

**B150 HEVC Codec Integration  
Document**

**Version 2.0**

## CONTENTS

<b>CONTENTS</b> .....	<b>2</b>
<b>PCB DESCRIPTION</b> .....	<b>3</b>
<b>SPECIFICATION</b> .....	<b>4</b>
Hardware Options .....	7
Software Options .....	7
<b>BLOCK DIAGRAM</b> .....	<b>8</b>
<b>PCB LAYOUT</b> .....	<b>9</b>
B150 Dimensions .....	9
B151 Dimensions .....	10
Pictures .....	11
Hot Components .....	12
Maximum Temperatures .....	12
<b>CONNECTORS</b> .....	<b>13</b>
B150 .....	13
B151 .....	16
B152 .....	17
<b>CONTROL</b> .....	<b>18</b>
MASH Remote CLI .....	18
MASH Remote Protocol .....	19
B110 Legacy Protocol .....	19
<b>APPLICATIONS</b> .....	<b>20</b>
Wireless Camera Systems .....	20
IP Processing Platform .....	21
Remote Production .....	21
Example Topologies .....	22
<b>ABOUT BROADCAST WIRELESS SYSTEMS</b> .....	<b>23</b>

## PCB DESCRIPTION

B150 is a broadcast quality HEVC codec module. The B150 can be configured as either encoder or decoder, but not both. The B150 is ideal for integration into broadcast systems such as wireless cameras, studio to transmitter links, satellite modems and ENG vehicles.

Offered initially as a drop-in decoder replacement for the B110 decoder module, end-to-end latency is reduced to typically 35ms in HD and 39ms in UHD. Latency is critical in many applications and the B150 decoder is built to minimise latency when paired with a B110 encoder making this combination a solution suitable for all live events.

This new platform aims to be future proof in terms for video connectivity by supporting both coaxial 12G-SDI interface and high data rate video over IP standards such as ST 2110. Combined with increased IP processing capabilities aiming to provide robust streaming whether low bitrate over public internet, or high bitrate redundant paths.

The compact, design is easy to integrate offering a low-risk route to market for customers.

### Standard Features:

- High quality HEVC codec
- Low latency HEVC and sub-frame ST 2110 options for live applications
- Supports 4K UHD or 4 simultaneous HD (using QuadSync)
- High bandwidth IP streaming platform with DVB\_ASI input/output
- 7 multipurpose 12G-SDI input/output
- SFP expansion for use with video SFPs
- Genlock support at decoder (Tri Level Composite)
- Video multiplexing and switching at the encoder
- Encryption/decryption (DES/BISS)
- Small size and low power consumption
- Web browser (can be customised), REST API and serial control
- High rate IP Streaming with redundancy in a variety of formats including Unicast / Multicast / UDP / RTP / SRT
- Analogue audio by option module

### Upgrade Features:

- UHD ST 2110 support for input/output (with expansion PCB)

## SPECIFICATION

### Connectors

12G-SDI 1-5	HD-BNC (option for MCX up-to 3G-SDI)
DVB ASI 1-2	MCX (option for H.FL)
Genlock In	MCX (option for H.FL)
SFP+	MSA or non-MSA
	10GbE IP or 12G-SDI Host
USB 2.0	Micro USB
Network Primary	RJ45 with integrated magnetics (option to remove) or Molex Picoblade no magnetics
Network Secondary	Molex Picoblade no magnetics
Serial RS-232/485	Molex Picoblade
Expansion Headers	Molex Picoblade and Samtec SEAF8
Front Panel	Molex FPC
Power	Molex SPOX

### Video Encoder / Decoder

Coding Modes	HEVC
Number of Encoders	Ultra HD = 1, Full HD = 4 (QuadSync)
Number of Decoders	Ultra HD = 1, Full HD = 4 (QuadSync)
HEVC Profiles	4K Ultra HD (4096 x 2160 pixels) 4:2:2/4:2:0, 8/10-bit 2160p / 23.98 / 24 / 25 / 29.97 / 30 / 50 / 59.94 / 60
	Full HD / DCI (2048 x 1080 pixels) 4:2:2/4:2:0, 8/10-bit 720p / 50 / 59.94 / 60 1080i / 50 / 59.94 / 60 1080p / 23.98 / 24 / 25 / 29.97 / 30 / 50 / 59.94 / 60 1080psf / 23.98 / 24 / 25 / 29.97 / 30
HDR/WCG	Rec. ITU-R BT.2100-2 (PQ and HLG) Rec. ITU-R BT.2020

### Audio Encoder / Decoder

Coding Modes	LPCM (SMPTE 302M) 16/20/24-bit MPEG-1 Layer I MPEG-1 Layer II
Number of Encoders	16 channels / 8 pairs
Number of Decoders	16 channels / 8 pairs

### Genlock Input

Format	Tri Level Composite Black and Burst
--------	--

Dual SFP28 Requires B152 expansion PCB  
ST 2110-10 (system synchronisation)  
ST 2022-7 (seamless protection switching, ST 2110)

### **Video Inputs / Outputs**

SDI 1-4 Single-link 12G/6G/3G/HD/SD-SDI  
Dual-link 6G-SDI  
Quad-link 3G/HD-SDI

SDI 5 Single-link 12G/6G/3G/HD/SD-SDI

SFP+ Single-link 12G/6G/3G/HD/SD-SDI

Dual SFP28 Requires B152 expansion PCB  
ST 2110-20 (uncompressed video transport)  
ST 2022-7 (seamless protection switching, ST 2110)  
JPEG-XS (TBC)

### **Audio Inputs / Outputs**

Digital Audio Embedded  
16 channels / 8 pairs

Analogue Audio Requires B151 expansion PCB  
4x balanced inputs (+20dBu peak)  
4x balanced outputs (+24dBu peak)  
48V phantom power

Dual SFP28 Requires B152 expansion PCB  
ST 2110-30/31 (uncompressed audio transport)  
ST 2022-7 (seamless protection switching, ST 2110)

### **Data Inputs / Outputs**

Serial Data 1x RS-485 or 4x RS-232 configurable

Dual SFP28 Requires B152 expansion PCB  
ST 2110-40 (uncompressed ancillary transport)  
ST 2022-7 (seamless protection switching, ST 2110)

### **TS Inputs / Outputs**

DVB ASI Transport stream  
Packets switching via ASI and/or IP

IP Streaming 1000BASE-T  
ST 2022-2 (compressed transport streams)  
ST 2022-7 (seamless protection switching, ST 2022-2)

SRT (Secure Reliable Transport)

