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Hytera Training Introduction

**Value**

**For Partner**
Enhance technical capacity. Promote business development. Create competitive advantage.

**For End User**
Understand product technology. Implement solution application. Maximize product value.

**Technical Certification**
To whom engaged in wireless communication, Hytera provide professional technical certification in following three areas:
- Product Technology
- Engineering Technology
- Wireless Solution

**Advantage**

Comprehensive Coverage of Products

Customized Training

Focus on Practical Operation Experience

Professional Technical Certification
# Wireless Solution

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<th>Duration</th>
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<tr>
<td>IP multi-site application technical training (A,P,E)</td>
<td>9 H</td>
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<tr>
<td>Digital Smartdispatch system application technical training (A,P)</td>
<td>9 H</td>
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<tr>
<td>Repeater coverage application technical training</td>
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</tr>
<tr>
<td>Video surveillance and emergency dispatch system technical training</td>
<td>6 H</td>
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# Product Technology

<table>
<thead>
<tr>
<th>Training Course</th>
<th>Duration</th>
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<tbody>
<tr>
<td>Tetra terminal application technical training</td>
<td>12 H</td>
</tr>
<tr>
<td>Tetra terminal repairing technical training (A,P)</td>
<td>18 H</td>
</tr>
<tr>
<td>DMR terminal application technical training</td>
<td>12 H</td>
</tr>
<tr>
<td>DMR terminal repairing technical training (A,P)</td>
<td>18 H</td>
</tr>
<tr>
<td>Analog terminal application technical training</td>
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<td>Analog terminal repairing technical training (A,P)</td>
<td>18 H</td>
</tr>
<tr>
<td>Tetra trunking system technical training</td>
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</tr>
<tr>
<td>DMR trunking system technical training</td>
<td>30 H</td>
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<tr>
<td>Analog trunking system technical training (P)</td>
<td>30 H</td>
</tr>
<tr>
<td>Digital simulcast technical training (A,P)</td>
<td>15 H</td>
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<tr>
<td>DMR trunking system Lite technical training</td>
<td>30 H</td>
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</table>

# Engineering Technology

<table>
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<tr>
<th>Training Course</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering specifications and operational training</td>
<td>9 H</td>
</tr>
<tr>
<td>Engineering electrical measurement application technical training (A,P)</td>
<td>9 H</td>
</tr>
<tr>
<td>Network planning and design application technical training (A,P)</td>
<td>9 H</td>
</tr>
</tbody>
</table>

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The applied technical training for Hytera product extension and integration (including product principle, function, program design, case studies, device selection, etc.)

The applied technical training for Hytera single product (including principle, functions, technical specifications, hardware / software components, installation, setting, commissioning, repair and maintenance, etc.)

The applied technical training for wireless communications products delivery in engineering (including surveying, measuring, construction practices, network planning and optimization, product integration device selection, etc.)
### Digital SmartDispatch System Application Technical Training (P)

**Benefits of Training:**
- Hytera SmartDispatch product, function application and common networking type.
- IP multi-site connect application solution design and common network troubleshooting.
- Digital SmartDispatch system case study.
- Installation, configuration, debugging, and troubleshooting of digital SmartDispatch system.

**Targeted participants:**
- Technical support engineer, service engineer;

**Admission Requirements:**
- Got digital SmartDispatch system application technology certification A.
- Understand IP protocol and network knowledge.
- Performance of IP network equipment.

**Class Hour:**
- 3 days (Theory & Operation & Discussion & Case study)

**Class Size:** 4-8 persons

### DMR trunking System Technical Training (P)

**Benefits of Training:**
- DMR standard and technology advantage.
- Hytera DMR trunking system and function.
- Function, installation, configuration, and commissioning of DMR trunking system single station (including hardware/software).
- Installation and application of NMS/DMS/RMS from DMR trunking system single station.
- DMR trunking system database backup.
- The method of DMR trunking single station troubleshooting.
- Function and programming of DMR trunking terminal.

**Targeted participants:**
- Technical support engineer, service engineer;

**Admission Requirements:**
- Got DMR trunking system technology certification A.
- Understand Linux system and operation commands.
- IP network basic knowledge.

**Class Hour:**
- 5 days (Theory & Operation & Discussion & Case study)

**Class Size:** 4-8 persons

### Engineering Technology--Engineering Specifications and Operation

**Benefits of Training:**
- The basic skill of system installation.
- Engineering installation specifications.
- Operation of engineering safety.
- Case analysis of engineering construction.

