MIPRO®
MICROPHONE PROFESSIONALS

Antenna Systems **2016**

Optimal Reception & Signal Quality

Contents

AT Series Antennas

Profile

The design & implementation of antennas are important to improve signal quality, enhance reception, and reduce dropouts during installations of transmitters and receivers.

AT-20 & AT-80 antennas were introduced in 1997. AT-90T/R introduced in 2005 and in 2008, second generation of AT-90.

AT-90W & AT-90T were added in 2011 to accommodate wideband receivers for both transmitting and receiving application with varied directionality.

In 2012, the reliable AT-100 wideband circularly polarized antenna was introduced.

In 2014, improved models AT-70Wa, AT-90Wa and AT-100a antennas were added. Each has two input connectors. “TX/RX” connector can be connected to a transmitter or receiver. “RX” connector (cannot be connected to a transmitter) has a built-in 0-12 dB ± 1 dB gain controllable booster and thus provides extended reception range and compensates the signal loss of coaxial cable to improve reception range and single quality.

MIPRO has a complete range of professional antennas, antenna dividers, antenna combiners, antenna boosters and other antenna systems that ensure maximum wireless transmission performance of MIPRO wireless microphone systems as well as systems from other leading brands.

AT-10 Whip Antenna

The AT-10 is a 1/4 wave single rod antenna featuring wider band, omni-directional reception and a 50 Ω impedance. Directly mounts on the antenna connectors of a receiver to become a monopole antenna for adequate sensitivity and operating range.

AT-20 Coaxial Antenna

The AT-20 is a 1/2 wave coaxial antenna that functions like a dipole antenna, featuring 2.15 dBi gain, 50 Ω impedance, and omni-directional reception. Directly mounts on the antenna connectors of a receiver for adequate sensitivity and operating range.

AT-70 Ground Plane Antenna

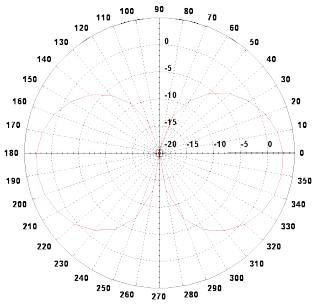
The AT-70 is a UHF antenna that stabilizes signal receiving and prevents impedance interference from nearby objects because its vertical 1/4 wave antenna is surrounded by horizontal antennas set at a 45° degree angle, causing a 1/2 wave dipole antenna effect. The AT-70 has higher positive gain than a 1/4 wave single rod antenna and smoother impedance within the 620 – 960 MHz band. Therefore, the length of the antenna does not need to be adjusted while receiving and the antenna is able to reduce interference by filtering signals outside the optimal range. Its 50 Ω impedance matches with regular 50 Ω impedance antenna cables. It is suggested it should be installed at the central location of a hall, on the wall, inverted on a ceiling, or mounted on a tripod (MS-30).

AT-70Wa Wideband Transmitting and Receiving Omni-directional Antenna

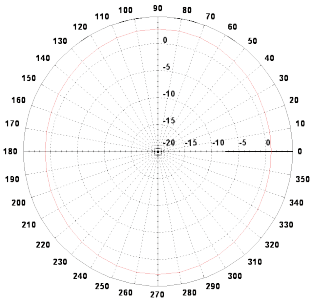
Features

1. AT-70Wa is a bi-functional omni-directional antenna for professional receiving and transmitting applications. It is optimized for 470 – 1000 MHz, which is fully compatible with US and EU new telecom regulations. It has a 2 – 4 dBi gain which is ideal for any specific installation requiring full directionality. It can be easily distinguished by its new “W-Shape” appearance.
2. The AT-70Wa has two input connectors: “TX/RX” connector can be connected to a transmitter or receiver, however, connection to a short coaxial cable is recommended when connected to a receiver. “RX” connector (cannot be connected to a transmitter) has a built-in 0 – 12 dB ± 1 dB gain adjustable booster, and thus provides extended reception range and compensates the signal loss of coaxial cable to improve reception range and signal quality.
3. The AT-70Wa offers users the options of transmitting or receiving based on their actual application. The power of gain controllable booster can be provided by a MIPRO AD-708 antenna divider or any MIPRO ACT Series receivers which provides bias by adding an adjustor on their antenna connectors.

Antenna Pattern



Vertical



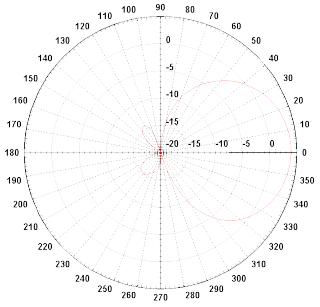
Horizontal

AT-90Wa Wideband Transmitting and Receiving Log Antenna

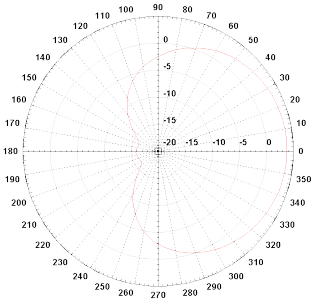
Features

1. The AT-90Wa is a bi-functional log antenna for professional receiving and transmitting applications. Optimized for 470 – 1000 MHz, it is compatible with US and EU new telecom regulations. It has a 4 – 6 dBi gain which is ideal for any installation requiring specific directionality. The wideband ACT-90Wa can be easily distinguished from its predecessor, the AT-90, by its new “W-Shaped” design.
2. The AT-90Wa has two input connectors: “TX/RX” connector can be connected to a transmitter or receiver, however, connection to a short coaxial cable is recommended when connected to a receiver. “RX” connector (cannot be connected to a transmitter) has a built-in 0 – 12 dB ± 1 dB gain adjustable booster and thus provides extended reception range and compensates the signal loss of coaxial cable to improve reception range and signal quality.
3. The power of gain controllable booster can be provided by a MIPRO AD-708 antenna divider or any MIPRO ACT Series receivers which provides bias by adding an adjustor on their antenna connectors.

Antenna Pattern



Vertical



Horizontal

AT-100a Wideband Circularly Polarized Antenna

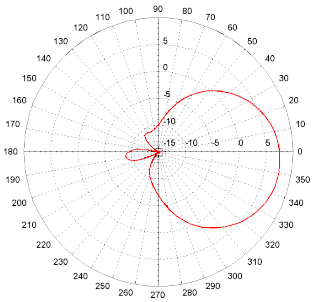
Patents :
Taiwan Design D150421
China Design ZL201230113513.5

Features

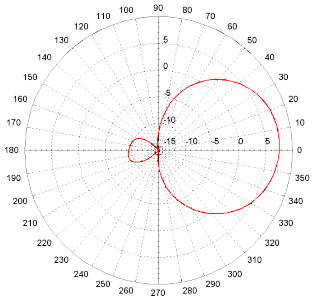
1. Patented in Multiple Countries. Distinctive Appearance: Providing an optimized solution for both transmitting and receiving RF signals throughout the UHF bandwidth, the AT-100a has a distinctive appearance and is patented in multiple countries.
2. Main Features: The front area is the main focus of antenna direction for either vertical or horizontal polarization. The AT-100a circularly polarized antenna can effectively reduce the polarization loss of the antenna to improve signal strength. It is the optimum solution for the 470 – 1000 MHz bandwidth with 6 – 8 dBi antenna gain and is certified to meet the latest CE/FCC new telecom regulations.
3. Results: The AT-100a is an ideal antenna system for utmost signal stability. Antenna features affect transmission range, stability and anti-interference performance. Therefore, the antenna is a vital component in any system installation, especially in complicated and demanding RF environments for wireless microphones and wireless monitoring systems. It greatly improves signal stability and reduces interference and signal drop-outs caused by polarization problems.
4. Built-in Connectors: The AT-100a has two built-in signal connectors: “TX/RX” connector can be connected to a transmitter or receiver, however, connection to a short coaxial cable is recommended when connected to a receiver. “RX” connector (cannot be connected to a transmitter) has a built-in 0 – 12 dB ± 1 dB gain adjustable booster and thus provides extended reception range and compensates the signal loss of coaxial cable to improve reception range and signal quality.

   The power of gain controllable booster can be provided by a MIPRO AD-708 antenna divider or any MIPRO ACT Series receivers which provides bias by adding an adjustor on their antenna connectors.
5. Waterproof: Waterproof and weather resistant, the AT-100a is Ideal for both outdoor and indoor applications.

Antenna Pattern



Vertical



Horizontal

AT Series Antennas

Specifications

Model	AT-10	AT-20	AT-70	AT-70Wa	AT-90Wa	AT-100a
Name	Whip Antenna	Coaxial Antenna	Ground Plane Antenna	Wideband Transmitting and Receiving Omni-directional Antenna	Wideband Transmitting and Receiving Log Antenna	Wideband Circularly Polarized Antenna
Type	Receiver antenna		Additional antenna			
Feature	A 1/4 wave single rod antenna mounts on the receiver to become a monopole antenna.	A 1/2 wave coaxial omni-directional antenna.	A 1/4 wave single rod antenna combines three ground plane antennas to become a 1/2 wave dipole omni-directional antenna.	Wideband omni-directional antenna.	Wideband log antenna.	The front area is the main focus of antenna direction for either vertical or horizontal olarization.
Frequency Range	UHF 620 – 960 MHz			UHF 470 – 1000 MHz		
Antenna Gain	2.15 dBi			2 – 4 dBi	4 – 6 dBi	6 – 8 dBi
Built-in Booster	N/A			Built-in 0 – 12 dB gain adjustable booster		
Impedance	50 Ω					
Connector	TNC male			TNC female × 2		
Power Supply	N/A			8 – 15 V DC bias is required for RX connector		
Dimensions	Refer to actual product		150 × 165 mm / 5.9 × 6.5 " (Ø × L)	120 × 261 × 32 mm / 4.7 × 10.3 × 1.3 " (W × H × D)	319 × 270× 25 mm / 12.5 × 10.6 × 1 " (W × H × D)	350 × 350 × 225 mm / 13.8 × 13.8 × 8.8 " (W × H × D)
Weight	Refer to actual product		Approx. 142 g / 5 oz	Approx. 200 g / 7 oz	Approx. 430 g / 15.2 oz	Approx. 1.5 kg / 3.3 lbs
Note	Refer to actual product in the event of product description discrepancy.					

