lsusb -vv -d 046d:0837
lsusb -v

Control Transfers

Control transfers are typically used for command and status operations. They are essential to set up a USB device with **all enumeration functions being performed using control transfers**

No code is required to run this. If you need to install gstreamer:

```
sudo apt-get install gstreamer1.0-tools gstreamer1.0-plugins-ugly gstreamer1.0-plugins-bad
```

To view a live preview:

```
gst-launch-1.0 v4l2src device=/dev/video0 ! xvimagesink
```

If you wish to use fixed scaling, you can use the `videoscale` element and leverage the lighter-weight `ximagesink`:

```
gst-launch-1.0 v4l2src device=/dev/video0 ! video/x-raw,format=UYVY \
! videoscale ! video/x-raw,width=640,height=480 ! videoconvert ! ximagesink
```

Name

usb_control_msg — Builds a control urb, sends it off and waits for completion

Synopsis

int **usb_control_msg** (struct usb_device * *dev*,unsigned int *pipe*,__u8 *request*,__u8 *requesttype*,__u16 *value*,__u16 *index*,void * *data*,__u16 *size*,int *timeout*);

In UVC module the control transfer is look like this

```
usb_control_msg(dev->udev, pipe, query, type, cs << 8,
        unit << 8 | intfnum, data, size, timeout);
```

data = data[33] in uvc_set_video_ctrl this array will be filled

in this data array bFrameIndex , bmControls ,bBitsperPixel, dwFrameInterval, ...!

Based on the **bFrameIndex** number the video resultion will be selected (**1920 X 1080**) etc.

MaxVideoFrameBufferSize = 1920*1080*width_multiplier is 2

                         = 960000

Based on the **bControlsize** 2bytes are considerded from the
bmControls (0x0000175b) .

Based on the bmControls : 0x00 0x00 0x17 0x5b

      hex to binary = 0001 0111 0101 1011

  D00 = 1 - **Brightness**
  D01 = 1 - **Contrast**
  D02 = 0 - Hue
  D03 = 1 - **Saturation**
  D04 = 1 - **Sharpness**
  D05 = 0 - Gamma
  D06 = 1 - **White Balance Temperature**
  D07 = 0 - White Balance Component
  D08 = 1 - **Backlight Compensation**
  D09 = 1 - **Gain**
  D10 = 1 - **Power Line Frequency**
  D11 = 0 - Hue, Auto
  D12 = 1 - **White Balance Temperature, Auto**
  D13 = 0 - White Balance Component, Auto
  D14 = 0 - Digital Multiplier
  D15 = 0 - Digital Multiplier Limit

Arguments

Dev: - pointer to the usb device to send the message to

pipe: - endpoint "pipe" to send the message to

request: - USB message request value

requesttype: - USB message request type value

value: - USB message value

index: - USB message index value

data: - pointer to the data to send

size: - length in bytes of the data to send

timeout: - time in msecs to wait for the message to complete before timing out (if 0 the wait is forever)

Context

Description

This function sends a simple control message to a specified endpoint and waits for the message to complete, or timeout.

If **successful**, it returns the number of bytes transferred, otherwise a negative error number.

Don't use this function from within an interrupt context, like a bottom half handler. If you need an asynchronous message, or need to send a message from **within** interrupt context, use `usb_submit_urb`. If a thread in your driver uses this call, make sure your `disconnect` method can wait for it to complete. Since you don't have a handle on the URB used, you can't cancel the request.

Based on **bAlternateSetting** number the **EP** (endpoint) noumber and **EP address** will be decided ,

The **bEndpointAddress** is **same** for different wMaxPacketSize , in this maxPacketSize haveing the no.of byte allowed through Endpoint and Multiplier value .

Endpoint is transfer at a time 1024 bytes only (its mean 11 bits)
One Endpoint multiple wMaxPacketSize s will be allowed .
Example:- wMaxPacketSize 0x0320   1x800 bytes
           wMaxPacketSize 0x1380   3x896 bytes
              ....   it contains **Data** and **Multiplier** value

psize = le16_to_cpu(ep->desc.wMaxPacketSize);

[psize is become 0x0320 or 0x1380]

psize   = (psize & 0x07ff) * (1 + ((psize >> 11) & 3));
       = (0x0320 & 0x07ff) * (1+((0x0320>>11)&3));
       = (0x0320) * (1 + 0)
       = 0x0320 is converted into decimal : 800 , 1 is a multiplier value
       =1 * 800 bytes can be transfer through Endpoint

Bus 003 Device 024: ID 046d:0837 Logitech, Inc. BCC950 ConferenceCam
Couldn't open device, some information will be missing
Device Descriptor:
  bLength   18
  bDescriptorType   1
  bcdUSB   2.00   // usb version
  bDeviceClass   239 Miscellaneous Device
  bDeviceSubClass   2 ?
  bDeviceProtocol   1 Interface Association

bMaxPacketSize0   64
idVendor   0x046d Logitech, Inc.
idProduct   0x0837 BCC950 ConferenceCam
bcdDevice   0.11
iManufacturer   0
iProduct   2
iSerial   0
bNumConfigurations   1 // no of configurations is 1
Configuration Descriptor:
  bLength   9
  bDescriptorType   2
  wTotalLength   2331
  bNumInterfaces   3
  bConfigurationValue   1
  iConfiguration   0
  bmAttributes   0x80
   (Bus Powered)
  MaxPower   500mA
  Interface Association:
   bLength   8
   bDescriptorType   11
   bFirstInterface   0
   bInterfaceCount   2
   bFunctionClass   14 Video
   bFunctionSubClass   3 Video Interface Collection
   bFunctionProtocol   0
   iFunction   0
  Interface Descriptor:
   bLength   9
   bDescriptorType   4
   bInterfaceNumber   0
   bAlternateSetting   0
   bNumEndpoints   1
   bInterfaceClass   14 Video
   bInterfaceSubClass   1 Video Control
   bInterfaceProtocol   0
   iInterface   0
   VideoControl Interface Descriptor: 1
    bLength   13
    bDescriptorType   36
    bDescriptorSubtype   1 (HEADER)
    bcdUVC   1.00   // uvc version
    wTotalLength   214
    dwClockFrequency   300.000000MHz
    bInCollection   1
    baInterfaceNr(0)   1
VideoControl Interface Descriptor:
    bLength   18
    bDescriptorType   36
    bDescriptorSubtype   2 (INPUT_TERMINAL)
    bTerminalID   1
    wTerminalType   0x0201 Camera Sensor

