EuroCaster

EC2406 DVB-T/T2 Modulator

User Manual

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Directory

Chapter 1 Introduction

1.1 Outline

Eurocaster EC2406 DVB-T/T2 modulator is our product developed complying with the DVB-T/T2 standard. With its advanced modulating technology, this modulator can effectively make use of the ground spectrum resources and make it possible to provide reliable signals for fixed, mobile and portable devices. Compared with DVB-T, the channel capacity is increased by 30% under the similar carrier to noise ratio (CNR) threshold.

Moreover, this device can be upgraded and controlled through network system, which allows it to be widely used in setting up digital broadcasting network and provide good signals for scientific laboratory and DVB-T/T2 STB.

1.2 Features

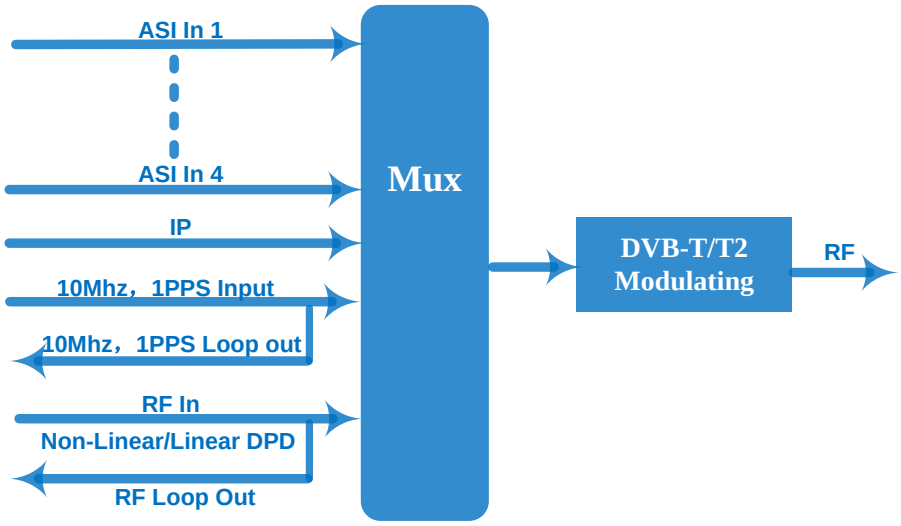
- Fully complying with EN302 755 and EN300 744 standard
- 4 ASI input ports
- 1 IP input over UDP protocol
- 10MHz input/loop out, 1PPS input/loop out
- DVB-T/T2 RF out in one device
- Supports single PLP
- Support MISO and SISO
- Support MFN net mode
- Supports non-linear and linear digital pre-distortion (DPD)
- Constant temperature crystal oscillator, as high as 0.1ppm stability
- Support PID bypass and pass through
- Keyboard operation and LCD display
- Web Network management system

1.3 Specifications

Input	TS input over 4 ASI and 1 IP port (UDP)		
	10MHz reference clock input and loop out, BNC interface		
	1PPS input and loop out, BNC interface		
Multiplexing	Maximum PID Remapping	128 input per channel	
	Function	PID remapping (automatically or manually)	
		Accurate PCR adjusting	
		Generate PSI/SI table automatically	
Modulation	DVB-T2	Standard	EN302 755
		Mode	Mode A: single-PLP;
		PLP Constellation	QPSK, 16QAM, 64QAM, 256QAM (Normal or Rotated)
		L1 Post Constellations	BPSK, QPSK, 16QAM, 64QAM
		FEC Length	Short(16K), Normal (64K)
		FEC Rate	1/2, 3/5, 2/3, 3/4, 4/5, 5/6
		Pilot Pattern	PP1 - PP8
		Guard Interval	1/128, 1/32, 1/16, 19/256, 1/8, 19/128, 1/4
		FFT Mode	1k, 2k, 4k 8k, 16k, 32k (normal or extended)
		Bandwidth	5MHz, 6MHz, 7MHz, 8MHz
		Net Mode	MFN
	DVB-T	Standard	EN300 744
		FFT	2K, 8K
		Bandwidth	5MHz, 6MHz, 7MHz, 8MHz
		Constellation	QPSK, 16QAM, 64QAM
		Guard interval	1/4, 1/8, 1/16, 1/32
		FEC	1/2, 2/3, 3/4, 5/6, 7/8
		Net Mode	MFN
RF Out	Connector	N Type, 50ΩImpedance	
	RF range	30~999Mhz, 1hz stepping	
	Output level ATT	-25~+3 dBm, 0.1db stepping	
	MER	> 43db	

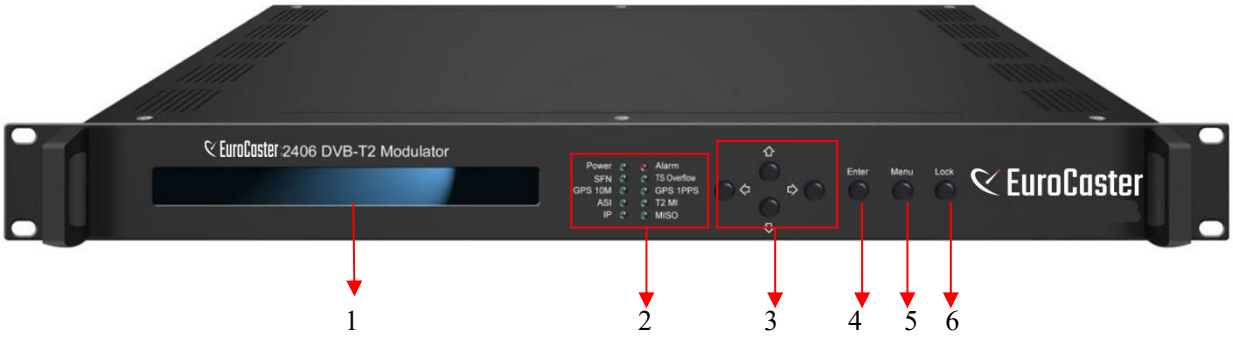
	Shoulder Level	>56dB
System	LCD display, keyboard and web Network management	
	Supporting software upgrading through network	
General	Demission (W*L*H)	482mm×410mm×44mm
	Temperature	0~45℃(operation),-20~80℃(storage)
	Power supply	AC 220V±10%,50/60Hz

1.4 Principle Chart



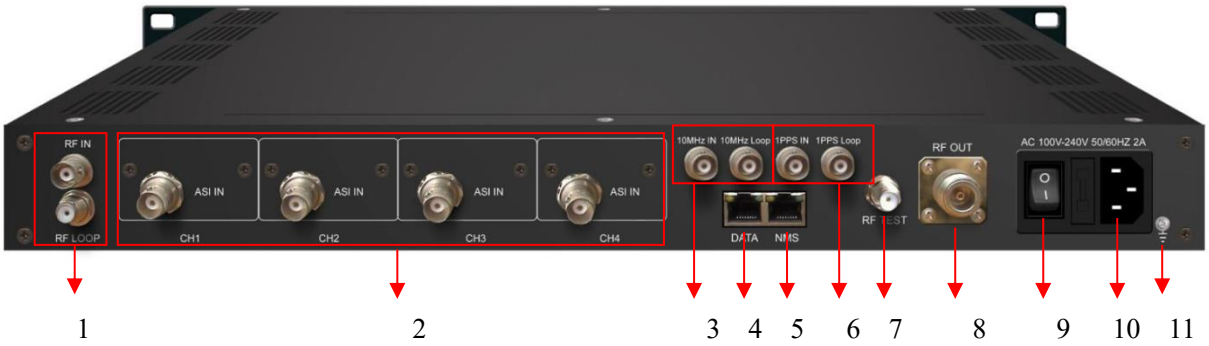
1.5 Appearance and Description

Front Panel Illustration



1	LCD Screen
2	Indicators
3	Left /Right /Up /Down Arrows
4	Enter key
5	Menu Key
6	Lock key

Rear Panel Illustration



1	RF Input and Loop out Port
2	ASI Input Port 1-4
3	External Clock 10MHz Input & Loop out Ports
4	Data Port
5	NMS Port for web-based management
6	GPS 1PPS Input & Loop out Ports
7	RF test out port (F type)
8	RF Output Port (N type)
9	Power Switch
10	AC Power Socket
11	Grounding

Chapter 2 Installation Guide

2.1 Acquisition Check

After user open the package of the device, it is necessary to check items according to packing list. Normally it should include the following items:

- EC2406 DVB-T/T2 Modulator
- User's Manual
- ASI Cable
- Power Adapter

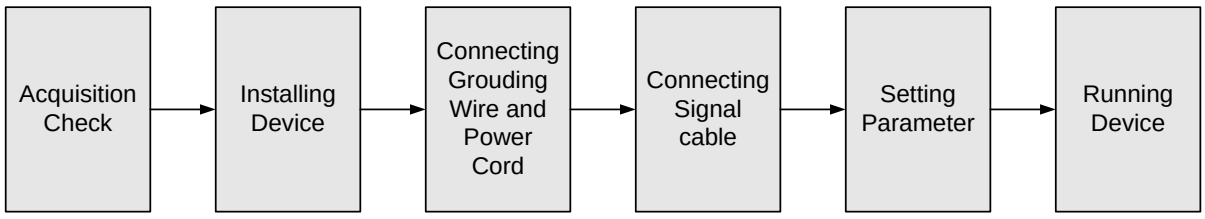
If any item is missing or mismatching with the list above, please contact the local manufacturer.

2.2 Installation Preparation

When user installs the device, please follow the steps below:

- Checking the possible device missing or damage during the transportation
- Preparing the relevant and correct environment for installation
- connecting Internet cable
- Connecting signal cables

2.2.1 Device's Installation Flow Chart Illustrated as following：



2.2.2 Environment Requirement

Item	Requirement
Machine Hall Space	When user installs machine frame array in one machine hall, the distance between 2 rows of machine frames should be 1.2~1.5m and the distance against wall should be no less than 0.8m.
Machine Hall Floor	Electric Isolation, Dust Free Volume resistivity of ground anti-static material: $1X10^7$~$1X10^{10}\Omega$, Grounding current limiting resistance: 1MΩ (Floor bearing should be greater than 450Kg/㎡)
Environment Temperature	5~40℃(sustainable), 0~45℃(short time), installing air-conditioning is recommended
Relative Humidity	20%~80% sustainable 10%~90% short time
Pressure	86~105KPa
Door & Window	Installing rubber strip for sealing door-gaps and dual level glasses for window
Wall	It can be covered with wallpaper, or brightness less paint.
Fire Protection	Fire alarm system and extinguisher
Power	Requiring device power, air-conditioning power and lighting power are independent to each other. Device power requires AC 110V±10%, 50/60Hz or AC 220V±10%, 50/60Hz. Please carefully check before running.

2.3 Wire's Connection

- Connecting Power Cord

  User can insert one end into power supply socket, while insert the other end to DC power.

Caution:

Before connecting power cord to EC2406 DVB-T/T2 Modulator, user should set the power switch to "OFF".

2.4 Signal Cables Connection

The signal connections include the connection of input signal, output signal and loop-through.

The details are as follows:

2.4.1 ASI cables illustration:

2.4.2 Network cable illustration:

2.4.3 RF in & loop out cables illustration:

Chapter 3 Front Panel Operation

EC2406 DVB-T/T2 Modulator's front panel is user operation interface, where users start their business. The LCD is a 2-line * 40-character back-lit dot-matrix user interface with pushbuttons for **UP, DOWN, LEFT, RIGHT, ENTER, MENU,** and **LOCK** for front panel control.

User can decide whether to directly use the factory setting, or customize the input/output parameters and business setting manually.

Detailed operations go as follows:

Keyboard Function Description

LEFT/RIGHT: To choose and set the parameters

UP/DOWN： To modify activated parameters or page up/down when parameter is inactivated.