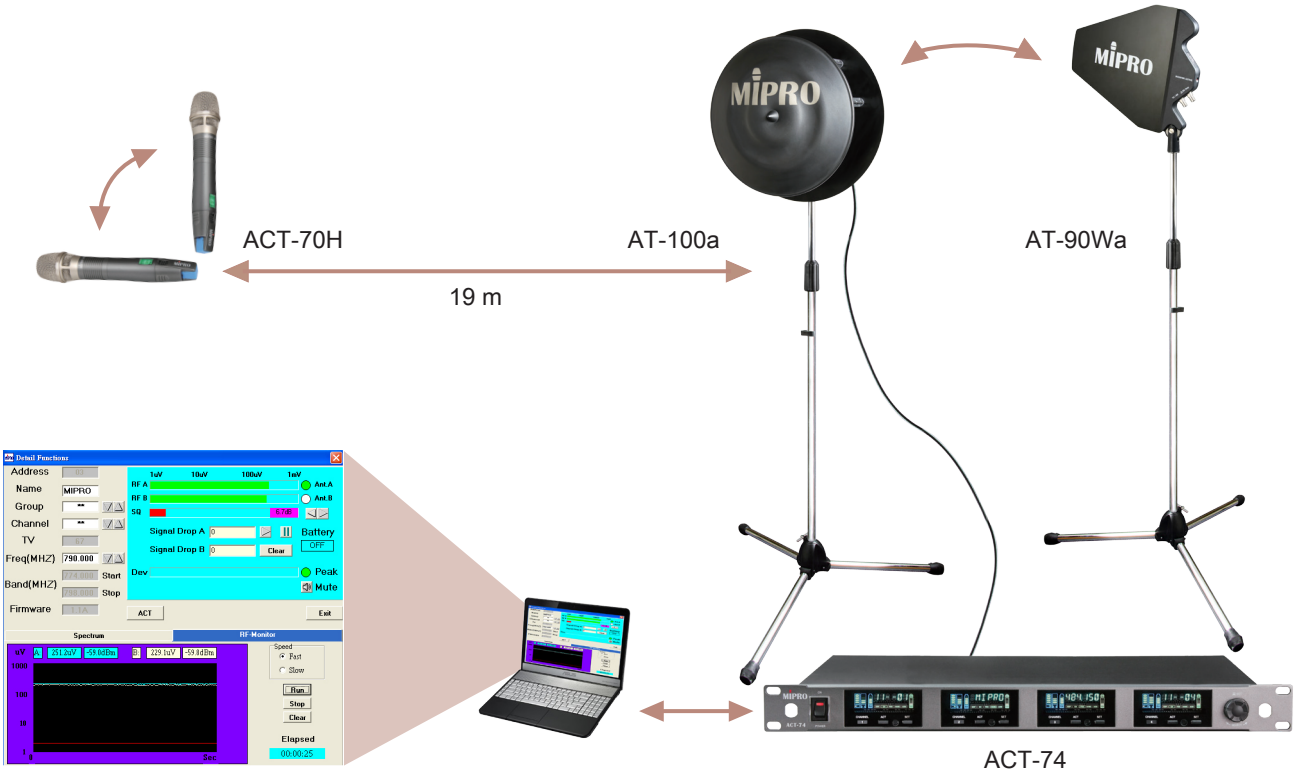
MS-90 Wall Mount

Wall mount for AT-70Wa, AT-90Wa, AT-100a.

AT-100a and AT-90Wa (or other directional antenna) Comparison Chart

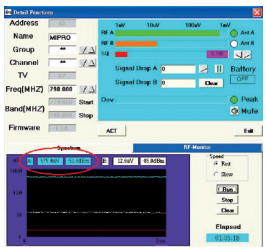
1. Static Measurement of Antenna Polarization Loss:

These antenna observation statistics were taken of the MIPRO RCS2.Net 2.6 monitoring software connected to an ACT-74 receiver with the signal transmitted by an ACT-70H handheld transmitter. The AT-100a and AT-90Wa directional antennas were connected to the same antenna input port at the receiver, measuring differences to antenna polarization characteristics as shown below:



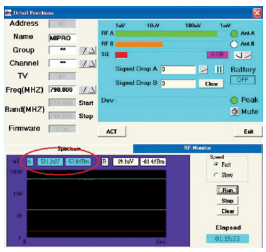
AT-100a Measurement Result

Vertical Position



Horizontal Position

AT-90Wa Measurement Result



Vertical Position

Horizontal Position

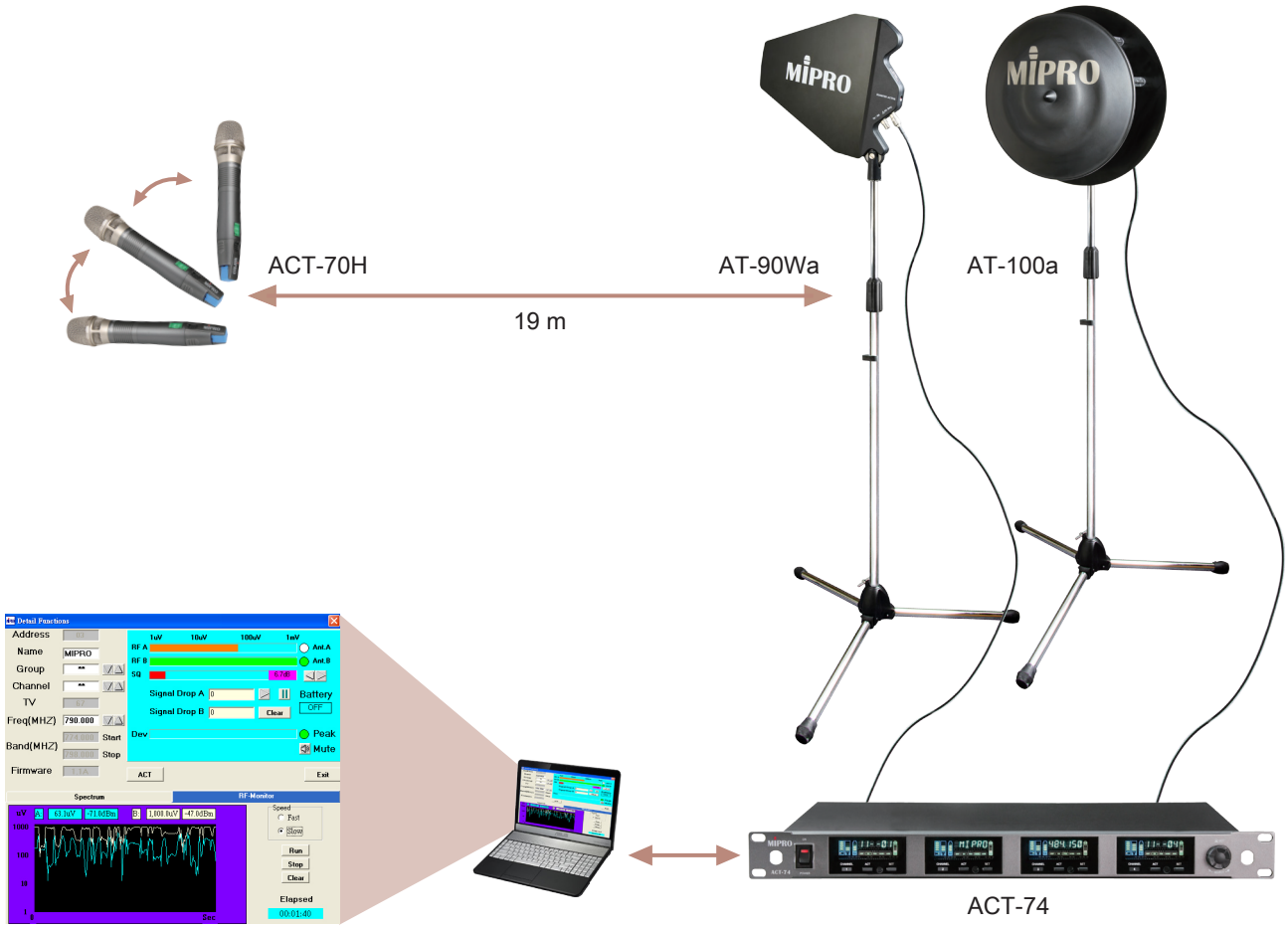
Measurement Result Clearly Indicated

Model	RF Received Signal Strength (dBm)	
	Vertical Position of Microphone	Horizontal Position of Microphone
AT-100a	-51.8	-51.8
AT-90Wa	-53.0	-72.6

Due to the low polarization loss of the AT-100a circularly-polarized antenna, the received signal strengths are almost the same and stable when the transmitting microphone is in both vertical and horizontal positions. On the contrary, due to the large polarization loss of the linearly-polarized AT-90Wa antenna, the received signal strengths indicate a difference of 19.6 dB when the transmitting microphone is in vertical versus horizontal positions.

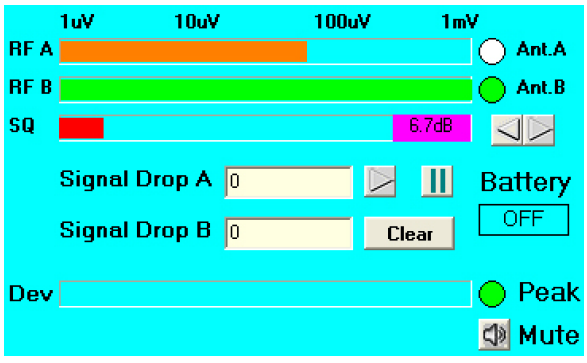
2. Antenna Dynamic Measurements with Polarization Loss Experiments

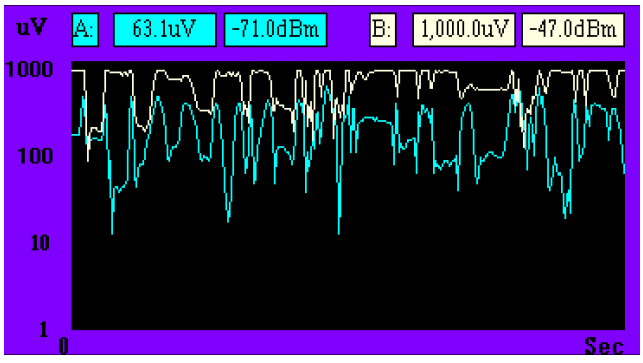
These antenna observation statistics were taken of the MIPRO RCS2.Net 2.6 monitoring software connected to an ACT-74 receiver with the signal transmitted by an ACT-70H handheld transmitter. The AT-100a and AT-90Wa were connected to the ACT-74 receiver input "B" and "A" terminals, respectively. The measuring differences to antenna polarization characteristics are as shown below:



Test Result

Below diagram clearly indicated that AT-100a circularly polarized antenna has improved performance than AT-90Wa in terms of received signal strengths and signal stability.

