9kHz…9GHz KC980X

Handheld Monitoring Antenna User Manual

(Trial Version)

KEXINSHE
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Special Notes

KC980D and KCR100C refer to the same product. KC980D is the designation assigned under the updated model naming convention. The KC980 series also includes other variants—such as KC980A, KC980B, and KC980C—each covering different frequency ranges. KCR100C was designated under the previous naming system and is temporarily retained to assist customers with model selection.

For consistency, this manual refers exclusively to the model as "KC980D", without further mention of "KCR100C".

Please note that product specifications are subject to change. This manual is for reference only.

KC980X represents a series of directional antennas featuring a consistent handle design. They are primarily used as accessories for spectrum analyzers and reconnaissance receivers, supporting applications such as transmitter detection, radio direction finding, near-field electromagnetic interference (EMI) troubleshooting, and, for certain models, field strength measurement. This series is characterized by a wide frequency range, moderate size, ease of portability, and robust construction, making it well suited for handheld use in both indoor and outdoor environments.

As of now, the KC980X series includes the following models:

Model	Type	Frequency Range
KC980A	Shielded Loop	9kHz~100MHz
KC980R	Shielded Loop	20kHz~400MHz
KC980B	Hybrid Loop	20~200MHz
KC980S	Hybrid Loop	30~350MHz
KC980C	Hybrid Loop	50~500MHz
KC980D	Log-Periodic	350MHz~9GHz

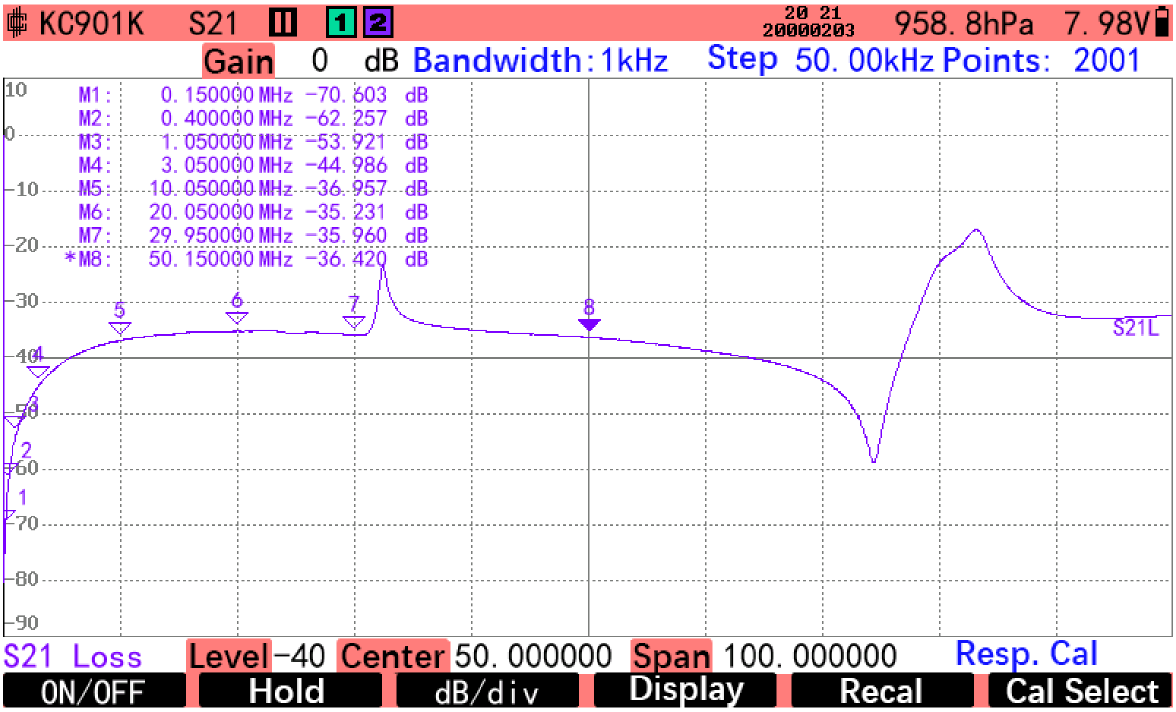
1.KC980A and KC980R

Both are pure magnetic field antennas with minimal response to electric fields. The main difference between the two extended models, A and R, lies in the size of the loop. Shielded loop antennas respond to magnetic fields over a broad frequency range and perform better at low frequencies (e.g., below 30 MHz) than hybrid loops or other types. However, at higher frequencies, magnetic field antennas generally have lower gain than electric field antennas. Therefore, the KC980A and KC980R are mainly used for detecting low-frequency electromagnetic waves.

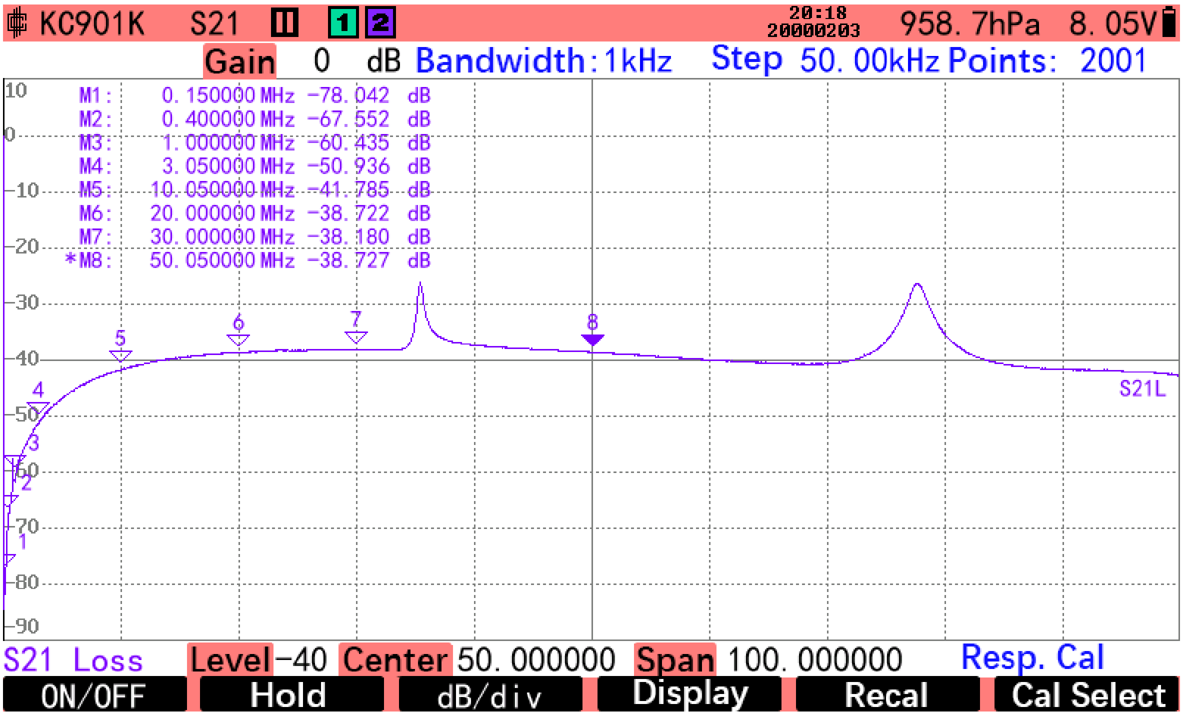
Shielded loop antennas do not have a strictly defined nominal frequency range. Their usable frequency depends on the strength of the original electromagnetic field, required sensitivity, and the desired antenna directionality. At low frequencies, because they behave as “small antennas,” their gain decreases as frequency decreases; however, when electromagnetic radiation is strong enough, sufficient reception levels can still be achieved. This type of antenna exhibits a high standing wave ratio (SWR) and is not suitable for transmission.

Frequency Response

The figure below shows the transmission loss of the KC980A measured in a transverse magnetic wave chamber. The reception level drops sharply near DC. The graph presents relative values for general reference only. Since the low-frequency field strength inside the chamber has not been normalized, the relative values indicated by the cursor may have some inaccuracies.



The KC980R has a slightly shorter loop circumference, resulting in lower low-frequency sensitivity compared to the KC980A. The figure below shows the response curve measured in the same transverse magnetic wave chamber under identical excitation conditions.

