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User Manual

HEROCast™ + HEROCast BacPac™

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Document History

Version	Date	Modification	Version
17	01/2016	Added LMS-T information. Added LMS-T Modulation information. Added Service page information. Added side-button functionality information. Added encoder delay information.	FW: v1.009 App: v1.009
18	05/2016	Added information for Preset files to highlight offline availability. Updated table headings for Function buttons to show the correct LED functions. Removed Table 8-3 for HEROCast 3 redundancy. Removed Section 7 for upgrade instructions – this is now a separate document available from the FTP site. Reference Number: RD002040. Referenced upgrade instructions in Section 4.1. Updated support email address in Section 6.3.3 to the Service email address.	FW: v1.009 App: v2.000

NOTE: Document history introduced at version 17 of the user manual.

Table of Contents

Table of Figures

Table of Tables

1. WEEE STATEMENT

VISLINK

WEEE Policy Statement

Vislink is committed to conducting business in a manner that respects, preserves, and improves the environment.

In recent years, there have been increasing concerns for environmental conservation globally.

One of the major events is that the European Union has issued a directive to address this growing concern.

The Waste Electrical and Electronic Equipment Regulations (WEEE), EU Directive 2002/96/EC, were adopted into UK law on 2nd January 2007 with full implementation from 1st July 2007. These regulations require that electrical and electronic equipment, when being disposed of at the end of its useful life in an EU Member State, must be recycled and/or disposed of in accordance with the EU directive as it is applied in local laws of that State. These regulations go further by making the manufacturer or importer (the producer) of the goods responsible for their disposal/recycling in the correct manner.

Although there are exemptions permitted within the regulations, particularly pertaining to contaminated and unsafe items, many of Vislink's products potentially fall within the scope of EU 2002/96/EC.

Vislink recognises and accepts its obligations and has taken the following steps to ensure compliance:

Labelling
Liable products manufactured by Vislink in compliance with UK Statutory Instrument 2006 No.3289 (the UK law) feature the approved crossed out wheeled bin symbol clearly marked on the serial number label.

Product Design
Vislink recognises the benefit to the environment of this legislation and is designing products to allow more recycling and less adverse environmental impact.

Registration
Vislink is a member of Environ's B2B Compliance scheme. and is registered as a producer with the UK Environment Agency.
Registration number: WEE/JD0078UU

Disposal Service
S2S Electronics Ltd undertake disposal of old products in the UK on our behalf in accordance with the latest requirements and in the most environmentally efficient manner.
Further details of this service can be obtained from: sales@vislink.com

Appointed Compliance Contractor
S2S Electronics Ltd
Environment Agency registration number: CB/DM3781HT
Website: www.s2s.uk.com
Telephone: +44 (0) 1709 763850

Customers outside the UK should contact their supplier/agent for further information on the arrangements in place for their own country.

For queries about WEEE please email our Quality, Safety, Environment and Facilities Manager at:
angelo.nicoletti@vislink.com

A Nicoletti

Angelo Nicoletti

Quality, Safety, Environment and Facilities Manager

April 2012

Issue date: April 2012

Figure 1-1 WEEE Policy Statement

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2. OVERVIEW

The HEROCast transmitter enables professional broadcasters to deliver engaging, live content with immersive POV footage and unique perspectives that are synonymous with GoPro. HEROCast integrates with GoPro cameras and its ecosystem of mounts, and delivers the most versatile, mountable broadcast solution available and transmits high definition 1080i/50 or 1080i/59 and 720p/50 or 720p/59 video using H.264 encoding with low glass-to-glass latency.

Two options are available:

- HEROCast is available as an independent device that can be connected to a GoPro camera via a lockable HDMI cable, which is optimal for body mounting and engaging POV shots.
- The HEROCast BacPac directly connects to the housing of a GoPro camera, delivering an integrated, water-resistant solution for immersive live action footage.

Both configurations are compatible with HERO4 Black, HERO4 Silver and HERO3+ Black cameras.

The transmitters operate in the professional licensed frequency band of 1.95GHz – 2.7GHz, and require a matching RF diversity receive infrastructure.

The software provided on the USB drive included in the package contains all the software required to enable operation. Once configured by the HEROCast application, operation of the transmitter is as basic as switching on HERO4.

For help or answers to questions not addressed in this manual, up-to-date support information is available at: www.vislink.com/support/.

Worldwide:

- support@vislink.com
- +44 (0) 1442 431410
- +44 (0) 1787 226227

Americas:

- USsupport@vislink.com
- +1 978 671 5929
- 888 777 9221

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3. SPECIFICATIONS

3.1. Compliance Standards

Your HEROCast device is in compliance with the standards listed below:

- Europe (CE):
  - EN 302 064-2 V1.1.1
  - EN 301 489-1 V1.9.2
  - EN 301 489-28 V1.1.1
  - RoHS
  - WEEE
  - FCC
  - FCC Part 74F
  - SAR
  - SAR Canada exempt.
  - Safety to EN60065:2014
- Proposition 65 (California)

3.2. Video Specifications

- HDMI Type-D plug input.
- H.264 low latency HD AVC video encoder/MPEG-4 Part 10 Video bit rates of 3.732 Mbps to 31.688 Mbps.
- Audio encoding using MPEG-1 Layer 2.

3.2.1. Supported Broadcast Standards

- 720p/50
- 720p/59.94
- 1080i/50
- 1080i/59.94

Based on the broadcast standard selected, the GoPro cameras have several configurable modes that are used to ensure video is available and transmitted. The complete tables of supported modes can be found in Section 7.4.

3.3. RF Specifications

Modulation Types	DVB-T
	LMS-T
Modulation Modes	QPSK
	16-QAM
	64-QAM
OFDM Guard Interval	1/32
	1/16
	1/8
	1/4
Modulation Forward error Correction (FEC)	1/2
	2/3
	3/4
	5/6
	7/8
Modulation Polarity	Normal
	Inverted
Modulation Bandwidth	4MHz
	5MHz
	6MHz
	7MHz
	8MHz
	10MHz
	12MHz
	14MHz
	16MHz
	20MHz
Transmitter Power	10mW
	50mW
	80mW
	100mW
Carrier Frequency	1.95GHz – 2.70GHz
Video Standards	720P/50
	720P/59.94
	1080I/50
	1080I/59.94

Table 3-1 RF Specifications

3.4. Antenna Specifications

3.4.1. Antenna 1 (1.95-2.3 GHz)

Design Specifications	Typical	Units
Type	Skirted Dipole	-
Operating Frequency	1.95-2.3	GHz
Gain	+0.5	dBi
Polarisation	Linear	-
VSWR	<2.0:1	-
Impedance	50	Ohms
Operating Temp	-40 to +85	Deg
Overall Dimensions	107 x 11	mm
Weight	15	grams