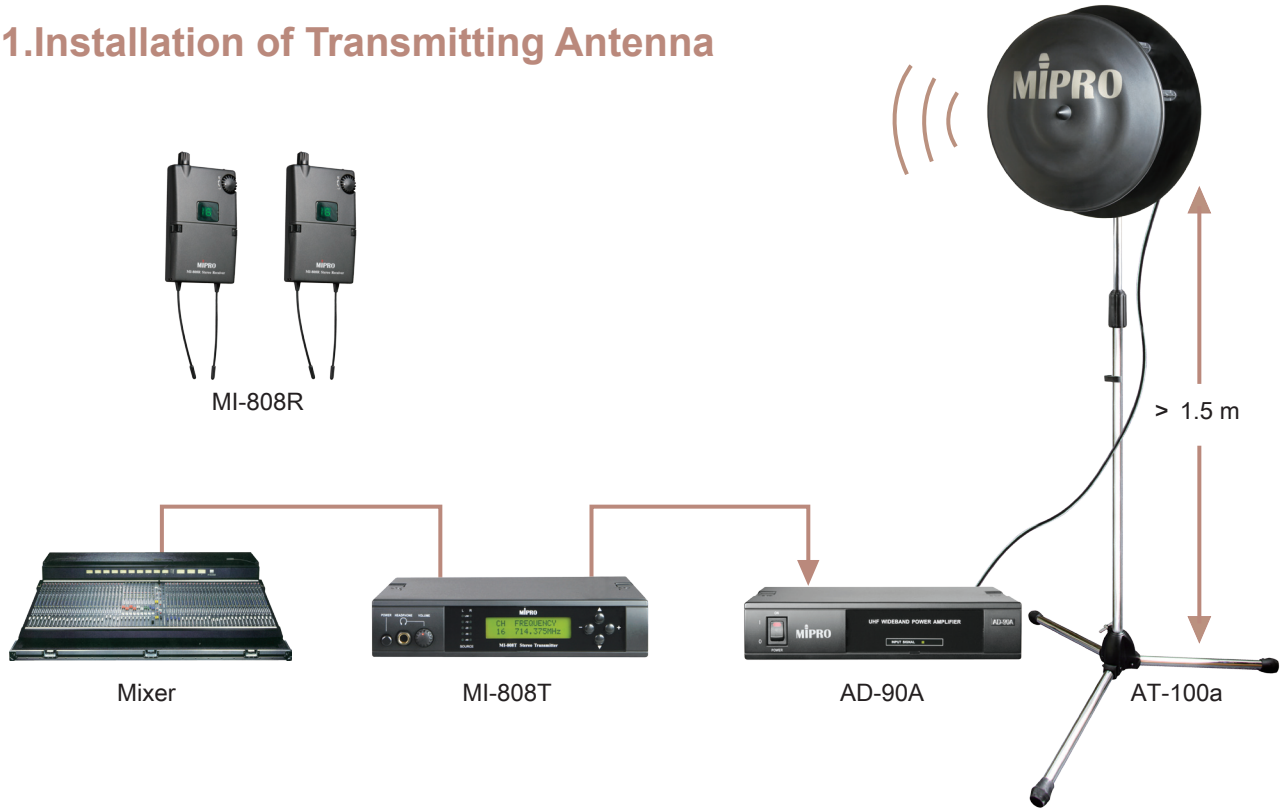




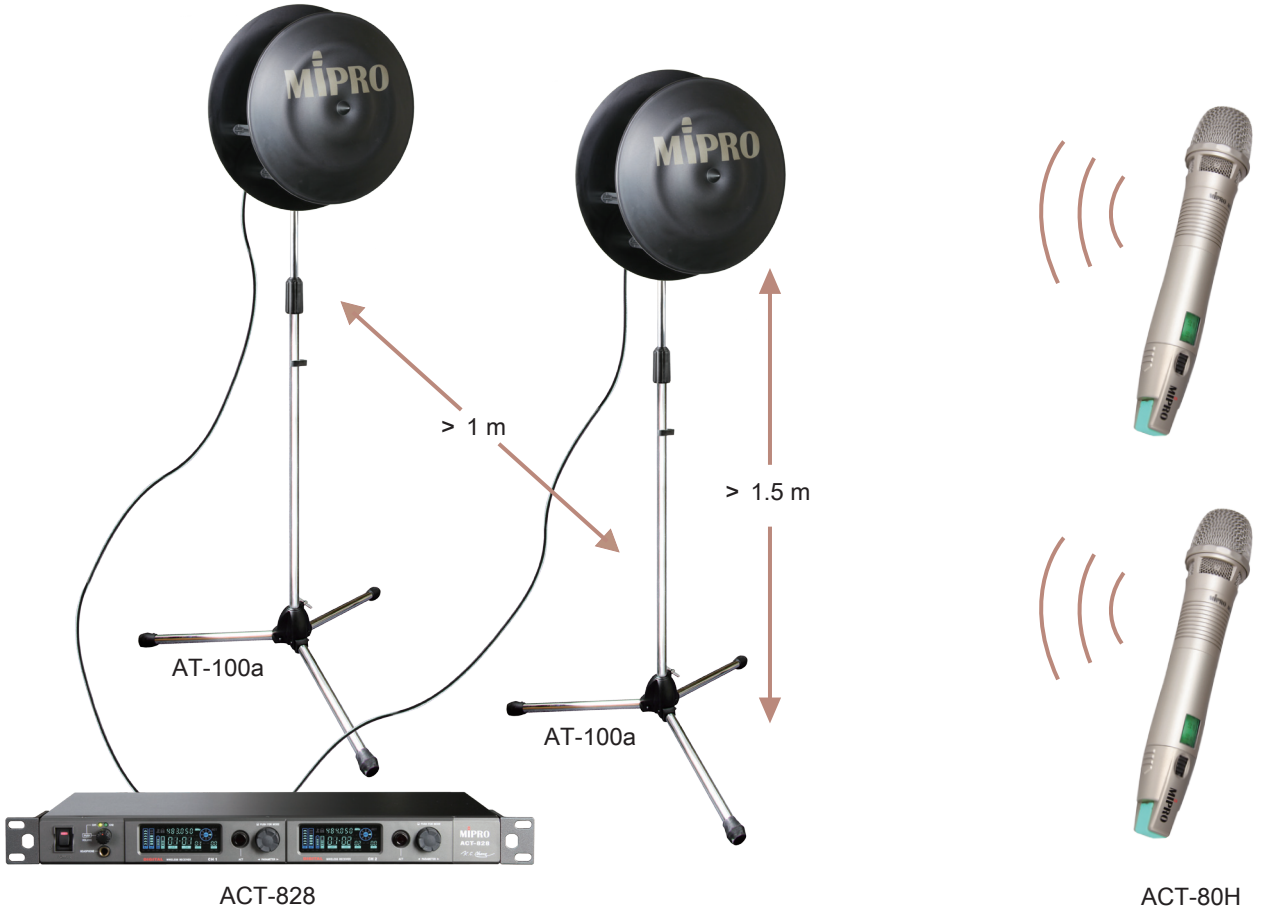
Computer Monitoring Graphs

Correct Antenna Installations

1.Installation of Transmitting Antenna



2.Installation of Receiving Antenna for Directional Stage Performances



Installed Venues and Mounting Methods

Stages

Convenient MS-30 mic stand

Ceiling Mounting-Vertical Position

Convenient MS-90 ceiling mount

Wall Mounting-Horizontal Position

Convenient MS-90 wall mount

Outdoor Installation

Convenient MS-90 mount

Built-in Booster Usage

1. Optimal signal quality through proper booster usage

Coaxial cable loss reduces signal receiving distance and stability. A booster must be connected to improve the antenna gain in order to compensate for this signal loss. However, too much antenna gain in the booster causes unnecessary interference from intermodulation distortion, resulting in deterioration of the received signal quality.

The AT-100a has two connectors. The one marked RX (receiver only) has a built-in 0 – 12 dB ± 1 dB gain adjustable booster, which can be used effectively to compensate for the signal loss from extended cable transmission.

2. Selection of appropriate cable to match the booster

Please refer to the Technical Knowledge section of this brochure.

AD Series Antenna Dividers

Profile

An antenna divider allows up to four MIPRO UHF diversity receivers to operate from a single pair of antennas or multiple antennas from a single transmitter, greatly reducing antenna clutter in multi-system installations and maintains clean signals with minimal distortion.

AD-20 & AD-80 dividers were introduced in 1997 & 1998. AD-707 was introduced in 2002 and AD-707a in 2011 to accommodate wideband receivers. MIPRO antenna dividers have built booster and latest high dynamic-range components and wideband microstrip circuit design, it features ultra-low intermodulation distortion, and eliminates spurious interference in multiple system usage.

Introduced in 2014, AD-708 is equipped with an automatic signal loss detector. It is designed to work with an MPB-30 gain-controllable antenna booster. It can control and compensate for the signal loss of antenna cables precisely and automatically in order to avoid the intermodulation caused by the higher gain supply from the booster and solve antenna systems installation issues to achieve optimal receiving performance.

AD-707a UHF Wideband 4-channel Antenna Divider

Features

1. Optimized for the 470 – 850 MHz carrier frequency range, the AD-707a is fully compatible with US and EU telecom regulations.
2. Allows 2 – 4 sets of UHF diversity receivers to operate from a pair of antennas, greatly simplifying antenna installation and increasing reception range and efficiency.
3. Built with the latest high dynamic-range components and wideband microstrip circuit design, it features ultra-low intermodulation distortion, and eliminates spurious interference in multiple system usage. System output gain approximately equals to 1.
4. Output connectors provide bias for a ground plane antenna with antenna booster and a wideband receiving log antenna with built-in booster.
5. It has 2 sets of 4-channel antenna output connectors for direct connection to 4 sets of diversity receivers.
6. It provides 2 sets of antenna input and output connectors.
7. The output connector can be linked to the input connector of another antenna divider.
8. Booster power indicators assist with identifying the booster linkage.

AD Series Antenna Dividers

AD-708 Wideband 4-channel Auto Gain-Control Antenna Divider

Features

1. Equipped with an automatic signal loss detector, the AD-708 is designed to work with an MPB-30 gain-controllable antenna booster. It can control and compensate for the signal loss of antenna cables precisely and automatically in order to avoid the intermodulation caused by the higher gain supply from the booster.
2. It shares the same features with the AD-707a wideband antenna divider and is compatible with the MPB-20 to compensate for the signal loss of cables, but cannot change the gain of the boosters themselves.
3. The AD-708 is housed in an EIA-Standard 1U metal case with a bright LED indicator to identify antenna cable signal loss as well as the booster compensation status.
4. It makes it fast and easy to install antenna systems without worrying about the calculations of signal loss of antennas and cables or booster specifications.

AD-702 Antenna Auto Gain Controller

Features

1. Automatically detects the signal loss between the built-in booster of the antenna and AD-702 itself. It can control and compensate for the signal loss of antenna cables precisely and automatically in order to avoid the intermodulation caused by the higher gain supply from the booster.
2. A bright LED indicator to identify antenna cable signal loss as well as the booster compensation status.
3. Its aluminum casing provides superb heat dissipation characteristics and constant stability.
4. It makes it fast and easy to install antenna systems without worrying about the calculations of signal loss of antennas and cables or booster specifications.

AD Series Antenna Dividers

Specifications

Model	AD-707a	AD-708	AD-702
Name	UHF Wideband 4-channel Antenna Divider	Wideband 4-channel Auto Gain-Control Antenna Divider	Antenna Auto Gain Controller
Frequency Range	UHF 470 – 850 MHz		
Input / Output Gain	1 dB ± 1 dB		-1 dB ± 0.5 dB
Input / Output Connector	2 sets of 1-to-4 active divider outputs; 2 sets of 1-to-1 active outputs. TNC female. Impedance 50 Ω		1-to-1 input/output TNC female. Impedance 50 Ω
Antenna Input Power Supply	Antenna A/B input port supplies bias 8.3 V DC, 230 mA max. to booster		Bias of the power supply (8 – 15 V DC)
Signal Loss Detection	N/A	Detect the signal loss of the cables and control the gain level of the gain adjustable booster.	
Power Supply	12 – 15 V DC		8 – 15 V DC
Dimensions (W × H × D)	420 × 44 × 190 mm / 16.5 × 1.7 × 7.5 "	420 × 44 × 180 mm / 16.5 × 1.7 × 7.1 "	90 × 25 × 55 mm / 3.5 × 1 × 2.2 "
Net Weight	Approx. 1.5 kg / 3.3 lbs	Approx. 1.5 kg / 3.3 lbs	Approx. 100 g / 3.5 oz
Note	Refer to actual product in the event of product description discrepancy.		

MPB Series Antenna Boosters

Profile

MIPRO antenna boosters amplify the antenna signals for increasing the RF signal strength. It increases transmission distance and maintains signal stability.

AB-20 & AB-80 boosters were introduced in 1997 and have 13 dB gain. AD-80B was introduced in 1999 and AD-707B in 2002. AT-70B wideband booster was introduced in 2005.

MPB-20 booster was introduced in 2012. With an external power supply, the MPB-20 provides power independently to the internal antenna booster. This allows complicated external antenna dividing systems to work efficiently and independently so that longer antenna cables can be connected with more boosters.

MPB-30 booster was introduced in 2014. It is compatible with the AD-708 Auto Gain-Control Antenna Divider or AD-702 Antenna Auto Gain Controller to detect and automatically compensate for the signal loss of cables to ensure stable signals transmission.

MPB-20 Antenna Booster with Built-in Power Supply

Features

1. Optimized in the 470 – 960 MHz frequency range, the MPB-20 offers 13 dB gain to compensate for signal loss due to long antenna cables, thereby enhancing signal stability and increasing reception range.
2. With an external power supply, the MPB-20 provides power independently to the internal antenna booster. This allows complicated external antenna dividing systems to work efficiently and independently so that longer antenna cables can be connected with more boosters.
3. Without an external power supply, the MPB-20 can work properly on the 8 V DC power provided by MIPRO ACT receivers to offer a stable 13 dB gain.
4. Its aluminum casing provides superb heat dissipation characteristics and a constant output voltage of 8 V DC.

