

BBEF

1.3KW DIGITAL TV TRANSMITTER USER MANUAL



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Content

1	Overview.....	1
1.1	Compliance of standard.....	1
2	Technical features	1
2.1	The transmitter has the following features	2
2.2	Product performance	4
2.2.1	Digital mode.....	4
2.2.2	Input Interface.....	4
2.2.3	Output Parameters.....	4
2.3	Environment condition	5
2.4	Working conditions	5
2.5	Main specification	5
3	Working principles.....	5
3.1	Principle of main units	7
3.1.1	Exciter	7
3.1.2	Switchover Amplifier.....	7
3.1.3	Power Amplifier.....	8
3.1.4	Distribution Unit	15
3.1.5	Central Control Unit	17
3.1.6	Switch power	34
3.1.7	Collecting & Control Unit	34
3.1.8	Band-pass filter	35
4	Structural characteristics.....	36
4.1	Structural characteristics	36
4.2	Dimension	37
4.3	Mounting dimensions	37



5	Installation and debugging.....	38
5.1	Installation	38
5.2	Electrical connection	39
5.3	Transmitter debugging	40
6	Use and operation	40
6.1	Personnel requirement.....	40
6.2	Safety Tips.....	41
6.3	Operation procedures	42
6.3.1	Preparation and examination before use	42
6.3.2	Power-on operation	43
6.3.3	Startup and shutdown operation.....	44
6.3.4	Operation for switching over of exciters	45
6.3.5	Running log.....	45
7	Fault analysis and troubleshooting.....	47
7.1	Common faults and troubleshooting	47
7.2	Common faults and maintenances.....	47
8	Maintenance	54
8.1	How to change the dust screen of the air inlet	55
8.2	Maintenance during operation.....	56
8.3	Overhaul period.....	56
8.3.1	Maintenance when the transmitter is out of service for a long time	56
8.3.2	Matters need attention.....	57
8.3.3	Emergency treatment	57
8.3.4	Maintenance of the PA.....	58



1.3kW Digital TV Transmitter User Manual

1 Overview

1.1 Compliance of standard

This manual is for UHF solid-state air-cooling 1.3kW digital TV transmitter. The largest output power is RMS 1.3 kW. The product accords with the following standards:

- ◆ It can apply to all working modes specified in digital TV standards: ATSC.

The reference of following documents is necessary for the completion of this manual. For the dated reference documents, only the version of the date applies to this document. For the undated reference documents, the latest version (including all modification) applies to this document.

- ◆ GB 2423.1 Environmental testing-Part 2: Test methods - Tests A: Cold
- ◆ GB 2423.2 Environmental testing-Part 2: Test methods - Tests B: Dry heat
- ◆ GB 2424.1 Basic environmental testing procedures for electric and electronic products Guidance for high temperature and low temperature tests
- ◆ GB 12449-90 Interface for using dedicated interconnections between sound and television broadcasting transmitting equipment and supervisory equipment
- ◆ GB/T 14433 Technical specifications for coverage networks of color TV broadcasting
- ◆ GB 20600-2006 Framing structure, channel coding and modulation for digital television terrestrial broadcasting system
- ◆ GY/T 229.4-2008 Technical specifications and methods of measurement for digital terrestrial television broadcasting transmitters
- ◆ SJ/T 207.1~3-1999 Management system for design documents Part 1: Classification and composition of design documents
- ◆ SJ/T 10373—1993 Test methods of reliability of television transmitter and transposer
- ◆ SJ/T 10351—1993 Generic specification for television transmitters

2 Technical features



2.1 The transmitter has the following features

- ◆ Using the latest LDMOS transistor with high linearity and high efficiency

The power amplifier adopts Phillips latest LDMOS transistor BLF888A. This transistor features high rated output power, high efficiency, high linearity, and low thermal resistance; by operating with the high efficient radiator and air-cooling system, it greatly reduces the junction temperature of the transistor.

- ◆ Cooling system is designed with simulation software taking into full account the operation in high altitude areas

Simulation technology is applied to the design of the cooling system that fully taking into account the wind resistance of the air duct. The effect of air density to the air volume at high altitudes (3000m - 4500m) is calculated as well and appropriate blower and its installation location are selected. The air-cooling system uses high-pressure dual-centrifugal blower and small wind resistance sealed duct design, so that the transmitter is able to effectively carry through heat dissipation in thin air. The dual-blower design improves the reliability of the air-cooling system. In case that one of the blowers fails, the transmitter could continue working in lower-power without interrupting broadcast. Hot-pluggable lightweight power amplifier modules, easy for assembly and disassembly, facilitating the maintenance and repair.

- ◆ Hot-pluggable lightweight power amplifier modules, easy for assembly and disassembly, facilitating the maintenance and repair.

This transmitter uses four 400W digital power amplifier modules to be combined as 1.3kW digital power with high power capacity. In case of one power amplifier fails, the power amplifier will automatically carry out protection and alarming. The power amplifiers are designed with multiple protection systems, such as over current, over voltage, over temperature, over reflection and so on. Depending on the severity of the faults, the amplifier will automatically take the following measures: inaction, reducing power and power off, etc. On the amplifier panel, there is a switch to turn off the power supply of the amplifier manually, in this way, the power amplifier can be easily took off after turning off the power supply and unscrewing the two screws while carrying repairs. There are also gain and phase adjustment potentiometer on the amplifier panel to ensure the consistency of amplifier's gain and phase and the high synthesis efficient. As we take the unique power combination technology and sealed air flue, the transmitter can keep broadcasting when taking the amplifier out for repair. The weight of the power amplifier is about 19kg, and the size is small; only one serviceman can deal with disassembly and installation.



- ◆ Using compact and high efficiency switching power supply, easy for installation and replacement.

The transmitter power amplification part adopts 4 high power switching power supplies to supply power for the power amplifiers individually. They can be cut off independently, thus the equipment's safety is improved. Power source efficiency is higher than 93%, therefore only a small blower is enough for heat dissipation of the internal power supply. In this way, power consumption and the maintenance costs is effectively reduced. The wide range of power supply input voltage is fit for regions with large supply variation. With various fault and voltage/current indicators on the power supply panel, users could visually determine the working state. Small size and light weight (only 10 kg) is easy to assembly. The input and output connector adopts aviation plug which has high reliability.

- ◆ High-power combiner, low combination loss.

This transmitter adopts the new type plug-in four in one coaxial power combiner whose combination loss is less than 0.2dB, and the phase congruency is less than 5°. Combiner is plugged in the circulator that is connect to power amplifier output, thus the reflected power from antenna can be lead to high-power absorbing load; This ensures that power amplifier will not be affected by antenna impedance changes.

- ◆ Advanced computer monitoring system

The transmitter adopts the advanced embedded industrial micro-controller, using the ARM9 control chips, True Color Touch Panel and embedded operating system. With the powerful monitoring system, it can turn on/off the transmitter and monitor the status of the transmitter remotely or locally. Controlling software is stable and reliable with favorable human-machine interface. It can be monitored and controlled remotely through Ethernet port. The installment and upgrade can be easily completed through SD card by means of changing the application. The controller is a plug-in card (4U). It has compact design, reserved serial port, and RJ45 net port. The interface is easy for disassembly and assembly.

- ◆ A variety of lightning protection to effectively prevent lightning attacks.

This equipment using a variety of lightning protection measures to prevent the thunder introduced from the power lines and feeder lines. There are three lightning protection measures. First, adopt lightning arrestor at power supply input terminal to absorb most of the lightning surge; second, use visitors at the input terminal of each power module to resorb lightning surge; third, use rapid release diode at the terminal of signal line to absorb lightning and other electrical impulse shock. RF lighting protection has two ways: First, the output filter has short circuit knob. Thunder and lightning from antenna feed line can be released through the grounded short circuit knob; at the output terminal of each PA, there is a



circulator for the effective introduction of various signal from antenna to absorbing load, thus the damage to PA could be avoid.

◆ Dual-exciter, non-bottleneck

The transmitter uses dual-exciter configuration. When one exciter fails and has no output, the system can detect this failure and make the corresponding actions. According the setting, it can switch to another exciter automatically or manually to guarantee uninterrupted broadcasting.

◆ The coaxial components have independent intellectual property rights. It features excellent performance and high stability and reliability.

The transmitter used self-developed coaxial devices, such as combiner, filter, and directional coupler and so on. We have used those components on the thousands of transmitters which have been sold.

◆ Compact structure, small size, light weight.

The transmitter adopts modular design. It uses the latest high-power transistors; we optimized the design for heat dissipation and structural. The whole structure of the transmitter is compact, and easy to assemble and disassemble.

2.2 Product performance

2.2.1 Digital mode

- ◆ Modulation standard.....ATSC
- ◆ Bandwidth6MHz

2.2.2 Input Interface

- ◆ Input signal2×ASI
- ◆ Input impedance.....75 Ω, BNC

2.2.3 Output Parameters

- ◆ Digital output power (RMS)1.3kW
- ◆ Shoulder ratio.....better than 36dB
- ◆ Frequency Response..... $\leq \pm 0.5$ dB
- ◆ Frequency stability..... ± 100 Hz



2.3 Environment condition

- 1 Altitude< 4500m
- 2 Operating temperature0°C to + 45°C
- 3 Relative humidity.....95% non-condensing

2.4 Working conditions

Power Requirements

- ◆ Voltage.....three-phase, four-wire, 220V AC $\pm 10\%$
- ◆ Frequency.60 Hz ± 1 Hz

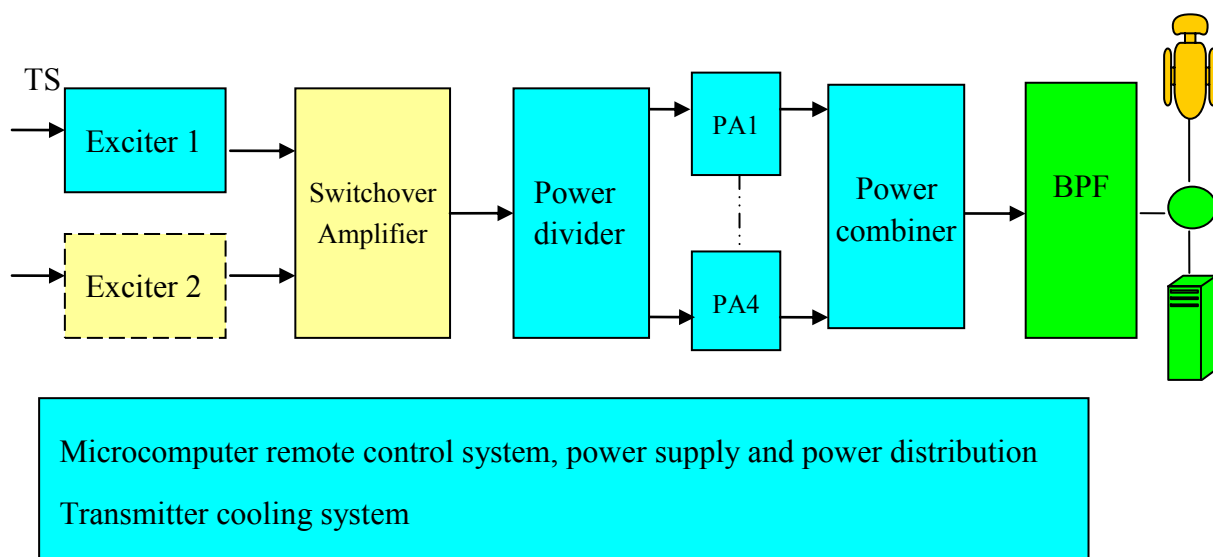
2.5 Main specification

- 1 Output power.....digital 1.3 kW
- 2 Frequency scope.470 - 806MHz
- 3 TV Standard.....ATSC
- 4 Cooling method.....Forced air cooling
- 5 Weigh.....about 320kg
- 6 Output connector.....50 Ω , 1 5/8" EIA Unfledged

3 Working principles

This transmitter is applicable for the transmitting for digital TV , where input is MPEG-2 format TS stream signal, through exciter style process channel code modulation, becomes digital baseband signal, which meet the standard, through directly up-conversion modulation become radio frequency signal, amplified step-by-step, reach digital 1.3 kW at last.

The block diagram of this transmitter is shown in Figure 3-1. The appearance and composition of this transmitter is shown in Figure 3-2.



Remarks: The yellow diagram is for double exciter; the yellow diagram is optional.