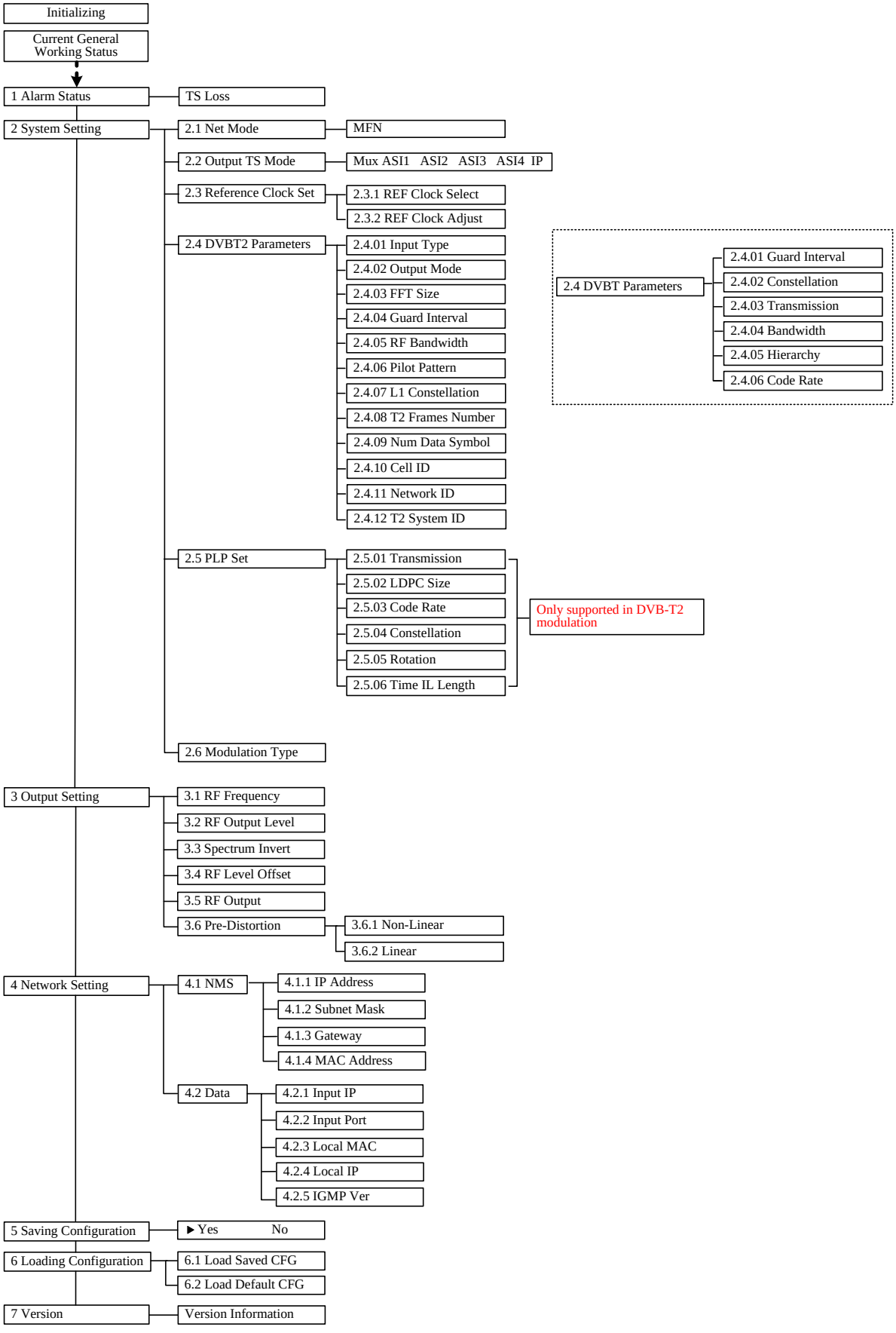
MENU： To cancel presently entered value, resume previous setting;

ENTER： To activate the parameters which need modification, and confirm the changes after modification.

LOCK： Lock the screen / cancel the lock state .After pressing lock key, the system will question the users to save or not .If not, the LCD will display the current configuration state

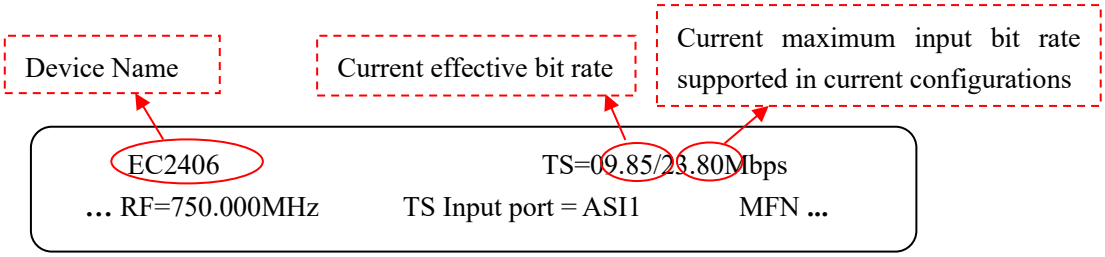
At the "Resume Factory Setting" page, user firstly presses "ENTER" key, consequently system resumes factory parameter setting.

3.1 LCD Menu Tree

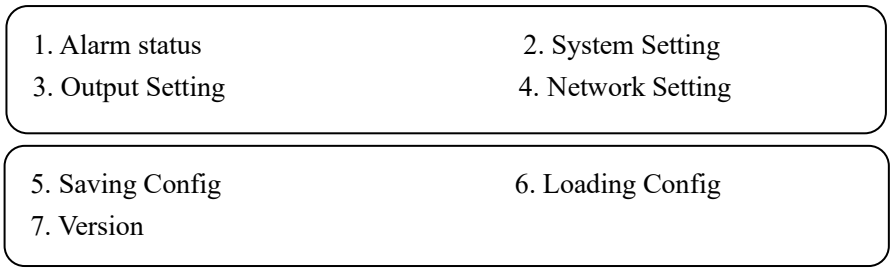


3.2 General Settings

After switching on the Modulator, the LCD sequentially will display as below:



By pressing "LOCK" key to enter the main menu, the LCD will display the following pages:



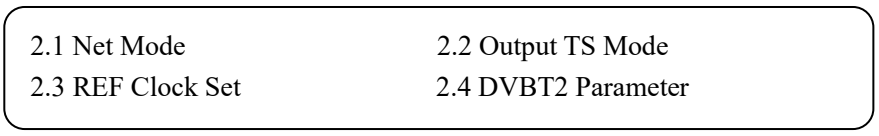
Press "UP" and "DOWN" or "LEFT" and "RIGHT" key to specify the menu item, and then press "ENTER" to enter the submenu as following pages:

3.2.1 Alarm status

When there is no TS inputting, this menu will display as follow.

3.2.2 System Setting

Press "MENU" to return to the main menu and then press "UP/DOWN" or "LEFT/RIGHT" to choose this item, and "ENTER" to set the parameters.

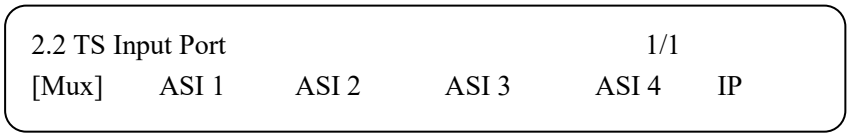


3.2.2.1 Net Mode

NDS2406 currently supports only MFN (Multi-Frequency Network) net mode. Menu 2.1 is read-only for checking the net mode.

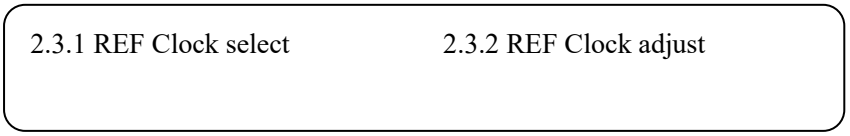
3.2.2.2 Output TS Mode

Users can select the TS input port from the 6 options at menu 2.2 according to the source port you connected.

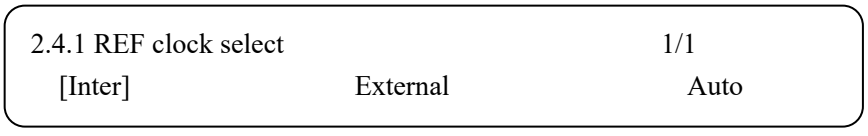


3.2.2.3 Reference Clock Set

After entering 2.3, the LCD will display submenus as follows:



Under menu 2.3.1, user can select the reference clock mode from the 3 modes showing below:



Internal: This modulator uses internal 10MHz crystal oscillator as reference clock.

External: This modulator uses external 10MHz input as reference clock.

Auto: The modulator will preferably select the external 10MHz input if it exists. Otherwise the

modulator will select the internal 10MHz crystal oscillator's output as reference clock.
And under menu 2.3.2, reference clock ad can be set manually. (From -7.000 to 7.000 Hz)

```
2.3.2 REF clock adjust
      +0.000Hz
```

3.2.2.4

User can select modulation between DVB-T and DVB-T2, and the parameters of different modulation type are different.

◆ DVBT2 Parameter

After entering 2.4, the LCD will display submenus as follows:

```
2.4.01 Input Type                2.4.02 Output Mode
2.4.03 FFT Size                  2.4.04 Guard Interval
```

```
2.4.05 RF Bandwidth              2.4.06 Pilot Pattern
2.4.07 L1 Constellation          2.4.08 T2 Frames Number
```

```
2.4.09 Num Data Symbol           2.4.10 Cell ID
2.4.11 Network ID                2.4.12 T2 System ID
```

➢ Input Type

Currently, EC2406 supports TS input over ASI ports. It's a read-only interface.

```
2.4.01 Input Type
       TS
```

➢ Output Mode

Currently, NDS2406 supports 2 output modes: SISO (Single Input Single Output) and MISO (Multi Input Single Output).

```
2.4.02 Output Mode                              1/1
       [SISO]                    MISO
```

➢ FFT Size

EC2406 supports modes: 1K, 2K, 4K, 8K+Ext, 8K, 16K+Ext, 16K, 32+Ext, and 32K.

"+Ext" means with Extension. Option with "+Ext" is a little bigger than the original value. For example, "8K+Ext" is a little bigger than 8K.

2.4.03 FFT Size			1/3
[1K]	2K	4K	8K+Ext

➢ Guard Interval

All the Guard Interval modes include: 1/128, 1/32, 1/16, 19/256, 1/8, 19/128 and 1/4.

Different combination of **Output Mode** and **FFT Size** will have an impact on the guard interval options provided with invalid options hidden. (See Appendix 1 for details.)

2.4.04 Guard Interval			1/1
[1/16]	1/8	1/4	

➢ RF Bandwidth

EC2406 supports 5M, 6M, 7M and 8M bandwidth.

2.4.05 RF Bandwidth			1/1
[5M]	6M	7M	8M

➢ Pilot Pattern

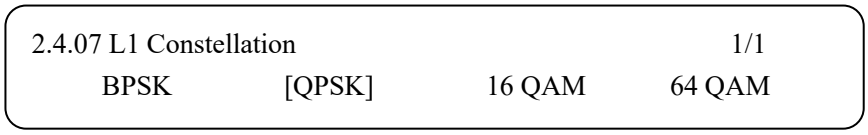
All the Pilot Patterns are from PP1 to PP8.

Different combination of **Output Mode, FFT Size** and **Guard Interval** will have an impact on the Pilot Pattern options provided with invalid options hidden. (See Appendix 1 for details.)

2.4.06 Pilot Pattern		1/1
[PP4]	PP7	

➢ L1 Constellation

Users can select one L1 (Layer 1) constellation from the options provided as below:



- T2 Frames Number

This 8-bit field indicates N_{T2}, the number of T2-frames per super-frame. (Number Range: 2-255)

- Number of Data Symbol

This 12-bit field indicates $L_{data}= L_F - N_{P2}$, the number of data OFDM symbols per T2-frame, excluding P1 and P2.

The range is determined conjointly by **FFT size** and **Guard Interval**.

If you set an inappropriate value (lower the minimum value or higher than the maximum value), it can automatically cast it to a proper value. To be specific, if you input a value lower than the minimum value allowed, the system will cast it to the minimum value. Similarly, the system will cast it to the maximum value allowed if you put an over-high value.

- Cell ID

Users can set the cell ID at this menu. It ranges from 0*0000 to 0*ffff. This is a 16-bit field which uniquely identifies a geographic cell in a DVB-T2 network. A DVB-T2 cell coverage area may consist of one or more frequencies, depending on the number of frequencies used per T2 system. If the provision of the CELL ID is not foreseen, this field shall be set to '0'.

- Network ID

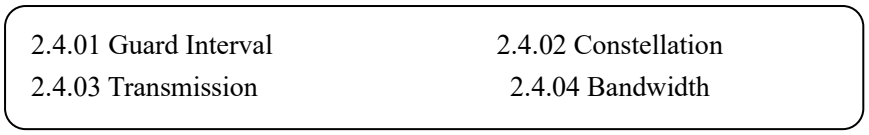
Users can set the network ID at this menu. It ranges from 0*0000 to 0*ffff. This is a 16-bit field which uniquely identifies the current DVB network.

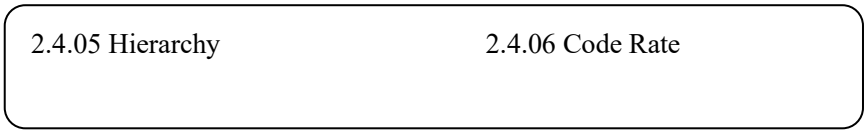
➢ T2 System ID

Users can set the system ID for the modulator at this menu. It ranges from 0*0000 to 0*ffff. This 16-bit field uniquely identifies a T2 system within the DVB network (identified by NETWORK_ID).