Table 3-2 Antenna 1 Specification

3.4.2. Antenna 2 (2.3-2.7 GHz)

Design Specifications	Typical	Units
Type	Skirted Dipole	-
Operating Frequency	2.3-2.7	GHz
Gain	+0.5	dBi
Polarisation	Linear	-
VSWR	<2.0:1	-
Impedance	50	Ohms
Operating Temp	-40 to +85	Deg
Overall Dimensions	107 x 11	mm
Weight	15	grams

Table 3-3 Antenna 2 Specification

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4. HEROCAST SETUP

Refer to this section to assemble and connect your HEROCast device and camera. See the Vislink website for further support information and HEROCast tutorial videos available at:

- http://www.vislink.com/HEROCast-tutorials/

4.1. Upgrading HEROCast

Refer to the Vislink FTP site for upgrade instructions:

- ftp://ftp.vislink.com/HeroCast/

4.2. HEROCast Overview

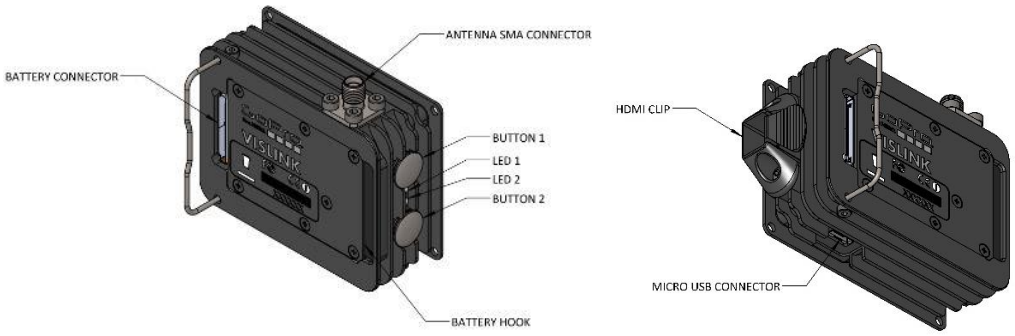

Figure 4-1 HEROCast Overview

4.3. Setting Up HEROCast

Figure 4-2 HEROCast Antenna Connection

1. Connect the antenna.

NOTE: Be careful not to cross-thread or overtighten the antenna N-type connector.

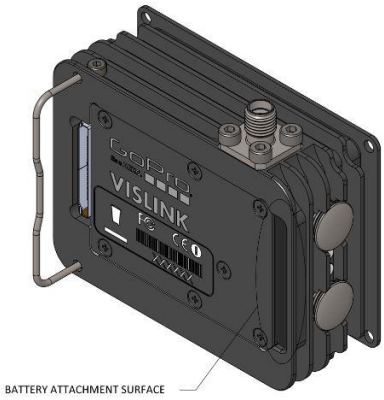

Figure 4-3 Battery Attachment Overview

2. Attach the battery or the battery eliminator.

NOTE: If you are setting up your HEROCast for the first time, make sure that the battery is 100% charged. If the battery is not 100% charged, use the battery eliminator for the setup process. The battery eliminator and battery can be swapped without reconfiguring your device.

NOTE: The batteries hooked end must be inserted first to help lock/hold it in place.

a. Insert the hooked end of the battery into the HEROCast first, then press the battery connector firmly into the transmitter connector, ensuring to carefully align the two elements.
b. Swing the spring clip over the back of the battery to hold it in place.

3. Power on the camera.

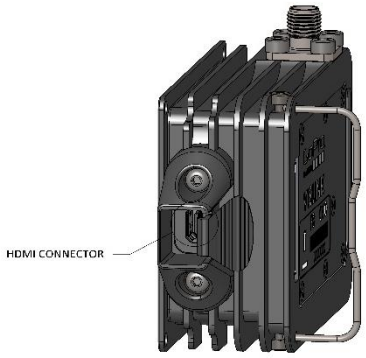

Figure 4-4 Connecting to the HDMI Connector

4. Select a suitable micro-HDMI cable from the set of cables provided to connect your HEROCast and camera.

NOTE: The camera must be powered on when connecting the HDMI cable.

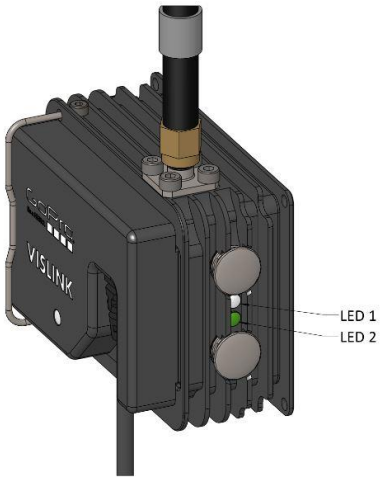

Figure 4-5 LED Status on Loading Software

5. With the camera connected and powered on, check the two LEDs alternate between red and green to indicate that the software is initializing.

When your HEROCast is transmitting, a steady green LED is visible. See Section 6.6 for LED status.

Your HEROCast has several configuration options allowing for precise specification of the transmission protocols and video encoding.

To configure your HEROCast refer to Section 6.

To update the firmware on your HEROCast, refer to Section 4.1.

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5. HEROCAST BACPAC SETUP

This section shows you how to assemble and connect your HEROCast BacPac device and camera.

