SVP
BROADCAST
MICROWAVE

HDT-02 Transmitter Manual
Version V9.9.15
SW V9_1991122999059-02

Accessories included in this manual:

PA / PA Ultralinear
Power Amplifier

PAC Clip-on Amplifier

AVF Flexible Antenna

GPS-01
Antenna

RTC-03
Remote Control

Contents

Chapter 1: Introduction

This chapter provides a general description of the High Definition HDT-02 camera transmitter.

Chapter 2: Technical features

This part offers the transmitter's physical and environmental characteristics.

Chapter 3: How to order

The third part provides the user with information on ordering and different configurations available for these receivers.

Chapter 4: Transmitter operation and Menus

This part provides the user with all the necessary information to control and operate the equipment properly. It is detailed the function of each button on the keyboard and the information shown on the display, menus, etc.

Chapter 5: GPS Application

In this chapter, the use of the GPS incorporated system and some of its applications are shown.

Chapter 6: Lau-K Application

In this chapter, the use of the Lau-k HEVC external encoder operation from the transmitter is explained.

Chapter 7: Web Server

This chapter provides a detailed description of the Web Server tool. This feature allows controlling the HDT-02 Transmitter through a website.

Chapter 8: Block Diagram

This chapter provides a block diagram of the HDT-02 Transmitter internal performance.

Chapter 9: Equipment Installation

This chapter indicates the available connections of the transmitter, the characteristics and the installation.

Chapter 10: Remote Control

The HDT-02 Transmitter can be controlled remotely by the RTC-01 or RTC-03 devices or a RS-485 connection.

Chapter 11: Mechanical Dimensions

In this chapter, the mechanical drawings of the units described in this manual are included.

Chapter 12: Preventive maintenance

This chapter explain the procedure that should be followed during the transmitter's life.

Chapter 13: Warranty

This chapter contains warranty considerations and conditions.

Annex A: PA Power Amplifiers

This annex explains the main characteristics of SVP Broadcast Microwave's PA Power Amplifiers.

Annex B: PAC Clip-On Power Amplifiers

This annex explains the main characteristics of SVP Broadcast Microwave's PAC Clip-On Power Amplifiers.

Annex C: AVF Flexible Antenna User's Guide

The different flexible antennas and its characteristics are explained in this chapter.

Annex D: GPS-01 Receiver

The technical information for the external GPS antenna and receiver is given here.

Annex E: Modulation Standards

This chapter describes the DVB-T/T2 and DVB-S/S2 standards, as well as their features and the differences between them.

Dear Customer,

We would like to thank you for selecting this equipment and welcome you to the SVP's growing family of products.

We are sure that the addition of this equipment will give you a complete satisfaction in your existing installation.

Please read these instructions carefully and keep them in hand in case you have to refer to them.

About this manual

This user's guide provides indications and explanations about how to set up the HDT-02 easily for the most common use cases.

This document is intended to help first time users:

- To find their way around the GUI.
- To understand the different possibilities of the HDT-02.
- To configure the HDT-02 for their specific configurations.

Symbols

The symbols that appear in this manual are:

An information message which indicates explanations for the proper operation of the equipment.

It advises users that if they do not take, avoid or make specific actions, damage could appear in the device.

In the places where this symbol appears it means that by pressing the Down button of the equipment the user can access to the next screen.

This symbol means that pressing the OK button in the options where this symbol appears, the user can access the submenu related to that option or can change the value of the parameter.

These symbols mean that the parameter can be modified on the same screen with the right and left keys.

Important Notes

- The HDT-02 H.264 High Definition Multiband Transmitter is completely compatible with the DVB-T/T2/S/S2 Standards, included in the European Standard ETSI EN300744 (DVB-T), ETSI EN300755 (DVB-T2), ETSI EN302307 (DVB-S2) (optional) and ETSI EN300421 (DVB-S) (optional).

- It is important to note that when the transmitter is switched on, the selected RF output connection must be connected to a suitable antenna or charged.

- The HDT-02 H.264 High Definition Multiband Transmitter applies a MPEG-4 compression to either HDMI, composite video or SDI input signals. An MPEG-1 layer 2 compression is applied to the corresponding 4 analogue Audio channels, the 2 stereo SDI embedded, the HDMI embedded and the AES digital Audio signals. The resulting multiplexed signal is transmitted using COFDM modulation.

- The HDT-02 H.264 High Definition Multiband Transmitter is available from 1 GHz to 6.4 GHz, for the DVB-T2 and DVB-T. The L band output for the DVB-S2 and DVB-S is optional.

- If the RF output is set to DVB-T2 and the selected bandwidth is 1.7 MHz then, the device automatically disables the Audio2 and it sets the bitrate of the Audio1 to 128 Kbps.

- The equipment's maximum output power for the DVB-T2/T is 100 mW in 2 GHz frequency band, (selectable from -5 to +20 dBm) and for the DVB-S2 and DVB-S is from -50 to + 5 dBm.

- Special care should be taken with SDI cables, quality and length, as these are very important, especially when HD-SDI or 3G SDI signals are transmitted.

- If any Audio or data channel are not used in a transmission, they should be disabled, in order to assign that bitrate to the video and achieve a higher quality transmitted video signal.

- Only authorized personnel should open the unit and any repair or warranty will be invalidated if the seals are broken.

Safe Operating Procedures

In this section the safety requirements are shown in order to ensure awareness of potential hazard to the personnel who is operating and maintaining the equipment.

FCC

This chapter has been made taking into account the OET bulletin 65, from August 1997, recommended by the FCC (Federal Communications Commission).

The HDT-02 H.264 Transmitter designed to provide services for broadcasting, will not create RF energy exceeding 1.0 mW/cm^2, the FCC limit for exposure. This is known as the Maximum Permissible Exposure (MPE) limit. This transmitter follows this law (with the AVF flexible antenna 3 dBi) as long as the distance between the antenna and the person is at least 4 cm. In the case the PA-5 (5 W Power Amplifier), the minimum distance is 28.2 cm and if PA-10 (10 W Power Amplifier) is used, the minimum distance is 39.9 cm. SVP Broadcast Microwave, in accordance with the requirements set forth by the FCC, provides this information as a guide to the user. Next are shown the calculations made to obtain those values:

S = MPE in mW/cm^2 (milliwatts per square centimetres)

To follow the law, S maximum must be 1.0 mW/cm^2

$$S = \frac{EIRP}{4\pi \cdot R^2}$$

$$Rmin = \sqrt{\frac{EIRP}{4\pi}}$$

$$EIRP = P \cdot G$$

$$G = 10^{\frac{G\,(dBi)}{10}}$$

Where:

$EIRP$: Equivalent isotropically radiated power

$G\,(dBi)$: Antenna gain in dBi

P: Output power of the transmitter (W)

R: Distance from the antenna to the transmitter (cm)

1. HDT-02 Transmitter with AVF antenna (3 dBi)

   $G = 3$

   $P_{max} = 100$ mW

   EIRP = 200 mW

   R_{min} = 4 cm = 1.57 in

2. HDT-02 Transmitter + PA-5 (5 W) with AVF antenna

   $G = 3$

   $P_{max} = 5000$ mW

   EIRP = 10000 mW

   R_{min} = 28.2 cm = 11.1 in

3. HDT-02 Transmitter + PA-10 (10 W) with AVF antenna

   $G = 3$

   $P_{max} = 10000$ mW

   EIRP = 20000 mW

   R_{min} = 39.9 cm = 15.7 in

Declaration of RF Exposure Compliance for Exemption from Routine Evaluation Limits

SAR Evaluation – AVF-203 antenna

As shown in the point number 2.5.1 from the RSS-102 Radio Standard Specification, **SAR evaluation is not required if the separation distance between the user and the radiating element of the device is more than 20 cm.**

The equipment, which consists of the HDT-02 Transmitter with the AVF-203 antenna fixed to it, fulfils this requirement. As shown in the figure below, the distance between the device's radiating element (situated at the top of the antenna) and the nearest part of the user's body is further than 20 cm in length. If the length from the radiating element to the bottom of the antenna is 20 cm, then the distance between the nearest part of the user's body and the radiating element will be higher than 20 cm. As the camera user always uses the camera in the same way and the antenna is fixed to the camera, the distance is always maintained.

Conclusion: This equipment is exempted from SAR evaluation.

RF Exposure Evaluation

As shown in the point number 2.5.2 from the RSS-102 Radio Standard Specification, **RF exposure evaluation is required** if the separation distance between the user and the device's radiating element is lower than 20 cm, **except when the device operates as follows**:

- **Below 1.5 GHz and the maximum e.i.r.p. of the device is equal to or less than 2.5 W.**
- **At or above 1.5 GHz and the maximum e.i.r.p. is equal to or less than 5 W.**

Due to the fact, this equipment is going to operate above 1.5 GHz and the maximum e.i.r.p. is 200 mW (with the AVF-203L or the AVF-203LB antenna), this equipment is exempted from the RF exposure evaluation. When this equipment is operating below 1.5 GHz, it is also exempted from the RF exposure evaluation because the maximum e.i.r.p. (200mW) is lower than 2.5 W.

Conclusion: This equipment is exempted from the RF exposure evaluation.

First Aid in Case of Electric Shock

DO NOT TOUCH THE VICTIM WITH YOUR BARE HANDS until the circuit is broken. SWITCH OFF. If this is not possible, PROTECT YOURSELF with DRY insulating material and pull the victim clear of the conductor.

If breathing has stopped, indicated by unconsciousness, lack of respiratory movements and a 'blue' look to cheeks, lips, ears and nails, START RESUSCITATION AT ONCE.

EMERGENCY RESUSCITATION – THE EXPIRED AIR METHOD

(Approved by the Royal Life Saving Society)

1. If possible, lie the victim on his back with his head slightly higher than his feet. Clear the mouth and throat of any obvious obstruction.

2. Kneel on one side of the victim, level with his head. LIFT THE JAW AND TILT THE HEAD BACK AS FAR AS POSSIBLE (Figs. 1a and 1b)

3. One of the following may happen:

   a. Breathing may begin and consciousness returns.

   b. Breathing may begin but consciousness NOT returns. Turn the victim on his side and ensure that the airway is kept clear.

   c. Breathing may return but be NOISY which means that the airway is not fully clear. Try to clear the airway.

4. IF THERE NO SIGN OF BREATHING:

   a. Check that the head is still tilted back.

   b. Take a deep breath.

   c. Pinch the victim's nose and blow firmly into his mouth (Fig. 2). As you do, the chest will RISE.

   d. Turn your head away and take another breath, watching for the chest to FALL (Fig. 3).

5. Start with four quick breaths and then continue with one breath every five seconds (i.e. 12 times a minute). This should be continued until the victim revives or a doctor certifies death.

6. As consciousness returns the victim will start to breathe on his own, and a 'pink' colour replaces the 'blue' look: this is the time to stop resuscitation. Continue to hold his chin up and so keep the airway clear.

7. In the case of injuries to the mouth, it may be necessary to use mouth-to-nose resuscitation. Seal the victim's mouth with your cheek and blow firmly into his nose, proceeding as above.

8. In the case of severe facial injuries, it may be necessary to do a manual method of artificial respiration (Silvester-Brosch or Holger Nielsen). Briefly, these methods apply compression to ribcage with the victim lying on his back (S-B) or face down (H.N.) with associated movement of his arms up and out. The cycle of movement should take about five seconds, i.e. the normal breathing phase.

9. Whatever the method, it is ESSENTIAL to commence resuscitation WITHOUT DELAY and to send for medical assistance immediately.

TREATMENT FOR BURNS

If the victim is also suffering from burns, then, without hindrance to resuscitation, observe the following:

1. DO NOT ATTEMP TO REMOVE CLOTHING ADHERING TO THE BURN.

2. If possible, alleviate the pain from the burnt part by immersing in cold water.

3. If help as available or as soon as resuscitation is no longer required, the wound should be covered with a DRY clean dressing.

4. Oil or grease in any form should not be applied.

5. If severely burnt, get the victim to hospital immediately.

Chapter 1: Introduction

The HDT-02 is the multifunction and multiband transmitter developed by SVP Broadcast Microwave. The features of this equipment, achievable only by SVP, make this transmitter the most advanced in the market to date.

Its feature H.264 encodes for 3G, high definition (HD) and standard definition (SD) signals with ultra-low latency. H.264 transmission is possible using 40% lower bitrate than conventional MPEG-2 systems.

This new generation transmitter accepts analogue video, 3G/HD/SD-SDI and HDMI video input signals. Analogue, SDI embedded, HDMI embedded and AES Audio inputs are available as standard. User data or GPS data can be transmitted over the data channel.

The ASI output enables the user to employ the transmitter as a standalone encoder.

The HDT-02 Transmitter performs DVB-T2 and DVB-T modulations with a frequency band from 1 GHz to 6.4 GHz. DVB-T enables compatibility with nearly all types of receivers. DVB-T2 modulation outperforms DVB-T modulation and offers much higher data rate, which renders a higher signal quality or much more robust signal than other modulations, achieving longer and more complex links.

Optionally, this transmitter also performs DVB-S2 and DVB-S modulation. An L band IF output is available, which enables use of the transmitter as a satellite Encoder & Modulator unit.

Control, operation and monitoring of the HDT-02 Transmitter are very friendly. All the parameters of the transmitter can be configured in field. Furthermore, 7 presets are configurable for quick equipment set up. A wide range of accessories allows the use of this equipment in many different applications.

General Features

Input video signals such as composite video, 3G–SDI, HD-SDI, SD-SDI or HDMI are MPEG-4 encoded, together with 4 analogue Audios, 2 stereo AES/EBU channels, HDMI embedded or 4 digital Audios embedded on the SDI signal. The video formats can be 1080p, 1080i, 720p, 576i or 480i. This transmitter also has a test pattern and a test tone generator available.

This device has a data channel available that allows transmitting user data or GPS data as well as a Transport Stream ASI input so it can be used as a repeater.

The encoder uses a H.264/MPEG-4 Part 10 video compression that provides output bitrates from 1 Mbps to 100 Mbps and a MPEG-1 Layer II Audio compression which supplies different Audio bit rates (128, 160, 192, 256 or 384 Kbps).

Encoded signals can be encrypted using BISS-1 or BISS-E scrambling system, and optionally AES 128 and 256. The encrypted signal will only be received by the receivers that have a valid descrambling key.

It has a display and a keyboard which makes the configuration and monitoring of every parameter of the equipment possible.

The equipment is fed with DC power supply from 8 to 36V. It can be powered through DC power supply connector or through the battery mount (optional).

Its excellent design, mechanical and electronic assembly make the HDT-02 a robust and reliable solution.

DVB-T2 features

It is available from 1 GHz to 6.4 GHz through three different output bands, being 100 mW the maximum output power. High quality components have been used to achieve the best output signal quality.

The HDT-02 digital camera transmitter uses COFDM (Coded Orthogonal Frequency Division Multiplexing) modulation system (1K, 2K, 4K) which provides superior signal robustness and a higher link performance. This technology provides operators with efficient means to overcome the challenges of NLOS propagation and mobile channels propagation.

COFDM spread spectrum modulation system distributes the data over a large number of closely-spaced carriers, for example, 1705 carriers in 2K mode. The data is divided into several parallel data streams, one for each carrier, so, each carrier transports a lower data rate and the symbol duration is longer. Each carrier is then modulated with a QPSK, 16QAM, 64QAM or 256QAM scheme. Moreover, the rotated constellation technique is applied in order to improve the link performance.

A COFDM modulated signal, as it uses a low symbol rate modulation scheme (*i.e.* where the symbols are relatively long compared to the channel time characteristics), suffers less from intersymbol interference (ISI) caused by multipath propagation. As the duration of each symbol is long, it is feasible to insert a guard interval between the COFDM symbols, thus eliminating the intersymbol and co-channel interference. So, if one carrier's information is lost, only a small part of the whole information would be lost.

Besides, in COFDM, the sub-carrier frequencies are chosen so that the sub-carriers are orthogonal to each other, meaning that cross-talk, interference, between the sub-channels is eliminated. The orthogonality allows high spectral efficiency.

On the other hand, COFDM system is invariably used in conjunction with channel coding (forward error correction). The error correction code used in this equipment is Reed-Solomon coding, which is concatenated with LDPC, and there is an additional interleaving between the two layers of coding. Error correcting codes build redundancy into the transmitted data stream. This redundancy allows bits that are in error or even missing to be corrected in the receiver.

The European ETSI EN 300755 standard defines the following LDPC coding rates: 1/2, 3/5, 2/3, 3/4, 4/5, 5/6. There is a compromise between the coding rate (signal robustness) and the transmitted bit rate. If the coding rate is higher the signal transmission is more robust (1/2 is the most robust) but the bit rate that the system is able to transmit is lower.

Used modulation scheme of each COFDM sub-carrier, QPSK, 16QAM, 64QAM and 256 QAM is also connected with signal robustness and transmitted bit rate. QPSK is the most robust and 256QAM is able to transport a higher bit rate.

Besides the system can define 4 guard intervals: 1/4, 1/8, 1/16 and 1/32. The guard interval is used to reduce intersymbol interferences due to the multipath propagation.

In addition, it also provides several bandwidths: 1.7, 5, 6, 7 and 8 MHz in case there are needed for different applications.

To summarize, with all these characteristics, the maximum bit rate achieved is 46 Mbps.

DVB-T features

The RF stage of the HDT-02 Transmitter is the same as the DVB-T2 one. The difference is found in the modulation part as it is commented below.

The HDT-02 digital camera transmitter uses COFDM (Coded Orthogonal Frequency Division Multiplexing) modulation system (2K mode).

The European ETSI EN 300744 standard defines the following convolutional coding rates: 1/2, 2/3, 3/4, 5/6, 7/8.

Used modulation scheme of each COFDM sub-carrier, QPSK, 16QAM and 64QAM, is also connected with signal robustness and transmitted bit rate. QPSK is the most robust and 64QAM is able to transport a higher bit rate.

Besides the system can define 4 guard intervals: 1/4, 1/8, 1/16 and 1/32.

In conclusion, with all these characteristics, the maximum bit rate achieved is 31.67 Mbps.

DVB-S2 features (optional)

In case the HDT-02 Transmitter is needed to be used as a satellite transmitter, it features an IF stage in the L band with an output power level from -50 to +5 dBm and a high stability and low phase noise.

The HDT-02 digital camera transmitter uses single carrier or one modulation from the next available: QPSK, 8PSK, 16APSK or 32 APSK where the most robust is the QPSK and the one with the bigger bit rate is the 32 APSK.

In addition, the European ETSI EN 302307 standard defines the following LDPC coding rates: 1/4, 1/3, 2/5, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10.

In the modulation stage it is also included a roll off factor (0.20, 0.25, 0.35) which is used to reduce intersymbol interference where the value that most reduces interference but with less bandwidth is 0.20.

To sum up, with all these characteristics, the maximum bit rate achieved is 31 Msym/s (108 Mbps).

DVB-S features (optional)

In case the HDT-02 Transmitter is needed to be used as a satellite transmitter, it features an IF stage in the L band with an output power level from -50 to +5 dBm and a 10 MHz reference oscillator.

The HDT-02 digital camera transmitter uses QPSK modulation. In addition, the European ETSI EN 300421 standard defines the following Reed Solomon coding rates: 1/2, 2/3, 3/4, 5/6, 7/8.

Chapter 2: Technical features

RF Stage DVB-T2 and DVB-T:

Frequency bands:	1 to 2.8 GHz
	3 to 4 GHz
	4 to 6.4 GHz
Frequency stability:	±10 ppm
Max. Output Power:	20 dBm (1 – 2.8 GHz)
	19 dBm (3 – 4 GHz)
	11 dBm (4 – 5.4 GHz)
	5 dBm (5.4 – 6.4 GHz)

Modulation:

DVB-T2:	COFDM 1K, 2K, 4K
	QPSK, 16QAM, 64QAM, 256QAM
	Constellation rotation
	LDPC FEC: 1/2, 3/5, 2/3, 3/4, 4/5, 5/6
	IG: 1/8, 1/16, 1/32
	Bandwidth: 1.7, 5, 6, 7, 8 MHz
	Max. bitrate: 46.4 Mbps
DVB-T:	COFDM 2K
	QPSK, 16QAM, 64QAM
	FEC: 1/2, 2/3, 3/4, 5/6, 7/8
	IG: 1/8, 1/16, 1/32
	Bandwidth: 5, 6, 7, 8 MHz
	Max. bitrate: 31.67 Mbps

DVB-S2 (optional):   QPSK, 8PSK, 16 APSK, 32 APSK

Constellation rotation

LDPC FEC: 1/4, 1/3, 2/5, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10

Max. Symbol Rate: 31 Msymb/s

Max. Bandwidth @ Rolloff: 0.35= 41.85 MHz

Max. Bitrate: 109 Mbps

DVB-S (optional):   QPSK

Constellation rotation

Reed Solomon FEC: 1/2, 2/3, 3/4, 5/6, 7/8

Baud Rate: 31 Msymb/s

Encoder:

Video compression:	H.264/MPEG-4 Part 10
Profile:	High 422, High, Main
Level:	3.0/3.1/3.2/4.0/4.1
Latency:	Ultra Low delay: 33 ms in NTSC.
Audio compression:	MPEG-1 Layer II
Audio bitrate:	128, 192, 256 or 384 Kbps
Output bitrate:	1 Mbps – 110 Mbps
Extra Feature	KLV Metadata Embedded on SDI (Optional)

Encryption:

BISS:	BISS-1 and BISS-E
AES (Optional):	AES-128 and AES-256

Video:

Inputs:	3G-SDI SMPTE-425M-A (299M)
	HD-SDI SMPTE-292M (299M)
	SD-SDI SMPTE-259M (272M)
	HDMI (1.4a) (Only cameras)
	Composite video (PAL/NTSC)
Formats:	**1080p** (1920x1080) – 23.98/ 24/ 25/ 29.97/ 30/ 50/ 59.94/ 60 Hz

1080i (1920x1080) – 50/ 59.94/ 60 Hz

720p (1280x720) – 23.98/ 24/ 25/ 29.97/ 30/ 50/ 59.94/ 60 Hz

576i (720x576) – 50 Hz

480i (720x480) – 59.94 Hz

Audio:

Input:	HDMI embedded/ SDI embedded
	AES Digital / Analogue
Analogue:	2 Stereo/ 4 Mono
	Line, Micro Dynamics and Phantom
SDI embedded:	1 Group (4 Audio channels)
AES/EBU:	2 Stereo channels

Data Channels:

Data channel:	User data (RS232)
Data rate:	1,200 to 230,400 bps
GPS Data Channel	Internal GPS receiver (Optional)

ASI:

Input and Output:	ASI Transport Stream (EN50083-9)
Extra feature	Remux (Optional)

Test Signals:

Video:	Bars with moving icon
Audio	4 Audio tones at 1 Khz.

Control and Monitorization of the device:

Control Interfaces:	Front panel & display
	Web Server interface
	RTC-03 via cable
Monitoring:	Encoding parameters
	Demodulation parameters
	Frequency and output level

	Alarms and warnings are sent to the receiver via RF
Presets	7 user define presets

Power Supply:

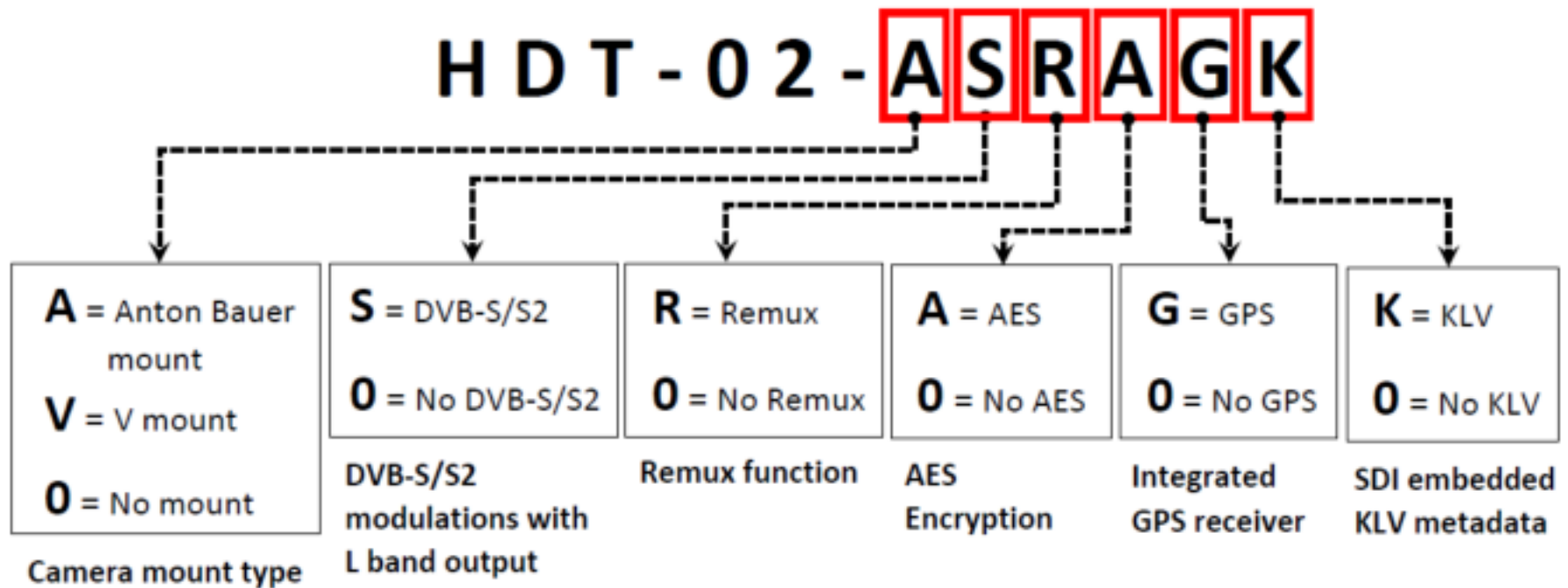| DC input:	8 to 36 V
	By batteries Anton-Bauer or V (AB or V mount clamping system optional)
Consumption:	16 W @ 12V
	20 W @ 28V

Weight on Wheel System (WoW)

Mechanical:

Size:	123.5 x 48.4 x 208.1mm
Weight:	1 kg (without fastenings)
	(2.2 lb)

Environmental:

Aeronautical	RTCA / DO-160E compliant
Temperature range:	-30 to 50 ºC
Height:	4.500 m
Humidity:	95%

Chapter 3: How to order

H D T - 0 2 - A S R A G K

A = Anton Bauer mount	S = DVB-S/S2	R = Remux	A = AES	G = GPS	K = KLV
V = V mount	0 = No DVB-S/S2	0 = No Remux	0 = No AES	0 = No GPS	0 = No KLV
0 = No mount	DVB-S/S2 modulations with L band output	Remux function	AES Encryption	Integrated GPS receiver	SDI embedded KLV metadata
Camera mount type					

Chapter 4: Transmitter Operation and Menus

This section provides the user all the necessary information to control, configure and operate the equipment properly

4.1 Display

To turn the equipment on and off, press ON/OFF button.

When a video, Audio or data input has been selected, a character connected to this input is displayed on the main screen.

Next, the main screen of the HDT-02_H.264 Transmitter is shown.
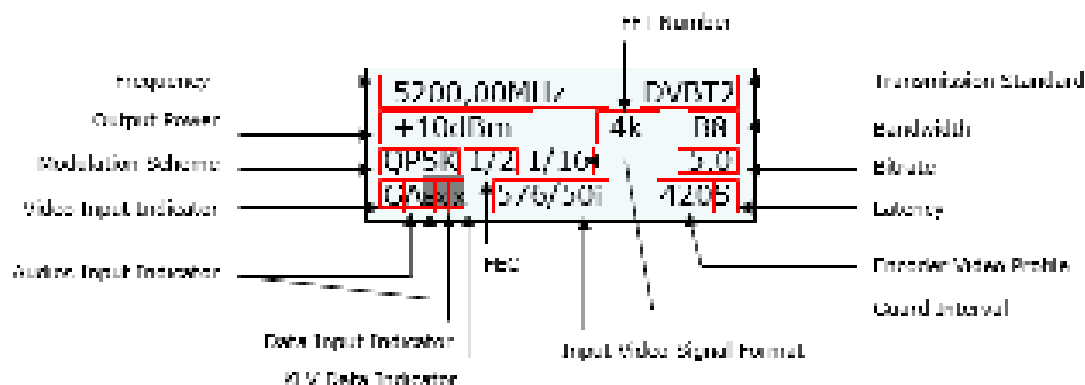
Figure 4.1: HDT-02 front panel / Main screen explanation

Once an option has been selected, the main screen appears and these parameters are displayed:

- Frequency (MHz)

- Transmission Standard (DVB-T2, DVB-T, DVB-S2, DVB-S,…)

- Output power (dBm). 3 options available:

  - Variable power range from -5 to 20 dBm (DVB-T/T2) and from-20 to 5 dBm (DVB-S2/S).

  - High power which means that the output power is 20 dBm.

  - Low power which means that the output power is 14 dBm.

- Bandwidth (MHz)

- Modulation Scheme

- FEC (Forward Error Correction)

- Guard Interval

- Transmitted bitrate (Mbps)

- Video Input selection

  Possibilities: CVBS, HDMI, SDI, DVB-ASI Transport Stream or Generator.

  Behaviour of the corresponding character: If the character is static then it means presence of that signal. If the character blinks, then it means absence of that signal.

- Audios status indication: If Audio 1 or 2 is not darkened then it is enabled. On the other hand, if Audio 1 or 2 is darkened then it is disabled.

- Data status indication: If this field is not darkened then it means that data is enabled. On the other hand, if this value is darkened it means that data is disabled. However, when this field is static, its meaning is presence of the data whereas if this field is blinking, it means absence of the data.

- KLV Metadata status indication: If this field is not darkened then it means that KLV metadata is enabled. On the other hand, if this value is darkened it means that data is disabled. Moreover, when this field is static, its meaning is presence of the data whereas if this field is blinking, it means absence of the data.

- Input video signal format.

- Encoder Video Profile (4.2.0 or 4.2.2).

- Latency (Standard Delay, Low Delay or Super Low Delay)

    - Standard Delay (Lipsync < 10 ms)

    - Super Low Delay (Lipsync < 10 ms) → 2 frames

    - Ultra Low Delay (Lipsync = 40ms) → 1 frame

Next, the linkages between the input and the character displayed on the principal screen is shown:

Video	CVBS	C
	HDMI	H
	SDI	S
	ASI	A
	Test-Pattern	G
Audio	Embedded	E
	AES/EBU	U
	Analogue	A
	Test-Tone	G

Data	RS232	D
KLV		K
Remux		R

Table 4.1: Linkages between the input and the character displayed

4.1.1 Main Screen for the DVB-T2

In the table below, the function of each parameter is explained. These values are numbered in the order they appear on the main screen.
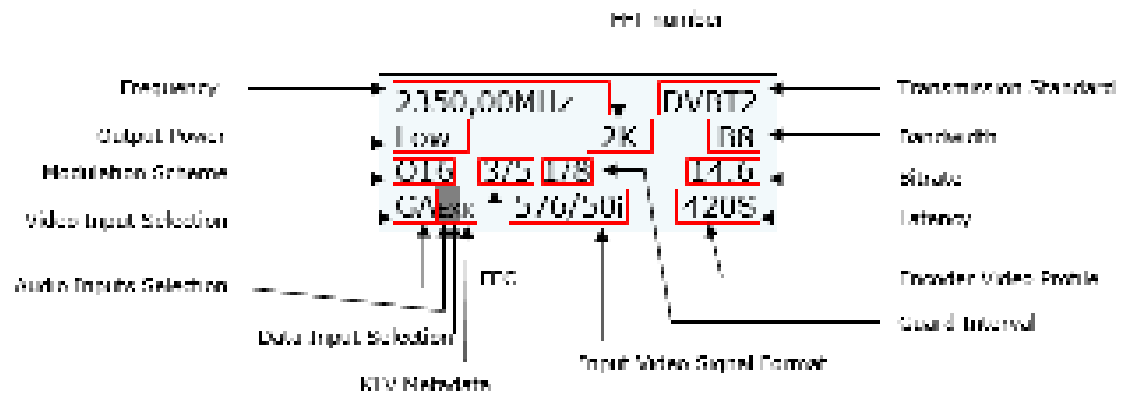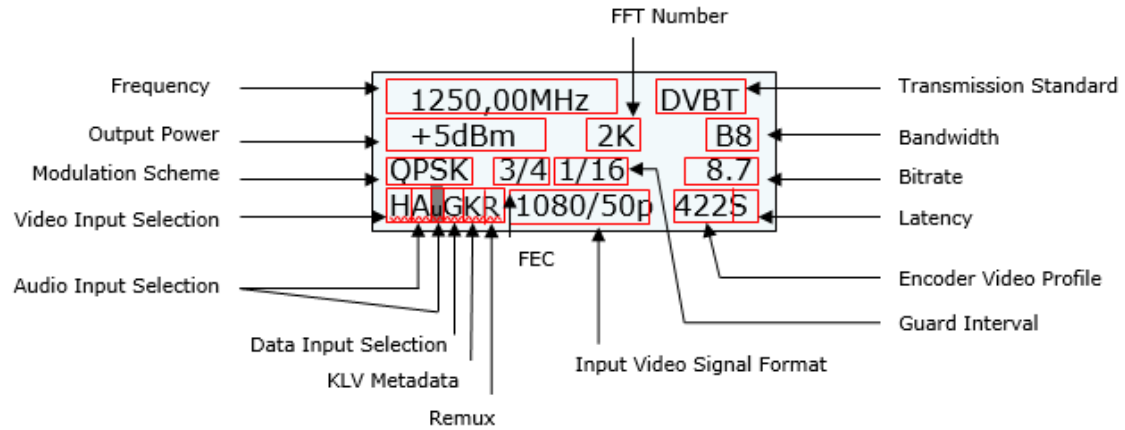

Figure 4.2: Main screen for DVB-T2 standard

Parameter nº	Function
1	Transmission frequency (MHz)
2	Transmission standard (DVB-T2)
3	Output power (dBm) or (High, Low, Mid)
4	Bandwidth (1.7, 5, 6, 7, 8 MHz)
5	Modulation (QPSK, 16QAM, 64QAM, 256QAM)
6	LDPC FEC (1/2, 3/5, 2/3, 3/4, 4/5, 5/6)
7	Guard Interval (1/4, 19/128, 1/8, 19/256, 1/16, 1/32, 1/128)
8	Transmitted bitrate (Mbps)
9	Character 1: Video input selection (SDI, HDMI, CVBS, DVB-ASI Transport Stream or Generator) and (static -> presence / blinking -> absence)
10	Character 2 (Audio 1) and character 3 (Audio 2): Audio inputs selection (Embedded, Analogue, AES/EBU, Tone Generator or None) and (Audio 1 and 2 not darkened -> enabled / darkened -> disabled)
11	Character 4: Data input selection (None or RS232) and (not darkened -> enabled / darkened -> disabled) and (static -> presence / blinking -> absence)
12	Character 5: KLV metadata enabled if K appears on the screen. If metadata is present, the character is static, otherwise it blinks.
13	Character 6: Remux option enabled if R appears on the screen.