Figure 3- 1 Block diagram of transmitter

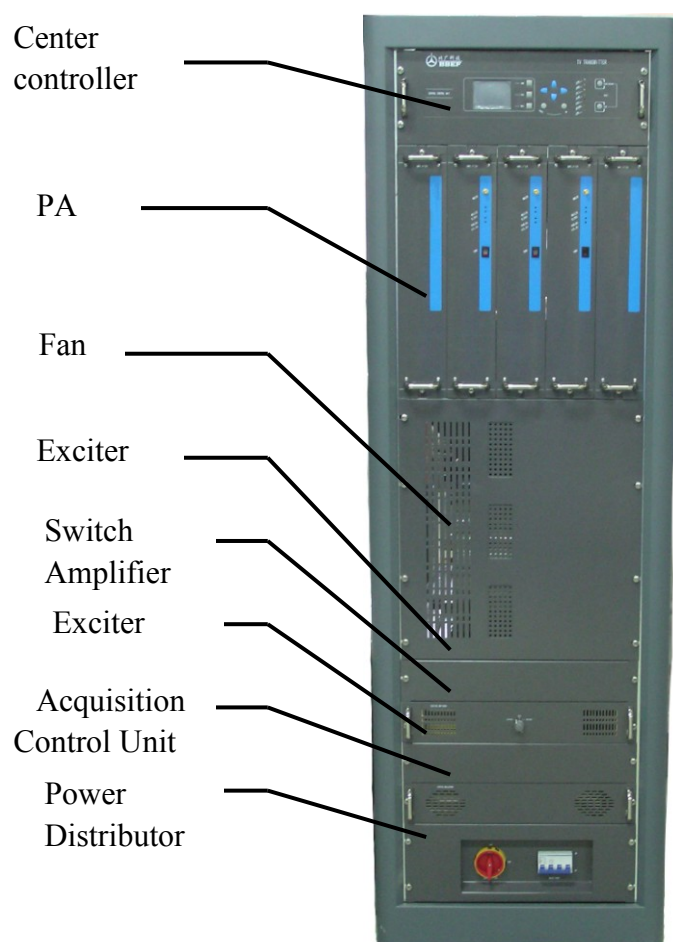


Figure 3- 2 Appearance and composition of the transmitter

3.1 Principle of main units

3.1.1 Exciter

For Exciter Instructions, please refer to annexed Exciter Instructions.

3.1.2 Switchover Amplifier

For principle drawing please refers to PF2. 900.

The Switchover Amplifier unit has two functions:

- ◆ RF output fault detection of the main exciter;
- ◆ RF switching and amplifying of main/standby exciter.

Exciter RF is switched by HF switch. When the exciter is no output or the operator send the switch order, this switch will act. The output of the exciter in operation will be connected to the absorbing load and turned to standby mode; the original standby exciter will be connected to the next stage through another pair of contactors and turned to operating mode. The switch over action is finished in this way.

3.1.3 Power Amplifier

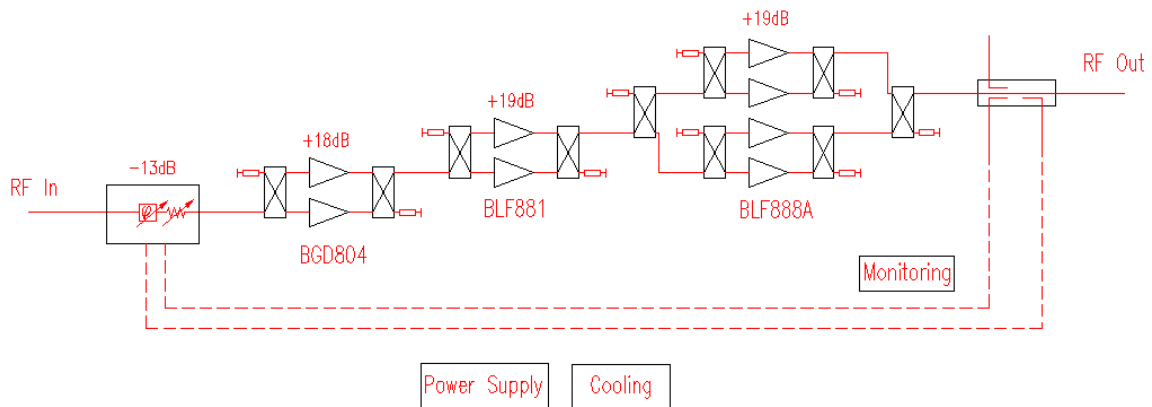
The power amplifier is operated in UHF band, with high gain and broadband linear. The output digital power is 400W.

The PA is composed of three stages of amplifiers. Power combining technique is used. Total gain is about + 43dB.

The power amplifier is equipped with perfect control and protecting system and detecting device.

Size of the power amplifier is 96mm× 532.6 mm× 528mm (W×H×D) in plug-in type.

The power supply of the power amplifier is an external 50V DC power supply. Forced-air cooling is needed force when operation.



Diagrams

We can see from the circuit diagram that the PA consists of the follow parts:

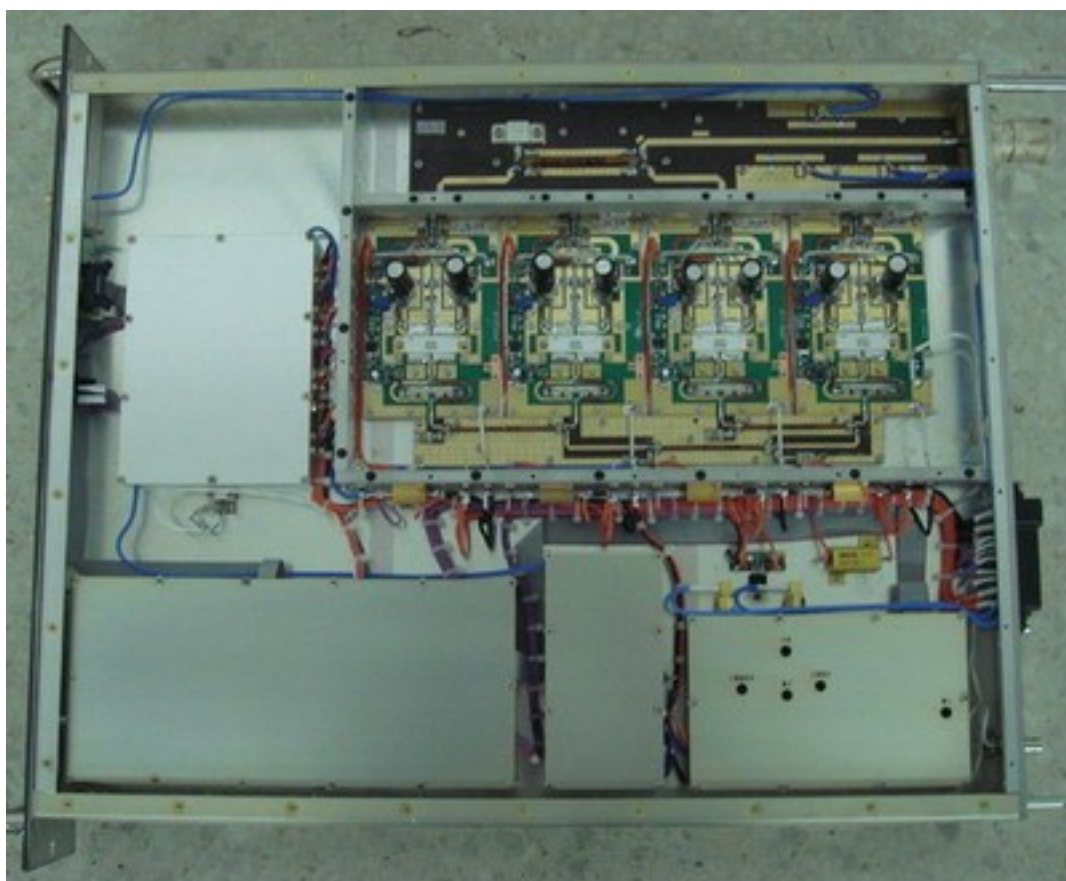
- ◆ Power amplification part;
- ◆ Power splitting and power combining part;
- ◆ Control and protection part;
- ◆ Display and monitoring part;

◆ Heat sink and shielding part

● Power Amplifier

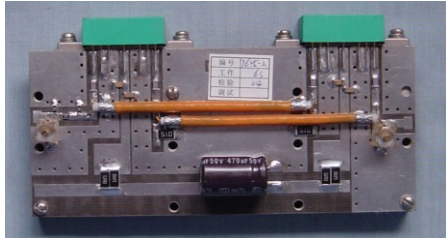
This power amplifier unit is composed of three level transistor amplifier. The first level adopts class A working status. The transistor is BGD804 whose function is to improve the gain and linearity of the whole PA. The second and third level adopts class AB working status. And the transistors are BLF881 and BLF888A whose function is to enhance the transmitter efficiency.

Each level of transistor power amplifier module is composed of high-frequency high-power transistor, relevant circuit (impedance matching circuit, feed circuit and bias circuit), and heat sink and screening box.



BGD804 is a broadband power amplifier module with class A working status. And its working frequency is 40~860MHz, gain is 19dB, working voltage is +24V, and working current is 410mA. Through 3dB coupling line, two BGD 804 realize power splitting and power combining and form the first level amplifier. Output 200mW distortion. One attenuator is used on input port to improve matching.

For circuit diagram please refer to PF2.800. 6295DL.

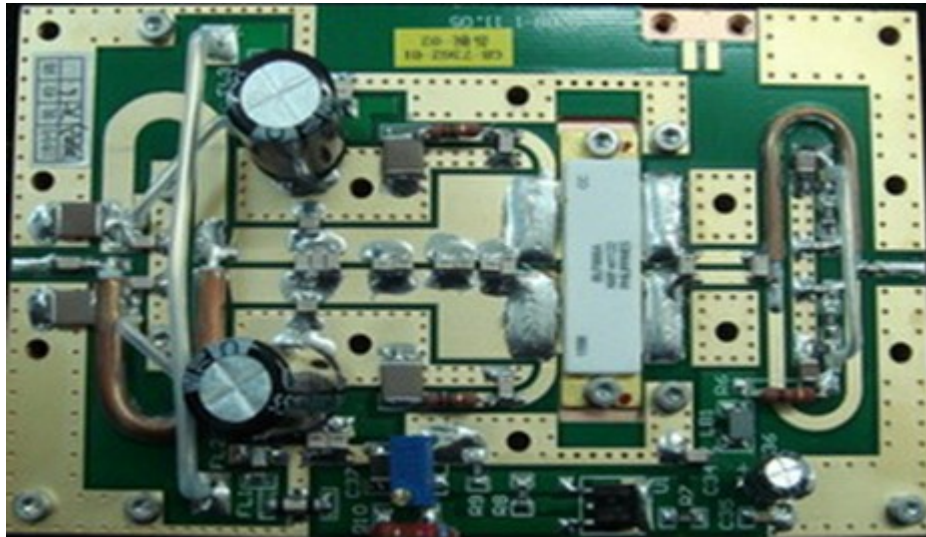


BLF881 is operated at Class-AB. DC voltage is +50V. Each tube is 0.5A at static work state. Relevant input match circuit, output match circuit, and bias circuit, etc. Two same PAs realize power splitting and power combining through 3dB coupler to form a power amplifier module. As the second level amplification, the gain is higher than +19dB. Output power 7W(rms), shoulder drop ($\pm 4.2\text{MHz}$) better than -39dB.



BLF888A is operated at Class-AB. DC voltage is +50V. Each tube is 1.3 A at static work state. Relevant input match circuit, output match circuit, balance imbalance converting circuit and bias circuit, etc. It gain is more than +19dB. Output power 110W(rms), shoulder drop ($\pm 4.2\text{MHz}$) better than -32dB. Four amplifiers with power same power using a twice 3dB coupler for power distributing and combination in this way comprise penultimate amplifier.

For circuit diagram please refer to PF2.800. 6754DL

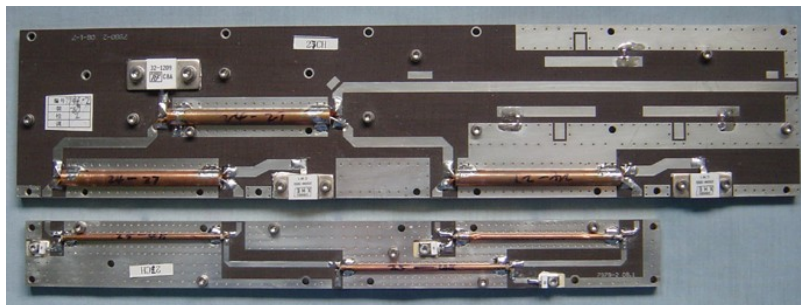
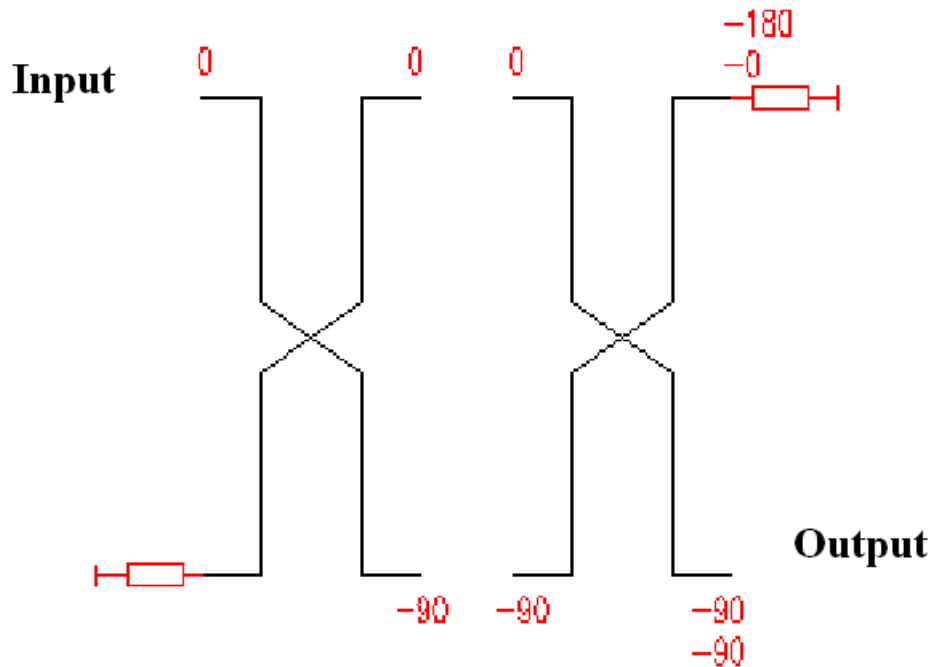


● Power Splitter and Combiner

The power splitting and power combining of each level of power amplifier module is realized by the adoption of 3dB coupler.