bAssocTerminal   0
          iTerminal   0
          wObjectiveFocalLengthMin   0
          wObjectiveFocalLengthMax   0
          wOcularFocalLength   0
          bControlSize   3   // it means bmControls has 3 bytes only
          bmControls   0x0002122e
hexdecimal formate to binary = 0000 0010 0001 0010 0010 1110
          ....
 Auto-Exposure Mode
          Auto-Exposure Priority
          Exposure Time (Absolute)
          Focus (Absolute)
          Zoom (Absolute)
          PanTilt (Relative)
          Focus, Auto
      VideoControl Interface Descriptor: 3
        bLength   11
        bDescriptorType   36
        bDescriptorSubtype   5 (PROCESSING_UNIT)
      Warning: Descriptor too short
        bUnitID   3
        bSourceID   1
        wMaxMultiplier   16384
        bControlSize   2
        bmControls   0x0000175b
      hex to binary = 0001 0111 0101 1011
        Brightness
          Contrast
          Saturation
          Sharpness
          White Balance Temperature
          Backlight Compensation
          Gain
          Power Line Frequency
          White Balance Temperature, Auto
        iProcessing   0
        bmVideoStandards   0x1b
          None
          NTSC - 525/60
          SECAM - 625/50
          NTSC - 625/50
      VideoControl Interface Descriptor: 4
        bLength   27
        bDescriptorType   36
        bDescriptorSubtype   6 (EXTENSION_UNIT)

[bUnitID number is decide the **guidExtensionCode**, this extension unit has 4 controls of size
(8,4,4,8 bytes.
GuidExtensionCode that is used to **identify vendors driver**.
It has 8 controls that are controlled by vendors driver (field **bNumControls**) , connected to unit
with ID , whitch is image sensor (input terminal) field **bNrlnPins** and **baSourceID**.]

bUnitID **6**
guidExtensionCode   {d09ee423-7811-314f-ae52-d2fb8a8d3b48}
bNumControl   10
bNrPins   1
baSourceID(0)   3
bControlSize   **2**
bmControls(0)   **0xff**
bmControls(1)   **0x03**
iExtension   0

VideoControl Interface Descriptor: 5
  bLength   27
  bDescriptorType   36
  bDescriptorSubtype   6 (EXTENSION_UNIT)
  bUnitID   **8**
  guidExtensionCode   {e48e6769-0f41-db40-a850-7420d7d8240e}
  bNumControl   7
  bNrPins   1
  baSourceID(0)   1
  bControlSize   **2**
  bmControls(0)   **0x3b**
  bmControls(1)   **0x03**
  iExtension   0
VideoControl Interface Descriptor: 6
  bLength   28
  bDescriptorType   36
  bDescriptorSubtype   6 (EXTENSION_UNIT)
  bUnitID   **9**
  guidExtensionCode   {a94c5d1f-11de-8744-840d-50933c8ec8d1}
  bNumControl   16
  bNrPins   1
  baSourceID(0)   1
  bControlSize   **3**
  bmControls(0)   **0xf3**
  bmControls(1)   **0xff**
  bmControls(2)   **0x03**
  iExtension   0
VideoControl Interface Descriptor: 7
  bLength   27
  bDescriptorType   36
  bDescriptorSubtype   6 (EXTENSION_UNIT)
  bUnitID   **10**
  guidExtensionCode   {1502e449-34f4-fe47-b158-0e885023e51b}
  bNumControl   7
  bNrPins   1
  baSourceID(0)   1
  bControlSize   **2**
  bmControls(0)   **0xaa**
  bmControls(1)   **0x07**
  iExtension   0
VideoControl Interface Descriptor: 8

```
    bLength              27
    bDescriptorType      36
    bDescriptorSubtype    6 (EXTENSION_UNIT)
    bUnitID              11
    guidExtensionCode        {212de5ff-3080-2c4e-82d9-f587d00540bd}
    bNumControl           6
    bNrPins               1
    baSourceID( 0)        1
    bControlSize          2
    bmControls( 0)     0x07
    bmControls( 1)     0x83
    iExtension            0
  VideoControl Interface Descriptor:                 9
    bLength              27
    bDescriptorType      36
    bDescriptorSubtype    6 (EXTENSION_UNIT)
    bUnitID              12
    guidExtensionCode        {41769ea2-04de-e347-8b2b-f4341aff003b}
    bNumControl          11
    bNrPins               1
    baSourceID( 0)        3
    bControlSize          2
    bmControls( 0)     0x07
    bmControls( 1)     0x7f
    iExtension            0
  VideoControl Interface Descriptor:                 10
    bLength               9
    bDescriptorType      36
    bDescriptorSubtype    3 (OUTPUT_TERMINAL)
    bTerminalID           4
    wTerminalType     0x0101 USB Streaming
    bAssocTerminal        0
    bSourceID             3
    iTerminal             0
  Endpoint Descriptor:
    bLength               7
    bDescriptorType       5
    bEndpointAddress    0x83  EP 3 IN
    bmAttributes          3
      Transfer Type         Interrupt
      Synch Type            None
      Usage Type            Data
    wMaxPacketSize    0x0040  1x 64 bytes
    bInterval             8
Interface Descriptor:
  bLength                 9
  bDescriptorType         4
  bInterfaceNumber        1
  bAlternateSetting       0
  bNumEndpoints           0
  bInterfaceClass        14 Video
  bInterfaceSubClass      2 Video Streaming
```

```
     bInterfaceProtocol      0
     iInterface             0
     VideoStreaming Interface Descriptor:
      bLength                15
      bDescriptorType                36
      bDescriptorSubtype              1 (INPUT_HEADER)
      bNumFormats                2
      wTotalLength              1869
      bEndPointAddress              129
      bmInfo               0
      bTerminalLink              4
      bStillCaptureMethod            0
      bTriggerSupport              0
      bTriggerUsage              0
```

bControlSize   1
bmaControls(0)   27
bmaControls(1)   27

```
     VideoStreaming Interface Descriptor:
      bLength                27
      bDescriptorType                36
      bDescriptorSubtype              4 (FORMAT_UNCOMPRESSED)
```
bFormatIndex   1

bNumFrameDescriptors   19   // this descriptor will deside the no of bFrameIndex s
are present.

```
      guidFormat                {59555932-0000-1000-8000-00aa00389b71}
      bBitsPerPixel              16
      bDefaultFrameIndex            1
      bAspectRatioX              0
      bAspectRatioY              0
      bmInterlaceFlags            0x00
       Interlaced stream or variable: No
       Fields per frame: 2 fields
       Field 1 first: No
       Field pattern: Field 1 only
      bCopyProtect              0
     VideoStreaming Interface Descriptor:
      bLength                54
      bDescriptorType                36
      bDescriptorSubtype              5 (FRAME_UNCOMPRESSED)
```
bFrameIndex   1