5.1. HEROCast BacPac Overview

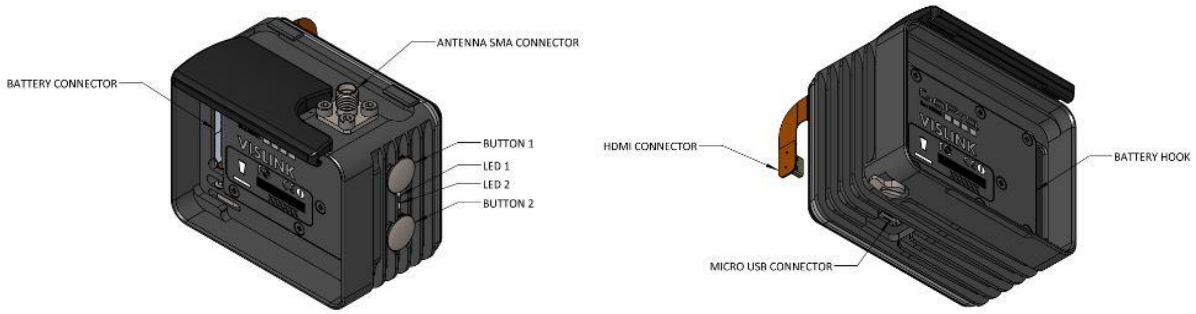

Figure 5-1 HEROCast BacPac Overview

5.2. Setting up HEROCast BacPac

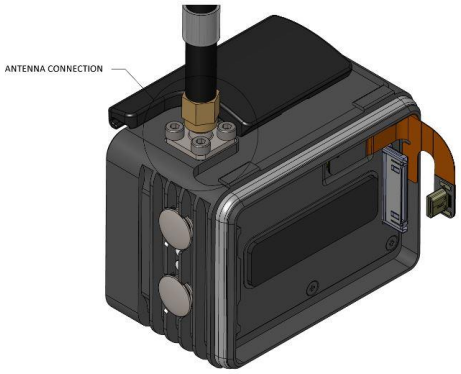

Figure 5-2 Connecting the Antenna

1. Connect the antenna. Do not over tighten. Figure 5-2 shows the antenna connector with an antenna in place.

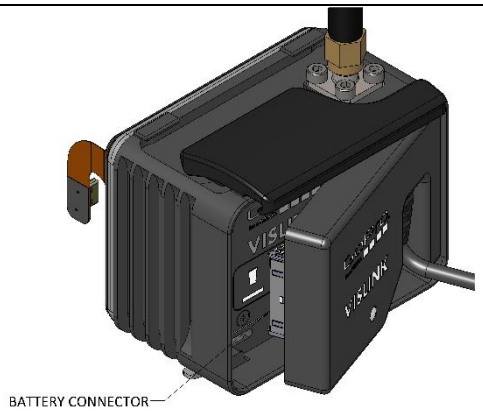

Figure 5-3 Connecting the Battery

2. Attach the battery or the battery eliminator.

NOTE: If you are setting up your HEROCast for the first time, make sure that the battery is 100% charged. If the battery is not 100% charged, use the battery eliminator for the setup process. The battery eliminator and battery can be swapped without reconfiguring your device.

a. Insert the hooked end of the battery into your HEROCast BacPac first, then press the battery connector firmly into the transmitter connector, ensuring to carefully align the two elements.

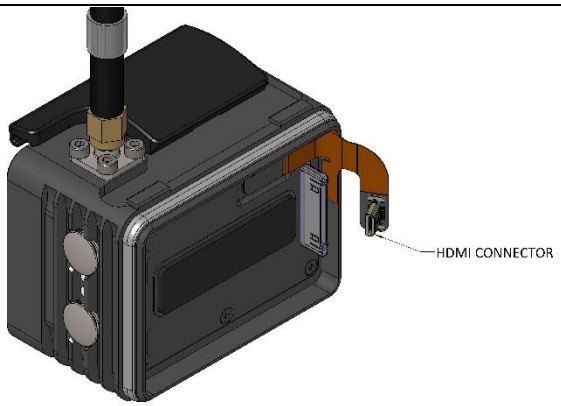

Figure 5-4 HDMI Connector Overview

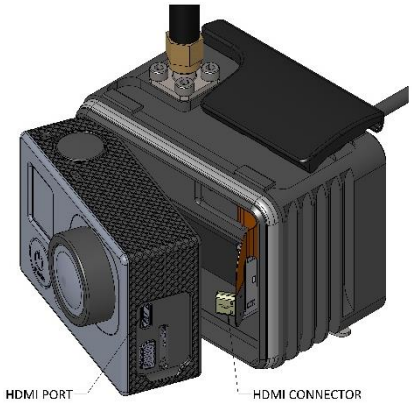

Figure 5-5 Mounting the Camera

4. Mount the camera on your HEROCast BacPac so the free end of the mini-HDMI connector is clear of the frame and can be connected to the camera.

NOTE: Figure 5-5 shows the correct positioning prior to pushing the camera in place. Once the camera is in place, connect the HDMI connector to the camera.

With the camera connected and powered on, check the two LEDs alternate between red and green to indicate that the software is initialising.

When your HEROCast BacPac is transmitting, a steady green LED is visible. See Table 6-8 for LED status.

Your HEROCast BacPac has several configuration options allowing for precise specification of the transmission protocols and video encoding.

To configure your HEROCast BacPac refer to Section 6.

To update the firmware on your HEROCast BacPac, refer to Section 4.1.

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6. CONFIGURING Your HEROCast DEVICE

The configuration steps for your HEROCast and HEROCast BacPac are identical and the same application works with either device. While we only reference HEROCast in this section, the steps and methods are identical and also apply to HEROCast BacPac.

NOTE: HEROCast is compatible with HERO4 Black, HERO4 Silver, and HERO3+ Black.

Required elements for configuration:

- The USB memory stick containing the software (shipped with your HEROCast).
- A USB cable, to connect your HEROCast to a PC (shipped with your HEROCast).
- A computer:
  - Mac running OS version 10.9 or later.
  - Windows running Windows 7 or later.

6.1. Preparing the PC and Camera

You are required to carry out the following steps before you connect your HEROCast to your PC. All of the software referenced in this section can be found on the USB memory stick (shipped with your HEROCast).

Before you attempt the camera update, ensure you have a compatible memory card available to install the camera upgrade (microSD1, microSDHC™ or microSDXC™). See your camera user manual for compatible memory cards.

1. Connect the included USB memory stick to your PC.
2. Connect a compatible memory card to your PC.

6.1.1. Updating the Camera Software:

1. Identify your camera model.
2. Navigate to the folder named 1 **- GoPro Camera Update** on the USB memory stick.
3. Open the appropriate camera model folder and drag the sub-folder named **UPDATE** to the connected blank compatible memory card.
4. With the camera powered off, insert the memory card.
5. Power on the camera.

NOTE: You will see the update begin automatically and notice the camera restarting several times during the process.

6. Verify that the camera software was updated.

NOTE: For HERO4 cameras, the version number must be v3.000 or higher.
For HERO3 cameras, the version number must be v3.84 or higher.

If the software version shown is lower than stated, repeat the above update steps. Make sure you use the correct software for your camera model.

6.1.2. Installing HEROCast USB Driver

To install your HEROCast USB driver:

1. Open the folder named 2 – HEROCast USB Drivers.
2. Open the appropriate installer for your computer system.

NOTE: For Mac, double-click HEROCast FTDI USB Drivers for Mac.dmg.
For Windows, double-click HEROCast FTDI USB Drivers for Windows.exe.

6.1.3. Installing HEROCast Setup Application

To install the HEROCast setup application and reset your HEROCast:

1. Open the folder named **3 - HEROCast Setup Application**.
2. Run the appropriate file to install it to your computer.

NOTE: For Mac, double-click **HEROCast Setup Application for Mac.dmg**, and then drag it to the application folder.
For Windows, double-click **HEROCast Setup Application for Windows.exe**.

6.2. Connecting HEROCast to a PC

Ensure the steps outlined in Sections 6.1.1 and 6.1.2 are carried out before attempting to connect your HEROCast to a PC.