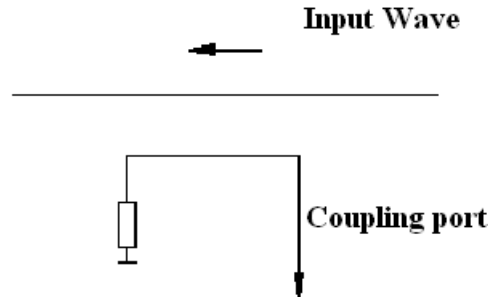
Power splitting and power combining of each amplifier adopt 3dB coupler to realize.

3dB coupler is a device with four terminals. After transmission, two input signals with phase difference of 90° will output signal with same phase at one output port, and output signal with opposite phase at the other output port. Thus, the output power for terminal with same phase signal is the sum of the input power; while the output power for the terminal with opposite phase signal is the offset of the two input signal. Therefore, it can be used as power divider as well as power combiner. The two transistors at the preceding stage is realized by 3dB divider and combiner. The dividing and combination of four PA modules at final stage is realized by twice 3dB coupler.



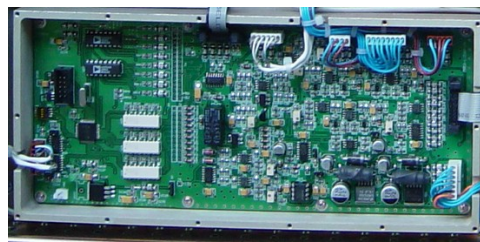
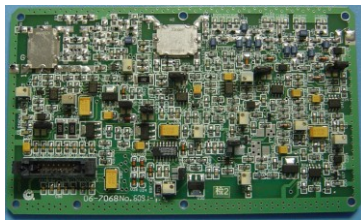
- Directional coupler

Directional coupler is located at the output port of power amplifier unit, and it is on the same PCB with power combiner, so as to play the function of RF detection, protection and indication respectively. Compared with the 3dB coupler, this directional coupler is a directional coupler with poor coupling degree (dozens of dB).



- ◆ One forward coupling port of the directional coupler coupled RF power to the socket on front panel, so as to make RF monitoring on the PA's total output working status.
- ◆ After sampling, the detection wave from another forward coupling port of directional coupler is DC voltage. It is used for the indication of output power.
- ◆ After sampling, the detection wave from backward power coupling port of directional coupler is DC voltage. It is used for the protection and indication of reflection power.
- Control and protection part;

Please refer to the circuits for input control panel (PF2. 900. 6330DL), and monitoring and sampling panel (PF2. 900. 6274DL).



- A. Manually adjust total gain and phase of PA units (It can be adjusted on the panel), which can ensure high-efficiency combination of transmitter with all PA equipped.
- B. Slow start-up and temperature control can avoid transits conflict of high current, which can compensate gain effluence by temperature change.
- C. Protection function:
 - a) Over excitation protection: When the input is 1dB higher than the normal power, it will be attenuated -13dB for protection.
 - b) Over reflection protection: When reflected power is detected to be 10% higher than the output power, -3dB attenuator will start protection. If the reflected power is still higher than the threshold value, -13dB attenuation protection will

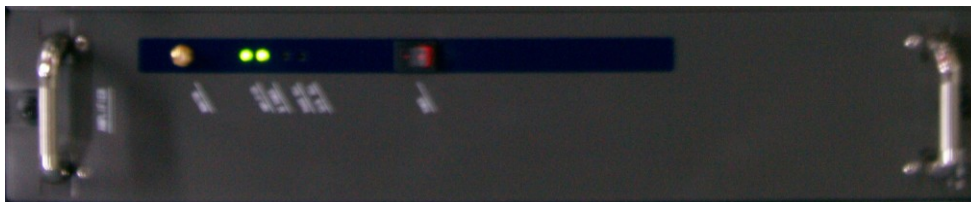
be executed. And if the fault could not be cleared within 10 mins, power supply will be blocked.

- c) Over current protection: If the current still increases to the threshold value, the attenuator -13db will start protection. If fault could not be cleared within 10mins, the power supply blockade protection will be carried out.
- d) Over voltage protection: When +50V power supply voltage surpasses +51V, the power supply blockade protection will be executed immediately
- e) Over temperature protection: When temperature surpasses 71 °C, the power supply blockade protection will be executed immediately.

● Display and monitoring function

The panel monitoring

- a) RF detection port (SMA, 50Ω)
- b) One green light indicates the power supply is normal.
- c) Another green light indicates the power amplifier output is normal.



Computer monitoring:

PA units are connected with computer via serial ports, so that their operating status can be monitored in real-time.

Monitoring items are as the following.

a) Analog variable:

+50V voltage (V), +5V voltage, +12V voltage (V);

Input power (MW), output power (W), reflected power (W);

Pre-stage current1 (A), pre-stage current2 (A)

Final stage current1 (A), final stage current2 (A), final stage current3 (A), final stage current4 (A)

Pre-stage temperature(°C), final stage temperature(°C)

b) Switching value:

Power amplifier work, power amplifier power ("Normal" green, "Fault" gray);

Over exciting, voltage ("Normal" gray, "Fault" red);

Pre-stage overcurrent, final stage overcurrent ("Normal" gray, "Fault" red);

Over temperature, over reflected ("Normal" Gray, "Fault" Red);

-3dB, power block ("Normal" gray, "Fault" red);

3.1.4 Distribution Unit

The function of the distribution unit is to distribute the mains power supply to different functional units such as exciter, switching power supply and central control unit. There is a main power switch in the power distribution unit to control the complete transmitter's power supply. Beside the main switch, there is a red emergence switch. Turn on the emergence switch at the time when transmitter could not be start up normally, thus the transmitter will be start up automatically. This can ensure the nonstop broadcast of the transmitter. There are phase dislocation protector and phase lack protector in the power distribution equipment. Transmitter could not be started up when phase dislocation or phase lack fault occurs. Besides, there is a surge protector in the power distribution equipment. During normal operation, it is green. It will turn into red after suffering lightning strike. At this time, it needs to be change into a new one. For work principle of power distribution equipment, please refer to the schematic diagram of PF3.624. 15003MX.



Air switch and emergency switch on the power distribution unit



Lightning arrester on power distribution unit



Power unit for emergency starting up



Phase dislocation and phase lack protection unit

3.1.5 Central Control Unit

3.1.5.1 Overview



Figure 3. 1. 5. 1 Central Control Unit outside view

The monitoring and control system of transmitter is consist of display control unit, acquisition control unit and status acquisition board. New generation of ARM9 controller, delicate LCD screen, distributed control sampling multi-mode communication interface



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and reliable friendly remote control interface are used in this central control unit. It provides a variety of easy using operation.

The display control unit is used to display the current states and faults of the transmitter, and responses to users' operation. The operation of the system be realized by touch screen and keyboard.

3.1.5.2 Start up

After the power is on, the monitoring system will start up automatically. In case the application is quieted during it is running, just click on the “My Computer\ResidentFlash\BBEF7346” in its path with nib. The application will be restarted.

3.1.5.3 Main interface

The starting interface will stay 2~ seconds to enter into the main interface of monitoring and control system Figure 3. 1.5.3 is the main interface.

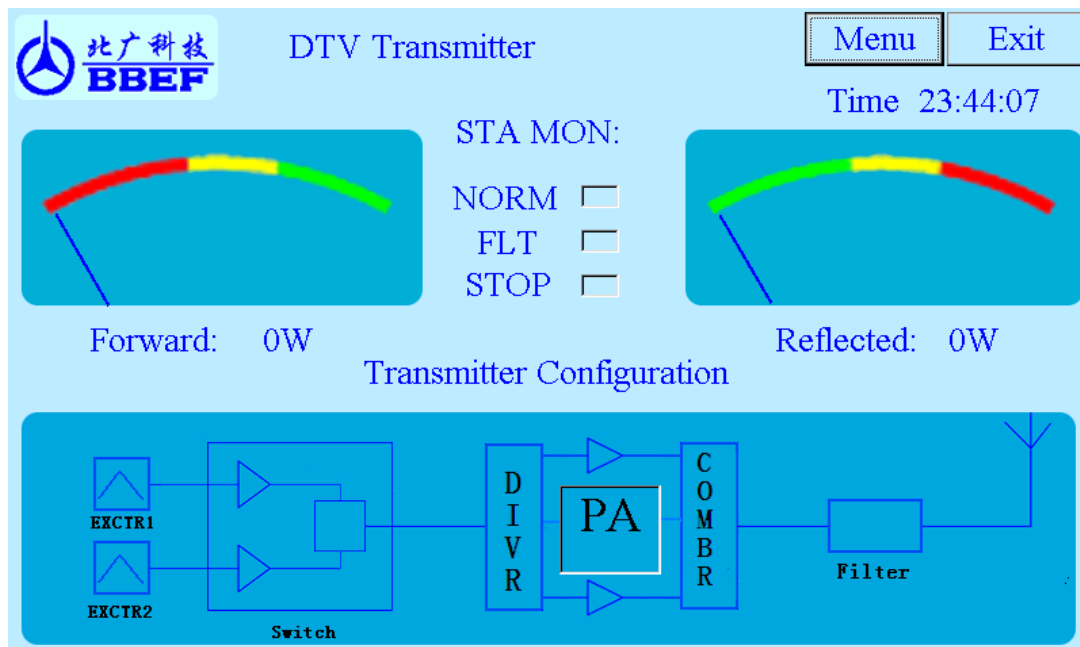


Figure 3. 1. 5. 3 Main interfaces

In the main interface, different colors are used to express the current state of the transmitter. Green means “Normal”, red means “Fault”, yellow means “shut off”. If the three colors are not on, that means communicating fault, and need to check the connecting situation of transmitter controller and outside. Two hands express transmitter’s output power and reflected power, and with the numeral below to illustrate the current output power value. After starting up, if the hand is in the green area, it means the output power is normal or reflected power is normal; Yellow area means in critical state, red area means the output power is lower or reflected power is higher, and in this case it is needed to check the transmitter hardware. The square button on the power unit of the main interface is the shortcut key to check PA state.

3.1.5.4 Menu

Click “main menu” on the touch screen, or directly push the “menu” button on the right of the screen, operation menu is opened, see Figure 3. 1.5.4.

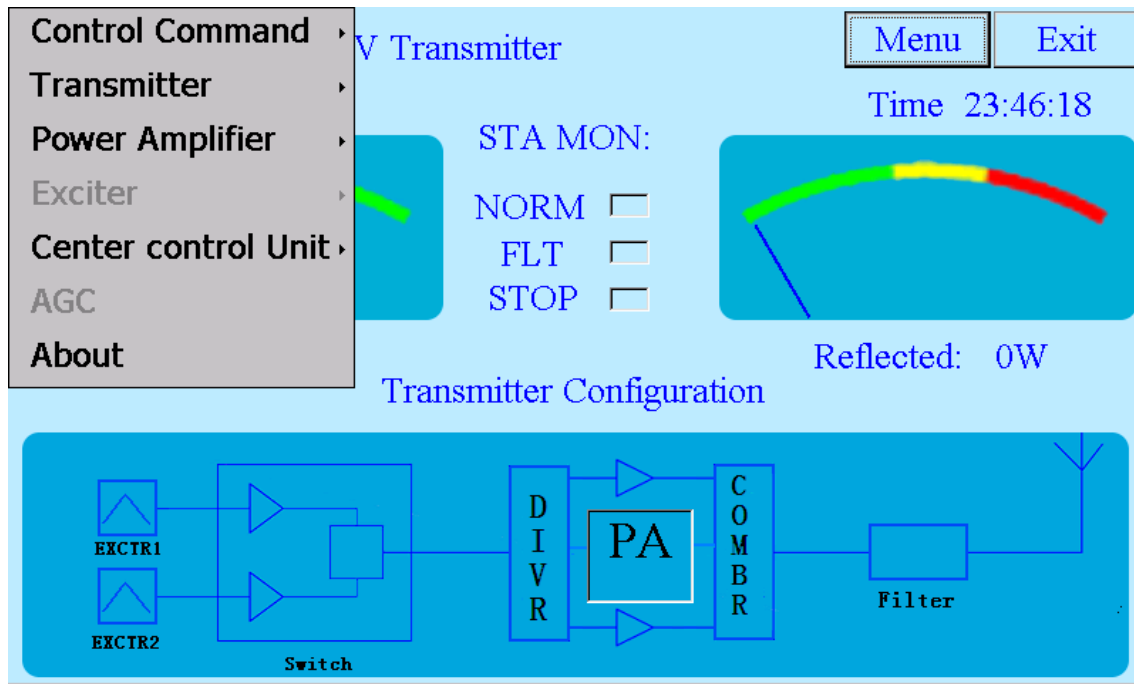


Figure 3.1.5.4 Menu interface

Through the menu selection, you can operate, set the transmitter and view the state of it. The main menu has seven sub-menus, and will be introduced in the following sections.

