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SK-RF CO.,Ltd

USER MANUAL

SK201E Module User Manual

Contactless Gigabit Ethernet Connection

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Document Summary: Describes the SK201E module functions, installation and wiring, link-speed configuration, network testing and troubleshooting for installation, commissioning and maintenance personnel.

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1 Functional Description

The SK201E integrates an SKA2P1 RF module, PCB patch antennas and a Gigabit Ethernet PHY to carry Ethernet data over a 60 GHz millimeter-wave link. Two SK201E modules operate as a pair, with their antenna faces opposing and aligned. Each module connects to its local Ethernet device through RJ45 and receives DC power through XHB-2P.

The Ethernet interface supports 10/100/1000 Mbit/s. Each module negotiates independently with its local device. Both ports must operate at the same link speed.

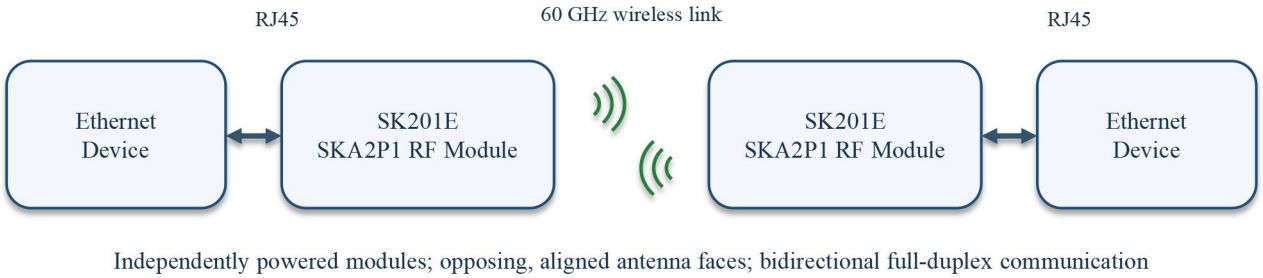

Figure 1. Typical SK201E system connection

2 Interface Definitions

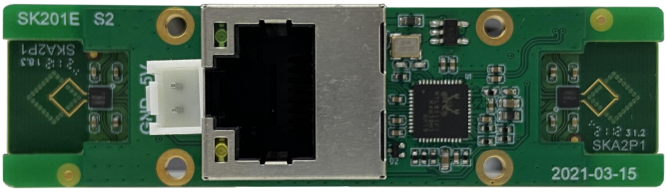

Figure 2. SK201E top view and interface locations

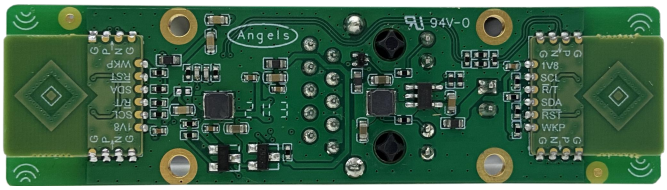

Figure 3. SK201E bottom view

Table 1. Interfaces and Wiring

Interface / Pin	Description
RJ45	Wired Ethernet port
XH 2P / 1	5 V power input
XH 2P / 2	Power ground (GND)

Wire the XHB-2P power connector according to the pin numbers. Check for shorts between the positive input and GND before applying power.

3 Electrical Characteristics

Table 2. Power Supply and Installation Conditions

Item	Description
Input voltage	3.5–5.5 V; 5 V recommended
Typical input current	0.12 A
Typical total power consumption	0.6 W
Operating ambient temperature	0～+70 °C
Installation	Opposing antenna faces with centers aligned; independently powered modules
Recommended initial spacing	Less than 10 mm

Table 3. Carrier Frequency

Symbol	Parameter	Min.	Typ.	Max.	Unit
F_{OSC}	Carrier frequency	-	60.6	-	GHz

4 Mode Configuration

The module's Ethernet port remains in auto-negotiation mode and supports 10/100/1000 Mbit/s. Each module independently negotiates with its local wired device. Read the actual link speed on each connected terminal or switch.

4.1 Identifying a Link-Speed Mismatch

If the computer supports Gigabit Ethernet but the camera supports only 100 Mbit/s, the computer end may negotiate to 1000 Mbit/s while the camera end negotiates to 100 Mbit/s. Even if both RJ45 ports indicate a local link, mismatched speeds prevent normal end-to-end communication.