## Control Interfaces

Serial Data	1x RS-485 or 4x RS-232 configurable Command protocol and development CLI Legacy protocol for drop-in B110 replacement
IP Interface	1000BASE-T Web browser (control, status and upgrades) RESTful API (control, status and upgrades)
Dual SFP28	Requires B152 expansion PCB AMWA NMOS IS-04 (discovery and registration) AMWA NMOS IS-05 (device connection management) AMWA NMOS IS-08 (audio channel mapping) AMWA NMOS IS-09 (system parameters) AMWA BCP-002-01 (natural grouping) JT-NM TR-1001

## Power

Main Input	7.0-35.0V
RTC Battery Input	1.2-1.5V recommended (1.89V max) 2.5uA typical without main power

## Latency

Encoder -> Decoder	B110 -> B110 <sup>(1)</sup>	B110 -> M50 <sup>(1)</sup>	M50 -> M50
2160p59 (2-SI)	66ms	39ms	TBC
2160p50 (2-SI)	75ms	41ms	TBC
1080p59	55ms	34ms	TBC
1080p50	70ms	45ms	TBC
1080i59	83ms	36ms	TBC
1080i50	98ms	48ms	TBC

<sup>(1)</sup> End-to-end measurement on representative hardware

## Pricing

The B150 comes as a standard base decoder and in this mode is priced similarly as an equivalent B110.

Additional features are licenced and priced separately; these are detailed below.