MPB-30 Gain-Controllable Antenna Booster

Features

1. Optimized in the 470 – 960 MHz frequency range, it works with the AD-708 antenna divider to detect and automatically compensate for the signal loss of cables by controlling the built-in variable 0 – 14dB ± 1dB gain.
2. With an external power supply, the MPB-30 provides power independently to the internal antenna booster. This allows complicated external antenna dividing systems to work efficiently and independently so that longer antenna cables can be connected with more boosters.
3. Without an external power supply, the MPB-30 works by the 8V DC power provided from MIPRO ACT Series receivers to ensure normal operation.
4. Its aluminum casing provides superb heat dissipation characteristics and a constant output voltage of 8 V DC.

Specifications

Model	MPB-20	MPB-30
Name	UHF Antenna Booster	Gain-Controllable Antenna Booster
Frequency Range	UHF 470 – 960 MHz	
Gain	Fixed 13 ± 1 dB	Variable 0 – 14 dB ± 1 dB
Input / Output Connector	1-to-1 TNC. Impedance 50 Ω	
Input Power	12 – 24 V DC / 350 mA	
Regulated Power Output	8 V DC / 250 mA	
Dimensions (W × H × D)	90 × 25 × 55 mm / 3.5 × 1 × 2.2 "	
Net Weight	Approx. 100 g / 3.5 oz	
Note	Refer to actual product in the event of product description discrepancy.	

AD Series Antenna Combiners

Profile

An antenna combiner allows up to four MIPRO wireless transmitters to use a single antenna. The unit combines four wireless transmitters to a single antenna, reducing stage clutter and improving intermodulation distortion performance. Ideal for professional stages.

AD-808 was introduced in 2005 and is compatible with up to 4 MIPRO MI-808T transmitters. Input signal indicator (threshold above +6 dBm). Maximum RF input power +20 dBm (100 mW). Ideal intermodulation characteristics (3rd order IM < -57 dBc under full band performance +15 dBm two-tone test).

The AD-12 was introduced in 2005 and can either divide a RF signal into 2 signal outputs or combine 2 signals into 1 signal output. Simultaneously, it transmits bias voltage to afterward boosters. The AD-12 adapts an isolated grounding design to avoid power noise from multi-receiver operation.

AD-808 UHF 4-channel Active Antenna Combiner

Features

1. Wideband frequency range from 470 – 960 MHz.
2. Operates with up to 4 transmitters.
3. Input signal indicator (threshold above +6 dBm).
4. Maximum RF input power +20 dBm (100 mW).
5. Ideal intermodulation characteristics (3rd order IM<-57 dBc under full band performance +15 dBm two-tone test).

AD-12 Passive Antenna Divider / Combiner

Features

1. The AD-12 can either divide a RF signal into 2 signal outputs or combine 2 signals into 1 signal output. Simultaneously, it transmits bias voltage to the boosters. The AD-12 is an ideal accessory when setting up antenna systems.
2. The AD-12 utilizes an isolated grounding design to avoid electrical noise from multi-receiver operations.

Specifications

Model	AD-808	AD-12
Name	UHF 4-channel Active Antenna Combiner	Passive Antenna Divider / Combiner
Features	The AD-808 combines up to 4 signal outputs into one signal output via a pair of antennas and greatly eliminates the mutual modulation of the signals.	The AD-12 can either divide a RF signal into 2 signal outputs or combine 2 signals into 1 signal output. Simultaneously, it transmits bias voltage to the afterward boosters.
Frequency Range	UHF 470 – 960 MHz	UHF 470 – 1000 MHz
Gain	0 dB ± 2 dB	Attenuation 3.5 dB (typ.)
Max. RF Input Power	20 dBm (100 mW)	30 dBm (1 W)
Inter-modulation Distortion	< -57 dBc	N/A
Input Connector	TNC female × 4	TNC female × 1
Output Connector	TNC female × 1	TNC female × 2
System Impedance	50 Ω	
Dimensions (W × H × D)	210 × 44 × 206 mm / 8.3 × 1.7 × 8.1 "	90.3 × 25 × 55.4 mm / 3.5 × 1 × 2.2 "
Net Weight	Approx. 1.1 kg / 2.4 lbs	Approx. 105 g / 3.7 oz
Note	Refer to actual product in the event of product description discrepancy.	

AD-90S UHF Wideband Power Splitter

Profile

Introduced in 2006, the AD-90S is a UHF 4-channel power antenna splitter with a maximum output level of +26 dBm (0.4 W), allowing one transmitter to connect to 4 transmitting antennas.

AD-90S with a maximum output level of +26 dBm (0.4 W) primarily operates with 4 MI-909T/MI-808T in-ear monitoring transmitters or 4 MT-92A wireless interlinking transmitters to send signals through 4 channels with reliable signal transmission and larger signal coverage in multiple directions.

Each channel of the AD-90S can be connected to an AD-90A wideband power amplifier to increase signal output power to +30 dBm (1W) and transmission range when the antenna is installed in complex terrain or a large building with many partitions.

AD-90S UHF 4-channel Wideband Power Splitter

Features

1. The AD-90S is a UHF 4-channel power antenna splitter with a maximum output level of +26 dBm (0.4 W), allowing one transmitter to connect to 4 transmitting antennas.
2. Primarily operates with 4 MI-909T/MI-808T in-ear monitoring transmitters or 4 MT-92A wireless interlinking transmitters to send signals through 4 channels with reliable signal transmission and larger signal coverage in multiple directions. Note that the AD-90S is not designed for receivers.
3. Each channel of the AD-90S can be connected to an AD-90A UHF wideband power amplifier to increase signal output power and transmission range when the antenna is installed in complex terrain or a large building with many partitions.

AD-90S UHF Wideband Power Splitter

Specifications

Model	AD-90S
Name	UHF Wideband Power Splitter
Frequency Range	UHF 470 – 960 MHz
System Gain	0 – 2 dB
Connector	TNC female (1 input, 4 output)
Max. RF Output Power	26 dBm
Power Supply	12 – 15 V DC
Transmitter	MI-909T / MI-808T IEM stereo transmitters, MT-92A interlinking transmitter
Dimensions (W × H × D)	210 × 44 × 206 mm / 8.3 × 1.7 × 8.1 "
Net Weight	Approx. 1.1 kg / 2.4 lbs
Note	Refer to actual product in the event of product description discrepancy.

AD-90A UHF Wideband High Power Amplifier

Profile

Introduced in 2006, AD-90A was designed to boost signal strength for MI-909T, MI-808T, MT-92A transmitters and AD-90S splitter. The AD-90A with maximum output power of +30 dBm (1 W) is designed ideally for maximum transmission. When connected to AT-70Wa, AT-90Wa and AT-100a external antennas can drastically boost signal strength for longer signal transmission distance, reduce signal dropouts for reliable RF reception quality in extremely complicated RF environments. Ideally suited for large outdoor installation sites requiring wireless transmission to remote powered active speakers.

AD-90A UHF Wideband High Power Amplifier

Features

1. The AD-90A is a professional UHF 470 – 960 MHz wideband power amplifier with maximum output power of +30 dBm (1 W).
2. The AD-90A is designed to operate with a MIPRO MI-909T/MI-808T stereo transmitter, a MT-92A wireless linking transmitter, and an AD-90S UHF wideband power splitter as an end-amplifier to boost signal strength for longer signal transmission distance and reduce signal dropout in extremely complicated environments.
3. Ideally suited for large outdoor installation sites requiring wireless transmission to remote powered active speakers.
4. The AD-90A's output can be connected to an AT-90W UHF wideband antenna to complete a highly efficient long distance transmission.

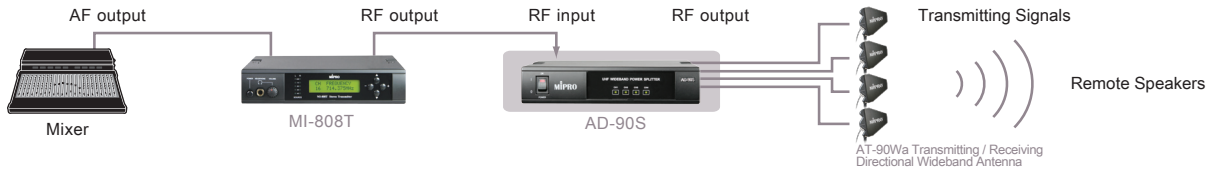
Specifications

Model	AD-90A
Name	UHF Wideband High Power Amplifier
Frequency Range	UHF 470 – 960 MHz
System Gain	8 ± 1 dB
Connector	TNC female (1 input, 1 output)
Max. RF Output Power	1 W
Power Supply	12 – 15 V DC
Transmitter	MI-909T / MI-808T IEM stereo transmitters, AD-90S wideband power splitter, MT-92A interlinking transmitter
Dimensions (W × H × D)	210 × 44 × 206 mm / 8.3 × 1.7 × 8.1 "
Net Weight	Approx. 1.1 kg / 2.4 lbs
Note	Refer to actual product in the event of product description discrepancy.

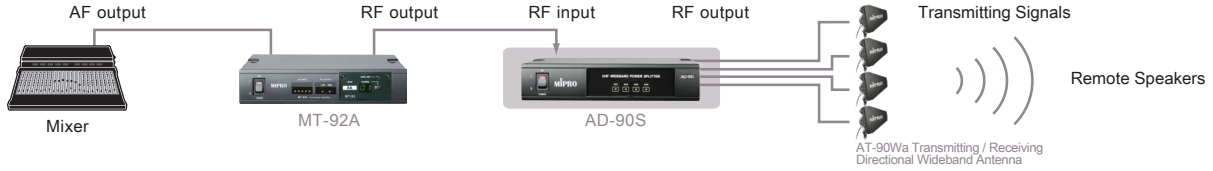
Applications

AD-90S Application

Application of AD-90S with MI-808T Stereo Transmitter & AT-90Wa Passive Directional Antenna

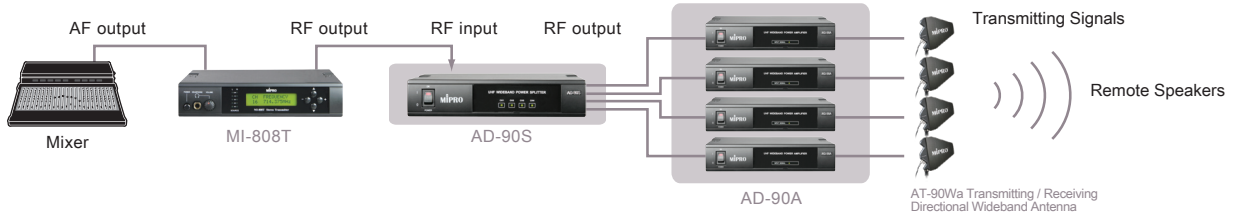


Application of AD-90S with MT-92A Wireless Interlinking Transmitter & AT-90Wa Passive Directional Antenna

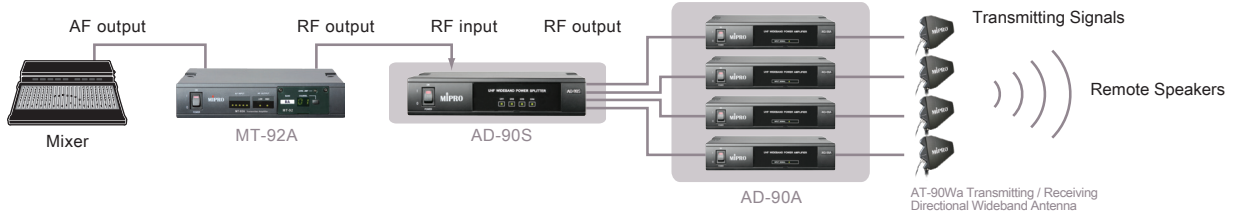


Transmission Enhancement Application

Application of AD-90S with MI-808T Stereo Transmitter & AD-90A Wideband High Power Amplifier

