return Parameters
HCI_VS_Set_PCM_Loopback_Enable	0xFE28	PCM loopback enable	Status

Description:

This command enables pulse-code modulation (PCM) loopback between the PCM input data to the PCM output data.

Command Parameters:

PCM Loopback Enable	Size: 1 byte
Value	**Parameter Description**
0x00 0x01	Stop PCM loopback operation. Start PCM loopback operation.

Return Parameters:

Status	Size: 1 byte
Value	**Parameter Description**
0x00 0x01–0xFF	Command succeeded Command failed

Events Generated:

Command Complete Event

4.1.2.5 HCI_VS_A3DP_Open_Stream (0xFD8C)

Command	Opcode	Command Parameters	Return Parameters
HCI_VS_A3DP_Open_Stream	0xFD8C	Connection handle L2CAP CID L2CAP MTU AVDTP version parameter AVDTP payload parameter Reserved Reserved	Status

Description:

This command must be called when the A2DP SNK moves to open state and establishes the transport A2DP channel to open an A3DP entity in the controller. The command contains the protocol parameters required for L2CAP and AVDTP packet construction. SBC and SARC parameters are applied using the HCI_VS_A3DP_CODEC_CONFIGURATION command.

Command Parameters:

Connection Handle	Size: 1 byte
Value	**Parameter Description**
0x01–0x07	The ACL connection handle

L2CAP CID	Size: 2 bytes
Value	**Parameter Description**
0x0040–0xFFFF	L2CAP channel ID of the AVDTP data stream. Refers to the L2CAP channel ID of the remote device.

L2CAP MTU	Size: 2 bytes
Value	**Parameter Description**
0x0030–0xFFFF	The maximum size of payload data, in octets, that the upper layer entity can accept

AVDTP Version Parameter	Size: 1 byte
Value	**Parameter Description**
0x00–0x03	AVDTP protocol header version parameter

AVDTP Payload Parameter	Size: 1 byte
Value	**Parameter Description**
0x30–0xFF	This AVDTP field identifies the format of the RTP payload and determines its interpretation by the application.

Reserved	Size: 4 bytes
Value	**Parameter Description**
	For future use

Reserved	Size: 4 bytes
Value	**Parameter Description**
	For future use

Return Parameters:

Status	Size: 1 byte
Value	**Parameter Description**
0x00 0x01–0xFF	Command succeeded Command failed

Events Generated:

Command Complete Event

4.1.2.6 HCI_VS_A3DP_Close_Stream (0xFD8D)

Command	Opcode	Command Parameters	Return Parameters
HCI_VS_A3DP_Close_Stream	0xFD8D	Connection handle Reserved	Status

Description:

This command must be called when the A2DP SNK moves to idle state and closes the transport A2DP channel. A stream started by the start stream command must be stopped by the stop stream command before closing.

Command Parameters:

Connection Handle	Size: 1 byte
Value	**Parameter Description**
0x01–0x07	The ACL connection handle

Reserved	Size: 4 bytes
Value	**Parameter Description**
	For future use

Return Parameters:

Status	Size: 1 byte
Value	**Parameter Description**
0x00 0x01–0xFF	Command succeeded Command failed

Events Generated:

Command Complete Event

4.1.2.7 HCI_VS_A3DP_Codec_Configuration (0xFD8E)

Command	Opcode	Command Parameters	Return 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 sub-bands SBC allocation method SBC bit pool low boundary SBC recommended bit pull SBC dynamic bit pull enable Reserved Reserved	Status

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. In addition to that API call, the controller PCM codec must also be configured using the commands:

- HCI_VS_Write_CODEC_Config
- HCI_VS_Write_CODEC_Config_Enhanced

Command Parameters:

Audio Source	Size: 1 byte
Value	**Parameter Description**
0x00	Determines the audio source of the A2DP stream: 0–Audio source is the host through the PCM bus

PCM Input Sample	Size: 1 byte
Value	**Parameter Description**
0x01–0x09	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 is used for sample rate conversion. 0x01: 8000 Hz 0x02: 11025 Hz 0x03: 12000 Hz 0x04: 16000 Hz 0x05: 22050 Hz 0x06: 24000 Hz 0x07: 32000 Hz 0x08: 44100 Hz 0x09: 48000 Hz

PCM Number of Channels	Size: 1 byte
Value	**Parameter Description**
0x01–0x02	The number of channels (1 or 2) of the PCM input. This parameter is valid only when the audio source is the host.

SBC Input Sample Frequency	Size: 1 byte
Value	**Parameter Description**
0x00–0x03	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. 0x00: 16000 Hz 0x01: 32000 Hz 0x02: 44100 Hz 0x03: 48000 Hz

SBC Channel Mode	Size: 1 byte
Value	**Parameter Description**
0x00–0x03	Describes the channel mode used to encode a stream: 0x00: MONO 0x01: DUAL_CHNL 0x02: STEREO 0x03: JOINT_STEREO

SBC Number of Blocks	Size: 1 byte
Value	**Parameter Description**
0x04, 0x08, 0x0C, 0x10	Number of SBC blocks. (4, 8, 12, 16)

SBC Number of Subbands	Size: 1 byte
Value	**Parameter Description**
0x04, 0x08, 0x0C, 0x10	Number of SBC encoder blocks. (4, 8, 12, 16)

SBC Allocation Method	Size: 1 byte
Value	**Parameter Description**
0x00–0x01	SBC allocation method (SNR, Loudness): 0: Loudness 1: SNR

SBC Bit Pool Low Boundary	Size: 1 byte
Value	**Parameter Description**
0x00–0x39	The lower boundary of the negotiated bit pool range.

SBC Recommended Bit Pull	Size: 1 byte
Value	**Parameter Description**
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	Size: 1 byte
Value	**Parameter Description**
0x00–0x01	Determines whether a dynamic bit pool mechanism should be used for performance and quality adjustment: 0: Disable 1:Enable

Reserved	Size: 4 bytes
Value	**Parameter Description**
	For future use

Reserved	Size: 4 bytes
Value	**Parameter Description**
	For future use

Return Parameters:

Status	Size: 1 byte
Value	**Parameter Description**
0x00 0x01–0xFF	Command succeeded Command failed

Events Generated:

Command Complete Event

4.1.2.8 HCI_VS_A3DP_Start_Stream (0xFD8F)

Command	Opcode	Command Parameters	Return Parameters
HCI_VS_A3DP_Start_Stream	0xFD8F	Connection handle Reserved	Status

Description:

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

Command Parameters:

Connection Handle	Size: 1 byte
Value	**Parameter Description**
0x01–0x07	The ACL connection handle

Reserved	Size: 4 bytes
Value	**Parameter Description**
	For future use

Return Parameters:

Status	Size: 1 byte
Value	**Parameter Description**
0x00 0x01–0xFF	Command succeeded Command failed

Events Generated:

Command Complete Event

4.1.2.9 HCI_VS_A3DP_Stop_Stream (0xFD90)

Command	Opcode	Command Parameters	Return Parameters
HCI_VS_A3DP_Stop_Stream	0xFD90	Connection handle Flush flag Generate stop event Reserved	Status

Description:

This command stops the SBC data streaming to the remote device. An input parameter determines whether the current internal buffers must be transmitted to the remote device (or devices) and then flushed (soft flush) or flushed immediately (hard flush). That option might be required if the stream 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.