◆ Control command menu

Figure 3. 1.5.5 shows entering the secondary menu of control command.

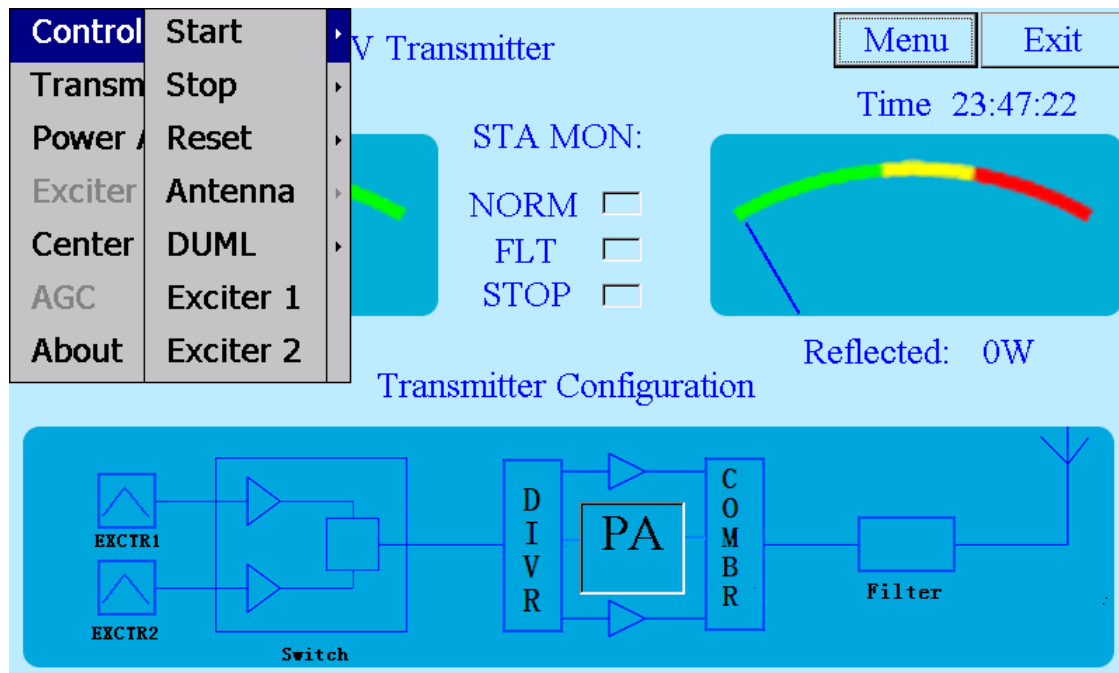


Figure 3. 1. 5. 5: The secondary menu of control command

The menu item under the control command is the operation order, execute actions of starting up, shut down, restart, switch to antenna, switch to load, switch to exciter 1, switch to exciter 2 and so on. When select those menu, the system will give an affirm dialog box . Click “Yes” or “No”, the system will execute the selected operation, otherwise the system does not carry out any operation.

Note: The switch between antenna and load must be controlled by the coaxial switch provided by BBEF under power-off status.



Figure 3. 1. 5. 6: Confirm Transmitter menu

● Transmitter Menu

Through the transmitter menu, we can view the current state of the transmitter, history state and fault log.

◆ Transmitter Status Menu

Click “Menu→Transmitter→Transmitter condition”, you will enter into the transmitter condition interface (Figure 3. 1.5.7).

Transmitter		
SERNO	Name	Value
1	FWD AFTER BPF	0
2	REFLD AFTER BPF	0
3	FWD BEFORE BPF	0
4	REFLD BEFORE BPF	0
5	FWD AFTER BPF	Normal
6	REFLD AFTER BPF	Normal
7	FWD BEFORE BPF	Normal
8	REFLD BEFORE BPF	Normal
9	Antenna	Stop
10	DUML	Stop
11	STG/STOP	COMM Fault
12	EXT INTLK	Fault

Figure 3. 1. 5. 7: Transmitter condition

This interface shows the current output power, reflected power, and the operating states of the transmitter. Drag the scroll bar or press the ▲/▼ buttons with nib to check the display data out off the display area. Press “Confirm” or “Cancel” to return。

● Transmitter Condition Record Menu and Transmitter Fault Record Menu

Click “Transmitter condition record” or “Transmitter fault record”, you will enter into the history condition and history fault record interface (Figure 3. 1.5.8, Figure 3.1.5.9).

[illegible]

Figure 3. 1. 5. 8: Condition Record Table

[illegible]

Figure 3. 1. 5. 9: Fault Record Table

Drag the scroll bar or press the ▲/▼ buttons with nib to check the display data out off the display area. To delete one record, first chose the record, and then press "Delete".

◆ Power Amplifier Menu

Through the power amplifier menu you can view the states, history data and set parameters of power amplifier modules.

◆ Power Amplifier Status Menu

Press power amplifier status menu to enter the power amplifier status interface, as is shown in Figure 3.1.5.9.

Power Amplifier 1		
SERNO	Name	Value
1	INP PWR	0.0
2	OUT PWR	0.0
3	REFLD PWR	0.0
4	PSTG VOLT	0.0
5	FPA VOLT	0.0
6	PSTG TEMP	0.0
7	FPA TEMP	0.0
8	PSTG CUR 1	0.0
9	PSTG CUR 2	0.0
10	FPA CUR 1	0.0
11	FPA CUR 2	0.0
12	FPA CUR 3	0.0

OK Cancel Previous Unit Next Unit

Figure 3. 1.5.10 PA State Menu

Use the scroll bar or ▲/▼ buttons to turn-page. Click “Previous unit” or “Next unit” to switch to other PA units, press “Ok” or “Cancel” to return.

◆ Power Amplifier condition menu and Power Amplifier Fault Record menu

The usage is the same as Transmitter Condition Record Menu and Transmitter Fault Record Menu. Figure 3. 1.5.11 and Figure 3.1.5.12 are the PA Fault Record interface and PA Condition Record interface.

[illegible]

Figure 3. 1.5.11 PA Condition Record interface

It allows reviewing the history status of power amplifier output, transmitting power, final stage current and temperature before each power amplifier through power amplifier status record. user can know the operating status of each power amplifier

Power Amplifier			
SERNO	Name	Type	Time

Figure 3. 1.5.12 PA Fault Record interface Master unit menu

◆ Master Control Unit Menu

The Master control unit menu includes the setting of hardware and software for the monitoring system and the current information display.

◆ Master unit condition menu

Open the Master unit condition interface by click “Master unit condition” menu. Figure 3. 1.5. 13 shows the Master unit condition interface. Communication condition、IP Address、MAC Address and Version number are displayed on this interface.

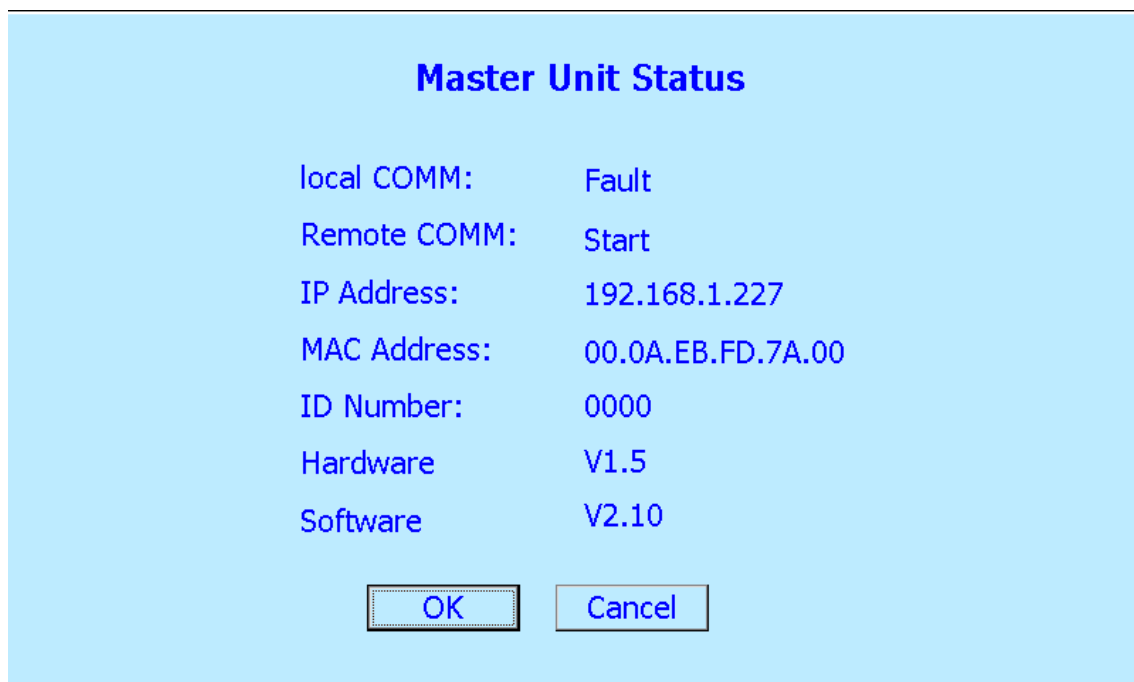


Figure 3.1.5.13 Master Control Unit Status

◆ Master Control Unit Setting Menu

b) Master unit setting menu Master unit setting menu includes setting IP/MAC Address, system time and timing ON/OFF. When textbox gains focus, the soft keyboard will pop up for input. The using method of time setting menu, timing ON/OFF menu is the same to the transmitter menu.

1. Setting current time of the transmitter. Figure 3. 1.5. 14.



Figure 3. 1.5. 14 Setting current time

2. Setting timing record time interval. This menu is used to setup the status recording time interval for overall transmitter and power amplifier. The default time interval is 30 minutes. Users can set the needed state record interval according to own requirement, and press “OK” to save the current settings, or press “Cancel” to return. Please refer to figure 3.1.5.15.

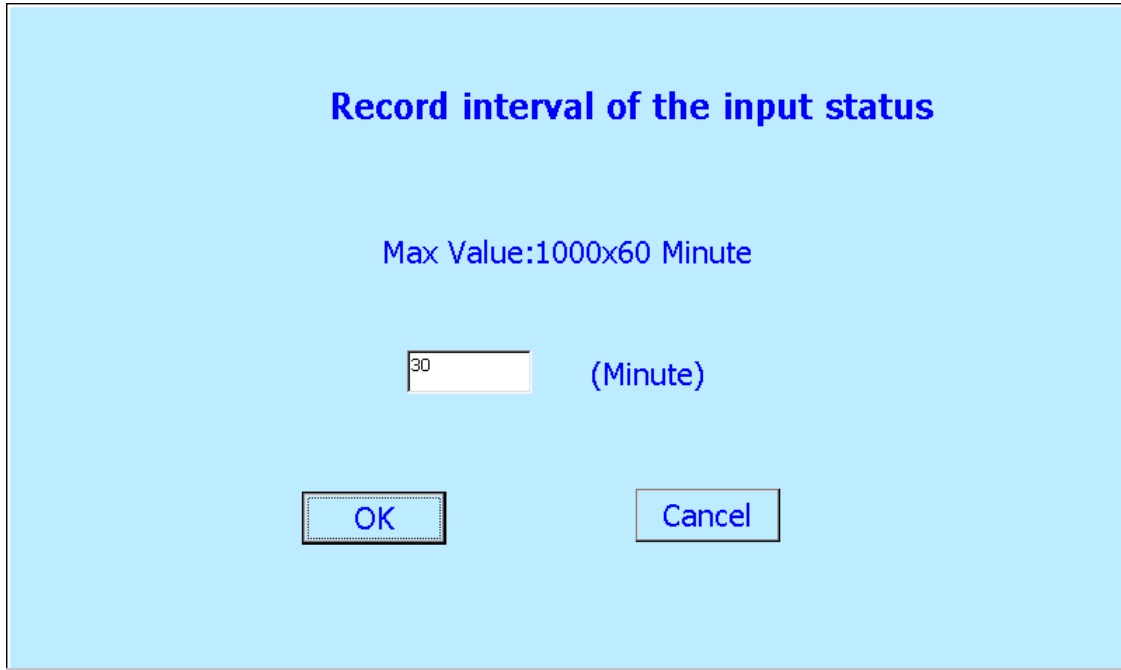
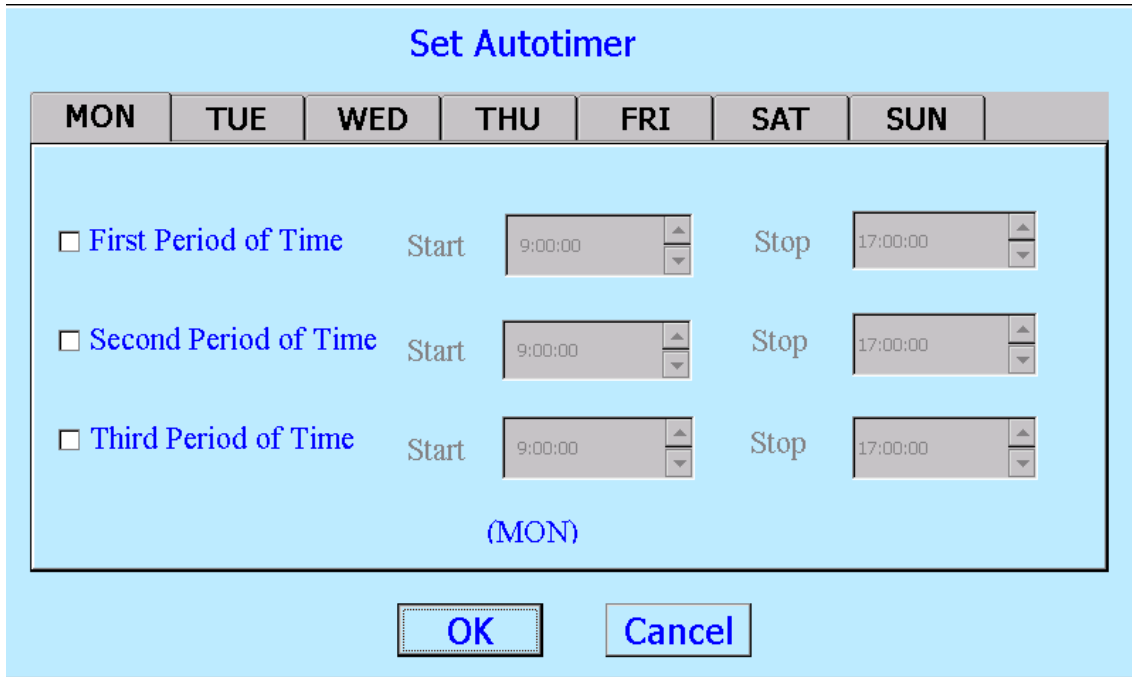