**Targeted participants:**
- Service engineer, technical support engineer.

**Admission Requirements:**
- Know well the principle of wireless communication.
- More than 1 year engineering construction experience.

**Class Hour:**
- 1.5 days (Theory & Operation & Case study)

**Class Size:** 5-15 persons
TC-508 Can’t Power on Fault Repair Case

1. Fault Phenomenon Description
   a. Connect to direct-current power supply and turn on the radio, no power on voice. Press the side key, no response either.
   b. Connect to direct-current power supply and turn on the radio, there is power on voice but the radio turns off immediately. It can’t power on normally.

2. Fault Reason Analysis
   a. According to above phenomenon, the terminal can’t power on.
   b. The cause of can’t power on: power supply circuit problem, CPU control circuit problem, reset circuit problem.

3. Specific maintenance case

   **Case 1**

<table>
<thead>
<tr>
<th>Model</th>
<th>Frequency</th>
<th>Firmware Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>TC-508</td>
<td>400-420MHZ</td>
<td>V1.01.08</td>
</tr>
</tbody>
</table>

   - **Fault Phenomenon Description**
     TC-508 has no power on voice, no response; press the side key, no response either.

   - **Fault Reason Analysis**
     From the fault description, the fault is can’t power on. It is caused by power supply/CPU control circuit/CPU crystal clock fault.

   - **Detection Steps**
     a. Supply 7.4V power to the main board. Use a multimeter to test the two pins voltage of the volume switch. The two pins voltage of the volume switch is 7.4V. It is normal.
     b. Test the voltage of the CPU power supply pin, it is 3V. It is normal.
     c. Test the voltage of pin#1 and pin#4 of CPU clock crystal, they are 1.3V, we preliminarily judge that the power on crystal works abnormally so that it can’t provide reference clock. Normally, in the oscillation period, the voltage should be different between pin#1 and pin#4.
     d. Replace the crystal, test the voltage of pin#1 and pin#4. Pin#1 is 1.3V, pin#4 is 0.7V. The radio can power on normally. The problem is solved.
Conclusion
The problem is that the CPU clock crystal can’t oscillate when powering on the radio. Normally, the oscillation could only happen when the voltage is different between pin#1 and pin#4.

Case 2

<table>
<thead>
<tr>
<th>Model</th>
<th>Frequency</th>
<th>Firmware version</th>
</tr>
</thead>
<tbody>
<tr>
<td>TC-508</td>
<td>450-470MHZ</td>
<td>V1.01.08</td>
</tr>
</tbody>
</table>

**Fault Phenomenon**
Turn on the radio, there is power on voice but the radio turns off immediately. It can’t power on normally.

**Fault Analysis**
From the above fault analysis, the fault should be automatically power off after power on. The problem should be caused by control circuit problem or battery voltage test circuit problem.

**Detection Steps**

a. First check the contact between the battery and the battery connector.
b. Take out the mainboard, we found the main radio has been watered slightly. The components around CPU are corroded and turned to be black.
c. We can judge that the battery low voltage test circuit error cause the battery die. Use a multimeter to test the R602 battery power supply voltage is 7.4V. No voltage at the other side. The multimeter resistor test shows the circuit is open. Take off the resistor, we find the copper has been corroded.
d. Clean PCB board and replace R602. Test the voltage, it is 3V. (In the full battery condition, if the battery power supply is low, the voltage should be low as well.)
e. After replacing the resistor, the radio can be powered on normally and are not turned off automatically. The problem is solved.
When the power supply is 7.4V, the voltage should be 3V at this point.

The Resistor’s Location in PCB

Power Supply Voltage: 7.4V

*Conclusion*

The cause is battery low voltage test circuit problem, but we mistook that the automatical turn-off is caused by exhausted battery.
TC518 Can’t Power On Fault Repair Case

1. Faulty Phenomenon Description
There is no reaction when connecting to the 7.4V standard power.

2. Faulty Reason Analysis
1) The fault is “can’t power on” according to the above phenomenon;
2) Detection place for hardware circuit: power supply circuit, CPU control circuit, main related components are power up key S601,L601,U601, CPU power supply IC U603, reset IC U605, memory U606 and CPU time crystal oscillator;
3) The main cause of software is E2ROM data missing, CPU program error, solutions are CPU/E2ROM replacement or E2ROM rewriting;
4) Power supply circuit diagram is shown as below:

**Power supply circuit principle:** 7.4V DC power converts to a stable 5V DC power through U601. One supplies 4.5DC voltage to TX, RX and VCO circuit after converting through U602. The other one supplies 3V to MCU, E2ROM and PLL after converting through U603.