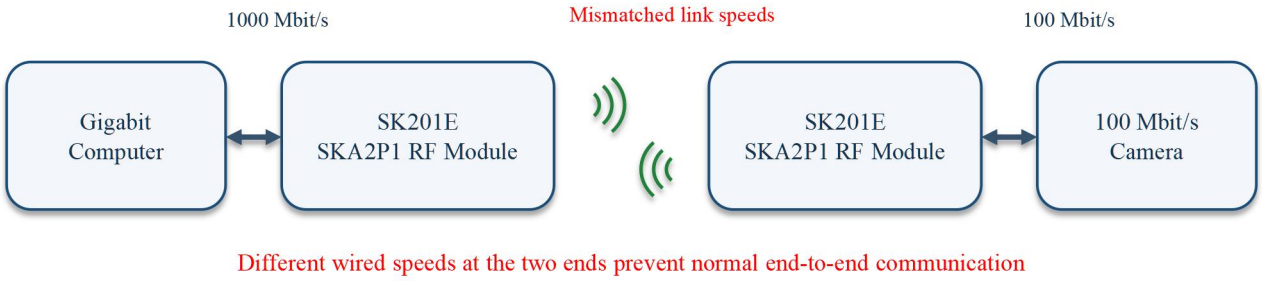

Figure 4. Example of mismatched link speeds

4.2 Limiting the Faster Device's Link Speed

Open the advanced network-adapter settings on the faster computer, or the port configuration on the managed switch, and restrict its advertised capabilities to match the slower end. For example, if the camera operates at 100 Mbit/s, limit the faster end to 100 Mbit/s, then re-establish the link.

If the adapter offers only fixed-speed settings, check the actual speed and duplex after applying the setting. If duplex is mismatched or the link is unstable, use the switch arrangement in Section 4.3. The SK201E remains in auto-negotiation mode.

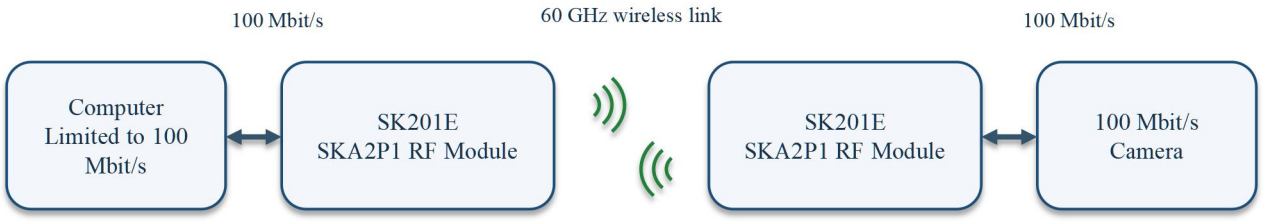

Figure 5. Example with the computer-end speed limited

4.3 Matching Speeds with a 100 Mbit/s Switch

Insert a 100 Mbit/s switch between the faster computer and its local SK201E. Connect the computer to one switch port and the SK201E to another port using Ethernet cables. Keep the camera connected to the other SK201E and power both modules independently.

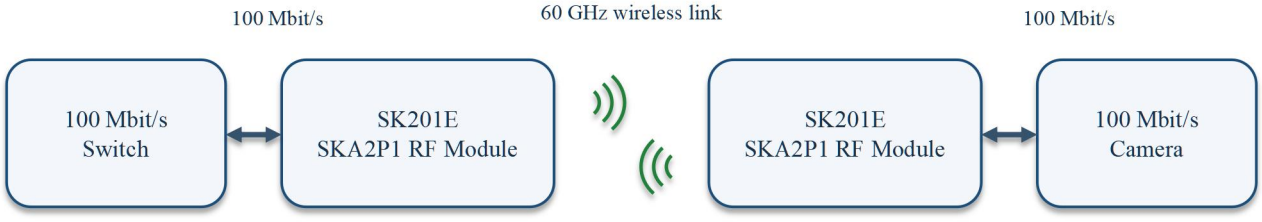

Figure 6. Matching link speeds using a 100 Mbit/s switch

After reconnecting, confirm that both local module ports operate at the same speed. Verify reachability and bidirectional transfer, and record both port configurations.