◆ DVBT Parameter

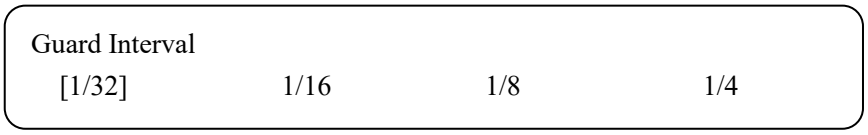
After entering 2.4, the LCD will display submenus as follows:





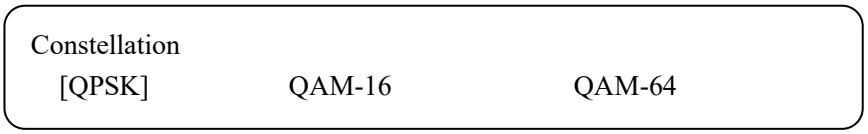
➢ Guard Interval

All the Guard Interval modes include: 1/32, 1/16, 1/8 and 1/4.



➢ Constellation

Users can set the constellation among QPSK, QAM-16 and QAM-64.



- Transmission

EC2406 DVB-T modulation supports Mode-2K and Mode-8K transmission modes.

Transmission Mode	
[Mode-2K]	Mode-8K

- Bandwidth

EC2406 DVB-T modulation supports 5M, 6M, 7M and 8M bandwidth.

Bandwidth			
[8M]	7M	6M	5M

- Hierarchy

EC2406 does not support "Hierarchy Function".

Hierarchy
None

- Code Rate

Users can adjust the code rate among 1/2, 2/3, 3/4, 4/5, 5/6 and 7/8.

Code Rate				
[1/2]	2/3	3/4	5/6	7/8

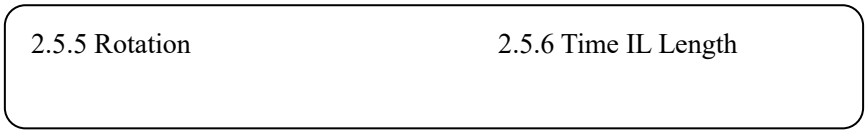
3.2.2.5 PLP Set

PLP (Physical Layer Pipe): Physical layer TDM channel that is carried by the specified sub-slices. (A PLP may carry one or multiple services).

Note: This function is not supported in DVB-T modulation.

After entering 2.5, the LCD will display submenus as follows:

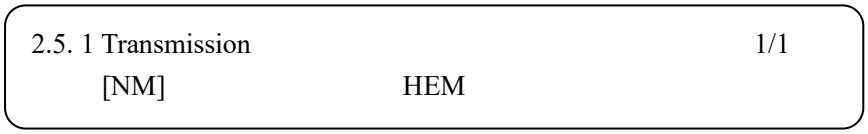
2.5. 1 Transmission	2.5.2 LDPC Size
2.5.3 Code Rate	2.5.4 Constellation



- Transmission

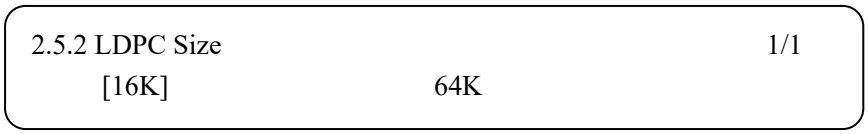
EC2406 supports both NM (Normal Mode) and HEM (High-Efficiency Mode) transmission modes.

HEM mode can enhance the total output bit rate a little.



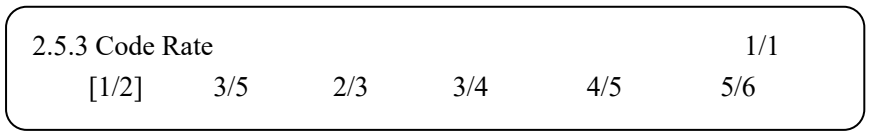
- LDPC Size

EC2406 has two types of LDPC (Low Density Parity Check) size as below:



- Code Rate

Users can adjust the code rate among 1/2, 3/5, 2/3, 3/4, 4/5 and 5/6.



- Constellation

Users can set the constellation among QPSK, 16QAM, 64QAM and 256QAM.

- Rotation

Users can rotate the constellation at this menu.

When constellation rotation is used, the normalized cell values of each FEC block coming from the constellation mapper are rotated in the complex plane and the imaginary part cyclically delayed by one cell within a FEC block.

When constellation rotation is not used, the cells are passed onto the cell interleave unmodified.

- Time IL Length

Users can set the time interleaving length at this menu. An inappropriate value will be automatically and compulsorily corrected to adapt the settings.

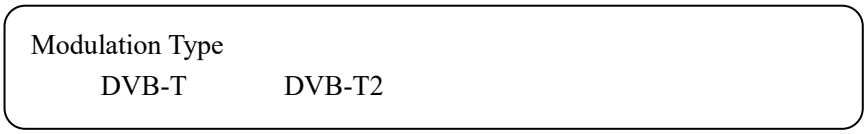
The parameters of the time interleaving may be different for different PLPs within a T2 system.

If time interleaving is not used (i.e. TIME_IL_LENGTH=0), the output of the time interleave shall consist of the cells presented at the input in the same order and without modification.

The time interleave will typically act as a buffer for PLP data and therefore the output may be delayed by a varying amount with respect to the input even when time interleaving is not used. In this case, a compensating delay for the dynamic configuration information from the scheduler will still be required.

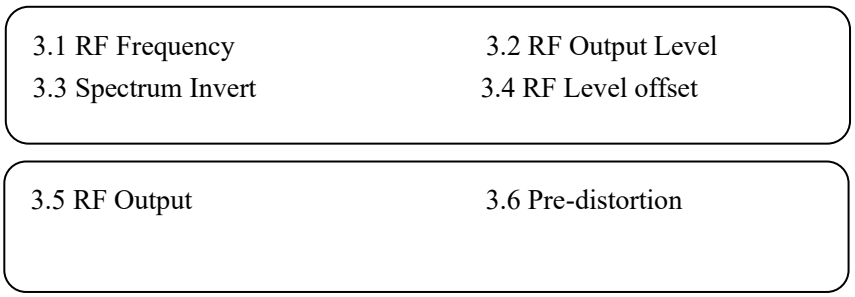
3.2.2.6 Modulation Type

EC2406 support DVB-T and DVB-T2 modulation, users can switch modulation type here or in Web management system.

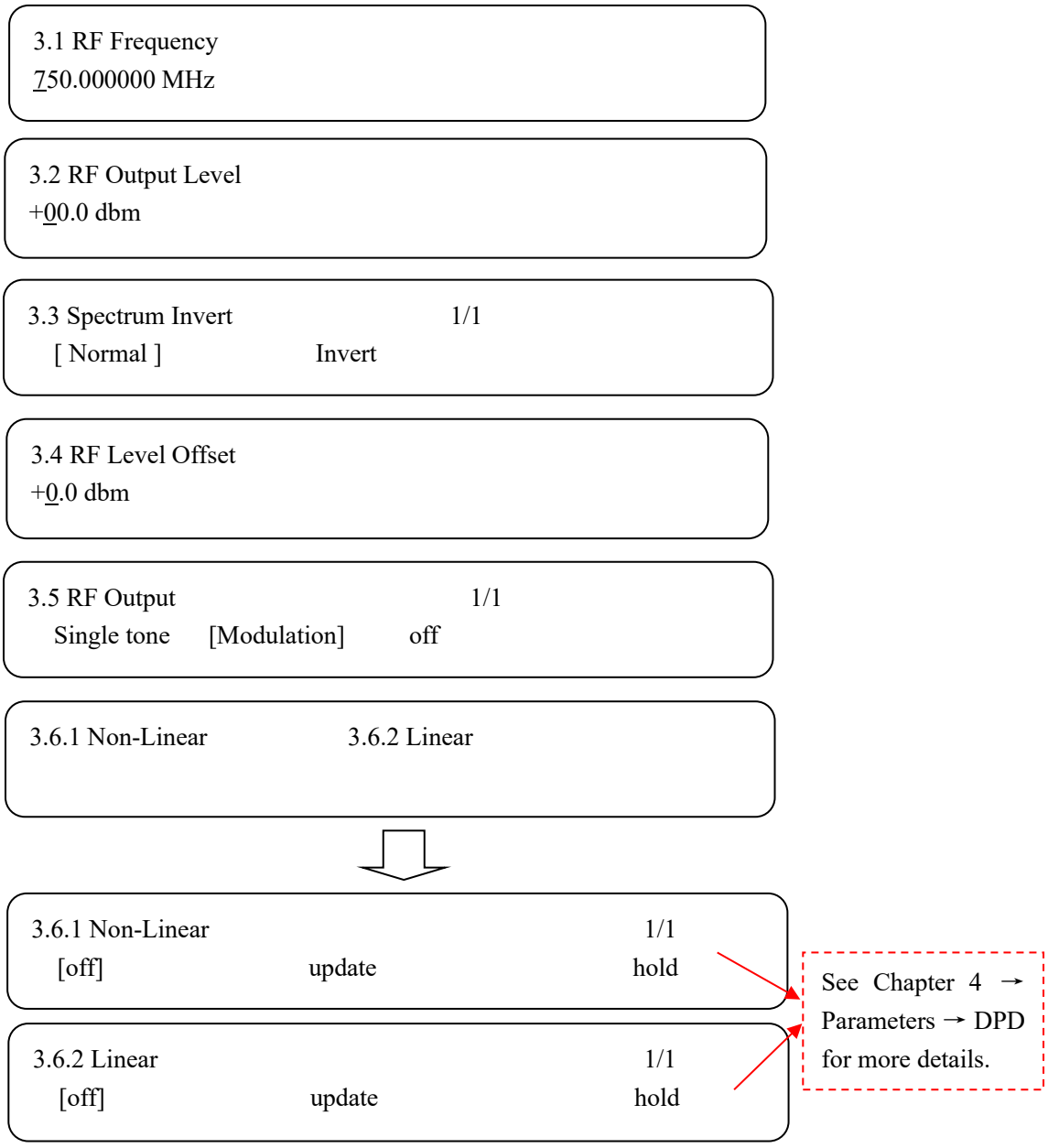


3.2.3 Output Setting

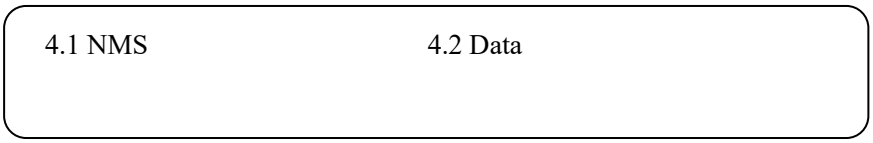
After entering Menu 3, the LCD will display submenus as follows:



Press "UP/DOWN" or "LEFT/RIGHT" to choose this item and "ENTER" to set the parameters or select the mode of corresponding items. The system will display as following pages:

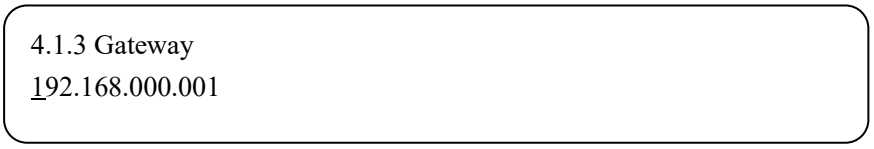


3.2.4 Network Setting



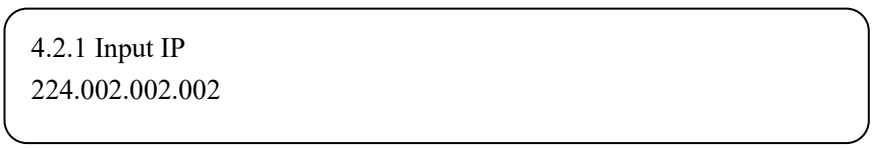
Under the two items, there are parameters which can be set manually. User can press "LEFT/RIGHT" to choose this item. "ENTER" and "UP/DOWN" to set the parameters. The system will display following pages:

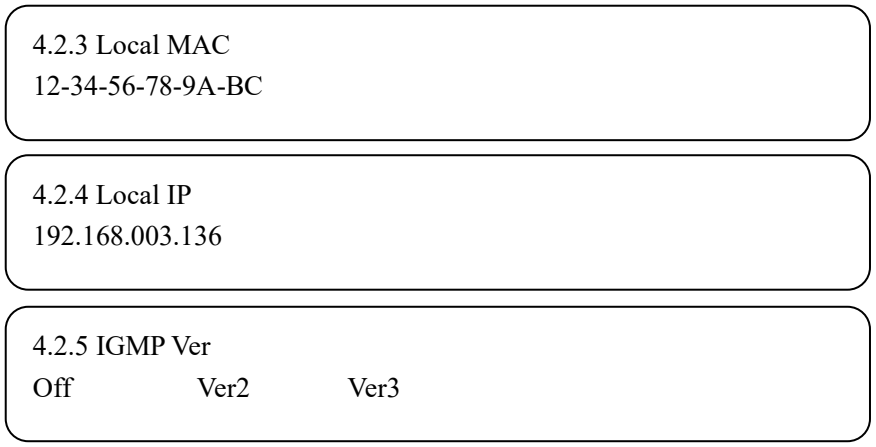
- NMS



NOTE: The MAC address is set by the factory and it's unique. It is read-only on the LCD screen and can only be modified through upgrade software on PC.