14	Video Format: • 1080p (1920x1080) – 23.98/ 24/ 25/ 29.97/ 30/ 50/ 59.94/ 60 Hz • 1080i (1920x1080) – 50/ 59.94/ 60 Hz • 720p (1280x720) – 23.98/ 24/ 25/ 29.97/ 30/ 50/ 59.94/ 60 Hz • 576i (720x576) – 50 Hz • 480i (720x480) – 59.94 Hz
15	Video options: Profile (MPEG-4 4:2:0 or MPEG-4 4:2:2) Delay (Standard (S), Super Low delay (SL) or Ultra Low delay (UL))

Table 4.2: DVB-T2 Main Screen parameters

4.1.2 Main Screen for the DVB-T

In the table below, the function of each parameter is explained. These values are numbered in the order they appear on the main screen.
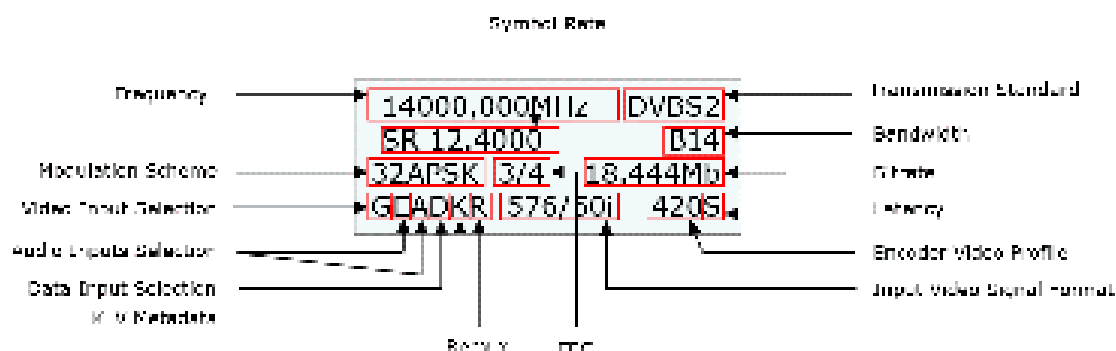

Figure 4.3: Main screen for DVB-T standard

Parameter nº	Function
1	Transmission frequency (MHz)
2	Transmission standard (DVB-T)
3	Output power (dBm)
4	Quantity of reflected power (0-99%)
5	Bandwidth (5, 6, 7, 8 MHz)
6	Modulation (QPSK, 16QAM, 64QAM)
7	LDPC FEC (1/2, 2/3, 3/4, 5/6, 7/8)
8	Guard Interval (1/4, 1/8, 1/16, 1/32)
9	Transmitted bitrate (Mbps)
10	Character 1: Video input selection (SDI, HDMI, CVBS, DVB-ASI Transport Stream or Generator) and (static -> presence / blinking -> absence)
11	Characters 2 (Audio 1) and 3 (Audio 2): Audio inputs selection (Embedded, Analogue, AES/EBU, Tone Generator or None) and (Audio 1 and 2 not darkened -> enabled / darkened -> disabled)
12	Character 4: Data input selection (None or RS232) and (not darkened -> enabled / darkened -> disabled) and (static -> presence / blinking -> absence)

13	Character 5: KLV metadata enabled if K appears on the screen. If metadata is present, the character is static, otherwise it blinks.
14	Character 6: Remux option enabled if R appears on the screen.
15	Video Format (1080p, 1080i, 720p, 576i, 480i)
16	Video options: Profile (MPEG-4 4:2:0 or MPEG-4 4:2:2) Delay (Standard (S), Low delay (L), Super Low delay (SL) or Ultra Low delay (UL))

Table 4.3: DVB-T Main Screen parameters

4.1.3 Main Screen for the DVB-S2

In the table below, the function of each parameter is explained. These values are numbered in the order they appear on the main screen.
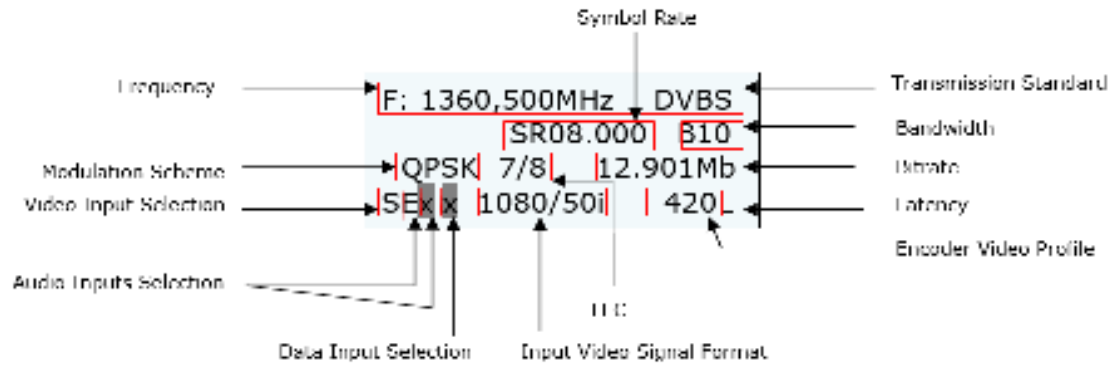

Figure 4.4: Main screen for DVB-S2 standard

Parameter nº	Function
1	Transmission frequency (MHz)
2	Transmission standard (DVB-S2)
3	SR (MSymb/s)
4	Bandwidth (adaptable)
5	Modulation (QPSK, 8PSK, 16APSK, 32APSK)
6	LDPC FEC (1/4, 1/3, 2/5, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10)
7	Transmitted bitrate (Mbps)
8	Character 1: Video input selection (SDI, HDMI, CVBS, DVB-ASI Transport Stream or Generator) and (static -> presence / blinking -> absence)
9	Characters 2 (Audio 1) and 3 (Audio 2): Audio inputs selection (Embedded, Analogue, AES/EBU, Tone Generator or None) and (Audio 1 and 2 not darkened -> enabled / darkened -> disabled)
10	Character 4: Data input selection (None or RS232) and (not darkened -> enabled / darkened -> disabled) and (static -> presence / blinking -> absence)
11	Character 5: KLV metadata enabled if K appears on the screen. If metadata is present, the character is static, otherwise it blinks.
12	Character 6: Remux option enabled if R appears on the screen.
13	Video Format (1080p, 1080i, 720p, 576i, 480i)

14	Video options:
	Profile (MPEG-4 4:2:0 or MPEG-4 4:2:2)
	Delay (Standard (S), Low delay (L), Super Low delay (SL) or Ultra Low delay (UL))

Table 4.4: DVB-S2 Main Screen parameters

4.1.4 Main Screen for the DVB-S

In the table below, the function of each parameter is explained. These values are numbered in the order they appear on the main screen.

Figure 4.5: Main screen for DVB-S standard

Parameter nº	Function
1	Transmission frequency (MHz)
2	Transmission standard (DVB-S)
3	SR (MSymb/s)
4	Bandwidth (adaptable)
5	Modulation (QPSK)
6	LDPC FEC (1/2, 2/3, 3/4, 5/6, 7/8)
7	Transmitted bitrate (Mbps)
8	Character 1: Video input selection (SDI, HDMI, CVBS, DVB-ASI Transport Stream or Generator) and (static -> presence / blinking -> absence) Characters 2 (Audio 1) and 3 (Audio 2): Audio inputs selection (Embedded, Analogue, AES/EBU, Tone Generator or None) and (Audio 1 and 2 not darkened -> enabled / darkened -> disabled) Character 4: Data input selection (None or RS232) and (not darkened -> enabled / darkened -> disabled) and (static -> presence / blinking -> absence) Character 5: KLV metadata enabled if K appears on the screen. If metadata is present, the character is static, otherwise it blinks. Character 6: Remux option enabled if R appears on the screen.
9	Video Format (1080p, 1080i, 720p, 576i, 480i)

	Video options:
10	Profile (MPEG-4 4:2:0 or MPEG-4 4:2:2)
	Delay (Standard (S), Low delay (L), Super Low delay (SL) or Ultra Low delay (UL))

Table 4.5: DVB-S Main Screen parameters

4.2 LEDs

The HDT-02 Transmitter has 5 LEDs on its front panel that show the information detailed below.

Figure 4.6: HDT-02 front panel LED indication

The **ON/OFF** provides the following information:

- If the LED is off, the equipment is not being fed.
- If the LED flickers in red, the equipment is being fed but it is turned off.
- The Led lights up in green when the equipment is turned on.

The **RF LED** provides the following information:

- If the LED is off, the equipment does not transmit RF signal.
- The LED lights up in green when the equipment transmits RF signal, RF stage is active.

The **ALARM LED** provides the following information:

- The LED lights up in red when any alarm occurs.
- The different alarms that can appear in the transmitter are:
  - Voltage High.
  - Voltage Low.
  - Temperature High.
  - ASI Overflow: This alarm means that the input bitrate is higher than the one that can be modulated due to the configured parameters (constellation, FEC, GI...).
- The different warnings that can appear in the transmitter are:
  - No SDI/HDMI/CVBS/ASI Input.
  - No GPS.
  - No KLV.

The **REMOTE LED** provides the following information:

- The LED lights up in blue when the user is connected remotely to the device (through the Web Server).

The **STATUS LED** provides the following information:

- The LED lights up when the encoder is working properly.

4.3 Front panel

The HDT-02 camera transmitter is configured following the menus structure on the display. The front panel has 8 buttons to enter and exit the equipment's control menus and submenus and to navigate through them. The function of each button is detailed in the following sections.

Figure 4.7: HDT-02 front panel

4.3.1 ON/OFF Button

To switch the equipment on and off, press this button. When the equipment is turned on, it will display the main screen.

If the power fails while the equipment is operating, it will restart automatically when the power returns, not being necessary to press the on/off button again.

Figure 4.8: ON/OFF button

4.3.2 OK Button

This button is used to:

- Enter to submenus and change parameters. To access to a submenu, OK button must be pressed. Moreover, in the fields where the enter symbol ↵ appears, by pressing the OK button the user can change the value of the selected parameter. To save the introduced value, the OK button must be pressed.

- When the main screen, pressing the OK button the user can access to the alarms screen where the different alarms that are taking place are. To return to the main screen, the cross button must be pressed.

Figure 4.9: OK button

4.3.3 Cross Button

This button is used to:

- Enter from the equipment main screen to the setup menu and vice versa.

- Exit equipment's submenus.

- This button allows the user to access the main screen from the alarms screen.

Figure 4.10: Cross button

4.3.4 Left and Right Button

These buttons are used to:

- To move the cursor towards the digit immediately on the left or right and to select a parameter from different options.

Figure 4.11: Left and Right buttons

4.3.5 Up and Down Button

- The up and down arrow buttons allow the navigation on the main menu and the rest of submenus. Using these buttons, the user can enter to the submenu or change a parameter. Once selected, the OK button must be pressed.

- These buttons are also used to change, for example, the frequency and PID parameter's values. Pressing up and down arrows the value of those parameters can be changed, increased or decreased respectively.

Figure 4.12: Up and Down buttons

4.3.6 RF Button

By pressing the RF button, RF output is enabled or disabled. The RF LED indicates the status of the RF output. It is important that before pressing this button, the selected RF output must be conveniently loaded and there is no reflected signal.

In case the device is switched off with the RF output enabled then, when it is switched on again it is necessary to push again this button to enable this feature.

However, if power supply fails when RF output is enabled then, once power supply returns it is not necessary to push this button because RF output will continue being enabled.

Figure 4.13: RF On/Off button

4.4 Menu Scheme

There is one menu in this transmitter that allows the user to change the transmitter's parameters and configure them.

To enter the menu of this equipment the cross button must be pressed.

In case you want to return to the principal screen from the menu, the cross button must be pressed. Furthermore, in the case of being in the submenus area, returning to the main screens is achieved by pressing the cross button as many times as it is needed.

On the next page, a scheme that specifies the different menu options available are shown.

MAIN SCREEN
Received signal standard, Bitrate, Video codification, Output video signal format, Profile, Delay, Audio and Data status, Received frequency, Scheme modulation, FEC, Guard Interval, Bandwidth, Number of cuts.

Continued→

Encoder

Continued→

Video

SDI	HDMI 1	HDMI 2	CVBS	ASI	Generator
Format	Format	Format	Format	Status	Format
Delay	Delay	Delay	Delay	Bitrate	Delay
Profile	Profile	Profile	Profile		Profile
GOP	GOP	GOP	GOP		GOP
Level	Level	Level	Level		Level

Audio 1 / 2

None	Embedded	Analogue	AES-EBU	Generator
	Bitrate	Bitrate	Bitrate	Bitrate
	Gp DID	L Type		Frequency
		R Type		Level

Data	GPS	KLV Metadata	Encoder output (Bitrate)	TS Parameters	Scrambler	Remux

Data: None, RS232, Lau-K

RS232:
- Baud Rate
- Parity
- Stop Bits

GPS:
- Antenna 5V
- GPS Info

Encoder output (Bitrate):
- Auto
- Manual

TS Parameters:
- Service name
- Program Nº
- Video PID
- Audio1 PID
- Audio2 PID
- Data PID
- GPS PID
- ALRM PID
- PMT PID
- PCR PID
- KLV Metadata PID
- TS ID
- Network ID
- Network Name

Scrambler: None, BISS-1, BISS-E, AES-128, AES-256

Remux: Disable, Enable

HDT-02_H.264 *High Definition Digital Camera Transmitter*

```
                                          ┌──────────────┐
                                          │      RF      │
                                          └──────────────┘
        ┌──────────────┬──────────────────────┴──────────────────────┬──────────────────┐
┌──────────────┐ ┌──────────────┐              ┌──────────────┐              ┌──────────────┐
│    DVB-T2    │ │    DVB-T     │              │    DVB-S2    │              │    DVB-S     │
└──────────────┘ └──────────────┘              └──────────────┘              └──────────────┘
```

DVB-T2	DVB-T	DVB-S2	DVB-S
Frequency	Frequency	Frequency	Frequency
Power	Power	Sort of Output	Sort of Output
Mode	Bandwidth	Power	Power
Bandwidth	Modulation	Modulation	FEC
Modulation	FEC	LDPC FEC	Symbol Rate and Bandwidth
LDPC FEC	Guard Interval	Symbol Rate and Bandwidth	Spectrum
FFT	Spectrum	Roll Off	10MHz Reference
Time Interleaving	DC by RF	Pilots	Antenna Gain
DC by RF	PA Unit	Spectrum	BUC
PA Unit		10MHz Reference	
		Antenna Gain	
		BUC	

HDT-02_H.264 *High Definition Digital Camera Transmitter*

←Continued

```
                                    ┌─────────────┐
                                    │    Unit     │
                                    └─────────────┘
                                          │
   ┌──────────┬───────────┬──────────┬────┴──────┬──────────────────┬──────────────┐
┌──────┐  ┌────────┐  ┌────────┐  ┌────────┐  ┌──────────────┐  ┌──────────┐
│RTC SEL│ │ Alarms │  │Monitor │  │ Remote │  │Miscellaneous │  │ Firmware │
└──────┘  └────────┘  └────────┘  └────────┘  └──────────────┘  └──────────┘
```

	Band

	View	Temperature	Local IP	Band
	Config	Voltage	Mask	Keyboard Beep
			Gate	Keyboard Lock
			MAC	Night Mode
			Admin Pas	Distance Units
			Restore Admin Pas	Video Switch
			User Pas	T / T2 Carrier
			Restore User Pas	Activation Key

Firmware:
| Update Firmware |
| Current Firmware |

Miscellaneous (continued):
| S/N |
| Activation Licenses |
| Load Encryption keys |

4.5 Menu Navigation

This section contains a detailed description of each parameter that can be configured in the HDT-02 H.264 camera transmitter via the menu.

To enter the menu, press the Cross button in the case of being on the principal screen or in any submenu.

To select a parameter or a submenu use Up, Down arrows. Once selected press OK button to access to a submenu or to edit a parameter. To exit a submenu or a parameter press Cross button.

> Figure ⬇ means that to have access to the right image that button must be pushed.
>
> Symbols <> mean that the parameter can be modified on the same screen with the right and left keys.
>
> Symbol ↵ means that pushing the OK button allows entering to the options of the submenu.

Several types of parameters are available:

- **Eligible:** When the user can choose between predetermined states. (They have the symbols <> near them)

- **Editable:** When the user can enter a value in that option. (The ↵ symbol is displayed on the right of the name). To save the introduced value, the OK button must be pressed.

- **Reading:** When the value of that parameter is a monitored parameter that can't be changed.

To change a parameter, for example, the transmitted frequency, press the OK button in the desired option and then with the Up, Down buttons choose the value. Once the parameter is set, press the OK button to save the value.

Next, the different menus and submenus with the options and the different parameters available are explained. Furthermore, in each figure, example parameters are shown.

4.6 Menu Structure

The main menu is used to access the main parameters of the transmitter which are explained below.

The following menu screen can be accessed by pressing the Cross key from the main screen.

MAIN MENU
Encoder
RF
Unit
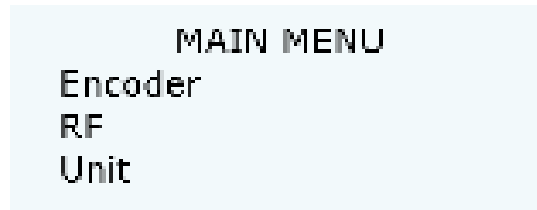
Figure 4.14: Main Menu

- **Encoder** – All the parameters related to the video, Audio and data inputs are configured here. Besides, all video, Audio, multiplexing and data encoding parameters are accessed here.

- **RF** – DVB-T2/T/S2/S transmission parameters are set in this section.

- **Unit** – Parameters related to the Web Server and other internal options of the transmitter are configured here.

4.6.1 Encoder Menu

The Encoder menu allows the configuration of the video, Audio and data input and KLV metadata selection. On this menu, the encoder can be configured to output the bitrate set manually or auto. If auto is selected, the bitrate is set by the modulation parameters automatically (bandwidth, modulation, FEC, GI, FTT number).

The PID assignment for each data transmitter is made in the Encoder menu.

The encryption is enabled or disabled here, and the key of the encryption selected is set inside the encryption menu.

In addition, you can send up to 8 different videos (1 SDI input+ 7 ASI input) by using the Remux option, which can be enabled in this menu.

Next, is explained how to configure each parameter.

By using the Up, Down arrow keys, select the **Encoder** option and press the OK key.

```
             ENCODER
Video:  Generator      < ↵
Audio1: Generator      < ↵
Audio2: None             >
```

```
             ENCODER
Data:  RS232           <>↵
GPS:  On               <  ↵
KLV Metadata: Off        >
```

```
             ENCODER
Encoder Output          ↵
TS Parameters           ↵
Scrambler: None          >
```

```
             ENCODER
Remux: Disable           >
```
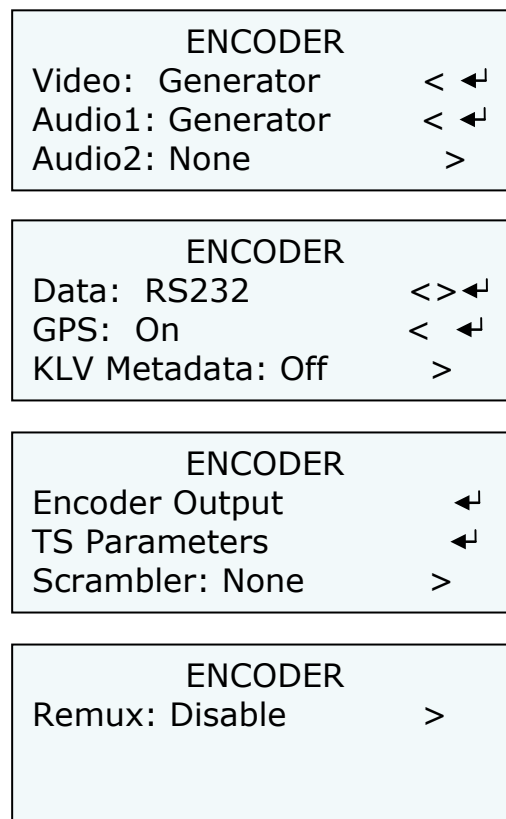
Figure 4.15: Encoder Menu

Line nº	Function
1	**Video** (eligible parameter)**:** In this field, the video input must be chosen with the Right and Left buttons. Once the video input has been selected, press the OK button to configure the parameters related to it. The available options are: • SDI • HDMI1 • HDMI2 • CVBS • ASI • Generator
2	**Audio 1** (eligible parameter)**:** In this field, the sort of Audio signal introduced in the Audio 1 input can be chosen with the right and left buttons. Once the Audio 1 input has been selected, press the OK button to configure the parameters related to it. The available options are: • None • Embedded • Analogue • AES-EBU • Generator
3	**Audio 2** (eligible parameter)**:** In this field, the sort of Audio signal introduced in the Audio 2 input can be chosen with the right and left buttons. Once the Audio 2 input has been selected, press the OK button to configure the parameters related to it. The available options are: • None • Embedded • Analogue • AES-EBU • Generator
4	**Data** (eligible parameter)**:** In this field, the sort of data input can be selected. The available options are: • None • RS232 • 4K Board
5	**GPS** (eligible parameter) (Optional): In this field, the GPS can be enabled. The GPS is an optional feature.

6	**KLV Metadata** (eligible parameter) (Optional)**:** In this field, the KLV metadata can be enabled. This feature is optional.
7	**Encoder Output** (eligible parameter)**:** In this field, the encoder output bitrate mode can be selected. The available options are: • Auto • Manual Bitrate (editable parameter) In the Manual Bitrate Mode, pressing the OK button, the output bitrate can be configured.
8	**TS Parameters** (editable parameters)**:** This field consists of the configuration of the parameters of the Transport Stream. In this option, the different program identifiers are configured.
9	**Scrambler** (eligible parameter)**:** In this field, the encryption system can be chosen with right and left buttons. The available options are: • None • BISS-1 • BISS-E • AES-128 (Optional) • AES-256 (Optional)
10	**Remux** (eligible parameter) (Optional)**:** In this field, remux option can be activated. This feature is optional.

Table 4.6: Encoder Menu

4.6.1.1 SDI Video Input

When SDI input is selected, press OK button to access the video configuration menu. The video format is automatically detected. The parameters which are configured in this section are explained below.

```
                SDI


    Format: 1080/30p
    Delay: SuperLD  2F        < >
    Profile: 4.2.0              >
```

```
                SDI

    GOP: Auto 15
    >
    Level: 4.1                  >
```

Figure 4.16: SDI Input Menu

Line nº	Function
1	**Format** (reading parameter)**:** In this field, the format of the SDI input signal is displayed. The available options are: • 1080p (1920x1080) – 23.98/24/25/29.97/30/50/59.94/60 Hz • 1080i (1920x1080) – 50/59.94/60 Hz • 720p (1280x720) – 23.98/24/25/29.97/30/50/59.94/60 Hz • 576i (720x576) – 50 Hz • 480i (720x480) – 59.94 Hz
2	**Delay** (eligible parameter)**:** In this field, the delay of the coding process is configured. To select the desired delay, press Right, Left arrows buttons. The available options are: • Standard • Super Low Delay (2 frames of delay) • Ultra Low Delay (1 frame of delay)
3	**Profile** (eligible parameter)**:** In this field, the codification profile can be configured. To select the desired profile, press Right, Left arrows buttons. The available options are: • 4.2.0 • 4.2.2 (not available in 1080p-50/59.94/60 Hz video formats)

4	**GOP** (eligible parameter)**:** In this field, the Group Of Pictures parameter is displayed. It specifies the order in which intra and inter-frames are arranged. The available options are: • Auto • Manual (editable parameter)
5	**Level** (eligible parameter)**:** In this field, the level of the H.264 encoder can be configured. The available options are: • 4.0 • 4.1 • 4.2 (only available in 1080p-50/59.94/60 Hz video formats)

Table 4.7: SDI Input menu options

4.6.1.2 HDMI Video Input

When HDMI input is selected, press OK button to access the video configuration menu. This input is ONLY compatible with video cameras, it doesn´t support laptop HDMI output or others. The video format is automatically detected. The parameter which are configured in this section are explained below.

```
              HDMI

Format: 1080p
Delay: Standard            >
Profile: 4.2.0             <
```

```
              HDMI

GOP: Auto 12
>
Level: 4.2
```
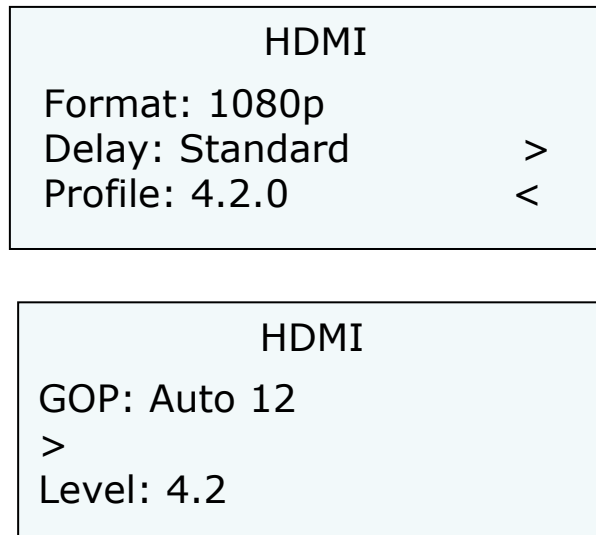
Figure 4.17: HDMI Input Menu

Line nº	Function
1	**Format** (eligible parameter)**:** In this field, the format of the HDMI input signal must be selected. In order to select a format, first, press the OK button to enter to the submenus where different formats available appear. Then, choose the desired option with the Up, Down keys. The available options are: • 1080p (Only Standard Delay) • 1080i • 720p
2	**Delay** (eligible parameter)**:** In this field, the delay of the coding process is configured. To select the desired delay, press Right, Left arrows buttons. The available options are: • Standard • Super Low Delay (2 frames of delay) • Ultra Low Delay (1 frame of delay)

3	**Profile** (editable parameter)**:** In this field, the codification profile can be configured. To select the desired profile, press Right, Left arrows buttons. The available options are: • 4.2.0 • 4.2.2
4	**GOP** (eligible parameter)**:** In this field, the Group of Pictures parameter is displayed. It specifies the order in which intra- and inter-frames are arranged. The available options are: • Auto • Manual (editable parameter)
5	**Level** (eligible parameter)**:** In this field, the level of the H.264 encoder can be configured. The available options are: • 4.0 • 4.1 • 4.2 (only available in 1080p-50/59.94/60 Hz video formats)

Table 4.8: HDMI Input menu options

When HDMI video input is selected, it is necessary to specify the format (1080p, 1080i, 720p). If another video input (SDI, CVBS or ASI) is selected, then the transmitter automatically captures its format and the frame rate. If the video format is changed, the time detection of this new format is less than 15 seconds.

This video input is compatible with video cameras. Laptops, computers or other HDMI interfaces are not compatible.

4.6.1.3 CVBS Video Input

In this section, the composite video input is selected. The equipment will automatically detect the input between PAL and NTSC formats. The CVBS video input is available on the Lemo 6 connector.

```
        CVBS

 Format: 480i
 Delay: SuperLD 2F   <>
 Profile: 4.2.0          >
```

```
        CVBS

 GOP: Auto 12           >
 Level: 4.1             <
```

Figure 4.18: CVBS Input Menu

Line nº	Function
1	**Format (CVBS)** (reading parameter)**:** In this field, the format of the CVBS input signal is displayed. The available options are: • 480i • 576i
2	**Delay** (eligible parameter)**:** In this field, the delay of the coding process is configured. To select the desired delay, press Right, Left arrows buttons. The available options are: • Standard • Super Low Delay (2 frames of delay) • Ultra Low Delay (1 frame of delay)
3	**Profile** (eligible parameter)**:** In this field, the codification profile can be configured. To select the desired profile, press Right, Left arrows buttons. The available options are: • 4.2.0 • 4.2.2

4	**GOP** (eligible parameter)**:** In this field, the Group Of Pictures parameter is displayed. It specifies the order in which intra- and inter-frames are arranged. The available options are: • Auto • Manual (editable parameter)
5	**Level** (eligible parameter)**:** In this field, the level of the H.264 encoder can be configured. The available options are: • 4.0 • 4.1

Table 4.9: CVBS Input Select menu options

4.6.1.4 ASI Video Input

When ASI input is selected, the signal is directly sent to the modulator.

This input is also used for Remux. When Remux option is enabled, the second video which is going to be sent must be connected to the ASI input, but the selected video input must be SDI or HDMI or CVBS (according to the inserted video input for the first channel to be remuxed) but not ASI.

```
          ASI IN

    Status: Present
    Bitrate: 18.0Mb
```
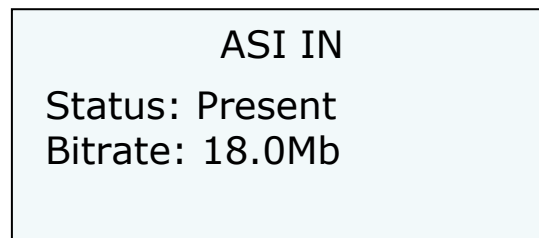
Figure 4.19: ASI Input Menu

Line nº	Function
1	**Status** (reading parameter)**:**
	This field indicates if there is any ASI signal in the ASI input. If there is ASI signal, this field will display the word "Present". If there is no ASI signal then, "No present" will be displayed.
	The available options are:
	• Present
	• No Present
2	**Bitrate** (reading parameter)**:**
	In this option, the bitrate of the ASI input signal is shown.

Table 4.10: ASI Input menu options

4.6.1.5 Generator Video Input

In this section the video generator can be configured, this option is used for tests when there is no video source.

```
           GENERATOR
   Format: 1080/50i    <>
   Delay: SuperLD  2F <>
   Profile: 4.2.0         >
```

```
           GENERATOR
   GOP: Auto      0        >
   Level: 4.1             <
```

Figure 4.20: ASI Main Screen

Line nº	Function
	Format (eligible parameter)**:**
	In this field, the format of the generated video signal is configured. To select the desired format, press Right, Left arrows buttons.
	The available options are:
1	• 1080p (1920x1080) – 25 Hz • 1080p (1920x1080) – 30 Hz • 1080i (1920x1080) – 50 Hz • 1080i (1920x1080) – 59.94 Hz • 1080i (1920x1080) – 60 Hz • 720p (1280x720) – 25 Hz • 720p (1280x720) – 30 Hz • 720p (1280x720) – 50 Hz • 720p (1280x720) – 59.94 Hz • 720p (1280x720) – 60 Hz • 480i (720x480) – 59.94 Hz • 576i (720x576) – 50 Hz

2	**Delay** (eligible parameter)**:** In this field, the delay of the coding process is configured. To select the desired delay, press Right, Left arrows buttons. The available options are: • Standard • Super Low Delay (2 frames of delay) • Ultra Low Delay (1 frame of delay)
3	**Profile** (eligible parameter)**:** In this field, the codification profile can be configured. To select the desired profile, press Right, Left arrows buttons. The available options are: • 4.2.0 • 4.2.2
4	**GOP** (eligible parameter)**:** In this field, the Group Of Pictures parameter is displayed. It specifies the order in which intra- and inter-frames are arranged. The available options are: • Auto • Manual (editable parameter)
5	**Level** (eligible parameter)**:** In this field, the level of the H.264 encoder can be configured. The available options are: • 4.0 • 4.1

Table 4.11: Generator Input menu options

4.6.1.6 Audio1 Embedded

When Embedded Audio is selected, it means that the transmitted Audio is catch from the video input selected, where the Audio is embedded. It can be SDI or HDMI.

```
   ENCODER AUDIO1
 Bitrate: 256K        <>


```
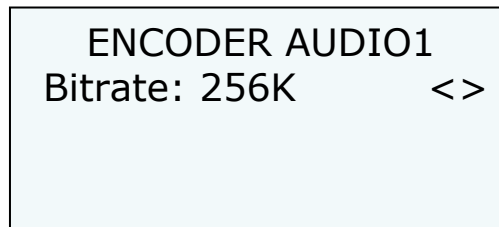
Figure 4.21 : Audio Embedded Input Menu

Line nº	Function
1	**Bitrate** (eligible parameter)**:** In this option the bitrate for the codification of the Audio signal 1 can be selected. To select the desired bitrate, press Right, Left arrows buttons. The available options are: • 128K • 192K • 256K • 384K

Table 4.12: Audio Embedded Input menu options

> If the selected video option is CVBS, ASI or Test Pattern generator, then, the option of Audio embedded will be blinking because that configuration is not possible.

4.6.1.7 Audio1 Analogue

When Analogue Audio is selected, the Audio is catch from the external Audio input. The cable from Lemo 5 to XLR-4 is needed, this cable is provided together with the transmitter.

```
ENCODER AUDIO1
Bitrate: 256K      < >
L Type: Line       >↵
R Type: Line       >↵
```
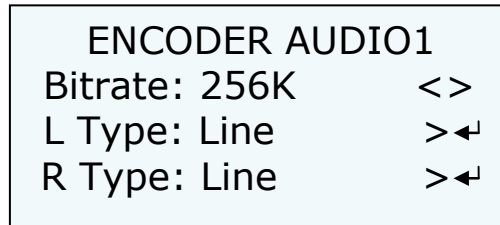
Figure 4.22: Audio Analogue Input Menu

Line nº	Function
1	**Bitrate** (eligible parameter)**:** In this option the bitrate for the codification of the Audio signal 1 can be selected. To select the desired bitrate, press Right, Left arrows buttons. The available options are: • 128K • 192K • 256K • 384K
2	**L Type** (eligible parameter)**:** In this field, the sort of signal of the Audio 1 Left channel introduced in the transmitter is selected. To choose the type of Audio1, press Right, Left buttons. The available options are: • Line • Mic Dynamic • Mic Phantom Pressing the OK key and then using the UP and DOWN keys the audio level can be adjusted. A gain of until 24dB or an attenuation of until 6dB can be applied.

R Type (eligible parameter)**:**

In this field, the sort of signal of the Audio 1 Right channel introduced in the transmitter is selected. To choose the type of Audio1, press Right, Left button.

The available options are:

3
- Line
- Mic Dynamic
- Mic Phantom

Pressing the OK key and then using the UP and DOWN keys the audio level can be adjusted. A gain of until 24dB or an attenuation of until 6dB can be applied.

Table 4.13: Audio Analogue Input menu options

4.6.1.8 Audio1 AES-EBU

When AES-EBU Audio 1 is selected, it must be connected to the Audio 1 Left connector.
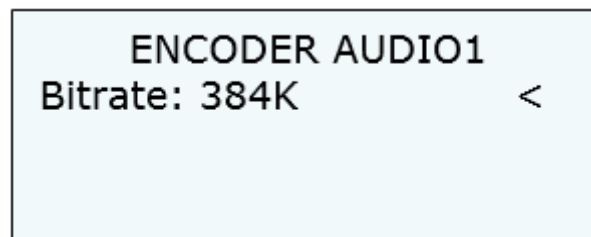
Figure 4.23: Audio AES-EBU Input Menu

Line nº	Function
	Bitrate (eligible parameter)**:**
	In this option, the bitrate for the codification of the Audio signal 1 can be selected. To select the desired bitrate, press Right, Left arrows buttons.
1	The available options are:
	- 128K
	- 192K
	- 256K
	- 384K

Table 4.14: Audio1 AES-EBU Menu

4.6.1.9 Audio1 Generator.

This Audio tone can be used for tests when an Audio source is not available.

```
ENCODER AUDIO1
Bitrate: 384K                <
Frequency: 1000Hz
Level: 18dBFs
```
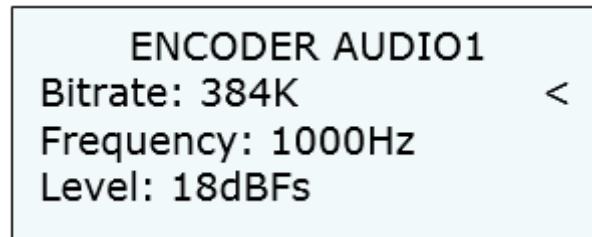
Figure 4.24: Audio Generator Input Menu

Line nº	Function
1	**Bitrate** (eligible parameter)**:** In this option, the bitrate for the codification of the Audio signal 1 can be selected. To select the desired bitrate, press Right, Left arrows buttons. The available options are: • 128K • 192K • 256K • 384K
2	**Frequency (Hz)** (reading parameter)**:** In this field, the frequency of the generated tone is displayed.
3	**Level (dBFs)** (reading parameter)**:** In this field, the level in dBFs of the generated tone is displayed.

Table 4.15: Audio Generator Input menu options

4.6.1.10 Audio2 Embedded

When Embedded Audio is selected, that means that the transmitted Audio is catch from the SDI video input, where the Audio is embedded.

```
ENCODER AUDIO2
Bitrate: 256K        <>


```
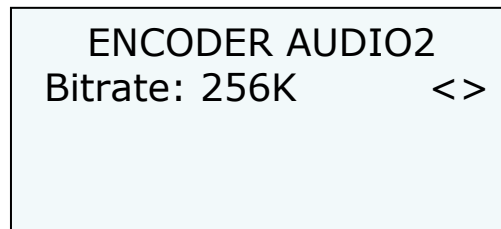
Figure 4.25 : Audio Embedded Input Menu

Line nº	Function
1	**Bitrate** (eligible parameter)**:** In this option the bitrate for the codification of the Audio signal 2 can be selected. To select the desired bitrate, press Right, Left arrows buttons. The available options are: • 128K • 192K • 256K • 384K

Table 4.16: Audio Embedded Input menu options

If the selected video option is CVBS, ASI or Test Pattern generator, then, the option of **Audio Embedded** will be blinking because that configuration is not possible.

4.6.1.11 Audio2 Analogue

When Analogue Audio is selected, the Audio is catch from the external Audio input. The cable from Lemo 5 to XLR-4 is needed, this cable is provided together with the transmitter.

```
ENCODER AUDIO2
Bitrate: 256K      <>
L Type: Line       >↵
R Type: Line       >↵
```
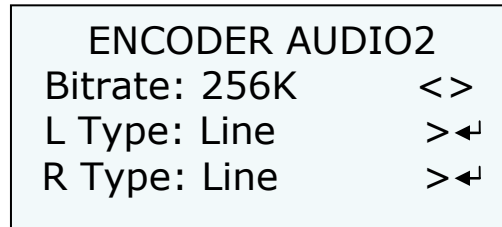
Figure 4.26: Audio Analogue Input Menu

Line nº	Function
1	**Bitrate** (eligible parameter)**:** In this option the bitrate for the codification of the Audio signal 2 can be selected. To select the desired bitrate, press Right, Left arrows buttons. The available options are: • 128K • 192K • 256K • 384K
2	**L Type** (eligible parameter)**:** In this field, the sort of signal of the Audio 2 Left channel introduced in the transmitter is selected. To choose the type of Audio2, press Right, Left buttons. The available options are: • Line • Mic Dynamic • Mic Phantom Pressing the OK key and then using the UP and DOWN keys the audio level can be adjusted. A gain of until 24dB or an attenuation of until 6dB can be applied.

R Type (eligible parameter)**:**

In this field, the sort of signal of the Audio 2 Right channel introduced in the transmitter is selected. To choose the type of Audio2, press Right, Left buttons.

The available options are:

3

- Line
- Mic Dynamic
- Mic Phantom

Pressing the OK key and then using the UP and DOWN keys the audio level can be adjusted. A gain of until 24dB or an attenuation of until 6dB can be applied.