To connect your HEROCast device to a PC:

1. Connect the battery or battery eliminator cable to your HEROCast device.
2. Connect one end of the supplied HDMI cable to the GoPro camera and the other end to your HEROCast device.
3. Switch the camera on.

NOTE: See Figure 5-4 and Figure 5-5 for details on connecting the camera to a HEROCast BacPac device.

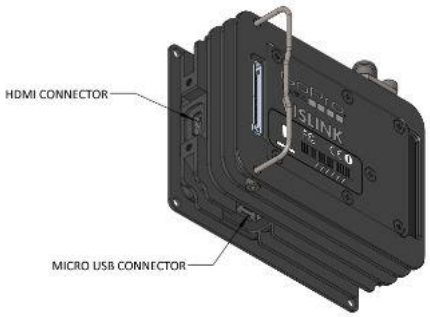

Figure 6-1 Micro USB Connector Overview

4. Connect the computer to the Micro USB port of your HEROCast using the included USB-to-Micro USB cable.

NOTE: Ensure your HEROCast battery is fully charged and the device has booted up before you attempt to connect your HEROCast device to a PC.

The Micro USB connector is situated on the underside of your device as show in Figure 6-1. If required, follow the directions in Section 4.3 to set up your HEROCast.

6.2.1. Connecting to HEROCast Using the PC Application

1. Connect your HEROCast device to the PC as per Section 6.2.
2. Open the HEROCast PC application on your computer.

NOTE: For Mac, it can be found in the **Applications** Folder.
For Windows, it can be found in the **GoPro** directory under **All Programs** in the **Windows** menu.

NOTE: See Section 6.1.2 for details on installing the HEROCast application.

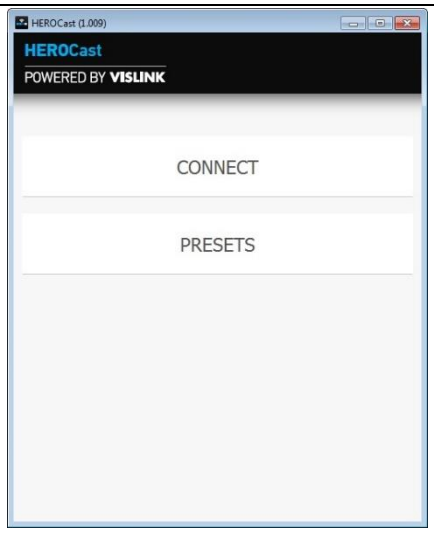

Figure 6-2 HEROCast Connect

3. Once the PC application is loaded, select **Connect**.
4. Click on the listed device that you want to control.

NOTE: When upgrading firmware, your device may appear as a COM port.

NOTE: The status light gives information about the connected HEROCast device, such as RF transmit status.

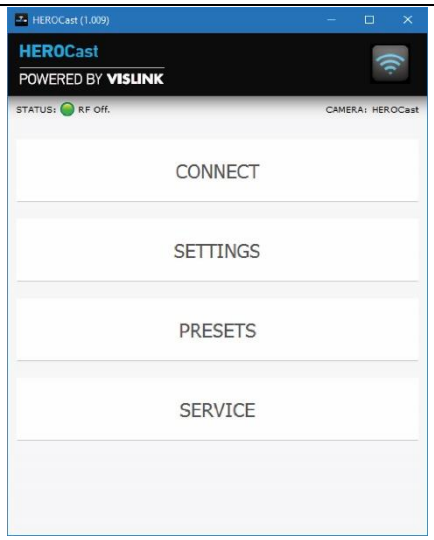

Figure 6-3 HEROCast Home Page

Figure 6-3 shows the home page, which appears when your HEROCast device is correctly connected.

To configure your HEROCast, either select each option individually from the **SETTINGS** menu, see Section 6.3.1 or choose a pre-defined configuration from the **PRESETS** menu, see Section 6.3.2.

NOTE: Section 6.3.4 details toggling RF transmit on/off using the RF Transmit button  , located in the top right-hand corner of the screen.

6.2.2. Disconnecting HEROCast from the PC Application

Always correctly disconnect your HEROCast device from the PC application. Incorrectly disconnecting your device can lead to software corruption.

1. Click **CONNNECT** from the home page (see Figure 6-3).

NOTE: If the message "No HEROCast devices were found.". Clicking the button labelled "**Don't see it? Click here to search again**" will restart the search (see Figure 6-5).

2. Click on your connected HEROCast device.

NOTE: Any connected device has a tick next to it.

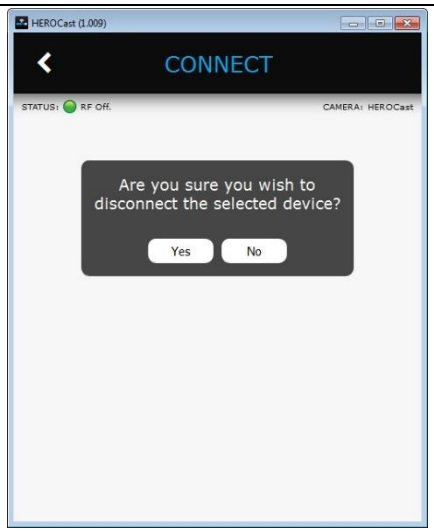

Figure 6-4 HEROCast Disconnect Page

3. Select **Yes** to disconnect the selected device.

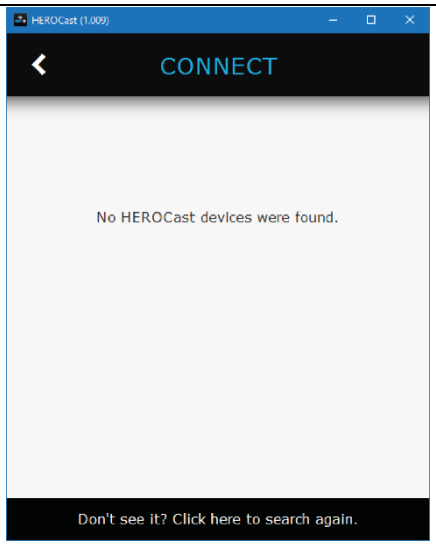

Figure 6-5 HEROCast Not Found Page

6.3. Configuring HEROCast Using the HEROCast Application

Before you attempt to change any configuration settings on your HEROCast device, make sure that your HEROCast device and connected camera are upgraded to the latest software version.

NOTE: The PC application may not connect to your HEROCast device if the software version is lower than the latest version available.

NOTE: See Section 4.1 to upgrade your HEROCast software and Section 6.1.1 to upgrade your camera software.

NOTE: You can also create new Preset files from existing Preset files without the device connected. See Section 6.3.2.1 for information.

