



Home Office

Technical Guidance for Body Worn Video Devices

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Introduction

This document is an updated version of the Technical Guidance for Body Worn Video Devices first published in October 2016 by the Home Office Centre for Applied Science and Technology (CAST). It not only reflects the improvements in BWV technology, but is also influenced by the experience of UK police forces committed to large scale deployment of BWV devices and through consultation with industry.

As well as being designed to assist police forces when procuring and deploying BWV devices, this guidance is also intended to enable industry with understanding the often unique technical functionality required by the police.

BWV devices come in a range of physical and technical designs, but ultimately perform the same basic functions. On a national level some aspects of this guidance are intended to improve conformity across all BWV devices particularly around effective operational functionality, safeguarding data and capturing best evidence. Furthermore, it aims to ensure that evidence produced by BWV can be shared with all Criminal Justice System partners.

Technology used in BWV devices continues to develop rapidly and, when appropriate, the technical guidance will be revised in the future.

Key

	Explains the significance of the topic
	Functionality that is considered appropriate
	Functionality that is NOT considered appropriate
	Provides background information on the topic

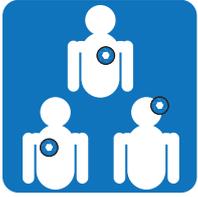
Colour has been used in this publication to convey information; should it be printed in black and white some of this will be lost.

Sections:

1. **POSITIONING AND ATTACHMENT** – Ensuring the camera is facing events and the device is secure
2. **RECORDING** – Capturing best evidence
3. **EVIDENTIAL INTEGRITY** – Enabling continuity along the evidential chain
4. **DATA SECURITY** – Protecting and managing evidence
5. **OPTIONAL FEATURES** – Enhancing the deployment of BWV

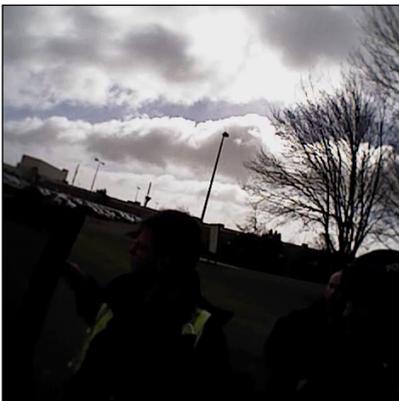
Positioning and Attachment

Ensuring the camera is facing events and the device is secure



POINTING THE CAMERA

	Devices must be pointed correctly to ensure that the best evidence is captured
	Body mounted devices are suitable for regular police roles, but some specialist roles require devices to be head mounted
	Articulation within the device/dock/camera combination should ensure the best video evidence is captured regardless of the User's shape, size or their other equipment demands
	Devices should be kept out of contact with clothing and other equipment to ensure the best audio evidence is captured
	When achieved, the correct pointing position should not be easily displaced
	Extreme wide angle lenses do not remove the need to correctly point the device
	Avoid the device being obscured by clothing and other equipment
	Inadequately pointed devices will produce a poor quality recording



Camera pointing too high so light sky causes dark foreground



Camera pointing too high so can't see subject



Ideal aiming so good light and view of suspect



Incorrect mounting position for this operational role



Correct mounting position for this operational role

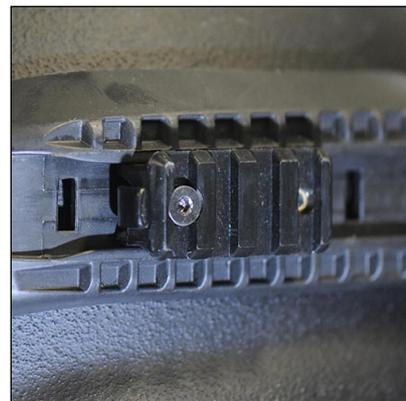


MOUNTS

⚠	Devices need to be securely attached to avoid accidental loss and malicious removal
✓	Secure and quick release mount, such as Klick Fast, attached to tactical vests and other police clothing
✓	Body harness or lanyard with secure and quick release mount, such as Klick Fast, for plain clothes operation
✓	Picatinny rail or ARC (Accessory Rail Connector) mount for ballistic helmets
✓	Physical design of some devices may require a bespoke mount
✓	Any mount should limit movement of the device when the User is in motion
✓	Any mount should still ensure that the device is pointed correctly
i	Secure and quick release mounts can be retro fitted to most police clothing