Command Parameters:

Connection Handle	Size: 1 byte
Value	**Parameter Description**
0x01–0x07	The ACL connection handle

Flush Flag	Size: 1 byte
Value	**Parameter Description**
0x00–0x01	Determines whether the current internal buffers should be transmitted to the remote device (or devices), or should be flushed immediately. 0x00: Transmit internal buffers before flush (soft flush) 0x01: Immediate flush of buffers (hard flush)

Generate Stop Event	Size: 1 byte
Value	**Parameter Description**
0x00–0x01	Determines whether a stop stream event will be generated as soon as stream is stopped. To be used in Soft Flush. 0x00: No 0x01: Yes

Reserved	Size: 4 bytes
Value	**Parameter Description**
	For future use

Return Parameters:

Status	Size: 1 byte
Value	**Parameter Description**
0x00 0x01–0xFF	Command succeeded Command failed

Events Generated:

Command Complete Event

4.1.3 RF and PHY Configuration Commands

This section describes the RF and PHY configuration commands.

4.1.3.1 HCI_VS_DRPb_Enable_RF_Calibration_Enhanced (0xFDFB)

Command	Opcode	Command Parameters	Return Parameters
HCI_VS_DRPb_Enable_RF_Calibration_Enhanced	0xFDFB	Mode Periodic Options Calibration procedures selection Override temp condition	Status

Description:

The command configures internal RF calibrations. Calibrations can run immediately (once) or periodically. Define the calibration procedures needed to run in each calibration mode. When enabling periodic mode run, the calibration will start running immediately, next periodic calibration will start after the configurable period.

NOTE: The command must run only during the initialization process as part of the initialization script.

Command Parameters:

Mode	Size: 1 byte
Value	**Parameter Description**
0x00	0x00 = Initial calibration (activate the selected calibrations one time)
0x01	0x01 = Periodic calibration

Periodic Options	Size: 1 byte
Value	**Parameter Description**
0x00–0xFD 0xFF	0x00–0xFD = sets the selected calibration period to [Value × 10] seconds. Performs when the system is in standby mode. 0xFE = Keep periodic calibration (update "Calibration procedures selection" and "Override temp condition" without executing the calibrations themselves). Default = 5 minutes or 0x1E). 0xFF = Stop periodic calibration

Calibration Procedures Selection	Size: 4 bytes
Value	**Parameter Description**
0x00000000–0x0000FFFF 0xFFFFFFFF	0x00000000–0x0000FFFF = See Procedures bitmap 0xFFFFFFFF = Keep last bitmap

Procedures Bitmap		
Value	**Parameter Description**	**Default Mode (After Initialization)**
Bit 0	Initialization	Disable
Bit 1	Timing	Disable
Bit 2	Random Seed	Disable
Bit 3	Clocks	Disable
Bit 4	AFE (Analog Front End)	Disable
Bit 5	DC	Disable
Bit 6	LDO	Disable
Bit 7	DCO current	Disable
Bit 8	DCO Open Loop Freq	Disable
Bit 9	KDCO	Disable
Bit 10	Not Used	
Bit 11	TPC (Transmit Power Control)	Disable
Bit 12	IFA Pole (IF Amplifier filter pole)	Disable
Bit 13	Not Used	
Bit 14	Not Used	
Bit 15	Not Used	
Bit 16	Not Used	
Bit 17	PD Extract (Pre Distortion extract)	Disable
Bit 18	Not Used	
Bits 19–31	Reserved	

Override Temp Condition	Size: 1 byte
Value	**Parameter Description**
0x00	Run selected calibrations only if temperature range changed
0x01	Run selected calibrations regardless of temperature range changes

Return Parameters:

Status	Size: 1 byte
Value	**Parameter Description**
0x00 0x01–0xFF	Command succeeded Command failed

Events Generated:

Command Complete Event

4.1.3.2 HCI_VS_DRPb_Set_Power_Vector (0xFD82)

Command	Opcode	Command Parameters	Return Parameters
HCI_VS_DRPb_Set_Power_Vector	0xFD82	Power type Power level N value (N = 0 – 7) tx_power_edr_epc_idx Reserved	Status

Description:

The transmit power control algorithm is based on the capability to construct the amplitude control word (ACW) for any given power level in dBm (see Note 1), as long as it is in the supported range.

When Vbat decreases below ≈3 V, automatic Vbat detection switches between HP (high power, Vbat is higher than 3 V) and LP (low power, Vbat is lower than 3 V) vectors; thus, setting both HP and LP power vectors is required for the relevant modulations.

NOTE:

1. 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 TPC calibration must run in initial calibration mode and the Override temp changes configuration.
2. The number of power levels must be the same for all power vector types (all modulation types). There are 0–7 levels.
3. Vbat is measured with an on-chip ADC that has an accuracy error of up to 5%.
4. Due to hysteresis, there is a threshold voltage that causes the transition between HP and LP modes and vice versa:
   From LP to HP → 3.2 V
   From HP to LP → 3.0 V