6.3.1. Settings Menu

1. Click **SETTINGS** from the home page.

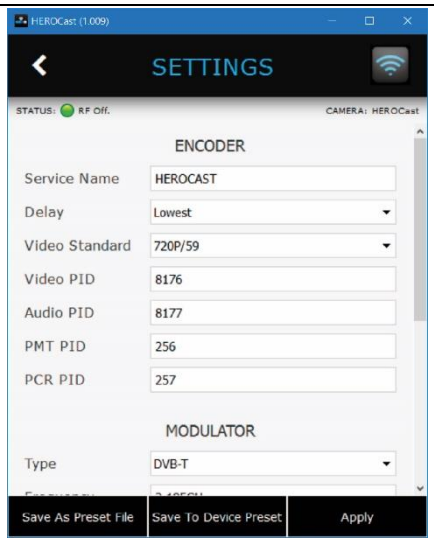

Figure 6-6 HEROCast Settings Screen

The two available menu sections allow you to configure your device to suit your needs:

- The ENCODER menus allows you to modify parameters related to video.
- The MODULATOR menu allows you to modify parameters related to RF transmissions.

Table 6-1 and Table 6-3 detail the configurable settings for the **ENCODER** and **MODULATOR** menus.

After making changes, you can do the following:

- Click **Save As Preset File** to save the Preset as a file on your PC.
- Click **Save to Device Preset** to save the Preset to your HEROCast to call on later. See Section 6.3.2 for details on changing Presets on the go.
- Click **Apply** to immediately save the Preset to your HEROCast device.

2. Click (**<**) to return to the home page.

6.3.2. Presets Menu

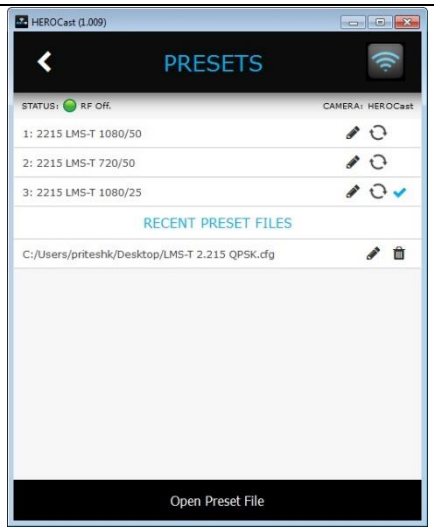

Figure 6-7 HEROCast Presets Screen

1. To open a Preset, click **PRESETS** from the main menu.

The Preset menu has several options available to you:

- Click ✎ to edit a Preset.
- Click 🗑 to delete a Preset.
- Click ⟳ to recall a Preset.

2. To select an existing, saved Preset, click **Open Preset File**:

   a. Navigate to a folder containing the saved Preset file(s).
   b. Highlight the required file and click **Open**.

3. To save the Preset, select an action button from the bottom of the SETTINGS screen:

- Click **Save As Preset File** to save the Preset as a file on your PC.
- Click **Save to Device Preset** to save the Preset to your HEROCast to call on later. See Section 6.3.2 for details on changing Presets on the go.
- Click **Apply** to immediately save the Preset to your HEROCast device.

4. Click (**<**) to return to the home page.

6.3.2.1. Offline Preset Files

If required, you can create preset files offline, without having the HEROCast unit connected to the application. This allows you to load Preset files at your own convenience.

NOTE: To create offline preset files, you need existing preset files saved on your PC.

1. To create new offline Preset files, open the HEROCast application and click **PRESETS**.
2. Click ✎ to edit an existing Preset.
3. When you are happy with the new settings, click **Save As Preset File** and give the file a new, unique name.
4. Click **Save**, the new preset file saves to the location you specify.

6.3.3. Service Menu

The Service menu allows you add license information and restore factory defaults to your HEROCast device. It also shows you the **Electronic Software Serial Number** and **Firmware** fields.

6.3.3.1. Entering License Codes

The license code activates LMS-T mode for units that require the functionality.

To allow us to generate the license code, you need to request it from us and provide the hardware and software serial numbers for your HEROCast unit.

Use the **License Code** field to add a valid license code.

Contact: support@vislink.com for further information.

6.3.3.2. Restoring Factory Default Settings

Click the **Restore** button to return the unit back to factory default settings.

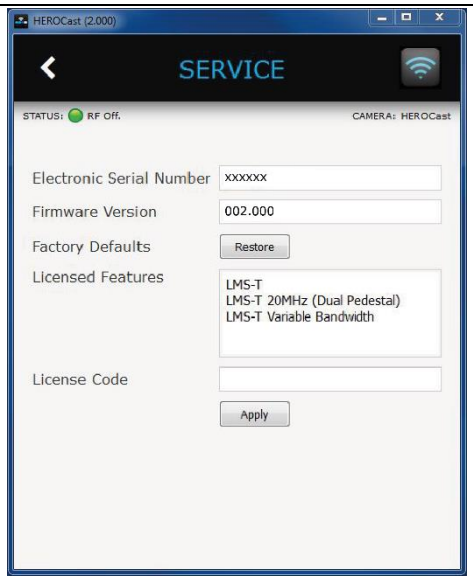

Figure 6-8 HEROCast Service Screen

6.3.4. RF Transmit Control

You can use the RF transmit button to toggle the RF transmit function on/off while your HEROCast device is connected to the PC application.

To toggle RF transmit control:

1. Click the RF transmit button , located in the top right-hand corner of the screen.

You can also use a function button on the side of your HEROCast device to toggle RF transmit on/off. See Section 6.6 for information.

See Table 6-8 for RF transmit LED status.

6.4. Settings Menu Overview

6.4.1. Encoder Menu

Menu Option	Values	Comment
Service Name	20 character string	Name/ID for HEROCast device.
Delay	*Standard	Delay applied to transmission. The lower delay may give lower quality transmission.
	Low	
	Lower	
	Lowest	
Video Standard	720p/50	Allows the video standard to be modified.
	720p/59	
	1080i/50	
	1080i/59	
Video PID	32 <= n <= 8190	Allows the transport stream video PID to modified if required.
Audio PID	32 <= n <= 8190	Allows audio PID to be specified.
PMT PID	32 <= n <= 8190	Allow the PMT PID value to be set if required. This is not normally necessary.
PCR PID	32 <= n <= 8190	Allow the PCR PID value to be set if required. This is not normally necessary.
*GOP Length	3 to 63	Sets the length for the GOP i.e. the number of frames in an I frame cycle. The higher the value used the better the quality of video, but with longer delay.
*GOP Structure	IBBP	Sets the GOP structure i.e. the sequence of I, B and P frames used in the video encoder.
	IBP	
	IPPP	

Table 6-1 Encoder Menu Options

*GOP options are only available if you select **Standard** delay settings.

6.4.3. Delay Setting Notes

The delay menu options allow you to set the delay mode for the encoder. Generally speaking, the longer the delay, the better the video quality.

