

Dream Chip Technologies

ATOM one SSM500



Super Slow-Motion Camera System

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I Introduction

Dear Customer,

Thank you for purchasing the Dream Chip Technologies **ATOM one SSM500** Super Slow-Motion Camera System.

This User Manual will provide all information to setup and operate your **ATOM one SSM500** system. More technical details about the camera functions can be found in the reference manual.

The **ATOM one SSM500** is the smallest 2/3" Full HD super slow-motion live camera with inbuild recording or quad SDI streaming. The camera family consists of multiple versions with different lens mount options:

Camera model	Lens type
SSM500 C-Mount	C-Mount
SSM500 B4	B4

The compact size and simple operation will enable you to place a camera at any location. The lack of a separate CCU simplifies the installation and operation.

You have full control to all the settings for best quality and highest flexibility.

1.1 Quality Policy

Dream Chip Technologies GmbH is committed to the delivery of safe, effective and reliable products to their consumers, a fundamental element of our Company's Targets.

Our mission is to bridge the gap between demand and offer by supporting our customers with sophisticated technology, thus enabling them to launch new products without having to neglect their core business. This strategy ensures business stability and steady growth through product innovations at the same time.

We have both outstanding engineering knowledge and many years of experience in the field of consumer and industrial focused semiconductor development.

Peter Schaper, CEO

2 Technical Data

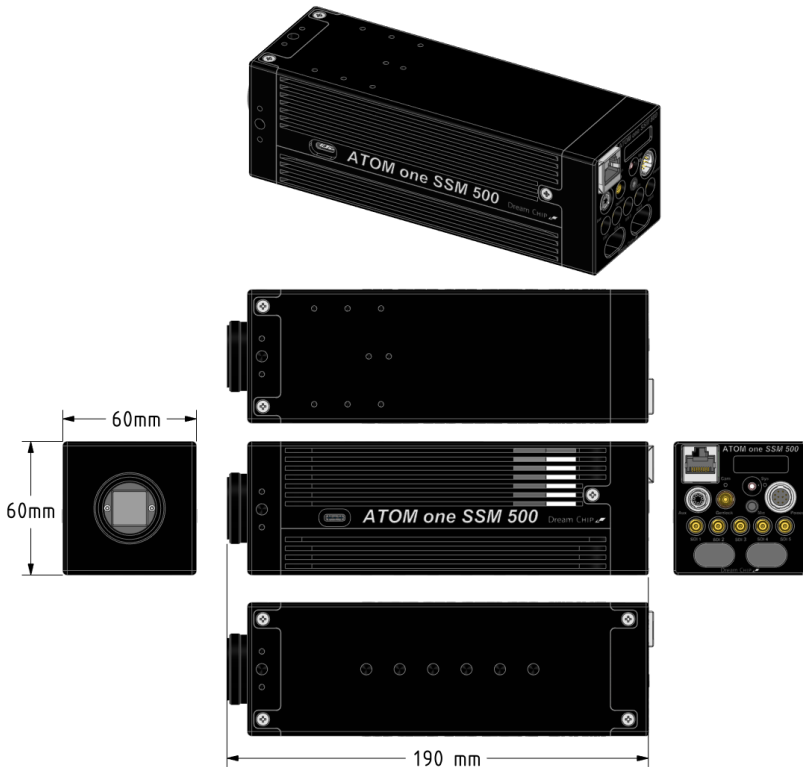
All versions of the camera feature seven 1/4" x 5 mm tripod threads at the bottom for balanced mounting as well as several M3 x 5 mm threads on the top for lens drive mounts or other accessories.

Depending on the lens mount, additional threads are available (see below).

2.1 Dimensions C-Mount

At the front there are four additional 1/4" x 5mm tripod threads (one on each side) and M3 threads for accessories.