Table 4.17: Audio Analogue Input menu options

4.6.1.12 Audio2 AES-EBU

When AES-EBU Audio 2 is selected, it must be connected to the Audio 2 Left connector.

```
     ENCODER AUDIO2
  Bitrate: 256K        <>

```

Figure 4.27: Audio AES-EBU Input Menu

Line nº	Function
1	**Bitrate** (eligible parameter)**:** In this option, the bitrate for the codification of the Audio signal 2 can be selected. To select the desired bitrate, press Right, Left arrows buttons. The available options are: • 128K • 192K • 256K • 384K

Table 4.18: Audio1 AES-EBU Menu

4.6.1.13 Audio2 Generator.

This Audio tone can be used for tests when an Audio source is not available.

```
ENCODER AUDIO2
Bitrate: 256K        <>
Frequency: 1000Hz
Level: 18dBFs
```

Figure 4.28: Audio Generator Input Menu

Line nº	Function
1	**Bitrate** (eligible parameter)**:** In this option, the bitrate for the codification of the Audio signal 2 can be selected. To select the desired bitrate, press Right, Left arrows buttons. The available options are: • 128K • 192K • 256K • 384K
2	**Frequency (Hz)** (reading parameter)**:** In this field, the frequency of the generated tone is displayed.
3	**Level (dBFs)** (reading parameter)**:** In this field, the level in dBFs of the generated tone is displayed.

Table 4.19: Audio Generator Input menu options

4.6.1.14 Data

To select the desired sort of data, press Right, Left buttons (eligible parameter).

The available options are:

- None
- RS232
- 4K Board

4.6.1.14.1 None

This option is selected when no data is inserted to the transmitter.

4.6.1.14.2 RS232 Screen


```
DATA INPUT RS232
BaudRate: 4800        <>
Parity: None           >
Stop Bits: 1           >
```
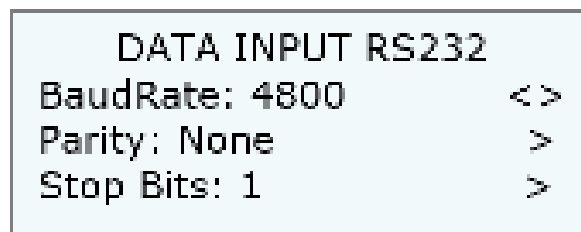
Figure 4.29: RS232 Input Menu

Data option	Parameters
1	**Baudrate** (eligible parameter)**:**
	Select the baudrate at which data user is received (Baudrate options are: 1200, 2400, 4800, 9600, 14400, 19200, 38400, 57600, 115200, 230400).
2	**Parity** (eligible parameter)**:**
	Select the same parity as the parity of the received data user signal (Parity options are None, Odd, Even).
3	**Stop Bits** (eligible parameter)**:**
	Select the same number of stop bits as the received data user signal has (Stop bit options are 1 or 2).

Table 4.20: RS232 Parameters

4.6.1.14.3 4K Board

This option is selected in order to control the Lau-K HEVC encoder from HDT-02 transmitter. Once the communication has been stabilized, the menus of the encoder would change automatically.

4.6.1.15 Internal GPS Screen (Optional)

If this option is selected, you can receive the GPS information from the internal GPS receiver using an external GPS antenna (which must be connected to the GPS Antenna Input). This information is sent to receiver. The antenna is fed directly from the transmitter at 5 V.
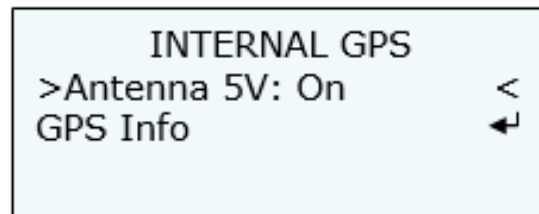
Figure 4.29:Internal GPS Main screen

Figure 4.30: GPS Transmitter screen
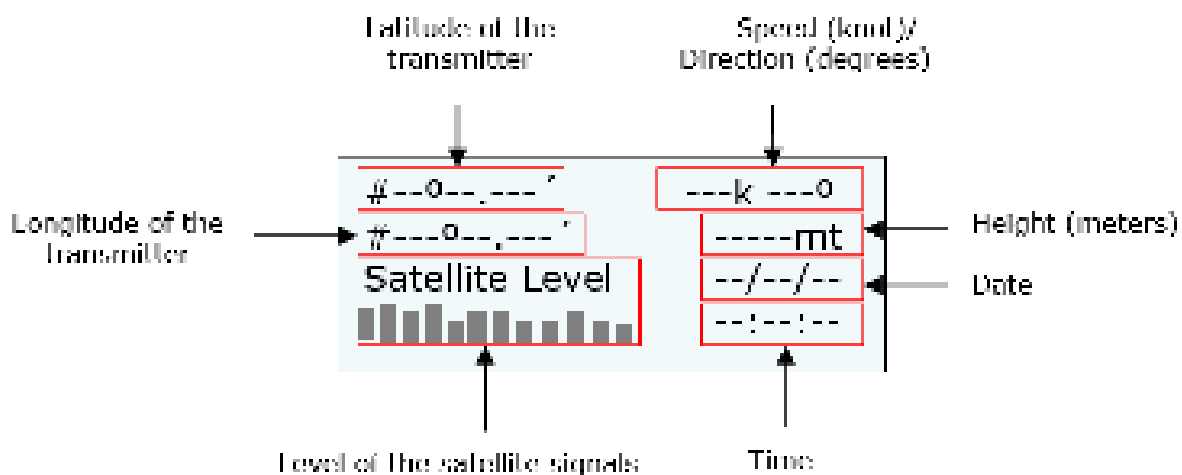
The GPS info option screen shows the following information:

- **Latitude of the Transmitter:** The latitude position of the transmitter is specified.

- **Speed of the Transmitter:** It shows the speed of the transmitter in knots.

- **Direction of the Transmitter:** The direction of the transmitter is shown in this field.

- **Longitude of the Transmitter:** The longitude position of the transmitter is specified.

- **Height of the Transmitter:** The height of the transmitter from ground is specified in this value.

- **Satellite Level:** The level of each satellite signal received is shown in this field.

- **Date:** The updated date is shown.

4.6.1.16 KLV Metadata (Optional)

When this option is ON, the KLV Metadata embedded on the SDI signal is sent through the radio link.

If KLV metadata is not embedded on SDI input, the HDT-02 Transmitter will show an alarm indicating that the KLV is not present.

```
         ENCODER
  KLV Metadata: On    <
  Encoder Output      ↵
  TS Parameters       ↵
```
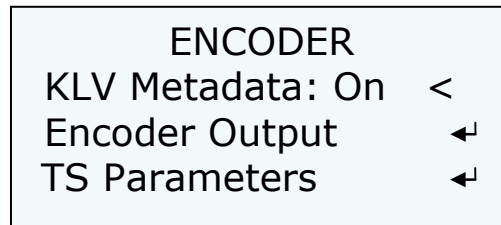
Figure 4.31: KLV Metadata option

Once that KLV is received at ground, using the TS over IP output of the receiver, KLV metadata can be monitored by a Mission Monitor program.

4.6.1.17 Encoder Output

The encoder output option allows the configuration of the transport stream bitrate. When you use the transmitter's ASI output, the output bitrate can be set manually on this screen. When the RF is enabled, the modulator starts working and the output bitrate is set by the modulation parameters, changing automatically to Auto mode.

```
      ENCODER OUTPUT
  BitRate:     10.0Mb  < ↵
```
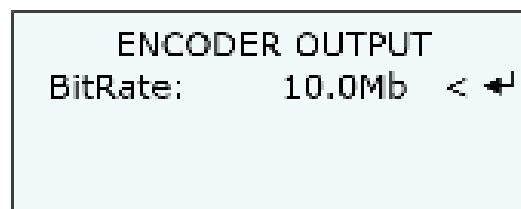
Figure 4.32: Encoder Output Menu

Line nº	Function
1	**Bit Rate** (eligible parameter)**:** In this field, the output bitrate is shown. When it is wanted to select between an automatic bitrate or configure manually the bitrate, press Right, Left buttons. If manual configuration is selected then, press OK button to select the desired bitrate with the UP, Down keys. Press the OK button to save the introduced value. The available options are: • Auto • Manual (editable parameter)

Figure 4.33: Encoder Output menu options

If the user selects the manual option, the first and second lines disappear on the main screen.

When the encoder output is in Manual, if you activate the RF, the encoder output changes to AUTO mode automatically.

4.6.1.18 TS Parameters

```
        ENCODER TS
Service Name              ↵
Program Nº:   2           ↵
Video PID:    200         ↵
```

```
        ENCODER TS
Audio1 PID:   201         ↵
Audio2 PID:   202         ↵
Data PID:     203         ↵
```

```
        ENCODER TS
GPS PID:      206         ↵
ALRM PID:     207         ↵
PMT PID:      204         ↵
```

```
        ENCODER TS
PCR PID:      205         ↵
KLV Metadata:    40       ↵
TS id:   7                ↵
```

```
        ENCODER TS
Network id:      7        ↵
Network Name:            ↵
```

Figure 4.34: Encoder TS Menu

Line nº	Function
1	**Service Name** (editable parameter)**:** Here the Service name must be entered. To change its value, first press the OK button and then, with the UP, Down arrows select the desired letter. With the Right, Left keys, the user can select the character of the word. Press the OK button to save the introduced value.
2	**Program Nº** (editable parameter)**:** Here the Program number must be entered. To change its value, first press the OK button and then, with the UP, Down arrows select the desired number. Press the OK button to save the introduced value.
3	**Video PID** (editable parameter)**:** Here the Video packet identifier must be entered. To change its value, first press the OK button and then, with the UP, Down arrows select the desired number. Press the OK button to save the introduced value.
4	**Audio1 PID** (editable parameter)**:** Here the Audio1 packet identifier must be entered. To change its value, first press the OK button and then, with the UP, Down arrows select the desired number. Press the OK button to save the introduced value.
5	**Audio2 PID** (editable parameter)**:** Here the Audio2 packet identifier must be entered. To change its value, first press the OK button and then, with the UP, Down arrows select the desired number. Press the OK button to save the introduced value.
6	**Data PID** (editable parameter)**:** Here the Data packet identifier must be entered. To change its value, first press the OK button and then, with the UP, Down arrows select the desired number. Press the OK button to save the introduced value.
7	**GPS PID** (editable parameter)**:** Here the GPS packet identifier must be entered. To change its value, first press the OK button and then, with the UP, Down arrows select the desired number. Press the OK button to save the introduced value.
8	**ALARM PID** (editable parameter)**:** Here the Alarm packet identifier must be entered. To change its value, first press the OK button and then, with the UP, Down arrows select the desired number. Press the OK button to save the introduced value.
9	**PMT PID** (editable parameter)**:** Here the Program Map Tables packet identifier must be entered. To change its value, first press the OK button and then, with the UP, Down arrows select the desired number. Press the OK button to save the introduced value.

10	**PCR PID** (editable parameter)**:** Here the Program Clock Reference packet identifier must be entered. To change its value, first press the OK button and then, with the UP, Down arrows select the desired number. Press the OK button to save the introduced value.
11	**KLV Metadata** (editable parameter)**:** Here the KLV Metadata packet identifier must be entered. To change its value, first press the OK button and then, with the UP, Down arrows select the desired number. Press the OK button to save the introduced value.
12	**TS id** (editable parameter)**:** Here the Transport Stream identifier must be entered. To change its value, first press the OK button and then, with the UP, Down arrows select the desired number. Press the OK button to save the introduced value.
13	**Network id** (editable parameter)**:** Here the Network identifier must be entered. To change its value, first press the OK button and then, with the UP, Down arrows select the desired number. Press the OK button to save the introduced value.
14	**Network Name** (editable parameter)**:** Here the Network name must be entered. To change its value, first press the OK button and then, with the UP, Down arrows select the desired letter. With the Right, Left keys, the user can select the character of the word. Press the OK button to save the introduced value.

Table 4.21: Encoder TS menu options

4.6.1.19 Scrambler

In this section the signal can be encrypted with different encryption methods.
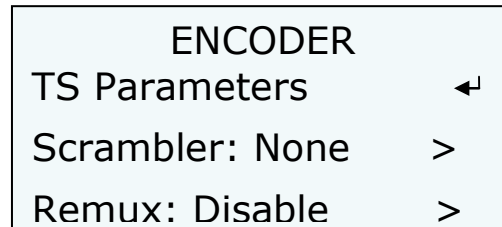
```
              ENCODER
TS Parameters            ↵

Scrambler: None        >

Remux: Disable         >
```
Figure 4.35: Scrambler menu

Line nº	Function
1	**Mode** (eligible parameter)**:** To choose the desired encryption, press the Right, Left keys. The available options are: • None • BISS-1 • BISS-E • AES-128 (Optional) • AES-256 (Optional)

Table 4.22: Scrambler menu options

To introduce the key of the encryption, follow these steps:

1. Choose the correct encryption.
2. Press the OK button to introduce the key.
3. With Left and Right buttons select one field and with UP, Down buttons choose one value from 0 to 9 or A to F.
4. Press the OK button to set the key.

4.6.1.20 Remux (Optional)

Remux option allows the transmitter to send up to 8 services multiplexed in one TS. The TS to be multiplexed with the TS from the encoder must be introduced in the ASI input.

```
        ENCODER
TS Parameters          ↵

Scrambler: None        >

Remux: Enable          <
```

Figure 4.36: Remux menu screen

Please, make sure that the TS parameters are different for all services. When the Remux option is enabled, the Encoder Output is changed to manual bitrate mode. The modulator bitrate must be set to support the total bitrate; Manual bitrate + ASI input bitrate must be lower than the bitrate configured in the modulator.
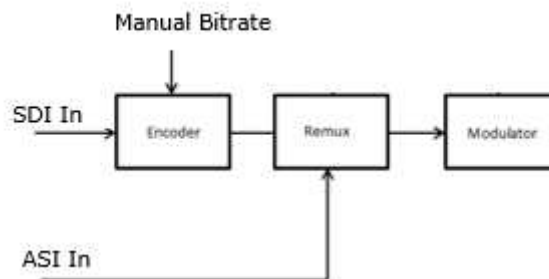
Figure 4.37: Remux work diagram

ASI bitrate must be known.

You must configure it to have ASI input Bit rate plus NTT encoder Bit rate minor than modulator total Bit rate.

4.6.2 RF Menu

By using the Up, Down arrow keys, select the **RF** option and press the OK key.

In this section, we make a selection of the modulation we are going to use. It permits 4 options. (The S2 and the S are optional).

```
    MODULATOR & RF
DVB-T2              DVB-S2
DVB-T               DVB-S


```
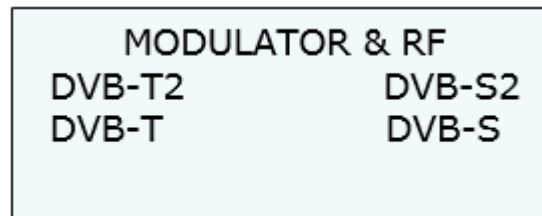
Figure 4.38: RF menu

4.6.2.1 DVB-T2

Here we can change different parameters of the T2 modulation. Some of these parameters affect the output bitrate of the modulator and the characteristics of the link: more robustness or more bitrate.

```
          DVB-T2

 F: 2.300,00MHz         ↵
 Power: PA(High)        <>
 Mode: Mobile 1/16      <
```

```
          DVB-T2

Bandwidth:8MHz          <
Modul: 16 QAM           <>
LDPC Fec: 2/3           <>
```

```
          DVB-T2

FFT:  4K                <
Time Int:   80   (34)   ↵
DC by RF: Off            >
```

```
          DVB-T2

PA Unit                 ↵


```
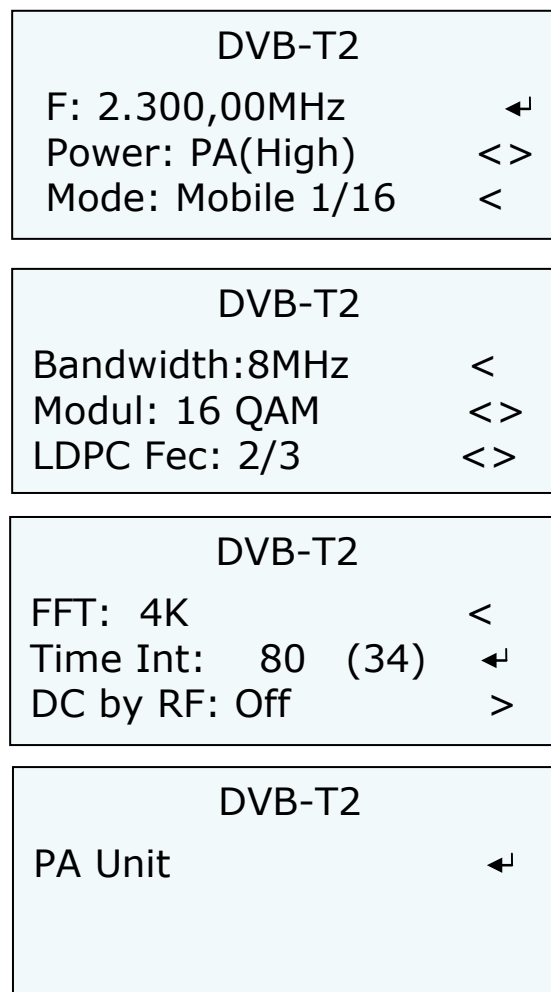
Figure 4.39: DVB-T2 Menu

Line nº	Function
1	**Frequency** (editable parameter)**:** Select the frequency at which the signal is going to be transmitted. To establish the frequency value first, press the OK button and then, with the Up, Down arrow buttons select the desired value. To save the introduced value, press the OK button.
2	**Power** (eligible parameter)**:** The output power can be selected with the Right and Left buttons. The available options are: • Manual (from -5 to 20 dBm) (without precorrection): To establish the output power value, first press the OK button and then, with the Up, Down buttons select the desired value. To save the introduced value, press the OK button (editable parameter). • Low (10 dBm) (precorrection until 4Ghz) • High (20 dBm) (precorrection until 4Ghz) • PA (Low) • PA (Mid) • PA (High) Power is automatically configured to PA mode when there is communication between the HDT-02 and the PA. Then, the output power can be selected using Left and Right buttons. The output power indicated as Low, Mid and High will depend on the PA model used.
3	**Mode** (eligible parameter)**:** Here the operation mode can be chosen. Use Right, Left buttons to select the desired value. The available options are: • Fixed 1/8: The guard Interval is configured to 1/8 and the receiver automatically detects the operation mode working on Fixed mode (packet switching reception). • Fixed 1/32: The guard Interval is configured to 1/32 and the receiver automatically detects the operation mode working on Fixed mode (packet switching reception). • Mobile 1/16: The guard Interval is configured to 1/16 and the receiver automatically detects the operation mode working on Mobile mode (MRC Diversity reception).
4	**Bandwidth** (eligible parameter)**:** Here the bandwidth of the transmitted signal can be chosen. Use Right, Left buttons to select the desired value. The available options are: • 1.7 MHz • 5 MHz • 6 MHz • 7 MHz • 8 MHz

5	**Modulation** (eligible parameter)**:** Here the constellation can be chosen. Use the Right, Left buttons to select the desired constellation. The available options are: • QPSK • 16QAM • 64QAM • 256QAM In the Mobile 1/16 guard interval mode, 16QAM can be only selected.
6	**LDPC FEC** (eligible parameter)**:** Here the value of the Forward Error Correction can be chosen. Use the Right, Left buttons to select the desired value. The available options are: • 1/2 • 3/5 • 2/3 • 3/4 • 4/5 • 5/6
7	**FFT Mode** (eligible parameter)**:** Here the number of FFT points can be chosen. Use Right, Left buttons to select the desired buttons. The available options are: • 2K • 4K
8	**Time Interleaving** (editable parameter)**:** This option indicates the number of interleaver blocks per interleaving frame. The user selects into how many interleaver blocks (TI_blocks) an interleaving frame is split. To configure this option, press the OK button and then select the desired value with the Up and Down buttons.
9	**DC by RF** (eligible parameter)**:** In this option, the power supply voltage at the RF output can be enabled, this option is only available when output frequency is 1 to 2.8 GHz. It is used to feed the amplifier remotely through the RF output of the HDT-02 transmitter. The available options are: • Off • On: Input supply voltage of the transmitter is delivered by the RF output (between 8 and 36 VDC)

	PA unit (Only accessible when Power PA is selected):
	In this field, by pressing the OK button, you access the PA Power Amplifier reading parameters. The parameters shown are:
10	• Direct Power (dBm)
	• Reverse Power (%)
	• PA alarms
	• Temperature
	• Voltage

Table 4.23: DVB-T2 menu option

4.6.2.2 DVB-T

Here we can change different parameters of the DVB-T modulation. Some of these parameters affect the output bitrate of the modulator and the characteristics of the link: more robustness or more bitrate.

```
            DVB-T

  F: 2.300.00MHz          ↵
  Power: PA(High)         <>
  Bandwidth: 8 MHz        <
```

```
            DVB-T

  Modul: 16 QAM           <>
  Fec: 2/3                <>
  GI: 1/16                <>
```

```
            DVB-T

  Spectrum: Normal        >
  DC by RF:  Off          >
  PA Unit                 ↵
```

Figure 4.40: DVB-T Menu

With these parameters the modulation parameters in DVB-T are configured. This is how we can vary the robustness and the bitrate of the link.

Line nº	Function
1	**Frequency** (editable parameter)**:** Select the frequency at which the signal is going to be transmitted. To establish the frequency value, first press the OK button and then, with the Up, Down arrow buttons select the desired value. To save the introduced value, press the OK button.

2	**Power** (eligible parameter)**:**
	
	The output power can be selected with the Right and Left buttons.
	
	The available options are:
	
	• Manual (from -5 to 20 dBm), (without precorrection):
	
	   To establish the output power value, first press the OK button and then, with the Up, Down buttons select the desired value. To save the introduced value, press the OK button (editable parameter).
	
	• Low (10 dBm), (with precorrection)
	
	• High (20 dBm), (with precorrection)
	
	• PA (Low)
	
	• PA (Mid)
	
	• PA (High)
	
	   Power is automatically configured to PA mode when there is communication between the HDT-02 and the PA. Then, the output power can be selected using Left and Right buttons. The output power indicated as Low, Mid and High will depend on the PA model used.

3	**Bandwidth** (eligible parameter)**:** Here the bandwidth of the transmitted signal can be chosen. Use Right, Left buttons to select the desired value. The available options are: • 5 MHz • 6 MHz • 7 MHz • 8 MHz
4	**Modulation** (eligible parameter)**:** Here the constellation can be chosen. Use Right, Left buttons to select the desired constellation. The available options are: • QPSK • 16QAM • 64QAM

5	**FEC** (eligible parameter)**:** Here the value of the Forward Error Correction can be chosen. Use Right, Left buttons to select the desired value. The available parameters are: • 1/2 • 2/3 • 3/4 • 5/6 • 7/8
6	**GI** (eligible parameter)**:** Here the Guard Interval value can be chosen. Use Right, Left buttons to select the desired value. The available options are: • 1/32 • 1/16 • 1/8
7	**Spectrum** (eligible parameter)**:** Here the type of the spectrum is configured. Inverted spectrum is just another method to help preventing signal theft. Use Right, Left buttons to select the desired option. The available options are: • Normal • Invert
8	**DC by RF:** In this option, the power supply voltage at the RF output can be enabled; this option is only available when output frequency is from 1 to 2.8 GHz. It is used to feed the amplifier remotely through the RF output of the HDT-02 transmitter. The available options are: • Off • On: Input supply voltage of the transmitter is delivered by the RF output (between 8 and 36 VDC)
9	**PA unit (Only accessible when Power PA is selected):** In this field, by pressing the OK button, you access the PA Power Amplifier reading parameters. The parameters shown are: • Direct Power (dBm) • Reverse Power (%) • PA alarms • Temperature • Voltage

Table 4.24: DVB-T menu option

4.6.2.3 DVB-S2

This section explains the configurations of the DVB-S2 satellite modulation present at its L band.

```
        DVB-S2

F: 1.640,365MHz        ↵
Modulation            <>
L-BAND: +5,0dBm    ↵  >
```

```
        DVB-S2

Modul: 32APSK          <
LDPC FEC: 4/5         <>
SR:12.400   B:14.88    ↵
```

```
        DVB-S2

Roll Off: 0.20          >
Pilots: On              >
Spectrum: Normal        >
```

```
        DVB-S2

10MHz: Off              <
Ant. Gain: 42.0dBi      ↵
BUC:None                >
```

Figure 4.41: DVB-S2 Menu

Line nº	Function
1	**Frequency** (editable parameter)**:** Select the frequency at which the signal is going to be transmitted. To establish the frequency value, first press the OK button and then, with the Up, Down arrow buttons select the desired value. To save the introduced value, press the OK button.
2	**Sort of output** (eligible parameter)**:** To select the sort of output, press Right and Left keys. Once the option is selected, press the OK button to save it. The possibilities are: • Low Carrier (the output signal is a continuous wave and the output power is adjusted to 10 dB less than that configured in the power field). • Carrier (the RF output is carrier only (CW) without modulation. To specify the output power, select it in the power option). • Modulation (the RF output carrier with modulation. To specify the output power, select it in the field below).
3	**Power** (editable parameter)**:** In this field, the value of the output power can be selected. The possible output power range is from -55 to +5 dBm. The available options are: • L-BAND (The output power of the HDT-02 in dBm). • HPA (The output power of the amplifier in dBW). • EIRP (HPA + Antenna Gain) (dBW).
4	**Modulation** (eligible parameter)**:** Here the constellation can be chosen. Use Right and Left buttons to select the desired constellation. The available options are: • QPSK • 8PSK • 16APSK • 32APSK

5	**LDPC Fec** (eligible parameter)**:** Here the value of the Forward Error Correction can be chosen. Use Right and Left buttons to select the desired value. The available options are: • 1/4 • 1/3 • 2/5 • 1/2 • 3/5 • 2/3 • 3/4 • 4/5 • 5/6 • 8/9 • 9/10
6	**SR** (editable parameter)**:** In this field, the value of the symbol rate can be introduced. **BW** (reading parameter)**:** In this field the value of the bandwidth of the transmitted signal is displayed.
7	**Roll Off** (eligible parameter)**:** Here the value of Roll Off factor can be chosen. Use Right and Left buttons to select the desired value. The available options are: • 0.20 • 0.25 • 0.35
8	**Pilots** (eligible parameter)**:** In this field, selecting the ON option, the carrier pilots are transmitted. If the OFF option is selected, then no carrier pilots are transmitted. To select an option, Right, Left keys must be pressed. The available options are: • On • Off
9	**Spectrum** (eligible parameter)**:** Here the type of the spectrum is configured. Inverted spectrum is just another method to help prevent signal theft. Use Right and Left buttons to select the desired option. The available options are: • Normal • Invert

10	**10 MHz** (eligible parameter)**:** This feature provides a reference signal of 10MHz to the satellite up-converter when ON. The available options are: • On • Off
11	**Antenna Gain (dBi)** (editable parameter)**:** To select the gain of the transmitter antenna. Press the OK button to configure it and then the OK button again to save the introduced value.
12	**BUC:** The BUC is used in the transmission (uplink) of the satellite signals. It converts a band of frequencies from a lower frequency to a higher frequency. In this option, the user can choose the type of BUC used and by enter inside the menu, the user can configure the local oscillator frequency of the BUC. The options available are: • None (There is not BUC) • IRT BUC • WAV BUC

Table 4.25: DVB-S2 menu options

4.6.2.4 Symbol Rate calculation

To calculate the symbol rate needed for a determined bandwidth, the next equation must be implemented:

$$SR = \frac{BW}{(1 + Rolloff)}$$

Where:

SR: Symbol Rate in Msymb/s

BW: Bandwidth in MHz

Next, a table is shown as an example of the Symbol Rate values for a determined Bandwidth of 28 MHz.

Bandwidth (MHz)	Roll-off	Symbol Rate (Msymb/s)
28	0.20	23.33
28	0.25	22.4
28	0.35	20.74

Table 4.26: Symbol Rate calculation

4.6.2.5 DVB-S

In this screen the modulation parameters in DVB-S are selected. These settings affect to its L band output.

```
        DVB-S
F: 1.360,500 MHz      >↵
Modulation            <>
L-BAND: -5.5dBm       ↵ >
```

```
        DVB-S

FEC: 7/8              <

SR:12.400   B:14.88   ↵
Spectrum: Normal      >
```

```
        DVB-S

10MHz: Off            <
Ant. Gain: 42.0dBi    ↵
BUC:None              >
```

Figure 4.42: DVB-S Menu

Line nº	Function
1	**Frequency** (editable parameter)**:** Select the frequency at which the signal is going to be transmitted. To establish the frequency value, first press the OK button and then, with the Up, Down arrow buttons select the desired value. To save the introduced value, press the OK button.
2	**Sort of output** (eligible parameter)**:** To select the sort of output, press Right and Left keys. Once the option is selected, press the OK button to save it. The possibilities are: • Low Carrier (the output signal is a continuous wave and the output power is adjusted to 10 dB less than that configured in the power field). • Carrier (The RF output is carrier only (CW) without modulation. To specify the output power, select it in the power option). • Modulator (The RF output carrier with modulation. To specify the output power, select it in the field below).
3	**Power** (editable parameter)**:** In this field, the value of the output power can be selected. The possible output power range is from -55 to 5 dBm. The available options are: • L-BAND (The output power of the HDT-02 in dBm). • HPA (The output power of the amplifier in dBW). • EIRP (HPA + Antenna Gain) (dBW).
4	**FEC** (eligible parameter)**:** Here the value of the Forward Error Correction can be chosen. Use Right and Left buttons to select the desired value. The available options are: • 1/2 • 2/3 • 3/4 • 5/6 • 7/8
5	**SR** (editable parameter)**:** In this field, the value of the symbol rate can be introduced. **BW** (reading parameter)**:** In this field, the value of the bandwidth of the transmitted signal is displayed.

6	**Spectrum** (eligible parameter)**:**

Here the type of spectrum is configured. Inverted spectrum is just another method to help prevent signal theft. Use Right and Left buttons to select the desired option.

The available options are:

- Normal
- Invert |
| 7 | **10 MHz:** (eligible parameter)

This feature provides a reference signal of 10MHz to the satellite up-converter when ON.

The available options are:

- On
- Off |
| 8 | **Antenna Gain (dBi)** (editable parameter)**:**

The select the gain of the transmitter antenna. Press the OK button to configure it and then the OK button again to save the introduced value. |
| 9 | **BUC:**

The BUC is used in the transmission (uplink) of the satellite signals. It converts a band of frequencies from a lower frequency to a higher frequency. In this option, the user can choose the type of BUC used and by enter inside the menu, the user can configure the local oscillator frequency of the BUC.

The options available are:

- None (There is not BUC)
- IRT BUC
- WAV BUC |

Table 4.27: DVB-S menu options

4.6.3 Unit Menu

In this section, the Remote Control is configured.

By using the Up, Down arrow keys, select the **Unit** option and press the OK key.

```
            UNIT
RTC SEL:  Disable      >
RTC-01 Config:         ↵
RTC-03 Config:         ↵
```

```
            UNIT
Alarms (None) View>↵
Monitor                ↵
Remote                 ↵
```

```
            UNIT
Miscellaneous          ↵
Firmware               ↵
```
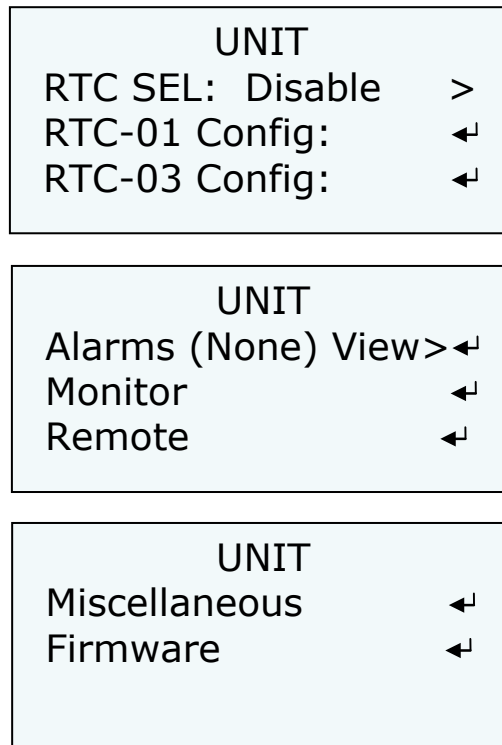
Figure 4.43: Unit Menu

4.6.3.1 RTC Selection

In the Profile option, use the Right and Left buttons to select with the Remote Control is going to be connected, RTC-01 or RTC-03, or disable it. Once you have selected the correct RTC model, press OK button to access to the profiles mode.

```
              UNIT
    RTC SEL:  Disable    >
    RTC-01 Config:       ↵
    RTC-03 Config:       ↵
```
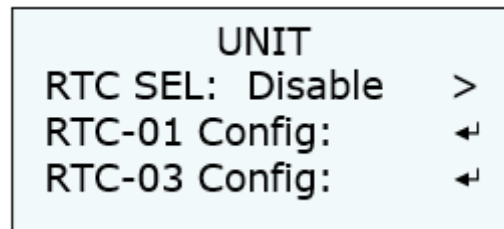
Figure 4.44: Unit Profile Menu

- Disable:

    The HDT-02 Transmitter works without the Profile option.

- RTC-01:

    Select this option if RTC-01 is used.

- RTC-03:

    Select this option when the NVIS RTC-03 is used.

4.6.3.2 RTC-01 Remote Control Screen

When we enter in the RTC-01 profile, the profile selection screen will appear automatically:

```
    PROFILE          PA Low
    MAIN
    MENU   1 2 3 4 5 6 7
```
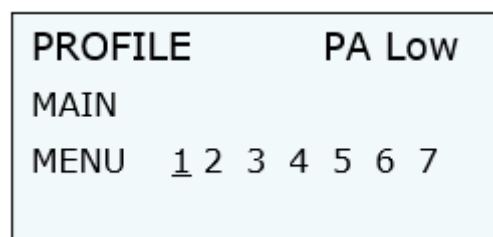
Figure 4.45: Profile Selection

This screen enables the user to choose one of the profiles that have been previously configured.

If one of the profiles is selected, a line under the profile number will appear and the device will be ready to work in that configuration. To access the profile and see its configuration, the down button must be pressed for a short time.

It is also possible to access to the main screen of a profile by pressing the up button for a short time.

Alarms and warnings are displayed if you press OK button for a short time.
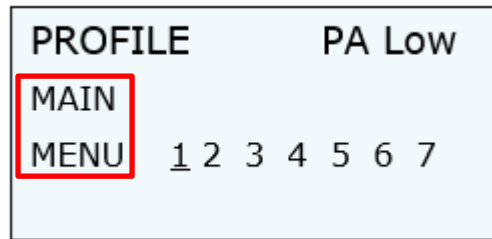
Figure 4.46: Profile selected

To exit profile mode and return to the Main menu click Main Menu.

> After entering the Main menu, the parameters can be configured from the Web Server.

4.6.3.3 RTC-03 Remote Control Screen

When we enter in the RTC-03 profile, the channel selection screen will appear:
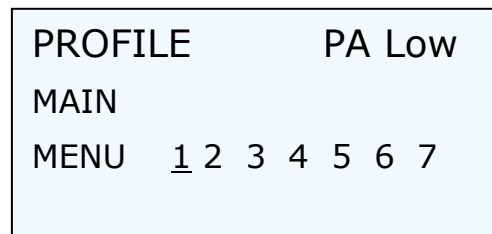
Figure 4.47: Profile Selection

This screen enables the user to choose one channel from the channel group that has been previously configured.

If one of the channels is selected, a line under the channel number will appear and the device will be ready to work in that configuration. To access to the channel and see its configuration, the down button must be pressed for a short time.

It is also possible to access to the main screen of a channel by pressing up button for a short time.

Alarms and warnings are displayed if you press OK button for a short time.

The output power configured on the RTC-03 is shown on the main screen of the channel selection.
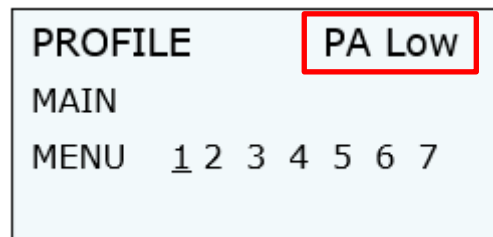
Figure 4.48: Profile selected

To return to the Main menu and change the HDT-02 configuration, press Main menu. You will get out of the remote control operation.

While the user is controlling the Transmitter via a Remote control, Web Server is not accessible.

