Power Meters & Power Sensors

Power is a fundamental parameter that characterises the properties of microwave signals, and its precise measurement is a critical aspect of modern microwave measurements. The microwave power meter is the foundational measurement device among instruments measuring microwave power characteristics.

Ceyear Technology has a long-standing commitment to researching microwave power measurement technology and developing related products. Our product portfolio includes microwave power meters, USB power sensors, LAN power sensors and more. Operating across the DC to 110 GHz frequency range, we deliver flexible, scientifically rigorous measurement solutions that are tailored to the specific testing requirements of power measurement applications.

Microwave power meters enable the accurate measurement of various parameters, including average power, peak power, peak-to-average power ratio (PAPR), pulse width, rise time and pulse period. Key specifications include a single-probe maximum average power dynamic range of 96 dB, a maximum peak power dynamic range of 55 dB, broadband coaxial frequency coverage of up to 110 GHz, a rise time of ≤13 ns and a minimum measurable pulse width of 50 ns.

Ceyear Technology utilises the 2439D microwave power meter as the base platform, paired with USB power sensors from the 87233, 87235, 87236 and 87237 series, for performing average and peak power measurements. These USB power sensors can also connect to computers, laptops, or other Ceyea measurement instruments.

87245 and 87246 Series LAN power sensors connect to computers via PoE switches, enabling power monitoring up to 60 metres away. This makes them ideal for scenarios requiring long-distance power measurement transmission, such as production line testing, field testing, and remote monitoring.

Product Overview

When paired with different types of USB power sensors, the 2439D Microwave Power Meter enables accurate measurement of average and peak power. It supports the simultaneous connection of up to four power sensors for efficient, multi-channel measurements. Power measurements can be performed rapidly via the front-panel function keys or touchscreen, with results displayed as numerical values or waveforms.

The table below lists the USB Power Sensor types that are compatible with the 2439D Microwave Power Meter, along with their respective measurement modes. Select the appropriate USB Power Sensor based on your requirements.

Key Features

- **Compact size, lightweight, and battery-powered for use**
- **Connects up to 4 Power Sensors simultaneously for multi-channel power testing**
- **Combines buttons and touchscreen for intuitive operation**
- **Rapid waveform stabilization via "Auto Setup" function**
- **Features GPIB, Ethernet, and USB interfaces for remote control operations**

Model	Description	Functions	Measurement Mode				
			CW Average	Modulation Average	Trace	Time Gate	Statistics
87233	USB CW Power Sensor	Fast and Accurate Measurement of CW Signals	•	—	—	—	—
87235	USB Average Power Sensor	CW and Modulated signal rapid and accurate measurement	•	•	—	—	—
87236	USB Peak/Average Power Sensor	Pulse modulation signal time and power parameter measurement and analysis	•	•	•	•	•
87237	USB Thermocouple Power Sensor	Precise power measurement in the power reference and calibration laboratory	•	•	—	—	—

Compatible with multiple high-accuracy power sensors

The 2439D microwave power meter supports plug-and-measure compatibility with the following Power Sensor series:

87233 USB CW Power Sensors

87235 USB Average Power Sensors

87236 USB Peak/Average Power Sensors

87237 USB Thermocouple Power Sensors

Each power sensor is factory-compensated, with all compensation data stored internally. This eliminates the need for calibration before measurement and ensures long-term stability.

Rich Interfaces

Front Panel Interfaces

Rear Panel Interfaces

The front panel of the 2439D features two channel interfaces, labelled A and B. A and B.
The USB port in the bottom right-hand corner can be shared with the C channel on the rear panel. However, only one probe can be connected to both the lower right USB port and the rear panel C channel simultaneously.
The rear panel of the 2439D has two channel interfaces: C and D, and the USB port can be shared with the D channel. Only one probe can be connected to both the USB port and the D channel simultaneously.