ARC
(Accessory Rail Connector)



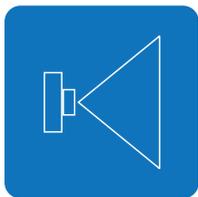
Picatinny mount



Secure and quick release
mount (e.g. Klick Fast)

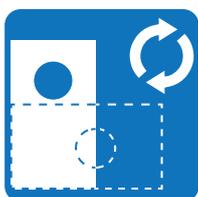
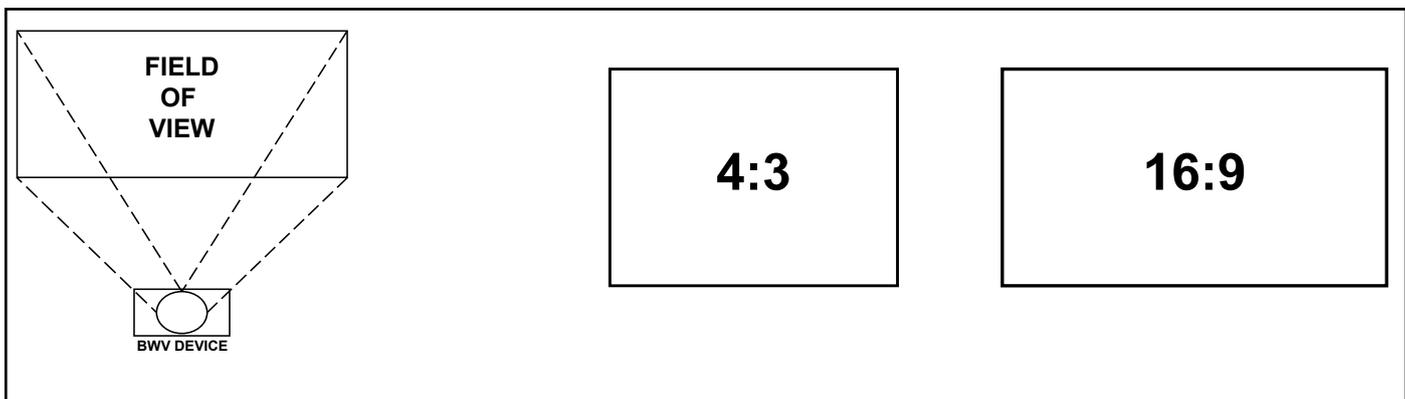


Harness with a
Klick Fast mount



FIELD OF VIEW

	Devices employ wide angle lenses that record a broad scene in full focus
	Between 70° and 130° on the horizontal for Standard Definition's 4:3 aspect ratio
	Between 120° and 170° on the horizontal for High Definition's 16:9 aspect ratio
	Extreme wide angle lenses do not remove the need to correctly point the device
	Extreme wide angle lenses cause image distortion, mostly visible at the edges of the image
	A camera's Field of View (FoV) cannot be compared with the complex human visual system

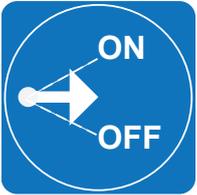


VIDEO ORIENTATION

	Video must be viewable at the correct orientation irrespective of how the device is attached
	Rotation of the video should be possible using free software including VLC media player
	Time and date information should remain correctly orientated
	Ideally video should be automatically re-orientated when required
	Incorrect video orientation should be avoided
	Correcting orientation in editing software can be a complex process
	Video should be rotated and not flipped to avoid a mirrored image

Recording

Capturing best evidence



ACTIVATION/DEACTIVATION

⚠	Standard Operating Procedures determine when the User activates and deactivates recording
✓	Easy to do when the device is attached and through touch only
✓	Prevention against accidental activation and deactivation
✓	Activation and deactivation control separate from other controls
✓	Feedback to the User when activation and deactivation occurs
i	Activation and deactivation can also be controlled by the User through a remote control unit
i	Automated or remote secondary activation can be used as a back up to manual activation