## Hardware Options

### B150-M50

B151

B152

### B150 with M50

Expansion PCB for analogue audio

Expansion PCB for dual 25GbE interfaces

## Software Options

LIC-ENCODER

License for HEVC encoding using M50

LIC-QUADSYNC

License for QuadSync 4x HD functionality

LIC-STREAMING

License for IP streaming and decoding

LIC-RECORDING

License for TS store and forward recording

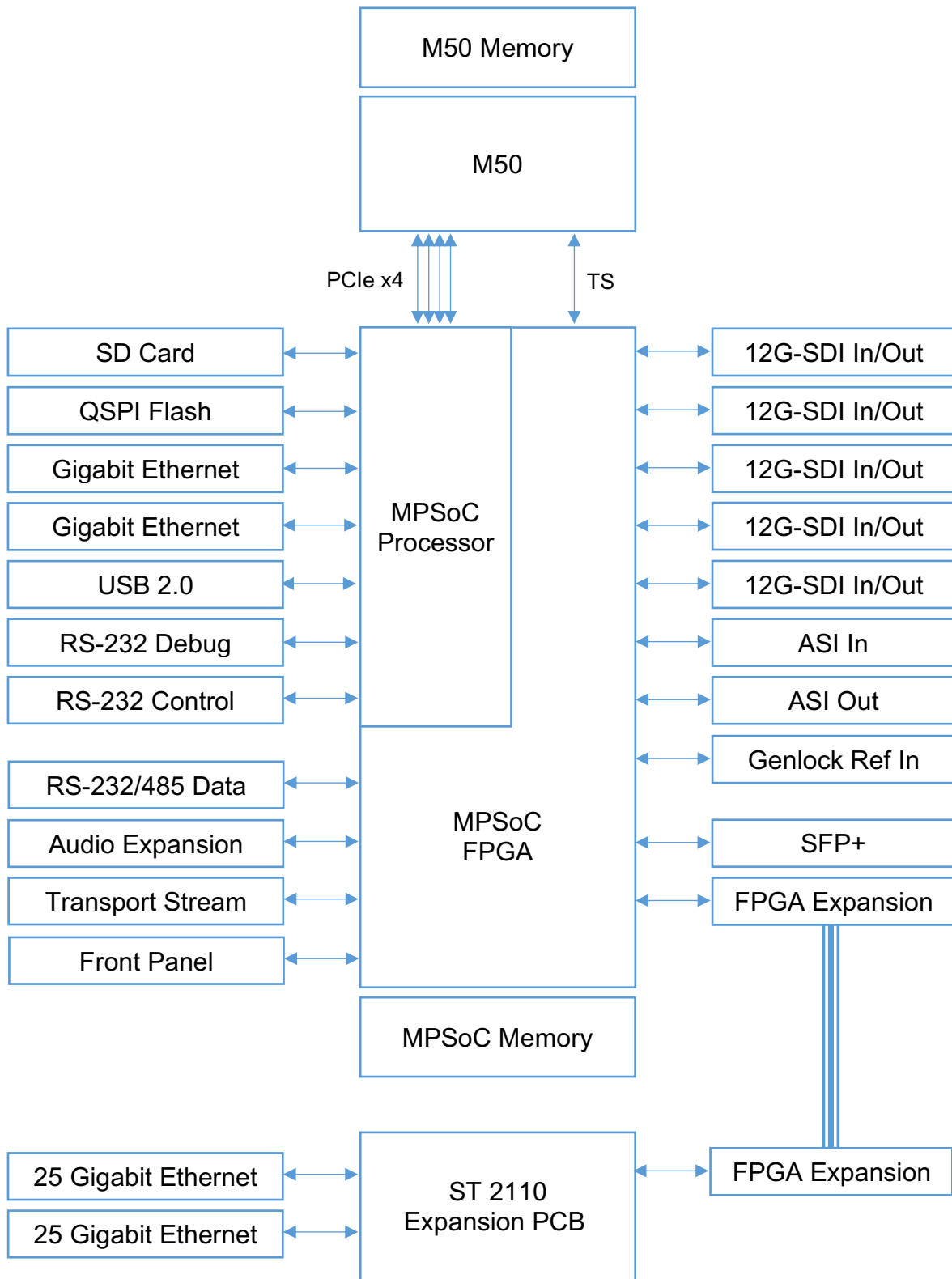
LIC-ST2110

License for ST 2110 on B152 PCB

LIC-JPEGXS

License for JPEG-XS on B152 PCB

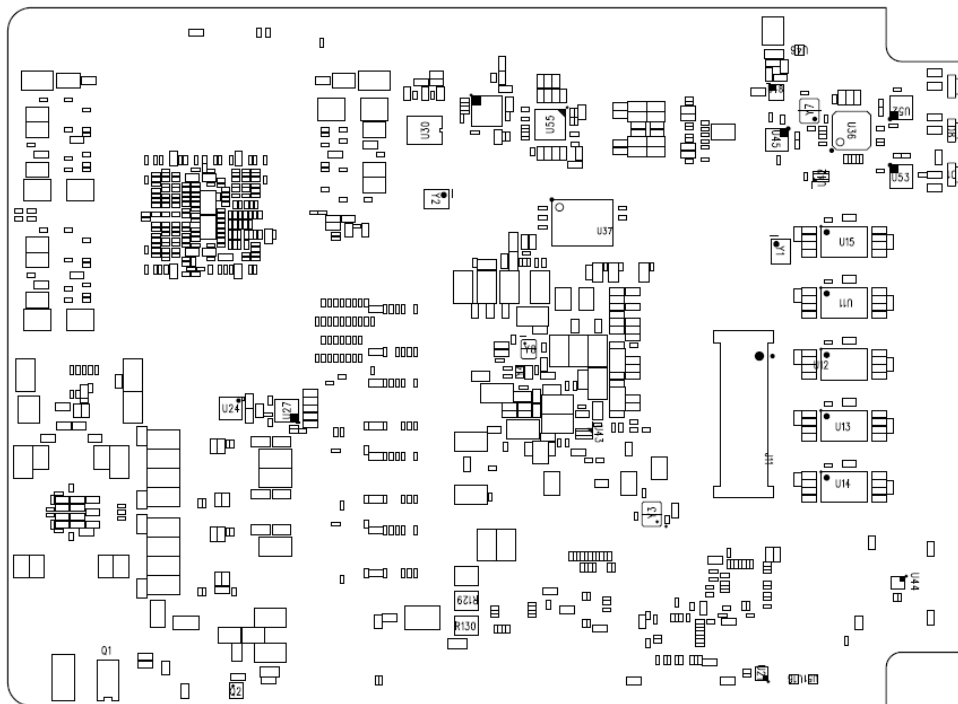
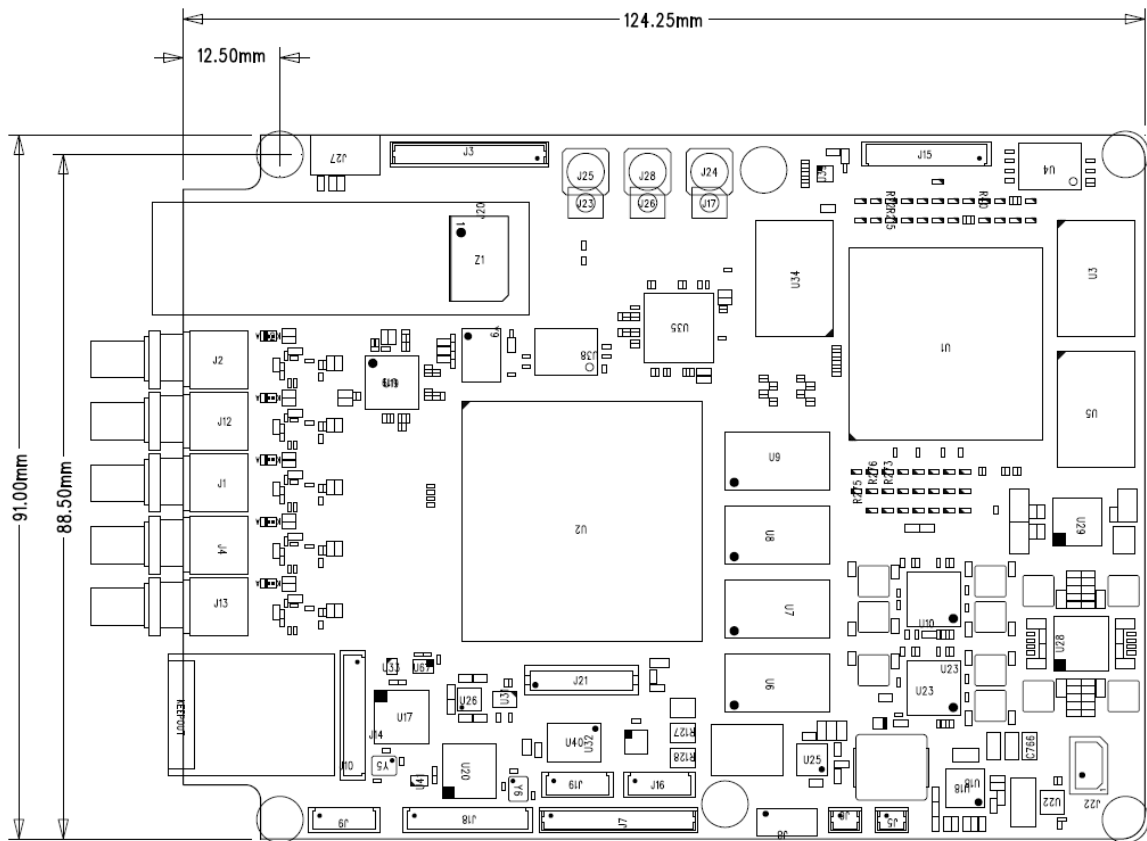
# BLOCK DIAGRAM