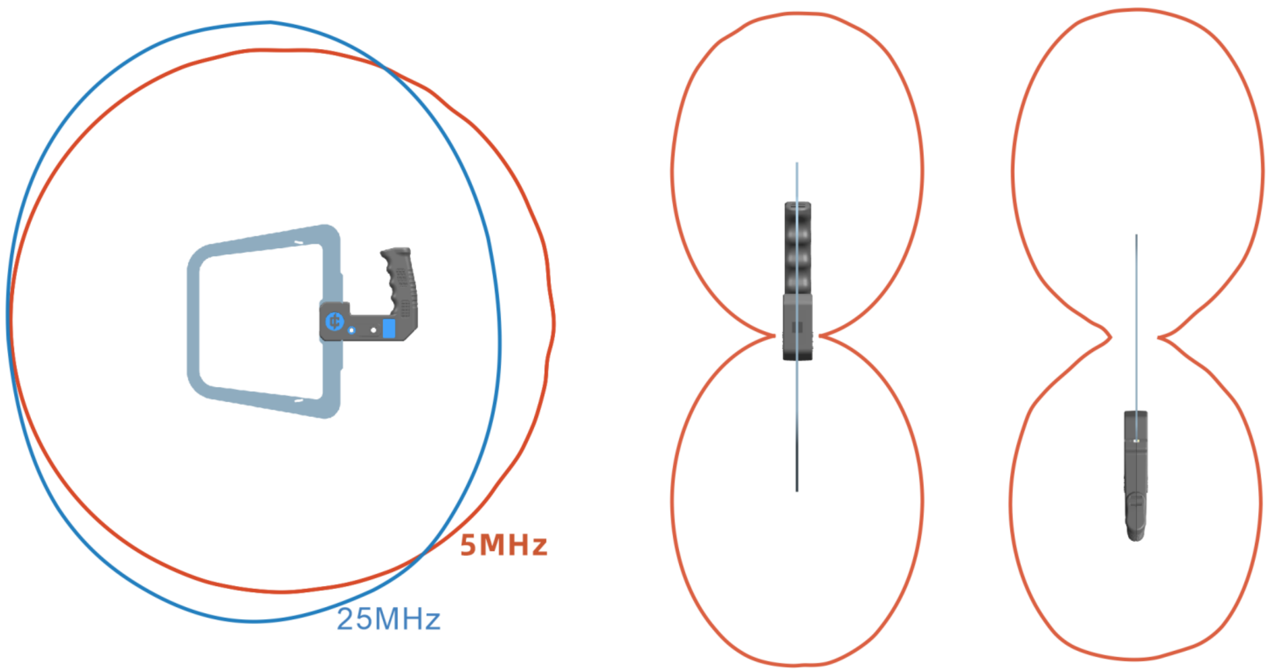


As the frequency increases, the antenna gain tends to stabilize. If directionality is not taken into account, the antenna can be used at much higher frequencies.

Directionality

At low frequencies, in the direction parallel to the antenna plane, the KC980A/R behaves nearly as an omnidirectional antenna, with a disc-shaped radiation pattern. When used for direction finding, attention must be paid to distinguishing the front from the back. Starting at around 15 MHz, the radiation pattern in the antenna plane begins to split, with a larger front lobe and smaller rear lobe, which is advantageous for direction finding. In the direction perpendicular to the antenna plane, the pattern takes on a figure-eight shape, with the main lobes pointing radially outward. Therefore, when the antenna is used in a vertical orientation, it can be used for horizontal direction finding, while when laid flat, it can be used to roughly estimate the signal's elevation angle.

The figure below illustrates the directionality of KC980A/R; users should summarize experience based on these characteristics.



From near DC, the antenna maintains the above directionality (with some changes in lobe shape) up to higher frequencies. As frequency continues to rise, the radial pattern also splits, gradually becoming a figure-eight shape perpendicular to the antenna plane, with main lobes along the axis.

The frequency at which the radial pattern splits depends on the loop circumference: about 300 MHz for KC980A and about 400 MHz for KC980R. At high frequencies, KC980A/R remain magnetic field antennas.

In theory, only the KC980R and KC980D antennas are required to cover the range from low frequencies up to 9 GHz, making them convenient for close-range searches and applications with moderate sensitivity requirements.

However, the KC980A and KC980R show a significant gain advantage only in the shortwave band. Above 40 MHz, the KC980B and KC980C offer higher gain in the intended direction, with a smooth gain response and a cardioid radiation pattern. Therefore, when conditions allow or when signals are weak, it is advisable to select a more suitable antenna.

Gain

The table below presents the near-field received signal levels (in dBm) of the KC980S, KC980A, and KC980R antennas when receiving signals from the same electrically small transmitting antenna. Measurements were taken in a typical large indoor environment. It is evident that the KC980A and KC980R demonstrate a clear advantage at low frequencies.

frequency	KC980S	KC980R	KC980A
50MHz	-45	-53	-52
20MHz	-61	-56	-53
10MHz	-78	-68	-65
5MHz	-86	-78	-72
1MHz	-108	-102	-97

The table below presents the received signal levels measured in a 10-meter semi-anechoic chamber, where two identical antennas serve as the transmitting and receiving antennas. They are aligned and positioned 10 meters apart at a height of 2 meters. Due to the lack of precise methods for measuring the gain of low-frequency antennas, these data are provided for reference only.

Frequency MHz	Output Power dBm	Received Level (dBm)		Imputed Gain(dBi)	
		KC980A	KC980R	KC980A	KC980R
1	17	-129.8	-136.0	-77.2	-80.3
2		-122.1	-132.5	-70.3	-75.5
5		-109.5	-120.4	-60.0	-65.5
10	16	-94.5	-103.2	-49.0	-53.4
15		-87.6	-94.7	-43.8	-47.4
20		-83.4	-89.2	-40.5	-43.4
30		-73.7	-81.4	-33.9	-37.7
50		-76.9	-75.6	-33.2	-32.6
100		-70.1	-87.6	-26.8	-35.6
200		-49.9	-67.5	-13.7	-22.5
300	12	-31.5	-46.5	-0.8	-8.3
400		-43.2	-40.2	-5.4	-3.9

The KC980X series is primarily used for direction finding. Except for the KC980D, when used for field strength measurement, please note that the above data represent the antenna gain in the antenna’s direct forward direction and may not reflect the maximum gain.

Mechanical Parameters

Name	KC980A	KC980R	Remarks
Dimensions/mm	370×310×27	303×230×27	Excludes cable
Cable Length/m	1.35	1.35	Measured from handle surface
Net Weight/g	330	300	Including cable
Packaging Size/mm	600×410×150	365×265×85	2 pieces per carton
Total Packaging Weight/kg	2.5kg	1kg	1 piece per carton

Note: Parameters have random errors and are for reference only.

2.KC980B, KC980C, and KC980S

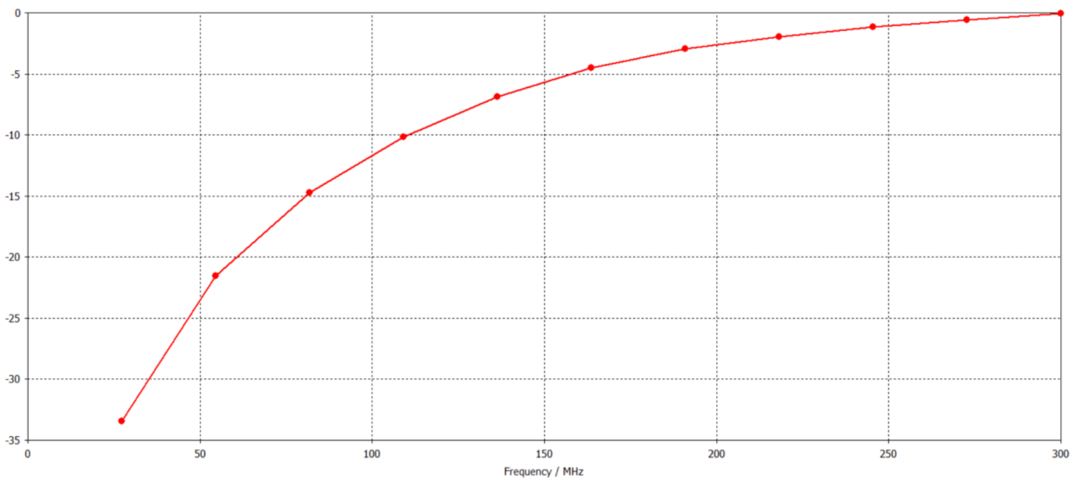
All are hybrid-field antennas. A loop with a circumference much smaller than the wavelength is typically a magnetic field antenna and should exhibit a figure-eight radiation pattern. However, if the loop is cut at the midpoint and a resistor is connected in series at the break, the dipoles formed on either side of the break respond to the electric field. Therefore, the response at the feed point is a combination of electric and magnetic field responses. Because these two responses have different phases, with an appropriately chosen resistor, the combined radiation pattern within the nominal frequency range changes from a figure-eight to a cardioid shape. This allows the antenna to be used for direction finding using the major lobe (strong signal peak) method, and at frequencies where nulls occur, the minor lobe (weak signal peak) method can also be applied. This type of antenna was invented around 1972 and is essentially the same as the historical shortwave direction-finding antenna composed of a loop antenna combined with a whip (rod) antenna.

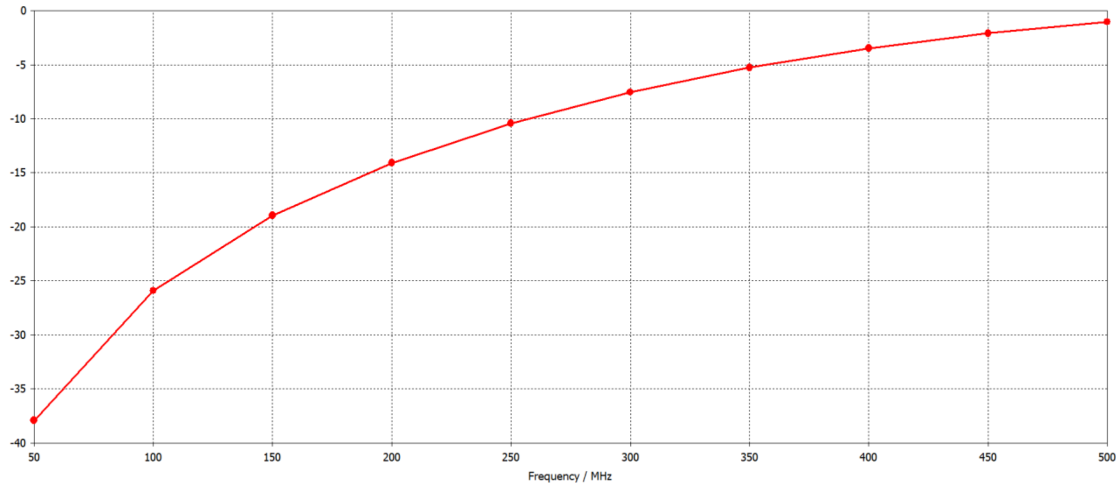
The circumferences of the KC980B, KC980C, and KC980S differ. The B model has the longest circumference, suitable for lower frequencies, exhibiting good directionality from 20 to 200 MHz. Above 250 MHz, the main lobe splits and gradually transitions to the radiation pattern of a dipole antenna. The C model has the shortest circumference, with acceptable directionality from 50 to 500 MHz; its main lobe splits at around 550 MHz, making it suitable for higher frequencies. The S model falls between B and C in circumference, and its gain is also intermediate. Below the lower frequency limit, the antenna behaves like a single-turn inductive coil, with the main lobe splitting and eventually forming a figure-eight pattern perpendicular to the antenna plane.