- Data



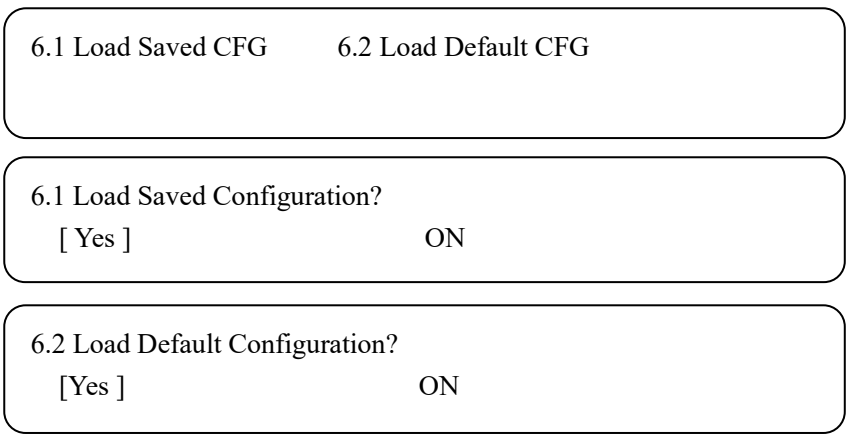


3.2.5 Saving Configuration

User can choose to save the current configured parameters by pressing ENTER key. The system will display following page:

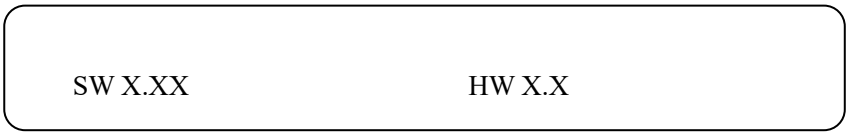
3.2.6 Loading Configuration

At this menu, user can restore the device into the last saved configuration by choosing "6.1" and restore the device into factory configuration by choosing "6.2" and press "LEFT/RIGHT" and "UP/DWON" keys and "ENTER" to confirm.



3.2.7 Version

User can check the hardware version and software version of the equipment.



Chapter 4 Web NMS Operation

In addition to using front panel to set configuration, users can also control and complete the configuration in a PC by connecting EC2406 to the PC through modulator's NMS Port. Users should ensure that the computer's IP address is different from the device's IP address; otherwise, it would cause IP conflict.

4.1 Login

The default IP address of this device is 192.168.0.136. (We can modify the IP through the front panel.)

Connect the PC (Personal Computer) and the device with net cable, and use ping command to confirm they are on the same network segment.

For instance, the PC IP address is 192.168.99.252, we then change the device IP to 192.168.99.xxx (xxx can be 0 to 255 except 252 to avoid IP conflict).

Use web browser to connect the device with PC by inputting the modulator's IP address in the browser's address bar and press Enter.

It will display the Login interface as Figure-1. Input the Username and Password (Both the default Username and Password are "admin".) and then click "LOGIN" to start the device setting.

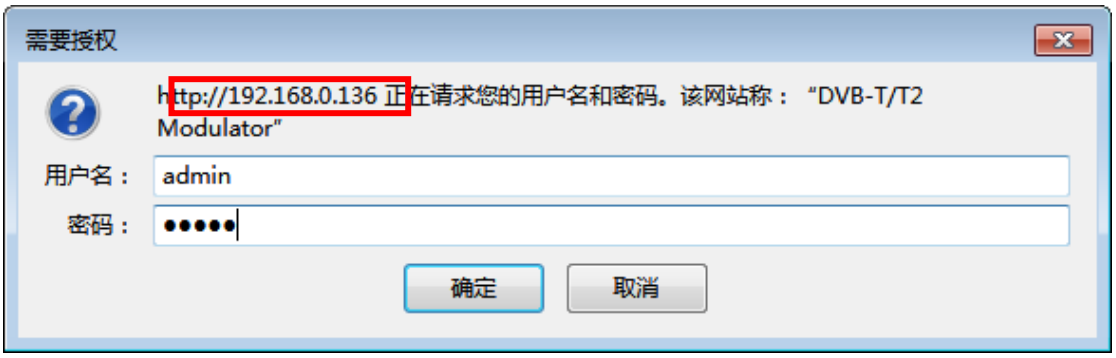


Figure-1

4.2 Operation

When we confirm the login, it will display the operating interface as follows:

Summary→Status

Users can have a general view of the device information and working status in this interface as Figure-2.

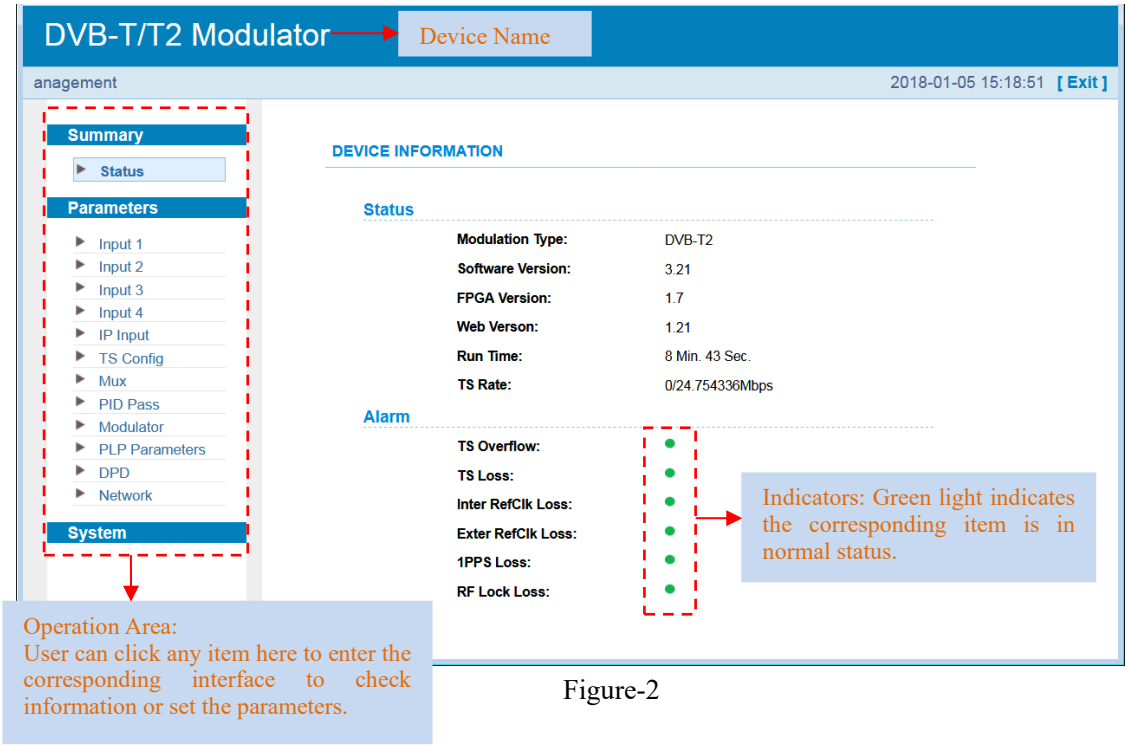


Figure-2

Parameter→Input 1-4

Clicking "Input X", it will display the interface as figure-3 where users can check ASI status.

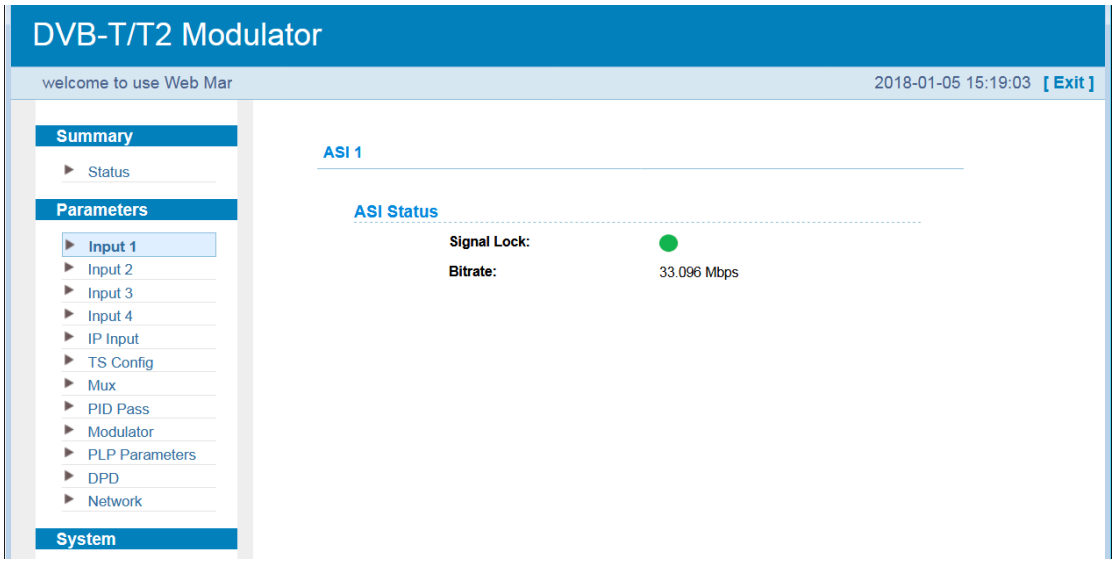


Figure-3

Parameter→IP Input

Clicking "IP Input", it will display the interface as figure-4 where users can set IP parameters.

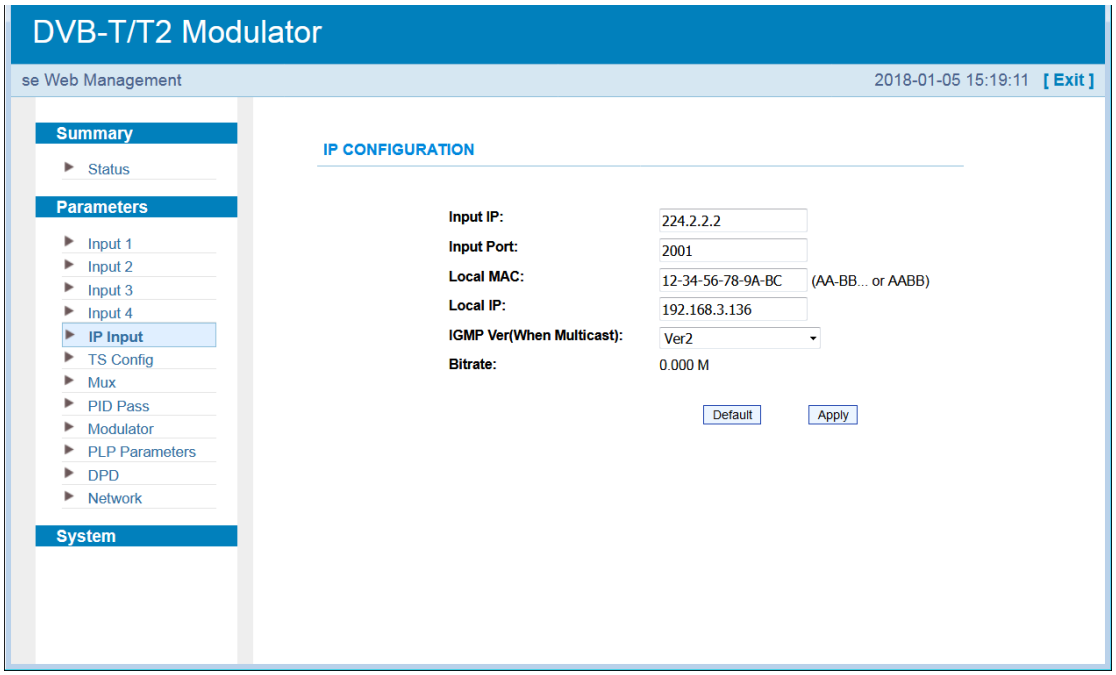


Figure-4

Parameter→TS Config

Clicking "TS Config", it will display the interface as Figure-5 where users can set TS stream parameters and choose output TS mode.