**Special case:** there is another similar faulty situation whose repair method is different, that is, the radio is in empty channel, the speaker and indicator damages at the same time (very low rate).

3. Specific Maintenance Case

| Case 1 |
|---|---|---|
| **Radio Type** | **Frequency** | **Firmware Version** |
| TC-518 | 400-470MHz | V1.01.21 |
- **Faulty Phenomenon Description**
  There is no powering up volume, flashing indicator, current and no reaction after pressing PTT.

- **Faulty Reason Analysis**
  This fault is “can’t power on” according to the fault phenomenon. We have to check power supply circuit and CPU control circuit.

- **Test Steps (See figure 1 and 2)**
  1. There is no liquid corrosive, burned trace of components after disassembling the radio;
  2. Power on the radio, and use multimeter to test L601’s two ports. It is 7.4V which is normal;
  3. Test S601 powering up key’s upper volt, it is 7.4V, it will change to 0V after pressing the PTT key, which is normal;
  4. Test U601’s output voltage after pressing powering up key, it is 5V which is normal;
  5. Test IC U603’s supplying voltage to MCU and E2ROM, it is 3V which is normal;
  6. Test supplying voltage pin to CPU, it is 3V; Test the 8th pin of U606 of E2ROM, it is 3V, all of them are normal;
  7. Use the oscillograph to detect time crystal oscillator X601 to see whether it can oscillate, and then test the two pins, there is no oscillation sine wave output, it is abnormal. Replace a new X601 and power on the radio, and the fault disappears;

---

**Figure 1**

| L601 Voltage: 7.4V | Powering up key | U601 output: 5V | U603 output: 3V |
Summary
This fault is the damaged time crystal oscillator X601 of CPU makes CPU out of work.

Case 2

<table>
<thead>
<tr>
<th>Radio Type</th>
<th>Frequency</th>
<th>Firmware Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>TC-518</td>
<td>400-470MHz</td>
<td>V1.01.21</td>
</tr>
</tbody>
</table>

Faulty Phenomenon description
There is no powering up volume, flashing indicator, current and no respondence after pressing PTT.

Faulty reason analysis
This fault is “can’t power on” according to the fault phenomenon, we have to check power supply circuit and CPU control circuit.

Test steps (See figure 1 and 2)
1) There is no liquid corrosive, burned trace of components after disassembling the radio;
2) After powering on the radio, use multimeter to test L601’s two ports, it is 7.4V which is normal;
3) Test S601 powering up key’s upper volt, it is 7.4V, it will change to 0V after pressing the PTT key, which is normal;
4) Test U601’s output voltage after pressing powering up key, it is 5V which is normal;
5) Use multimeter to test the 2nd pin input voltage of U603, it is 5V which is normal, test the 6th pin output voltage, it is 0V which is abnormal. We can conclude that the front circuit part of U603 is normal which means the cause is the back part of U603 or itself. Remove inductance L603 and break the latter circuit and then power on the radio to test the 6th pin of U603, it is still 0V and U603 may damage, and replace U603 and power on the radio to test again, it is still 0V and the radio still can’t power on.
6) Use anti-static nipper to touch several components around U603 slightly and find that one filter C608 is broken which is short circuit after testing by multimeter. The radio returns to normal condition after replacing C608 and soldering L603 back.
Summary
This fault is the broken C608 causes 0V output of U603 which leads the “can’t power on” fault, in order to improve the repair efficiency, it is better to break the inductance like L603 or similar on the main circuit to narrow the fault detection range when checking the power supply circuit.
1. Failure Phenomenon Description
   1) Press TC-610 PTT button to setup a call to radio “A”, TC-610 red LED glows and radio “A” green LED glows as well. But there is no voice output on radio “A”.
   2) Check the TX FM deviation by test machine, there is no FM deviation.

2. Failure Cause Analysis
   1) According to the above failure phenomenon and check result, we can judge that the radio has TX voice problem.
   2) To analyze this problem in the view of hardware part, the involved circuits are: MIC, MIC accessory input circuit, TX audio processing circuit, or VCO modulation circuit. The possible damaged components are: MIC, MIC protection diode, MIC accessory interface, or audio processing IC (AN29160AA).