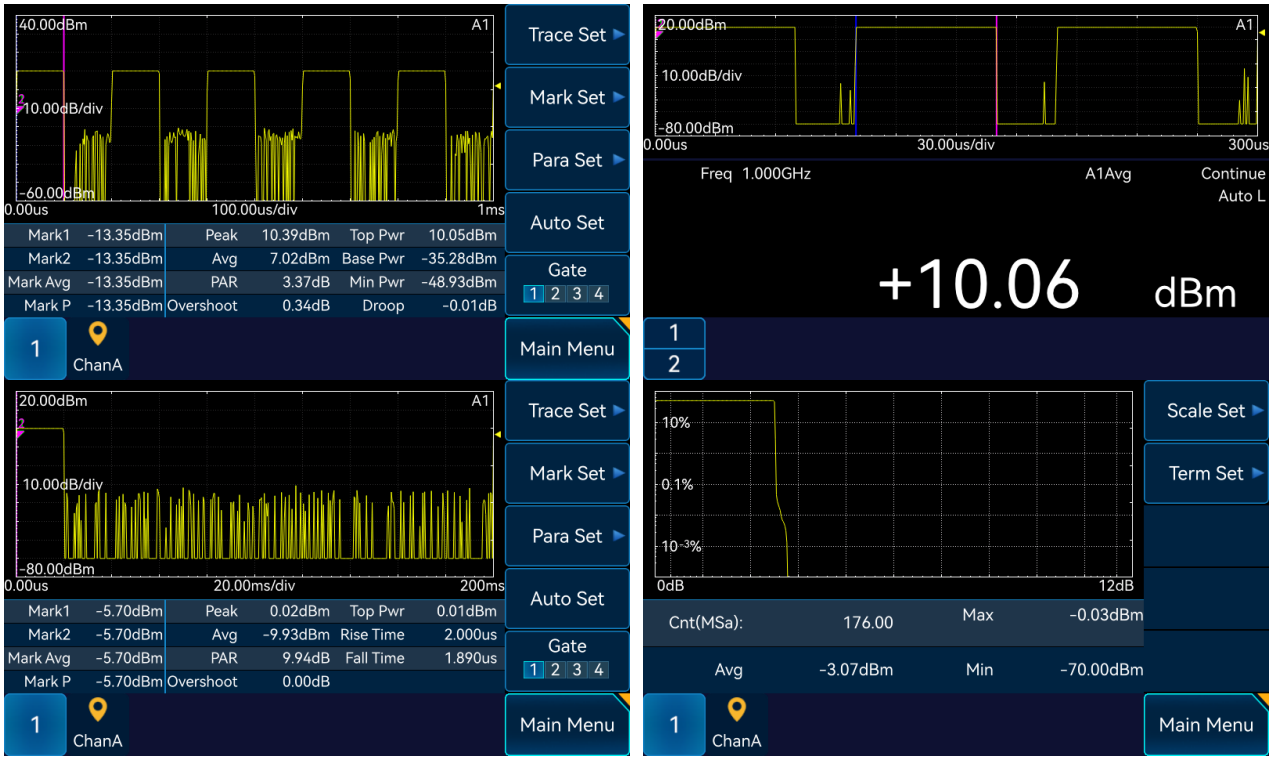
Multiple measurement modes

The 2439D microwave power meter supports multiple measurement modes:
Averaging mode: This mode enables precise average power measurements for continuous wave signals and various modulated signals, including common wireless signals such as 5G, LTE, Wi-Fi and WLAN.
Trace mode: Displays envelope power over time, presenting results as a combination of waveforms and numerical values. It supports the simultaneous measurement of up to 16 pulse parameters, with a maximum of eight parameters displayed concurrently on the panel.
Time-Gated Mode: This mode measures average power, peak power, peak-to-average ratio and

minimum power within up to four independent time gates. The start position and duration of each gate can be defined, and measurements from two gates can be combined.

Burst Power Mode: This mode enables the rapid capture and measurement of large-cycle burst power by configuring a normal trigger mode.

Statistical Mode: The CCDF statistical measurement mode calculates the percentage of power that exceeds or is equal to a specified threshold.



External Trigger Functions

By connecting an external trigger signal via a trigger cable, stable triggering of low-power signals can be achieved and timing measurements can be initiated based on the external trigger signal.

Wider Operating Temperature Range

The 2439D microwave power meter and series USB Power Sensors have a wider operating temperature range of -10°C to 50°C. They maintain the same power measurement accuracy at temperature extremes as in ambient conditions.

2U Standard Rack Mounts Kit

An optional 2U standard rack mount kit is available for the 2439D, facilitating integration into cabinets for building test systems.

Battery Option

The 2439D microwave power meter delivers at least 5 hours of continuous operation when fully charged and connected to two Power Sensors, making it ideal for field testing.

Extensive Programmable Interfaces

Standard LAN, USB and GPIB interfaces are included. The LAN interface fully supports Socket, VXI-11 and HISLIP protocols, as well as network auto-discovery, enabling simple and efficient instrument networking.

Technical Specification

Model	2439D
Channel	4
Frequency Range[1]	DC to 110GHz(sensor-dependent)
Power measurement Range[2]	-70dBm to +44dBm(sensor-dependent)
Display Resolution	Log mode: 0.001dB Linear mode:4 bit
Channel Bias Range	±100.00dB
Horizontal Scale Range	2ns/div to 3600s/div
Reference Source Frequency	50MHz±0.5MHz(23°C±5°C)
Reference Source Power	1.000mW(1±1.0%)(23°C±5°C)
Physical Characteristics	5”LCD, 800 x 480 pixer(WVGA)
Power Rating	100VAC to 240VAC 50Hz to 60Hz
Power Consumption	<25W (with 2 Power Sensors, battery not included)
Battery	Nominal voltage: 14.4V Nominal capacity: 91.76Wh Operating time: >5 hours (with two power sensors connected)
Dimension (W*H*D)	Outline dimension:(231.0±2.5)mm×(105.6±1.5mm×(251.0±2.5)mm Nominal Dimension:(213.0±1.2mm×(88.1±0.8mm×(213.5±1.2)mm Without protective cover
Weight	<2.4kg(without battery) <3.0kg(with battery)
Temperature	Operating temperature: -10°C to 50°C Storage temperature: -40°C to 70°C
Communication Interface	USB Port: Type A Host Port, 1 on front panel, 1 on rear panel USB Port: Type B Slave Port, 1 on rear panel, for remote control LAN Port: RJ45, for remote control GPIB Port: IEEE-488 bus connector, for remote control
Other Interface	Trigger input interface: BNC (f) for connecting external trigger signals. Analog output interface: BNC (female), for outputting an analogue voltage that varies with power.

Note:

1. The frequency range of the 2439D Microwave Power Meter depends on that covered by the connected probe. When paired with the 87237P USB thermocouple Power Sensor, the frequency range extends from DC to 110 GHz.
2. The power range of the 2439D Microwave Power Meter depends on the connected Power Sensor. For example, when the 87235D and 87235DG Power Sensors are connected simultaneously, the combined power range covers -70 dBm to +44 dBm.

Power Sensor Overview

Name	Model	Specification
USB CW Power Sensor	87233C	Frequency range: 8kHz to 12GHz, Power range: -60dBm to +20dBm
	87233D	Frequency range: 10MHz to 18GHz, Power range: -70dBm to +20dBm
	87233E	Frequency range: 50MHz to 26.5GHz, Power range: -70dBm to +20dBm
	87233F	Frequency range: 50MHz to 40GHz, Power range: -70dBm to +20dBm
	87233L	Frequency range: 50MHz to 67GHz, Power range: -55dBm to +20dBm
USB Average Power Sensor	87235B	Frequency range: 8kHz to 8GHz, Power range: -70dBm to +26dBm
	87235C	Frequency range: 10MHz to 8GHz, Power range: -60dBm to +23dBm
	87235D	Frequency range: 10MHz to 18GHz, Power range: -70dBm to +26dBm
	87235F	Frequency range: 10MHz to 33GHz, Power range: -65dBm to +26dBm
	87235FA	Frequency range: 10MHz to 40GHz, Power range: -65dBm to +26dBm
	87235H	Frequency range: 10MHz to 50GHz, Power range: -65dBm to +23dBm
	87235L	Frequency range: 50MHz to 67GHz, Power range: -60dBm to +23dBm
	87235DG	Frequency range: 10MHz to 18GHz, Power range: -50dBm to +44dBm
USB Peak/Average Power Sensor	87236D	Frequency range:50MHz to 18GHz, Power range:-45dBm to +20dBm
	87236E	Frequency range:50MHz to 26.5GHz, Power range:-45dBm to +20dBm
	87236F	Frequency range: 50MHz to 40GHz, Power range:-45dBm to +20dBm

	87236L	Frequency range: 500MHz to 67GHz, Power range:-45dBm to +20dBm
USB Thermal Power Sensor	87237D	Frequency range: DC to 18GHz, Power range:-35dBm to +20dBm
	87237L	Frequency range: DC to 67GHz, Power range:-35dBm to +20dBm
	87237P	Frequency range: DC to 110GHz, Power range:-30dBm to +20dBm