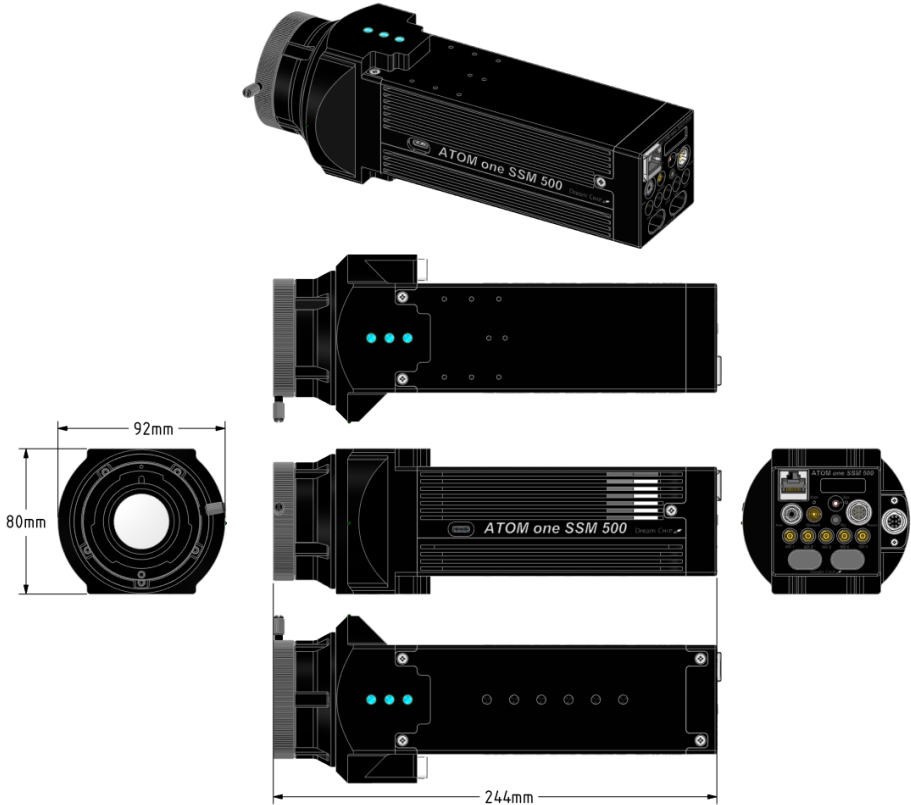
Please refer to the drawing below for details.



2.2 Dimensions B4

At the front there are six additional 1/4" x 5 mm tripod threads for accessories (three on the top and three on the bottom).

Please refer to the drawing below for details.



2.3 Overview

Common attributes for all models:

- Power supply: 11.5 V to 36 V, 25 W
- Operation conditions: 0 °C to +50 °C
- Active cooling

Attributes that depend on the lens mount:

Lens Mount	Dimensions (WxHxL)	Weight
C-Mount	60mm x 60mm x 190mm	900 g
B4	92 mm x 80mm x 244mm	1700 g

2.4 Sensor

- 2/3" image sensor with 4.5 µm pixel size
- 300 FPS @ 12 bit
- 500 FPS @ 10 bit

2.5 Recoding Engine (Trigger Mode)

- Internal recording on SSD
- 30.000 frames storage
- 60 seconds @ 500 FPS

2.6 Image Processing Features

- Defect Pixel Correction
- Black level, White Level, Master Black
- Lens shade correction
- White balance / Auto white balance
- Auto exposure with adjustable weight grid
- Flare compensation
- High quality color interpolation (Debayer)
- Color Matrix / Color correction
- Color temperature settings / presets
- Multimatix Color Correction (12/24/32 angles)

- Denoise filter
- Detail filter
- Color post processing (luminance, contrast, saturation, hue)
- SDI range adjustable (black / white)
- HDR output (HLG or PQ gamma curve with Rec709 or BT2020 Color Space)

2.7 Video Output

- 5 channel, 10 BIT YUV422 3G SDI output
- 10 bit, YUV422, 1920x1080
- Interlaced framerates: 50, 59.94, 60
- Progressive framerates: 23.98, 24, 25, 29.97, 30, 47.96, 48, 50, 59.94, 60

2.8 System Functions

- Autostart with last settings
- Embedded time code
- Tri-level sync (genlock) input and output
- Remote control via RS485 and RS232 (3.3V)
- Lens control
 - C-Mount: Dream Chip Lens control system
 - B4: Full control of B4 motors

3 Connectors

The **ATOM one SSM500** has 10 connectors at the back side.