3. Specific Repair Case
   **Case one**

<table>
<thead>
<tr>
<th>Model</th>
<th>Frequency</th>
<th>Firmware Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>TC-610</td>
<td>450-470MHz</td>
<td>V1.03.10</td>
</tr>
</tbody>
</table>

   - Phenomenon Description
     Press TC-610 radio PTT button to setup a call to another radio “A”, TC-610 red LED glows and radio “A” green LED glows as well. But there is no voice output on radio “A”. Check it and find there is no TX FM deviation.

   - Failure Analysis
     Based on the failure phenomenon, we can judge that it’s no TX voice problem. There is no FM deviation, so no voice signal is transmitted.

   - Check Steps
     1) Measure the pin #1 of MIC, the value is 4.5V and it’s no problem.
     2) Check and find that the pin #2 and #4 of MIC Jack are connected, it’s no problem. (If pin #2 and #4 are not connected, it means the MIC Jack is damaged.)
     3) Connect the TC-610 to the integrated test instrument by test cable. Find the TX Test item of integrated test instrument and set the audio output as: 1 KHz, 100mv. And then press the
PTT to make radio in transmitting mode. Check the TX power value and the other TX related parameters, they are all OK but still no FM deviation. Generally there should be 4 KHz FM deviation.

4) Set the test environment just like step 3. Press the PTT and measure the pin #2 signal of MIC Jack by oscilloscope, the value is 0mV. If the signal is normal, there should be 100mV.

5) Use the multimeter to measure the resistance to ground value of pin #2 of MIC Jack, the value is 0Ω and it’s abnormal. It tells that the pin #2 of MIC Jack is grounding short-circuit. It is possible that the MIC Jack is damaged.

6) Replace the MIC Jack, the problem still exists. Re-measure the resistance to ground value of pin #2 of MIC Jack, the value is still 0Ω.

7) Dismantle the protection diode D200 and measure the resistance value, the positive and negative resistance are both 0Ω, it means that the diode is damaged.

8) Replace the D200, and then check TX FM deviation, the value is OK. TX function is also working well. This problem is solved.

**Summary**

This problem is caused by the damaged diode D200. The function of D200 is to protect the accessory interface circuit from being damaged by foreign high voltage signal. If D200 is damaged, it could cause the FM deviation problem and no TX voice problem.
1. Failure Reason Analysis

According to the above failure phenomenon and the below check result, we can judge that the radio can’t be switched on. The involved circuits are: power supply circuit, and CPU circuit. The main related components are: volume switch, 9.8304MHz crystal oscillator, U602, and U606.

2. Specific Repair Case

Case one

<table>
<thead>
<tr>
<th>Model</th>
<th>Frequency</th>
<th>Firmware Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>TC-780</td>
<td>400-470MHz</td>
<td>V1.07.01</td>
</tr>
</tbody>
</table>

- **Phenomenon Description**
  Power on the radio, there is not any response: no power-on sound, or no display by LCD. Press the PTT, there is no response and reading and writing are out of work.

- **Failure Analysis**
  This is power-on malfunction according to the phenomenon. We have to check power supply circuit and CPU control circuit.

- **Check Steps**

3. Power on the radio, and measure the voltage of two ports of F601, both of them are 7.4V. They are normal.
4. Measure the output voltage of power switch SW601. it’s 7.4V which is normal.
5. Measure the voltage of M5V (supply voltage to CPU), there is no 5V output. Measure the pin #3 and pin #1 of U602, there is 7.4V voltage input to pin#3 but there is no 5V output from pin #1. It is abnormal. The U602 is probably damaged.
6. Replace U602 and check M5V output. It’s 5V which is normal. And the radio can be switched on normally. The problem is solved.
**Summary**

This power-on malfunction is caused by damaged U602, and the U602 is the voltage-stabilized IC.
1. Background
In the Tetra radio, when the channel, group or radio are busy, there will be some alert: Busy, Waiting and Queuing if a second person wants to request a call.

What’s the difference among them? Do they have alert tone?

2. Difference
1) What situation will cause Busy?
We take the individual call for example. There are 3 radios, Radio1, Radio2 and Radio3. Radio 1 is talking to Radio2. At the same time, if Radio3 requests a call to Radio2, Radio3 will show "the RX radio is busy" alert tip on the screen, and there will be an alert tone telling you that Radio2 is busy.

2) What situation will cause Queuing?
In several communications condition (using different base station channel), for example, there are 3 base station channels, and 3 communications are already using the 3 base station channels. The base station channel resources are full, if the 4th or 5th communications need to use the base station channel resource, they need to "Queuing", and there will be queue alert tone.