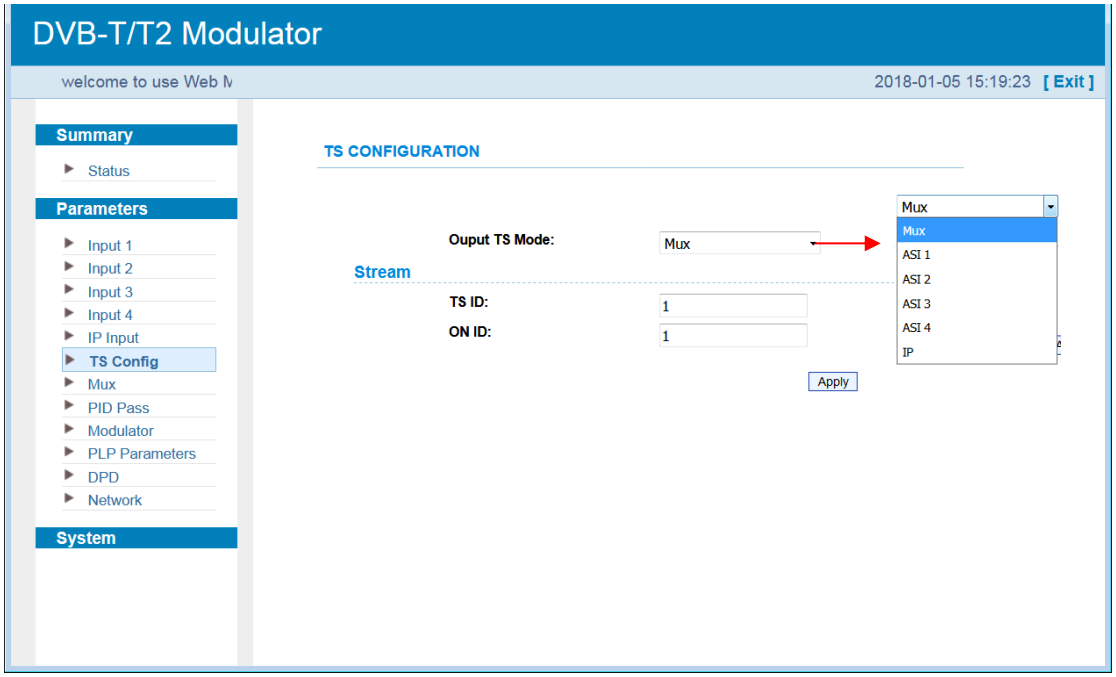


Figure-5

Parameter→Mux

Clicking "Mux", it will display the interface as Figure-6 where users can select program(s) to multiplex out and modify program info.

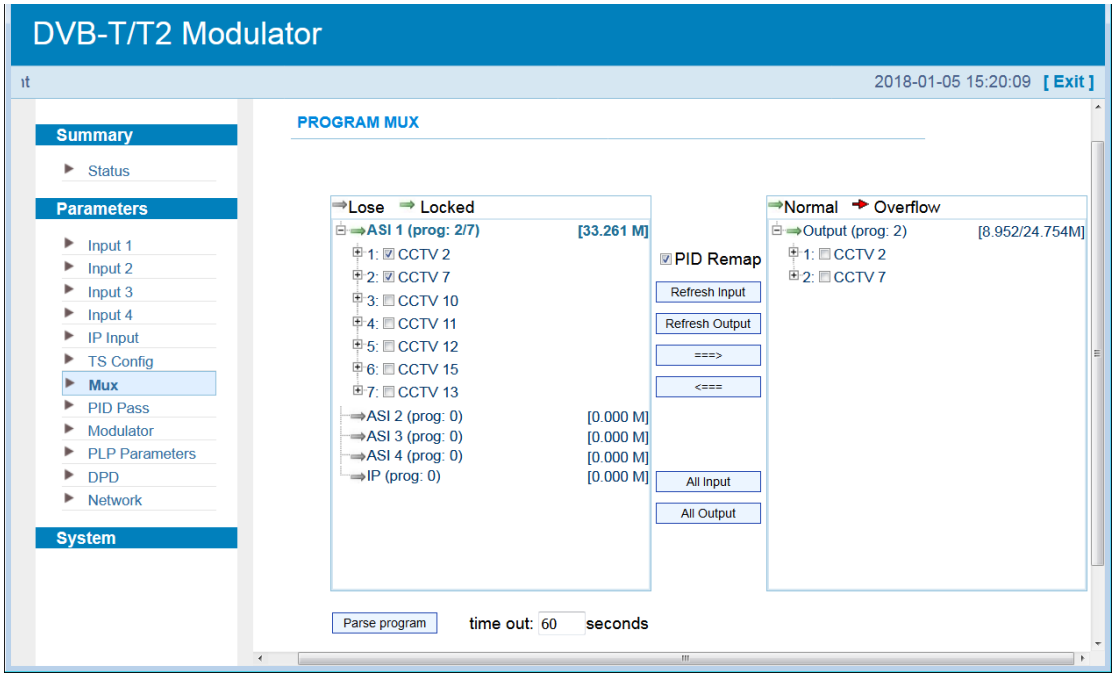


Figure-6

Configure 'Input Area' and 'Output Area' with buttons in 'Operation Area'. Instructions are as below:

Lose Locked : To check input IP lock or not, green means current IP locked

Normal Overflow : To check current TS overflow or not, red color means current TS overflow, need reduce program

PID Remap : To enable/disable the PID remapping

Refresh Input To refresh the input program information

Refresh Output To refresh the output program information

===> Select one input program first and click this button to transfer the selected program to the right box to output.

<=== Similarly, user can cancel the multiplexed programs from the right box.

All Input To select all the input programs

All Output To select all the output programs

Parse program To parse programs time out: 60 seconds time limitation of parsing input programs

Parse-Select all(SPTS) To parse all the selected programs

➢ **Program Modification:**

The multiplexed program information can be modified by clicking the program in the 'output' area. For example, when clicking 1: CCTV 2 , it triggers a dialog box (Figure-7) where users can input new information.

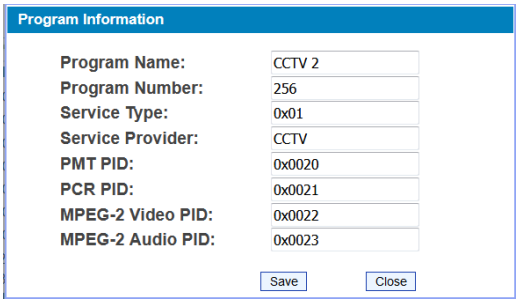


Figure-7

Parameter→PID Pass

Clicking "PID Bypass", it will display the interface where to add the PIDs which need pass through. (Figure-8)

In some occasions, there are some PIDs which won't belong to any program, such as EPG, NIT tables and so on which user just wants to pass them through the multiplexing module without changing anything. This is the main purpose of this function.

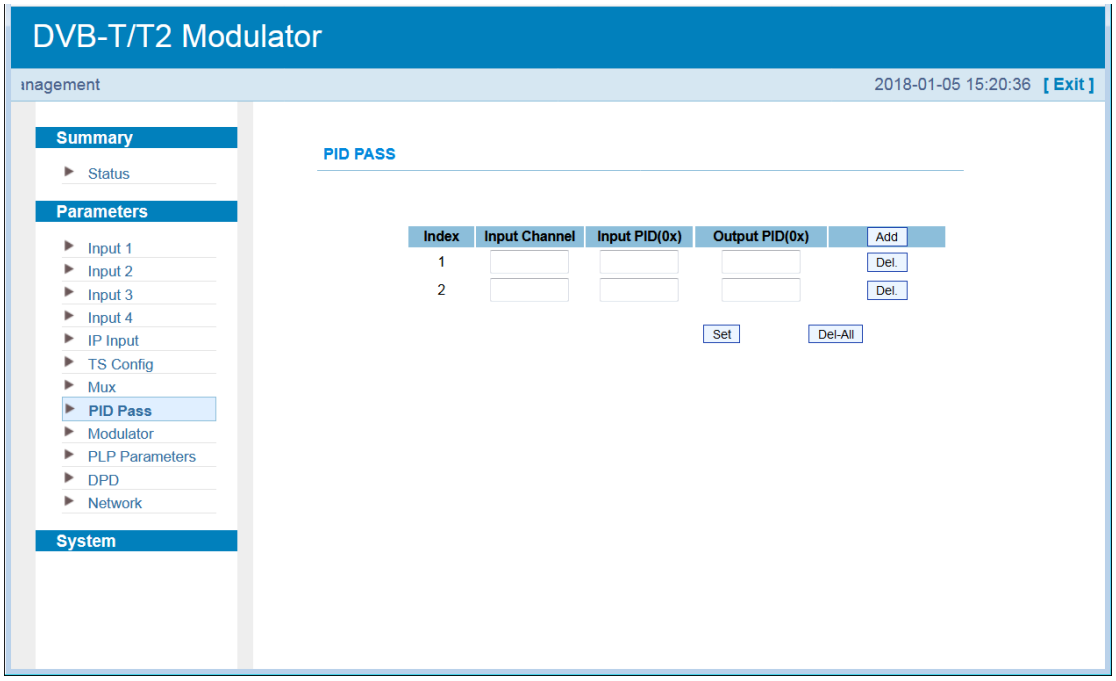


Figure-8

Parameters→Modulator

Clicking "Modulator" from the menus on left side, it will display the editing item of the DVB-T2 modulation as Figure-9.

After setting all the Modulator parameters, click Apply button to confirm and put the configuration into effect.

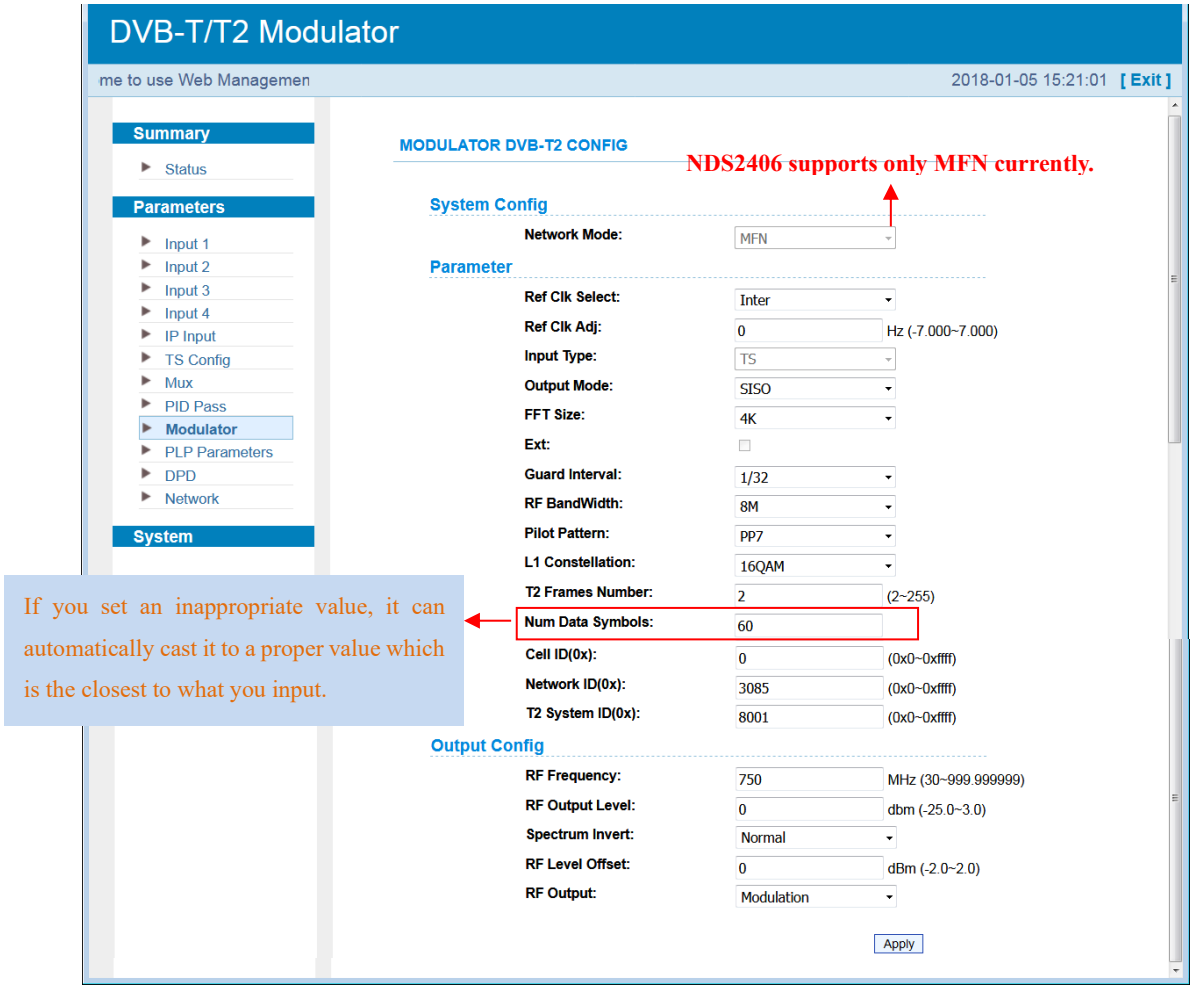


Figure-9

Parameters→PLP Parameter

Clicking "PLP Parameter" from the menus on left side, it will display the editing item of the PLP (Physical Layer Pipe) as Figure-10.