Default:

```
############################################################
####  Power Tables ROM Data is aligned to the following ####
############################################################

############################################################
####            Low Power (LP) Vector Table             ####
############################################################

#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, -22.5 *2, -18 *2, -13.5 *2, -9 *2, -
4.5 *2, 0 *2, 5 *2, 10 *2, 0x3F, 0x00FF
Wait_HCI_Command_Complete_VS_DRPb_Set_Power_Vector_Event 5000, any,
HCI_VS_DRPb_Set_Power_Vector,0x00

#Set BT LE (BLE) LP Vectors Values (note the need to multiply the output power in dBm by '2'
Send_HCI_VS_DRPb_Set_Power_Vector 0xFD82, 0x03, -22.5 *2, -18 *2, -13.5 *2, -9 *2, -
4.5 *2, 0 *2, 5 *2, 10 *2, 0x3F, 0x00FF
Wait_HCI_Command_Complete_VS_DRPb_Set_Power_Vector_Event 5000, any,
HCI_VS_DRPb_Set_Power_Vector,0x00

#Set ANT LP Vectors Values (note the need to multiply the output power in dBm by '2'
Send_HCI_VS_DRPb_Set_Power_Vector 0xFD82, 0x04, -22.5 *2, -18 *2, -13.5 *2, -9 *2, -
4.5 *2, 0 *2, 5 *2, 10 *2, 0x3F, 0x00FF
Wait_HCI_Command_Complete_VS_DRPb_Set_Power_Vector_Event 5000, any,
HCI_VS_DRPb_Set_Power_Vector,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, -25 *2, -20.5 *2, -16 *2, -11.5 *2, -7 *2, -
2 *2, 3 *2, 8 *2, 0x3F, 0x00FF
Wait_HCI_Command_Complete_VS_DRPb_Set_Power_Vector_Event 5000, any,
HCI_VS_DRPb_Set_Power_Vector,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, -25 *2, -20.5 *2, -16 *2, -11.5 *2, -7 *2, -
2 *2, 3 *2, 8 *2, 0x3F, 0x00FF
Wait_HCI_Command_Complete_VS_DRPb_Set_Power_Vector_Event 5000, any,
HCI_VS_DRPb_Set_Power_Vector,0x00

############################################################
####            High Power (HP) Vector Table            ####
############################################################

#Set BT BR (GFSK) HP Vectors Values (note the need to multiply the output power in dBm by '2'
Send_HCI_VS_DRPb_Set_Power_Vector 0xFD82, 8, -19.5 *2, -14.5 *2, -9.5 *2, -
4.5 *2, 0.5 *2, 5.5 *2, 10.5 *2, 15.5 *2, 0x3F, 0x00FF
Wait_HCI_Command_Complete_VS_DRPb_Set_Power_Vector_Event 5000, any,
HCI_VS_DRPb_Set_Power_Vector,0x00

#Set BT LE (BLE) HP Vectors Values (note the need to multiply the output power in dBm by '2'
Send_HCI_VS_DRPb_Set_Power_Vector 0xFD82, 9, -19.5 *2, -14.5 *2, -9.5 *2, -
4.5 *2, 0.5 *2, 5.5 *2, 10.5 *2, 15.5 *2, 0x3F, 0x00FF
Wait_HCI_Command_Complete_VS_DRPb_Set_Power_Vector_Event 5000, any,
HCI_VS_DRPb_Set_Power_Vector,0x00

#Set ANT HP Vectors Values (note the need to multiply the output power in dBm by '2'
Send_HCI_VS_DRPb_Set_Power_Vector 0xFD82, 10, -19.5 *2, -14.5 *2, -9.5 *2, -
4.5 *2, 0.5 *2, 5.5 *2, 10.5 *2, 15.5 *2, 0x3F, 0x00FF
Wait_HCI_Command_Complete_VS_DRPb_Set_Power_Vector_Event 5000, any,
HCI_VS_DRPb_Set_Power_Vector,0x00

#Set BT BR EDR 2MB HP Vectors Values (note the need to multiply the output power in dBm by '2'
Send_HCI_VS_DRPb_Set_Power_Vector 0xFD82, 11, -22.5 *2, -18 *2, -13.5 *2, -9 *2, -
4.5 *2, 0 *2, 5 *2, 10 *2, 0x3F, 0x00FF
Wait_HCI_Command_Complete_VS_DRPb_Set_Power_Vector_Event 5000, any,
HCI_VS_DRPb_Set_Power_Vector,0x00

#Set BT BR EDR 3MB HP Vectors Values (note the need to multiply the output power in dBm by '2'
Send_HCI_VS_DRPb_Set_Power_Vector 0xFD82, 12, -22.5 *2, -18 *2, -13.5 *2, -9 *2, -
4.5 *2, 0 *2, 5 *2, 10 *2, 0x3F, 0x00FF
Wait_HCI_Command_Complete_VS_DRPb_Set_Power_Vector_Event 5000, any,
HCI_VS_DRPb_Set_Power_Vector,0x00

############################################################
####  Class 2 Power ROM Data is aligned to the following ####
############################################################

Send_HCI_VS_DRPb_Set_Class2_Single_Power 0xFD87, 5, 5, 5, 5, 5, 4, 5, 4, 4, 4
Wait_HCI_Command_Complete_VS_DRPb_Set_Class2_Single_Power_Event 5000, any,
HCI_VS_DRPb_Set_Class2_Single_Power, 0x00
```

Command parameters:

Power Table Type (Modulation Type)	Size: 1 byte
Value	**Parameter Description**
0x00–0x04 0x08–0x0C	LP = Low Power (Vbat is lower than ≈3 V) HP = High Power (Vbat is higher than ≈3 V) 0x00 = BT BR (GFSK) LP 0x01 = BT EDR 2MB LP 0x02 = BT EDR 3MB LP 0x03 = BT LE (BLE) LP 0x04 = ANT LP 0x08 = BT BR (GFSK) HP 0x09 = BT LE (BLE) HP 0x0A = ANT HP 0x0B = BT EDR 2MB HP 0x0C = BT EDR 3MB HP

Power Level N Value (N = 0 – 7)	Size for Each Power Level N Value: 1 byte
Value	**Parameter Description**
BT BR (GFSK) LP: –45 – 20 BT LE (BLE) LP: –45 – 20 ANT LP: –45 – 20 BT EDR 2MB LP: –50 – 16 BT EDR 3MB LP: –50 – 16 BT BR (GFSK) HP: –39 – 31 BT LE (BLE) HP: –39 – 31 ANT HP: –39 – 31 BT EDR 2MB HP: –45 – 20 BT EDR 3MB HP: –45 – 20	Required RF power for each of the 8 power levels (0–7) in dBm, multiplied by 2

tx_power_edr_epc_idx	Size: 1 byte
Value	**Parameter Description**
0x00–0x3F	EDR power level index for EPC (enhanced power control) use. This parameter indicates the BT BR (GFSK) power level index that holds the value similar (up to ±2 dB) to the EDR power level value in index 7 (maximal index). For EDR 2-MB modulation, bits 0–2 are used. For EDR 3-MB modulation, bits 3–5 are used.

Reserved	Size: 2 bytes
Value	**Parameter Description**
Reserved	Reserved

Return Parameters:

Status	Size: 1 byte
Value	**Parameter Description**
0x00 0x01–0xFF	Command succeeded Command failed

Events Generated:

Command Complete Event

Procedure:

For power level vector update:

1. Set the power vector type (modulation) to update the power level vector.

   NOTE: If updating all power levels for all supported modulation types, then 10 HCI_VS_DRPb_Set_Power_Vector commands will be executed.