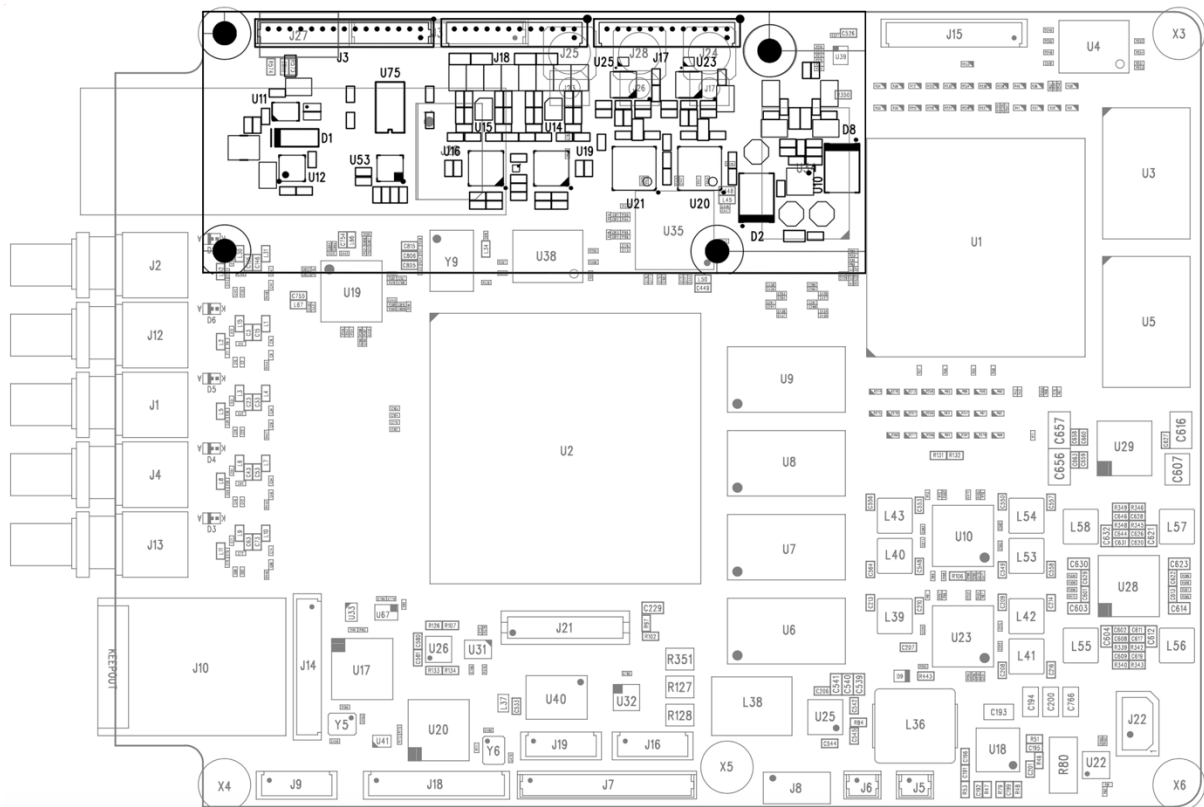
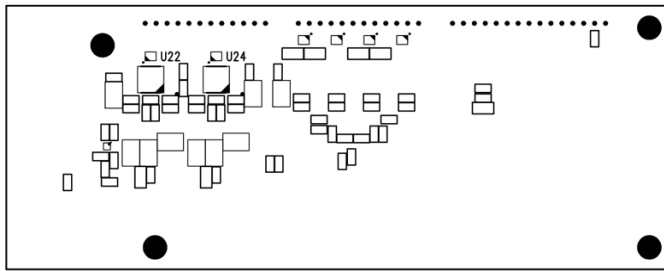
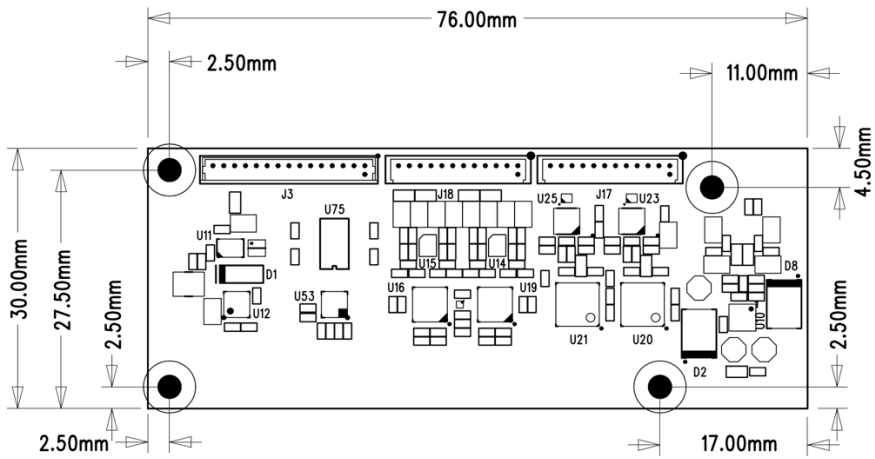


# PCB LAYOUT

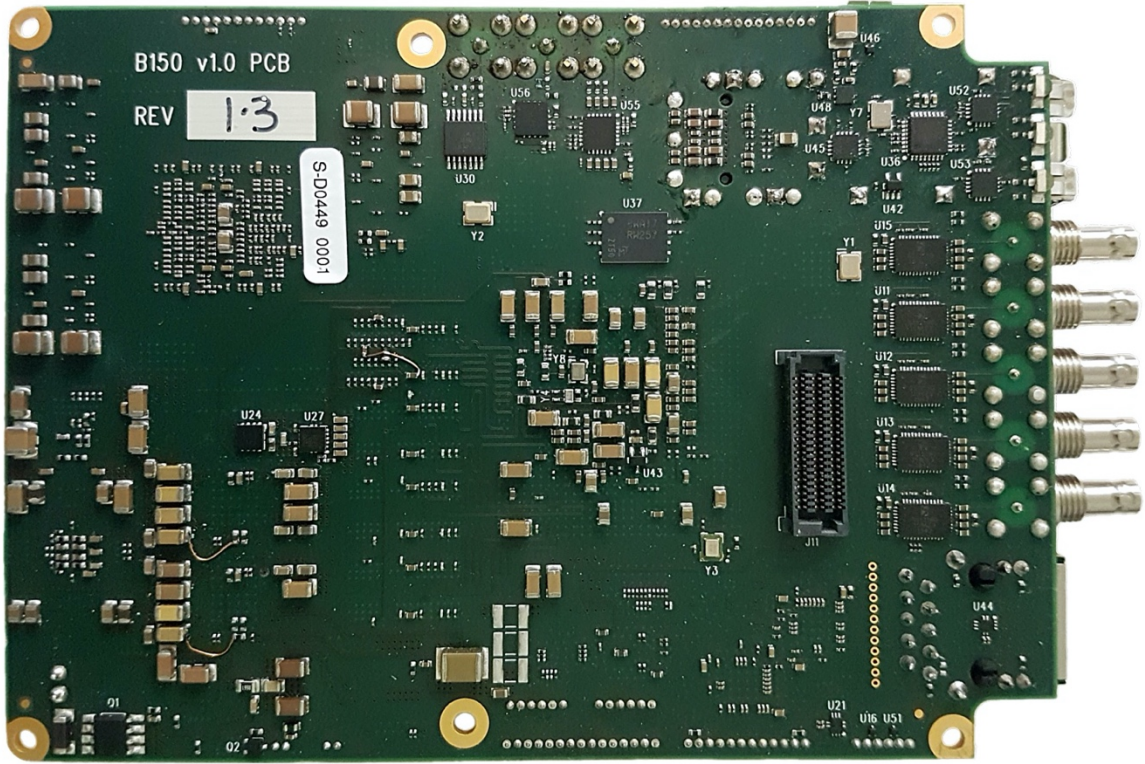
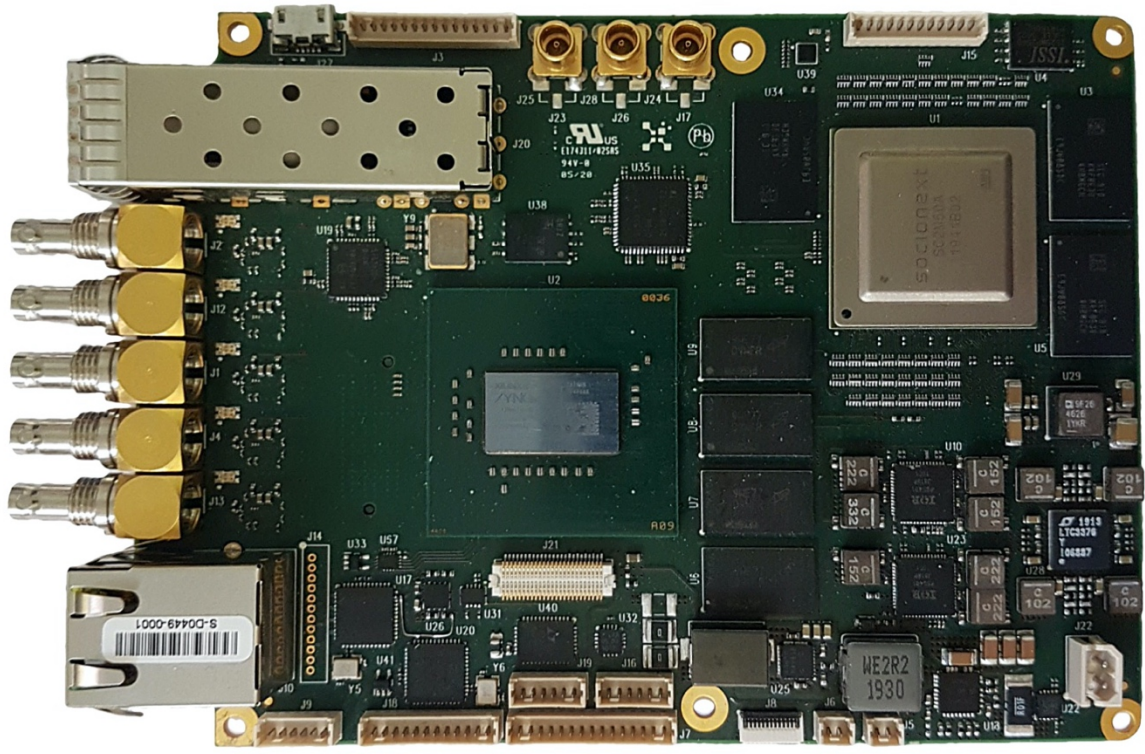
## B150 Dimensions