  // Based on **bFrameIndex** number , the **wWidth** and **wHeight** will be send to the device

```
    bmCapabilities              0x00
       Still image unsupported
      wWidth                640
      wHeight                480
      dwMinBitRate              24576000
      dwMaxBitRate              147456000
      dwMaxVideoFrameBufferSize      614400
      dwDefaultFrameInterval        333333
      bFrameIntervalType              7
      dwFrameInterval( 0)          333333
```

```
                  dwFrameInterval( 1)        416666
                  dwFrameInterval( 2)        500000
                  dwFrameInterval( 3)        666666
                  dwFrameInterval( 4)       1000000
                  dwFrameInterval( 5)       1333333
                  dwFrameInterval( 6)       2000000
VideoStreaming Interface Descriptor:
  bLength                     54
  bDescriptorType             36
  bDescriptorSubtype           5 (FRAME_UNCOMPRESSED)
  bFrameIndex                  2
  bmCapabilities             0x00
    Still image unsupported
  wWidth                     160
  wHeight                     90
  dwMinBitRate              1152000
  dwMaxBitRate              6912000
  dwMaxVideoFrameBufferSize     28800
  dwDefaultFrameInterval       333333
  bFrameIntervalType           7
  dwFrameInterval( 0)        333333
  dwFrameInterval( 1)        416666
  dwFrameInterval( 2)        500000
  dwFrameInterval( 3)        666666
  dwFrameInterval( 4)       1000000
  dwFrameInterval( 5)       1333333
  dwFrameInterval( 6)       2000000
VideoStreaming Interface Descriptor:
  bLength                     54
  bDescriptorType             36
  bDescriptorSubtype           5 (FRAME_UNCOMPRESSED)
  bFrameIndex                  3
  bmCapabilities             0x00
    Still image unsupported
  wWidth                     160
  wHeight                    120
  dwMinBitRate              1536000
  dwMaxBitRate              9216000
  dwMaxVideoFrameBufferSize     38400
  dwDefaultFrameInterval       333333
  bFrameIntervalType           7
  dwFrameInterval( 0)        333333
  dwFrameInterval( 1)        416666
  dwFrameInterval( 2)        500000
  dwFrameInterval( 3)        666666
  dwFrameInterval( 4)       1000000
  dwFrameInterval( 5)       1333333
  dwFrameInterval( 6)       2000000
VideoStreaming Interface Descriptor:
  bLength                     54
  bDescriptorType             36
  bDescriptorSubtype           5 (FRAME_UNCOMPRESSED)
```

bFrameIndex **4**
bmCapabilities   0x00
  Still image unsupported
wWidth   176
wHeight   144
dwMinBitRate   2027520
dwMaxBitRate   12165120
dwMaxVideoFrameBufferSize   50688
dwDefaultFrameInterval   333333
bFrameIntervalType   7
dwFrameInterval(0)   333333
dwFrameInterval(1)   416666
dwFrameInterval(2)   500000
dwFrameInterval(3)   666666
dwFrameInterval(4)   1000000
dwFrameInterval(5)   1333333
dwFrameInterval(6)   2000000
VideoStreaming Interface Descriptor:
  bLength   54
  bDescriptorType   36
  bDescriptorSubtype   5 (FRAME_UNCOMPRESSED)
  bFrameIndex **5**
  bmCapabilities   0x00
   Still image unsupported
  wWidth   320
  wHeight   180
  dwMinBitRate   4608000
  dwMaxBitRate   27648000
  dwMaxVideoFrameBufferSize   115200
  dwDefaultFrameInterval   333333
  bFrameIntervalType   7
  dwFrameInterval(0)   333333
  dwFrameInterval(1)   416666
  dwFrameInterval(2)   500000
  dwFrameInterval(3)   666666
  dwFrameInterval(4)   1000000
  dwFrameInterval(5)   1333333
  dwFrameInterval(6)   2000000
VideoStreaming Interface Descriptor:
  bLength   54
  bDescriptorType   36
  bDescriptorSubtype   5 (FRAME_UNCOMPRESSED)
  bFrameIndex **6**
  bmCapabilities   0x00
   Still image unsupported
  wWidth   320
  wHeight   240
  dwMinBitRate   6144000
  dwMaxBitRate   36864000
  dwMaxVideoFrameBufferSize   153600
  dwDefaultFrameInterval   333333
  bFrameIntervalType   7