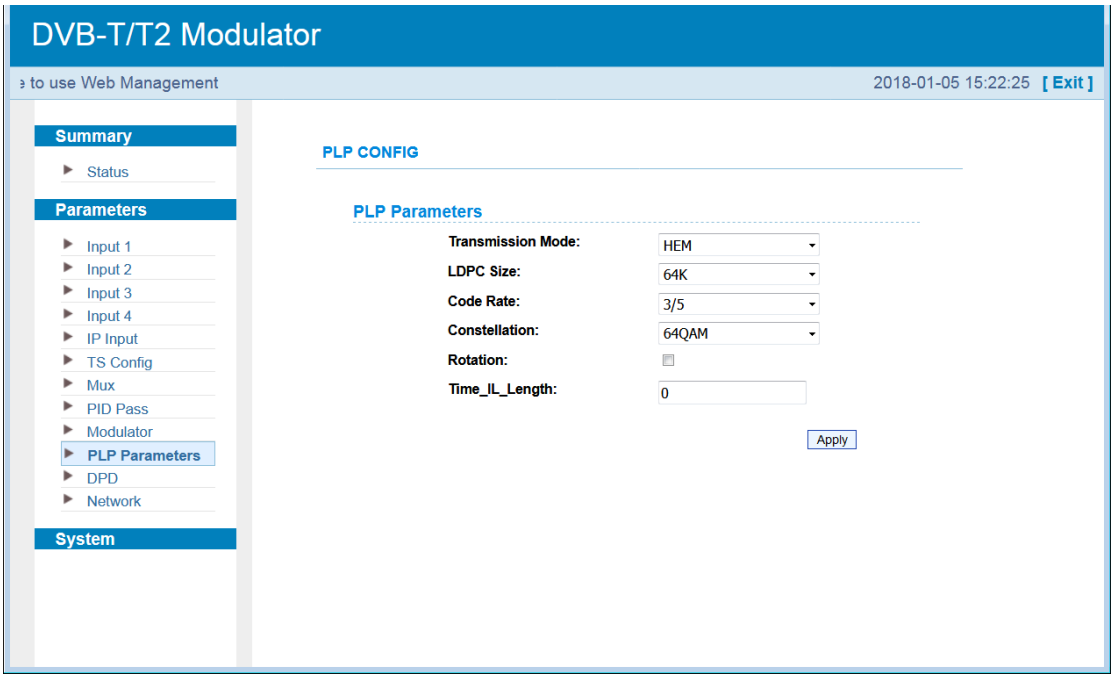


Figure-10

Transmission Mode:

EC2406 supports both NM (Normal Mode) and HEM (High-Efficiency Mode) transmission modes. HEM mode can enhance the total output bit rate a little.

LDPC Size:

It refers to Low Density Parity Check and has two size modes: 16K and 64K.

Code Rate:

Users can adjust the code rate among 1/2, 3/5, 2/3, 3/4, 4/5 and 5/6.

Constellation:

Users can adjust the constellation among QPSK, 16QAM, 64QAM and 256QAM.

Rotation:

Users can rotate the constellation by checking the box.

Time IL Length:

Users can set the time interleaving length in the right box. An inappropriate value will be automatically and compulsorily corrected to adapt the settings.

Parameters→DPD (Digital Pre-Distortion)

Clicking "DPD" from the menus on left side, it will display the DPD control interface as Figure-11. NDS2406 supports both None-linear and Liner DPD. Click Update button to start

to correct the distortion. If it success, it shows "Hold" in status box, otherwise it shows "Off" instead.

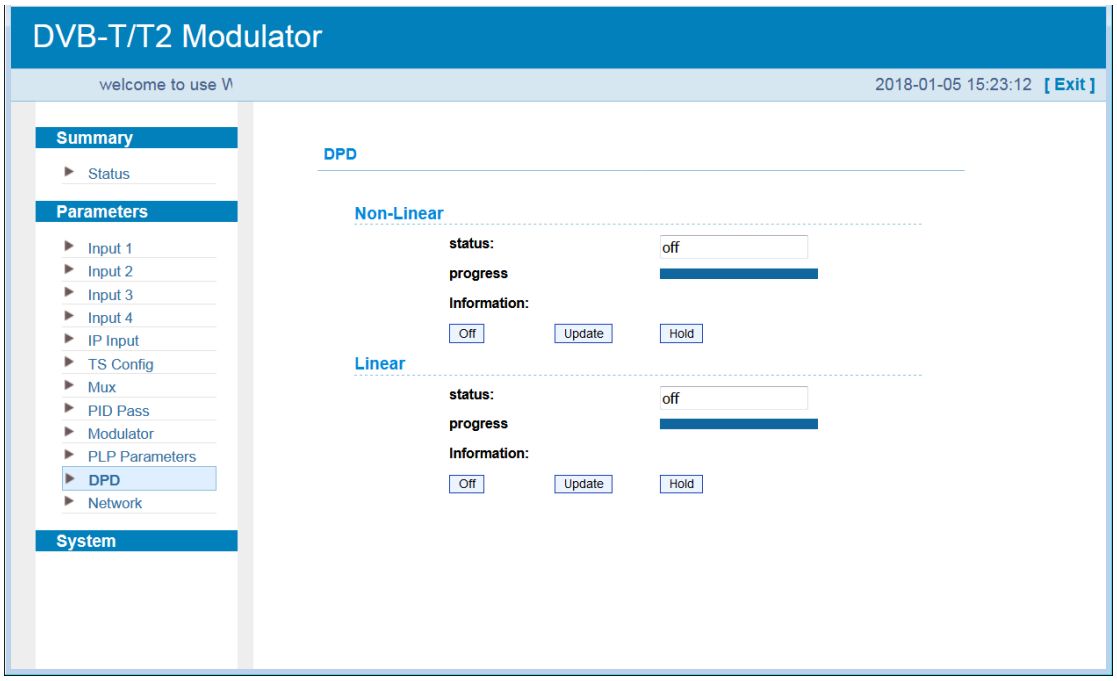
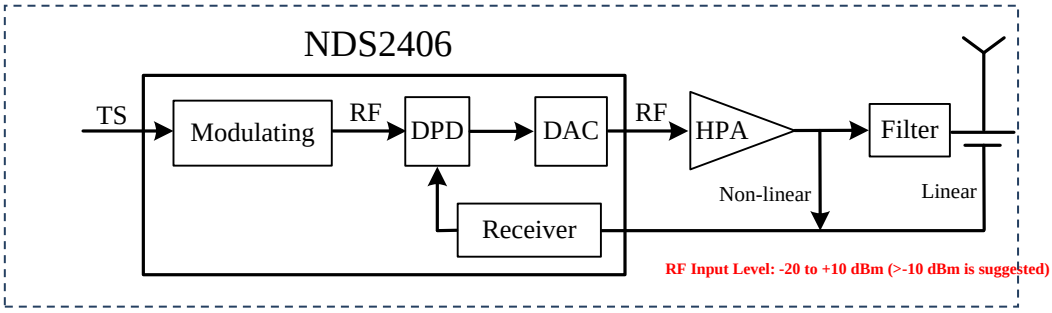
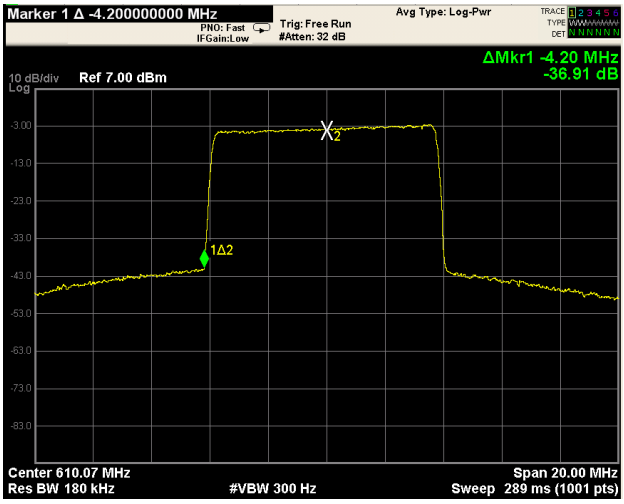


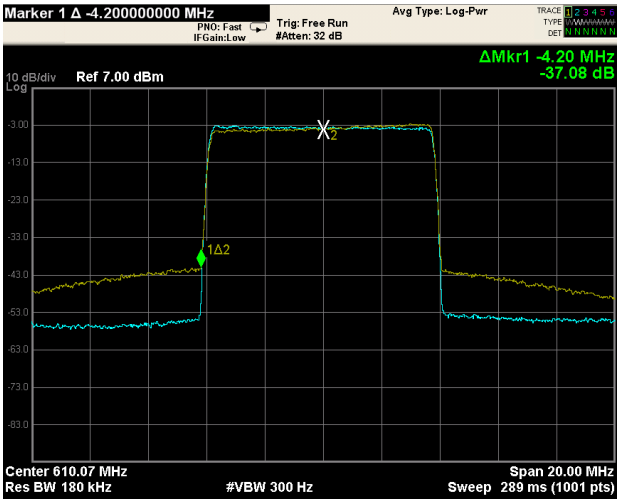
Figure-11

Below chart has shown the principle and system connection of DPD.



Below two pictures are the screenshots from signal analyzer comparing the spectrum with DPD off and updated.





Shoulder Level with DPD Disabled **vs** **Shoulder Level with DPD Enabled**

Error Alarm:

If there are errors in the DPD process, it will give alarm on the device's front panel with the alarm LED on. Users can then enter menu '1 Alarm Status' to check the error(s).

Non-Linear Errors may occur are: 'Error Feedback Lose', 'Error Update [code=x]', and 'Warning: over drive detected'.

Linear Errors may occur are: 'Error Feedback Signal Lose', 'Error Feedback Signal Error' and 'Error Update [code=x]'.

Parameters→Network

Clicking "Network" from the menus on left side, it will display the interface as Figure-12 where to modify the IP address and other network settings of the modulator.

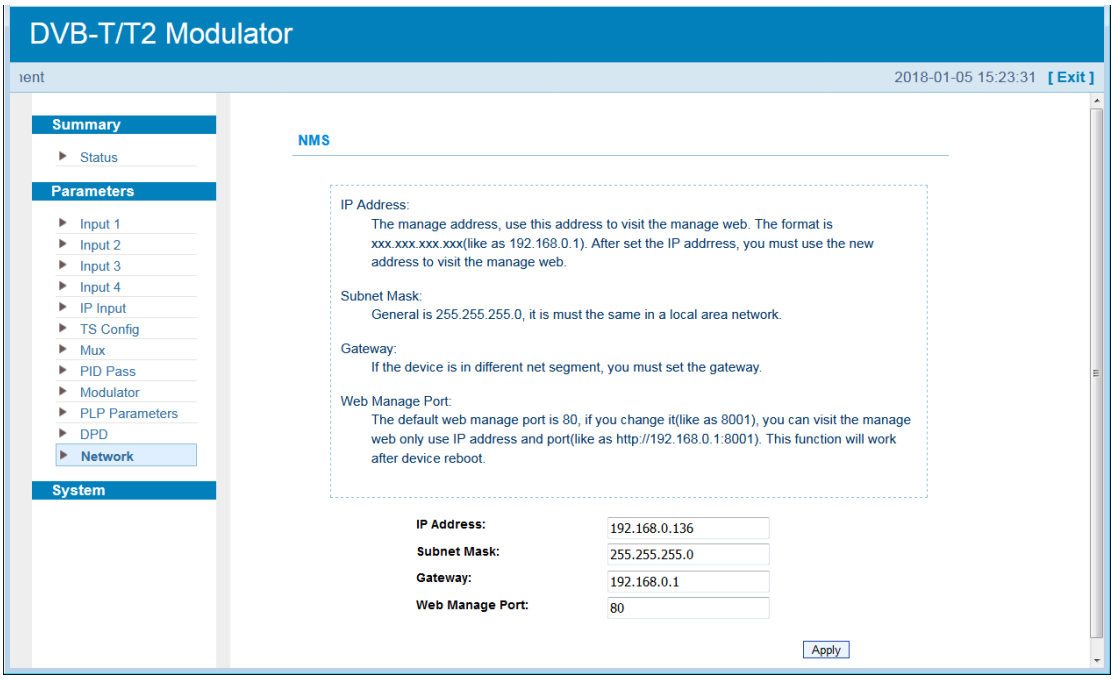


Figure-12

System→Modulation Type

Clicking "Modulation Type", it will display the interface as Figure-13 where to select modulation type as DVB-T or DVB-T2.