Gain

The antenna’s main lobe gain increases as frequency rises. The relative variation with frequency is illustrated in the figure below:

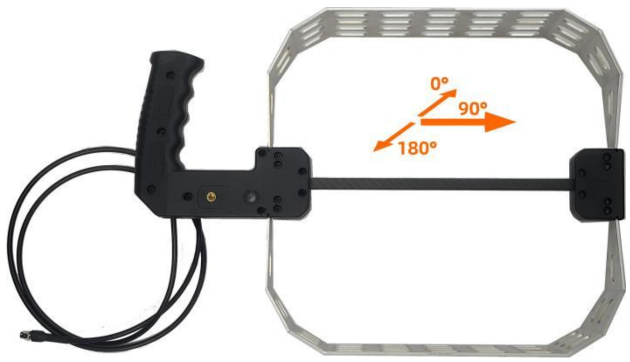
Top: Theoretical performance of KC980B   Bottom: Theoretical performance of KC980C

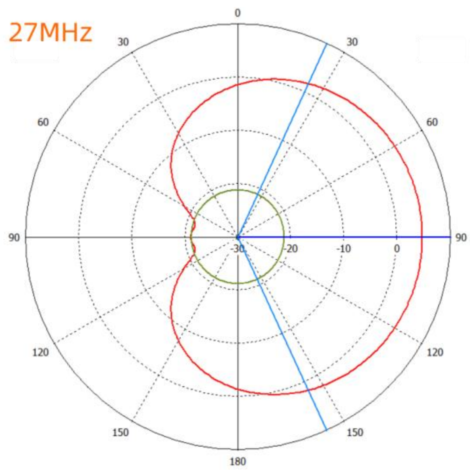


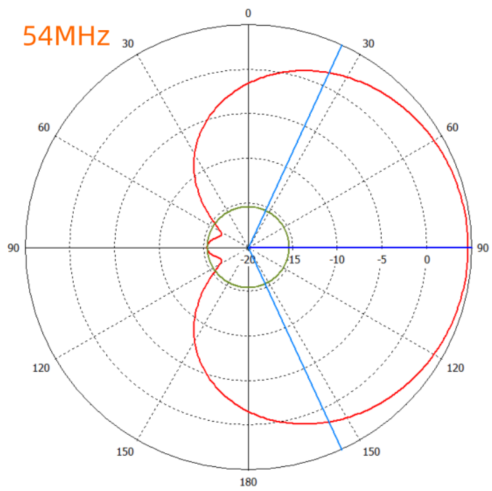


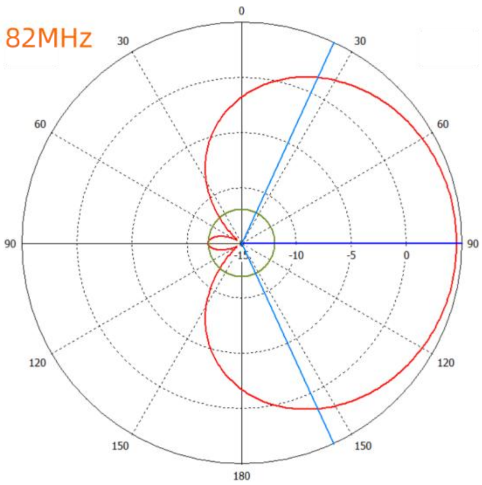
Directionality

The main lobes of the KC980B, KC980C, and KC980S antennas are relatively broad, so signal level readings should be observed carefully during direction finding. Occasionally, by swinging the antenna and identifying positions on either side where the signal level drops significantly, the location of the major lobe can be estimated. The theoretical directivity pattern of the KC980B is shown below; please note that the horizontal axis represents relative values only.





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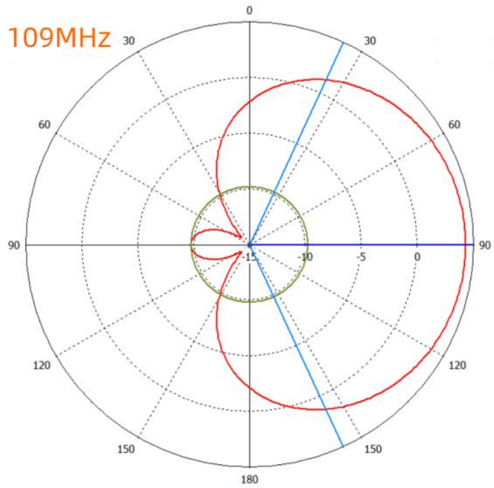
90
120
150
180
-15
-10
-5
0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120
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-15
-10
-5
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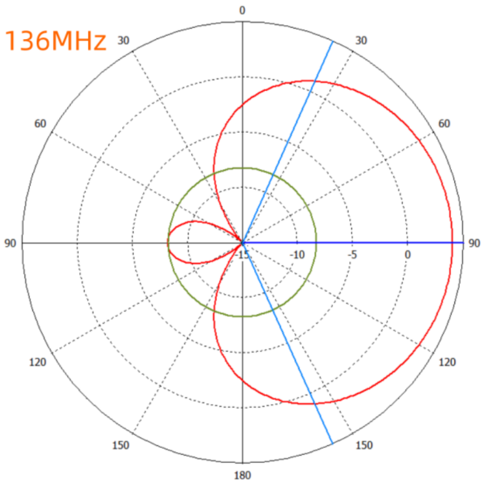
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-5
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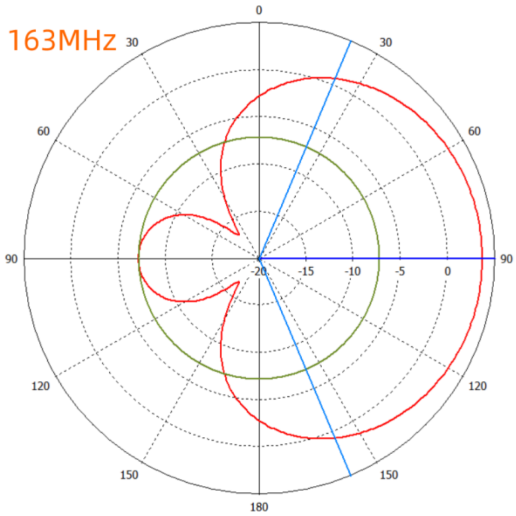
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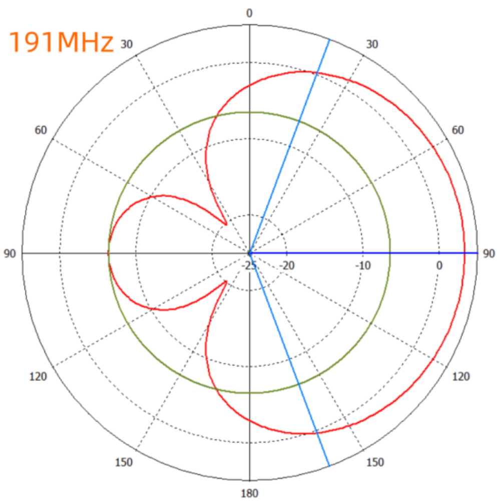
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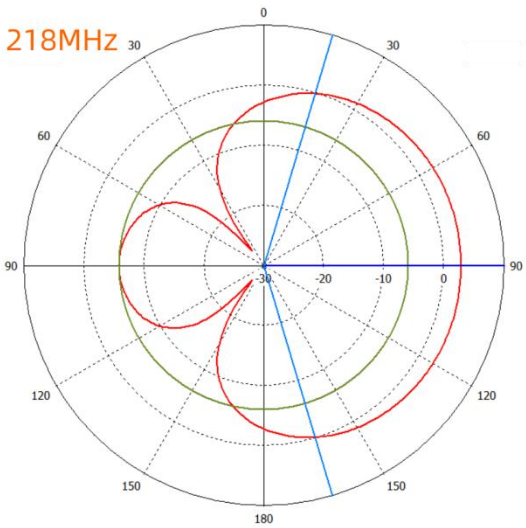
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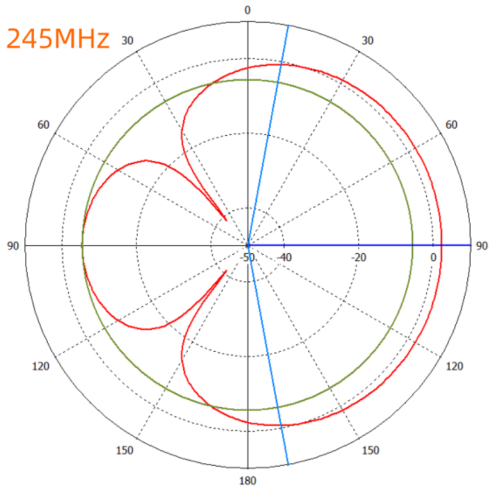
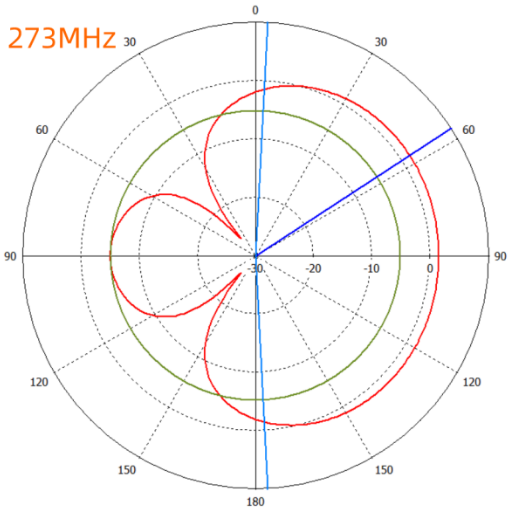
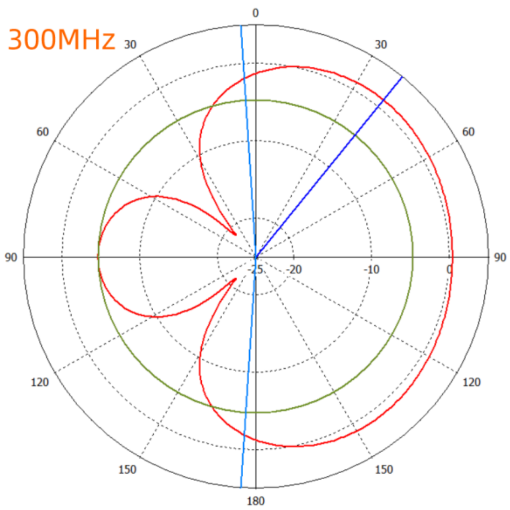
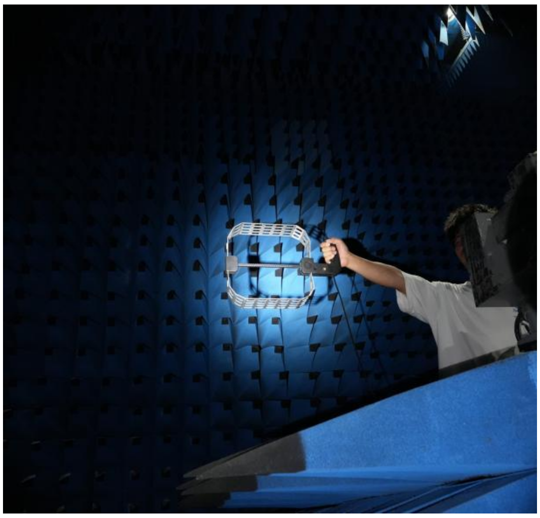
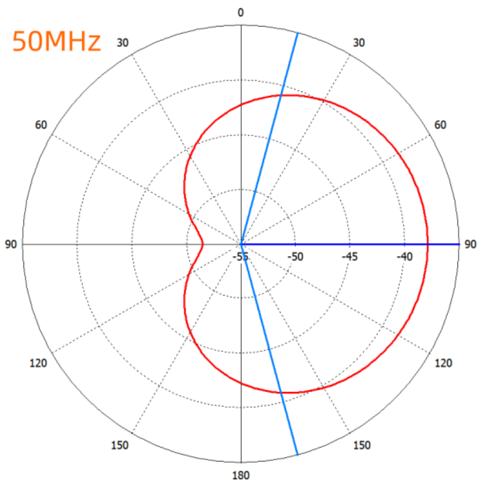