2. Set the desired power (in dBm × 2) for each of the power levels (0–7).

   NOTE:

   - When setting the new power levels, follow the power limitations described previously in the Power level n value parameter table. Start by setting the maximal output power level (level 7) according to the need, and then set the rest of the power levels, maintaining steps of –4.5 dB, –5 dB, or –5.5 dB until reaching the lowest allowed power value. This step is required to maintain the 2- to 8-dB step size allowed by the specification.
   - To stop at a particular power level (which is any power level m ≠ 0), the same value written in power level m must be duplicated in all power levels m-1, m-2, … , 0.
   - For Bluetooth low energy modulation, when setting the power level 7 value, remember to meet the maximum 10-dBm output power at the antenna.

3. Per LP and HP and according to the EDR2 or EDR3 modulation type, set the tx_pwr_edr_epc_idx parameter.

   NOTE: Keep the same value in any LP or HP family of vectors (even when the modulation type in the command is not EDR2 or EDR3).

4. If necessary, configure and execute the relevant Class 2 single power to use with a peer device that does not support power control (per LP/HP and per modulation) using: HCI_VS_DRPb_Set_Class2_Single_Power (0xFD87).
5. Execute transmit power control (TPC) calibration, configuring Initialization calibration mode and override temp changes condition:

```
# Run TPC calibration to update the ACW (Amplitude Control Word) to the PA
Send_HCI_VS_DRPb_Enable_RF_Calibration_Enhanced 0xFDFB, 0x00, 0x00000800, 0x01
Wait_HCI_Command_Complete_VS_DRPb_Enable_RF_Calibration_Enhanced_Event 5000, any,
HCI_VS_DRPb_Enable_RF_Calibration_Enhanced, 0x00
```

4.1.3.3 HCI_VS_DRPb_Set_Class2_Single_Power (0xFD87)

Command	Opcode	Command Parameters	Return Parameters
HCI_VS_DRPb_Set_Class2_Single_Power	0xFD87	GFSK power level idx LP EDR2 power level idx LP EDR3 power level idx LP BLE power level idx LP ANT power level idx LP GFSK power level idx HP BLE power level idx HP ANT power level idx HP EDR2 power level idx HP EDR3 power level idx HP	Status

Description:

This command allows the user to set the power level to use during a connection so that the fixed power does not compress the other receiver. This is done by selecting from the 8 available power levels. The device then transmits at this level all the time. This single power should be set according to the power level vectors configurations, per modulation scheme, and per low power (LP) and high power (HP), and initiated through: HCI_VS_DRPb_Set_Power_Vector (0xFD82).

NOTE: The output power in a connection cannot exceed the maximum output power of power class 2 for transmitting packets, if the receiving device does not support the necessary messaging to send the power control messages.

Command Parameters:

GFSK Power Level idx LP	Size: 1 byte
Value	**Parameter Description**
0x00–0x07	Sets the GFSK power level to use without power control for LP vectors

EDR2 Power Level idx LP	Size: 1 byte
Value	**Parameter Description**
0x00–0x07	Sets the EDR2 power level idx to be used without power control for LP vectors

EDR3 Power Level idx LP	Size: 1 byte
Value	**Parameter Description**
0x00–0x07	Sets the EDR3 power level idx to be used without power control for LP vectors

BLE Power Level idx LP	Size: 1 byte
Value	**Parameter Description**
0x00–0x07	Sets the Bluetooth low energy power level idx to be used without power control for LP vectors

ANT Power Level idx LP	Size: 1 byte
Value	**Parameter Description**
0x00–0x07	Sets the Bluetooth low energy power level idx to be used without power control for LP vectors

GFSK Power Level idx HP	Size: 1 byte
Value	**Parameter Description**
0x00–0x07	Sets the GFSK power level idx to be used without power control for HP vectors

BLE Power Level idx HP	Size: 1 byte
Value	**Parameter Description**
0x00–0x07	Sets the Bluetooth low energy power level idx to be used without power control for HP vectors

ANT Power Level idx HP	Size: 1 byte
Value	**Parameter Description**
0x00–0x07	Sets the ANT power level idx to be used without power control for HP vectors

EDR2 Power Level idx HP	Size: 1 byte
Value	**Parameter Description**
0x00–0x07	Sets the EDR2 power level idx to be used without power control for HP vectors

EDR3 Power Level idx HP	Size: 1 byte
Value	**Parameter Description**
0x00–0x07	Sets the EDR3 power level idx to be used without power control for HP vectors

Return Parameters:

Status	Size: 1 byte
Value	**Parameter Description**
0x00 0x01–0xFF	Command succeeded Command failed

Events Generated:

Command Complete Event

4.1.3.4 HCI_VS_DRPb_Tester_Con_TX (0xFDCA)

Command	Opcode	Command Parameters	Return Parameters
HCI_VS_DRPb_Tester_Con_TX	0xFDCA	Frequency Modulation scheme Test pattern Power level index Reserved Reserved	Status

Description:

This command operates the RF transceiver in continuous transmission mode, which is most likely used in regulatory and standardization procedures and tests, such as FCC and ETSI certifications. Activating the VS runs the TX START sequence code using the configured frequency, modulation, pattern, and power level. The VS also enables the generation of a user-defined pattern (or correcting definitions without a patch) by setting a new pattern generator (also known as a PN generator) initialization value and mask.

NOTE:

1. Unlike a normal connection, the PHY configuration does not take place in the MAC. Instead, the reception parameters are set by the VS command itself (RX mode, frequency, and so on), directly to the registers.
2. Periodic calibration activity might interrupt the continuous transmission activity. Recall disabling periodic calibration activity when continuous transmission duration is longer than the periodic calibration period duration:

```
# Disable periodic calibration
Send_HCI_VS_DRPb_Enable_RF_Calibration_Enhanced 0xFDFB, 1, 0xFF,
0x00000000, 0x01

Wait_HCI_Command_Complete_VS_DRPb_Enable_RF_Calibration_Enhanced_Event
5000, any, HCI_VS_DRPb_Enable_RF_Calibration_Enhanced, 0x00

# Disable RXRX periodic calibration
Send_HCI_VS_DRPb_Enable_RF_Calibration_Enhanced 0xFDFB, 3, 0xFF,
0x00000000, 0x01

Wait_HCI_Command_Complete_VS_DRPb_Enable_RF_Calibration_Enhanced_Event
5000, any, HCI_VS_DRPb_Enable_RF_Calibration_Enhanced, 0x00

# Disable RXRX LNA (periodic) calibration
Send_HCI_VS_DRPb_Enable_RF_Calibration_Enhanced 0xFDFB, 4, 0xFF,
0x00000000, 0x01

Wait_HCI_Command_Complete_VS_DRPb_Enable_RF_Calibration_Enhanced_Event
5000, any, HCI_VS_DRPb_Enable_RF_Calibration_Enhanced, 0x00
```