5 Communication Connections

Connect the computer and IP camera to the two SK201E modules using RJ45 Ethernet cables. Power each module separately through XHB-2P; 5 V is recommended. Disconnect power before wiring. Check pin numbers and polarity against Table 1, then align the patch antennas at both ends as described in Section 6.2.

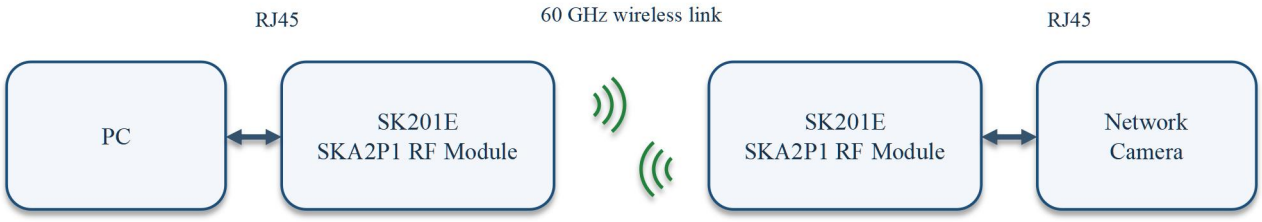

Figure 7. Example connection between a computer and an IP camera

The two modules are the same model. If the computer and local module negotiate to 1000 Mbit/s, the camera end must also negotiate to 1000 Mbit/s for Gigabit communication. If the camera supports only 100 Mbit/s, match both speeds as described in Chapter 4.

6 Assembly Instructions

6.1 Assembly Preparation

Prepare two SK201E modules, two Cat5e or higher-category Ethernet cables, suitable DC supplies and mounting brackets. For testing, prepare two computers, or one computer and the intended Ethernet device.

(1) Disconnect power at both ends. Inspect the modules, connectors, cables and mounting holes for damage.

(2) Position the antenna faces opposite each other with centers aligned. For initial setup, use a spacing below 10 mm.

(3) Secure the RJ45 and power cables so that cable tension cannot alter antenna alignment.

(4) For a metal enclosure, provide nonmetallic windows directly in front of the antennas at both ends. Keep the propagation path free of metal obstructions.