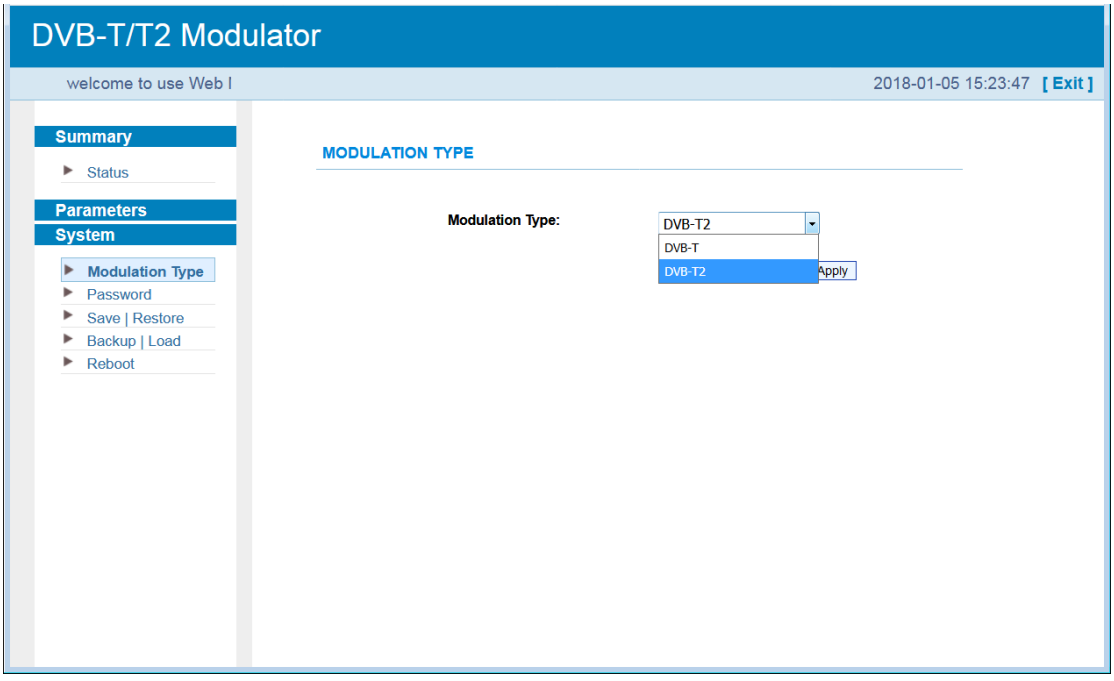


Figure-13

When select modulation as DVB-T, some interfaces will be different from DVB-T2.

Status:

When click status, the modulation type will be DVB-T (Figure-14).

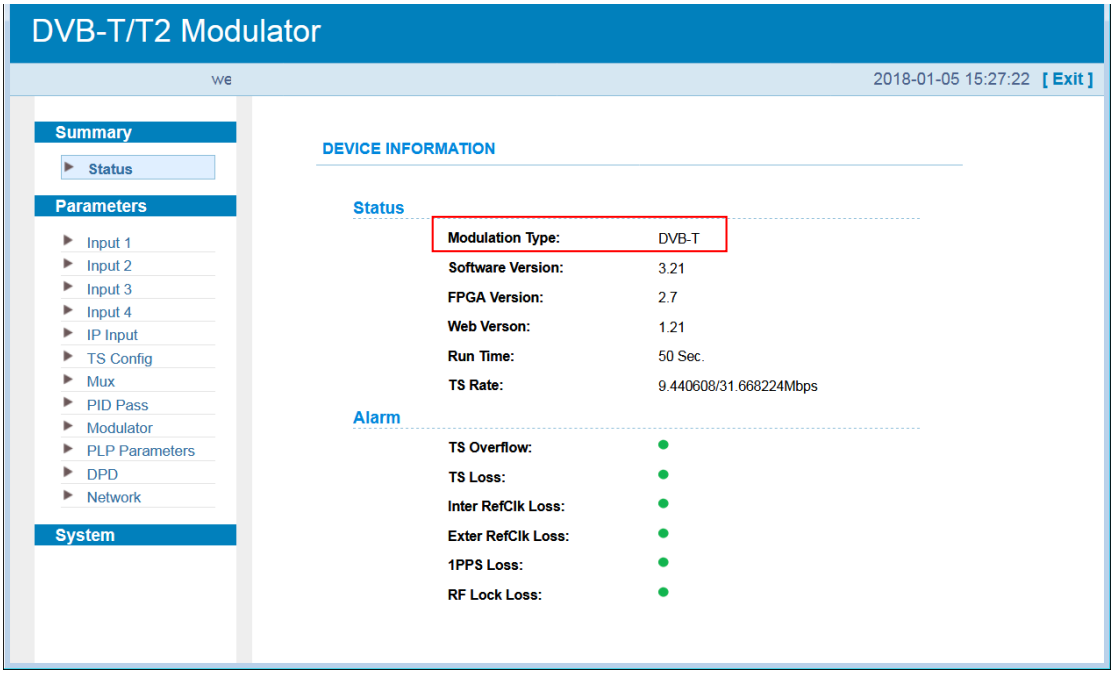


Figure-14

Modulator:

Clicking "Modulator" under DVB-T modulation type, it will display the interface as Figure-15.

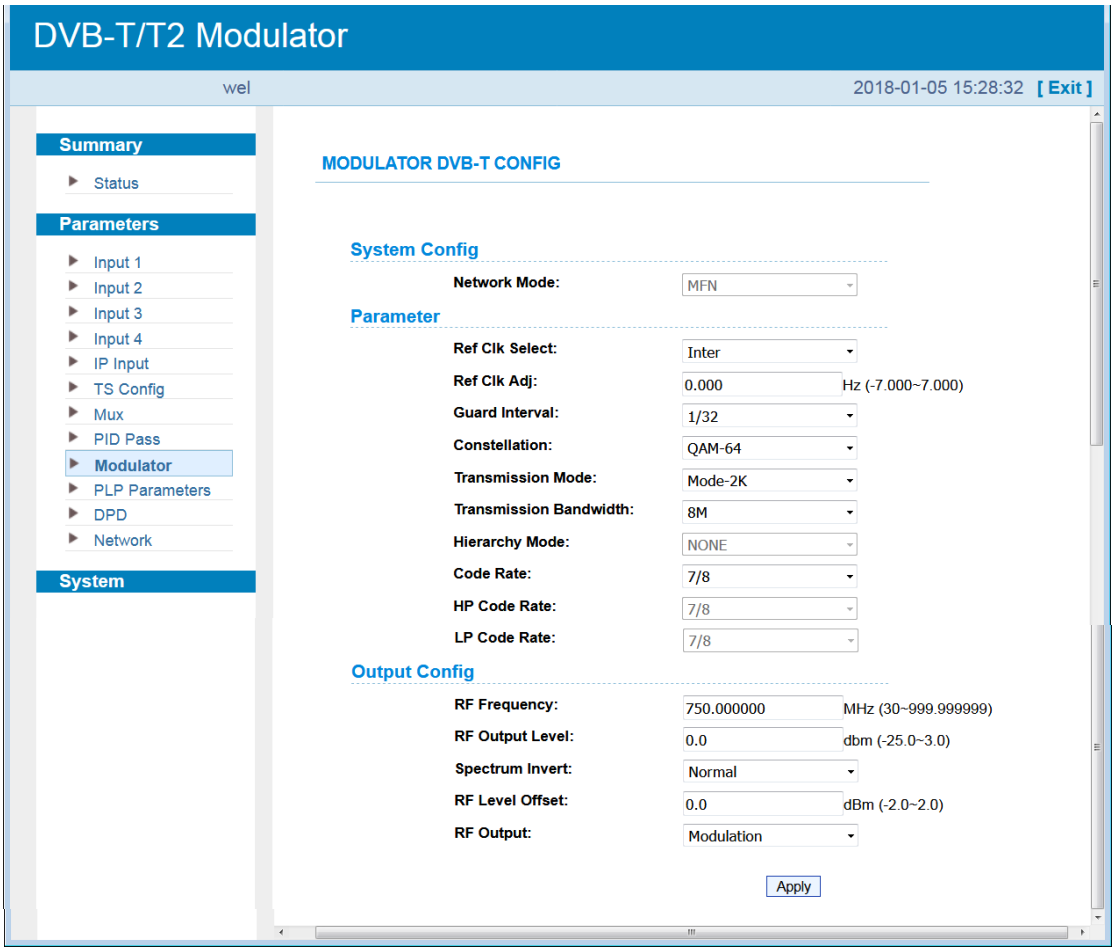


Figure-15

PLP Parameters:

DVB-T modulation does not support PLP function (Figure-16).

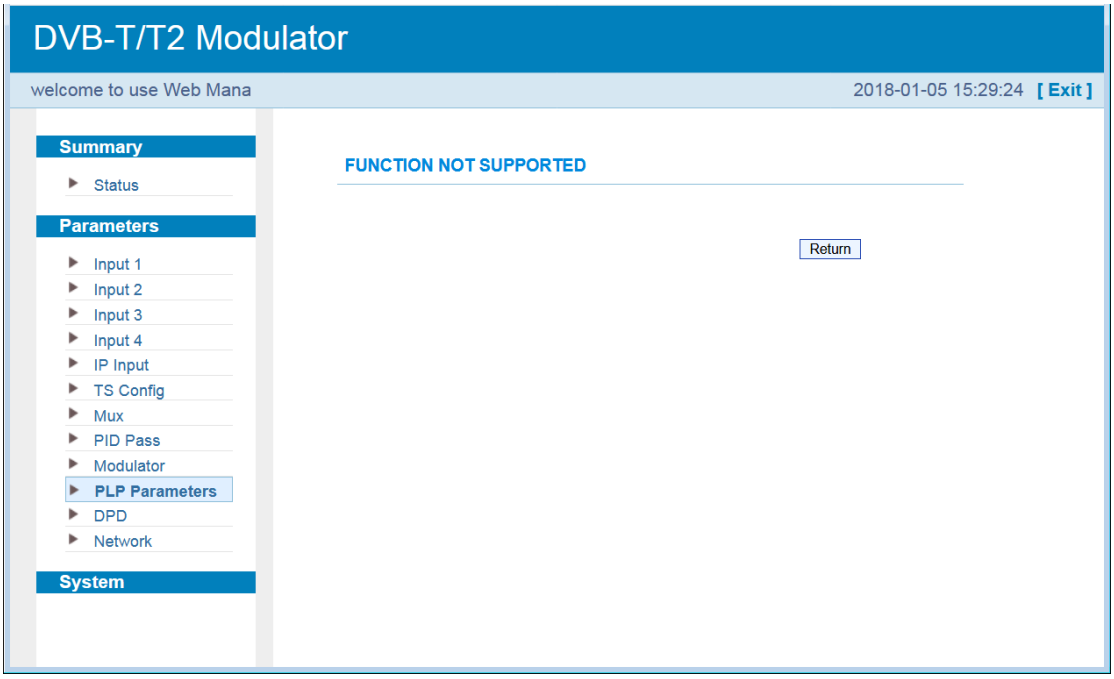


Figure-16

System→Password

Clicking "Password", it will display the interface as Figure-17 where to modify the login User ID and password.