3.1 Power / RS485 connector

Dream Chip Technologies offers an optional Power / Control cable.



For power and control, a Hirose male HR10A-10R-10PB connector is used. The following table shows the required plugs.


Female HR10A-10P- 10S(73)	Signal	Power XLR 4-pin male 6-wire AWG 26 Power cable	RS485 ITT Female M-XL-3-11L 6-wire AWG 26 RS422 cable
			 <small>Mini XLR Female</small>
6 + 7 + 10	Power in (25W power)	Pin 4 orange yellow green	
2 + 3 + 9	GND	Pin 1 black brown red	3 (see note) brown
1	RS422_RX_A		1 (see note) orange
8	RS422_RX_B		2 (see note) black
4	RS422_TX_A		1 (see note) green
5	RS422_TX_B		2 (see note) yellow

Note: The RS422 RX and TX are bonded in the Mini XLR connector for RS485. For RS422 operation, remove the connector to split RX from TX.

3.2 Aux connector

The AUX connector is a Hirose female HR10A-7R-6SB pin connector which can be used for lens control or local control via UART.

The following table shows the required plug.

Male Pin HR10A-7P-6P(73)	Signal
	
1	Power pass through
2	GND
3	Uart TX 3.3V
4	Uart RX 3.3V
5	Lens I2C SCL
6	Lens I2C SDA

3.3 SDI outputs

The 5 HD-BNC 3G outputs are SMPTE 424M compliant.

Depending on the operation mode (Trigger / SSM), the mapping differs.

SDI connector	Trigger Mode	SSM Mode
1	Live	Phase 1
2	Live	Phase 2
3	Playback	Phase 3
4	Playback	Phase 4
5	Live	Live (Phase 1)

3.4 Genlock

The HD-BNC genlock connector can be used as a tri-level sync input or output. With this feature the camera can work synchronal to your production environment.

3.5 Microphone Input

The microphone connector is a standard 3.5 mm stereo jack. It supports 2.5 V phantom power for electret microphones.

The audio will be inserted into all SDI signals.

3.6 RJ45 Ethernet connector

The network connector is reserved for future applications like control via IP.

3.7 SD card slot

The **ATOM one SSM500** has a SD card slot on the right side. This slot is used for firmware updates. Details can be found in chapter 8.

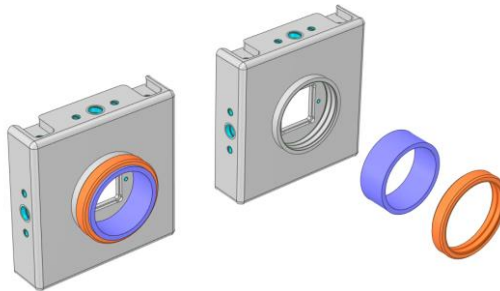
4 Optical System

4.1 C-Mount Back-Focus Adjustment

The back-focus of the **ATOM one SSM500** is adjustable. This helps to adapt to any lens to have a perfect focus.

The following diagram is showing the components of the lens mount, from left to right those are:

- Sensor mount
- Lens mount
- Lock ring



For adjustment do the following procedure:

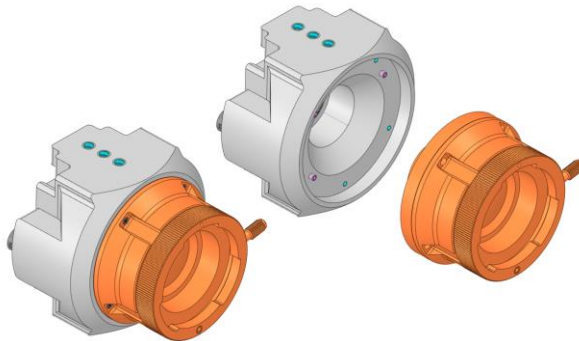
1. Attach your target lens to the **ATOM one SSM500**. Try to tighten it a little.
2. Loosen the lock ring to release the lens mount.
3. Turn the lens mount with your lens for back-focus adjustment.
4. Check your focus on a monitor. Focus assistant is helpful.
5. Carefully tighten the lock ring since this will change back focus a little.
6. Check focus again. You may repeat steps 3-6 until you are satisfied.
7. Finally, firmly tighten the lock ring with your hand (do not use tools!).