dwFrameInterval(0)   333333
        dwFrameInterval(1)   416666
        dwFrameInterval(2)   500000
        dwFrameInterval(3)   666666
        dwFrameInterval(4)   1000000
        dwFrameInterval(5)   1333333
        dwFrameInterval(6)   2000000
VideoStreaming Interface Descriptor:
  bLength   54
  bDescriptorType   36
  bDescriptorSubtype   5 (FRAME_UNCOMPRESSED)
  bFrameIndex   7
  bmCapabilities   0x00
    Still image unsupported
  wWidth   352
  wHeight   288
  dwMinBitRate   8110080
  dwMaxBitRate   48660480
  dwMaxVideoFrameBufferSize   202752
  dwDefaultFrameInterval   333333
  bFrameIntervalType   7
  dwFrameInterval(0)   333333
  dwFrameInterval(1)   416666
  dwFrameInterval(2)   500000
  dwFrameInterval(3)   666666
  dwFrameInterval(4)   1000000
  dwFrameInterval(5)   1333333
  dwFrameInterval(6)   2000000
VideoStreaming Interface Descriptor:
  bLength   54
  bDescriptorType   36
  bDescriptorSubtype   5 (FRAME_UNCOMPRESSED)
  bFrameIndex   8
  bmCapabilities   0x00
    Still image unsupported
  wWidth   432
  wHeight   240
  dwMinBitRate   8294400
  dwMaxBitRate   49766400
  dwMaxVideoFrameBufferSize   207360
  dwDefaultFrameInterval   333333
  bFrameIntervalType   7
  dwFrameInterval(0)   333333
  dwFrameInterval(1)   416666
  dwFrameInterval(2)   500000
  dwFrameInterval(3)   666666
  dwFrameInterval(4)   1000000
  dwFrameInterval(5)   1333333
  dwFrameInterval(6)   2000000
VideoStreaming Interface Descriptor:
  bLength   54
  bDescriptorType   36

```
    bDescriptorSubtype           5 (FRAME_UNCOMPRESSED)
    bFrameIndex                  9
    bmCapabilities            0x00
      Still image unsupported
    wWidth                    640
    wHeight                   360
    dwMinBitRate              18432000
    dwMaxBitRate              110592000
    dwMaxVideoFrameBufferSize     460800
    dwDefaultFrameInterval        333333
    bFrameIntervalType            7
    dwFrameInterval( 0)       333333
    dwFrameInterval( 1)       416666
    dwFrameInterval( 2)       500000
    dwFrameInterval( 3)       666666
    dwFrameInterval( 4)       1000000
    dwFrameInterval( 5)       1333333
    dwFrameInterval( 6)       2000000
  VideoStreaming Interface Descriptor:
    bLength                   54
    bDescriptorType           36
    bDescriptorSubtype           5 (FRAME_UNCOMPRESSED)
    bFrameIndex               10
    bmCapabilities            0x00
      Still image unsupported
    wWidth                    800
    wHeight                   448
    dwMinBitRate              28672000
    dwMaxBitRate              172032000
    dwMaxVideoFrameBufferSize     716800
    dwDefaultFrameInterval        333333
    bFrameIntervalType            7
    dwFrameInterval( 0)       333333
    dwFrameInterval( 1)       416666
    dwFrameInterval( 2)       500000
    dwFrameInterval( 3)       666666
    dwFrameInterval( 4)       1000000
    dwFrameInterval( 5)       1333333
    dwFrameInterval( 6)       2000000
  VideoStreaming Interface Descriptor:
    bLength                   50
    bDescriptorType           36
    bDescriptorSubtype           5 (FRAME_UNCOMPRESSED)
    bFrameIndex               11
    bmCapabilities            0x00
      Still image unsupported
    wWidth                    800
    wHeight                   600
    dwMinBitRate              38400000
    dwMaxBitRate              184320000
    dwMaxVideoFrameBufferSize     960000
    dwDefaultFrameInterval        416666
```

```
      bFrameIntervalType              6
      dwFrameInterval( 0)         416666
      dwFrameInterval( 1)         500000
      dwFrameInterval( 2)         666666
      dwFrameInterval( 3)        1000000
      dwFrameInterval( 4)        1333333
      dwFrameInterval( 5)        2000000
    VideoStreaming Interface Descriptor:
      bLength                     50
      bDescriptorType             36
      bDescriptorSubtype           5 (FRAME_UNCOMPRESSED)
      bFrameIndex                 12
      bmCapabilities            0x00
        Still image unsupported
      wWidth                     864
      wHeight                    480
      dwMinBitRate           33177600
      dwMaxBitRate          159252480
      dwMaxVideoFrameBufferSize     829440
      dwDefaultFrameInterval      416666
      bFrameIntervalType              6
      dwFrameInterval( 0)         416666
      dwFrameInterval( 1)         500000
      dwFrameInterval( 2)         666666
      dwFrameInterval( 3)        1000000
      dwFrameInterval( 4)        1333333
      dwFrameInterval( 5)        2000000
    VideoStreaming Interface Descriptor:
      bLength                     42
      bDescriptorType             36
      bDescriptorSubtype           5 (FRAME_UNCOMPRESSED)
      bFrameIndex                 13
      bmCapabilities            0x00
        Still image unsupported
      wWidth                     960
      wHeight                    720
      dwMinBitRate           55296000
      dwMaxBitRate          165888000
      dwMaxVideoFrameBufferSize    1382400
      dwDefaultFrameInterval      666666
      bFrameIntervalType              4
      dwFrameInterval( 0)         666666
      dwFrameInterval( 1)        1000000
      dwFrameInterval( 2)        1333333
      dwFrameInterval( 3)        2000000
    VideoStreaming Interface Descriptor:
      bLength                     42
      bDescriptorType             36
      bDescriptorSubtype           5 (FRAME_UNCOMPRESSED)
      bFrameIndex                 14
      bmCapabilities            0x00
        Still image unsupported
```

```
    wWidth                  1024
    wHeight                 576
    dwMinBitRate            47185920
    dwMaxBitRate            141557760
    dwMaxVideoFrameBufferSize    1179648
    dwDefaultFrameInterval       666666
    bFrameIntervalType          4
    dwFrameInterval( 0)       666666
    dwFrameInterval( 1)      1000000
    dwFrameInterval( 2)      1333333
    dwFrameInterval( 3)      2000000
 VideoStreaming Interface Descriptor:
    bLength                 38
    bDescriptorType              36
    bDescriptorSubtype           5 (FRAME_UNCOMPRESSED)
    bFrameIndex                 15
    bmCapabilities             0x00
      Still image unsupported
    wWidth                  1280
    wHeight                 720
    dwMinBitRate            73728000
    dwMaxBitRate            147456000
    dwMaxVideoFrameBufferSize    1843200
    dwDefaultFrameInterval      1000000
    bFrameIntervalType          3
    dwFrameInterval( 0)      1000000
    dwFrameInterval( 1)      1333333
    dwFrameInterval( 2)      2000000
 VideoStreaming Interface Descriptor:
    bLength                 34
    bDescriptorType              36
    bDescriptorSubtype           5 (FRAME_UNCOMPRESSED)
    bFrameIndex                 16
    bmCapabilities             0x00
      Still image unsupported
    wWidth                  1600
    wHeight                 896
    dwMinBitRate            114688000
    dwMaxBitRate            172032000
    dwMaxVideoFrameBufferSize    2867200
    dwDefaultFrameInterval      1333333
    bFrameIntervalType          2
    dwFrameInterval( 0)      1333333
    dwFrameInterval( 1)      2000000
 VideoStreaming Interface Descriptor:
    bLength                 30
    bDescriptorType              36
    bDescriptorSubtype           5 (FRAME_UNCOMPRESSED)
    bFrameIndex                 17
    bmCapabilities             0x00
      Still image unsupported
    wWidth                  1920
```

```
        wHeight                 1080
        dwMinBitRate            165888000
        dwMaxBitRate            165888000
        dwMaxVideoFrameBufferSize    4147200
        dwDefaultFrameInterval       2000000
        bFrameIntervalType           1
        dwFrameInterval( 0)          2000000
    VideoStreaming Interface Descriptor:
        bLength                 30