# B151 Dimensions



# Pictures



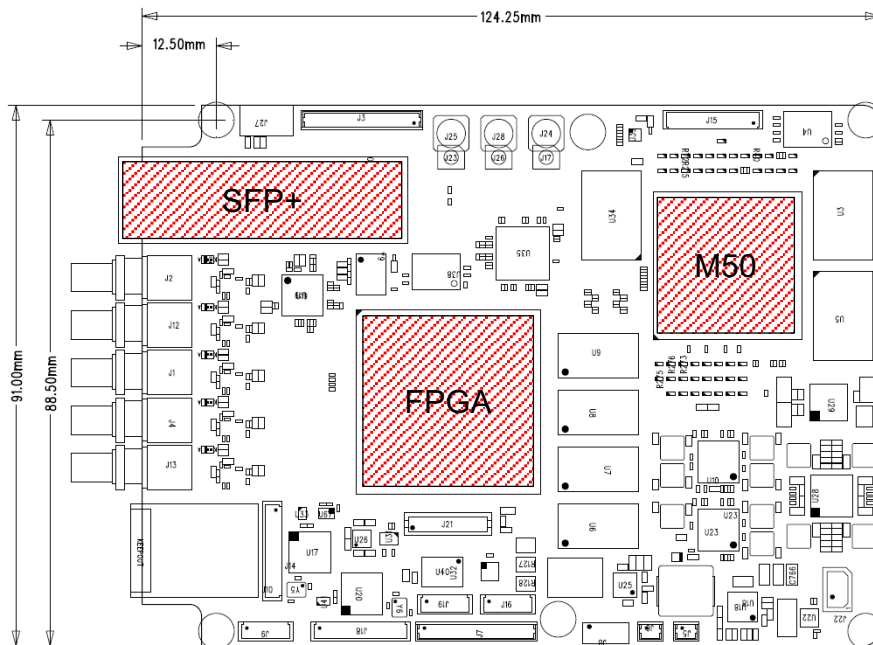
## Hot Components

There are three types of component that get hot on the B150 all on the top of the PCB. These components should be heatsunk to the chassis, and/or cooled with appropriate heatsinks and airflow:

FPGA: Dimensions TBC.

M50: Dimensions TBC.

SFP+: Dimensions TBC.



## Maximum Temperatures

The operating temperatures for core devices are:

FPGA: 0 to +100°C

M50: 0 to +70°C

SFP+: 0 to +70°C

## CONNECTORS

### B150

Connector	Description	Type	Pins
J12	12G-SDI 1	HD-BNC	
J1	12G-SDI 2	HD-BNC	
J4	12G-SDI 3	HD-BNC	
J13	12G-SDI 4	HD-BNC	
J2	12G-SDI 5	HD-BNC	
J25/J23	ASI In	MCX	
J28/J26	ASI Out	MCX	
J24/J17	Genlock In	MCX	
J20	SFP+	SFP Cage	MSA or non-MSA 10GbE IP or 12G-SDI Host
J27	USB 2.0	Micro AB	
J22	DC Power In	2-way Molex SPOX (through hole)	1 = PWR 2 = GND
J6	RTC Battery In	2-way Molex SPOX (through hole)	1 = BATT ( <b>BATT must be connected to GND if not used</b> ) 2 = GND
J5	Fan DC Out	2-way Molex SPOX (through hole)	1 = 5V 2 = GND
J10	Ethernet 0	RJ45	Includes Magnetics
J14	Ethernet 0	12-way Molex Picoblade (through hole)	Without Magnetics 1 = Yellow LED Anode 3.3V 2 = Yellow LED Cathode 3 = Pair A+ 4 = Pair A- 5 = Pair B+ 6 = Pair B- 7 = Pair C+ 8 = Pair C- 9 = Pair D+ 10 = Pair D- 11 = Green LED Anode 3.3V 12 = Green LED Cathode

<b>J18</b>	Ethernet 1	12-way Molex Picoblade (through hole)	Without Magnetics 1 = Yellow LED Anode 3.3V 2 = Yellow LED Cathode 3 = Pair A+ 4 = Pair A- 5 = Pair B+ 6 = Pair B- 7 = Pair C+ 8 = Pair C- 9 = Pair D+ 10 = Pair D- 11 = Green LED Anode 3.3V 12 = Green LED Cathode
<b>J15</b>	SD Card	12-way Molex Picoblade (through hole)	1 = SDIO DATA3 1 = SDIO CMD 1 = GND 1 = 3.3V 1 = SDIO CLK 1 = GND 1 = SDIO DATA0 1 = SDIO DATA1 1 = SDIO DATA2 1 = SDIO DETECT 1 = SDIO PROTECT 1 = GND
<b>J3</b>	Audio Expansion	15-way Molex Picoblade (through hole)	1 = PWR (un-regulated) 2 = 5.0V 3 = 1.8V (IO voltage) 4 = Audio 1 SDIN 5 = Audio 2 SDIN 6 = Audio 1 SDOUT 7 = Audio 2 SDOUT 8 = Audio BCLK 9 = Audio SCLK 10 = Audio LRCLK 11 = Audio MCLK 12 = Audio I <sup>2</sup> C SDA 13 = Audio I <sup>2</sup> C SCL 14 = Audio spare 15 = GND