Figure 3. 1.5. 15 Setting history state recording interval of overall and PA

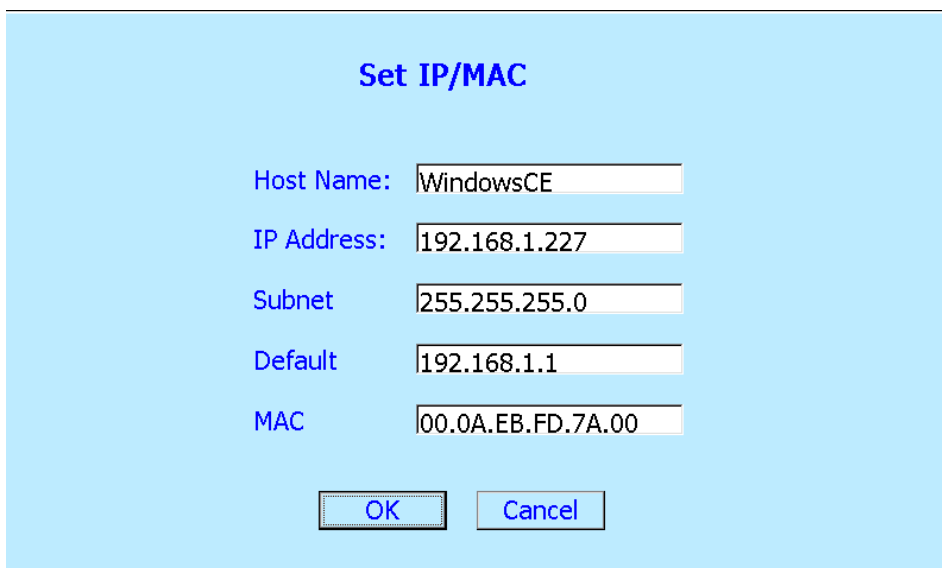
3. Setting timing ON/OFF. The unit of timing ON/OFF is day. Users can set timing ON/OFF time of 7 days at the same time. At most can set 3 periods every day. Users can select the needed periods according to own requirements. After selecting, you can set the ON/OFF time. Press “OK” to save the settings, or press “Cancel” to return. Please refer to figure 3.1.5.16 .



The "Set Autotimer" interface features a light blue background. At the top, the title "Set Autotimer" is centered in blue. Below the title is a horizontal row of seven tabs labeled "MON", "TUE", "WED", "THU", "FRI", "SAT", and "SUN". The "MON" tab is currently selected. The main content area contains three rows of settings, each with a checkbox and a label: "First Period of Time", "Second Period of Time", and "Third Period of Time". Each row has a "Start" time field (set to 9:00:00) and a "Stop" time field (set to 17:00:00). Below these fields, the text "(MON)" is centered. At the bottom of the interface are two buttons: "OK" and "Cancel".

Figure 3. 1.5. 16 Timing ON/OFF interface

4. Setting IP/MAC address. When textbox gains focus, the soft keyboard will pop up for input. Press "OK" button to save the setting. To save setup by press "OK" The MAC address composes of spaced six groups of number. Users could modify the transmitter IP address by modify anyone of the last three groups number. Please refer to figure 3.3.5.17.



The "Set IP/MAC" interface has a light blue background. The title "Set IP/MAC" is centered at the top in blue. Below the title, there are five rows of labels and text boxes: "Host Name:" with the text "WindowsCE", "IP Address:" with "192.168.1.227", "Subnet" with "255.255.255.0", "Default" with "192.168.1.1", and "MAC" with "00.0A.EB.FD.7A.00". At the bottom of the interface are two buttons: "OK" and "Cancel".

Figure 3. 1.5. 17 Setting IP/MAC address interface

3.1.5.5 Remark

The historical data and relevant setting of this monitoring system is stored in database. The overdue data should be cleared instantly to prevent oversized database.

3.1.5.6 Program Update

In case of the application program is improved, users need to update the application programs. The methods are described below.

- Copy the program need to be updated to SD card or U-disk, and insert this SD card or U-disk into 2440 slot.
- Click “Exit” in the main interface to quit the supervisory program. Figure (3. 1.5. 18 Exit the program)

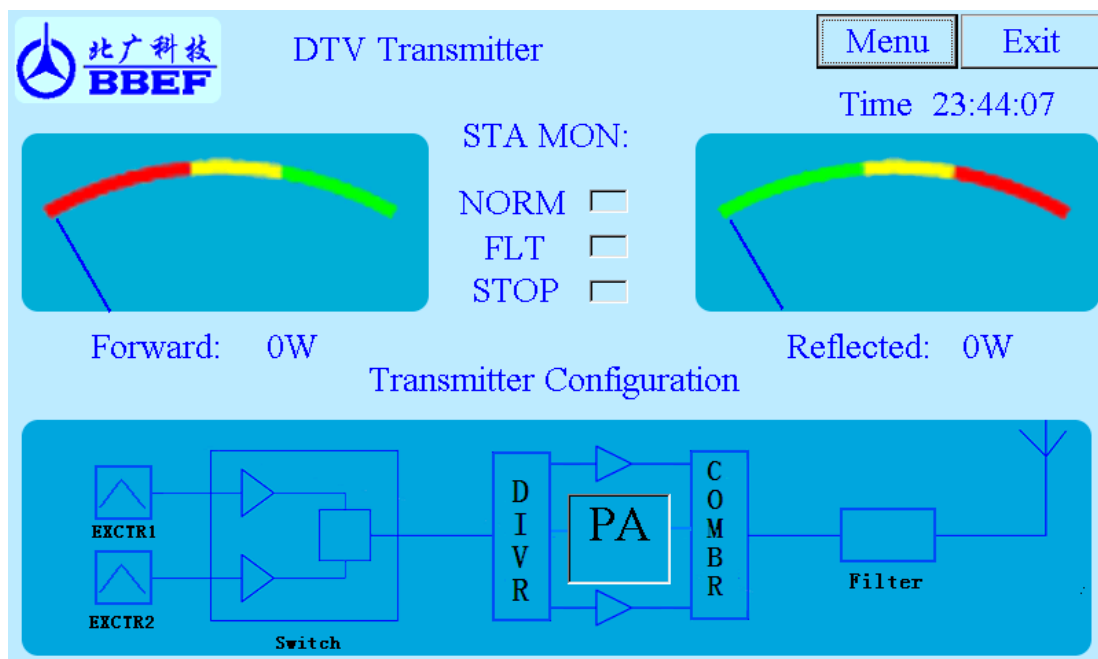


Figure 3. 1.5. 18 Exit the program

- Enter into card or U-disk according to the path “My equipment/SD card”

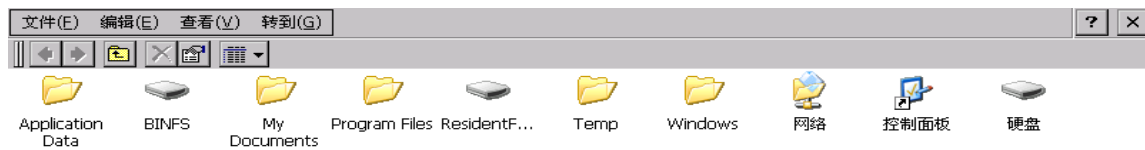


Figure 3. 1.5. 19: USB interface

- Select the program need to be updated (AspCom, MyWeb or BBEF7346) and click “Copy” button under “Edit”, or long-press the application and then select "Copy" in the popup menu

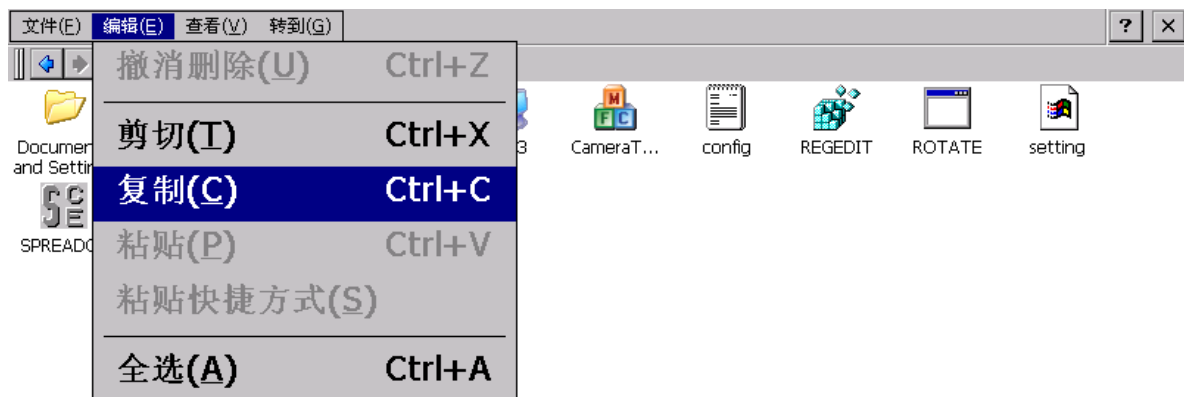


Figure 3. 1.5. 20 Copy program in SD card interface

Enter the path "My equipment\ Residentflash".

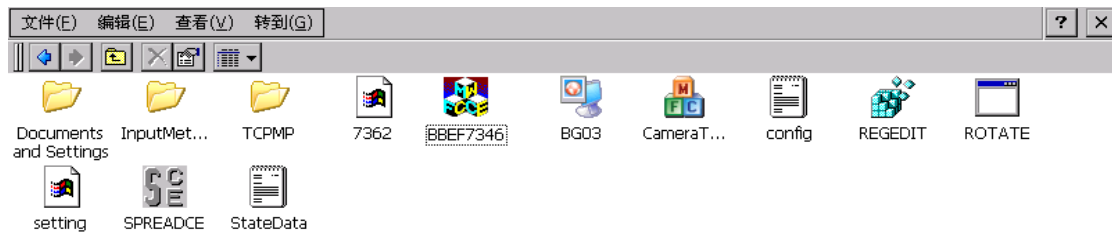


Figure 3. 1.5. 21: Residentflash folder interface

- Click “paste” under “Edit” menu, the system will popup dialog box for whether replacing files. If you click “yes”, the system appears the bar displaying replacing progress.



Figure 3.1.5.22 Residentflash files paste documents

- After updating is finish, double click “BBEF7346” to rerun supervisory program and continue the operation of the transmitter.

3.1.5.7 Database deletion

The controller is in charge of recording transmitter’s condition and fault data. Large storage in the database will affect inquiring speed of condition and fault records, Users are suggested to delete database timely after backup of the data. Like the replacement of the application program, deleting operation of database needs to “Exit” from application program. The methods of exit is shown as "Figure 3.1.5.23", the methods of database deleting are as follows.