Ordering Information

- **2439 Mainframe:**

No.	Name	Quantity	Remark
1	2439D Microwave Power Meter	1	/
2	User Manual	1	/
3	Programming Manual	1	/
4	Power Cord	1	Standard three-core power cord
5	Product Qualification certificate	1	/

- **Option:**

No.	Model	Name	Function
1	2439D-H05	Safety instrument transport case	Portable packaging box, with handle, capable of carrying two sets of probes
2	2439D-H06	Rack Mounting kit	Cabinet selection option
3	2439D-H12	English Option	English panels, manuals, software, etc.
4	2439D-H13	Battery Option	Li-ion battery accessory, nominal voltage: 14.4V, nominal capacity: 91.76Wh
5	2439D-JL	Calibration Service	Provide metrological calibration services and metrological reports
6	2439D-EWT1	One-year extended warranty	Extended warranty beyond the standard coverage period: 1-year extension available. 2-year extension includes two optional services. Calibration is not included in this service.

87233 USB CW Power Sensor (8 kHz to 67 GHz)

The 87233 Series USB CW Power Sensor is a high-precision instrument for measuring continuous wave signal power over a wide dynamic range. It is based on a USB 2.0 interface, enabling accurate measurements. It is primarily intended for use in field and production line testing and system integration.

Key Features

- **Wide frequency range and Large measurement dynamic range**

  Covers frequencies from 8 kHz to 67 GHz and has a power measurement range of -70 dBm to +20 dBm. It provides high power measurement accuracy of ±0.20 dB for the 87233C within the -40 dBm to +20 dBm range.

- **Compact, Portable design for handheld operation**

  Less than 0.3 kg weight for easy carrying

Technical Specification

Specifications		
Frequency Range	87233C	8kHz to 12GHz
	87233D	10MHz to 18GHz
	87233E	50MHz to 26.5GHz
	87233F	50MHz to 40GHz
	87233L	50MHz to 67GHz
Measurement Power Range[1]	87233C	-60dBm to +20dBm
	87233D	-70dBm to +20dBm
	87233E	-70dBm to +20dBm
	87233F	-70dBm to +20dBm
	87233L	-55dBm to +20dBm
Damage Level[2]	87233C/D/E/F/L	+23dBm(Average Power) +26dBm(Peak Power, Duration time<10us)
Amplitude Measurement Accuracy[3]	87233C	±0.20dB
	87233D	±0.20dB
	87233E	±0.23dB
	87233F	±0.25dB
	87233L	±0.33dB
Maximum VSWR	87233C	1.20
	87233D	1.25(10MHz≤f≤50MHz) 1.15(50MHz<f≤2GHz) 1.20(2GHz<f≤12.4GHz) 1.26(12.4GHz<f≤18GHz)
	87233E	1.15(50MHz≤f≤2GHz) 1.20(2GHz<f≤12.4GHz) 1.26(12.4GHz<f≤18GHz) 1.35(18GHz<f≤26.5GHz)
	87233F	1.15(50MHz≤f≤2GHz) 1.20(2GHz<f≤12.4GHz) 1.26(12.4GHz<f≤18GHz) 1.35(18GHz<f≤26.5GHz) 1.50(26.5GHz<f≤40GHz)
	87233L	1.20(50MHz≤f≤18GHz) 1.30(18GHz<f≤26.5GHz) 1.45(26.5GHz<f≤50GHz) 1.50(50GHz<f≤67GHz)
Calibration Uncertainty[4]	87233C	0.17dB
	87233D	0.19dB
	87233E	0.19dB(50MHz≤f≤18GHz) 0.21dB(18GHz<f≤26.5GHz)

	87233F	0.19dB(50MHz≤f≤18GHz) 0.21dB(18GHz<f≤26.5GHz) 0.23dB(26.5GHz<f≤40GHz)
	87233L	0.19dB(50MHz≤f≤18GHz) 0.21dB(18GHz<f≤26.5GHz) 0.23dB(26.5GHz<f≤40GHz) 0.31dB(40GHz<f≤67GHz)
Zero set[5]	87233C	±0.4nW
	87233D/E/F	±70pW
	87233L	±0.7nW
Measurement Noise[6]	87233C	±0.5nW
	87233D/E/F	±80pW
	87233L	±0.8nW
Interface Connectors	87233C	N-Type(m)
	87233D	N-Type(m)
	87233E	3.5mm(m)
	87233F	2.4mm(m)
	87233L	1.85mm(m)
Dimensions(W×H×D)	87233C	51.5mm×33.5mm×141.0mm
	87233D	51.5mm×33.5mm×141.0mm
	87233E	51.5mm×33.5mm×134.0mm
	87233F	51.5mm×33.5mm×124.5mm
	87233L	51.5mm×33.5mm×124.5mm
Weight	<0.3kg	
Maximum sampling rate [7]	1M Samples/sec	
Control Interface	USB 2.0 interface, compatible with USB-TMC	
Maximum Measurement Speed [8]	50000 readings/s	
Operation Temperature Range	-10°C to 50°C	
Storage Temperature Range	-40°C to 70°C	
Calibration Cycle(Recommend)	12 months	

Ordering Information

- **Mainframe**

No.	Model	Name	Comments
1	87233C	USB CW Power Sensor	USB cable: Length 2.0m, Quantity 1 CD: Contains manuals and power measurement display software, Quantity 1
2	87233D		
3	87233E		
4	87233F		
5	87233L		

- **Option**

No.	Option	Name	Function
1	87230-H01	USB Cable	Connected to the computer, length 2.0 meters
2	87230-H02	USB Cable	Connected to the computer, length 4.5 meters
3	2439D-H07	Six-core to MINI_USB Cable (1.5 meters)	Connection with 2439D power meter, length 1.5 meters
4	2439D-H08	Six-core to MINI_USB Cable (4.5 meters)	Connection with 2439D power meter, length 4.5 meters
5	87230-H05	Safety instrument transport case	Portable packaging box, with handle, capable of carrying 1 set of probes
6	87230-H06	Safety instrument transport case	Portable packaging box, with handle, capable of carrying 2 set of probes
7	87233C-H12	English Option	English panels, manuals, software, etc.
8	87233D-H12		
9	87233E-H12		
10	87233F-H12		
11	87233L-H12		
12	87233C-JL	Calibration Service	Provide metrological calibration services and metrological reports
13	87233D-JL		
14	87233E-JL		
15	87233F-JL		
16	87233L-JL		
17	87233C-EWT1	One-year extended warranty	Extended warranty beyond the standard coverage period: 1-year extension available. 2-year extension includes two optional services. Calibration is not included in this
18	87233D-EWT1		
19	87233E-EWT1		
20	87233F-EWT1		
21	87233L-EWT1		

			service.