<b>J7</b>	Transport Stream	15-way Molex Picoblade (through hole)	<ul style="list-style-type: none"> <li>1 = PWR (un-regulated)</li> <li>2 = 5.0V</li> <li>3 = 1.8V (IO voltage)</li> <li>4 = TS DATA0</li> <li>5 = TS DATA1</li> <li>6 = TS DATA2</li> <li>7 = TS DATA3</li> <li>8 = TS DATA4</li> <li>9 = TS DATA5</li> <li>10 = TS DATA6</li> <li>11 = TS DATA7</li> <li>12 = TS PKST</li> <li>13 = TS DV</li> <li>14 = TS CLK</li> <li>15 = GND</li> </ul>
<b>J8</b>	Front Panel	12-way Edge Ribbon Molex FPC side 0.5mm	<ul style="list-style-type: none"> <li>1 = 1.8V (IO voltage)</li> <li>2 = I<sup>2</sup>C SCL</li> <li>3 = I<sup>2</sup>C SDA</li> <li>4 = OLED Power Enable</li> <li>5 = OLED Negative Reset</li> <li>6 = Cancel Switch</li> <li>7 = Enter Switch</li> <li>8 = Right Switch</li> <li>9 = Left Switch</li> <li>10 = Down Switch</li> <li>11 = Up Switch</li> <li>12 = GND</li> </ul>
<b>J9</b>	Additional GPIO	6-way Molex Picoblade (through hole)	<ul style="list-style-type: none"> <li>1 = 1.8V (IO voltage)</li> <li>2 = PS GPIO (CAN TX)</li> <li>3 = PS GPIO (CAN RX)</li> <li>4 = FPGA GPIO0</li> <li>5 = FPGA GPIO1</li> <li>6 = GND</li> </ul>
<b>J16</b>	Processor RS-232/485	6-way Molex Picoblade (through hole)	<ul style="list-style-type: none"> <li>1 = RS-232 1 TX</li> <li>2 = RS-232 1 RX</li> <li>3 = GND</li> <li>4 = RS-232 2 TX</li> <li>5 = RS-232 2 RX</li> <li>6 = GND</li> </ul>
<b>J19</b>	FPGA RS-232/485	6-way Molex Picoblade (through hole)	<ul style="list-style-type: none"> <li>1 = RS-232 3 TX (RS-485 TX+)</li> <li>2 = RS-232 3 RX (RS-485 RX+)</li> <li>3 = GND</li> <li>4 = RS-232 4 TX (RS-485 TX-)</li> <li>5 = RS-232 4 RX (RS-485 RX-)</li> <li>6 = GND</li> </ul>
<b>J11</b>	FPGA Expansion	120-way Samtec SEAF8	
<b>J21</b>	JTAG	50-way Hirose DF12	

## B151

Connector	Description	Type	Pins
<b>J3</b>	Audio Expansion	15-way Molex Picoblade (through hole)	1 = PWR (un-regulated) 2 = 5.0V 3 = 1.8V (IO voltage) 4 = Audio 1 SDIN 5 = Audio 2 SDIN 6 = Audio 1 SDOUT 7 = Audio 2 SDOUT 8 = Audio BCLK 9 = Audio SCLK 10 = Audio LRCLK 11 = Audio MCLK 12 = Audio I <sup>2</sup> C SDA 13 = Audio I <sup>2</sup> C SCL 14 = Audio spare 15 = GND
<b>J17</b>	Audio Output	12-way Molex Picoblade (through hole)	1 = Output 1 Left -ve 2 = Output 1 Left +ve 3 = GND 4 = Output 1 Right +ve 5 = Output 1 Right -ve 6 = GND 7 = Output 2 Left -ve 8 = Output 2 Left +ve 9 = GND 10 = Output 2 Right +ve 11 = Output 2 Right -ve 12 = GND
<b>J18</b>	Audio Input	12-way Molex Picoblade (through hole)	1 = Input 1 Left -ve 2 = Input 1 Left +ve 3 = GND 4 = Input 1 Right +ve 5 = Input 1 Right -ve 6 = GND 7 = Input 2 Left -ve 8 = Input 2 Left +ve 9 = GND 10 = Input 2 Right +ve 11 = Input 2 Right -ve 12 = GND



## B152

<b>Connector</b>	<b>Description</b>	<b>Type</b>	<b>Pins</b>
	SFP28	SFP Cage	25GbE IP
	SFP28	SFP Cage	25GbE IP
	FPGA Expansion	120-way Samtec SEAM8	

# CONTROL

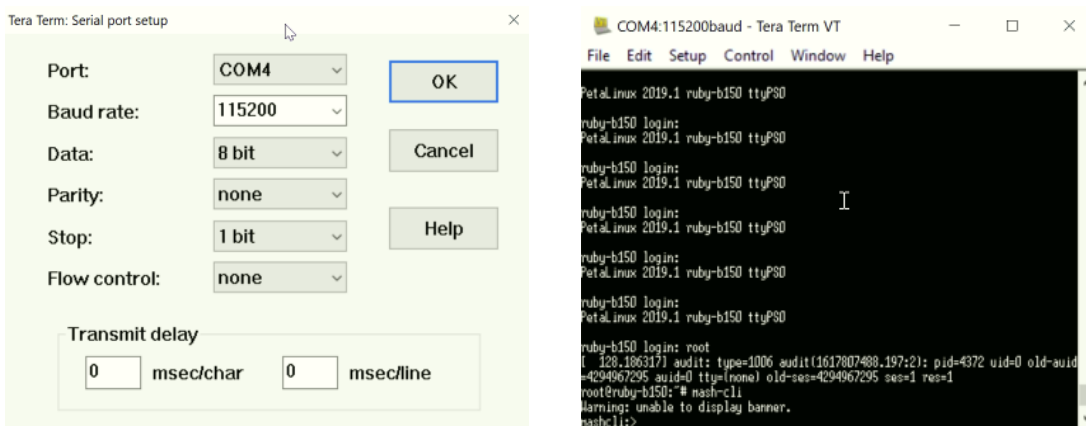
## MASH Remote CLI

A Command Line Interface is available via RS-232 or SSH. `mash-cli` is intended as a development interface and allows direct access to all MASH (Management and Status Hub) functionality on the B150.

Connecting via RS-232:

RS-232 serial interface 1 defaults to console access. Configure a serial terminal such as Tera Term to 115200 baud for access.