        bDescriptorType               36
        bDescriptorSubtype             5 (FRAME_UNCOMPRESSED)
        bFrameIndex                   18
        bmCapabilities            0x00
          Still image unsupported
        wWidth                  2304
        wHeight                 1296
        dwMinBitRate            238878720
        dwMaxBitRate            238878720
        dwMaxVideoFrameBufferSize    5971968
        dwDefaultFrameInterval       4999998
        bFrameIntervalType           1
        dwFrameInterval( 0)          4999998
    VideoStreaming Interface Descriptor:
        bLength                 30
        bDescriptorType               36
        bDescriptorSubtype             5 (FRAME_UNCOMPRESSED)
        bFrameIndex                   19
        bmCapabilities            0x00
          Still image unsupported
        wWidth                  2304
        wHeight                 1536
        dwMinBitRate            283115520
        dwMaxBitRate             283115520
        dwMaxVideoFrameBufferSize    7077888
        dwDefaultFrameInterval       4999998
        bFrameIntervalType           1
        dwFrameInterval( 0)          4999998
    VideoStreaming Interface Descriptor:
        bLength                  6
        bDescriptorType               36
        bDescriptorSubtype            13 (COLORFORMAT)
        bColorPrimaries            1 (BT.709,sRGB)
        bTransferCharacteristics     1 (BT.709)
        bMatrixCoefficients          4 (SMPTE 170M (BT.601))
    VideoStreaming Interface Descriptor:
        bLength                 11
        bDescriptorType               36
        bDescriptorSubtype             6 (FORMAT_MJPEG)
        bFormatIndex               2
        bNumFrameDescriptors          17
        bFlags                   1
          Fixed-size samples: Yes
```

```
    bDefaultFrameIndex              1
   bAspectRatioX                0
   bAspectRatioY                0
   bmInterlaceFlags          0x00
     Interlaced stream or variable: No
     Fields per frame: 1 fields
     Field 1 first: No
     Field pattern: Field 1 only
     bCopyProtect               0
 VideoStreaming Interface Descriptor:
   bLength                   54
   bDescriptorType              36
   bDescriptorSubtype          7 (FRAME_MJPEG)
   bFrameIndex               1
   bmCapabilities            0x00
     Still image unsupported
   wWidth                   640
   wHeight                  480
   dwMinBitRate             24576000
   dwMaxBitRate             147456000
   dwMaxVideoFrameBufferSize     614400
   dwDefaultFrameInterval       333333
   bFrameIntervalType            7
   dwFrameInterval( 0)        333333
   dwFrameInterval( 1)        416666
   dwFrameInterval( 2)        500000
   dwFrameInterval( 3)        666666
   dwFrameInterval( 4)       1000000
   dwFrameInterval( 5)       1333333
   dwFrameInterval( 6)       2000000
 VideoStreaming Interface Descriptor:
   bLength                   54
   bDescriptorType              36
   bDescriptorSubtype          7 (FRAME_MJPEG)
   bFrameIndex               2
   bmCapabilities            0x00
     Still image unsupported
   wWidth                   160
   wHeight                   90
   dwMinBitRate             1152000
   dwMaxBitRate             6912000
   dwMaxVideoFrameBufferSize     28800
   dwDefaultFrameInterval       333333
   bFrameIntervalType            7
   dwFrameInterval( 0)        333333
   dwFrameInterval( 1)        416666
   dwFrameInterval( 2)        500000
   dwFrameInterval( 3)        666666
   dwFrameInterval( 4)       1000000
   dwFrameInterval( 5)       1333333
   dwFrameInterval( 6)       2000000
 VideoStreaming Interface Descriptor:
```

```
        bLength                    54
        bDescriptorType                36
        bDescriptorSubtype              7 (FRAME_MJPEG)
        bFrameIndex                 3
        bmCapabilities             0x00
          Still image unsupported
        wWidth                    160
        wHeight                   120
        dwMinBitRate            1536000
        dwMaxBitRate            9216000
        dwMaxVideoFrameBufferSize      38400
        dwDefaultFrameInterval      333333
        bFrameIntervalType             7
        dwFrameInterval( 0)       333333
        dwFrameInterval( 1)       416666
        dwFrameInterval( 2)       500000
        dwFrameInterval( 3)       666666
        dwFrameInterval( 4)      1000000
        dwFrameInterval( 5)      1333333
        dwFrameInterval( 6)      2000000
      VideoStreaming Interface Descriptor:
        bLength                    54
        bDescriptorType                36
        bDescriptorSubtype              7 (FRAME_MJPEG)
        bFrameIndex                 4
        bmCapabilities             0x00
          Still image unsupported
        wWidth                    176
        wHeight                   144
        dwMinBitRate            2027520
        dwMaxBitRate            12165120
        dwMaxVideoFrameBufferSize      50688
        dwDefaultFrameInterval      333333
        bFrameIntervalType             7
        dwFrameInterval( 0)       333333
        dwFrameInterval( 1)       416666
        dwFrameInterval( 2)       500000
        dwFrameInterval( 3)       666666
        dwFrameInterval( 4)      1000000
        dwFrameInterval( 5)      1333333
        dwFrameInterval( 6)      2000000
      VideoStreaming Interface Descriptor:
        bLength                    54
        bDescriptorType                36
        bDescriptorSubtype              7 (FRAME_MJPEG)
        bFrameIndex                 5
        bmCapabilities             0x00
          Still image unsupported
        wWidth                    320
        wHeight                   180
        dwMinBitRate            4608000
        dwMaxBitRate            27648000
```

```
    dwMaxVideoFrameBufferSize      115200
    dwDefaultFrameInterval         333333
    bFrameIntervalType               7
    dwFrameInterval( 0)          333333
    dwFrameInterval( 1)          416666
    dwFrameInterval( 2)          500000
    dwFrameInterval( 3)          666666
    dwFrameInterval( 4)         1000000
    dwFrameInterval( 5)         1333333
    dwFrameInterval( 6)         2000000
 VideoStreaming Interface Descriptor:
   bLength                       54
   bDescriptorType               36
   bDescriptorSubtype             7 (FRAME_MJPEG)
   bFrameIndex                    6
   bmCapabilities              0x00
     Still image unsupported
   wWidth                       320
   wHeight                      240
   dwMinBitRate             6144000
   dwMaxBitRate            36864000
   dwMaxVideoFrameBufferSize      153600
   dwDefaultFrameInterval         333333
   bFrameIntervalType               7
   dwFrameInterval( 0)          333333
   dwFrameInterval( 1)          416666
   dwFrameInterval( 2)          500000
   dwFrameInterval( 3)          666666
   dwFrameInterval( 4)         1000000
   dwFrameInterval( 5)         1333333
   dwFrameInterval( 6)         2000000
 VideoStreaming Interface Descriptor:
   bLength                       54
   bDescriptorType               36
   bDescriptorSubtype             7 (FRAME_MJPEG)
   bFrameIndex                    7
   bmCapabilities              0x00
     Still image unsupported
   wWidth                       352
   wHeight                      288
   dwMinBitRate             8110080
   dwMaxBitRate            48660480
   dwMaxVideoFrameBufferSize      202752
   dwDefaultFrameInterval         333333
   bFrameIntervalType               7
   dwFrameInterval( 0)          333333
   dwFrameInterval( 1)          416666
   dwFrameInterval( 2)          500000
   dwFrameInterval( 3)          666666
   dwFrameInterval( 4)         1000000
   dwFrameInterval( 5)         1333333
   dwFrameInterval( 6)         2000000
```