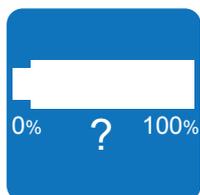
RECORDING INDICATOR

⚠	People need to be made aware that they are being recorded
✓	Indicator such as a red light visible from the front of the device when recording is activated
✓	Additional indicator may be required to inform the User when recording is activated
✓	Ability to disable all visual and audible indicators for specialist operational roles that require the device's presence to be concealed
✓	Devices should display an icon and/or text notifying its function to record video and audio Body Worn Video Icons
i	Users should display an icon and/or text notifying they are carrying a device that records video and audio, if it is not possible to display this on the device
i	Users should whenever possible tell people that they are recording video and audio



RECORDING CAPACITY

⚠	Devices require enough storage capacity to cover the recording requirements of a working shift			
✓	Minimum of 2-3 hours recording capacity is suitable for normal operations			
i	Average length of all video recordings per shift is unlikely to exceed 60 minutes			
i	Some operations may result in recordings lasting over 2 hours			
i	If operations are likely to exceed the recording capacity it may be beneficial to reduce the number of devices recording at any one time			
i	For a 10 minute video expect: <table style="margin-left: 20px;"> <tr> <td>100-300 MB for SD</td> </tr> <tr> <td>350-500MB for HD</td> </tr> <tr> <td>1000-1500MB for UltraHD/4K</td> </tr> </table>	100-300 MB for SD	350-500MB for HD	1000-1500MB for UltraHD/4K
100-300 MB for SD				
350-500MB for HD				
1000-1500MB for UltraHD/4K				



BATTERY CAPACITY

⚠	Devices require enough battery capacity to cover the recording requirements of a working shift
✓	Fulfil the 2-3 hour minimum recording capacity on a single charge irrespective of continuous background power demands
✓	Chargeable with docking station and by USB cable
✓	Mobile charging using in-car power socket and portable USB chargers
✓	Battery only replaceable by manufacturer unless designed to be user-swappable
i	Continuous background features that increase power consumption include pre-record buffer, standby mode, GPS and secondary camera
i	Temporary User activated features that increase power consumption include Infrared lamp, LED lamp, 4G, WiFi and Bluetooth
i	Battery performance is reduced in cold temperatures
i	Higher image resolution recordings increase power consumption
i	Batteries have a limited life and a performance drop is likely after 300 charging cycles
i	If operations are likely to exceed the battery capacity it may be beneficial to reduce the number of devices recording at any one time



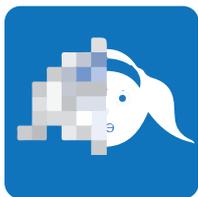
BATTERY STATUS INDICATOR

⚠	Users need to know the device's state of charge
✓	Indicator showing the charge level and when the device is being charged
i	Charge indicators normally take the form of a bar graph or coloured LED
i	Indicators only act as a guide and devices should be fully charged at the start of a shift
i	Devices deploying a Battery Management System provide greater accuracy on the charge level and the battery's state of health



AUDIO QUALITY

⚠	Audio performance is heavily influenced by environmental effects and devices are frequently used outside where these effects are strongest
✓	Clearly record a conversation between the User and people in close proximity
✓	Optimised to record speech rather than background noise
✓	Ability to record video without audio <small>"In the Picture: A data protection code of practice for surveillance cameras and personal information" - ICO, May 2015</small>
i	Audio will be adversely affected by background factors that include wind, traffic, barking dogs, shouting and clothes rustling
i	Headphones or good quality speakers will, up to a point, improve the intelligibility of the recording



VIDEO QUALITY

⚠	Several factors affect video quality although the most obvious are resolution and frame per second rate (fps). In addition, devices are frequently used when light levels are low
✓	Minimum resolution is Standard Definition
✓	Minimum frame rate is 25fps (UK PAL standard)
✓	Produce an acceptable video recording under street lighting and inside buildings
✓	Maintain a constant frame rate; except in low light when a reduction can result in a better video recording
①	Higher resolution and increased frame rates improve quality, but increase file size, data transfer time, storage requirements and likelihood of playback performance issues as well as a decrease in low light level performance
①	Poor environmental conditions such as rain, fog and low light significantly affect quality regardless of resolution or frame rate
①	Boosted low light level performance can result in a blurred, grainy or unnatural looking recording
①	Infrared and LED lamps can enhance low light performance, but increase power consumption
①	A good quality display will, up to a point, improve the visual appearance of the recording
①	Unlike CCTV, BWV recordings are not heavily affected by data compression
①	Video quality cannot be compared with the complex human visual system