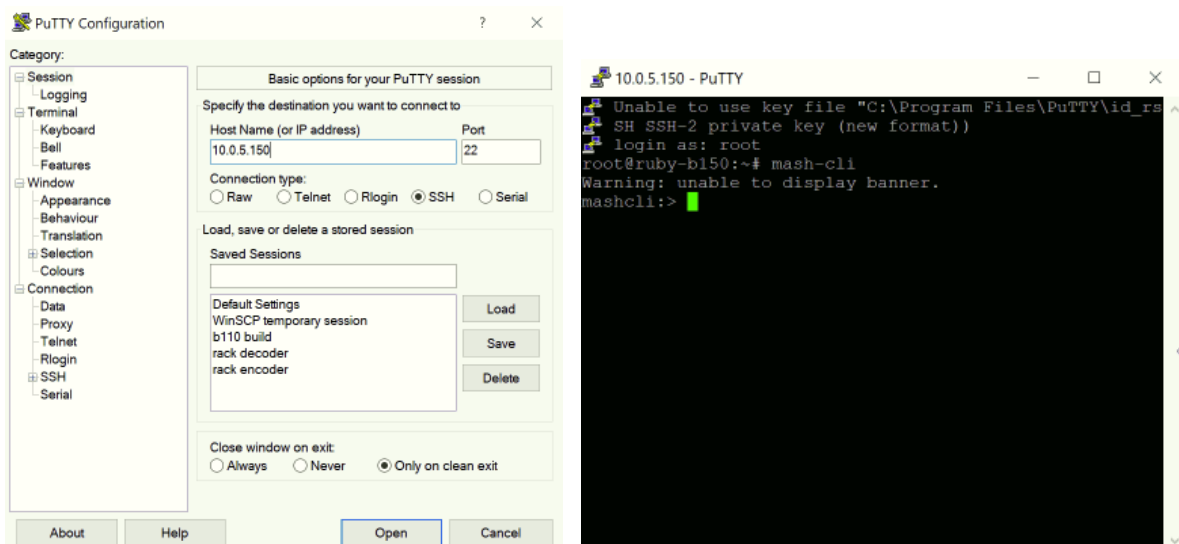
Login as `root` (no password currently required) when prompted, then run `mash-cli`.



Connecting via SSH:

You will need prior knowledge of the B150's IP address. Configure a SSH terminal such as PuTTY with IP address and port 22.

Login as `root` (no password currently required) when prompted, then run `mash-cli`.



`mash-cli` is intended to be self-documenting and pressing `tab` can be used for getting available commands and auto-completing.

## **MASH Remote Protocol**

To be defined.

## **B110 Legacy Protocol**

The B150 supports a legacy RS-232 command protocol from the B110 decoder platform, facilitating easy integration for any users transitioning from B110 to B150 decoders.

For full details of the command protocol see the B110 integration document. It's our intention to provide the simplest transition as possible however differences between the platforms will mean there is not always a direct translation for any new functionality across to the legacy protocol. We will provide on request a complete legacy command list with each software release including any quirks of the translation.

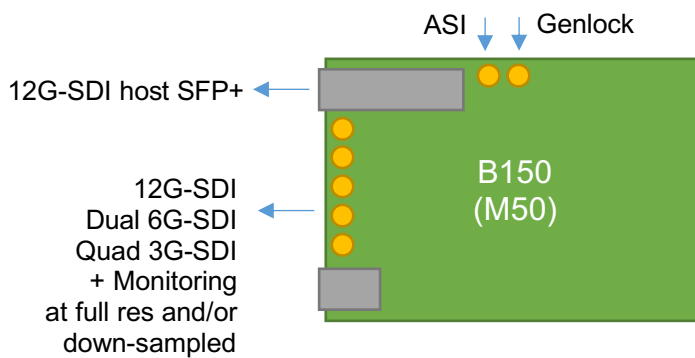
It is not our intention to expand on the legacy protocol apart from to keep compatibility with future B110 releases, for long term support and access to all features, integrations should be transitioned to the new MASH Remote Protocol.

# APPLICATIONS

## Wireless Camera Systems

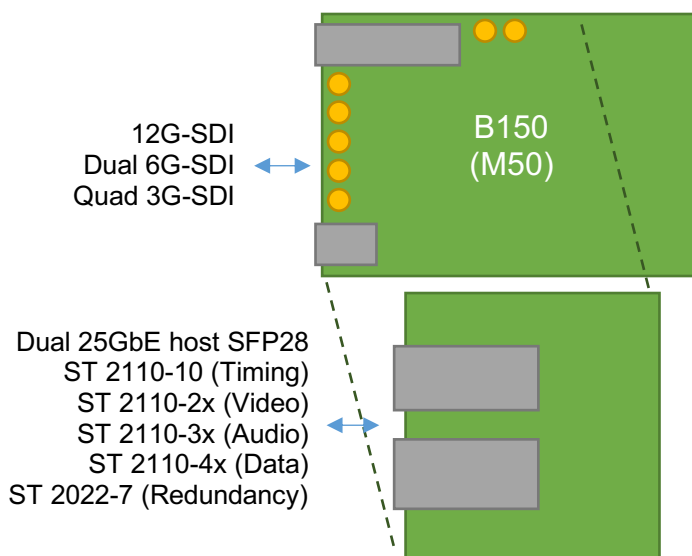
The B150 provides a next generation decoder platform perfect for use in wireless cameras systems. In combination with the Ultra Low Latency B110 encoding end-to-end latencies drop by 1-2 frames in all formats.

The first phase of development will see Ultra Low Latency M50 HEVC decoding realised alongside increased video output flexibility. The B110 supported Quad 3G-SDI outputs for UHD, the B150 will also support Dual 6G-SDI and 12G-SDI direct from the PCB. Having 5 multi-purpose 12G-SDI outputs available means the B150 can also provide secondary feeds with OSD status and/or down-sampled monitoring.



12G-SDI SFP+ modules can be used to expand connectivity providing additional copper outputs, or ST 2110 or ST 2110-6 IP interfaces can be supported for up to 2x HD channels using readily available SFP modules.

Designed to be highly expandable we will produce an expansion PCB which provides bi-directional ST 2110 support for UHD or 4x HD channels.