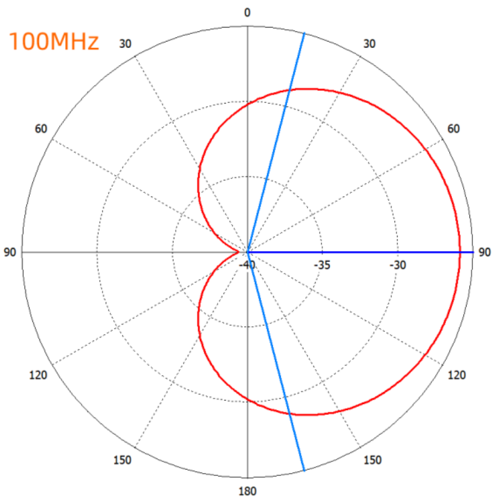


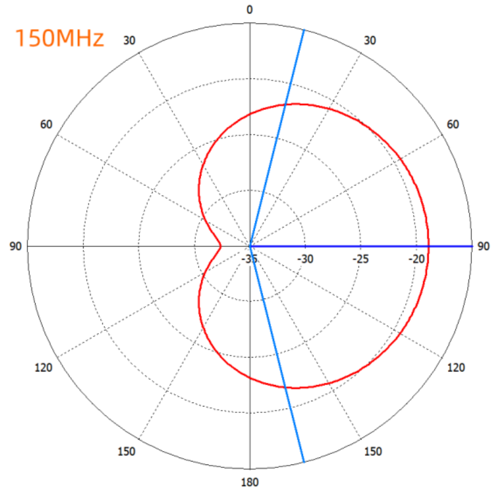




Theoretical Directionality of KC980C is shown below.



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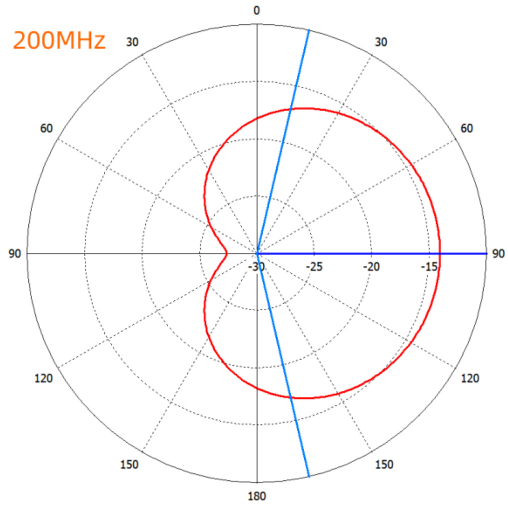
-30
-25
-20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-25
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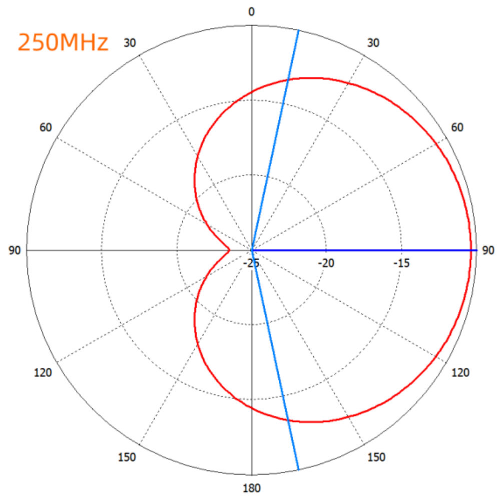
-15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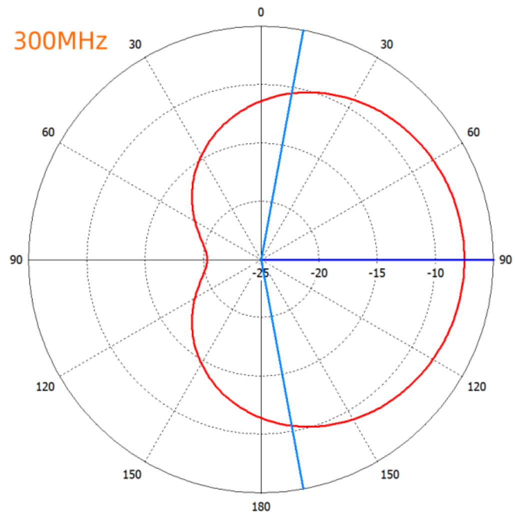
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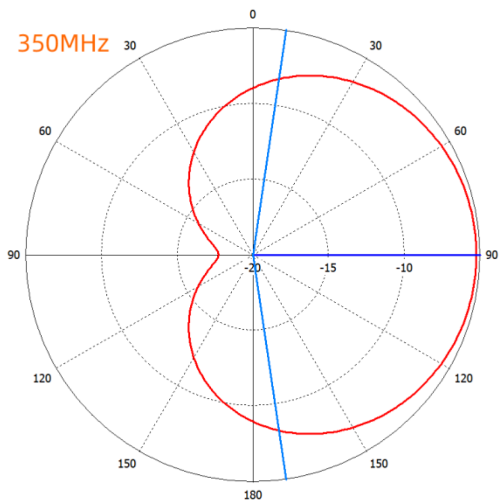
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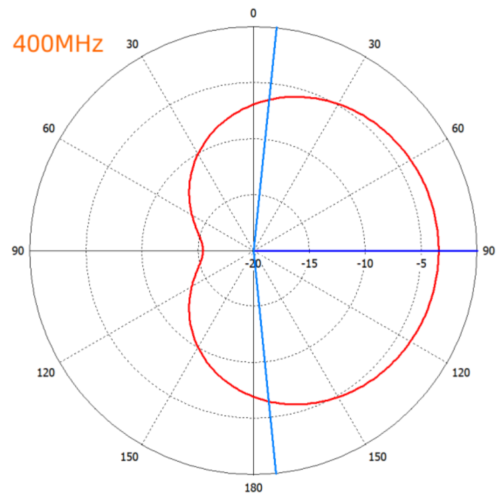
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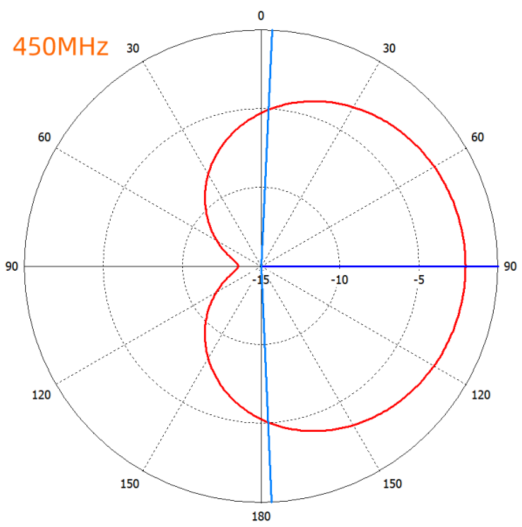
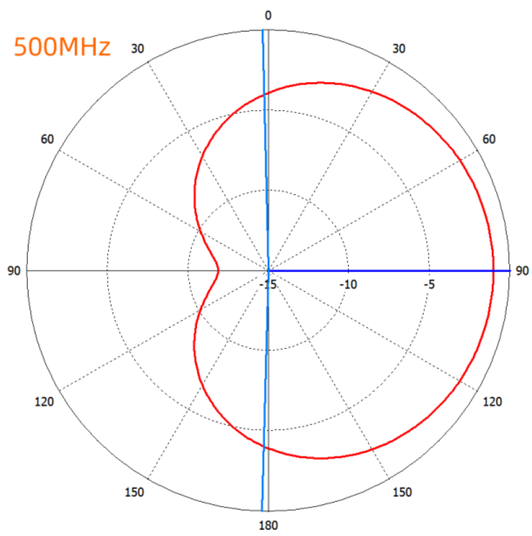
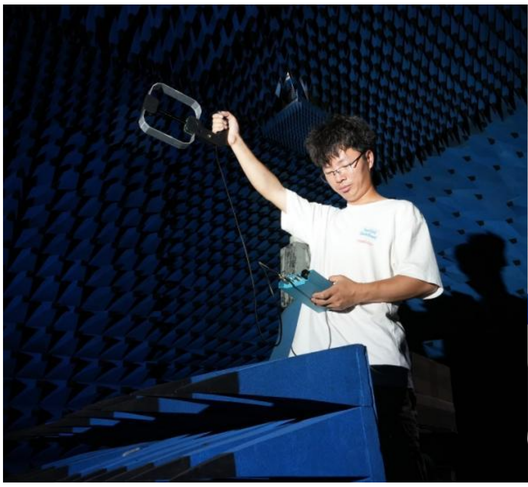