Rain



Night



Rain at night

PACE
Codes
E and F

INTERVIEWING SUSPECTS

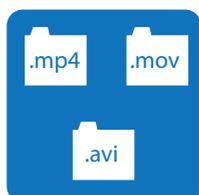
⚠ PACE Codes E and F cover the practice of recording interviews with suspects using audio-visual devices. The Codes now allow for a wider use of modern recording technology including BWV devices under the “secure digital recording network device” option

✓	Non-removable media sealed within the device
✓	Indicator that enables the suspect to know when the recording is in progress
✓	Display screen that allows the User to check camera view
✓	Mountable on a stand for stability
✓	Ability to obscure camera element or configurable for audio only recording
✓	Data transmission from the device can be via a cable or docking station or wirelessly
✓	Back office system is required to manage data storage and automate continuity as well as enable sharing with CJS partners and other agencies
✓	Back office system able to provide a copy of the interview by email and on CD/DVD
✓	User training required for PACE interviews
✗	Devices not to be mounted on the body when recording

ⓘ	Recording and data management procedure needs to be explained to the suspect
ⓘ	Suspect needs to be informed when an interview recording will include video
ⓘ	Venue where the interview takes place must be suitable, especially if being conducted away from police premises
ⓘ	Background sounds, especially when recording away from police premises, need to be minimised to obtain a clear audio recording
ⓘ	External microphone can be used to improve the audio recording
ⓘ	Lighting needs to be suitable to obtain a clear video recording
ⓘ	If recording a video interview, ensure that everyone in the room is visible. This may require two devices (one focused on the suspect, one covering the room)
ⓘ	Devices should be fully charged before commencing the interview recording
ⓘ	Single contiguous recordings may be split by the device into more than one file
ⓘ	Interview recording should be transferred to back office system as soon as possible
ⓘ	Devices should be used in accordance with force standard operating procedures that follow the manufacturer’s instructions and internal data management processes

Evidential Integrity

Enabling continuity along the evidential chain



OPEN STANDARD VIDEO FORMAT

⚠	BWV recordings need to be viewed by Police and Criminal Justice System partners across multiple IT platforms
✓	Recording is viewable in its original format using free software including VLC media player
✓	Audio is synchronised with video
✓	When transferred off the device, recordings should be preserved in their original format and any metadata retained
✗	Proprietary file formats that require specialist replay software should not be used
i	In video terminology, a container file format (e.g. mp4, mov or avi) comprises a video codec (e.g. H264 or H265), an audio codec (e.g. mp3 or AAC) and information (e.g. technical metadata, time & date and subtitles)



TIME AND DATE

⚠	For evidential continuity, the correct time and date must always be visible in BWV footage
✓	Visible when being replayed using free software including VLC media player
✓	Visible in clips and stills acquired from an original video file
✓	Visible when downscaled to Standard Definition resolution
✓	Visible and accurate when frame rate is reduced to 25fps for DVD-Video for court replay
✓	GMT time zone for UK
✓	ISO format YYYY-MM-DD and hh:mm:ss (24hr)
✗	Proprietary software should not be required to view the time and date
i	Time requires regular correction to maintain accuracy
i	Devices may require additional manual correction for BST
i	GPS data can provide independent and automated calibration



VIDEO FILE CREATION

- | | |
|---|--|
| ⚠ | For continuity, each recorded incident should have its own file or files, with a unique file name or code |
| ✓ | File name or code is not altered when the video file is transferred off the device |
| ✓ | Characters in the file name or code should indicate when a single recorded incident has been saved in multiple files |
| i | Long video recordings may be saved by the device not as a large single file, but rather in smaller multiple files designed to improve playback |

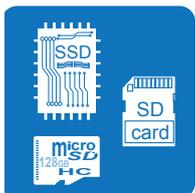
Data Security

Protecting and managing evidence

For an improved understanding of Data Security please also see the following publications:

[Safeguarding Body Worn Video Data](#) - Home Office, October 2018

[Encryption guidance](#) - Information Commissioner’s Office, March 2016



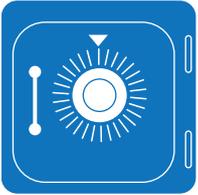
STORAGE MEDIA

⚠	Video recordings must not be tampered with, lost or accidentally destroyed
✓	Non removable internal media is best for data security
✓	If media is removable, there should be a safeguard to impede its removal so that it is not vulnerable to accidental loss
i	Common media options are solid state drive (non removable only), SD or microSD cards (removable or non removable)
i	Removal of media should only be performed by an appointed and technically competent person