Note:

1. When testing the lower power limit of the 87233 series Power Sensors, the test must be conducted under fixed conditions. For the 87233C/D/E/F models at <-40 dBm and the 87233L model at <-20 dBm: Connect the Power Sensor to the device under test (DUT). After one hour of preheating in a temperature-controlled environment, set 'Step Detection' to 'Off', configure an appropriate number of averages and execute 'External Zero Calibration'. Then activate the DUT's signal output. Observe the test results after waiting one minute. These test results include errors from the Power Sensor's 'zero setting' and 'measurement noise'.
2. 'Maximum input power' is the highest power that the Power Sensor can handle. Exceeding this limit may damage or even burn out the probe.
3. 'Power measurement accuracy' is achieved under fixed conditions: - For 87233C/D/E/F: -40 dBm to +20 dBm, For 87233L: -20 dBm to +20 dBm. When the DUT's SWR is less than 1.20, With the Power Sensor average count set to 128. For 87233C/D/E/F below -40 dBm and 87233L below -20 dBm, as the measured power decreases, the impact of the zero-point setting and measurement noise on power measurement accuracy progressively increases.
4. 'Calibration uncertainty' refers to the inherent linear deviation, temperature effects and expanded uncertainty that arise from calibrating the Power Sensor. The 'power measurement uncertainty' experienced by users encompasses the probe's 'calibration uncertainty', as well as uncertainty caused by a mismatch between the probe and the device port and uncertainty stemming from the probe's 'zero setting' and 'measurement noise'.
5. 'Zero setting' refers to the fixed output deviation of the Power Sensor when no signal is input. This is caused by the non-ideal characteristics of the internal circuits (e.g. amplifier offset and thermoelectric potential) or external interference. This significantly impacts low-power testing with the probe. Zero setting requires preheating for one hour in a temperature-controlled environment, followed by external zero calibration, before testing can begin.
6. 'Measurement noise' represents the impact of internal circuit noise on measurements, which is more pronounced during small-signal measurements with the Power Sensor. Measurement noise testing requires preheating for one hour in a temperature-controlled environment, followed by external zero calibration.
7. 'Maximum sampling rate' denotes the highest conversion rate of the ADC and represents the design specification for the 87233 series of Power Sensors.
8. 'Maximum measurement rate' indicates the maximum amount of data that can be read by the Power Sensor per second. The maximum measurement rate is precisely correlated with the aperture time (equal to 1/aperture time).

87235 USB Average Power Sensor (8 kHz to 67 GHz)

The 87235 Series USB Average Power Sensor is a high-precision, wide dynamic range average power measurement instrument based on the USB 2.0 interface, enabling accurate measurement of the average power of modulated signals.

Key Features

- **Wide frequency range and Large measurement dynamic range**

  It features wide frequency coverage and a large dynamic range spanning 8 kHz to 67 GHz, and power measurements ranging from -70 dBm to +44 dBm.

- **Accurate measurement of multiple type signals**

  It enables the accurate measurement of the average power of modulated signals, making it ideal for power measurements in communications and other fields. Supported signal formats include continuous wave, pulse modulation and vector modulation, including 3G, 4G and 5G.

- **Outstanding average power measurement accuracy**

  It delivers outstanding average power measurement accuracy. For instance, the 87235C achieves power measurement accuracy of ±0.20 dB within the range of -40 dBm to +20 dBm.

Technical Specification

Specifications		
Frequency Range	87235B	8kHz to 8GHz
	87235C	10MHz to 8GHz
	87235D	10MHz to 18GHz
	87235F	10MHz to 33GHz
	87235FA	10MHz to 40GHz
	87235H	10MHz to 50GHz
	87235L	50MHz to 67GHz
	87235DG	10MHz to 18GHz
Measurement Power Range[1]	87235B	-70dBm to +26dBm
	87235C	-60dBm to +23dBm
	87235D	-70dBm to +26dBm
	87235F	-65dBm to +26dBm
	87235FA	-65dBm to +26dBm
	87235H	-65dBm to +23dBm
	87235L	-60dBm to +23dBm
	87235DG	-50dBm to +44dBm
Damage Level[2]	87235B/C/D/F/FA	+29dBm(Average Power) +32dBm(Peak Power, Duration time<10us)
	87235H/L	+26Bm(Average Power) +29dBm(Peak Power, Duration time<10us)
Amplitude Measurement Accuracy[3]	87235B	±0.20dB
	87235C	±0.20dB
	87235D	±0.20dB
	87235F	±0.23dB
	87235FA	±0.24dB
	87235H	±0.25dB
	87235L	±0.33dB
	87235DG	±0.19dB(10MHz≤f≤8GHz) ±0.23dB(8GHz<f≤18GHz)
	87235B	1.20
	87235C	1.20
	87235D	1.20(10MHz≤f≤6GHz) 1.26(6GHz<f≤18GHz)
	87235F	1.16(10MHz≤f≤6GHz) 1.24(6GHz<f≤16GHz) 1.38(16GHz<f≤26.5GHz) 1.41(26.5GHz<f≤33GHz)