- Operation is Find out “7346.db”under the file “My equipment\ Residentflash”, click right key of mouse (or long time touching screen) to popup the menu

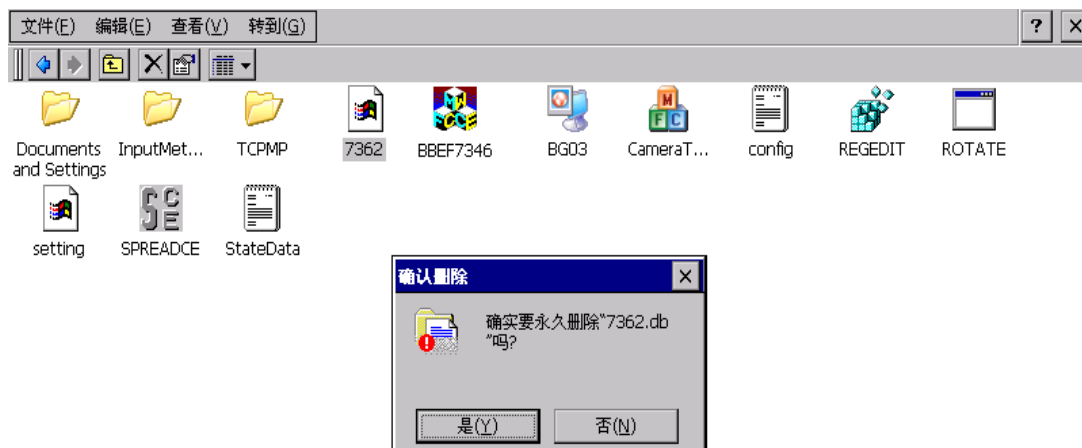


Figure 3. 1.5. 23 BBEF deleted database

- Click “delete”, popup a dialog box.



Click “delete”, popup a dialog box.

- Click "Y" to delete database.
- After deleting, double click BBEF7346, application program will started up and new set up automatically for recording data later

3.1.5.8 Tips

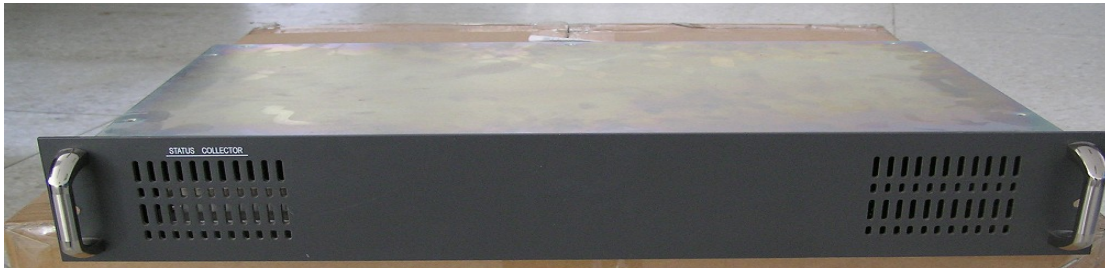
- 1) In case of the central control unit need to restart, it is permitted to shut off power switch on rear panel so that the normal broadcast is not affected.
- 2) When many sets of transmitters are connected in a local area network, you need to change IP address and MAC address, and make each IP address and MAC address is unique, not conflict with each other otherwise, it is impossible for the transmitter to be connected to remote control function.

3.1.6 Switch power

Please see the manual for power supply.

3.1.7 Collecting & Control Unit

Data collecting and control unit accomplishes data collection of the transmitter, including output power, reflected power, coaxial switch, and so on. At the same time, the ON/OFF command, and coaxial switching command of master control unit are also send to data sampling and control unit, and then performed by control panel. Its principle diagram is in PF2. 900.15003MX, and structural drawing is in PF2.900. 15003FL. Pic of Data sampling unit is as follow:



Front View



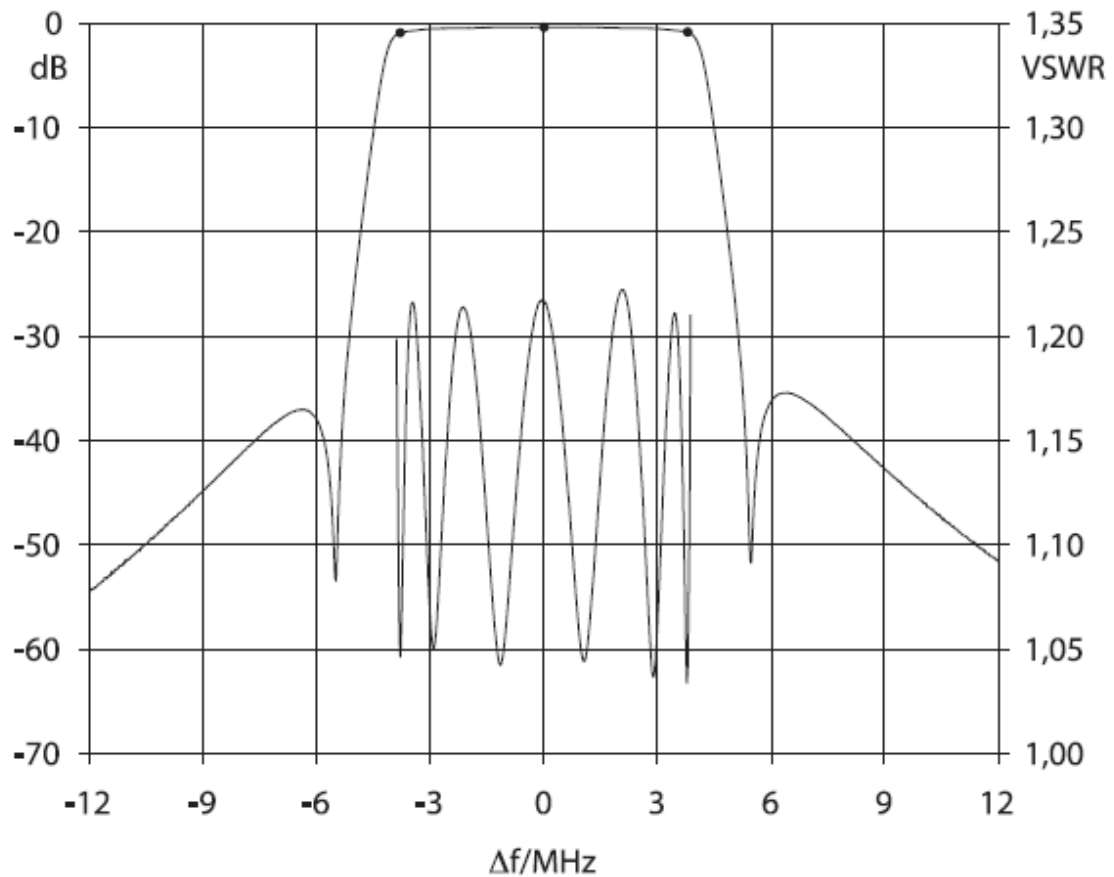
Rear View

Interface Definition:

- ◆ 220 IN Power supply 220V
- ◆ START/STOP CTRL Control Transmitter ON/OFF
- ◆ MOTHER BOARD Supply control electricity to each PA and master the working of PA power supply
- ◆ 485-1 Communicating with RS485 of central control unit
- ◆ 485-2 Reserve RS485 interface
- ◆ EXT.LNK/EXT.CTRL External interlock and external control interface
- ◆ EXC.CTRL Reserve exciter control interface
- ◆ RF-DETECTOR Overall data collecting interface

3.1.8 Band-pass filter

The band pass filter is used to filter unwanted emission, to prevent the stray RF power of adjacent channel from influencing the broadcasting of transmitter in adjacent frequency. The technical specification is as follows:



4 Structural characteristics

4.1 Structural characteristics

The structure of main components or functional units as well as the mechanical and electrical connections among each unit is as follows:

No.	Name	Qty.	Height(U/mm)	Function Description
1	Central Control Unit	1	4U	Transmitter control, monitoring the status, with the RJ45 port for remote control.
2	Exciter	2	1U	Digital exciter, carry out signal coding, modulation and small signal amplification.
3	Switchover Amplifier	1	2U	Carry out auto/manual switch over and main/standby switch

No.	Name	Qty.	Height(U/mm)	Function Description
				over.
4	Power Amplifier	4	533mm	Finish the power amplification of excited signal; output power of each amplifier is digital 400W.
5	Switching power supply;	4	220mm	Installed and provide power supply to each power amplifier in one-to-one correspondence.
6	Data Collecting Unit	1	2U	Carry out the data acquisition and control of the operation status of the transmitter.
7	One to Four Power Splitter	1	1U	Divided the exciting signal equally, send them to input ports of the 4 power amplifiers.
8	Four to one Power combiner	1	Combine the output power of four power amplifiers into digital 1.3kW according to channel.	
9	Band-pass filter	1	440mm	Filtering the useless signal out of band.

4.2 Dimension

Dimension of transmitter (W x D x H): 606×960×1900mm

4.3 Mounting dimensions

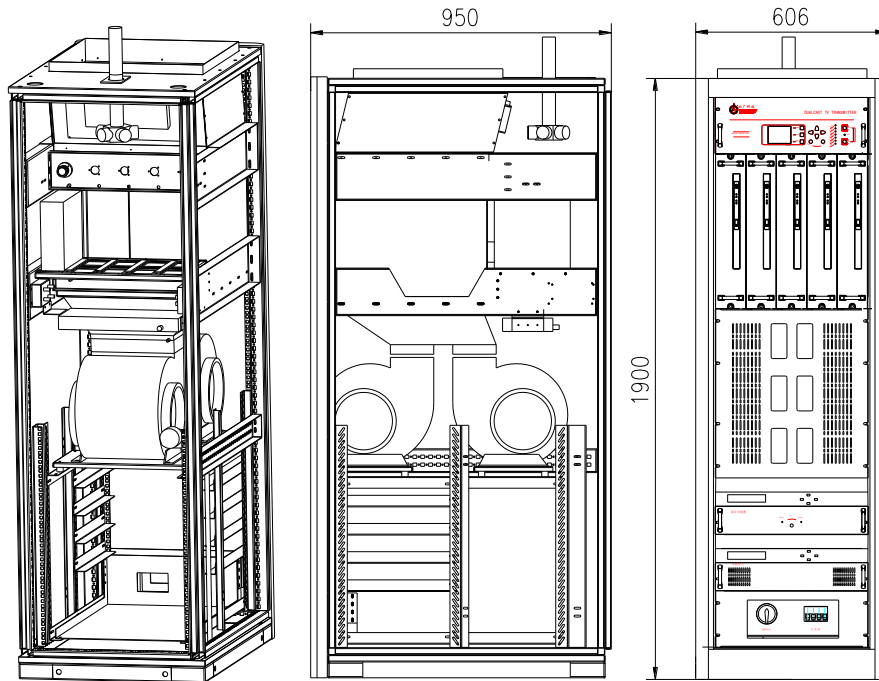


Figure 4-3 Transmitter installation schematic diagram

5 Installation and debugging

5.1 Installation

In the front view of the transmitter users can see the central controller, power amplifiers, exciters, switching amplifier, data sampling unit and distribution unit. Open back door of the transmitter visible in the view of rear panel of above mentioned plug-in units, switch Power Supply, power splitter, power combiner and interfaces. Please refer to Figure 5-1 for installation drawing.

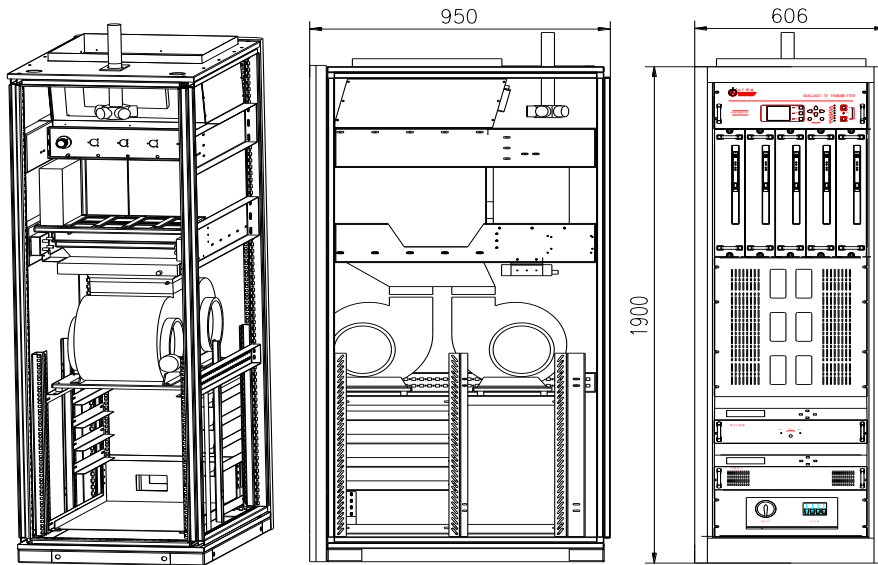
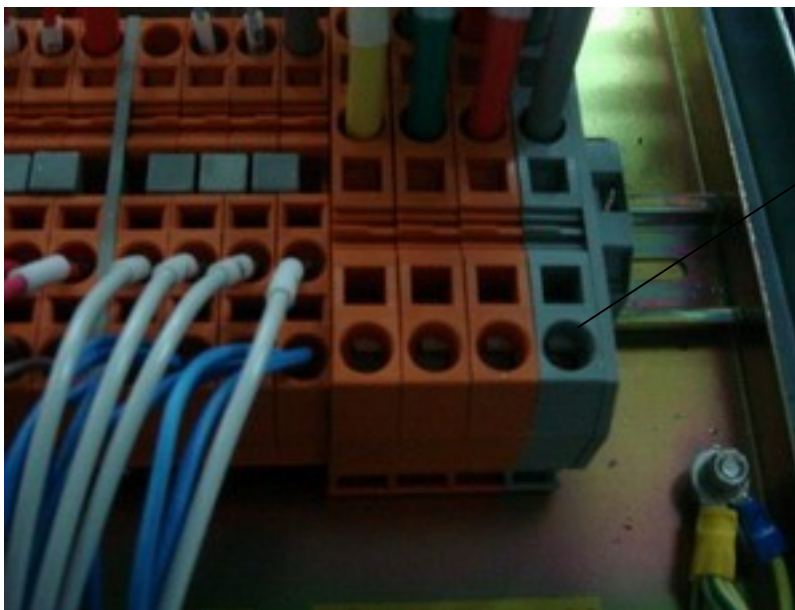


Figure 5- 1 Transmitter installation schematic diagram

5.2 Electrical connection

Mains power cable: This transmitter adopts 3-phase 4-wire mains power supply. Quick remove power plug terminals are used as the connectors of the mains power supply input, they permit cables with section area of 16mm² maximum. When operating in digital 1.3kW, the section area of inlet cable for each phase is 10 mm² at minimum. Figure 3-5 shows the power line input connector of power distribution unit.