Be carefully and sensitive with the locking threads. In rough environments you may secure the lock ring with Loctite.

4.2 B4 Back-Focus Adjustment

The back-focus of the **ATOM one SSM500** is adjustable. This helps to adapt to any lens to have a perfect focus.

The following diagram is showing the optical converter, what can be removed for adjustment.



For adjustment do the following procedure:

1. Remove the optical converter by unscrewing the 5 front screws.
2. Behind the converter, you can place shims to compensate back focus settings.
3. Add or remove shims on demand. The shims will fit only in at one orientation. Refer to the index bolts for rotation and the laser engraving for orientation.
4. Reassemble the optical converter with the 5 screws.
5. Attach you B4 lens and check again the back focus.
6. Repeat until back focus is correct.
7. Note the used shims used for a specific lens for faster changes later.

The provided shim set does have a lasered thickness marking to simplify the process of setting back focus. It is highly recommended to check and adjust back focus on B4 lenses, especially when you swap between brands.

5 Power On/Off

After connecting the power cable, the camera will turn on automatically and the Sys LED begins to blink green. The boot process takes about 20 seconds and is being visualized in the OLED display. During boot the fan will spin at maximum speed.

If the camera has been turned on and the power is interrupted, the camera will turn on again automatically once power is supplied again.

To power down the camera press the power button for ~3 seconds or use the shutdown command. During power down the fan will spin at maximum speed. The camera will then enter standby mode.

In standby mode the Sys LED glows yellow. To turn the camera on again, press the power button for ~3 seconds, or cut the power for at least 5 seconds before reconnecting it.

Note: It is recommended to shut down the camera with the power button or shutdown command at the end of a production to ensure no corrupt image data is stored.

6 Display and Status Leds

The device has two status LEDs.

The right LED labeled “Sys” shows the general status of the system:

Value	Status	Note
Green flashing	Booting	The operating system is booting
Solid Blue	Running	System is running normally
Yellow flashing	Shutdown	Device is shutting down
Solid Red	Reboot	Device is rebooting
Red flashing	Reboot delay	Device is waiting before performing reboot (short, temporary power off)
Solid Yellow	Standby	Device is powered down, but power is still attached

The left LED labeled “Cam” shows the status of the image processing system. The image processor is started after the operating system has finished booting (see above).

Value	Status	Note
Solid Purple	Powered Down	Image processing core is powered down (will be shown during boot or shutdown)
Yellow flashing	Busy	Device is processing a command or loading settings
Red flashing	Genlock Error	Device was unable to lock to genlock signal
Toggle between Yellow and Red	Over Temperature	The device reached it’s maximum temperature of 90°C and is in a low power state to cool down
Blue flashing	Ready	Device is up and waiting for commands

The ATOM one SSM500 has a build in OLED display which shows additional status information. This includes the current firmware version and the IP address.

The OLED display will show the following screens, each screen is shown for 3 seconds before switching to the next screen:

- **Main Screen:** Shows the operational mode (“TRIG” for the Trigger Mode and “SSM” for the SSM Mode), the firmware version and the IP address.
- **Genlock Screen:** Shows the Genlock status. See chapter 10.6 for details.
- **Record Screen:** Only displayed if a recording is running, shows the buffer which is currently used for recording (Trigger Mode only).
- **Playback Screen:** Only displayed if playback is running, shows the buffer which is currently used for playback (Trigger Mode only).
- **Phases Screen:** Shows the number of active phases (SSM Mode only).

