



# DropCam-SDR User Manual



Rapid Deployable  
Mesh Enabled Camera



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## Document History

Version	Date	Change Summary
v1.00	06/09/2022	Initial Draft
v2.00	14/03/2024	System Updates

## Warranty and Support

All Visual Engineering products are supplied as standard with a 12 month 'Return to Base' warranty.

**Please note: Any unauthorised product disassembly, modification or the removal of tamper proof labels will void the warranty.**

In the event of a suspected product failure, users should contact the Visual Engineering support team on the telephone number +44 (0) 1206 211842 or please email us at:

[support@visualengineering.co.uk](mailto:support@visualengineering.co.uk)

Should the fault persist or if the support team are unable to resolve the fault, it may be necessary to return the equipment.

Equipment should only be returned using the RMA (Returns Management Authorisation) process. Users should contact the support team on the above number and request an RMA number.

## Safe Operating Procedure

- The equipment should be operated within the environmental limits as detailed in the [Specifications](#) section of this user manual.
- Only authorised and trained personnel should operate the equipment.
- There are no functions that require the user to gain access to the interior.
- Changes to the radio settings as described in the [Maintainer Guide](#) section should only be carried out by personnel that have had the appropriate training.



## User Guide

### Introduction

The DropCam-SDR is a Mesh enabled camera module which incorporates a DTC Software Defined Radio, a HD camera, a microphone, a flexible antenna pair and a battery.

The simple to use button interface allows the DropCam-SDR to be rapidly deployed.

Demand for system flexibility has led to Mesh being the first choice for transferring video. A digital Mesh radio network allows encoded video, audio and data to be shared between several nodes simultaneously.

COFDM point to point type RF transmission is also supported as a configurable option.

The video output is configurable as either HD or a standard definition windowed version of the video. SD video mode supports a solid state [PTZ function](#) by taking advantage of a 3x lossless digital zoom made possible by using the HD sensor as its source.

The DropCam-SDR also supports the option to connect IP and HD-SDI [external cameras](#) as its video source.

The transmitted video can be observed using the TM-RX Receiver partner product:

<https://www.visualengineering.co.uk/tm-rx-mesh-receiver/p/1196>

The DropCam-SDR can also be configured exclusively as a [Mesh relay node](#). When coupled with high gain antennas it allows the connection of remote nodes that would otherwise be outside the network's RF coverage.

Activation of the unit can be configured to activate on [external trigger events](#). It also incorporates four LEDs which can be either white light or infrared.

The housing is a very rugged CNC machined IP67 rated waterproof enclosure.

Security of the link is ensured either through standard DES encryption or optional AES128 or AES256.



## DropCam-SDR Kit

The DropCam-SDR kit comes complete in a foam lined Peli flight case.

In addition to the DropCam-SDR the kit also includes two antennas, a configuration cable and a mains power adaptor.

The kit contents are shown here and listed below, along with their part numbers.



	Part Description	Part Number
①	DropCam-SDR 114150	110-0497
②	Antennas 1GHz to 1.5GHz	110-0190
③	Configuration Cable	110-0077
④	Mains PSU with Adaptors	110-8661
⑤	Documentation	110-8697



## DropCam-SDR Features





## Rear Connectors

The DropCam-SDR has two Fischer MiniMax connections on the rear. They are key specific to avoid incorrect cable use.

Remove the protective caps before use.

The top blue connector is used for battery charging with the mains PSU, included in the kit.

The bottom green connector supports connections to the embedded SDR Mesh radio.



## Battery Charging

The unit is charged by connecting the mains power supply to the blue Fischer power connector.

The status screen displays the progress of the battery charging.

A fully depleted battery will take approximately 3 hours to gain a full charge.

The status screen reports once the charging cycle is complete.



## Connecting Antennas

The antennas are a push fit QMA type.

Click the antennas into position by inserting each antenna vertically downwards on to the antenna connectors.

To remove: Slide the connector's silver collar up and continue to pull the collar vertically upwards.



**Avoid removing the antenna by pulling up on the antenna's black body as this can cause damage.**





## Powering On

A long press on the power button will start the boot up procedure.

At start up the status screen will display DropCam-SDR, as shown.

The initiation of the start up procedure is further confirmed by the unit producing a haptic vibration.



## Status Screen Menus

The DropCam-SDR incorporates a simple to use status screen to monitor and configure user settings. Use the + control button to scroll through the available options, select an option using the power button.

### Battery Level

The first status information screen displays the battery level, giving both a percentage of charge remaining and a time in minutes until empty.

Typically a full battery will power the DropCam-SDR for 3 hours this is when the Mesh radio is transmitting full motion video. This time can vary depending on the RF profile used.

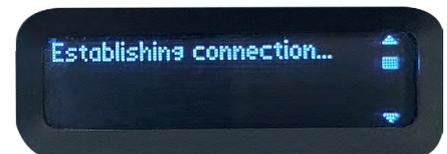


### Radio Presets

Following power on the Mesh radio will take a short time to initialise and establish a connection.

The radio presets are configured as described in the [Maintainer Guide](#).

Use the + control button to scroll through the preset options, select a preset using the power button.





## External Triggers

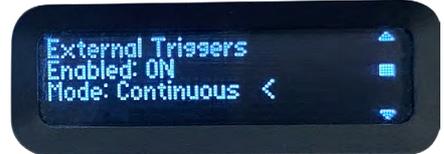
The DropCam-SDR can be configured to activate on external trigger events. The control pin for the triggers is detailed in the [Connector Pin-outs](#) section.

The trigger input (TRIG\_INP) pin is active low. In continuous mode the DropCam-SDR will stay on as long as this pin is held low. It will then turn off when released, the pin is pulled high using an internal pull-up.

In Timed mode, the unit will power up on a falling edge of the trigger and stay on for a defined amount of time; 20, 30, 90 or 120 seconds.

If external trigger control is required please contact support to discuss connector requirements for the interface cable.

[support@visualengineering.co.uk](mailto:support@visualengineering.co.uk)



## Video Quality

Configure the level of video quality to match the deployment.

Typically a reduced video quality selection will match a limited bandwidth radio link.

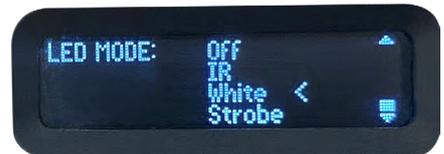


## LED Mode

The DropCam-SDR incorporates IR and white LEDs. Activate either type by selecting the option in the menu. Selecting strobe mode will rapidly flash the white LEDs.

The control of the LEDs is achieved using the TM-RX Receiver partner product. This is described in the Viewer App section of the user guide, available here:

<https://www.visualengineering.co.uk/supportdownload/53>





## Video Mode

The camera can output either HD or SD video.

By default the DropCam-SDR will always boot up in SD mode.

When SD video is selected it is possible to pan and tilt a SD video window around the higher resolution HD sensor frame. The camera's HD sensor also supports a 3x lossless digital zoom.



PTZ control of the SD video frame can be controlled using the joystick and the + and - keys on the TM-RX Receiver partner product.

This process is described in the **TM-RX Screens : Digital PTZ** section of the TM-RX Receiver user guide, available here:

<https://www.visualengineering.co.uk/supportdownload/53>

## Powering Off

A long press on the Power Button will power the unit off.

In addition to the indication on the status screen the power down is further confirmed by a haptic vibration.





## External Cameras

The rear connectors of the DropCam-SDR allows external IP and HD-SDI cameras to be connected to the Mesh radio as the video source.

If this feature is required please contact support to check for camera compatibility and for the necessary adaptor cable.

[support@visualengineering.co.uk](mailto:support@visualengineering.co.uk)

## Range Extender

In addition to the DropCam-SDR being used as a video source on a Mesh network it can also be used exclusively as a range extender.

Taking advantage of its portability, strategic placement of the DropCam-SDR can incorporate the connection of remote nodes that would otherwise be outside the network's RF coverage.

If the DropCam-SDR is used for this mode of operation the battery life can be optimised by switching off the internal video encoder.



The system range can be further extended by including high gain antennas with an integrated secure DropCam mount as shown here.

Typically the assembly should be mounted at height so as to allow the system to cover the maximum area.

The V-block mount on the reverse allows the assembly to be secured to a pole using worm drive hose clips.



## Maintainer Guide

This section is intended for the Maintainer to configure the network and radios using the web browser control interface.

**Web browser configuration of the Mesh radio is not required for normal operation and should only be undertaken to achieve the following:**

- Change the system frequency
- Change the system IP addresses
- Change the Encryption key
- Switch the operating mode of the radio
- Understand the RF performance of the system better



**Maintainers should be very careful when using this interface because it is entirely possible to make changes that will leave the system inoperable, requiring the system to be returned to base for repair.**



### Web Interface Access

Power up the DropCam-SDR and connect its configuration cable to the green Fischer connector, then connect the RJ45 connector end to a PC.

- Open a web browser on the PC
- Type the IP address of the unit e.g. **192.168.1.211** into the address bar
- The web browser will open a **Login Prompt**

To find IP address of radio in the DropCam-SDR or the TM-RX Receiver refer to the Radio App section of the TM-RX Receiver User Manual.