The **Standard** delay option mode is GOP (Group Of Pictures) structured. An 'I frame' is an image that can stand on its own without the need for data from other frames within the GOP.

Delay Mode	720P/50 (ms)	720P/59 (ms)	1080I/50 (ms)	1080I/59 (ms)
Standard	1330-1460	1370-1440	1510-1630	1500-1640
Low	190-310	150-310	190-320	250-380
Lower	120-250	120-190	190-250	190-310
Lowest	120-190	120-200	110-250	130-250

Table 6-2 Typical Delay Mode Figures

The Standard delay figures above were recorded with a GOP Structure of IBBP & GOP Length of 12.

NOTE: The Low, Lower and Lowest figures recorded show a typical range and are only intended as a rough guide. You may experience different results based on your individual settings.

6.4.4. Modulator Menu

Table 6-3 details all the available options. However, the visible modulator options depend on the type selected. For example, if you select DVB-T, only 6, 7 and 8 MHz options are available. See the comments column for further information on each option.

Menu Option	Values	Comment
Type	LMS-T	The LMS-T options depends on licensing.
	DVB-T	
Frequency (GHz)	1.95 <= n <= 2.7	Transmission centre frequency.
TX Power	10mW	Provides a selection of transmit power levels, specified in mW.
	50mW	
	80mW	
	100mW	
Mode	QPSK	Sets the modulation mode. 64-QAM only relevant to DVB-T
	16-QAM	
	64-QAM	
Bandwidth	4 MHz	Transmission bandwidth. Only 6/7/8MHz are relevant to DVB-T modulation. Dual operation, indicates dual pedestal mode. In this mode the number of COFDM carriers is doubled. This leads to enhanced performance in highly reflective environments and greater tolerance to different transmit path lengths, at the expense of reduced tolerance to Doppler shifts, therefore reduced high speed/mobile performance.
	5 MHz	
	6 MHz	
	7 MHz	
	8 MHz	
	10 MHz	
	14 MHz	
	16 MHz	
	18 MHz	
	20 MHz	
FEC Rate	1/2	Sets the modulation forward error correction. 2/3 is a good default to use. LMS-T only supports 2/3.
	2/3	
	3/4	
	5/6	
	7/8	
Guard	1/32	Sets the guard interval and therefore the tolerance to transmission reflections. 1/16 is a good default figure.
	1/16	
	1/8	
	1/4	
Carrier Offset	0	An engineering setting used to offset the spectrum by one carrier.
	-1	
	+1	
Polarity	Normal	Allow the transmit spectrum to be frequency inverted.
	Inverted	
Pedestal	Single	Option dependent on licencing of LMS-T. When licensed this allows you to change to dual pedestal in LMS-T mode.
	Dual	

Table 6-3 Modulator Menu Options

6.5. Modulator

It is important to check and re-select certain operating parameters when changing between modes of operation. This is due to the interaction of some parameters.

For example, when changing from DVB-T to LMS-T mode it will be necessary to reset the required modulation scheme.

NOTE: There should always be an antenna connected to the N-Type connector when your HEROCast device is powered.

6.5.1. DVB-T Operation

Table 6-4 shows the defined sequence of changes required when changing to DVB-T operation.

Step	Menu	Option	Setting
1	MODULATOR	Type	DVB-T.
2	MODULATOR	Guard Interval	As Required. 1/8 or 1/16. Must match receiver.
3	MODULATOR	QPSK/16QAM/64QAM	As Required.
4	MODULATOR	FEC Rate	As Required.
5	MODULATOR	Polarity	Must match receiver.
6	MODULATOR	Bandwidth	As Required.
7	MODULATOR	TxPower (mW)	As Required.
8	MODULATOR	Frequency	As Required.

Table 6-4 DVB-T Overview

The H.264 encoder will set the data rate appropriately to match the modulation scheme settings.

Table 6-5 defines the corresponding transport stream bit rates for DVB-T operation with the bandwidth set to 8MHz.

Modulation	GI	1/4	1/8	1/16	1/32
QPSK	1/2	4.97	5.52	5.85	6.03
QPSK	2/3	6.63	7.37	7.80	8.04
QPSK	3/4	7.46	8.29	8.78	9.04
QPSK	5/6	8.29	9.21	9.75	10.05
QPSK	7/8	8.70	9.67	10.24	10.55
16QAM	1/2	9.95	11.05	11.70	12.06
16QAM	2/3	13.27	14.74	15.61	16.08
16QAM	3/4	14.92	16.58	17.56	18.09
16QAM	5/6	16.58	18.43	19.51	20.10
16QAM	7/8	17.41	19.35	20.49	21.11
64QAM	1/2	14.92	16.58	17.56	18.09
64QAM	2/3	19.90	22.11	23.41	24.12
64QAM	3/4	22.39	24.88	26.34	27.14
64QAM	5/6	24.88	27.64	29.27	30.16
64QAM	7/8	26.12	29.02	30.73	31.66

Table 6-5 DVB-T Bit-Rate Operation

NOTE: The rates shown in Table 6-5 can be confirmed by checking the Modulator menu in the SETTINGS menu. These rates correspond to the total data rate from the multiplexer which includes the video, audio and any user data.

6.5.2. LMS-T Operation

LMS-T is configurable under license and is controlled via software. Operation is possible in Single (S) and Dual (D) pedestal modes. LMS-T operation can be licensed in 10MHz, 20MHz and variable channel bandwidth modes:

- Single Mode:
  - 4, 5, 6, 7, 8, and 10 MHz
- Dual mode:
  - 6, 8, 10, 12, 14, 16 and 20 MHz

Using LMS-T allows much greater flexibility in tailoring the RF link performance to the channel and operating environment. For example, options available using LMS-T allow you to use a wider pedestal by selecting QPSK instead of 16-QAM, while still achieving acceptable bitrates or use a narrower pedestal to allow multiple cameras to use the same RF channel.

The following sequence defines the changes and sequence required when changing to LMS-T operation.

Step	Sub Menu	Option	Setting
1	MODULATOR	Type	LMS-T (Single) or LMS-T (Dual). Pedestal type is set in the Pedestal drop-down.
2	MODULATOR	Guard	As Required. 1/8 or 1/16.
3	MODULATOR	QPSK/16QAM	As Required 16QAM or QPSK
4	MODULATOR	FEC Rate	2/3 Only
5	MODULATOR	Polarity	Must match receiver.
6	MODULATOR	Bandwidth	Single Pedestal: 4, 5, 6, 7, 8, 10 MHz Dual Pedestal: 6, 8, 10, 12, 14, 16, 20 MHz
7	MODULATOR	TxPower (mW)	As Required
8	MODULATOR	Frequency	As Required

Table 6-6 LMS-T Sequence Change Overview

The encoder will set the data rate appropriately to match the modulation scheme settings.