4.6.3.4 RTC-01 Config

In this option, a profile can be configured. Select RTC-01 Config option and then by pressing the OK button, the available profiles will be displayed. There are seven profiles available and can be enabled or disabled.
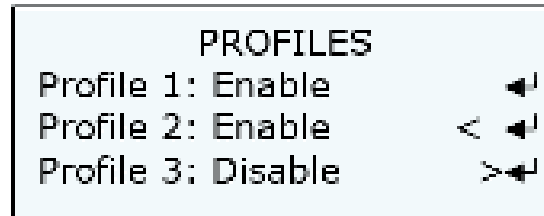
Figure 4.49: Profile Config Menu

Select a profile and then press the OK button to configure the parameters related to it:

```
          PROFILE 1

GPS:On <  Ant5V: On      ↵
KLV Metadata: Off         >
Video Delay: Std          >
```

```
          PROFILE 1

Video Profile:420         >
Scrambler:None            >
Service Name              ↵
```

```
          PROFILE 1

Program Nº: 2             ↵
Video PID:  200           ↵
Audio1 PID: 201           ↵
```

```
          PROFILE 1

Audio2 PID:  202          ↵
Data PID:  203            ↵
GPS PID: 206              ↵
```

```
          PROFILE 1

Alarm PID:207             ↵
PMT PID:204               ↵
PCR PID:205               ↵
```

```
          PROFILE 1

KLV Metadata: 40          ↵
TS is:  7                 ↵
Network id: 7             ↵
```

```
            PROFILE 1

Network Name              ↵
Remux: Disable            >


```
Figure 4.50: Profile 1 Menu

Line nº	Function
1	**System** (eligible parameter)**:** Select the type of the transmission system with the Right and Left buttons. There are two options available: • DVB-T2 • DVB-T
2	**Frequency** (editable parameter)**:** Select the frequency at which the signal is going to be transmitted. Press the OK button and with Up, Down keys configure the desired value.
3	**Power** (eligible parameter)**:** Select the desired power with the Right and Left buttons. There are three options available: • High • Low • PA (High)
4	**Bandwidth** (eligible parameter)**:** Select the desired bandwidth with the Right and Left buttons. There are five options available: • 1.7 MHz (Only DVB-T2) • 5 MHz • 6 MHz • 7 MHz • 8 MHz
5	**Modulation** (eligible parameter)**:** In this field, the modulation must be chosen with the Right and Left buttons. The available options are: • QPSK • 16QAM • 64QAM • 256QAM (Only DVB-T2)

6	**LDPC Fec** (eligible parameter)**:** Select the desired FEC value with the Right and Left buttons. The available options are: • 1/2 • 3/5 • 2/3 • 3/4 • 4/5 • 5/6 • 7/8
7	**FFT** (eligible parameter)**:** Select the desired FFT value with the Right and Left buttons. The available options are: • 1K • 2K • 4K All options are not available with all modulation parameters.
8	**Guard Interval** (eligible parameter)**:** Select the desired GI value with the Right and Left buttons. The available options are: • 1/4 • 1/8 • 1/16 • 1/32
9	**Video Input** (eligible parameter)**:** In this field, the video input must be chosen with the Right and Left buttons. The available options are: • SDI • HDMI1 • HDMI2 • CVBS • ASI • Generator

10	**Audio1 Input** (eligible parameter)**:** In this field, the sort of Audio signal introduced in the Audio 1 input can be chosen with right and left buttons. The available options are: • Embedded • Analogue • AES-EBU • Tone.Gen • None
11	**Audio2 Input** (eligible parameter)**:** In this field, the sort of Audio signal introduced in the Audio 2 input can be chosen with right and left buttons. The available options are: • Embedded • Analogue • AES-EBU • Tone.Gen • None
12	**Data Input** (eligible parameter)**:** In this field, the data input must be chosen with the Right and Left buttons. The available options are: • RS-232 • 4k Board • None
13	**GPS:** In this field, the GPS data can be enabled or disabled using Right and Left buttons. The available options are: • On • Off **ANT 5V:** In this field, you can activate 5V to feed the GPS antenna by pressing Ok button.
14	**KLV Metadata** (eligible parameter)**:** In this field, the KLV metadata can be enabled or disabled.

15	**Video Delay** (eligible parameter)**:** In this field, the delay of the coding process is configured. To select the desired delay, press Right, Left arrows buttons. The available options are: • Standard • Super Low Delay (2 frames of delay) • Ultra Low Delay (1 frame of delay)
16	**Video Profile** (eligible parameter)**:** In this field, the codification profile can be configured. To select the desired profile, press Right, Left arrows buttons. The available options are: • 4.2.0 • 4.2.2
17	**Scrambler** (eligible parameter)**:** Select the desired encryption with the Right and Left buttons. There are five options available: • None • Biss-1 • Biss-E • AES-128 (optional) • AES-256 (optional)
18	**Service Name** (editable parameter): Set the name of the service.
19	**Program Number** (editable parameter): Here the program number must be entered.
20	**Video PID** (editable parameter): Here the video packet identifier must be entered.
21	**Audio 1 PID** (editable parameter): Here the Audio 1 packet identifier must be entered.
22	**Audio 2 PID** (editable parameter): Here the Audio 2 packet identifier must be entered.
23	**Data PID** (editable parameter): Here the data packet identifier must be entered.
24	**GPS PID** (editable parameter): Here the GPS packet identifier must be entered.
25	**ALARM PID** (editable parameter): Here the Alarms packet identifier must be entered.
26	**PMT PID** (editable parameter): Here the program map tables packet identifier must be entered.

27	**PCR PID** (editable parameter): Here the program clock reference packet identifier must be entered.
28	**KLV Metadata** (editable parameter): Here the KLV Metadata packet identifier must be entered.
29	**TS id** (editable parameter): In this field the Transport Stream identifier must be set.
30	**Network id** (editable parameter): In this option the network identifier must be specified.
31	**Network Name** (editable parameter): Specify the name of the network.
32	**Remux:** You can enable or disable remux mode with Right and Left buttons.

Table 4.28: Profile menu options

4.6.3.5 RTC-03 Config

In this option, a profile can be configured. Select RTC-03 Config option and then by pressing the OK button, the available profiles will be displayed. There are seven profiles available and can be enabled or disabled.

```
          PROFILES
Profile 1: Enable        ↵
Profile 2: Enable      < ↵
Profile 3: Disable     >↵
```

Figure 4.51: Profile Config Menu

Select a profile and then press the OK button to configure the parameters related to it:

```
          PROFILE 1

System:DVB-T2          <
Freq: 2.300,00MHz      ↵
RF Power: PA High      <
```

```
          PROFILE 1
Bandwidth:8 MHz        >
Modul: 16 QAM          >
LDPC Fec: 3/4          >
```

```
          PROFILE 1
FFT:2K                 >
GI: 1/8                >
Video Input: SDI       >
```

```
          PROFILE 1
Audio1 Input: Emb      >
Audio2 Input: Emb      >
Data Input: GPS        >
```

```
          PROFILE 1

GPS:On <  Ant5V: On      ↵
KLV Metadata: Off          >
Video Delay: Std           >
```

```
          PROFILE 1

Video Profile:420          >
Scrambler:None             >
Service Name               ↵
```

```
          PROFILE 1

Program Nº: 2              ↵
Video PID:  200           ↵
Audio1 PID: 201           ↵
```

```
          PROFILE 1

Audio2 PID:  202          ↵
Data PID:  203            ↵
GPS PID: 206              ↵
```

```
          PROFILE 1

Alarm PID:207             ↵
PMT PID:204               ↵
PCR PID:205               ↵
```

```
          PROFILE 1

KLV Metadata: 40          ↵
TS is:  7                 ↵
Network id: 7             ↵
```

```
               PROFILE 1

Network Name                    ↵
Remux: Disable                  >

```

Figure 4.52: Profile 1 Menu

Line nº	Function
1	**System** (eligible parameter)**:** Select the type of the transmission system with the Right and Left buttons. There are two options available: • DVB-T2 • DVB-T
2	**Frequency** (editable parameter)**:** Select the frequency at which the signal is going to be transmitted. Press the OK button and with Up, Down keys configure the desired value.
3	**RF Power:** Select the output power with the Right and Left buttons. There are three options available: • HDT-02 LOW • HDT-02 HIGH • PA LOW • PA MID • PA HIGH When the transmitter is controlled via the RTC-03 or RS-485 operation, the output power is controlled remotely by the external device and not by the configuration on the profile.
4	**Bandwidth** (eligible parameter)**:** Select the desired bandwidth with the Right and Left buttons. There are five options available: • 1.7 MHz (Only DVB-T2) • 5 MHz • 6 MHz • 7 MHz • 8 MHz
5	**Modulation** (eligible parameter)**:** In this field, the modulation must be chosen with the Right and Left buttons. The available options are: • QPSK • 16QAM • 64QAM • 256QAM (Only DVB-T2)

6	**LDPC Fec** (eligible parameter)**:** Select the desired FEC value with the Right and Left buttons. The available options are: • 1/2 • 3/5 • 2/3 • 3/4 • 4/5 • 5/6 • 7/8
7	**FFT** (eligible parameter)**:** Select the desired FFT value with the Right and Left buttons. The available options are: • 1K • 2K • 4K All options are not available with all modulation parameters.
8	**Guard Interval** (eligible parameter)**:** Select the desired GI value with the Right and Left buttons. The available options are: • 1/4 • 1/8 • 1/16 • 1/32
9	**Video Input** (eligible parameter)**:** In this field, the video input must be chosen with the Right and Left buttons. The available options are: • SDI • HDMI1 • HDMI2 • CVBS • ASI • Generator

10	**Audio1 Input** (eligible parameter)**:** In this field, the sort of Audio signal introduced in the Audio 1 input can be chosen with right and left buttons. The available options are: • Embedded • Analogue • AES-EBU • Tone.Gen • None
11	**Audio2 Input** (eligible parameter)**:** In this field, the sort of Audio signal introduced in the Audio 2 input can be chosen with right and left buttons. The available options are: • Embedded • Analogue • AES-EBU • Tone.Gen • None
12	**Data Input** (eligible parameter)**:** In this field, the data input must be chosen with the Right and Left buttons. The available options are: • RS-232 • 4k Board • None
13	**GPS:** In this field, the GPS data can be enabled or disabled using Right and Left buttons. The available options are: • On • Off **ANT 5V:** In this field, you can activate 5V to feed the GPS antenna by pressing Ok button.
14	**KLV Metadata** (eligible parameter)**:** In this field, the KLV metadata can be enabled or disabled.

15	**Video Delay** (eligible parameter)**:** In this field, the delay of the coding process is configured. To select the desired delay, press Right, Left arrows buttons. The available options are: • Standard • Super Low Delay (2 frames of delay) • Ultra Low Delay (1 frame of delay)
16	**Video Profile** (eligible parameter)**:** In this field, the codification profile can be configured. To select the desired profile, press Right, Left arrows buttons. The available options are: • 4.2.0 • 4.2.2
17	**Scrambler** (eligible parameter)**:** Select the desired encryption with the Right and Left buttons. There are five options available: • None • Biss-1 • Biss-E • AES-128 (optional) • AES-256 (optional)
18	**Service Name** (editable parameter): Set the name of the service.
19	**Program Number** (editable parameter): Here the program number must be entered.
20	**Video PID** (editable parameter): Here the video packet identifier must be entered.
21	**Audio 1 PID** (editable parameter): Here the Audio 1 packet identifier must be entered.
22	**Audio 2 PID** (editable parameter): Here the Audio 2 packet identifier must be entered.
23	**Data PID** (editable parameter): Here the data packet identifier must be entered.
24	**GPS PID** (editable parameter): Here the GPS packet identifier must be entered.
25	**ALARM PID** (editable parameter): Here the Alarms packet identifier must be entered.
26	**PMT PID** (editable parameter): Here the program map tables packet identifier must be entered.

27	**PCR PID** (editable parameter): Here the program clock reference packet identifier must be entered.	
28	**KLV Metadata** (editable parameter): Here the KLV Metadata packet identifier must be entered.	
29	**TS id** (editable parameter): In this field the Transport Stream identifier must be set.	
30	**Network id** (editable parameter): In this option the network identifier must be specified.	
31	**Network Name** (editable parameter): Specify the name of the network.	
32	**Remux:** You can enable or disable remux mode with Right and Left buttons.	

Table 4.29: Profile menu options

4.6.3.6 Alarms

In this section, you can View and Configure the Alarms shown by the Transmitter. You can select view or configure the alarms by pressing Left and Right arrows.

The alarm screen can be accessed by pressing the OK button from the main screen as well. To return to the main screen from the alarm screen, the Cross button must be pressed.

The different alarms and warnings that can be configured in the transmitter are:

- High Voltage
- Low Voltage
- High Temperature
- ASI Overflow: this alarm means that the bit rate at the ASI input is higher than the one that can be modulated due to the parameters configured (constellation, FEC, GI...).
- No SDI Input: SDI source is not connected.
- No HDMI Input: HDMI source is not connected.
- No CVBS Input: CVBS source is not connected.
- No ASI Input: ASI source is not connected.
- No Audio 1 Input: Audio source is not connected.
- No Audio 2 Input: Audio source is not connected.
- No GPS: GPS source is not connected.
- No RS232: RS232 data source is not connected.
- No KLV
- PA No Forward
- PA Rev High
- PA Volt Low
- PA Temp High
- WeightOnWheels
- TS Error

4.6.3.7 Monitor
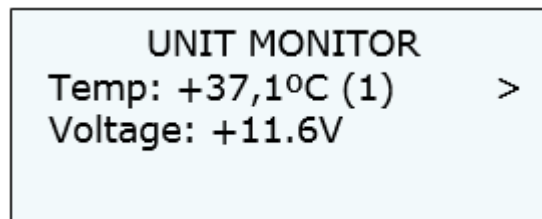
Figure 4.53: Unit Monitor Menu

- **Temperature** (reading parameter):

  In this field, the internal temperature of the device is displayed. With the Right, Left keys, the user can select if the temperature is shown in ⁰C or in ⁰F. Moreover, the value which is between square brackets means the speed of the fans (values from 1 to 4) where 1 means that the fans are stopped and value 4 that they are at the maximum speed.

- **Voltage** (reading parameter):

  In this field, the voltage of the transmitter is shown.

4.6.3.8 Remote
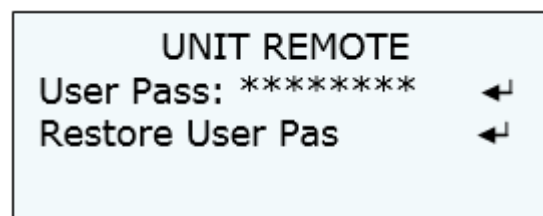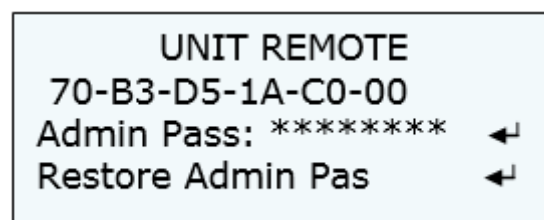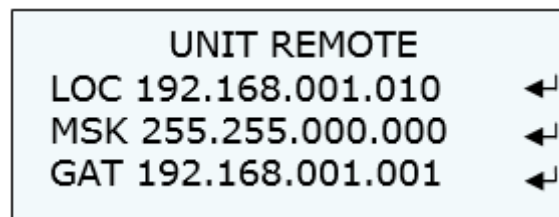
Figure 4.54: Unit Remote Menu

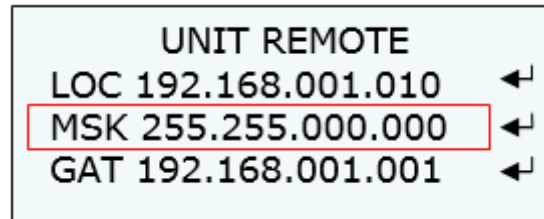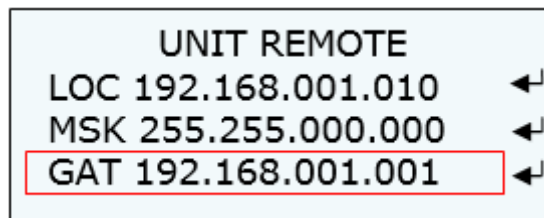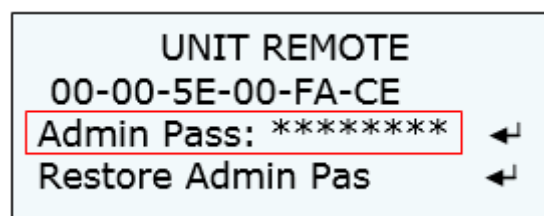| Line nº	Function
1	**Local IP** (editable parameter)**:**
	In this option the IP address of the device can be set in the case that it is wanted to control the device remotely. To change the IP address first press OK button and then, with the Up and Down keys select the desired number. To change from one character to another, press Right and Left keys. Press the OK button to save the introduced value.
2	**Subnet Mask** (editable parameter)**:**
	Here the Subnet Mask address of the device can be written. To change the Subnet Mask address first press the OK button and then, with the Up and Down keys select the desired number. To change from one character to another, press Right and Left keys. Press the OK button to save the introduced value.
3	**Gateway** (editable parameter)**:**
	In this option, the address of the Gateway must be written. To change the Gateway address first press OK button and then, with the Up and Down keys select the desired number. To change from one character to another, press Right and Left keys. Press the OK button to save the introduced value.
4	**MAC ADDRESS** (reading parameter)**:**
	The MAC address of the device is shown.
5	**Admin Pass** (editable parameter)**:**
	The administrator's password is introduced. An own password, which is a list of 8 digits, can be set.
	To set the password, press the OK button and then use the Up and Down button to establish the desired value. Press Right and Left buttons to change other digits. Finally press the OK button to save the introduced values.
6	**Restore Admin Pass:**
	This option enables you to restore the default administrator password (00000000).
7	**User Pass** (editable parameter)**:**
	The user's password is introduced. It can be set an own password which is a list of 8 digits.
	To set the password, press the OK button and then use the Up and Down button to establish the desired value. Press Right and Left buttons to change other digits. Finally press the OK button to save the introduced values.
8	**Restore User Pass:**
	This option enables you to restore the default user password (00000000).

Table 4.30: Unit remote menu options

4.6.3.9 Miscellaneous

```
UNIT MISCELLANEOUS

Band: 5,300.00MHz      >
Keyboard Beep: Off     <
Keyboard Lock: Off     <
```

```
UNIT MISCELLANEOUS

Night Mode: 0
Dist Units: Km         >
Video Switch: No       >↵
```

```
UNIT MISCELLANEOUS

T/T2 Carrier: Off      ↵
Activ Key:******       ↵
S/N: 660010911
```

```
UNIT MISCELLANEOUS
Activ Licenses:        ↵
Load Encry keys:       ↵
WoW: Disable           >
WoW Polarity:>15V      <
```

Figure 4.55: Miscellaneous Menu

Line nº	Function
1	**Band** (eligible parameter)**:** In this field, the output band can be selected. The available options are: • RF band (from 1.0 to 6.4 GHz) • 70 MHz Output
2	**Keyboard Beep** (eligible parameter)**:** If the On option is selected, each time a key is pressed a beep sound will appear. If the Off option is selected, there will be no sound when a key is pressed. The available options are: • On • Off

3	**Keyboard Lock** (eligible parameter)**:** If the On option is selected and the buttons of the equipment remain for 5 minutes without being pressed, a message will appear on the screen saying that the keyboard is locked. By pressing the cross button, the keyboard can be unlocked. If the Off option is selected there will be no messages on the screen. The available options are: • On • Off
4	**Night Mode** (eligible parameter)**:** There are four possible states for the night mode. If the night mode is in state 0 then the light on the screen will be brighter than if it is in state 1. If the state is 3 then, the light on the screen will be the dimmest of the four possible states. The available options are: • 0 (Day mode) • 1 • 2 • 3
5	**Distance Units** (eligible parameter)**:** If miles are selected, all the distances will be in miles and the same occurs if kilometers are selected. The available options are: • Kilometers • Miles
6	**Video switch:** This option permits you to automatically switch the input signal source once the configured time for the signal source has ended. The configured video sources are switched in a looped sequence.
7	**T/T2 Carrier** (eligible parameter)**:** The available options are: • On: The carrier (without modulation) is shown for 1 minute. • Off: The option is disabled.
8	**Activation Key** (editable parameter)**:** In this field, you can activate your license. You can set the activation key by pressing the up and down buttons. It must have 8 alphanumeric characters.
9	**S/N** (reading parameter)**:** In this field the serial number of the device is shown.

10	**Activ Licenses:** In this field you can enter the license code for the following optional features: • AES • KLV • Remux • Internal GPS Once the code has been introduced, the licence is enabled on the unit. You can use this menu to check which licenses are enabled on this unit. For a new license code, please contact us.
11	**Load Encry Keys:** In this field you can load the encryption keys for BISS and AES modes by USB. The file must have ".svp" extension and the content must be as it is indicated in the following example: AES128:1202A3412348C9127348FE2348971234 AES256:123AB89070F8097D897EE8970DE87987980109891829182391 82399AFFC123AE BISS1:89701234ABE1 BISSESW:0123AC1238907098 BISSEU:413809ABA12393 Once the keys information has been loaded properly, "KEYS LOADED" message is shown in the screen.
12	**WoW Weight on Wheels** (eligible parameter)**:** The available options are: • On: Wow is enabled. When the aircraft lands the RF is automatically disconnected. • Off: The option is disabled.
13	**WoW Weight on Wheels Polarity** (eligible parameter)**:** The available options are: • >15 VDC • <15 VDC

Table 4.31: Unit Miscellaneous menu options

4.6.3.10 Firmware

Transmitter PCB Version
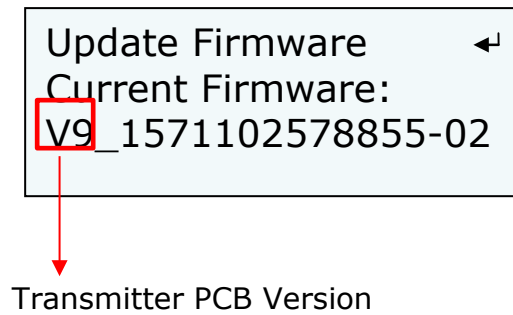
Figure 4.56: Firmware Menu

Line nº	Function
1	**Update Firmware:** In this field you can update the version of the device. To update the equipment properly, follow the instructions below.
2	**Current firmware:** In this field, the number of the version installed in the device is shown. The characters which describe the number of the version are inside the red box shown in the figure above. The rest of the characters are important for the manufacturer but are not important for the user.

Table 4.32: Firmware menu options

Next, the necessary steps to make a successful update are explained.

1. The latest firmware can be found on the website of SVP Broadcast Microwave. To access the firmware file, first enter www.svpbm.com in your web browser.

2. Click on the Support tab.

Figure 4.57 Updating firmware step 2

3. Click on Firmware.

Figure 4.58: Updating firmware step 3

4.   Go to TX_Firmware.

Figure 4.59: Updating firmware step 4

5.   Press the version of the transmitter model (version of the equipment) to download the file.

To verify the version of the transmitter, go to firmware field and then look at the current firmware to check the number installed in the device (the first two digits).

Figure 4.60: Updating firmware step 5

6. Once the firmware file has been downloaded, save it in a USB device.

In the USB device, the only file that can be allocated inside it is the firmware file of the device to be updated.

7. With the equipment powered off (**with no power supply**), insert the USB device in the USB connector, placed in the rear panel.

Before introducing the USB device, remove the power supply of the equipment.

8. Now, switch on the device.

9. Go to Unit menu. From the main screen, press cross button to access the menu. There, with the Up, Down buttons, select the Unit option.

10. Select Firmware by pressing the OK button.

11. Select Update Firmware with the OK button.

Don't power off the device during the updating process.

4.6 Introduction

The HDT-02 Transmitter has an integrated GPS receiver; for the use it is needed to connect an external GPS antenna, which can be active or passive.

The data from the GPS are multiplexed with the compressed video and audio information and sent to the receiver. If the signal arrives correctly to the receiver system, then the HDR will have all the GPS data available (of the transmitter and of the receiver). In this way, the receiver device will be able to calculate the direction, distance and positioning of the transmitter.

The HDR receiver also includes another feature that consists of an output RS232 connection which allows watching through Google Maps application the position of the transmitter in real time.

Figure 4.1: HDT-02 Transmitter and GPS antenna

4.7 Main Screen

Next the value of the data field which appears on the main screen of the HDT-02 Transmitter is explained.

Figure 4.2: Main screen

The data status field indicates with a darkened X that it is disabled. When this parameter is enabled and blinks, this means that there is nothing connected to the data input. When this field alternates the value between 'g' and 'G', it means that it is trying to get the GPS satellites. If the 'G' does not vary, then it is connected to the satellites (at least 6 satellites).

4.8 GPS Transmitter Screen

When the internal GPS receiver is being used, to access the GPS screen, go to the encoder option in the menu. Once inside this option, go to the GPS field, press the OK button, go to the GPS Info option and press again the OK button.

The format of the GPS coordinates used is decimal minutes as shown in the next example:

N43º02.032'
W023º03.023'

Next the different field meanings are shown.
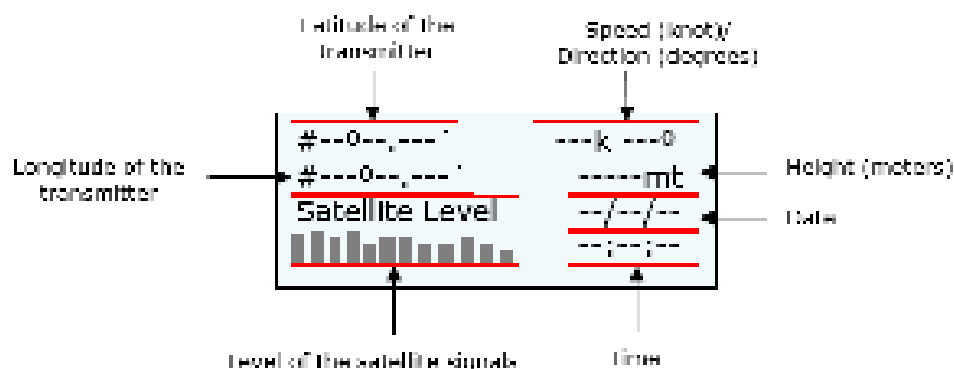
Figure 4.3: GPS Transmitter screen

- **Latitude of the Transmitter:** It specifies the latitude position of the transmitter.

- **Speed of the Transmitter:** It shows the speed of the transmitter in knots.

- **Direction of the Transmitter:** The direction of the transmitter is shown in this field.

- **Longitude of the Transmitter:** It specifies the longitude position of the transmitter.

- **Height of the Transmitter:** The height of the transmitter from the sea level, is specified in this value.

- **Satellite Level:** The level of each satellite signal received is shown in this field.

- **Date:** The updated date is shown.

4.9 Application Example 1 – Constant Positioning

Suppose the transmitter device is on an aeroplane and we need to know the constant positioning of the vehicle. You need the following items:

- HDT-02_H.264 Transmitter
- GPS antenna
- HDR-108 receiver

With the GPS antenna connected to the HDT-02 Transmitter, positioning of the aeroplane is achieved once the GPS system is connected to the necessary satellites. With the data obtained in the transmitter we can know the positioning of the aeroplane.

Next, this GPS data is sent to the HDR-106 receiver. When this signal arrives to the receiver, the HDR-106 shows on its screen some GPS values like:

- Transmitter positioning
- Transmitter direction
- Distance from receiver to transmitter

Below a picture of this system is shown:
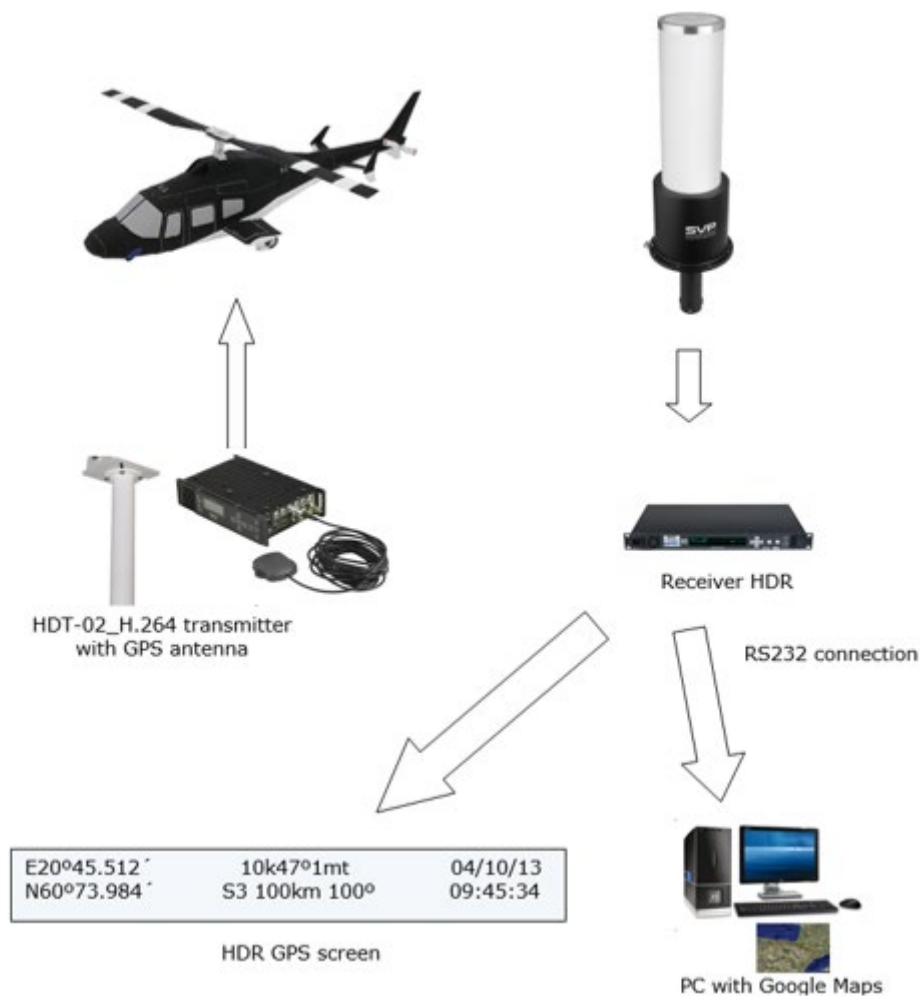
Figure 4.4: GPS system example 1 picture

Chapter 5: Lau-K Application

6.1 Introduction

This chapter describes the control and operation of a transmitter when we connect an external Lau-k family encoder to it.

Once communication via the data channel is established between the transmitter and the encoder, the transmitter Encoder menu will automatically change to control the Lau-K encoder.

6.2 4K SDI video encoding

Once the device is connected to the Lau-K encoder, the transmitter encoder menu will show the following options:

```
                  ENCODER
   Video: SDI                    ←
   Audio1:Generator      <  ←
   Audio2:None                 >
```

OK

⬇

```
ENCODER: VIDEO  SDI4K
 Format: 1080/50i       <>
 Delay: Normal          <>
 Profile: 4.2.0          >
```

```
ENCODER: VIDEO  SDI4K
Depth:   8  bits          >
Mode: H.265               >
Source:2SI                >
```

```
ENCODER: VIDEO  SDI4K
Num Videos:  4            <
```
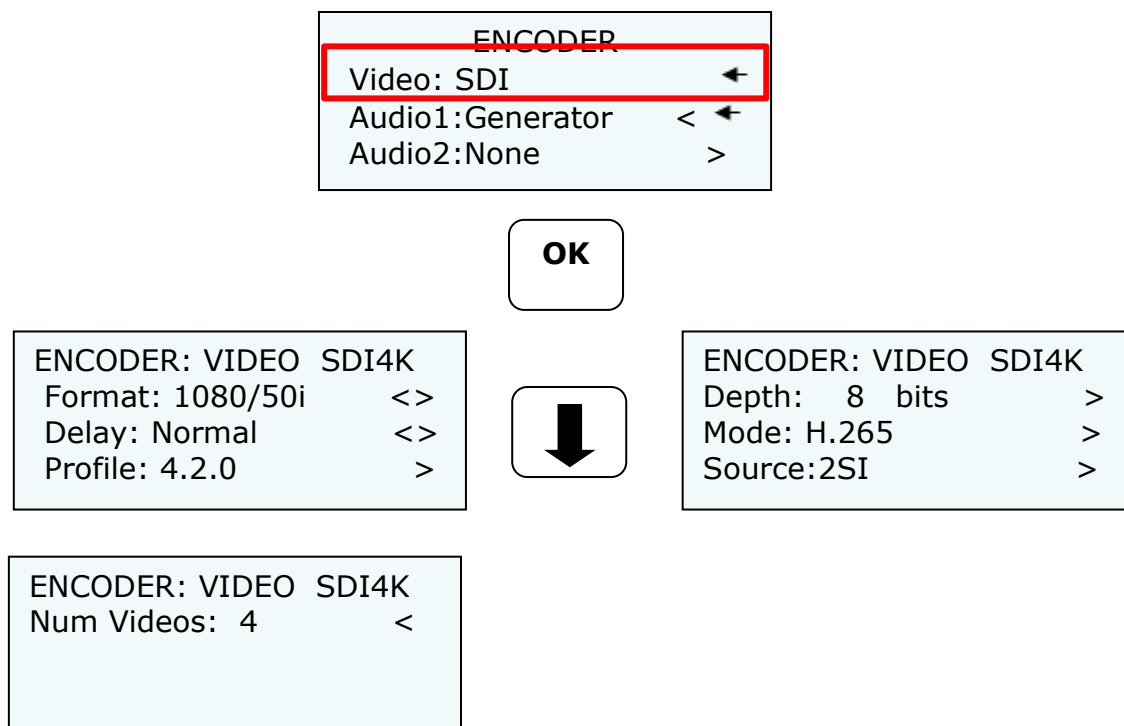
Figure 6.1: SDI Input Menu

Line nº	Function

Format (SDI):

In this field, the format of the SDI input signal is displayed. (reading parameter)

1

The available options are:

- 2160p - 23.98/24/25/29.97/30/50/59.94/60
- 720p - 50/59.94/60
- 1080i - 50/59.94/60
- 1080p - 23.98/24/25/29.97/30/50/59.94/60
- 480i - 29.97
- 576i - 25

Delay:

In this field, the delay of the coding process is configured. So as to select the desired delay, press Right, Left arrows buttons. (eligible parameter)

2

The available options are:

- Normal
- Low Delay
- Ultra Low Delay

Profile:

In this field, the video chroma format can be configured. So as to select the desired profile, press Right, Left arrows buttons. (eligible parameter)

3

The available options are:

- 4.2.0
- 4.2.2

Depth:

In this field, the video bit depth can be configured. (eligible parameter)

4

The available options are:

- 8 bits
- 10 bits

Mode:

In this field, the mode of the encoder can be configured. The available options are:

5

- H.265
- H.264
- Mpeg2

Source:

In this field, the input format can be configured. The available options are:

6

- 2SI (2 sample interleave)
- SQD (Square Division)

Num of Video:

In this field, the number of video inputs can be configured. The available options are:

7

- 0
- 4 (4 HD videos simultaneously transmitted)

Table 5.1: 4K SDI Input menu options

7.1 Introduction

This equipment can be controlled from a PC connected at the rear panel Ethernet connector.

To enable the browser interface correctly, the IP address, Subnet Mask, Gateway, User Password and Administrator Password need to be set correctly on this unit. Next, the steps to setup network parameters are shown:

1. Go to Unit -> Remote
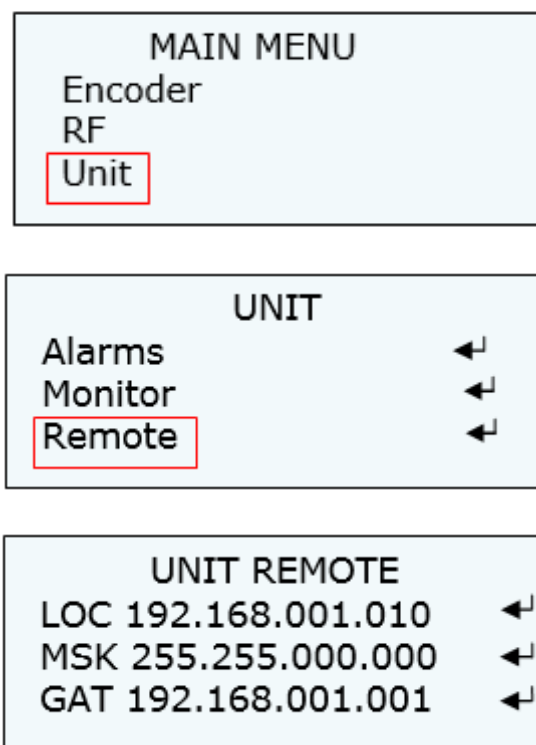
Figure 6.1: Web Server screen

2. Select LOC option and set a local IP address. To change the IP address first press the OK button and then, with the Up, Down keys select the desired number. To change from one character to another, press Right, Left keys. Press the OK button to save the introduced value.
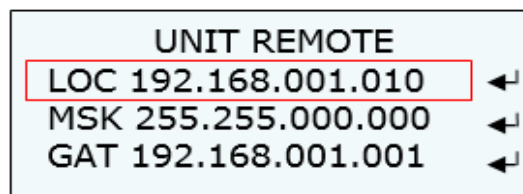
Figure 6.2: Local IP

---

3. Select MSK option and set the Subnet Mask address. To change the Subnet Mask address first press OK button and then, with the Up, Down keys select the desired number. To change from one character to another, press Right, Left keys. Press the OK button to save the introduced value.

UNIT REMOTE
LOC 192.168.001.010 ↵
MSK 255.255.000.000 ↵
GAT 192.168.001.001 ↵

Figure 6.3: Subnet Mask

4. Select GAT option and set the Gateway address. To change the Gateway address first press the OK button and then, with the Up, Down keys select the desired number. To change from one character to another, press Right, Left keys. Press the OK button to save the introduced value.