DATA ENCRYPTION

⚠	Video recordings should be protected if the device is lost
✓	Encryption is recommended by the Information Commissioners Office and Surveillance Camera Commissioner as an effective way to achieve data security
✓	AES-128 and AES-256 are common standards for data encryption
✗	Proprietary file formats are not a substitute for correctly implemented encryption
i	Encryption is only effective if access codes and authentication systems are correctly managed
i	Correctly managed encryption should form only part of a data protection strategy



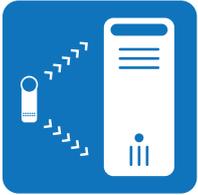
RECORDING INTEGRITY

⚠	User should be confident that the device has correctly produced the recording
✓	No data is lost due to power failure
✓	Not possible to overwrite data once recording capacity is reached
✓	Disrupted video file is still readable if the device malfunctions during recording
✓	Audio is still recorded if the camera malfunctions
✓	Video is still recorded if the microphone malfunctions
✗	Other police issue equipment should not interfere with BWV devices
✗	BWV devices should not interfere with other police issue equipment



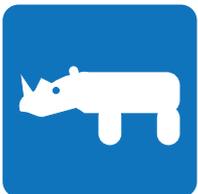
USER ACCESS

⚠	Limit the potential for the User to interfere with the recording
✓	User is unable to erase or edit the recordings on the device
✓	Ability to manage recordings on the device is only possible with special administrator access
✓	Authentication such as a PIN is required to replay any recording either on the BWV device or via a mobile app
i	Erasing and editing of video recordings should only be performed via the back office system unless the device is a standalone unit
i	Video recordings should be erased from the device only after being transferred to and secured in the back office system



DATA TRANSFER TO BACK OFFICE SYSTEM

⚠	Video recordings should be transferred off the device as soon as possible
✓	Data transfer is via a docking station or with a USB cable
✓	Back office systems should allow the transfer of data from any manufacturer's devices
✓	For higher data transfer rates the use of USB 3.0 technology can be beneficial
✗	Standard data transfer procedure should not require the removal of storage media
i	Typically, Users will transfer video recordings off the device by the end of the shift
i	Expect data transfer rates of 5-25MB/s for USB 2.0 and 100MB/s plus for USB 3.0
i	Transfer rates are affected by connector type, the number of devices transferring data, IT infrastructure and network bandwidth
i	Mutual aid may require a portable data transfer system



DURABILITY

⚠	Devices should be suitably robust and function effectively in their operational environment
✓	Minimum rating of IP54
i	IP (Ingress Protection) rating is the common measure of the device's resistance to dust and water
i	IP54 is 'dust protected' and 'protected against water splashes'
i	Most devices are at least IP65 that is 'dust tight' and 'protected against water jets'
i	Higher still is IP67 that is 'dust tight' and 'water proof up to 1m'
i	IK (Impact Protection) ratings also exist that indicate impact protection from the device being dropped
i	IP and IK ratings do not require certification by an independent testing laboratory

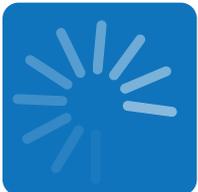
Optional Features

Enhancing the deployment of BWV



DISPLAY SCREEN

⚠	Enables a range of functions whether on the front or rear of the device or through a mobile app
✓	Display requires a safeguard to ensure recordings cannot be replayed and viewed by a third party if the device is lost
i	Allows the User to check camera view, review video recordings and can improve its functionality
i	Mobile apps on an additional device can allow video recordings to be reviewed on a larger display with better audio as well as improve functionality such as tagging video files
i	Built-in display does not require an additional device using a mobile app, but can increase power consumption



PRE-EVENT RECORDING BUFFER

⚠	A continuous recording loop designed to ensure that relevant information is still captured if the User is unable to immediately activate the recording
✓	Configurable buffer time and ability to disable the function
✓	Should not affect when a User activates recording on the device
i	Can ensure potential evidence is not lost if manual recording activation is delayed
i	Recording buffer is an overwriting loop and is only permanently saved after manual activation
i	Increases power consumption
i	Standard Operating Procedures and supervision should dictate activation and deactivation of recording