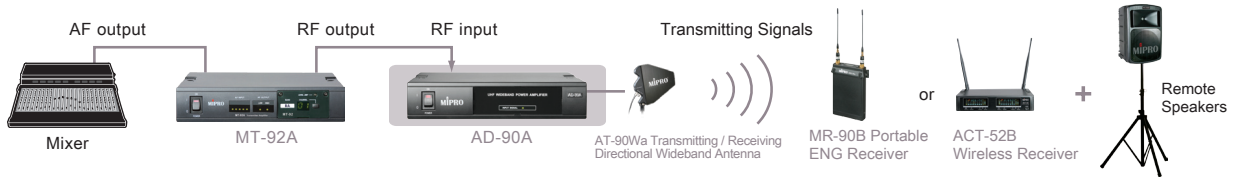


Application of AD-90S with MT-92A Wireless Interlinking Transmitter & AD-90A Wideband High Power Amplifier

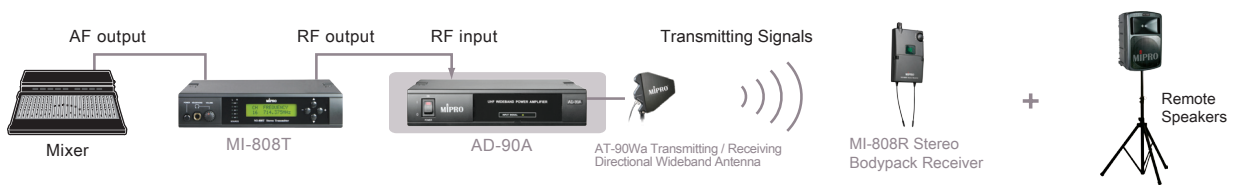


AD-90A Application

Application of AD-90A with MT-92A Wireless Interlinking Transmitter & AT-90Wa Transmitting / Receiving Directional Wideband Antenna



Application of AD-90S with MI-808T Stereo Transmitter & AT-90Wa Transmitting / Receiving Directional Wideband Antenna

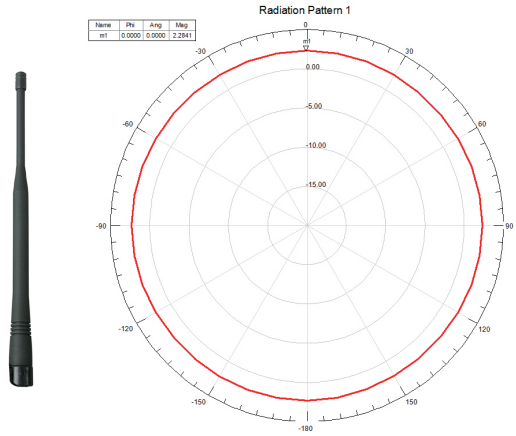


The Proximity Effect of Multiple Antennas

During multi-channel operation, receivers are usually stacked up where antennas of each receiver are very close to each other. However, many people neglect the problem of how such arrangements will affect antenna efficiency. In fact, reduction of antenna efficiency greatly affects both the stability of signal reception and the operating distance. Hence, the calculation of cable loss, antenna angles and the distance of each antenna are critical conditions to be taken into consideration. The following provides a variety of antenna installation examples, and their advantages and disadvantages:

Case 1: Single Dipole Antenna

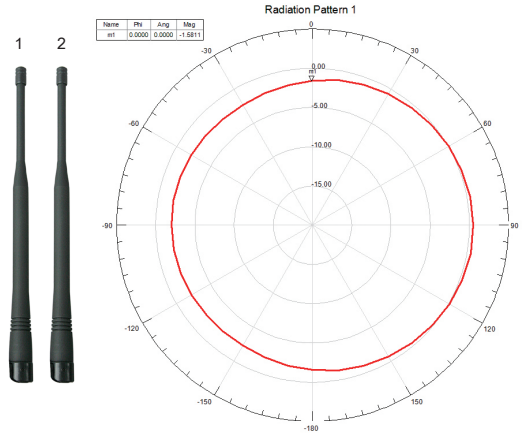
Antenna Pattern (Top View)



1. Antenna Gain: 2.3 dBi @ 0 degree
2. Antenna Efficiency: ~ 100%
3. Impedance Matching Loss: 0.16 dB
4. Total Antenna Gain (Antenna Gain - Impedance Matching Loss): 2.14 dBi @ 0 degree

Case 2: Dual Dipole Antennas (Distance between Antennas: 20 mm)

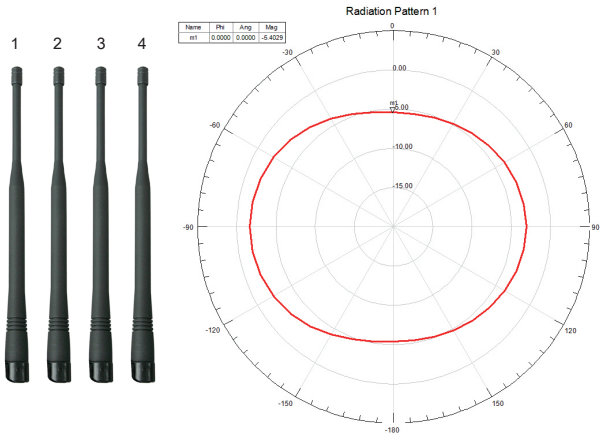
Antenna Pattern (z-axle)



1. Antenna Gain: -1.6 dBi @ 0 degree
2. Antenna Efficiency: 46%
3. Impedance Matching Loss: 0.29 dB
4. Total Antenna Gain (Antenna Gain - Impedance Matching Loss): -1.89 dBi @ 0 degree

Case 3: Four Dipole Antennas (Distance between Antennas: 20 mm)

Antenna Pattern (z-axle)



1. Antenna Gain: -5.4 dBi @ 0 degree
2. Antenna Efficiency: 25 %
3. Impedance Matching Loss: 1.25 dB
4. Total Antenna Gain (Antenna Gain - Impedance Matching Loss): -6.65 dBi @ 0 degree

Measurement Data of the Proximity Effect of Multiple-Antenna Installation (Distance: 1/20λ)

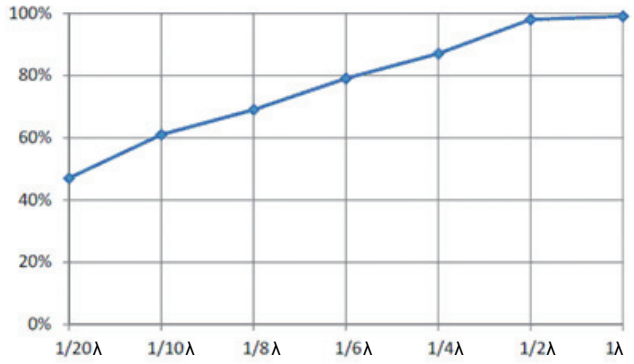
Antenna	Numbers of Antenna Used	1 pc	2 pcs	3 pcs		4 pcs	
	Antenna No.	1	1、2	1、3	2	1、4	2、3
Antenna Efficiency		100 %	46 %	41 %	29 %	42 %	25 %
Total Receiving Efficiency (incl. Impedance Matching Loss)		96 %	43 %	36 %	23 %	38 %	19 %
Antenna Gain Loss Compare to Single Antenna		0 dB	-3.53 dB	-4.27 dB	6.2 dB 1	-4.03 dB	-7.04 dB
Antenna Pattern		Very Evenly Radiated	Close to Evenly Radiated	Unevenly Radiated	Close to Evenly Radiated	Extremely Unevenly Radiated	Unevenly Radiated

Discussion about the Proximity Effect of Multiple Antennas

From the above chart, we can see antenna efficiency drops from 100% to 19% when the total antenna count increases from 1 antenna to 4 antennas and results in an additional 7 dB of gain loss. A 6 dB gain loss means the operating distance is shortened by half and a 7 dB loss means that the operating distance is shortened from 100 meters to 45 meters due to the additional installation of antennas. Hence, the proximity effect of multi-antenna installations greatly affects the receiving efficiency and should not be neglected.

How to Keep an Ideal Interval between Antennas

The chart of interval and gain loss between 2 antennas (λ = wavelength)



As shown in the above chart, if the interval between the antennas is more than 1/4 λ , efficiency can reach more than 80%, and the interacting effect can be ameliorated. However, if the interval can be extended to 1/2 λ , the efficiency can reach 90%.

1/4λ Interval of Each Frequency Band

When installing antennas, the minimum interval between antennas varies. Please refer to the chart below for recommendations on the minimum interval between antennas under each frequency band. However, if an installation requires a mixture of various frequency bands, always refers to the minimum interval between antennas of the lowest frequency band.

Frequency (MHz)	500 MHz	600 MHz	700 MHz	800 MHz	900 MHz
1/4 λ Distance (cm)	About 15 cm	About 12.5 cm	About 10 cm	About 9.4 cm	About 8.3 cm

Writer Profile: Michael Tsai, VP R&D of MIPRO. Over 30 years in research and development of wireless microphone systems.

How to Improve the Transmission Distance and Signal Quality in a Wireless Microphone System

Antennas determine the actual reception distance and quality of reception

Wireless transmission distance is mainly determined by the sensitivity of the receiver and the power of the transmitter. It can be improved by directly increasing the transmitting power or receiving sensitivity. However, these two characteristics are determined by the manufacturer and cannot be changed arbitrarily by the user. In particular, increasing a transmitters' power is not only limited by telecom regulations, but multi-channel signal interference can be a more serious consequence of doing so. Furthermore, the power consumption will increase, considerably reducing the battery life.

The other option is to increase the sensitivity of the receiver. In theory, increasing the sensitivity by 6dB will give twice the receiving distance, but in fact, it is not easy for a user to change the sensitivity. In actual practice, the signal is received via the receiver's antenna, so the best way to improve the transmission efficiency of the overall system is through improving the characteristics of antennas and the antenna installations.

The characteristics of antennas

In a wireless microphone system, the signal is transmitted via the transmitting antenna of the transmitter, and is received via the receiving antenna of the receiver. Therefore, the antenna is the passageway for transmitting and receiving the wireless signals, and its functionality directly affects the signal transmission range and stability.

The detachable antenna design of MIPRO receivers allows users to choose different types of antennas to install for optimal reception.

The main characteristics of the antenna below are as follows:

1. Frequency

To choose the correct antenna to be installed on a wireless microphone receiver, we must first identify its frequency range. The antenna usually has the frequency range code on it. To select an antenna, we should make sure the frequency range is within the frequency range of the receiver, so that the signals received by the antenna can be delivered effectively to the receiver. Frequency is inversely proportional to the length of the antenna, thus the antenna of a VHF system is significantly longer than those of a UHF system.

2. Impedance

In general, the antenna impedance has two categories: 50 Ω and 75 Ω . MIPRO receiver antenna input impedance is designed with 50 Ω , so you must select an antenna with 50 Ω impedance to match perfectly to the receiver. Its specification is generally labeled with an input reflection coefficient or Voltage Standing Wave Ratio (VSWR). A good antenna generally has the input reflection coefficient less than -10dB or VSWR less than 2:1.

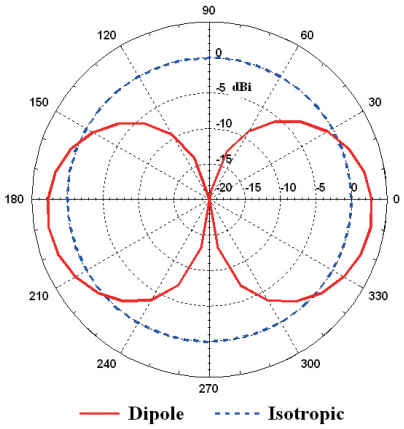


Figure 1: The vertical radiation pattern of a dipole antenna.

3. Antenna Gain

Antenna gain indicates the signal transmitting or receiving ability. The gain value is relative to an isotropic radiator, shown in dBi units, in which "i" represents the isotropic radiator, a virtual sphere in which the signals can transmit or receive towards all directions. As shown in Figure 1, the theoretical maximum gain value of a dipole antenna is about 2.15dBi. As the gain is usually designed to be concentrated to some degree, a value > 0dBi is obtained. If the gain is designed to be concentrated toward one direction only, the antenna is called a "Directional Antenna." The narrower the angle is, the higher the gain value; meanwhile, the gain of other directions will decline. Therefore, when users are installing antennas, close attention should be paid to the signal directionality.