Command Parameters:

Register Address	Size: 2 bytes
Value	**Parameter Description**
2402–2480	Transmission frequency in MHz

Modulation Scheme	Size: 1 byte
Value	**Parameter Description**
0x00–0x05	0x00 = CW 0x01 = BT BR (GFSK) 0x02 = BT EDR 2MB (π/4-DQPSK) 0x03 = BT EDR 3MB (8-DPSK) 0x04 = BT LE (BLE, GFSK) 0x05 = ANT (GFSK)

Test Pattern	Size: 1 byte
Value	**Parameter Description**
0x00–0x07	0x00 = PN9 0x01 = PN15 0x02 = ZOZO (101010101010101010) 0x03 = All 1 0x04 = All 0 0x05 = FOFO (1111000011110000) 0x06 = FFOO (1111111100000000) 0x07 = Not used

Power Level Index	Size: 1 byte
Value	**Parameter Description**
0x00–0x07 0x08 (PA off)	Range 0–7: 7 = Max Output Power (default), 0 = Min Output Power 8 = PA Off (leakage) **Note**: Value is written as is. Make sure to configure legal values only.

Reserved	Size: 4 bytes
Value	**Parameter Description**
0x00000000	Reserved

Reserved	Size: 4 bytes
Value	**Parameter Description**
0x00000000	Reserved

Return Parameters:

Status	Size: 1 byte
Value	**Parameter Description**
0x00 0x01–0xFF	Command succeeded Command failed

Events Generated:

Command Complete Event

4.1.3.5 HCI_VS_DRPb_Tester_Con_RX (0xFDCB)

Command	Opcode	Command Parameters	Return Parameters
HCI_VS_DRPb_Tester_Con_RX	0xFDCB	Frequency RX mode Modulation type	Status

Description

This command operates the RF transceiver in continuous reception mode (most likely used in regulatory and standardization procedures and tests, such as FCC and ETSI certifications). By activating the VS, the RX START sequence code runs, using the configured frequency, RX mode, and modulation type.

NOTE:

1. Unlike a normal connection, the PHY configuration does not take place in the MAC. Instead, the reception parameters are set by the VS command itself (RX mode, frequency, and so on), directly to the registers.
2. Periodic calibration activity might interrupt the continuous transmission activity. Recall disabling periodic calibration activity when continuous transmission duration is longer than the periodic calibration period duration:

```
# Disable periodic calibration
Send_HCI_VS_DRPb_Enable_RF_Calibration_Enhanced 0xFDFB, 1, 0xFF,
0x00000000, 0x01

Wait_HCI_Command_Complete_VS_DRPb_Enable_RF_Calibration_Enhanced_Event
5000, any, HCI_VS_DRPb_Enable_RF_Calibration_Enhanced, 0x00

# Disable RXRX periodic calibration
Send_HCI_VS_DRPb_Enable_RF_Calibration_Enhanced 0xFDFB, 3, 0xFF,
0x00000000, 0x01

Wait_HCI_Command_Complete_VS_DRPb_Enable_RF_Calibration_Enhanced_Event
5000, any, HCI_VS_DRPb_Enable_RF_Calibration_Enhanced, 0x00

# Disable RXRX LNA (periodic) calibration
Send_HCI_VS_DRPb_Enable_RF_Calibration_Enhanced 0xFDFB, 4, 0xFF,
0x00000000, 0x01

Wait_HCI_Command_Complete_VS_DRPb_Enable_RF_Calibration_Enhanced_Event
5000, any, HCI_VS_DRPb_Enable_RF_Calibration_Enhanced, 0x00
```

Command Parameters:

Frequency	Size: 2 bytes
Value	**Parameter Description**
2402–2480	Reception frequency in MHz

RX Mode	Size: 1 byte
Value	**Parameter Description**
0x00–0x03	0x00 = Connection mode 0x01 = Reserved 0x02 = Reserved 0x03 = Scan mode

Modulation Type	Size: 1 byte
Value	**Parameter Description**
0x00–0x05	0x00 = CW 0x01 = BT BR (GFSK) 0x02 = BT EDR 2MB (π/4-DQPSK) 0x03 = BT EDR 3MB (8-DPSK) 0x04 = BT LE (BLE, GFSK) 0x05 = ANT (GFSK)

Return Parameters:

Status	Size: 1 byte
Value	**Parameter Description**
0x00 0x01–0xFF	Command succeeded Command failed

Events Generated:

Command Complete Event

4.1.3.6 HCI_VS_DRPb_Tester_Packet_TX_RX (0xFDCC)

Command	Opcode	Command Parameters	Return Parameters
HCI_VS_DRPb_Tester_Packet _TX_RX	0xFDCC	ACL TX packet type Frequency mode TX single frequency RX single frequency ACL TX data pattern Reserved ACL packet data length Power level index Disable whitening PRBS9 Initialization value	Status

Description

This command operates the RF transceiver in continuous reception mode (most likely used in regulatory and standardization procedures and tests, such as FCC and ETSI certifications). Activating the VS runs the RX START sequence code using the configured frequency, RX mode, and modulation type.

This command emulates Bluetooth connection mode. Connection does not require a setup procedure.

Command Parameters:

ACL TX Packet Type	Size: 1 byte
Value	**Parameter Description**
0x00–0x0B	0x00 = DM1 (default) 0x01 = DH1 0x02 = DM3 0x03 = DH3 0x04 = DM5 0x05 = DH5 0x06 = 2-DH1 0x07 = 2-DH3 0x08 = 2-DH5 0x09 = 3-DH1 0x0A = 3-DH3 0x0B = 3-DH5

Frequency Mode	Size: 1 byte
Value	**Parameter Description**
0x00 0x03 (default)	Hopping Single frequency

TX Single Frequency	Size: 2 bytes
Value	**Parameter Description**
2402–2480 0xFFFF	Transmission frequency in MHz No TX

RX Single Frequency	Size: 2 bytes
Value	**Parameter Description**
2402–2480 0xFFFF	Transmission frequency in MHz No RX

ACL TX Packet Data pattern	Size: 1 byte
Value	**Parameter Description**
0x00 0x01 0x02 0x03 0x04 0x05	All 0 All 1 ZOZO (101010101010101010) (default) FOFO (1111000011110000) Ordered (1, 2, 3, 4, and so on) PRBS9 (pseudo-random bit sequence)

Reserved	Size: 1 byte
Value	**Parameter Description**
0x00	Reserved

ACL Packet Data Length	Size: 2 bytes
Value	**Parameter Description**
DM1: 0–17 DH1: 0–27 (default) DM3: 0–121 DH3: 0–183 DM5: 0–224 DH5: 0–339 2-DH1: 0–54 2-DH3: 0–367 2-DH5: 0–679 3-DH1: 0–83 3-DH3: 0–552 3-DH5: 0–1021	ACL packet data length in bytes

Power Level Index	Size: 1 byte
Value	**Parameter Description**
0x00–0x07 0x08 (PA off)	Range 0–7: 7 = Max Output Power (default); 0 = Min Output; Power 8 = PA Off (leakage) **Note**: Value is written as is. Make sure configuring only legal values.