7 Operation modes

The ATOM one SSM500 supports two operation modes:

- **Trigger Mode:** This mode uses the internal storage space to record and playback slow motion video with up to 500 frames per second. This version can be used stand alone.
- **SSM Mode (Super Slow Motion 4x):** This mode does not use the internal storage but streams with 240 FPS via four HD SDI (4x 1080p60) outputs. This version is intended to be used with external storage / video server solutions (like EVS).

The operation mode can be switched by the user with the **switch_mode** command. To trigger this command from the ProVideo GUI go to the Info tab and click on the “Switch to Trigger Mode” or “Switch to SSM Mode” button and wait until the device has rebooted.

The following chapters give an overview on the functionality of the camera, for further details, please refer to the Reference Manual.

7.1 Trigger Mode

In this variant the ATOM one SSM500 works as a stand-alone camera with internal recording.

It can record up to 500 frames per second with a memory depth of 30.000 frames. This will give you a recording time of 1 minute at 500 FPS. By lowering the frame rate the recording time can be extended accordingly.

It is possible to split the 30.000 frames in up to 4 smaller buffers on demand.

The recording frame rate is independent of the video output format.

The slow motion ratio is defined by:

Slow Motion Ratio = Recording Frame Rate / Output Frame Rate

Examples:

Record 500 FPS / 1080p50 = 10x

Record 500 FPS / 1080p25 = 20x

In addition to that, the playback speed can be slowed down to further increase the ratio.

In trigger mode the camera has 2 independent output channels:

- **Live**
 - Always shows the live stream
 - The live frame rate is independent of the recording frame rate
 - Is shown on SDI outputs 1 & 2
- **Playback**
 - Can show the recorded slow motion video.
 - The slow motion factor is recording FPS / play back FPS
 - Optional it can show the live image if no playback is running (auto live)
 - Is shown on SDI outputs 3 & 4

SDI 5 is always showing a live image. This can be used by the camera operator as a local monitor.

Both output groups have independent image processing pipelines for best flexibility for color grading and post processing.

Refer to chapter 7.1.2 for workflows details.

7.1.1 Production Preparation

For any production, the camera needs some settings to meet the project requirements.

The following order is recommended:

1. Define lens system / lens control (motors, RCP, etc.)
2. Select the video output format, e.g. 1080i50
3. Select the recording frame rate / slow motion ratio, e.g. 300 FPS = 6x
4. Select number of buffers e.g. 3 x 10.000 frames (~33 seconds @ 300 FPS per buffer)

5. Select the color profile on the live channel e.g. 6500K (playback will follow automatically)
6. Setup white balance or use auto white balance
7. Start recording on a buffer

7.1.2 Trigger Workflows

Since the SSM500 Trigger does not have multiple independent image processing pipelines, the color workflow is different to other cameras.

This chapter defines recommended workflows for best results.

Trigger mode supports independent color grading for the live and playback channel. Depending on the need for the production, 2 different workflows can be defined:

- **Link Channels** (live = playback)
- **Pull Settings** (live → playback)

Important: Both workflows have in common, that the selection of the color temperature / white balance is defined from the live channel.

This means that any recording does include white balance from live settings at recording time. Optionally the white balance can be modified/fine-tuned during playback if needed.

7.1.2.1 Link Channels

In the first workflow, both live and playback image processing are always in sync. The operator controls the live output, the playback output will follow automatically.

The command

```
link_settings 1
```

links both channels, have a look at the Reference Manual for details.

Advantages

- Very easy to use
- Record and play do always have the same look
- Low workload for the operator

Disadvantages

- It is not possible to “tweak” the playback without changing the live image
- Risk: During playback, changes of live channel will show up directly “on air”

7.1.2.2 Pull Settings

In the second workflow, both live and playback image processing is independent. The image engineer can control live and playback settings as wanted. In many cases one image engineer is controlling the live image, while a 2nd engineer is controlling the playback image.

On demand the playback operator can “pull” the settings from the current live image by running a **copy_settings** command (see Reference Manual) for details. This command applies all settings from the live channel to the playback channel.