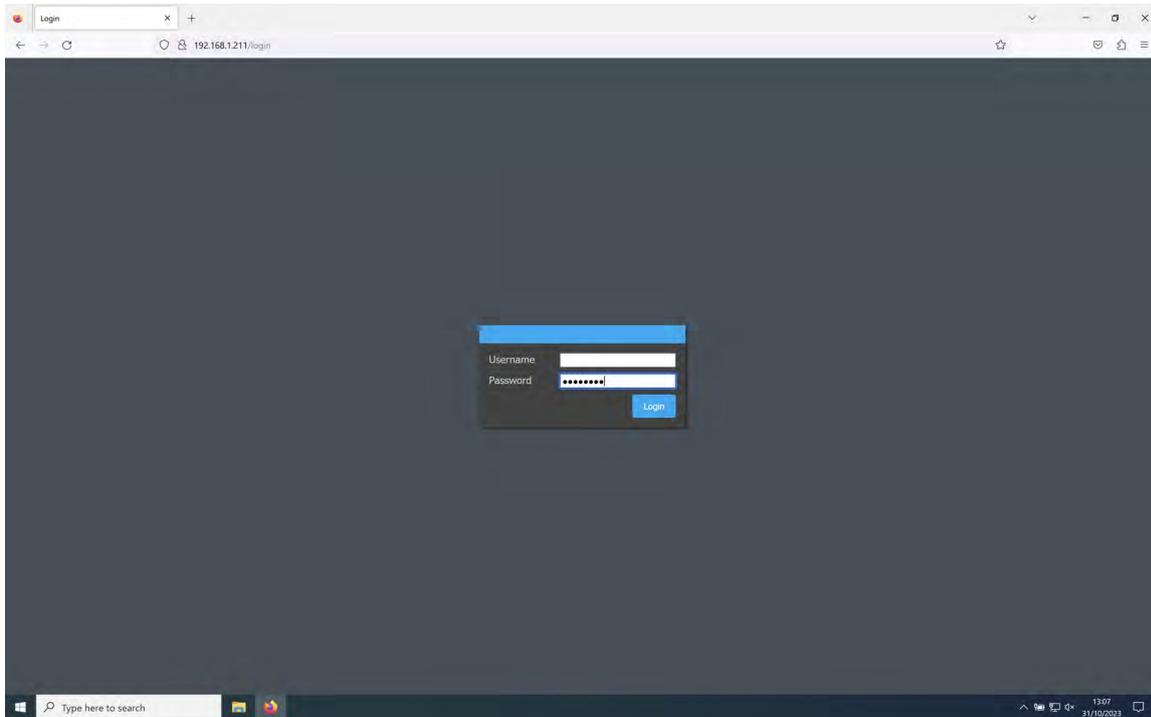
<https://www.visualengineering.co.uk/supportdownload/53>

If the link cannot be established to find the DropCam-SDR's IP address it will be necessary to use the **Node Finder Application**, it may be necessary to contact Visual Engineering for support in this instance:

[support@visualengineering.co.uk](mailto:support@visualengineering.co.uk)

## Login Prompt

Login authentication is required to connect to the SDR Mesh radio configuration pages. By default the user name should be left blank and the password is **Eastwood**

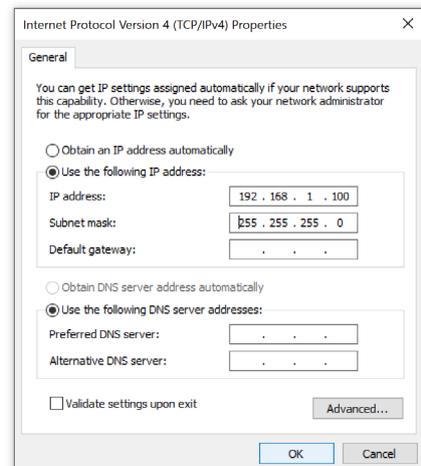
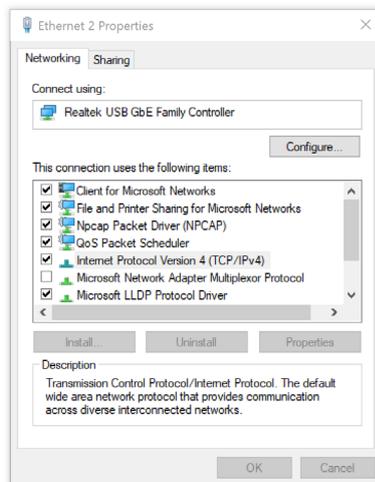
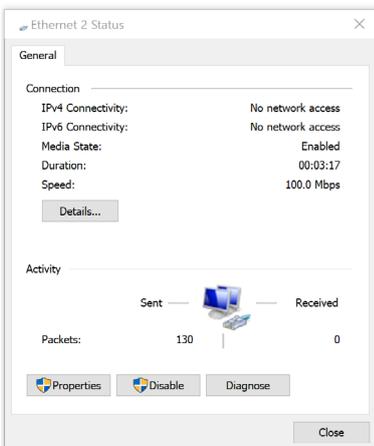
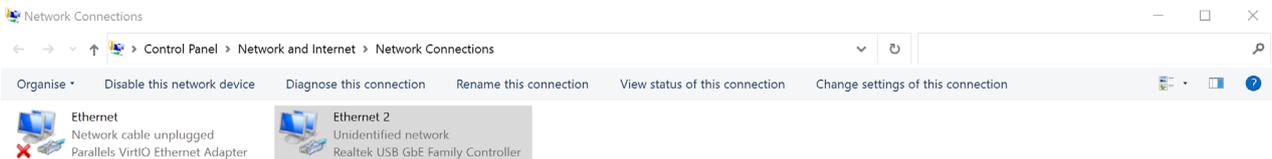
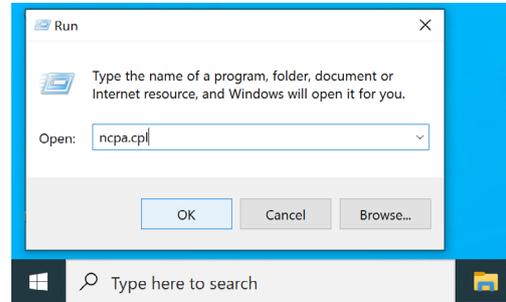


If a connection cannot be established with the login page it may be that the controlling PC is not on the same IP subnet as the radio. The following section describes how to set the PC to a specific IP address.

## PC IP Address Configuration

For a direct Ethernet connection between the DropCam-SDR and a PC, it may be necessary to configure the PC's network adapter to use a static IP address, as described below.

1. Open the Run app. (Press and hold Windows Key (W) on the keyboard, then press the "R" key)
2. Type the command "ncpa.cpl", then click OK.
3. Right click on the network adapter where the unit is connected to, then click "Properties". (If there are multiple adapters, the correct one can be identified by disconnecting the Ethernet cable, one of the adapters should now show "Network cable unplugged" upon reconnection it should eventually change to "Unidentified Network", this is the one connected to the system)
4. In the window that pops up, select "Internet Protocol Version 4 (TCP/IPv4)" then click "Properties".
5. Another window will now pop up, select "Use the following IP Address" and enter an IP Address on the same subnet as the system.
6. Click OK and Close

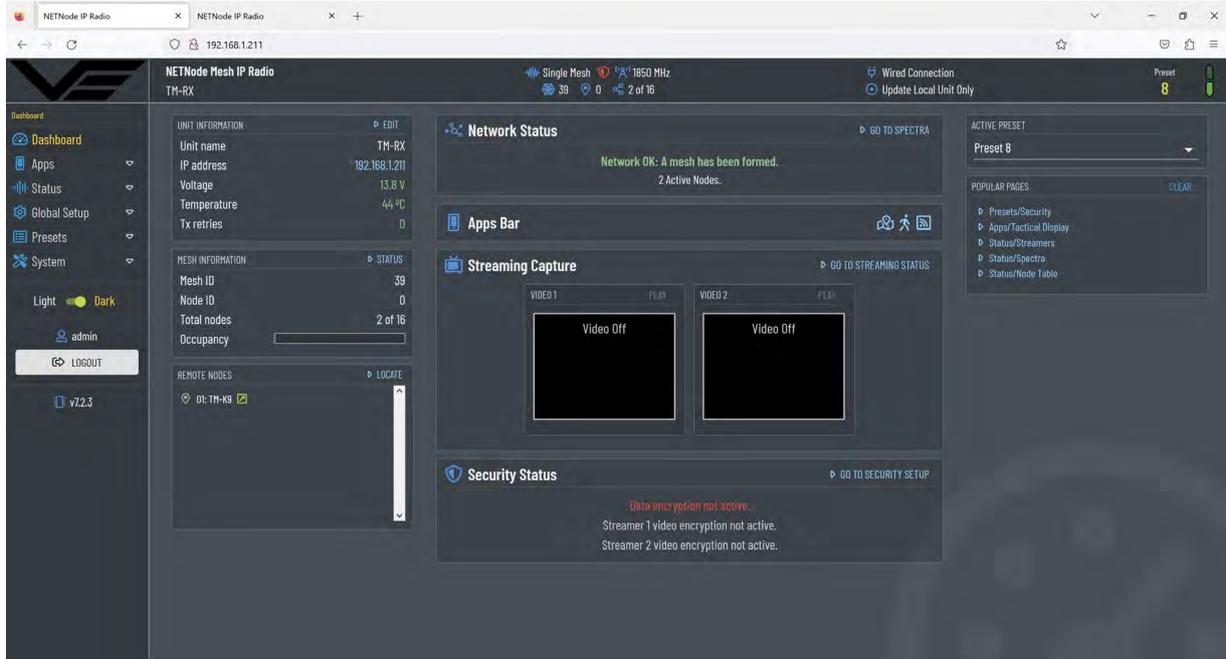


To re-configure to the original settings where the PC's IP address is obtained automatically follow the steps above except in step 5 select "Obtain an IP address automatically"