UNIT REMOTE
LOC 192.168.001.010 ↵
MSK 255.255.000.000 ↵
GAT 192.168.001.001 ↵

Figure 6.4: Gateway

5. Select Admin Pass option and set the administrator's password. To access to the Webserver directly without setting any password, the Admin Pass must be set to 0 (00000000). However, if you want to set an administrator's password, it is necessary to introduce 8 digits. In this way, with this password, the administrator can access to the Webserver and make any configuration, modification or monitoring.

UNIT REMOTE
00-00-5E-00-FA-CE
Admin Pass: ******** ↵
Restore Admin Pas ↵

Figure 6.5: Admin Pass

6. Select Restore Admin Pass option to restore the default value of the administrator's password (00000000).
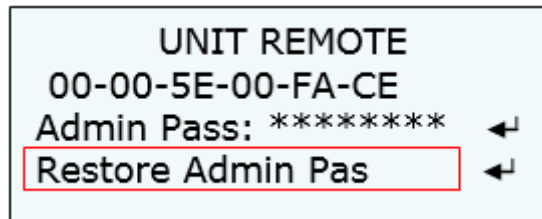
Figure 6.6: Restore Admin Pass

7. Select User Pass option and set the user's password. If you want to access the Webserver directly without setting any password, the User Pass must be set to 0 (00000000). However, if you want to set a user's password, it is necessary to introduce 8 digits. In this way, with this password, the user can access to the Webserver and make any monitoring, but without changing anything.
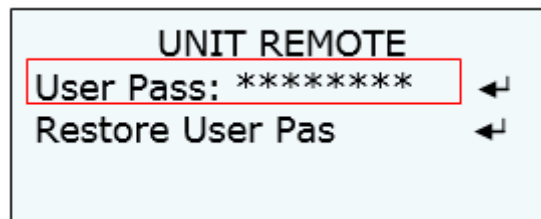
Figure 6.7: User Pass

8. Select Restore User Pass option to restore the default value of the administrator's password (00000000).
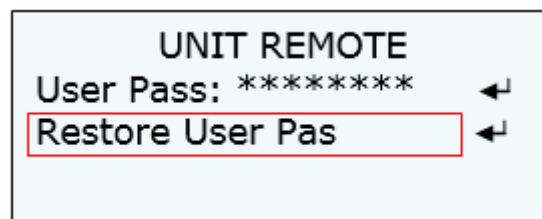
Figure 6.8: Restore User Pass

Once the IP, Subnet Mask, Gateway, Admin Pass and User Pass are set and the laptop or PC is connected to the HDT-02 H.264, open the web browser and type in the Local IP configured in the transmitter.

Press the enter button in your computer and then the main screen will appear.

7.2 Web Page Overview

The main menu is set in the upper position of the screen. Once an option is chosen, it is possible to change any parameter allowed, or to see the values of some options.

To modify an editable parameter, introduce the new one and press enter button. Then the change will be set in the transmitter device. Moreover, to modify an eligible parameter, select the new one and the change will appear in the transmitter.

Next several screens of the web server and their features are shown.

7.2.1 ENCODER

Figure 6.9: Web Server Encoder screen

7.2.1.16 Video

- Input (eligible parameter):

  Select the type of the video input. The video input options available are SDI, HDMI1, HDMI2, CVBS, ASI and Generator.

- Format (reading parameter):

  Here the format of the video input signal is displayed. If there is no video input then the message 'not detected' is displayed.

- Bitrate (reading parameter):

  In this field, the user can see the bitrate in Mbps assigned by the encoder to the video input signal.

  However, if the introduced signal is ASI, this field indicates the input bitrate of this ASI signal.

- Delay (eligible parameter):

  In this field, the delay of the coding process is configured. The available options are Standard Delay, Super Low Delay or Ultra Low Delay.

- Profile (eligible parameter):

  In this field, the codification profile can be configured. The available options are 4:2:0 and 4:2:2.

- GOP (eligible parameter):

  In this field, the Group Of Pictures parameter is displayed. It specifies the order in which intra and inter-frames are arranged.

  The available options are:

  - Auto

  - Manual

- Level (eligible parameter):

  In this field, the level of the H.264 encoder can be configured. The available options are:

  - 4.0

  - 4.1

  - 4.2 (only available in 1080p-50/59.94/60 Hz video formats)

7.2.1.17 Audio

- [A1] Input (eligible parameter):

  Select the type of signal introduced in the Audio 1 input. The Audio input options available are Embedded, Analogue, AES-EBU, Test Tone and None.

- [A1] Bitrate (eligible parameter):

  Select the bitrate for the coding process of the Audio 1 signal. The available options are 128, 192, 256 and 384 Kbps.

- [A2] Input (eligible parameter):

  Select the type of signal introduced in the Audio 2 input. The Audio input options available are Embedded, Analogue, AES-EBU, Test Tone and None.

- [A1] L Type (Analogic) (eligible parameters):

  This field is only configurable if analogic audio signals are introduced.

  The user can select the sort of signal of the Audio 1 left channel introduced in the transmitter.

  The available options are:

  - Line
  - MIC Dynamic
  - MIC Phantom

- [A1] R Type (Analogic) (eligible parameters):

  This field is only configurable if analogic audio signals are introduced.

  The user can select the sort of signal of the Audio 1 right channel introduced in the transmitter.

  The available options are:

  - Line
  - MIC Dynamic
  - MIC Phantom

7.2.1.18 Data

- Input (eligible parameter):

  Select the type of data introduced to the device. The available options are None, RS232 and 4k board.

7.2.1.18.1 RS-232

If the RS-232 connection is selected, the next parameters must be configured to achieve a successful communication:

- Baudrate (eligible parameter):

  Choose the baudrate of the RS-232 connection. The available options are 1200, 2400, 4800, 9600, 14400, 19200, 38400, 57600, 115200, 230400.

- Parity (eligible parameter):

  Select the parity for the RS-232 connection. The available options are None, Odd and Even.

- Stop Bits (eligible parameter):

  Establish the number of stop bits for the RS-232 connection. The available options are 1 and 2.

7.2.1.19 GPS (Optional)

If GPS is enabled, then different parameters are shown:
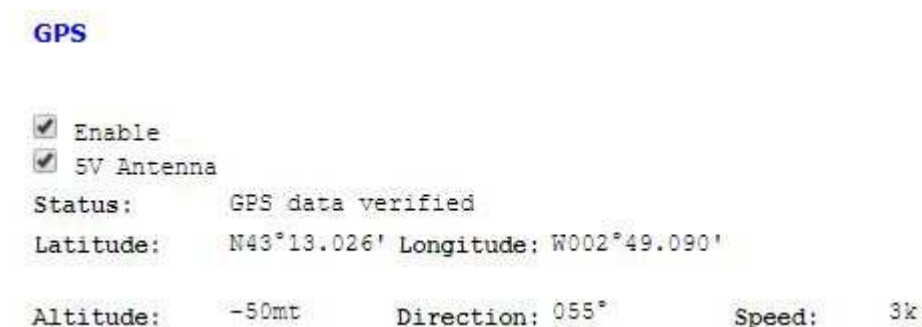
Figure 5.10 Web Server GPS screen

If GPS is enabled and the GPS antenna is connected, the status field will show "GPS data verified" message. Nevertheless, if the transmitter does not detect any GPS input signal, the status field will show "GPS not detected".

The format of the GPS coordinates used is decimal minutes as shown in the next example:

N43º02.032'

W023º03.023'

- Status (reading parameter):

    The status of the GPS input is displayed in this field.

- Latitude (reading parameter):

    It specifies the latitude position of the transmitter.

- Longitude (reading parameter):

    It specifies the longitude position of the transmitter.

- Altitude (reading parameter):

    The height of the transmitter from ground in meters is specified in this value.

- Direction (reading parameter):

    The direction in degrees of the transmitter is shown in this field.

- Speed (reading parameter):

    The speed of the transmitter in km/h is shown in this field.

7.2.1.20 KLV Metadata (Optional)

When this option is ON, the KLV Metadata embedded on the SDI signal is sent through the radio link.

7.2.1.21 Encoder output

- TS Bitrate Auto (eligible parameter):

    The bitrate mode can be automatic or manual. In case automatic mode is selected, the device configures automatically the video bitrate depending on the modulation, FEC, IG, BW used, in order to the video bitrate can be always the maximum allowed. SVP advises the use of the automatic mode when the signal is transmitted through RF. Manual mode is useful when the device is used as an encoder to configure the desired output bitrate in the ASI output.

- TS Bitrate Manual (editable parameter):

    If the bitrate mode is manual, select the bitrate.

7.2.1.22 TS Parameters

- Video PID (editable parameter):

    Here the video packet identifier must be entered.

- Audio 1 PID (editable parameter):

  Here the Audio 1 packet identifier must be entered.

- Audio 2 PID (editable parameter):

  Here the Audio 2 packet identifier must be entered.

- Data PID (editable parameter):

  Here the data packet identifier must be entered.

- PMT PID (editable parameter):

  Here the program map table packet identifier must be entered.

- PCR PID (editable parameter):

  Here the program clock reference packet identifier must be entered.

- GPS PID (editable parameter):

  Here the GPS packet identifier must be entered.

- ALARM PID (editable parameter):

  Here the Transmitter Alarms identifier must be entered.

- KLV Metadata (editable parameter):

  Here the KLV packet identifier must be entered.

- Program Number (editable parameter):

  Here the program number must be entered.

- TS id (editable parameter):

  In this field the Transport Stream identifier must be set.

- Network id (editable parameter):

  In this option the network identifier must be specified.

- Network Name (editable parameter):

  Specify the name of the network.

- Service Name (editable parameter):

  Set the name of the service.

> When editable parameters are being set in the Web Server and new values are being introduced, the text remains in RED until the enter button is pressed. When the enter button is pressed, the new values are saved, and the text will appear in BLACK. It is necessary to press the enter button to save the new values in the transmitter.

7.2.1.23 Scrambler
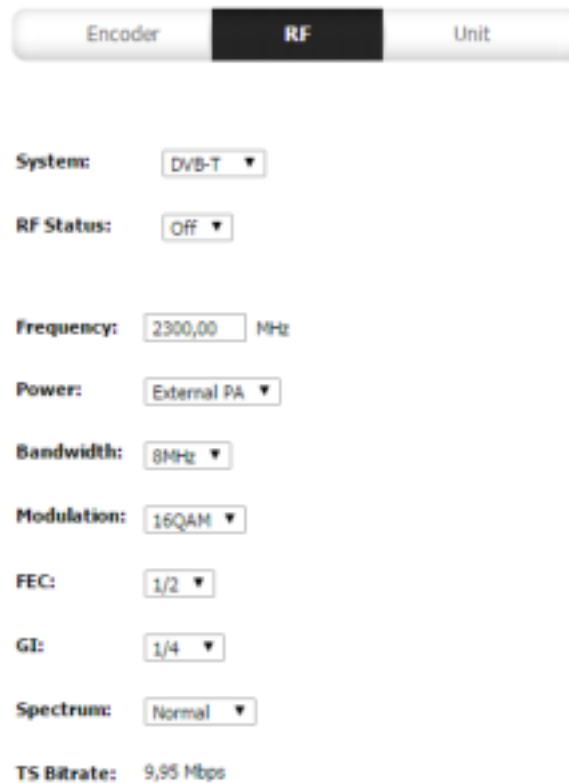
If you want an encryption system, it can be chosen here.

- None:

  None encryption

- BISS-1:

  Uses an unencrypted key for the BISS key

- BISS-E:

  Uses an encrypted key

- AES 128 (optional)

- AES 256 (optional)

7.2.1.24 Remux (Optional)

- Mode (eligible parameter):

  Here you can enable or disable the Remux mode. When the enable mode is selected, Transport Stream Bitrate mode is always manual so that the user can configure the output bitrate of the TS from the internal NTT encoder. You must configure it considering that the ASI input Bit rate plus the NTT encoder Bit rate must be minor than modulator total Bit rate.

7.2.2 RF

Figure 6.10 Web Server RF screen (DVB-T)

- System (eligible parameter):

  In this field the transmission standard can be chosen. The available options are DVB-T2, DVB-T, DVB-S2 and DVB-S.

- RF Status (eligible parameter):

  Select ON to activate the RF transmission or press OFF button to deactivate it.

7.2.2.16 DVB-T

- Frequency (editable parameter):

  Introduce the frequency at which the signal is being transmitted.

- Power (eligible parameter):

  Specify the power at which the signal is being transmitted (Variable, Low, High and PA).

- Bandwidth (eligible parameter):

  Enter the transmitted signal bandwidth. The available options are 5, 6, 7 and 8 MHz.

- Modulation (eligible parameter):

  Select the constellation of the transmitted signal. The available options are QPSK, 16QAM, 64QAM.

- FEC (eligible parameter):

  Select the FEC value for the transmitted signal. The available options are 1/2, 2/3, 3/4, 5/6, 7/8.

- GI (eligible parameter):

  Select the guard interval of the transmitted signal. The available options are 1/4, 1/8, 1/16, 1/32.

- Spectrum (eligible parameter):

  Here the spectrum type is configured. Inverted spectrum is just another method to help prevent signal theft.

  The available options are normal or invert.

- Bitrate (reading parameter):

  In this field it is displayed the bitrate of the transmitted signal according to the modulation parameters used.

> When editable parameters are being set in the Web Server and new values are being introduced, the text remains in RED until the enter button is pressed. When the enter button is pressed, the new values are saved, and the text will appear in BLACK. It is necessary to press the enter button to save the new values in the transmitter.

7.2.2.17 DVB-T2

Figure 6.11: Web server RF screen (DVB-T2)

- Frequency (editable parameter):

  Introduce the frequency at which the signal is being transmitted.

- Power (eligible parameter):

  Specify the power at which the signal is being transmitted (Variable, Low, High and PA).

- Mode (eligible parameter):

  Select the guard interval of the transmitted signal. The available options are 1/8, 1/16 and 1/32.

- Bandwidth (eligible parameter):

  Enter the transmitted signal bandwidth. The available options are 1.7, 5, 6, 7 and 8 MHz.

- Modulation (eligible parameter):

  Select the constellation of the transmitted signal. The available options are QPSK, 16 QAM, 64 QAM and 256 QAM.

- LDPC FEC (eligible parameter):

  Select the FEC value for the transmitted signal. The available options are 1/2, 3/5, 2/3, 3/4, 4/5 and 5/6.

- FFT (eligible parameter):

  Specify the FFT mode. The available options are 1K, 2K and 4K.

- Pilot Pattern (reading parameter):

  This field indicates the scattered pilot pattern used for the OFDM data symbols. The available options are between PP1 and PP8.

- Time Interleaving (editable parameter):

  This option indicates the number of Time Interleaving Blocks (TI blocks) per interleaving frame.

  The user must select, in how many TI blocks an interleaving frame is split.

  Only the time interleaving mode 0 (TIME_IL_TYPE=0) is supported, so one interleaving frame always equates to exactly one OFDM frame. To deactivate the time interleaving, this parameter must be set to 0.

  Press the OK button and then select the Up and Down buttons to configure the desired value.

- TS Bitrate (reading parameter):

  In this field it is displayed the bitrate of the transmitted signal according to the modulation parameters used.

When editable parameters are being set in the Web Server and new values are being introduced, the text remains in RED until the enter button is pressed. When the enter button is pressed, the new values are saved, and the text will appear in BLACK. It is necessary to press the enter button to save the new values in the transmitter.

7.2.2.18 DVB-S2 (Optional)

Figure 6.12: Web Server RF screen (DVB-S2)

- Frequency (editable parameter):

  Introduce the frequency at which the signal is being transmitted.

- Output Mode (eligible parameter):

  Specify the output mode.

  The available options are:

  - Low Carrier

- ▪ Carrier
- ▪ Modulator ON

- Power (editable parameter):

  Specify the power at which the signal is being transmitted.

- Mod / FEC (eligible parameter):

  Introduce the constellation and LDPC FEC value of the transmitted signal. (Constellation options are: QPSK, 8PSK, 16 APSK and 32 APSK) (LDPC FEC options are: 1/4, 1/3, 2/5, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10).

- Symbol Rate (editable parameter):

  In this field the symbol rate of the transmitted signal can be selected. The valid range is from 2 to 45 Mbaud/s.

- Bandwidth (reading parameter):

  In this field, the bandwidth of the transmitted signal is displayed according to the Symbol Rate and Roll Off parameters used.

- TS Bitrate (reading parameter):

  In this field it is displayed the bitrate of the transmitted signal according to the modulation parameters used.

- Roll Off (eligible parameter):

  In this field the value of the roll off factor can be chosen. The available options are 0.20, 0.25 and 0.35.

- Pilots (eligible parameter):

  In this field, selecting the ON option, carrier pilots are transmitted. If OFF option is selected, then no carrier pilots are transmitted.

- Spectrum (eligible parameter):

  Here the spectrum type is configured. Inverted spectrum is just another method to help preventing signal theft. The spectrum options are inverted and normal.

- 10 MHz (eligible parameter):

  10 MHz reference oscillator mode ON or OFF. This feature provides a reference signal to the satellite up-converter (BVC) when ON.

- BUC LO (eligible parameter):

   BUC LO is used in the transmission (uplink) of satellite signals. It converts a band of frequencies from a lower frequency to a higher frequency. In this option, the user can choose the local oscillator of the BUC. The available options are:

   - None
   - 12.80 GHz
   - 13.05 GHz

> When editable parameters are being set in the Web Server and new values are being introduced, the text remains in RED until the enter button is pressed. When the enter button is pressed, the new values are saved, and the text will appear in BLACK. It is necessary to press the enter button to save the new values in the transmitter.

7.2.2.19 DVB-S

Figure 6.13: Web Server RF screen (DVB-S)

- Frequency (editable parameter):

  Introduce the frequency at which the signal is being transmitted.

- Output Mode (eligible parameter):

  Specify the output mode which can be: Low Carrier, Carrier or Modulator ON.

- Power (editable parameter):

  Specify the power at which the signal is being transmitted.

- FEC (eligible parameter):

  Introduce the FEC value of the transmitted signal. The available FEC options are: 1/2, 2/3, 3/4, 5/6, 7/8.

- Symbol Rate (editable parameter):

  In this field the symbol rate of the transmitted signal can be selected. The valid range is from 2 to 45Mbaud/s.

- Bandwidth (reading parameter):

  In this field, the bandwidth of the transmitted signal is displayed according to the Symbol Rate and Roll Off parameters used.

- TS Bitrate (reading parameter):

  In this field it is displayed the bitrate of the transmitted signal according to the modulation parameters used.

- Spectrum (eligible parameter):

  Here the spectrum type is configured. Inverted spectrum is just another method to help preventing signal theft. The spectrum options are inverted and normal.

- 10 MHz (eligible parameter):

  10 MHz reference oscillator mode ON / OFF. This feature provides a reference signal to the satellite up-converter when ON.

- BUC LO:

  BUC LO is used in the transmission (uplink) of satellite signals. It converts a band of frequencies from a lower frequency to a higher frequency. In this option, the user can choose the local oscillator of the BUC.

  The available options are:

  - None
  - 12.80 GHz
  - 13.05 GHz

When editable parameters are being set in the Web Server and new values are being introduced, the text remains in RED until the enter button is pressed. When the enter button is pressed, the new values are saved, and the text will appear in BLACK. It is necessary to press the enter button to keep and save the new values on the screen.

7.2.3 UNIT

Encoder	RF	Unit

LEDs Status

ON/OFF: 🟩
RF: 🟩
ALARM: 🟥
STATUS: ☐

Alarms

WARNING: No SDI Input
WARNING: No Audio1 Input
WARNING: No Audio2 Input

Alarms configuration

☑ High Voltage
☑ Low Voltage
☑ High Temperature
☑ ASI Overflow
☑ No SDI Input
☑ No CVBS Input
☑ No HDMI Input
☑ No ASI Input
☑ No IP Input
☑ No Audio 1 Input
☑ No Audio 2 Input
☑ No GPS
☑ No RS232
☑ No KLV
☑ PA No Forward
☑ PA Rev High
☑ PA Volt Low
☑ PA Temp High
☑ Weight on Wheels
☑ TS Error

Monitor

Voltage: 17,9 V

Temperature: +32 ,9   °C ▾

Figure 6.14: Web Server UNIT screen

7.2.3.16 LEDs Status (reading parameters)

- ON/OFF:
    - If the Led is off the equipment is not being fed.
    - The Led lights up in green when the equipment is turned on.
    - If the Led is orange, the equipment is in standby mode.
- RF:
    - If the Led is off the equipment does not transmit RF signal.
    - The Led lights up in green when the equipment transmits RF signal, that is, RF stage is active.
- ALARM:
    - The Led lights up in red when any alarm occurs.
- STATUS:

    The Led lights up when a change in the configuration of the device is being processed.

7.2.3.17 Alarms (reading parameter)

In this option, different alarms which are present in the device are shown.

7.2.3.18 Alarms Configuration (eligible parameter)

In this option, the alarms to be shown can be selected.

The different alarms that can be configured to be shown are:

- High Voltage
- Low Voltage
- High Temperature
- ASI Overflow: this alarm means that the bit rate at the ASI input is higher than the one that can be modulated due to the parameters configured (constellation, FEC, GI...).
- No SDI Input: SDI source is not connected.
- No HDMI Input: HDMI source is not connected.
- No CVBS Input: CVBS source is not connected.
- No ASI Input: ASI source is not connected.
- No Audio 1 Input: Audio source is not connected.
- No Audio 2 Input: Audio source is not connected.
- No GPS: GPS source is not connected.
- No RS232: RS232 data source is not connected.
- No KLV
- PA No Forward
- PA Rev High

- PA Volt Low

- PA Temp High

- WeightOnWheels

- TS Error

7.2.3.19 Monitor

- Voltage (reading parameter):

  In this field, the power supply voltage of the transmitter is shown.

- Temperature (reading parameter):

  In this field, the internal temperature of the device is displayed.

7.2.3.20 Configuration

- Webserver Address (editable parameter)

  In this option the IP address of the device can be set if you want to control the device remotely. To change the IP address, introduce the desired number and then press enter to save the introduced value.

- Webserver Subnet (editable parameter)

  Here the Subnet Mask address of the device can be written. To change the Subnet Mask address, introduce the desired value and then press enter to save it.

- Webserver Gateway (editable parameter)

  In this option, the address of the Gateway must be written. To change the Gateway address, introduce the desired value and then press enter to save it.

- Webserver MAC (reading parameter)

  In this field, the MAC address of the device is shown.

- Standby Mode (eligible parameter)

  In this option the user can turn off or on the device by pressing On or Standby options.

- Admin Password (editable parameter):

  In this field, the administrator's password is introduced. It can be set to an own password which is a list of 8 digits. Then, to save the introduced value, press Enter button. There is the option to restore the default administrator password (00000000).

- User Password (editable parameter):

  In this field, the user's password is introduced. It can be set an own password which is a list of 8 digits. Then, to save the introduced value, press Enter button. There is the option to restore the default user password (00000000).

7.2.3.21 Miscellaneous

- Night Mode (eligible parameter):

  There are four possible states for the night mode. If the night mode is in state 0 then the light on the screen will be brighter than if it is in state 1. If the state is 3 then, the light on the screen will be the dimmest of the four possible states.

- S/N (reading parameter):

  In this field, the serial number of the device is displayed.

- Firmware (reading parameter):

  In this field, the number of the version installed in the device is displayed.

> When editable parameters are being set in the Web Server and new values are being introduced, the text remains in RED until the enter button is pressed. When the enter button is pressed, the new values are saved, and the text will appear in BLACK. It is necessary to press the enter button to save the new values in the transmitter.

7.2.3.22 Firmware Update

In this field, the user can upload the firmware .SVP file and upgrade the firmware remotely.

7.3 Web Page Setup Notes

For the data to be refreshed correctly, you may need to change some settings on your browser.

Please follow these instructions carefully.

For Google Chrome:

1. Click on the Chrome menu   situated in the toolbar of the browser.
2. Select tools.
3. Choose the option Delete navigation data.
4. Choose the option empty cache.
5. Click on Delete navigation data.

For Internet Explorer:

1. From the Tools menu, select Internet Options.

2. In the General tab, click on the Settings button in the Browsing History section.

3. Select 'Every time I visit the webpage' then click the OK button.

4. Click the OK button.

For Mozilla Firefox:

1. Open a new tab, in the address bar enter about:config.

2. In the Filter box, enter disk.

3. Set the value for 'browser.cache.disk.enable' to false (double click to change the setting).

4. Close the about:config tab.

8.1 Introduction

In this chapter, the block diagram of the HDT-02 Transmitter is explained.

This diagram has several parts related to the HDT-02 internal performance which are shown in blocks with different inputs and outputs.

In the first part, the outputs from the video encoder, Audio 1 encoder and Audio 2 encoder go to the multiplexer to obtain one common output signal. Then, the signal passes through the encryption system to make the message unintelligible at a receiver not equipped with an appropriately configured decryption device. In the same way, the ASI transport stream can be scrambled in BISS 1 or BISS E, with a Session Word, or encrypted with AES128 and AES256. This is an ultimate solution for reliable and interoperable protection of the communication. As it is explained in the manual, if NONE option is selected the signal will not be encrypted.

Once the signal has passed the encryption block, it passes through the DVB-T/T2/S/S2 modulator. In this part, the signal is modulated according to the needed requirements and a digital signal is obtained. The next step is to go to the DAC converter to obtain an analogue signal. There are two digital to analog converters blocks. The first one provides a 70 MHz output and the other one goes to the Quadrature Modulator which is a general technique of modulating employing a VCO & PLL system. Thanks to the VCO & PLL block, the system frequency can be configured, and then, in the output of the Quadrature Modulator block, the RF signal is obtained.

The next block consists of a variable attenuator that controls the output power. Then a splitter is required, which distributes the signal to four different amplifier blocks. In this way, there are four different outputs, one for DVB-S/S2 L-Band and three for DVB-T/T2 1-6,4 GHz depending on the user necessities. The 10 MHz oscillator is used for the synchronization of the BUC and it can be enabled or disabled.

At the bottom of the diagram, there is a FPGA Controller, which is responsible for controlling all the system. This block also controls the Remote Control (RTC), the Power Amplifier (PA), the temperature and the voltage. It has an USB and Ethernet control connection too.
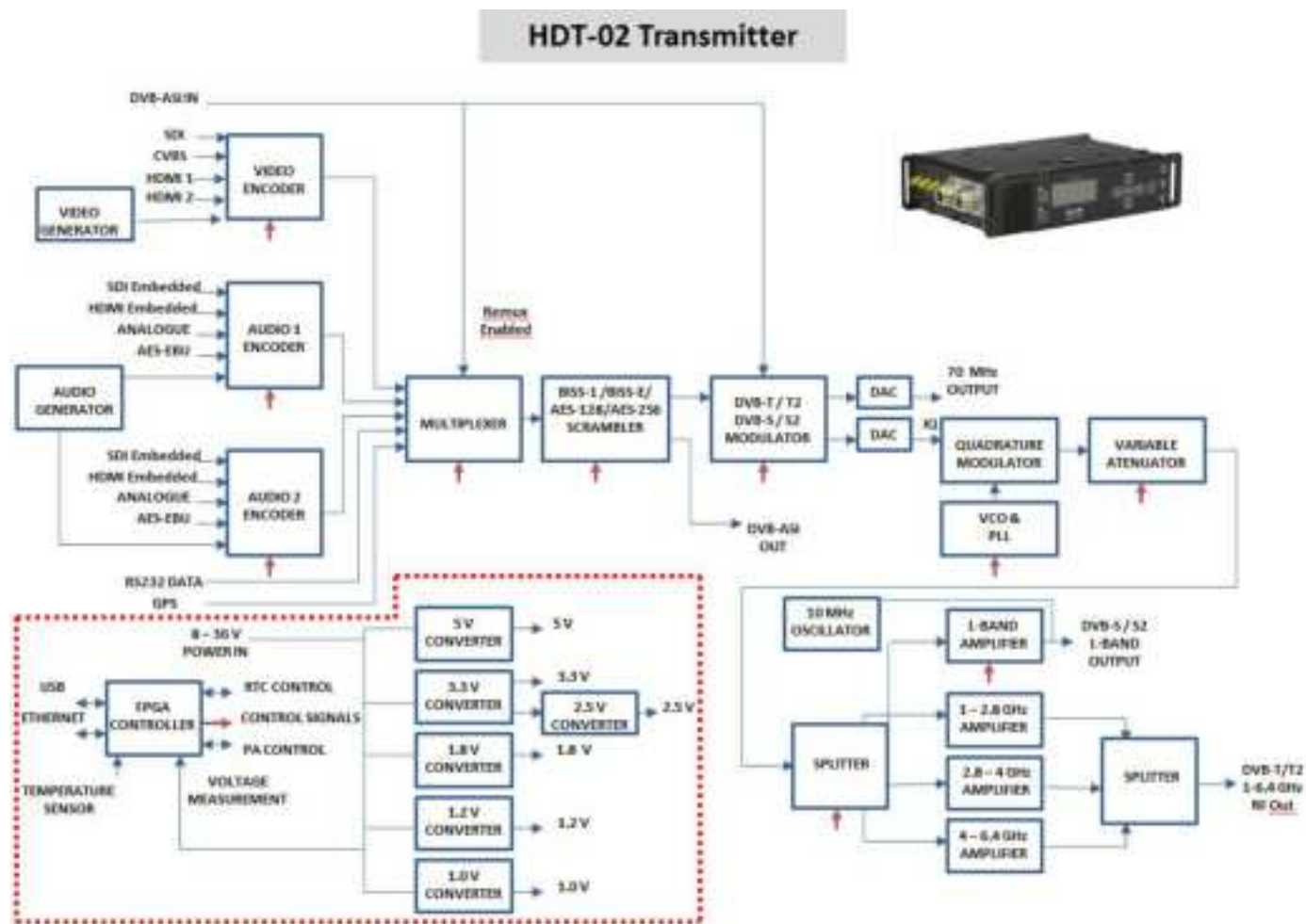
Figure 7.1: HDT-02 Block Diagram

9.1 Introduction

This chapter provides important information for the transmitter system installation such as connections available in the rear and front panel of the HDT-02 Transmitter and their pinout, needed connectors and the accessories which are available with the transmitter device.

9.2 Connections

Every connection of the HDT-02 camera transmitter is on the rear panel, except for the RF antenna connections that are on the front panel.

> All the Lemo part numbers and pinout refer to the connector of the HDT-02. The pinout is shown as it is seen in the HDT-02.

> In all the Lemo connectors, the pin number one is circled and the succeeding pins are in counter clockwise order.

All input and output connections of the transmitter are shown in the figure below:
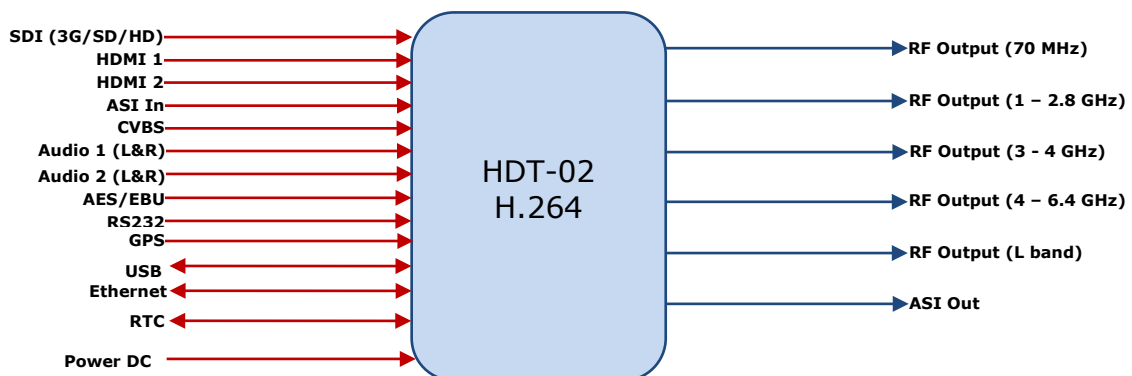
Figure 9.1: HDT-02 connections

The following figures show the HDT-02 front and rear panel. Connections mentioned in the upper figure are shown below.
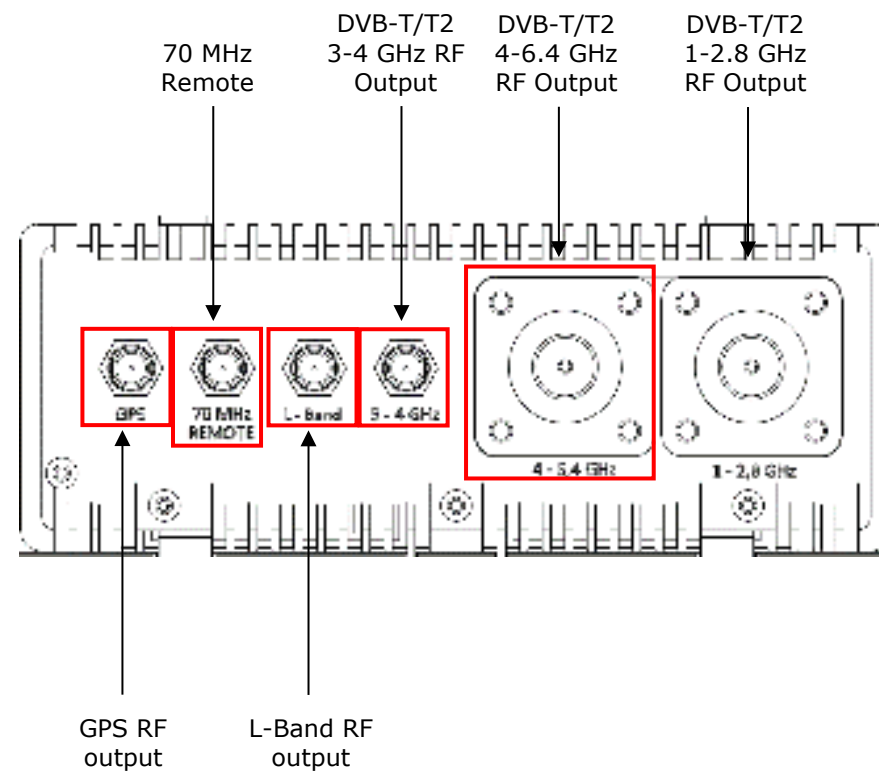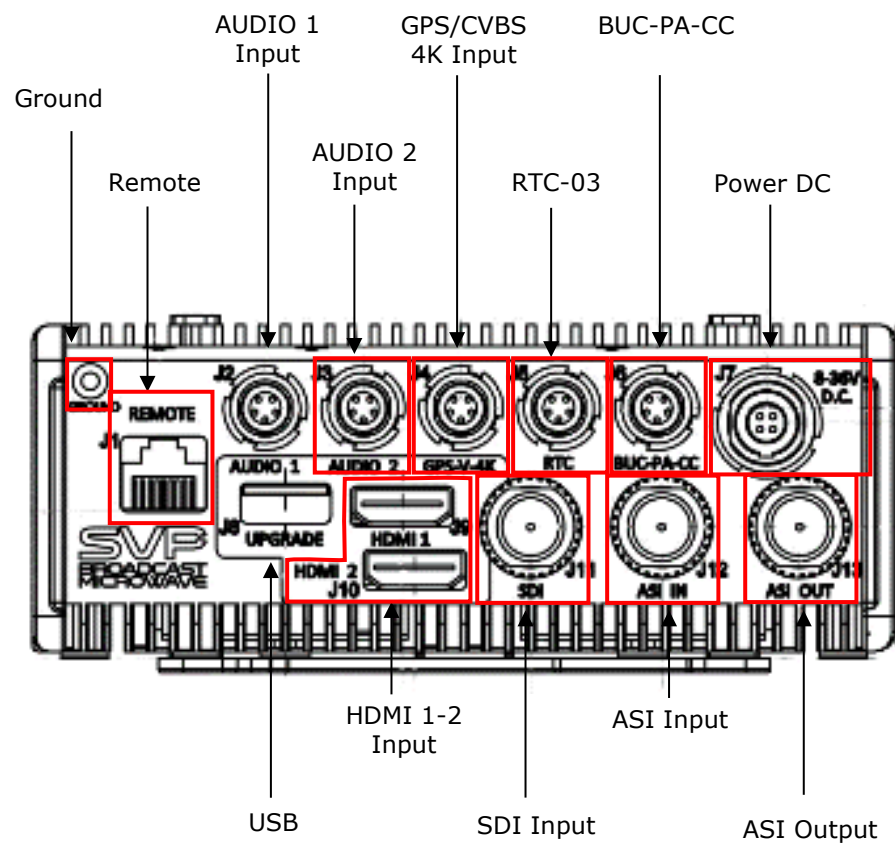
Figure 8.2: Rear and front view of the HDT-02

9.2.1 Power supply

The equipment is powered by a DC source from 8 to 36 V. If the input voltage of the equipment is out of that range, the LED of the equipment blinks GREEN and RED showing an alarm.

> The power source of the HDT-02 should be the same as the one used for the PA. Both should be turned on and off simultaneously. They must use the same breaker.

The DC power supply is connected to the equipment via a 4 pin Lemo 1B connector.

Power supply connection technical features

Item	Features
Connector label	8-36V D.C.
Connector type	4 pin Lemo 1B
Part number (HDT-02)	ECG.1B.304
Part number (cable connector)	FGG.1B.304.CLAD52
Input voltage range	8-36 V.
Consumption	20 Watt.