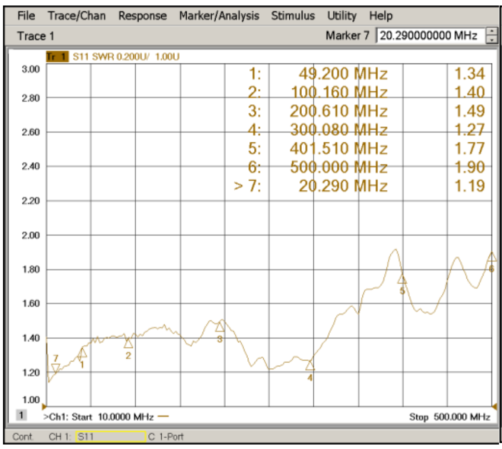


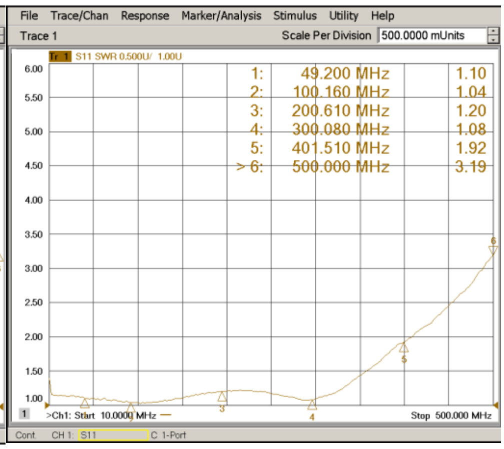


The frequency range from 50 MHz to 200 MHz is covered by the KC980B, KC980C, and KC980S models. Within this range, the gain ranking is B > S > C. Antenna selection should be based on sensitivity requirements.

VSWR

Typical VSWR values are as follows: Left: KC980B Right: KC980C





The VSWR of the KC980B, KC980C, and KC980S antennas is generally good, remaining below 3.0 across the nominal frequency range and below 1.5 at frequencies under 200 MHz. However, since these antennas contain resistive components, they are intended primarily for receiving. When used for transmission, the input power must not exceed 0.5 W.

Mechanical Parameters

Name	KC980B	KC980C	KC980S	Remarks
Dimensions/mm	430×295×90	220×210×40	305×210×40	Excludes cable
Cable Length/m	1.35	1.35	1.35	Measured from handle
Net Weight/g	800	350	405	Includes cable
Packaging Size/mm	520×360×130	365×265×85	365×265×85	One piece per carton
Total Packaging Weight/kg	1.5	0.8	0.9	

Note: Parameters have some random fluctuations and are for reference only.

3.KC980D

KC980D is a printed log-periodic antenna primarily designed as a supporting antenna for field strength meters, spectrum analyzers, and reconnaissance receivers. It is used for field strength evaluation, emission source detection, and radio direction finding. The antenna features a wide frequency range, moderate size, easy portability, and a robust construction, making it suitable for a variety of testing applications.

Frequency Range: 350 MHz … 9 GHz

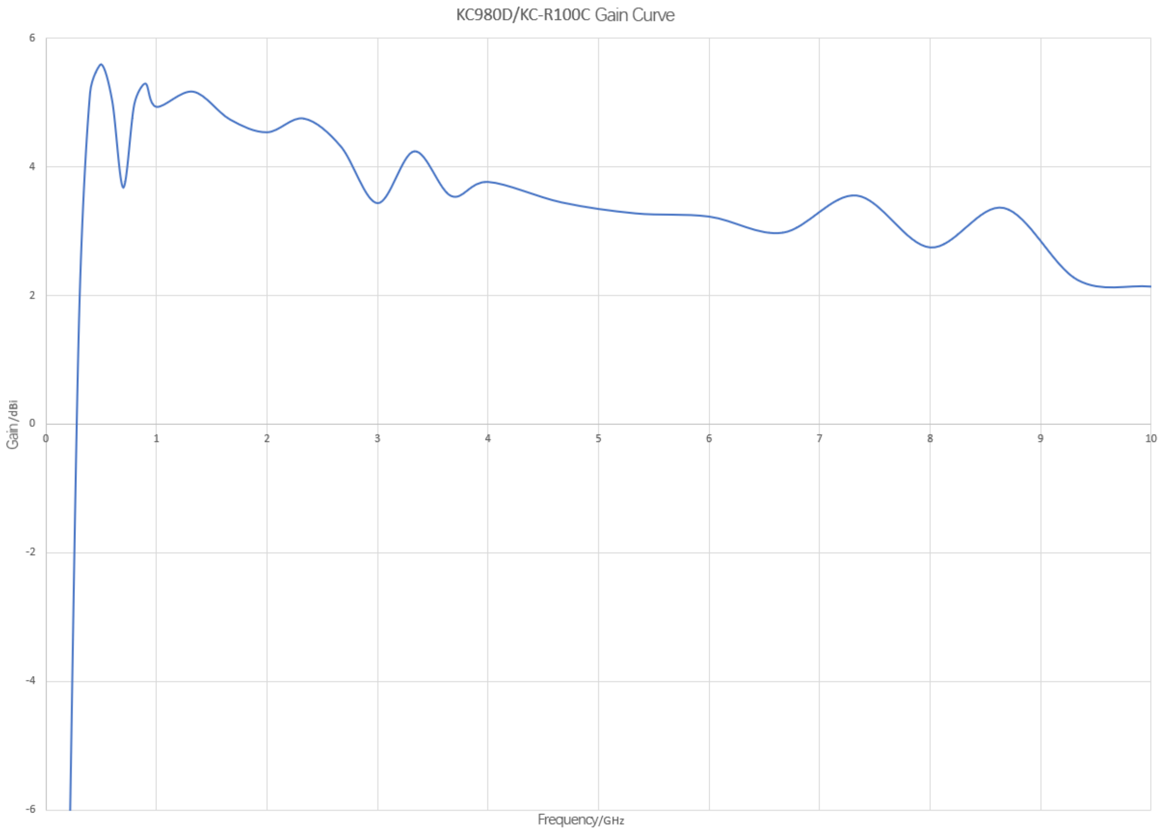
The KC980D performs reliably and effectively within the frequency range of 350 MHz to 9.0 GHz. Below 350 MHz, its gain drops rapidly, reaching approximately 0 dB at 300 MHz and about −8 dB at 200 MHz. Above 9.0 GHz, the return loss and gain decline more gradually. When performance requirements are less stringent, the antenna can be operated within a broader range of 330 MHz to 10 GHz.

Rated Gain: 3.5 dBi

Typical gain values of the KC980D start at 5.5 dB at low frequencies and gradually decrease as frequency increases, reaching approximately 2.5 dB at 9 GHz.

The gain exhibits rapid fluctuations across the frequency range, with an amplitude of about 2 dB. When using the antenna, its usability should be verified within a gain range of +3.5 dB to −0.5 dB as frequency rises.

The KC980D uses a coaxial cable for signal output; the gain values above are measured with the original cable. As a portable instrument, it is desirable for the cable to have low loss, high stability, and flexibility—though these three qualities often conflict. The KC980D employs a cable selected for balanced overall performance. If a different cable is used, please be aware that gain may vary accordingly.