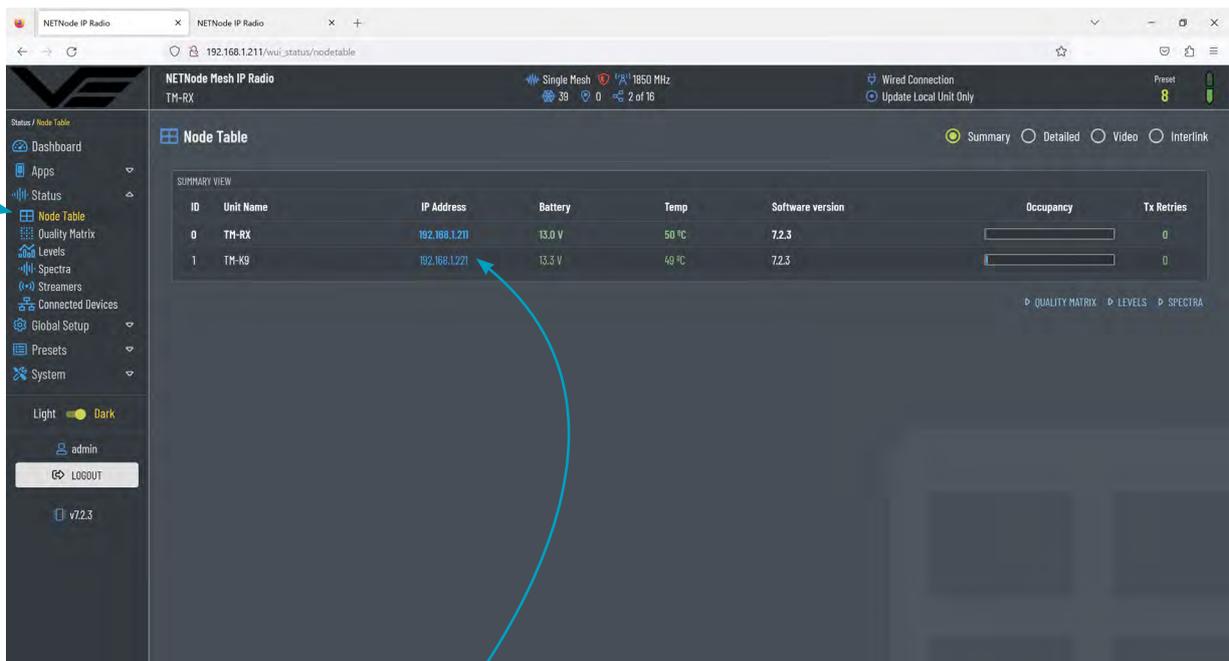
## Dashboard

The Dashboard is a summary page. The blue text icons are hyper-links which lead to pages where parameters can be viewed in closer detail or edited.

The **TM-RX Dashboard** below shows an active Mesh with one other active node on Preset 8.

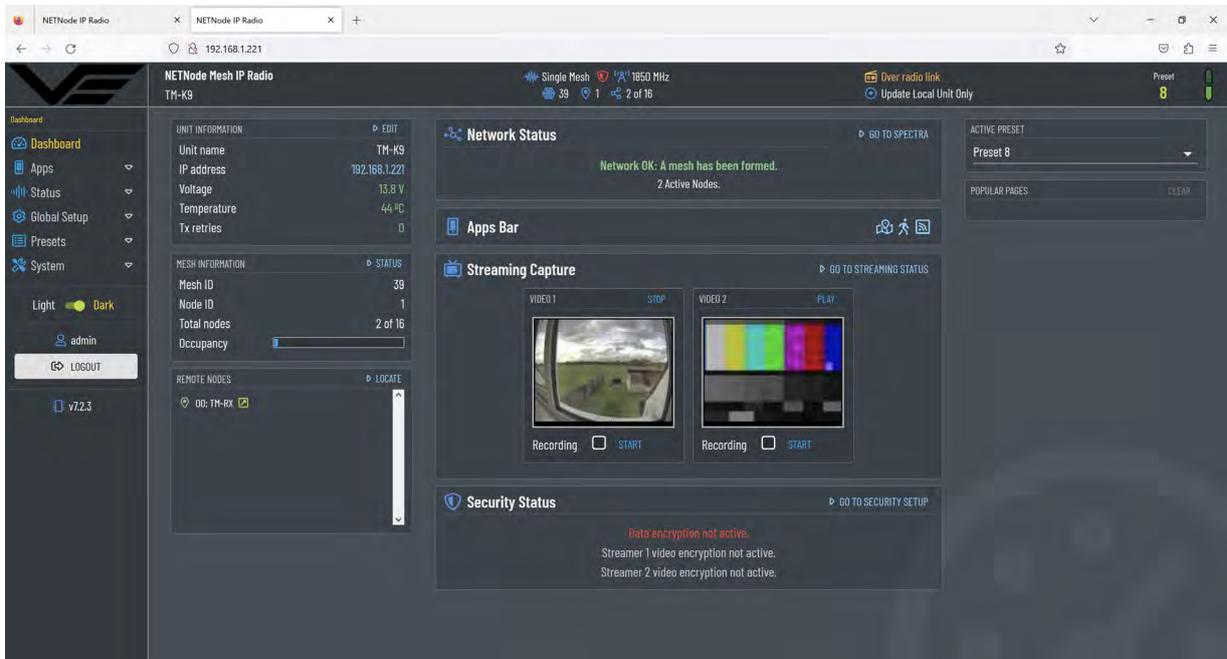


Select **Status>Node Table** to list all active nodes on the Mesh network.



The only other node on the network is named TM-K9. Click on the IP Address to access its Dashboard.

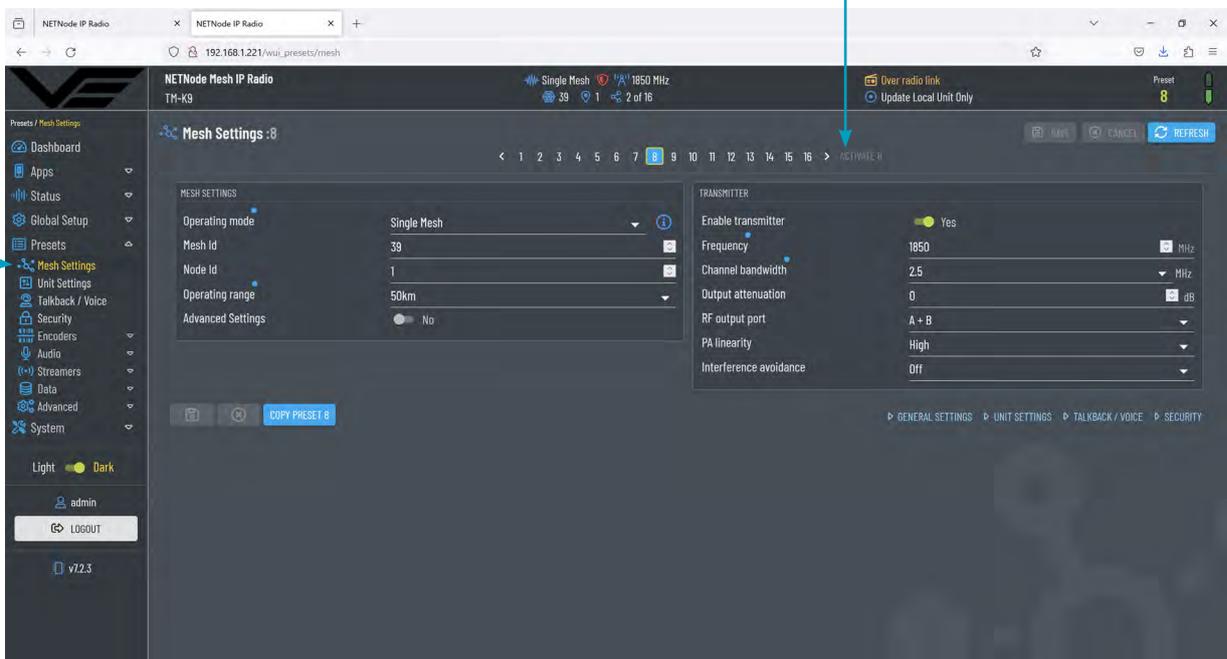
The TM-K9 Dashboard below displays the Mesh node status.  
 VIDEO 1 preview displays the active main camera feed.  
 VIDEO 2 preview displays a test bars signal since there is no external camera connected.