4. Antenna Polarization

In actual use, the antenna polarization is an easily neglected character. Depending on the ratio of the electric field distribution, polarization can be divided into "linear polarization" and "circular polarization." Linear polarization can be divided into horizontal or vertical polarization, according to different placements, while circular polarization can be divided into clockwise or counter-clockwise circular polarization, depending on the rotation direction of the electric field. Most of the antennas are of the linear polarization type, such as a single-pole antenna, coaxial antenna, AT-70, AT-70Wa and AT-90Wa. Circularly polarized antennas, in fact, are more like "Elliptical polarization" in their characteristics. The MIPRO AT-100a is representative of this kind.

The polarized relationship between the receiving and transmitting antennas will directly affect the quality of the signal. As shown in Figure 2 and Figure 3, if the wireless microphone receiver antenna is fixed to vertical polarization, and users swing the transmitter to the horizontal position, the signal will decline greatly and may result in unstable reception quality. Especially in far and wide environments, the decline will be larger and may cause a brief signal drop-out. In this case, if the circularly polarized antenna is used, the vertical or horizontal polarization signals can maintain stable reception, so the signal will not significantly decline when the transmitter's position is changed.

Figure 2: How the signal quality is presented between the linearly polarized antennas.

Figure 3: How the signal quality is presented between the linear and the circular polarization antennas.

5. Antenna Radiation Pattern

In a listing of the complete specifications of an antenna, the antenna radiation pattern is indispensable. It helps users to recognize the antenna gain at the Null as well as the angle & direction of the Main Beam. As shown in Figure 4 and 5, antenna pattern diagrams include vertical pattern and horizontal patterns, providing important reference for antenna installation.

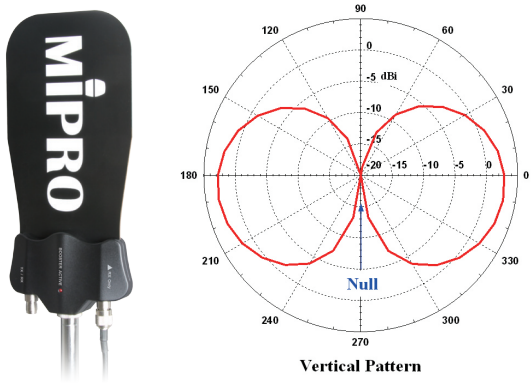


Figure 4: Vertical pattern for AT-70Wa antenna.

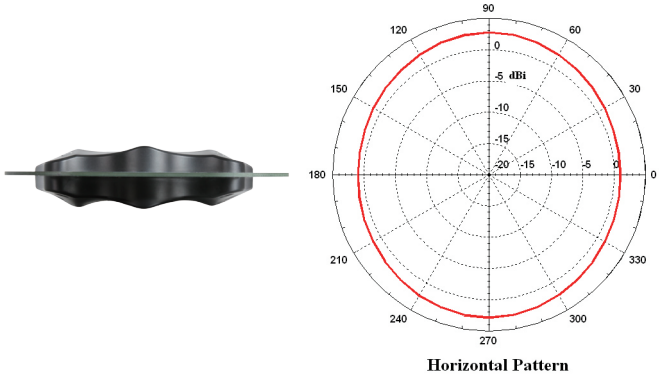


Figure 5: Horizontal pattern for AT-70Wa antenna.

From the radiation pattern diagrams, we can perceive the difference between the omni-directional and directional antennas. The omni-directional antenna has 360 degrees of reception angle and doesn't require adjusting the angle of the antenna, as shown in Figure 6. The directional antenna with 3dB beam width provides a more focused reception where the range of antenna gain is dependent on the angles and the directionality, attenuating from the maximum to 3dB, as shown in Figure 7. Users can select the proper antenna according to the environment. For example, when there's no particular direction between the microphone and the receiver, and at short distances, the MIPRO omni-directional antenna is recommended. For live stages which need long-distance reception in a particular direction, a MIPRO directional antenna is usually selected to get better signal quality and prevent interfering signals coming from other directions.

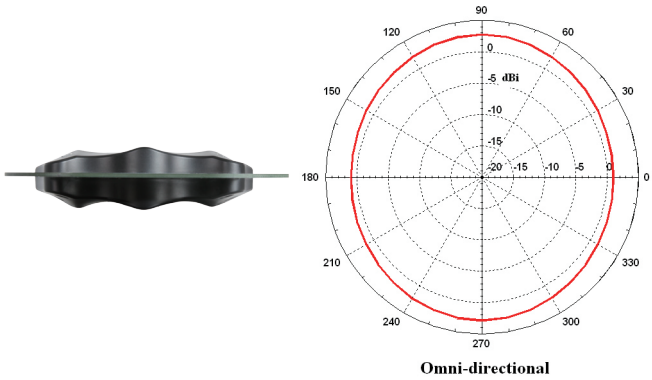


Figure 6: Horizontal pattern for AT-70Wa antenna.

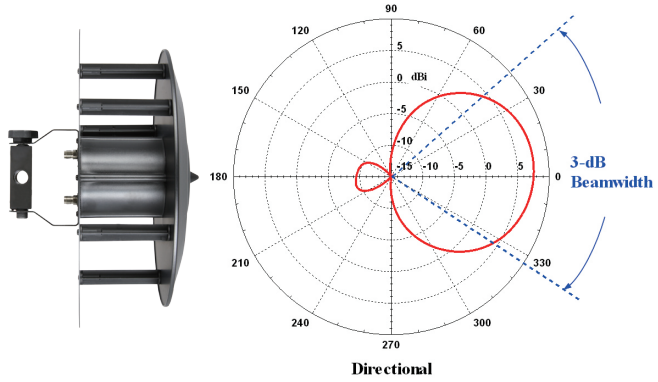


Figure 7: Horizontal pattern for AT-100a antenna.

Select different types of MIPRO receiving antennas to get the optimal reception quality

MIPRO antenna systems have the most complete product line, providing multi-channel wireless microphone systems with better long-distance transmission and improved signal quality as well as simplifying antenna installation.

MIPRO has the following types of receiving antennas:

1. AT-10 Whip Antenna

The AT-10 is a 1/4 wave single rod antenna featuring a wider band, omni-directionality and 50 Ω impedance. It mounts directly on the antenna connectors of a receiver to become a monopole antenna for adequate sensitivity and operating range.

Figure 1

Figure 2

2. AT-20 Coaxial Antenna

The AT-20 is a 1/2 wave coaxial antenna that functions like a dipole antenna, featuring 2.15 dBi gain, 50 Ω impedance, and omni-directional reception. It mounts directly on the antenna connectors of a receiver for adequate sensitivity and operating range.

3. AT-70 UHF Ground Plane Antenna

The AT-70 is an UHF antenna that stabilizes signal reception and prevents impedance interference from nearby objects because its vertical 1/4 wave antenna is surrounded by horizontal antennas at a 45 ° degree, causing a 1/2 wave dipole antenna effect. This gives the AT-70 a higher positive gain than a 1/4 wave single rod antenna and smoother impedance within the 620~960 MHz band. Therefore, the length of the antenna does not need to be adjusted while receiving. The antenna is able to reduce interference by filtering signals outside the range. It is suggested for installation at the central location of a hall, on the wall, inverted on a ceiling, or mounted on a tripod (MS-30).

Figure 3

Figure 4

4. AT-70Wa Wideband Transmitting and Receiving Omni-directional Antenna

The AT-70Wa is optimized for 470~1000 MHz and has a 2~4 dBi gain which is ideal for any specific installation requiring full signal directionality. The AT-70Wa has 2 input connectors, the "TX/RX" which can be connected to the transmitter or receiver directly and the "RX Only" connector which has a 12 dB gain controllable booster, specifically enabling receivers for long distance reception.

5. AT-90Wa Wideband Transmitting and Receiving Log Antenna

The AT-90Wa is optimized for 470~1000 MHz and has a 4~6 dBi gain which is ideal for any installation requiring specific directionality. The AT-90Wa has 2 input connectors, the “TX/RX” which can be connected to the transmitter or receiver directly and the “RX Only” connector which has a built-in 12 dB gain controllable booster, specifically enabling receivers for long distance reception.

Figure 5

6. AT-100a Wideband Circularly Polarized Antenna

The AT-100a is optimized for 470~1000 MHz and has a 6~8 dBi gain which is ideal for any installation requiring specific directionality. The AT-100a has two built-in signal connectors: “TX/RX” connector can be connected to a transmitter or receiver, however, connection to a short coaxial cable is recommended when connected to a receiver. “RX” connector (cannot be connected to a transmitter) has a built-in 12 dB gain controllable booster and thus provides extended reception range and compensates the signal loss of coaxial cable to improve reception range and signal quality.

Figure 6

The receiver must be equipped with the right antenna system to get optimal reception quality

1. The receiver is operated in indoor / outdoor location with short-distance reception

For karaoke, small conference rooms, small concerts or other small-scaled environments, just mount a pair of single pole antenna or standard coaxial antenna directly on the antenna input connector of the receiver and then screw-lock tightly. Even for short distances, the receiver still must keep a stable reception free from interference. When using a single-pole antenna, due to the metal chassis being a part of the ground element of the antenna, you should keep the antenna vertical to the receiver chassis. The receiving antenna should be far away from metal obstructions and noise interference sources in order to get optimal reception.

2. The receiver is operated in indoor / outdoor location with long-distance reception

In live stage or other long-distance reception venues, a professional true diversity receiver is required. In addition, installation of the proper antenna system is more important.

Mounting an AT-70 or AT-70Wa omni-directional antenna on a stand or upside down on the ceiling, then connecting it directly to the antenna input port of the receiver with a coaxial cable will increase the receiver’s reception range and quality. However, since the antenna is installed at a great distance from the receiver, connecting with a long coaxial cable will cause some signal loss. The user should choose a cable with lower loss based on the distance, or else add an AT-70B or MPB-30 antenna booster to compensate for the cable signal loss.

For long-distance reception in a high signal interference environment, the better choice is to use an AT-90Wa wideband log antenna. Set it on the stand vertically and adjust the polarity direction toward the wireless microphones’ operating position. Since the log antenna has directivity and higher gain, it gets better reception quality. Alternatively, in the same high-interference operating environment, the best option is to use the AT-100a wideband circularly polarized antenna to eliminate possible signal dropouts and insure more stable reception quality. (Refer to the AT-100a catalogue).

3. Use the antenna divider for two or more receivers to simplify the antenna installation

When two receivers need an external antenna to increase reception distance, you can use the AD-12 Passive Antenna Divider/ Combiner to simplify the installation.

When three or more receivers need an external antenna to increase reception distance, you can use the AD-708 UHF 4-channel antenna divider to simplify and improve reception quality. For five or more receiving systems, you can use two or more AD-708.

4. Antenna systems for extremely long distances

In some large-scale professional stages requiring long-distance receiving operation, where the antenna system requires long cable connections, you must install an AT-70B or MPB-30 booster or an AT-90Wa or AT-100a directional antenna with built-in booster, to compensate for the cable loss in order to get optimal reception.

5. An example of a 16-channel wireless system antenna installation for long-distance reception

In professional live stage, auditorium and similar long-distance reception venue applications requiring up to 16 channels to be operated simultaneously, use 4 sets of ACT-74 quad-channel true diversity receivers and one AD-708 wideband antenna divider, connecting with a pair of AT-100a UHF circularly polarized wideband directional antennas. This package is the most economical combination, providing optimal performance with easy operation and requiring minimal installation space.