VideoStreaming Interface Descriptor:
 bLength   54
 bDescriptorType   36
 bDescriptorSubtype   7 (FRAME_MJPEG)
 bFrameIndex   8
 bmCapabilities   0x00
   Still image unsupported
 wWidth   432
 wHeight   240
 dwMinBitRate   8294400
 dwMaxBitRate   49766400
 dwMaxVideoFrameBufferSize   207360
 dwDefaultFrameInterval   333333
 bFrameIntervalType   7
 dwFrameInterval(0)   333333
 dwFrameInterval(1)   416666
 dwFrameInterval(2)   500000
 dwFrameInterval(3)   666666
 dwFrameInterval(4)   1000000
 dwFrameInterval(5)   1333333
 dwFrameInterval(6)   2000000
VideoStreaming Interface Descriptor:
 bLength   54
 bDescriptorType   36
 bDescriptorSubtype   7 (FRAME_MJPEG)
 bFrameIndex   9
 bmCapabilities   0x00
   Still image unsupported
 wWidth   640
 wHeight   360
 dwMinBitRate   18432000
 dwMaxBitRate   110592000
 dwMaxVideoFrameBufferSize   460800
 dwDefaultFrameInterval   333333
 bFrameIntervalType   7
 dwFrameInterval(0)   333333
 dwFrameInterval(1)   416666
 dwFrameInterval(2)   500000
 dwFrameInterval(3)   666666
 dwFrameInterval(4)   1000000
 dwFrameInterval(5)   1333333
 dwFrameInterval(6)   2000000
VideoStreaming Interface Descriptor:
 bLength   54
 bDescriptorType   36
 bDescriptorSubtype   7 (FRAME_MJPEG)
 bFrameIndex   10
 bmCapabilities   0x00
   Still image unsupported
 wWidth   800
 wHeight   448
 dwMinBitRate   28672000

```
    dwMaxBitRate           172032000
    dwMaxVideoFrameBufferSize      716800
    dwDefaultFrameInterval       333333
    bFrameIntervalType             7
    dwFrameInterval( 0)        333333
    dwFrameInterval( 1)        416666
    dwFrameInterval( 2)        500000
    dwFrameInterval( 3)        666666
    dwFrameInterval( 4)        1000000
    dwFrameInterval( 5)        1333333
    dwFrameInterval( 6)        2000000
  VideoStreaming Interface Descriptor:
    bLength                54
    bDescriptorType            36
    bDescriptorSubtype          7 (FRAME_MJPEG)
    bFrameIndex               11
    bmCapabilities           0x00
      Still image unsupported
    wWidth                 800
    wHeight                600
    dwMinBitRate           38400000
    dwMaxBitRate           230400000
    dwMaxVideoFrameBufferSize      960000
    dwDefaultFrameInterval       333333
    bFrameIntervalType             7
    dwFrameInterval( 0)        333333
    dwFrameInterval( 1)        416666
    dwFrameInterval( 2)        500000
    dwFrameInterval( 3)        666666
    dwFrameInterval( 4)        1000000
    dwFrameInterval( 5)        1333333
    dwFrameInterval( 6)        2000000
  VideoStreaming Interface Descriptor:
    bLength                54
    bDescriptorType            36
    bDescriptorSubtype          7 (FRAME_MJPEG)
    bFrameIndex               12
    bmCapabilities           0x00
      Still image unsupported
    wWidth                 864
    wHeight                480
    dwMinBitRate           33177600
    dwMaxBitRate           199065600
    dwMaxVideoFrameBufferSize      829440
    dwDefaultFrameInterval       333333
    bFrameIntervalType             7
    dwFrameInterval( 0)        333333
    dwFrameInterval( 1)        416666
    dwFrameInterval( 2)        500000
    dwFrameInterval( 3)        666666
    dwFrameInterval( 4)        1000000
    dwFrameInterval( 5)        1333333
```

```
    dwFrameInterval( 6)        2000000
VideoStreaming Interface Descriptor:
  bLength                    54
  bDescriptorType              36
  bDescriptorSubtype            7 (FRAME_MJPEG)
  bFrameIndex                13
  bmCapabilities             0x00
    Still image unsupported
  wWidth                    960
  wHeight                   720
  dwMinBitRate              55296000
  dwMaxBitRate              331776000
  dwMaxVideoFrameBufferSize   1382400
  dwDefaultFrameInterval       333333
  bFrameIntervalType           7
  dwFrameInterval( 0)        333333
  dwFrameInterval( 1)        416666
  dwFrameInterval( 2)        500000
  dwFrameInterval( 3)        666666
  dwFrameInterval( 4)        1000000
  dwFrameInterval( 5)        1333333
  dwFrameInterval( 6)        2000000
VideoStreaming Interface Descriptor:
  bLength                    54
  bDescriptorType              36
  bDescriptorSubtype            7 (FRAME_MJPEG)
  bFrameIndex                14
  bmCapabilities             0x00
    Still image unsupported
  wWidth                    1024
  wHeight                   576
  dwMinBitRate              47185920
  dwMaxBitRate              283115520
  dwMaxVideoFrameBufferSize   1179648
  dwDefaultFrameInterval       333333
  bFrameIntervalType           7
  dwFrameInterval( 0)        333333
  dwFrameInterval( 1)        416666
  dwFrameInterval( 2)        500000
  dwFrameInterval( 3)        666666
  dwFrameInterval( 4)        1000000
  dwFrameInterval( 5)        1333333
  dwFrameInterval( 6)        2000000
VideoStreaming Interface Descriptor:
  bLength                    54
  bDescriptorType              36
  bDescriptorSubtype            7 (FRAME_MJPEG)
  bFrameIndex                15
  bmCapabilities             0x00
    Still image unsupported
  wWidth                    1280
  wHeight                   720
```

```
  dwMinBitRate           73728000
  dwMaxBitRate           442368000