## Mesh Settings

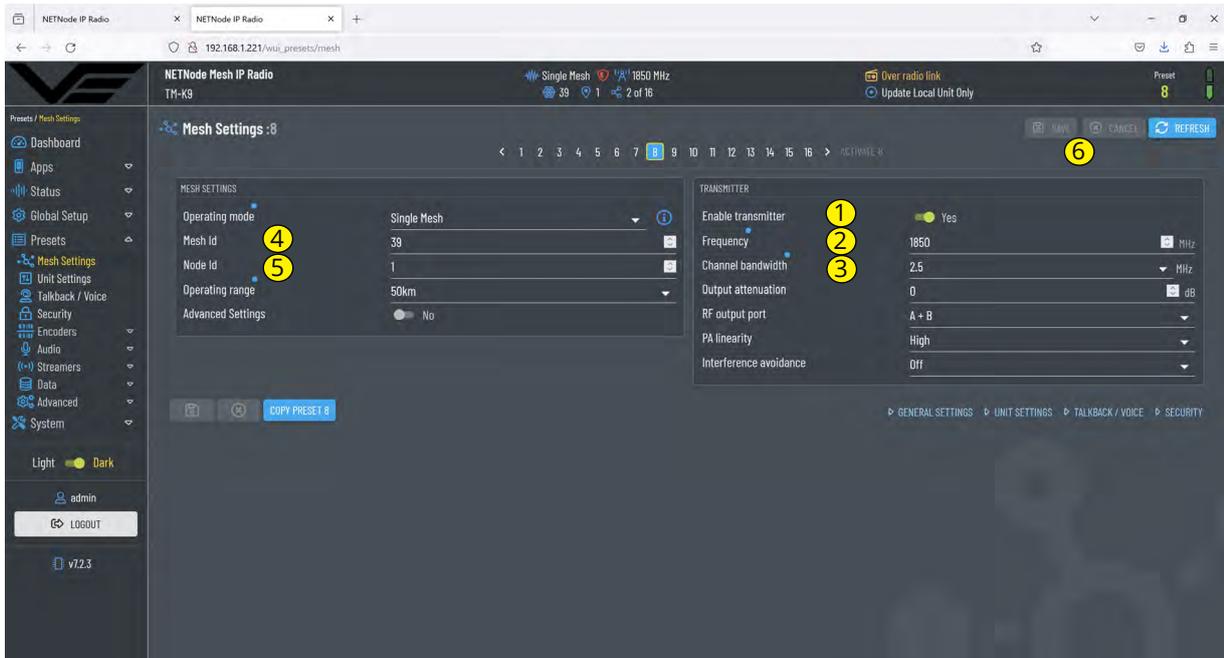
The control page below can be used to control and configure a Mesh node.  
 Browse to the **Presets>Mesh Settings** tab.

The RF channel on the selected Mesh node can be changed from here, select the required channel and Activate.



## Key RF Settings

The highlighted options in the Mesh Settings page are the key points to consider when configuring the RF channel, as described in the table below.



Item	Description
① Enable transmitter	Slide to Yes to switch the transmitter on. All nodes in a Mesh must have their transmitters enabled.
② Frequency	Type in the frequency to use for the Mesh. This must be the same for all units.
③ Channel bandwidth	Select the bandwidth to use for your Mesh from the drop-down list. This must be the same for all units.
④ Mesh Id	Type in a Mesh ID, this must be the same on all units in the Mesh network. The Mesh ID sets which Mesh network the unit belongs to. All nodes on a particular Mesh ID can communicate with each other.
⑤ Node Id	Type in a Node ID for each node. The node ID must be unique in the Mesh network. <b>Note:</b> A node can automatically reassign its Node ID at power up if it finds a conflict with an existing node.
⑥ Save or Cancel	Once values have been set, click Save to commit to the changes or Cancel to revert to the existing configuration.

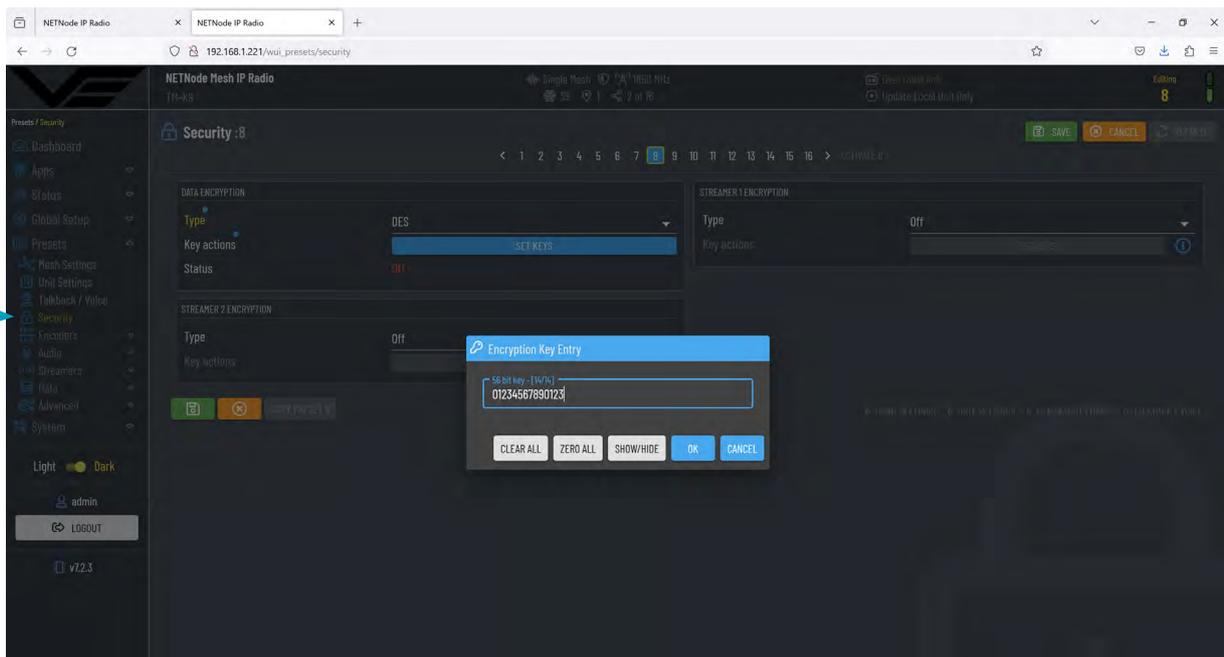
## Additional RF Settings

In addition to the key parameters the table below describes additional parameters in the Mesh Settings page that can also be used to optimise the RF performance.

Item	Description
<b>Output attenuation</b>	The level of attenuation in dB applied to the output. Can be useful if the transmitter is swamping a second unit nearby.
<b>RF output port</b>	Selects which of the two output ports (or both) is to be used as a transmit port.
<b>PA linearity</b>	High linearity, improves RF quality at the expense of power consumption. Low linearity will have some saving in power consumption.
<b>Interference Avoidance</b>	Switches frequency automatically when channel interference is experienced. If master mode is selected, the transmitter frequency is replaced by a Set button. If clicked, up to eight preset frequencies can be entered which are followed by all other Slave nodes in the network.
<b>Operating Range</b>	A larger range allows the Mesh network to operate over a bigger distance at the expense of bit-rate.

## Security

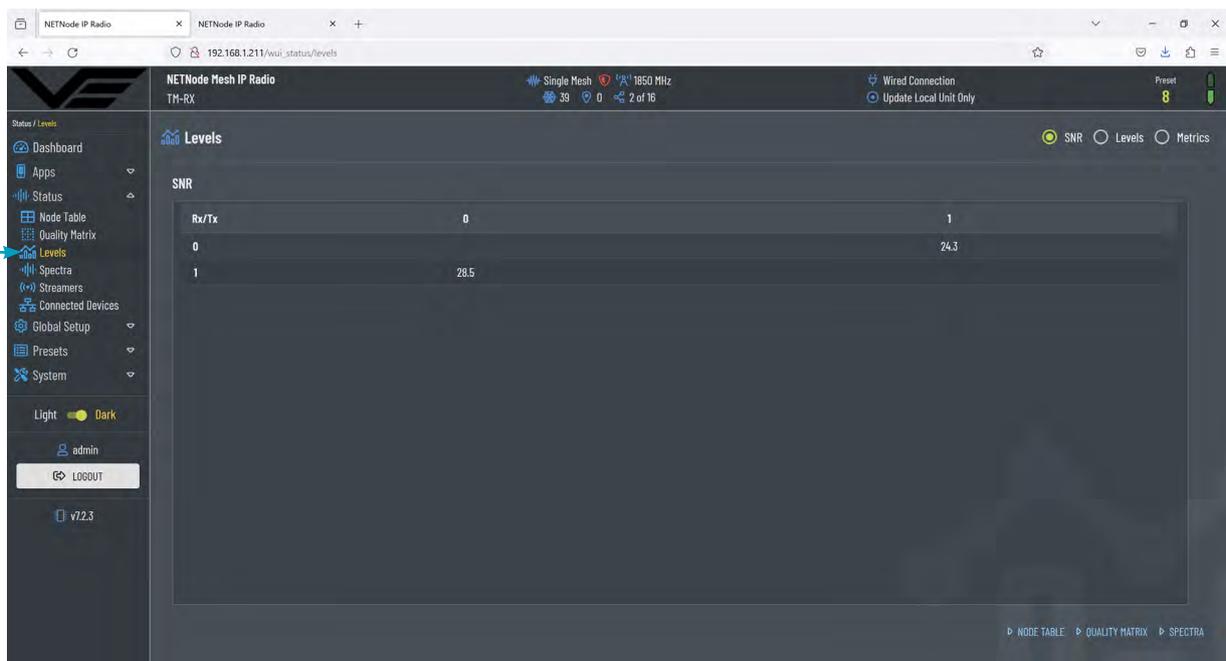
The security page can be used to configure the unit's encryption keys for the data channel and the two video streamers. DES encryption is standard with other types licence dependant. Browse to the **Presets>Security** tab.