Table 9.1: Power supply connection technical features
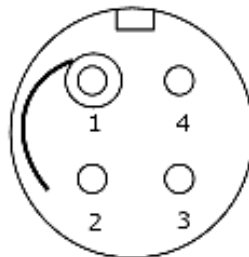
Pinout

Figure 9.2: Connector pinout

Pin	Description
1	GND
2	GND
3	+ VCC
4	+ VCC

Table 9.2: Power supply connector pinout

9.2.2 BUC-PA-CC Connector

The HDT-02 Transmitter incorporates an input to control remotely the PA-10 Power Amplifier.

BUC-PA-CC Connector technical features

Item	Features
Connector Label	BUC-PA-CC
Connector type	7 pin Lemo 0B
Part number (HDT-02)	ECG.0B.307.CLV
Part number (cable connector)	FGG.0B.307.CLAZ

Table 9.3: BUC-PA-CC Connector features

Pinout of the connector
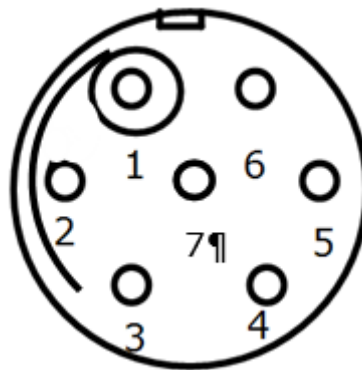
Pin	Description
1	GND
2	TX (-)
3	TX (+)
4	Weight on Wheels (WoW)
5	PA ON/OFF
6	RX (+)
7	RX (-)

Table 9.4 BUC-PA-CC connector pinout

Weight on Wheels System (WoW)

Pin 4 of this connector is prepared for automatically shut down the transmission when the aircraft lands.
We have 2 WoW options in the Unit / Miscellaneous menu.

If we select <15V.:
- If the WoW input detects a voltage higher than 15V, it will be able to transmit.
- If the WoW entry is on air, it will not be able to stream.
- If the WoW input is GND, it will not be possible to transmit.

If we select >15V.:
- If the WoW input detects a voltage higher than 15V, it will not be able to stream.
- If the WoW entry is on the air, it will be able to stream.
- If the WoW input is GND, you will be able to transmit.

9.2.2.16 BUC Connection pinout

When the Transmitter is configured in DVB-S/S2, the communication with the BUC is made through a RS422 port. The pinout of the connector is indicated on the following table:

BUC Connection pinout

Pin	Description
1	GND
2	TX (-)
3	TX (+)
6	RX (+)
7	RX (-)

Table 9.5: BUC Connection pinout

9.2.2.17 HDT-02 to PA Control Cable pinout

If the transmitter is configured to be used with PA Power Amplifiers, the communication and control is made through a RS232 port. The pinout of the cable which interconnects the HDT-02 Transmitter and PA Power Amplifier is indicated in the following table:

HDT-02 to PA Control Cable pinout

BUC-PA-CC Cable Connector (Lemo FGG.0B.307)	PA Remote Cable Connector (JD38999/26WA35SN Amphenol)
Pin 1	Pin 1
Pin 2	Pin 6
Pin 5	Pin 5
Pin 7	Pin 2

Table 9.6: HDT-02 to PA Control Cable pinout

9.2.3 RTC Connector

This is the connector for the RTC-03 Remote Control. It is 4 pin Lemo 0B connector, located on equipment's rear panel.

The RTC is supplied by the transmitter device to the device input power supply.

RTC Connector technical features

Item	Features
Connector Label	RTC
Connector type	4 pin Lemo 0B
Part number (HDT-02 connector)	EGG.0B.304.CLV
Part number (Cable connector)	FGG.0B.304.CLAZ

Table 9.7: RTC Connector technical features

Pinout of the connector
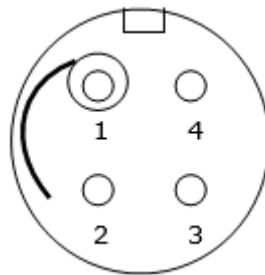
Pin	Description
1	GND
2	RS 485 (+)
3	RS 485 (-)
4	9 to 36 V.DC

Table 9.8: RTC connector pinout

9.2.3 GPS-V-4K

This connection is mainly used to allow the CVBS video input signal and to transfer RS232 user data.

GPS-V-4K connection technical features

Item	Features
Connector Label	GPS-V-4K
Connector type	6 pin Lemo 0B
Part number (HDT-02 connector)	ECG.0B.306.CLV
Part number (Cable connector)	FGG.0B.306.CLAZ

Table 9.9: GPS-V-4K connection technical features

Pinout of the cable connector (Watched from the soldering side)
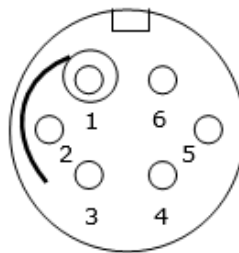
Pin	Description
1	GND
2	Video CVBS
6	RS232 DATA

Table 9.10: RS232/CVBS cable connector pinout

9.2.4 Video inputs

HDMI 1 and 2 connection technical features

Item	Features
Connector Label	HDMI 1 HDMI 2
Connector type	Type A

Table 9.11: HDMI input signal connection features

SDI connection technical features

Item	Features
Connector Label	SDI
Connector type	Female BNC
Impedance	75 Ω
Input Level	800 mVpp nominal ±10%
Standards	SMPTE-259M and SMPTE-272M SMPTE-292M and SMPTE-299M SMPTE-425M
Bitrate	SD: 270 Mbit/s, HD: 1485 Mbit/s, 3G: 3 Gbit/s

Table 9.12: SDI input signal connection features

ASI IN connection technical features

Item	Features
Connector label	ASI IN
Connector type	BNC
Impedance	75 Ω
Standard	EN50083-9
Maximum Bitrate	216 Mbps

Table 9.13: ASI Transport Stream input connection features

9.2.5 Audio inputs

The HDT-02 Transmitter has four possible Audio inputs:

- 2 Audio inputs to insert 2 stereo channels AES/EBU, 2 stereo or 4 mono analogue (mic phantom, mic dynamic and line) signals where connections are made using two 5 pin Lemo 0B connectors on equipment's rear panel.

- 1 input to insert either 4 Audio channels embedded on a SDI signal where connections are made with a BNC connector on equipment's rear panel.

- 1 HDMI input to insert HDMI embedded Audio signals where connections are made with a HDMI connector on equipment's rear panel.

Embedded Audio signals must be compliant with SMPTE-272M standard when embedded on SD-SDI video signal, with SMPTE-299M standard when embedded on HD-SDI video signal and with SMPTE-425M standard when embedded on 3G-SDI video signal.

AES/EBU and analogue Audio input technical features

Item	Features
Audio channel number	4
Connector labels	AUDIO 1
	AUDIO 2
Connector type	5 pin Lemo 0B
Part number (HDT-02 connector)	ECG.0B.305.CLV
Part number (Cable connector)	FGG.0B.305.CLAZ

Table 9.14: AES/EBU and analogue Audio input connection technical features

Pinout of the cable connector (Watched from the soldering side)
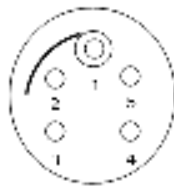
Pin	Description
1	A1L+ / AES1P
2	A1L- / AES1N
3	GND
4	A1R+
5	A1R-

Table 9.15: AES/EBU and analogue Audio cable connector pinout

9.2.6 Remote

This connection allows the user to monitor and setup any parameter of the transmitter through Web Browser. The connector used is a RJ-45.

Remote connection technical features

Item	Features
Connector Label	REMOTE
Connector type	RJ-45

Table 9.16: Ethernet remote connection technical features

9.2.7 UPGRADE (USB)

Through the USB connection, it is possible to update the firmware of the transmitter directly from an external USB device.

USB connection technical features

Item	Features
Connector Label	USB
Connector type	Type A

Table 9.17: USB input connection technical features

9.2.8 RF output

The antenna or Power Amplifier is directly connected to the female N-type or SMA-type connectors on the front panel of the HDT-02 camera transmitter. There are up to six connectors available, each one for a different frequency band (type N for the 1-2.8 GHz band, type SMA for 3-4 GHz band, type N for 4-6.4 GHz band, type SMA for the L band, 70 MHz SMA connector and SMA connector for GPS antenna)

RF connection technical features

Item	Features
Connector label	1-2.8 GHz
Connector type	N female
Output frequency range	1 to 2.8 GHz
Impedance	50 Ω
Output power	Maximum: 100 mW

Item	Features
Connector label	3-4 GHz
Connector type	SMA female
Output frequency range	3 to 4 GHz
Impedance	50 Ω
Output power	Maximum: 100 mW

Item	Features
Connector label	4-6.4 GHz
Connector type	N female
Output frequency range	4 to 6.4 GHz
Impedance	50 Ω
Output power	Maximum: 100 mW

Item	Features
Connector label	L-Band
Connector type	SMA female
Output frequency range	L band
Impedance	50 Ω
Output power	Maximum: +5dBm

Item	Features
Connector label	70 MHz
Connector type	SMA female
Output frequency range	70 MHz
Impedance	50 Ω
Output power	-10 dBm (DVB-T/T2) -14 dBm (DVB-S/S2)

Item	Features
Connector label	GPS Antenna
Connector type	SMA female
Impedance	50 Ω

Table 9.18: RF output connections characteristics

9.2.9 ASI output

ASI output signal type uses 75Ω BNC connector. This connector is placed on transmitter's rear panel.

It is important that 75 Ω connectors are used. This is because the female output connector of the HDT-02 unit could be damaged because of an impedance mismatch.

ASI connection technical features

Item	Features
Connector label	ASI-OUT
Connector type	BNC female
Impedance	75 Ω
Standard	EN50083-9
Maximum Bitrate	100 Mbit/s

Table 9.19: DVB-ASI Transport Stream output connection features

9.3 Mechanical Accessories

In this section, different short of accessories of the HDT-02 H.264 Transmitter are shown.

The accessories required by the customer must be defined when the transmitter is ordered.

9.3.3 Battery Fastening

This item allows the connection to the battery (V type or Anton Bauer) to the transmitter's case (optional).

The type of the battery fastening must be defined when the transmitter is ordered.

Figure 9.3: V type battery fastening

Chapter 10: Remote Control

10.1 Introduction

The RTC-03 equipment is compact lightweight Remote Controller for SVP Broadcast Microwave transmitters. They can control the HDT-04 and the HDT-02 Transmitters.

Thanks to this equipment, the user can control the transmitter remotely in an easy and comfortable way. The RTC-03 front panel consists of several switch which allow the user to configure and modify different features such as the actuator arm state (up/down), the level of the RF and the profile selected.

This equipment is especially useful in applications where the HDT-02 or HDT-04 Transmitter is mounted away from the operator and the parameters can't be modified directly from the front panel.

10.2 RTC-03

10.2.1 Remote Control Operation

This chapter provides the user with all the necessary information to control and operate the equipment properly.

Figure 10.1: RTC-03-A and RTC-03-B front view

Figure 10.2: RTC-03-0 front view

There are several buttons in the front panel of the device that allows the control of the HDT-02 and HDT-04 Transmitter remotely.

- Actuator

  This Up/Down switch is used to control the antenna actuator in different systems. With this switch, it is possible to move the antenna up and down remotely. It has also two LEDs to indicate the status of the actuator (Up or Down).

  In order to disable the actuator function, please you hold down the PROFILE button and press the Actuator DOWN button for 3 seconds.

- Standby/RF

  To select the amplifier output power level or leave it in standby mode please move this selector. The options available are:

    - Standby "."

    - RF Off "o"

    - Low power "L"

    - Medium power "M"

- High power "H"

• Profiles

   With this button, the user can choose between different profiles which have been configured previously. There are seven profiles available. Each profile has different features related to the type of transmission system, the frequency at which the signal is going to be transmitted, the bitrate, the type of video input, the type of Audio 1 and Audio 2 inputs, the video delay and the codification profile.

10.2.2 Connections

This chapter provides important information such as connections available in the Remote Control and the connectors needed.

Figure 10.3: RTC-03-A and RTC-03-B rear view

Figure 10.4: RTC-03-0 rear view

Note: The ground connection is grounded in the equipment, size is M3.

How to Order:

O = No Actuator	O = No NVIS	H = Active at High Level
A = Type A Actuator	N = NVIS	L = Active at Low Level
B = Type B Actuator		
Actuator Type	NVIS Option	Radar Polarity Option
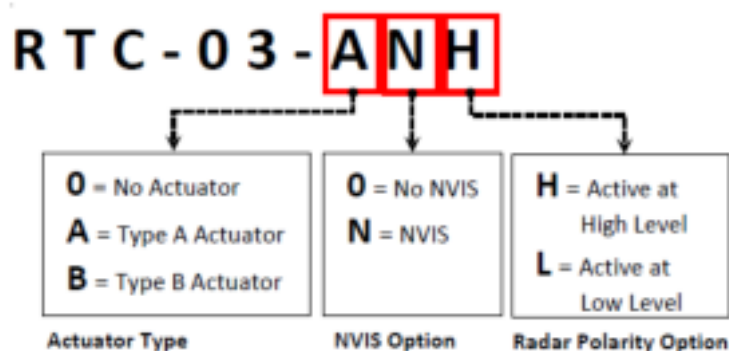
10.2.2.1 Transmitter Dimmer Connector J1 (NVIS Option)

This connector is used for the communication between (J1) HDT-02 Transmitter and the RTC-03 Remote Control.

Transmitter Dimmer connection technical features

Item	Features
Connector label	TRANSMITTER DIMMER J1
Connector type	MIL-DTL-38999 Series 3 D38999/24
Part number E.g. (RTC-03 connector)	D38999/24WA35PN
Part number E.g. (cable connector)	D38999/26WA35SN

Table 10.1: Transmitter Dimmer connection technical features

Transmitter Dimmer connector pinout

Pin	Description
1	GND
2	RTC RS485 (+) Half Duplex
3	RTC RS485 (-) Half Duplex
4	+V power supply
5	NVG Dimmer
6	Dimmer Enable

Table 10.2: Transmitter Dimmer connector pinout

Pin 6 of Dimmer Enable has the function of enabling the external Dimmer. For this purpose, you have to connect Pin 6 from J1 to GND.

Please note that NVIS Dimmer signal is 0 to 5 Volts.

When pin 6 is not connected to GND, the brightness is controlled manually. That means the brightness is controlled by pushing STBY/RF button and then rotating it, it has 9 levels of brightness. To set a level, push the button until the level number is steady.

10.2.2.2 Actuator Arm Altimeter Connector

This connector is used for the communication between (J2) HDT-04 Transmitter and the actuator arm. This connector has different pinouts depending on the internal selection of the actuator type; type A or Type B as described below.

Actuator Arm Altimeter connection technical features

Item	Features
Connector label	ACTUATOR ARM ALTIMETER J2
Connector type	MIL-DTL-38999 Series 3
	D38999/24
Part number E.g. (RTC-03 connector)	D38999/24WB35SN
Part number E.g. (cable connector)	D38999/26WB35PN

Table 10.3: Actuator Arm Altimeter connection technical features

RTC-03 connector pinout for Type A actuator (P/N: RTC-03-A)

Pin	Description
1	Switch common
2	Retract
3	Extend
4	Actuator power Out GND
5	Actuator power Out +28V
6	Limit Switch common
7	Altimeter
8	GND
9	Not Used
10	+ 28V. DC
11	28V DC Return
12	Not Used
13	Not Used

Table 10.4: Connector pinout for Type A actuator

RTC-03 connector pinout for Type B actuator (P/N: RTC-03-B)

Pin	Description
1	Not Used
2	Down indicator
3	Up command
4	GND Chassis
5	Up indicator
6	Down command
7	Altimeter
8	GND
9	Not Used
10	+28V. DC
11	28V. DC Return
12	Not Used
13	Not Used

Table 10.5: Connector pinout for Type B actuator

The equipment supports two polarity options to automatically retract the arm, this is made based on the altimeter radar signal. There are two optionsm this should be defined in the P/N when ordering the remote control. Low level (bring pin 7 to GND), or high level (bring pin 7 to + 28V DC).

10.2.3 Alarms

The RTC-03 Remote Control shows transmitter alarms. When there is an alarm there will be a point in the profile screen.

10.3 RS-485 Operation

10.3.1 PC Control Operation

The HDT-02 can be controlled remotely from a computer via RS-485 commands using the RTC connector.

The port must be configured as; 8 bits, 1 stop bit, no parity and 9600bps.

In the transmitter you need to select the RTC-03 remote control.

First you need to check the transmitter configuration by sending the following command:

0x7D 0x04 0x01 0xB8 CHK 0x7D

The transmitter answers a message with the following format:

0x7D 0x07 0x22 WW XX YY ZZ CHK 0x7D

The bytes WW XX YY ZZ can be seen as a 32 bit word. In this word the meaning of the bits are (MSB first)

31-26 => not of interest

25-20 => profile enable/disable   Bit 25 => Profile 7 enable/disable

                                            Bit 24 => Profile 6 enable/disable

                                            Bit 23 => Profile 5 enable/disable

                                            Bit 22 => Profile 4 enable/disable

                                            Bit 21 => Profile 3 enable/disable

                                            Bit 20 => Profile 2 enable/disable

19 => PA at HIGH POWER

18 => PA at LOW POWER

17 => PA at MEDIUM POWER

16-9 => not of interest

8 => RF status (0:OFF 1:ON)

7 => ON/OFF status (1:OFF 0:ON)

6-0 => selected profile   Bit 6 => Profile 7 selected

                                              Bit 5 => Profile 6 selected

                                              Bit 4 => Profile 5 selected

Bit 3 => Profile 4 selected

Bit 2 => Profile 3 selected

Bit 1 => Profile 2 selected

Bit 0 => Profile 1 selected

CHK is the XOR of all the previous bytes, excluding the first byte with value 0x7D.

The message that you can send from the PC to the transmitter to change its configuration must have the following format:

0x7D 0x07 0x23 WW XX YY ZZ CHK 0x7D

The bytes WW XX YY ZZ can be seen as a 32 bit word. In this word the meaning of the bits are (MSB first)

26-24 => profile select

Profile 1 => 001

Profile 2 => 010

Profile 3 => 011

Profile 4 => 100

Profile 5 => 101

Profile 6 => 110

Profile 7 => 111

27 => ON/OFF (0:OFF 1:ON)

28 => RF ON/OFF (0:OFF 1:ON)

29 => PA at LOW POWER

30 => PA at MID POWER

31 => PA at HIGH POWER

23-0 => not interesting

CHK must be set to the XOR of all the previous bytes, excluding the first byte with value 0x7D.

The transmitter will answer a message with the following format:

0x7D 0x07 0x32 WW XX YY ZZ CHK 0x7D

The bytes WW XX YY ZZ can be seen as a 32 bit word. In this word the meaning of the bits are (MSB first)

31-26 => not of interest

25-20 => profile enable/disable

Bit 25 => Profile 7 enable/disable

Bit 24 => Profile 6 enable/disable

Bit 23 => Profile 5 enable/disable

Bit 22 => Profile 4 enable/disable

Bit 21 => Profile 3 enable/disable

Bit 20 => Profile 2 enable/disable

19 => PA at HIGH POWER

18 => PA at LOW POWER

17 => PA at MEDIUM POWER

16-9 => not of interest

8 => RF status (0:OFF 1:ON)

7 => ON/OFF status (1:OFF 0:ON)

6-0 => selected profile

Bit 6 => Profile 7 selected

Bit 5 => Profile 6 selected

Bit 4 => Profile 5 selected

Bit 3 => Profile 4 selected

Bit 2 => Profile 3 selected

Bit 1 => Profile 2 selected

Bit 0 => Profile 1 selected

> An important note to keep in mind. As the communication is half-duplex, and the master is the transmitter, to send a command to the transmitter you must wait to receive a message first, wait 20 ms, and send only one message.

Chapter 11: Mechanical Dimensions

In this chapter, the mechanical drawings of the units described in this manual are included.

11.1 HDT-02 Transmitter
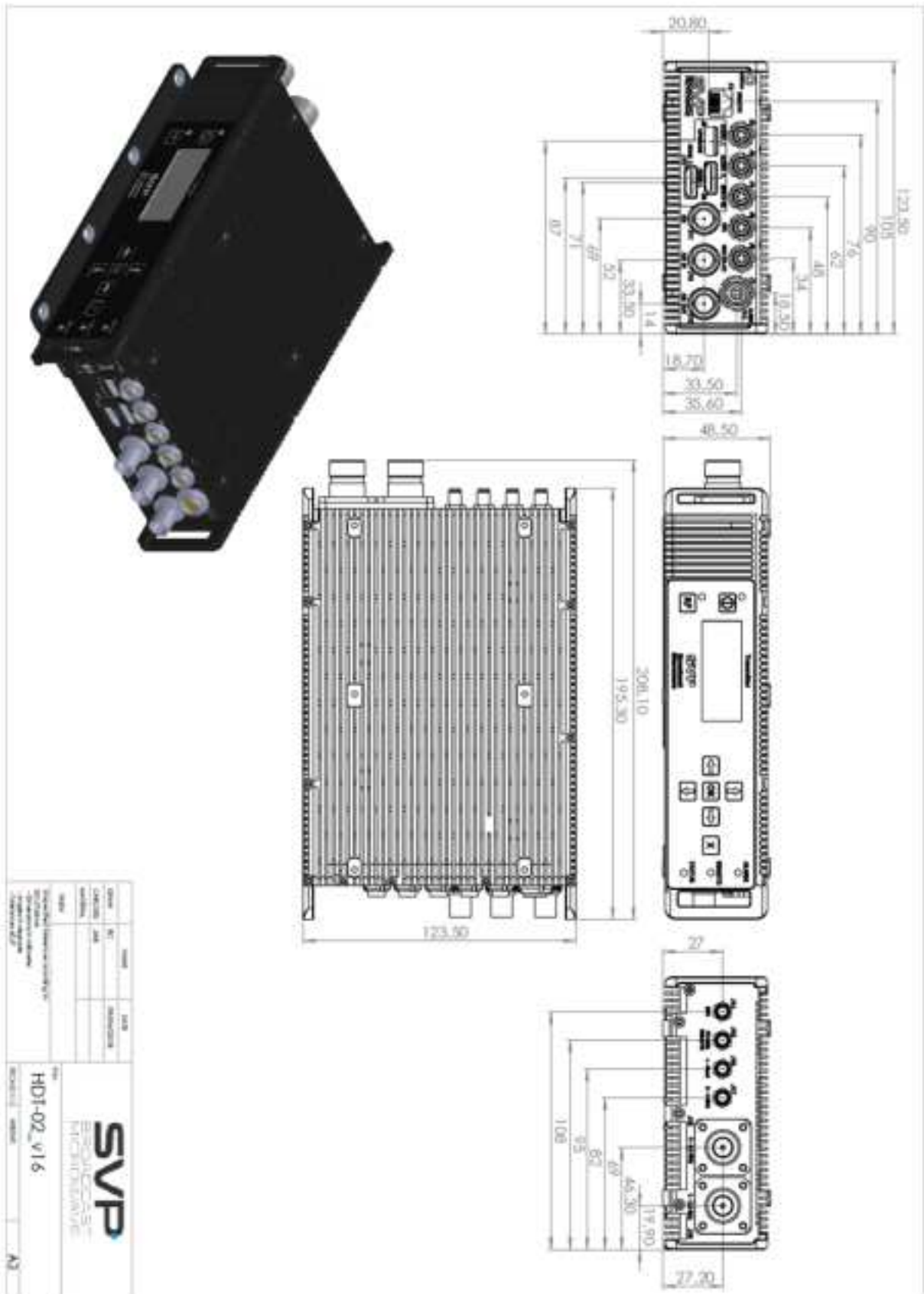
In the following figure, the procedure to follow for assembling the different parts of the HDT-02 transmitter is shown.
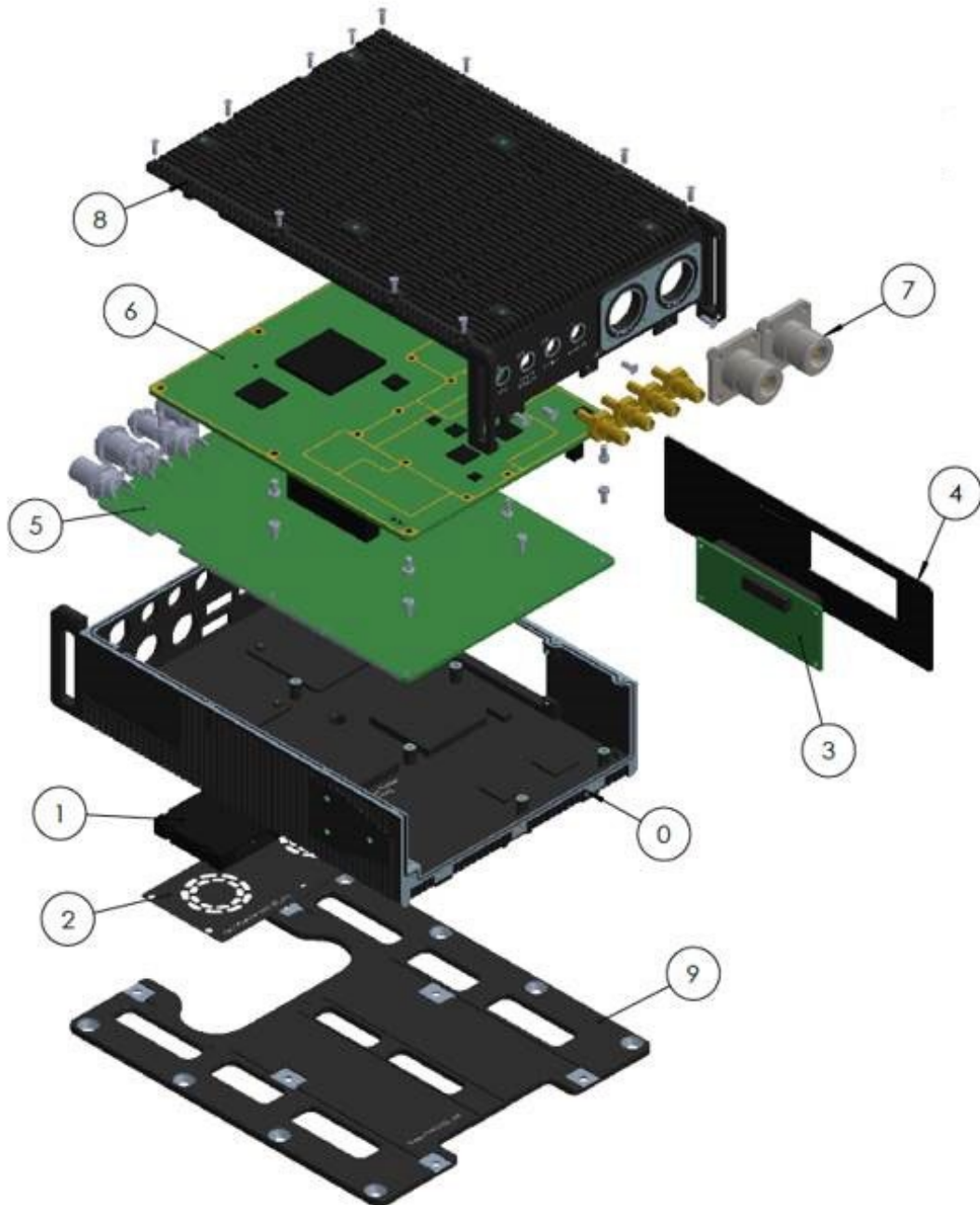
11.2 PA Standard and PA Ultralinear Power Amplifiers
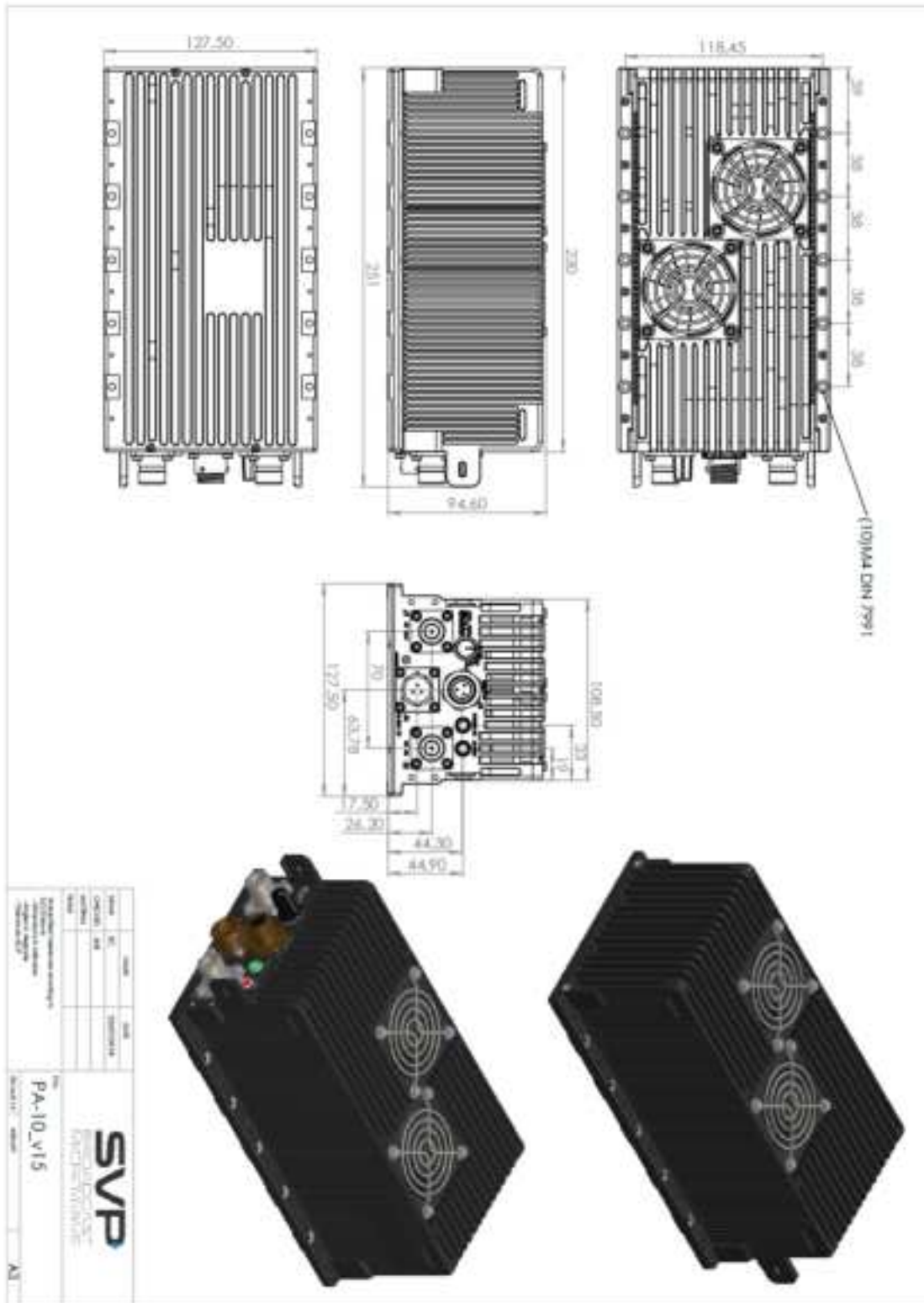
11.3 PA Standard and PA Ultralinear Power Amplifiers Installation

ISO 14581 M4 (10 Units)

11.4 RTC-03 Remote Control

11.5 CLTX-01 Support

HDT-02_H.264 *High Definition Digital Camera Transmitter*
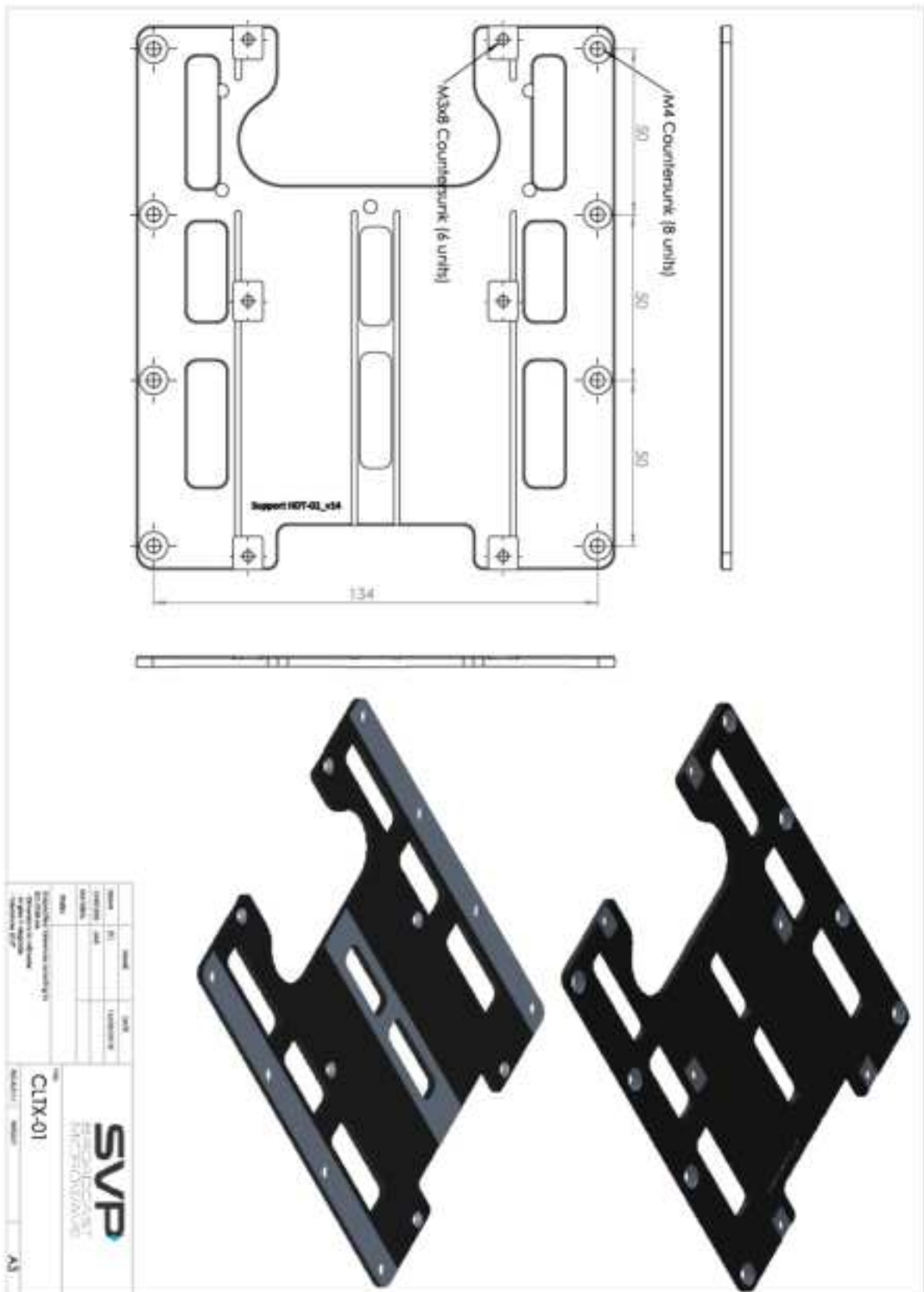
11.6 CLTX-02 Support Installation

ISO 14581 M4 (8 Units)

ISO 14581 M3x8 (6 Units)

11.7 GPS-01 Antenna & Receiver

P/N: GPS-01

conector
FGG.0B.306.CLAZ

54,90
48
56,80
5M

14,50
Ø3,50
61,50
7
3,25

M3x0,5↧3,6
45°
Ø3,10
Ø49,30

	NAME	DATE
DRAW	EC	04/09/2017
CHECKED	JAB	
MATERIAL		
FINISH		

Unspecified tolerances according to
ISO-2768-mk
- Dimensions in millimeter
- Angles in degrade
- Tolerances ±0,9°

P/N
GPS Receiver

ESCALE:1:1 | WEIGHT: | A4
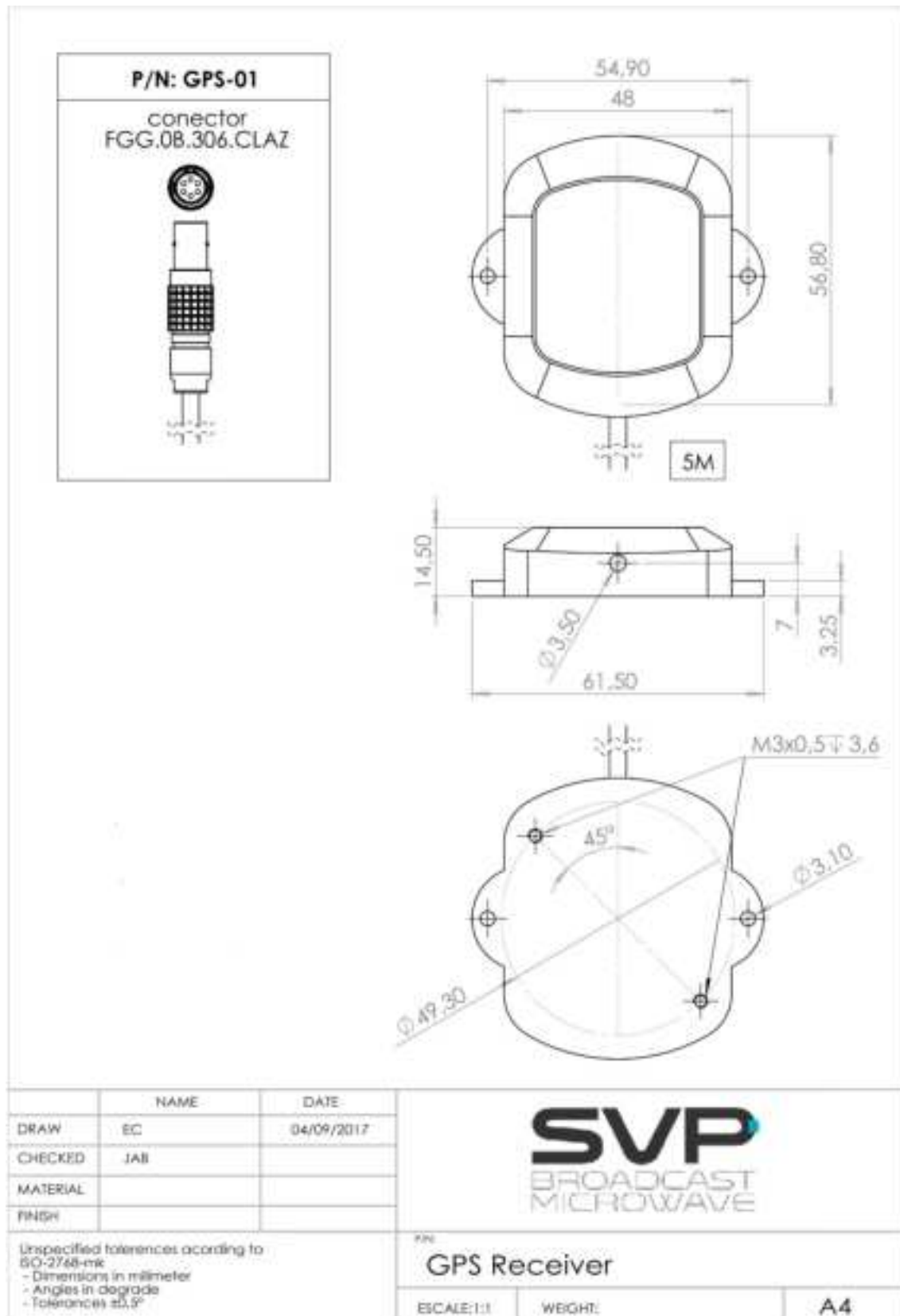
Chapter 12: Preventive Maintenance

To ensure system longevity, it is highly recommended that the following preventive maintenance procedures be done at the appropriate time.