Advantages

- Full control over live and playback look
- Changes only get applied on demand, when the image engineer decides to do so (lower risk of having wrong settings “on air”)

Disadvantages

- Higher workload for the operator (ideally two image engineers)
- Risk: Operator must make sure that settings get pulled, otherwise playback can have wrong look

7.2 SSM Mode

In this mode the ATOM one SSM500 does not use its internal storage. The camera is steaming in super slow motion speed with up to 240 FPS.

The slow motion ratio is changed by adjusting the number of active phases. There are 4 different phase settings possible:

- 1 Phase: SDI 1 → **1x**
- 2 Phases: SDI 1, SDI 2 → **2x**
- 3 Phases: SDI 1, SDI 2, SDI 3 → **3x**
- 4 phases: SDI 1, SDI 2, SDI 3, SDI 4 → **4x**

SDI 5 is always showing a copy of phase 1. This can be used for the camera operator as a local monitor.

The frame rate is defined by the video output frame rate and the number of selected phases.

$$\text{FPS} = \text{Output FPS} * \text{Number of Phases}$$

Examples:

Video Mode 1080p50 on 3 Phases:

$$\text{FPS} = 3 * 50 = 150 \text{ FPS}$$

Video Mode 1080p60 on 4 Phases:

$$\text{FPS} = 4 * 60 = 240 \text{ FPS}$$

From the image processing perspective, this camera is operated like any “normal” camera. The image processors of all outputs are configured with the same settings, so no special workflows are required.

8 Firmware Update via SD Card

The firmware can be updated via SD card. Make sure, that the power supply of the camera is in a stable state.

A firmware update will reset all camera settings to their default values.

You can download the latest updated from our GitLab repository:

<https://gitlab.com/dreamchip/provideo-downloads>

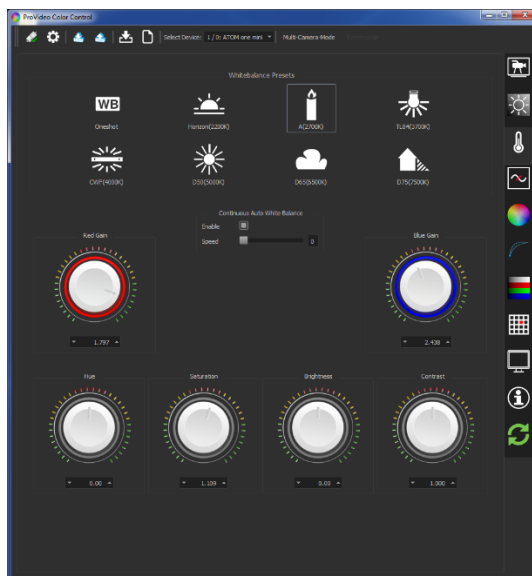
Procedure:

1. Format SD card with FAT32 format (vFat is not supported!)
2. Copy firmware update file to SD card
Caution: The file name must be “SSM500.swu”, otherwise the update will not be performed!
3. Insert SD card into cameras' SD card slot
4. Power on or reboot device
5. During boot the device will automatically detect the update on the SD card and boot into Update Mode
6. The update will be installed automatically, during the installation an according info message will be shown on the OLED screen
7. When the update was installed successfully, the device will shut down automatically
8. Once the device is powered down, remove the SD card
9. Power on the device, the new firmware is installed

9 ProVideo Control Software

The **ATOM one SSM500** comes with a free Windows control software. The ProVideo camera control software gives an easy access to most of the camera functions.

To use the software you need a serial connection from **ATOM one SSM500** to a Windows PC. This can be done with a USB – RS485 adapter. You can build your own adapter with a serial FTDI cable or purchase a cable from Dream Chip.



The ProVideo GUI is an open source software which is hosted on GitLab. The latest release of the Windows version of the software can be downloaded here:

<https://gitlab.com/dreamchip/provideo-downloads>

If you wish to use the GUI as the starting point of your own control software feel free to download the source code. Details can be found here:

<https://gitlab.com/dreamchip/provideo-gui>

10 FAQ

10.1 Q: The camera does not respond to serial commands

Make sure, your cables are connected correctly. Check you baud rate, the default is 115200 8N1.