Writer Profile: Harry Hsiao, received his M.S.E.E. degree from National Chung Cheng University. His research topics focus on RF electric circuit and IC design. Currently R&D Engineer of MIPRO. Primarily responsible for research and development of antenna system products.

Reference: J. D. Kraus and R. J. Marhefka, Antennas: for All Applications, 3rd Edition, McGraw-Hill, 2003.

How to Use the MIPRO Auto Gain-Control Antenna Systems

In a wireless microphone system installation, the correctness of the antenna system installation greatly affects the quality of the received signal. Especially in long-distance receiving, the specifications of antenna, coaxial cable and booster must be considered carefully. In order to get the best reception, it is important to properly calculate the gain of the antenna system. If the gain of the system is insufficient, it will reduce the receiving distance and stability; if the gain is too high, it will cause inter-modulation interference in the receiver and result in poor reception quality.

In order to solve this problem, MIPRO developed the AD-708 UHF Auto Gain-Control Antenna Divider and AD-702 Antenna Auto Gain Controller to go with the MIPRO AT-70Wa / AT-90Wa / AT-100a Wideband Antenna, which all has a built-in booster, to detect the cable signal loss between the divider / controller and the booster, automatically adjusting the proper gain of the booster to compensate for the cable loss, and providing the receiver with a stable receiving signal of sufficient strength. In the case of longer cable required, MIPRO MPB-30 UHF Auto Gain-Controlled Antenna Booster can be added to adjust the gain.

The application of MIPRO auto gain-control antenna systems are as follows:

AD-708 Installation Instructions

1.The coaxial cable length does not exceed the limit of acceptable line signal loss in table A

As shown in Figure 1, the AD-708 can detect the signal-loss of the cables between antenna and divider, and then automatically control the gain of gain controllable booster to compensate the signal loss precisely. Therefore, the AD-708 can be used with all MIPRO antenna products which have a built-in gain controllable booster. Connect the cable to the “RX Only” connector of the antenna to obtain sufficient and stable signal strength.

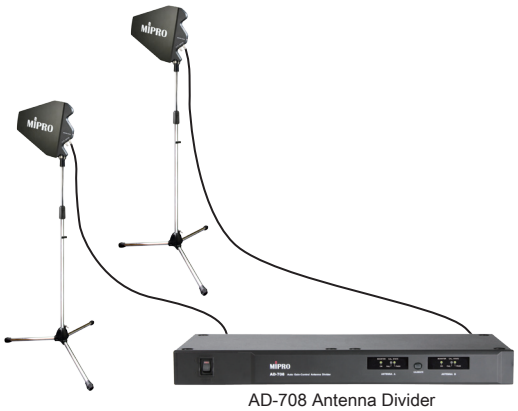


Figure 1: The system cable length does not exceed the limit of maximum acceptable line signal loss. (Connected to RX Only connector of the antenna)

2. The coaxial cable length exceeds the maximum limit of acceptable cable signal loss in table A

It is necessary to use two cables to connect the system. One cable connects the AD-708 and MPB-30. The other cable connects the AD-702 to the RX Only connector on the antenna. The cable length must not exceed the maximum length limit. As shown in Figure 2, thus the signal loss of the cable can be compensated precisely by the auto gain-control system to get the proper noise figure and inter-modulation interference of the system. The cable loss of the receiving system will then be controlled within an acceptable range.

Note: MPB-30 requires an external power supply to provide bias for the AD-702 and the antenna booster.

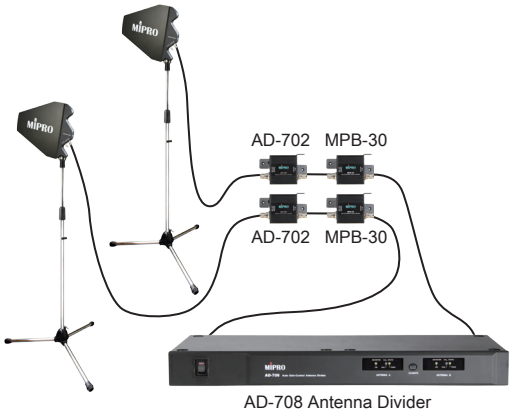


Figure 2: The system cable length exceeds the maximum length of adequate limit. (Connected to RX Only connector of the antenna)

3. AD-708 can be directly connected to MIPRO’s antennas

The AD-708 can also be connected directly to all of MIPRO’s new antennas which have the gain controllable booster and those antennas which don’ t have. It provides four channel signals for four receivers and supplies the booster bias. The AD-708 may be connected to the additional fixed-gain booster, such as MPB-20, to compensate the signal loss, but there is no automatic variable gain-controlled function in this configuration.

AD-708 Operating Instructions

After the antenna system is installed, turn on the AD-708. As shown in Figure 3, the AD-708 divider will identify whether the antenna input port A and B are connected to the MPB-30 booster. If the front panel “BOOSTER ON” LED lights, the booster is already working properly. Otherwise, the cable should be checked for a possible improper connection or lack of bias. If the latter, you must add an external power supply to the booster. Next, press the “CALIBRATE” button. The divider will automatically detect the cable loss of antenna port A and B and adjust the gain of the system. Then, if the front panel “PASS” LED lights are on, it indicates the gain adjustment has been completed, and the system can be used normally. If “FAIL” LED lights are on, it indicates the cable loss exceeds the range for which the booster is able to compensate and you must check whether the cable is too long or the connector has not been perfectly locked, causing the RF signal loss. After checking and making adjustments, press the “CALIBRATE” button again; the divider will once again quickly detect the cable loss and make the gain adjustment.

Notice! When the “BOOSTER ON” LED does not light up, the cable loss detection and gain adjustment functions will not be activated, “PASS” and “FAIL” LEDs will remain off.

Figure 3A: Booster is working

Figure 3B: Calibration is completed

Figure 3C: Cable loss is overload

AD-702 Installation Instructions

1. The coaxial cable length does not exceed the limit of acceptable line signal loss in table A

As shown in Figure 4, connect the AD-702 to the “ANTENNA” connector of the receiver. The AD-702 will detect the signal-loss of the cables between the antenna and the receiver and then automatically control the gain of gain controllable booster to compensate the signal loss precisely. Therefore, the AD-702 can be used with all MIPRO antenna products which have a built-in gain controllable booster. Connect the cable to the “RX Only” connector of the antenna to obtain sufficient and stable signal strength.

2. The coaxial cable length exceeds the maximum limit of acceptable cable signal loss in table A

It is necessary to use two AD-702 controllers and two cables to connect the system. One AD-702 connects to the “ANTENNA” connector of the receiver, and the other AD-702 connects to the “RF IN” connector of the MPB-30. One cable connects the AD-702 and MPB-30 (Receiver side), and the other cable connects the AD-702 to the RX Only connector on the antenna (Antenna side). The cable length must not exceed the maximum length limit. As shown in Figure 5, thus the signal loss of the cable can be compensated precisely by the auto gain-control system to get the proper noise figure and inter-modulation interference of the system. The cable loss of the receiving system will then be controlled within an acceptable range.

Note: MPB-30 requires an external power supply to provide bias for the AD-702 and the antenna booster.

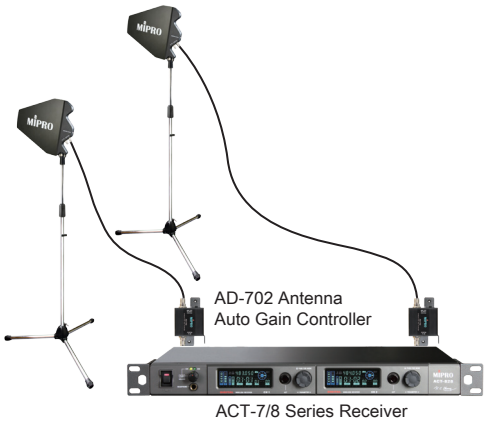


Figure 4: The system cable length does not exceed the limit of maximum acceptable line signal loss. (Connected to RX Only connector of the antenna)

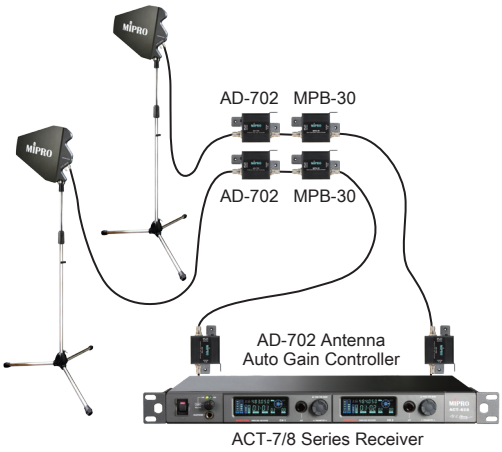


Figure 5: The system cable length exceeds the maximum length of adequate limit. (Connected to RX Only connector of the antenna)

AD-702 Operating Instructions

After the antenna system is installed, turn on the receiver. As shown in Figure 4, the AD-702 controller will identify whether the input port is connected to the gain-controllable booster. If the “STATE” RED LED light is on, the booster is already working properly. Otherwise, the cable should be checked for a possible improper connection or lack of bias. If the latter, you must add an external power supply to the booster. Next, press the“CAL.”button. The controller will automatically detect the cable loss of“RF IN” port and adjust the gain of the system. Then, if the “STATE” GREEN LED light is on, it indicates the gain adjustment has been completed, and the system can be used normally. If “STATE” RED LED light is on, it indicates the cable loss exceeds the range for which the booster is able to compensate and you must check whether the cable is too long or the connector has not been perfectly locked, causing the RF signal loss. After checking and making adjustments, press the “CAL.” button again; the divider will once again quickly detect the cable loss and make the gain adjustment.

Note: When the “STATE” LED does not light up, the cable loss detection and gain adjustment functions will not be activated.

Figure 6A: Calibration is completed

Figure 6B: Cable loss is overload

The coaxial cable list for reference

According to the variable gain range of the MPB-30, Table A lists several available cable specifications. Cable length can be used normally within the maximum acceptable length limit, and the maximum acceptable loss of the receiving system is controlled to less than 3dB.

Table A: General 50Ω coaxial cable specifications

Models	Attenuation (dB/10m)		Maximum length limit (m)
	200 MHz	1.0 GHz	
RG-58A / U	2.3	5.8	30
3D-2V	2.1	5.2	33
5D-2V	1.5	3.8	45
8D-2V	0.9	2.2	80
5D-SFA		1.8	95
8D-SFA		1.2	140

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The Best Solution for Multi-Channel Receiving Antenna Installation

Antenna installation is the most important factor affecting the transmission distance and signal quality of wireless microphone systems. Therefore, for multi-channel wireless microphone systems, it is necessary to know how to effectively simplify the large number of antennas to obtain efficient and stable reception quality as well as savings on installation costs.

The following provides a variety of antenna installation examples, and their advantages and disadvantages:

Antenna mounted directly on each receiver

If you want to set up an 8-channel wireless microphone system, you can choose four dual-channel receivers (e.g., MIPRO ACT-72) or two quad-channel receivers (e.g., MIPRO ACT-74), then directly mount each antenna on the receiver as shown in Figure 1. This installation is simple and economical, but each antenna is so close that it inevitably will produce “The proximity effect of multi-antennas and worsen the reception quality. (See 5. The Proximity Effect of Multiple Antennas, Technical Knowledge)

Figure 1A: Antenna installation with four dual-channel receivers.

Figure 1B: Antenna installation with two quad-channel receivers.

From Figure 2, we can see the variation of the antenna receiving pattern and efficiency. The horizontal radiation pattern of antenna 1 presents a very uneven distribution, and the overall antenna efficiency decreases greatly to 42%! This setup method may result in different receiving signal strengths for each channel, and may affect the signal stability. This method would be the most simple and economical installation for a short-distance reception that does not demand efficiency.