12.1 Maintenance Schedule

Procedure	Yearly	Quarterly	Monthly	Prior each use
Inspect wiring	✓			
Inspect the cables connection		✓		
Inspect the antenna connection			✓	✓(*)

Table 10.1. Maintenance Schedule table

(*) If the HDT-02 installation is constantly changed, prior to each use make sure the RF output is loaded.

12.2 Maintenance Procedures

Quarterly, the following inspections should be done:

- Inspect antenna installation to ensure all components are secure and in good conditions.
- Inspect cables and connections.

12.3 Spare Parts

The transmitter system has no user replaceable parts. Contact SVP Broadcast Microwave for all service and repair inquiries.

Contact email: info@svpbm.com

Note: Any attempts to service individual components may make the warranty void.

Chapter 13: Warranty

13.1 Warranty information

Under recommended use and service, all SVP Broadcast Microwave products are warranted against defects in material and workmanship to twenty-four (24) months from the date of original shipment.

SVP Broadcast Microwave's obligation is limited to repairing or replacing, at our plant, products, which prove to be defective during the warranty period.

Under no circumstances shall the warranty be transferred or assigned to any third party unless consent in writing has first been obtained from SVP Broadcast Microwave. SVP Broadcast Microwave shall not be under any liability for warranty in respect to any equipment, which shall be sold by the Customer to any third party unless otherwise agreed in writing.

SVP Broadcast Microwave is not liable for consequential damage resulting from the use of SVP Broadcast Microwave equipment.

13.2 Claim for damage in shipment

Your unit should be inspected and tested as soon as it is received. Claims for damage should be filed with carrier.

13.3 Return procedures

All claims under warranty must be made promptly after occurrence of circumstances giving rise to the claim and must be received within the applicable warranty period by SVP Broadcast Microwave or its authorized representative. SVP Broadcast Microwave reserves the right to reject any warranty claim not promptly reported. After expiration of the applicable warranty period, products are not subject to adjustment.

Before any Product is returned for repair and / or adjustment, authorization from SVP Broadcast Microwave for the return and instructions as to how and where the Product should be shipped must be obtained. The Product type, serial numbers, and a full description of the circumstances giving rise to the warranty claim should be included. Such information will help establish the cause of failure and expedite adjustment or repair.

Important

Any Product returned without complete information will be considered not to have met all contractual requirements. Information required includes (as a minimum): Model Number, Serial Number, Description, Hours of Use, Type of Failure, and Operating Conditions during failure.

13.4 Transportation and packaging

Any Product returned for examination must be sent prepaid via the means of transportation indicated as acceptable by SVP Broadcast Microwave. SVP Broadcast Microwave reserves the right to reject any warranty claim on any item that has been altered or has been shipped by non-acceptable means of transportation. Returned Products should be carefully packed and unless otherwise indicated, shipped to:

> SVP Broadcast Microwave
> Zubiaurre 7
> 48215 Iurreta
> Vizcaya
> Spain

13.5 Authorization for evaluation

When any Product is returned for examination and inspection, or for any other reason, Customer and its shipping agency shall be responsible for all damage resulting from improper packing or handling, and for loss in transit, notwithstanding any defect or nonconformity in the Product. By returning a Product, the owner grants SVP Broadcast Microwave permission to open and inspect the returned Product to determine the cause of failure, and SVP Broadcast Microwave's determination with regard hitherto shall be final.

If it is found that the Product has been returned without cause and is still serviceable, the Customer will be notified and the Product returned with appropriate inspection charges billed, at SVP Broadcast Microwave's discretion, to the Customer.

Annex A: PA Standard and PA Ultralinear Power Amplifiers

<u>Important Notes</u>

1. Read the instructions carefully before connecting the machine.

2. In our effort to improve our products constantly, we may change their specifications without prior notice.

3. Use high quality, low loss cables and connectors to ensure proper functioning of the equipment's features.

4. This equipment is to be installed and operated by qualified personnel only.

5. The equipment has a two-year warranty that covers any failure or manufacturing defect, providing it is not handled by anyone other than SVP Broadcast Microwave personnel and the warranty seal has not been broken.

A.1 Introduction

The PA Power Amplifier expands the possibilities of COFDM digital links on the market. Low intermodulation and high reliability make these Amplifiers especially interesting for broadcast and airborne applications.

This PA can be controlled from the HDT-02 remotely thanks to the RS-232 communication.

An excellent design, mechanical and electronic assembly make the PA a robust and reliable solution.

Figure A.1: PA Power Amplifiers

A.2 PA Ultralinear & PA

A.2.1 Technical Specifications

PA Ultralinear

Item	Features
Max. Output power	15 W linear in 2.0 to 2.4 GHz
	10 W linear in 2.3 to 2.7 GHz
	10 W linear in 3.3 to 3.6 GHz
Selectable output power level	3 output power levels selectable
Frequency range	2,000 – 2,400 MHz
	2,300 – 2,700 MHz
	3,300 – 3,600 MHz
Input level	+13 dBm to +20 dBm (ALC)
Shoulders rejection	>40dB @ 10 Watts
	>35dB @ 15 Watts
I/O Impedance	50 ohm, >10 dB return loss
Supply Voltage	9 to 36 VDC
Power consumption	80 W
Operating temperature range	-20ºC to +50ºC
Mechanical dimensions	251x 127.5 x 94.6 mm
Weight	2.5 kg
P/N	PA-15-2024U
	PA-10-2324U
	PA-10-3336U
	Arinc front Hook versions:
	PA-15-2024UH
	PA-10-2324UH
	PA-10-3336UH

Table A.1 PA Ultralinear Main Characteristics

PA Standard

Item	Features
Frequency range/Max power	1.3 to 1.55 GHz for 10W 1.7 to 2.2 GHz for 10W 4.4 to 5 GHz for 10W 5.0 to 5.3 GHz for 10W 6.4 to 7.0 GHz for 5 W
Input level	+13 dBm to +20 dBm with ALC
Harmonics suppression	>60 dB typ.
I/O Impedance	50 ohm, >10 dB return loss
Supply Voltage	9 to 36 VDC
Power consumption	80 W to 125 W
Operating temperature range	-20ºC to +50ºC
Mechanical dimensions	251x 127.5 x 94.6 mm
Weight	2.5 kg
P/N	PA-10-1315 PA-10-1722 PA-10-4450 PA-10-5053 PA-5-6470

Table A.2 PA Standard Main Characteristics

A.2.2 Block Diagram

This section provides the block diagram of the PA Ultralinear and PA Standard Power Amplifiers showing the internal performance of the device.
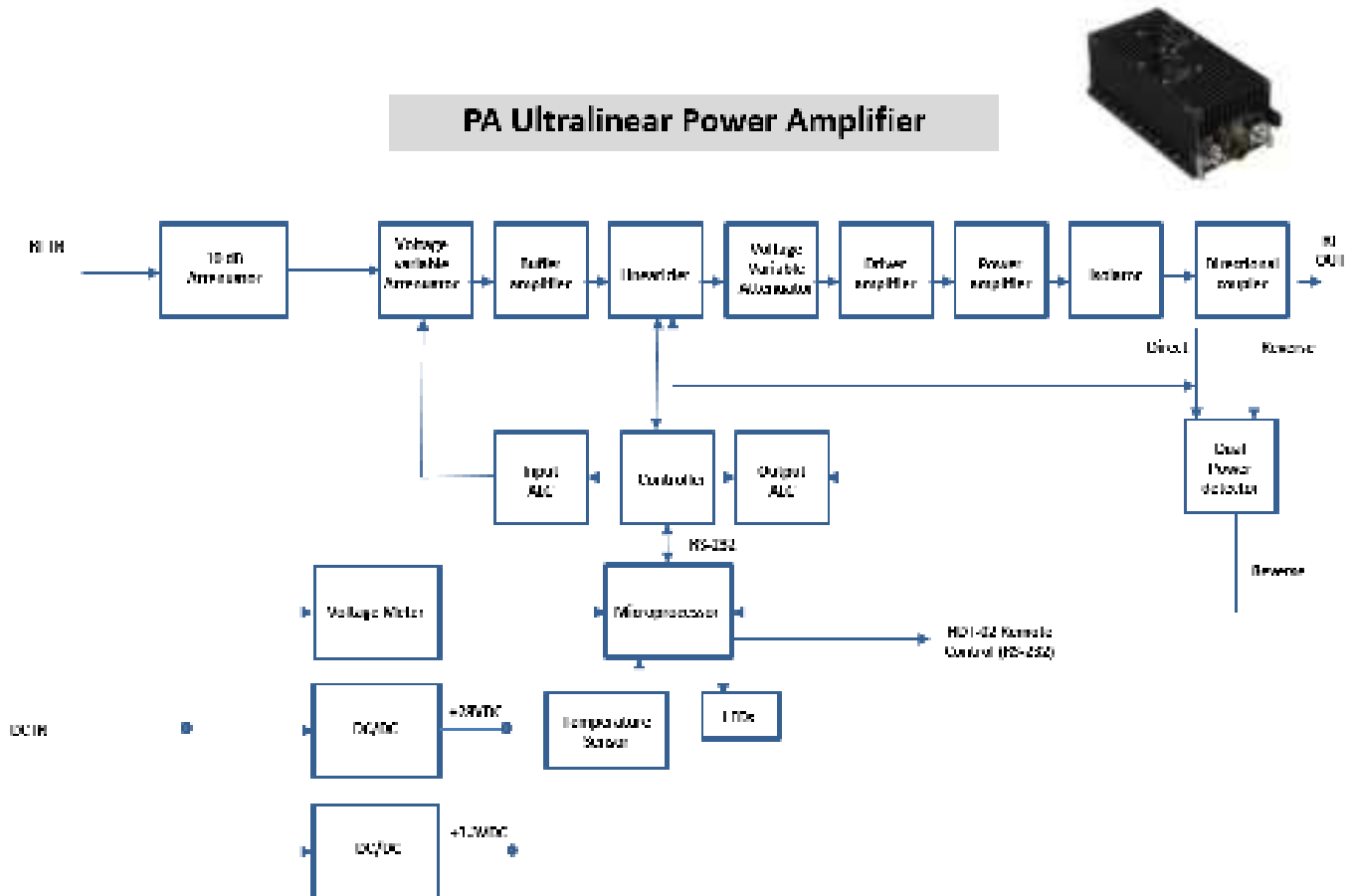
Figure A.2: PA Ultralinear Block Diagram
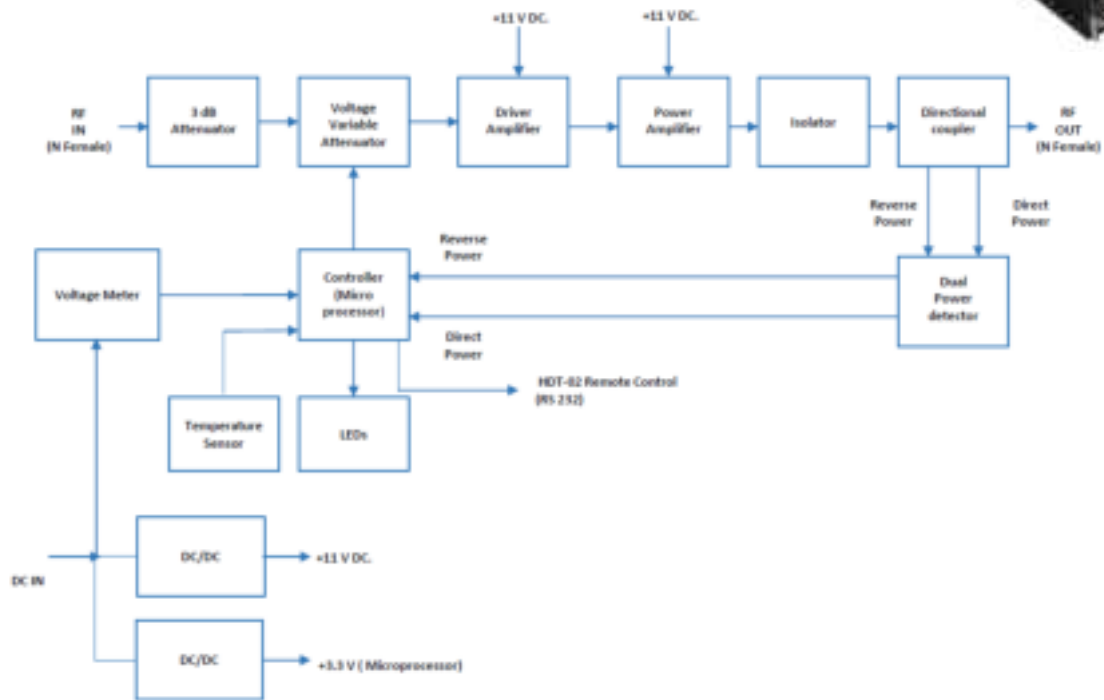
Figure A.3: PA Standard Block Diagram

A.2.3 Equipment Installation

A.2.3.1 Introduction

This section provides information for the Power Amplifiers installation such as connections available in the front panel of the PA Amplifiers and their pinout, and connectors needed.

A.2.3.2 Connections

The connections of the PA Power Amplifier are distributed on the front panel of the device.

All the input/output connections of the Power Amplifier are shown in the figure below:
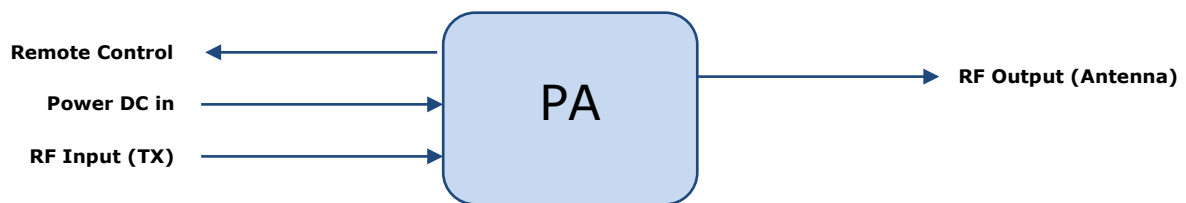
Figure A.4: PA Connections

A.2.3.2.1 Power supply

The equipment is powered by a DC source from 9 to 36 V.

Power supply connection technical features

Item	Features
Connector label	9-36V D.C.
Connector type	MIL-DTL-26842 Series 2 MS3112E
Connector Part number (PA connector)	SOURIAU 851-02E123P50
Connector Part number (cable connector)	SOURIAU 851-06EC123S50
Input voltage range	9-36 V.
Consumption	Max 125 W

Table A.3: Power supply connection technical features

Pinout of the connector

Pin	Description
A	VCC
B	RETURN
C	Not Used

Table A.4: Power supply cable connector pinout

A.2.3.2.2 Remote Control

The PA Power Amplifiers incorporate an input to be controlled remotely by a HDT-02 Transmitter.

This Remote Control allows switch ON/OFF, send the Power Direct, Power Reverse and Alarms to the HDT-02 Transmitter and enable the configuration of the output power.

Remote Control connection technical features

Item	Features
Connector Label	REMOTE
Connector type	MIL-DTL-38999/24
Connector Part number (PA connector)	JD38999/24WA35SN (Amphenol)
Connector Part number (cable connector)	D38999/26WA35PN (Amphenol)

Table A.5: Remote Control connection features

Pinout of the connector

Pin	Description
1	Return of RS232 and PA ON/OFF
2	RS232 (RX)
3	Not Used
4	Not Used
5	PA ON/OFF (0 to 3.3 VDC)
6	RS232 (TX)

Table A.6 Remote Control connector pinout

A.2.3.2.2.1 Remote Control Cable Pinout (HDT-02 to PA)

The Remote Control cable which connects the BUC-PA-CC (Lemo 7) with the Remote (D38999) connector on the amplifier has the following pinout:

Pinout of the control cable from HDT-02 to PA

BUC-PA-CC Cable Connector (Lemo FGG.0B.307)	PA Remote Cable Connector (JD38999/26WA35SN Amphenol)
Pin 1	Pin 1
Pin 2	Pin 6
Pin 5	Pin 5
Pin 7	Pin 2

Table A.6: Remote Control Cable Pinout

A.2.3.2.3 RF input

Here, the RF signal which comes from the HDT-02 Transmitter is connected.

RF IN connection technical features

Item	Features
Connector label	RF IN (TX)
Connector type	N female
Impedance	50 Ω

Table A.7 RF IN connection features

A.2.3.2.4 RF output (Antenna)

The antenna is directly connected to the female N-type connector of the PA Power Amplifiers. One circulator is integrated in the RF output to protect the amplifier from the possible damage suffered by the reflected power.

RF OUT connection technical features

Item	Features
Connector label	RF OUT (Antenna)
Connector type	N female
Impedance	50 Ω

Table A.8 RF OUT connections characteristics

A.2.3.3 Thermal Protections

The PA Power Amplifier has an IP65 radiator that dissipates heat throughout a fan. The fan is activated when temperature exceeds 50ºC.

A.2.3.4 Connection Guide

For the installation of the PA amplifier, these items are needed:

- PA Power Amplifier
- HDT-02 Transmitter
- RF cable with N male to N male type connector.
- Remote Control cable (6 pin MIL-DTL-38999 to 7 pin Lemo)
- Antenna

The HDT-02 Transmitter is powered throughout the Lemo 1B connector and the Power Amplifier is powered throughout the SOURIAU connector. The input level is indicated in each connector's label.

The HDT-02 Transmitter is connected to the Power Amplifier throughout the BUC-PA-CC connector and RF out connector.

The Amplifier's RF OUT connector must be connected to the antenna, please do not disconnect the antenna while the amplifier is transmitting.

If a ground connection is needed for the installation, there is a M4 screw on the front side of the amplifier which allows grounding at low impedance.
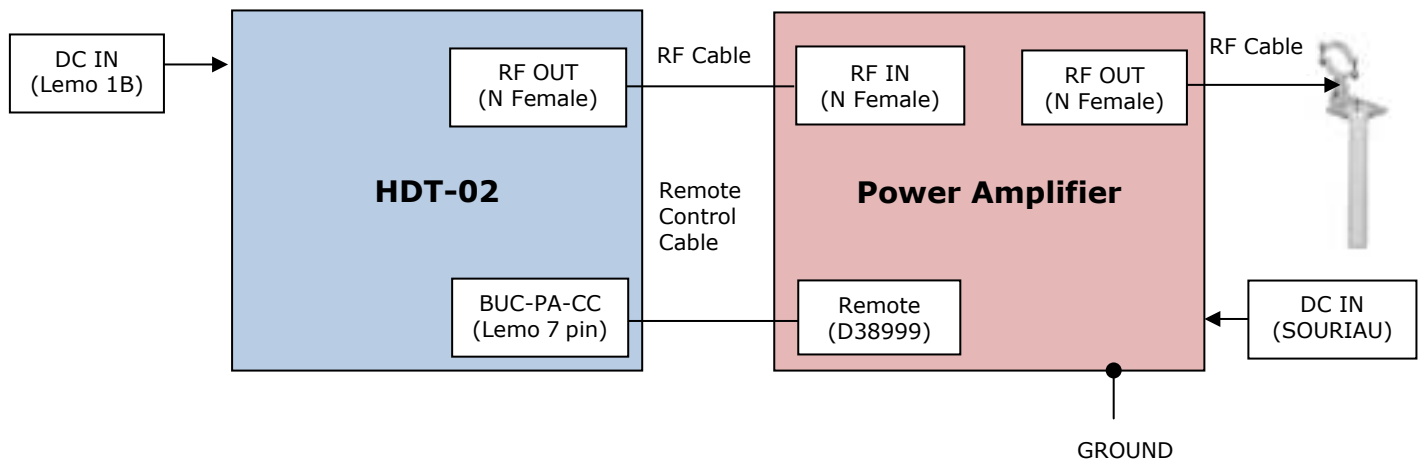
Figure A.5: Installation scheme

A.3 Quick User Guide

The new Power Amplifiers allow the user to control automatically the power that these devices provide.

When the POWER DC LED lights in Green on the amplifier, indicates that the PA is activated from the transmitter. To activate the amplifier, the RF button on the transmitter must be ON.

If the power supply is not correct, the POWER DC LED on the amplifier blinks. The different alarms are explained in section A.3.2 Alarms.

ALARM LED shows the status of the device. If there is any alarm, the LED will indicate which alarm is present by lighting up RED in different sequences for each alarm (blinking in different time intervals). All the alarms are explained in section A.3.2. Alarms.

The equipment is fed with DC power supply from 9 to 36V. It is powered through DC power supply connector. Furthermore, for a long operating temperature range, the fans start running at 50ºC.

A.3.1 PA Configuration

The following menu screen and figures show the different steps that must be followed when the connection between the HDT-02 transmitter and the PA amplifier is established.

First, connect the two equipment as it is shown below:
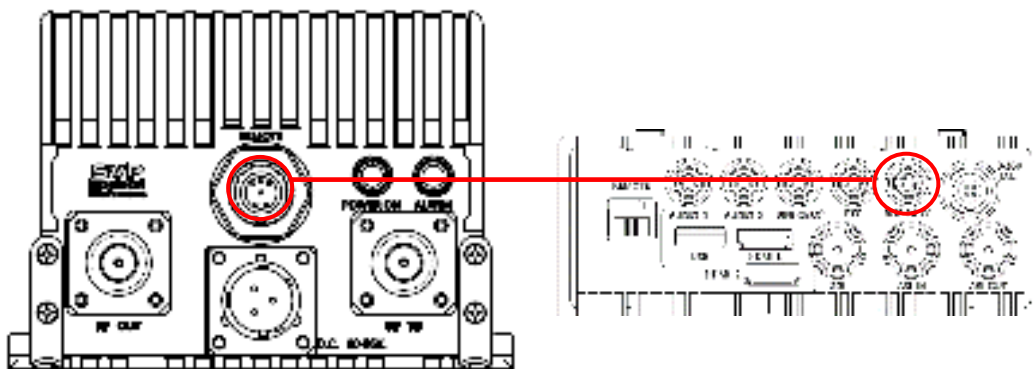
Figure A.6: Connection between the HDT-02 and the PA

> The RF ON button must be pressed to allow the communication between the HDT-02 transmitter and the PA amplifier.

HDT-02_H.264 *High Definition Digital Camera Transmitter*

MANUAL V9.9.15   *205*

Once the connection is established, go to the main menu of the HDT-02 Transmitter pressing the cross button and select the RF option:
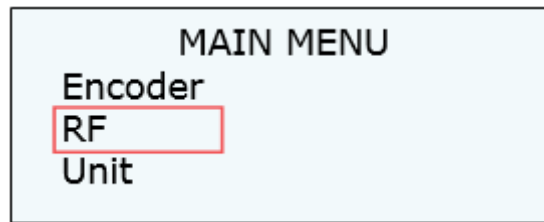
Figure A.7: Main Menu

Go to DVB-T or DVB-T2 option and press the OK button to configure

the parameters related to the PA amplifier.
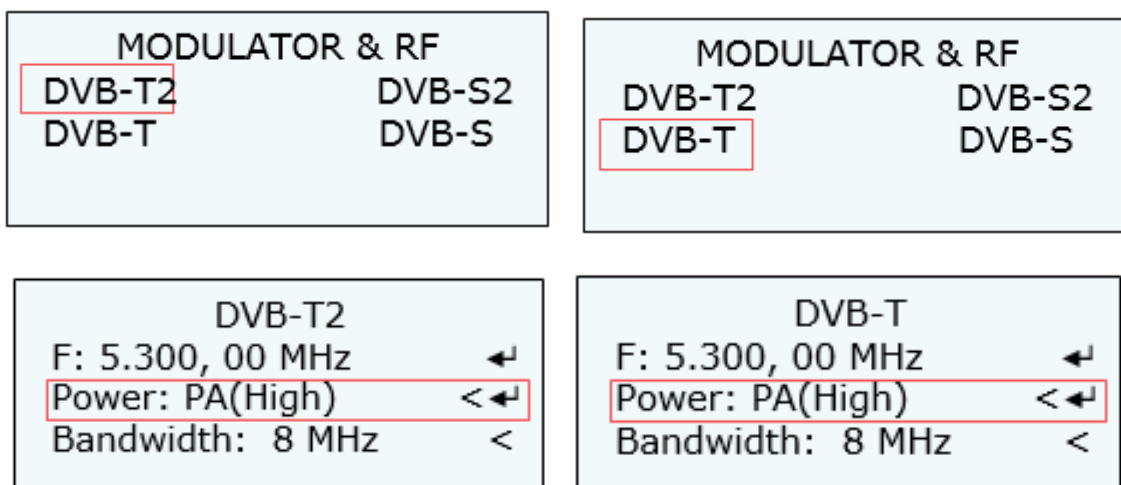
Figure A.8: DVB-T2 and DVB-T Menu

If there is communication between the HDT-02 and the PA, the "Power" parameter will be automatically configured to PA, and the other options will disappear from the menu. Then, the output power of the PA can be automatically configured by pressing Left and Right buttons.The available options are:

- Low
- Mid
- High

The output level of these parameters will depend on the amplifier's maximum output power.

Finally, return to the main screen and two new parameters will appear in the second line of the screen.

Figure A.9: DVB-T2 and DVB-T main screen

The meaning of these parameters is shown below:

- **P:** The level of the transmitted power measured in dBm.
- **R:** The reverse power percentage.

If the RF button is OFF, these parameters blink on the main screen. To transmit, press the RF button.

A.3.2 Alarms

If there is an alarm, the alarm type is indicated by the amplifier's LEDs. The LED will blink in different time sequences to indicate which alarm is present on the device.

The different alarms related to the PA amplifier are indicated by the sequences indicated below.

On the **ALARM** LED:

- Forward Power Alarm: There is not direct power or it is very low. The alarm sequence starts with one small blink followed by one longer blink.

- Reverse Power Alarm: The reverse power is too high, please check the antenna connectors and cables. The alarm sequence starts with 2 small blinks followed by one longer blink.

- Voltage Alarm: The voltage is too high or too low, please check POWER DC LED. The alarm sequence starts with 3 small blinks followed by one longer blink.

- High Temperature Alarm: The temperature is too high. The alarm sequence starts with 4 small blinks followed by one longer blink.

On the **POWER DC** LED:

- While the LED is continuously ON in green, there is no alarm.

- If the LED blinks slowly, the input power is below the DC power supply range.

- If the LED blinks fast, the input power is above the DC power supply range.

- When the LED remains switched off for long, but sometimes blinks. It means that the amplifier has been switched off remotely by the HDT-02 or by the RTC-03 Remote Control.

Anyway, when the **POWER DC** LED is on, the amplifier is powered.

HIGH TEMPERATURE Protection:

The amplifier, as protection against overheating, checks the operation of the fans. In this way we protect the amplifier from breakage by overheating. The alarms for breakage of fans will behave as follows:

- If one fan stops working, High Temperature alarm is displayed on both the transmitter and the ALARM LED of the amplifier.

- If the two fans stop working, as a protection measure the amplifier will **turn off** automatically, to avoid any overheating.

Annex B: PAC Clip-On Power Amplifiers

B.1 Introduction

The new PAC is a clip-on amplifier which works in the 2 GHz band. It is used together with SVP Broadcast Microwave's camera Transmitters, allowing the coverage of wider areas.

It can be used with nearly all camera transmitters as it can have V battery adapter plates. This small and powerful amplifier expands the possibilities of the wireless camera transmitters. Just by adding this low weight and compact amplifier to a camera transmitter, medium range links can be possible.

This amplifier has a 3 W output and the input signal level has to be in the range of 10 to 100 mW, as it has 10 dB ALC.

This solid state LDMOS amplifier has been designed and optimized for being used with COFDM digital video signals. The low intermodulation and our proprietary pre-distortion technique provide an excellent linearity and better ACP performance. The pre-distortion technique enables higher power output maintaining transmitted signal quality.

The amplifier can be powered through the V or through a DC power supply connector, which accepts input power voltage from 11 to 16 VDC.

The PAC amplifier is protected against polarity reverse and over voltage. It also has thermal protection with auto reset.

The equipment has also two LEDs (Out, Level and DC), that show the equipment's operation state. The information provided by these two LEDs is described below:

- DC Power Supply Led: green light when the amplifier is powered.
- Output Power Led: green light when the output power is set level.

The low intermodulation, the excellent RF performance and the high reliability make this amplifier especially interesting for most demanding wireless camera link applications.

B.2 Technical Features

PAC

Item	Features
Frequency range:	2.0 to 2.5 GHz band (Other frequency bands upon request)
Output Power:	3 W
Input level:	10 to 100 mW (10 to 20 dBm)
ALC:	10 dB
Gain flatness:	0.5 dB (over full band)
Harmonics suppression:	>60 dB
Output IP3:	+58 dBm
Monitoring:	2 LEDs in the front panel
Power supply:	11 to 16 VDC
Consumption:	3 W: 2.9A @ 12V
DC power supply connector:	4 pin Lemo 1B Battery V adapter
Protections:	Polarity Reverse Reverse power (by a circulator)
RF Connectors:	2 x N female
Mechanical dimensions:	180 x 105 x 33 mm (without connectors)
Weight:	0.97 kg

Table B.1: PAC Main Characteristics

B.3 Connections

Every connection of the PAC Clip-on amplifier is shown in the figure below.

Figure B.1: PAC Connections

The following figures show the PAC front and rear panels. Connections mentioned in the upper figure are shown below.

Figure B.2 Front panel of the PAC Amplifier

Figure B.3 Rear panel of the PAC Amplifier

Technical features of each connection are described in the following sections.

B.3.1 Power supply

The equipment can be powered by a DC source from 11 to 16 V or through the V battery clamps.

The DC power supply is connected to the equipment via a 4 pin Lemo 1B connector.

Item	Features
Connector label	POWER DC
Connector type	4 pin Lemo 1B
Input voltage range	11-16 V
Consumption	4 Watt: 2.9A @ 12V

Table B.2: Power supply connection technical features

The pin-out of the power supply connector is:

- 1 and 2 pins --> ground
- 3 and 4 pins --> from 11 to 16 V

B.3.2 RF Input

The RF input of the HDT-02 camera transmitter is connected to the RF input of the PAC amplifier. A very low loss cable should be used to make this connection.

Item	Features
Connector label	RF IN
Frequency range	2.0 to 2.5 GHz frequency band (Other frequency bands upon request)
Input Level	10 to 100 mW (10 to 20 dBm)
Connector type	N female
Impedance	50 Ω

Table B.3: RF input connection technical features

Note: In some transmitters, increasing the output power implies output signal quality degradation due to intermodulation. Normally, at low powers a better shoulder level is obtained. SVP Broadcast Microwave recommends using the transmitters configured with the lowest output power.

B.3.3 RF Output

The antenna is directly connected to the RF output of the amplifier.

The amplifier has a Led in the front panel which indicates the RF power output. The RF output is protected against polarity reverse by a circulator.

Item	Features
Connector label	RF OUT
Output frequency range	2.0 to 2.5 GHz (Other frequency bands upon request)
Connector type	N female
Impedance	50 Ω
Output power	4 W

Table B.4: RF output characteristics

B.4 Amplifier operation tips

This fourth chapter provides the user with all necessary information to operate the equipment properly.

1. If the amplifier is powered by a battery, make sure that you have the right battery for the equipment to operate.

2. If the amplifier is powered through the DC IN connector, check the continuous voltage range and use the appropriate cable. The range of the continuous voltage is the following one: 11 to 16 V.

3. When powering the equipment using the DC connector, be particularly careful of the continuous power's polarity. The Power Amplifier is protected against reverse polarity.

4. Set the output power of the transmitter to Low mode.

5. Before you connect the amplifier, check that the antenna, cables and connectors are in perfect condition. Do not switch on the device if the antenna is not connected.

6. For the use of this amplifier together with wireless camera transmitter, it is recommended that flexible long antennas are used, for example: AVF-203. In this way, the radiation element of the antenna is over the cameraman's head.

Annex C: AVF Flexible Antenna

C.1 Description

AVF antenna, which is a linear omnidirectional flexible antenna, is suitable for the 1.3 to 7.5 GHz frequency band. It is very useful for mobile camera links and it is the most appropriate antenna for live broadcast.

The design of this antenna makes it very suitable for transmission when using a camera transmitter, because the radiating element is above the cameraman's head. Besides, its radiation pattern, a wide vertical beamwidth and an omnidirectional horizontal beamwidth, makes it possible to maintain the signal as the camera position changes. So, the use of this antenna offers an important advantage: there is no need to position the antenna and the cameraman can move freely.

This antenna has 3dBi gain and the operating frequency range is from 1.3 to 7.5 GHz. It is made of brass, stainless steel and Teflon.

The figure below shows the AVF flexible antenna:

Figure C.1: AVF flexible antenna

C.2 Technical Specifications

Item	Feature
Frequency range	1.3 to 7.5 GHz (Different bands available)
Gain	3 dBi
Polarization	Linear (Vertical)
Beamwidth	76ºV and Omnidirectional H
Bandwidth	Depends on the frequency range
Connector	N male
Temperature	-30º a +70ºC
Size / Weight	330mm x D22mm / 158 gr. (AVF-103)
	300mm x D22mm / 158 gr. (AVF-X03)
	400mm x D22mm / 212 gr. (AVF-X03LB)
Order Information	AVF-103 (1.2 to 1.55 GHz)
	AVF-203 (2.0 to 2.7 GHz)
	AVF-303 (3.0 to 3.7 GHz)
	AVF-403 (4.4 to 5.9 GHz)
	AVF-603 (6.0 to 7.5 GHz)

Table C.1: AVF flexible antenna technical features

The figure below shows antenna adaptation:
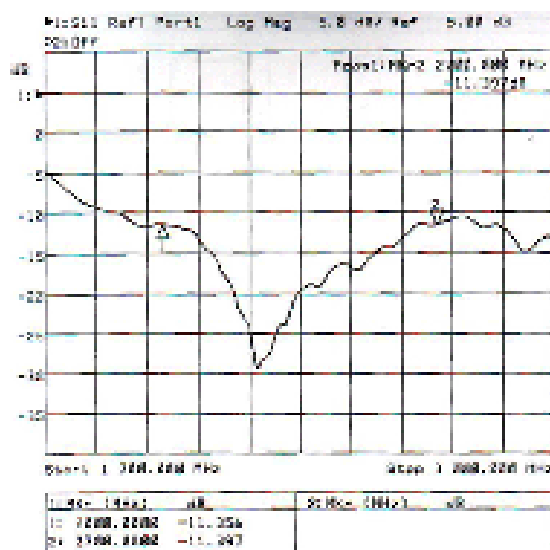
Figure C.2: S11 parameter measurement
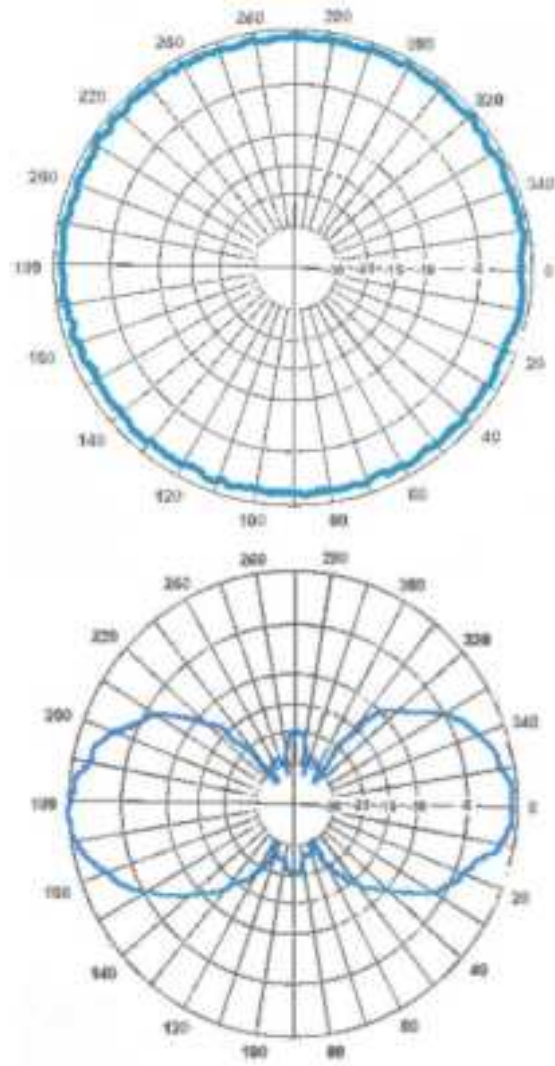
Figure C.3: Horizontal and Vertical Radiation patterns

Annex D: GPS-01 Receiver

D.1 Description

Our GPS receiver is a compact and easy solution to know where the transmitter is located.