Maximum VSWR	87235FA	1.15(10MHz≤f≤6GHz) 1.25(6GHz<f≤16GHz) 1.40(16GHz<f≤26.5GHz) 1.45(26.5GHz<f≤40GHz)
	87235H	1.16(10MHz≤f≤6GHz) 1.24(6GHz<f≤16GHz) 1.35(16GHz<f≤26.5GHz) 1.41(26.5GHz<f≤40GHz) 1.48(40GHz<f≤50GHz)
	87235L	1.20(50MHz≤f≤6GHz) 1.35(6GHz<f≤16GHz) 1.45(16GHz<f≤26.5GHz) 1.55(26.5GHz<f≤40GHz) 1.68(40GHz<f≤67GHz)
	87235DG	1.20(10MHz≤f≤8GHz) 1.30(8GHz<f≤12.4GHz) 1.41(12.4GHz<f≤18GHz)
Calibration Uncertainty[4]	87235B	0.16dB
	87235C	0.16dB
	87235D	0.17dB
	87235F	0.17dB(10MHz≤f≤18GHz) 0.22dB(18GHz<f≤33GHz)
	87235FA	0.17dB(10MHz≤f≤18GHz) 0.22dB(18GHz<f≤33GHz) 0.24dB(33GHz<f≤40GHz)
	87235H	0.17dB(10MHz≤f≤18GHz) 0.22dB(18GHz<f≤33GHz) 0.24dB(33GHz<f≤50GHz)
	87235L	0.17dB(50MHz≤f≤18GHz) 0.22dB(18GHz<f≤33GHz) 0.24dB(33GHz<f≤50GHz) 0.33dB(50GHz<f≤67GHz)
	87235DG	0.15dB(10MHz≤f≤8GHz) 0.19dB(8GHz<f≤18GHz)
Zero Set[5]	87235B/D	±70pW
	87235C/F/FA/H	±0.20nW
	87235L	±0.4nW
	87235DG	±7.0nW
Measurement Noise[6]	87235B/D	±80pW
	87235C/F/FA/H	±0.30nW
	87235L	±0.5nW

	87235DG	±8.0nW
Interface Connectors	87235B	N-Type(m)
	87235C	N-Type(m)
	87235D	N-Type(m)
	87235F	3.5mm(m)
	87235FA	2.92mm(m)
	87235H	2.4mm(m)
	87235L	1.85mm(m)
	87235DG	N-Type(m)
Dimensions(W×H×D)	87235B	52.0mm×34.0mm×160.5mm
	87235C	52.0mm×34.0mm×176.0mm
	87235D	52.0mm×34.0mm×160.5mm
	87235F	52.0mm×34.0mm×150.0mm
	87235FA	52.0mm×34.0mm×166.0mm
	87235H	52.0mm×34.0mm×163.0mm
	87235L	52.0mm×34.0mm×159.0mm
	87235DG	63.0mm×63.0mm×248.0mm
	87235B/C/D/F/FA/H/L	<0.4kg
	87235DG	<0.7kg
Maximum sampling rate[7]	1M Samples/sec	
Control Interface	USB 2.0 interface, compatible with USB-TMC	
Maximum Measurement Speed [8]	50000 readings/s	
Operation Temperature Range	-10°C to 50°C	
Storage Temperature Range	-40°C to 70°C	
Calibration Cycle (Recommend)	12 months	

Ordering Information

- **Mainframe**

No.	Model	Name	Comments
1	87235B	USB Average Power Sensor	USB cable: Length 2.0m, Quantity 1 CD: Contains manuals and power measurement display software, Quantity 1
2	87235C		
3	87235D		
4	87235F		
5	87235FA		
6	87235H		
7	87235L		
8	87235DG		

- **Option**

No.	Option	Name	Function
1	87230-H01	USB Cable	Connected to the computer, length 2.0 meters
2	87230-H02	USB Cable	Connected to the computer, length 4.5 meters
3	2439D-H07	Six-core to MINI_USB Cable (1.5 meters)	Connection with 2439D power meter, length 1.5 meters
4	2439D-H08	Six-core to MINI_USB Cable (4.5 meters)	Connection with 2439D power meter, length 4.5 meters
5	87230-H05	Safety instrument transport case	Portable packaging box, with handle, capable of carrying 1 set of probes
6	87230-H06	Safety instrument transport case	Portable packaging box, with handle, capable of carrying 2 set of probes
7	87235B-H12	English Option	English panels, manuals, software, etc.
8	87235C-H12		
9	87235D-H12		
10	87235F-H12		
11	87235FA-H12		
12	87235H-H12		
13	87235L-H12		
14	87235DG-H12		

15	87235B-JL	Calibration Service	Provide metrological calibration services and metrological reports
16	87235C-JL		
17	87235D-JL		
18	87235F-JL		
19	87235FA-JL		
20	87235H-JL		
21	87235L-JL		
22	87235DG-JL		
23	87235B-EWT1	One-year extended warranty	Extended warranty beyond the standard coverage period: 1-year extension available. 2-year extension includes two optional services. Calibration is not included in this service.
24	87235C-EWT1		
25	87235D-EWT1		
26	87235F-EWT1		
27	87235FA-EWT1		
28	87235H-EWT1		
29	87235L-EWT1		
30	87235DG-EWT1		

Note:

1. For the 87235 series Power Sensors, testing the lower power limit must be conducted under fixed conditions. For 87235B/C/FA/H models, this is at < -40 dBm; for 87235D/F models, at < -45 dBm; 87235L/DG at < -20dBm. Connect the Power Sensor to the device under test (DUT), preheat for 1 hour in a temperature-controlled environment, set “Step Detection” to “Off,” configure an appropriate number of averages, execute “External Zero Calibration,” then activate the DUT's signal output. Observe the test results after a 1-minute wait. This result incorporates errors from the Power Sensor's “Zero Setting” and “Measurement Noise.”
2. “Maximum Input Power” denotes the highest power the Power Sensor can handle. Exceeding this limit may damage the probe, potentially causing burnout in severe cases.
3. “Power Measurement Accuracy” is guaranteed under fixed conditions: 87235B/C/FA/H: -40dBm to +20dBm, 87235D/F: -45dBm to +20dBm, 87235L: -20dBm to +20dBm, 87235DG: -20dBm to +44dBm. When the SWR of the device under test is <1.20 and the Power Sensor's average count is set to 128, the power measurement accuracy meets requirements. For 87235B/C/FA/H below 40dBm, 87235D/F below -45dBm, and 87235L/DG below -20dBm, as measured power decreases, zero-set and measurement noise gradually increase their impact on power measurement accuracy.
4. “Calibration uncertainty” refers to the inherent linear deviation, temperature effects, and expanded uncertainty arising from the manufacturing calibration process of the Power Sensor itself. The “power measurement uncertainty” experienced by users when using the Power Sensor includes the Power Sensor's “calibration uncertainty,” uncertainty caused by mismatch between the Power Sensor and the device under test (DUT) port, and uncertainty resulting from the Power Sensor's “zero setting” and “measurement noise.”
5. “Zero setting” refers to the fixed output deviation of the Power Sensor when no signal is input, caused by non-ideal characteristics of internal circuits (such as amplifier offset, thermoelectric potential) or external interference. This significantly impacts low-power testing with the probe. “Zero setting” requires preheating for 1 hour in a temperature-controlled environment followed by external zero calibration before testing.
6. “Measurement noise” represents the impact of internal circuit noise on measurements, which

significantly affects small-signal measurements with the Power Sensor. Testing for measurement noise requires preheating for one hour in a constant-temperature environment followed by external zero calibration.