6.2 Mechanical Assembly

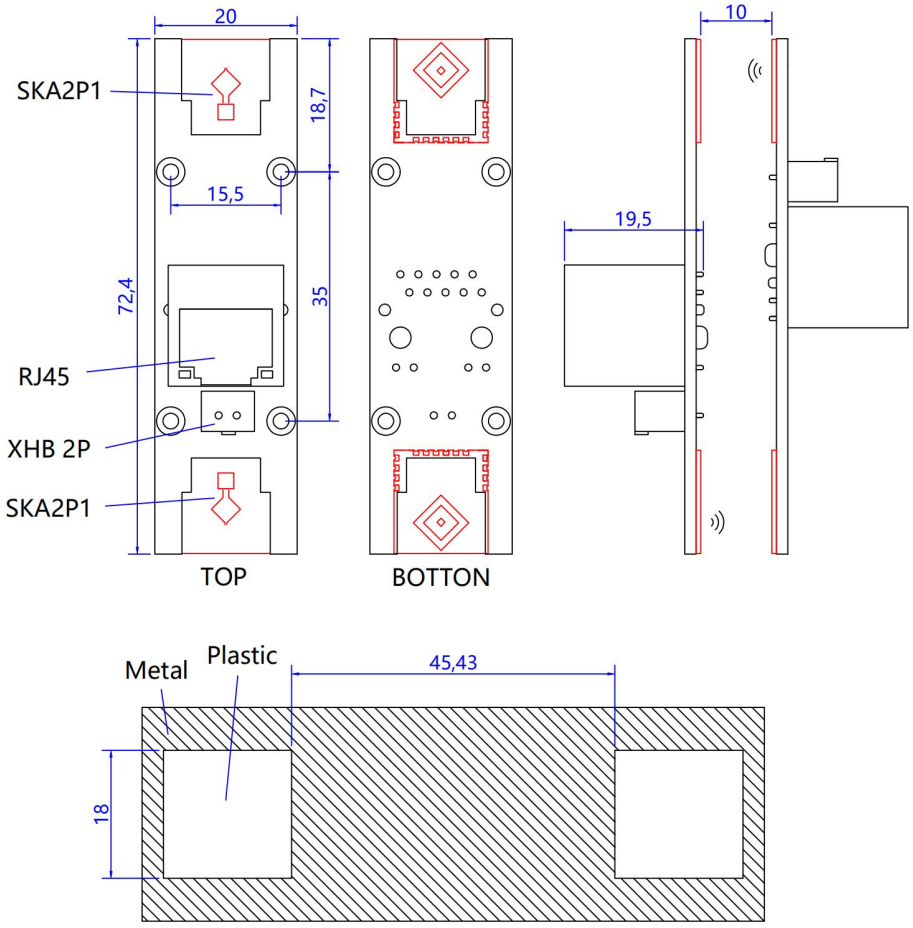

Figure 8. SK201E mounting dimensions and enclosure window (unit: mm)

Use Figure 8 to locate the module and mounting holes using the top, bottom and side views. For paired installation, position the PCB patch antenna faces opposite each other and align both RF positions shown. An antenna spacing below 10 mm is recommended for initial setup. The 10 mm in the side view is an illustrative assembly dimension.

Provide a separate window in the metal enclosure directly in front of each patch antenna to prevent metal from obstructing either path. Figure 8 shows the hatched area below represents the metal enclosure. The clear area is a window that may be covered with plastic or another nonmetallic material suitable for millimeter-wave transmission. Follow the SK201E assembly drawings for window positions and dimensions.

7 Power-Up and Operation

7.1 Initial Power-Up

(1) Recheck XHB-2P power wiring and antenna positions at both ends. A 5 V supply is recommended; see the permitted input range in Chapter 3.

(2) Apply power to both ends separately and observe the port status on the local computer or switch.

(3) Read the actual link speed on both connected devices and confirm that both operate at the same speed: 10, 100 or 1000 Mbit/s.

(4) Perform bidirectional communication tests using the intended application or the method in Section 8. Secure the assembly after confirming stable communication.

8 Data Tests

8.1 Test Preparation and Link-Speed Checks

Connect the two computers to the paired SK201E modules as described under Communication Connections. Set Computer A to 192.168.10.2 and Computer B to 192.168.10.3, both with subnet mask 255.255.255.0. Use addresses not already in use on site; no gateway is required for an isolated local test.

Power each SK201E separately through XHB-2P and keep the PCB patch antenna faces opposite each other.

Install the same version of iperf3 on both computers. Select the wired adapters connected to the modules and prevent test traffic from using Wi-Fi or other ports. Allow ping and iperf3 through the firewall for the test network. For Gigabit connections, use suitable cables with all four pairs connected.

Read the actual link speed and duplex status at both ends, select a speed supported by both devices, and complete a wired baseline test. Record the module, firmware, mode, network adapter, cable and software versions.

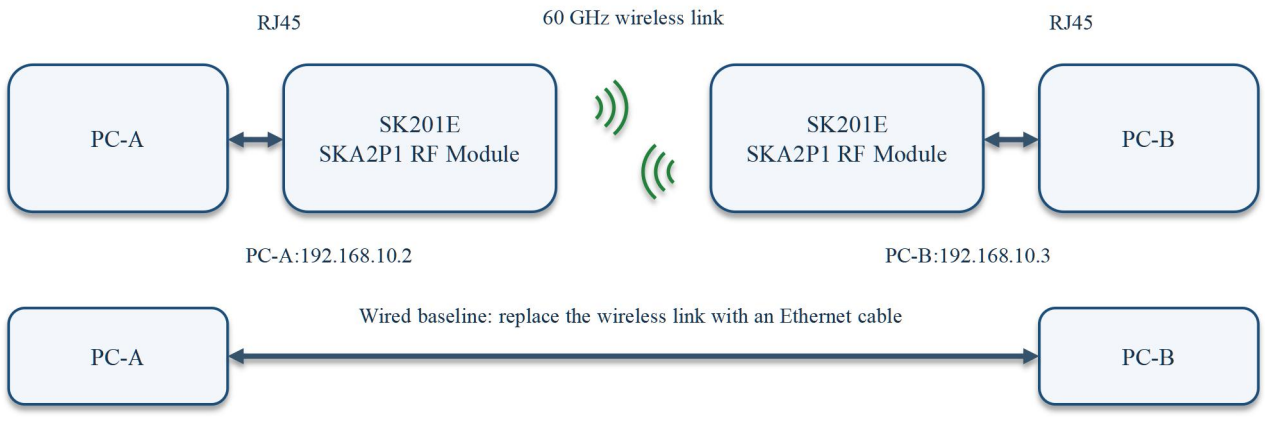

Figure 9. SK201E two-computer test connection and wired baseline

8.2 Reachability and TCP Transfer Tests

Check B from Computer A, then check A from Computer B:

```
ping -S 192.168.10.2 192.168.10.3 -n 20
ping -S 192.168.10.3 192.168.10.2 -n 20
```