It has a direct connection to the transmitter which sends this GPS information to the receiver to track the transmitter automatically.

The transmitter is responsible for the power supply of the GPS. Also, it's the transmitter which is in charge of receiving the data information from the GPS. The connection is via Lemo 6 pin connector.

The speed of the output data in the GPS receiver is 4800 bauds. When the GPS receiver is connected, the transmitter automatically detects the position if the GPS-01 receives signal from enough satellites.

Figure D.1: GPS antenna

D.2 Technical Specifications

Item	Feature
Power Supply	+5V (provided by the Transmitter)
Dimension	L: 47mm, W: 38mm, H: 16mm
Receiving frequency	1,575.42 MHz
Mounting	Magnetic base
Sensibility	-158 dBm
Start-up time	1 sec typical (hot start)
	35 sec. Typical (warm start)
	41 sec. Typical (cold start)
Baud rate	4,800 bps
Signal level	RS-232
Position accuracy	3.3 m
Connector	FGG.0B.306.CLAZ
Weight without cable	70 gr
Cable Length	5 meters
Enclosure	Highly impact; corrosion-proof
Construction	Ultrasonic welded, fully waterproof
Built in antenna	Highly-reliable ceramic path
SBAS	1 channel (Waas, Egnos, Msas)
Update rate	1 Hz
Protocol	NMEA V3.01
Power consumption	50 mA

Table D.1 GPS antenna technical features

Antenna Tx
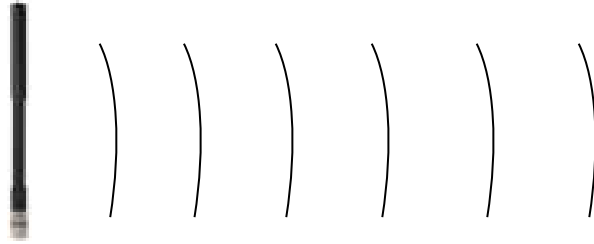
Parabolic antenna
with positioner
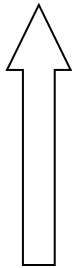
RX-GPS
Antenna

HDT-02   TX-GPS
         Antenna
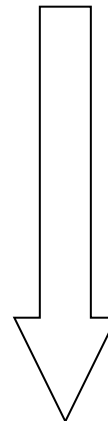
Receiver

RS-232 at
4800 baud

PC with

Google Maps

Figure D.2 Link with GPS scheme

Annex E: Modulation Standards

This chapter describes the DVB-T/T2 and DVB-S/S2 standards, as well as their features and the differences between them.

E.1 DVB-T

DVB-T is a technical standard that specifies the framing structure, channel coding and modulation for digital terrestrial television (DTT) broadcasting. It is a flexible system that allows networks to be designed for the delivery of a wide range of services, from HDTV to multichannel SDTV, fixed, portable, mobile, and even handheld reception.

E.1.1 How Does It Work

DVB-T, in common with almost all modern terrestrial transmission systems, uses OFDM (orthogonal frequency division multiplex) modulation. This type of modulation, which uses a large number of sub-carriers, delivers a robust signal that has the ability to deal with very severe channel conditions.

DVB-T has technical characteristics that make it a very flexible system:

- 3 modulation options (QPSK, 16QAM, 64QAM).
- 5 different FEC (forward error correction) rates.
- 4 Guard Intervals.
- Choice of 2k or 8k carriers.
- Can operate in 6, 7 or 8MHz channel bandwidths.

Using different combinations of the above parameters a DVB-T network can be designed to match the requirements of the network operator, finding the right balance between robustness and capacity.

E.2 DVB-T2

DVB-T2 is the world's most advanced digital terrestrial television (DTT) system, offering more robustness, flexibility and at least 50% more efficiency than any other DTT system. It supports SD, HD, UHD, mobile TV, or any combination thereof.

E.2.1 How Does It Work

Like its predecessor, DVB-T2 uses OFDM (orthogonal frequency division multiplex) modulation with a large number of subcarriers delivering a robust signal, and offers a range of different modes, making it a very flexible standard. DVB-T2 uses the same error correction coding as used in DVB-S2 and DVB-C2: LDPC (Low Density Parity Check) coding combined with BCH (Bose-Chaudhuri-Hocquengham) coding, offering a very robust signal. The number of carriers, guard interval sizes and pilot signals can be adjusted, so that the overheads can be optimised for any target transmission channel.

E.2.2 DVB-T2 New Features

The DVB-T2 standard has several improvements in comparison with the DVB-T standard.

FEC coding

In the error correction stage, the DVB-T2 standard implements a combination of LDPC codes with BCH codes. LDPC codes allow a close performance to Shannon limit and the BCH codes are used to eliminate the floor error of the LDPC codes.
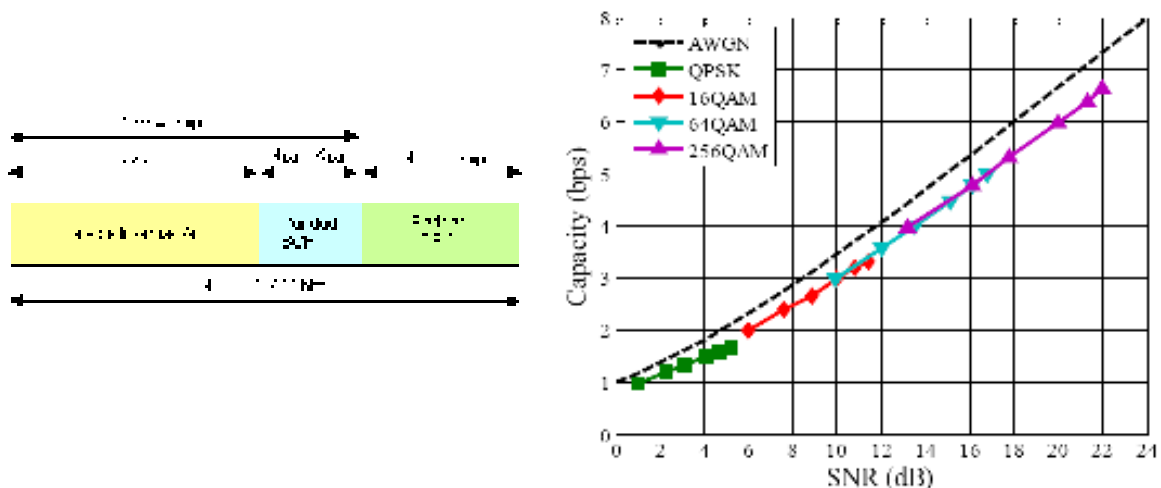
Figure E.1: LDPC and BCH codes

Constellation Rotation

This new feature consists of a rotation of some degrees of the constellation. With this rotation, dependence between the I and Q components of the signal is achieved. This means that with only one component (the I or the Q) it is possible to know exactly the symbol to which it belongs.

This new feature provides additional robustness for low order constellations.
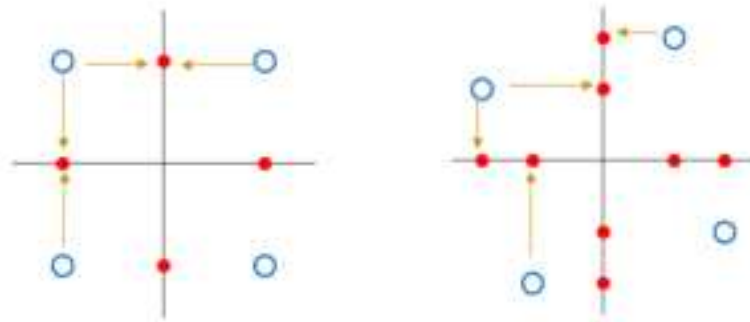
Figure E.2: Constellation Rotation

E.2.3 DVB-T vs DVB-T2

Next, it is shown a comparison table between the two existing DVB terrestrial standards. The new features of the DVB-T2 standards respect to the DVB-T are in bold.

	DVB-T	DVB-T2 (new/improved options in **bold**)
FEC	Convolutional Coding + Reed Solomon 1/2, 2/3, 3/4, 5/6, 7/8	LDPC + BCH 1/2, **3/5**, 2/3, 3/4, **4/5**, 5/6
Modes	QPSK, 16QAM, 64QAM	QPSK, 16QAM, 64 QAM, **256 QAM**
Guard Interval	1/4, 1/8, 1/16, 1/32	1/4, **19/128**, 1/8, **19/256**, 1/16, 1/32, **1/128**
FFT Size	2k, 8k	**1k**, 2k, **4k**, 8k, **16k**, **32k**
Scattered Pilots	8% of total	**1%, 2%, 4%,** 8% of total
Continual Pilots	2.0% of total	**0.4% - 2.4%** (0.4% - 0.8% in 8k–32k)
Bandwidth	6, 7, 8 MHz	**1.7, 5**, 6, 7, 8, **10** MHz
Typical data rate (UK)	24 Mbit/s	**40 Mbit/s**
Max. Data rate (@20 dB C/N)	31.7 Mbit/s (using 8 MHz)	**45.5 Mbit/s** (using 8 MHz)
Required C/N ratio (@24 Mbit/s)	16.7 dB	**10.8 dB**

Table E.1: DVB-T vs DVB-T2

E.3 DVB-S

DVB-S is the first generation of a standard for digital broadcasting via satellite.

E.3.1 How Does It Work

DVB-S was designed to carry MPEG-2 transport streams over satellite. MPEG-2 transport streams typically carry one or several television or radio services multiplexed into a synchronous bit stream. All service components are divided in short packets of 188 bytes, each identified by a Program Identifier in the header of the packet.

Generic data can also be carried in MPEG transport streams, provided that it is first encapsulated in the transport stream packets. The most common way to encapsulate IP data into MPEG streams is called Multi Protocol Encapsulation (MPE) and is also specified by a DVB standard.

The total bit rate of the transport stream is constant but can typically be adjusted to match the needs of the satellite link. If the desired transport stream rate is greater than the sum of the carried components, empty packets are added to the stream by the multiplexer or the modulator. This operation is called rate adaptation.

DVB-S uses QPSK modulation and concatenated error protection based on a convolutional Viterbi code and a shortened Reed Solomon code.
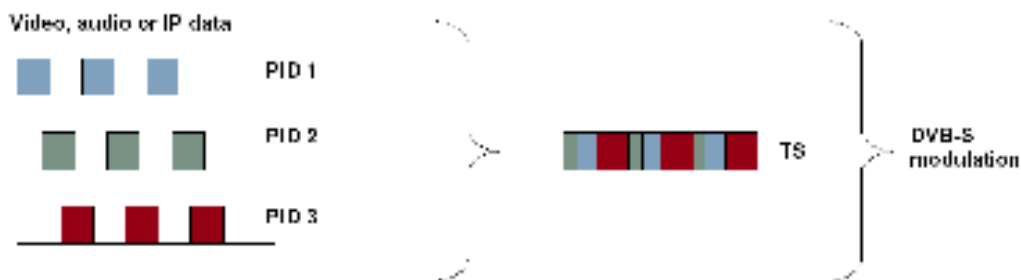
Figure E.3: Future Extension Frames

E.4 DVB-S2

DVB-S2 is a digital satellite system developed by the DVB Project. It makes use of the latest modulation and coding techniques to deliver performance that approaches the theoretical limit for such systems.

E.4.1 How Does It Work

The original DVB-S system, on which DVB-S2 is based, specifies the use of QPSK modulation along with various tools for channel coding and error correction. Further additions were made with the emergence of DVB-DNSG (Digital Satellite News Gathering), for example allowing the use of 8PSK and 16QAM modulation. DVB-S2 delivers excellent performance, coming close to Shannon limit, the theoretical maximum information transfer rate in a channel for a given noise level. It can operate at carrier-to-noise ratios from -2dB (i.e., below the noise floor) with QPSK, through to +16dB using 32APSK. DVB-S2 benefits from more recent developments and has the following key technical characteristics:

New modulation schemes

There are four modulation modes available, with QPSK and 8PSK intended for broadcast applications in non-linear satellite transponders driven close to saturation. 16APSK and 32APSK, requiring a higher level of C/N, are mainly targeted at professional applications such as news gathering and interactive services.
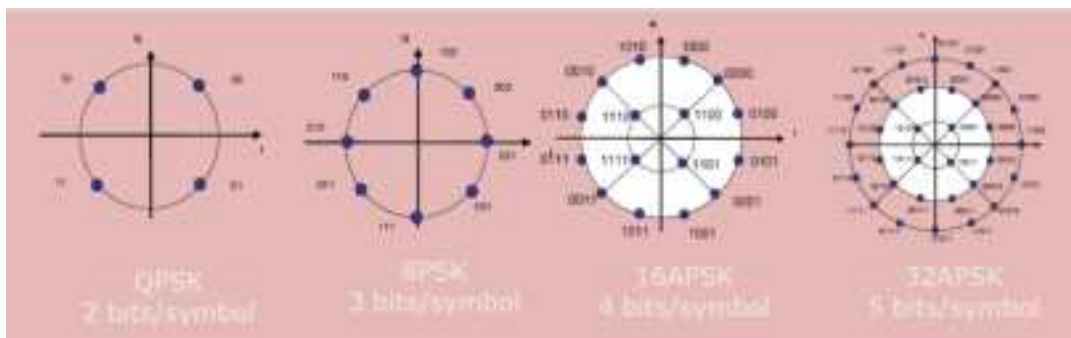
Figure E.4: New DVB-S2 modulation schemes

Forward Error Correction

DVB-S2 uses a very powerful Forward error Correction scheme (FEC), a key factor in allowing achievement of excellent performance in the presence of high levels of noise and interference. The FEC system is based on concatenation of BCH (Bose, Chaudhuri – Hocquengham) with LDPC (Low density Parity Check) inner coding.

Figure E.5: DVB-S2 FEC

Variable Coding and Modulation (VCM) (Used in the HRD-106 and IRD-70)

Variable Coding and Modulation is a mode of operation that allows different modulation parameters to be applied to the different DVB-S2 streams of a multistream signal. If each of the streams are intended for a different receiving site, VCM allows optimizing the parameters of each stream to get the best performance for each receive station, instead of dimensioning the whole link according to the smallest station.
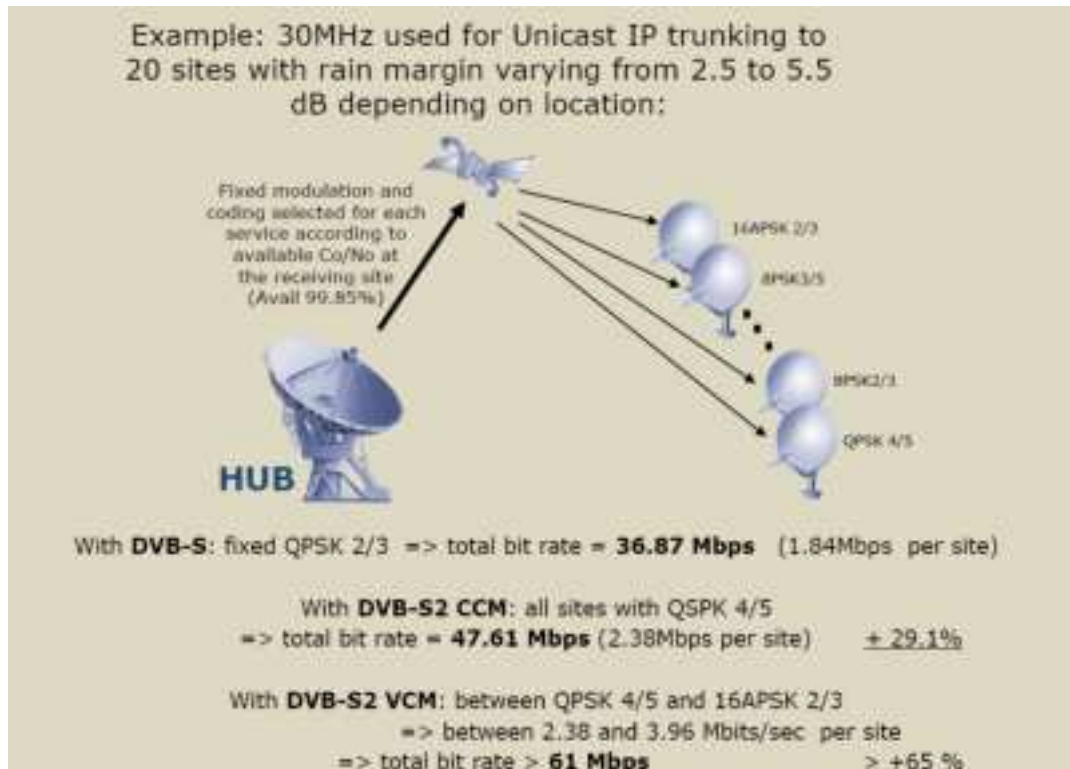
Figure E.6: VCM mode

Adaptive Coding and Modulation (ACM) (Used in the HRD-106 and IRD-70)

In Adaptive Coding and Modulation mode, the modulation parameters of the Baseband frames can vary over time, according to the instantaneous receiving conditions of the site where the frame will be received. In ACM there is a feedback mechanism between the demodulator and the modulator. This feedback mechanism dynamically tells the modulator which modulation parameters to use for each baseband frame. ACM allows operating satellite links with almost no margin, since the system adapts automatically to fading or interference conditions.
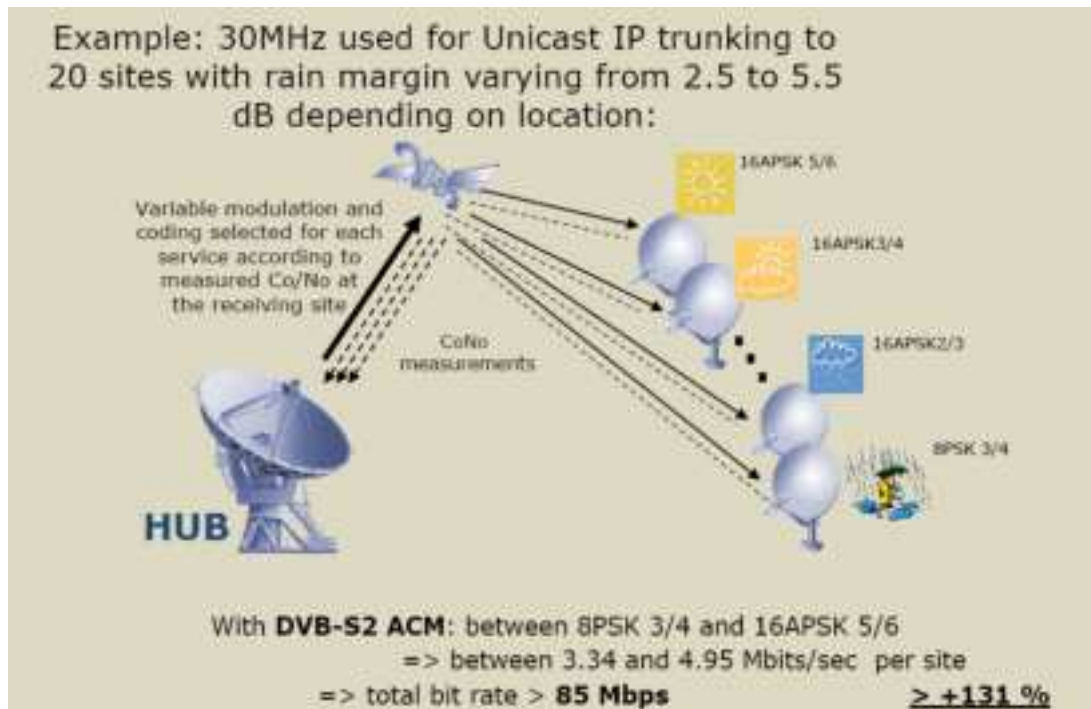
Figure E.7: ACM mode

Other features implemented in the DVB-S2 standard are:

- Sharper roll-off factors which results in a direct gain of bandwidth.

- The ability to carry several signals on a single satellite carrier, without multiplexing in front of the modulator. This is called Multi-Stream.

- The ability to carry signals other than MPEG transport stream. This is called Generic Stream.

E.4.2 Pilots in DVB-S2

Pilots are unmodulated symbols grouped in blocks that can be added on the physical layer framing level.

Pilots are used to:

- Reduce the phase noise influence. Phase noise is created by the frequency components around the main carrier frequency. This noise contains components at many frequencies with randomly changing phase.

- Pilots are used to increase the reliability and the continuous receiver synchronization.

> It is advisable to use pilots in the following cases:
>
> - In ACM mode (always on).
>
> - When a noticeable amount of phase noise is present.
>
> - At low data rates.
>
> - When distortion is present on the signal for example due to non-linearity.
>
> - When using one of the following ModCods:
>
>   - 8PSK 3/5 and 2/3
>
>   - 16APSK 3/4
>
>   - 32APSK 3/5

E.4.3 DVB-S vs DVB-S2

Next there are shown a series of comparisons between DVB-S and DVB-S2 standards.

DVB-S vs DVB-S2 Performance
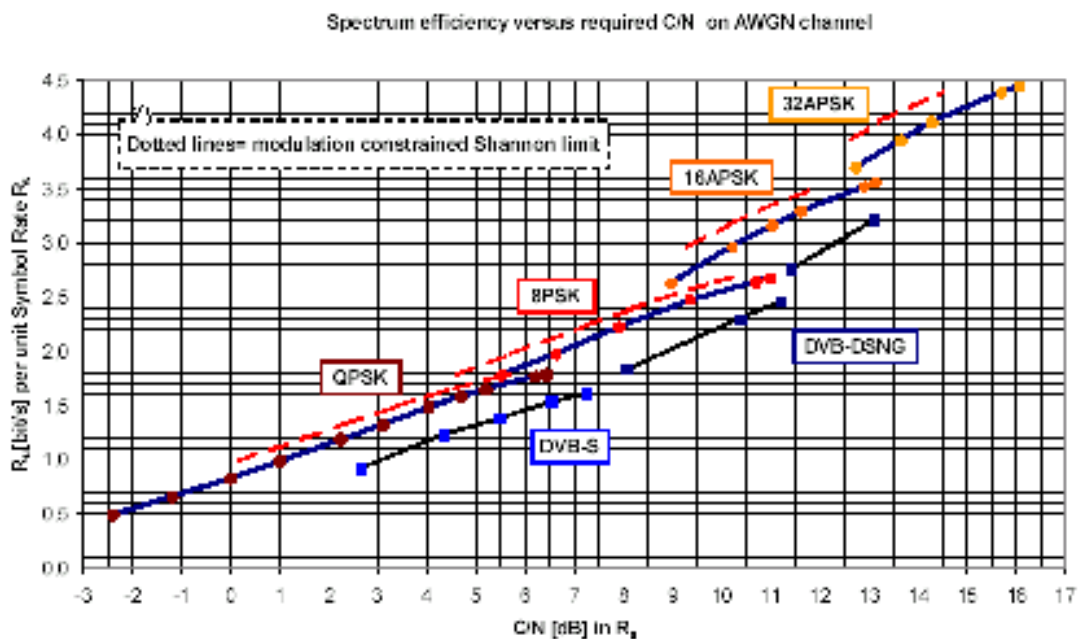
Figure E.8: DVB-S vs DVB-S2 Performance

The figure above shows how the DVB-S2 standard is really close to the Shannon limit.

Main differences between DVB-S and DVB-S2

DVB-S	DVB-S2
Meant for broadcast only	Fully transparent to all data
Fixed 188 byte/packets	Baseband in 16 or 64 kbps
One TS/carrier	CCM/MultiStream – VCM – ACM
RS and Viterbi coding	LDPC and BCH coding
Need of high RX margin	Can work within noise floor
QPSK / QPSK-8PSK-16QAM	QPSK – 8PSK – 16APSK – 32APSK
35% and 25% Roll-off carrier	20% Roll off carrier
Consumer LNB's work in QPSK only	Pilot tones for extra synch in 8PSK

Figure E.9: Main differences between DVB-S and DVB-S2

Glossary

AES/EBU	Audio Engineering Society/European Broadcasting Union
AM	Multisectorial Antenna
APSK	Amplitude and phase-shift keying or asymmetric phase-shift keying
ASI	Asynchronous Serial Interface
BNC	Bayonet Neill-Concelman
BR	BitRate
CA-BISS	Conditional Access-BISS
COFDM	Coded Orthogonal Frequency Division Multiplexing
DC	Direct current or Down Converter
DVB-T	Digital Video Broadcasting – Terrestrial
DVB-T2	Digital Video Broadcasting – Terrestrial Second Generation
ETSI	European Telecommunications Standards Institute
FEC	Forward Error Correction
FFT	Fast Fourier transform
GPS	Global Positioning System
HD	High Definition
HDMI	High-Definition Multimedia Interface
HDR	High Definition Receiver
HDT	High Definition Transmitter
IF	Intermediate Frequency
IG	Interval Guard
IP	Internet Protocol
IP3	3rd order Intermodulation Product
LCD	Liquid Crystal Display

LD	Low Delay
LED	Light-Emitting Diode
LNA	Low Noise Amplifier
MPEG	Moving Picture Experts Group
NLOS	No Line of Sight
PAL	Phase Alternating Line
PLL	Phase Locked Loop
PID	Packet Identification
QAM	Quadrature Amplitude Modulation
QPSK	Quadrature Phase-Shift Keying
RF	Radio Frequency
RTC	Remote Control
SD	Standard Delay
SDI	Serial Digital Interface
TFT	Thin-Film Transistor
TS	Transport Stream
UDP	User Datagram Protocol
UHF	Ultra High Frequency
USB	Universal Serial Bus
VSWR	Voltage Standing Wave Ratio

Certificate of Conformance
Declaración de Conformidad

Certificate No. / *Nº de declaración*: S 121110
Description / *Descripción*: **Power Amplifier**
Model / *Modelo*: PA-10

The equipment has been designed and tested to meet the following standards applicable to the 1999/5/CE directive:
El equipo ha sido diseñado y analizado para satisfacer las siguientes normas aplicables a la normativa 1999/5/CE:

Safety / *Seguridad*

EN 60215	Security rules for radioelectric emmission equipments
	Reglas de seguridad para equipos de emisión radioeléctrica
EN 60950-1	Article 3.1a (Electric Security).
	Artículo 3.1a (Seguridad Eléctrica)

Electromagnetic Compatibility / *Compatibilidad Electromagnética*

EN 301 489-1&3:	Article 3.1b (Electromagnetic Compatibility)
	Artículo 3.1b (Compatibilidad Electromagnética)
EN 50 130-1:	Article 3.1b (Electromagnetic Compatibility)
	Artículo 3.1b (Compatibilidad Electromagnética)
EN 300220-3:	Article 3.2 (Protection and good use of the spectrum)
	Artículo 3.2 (Protección y buen uso del espectro)
EN 61000-3 (2-3):	Electromagnetic emission (harmonics and fluctuations).
	Emisión electromagnética (armónicos y fluctuaciones).
EN 55022:	Electromagnetic emission (conducted and radiated Class B).
	Emisión electromagnética (conducida y radiada Clase B).
EN 61000-4 (2-3-4-5-6-11):	Electromagnetic immunity.
	Inmunidad electromagnética.

Manufacturer / *Fabricante*

SVP Broadcast Microwave S.L.
Uralde, 2 Iurreta 48215 Vizcaya SPAIN
VAT/NIF: ES B95136719

Certified by / *Certificado por*

Juan Antonio Burgos
Technical Manager

Date / *Fecha*   12/11/2010

Certificate of Conformance
Declaración de Conformidad

Certificate No. / *Nº de declaración*: S 131015
Description / *Descripción*: **HDT-02 H.264 Multiband Transmitter**
Model / *Modelo*: HDT-02

The equipment has been designed and tested to meet the following standards applicable to the 1999/5/CE directive:
El equipo ha sido diseñado y analizado para satisfacer las siguientes normas aplicables a la normativa 1999/5/CE:

Safety / *Seguridad*

EN 60215	Security rules for radioelectric emmission equipments
	Reglas de seguridad para equipos de emisión radioeléctrica
EN 60950-1	Article 3.1a (Electric Security).
	Artículo 3.1a (Seguridad Eléctrica)

Electromagnetic Compatibility / *Compatibilidad Electromagnética*

EN 301 489-1&3:	Article 3.1b (Electromagnetic Compatibility)
	Artículo 3.1b (Compatibilidad Electromagnética)
EN 50 130-1:	Article 3.1b (Electromagnetic Compatibility)
	Artículo 3.1b (Compatibilidad Electromagnética)
EN 300220-3:	Article 3.2 (Protection and good use of the spectrum)
	Artículo 3.2 (Protección y buen uso del espectro)
EN 61000-3 (2-3):	Electromagnetic emission (harmonics and fluctuations).
	Emisión electromagnética (armónicos y fluctuaciones).
EN 55022:	Electromagnetic emission (conducted and radiated Class B).
	Emisión electromagnética (conducida y radiada Clase B).
EN 61000-4 (2-3-4-5-6-11):	Electromagnetic immunity.
	Inmunidad electromagnética.

Manufacturer / *Fabricante*

    SVP Broadcast Microwave S.L.
    Uralde, 2 Iurreta 48215 Vizcaya SPAIN
    VAT/NIF: ES B95136719

Certified by / *Certificado por*

    Juan Antonio Burgos
    Technical Manager

Date / *Fecha*   15/10/2013

Uralde, 6 - 2 / 48 215 IURRETA - Bizkaia
Tel: 94 620 37 22 - Fax: 94 620 43 55

Certificate of Conformance
Declaración de Conformidad

Certificate No. / Nº de declaración: S 150414
Description / Descripción: **RTC-01 Remote Control**
Model / Modelo: RTC-01

The equipment has been designed and tested to meet the following standards applicable to the 1999/5/CE directive:
El equipo ha sido diseñado y analizado para satisfacer las siguientes normas aplicables a la normativa 1999/5/CE:

Safety / Seguridad

EN 60215	Security rules for radioelectric emmission equipments
	Reglas de seguridad para equipos de emisión radioeléctrica
EN 60950-1	Article 3.1a (Electric Security).
	Artículo 3.1a (Seguridad Eléctrica)

Electromagnetic Compatibility / Compatibilidad Electromagnética

EN 301 489-1&3:	Article 3.1b (Electromagnetic Compatibility)
	Artículo 3.1b (Compatibilidad Electromagnética)
EN 50 130-1:	Article 3.1b (Electromagnetic Compatibility)
	Artículo 3.1b (Compatibilidad Electromagnética)
EN 300220-3:	Article 3.2 (Protection and good use of the spectrum)
	Artículo 3.2 (Protección y buen uso del espectro)
EN 61000-3 (2-3):	Electromagnetic emission (harmonics and fluctuations).
	Emisión electromagnética (armónicos y fluctuaciones).
EN 55022:	Electromagnetic emission (conducted and radiated Class B).
	Emisión electromagnética (conducida y radiada Clase B).
EN 61000-4 (2-3-4-5-6-11):	Electromagnetic immunity.
	Inmunidad electromagnética.

Manufacturer / *Fabricante*

> SVP Broadcast Microwave S.L.
> Uralde, 2 Iurreta 48215 Vizcaya SPAIN
> VAT/NIF: ES B95136719

Certified by / *Certificado por*

Juan Antonio Burgos
Technical Manager

Date / *Fecha*   15/04/2014

Certificate of Conformance
Declaración de Conformidad

Certificate No. / Nº de declaración: S 170505
Description / Descripción: **RTC-02 Remote Control**
Model / Modelo: RTC-02

The equipment has been designed and tested to meet the following standards applicable to the 1999/5/CE directive:
El equipo ha sido diseñado y analizado para satisfacer las siguientes normas aplicables a la normativa 1999/5/CE:

Safety / Seguridad

EN 60215	Security rules for radioelectric emmission equipments
	Reglas de seguridad para equipos de emisión radioeléctrica
EN 60950-1	Article 3.1a (Electric Security).
	Artículo 3.1a (Seguridad Eléctrica)

Electromagnetic Compatibility / Compatibilidad Electromagnética

EN 301 489-1&3:	Article 3.1b (Electromagnetic Compatibility)
	Artículo 3.1b (Compatibilidad Electromagnética)
EN 50 130-1:	Article 3.1b (Electromagnetic Compatibility)
	Artículo 3.1b (Compatibilidad Electromagnética)
EN 300220-3:	Article 3.2 (Protection and good use of the spectrum)
	Artículo 3.2 (Protección y buen uso del espectro)
EN 61000-3 (2-3):	Electromagnetic emission (harmonics and fluctuations).
	Emisión electromagnética (armónicos y fluctuaciones).
EN 55022:	Electromagnetic emission (conducted and radiated Class B).
	Emisión electromagnética (conducida y radiada Clase B).
EN 61000-4 (2-3-4-5-6-11):	Electromagnetic immunity.
	Inmunidad electromagnética.

Manufacturer / Fabricante

SVP Broadcast Microwave S.L.
Uralde, 2 Iurreta 48215 Vizcaya SPAIN
VAT/NIF: ES B95136719

Certified by / Certificado por

Juan Antonio Burgos
Technical Manager

Date / Fecha   04/05/2017

Test report No:

NIE: 51854REM.001

Test Report
RTCA/DO 160-E SECTION 15: MAGNETIC EFFECT
RTCA/DO 160-E SECTION 17: VOLTAGE SPIKE
RTCA/DO 160-E SECTION 18: AUDIO FREQUENCY CONDUCTED SUSCEPTIBILITY – POWER INPUTS
RTCA/DO 160-E SECTION 19: INDUCED SIGNAL SUSCEPTIBILITY
RTCA/DO 160-E SECTION 20: RADIOFREQUENCY SUSCEPTIBILITY
RTCA/DO 160-E SECTION 21: EMISSION OF RADIOFREQUENCY ENERGY

Identification of item tested...................................:	Microwave transmitter / Power Amplifier / Remote Control
Trade ....:	SVP Broadcast Microwave
Model and /or type reference ....:	HDT-02 / PA / RTC
Other identification of the product......................:	S/N: 420161216 / 290011216 / 350010516
Final HW version...:	V7
Final SW version...:	9545955629-01
Features ....:	HTD-02: Max. Output Power: 100mW Modulations: DVB-T, DVB-T2, DVB-S and DVB-S2 Encoding: H.246, 4.2.0 and 4.2.0 PA: Input Level: 10 – 20 dBm Operating Temperature: -20 + 50°C Max. Output: 10 W RTC: Profiles CH PWR ON/OFF Encryption ON/OFF
Manufacturer...:	SVP BROADCAST MICROWAVE S.L. C/Zubiaurre 7, Iurreta 48215 Bizkaia SPAIN
Test method requested, standard.........................:	RTCA/DO 160-E (2004)
Summary ....:	IN COMPLIANCE
Approved by (name / position & signature).......:	Rafael López Martin LAB EMC Manager	Firmado digitalmente por RAFAEL LÓPEZ MARTÍN Fecha: 2016.12.29 11:30:50 +01'00'
Date of issue..:	2016-12-27
Report template No..:	FDT08_18

Notes

Final note

SVP Broadcast Microwave S.L. is constantly striving to improve all of its products.

Therefore, we ask you to understand that modifications may occur in designs, equipment and technology. Consequently, we do not accept responsibility for any variations of information, illustrations or descriptions contained in this manual.

The texts, illustrations and instructions in the manual are based on the existing situation when the manual is published.

Reprinting, reproduction and translation, in part or in whole, is forbidden without written authorisation from SVP Broadcast Microwave S.L.

SVP Broadcast Microwave reserves all rights regarding intellectual property rights.

All rights reserved regarding modifications.

SVP Broadcast Microwave reserves the right to make changes to this manual and to the equipment without prior notice.

C/Zubiaurre 7 bajo

48215   Iurreta

Vizcaya – Spain

Tel: (+34) 94620 3722

info@svpbm.com

www.svpbm.com