  dwMaxVideoFrameBufferSize     1843200
  dwDefaultFrameInterval        333333
  bFrameIntervalType            7
  dwFrameInterval( 0)           333333
  dwFrameInterval( 1)           416666
  dwFrameInterval( 2)           500000
  dwFrameInterval( 3)           666666
  dwFrameInterval( 4)           1000000
  dwFrameInterval( 5)           1333333
  dwFrameInterval( 6)           2000000
VideoStreaming Interface Descriptor:
  bLength                 54
  bDescriptorType              36
  bDescriptorSubtype           7 (FRAME_MJPEG)
  bFrameIndex             16
  bmCapabilities          0x00
    Still image unsupported
  wWidth                  1600
  wHeight                 896
  dwMinBitRate            114688000
  dwMaxBitRate            688128000
  dwMaxVideoFrameBufferSize     2867200
  dwDefaultFrameInterval        333333
  bFrameIntervalType            7
  dwFrameInterval( 0)           333333
  dwFrameInterval( 1)           416666
  dwFrameInterval( 2)           500000
  dwFrameInterval( 3)           666666
  dwFrameInterval( 4)           1000000
  dwFrameInterval( 5)           1333333
  dwFrameInterval( 6)           2000000
VideoStreaming Interface Descriptor:
  bLength                 54
  bDescriptorType              36
  bDescriptorSubtype           7 (FRAME_MJPEG)
  bFrameIndex             17
  bmCapabilities          0x00
    Still image unsupported
  wWidth                  1920
  wHeight                 1080
  dwMinBitRate            165888000
  dwMaxBitRate            995328000
  dwMaxVideoFrameBufferSize     4147200
  dwDefaultFrameInterval        333333
  bFrameIntervalType            7
  dwFrameInterval( 0)           333333
  dwFrameInterval( 1)           416666
  dwFrameInterval( 2)           500000
  dwFrameInterval( 3)           666666
  dwFrameInterval( 4)           1000000
```

```
        dwFrameInterval( 5)        1333333
        dwFrameInterval( 6)        2000000
     VideoStreaming Interface Descriptor:
       bLength                    6
       bDescriptorType           36
       bDescriptorSubtype        13 (COLORFORMAT)
       bColorPrimaries            1 (BT.709,sRGB)
       bTransferCharacteristics   1 (BT.709)
       bMatrixCoefficients        4 (SMPTE 170M (BT.601))
Interface Descriptor:
  bLength                 9
  bDescriptorType         4
  bInterfaceNumber        1
  bAlternateSetting       1
  bNumEndpoints           1
  bInterfaceClass        14 Video
  bInterfaceSubClass      2 Video Streaming
  bInterfaceProtocol      0
  iInterface              0
  Endpoint Descriptor:
    bLength               7
    bDescriptorType       5
    bEndpointAddress    0x81  EP 1 IN
    bmAttributes          5
      Transfer Type        Isochronous
      Synch Type           Asynchronous
      Usage Type           Data
    wMaxPacketSize      0x00c0  1x 192 bytes
    bInterval             1
Interface Descriptor:
  bLength                 9
  bDescriptorType         4
  bInterfaceNumber        1
  bAlternateSetting       2
  bNumEndpoints           1
  bInterfaceClass        14 Video
  bInterfaceSubClass      2 Video Streaming
  bInterfaceProtocol      0
  iInterface              0
  Endpoint Descriptor:
    bLength               7
    bDescriptorType       5
    bEndpointAddress    0x81  EP 1 IN
    bmAttributes          5
      Transfer Type        Isochronous
      Synch Type           Asynchronous
      Usage Type           Data
    wMaxPacketSize      0x0180  1x 384 bytes
    bInterval             1
Interface Descriptor:
  bLength                 9
  bDescriptorType         4
```

```
      bInterfaceNumber        1
      bAlternateSetting       3
      bNumEndpoints           1
      bInterfaceClass        14 Video
      bInterfaceSubClass      2 Video Streaming
      bInterfaceProtocol      0
      iInterface              0
      Endpoint Descriptor:
        bLength               7
        bDescriptorType       5
        bEndpointAddress    0x81  EP 1 IN
        bmAttributes          5
          Transfer Type          Isochronous
          Synch Type             Asynchronous
          Usage Type             Data
        wMaxPacketSize    0x0200  1x 512 bytes
        bInterval             1
    Interface Descriptor:
      bLength               9
      bDescriptorType       4
      bInterfaceNumber      1
      bAlternateSetting     4
      bNumEndpoints         1
      bInterfaceClass      14 Video
      bInterfaceSubClass    2 Video Streaming
      bInterfaceProtocol    0
      iInterface            0
      Endpoint Descriptor:
        bLength               7
        bDescriptorType       5
        bEndpointAddress    0x81  EP 1 IN
        bmAttributes          5
          Transfer Type          Isochronous
          Synch Type             Asynchronous
          Usage Type             Data
        wMaxPacketSize    0x0280  1x 640 bytes
        bInterval             1
    Interface Descriptor:
      bLength               9
      bDescriptorType       4
      bInterfaceNumber      1
      bAlternateSetting     5
      bNumEndpoints         1
      bInterfaceClass      14 Video
      bInterfaceSubClass    2 Video Streaming
      bInterfaceProtocol    0
      iInterface            0
      Endpoint Descriptor:
        bLength               7
        bDescriptorType       5
        bEndpointAddress    0x81  EP 1 IN
        bmAttributes          5
```

```
    Transfer Type        Isochronous
    Synch Type           Asynchronous
    Usage Type           Data
  wMaxPacketSize     0x0320  1x 800 bytes
  bInterval              1
Interface Descriptor:
  bLength                9
  bDescriptorType        4
  bInterfaceNumber       1
  bAlternateSetting      6
  bNumEndpoints          1
  bInterfaceClass       14 Video
  bInterfaceSubClass     2 Video Streaming
  bInterfaceProtocol     0
  iInterface             0
  Endpoint Descriptor:
    bLength              7
    bDescriptorType      5
    bEndpointAddress    0x81  EP 1 IN
    bmAttributes         5
      Transfer Type        Isochronous
      Synch Type           Asynchronous
      Usage Type           Data
    wMaxPacketSize     0x03b0  1x 944 bytes
    bInterval            1
Interface Descriptor:
  bLength                9
  bDescriptorType        4
  bInterfaceNumber       1
  bAlternateSetting      7
  bNumEndpoints          1
  bInterfaceClass       14 Video
  bInterfaceSubClass     2 Video Streaming
  bInterfaceProtocol     0
  iInterface             0
  Endpoint Descriptor:
    bLength              7
    bDescriptorType      5
    bEndpointAddress    0x81  EP 1 IN
    bmAttributes         5
      Transfer Type        Isochronous
      Synch Type           Asynchronous
      Usage Type           Data
    wMaxPacketSize     0x0a80  2x 640 bytes
    bInterval            1
Interface Descriptor:
  bLength                9
  bDescriptorType        4
  bInterfaceNumber       1
  bAlternateSetting      8
  bNumEndpoints          1
  bInterfaceClass       14 Video
```

```
    bInterfaceSubClass      2 Video Streaming
    bInterfaceProtocol      0
    iInterface              0
    Endpoint Descriptor:
      bLength               7
      bDescriptorType       5
      bEndpointAddress     0x81  EP 1 IN
      bmAttributes          5
        Transfer Type         Isochronous
        Synch Type            Asynchronous
        Usage Type            Data
      wMaxPacketSize     0x0b20  2x 800 bytes
      bInterval             1
  Interface Descriptor:
    bLength                 9
    bDescriptorType         4
    bInterfaceNumber        1
    bAlternateSetting       9
    bNumEndpoints           1
    bInterfaceClass        14 Video
    bInterfaceSubClass      2 Video Streaming
    bInterfaceProtocol      0
    iInterface              0
    Endpoint Descriptor:
      bLength               7
      bDescriptorType       5
      bEndpointAddress     0x81  EP 1 IN
      bmAttributes          5
        Transfer Type         Isochronous
        Synch Type            Asynchronous
        Usage Type            Data
      wMaxPacketSize     0x0be0  2x 992 bytes
      bInterval             1
  Interface Descriptor:
    bLength                 9
    bDescriptorType         4
    bInterfaceNumber        1
    bAlternateSetting      10
    bNumEndpoints           1
    bInterfaceClass        14 Video
    bInterfaceSubClass      2 Video Streaming
    bInterfaceProtocol      0
    iInterface              0
    Endpoint Descriptor:
      bLength               7
      bDescriptorType       5
      bEndpointAddress     0x81  EP 1 IN
      bmAttributes          5
        Transfer Type         Isochronous
        Synch Type            Asynchronous
        Usage Type            Data
      wMaxPacketSize     0x1380  3x 896 bytes
```

```
        bInterval               1
  Interface Descriptor:
    bLength                 9
    bDescriptorType         4
    bInterfaceNumber        1
    bAlternateSetting      11
    bNumEndpoints           1
    bInterfaceClass        14 Video
    bInterfaceSubClass      2 Video Streaming
    bInterfaceProtocol      0
    iInterface              0
    Endpoint Descriptor:
      bLength               7
      bDescriptorType       5
      bEndpointAddress   0x81  EP 1 IN
      bmAttributes          5
        Transfer Type          Isochronous
        Synch Type             Asynchronous
        Usage Type             Data
      wMaxPacketSize     0x13fc  3x 1020 bytes
      bInterval             1
  Interface Descriptor:
    bLength                 9
    bDescriptorType         4
    bInterfaceNumber        2
    bAlternateSetting       0
    bNumEndpoints           1
    bInterfaceClass         3 Human Interface Device
    bInterfaceSubClass      0 No Subclass
    bInterfaceProtocol      0 None
    iInterface              0
      HID Device Descriptor:
        bLength               9
        bDescriptorType      33
        bcdHID             1.11
        bCountryCode          0 Not supported
        bNumDescriptors       1
        bDescriptorType      34 Report
        wDescriptorLength    34
      Report Descriptors:
        ** UNAVAILABLE **
    Endpoint Descriptor:
      bLength               7
      bDescriptorType       5
      bEndpointAddress   0x82  EP 2 IN
      bmAttributes          3
        Transfer Type          Interrupt
        Synch Type             None
        Usage Type             Data
      wMaxPacketSize     0x0002  1x 2 bytes
      bInterval            10
```