7. “Maximum sampling rate” denotes the highest conversion rate of the ADC, representing the design specification for the 87235 series Power Sensors.

8. “Maximum measurement speed” indicates the maximum data that can be read per second by the Power Sensor. Maximum measurement speed is precisely correlated with aperture time (equal to 1/aperture time).

87236 USB CW Power Sensor (50 MHz to 67 GHz)

The 87236 Series USB Peak/Average Power Sensor is a broadband power measurement instrument that uses a USB 2.0 interface to enable average and pulse power measurements, as well as CCDF statistical analysis. It has a frequency range of 50 MHz to 67 GHz, with maximum average power measurement accuracy of ±0.20 dB, a video bandwidth of ≥30 MHz and rise/fall times of ≤13 ns. This compact and lightweight product utilises USB power and communication for connection to a computer. It can be used to expand the power measurement capabilities of electronic measurement instruments and test systems, making it suitable for field testing, production line testing, and system integration.

Key Features

- The 87236 Series features average power measurements down to -45dBm and pulse envelope measurements down to -35dBm, with average power measurement accuracy up to ±0.20dB. It supports external triggering in average-only mode. By adjusting aperture size and trigger delay, users can select any portion of the waveform for measurement.
- The 87236 Series accurately measures both power and timing parameters of pulsed signals. With a maximum video bandwidth of 30 MHz and rise/fall times of 13 ns, it can measure pulses with widths down to 50 ns.
- The 87236 Series enables internal zero calibration of Power Sensors via internal switching circuits when connected to the device under test. This accelerates measurement speed, reduces connector wear, and lowers measurement uncertainty.

- The 87236 series incorporates a built-in trigger input function. Using the standard trigger cable, external trigger signals from the signal source or device under test can be connected to the Power Sensor, enabling precise triggering of small signals approaching the lower limit of signal noise.
- The auto measurement function allows users to obtain measurement results with a single button press when measuring pulse-modulated signals.
- Auto measurement covers 16 pulse power and timing parameters.
- Power parameters: Peak power, minimum power, average power, top power, bottom power, peak-to-average ratio, overshoot, pulse rise/fall time.
- Time parameters: Pulse width, pulse period, pulse frequency, edge delay, rise time, fall time, duty cycle, off-time.
- The 87236 series achieves measurement speeds of up to 50,000 readings per second in buffer mode.
- Pre-set functions enable direct access to measurement configurations for 23 common wireless communication formats, including GSM900, EDGE, NADC, iDEN, Bluetooth, CDMAOne, and CDMA2000, reducing user setup time.
- External trigger buffered measurement mode allows customization of measurement sequences based on test requirements. Results are cached in real-time and can be retrieved after completing the entire sequence. This mode is typically used for: power sweep measurements; step frequency sweep measurements; list measurements based on communication signal time slots and frame structures.
- Connections to the device under test are established via hardware handshaking, ensuring the 87236 series can rapidly execute each measurement in the custom sequence. This significantly reduces measurement time and improves efficiency when the number of measurement points increases dramatically.

Technical Specification

Specifications		
Frequency Range	87236D	50MHz to 18GHz
	87236E	50MHz to 26.5GHz
	87236F	50MHz to 40GHz
	87236L	500MHz to 67GHz
Measurement Power Range[1]	87236D/E/F	Normal Mode: -30dBm to +20dBm(50MHz≤f<500MHz) -35dBm to +20dBm(f≥500MHz)
		Average Mode: -45dBm to +20dBm
	87236L	Normal Mode: -35dBm to +20dBm(500MHz≤f≤40GHz) -30dBm to +20dBm(40GHz<f≤67GHz)
		Average Mode: -45dBm to +20dBm(500MHz≤f≤40GHz) -40dBm to +20dBm(40GHz<f≤67GHz)
Damage Level[2]	+23dBm(Average Power), +30dBm(Peak Power, Duration Time<1us)	
Rise/fall time[3]	≤13ns	
Sampling Rate[4]	80MSamples/sec, Continuous sampling	
Video bandwidth	≥30MHz	
Single capture bandwidth	≥30MHz	
Minimum pulse width	50ns	
Basic accuracy of average power measurement[5]	87236D	±0.20dB(±4.7%)
	87236E	±0.25dB(±5.9%)
	87236F	±0.30dB(±7.2%)
	87236L	±0.33dB(±7.9%)
Maximum capture length	1s(Down frequency), 1.2ms(Maximum sampling rate)	
Maximum pulse repetition rate	10MHz	
Maximum SWR	87236D	1.20(50MHz≤f≤2GHz) 1.26(2GHz<f≤18GHz)
	87236E	1.20(50MHz≤f≤2GHz) 1.26(2GHz<f≤18GHz) 1.35(18GHz<f≤26.5GHz)

	87236F	1.20(50MHz≤f≤2GHz) 1.26(2GHz<f≤18GHz) 1.35(18GHz<f≤26.5GHz) 1.50(26.5GHz<f≤40GHz)
	87236L	1.20(500MHz≤f≤2GHz) 1.26(2GHz<f≤18GHz) 1.35(18GHz<f≤26.5GHz) 1.50(26.5GHz<f≤40GHz) 1.70(40GHz<f≤67GHz)
Calibration Uncertainty[6]	87236D	0.17dB(4.0%)(50MHz≤f≤10GHz) 0.19dB(4.5%)(10GHz<f≤18GHz)
	87236E	0.18dB(4.2%)(50MHz≤f≤1GHz) 0.19dB(4.5%)(1GHz<f≤18GHz) 0.22dB(5.2%)(18GHz<f≤26.5GHz)
	87236F	0.18dB(4.2%)(50MHz≤f≤1GHz) 0.19dB(4.5%)(1GHz<f≤18GHz) 0.22dB(5.2%)(18GHz<f≤26.5GHz) 0.24dB(5.7%)(26.5GHz<f≤40GHz)
	87236L	0.19dB(4.5%)(500MHz≤f≤18GHz) 0.22dB(5.2%)(18GHz<f≤26.5GHz) 0.24dB(5.7%)(26.5GHz<f≤40GHz) 0.29dB(6.9%)(40GHz<f≤67GHz)
Interface Connectors	87236D	N-Type(m)
	87236E	3.5mm(m)
	87236F	2.4mm(m)
	87236L	1.85mm(m)
Timebase and Trigger		
Timebase	2ns/duv to 3600s/div	
Internal trigger level (typical)	-20dBm to +20dBm	
Trigger delay	±1.0s(Max.)	
Trigger hold off	1μs to 1s	
Trigger lag	0dB to 10dB	
Inputs/Outputs		
Trigger input	Compatible with TTL level, MMCX connector	
Trigger output	Compatible with TTL level, MMCX connector	
Program control interface	USB2.0 port,Compatible with USB-TMC	
Maximum measurement speed[7]	50000 readings per second	
Product features		