## Signal Levels

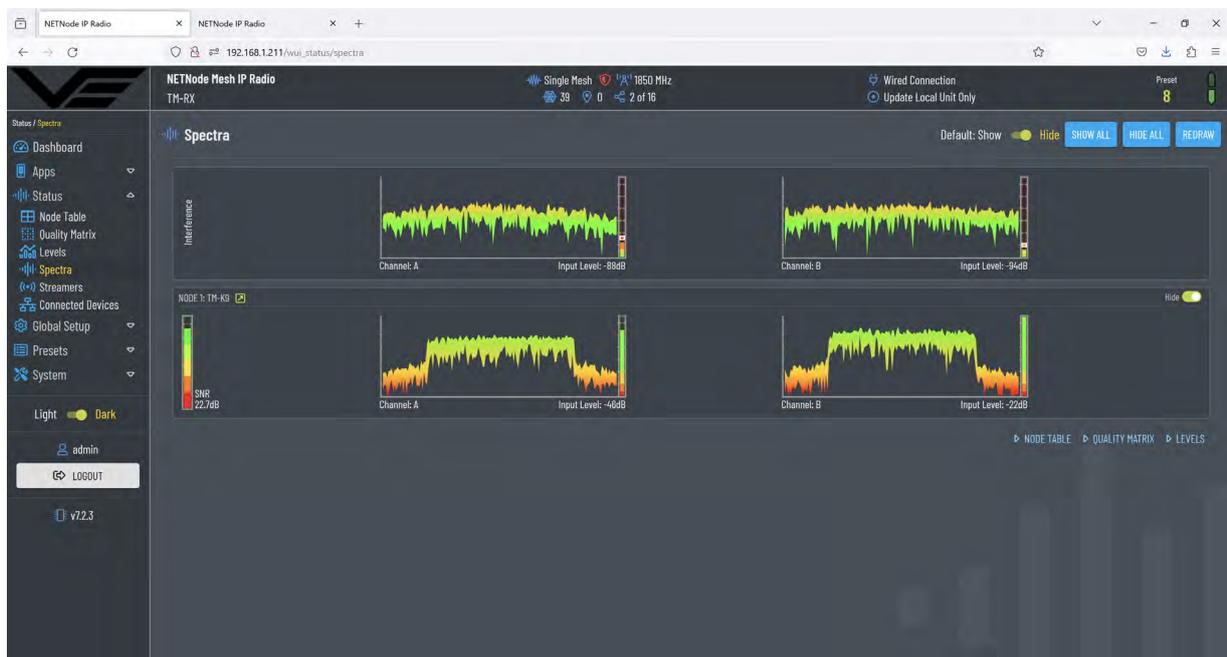
This page gives an overview of the signal quality around the Mesh system. Typically SNRs > 15 are very good. The number will reduce as the unit goes out of range or interference is present. If there are more than two Mesh nodes in the network the system will automatically find a new path to route the signal.

Browse to the **Status>Levels** tab.



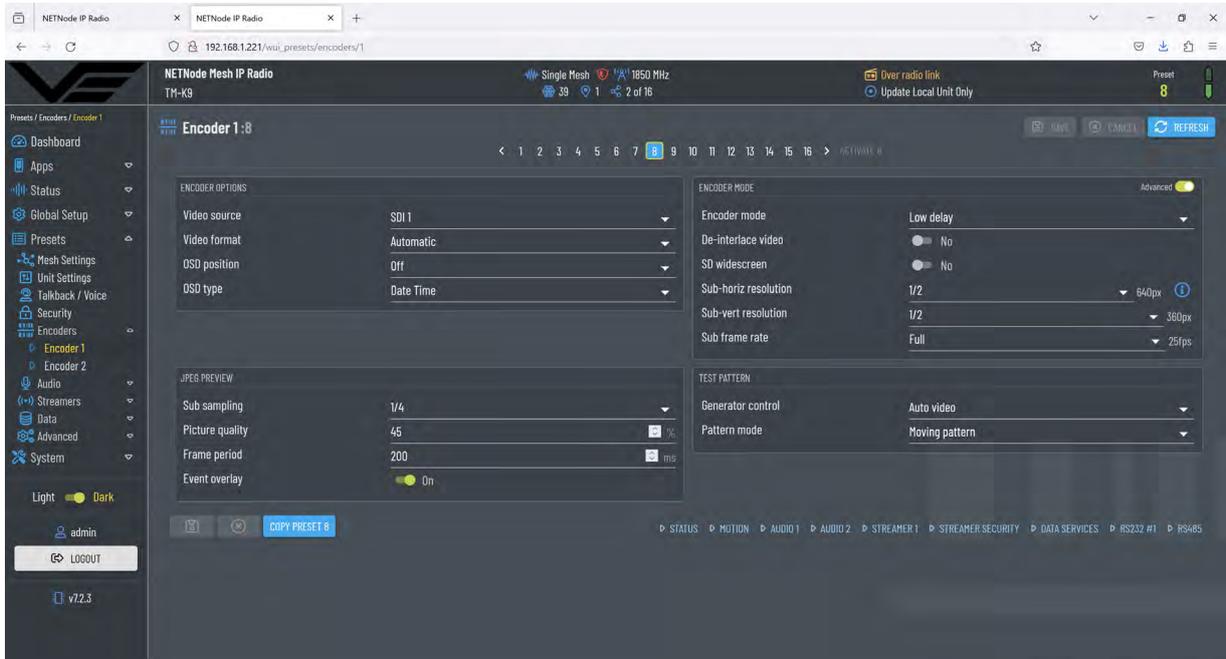
This spectra page below gives a graphical view of the RF channel. The interference graphs can be a very useful tool to detect any other users occupying the spectrum, which will ultimately result in glitches in the RF channel performance.

The RF signal graph of the remote node underneath gives a colour graded overview of the level of the COFDM signal.



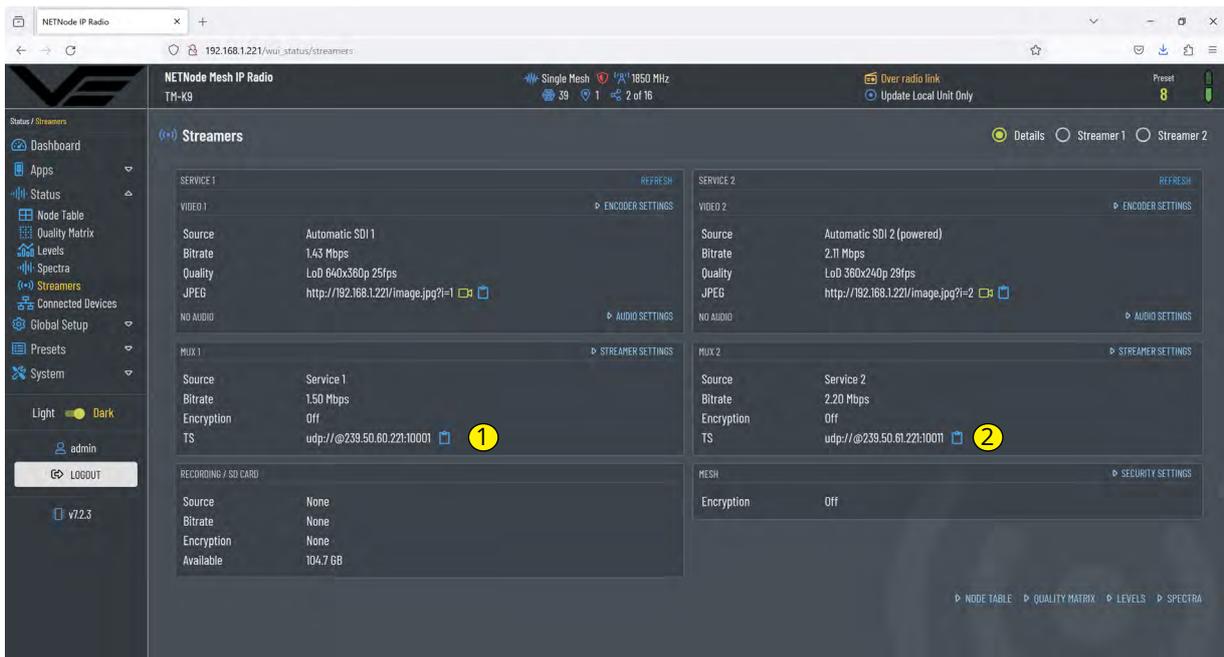
## Video Encoders

The two video encoders in the DropCam-SDR are configured to match the system hardware. On screen display information can be added if required. Most other parameters are not normally required to be changed unless re-configuring the system or fault finding.