PHOTOGRAPH FUNCTION

	A better method of producing an image than acquiring a still from a video recording
	Ability to take a photograph while recording is activated
	Save as a High Quality JPEG image format
	Populate Exif technical metadata fields
	An LED lamp or flash will improve photos in low light
	Ability to view photo on a display will assist the User
	Image files will have the same continuity and data loss safeguards as video files
	Additional user instruction should be provided for this function



GEO TAGGING

	Applies location data to image and video files
	Use open standard protocols
	Apply to image and video files
	Can be paired with additional mobile device to extract location data
	Accuracy of GPS data may decrease in built up areas
	Can improve the organising and retrieval of video within the back office system
	Can be used for regular calibration of time and date
	Generally limited to external locations



WIRELESS CONNECTIVITY

⚠	Enables video with audio to be streamed from the BWV device to a mobile display device such as a smartphone, tablet or laptop, as well as to a control room or mobile command. Furthermore can enhance the functionality of the BWV device
✓	Transmitted data should be encrypted to at least AES-128 standards
✓	Ability to disable wireless connectivity
✓	Indicators showing signal strength and when data is being transmitted
✓	Indicators on a receiving device showing when video stream freezes, is buffering and when signal is either low or lost
✓	Near Field Communication (NFC) used to enable connection between the BWV device and a mobile display device
✓	Mobile apps should be available for Android, iOS and Windows
✓	Computer software should be browser based
✓	Additional user training required to operate wireless functions
ⓘ	Most common are 3G, 4G, 4G LTE, WiFi and Bluetooth based on international standards. Other proprietary wireless standards exist, but are less likely to be integrated into BWV devices
ⓘ	Battery power consumption increases when wireless is enabled
ⓘ	Master copy status should be applied to the highest quality recording although this may not be the case for some operational deployments



WiFi

⚠	Transmits data over a medium distance (<100m) between the BWV device and a mobile display device or a WiFi network. Primarily used for reviewing BWV data
ⓘ	Metadata can be applied to video files (tagging) without accessing a desk top computer
ⓘ	Camera preview via a mobile display assists with correctly aiming the BWV device's camera if it does not have a built-in display
ⓘ	Video stored on the BWV device can be reviewed on a mobile display device
ⓘ	Video and audio can be 'live' streamed to a mobile display device
ⓘ	A mobile display device can be used as a transitional step to 'live' stream video and audio onto the 3G/4G network
ⓘ	Data can be copied to a mobile display device and re transmitted over a secure police network to the back office system
ⓘ	Recording can be activated and deactivated remotely
ⓘ	Signal range is determined by both the transmitting and receiving devices
ⓘ	Signal strength is reduced by objects in the line of sight
ⓘ	Relatively high power consumption when enabled



3G/4G/4G LTE

⚠ Transmits data across the global mobile data network from the BWV device to a mobile display device connected to that network or the Internet. Primarily used for live video streaming

- ✓ Automatically reconnect streaming if signal suffers a temporary drop
- ✓ Dynamic management of streaming parameters to match available network performance
- ✓ Encoded output video stream should be saved on the BWV device
- ✓ Encoded input video stream should be saved on the receiving device or system

- ⓘ Performance of any 3G/4G enabled device is highly dependent on the mobile data network
- ⓘ Data secured on the BWV device can be transmitted to a back office system
- ⓘ Recording can be activated and deactivated remotely
- ⓘ Image and audio quality can be heavily affected by network congestion causing pixelation, buffering and freezing
- ⓘ Significant camera movement will cause a reduction in video quality
- ⓘ Latency of at least one second should be expected
- ⓘ Combined with GPS, allows a user's location to be monitored
- ⓘ Network coverage can be checked using Ofcom mobile checker app and opensignal.com
- ⓘ Data charges will apply
- ⓘ Relatively high power consumption when enabled



BLUETOOTH®

⚠ Transmits data over a short distance (<10m) between the BWV device and a mobile display device. Primarily used for tagging BWV recordings

- ⓘ Camera preview via a mobile display device assists with correctly aiming the BWV device's camera if it does not have a built-in display
- ⓘ Additional functions and settings of the device can be accessed and configured
- ⓘ Recording can be activated and deactivated remotely
- ⓘ Signal range is determined by both the transmitting and receiving devices
- ⓘ Signal strength is reduced by objects in the line of sight
- ⓘ Relatively low power consumption when enabled

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