Return Loss: 13 dB

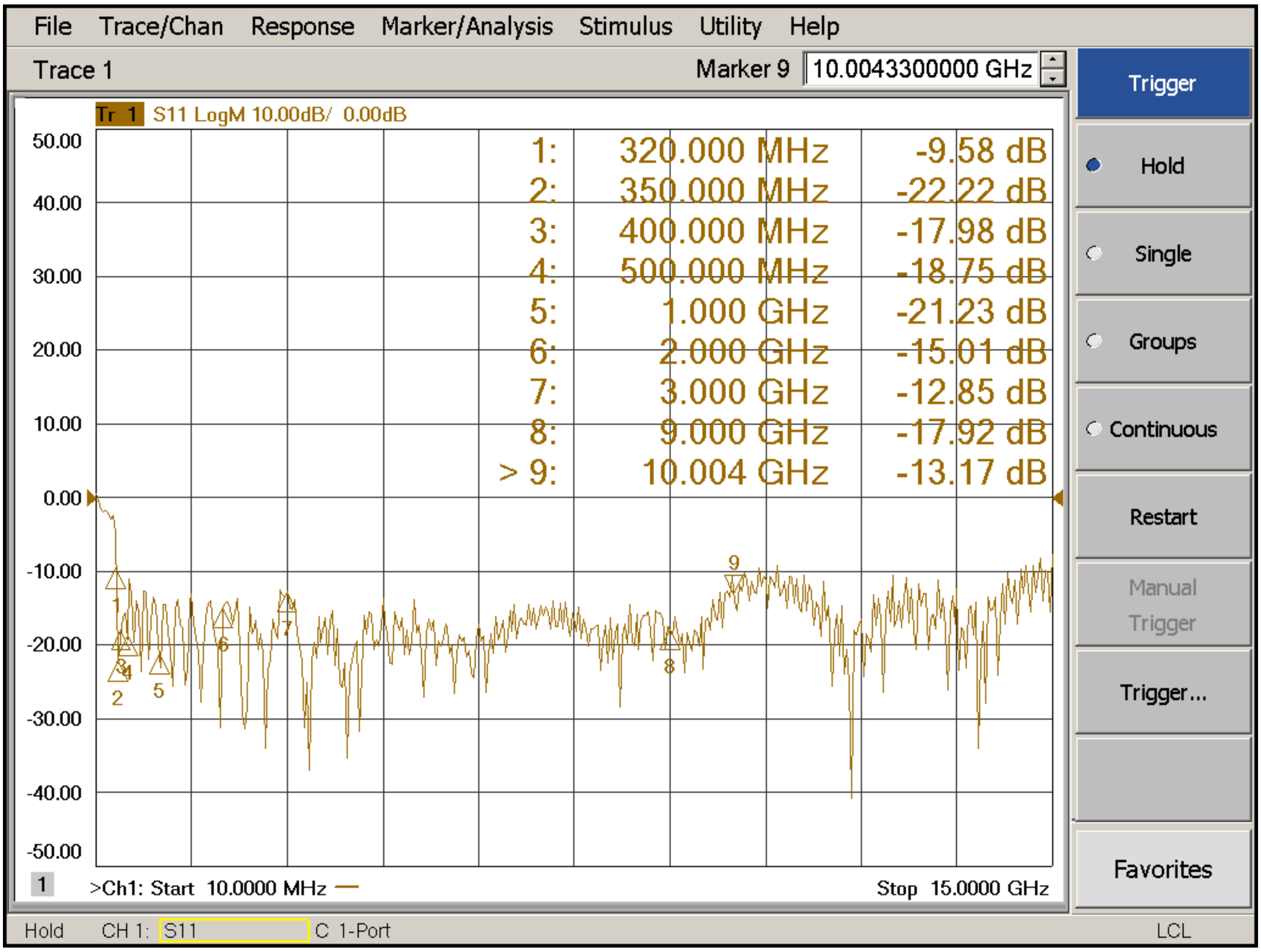
The antenna's rated input impedance is 50 Ω. When matched to a 50 Ω source, the return loss varies but remains mostly around 13 dB or better, corresponding to a VSWR of approximately 1.6. Below 350 MHz, the VSWR increases rapidly.

Power Handling: 5 W

The KC980D can be used both as a receiving and transmitting antenna. When used for transmission, its power handling capacity depends on frequency: it is 25 W at lower frequencies (below 1 GHz) and 5 W above 1 GHz. We have performed stress tests at 50 W without damage; however, this is not guaranteed, especially at higher frequencies where power limits must be strictly observed.

As a receiving antenna, the maximum permissible power flux density in the antenna’s environment is 20 mW/cm^2 (continuous wave). Exposure to strong microwave radiation may cause the antenna to ignite.

Measured Sample Return Loss Plot

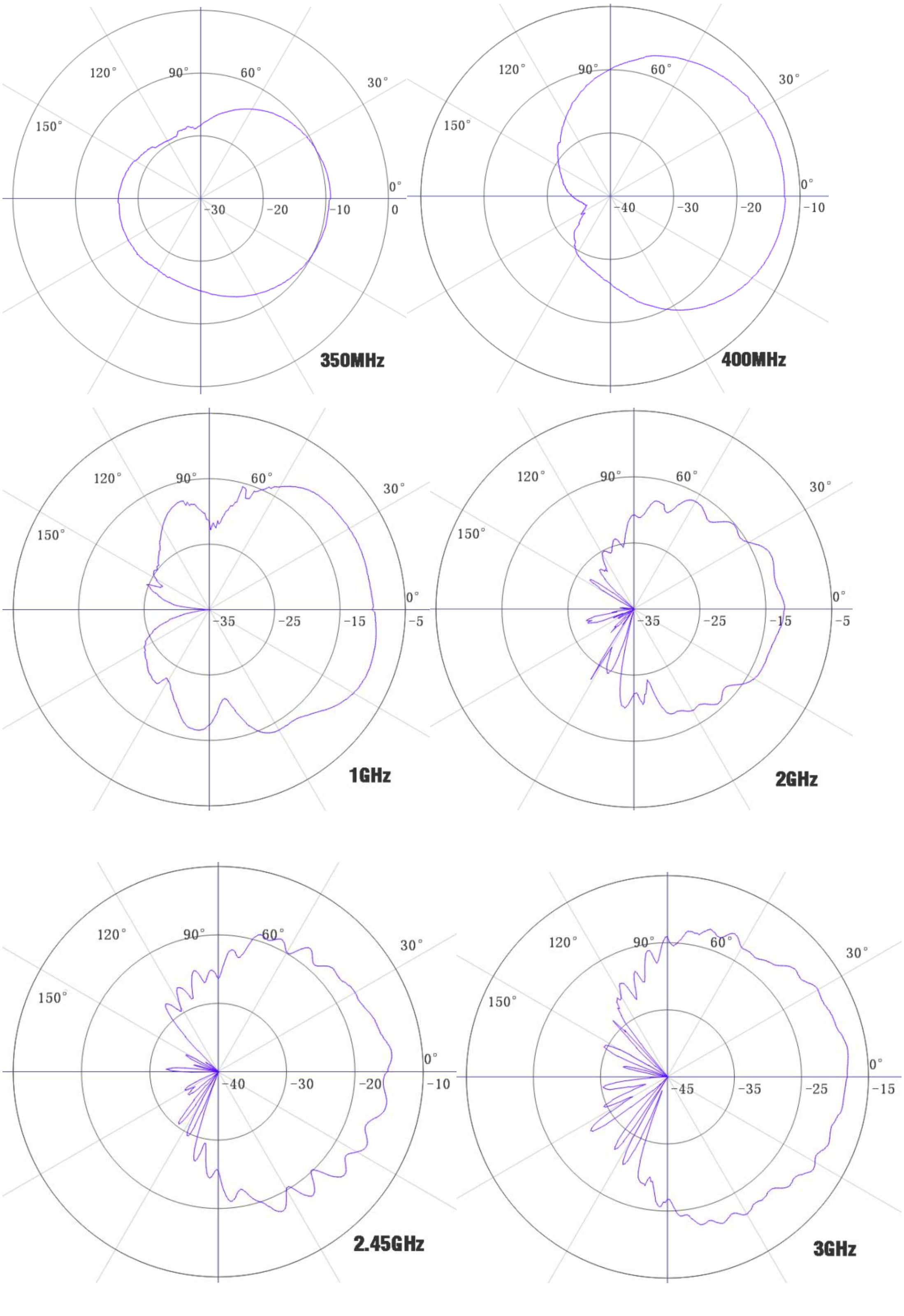


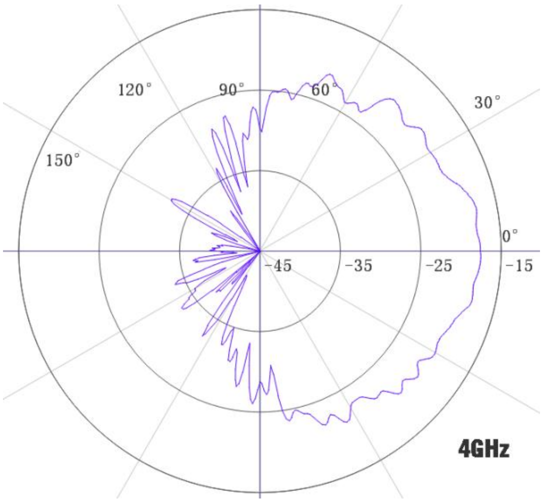
Directional Sensitivity

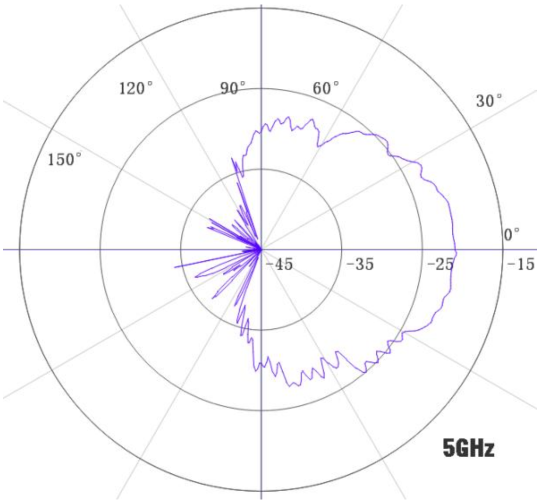
The KC980D can be used for direction finding across the frequency range of 350 MHz to 9 GHz. When held in one hand and rotated along with the user’s body, it exhibits high sensitivity to the direction of the transmitting source, making it suitable for progressive source localization. Within the 350 MHz to 7 GHz range, the antenna maintains good directionality regardless of human presence and is suitable for triangulation. Above 7 GHz, multiple narrow and strong sidelobes appear, and the main lobe may slightly split; therefore, practical experience and judgment are required during use.