Table 6-7 defines the corresponding bit rates for LMS-T operation:

SINGLE PEDESTAL - 1/16 GI							
Bandwidth MHz	**4**	**5**	**6**	**7**	**8**	**10**	**-**
QPSK	3.90	4.88	5.85	6.83	7.81	9.76	-
16QAM	7.81	9.76	11.71	13.66	15.61	19.52	-
SINGLE PEDESTAL - 1/8 GI							
Bandwidth MHz	**4**	**5**	**6**	**7**	**8**	**10**	**-**
QPSK	3.69	4.61	5.53	6.45	7.37	9.22	-
16QAM	7.37	9.22	11.06	12.90	14.75	18.43	-
DUAL PEDESTAL - 1/16 GI							
Bandwidth MHz	**6**	**8**	**10**	**12**	**14**	**16**	**20**
QPSK	5.85	7.81	9.76	11.71	13.66	15.61	19.52
16QAM	11.71	15.61	19.52	23.41	27.32	31.22	39.03
DUAL PEDESTAL - 1/8 GI							
Bandwidth MHz	**6**	**8**	**10**	**12**	**14**	**16**	**20**
QPSK	5.53	7.37	9.22	11.06	12.91	14.75	18.43
16QAM	11.06	14.75	18.43	22.12	25.80	29.49	36.86

Table 6-7 LMS-T Bit-Rate Operation

NOTE: Dual pedestal rates are double the equivalent Single pedestal values shown in Table 6-7.

The LMS-T rates shown in Table 6-7 can be confirmed by checking the ENCODER/ENCODER SETUP menu.

NOTE: The rates shown in Table 6-7 correspond to the total data rate which includes the video, audio and any user data.

Due to the improvement that LMS-T has over DVB-T these settings give approximately 50% improvement of bit rates for the same level of ruggedness of the RF link.

6.6. Function Buttons and LED Status

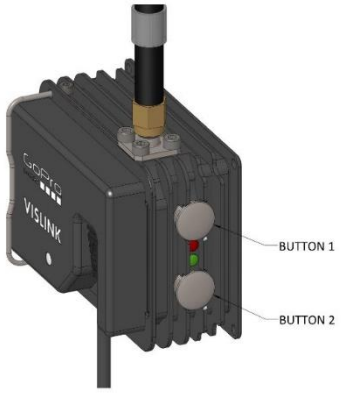

Figure 6-9 HEROCast Function Buttons

The two function buttons, coupled with two LEDs, located on the side of your device, allow you to switch RF transmission on/off and switch between Presets on the go. The LEDs also indicate certain operating states and report errors.

NOTE: It may take a few seconds for any change to show, via the LEDs.

To make changes on the go:

1. Press and hold function button 1 (approx. 3 seconds) to toggle between the installed Presets. The change is confirmed by the LED changing state/colour. See Table 6-8 for the Preset LED status.
2. Press and hold function button 2 (approx. 3 seconds) to toggle RF transmission on/off. The change is confirmed by the LED changing state/colour. See Table 6-8 for the different RF transmission LED states.

NOTE: To install Presets, see Section 6.3.2.

Table 6-8 details the different colours and states indicated by the LEDs.

Bottom LED	Top LED	Description
Blinking Red & Green		Initializing
Quick Blinking Amber & Green		Boot up to Upgrade Mode
Blinking Amber		Upgrade Mode
-	Off	Preset 1
-	Solid Amber	Preset 2
-	Solid Green	Preset 3
Solid Green	-	Transmitting with correct video format
Blinking Green	-	RF disabled/off with correct video format
Solid Amber	-	No video from camera
Blinking Amber	-	Wrong video format on camera
Blinking Red	-	No camera detected/Cannot detect camera.

Table 6-8 Function LED Status

7. Q&A

7.1. About my Video Transmission

7.1.1. Video not Received. What Should I Check?

Assuming the receive infrastructure is known to be working, the following is a list of potential areas that would stop your transmission from being received:

- Ensure that no other transmitter is on the same frequency as your transmitter.
- Ensure that the lower status LED is solid green.
- Ensure that the HDMI or integral HDMI interface is still connected.
- Check for physical damage to the antenna.

7.2. Status Indicators

7.2.1. What do the LED Colours Indicate?

The LED colours indicate the status of the transmitter, as described in Section 6.6 and in Table 6-8.

7.3. Image Quality and Robustness

7.3.1. What are the Trade-offs Between Various Settings?

The choice of modulation type, FEC, Guard Interval, and Bandwidth affect the range of the transmission from your HEROCast transmitter, and the perceived video quality.

Modulation type – QPSK provides a more resilient RF connection than 64QAM, but the available video data rate is reduced, lowering the perceived quality. If the distance to the receiver is small, 64QAM could give the best picture quality.

FEC (forward error correction) – ½ is more robust than 7/8, but the available video bitrate is reduced, lowering the perceived quality. If the environment is non-reflective & distances short, then 7/8 could give the highest picture quality.

Guard Interval – ¼ is more tolerant to echoes and reflections than 1/32, but the available video bitrate is reduced, lowering the perceived quality.

Bandwidth – Defined by the available RF spectrum at the transmitter site. 6MHz channel supports lower video bit rate than an 8MHz channel.

The 4 parameters should be traded off, taking into account the distance between the transmitter & receiver, and the environment (whether it be line-of-sight or a highly reflective built up area).

Table 7-1 gives a guide to the available bit rate based on the RF parameters in 6/7/8MHZ RF channels using DVB-T modulation.

Modulation	Code rate	Guard Interval											
		1/4			1/8			1/16			1/32		
		Bandwidth (MHz)			Bandwidth (MHz)			Bandwidth (MHz)			Bandwidth (MHz)		
		6	7	8	6	7	8	6	7	8	6	7	8
QPSK	1/2	3.73	4.35	4.98	4.14	4.83	5.53	4.39	5.12	5.85	4.52	5.27	6.03
	2/3	4.97	5.80	6.64	5.52	6.45	7.37	5.85	6.83	7.81	6.03	7.03	8.04
	3/4	5.59	6.53	7.46	6.22	7.25	8.29	6.58	7.68	8.78	6.78	7.91	9.05
	5/6	6.22	7.25	8.29	6.91	8.06	9.22	7.31	8.53	9.76	7.54	8.79	10.05
	7/8	6.53	7.62	8.71	7.25	8.46	9.68	7.68	8.96	10.25	7.91	9.23	10.56
16-QAM	1/2	7.46	8.70	9.95	8.29	9.67	11.06	8.78	10.24	11.71	9.04	10.55	12.06
	2/3	9.95	11.61	13.27	11.05	12.90	14.75	11.70	13.66	15.61	12.06	14.07	16.09
	3/4	11.19	13.06	14.93	12.44	14.51	16.59	13.17	15.36	17.56	13.57	15.83	18.10
	5/6	12.44	14.51	16.59	13.82	16.12	18.43	14.63	17.07	19.52	15.08	17.59	20.11
	7/8	13.06	15.24	17.42	14.51	16.93	19.35	15.36	17.93	20.49	15.83	18.47	21.11
64-QAM	1/2	11.19	13.06	14.93	12.44	14.51	16.59	13.17	15.36	17.56	13.57	15.83	18.10
	2/3	14.92	17.41	19.91	16.58	19.35	22.12	17.56	20.49	23.42	18.09	21.11	24.13
	3/4	16.79	19.59	22.39	18.66	21.77	24.88	19.76	23.05	26.35	20.35	23.75	27.14
	5/6	18.66	21.77	24.88	20.73	24.19	27.65	21.95	25.61	29.27	22.62	26.39	30.16
	7/8	19.59	22.86	26.13	27.77	25.40	29.03	23.05	26.89	30.74	23.75	27.71	31.67