Disable Whitening	Size: 1 byte
Value	**Parameter Description**
0x00 0x01	Enable whitening Disable whitening

PRBS9 Initialization value	Size: 2 bytes
Value	**Parameter Description**
0x0000–0x01FF	Used only in PRBS9 patterns to initialize PRBS9 data

4.1.3.7 HCI_VS_DRPb_Reset (0xFD88)

Command	Opcode	Command Parameters	Return Parameters
HCI_VS_DRPb_Reset	0xFD88	None	Status

Description:

This VS command is designed to run the firmware sequence to reset all DRP (PHY) register values and bring them back to initial state.

This command can be used to stop the continuous transmission or continuous reception initiated through HCI_VS_DRPb_Tester_Con_TX or HCI_VS_DRPb_Tester_Con_RX, respectively.

Return Parameters:

Status	Size: 1 byte
Value	**Parameter Description**
0x00 0x01–0xFF	Command succeeded Command failed

Events Generated:

Command Complete Event

4.1.3.8 HCI_VS_DRPb_BER_Meter_Start (0xFD8B)

Command	Opcode	Command Parameters	Return Parameters
HCI_VS_DRPb_BER_Meter_Start	0xFD8B	Frequency channel Reserved BD Address LT Address ACL Packet Type Packet Length Number of Packets PRBS Initialize POLL Period	Status

Description:

This command activates the internal software-based BER meter, while the device receives a predefined pseudo-random binary sequence (PRBS) pattern created by another device or an I-Q RF modulator. The VS command controls the reception frequency and the packet-connection parameters, turns on a continuous RX, and triggers the BER meter into operation so the BER result is logged out to a user interface (such as Logger).

Command Parameters:

Frequency Channel	Size: 1 byte
Value	**Parameter Description**
0 ÷ 78	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	Size: 6 bytes
Value	**Parameter Description**
0x00	Reserved

BD Address	Size: 6 bytes
Value	**Parameter Description**
0x000000000000 ÷ 0xFFFFFFFFFFFF	BD address of the device being tested by its internal BER meter

LT Address	Size: 1 byte
Value	**Parameter Description**
0 ÷ 5	Address of the device within a specific Piconet

ACL Packet Type	Size: 1 byte
Value	**Parameter Description**
0x00 ÷ 0x0B	0x00 = DM1 0x01 = DH1 (default) 0x02 = DM3 0x03 = DH3 0x04 = DM5 0x05 = DH5 0x06 = 2-DH1 0x07 = 2-DH3 0x08 = 2-DH5 0x09 = 3-DH1 0x0A = 3-DH3 0x0B = 3-DH5

Packet Length	Size: 2 bytes
Value	**Parameter Description**
0x0000 ÷ 0x03FD	Number of bytes per packet, according to packet type DM1: 0–17 DH1: 0–27 DM3: 0–121 DH3: 0–183 DM5: 0–224 DH5: 0–339 2-DH1: 0–54 2-DH3: 0–367 2-DH5: 0–679 3-DH1: 0–83 3-DH3: 0–552 3-DH5: 0–1021

Number of Packets	Size: 2 bytes
Value	**Parameter Description**
0x0000 ÷ 0xFFFF	Number of packets from 0 to 65,535

PRBS Initialization Value	Size: 2 bytes
Value	**Parameter Description**
0x0000 ÷ 0x01FF	Value from which the PRBS pattern generator must start

Poll Period	Size: 1 byte
Value	**Parameter Description**
0x00 ÷ 0xFF	Poll period in number of Bluetooth frames

Return Parameters:

Status	Size: 1 byte
Value	**Parameter Description**
0x00 0x01–0xFF	Command succeeded Command failed

Events Generated:

Command Complete Event

4.1.3.9 HCI_VS_DRP_Read_BER_Meter_Result (0xFD13)

Command	Opcode	Command Parameters	Return Parameters
HCI_VS_DRP_Read_BER_Meter_Result	0xFD13		Status Finished at least 1 test Packets received Total bits counted Number of error bits found

Description:

This command allows reading of the BER result produced by the internal software-based BER meter. The results are logged to the device HCI debug interface (Logger application). This command can be used instead of the logger to enable the use of the BER meter results in production testing where the Logger is not available.

Command Parameters: There are no command parameters.

Return Parameters:

Status	Size: 1 byte
Value	**Parameter Description**
0x00 0x01–0xFF	Command succeeded Command failed

Finished at Least 1 Test	Size: 1 byte
Value	**Parameter Description**
0x00 0x01	First test has not been finished. Values are valid for current measurement.

Packets Received	Size: 2 byte
Value	**Parameter Description**
	Number of packets received in current measurement.

Total Bits Counted	Size: 4 byte
Value	**Parameter Description**
	Total number of bits counted.

Number of Error Bits Found	Size: 4 byte
Value	**Parameter Description**
	Number of bits in error in a single test cycle.

Events Generated:

Command Complete Event

4.1.4 Debug Commands

This section describes the debug commands.

4.1.4.1 HCI_VS_Set_Supported_Features (0xFF26)

Command	Opcode	Command Parameters	Return Parameters
HCI_VS_Set_Supported_Features	0xFF26	Byte Bit Support	Status

Description:

This command changes the supported features of the device.