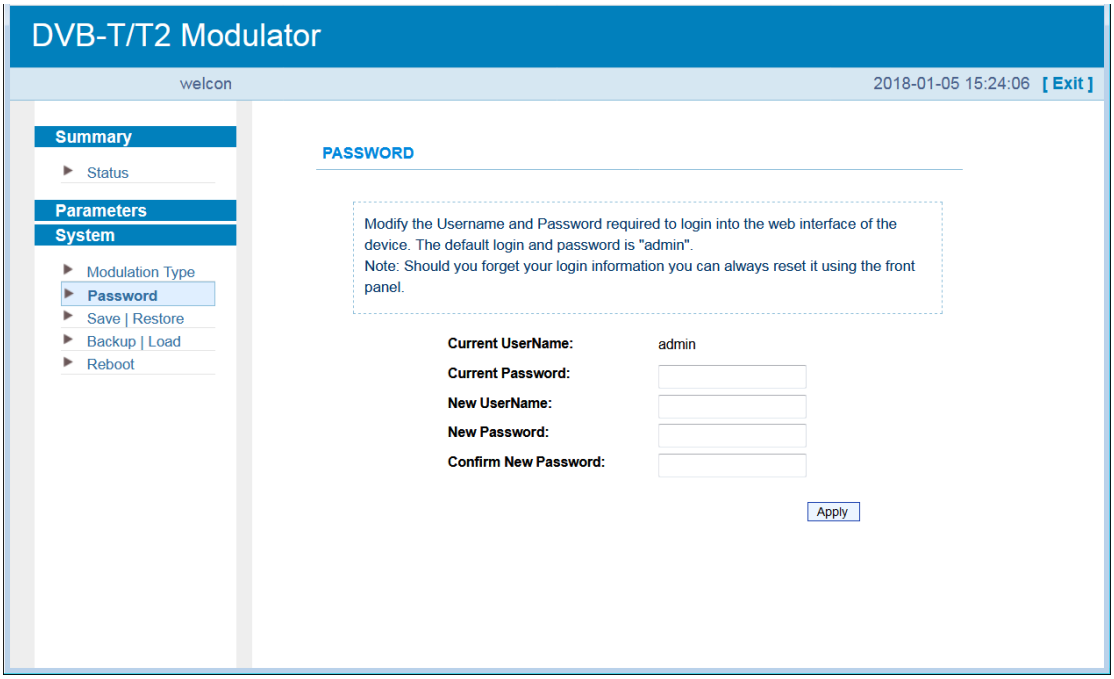


Figure-17

System→Save/Restore

Click "Save/Restore" from the menus on left side, it will display the interface as Figure-18

where to save your configuration or load your latest saved configuration.

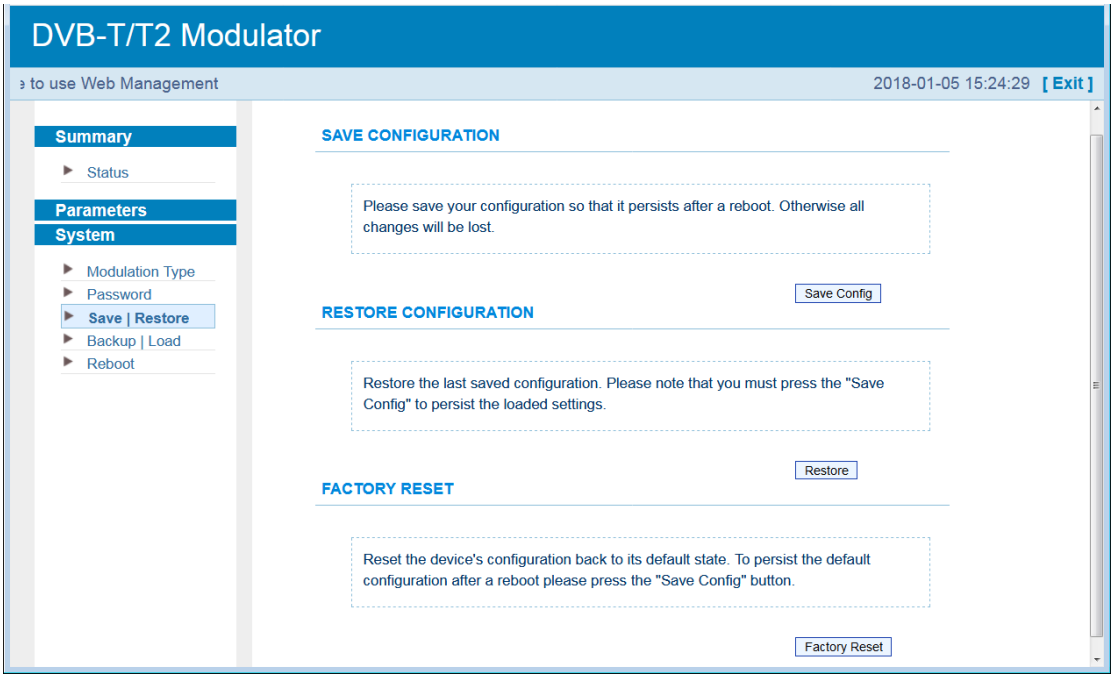


Figure-18

System→Backup/Load

Clicking "Backup/Load", it will display the interface as Figure-19 where to backup your current configuration to the local file or load your backup file to restore your configuration.

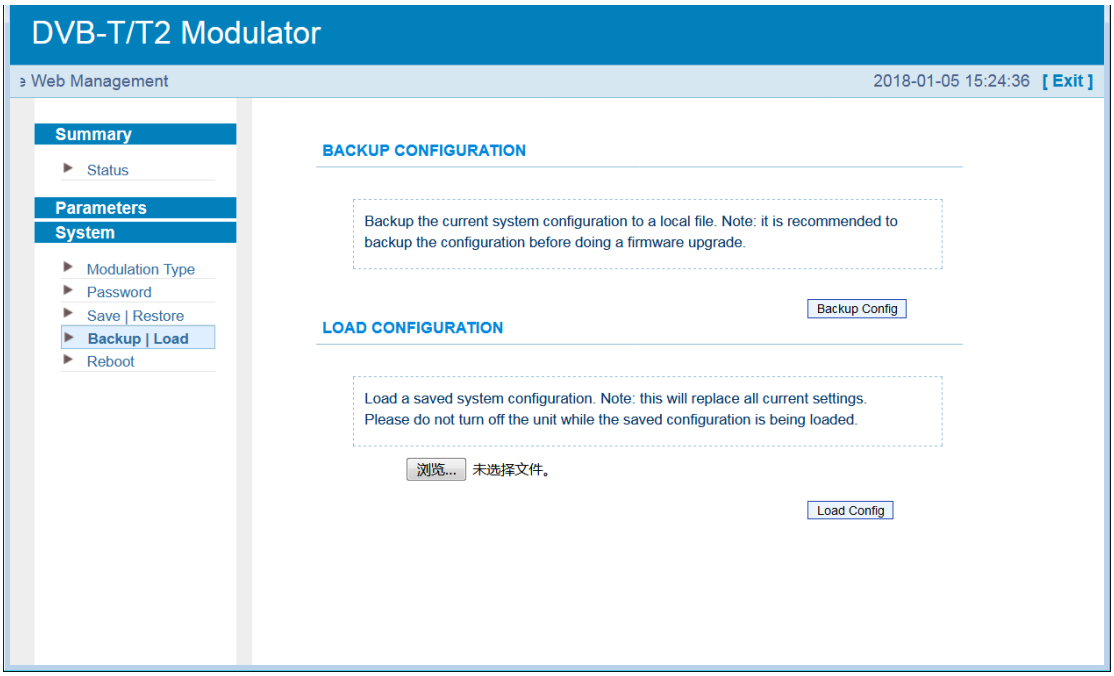


Figure-19

System→Reboot

Clicking "Reboot", it will display the interface as Figure-20 where to reboot the device as

needed.

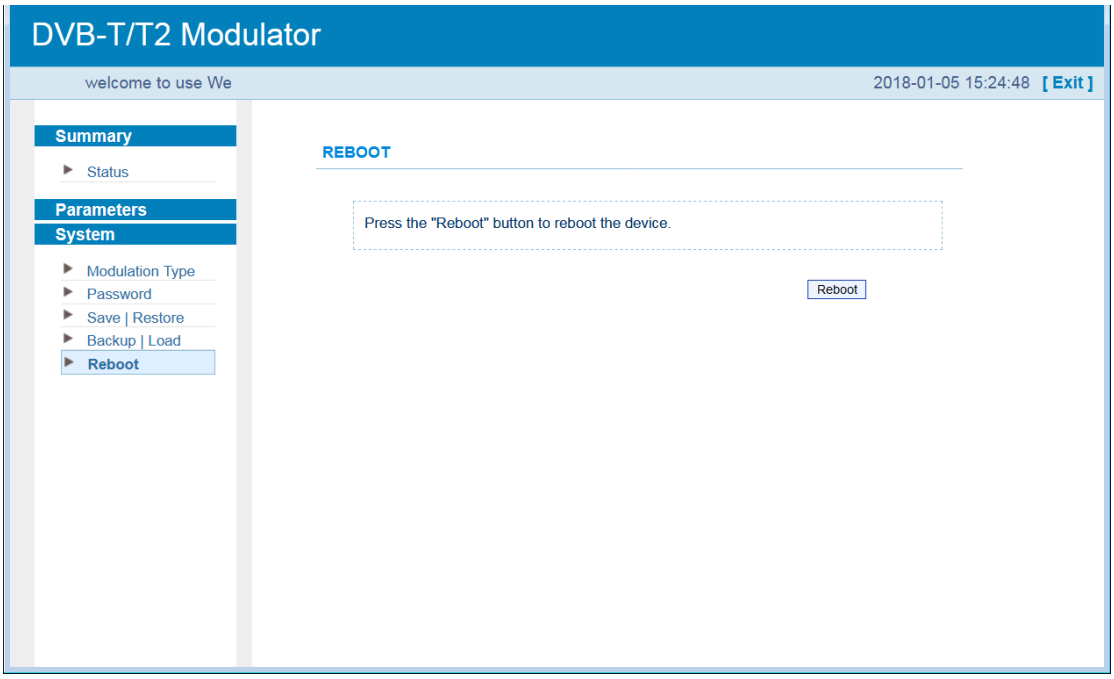


Figure-20

Chapter 5 Troubleshooting

Eurocaster's manufacturing partner's ISO9001 quality assurance system has been approved by CQC organization. For guarantee the products' quality, reliability and stability. All our products have been passed the testing and inspection before ship out factory. The testing and inspection scheme already covers all the Optical, Electronic and Mechanical criteria which have been published by Eurocaster. To prevent potential hazard, please strictly follow the operation conditions.

Prevention Measure

- Installing the device at the place in which environment temperature between 0 to 45 °C
- Making sure good ventilation for the heat-sink on the rear panel and other heat-sink bores if necessary
- Checking the input AC within the power supply working range and the connection is correct before switching on device
- Checking the RF output level varies within tolerant range if it is necessary
- Checking all signal cables have been properly connected
- Frequently switching on/off device is prohibited; the interval between every switching on/off must greater than 10 seconds.

Conditions need to unplug power cord

Power cord or socket damaged.
Any liquid flowed into device.
Any stuff causes circuit short
Device in damp environment
Device was suffered from physical damage
Longtime idle.
After switching on and restoring to factory setting, device still cannot work properly.
Maintenance needed

Chapter 6 Packing List

Eurocaster EC2406 DVB-T/T2 Modulator

User's manual

ASI cables

Power adapter

Annex

e 58: Scattered pilot pattern to be used for each allowed combination of FFT size and guard interval in SISO mode

FFT size	Guard interval						
	1/128	1/32	1/16	19/256	1/8	19/128	1/4
32K	PP7	PP4 PP6	PP2 PP8 PP4	PP2 PP8 PP4	PP2 PP8	PP2 PP8	NA
16K	PP7	PP7 PP4 PP6	PP2 PP8 PP4 PP5	PP2 PP8 PP4 PP5	PP2 PP3 PP8	PP2 PP3 PP8	PP1 PP8
8K	PP7	PP7 PP4	PP8 PP4 PP5	PP8 PP4 PP5	PP2 PP3 PP8	PP2 PP3 PP8	PP1 PP8
4K, 2K	NA	PP7 PP4	PP4 PP5	NA	PP2 PP3	NA	PP1
1K	NA	NA	PP4 PP5	NA	PP2 PP3	NA	PP1

e 59: Scattered pilot pattern to be used for each allowed combination of FFT size and guard interval in MISO mode

FFT size	Guard interval						
	1/128	1/32	1/16	19/256	1/8	19/128	1/4
32K	PP8 PP4 PP6	PP8 PP4	PP2 PP8	PP2 PP8	NA	NA	NA
16K	PP8 PP4 PP5	PP8 PP4 PP5	PP3 PP8	PP3 PP8	PP1 PP8	PP1 PP8	NA
8K	PP8 PP4 PP5	PP8 PP4 PP5	PP3 PP8	PP3 PP8	PP1 PP8	PP1 PP8	NA
4K, 2K	NA	PP4 PP5	PP3	NA	PP1	NA	NA
1K	NA	NA	PP3	NA	PP1	NA	NA