Table 7-1 RF Parameter Bit Rate Trade-off Comparison

7.3.2. Transmission is Robust Over Distance, But Video Quality is Not?

Assuming the RF transmission is good, and can support high video bit rates, another factor affecting perceived video quality is the delay (latency) setting.

Low delay modes present the images in the fastest possible time to the receiver, but quality will be lower than in a higher delay setting where the picture can be processed more accurately. If there are no other fixed wired cameras on the shot showing the same action, higher delay settings should be used for the best quality video possible.

7.3.3. I Don't Seem Able to Cover Much Distance?

Not only are the transmitter RF parameters discussed above influential on the distance your transmitter will work, but equally important are the placement of the receive infrastructure and the number of receive points. This subject is beyond the scope of this user manual and should be discussed with your receiver installer.

7.3.4. Is There an Easy Way to Summarise How to Get the Best from My System?

Read all of the above discussion on the effects of RF and video parameters. A summary of each parameter can be shown with Figure 7-1, affecting the available bit rate vs. robustness, and quality.

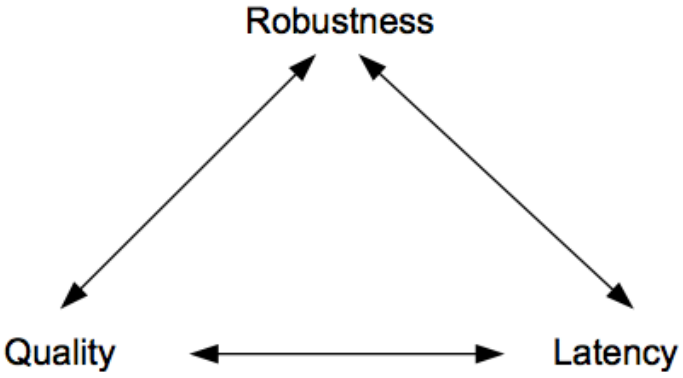

Figure 7-1 Bit Rate vs Robustness and Quality

7.4. What Camera Modes Are Supported?

7.4.1. HERO4 SILVER and HERO4 BLACK

		HEROCast Configured to 1080i59/50		HEROCast Configured to 720p59/50	
Mode selected on HERO4	**Frames Per Second**	**When Camera is in Preview Mode**	**When Camera is Recording**	**When Camera is in Preview Mode**	**When Camera is Recording**
4K	25*	Video Available	No Video	Video Available	No Video
	24*	Video Available	No Video	Video Available	No Video
	12.5	Video Available	No Video	Video Available	No Video
4K SuperView	24*	Video Available	No Video	Video Available	No Video
2.7K	50*	Video Available	No Video	Video Available	No Video
	48*	Video Available	No Video	Video Available	No Video
	25	Video Available	No Video	Video Available	No Video
	24	Video Available	Video Available	Video Available	Video Available
2.7K SuperView	25*	Video Available	Video Available	Video Available	Video Available
2.7K 4:3	25*	Video Available	Video Available	Video Available	Video Available
1440p	80*	Video Available	No Video	Video Available	No Video
	50*	Video Available	No Video	Video Available	No Video
	48	Video Available	No Video	Video Available	No Video
	25	Video Available	1080i50	Video Available	Video Available
	24	Video Available	1080i50	Video Available	Video Available
1080p	120	Video Available	No Video	Video Available	No Video
	90	Video Available	No Video	Video Available	No Video
	50	Video Available	Video Available	Video Available	Video Available
	48	Video Available	Video Available	Video Available	Video Available
	25	Video Available	Video Available	Video Available	Video Available
	24	Video Available	Video Available	Video Available	Video Available
1080p SuperView	80*	Video Available	No Video	Video Available	No Video
	50	Video Available	Video Available	Video Available	Video Available
	48	Video Available	Video Available	Video Available	Video Available
	25	Video Available	Video Available	Video Available	Video Available
	24	Video Available	Video Available	Video Available	Video Available
960p	120	No Video	No Video	Video Available	No Video
	100	No Video	No Video	Video Available	No Video
	50	No Video	Video Available	Video Available	No Video
720p	240*	No Video	No Video	Video Available	No Video
	120	No Video	No Video	Video Available	Video Available
	50	No Video	No Video	Video Available	Video Available
	25	No Video	No Video	Video Available	Video Available
720p SuperView	120*	No Video	No Video	Video Available	Video Available

	100	No Video	No Video	Video Available	Video Available
	50	No Video	No Video	Video Available	Video Available
WVGA	240	No Video	No Video	Video Available	No Video
Photo Mode	N/A	Video Available	No Video	Video Available	No Video

* Indicates modes not available on Hero4 Silver

Table 7-2 HERO4 SILVER and HERO4 BLACK Supported Camera Modes

* Indicates modes not available on Hero4 Silver.

7.5. Further Information

7.5.1. How Can I Get More Information About Vislink Products?

Information about the range of Vislink equipment can be found using the **Product** link from the home page of the Vislink website at http://www.vislink.com/.

7.5.2. Can I Use Other Brands of Camera?

In short, no. Your HEROCast device is designed to work with the following cameras only:

- HERO3 PLUS BLACK
- HERO4 SILVER
- HERO4 BLACK

8. RF SAFETY

8.1. SAR Statement

This HEROCast system has been designed and manufactured to comply with the limits for exposure to RF energy set by the Federal Communications Commission (FCC) USA, Industry Canada (IC), EU and other countries.

The exposure standards for wireless devices employ a unit of measurement known as the Specific Absorption Rate (SAR).

The SAR limit set by FCC / IC is 1.6W/kg averaged over 1 gram of tissue.

The SAR limit recommended by the council of the EU, has a higher limit of 2.0W/kg averaged over any 10 grams of tissue.

The HEROCast system SAR value is 1.526W/kg.

Figure 8-1 HEROCast Antenna

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