Command Parameters:

Byte	Size: 1 byte
Value	**Parameter Description**
0x00 0x01 0x02 0x03 0x04 0x05 0x06 0x07	Byte 0 Byte 1 Byte 2 Byte 3 Byte 4 Byte 5 Byte 6 Byte 7

Bit	Size: 1 byte
Value	**Parameter Description**
0–7 0xXX	Single bit Whole byte value

Support	Size: 1 byte
Value	**Parameter Description**
0x00 0x01 0xFF	Not supported Supported Change whole byte

Return Parameters:

Status	Size: 1 byte
Value	**Parameter Description**
0x00 0x01–0xFF	Command succeeded Command failed

Events Generated:

Command Complete Event

4.1.4.2 HCI_VS_Get_System_Status (0xFE1F)

Command	Opcode	Command Parameters	Return Parameters
HCI_VS_Get_System_Status	0xFE1F	None	Status Software version X Software version Z Chip revision Chip mode Root Clock Slow clock used Process type detected ODP Process Deep-sleep mode Whitening mode CDC mode Self-test Hopping mode UART baud rate Temperature detected Index Temperature value FREF/TCXO clock Reserved Reserved

Description:

This command returns the current system parameters.

Return Parameters:

Status	Size: 1 byte
Value	**Parameter Description**
0x00 0x01–0xFF	Command succeeded Command failed

Software Version X	Size: 1 byte
Value	**Parameter Description**
0x01–0xFF	Major version of the software used.

Software Version Z	Size: 1 byte
Value	**Parameter Description**
0x01–0xFF	Internal software version.

Chip Revision	Size: 1 byte
Value	**Parameter Description**
0x00–0xFF	Hardware revision number.

Chip Mode	Size: 1 byte
Value	**Parameter Description**
0x00 0x01 0x02–0x05	Reserved for TI internal use TI mode Reserved for TI internal use

FREF	Size: 2 bytes
Value	**Parameter Description**
0x0000–0xFFFF	FREF in use (kHz)

Slow Clock Used	Size: 1 byte
Value	**Parameter Description**
0x00 0x01	Internal slow clock used External slow clock used

Process Type Detected	Size: 1 byte
Value	**Parameter Description**
0x00 0x01 0x02	Nominal process detected Weak process detected Strong process detected

ODP Process	Size: 1 byte
Value	**Parameter Description**
0x00 0x01 0x02	Nominal process detected Weak process detected Strong process detected

Deep-Sleep Mode	Size: 1 byte
Value	**Parameter Description**
0x00 0x01 0x02 0x03–0x08	Deep sleep disabled Reserved HCILL deep sleep enabled For future use

Whitening Mode	Size: 1 byte
Value	**Parameter Description**
0x00 0x01	Whitening enabled Whitening disabled

CDC Mode	Size: 1 byte
Value	**Parameter Description**
0x00 0x01	CDC disabled CDC enabled

Self-Test	Size: 1 byte
Value	**Parameter Description**
0x00 0x01	Self-test failed Self-test passed

Hopping Mode	Size: 1 byte
Value	**Parameter Description**
0x00 0x01 0x02 0x03	Frequency Hopping Single Frequency TX and RX Only TX Single Frequency Only RX Single Frequency

UART Baud Rate	Size: 4 bytes
Value	**Parameter Description**
0x00000000–0xFFFFFFFF	UART baud rate (bps)

Temperature Index	Size: 1 byte
Value	**Parameter Description**
0x00 0x01 0x02 0x03 0x04	Hot Room Cold Warm Cool

Temperature Detected	Size: 1 byte
Value	**Parameter Description**
0x00–0x7F 0xFF–0x80	Positive temperature value in Degrees Celsius. Negative temperature in Degrees Celsius.

I2C Status	Size: 1 byte
Value	**Parameter Description**
Bit 0 Bit 1 Bit 2	I2C Enabled EEPROM Connected Codec Connected

FREF/TCXO Clock	Size: 2 bytes
Value	**Parameter Description**
0x0000–0xFFFF	This parameter returns the clock rate in kHz.

Reserved	Size: 1 byte
Value	**Parameter Description**
	Reserved

Reserved	Size: 1 byte
Value	**Parameter Description**
	Reserved

4.1.4.3 HCI_VS_Read_RSSI (0xFDFC)

Command	Opcode	Command Parameters	Return Parameters
Send_HCI_VS_Read_RSSI	0xFDFC	Connection handle	Status Handle RSSI

Description:

This command returns the RSSI value for a specified connection handle.

NOTE: The Golden Range Threshold refers to an ideal range of RSSI values (–74 to –54). In some software, an RSSI value of 0 indicates that the RSSI value is within the Golden Range Threshold. This command does not support this feature, and will return the precise RSSI value irrespective of the Golden Range Threshold.

Command Parameters:

Connection Handle	Size: 1 byte
Value	**Parameter Description**
0x01–0x07	Connection handle

Return Parameters:

Status	Size: 1 byte
Value	**Parameter Description**
0x00 0x01–0xFF	Command succeeded Command failed

Handle	Size: 2 bytes
Value	**Parameter Description**
0x0001–0x0007	Connection handle

RSSI	Size: 1 byte
Value	**Parameter Description**
Signed integer	RSSI value

Events Generated:

Command Complete Event

4.1.5 Memory Access Commands

This section describes the memory access commands.

4.1.5.1 HCI_VS_Read_Hardware_Register (0xFF00)

Command	Opcode	Command Parameters	Return Parameters
HCI_VS_Read_Hardware_Register	0xFF00	Register address	Status Register value

Description:

This command returns the value of a specific hardware register.

Command Parameters:

Register Address	Size: 4 bytes
Value	**Parameter Description**
0xXXXXXXXX	Address of register

Return Parameters:

Status	Size: 1 byte
Value	**Parameter Description**
0x00 0x01–0xFF	Command succeeded Command failed

Register Value	Size: 2 bytes
Value	**Parameter Description**
0xXXXX	Value of register

Events Generated:

Command Complete Event

4.1.5.2 HCI_VS_Write_Hardware_Register (0xFF01)

Command	Opcode	Command Parameters	Return Parameters
HCI_VS_Write_Write_Register	0xFF01	Register address Register value	Status

Description:

This command assigns a value to a hardware register.

Command Parameters:

Register Address	Size: 4 bytes
Value	**Parameter Description**
0xXXXXXXXX	Address of register

Register Value	Size: 2 bytes
Value	**Parameter Description**
0xXXXX	Value to assign

Return Parameters:

Status	Size: 1 byte
Value	**Parameter Description**
0x00 0x01–0xFF	Command succeeded Command failed

Events Generated:

Command Complete Event

4.1.5.3 HCI_VS_Read_Modify_Write_Hardware_Register (0xFD09)

Command	Opcode	Command Parameters	Return Parameters
HCI_VS_Read_Modify_Write_Hardware_Register	0xFD09	Register address Register value Register mask	Status

Description:

This command assigns a value to a hardware register using a bit mask, thus changing only the requested bits.