3) What situation will cause Waiting?
In one talking group, if one radio is talking, the other radios will receive the voice from the TX radio. In this condition, if any other radios in that group want to talk, they need to wait. When the other radio press PTT, there will be "Waiting" alert tip on the screen, but no alert tone, because the radio is already in use, and it cannot make the other invoice. Actually if you receive the TX radio, you can hear the voice from the TX radio, you can easily tell that someone is using the group for talking. You have to wait, no need of alert tone.

3. Alert Tone Setting In Tetra Terminal
Go to Tetra CPS->User Settings->Voice->Alert Tone, you can set the alert tone:
<table>
<thead>
<tr>
<th>Call</th>
<th>Tone Type</th>
<th>Listen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duplex Ring Back Tone</td>
<td>Default Tone</td>
<td>Listen</td>
</tr>
<tr>
<td>Simplex Ring Back Tone</td>
<td>Default Tone</td>
<td>Listen</td>
</tr>
<tr>
<td>Get Talk Right Tone</td>
<td>Default Tone</td>
<td>Listen</td>
</tr>
<tr>
<td>Lose Talk Right Tone</td>
<td>Default Tone</td>
<td>Listen</td>
</tr>
<tr>
<td>Call End Tone</td>
<td>Default Tone</td>
<td>Listen</td>
</tr>
<tr>
<td>Emergency Call Tone</td>
<td>Default Tone</td>
<td>Listen</td>
</tr>
<tr>
<td>Broadcast Call Tone</td>
<td>Default Tone</td>
<td>Listen</td>
</tr>
<tr>
<td>Queue Tone</td>
<td>Default Tone</td>
<td>Listen</td>
</tr>
<tr>
<td>TMO Preemption Tone</td>
<td>Default Tone</td>
<td>Listen</td>
</tr>
<tr>
<td>TMO Disable Emergency Button Tone</td>
<td>Default Tone</td>
<td>Listen</td>
</tr>
<tr>
<td>TMO Forbid Talk Right Application Tone</td>
<td>Default Tone</td>
<td>Listen</td>
</tr>
<tr>
<td>DMO Preemption Tone</td>
<td>Default Tone</td>
<td>Listen</td>
</tr>
<tr>
<td>DMO Disable Emergency Button Tone</td>
<td>Default Tone</td>
<td>Listen</td>
</tr>
<tr>
<td>DMO Preemption Failure Tone</td>
<td>Default Tone</td>
<td>Listen</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Short Message</th>
<th>Tone Type</th>
<th>Listen</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Emgrg Message Tone</td>
<td>Default Tone</td>
<td>Listen</td>
</tr>
</tbody>
</table>
How to fix the error band issue on TC700

**Problem:** TC700 U(7) 400-470mhz get corrupted with the U(8) 450-520mhz.
Radio information:
  a), TC 700U(7) 2tone
  b), Frequency: 400-470Mhz
  c), S/N: 09924A0534
1, This is the label on the back:

![Label Image](image)

2, The out of range windows appear and remind you to modify the test frequencies

![Warning Image](image)
Solution:
here is one suggested method for you to solve the problem as below:
1, We need disassemble the radio first.
2, Then connect the SELF (see below picture) to ground, at same time press Top key then power up the radio, the radio will enter reset mode.
3, Check your CPS model type, if the ninth is the correct band, switch the Channel Selector Knob to ninth (corresponding number), and press PTT. Resetting will be OK.
1. **Purpose**
   This document is used for guiding engineers how to setup MT680 ignition sense on software and hardware.

2. **Suitable for**
   Service Center/Global Station of Hytera.

3. **Operating step**
   1). Software:
   Tetra mobile Ignition sense feature had been added in version 4.0.
   In CPS, Follow the path “User Settings”->“Common Settings”->Others->Ignition Sense, and check the option.
2) Hardware:

Pins of 26PIN connector for ignition function:

Below is the definition of MT680 BACK 26PIN Connector, you could find the printed pin number on the connector which are marked in red.

Use a pair of signal wires to connect Pin2 and Pin26 of the connector which are marked in blue to the cigar lighter in vehicle.
1. Failure Phenomenon Description
The following error “Repeater Wake Up Failed” appears in RM mode when pressing PTT.

2. Possible Failure Cause Analysis
1. Frequency does not match. Please use the correct frequency value.
2. Color code does not match. Please use the correct color code value.
3. Radio Tx signal strength is too weak or Repeater Rx signal is too weak.
4. Radio ID is not in the range of repeater access management. Please check the settings in CPS.
5. The protocol between radio and repeater does not match.
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