Power
Source Input

Figure 3- 5 The installation drawing of the power line



Coaxial Switch: The coaxial switch is semi-rigid coaxial cable with large bend semi diameter. It should be kept straight or proper bend when it is connected. The plug should be connected tightly.

Grounding wire: The common grounding copper plate need to be connected with grounding wire of transmitting room.

Wires inside transmitter: Separated packed units should be installed in their right position in the cabinet according to the assembly diagram. Then wire according to the wiring diagram and the identifier labels.

5.3 Transmitter debugging

Power amplifier, central control unit, sampling control unit is needed to be adjusted independently. The amplifiers will not be re-adjusted in transmitter adjusting.

The adjustment of transmitter should be carried out on the basis that plug-in boxes and unit circuit has been well adjusted. Before adjusting, output end of the transmitter must be connected with antenna and 50Ω dummy load (power capability is higher than the rated output power of this transmitter). Check the wire is correct. Confirm that the cooling system is run nominal. Only in this case, the transmitter is allowed to be switched on.

For the first step, check the AC distribution control system in the condition that amplifier units and other circuit units are not connected. If everything is normal, switching power supplies can be connected and turn on, check if their DC output is correct. If everything is normal, all signal processing, amplification plug-in modules and other unit circuits, completing all connections of the transmitter. After confirming that the connection is correct and the control system is normal, start up power amplifiers at their static state. In the conditions that the amplifiers are normal, increase their driving to drive them to higher output power gradually.

After the rated output power of transmitter is reached, adjust its technical specifications according to the technical requirements. Final, a comprehensive test should be carried to check if all specifications can up to the technical requirements.

6 Use and operation

6.1 Personnel requirement

- ◆ The equipment should be operated and maintained by the professional personnel defined in GB 9159-88 Safety requirement for radio transmitting equipment.



- ◆ The operator and maintainer should be very familiar with the principle and structure of equipment, the voltage of each unit, and basic knowledge of electric shock prevention rules and medical service.
- ◆ The adjusting and maintaining need at least two persons. The operation command must be send by master adjusting personnel.
- ◆ Normally speaking, the adjusting and maintaining are not allowed to carry out with power on, especially when the transmitter is on. If necessary, it must be guaranteed that the human body cannot touch charged terminal; and there must be specially-assigned personnel who are in charge of monitoring and protection.
- ◆ Whenever the operation needs to touch the circuit or terminal, especially the high voltage circuit or terminal, the supervisor needs to cut off power first.

6.2 Safety Tips

Safety precautions

- ◆ The operator should read this manual before starting transmitter,
- ◆ And perform daily maintenance according to this manual.
- ◆ The input signal type and level must be within range specified in this manual.
- ◆ Do not modify the output power of exciter when the transmitter is working.
- ◆ Please equip with fire-fighting unit in machine room.

Warning

- ◆ The transmitter RF output terminal must connect with proper antenna or test load.
- ◆ Do not cut any RF cable when transmitter is working.
- ◆ Do not open cover plate of any cabinet when transmitter is working.

Safety protection

- ◆ AC power of this transmitter is three phase 220V; Pay attention to safety when operating and maintain it.
- ◆ Well connect the safety grounding wire, in case the cabinet is electrified and hurt somebody consequently.
- ◆ PA and power supply modules are heavy and need to be carry with care.

Equipment safety

- ◆ Operate this transmitter according to correct procedure.
- ◆ Keep the cooling system in normal conditions. It is banned to start the transmitter when cooling system is not on operation or its flow and temperature is not up to the requirements.
- ◆ Output parts of high power can not be open or short circuit, or else it is banned to start the transmitter.
- ◆ Tuning components of output filter and directional coupler need to be tightened.
- ◆ Collision against coaxial feeder tube and cables is strictly prohibited.

Safety mark

Safety icon The parts with the following icon have high pressure, which need protective measures during operation.



High temperature! Attention !



6.3 Operation procedures

6.3.1 Preparation and examination before use

Before power-on

Before this transmitter is put into use, the user should read technical manuals to learn caution marks and operating procedure.

At first using of this transmitter, checks listed below must be done before the transmitter is turn on:

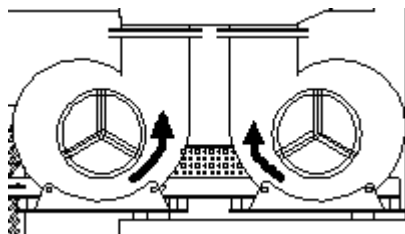
- ◆ Whether AC power supply and safety grounding wire is correct connected; Whether power cable is short circuit to ground.
- ◆ There is no clogging inside the cooling system and the liquid paths;
- ◆ RF coaxial hard feeder and RF coaxial cable connections is correct and reliable;
- ◆ Output port of the transmitter should be connected with dummy load or antenna;
- ◆ Whether input signal is in accordance with the requirement;
- ◆ Whether switches on the panel of plug-in modules is under normal conditions.

6.3.2 Power-on operation

Connect three-phase four-wire type 220V mains power according to the draw in; Connect -wire type mains power Connect its output terminals to antenna or dummy loads. Then switch the main air breaker to “ON” position (up). After the Master control circuit finishing its start process and LCD screen displays the control interface, you may start various operation controls.

Please pay attention at your first start up, be sure the blowers are rotating in the required direction unless the blower may be damaged.

The method of checking blower’s rotation is as follows: Open the side cover from the cabinet, you may see the rotor, rotor wheel and casing; Press down the START button and make the blower running and then press "STOP" to shut it down quickly; Check the rotor wheel if it rotates in the involute direction of the snail casing; If YES, it means the fan is in normal operation. If NO, one need to adjust the three phase sequence by exchanging any of two phase wires’ position.



Forward rotation of blower

Please specially notice that: when the spare power (say diesel generator) is supplied, check if the blower rotates in the forward direction when starting the backup power supply. If the



rotation is not correct, you must change the phase sequence between the spare and the main power supply, to make sure the rotation direction of blower is normal under both spare and main power supply.

Under this situation, please pay attention during switching the phase sequence of power supply.

Once you touch the “start” button. Then the transmitter is started into operation. By the touch screen (or buttons) you can enter into different menu and observe the corresponding status of the transmitter. (See in the following chapter the detailed introduction)

When the transmitter is powered on, all three phase power line being connected must be ensured; otherwise the transmitter will not work normally. Mains power supply of this transmitter is three-phase four-wire type 220V. The main power switch of transmitter is at the power distribution panel in the front and at the bottom of the transmitter. The blue/white breaker on left is the power switch; red/yellow switch on right is emergency booting switch. Under normal condition, the emergency switch must be off; otherwise, the transmitter will start up when switch is closed.

DC power supply of this transmitter includes switching power supply for control system and switching power supplies for power amplifiers. Power supply of control system is the 24V/12V power supply. Four power amplifiers are powered by three 50V/50A switching power supplies separately. These power supplies are equipped with over-voltage and over-current protection. Exciters of this transmitter are powered independently. 24V/12V power source for control system one is installed in the acquisition control unit. This unit is powered by single-phase 110V AC. After insert the plug and turn on the power switch, acquisition control unit is powered, and the 24V/12V supply inside this unit is started also. It will supply DC power to control and collecting board inside power amplifier units and the transmitter acquisition and control board inside the acquisition control unit. Then the transmitter acquisition and control system is formed, and will response the display control query and control command, accomplish the functions of transmitter startup, shutdown and status check. Another 12V/24V power supply is for standby and installed on the distributor panel., when the power supply inside the acquisition control box is failure or acquisition control system fault and results the transmitter cannot complete its start operation, you can trigger the yellow emergency switch, which is on bottom of the front panel, clockwise to start the transmitter.

Note: In the case of emergency starting, there is no interlock with outside equipment. You must confirm that the cooling system of the dummy load has been in operation.

6.3.3 Startup and shutdown operation



The transmitter can be startup and shut down by using of the Master controller ON/OFF button or the emergency switch on the distributor unit. Blower begins to run when the transmitter is started up. On/off operation also can be done by remote control.

6.3.4 Operation for switching over of exciters

When the changeover switch on panel of the switchover amplifier unit is set in automatic mode, the transmitter will detect exciters automatically. When the operating exciter faults, it is automatically switched to standby exciter. When the switch is in the position of main exciter or standby exciter, the transmitter will compulsorily use main or standby exciter.

6.3.5 Running log

The status of the transmitter and each power amplifier during normal running of transmitter needs to be recorded as the material for future maintenance. Record and content is as following:



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北广科技 创造非凡

Record of transmitter status										
No.	Record time	Output power	Reflection power	PA 1 current	PA 2 current	PA 3 current	PA 1 temperature	PA 2 temperature	PA 3 temperature	Remark
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										

7 Fault analysis and troubleshooting

7.1 Common faults and troubleshooting

- ◆ What if VSWR of PA unit is too high?

Check the antenna or test load to make their VSWR less than 1.3.

Loosen fixed screws and take PA out, then put it inside again. Make sure PA unit has been put at the bottom of guide rail.

- ◆ What if it alarms overheat?

Check ambient temperature. If temperature is too high, lower it.

Check heat sink of PA unit. If cooling fin has dust or foreign object, clean it.

Check air blower and air flue, to make ventilation smooth.

7.2 Common faults and maintenances

Common faults and maintenances

Fault	Fault cause	Solution
Starting light and external interlock light are all yellow.	Transmitter serial wire is open circuit.	Connect the serial wire from the display control unit to the acquisition unit.
	Transmitter serial port of control panel fails.	Replace failed control board.
Code stream input light above exciter is red.	Multiplexer code rate is wrong and can be triggered, or exciter code rate inspects logic faults.	Restart Multiplexer and exciter. If it is still not solved, send it back to factory.
	Code stream cable from multiplexer to exciter fails.	Re-connect cable.
		Send it for repair.



Fault	Fault cause	Solution
The transmitter cannot be started by pushing the “start” button on the central control unit.	Interlock contactor of the acquisition control unit is disconnected, or coaxial switch is wrongly switched.	Insert its plug or well connect the external wire, and switch the coaxial switch to the right place.
	Power supply plug on back of acquisition control unit fall off.	Insert the power supply plug.
	Power switch on back of the acquisition control unit is turn off.	Turn on the power switch back panel of this unit.
	Fuse on back of the acquisition control unit back is burnt out.	Use emergency switch to start the transmitter first. Then check the acquisition control unit. If there is no trouble in it, you can change the fuse and re-start transmitter. If there are faults with the unit, you should repair it and change fuse after then.
	Three-core cable connecting the central control unit and the acquisition control unit is disconnected.	Use emergency switch to start the transmitter first. After then, connect the cable.
The transmitter cannot be started by pushing the “start” button on the central control unit.	24V power supply in the Acquisition control unit is damaged or wire is broken.	Use emergency switch to start the transmitter first. After then, reconnect the wire, or inspect output of the power supply and power connector. If the power supply is confirmed with damage, replace it.
		to send to repair
	Control board in the acquisition control unit fault or the wire from it to extended board is disconnected.	Use emergency switch to start the transmitter first. Then reconnect the wire or replace the control board. Send it for repair.



Fault	Fault cause	Solution
After push the “start” button on the central control unit, the blower is started normally, but the power supply light of PA is not on.	The power supply switch on front panel of the power amplifier is not closed.	Close the power supply switch on the front panel of PA unit.
	The air breaker of its corresponding power supply unit is not turn on.	Turn on the air breaker which is on rear panel of the power supply.
	Power amplifier module or power supply module is not inserted in position, resulting the quick plug is not well contacted.	Push the power amplifier module or power supply module in position with care. In this operation, attention must be paid to matching of the plug, to avoid bending pins of connectors by violent collisions.
	PA power supply has no AC voltage input or the AC input wire is not well connected.	Shut down the transmitter and reconnect its AC input wire.
		Replace it with standby power supply or the one of other PA module to see whether it is normal started. If the power supply problem is confirmed, send it for repair. Regularly, otherwise you should check the PA module.
After the main power switch is turned on, the exciter has no indication.	Power switch on back panel of the exciter falls.	Insert the power plug.
	Power switch on back panel of the exciter is off.	Turn on the power switch on the back panel of this unit.
	Not the above two cases.	Open cover plate of the exciter and check whether there is fault in its power supply, or send the exciter for repair.