Dimensions(W×H×D)	87236D	141.1mm×52.0mm×34.0mm
	87236E	133.9mm×52.0mm×34.0mm
	87236F	124.7mm×52.0mm×34.0mm
	87236L	124.7mm×52.0mm×34.0mm
Weight	<0.30kg	
Operation Temperature Range	-10°C to 50°C	
Storage Temperature Range	-40°C to 70°C	
Calibration Cycle(Recommend)	12 months	

Ordering Information

- **Mainframe**

No.	Model	Name	Comments
1	87236D	USB Peak/Average Power Sensor	USB cable: Length 2.0m, Quantity 1; Trigger cable: Length 1.5m, Quantity 2; CD: Contains manuals and power measurement display software, Quantity 1.
2	87236E		
3	87236F		
4	87236L		

- **Option**

No.	Option	Name	Function
1	87230-H01	USB Cable	Connected to the computer, length 2.0 meters
2	87230-H02	USB Cable	Connected to the computer, length 4.5 meters
3	2439D-H07	Six-core to MINI_USB Cable (1.5 meters)	Connection with 2439D power meter, length 1.5 meters
4	2439D-H08	Six-core to MINI_USB Cable (4.5 meters)	Connection with 2439D power meter, length 4.5 meters
5	87230-H03	Trigger Cable	Length: 1.5m
6	87230-H04	Trigger Cable	Length: 4.5m
7	87230-H05	Safety instrument transport case	Portable packaging box, with handle, capable of carrying 1 set of probes
8	87230-H06	Safety instrument transport case	Portable packaging box, with handle, capable of carrying 2 set of probes
9	87236D-H12	English Option	English panels, manuals, software, etc.

10	87236E-H12		
11	87236F-H12		
12	87236L-H12		
13	87236D-JL	Calibration Service	Provide metrological calibration services and metrological reports
14	87236E-JL		
15	87236F-JL		
16	87236L-JL		
17	87236D-EWT1	One-year extended warranty	Extended warranty beyond the standard coverage period: 1-year extension available. 2-year extension includes two optional services. Calibration is not included in this service.
18	87236E-EWT1		
19	87236F-EWT1		
20	87236L-EWT1		

Note:

1. For models 87236D/E/F/L, connect the Power Sensor to the device under test (DUT) when the signal level is below -35dBm. After preheating for 30 minutes in a temperature-controlled environment, set the step detection to 'Off', configure the correct number of averages and perform 'External Zero Calibration'. Then activate the DUT's signal output. Wait one minute before observing the test results.
2. 'Maximum input power' denotes the highest power that the Power Sensor can handle. Exceeding this limit may damage the probe, potentially causing burnout in severe cases.
3. 'Rise/fall time' applies when the frequency is ≥500 MHz and the video bandwidth is disabled. If the measured signal's rise/fall time is ≤13 ns, the measurement error may be approximately 30%.
4. 'Maximum sampling rate' represents the probe's ADC's highest conversion rate and is a probe design specification.
5. 'Average power measurement accuracy' applies when: Power range: -15 dBm to +20 dBm, Frequency ≥ 500 MHz, DUT SWR <1.20. In Free Run mode, set the average value to 32 to ensure that the measurement accuracy meets the required standard.
6. 'Maximum measurement speed' denotes the highest data readout rate per second for the Power Sensor. This speed is precisely correlated with the aperture time (equal to 1/aperture time).

87237 USB CW Power Sensor (DC to 110 GHz)

The 87237 Series USB Thermocouple Power Sensor is a high-precision, metrology-grade power measurement instrument with high stability, based on thermocouple chips. It enables the accurate measurement of average power in any format of modulated signal.

Key Features

- **With a wide frequency range and high power accuracy**

  The 87237 Series single Power Sensor covers DC to 110 GHz, providing power measurement accuracy of up to ±0.16 dB.

- **Built-in Non-volatile Memory Calibration Data**

  Its built-in non-volatile memory automatically stores calibration data and parameters, eliminating the need for external calibration. Plug-and-play functionality enhances testing efficiency.

- **Excellent VSWR performance**

  It features a low voltage standing wave ratio (VSWR) across the entire frequency band and flat frequency response characteristics, which significantly reduce measurement uncertainty caused by impedance matching between the device under test and the Power Sensor.

Technical Specification

Specifications		
Frequency Range	87237D	DC to 18GHz
	87237L	DC to 67GHz
	87237P	DC to 110GHz
Measurement Power Range[1]	87237D	-35dBm to +20dBm
	87237L	-35dBm to +20dBm
	87237P	-30dBm to +20dBm
Damage Level[2]	87237D/L/P	+23dBm(Average Power)
Amplitude Measurement Accuracy[3]	87237D	±0.16dB(DC≤f≤8GHz) ±0.19dB(8GHz<f≤18GHz)
	87237L	±0.19dB(DC≤f≤8GHz) ±0.21dB(8GHz<f≤18GHz) ±0.25dB(18GHz<f≤26.5GHz) ±0.31dB(26.5GHz<f≤40GHz) ±0.37dB(40GHz<f≤67GHz)
	87237P	±0.19dB(DC≤f≤8GHz) ±0.21dB(8GHz<f≤18GHz) ±0.25dB(18GHz<f≤26.5GHz) ±0.31dB(26.5GHz<f≤40GHz) ±0.37dB(40GHz<f≤67GHz) ±0.41dB(67GHz<f≤80GHz) ±0.57dB(80GHz<f≤95GHz) ±0.61dB(95GHz<f≤110GHz)
Maximum VSWR	87237D	1.20
	87237L	1.19(DC≤f≤18GHz) 1.25(18GHz<f≤26.5GHz) 1.31(26.5GHz<f≤33GHz) 1.48(33GHz<f≤50GHz) 1.57(50GHz<f≤67GHz)
	87237P	1.20(DC≤f≤18GHz) 1.25(18GHz<f≤26.5GHz) 1.31(26.5GHz<f≤33GHz) 1.48(33GHz<f≤50GHz) 1.57(50GHz<f≤67GHz) 1.67(67GHz<f≤95GHz) 1.79(95GHz<f≤110GHz)
Calibration Uncertainty[4]	87237D	0.12dB(DC≤f≤8GHz) 0.15dB(8GHz<f≤18GHz)
	87237L	0.15dB(DC≤f≤8GHz) 0.19dB(8GHz<f≤18GHz) 0.21dB(18GHz<f≤26.5GHz)