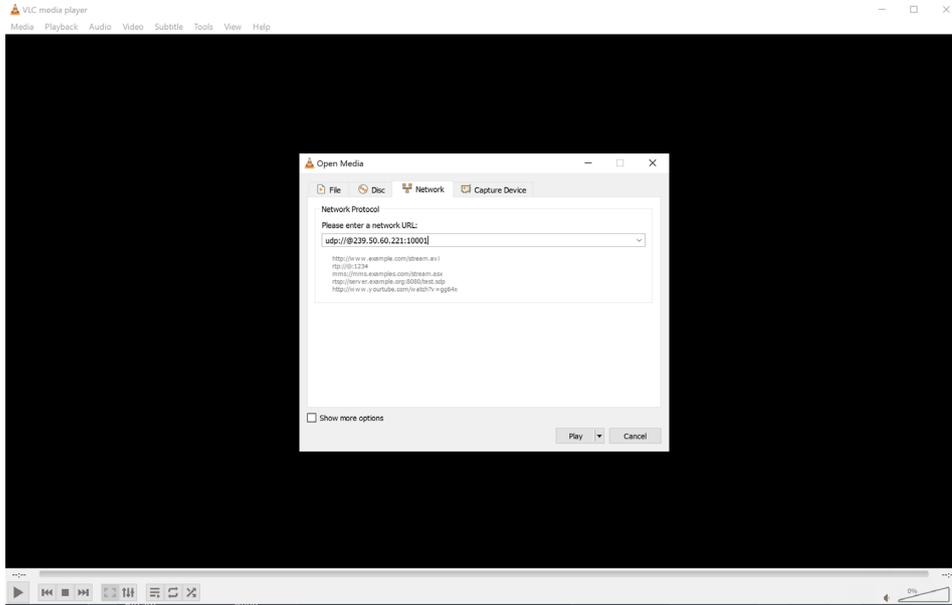
## Video Redistribution

The DropCam-SDR video streams can be played in a suitable media player connected to the network. Check the URL addresses in the **Status>Streamers** page as highlighted in the example below.



## VLC Playback

The VLC is a free media player which can be used to playback the video stream. From the Media menu select the 'Open Network Stream' and enter the URL stream as shown in the example below.



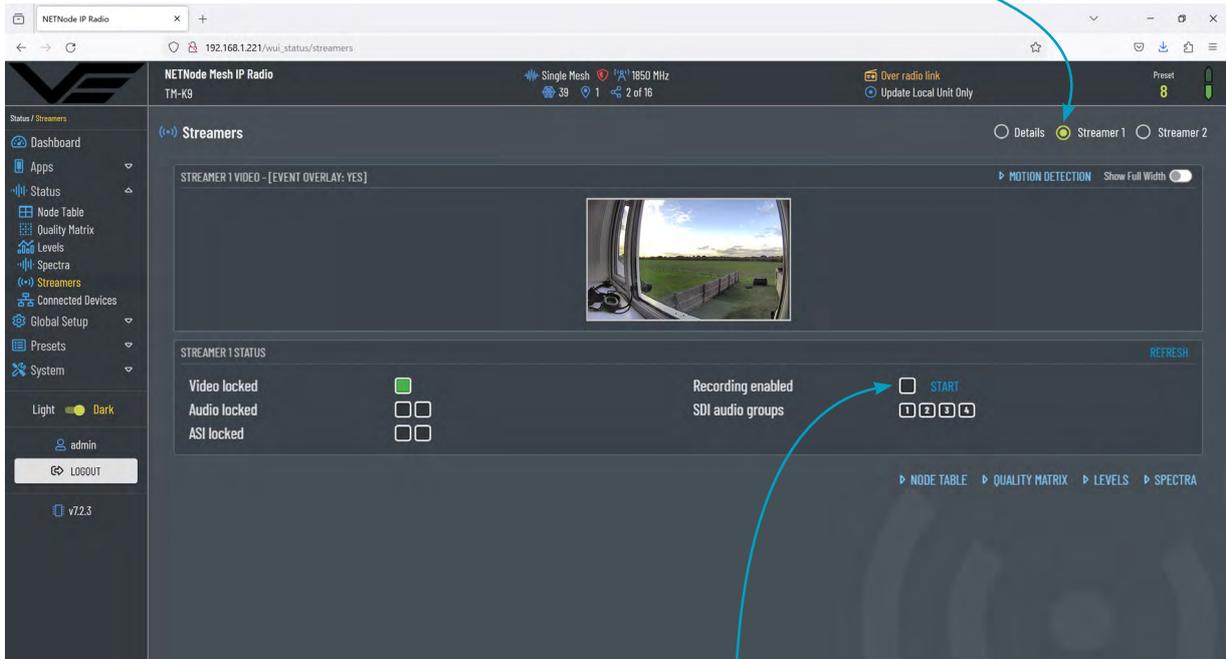
The video can be monitored on the local network connected to the Mesh or remotely monitored through a back-haul system, as described in the [Mesh Networks](#) section.



## Edge Recording

The SDR radio in the DropCam has an integrated 128GB SD card that can be used for video recording. The configuration of this feature is on the **Status>Streamers** page. Downloading and viewing of the files is supported using DTC software tools.

To enable recording first select a Streamer instance.



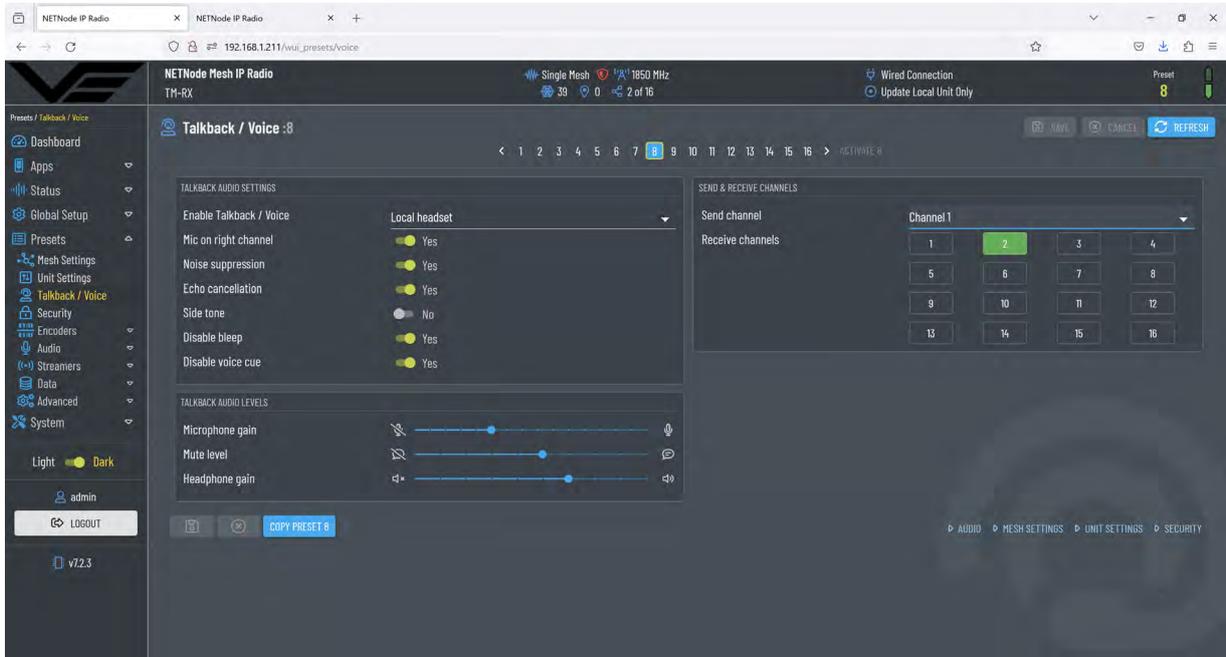
Recordings are controlled by clicking the Start/Stop button.

The control of the recording can also be made through the **Presets>Streamers>Streamer1** menu.

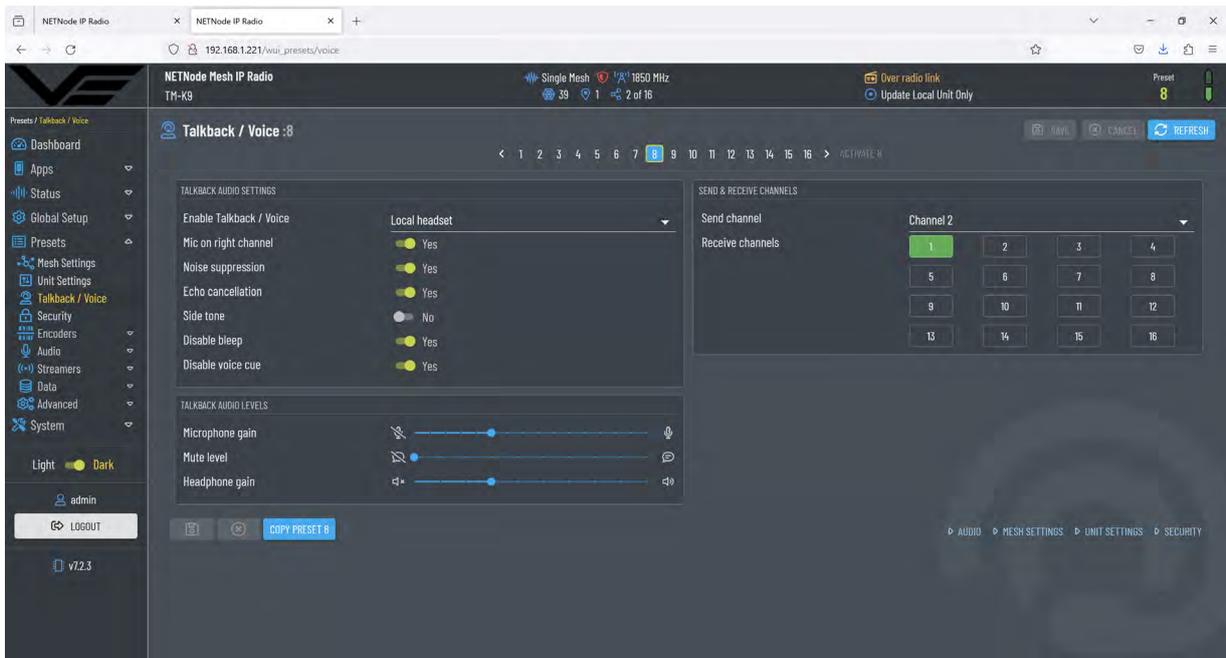
To view recordings it is necessary to use the Domo Video Download Tool (DVDT), which is a software application that can be used to download and convert files from DTC products.