Fault	Fault cause	Solution
After turn on the main power switch, light of central control unit is not on.	AC power supply plug on back panel of the central control unit fell off.	Insert the power plug.
	AC power supply switch on back panel of the central control unit is cut off.	Turn on the power switch on the back panel of this unit.
	Fuse of power switch on back panel of the central control unit is broken circuit.	Confirm the central control unit without question then change the fuses and restart the transmitter.
After the transmitter is started-up, blower is started normally, but the change-over controller switches to standby exciter automatically.	The main exciter has no RF output.	Check whether the exciter sets RF block function. If so, turn on the RF output.
	Check the RF cable from change-over controller to exciter and confirm whether it is reliably connected.	Connect RF cables
		If the problem is not as above mentioned, open the change-over controller for checking and repair or send it back for repair.
Blower cannot start up normally	Plug of blower device fell off	Insert the plug
	Solid-state relay control circuit driving the blower is disconnected.	Reconnect the solid-state relay control wire.
	Solid-state relay failure	Change the control relay.
After started up the transmitter, panel display power output is	Exciter RF output is locked, so RF output of power amplifiers is zero	Turn on RF output of exciter.

Fault	Fault cause	Solution
zero and output power green indicator lamp on the front panel of power amplifier units is not lit.	RF cable from exciter to switching amplifier or from switching amplifier to splitter is open circuit or short circuit or fell off.	Check or replace the cables to make sure it is connected well.
After started up, the transmitter display the output power is zero or very low, but the green indicator lamp on front panel of PAs are lit.	The cable from directional coupler behind output filter to RF output detector is open circuit or short circuit.	Check or replace the cables to make sure it is connected well.
	Filter breakdown or hard feeder connection from the filter to the combiner failure	Check whether over front-reflection takes place. If so, check the connector or test the filter.
After the transmitter is started and power on, indicator of power supply unit is lit up, but the green indicator on the panel of power amplifier is not lit up. Monitoring shows there is no output from the power amplifier.	RF input is blocked because of over-excited, over-current or over-heat in the PA module.	Push the reset button to restore PA system.
		Send it for repair.
	The input signal cable behind the power amplifier module is not connected well, so the power amplifier has no input signal.	Connect input signal cable.
	RF input plug of the power amplifier is open circuit or short circuit, or RF input wire inside the PA module fails.	Check input plug and RF input wire inside PA module.



Fault	Fault cause	Solution
	No output in driving power supply of PA causes any RF output in driving PA, or the driving power amplifier fault.	Check driving power amplifier and its power supply circuit.
Exciter operation has no effect.	Procedure of controller interface is endless loop.	Restart exciter
	Internal control port circuit inside exciter is cut off.	Connect the control port.
	Exciter port fails.	Send it for repair.
Start transmitter and power on, it can't reach to full power and it will turn off automatically.	Filter front reflection is too high, exceeding 10% of full power, or the rear reflection is too high, exceeding 10% of full power.	Check the output cable, output filter, multiplexer (if it has), coaxial switch (if it has), antenna, etc. whether there is no disconnection. RF connector is not installed well or poor RF matching.
After started on, the transmitter can work normally, but will be turned off automatic all	Automatic "timing OFF" is set and is used in the ON/OFF setting in central control unit.	Set auto on/off according to your needs or select to not use the auto on/off.
Settings of exciter output are not changed, but the output power of the transmitter is around 50% lower. Its initial value and the operating currents of PA are balanced.	PAs is blocked 3dB because of instant over-excited.	Click "start/recovery" button to remove the block.

Fault	Fault cause	Solution
There is big noise or abnormal grating during three-phase fan operation.	The unbalance operation of fan causes heavy shaking or foreign objects cause friction, or damage of fan bearing causes big noise.	<ol style="list-style-type: none"> 1. Check whether there is foreign matter in the fan. If it has, clean it. 2. Check whether fan rotor is deformed. If so, change the fan. 3. Power off fan, and stir fan rotor, if there is friction or stagnation during bearing operation, change the fan.
Start fan and it runs normally, but it stops after a while.	Overheat protection.	<ol style="list-style-type: none"> 1. Check whether there is foreign matter in the fan. If it has, clean it. 2. Check whether friction is heavy due to ageing or damaged fan, which causes overheat protection. If so, change the fan. 3. Check whether phase loss causes fan overheat protection. Phase loss might be caused by transmitter input phase loss. Check whether transmitter input voltage is normal. 4. If transmitter input voltage is normal, then check whether three-phase solid state relay input of fan has phase loss. If it has phase loss, change the solid state relay.
Overall output power is a little lower, one or two PA output is lower or no output.	RF input wire of this PA is loose or RF loss is larger	Connect input wire again or change RF wire, but pay attention to keep path with the phase of other input wire
	Problems of front stage PA	Change or maintain

Fault	Fault cause	Solution
	Problems of final stage PA or combiner behind final stage PA	If final-stage PA current is normal, check combiner behind final stage PA. Change it or send it for repair.

8 Maintenance

Daily maintenance

The transmitter should be operated in a clean room. In regular maintenance, you just need to clean the equipment and record the main index, e.g. power and current, etc.

Pay attention to check cooling system and ensure the wind path keeping clear. Dust collector is used to clean dust on dust filter gauze montly or half month. If the dust is too much to be cleaned, uninstall filter and wash it by water. Dry it, and install the filter back to the inlet of fan.

The air volume of each transmitter is 5000m³/h, (DW10-37NO2.25 0.45kW, 2 sets). Thus, while designing the air channel of the transmitter, the designed air volume of the outlet should not be less than the total air outlet of the transmitter. The designed air volume of the inlet should not be less than the total supply air of the transmitter Otherwise, the wind drag of the transmitter's cooling system would increase, which causes the temperature of the transmitter too high and leads to fault.

When necessary, clean the filter screens for all the entrance of wind duct by using the vacuum cleaner or dismantling and washing in half month or one month.

During normal operation, some fasteners inside the transmitter, may be loose because the shake of the blower. Fasteners should be checked and tighten timely. If some one amplifier unit faults, it can be pulled-out and replaced after its DC power supply is switched off.

MOSFETs are used in the final stage amplifiers. In normal operation, they are basically the same as other type of transistors. If a MOSFET need to be replaced, anti-static measures must be adopted. The working table must be with grounding wire. The operator must operate with anti-static wristbands. The electric iron used in operation must be good grounding or disconnect its power supply during welding.

You should often check whether the RF connecting cable is screwed fasten to avoid open circuit.

Always check the RF cable is fastened or not, prevent open circuit happening. Check the transmitter working statues in regular.

(By high frequency monitoring port)

During the transmitter is in operation, don't stir switches on the exciters, do not pull out or plug in the power amplifier units so as to avoid damage or abnormal operation on the transmitter.

If you need to take maintenance of power amplifier, note that the plugs on rear panel must be disconnected in advance and then pull out the amplifier module from front of the cabinet. When the amplifier module is plug into the cabinet, you had better to pull its corresponding power supply module backwards a few centimeters so as to avoid bending pins of connectors by violent collisions. After the amplifier has been well inserted, push the power supply to its position, and fasten the screws.

Prevent bump against output filter cavity. The collision may change correct position of the adjustable parts inside the filter. In case the adjustable parts are changed carelessly, the adjustment should be carried out under surveillance with instruments.

If case of changes happens, adjust with professional instruments.

	Routing maintenance as below:	Items	Content
1	Working conditions	Output power, load reflection, temperature, current and voltage	Output power
2	Weekly	Fan	Once per year (within 2 years) Once every half year(after 2 years)
3	Dust screen of the air inlet	Whether the dust screen is blocked by dust or other objects	Once every half year(after 2 years or according to working environment)
4	Every half-year once, or depend on working environment	PA heat sink	Is there any dust or other matters on the heat sink or not

8.1 How to change the dust screen of the air inlet

- ◆ By using the screwdriver, loosen the 4 fixed screws of the dust screen



- ◆ Take out of the frame of the dust screen with backward and upward directions
- ◆ Inside the frame of the dust screen, there are 8 tight nuts. By taking out of them, the frame that is used to compress tightly could be pulled out. Then the dust screen could be replaced
- ◆ Cut the dust screen according to the size of the outline frame. Then assemble it by following the reverse order of the above

8.2 Maintenance during operation

- ◆ During operation, regularly check whether the current and operating temperature of each amplifier tube are within the normal operating range. During transmitter operating process, should check the transmitter is under normal working statues or not regularly.
- ◆ The normal value can refer to handover working status record, or daily working status record. Carefully check the noise during operating and the rotation direction of the fan is normal or not.
- ◆ Clean the dust and sundries on the distribution panel at regular time Should clean the dust and other matters on the transmitter at regular time.
- ◆ During examination, check whether the combiner, cable, filter and isolator of the transmitter have abnormal high temperature. If necessary, carry out further inspection and replace parts. Pay more attention on the cable of transmitter and filter have abnormal heating situation or not when process checking.
- ◆ If have, process future check and replace parts. The status of exciter does not have to change frequently, does not have to appear in the daily routine working statues record.

8.3 Overhaul period

- ◆ The transmitter shall be overhauled at regular time. Generally, routine overhaul is carried out every week. The overhaul contents are to clean accumulated dust, dredge the air channel, clean the panel, and record working status of each unit.
- ◆ As for monthly overhaul, check connection of the interfaces, working status of the exciter, connection of the isolator, filter and combiner, as well as temperature.
- ◆ Clean accumulated dust inside the PA every half year. Check the rotation axis of blower.

8.3.1 Maintenance when the transmitter is out of service for a long time



- ◆ If the transmitter is out of service for a long time, it should be cleaned regularly. This is to avoid faults at starting up.
- ◆ Even if there is no broadcast, the transmitter shall also be powered on regularly. In dry areas, it can be turned on once a month. The operation time shall not be less than half an hour. In wet areas, it can be turned on once per week. The operation time shall not be less than one hour.
- ◆ Preparation of preventing rats and insects must be made. This is to avoid damage towards the power line and circuit. Otherwise, the transmitter might be destroyed or personal injury might happen.

8.3.2 Matters need attention

- Maintenance tips

Transmitter maintenance is the key point to make sure transmitting normally. During maintenance, pay attention to the following tips:

The dust on the transmitter needs to be removed regularly. This is to prevent too much dust from blocking the air channel. Check whether the fan works normally. Clean the air channel and dust screen regularly.

Check whether connection of the AC contactor and air switch (circuit breaker) is good, whether the contact is clean, and linkage data line is connected soundly.

Check and test the antenna/feeder system regularly to make sure the whole system working well.

Check the operation condition of the exciter's fan and panel's buttons. Check the operating data of all PAs, connector and cleaning condition of the heat sink. Take care of electrostatic discharge damage when use or change LDMOS transistor. While installing the LDMOS tube, the applied soldering iron must be grounded. If there is no good grounding condition, the attaching plug could be pulled out after the soldering iron is warmed. Then welding can be carried out.

8.3.3 Emergency treatment

- During debugging or broadcast, if personal injury such as electric shock occurs, the transmitter's power should be cut off first. Carry out treatment according to the rescue measures.
- Under the condition that reflection power is too high, check the connection status of the output port, filter and antenna feeder after turning off the transmitter, and eliminate faults.



- Under the condition that mechanical parts, such as the fan, are jammed or striking sound occurs, treatment could be carried out after turning off the transmitter. Or if the situation is too urgent, the transmitter needn't to be turned off; the total input power could be cut off directly, and then overhaul can be carried out.
- If some tube in the PA fails, or even a PA unit fails, overhaul can be carried out when turning off the transmitter. The precondition is that the fault does not affect transmitting of the overall machine. And the coverage area is not influenced either.
- If overheating occurs to the combiner, filter and isolation load, etc., judge the fault position first. And then immediately turn off the transmitter and carry out overhaul.

8.3.4 Maintenance of the PA

◆ Maintenance attentions

Use

Make sure the PA is powered on under the condition of being connected with 50Ω terminal load (support power of over 1kW) and forced air cooling.

When the power amplifier is in operation, do not open the shielding box.

When the power amplifier is in operation, you should pay attention to the indication lights, and deal with the fault timely.

Applicability about the external interface and button switch of the PA unit (refer to PF2.800.65DL):

Front panel: X7 (output monitoring)—RF detection port of the PA's total output (SMA, 50Ω).

R6 (gain)—gain adjustment potentiometer. It should be adjusted by professional technicians.

R7 (phase)—phase adjustment potentiometer. Adjustment can only be carried out when professional technicians present.

S (switch)—power supply switch

Rear panel: X6 -- RF output port of the PA (7/8")

1X1 -- power socket of the PA (297-08-01100)

X1 -- RF input port of the PA (N-50KFB2)

Maintenance



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Keep the working environment cleaning.

Check connectors of the power amplifier periodically, to prevent loosening, make sure the RF output port in good contact.

Check the state of power amplifier periodically (Technical persons).