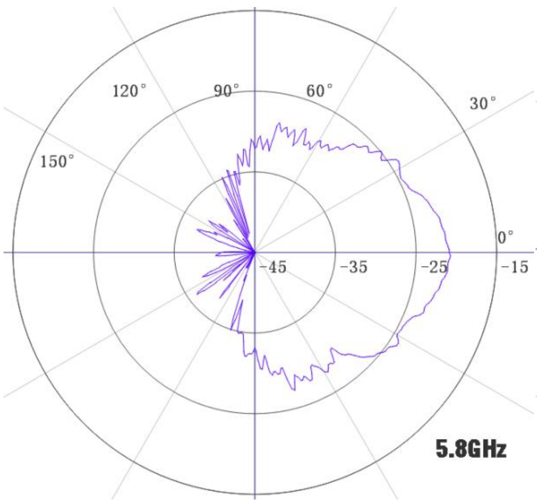
*Test results are provided for reference only, as variations in mounting methods and the distance between the hand and body can affect the radiation pattern. Some curves display minor steps due to the testing system.

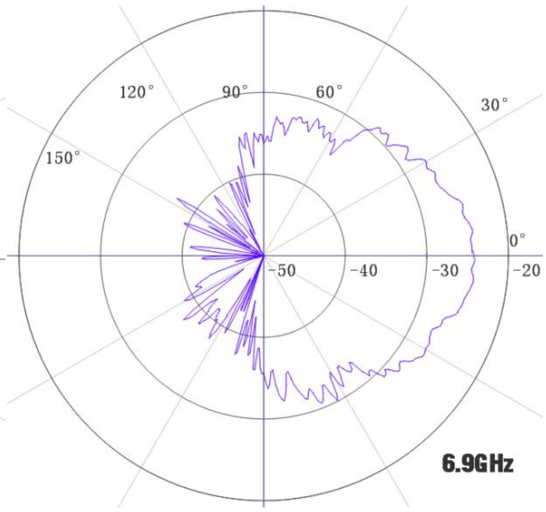
In all diagrams, 0 degrees corresponds to the geometric front; the coordinate radius (gain) is relative and carries no absolute value.

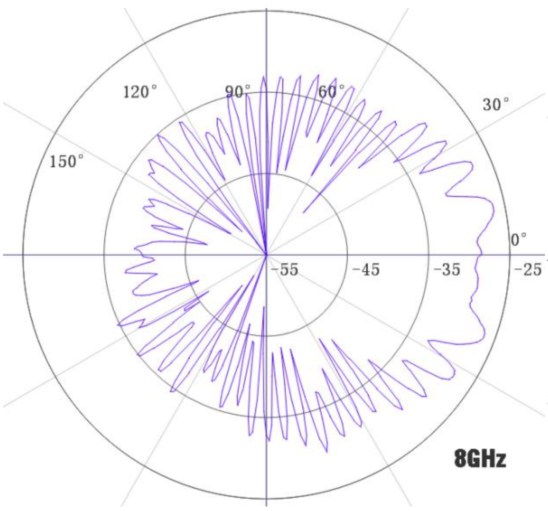


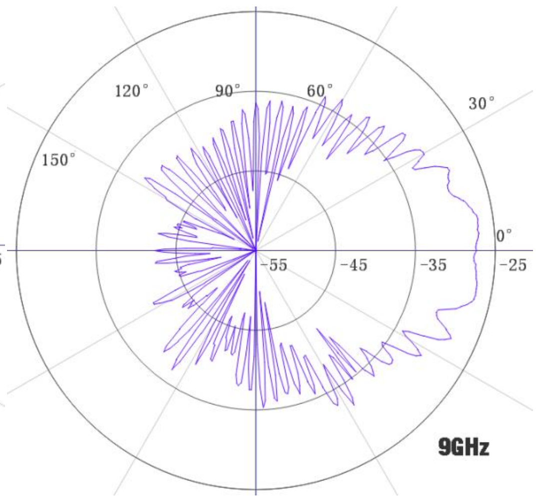

120°
90°
60°
30°
150°
0°
-45
-35
-25
-15
4GHz

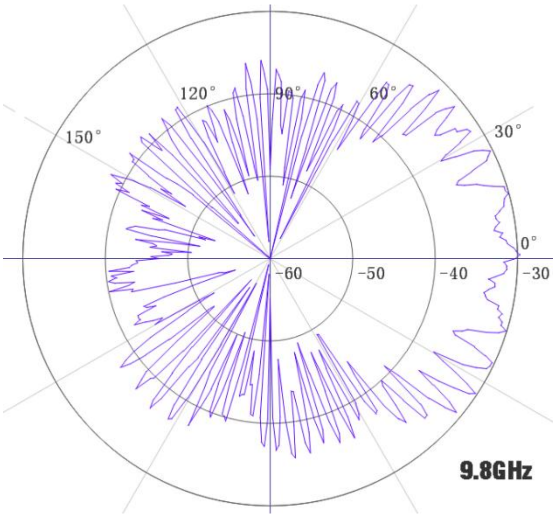

120°
90°
60°
30°
150°
0°
-45
-35
-25
-15
5GHz


120°
90°
60°
30°
150°
0°
-45
-35
-25
-15
5.8GHz

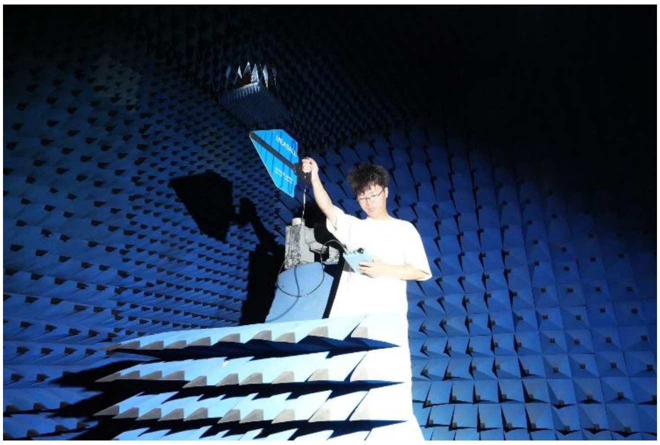

120°
90°
60°
30°
150°
0°
-50
-40
-30
-20
6.9GHz


120°
90°
60°
30°
150°
0°
-55
-45
-35
-25
8GHz


120°
90°
60°
30°
150°
0°
-55
-45
-35
-25
9GHz



The figure below simulates a handheld usage scenario. By comparing the KC980D with standard gain horn antennas and other known references, its gain can be estimated.




Mechanical Parameters

Name	KC980D	Remarks
Dimensions/mm	495×310×25	Excluding cable
Cable Length/m	Internal: approx. 0.45 m; external: approx. 1.35 m	Measured from handle surface
Net Weight/g	660	Including cable
Package Size/mm	600×420×150mm	Each box can hold 2 units
Packaging Gross Weight/kg	2.5kg	When packing 1 unit

Note: Parameters are subject to random variations and are for reference only.

4.Operating Conditions

Operating Temperature: -40 °C to +75 °C

Humidity Range: 0% to 95% (short-term exposure to 100% is acceptable, provided there is no direct water contact)

Water Resistance: After splashing, the antenna must be thoroughly cleaned and dried. Immersion may lead to water ingress into connectors and cables, compromising performance and lifespan; in principle, replacement is recommended.

Wind Resistance: For safety, use is prohibited when wind speed exceeds 20 m/s (equivalent to Beaufort scale 8).

5.Non-handheld Usage

The KC980X is designed primarily for handheld use and is generally not intended for fixed installation unless absolutely necessary. If installed in an outdoor environment that is sheltered from wind and rain, the usage duration should not exceed three days.

The antenna handle features two mounting screw holes. The 3/8-inch screw hole (on the left, the larger one) is used to secure the antenna and can be connected using appropriate photographic clamps. The 1/4-inch screw hole (on the right, the smaller one) is intended for attaching accessories (e.g., a smartphone holder) and is generally not suitable for mounting the antenna itself.

When using the mounting holes, ensure that the orientation of the antenna and handle allows the natural sagging tendency to align with the tightening direction of the bolt. The antenna must not be used in environments subject to vibration.

6.Safety Precautions

1.Avoid contact with live electrical components during use to prevent electric shock.

2.Do not use the antenna outdoors during thunderstorms. If in mountainous or open areas, immediately seek lower ground and lower the antenna.

3.When working at height, ensure the antenna is securely carried to prevent dropping.

4.The antenna has sharp edges; carry it properly to avoid cuts or injury.

5.When traveling by air, comply with all airport and airline safety regulations.

6.The antenna cable must not bear any load. Do not pull the instrument or antenna using the cable.