## Audio Encoders

The audio encoders in the SDR radio are configured to achieve two way audio between the TM-RX Receiver and the DropCam-SDR. In the example configuration below the sent audio from the TM-RX Receiver is on channel 1, the TM-RX received audio is on channel 2.



Conversely the sent audio from the DropCam-SDR is on channel 2, the received audio is on channel 1, as shown below. This configuration is typical of a simple audio pairing between the two.



There are many possibilities to configure the audio matrix where audio from multiple nodes in the Mesh network are received by a single node. For example, many DropCams to one user or many users on an open channel. Care should be exercised to keep careful track of such system configurations as multiple audio crossovers could lead to confusion.



## JSON Configuration

The DropCam-SDR supports the upload and export of selected settings via the Java Script Open Notation file format. JSON files can be uploaded using the [File Uploader](#) Application.

The File Uploader application can be used to configure selected DropCam-SDR settings, below are example files in JSON format. The file must have the name: "UserSettings.json"

### Upload User Settings Example File

The file must have the name:  
"UserSettings.json".

```
{
  "Display_DarkBoot": {
    "_Value": false
  },
  "Display_AutoBacklight": {
    "_Value": false
  },
  "Display_BacklightBrightness": {
    "_Value": 60
  },
  "Apps_BootApp": {
    "_Value": "Viewer"
  },
  "JoystickButtons_VibrationFeedback": {
    "_Value": true
  },
  "Network_IpAddress": {
    "_Value": "192.168.1.243"
  },
  "Network_SubnetMask": {
    "_Value": "255.255.255.0"
  },
  "Network_DefaultGateway": {
    "_Value": "192.168.1.254"
  },
  "Telemetry_GroupID": {
    "_Value": 12345
  },
  "Telemetry_ExternalModule": {
    "_Value": false
  },
  "Recording_Record": {
    "_Value": false
  },
  "CursorOnTarget_Enable": {
    "_Value": false
  },
  "CursorOnTarget_ServerAddress": {
    "_Value": "127.0.0.1"
  },
  "CursorOnTarget_ServerPort": {
    "_Value": 18122
  }
}
```

### Upload Camera Settings Example File

The file must have the name:  
"Camera##.json"  
Where ## is equal to the camera number.

```
{
  "Enabled": {
    "_Value": false
  },
  "ConnectionType": {
    "_Value": "MESH"
  },
  "CameraName": {
    "_Value": "Camera"
  },
  "TelemetryAddress": {
    "_Value": 0
  },
  "Radio_Preset": {
    "_Value": 1
  },
  "Encoder_Stream_Address": {
    "_Value": "192.168.1.212"
  },
  "Encoder_Stream_Mode": {
    "_Value": "UDP (DTC)"
  },
  "Encoder_Stream_Multicast_Address": {
    "_Value": "239.50.60.212"
  },
  "Encoder_Stream_Port": {
    "_Value": 10001
  },
  "Encoder_Stream_Custom_MRL": {
    "_Value": ""
  },
  "Encoder_Stream_Custom_TCPUDP": {
    "_Value": "TCP"
  },
  "Encoder_CacheSize": {
    "_Value": 100
  },
  "CameraModel": {
    "_Value": "TM-K9"
  }
}
```



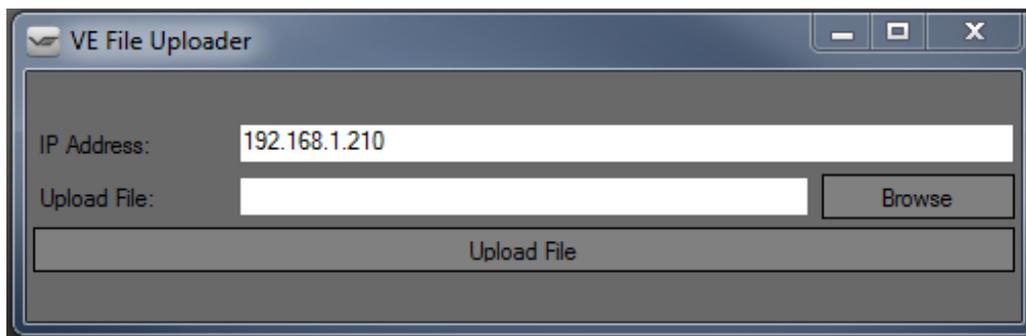
## File Uploader

The File Uploader is a PC software application which supports JSON configuration files to be uploaded to the DropCam-SDR.

The File Uploader application can be downloaded from the following location:

<https://www.visualengineering.co.uk/supportdownload/51>

- Start the downloaded executable.
- Ensure the PC and DropCam-SDR are on the same IP subnet. To find IP address of the DropCam-SDR or the TM-RX Receiver refer to the Settings App section of the TM-RX User Manual.
- Enter the IP Address of the DropCam-SDR into the File Uploader software.
- Browse to the file to be uploaded from the PC to the DropCam-SDR and press the "Upload File" button.





## Mesh Networks

In a Mesh network each node acts as an independent router. This allows for continuous connections and reconfiguration around broken or blocked paths by hopping from node to node until the destination is reached.

**All nodes in a Mesh network are required to be on the same frequency and share the same Mesh ID.**

Mesh networks are self-forming and self-healing which means that the network can still operate when a node or connection fails. This results in a network that is very reliable as there is often more than one path between a source and a destination.

The Mesh network constantly assesses which nodes are in range and the best routing to use.

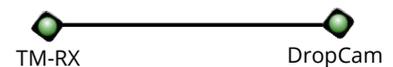
A group of nodes automatically form a network at power on. All nodes detect each other and a network is formed. If a node fails or is out of range the network will find an alternative routing path. Connectivity is thus preserved automatically.

## Mesh Topologies

### Two Node Network

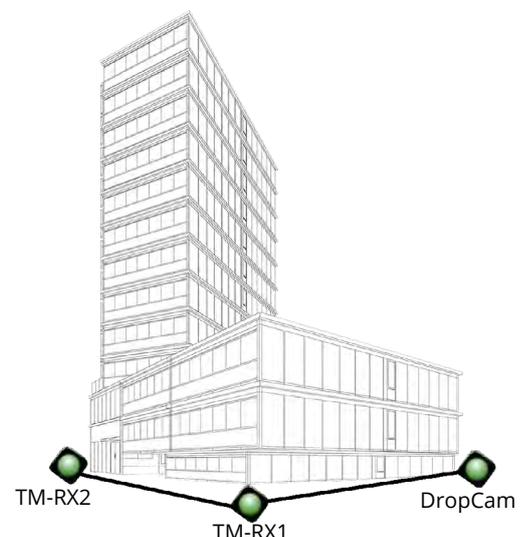
In its simplest form the Mesh network includes a single TM-RX Receiver and a single DropCam, resulting in a Mesh network topology as shown here.

As more nodes get introduced to the system the network map will take on different forms.



### Chain Network

Mesh nodes chain together to extend the network range or navigate around obstacles. In this example the video from the DropCam is received at by both TM-RX units. Since the link between the DropCam and TM-RX2 is blocked by the building the link between the two is channelled through TM-RX1.





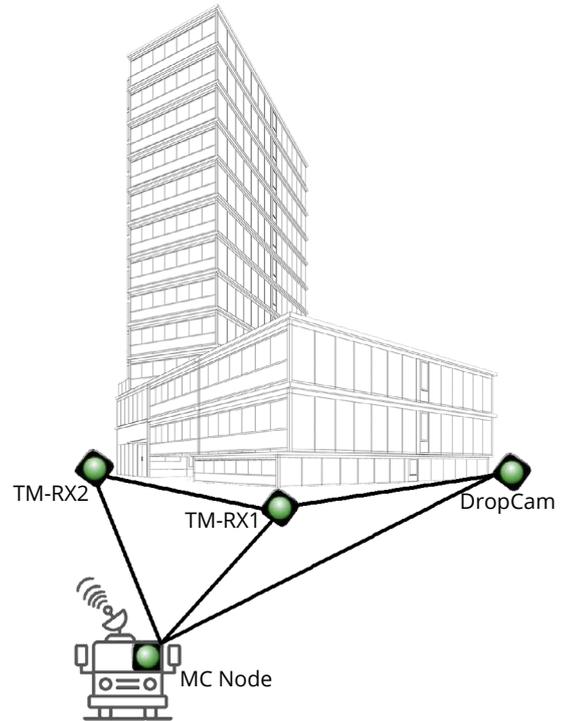
### Interlinked Network

As Mesh nodes are added the network map expands. As shown in this example the addition of the Mission Command node added to the previous configuration now gives two active paths between the DropCam and TM-RX2.