Confirm that each direction receives 20 valid replies from the remote computer with no packet loss. Local errors such as "Destination host unreachable" or "General failure" are not remote replies. Record the maximum, minimum and average round-trip times. Use ping to check network reachability; check industrial cyclic data and I/O states separately.

Start the server on Computer A and leave its window open:

```
iperf3 -s -B 192.168.10.2
```

On Computer B, run the forward and reverse TCP tests in sequence. Each test runs for 60 seconds and reports once per second:

```
iperf3 -c 192.168.10.2 -B 192.168.10.3 -t 60 -i 1
iperf3 -c 192.168.10.2 -B 192.168.10.3 -t 60 -i 1 -R
```

The first command transfers data from B to A; the command with -R transfers data from A to B. The server remains on A. Run these tests sequentially, rather than simultaneously. Record the receiver summary rate, per-second variations and Retr retransmission count, where supported, and observe the indicators and link state.

8.3 UDP Transfer and Offered-Load Selection

Keep the server running on Computer A. On Computer B, run the following UDP tests separately:

```
iperf3 -c 192.168.10.2 -B 192.168.10.3 -u -b 80M -l 1400 -t 60 -i 1
iperf3 -c 192.168.10.2 -B 192.168.10.3 -u -b 80M -l 1400 -t 60 -i 1 -R
```

Use MTU 1500 for the baseline test. This example uses an offered load of 80 Mbit/s, a 1400-byte UDP payload and a duration of 60 seconds. Choose the initial load for the actual port speed, increase it only after the preceding step is stable, and stop when the application requirement is met. Suggested test loads are:

(1) 10 Mbit/s link: start at 5M, then test 8M. Do not use the 80M or 100M offered load in this example.

(2) 100 Mbit/s link: start at 50M, then test 80M and 100M.

(3) 1000 Mbit/s link: start at 100M, then test 500M, 800M and 1000M.

Read the receiver statistics on A for the forward test and on B for the reverse test. Record the receiver rate, Lost/Total Datagrams, packet loss percentage and Jitter. For the baseline check, aim for a receiver rate close to the offered load with zero packet loss. The -b option specifies offered load, not measured throughput. Select the load using the lower actual link capacity of the two ends and the wired baseline.

8.4 Extended Tests and Result Recording

(1) To identify a host single-stream limit, append -P 4 to each TCP command and compare the receiver [SUM] result with the single-stream result, keeping all other conditions unchanged. If both versions support --bidir, run a separate simultaneous bidirectional TCP test and record each direction.

(2) The original Gigabit UDP comparison may be used after confirming Gigabit links at both ends and completing the wired baseline. Keep the server running on Computer A and execute the following on B:

```
iperf3 -c 192.168.10.2 -B 192.168.10.3 -u -b 1G -t 100
```

1G specifies the offered load and 100 specifies the duration in seconds. For the original large-datagram test, append -l 63k and run both forward and reverse directions separately; append -R for reverse. A 63k datagram exceeds the conventional Ethernet MTU and involves IP fragmentation and reassembly. Record it separately from the 1400-byte baseline test. Use identical payload lengths, loads and durations for wireless and wired comparisons.

(3) Once both directions are stable, extend the successfully tested load to 30 minutes or the duration specified for the project. For a 30-minute test, replace -t 60 with -t 1800. Record link interruptions, program exits and application reconnections separately. These are test procedures and do not constitute a record of completed testing.

(4) Save the complete output from both ends. Record the commands used, direction, duration, offered load, port speed, duplex, IP addresses, MTU, tool version and receiver statistics. Transfer is the amount of data transferred; Bandwidth/Bitrate is the transfer rate; Jitter is the variation in received datagram interarrival time; Lost/Total Datagrams gives the lost and total datagram counts. Calculate packet loss percentage as lost datagrams divided by total datagrams. Results showing 0 Bytes, 0/0 datagrams, connection failures or tool errors are not valid passes.