7.When transporting the equipment, unplug the connector from the device. In environments such as railways, roads, or mechanical workshops, coil the cable around the handle to a suitable length. Do not tie the antenna, instrument, or shoulder strap to the body, as this may cause injury if dragged.

8.Do not use the antenna on a moving vehicle unless absolutely necessary and only when safety can be guaranteed.

7. Disclaimer

To achieve a balance among bandwidth, size, and performance—while keeping the antenna compact and extending its operating range—the KC980X is understandably not comparable to narrowband antennas such as Yagi-Uda antennas. It is not intended to address all challenges in RF research, nor can it meet every user’s expectations regarding appearance or finer details. While we strive to make the product practical, user-friendly, and reliable, there are inevitably areas for improvement. We sincerely welcome constructive feedback and appreciate your understanding and support.

Within the scope permitted by law, the designer, manufacturer, and seller of this product shall under no circumstances be held liable for any damages exceeding the original purchase price. They shall also bear no responsibility for losses related to time, business, inconvenience, profit, misuse, or any form of indirect or consequential damages. The manufacturer’s decision to repair, replace, refund, or reimburse the product’s purchase price shall constitute the sole and exclusive remedy for the user or purchaser. The warranty period defines the manufacturer’s final limit of responsibility for the product.

8. Maintenance

The antenna requires no special maintenance. However, to extend its service life, please observe the following precautions:

1..Avoid collisions, drops, scratches, or excessive pressure.

2.Do not excessively bend the cable, especially at the same spot repeatedly.

3.When connecting the plug, align it carefully and insert gently. Slightly wiggle and rotate slowly only after you feel the center pin enter the socket. Tighten the outer thread using both hands: one hand should hold the rear part of the connector to prevent it from rotating, while the other hand turns the outer sleeve. Avoid twisting the entire connector, as this may damage the cable and the connector itself.

4.Periodically inspect all bolts and tighten them immediately if found loose.

5.A quarterly performance test is recommended. Refer to the "Warranty and Repair" section for model-specific procedures.

6.If the antenna is exposed to rain or moisture, wipe and dry it promptly. Keep drying temperatures below 60 ° C. If the water is dirty, disassemble the antenna, clean it thoroughly, and dry it again. Avoid contact with chemical substances and corrosive environments.

7.If the antenna becomes bent, it may be carefully straightened. However, take care not to apply excessive force, which may break internal solder joints.

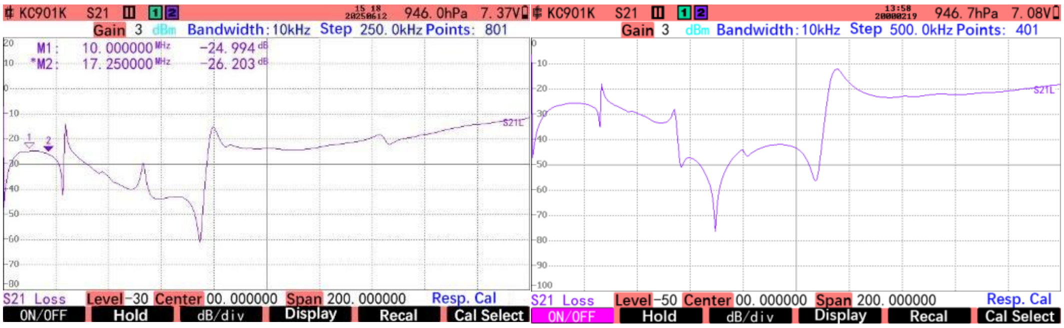
9.Warranty and Repair

The KC980X is considered a consumable device. Our company provides a quality guarantee period and free warranty period of 3 months, covering only damage caused by quality defects.

For antennas used frequently, it is recommended to perform testing every 3 months. Use an ohmmeter to measure the resistance between the connector pin and the shell: KC980A/R/D should show high resistance, while KC980B/C should show low resistance. Except for KC980D, both the pin and the shell should be open circuit to the antenna element (due to protective isolation). For KC980B/C, the two half-rings should exhibit low resistance. The VSWR of KC980B/C should be better than 1.5 within the 50 MHz to 200 MHz range. For KC980D, the VSWR should be better than 2.0 across the 350 MHz to 9 GHz range. KC980A/R cannot be tested by VSWR; its condition can be roughly judged by receiving broadcast radio stations or similar methods. When conditions permit, place two antennas close to each other and observe their mutual coupling. Around 10 MHz, the coupling should be better than -30 dB and there should be a flat region, as shown in the figure below.

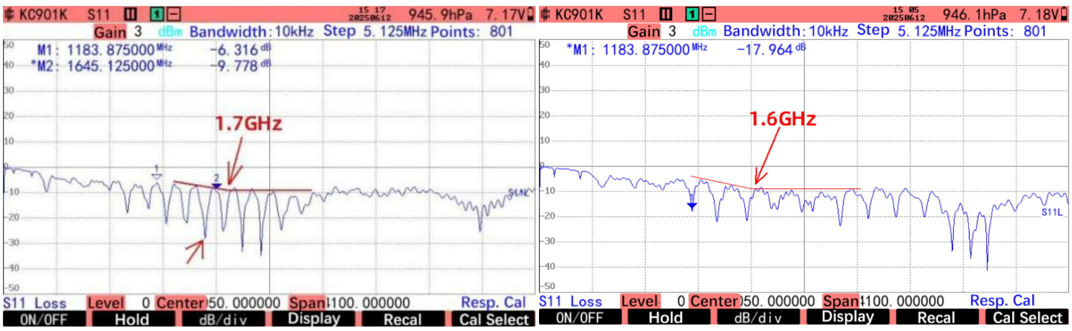
Testing Method

Left image: KC980A; Right image: KC980R



S11 testing also helps check the condition of KC980A/R. The instrument should have a frequency upper limit of at least 2 GHz. As shown below, the S11 curve should drop relatively quickly to -10 dB, with the turning point typically no higher than 2 GHz. The curve should show a negative dip. If the curve is straight and relatively smooth, there may be an open or short circuit. If the S11 dip is not obvious and the attenuation is slow—only dropping to around -10 dB above 2 GHz—there may be a circuit fault.

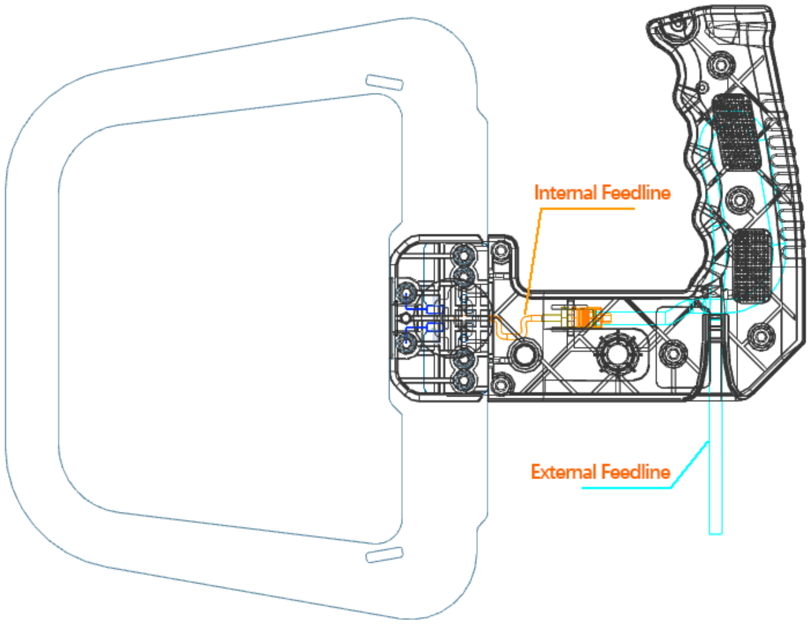
Left image: S11 curve of KC980A; Right image: S11 curve of KC980R.



If the antenna is heavily used or suspected to have issues, inspections should be carried out more frequently.

The antenna’s main components include a printed circuit board or metal loop, internal feedline, external feedline, and the associated connectors. To inspect, disassemble the antenna handle and check for any visible signs of solder joint failures, cracks, or looseness, and address these issues. Remove the internal and external feedlines to perform S21 measurements to verify their integrity. Connect a network analyzer to the RF input on the PCB (applicable for KC980B/C/D models) to evaluate the antenna body’s performance.

The most common issues involve damage to the external cable and connectors. Replacement cable assemblies can be ordered from distributors. For KC980A/B/C/R models, users may also substitute cables themselves, with RG58 recommended. The feedline for KC980D is different; its loss at 10 GHz must be below 2.5 dB, and VSWR should not exceed 1.25, otherwise gain degradation may occur. Low-frequency feedlines must not be used with high-frequency antennas. If the internal feedline or antenna body is damaged, disposal is generally advised. Minor damage that does not affect the copper traces may be repaired either through the distributor (for a fee) or by the user.



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Equipment Logbook

Model: **KC980_____**

Serial Number: Filled in by the user

Commissioning Date: Year Month Day

Date	Summary	Registered by	Remarks

Recommended Sets

Set Name	Set Contents	Usage Frequency	specificities
KC980ABCD (Standard Set)	KC980A	9k~30M	Selected based on recommended frequency for optimal performance
	KC980B	30M~200M	
	KC980C	200M~400M	
	KC980D	400M~9G	
KC980RD (Minimal Set)	KC980R	20k~350M	Minimal carry load and lowest cost
	KC980D	350M~9G	
KC980ASD (Balanced Set)	KC980A	9k~50M	Balanced performance, cost, and portability
	KC980S	50M~350M	
	KC980D	350M~9G	

KC980X