The vehicle based MC node can be any active Mesh node such as an additional TM-RX or a DropCam equipped with high gain antennas.

Additionally, the MC node also allows the option to extend the Mesh network to any remote location through a 5G connection or a satellite link.

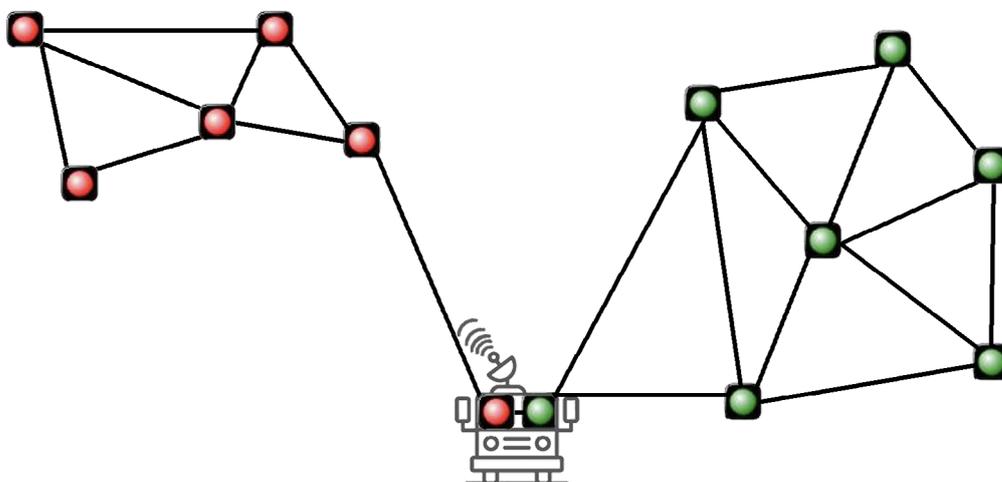
This allows the playback of any video feed in the Mesh network at a remote location. This configuration is described in the [Video Redistribution](#) section.



### Combined Network

If two separate networks are incompatible or operating at different frequencies, they can be combined at the IP layer as long as they belong to the same Mesh ID and share the same IP address subnet.

In the example below the red group Mesh network and the green group Mesh network are operating on separate frequencies. By including the Mission Command common receive point these two groups can be combined using a wired IP connection.



Wired IP Connection  
in Mission Command  
combining the two groups.



## System Configuration

Using the networking principles outlined above together with a good understanding of how to configure Mesh nodes as outlined in [Key RF Settings](#) it is possible to adjust the configuration of the system to meet the exact field requirements.

It should be noted that there is a limitation of a **maximum of 16 nodes** that can be supported by a single Mesh network. Furthermore bandwidth planning is important when populating a Mesh network, especially when attempting to stream multiple video streams simultaneously using a low radio bandwidth. In this circumstance the bandwidth limitation can be somewhat mitigated by reducing the video encoding rate.



**Care should be exercised when making far reaching changes away from the factory configuration.** In the absence of a good system understanding it is entirely possible that certain changes could leave the system inoperable, requiring the system to be returned to base for repair.

As a precautionary measure before changing the system's configuration it's a good plan to back up the system by exporting its settings using [JSON Configuration](#). If required, JSON configuration files can be used to recover the system back to a known working state.

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## Connectors

The two connectors on the rear of the DropCam-SDR are Fischer MiniMax type. Details of the pin-out of both connectors are described below.

### Pin-outs

Charging - Blue Connector	
Pin Number	Signal
1	SDA
2	ETHTX-
3	ETHTX+
4	232TXD
5	VCC12V0
6	SCL
7	ETHTX+
8	SDI_INPUT_2
9	GND
10	ETHRX-
11	232RXD
12	TRIG_INP

SDR Radio - Green Connector	
Pin Number	Signal
1	NC
2	ETHTX2-
3	ETHTX2+
4	USB D+
5	VCC12V0
6	AUDIO_OUT
7	ETHTX2+
8	MIC_INPUT
9	GND
10	ETHRX2-
11	USB D-
12	USB_5V



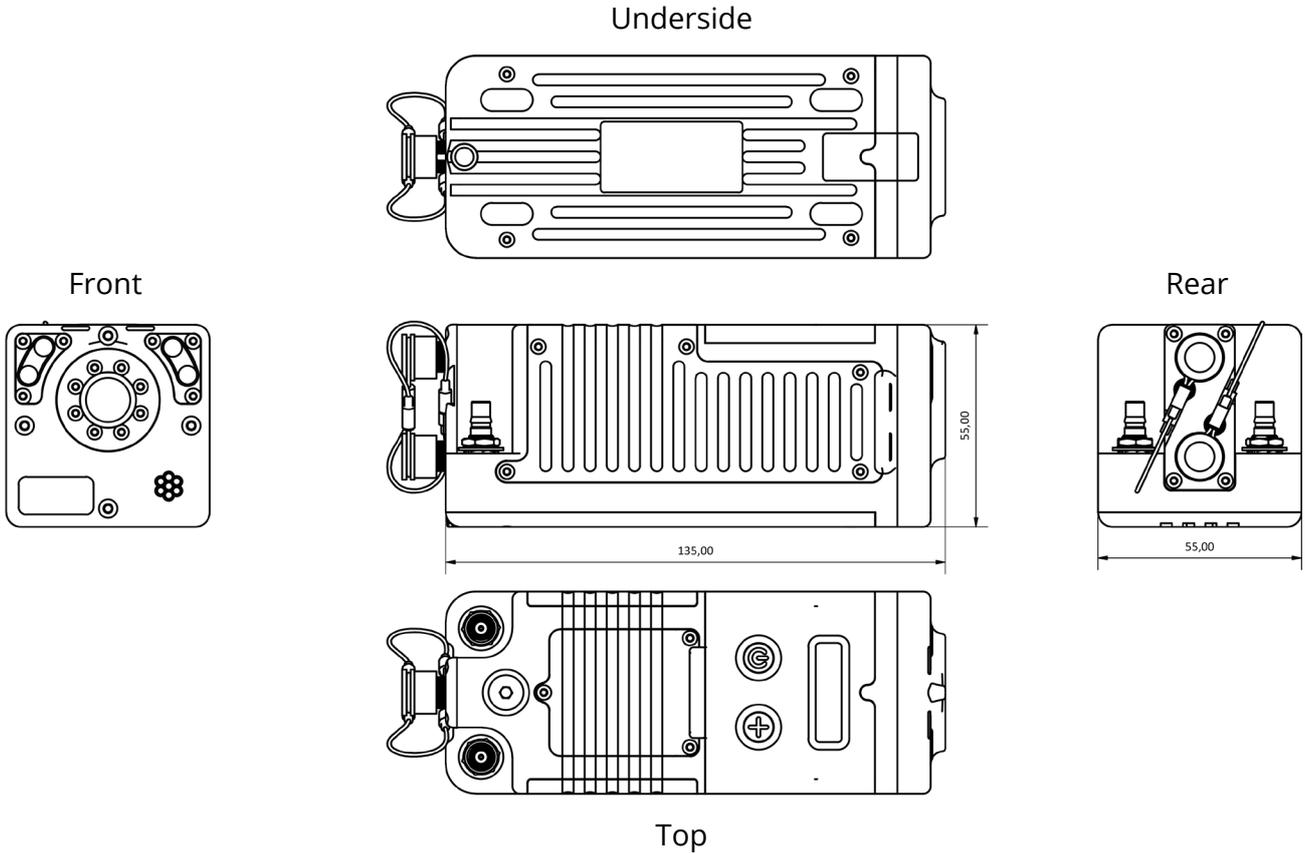
## Specifications

Specifications			
Camera Sensor	3.1 Megapixel, CMOS	External Camera Inputs	IP, HD-SDI
Camera Sensitivity	< 0.1 Lux	External Triggers	Input
Camera SNR	> 50dB	Cable Connection	Ethernet
Horizontal FOV	120°	Configuration	Web Interface
RF Frequency	L-Band, S-Band, C-Band	LEDs	4 x White or IR
RF Type	COFDM Mesh and PtoP	Setup Interface	Button
Pan Tilt Zoom	Supported in SD Mode	Status Screen	OLED
Video Encoder Control	Relay Node Configurable	Integral Battery	Rechargeable
Video Encoding	H.264	Max Charge Time	3 Hours
Audio	High Quality Microphone	Run Time - FMV	3 Hours
Encryption	DES, AES128, AES256	Weight	600g
Antennas	Flexible Dual Diversity	Environmental	IP67
Antenna Connectors	QMA	Dimensions	135 x 55 x 55 mm



## Dimensions

All dimensions are in mm



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