## IP Processing Platform

The second phase adds high bitrate IP processing capabilities via two onboard Gigabit Ethernet ports, USB and/or SFP+. Targeted standards include:

- UDP/RTP streaming with redundancy (ST 2022-7)
- SRT including AES encryption, and future link bonding and redundancy features
- RIST also to be considered

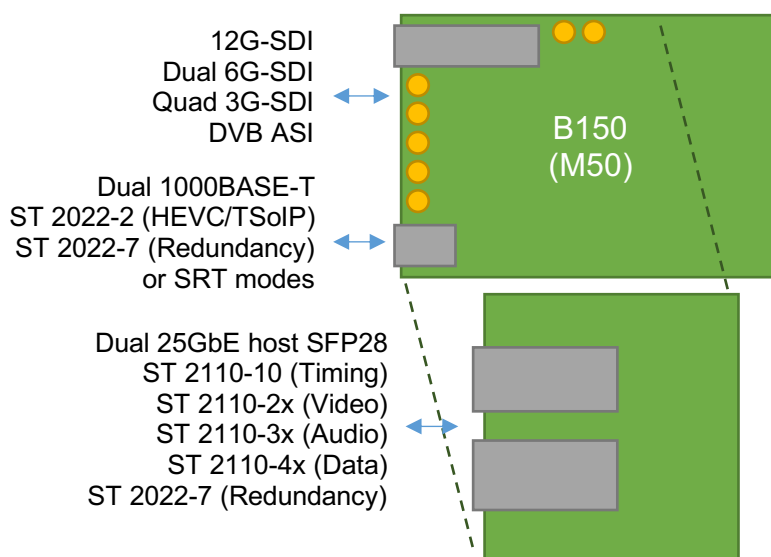
The B150 hardware has routes for up to 8 ASI inputs or outputs. OEM customers are invited to discuss IP packet switching applications based around a mix of ASI / IP interfaces.

## Remote Production

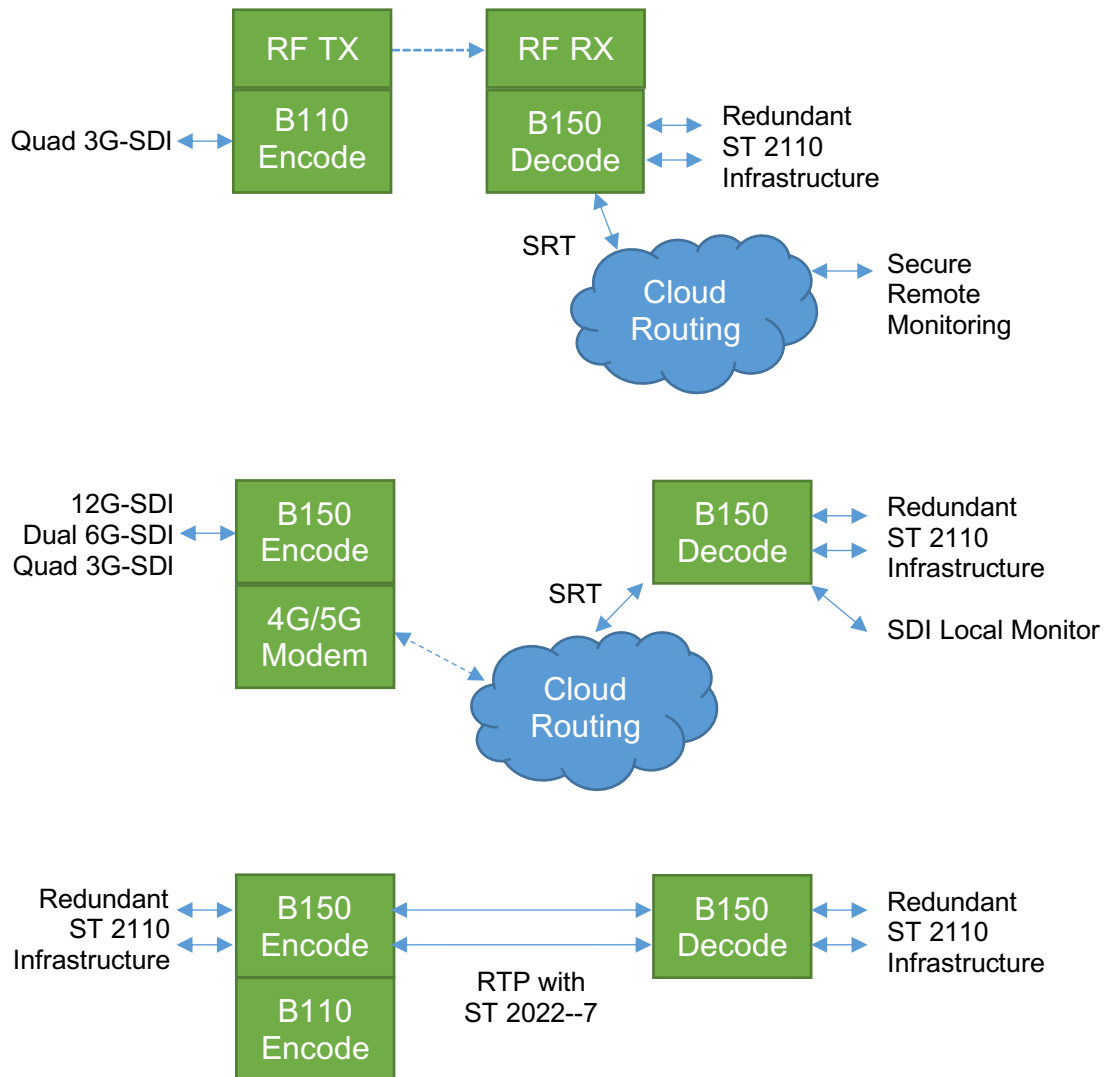
The B150 is also designed with the end goal of being a highly flexible remote production codec. This would be comprised of 4 core modes of operation all soft configurable. With a range of licensable options covering HD, 4K or 4x HD.

Combining the B110 encoding capabilities provides Ultra Low latency HEVC encoding. The B110/B150 to B150 platform would support anything from low bitrate HEVC up to uncompressed ST 2110 video all over redundant networks.

Mode	Latency	HD (Mbps)	4K (Mbps)	
Low bitrate HEVC	~1 second	~5	~15	
Low latency HEVC	<2 frames	~20	~50	with B110
Sub-frame JPEG-XS	<1 frame	70 - 400	500 - 1600	TBC
Uncompressed ST 2110	<1 frame	1500 - 3000	6000 - 12000	



## Example Topologies



## ABOUT BROADCAST WIRELESS SYSTEMS

Broadcast Wireless Systems is a UK company founded to provide specialist provision and support of RF systems to the world-wide Broadcast industry. Our staff have many years of experience in this area, having previously worked for DTC/Cobham, Link Research, Tandberg/Ericsson, Vislink and the BBC.



Operating from our offices in Southampton, UK, and Dubai, UAE, we aim to offer:

- Sales of 'best-in-class' wireless systems from a variety of manufacturers, enabling us to exactly meet customer requirements
- 24/7/365 service and after-sales support
- Development of bespoke products to meet specialist requirements
- High-level Systems Integration and turn-key Project Management – we take 100% responsibility for the design, integration and support for all components in the systems we supply