8.5 Wired Baseline and Assembly Verification

(1) Remove the link formed by the two modules and connect the computers directly with an Ethernet cable. Repeat the tests with the same IP addresses, actual port speeds, duplex, MTU, direction, offered load, duration and commands. Compare receiver throughput, packet loss, jitter and TCP retransmissions.

(2) Restore the wireless connection and repeat both directions with the final antenna spacing and alignment, enclosure, window material and thickness, brackets and secured wiring. Select test positions within the assembly and temperature conditions specified for this model. Record supply voltage, temperature, spacing, offset and duration.

(3) After servicing, cable replacement or mechanical adjustment, recheck power and mode settings, then repeat the communication tests. If a problem occurs, first use the wired baseline to check the hosts, cables and test configuration, then check antenna alignment, obstructions and power.

8.6 Functional and Application Verification

(1) Follow Chapter 4 to check the actual terminal link speed at each end. Test the 10, 100 or 1000 Mbit/s speeds used by the project. Both ends must use the same speed. For a 100 Mbit/s camera, restrict the faster end to 100 Mbit/s or use a 100 Mbit/s switch to match the speeds.

(2) Reconnect the actual computers, cameras or other Ethernet devices and check continuous image, file or application-data transfer. Power-cycle the equipment and disconnect/reconnect Ethernet cables separately. Record port recovery, application reconnection and data results.

9 Common Questions and Operating Checks

9.1 Common Questions and Corrective Actions

Table 4. Troubleshooting

Symptom	Checks and Corrective Action
RJ45 link not established	Check the power input, connector polarity and Ethernet cables. Check each end using known-good devices and cables.
Both local ports linked but no communication	Check negotiated speeds, IP addresses, subnet masks and firewalls at both ends. Confirm that antenna faces oppose each other with centers aligned.
Intermittent disconnection or increased packet loss	Check supply stability, mounting, spacing, antenna keep-out areas and metal obstructions. Repeat tests at the actual operating temperature.
No valid data at the test receiver	Confirm client/server roles and addresses. Check test-program permissions and commands, then restart the test.

(1) Disconnect power before wiring or adjusting the assembly. Keep both modules securely mounted during operation and avoid tension on power and Ethernet cables. After maintenance, recheck speeds as described in Section 7, then verify communication as described in Section 8.

9.2 Technical Support

When contacting technical support, provide the product model and revision, connections and settings at both ends, power-supply conditions, indicator states, symptoms and steps to reproduce the issue. Include wiring and assembly photographs, test settings and recorded results.

10 Revision History

Date	Revision	Description of Changes
2026-11-04	V1.0	First English user-manual edition, based on the latest datasheet for this model. Retained technical parameters and original drawings; added installation, power-up configuration, operational verification and fault-checking procedures.; reorganized the installation, configuration, testing and maintenance procedures; added link-speed matching, bidirectional tests and troubleshooting; updated editable system connection diagrams.
2026-11-05	V1.1	(1) Added an illustrated computer-to-IP-camera connection example, detailed speed-mismatch diagnosis and two matching methods: limiting the faster end and using a 100 Mbit/s switch. (2) Expanded enclosure-window, initial power-up, iperf3 UDP, wired-baseline and final-assembly verification procedures. (3) Expanded troubleshooting and retesting after power-off maintenance; standardized system diagrams, interface descriptions, corresponding device boxes and internal references. (4) Equalized the Min., Typ. and Max. columns while retaining all values, conditions, units, font sizes and standard row spacing. (5) Arranged revisions from oldest to newest, retaining the original dates, revision numbers and historical changes. (6) Standardized chapter names, order and content allocation using the common outline, retaining technical descriptions and illustrations; updated the contents, figure/table numbering and internal references. Moved initial power-up under Power-Up and Operation, standardized Common Questions and Operating Checks, and added the information required for technical support. (7) Standardized Ethernet test sections; added bidirectional reachability, TCP, UDP loads by actual link speed, extended records and wired comparisons, with functional checks tailored to this model. Retained the original test illustrations and updated contents and internal references. (8) Prepared and checked this English edition against the current Chinese edition, preserving numbered items, parameters, illustrations, commands and operating instructions.