10.2 Q: Is there a hardware camera controller available

Currently, Dream Chip does not provide a hardware camera controller, but 3rd party controllers are available in the market.

A free Windows software and a full API documentation comes with the camera. With this documentation you may adapt the camera to your existing controller.

10.3 Q: Where can I find firmware updates for my camera?

You can download the latest firmware and control software from our GitLab repository:

<https://gitlab.com/dreamchip/provideo-downloads>

11 Warranty

Dream Chip Technologies GmbH warrants that this product will be free from defects in materials and workmanship for a period of **6 months** from the date of purchase. If a product proves to be defective during this warranty period, Dream Chip Technologies GmbH, at its option, either will repair the defective product without charge for parts and labor or will provide a replacement in exchange for the defective product.

In order to obtain service under this warranty, you the Customer, must notify Dream Chip Technologies GmbH of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service. The Customer shall be responsible for packaging and shipping the defective product to a designated service center nominated by Dream Chip Technologies GmbH, with shipping charges pre-paid. Customer shall be responsible for paying all shipping changes, insurance, duties, taxes, and any other charges for products returned to us for any reason.

This warranty shall not apply to any defect, failure or damage caused by improper use or improper or inadequate maintenance and care. Dream Chip Technologies GmbH shall not be obligated to furnish service under this warranty: a) to repair damage resulting from attempts by personal other than Dream Chip Technologies GmbH representatives to install, repair or service the product, b) to repair damage resulting from improper use or connection to incompatible equipment, c) to repair any damage or malfunction caused by the use of non Dream Chip Technologies GmbH parts or supplies, or d) to service a product that has been modified or integrated with other products when the effect of such a modification or integration increases the time or difficulty of servicing the product.

THIS WARRANTY IS GIVEN BY DREAM CHIP TECHNOLOGIES GMBH IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED. DREAM CHIP TECHNOLOGIES GMBH AND ITS VENDORS DISCLAIM ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. DREAM CHIP TECHNOLOGIES GMBH'S RESPONSIBILITY TO REPAIR OR REPLACE DEFECTIVE PRODUCTS IS THE WHOLE AND EXCLUSIVE REMEDY PROVIDED TO THE CUSTOMER FOR ANY INDIRECT, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES IRRESPECTIVE OF WHETHER DREAM CHIP TECHNOLOGIES GMBH OR THE VENDOR HAS ADVANCE NOTICE OF THE POSSIBILITY OF SUCH DAMAGES. DREAM CHIP TECHNOLOGIES GMBH IS NOT LIABLE FOR ANY ILLEGAL USE OF EQUIPMENT BY CUSTOMER. DREAM CHIP TECHNOLOGIES GMBH IS NOT LIABLE FOR ANY DAMAGES RESULTING FROM USE OF THIS PRODUCT. USER OPERATES THIS PRODUCT AT OWN RISK.

12 Certifications

12.1 CE Compliance

ATOM one SSM500 has been shown to comply with the listed technical standards below. The tests have been done according to the measurement procedures specified in European Council Directive- EMC Directive 2014/30/EU.

The **ATOM one SSM500** passed the tests performed according to:

- EN 55022:2011-12 Class B / CISPR 22:2013-09-03
- EN 55024:2016-05 Class B / CISPR 24:2014-10-08
- EN 61000-3-2: 2015-03
- EN 61000-3-3: 2014-03

12.2 For Customers in the U.S.A.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures: Reorient or relocate the receiving antenna. Increase the separation between the equipment and receiver. Connect the equipment into an outlet on a circuit different from that to which the receiver is connected. Consult the dealer or an experienced radio/TV technician for help.

You are cautioned that any changes or modifications not expressly approved in this manual could void your authority to operate this equipment. The shielded interface cable recommended in this manual must be used with this equipment in order to comply with the limits for a computing device pursuant to Subpart J of Part 15 of FCC Rules.