Command Parameters:

Register Address	Size: 4 bytes
Value	**Parameter Description**
0xXXXXXXXX	Hardware register address (32 bits)

Register Value	Size: 2 bytes
Value	**Parameter Description**
0xXXXX	Value to be written. Bits that equal 0 in the mask are ignored.

Register Mask	Size: 2 bytes
Value	**Parameter Description**
0xXXXX	Bit mask of the bits to be overwritten. In every bit: 0 = No change; 1 = Change. For every bit that equals 1 in the mask, the write value is taken from the corresponding bit in the Value field.

Return Parameters:

Status	Size: 1 byte
Value	**Parameter Description**
0x00 0x01–0xFF	Command succeeded Command failed

Events Generated:

Command Complete Event

4.1.5.4 HCI_VS_Write_I2C_Register (0xFE0E)

Command	Opcode	Command Parameters	Return Parameters
HCI_VS_Write_I2C_Register	0xFE0E	Slave ID Reserved Working Frequency Sub Address Data Length Data	Status

Description:

Writes to the I2C register specified.

Command Parameters:

Slave ID	Size: 1 byte
Value	**Parameter Description**
0x00–0xFF	Configured to the I2C address of the slave for communication. Example: • 0x71: Codec 1 • 0x1A : Codec 2 • 0x50: EEPROM

Reserved	Size: 1 byte
Value	**Parameter Description**
0	Reserved. Use 0 for future compatibility.

Working Frequency	Size: 2 bytes
Value	**Parameter Description**
0x0064–0x0190	Sets transmission frequency in kHz. Range = 100 kHz–400 kHz Example: • CODEC speed, 400 kHz • EEPROM speed, 100 kHz

Subaddress	Size: 1 byte
Value	**Parameter Description**
0–255	Internal register address of the slave device to write to or read from.

Data Length	Size: 1 byte
Value	**Parameter Description**
0x01–0x10	Data length in bytes (Range: 1–16 bytes).

Data	Size: 16 bytes
Value	**Parameter Description**
	Data stream in hex, from left to right.

Return Parameters:

Status	Size: 1 byte
Value	**Parameter Description**
0x00 0x01–0xFF	Command succeeded Command failed

Events Generated:

Command Complete Event

4.1.5.5 HCI_VS_Read_Memory (0xFF02)

Command	Opcode	Command Parameters	Return Parameters
HCI_VS_Read_Memory	0xFF02	Memory address Type	Status Memory value

Description:

This command returns a specific memory address value.

Command Parameters:

Memory Address	Size: 4 bytes
Value	**Parameter Description**
0xXXXXXXXX	Legal address in memory

Type	Size: 1 byte
Value	**Parameter Description**
0x01 0x02 0x04	UINT8 UINT16 UINT32

Return Parameters:

Status	Size: 1 byte
Value	**Parameter Description**
0x00 0x01–0xFF	Command succeeded Command failed

Memory Value	Size: 1, 2, 4 bytes
Value	**Parameter Description**
0xXXXXXXXX	Any value

Events Generated:

Command Complete Event

4.1.5.6 HCI_VS_Write_Memory (0xFF03)

Command	Opcode	Command Parameters	Return Parameters
HCI_VS_Write_Memory	0xFF03	Memory address Type Value	Status

Description:

This command writes a value into a specific memory address.

Command Parameters:

Memory Address	Size: 4 bytes
Value	**Parameter Description**
0xXXXXXXXX	Memory address

Type	Size: 1 byte
Value	**Parameter Description**
0x01 0x02 0x04	UINT8 UINT16 UINT32

Value	Size: 4 bytes
Value	**Parameter Description**
0xXXXXXXXX	Types 1, 2 – MS bytes don't care

Return Parameters:

Status	Size: 1 byte
Value	**Parameter Description**
0x00 0x01–0xFF	Command succeeded Command failed

Events Generated:

Command Complete Event

4.1.5.7 HCI_VS_Read_Memory_Block (0xFF04)

Command	Opcode	Command Parameters	Return Parameters
HCI_VS_Read_Memory_Block	0xFF04	Start memory address Size (in bytes)	Status Memory block value

Description:

This command returns a specific memory block value.

Command Parameters:

Start Memory Address	Size: 4 bytes
Value	**Parameter Description**
0xXXXXXXXX	Any legal address

Size	Size: 1 byte
Value	**Parameter Description**
0x01–0xFA	Any value from 1 to 250 bytes

Return Parameters:

Status	Size: 1 byte
Value	**Parameter Description**
0x00 0x01–0xFF	Command succeeded Command failed

Memory Block Value	Size: 1–250 bytes
Value	**Parameter Description**
	Value of specified memory block

Events Generated:

Command Complete Event

4.1.5.8 HCI_VS_Write_Memory_Block (0xFF05)

Command	Opcode	Command Parameters	Return Parameters
HCI_VS_Read_Write_Memory_Block	0xFF05	Start memory address Size Values	Status

Description:

This command writes a value into a specific memory block address.

Command Parameters:

Start Memory Address	Size: 4 bytes
Value	**Parameter Description**
0xXXXXXXXX	Any legal address

Size (in bytes)	Size: 1 byte
Value	**Parameter Description**
0x01–0xFA1	Any value from 1 to 250 bytes

Values	Size: 1–250 bytes
Value	**Parameter Description**
	Addresses increase from left to right.

Return Parameters:

Status	Size: 1 byte
Value	**Parameter Description**
0x00 0x01–0xFF	Command succeeded Command failed

Events Generated:

Command Complete Event

5 Related Documentation

Table 7 lists the reference documents referred to in this user's guide.

Table 7. Reference Documents

Document	Revision	Date
1. *Specification of the Bluetooth System*	1.1	22 Feb 2001
2. *Specification of the Bluetooth System*	1.2	05 Nov 2003
3. *Specification of the Bluetooth System*	4.0	30 June 2010

5.1 Trademarks

Revision History

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

Changes from February 29, 2016 to October 17, 2017 **Page**

- Changed *Return Parameters* to *Status* in *HCI_VS_Write_CODEC_Config (0xFD06)* 23
- Changed *Parameter Description* in *Frame-Sync Edge* table 24
- Changed *Parameter Description* in *Channel X Data Out Edge* table 25
- Changed *Parameter Description* in *Channel X Data In Edge* table 25
- Changed *Return Parameters* to *Status* in *HCI_VS_Write_CODEC_Config_Enhanced (0xFD07)* 26
- Changed from *1 byte* to *4 byte* in the *Number of Error Bits Found* table 53

Changes from October 22, 2015 to February 29, 2016 **Page**

- Added *HCI_VS_Clock_Set_Timeout (0xFE24)* 22

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