		0.27dB(26.5GHz<f≤40GHz) 0.33dB(40GHz<f≤67GHz)
	87237P	0.15dB(DC≤f≤8GHz) 0.19dB(8GHz<f≤18GHz) 0.23dB(18GHz<f≤26.5GHz) 0.29dB(26.5GHz<f≤40GHz) 0.37dB(40GHz<f≤67GHz) 0.43dB(67GHz<f≤80GHz) 0.53dB(80GHz<f≤95GHz) 0.57dB(95GHz<f≤110GHz)
Zero set[5]	87237D/L/P	±70nW
Measurement Noise[6]	87237D/L/P	±80nW
Interface Connectors	87237D	N-Type(m)
	87237L	1.85mm(m)
	87237P	1.0mm(m)
Dimensions(W×H×D)	87237D	51.5mm×33.5mm×148.0mm
	87237L	51.5mm×33.5mm×127.0mm
	87237P	51.5mm×33.5mm×122.0mm
Weight	<0.3kg	
Maximum sampling rate [7]	100k Samples/sec	
Control Interface	USB 2.0 interface, compatible with USB-TMC	
Maximum Measurement Speed [8]	1000 readings/s	
Operation Temperature Range	-10°C to 50°C	
Storage Temperature Range	-40°C to 70°C	
Calibration Cycle(Recommend)	12 months	
Power Supply	+5V, 500mA	

Ordering Information

- **Mainframe**

No.	Model	Name	Comments
1	87237D	USB Thermocouple Power Sensor	USB cable: Length 1.5m, Quantity 1 CD: Contains manuals and power measurement display software, Quantity 1
2	87237L	USB Thermocouple Power Sensor	
3	87237P	USB Thermocouple Power Sensor	

- **Option**

No.	Option	Name	Function
1	2439D-H01	Six-core to MINI_USB Cable (1.5 meters)	Connection with 2439D power meter, length 1.5 meters
2	2439D-H02	Six-core to MINI_USB Cable (4.5 meters)	Connection with 2439D power meter, length 4.5 meters
3	2439D-H03	USB Cable	Connected to the computer, length 2.0 meters
4	2439D-H04	USB Cable	Connected to the computer, length 4.5 meters
5	87230-H05	Safety instrument transport case	Portable packaging box, with handle, capable of carrying 1 set of probes
6	87230-H06	Safety instrument transport case	Portable packaging box, with handle, capable of carrying 2 set of probes
7	87237D-H12	English Option	English panels, manuals, software, etc.
8	87237L-H12		
9	87237P-H12		
10	87237D-JL	Calibration Service	Provide metrological calibration services and metrological reports
11	87237L-JL		
12	87237P-JL	Calibration Service	Provide measurement calibration and testing services. Measurement reports are provided for frequencies below 67 GHz. Test reports are provided for frequencies between 67 GHz and 110 GHz.
13	87237D-EWT1	One-year extended warranty	Extended warranty beyond the standard coverage period: 1-year extension available. 2-year extension includes two optional services. Calibration is not included in this service.
14	87237L-EWT1		
15	87237P-EWT1		

Note:

1. For the 87237 series Power Sensors, testing the lower power limit must be conducted under fixed conditions. At levels below -15dBm, connect the Power Sensor to the device under test (DUT).

After preheating for 1 hour in a temperature-controlled environment, set the step detection to “Off,” configure an appropriate number of averages, and perform an “External Zero Calibration.” Then activate the DUT's signal output. Wait for 1 minute before observing the test results. This result incorporates errors from the probe's “zero setting” and “measurement noise.”

2. “Maximum Input Power” denotes the probe's permissible load limit. Exceeding this value may damage the probe, potentially causing burnout in severe cases.

3. “Power measurement accuracy” is satisfied under fixed conditions: within -15dBm to +20dBm, when the DUT's SWR < 1.20, and with the probe's average count set to 128. Below -15dBm, as measured power decreases, zero setting and measurement noise progressively increase their impact on power measurement accuracy.

4. “Calibration uncertainty” refers to the inherent linear deviation, temperature effects, and expanded uncertainty arising from the manufacturing calibration process of the Power Sensor itself. The “power measurement uncertainty” experienced by users when using the Power Sensor encompasses the probe's “calibration uncertainty,” uncertainty caused by mismatch between the Power Sensor and the device under test (DUT) port, and uncertainty stemming from the Power Sensor's “zero setting” and “measurement noise.”

5. “Zero setting” refers to the fixed output deviation of the Power Sensor when no signal is input, caused by non-ideal characteristics of internal circuits (such as amplifier offset, thermoelectric potential) or external interference. This significantly impacts low-power testing with the probe. Zero setting requires preheating for 1 hour in a temperature-controlled environment followed by external zero calibration before testing.

6. “Measurement noise” represents the impact of internal circuit noise on measurements, which is more pronounced during small-signal measurements with the Power Sensor. Measurement noise testing requires preheating for one hour in a temperature-controlled environment followed by external zero calibration.

7. “Maximum sampling rate” denotes the highest conversion rate of the ADC, representing the design specification for the 87237 series Power Sensors.

8. “Maximum measurement speed” indicates the maximum data that can be read per second by the Power Sensor. Maximum measurement speed is precisely correlated with the aperture time (equal to 1/aperture time).

Computer Requirements for USB Power Sensor

The computer must meet the following requirements:	
Operating System	Windows11 64-bit
Hardware	Processor: 1GHz or higher (2GHz or higher recommended) Memory: 2GB or higher (4GB or higher recommended) Hard disk space: 1.0GB or higher Display: 1280×1024 or higher
USB Power Supply	+5V, 500mA