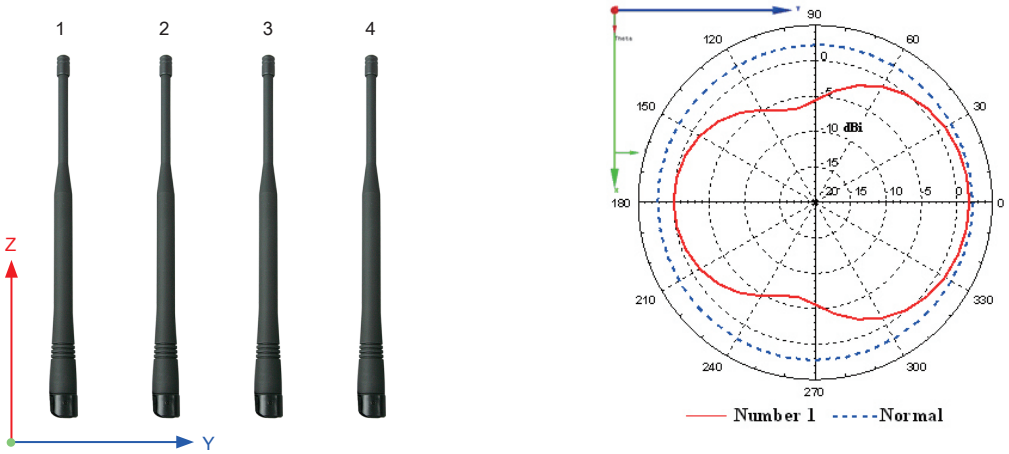

Figure 2: Horizontal radiation pattern of Antenna 1.

Daisy chain antenna divider

To avoid “The proximity effect of multi-antennas” caused by the antennas directly installed on the stacked up receivers, you can use an external or built-in daisy-chain antenna divider to share one pair of antennas, and simplify the system installation.

As shown in Figure 3, the input signal of the antenna connected to the MIPRO AD-12 is divided into two signal outputs and these two outputs directly connect to the receiver’s antenna inputs. This setup method is used for two receivers being stacked up.

However, although the 1-to-2 passive antenna divider simplifies the installation of antennas and avoids the “The proximity effect of multi-antennas”, the cascaded divider would weaken the receiving signal strength, increase the noise figure and decrease the sensitivity. Thus, the number of cascaded dividers must be as few as possible.

Figure 3: MIPRO AD-12 passive antenna divider.

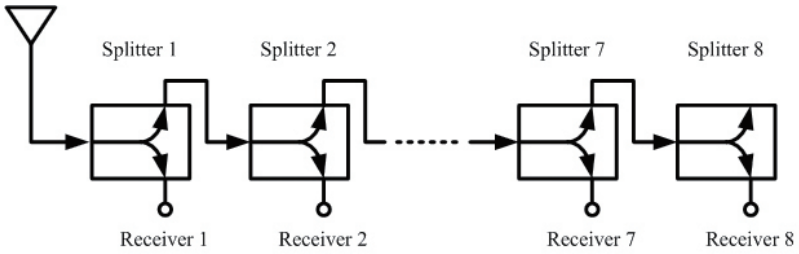

Figure 4: 1-to-8 active daisy-chain antenna divider.

In order to solve the problem of the signal attenuation caused by the cascaded passive antenna dividers, a booster must be added to the divider to make it an active divider, so as to compensate for the signal attenuation.

Figure 4 shows a 1-to-8 active “daisy-chain” antenna divider. Ideally, the active daisy-chain antenna divider with a booster can compensate for signal attenuation. However, in a cascade of multiple receiver antenna systems, the noise figure of the divider will cause deterioration of the sensitivity.

As shown in Figure 5, assuming the noise figure of an active daisy-chain antenna divider is 5dB, the gain is 0dB, and the noise figure of the receiver is 7dB. If there are eight dividers cascaded, the system noise figure of the eighth receiver will become 13dB, that is, the noise figure is 6dB worse than the first one.

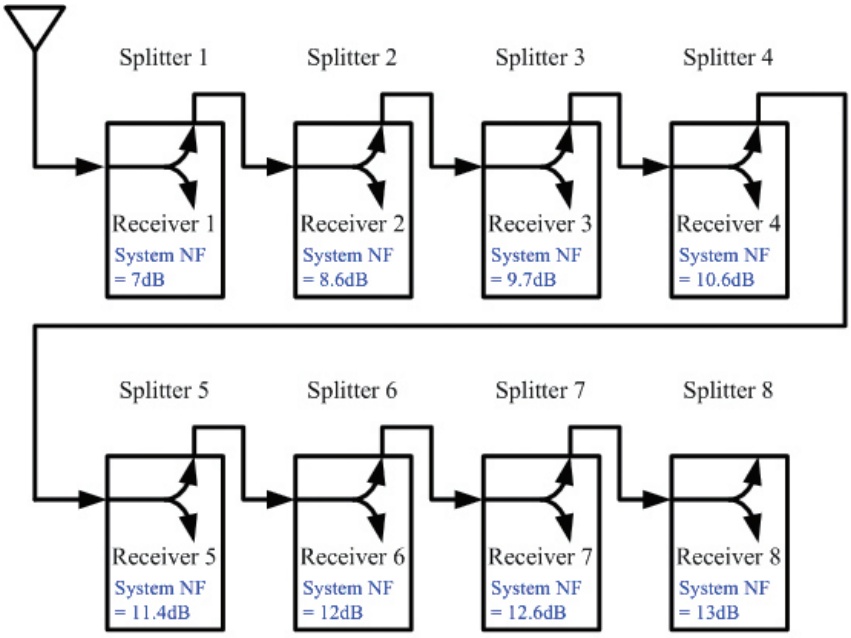

Figure 5: The noise figure of a 1-to-8 active daisy-chain antenna divider.

Parallel antenna divider

To avoid the disadvantages of the daisy-chain antenna divider, and to simplify the antenna installation by sharing a pair of antennas, the best method is to use the “parallel” antenna divider.

As shown in Figure 6, the MIPRO AD-707a is an active parallel antenna divider. It has 1-to-4 outputs with a booster circuit to compensate for the signal loss, also an active output for connecting to another divider input port, so as to meet the needs of more than four receivers.

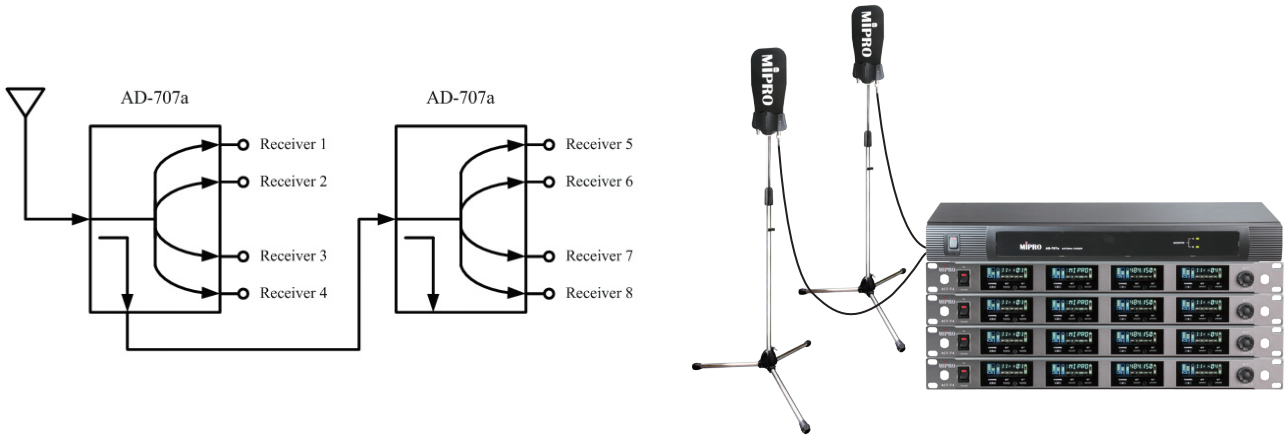

Figure 6: One AD-707a active parallel divider connected to four receivers; can be cascaded to another divider.

For installations with eight receivers, assuming the noise figure of an active parallel antenna divider is 5dB, the gain is 0dB, and the noise figure of the receiver is 7dB. The noise figure is estimated as shown in Figure 7A, the noise figure of the system is 8.6dB (Receiver 1~4) and 9.7dB (Receiver 5~8). Compared to the noise figure of the original receiver, the differential can be controlled within 3dB. Under the same conditions, the active daisy-chain antenna divider can connect only up to three receivers, as shown in Figure 7B.

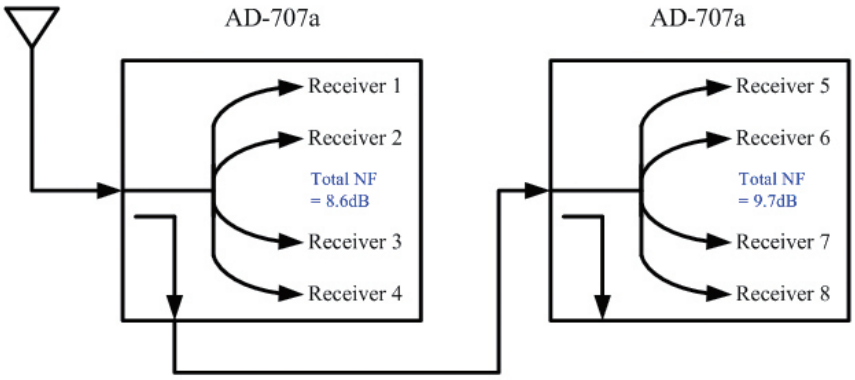

Figure 7A: The noise figure of two 1-to-8 MIPRO AD-707a wideband antenna dividers.

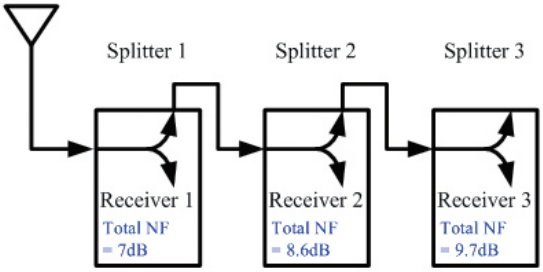

Figure 7B: For the same noise figure in an active daisy-chain antenna divider system, only three receivers can be cascaded.

MIPRO's multi-channel receiver antenna system is the best solution

Some brands design their receivers with a built-in active daisy-chain antenna divider to simplify the antennas installation. In fact, the sensitivity of the receiver would decrease as the number of cascaded units are added. The MIPRO receiver with a built-in or external active "parallel" divider is designed to completely solve the above disadvantages. Studying the following cases will help you understand further.

1. 4-channel wireless microphone system

If you choose other brands, you must stack up two dual-channel receivers, and the sensitivity will decrease more than 1.6dB, as shown in Figure 8A.

If you choose a MIPRO ACT-74 or ACT-747 quad-channel receiver, only one pair of antennas is required as both of these receivers have a built-in premium quality active parallel divider with an ultra-low noise figure and high dynamic input characteristics. Without any cascade, the quad-channel receiver provides maximum sensitivity. This is the simplest, most effective and cost-saving professional multi-channel system, as shown in Figure 8B.

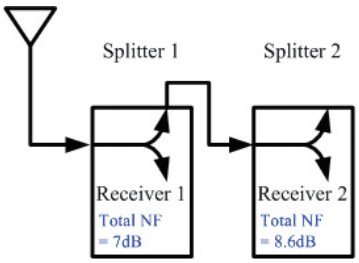

Figure 8A: Two dual-channel receivers with built-in active daisy-chain divider.

Figure 8B: MIPRO ACT-74 quad-channel receiver, with built-in active divider, shows the highest sensitivity.

2. 8-channel wireless microphone system

If you choose other brands, you must stack up four dual-channel receivers and connect the antenna input and output of each receiver in order to share one pair of antennas. The result is the sensitivity will decrease more than 3.6dB, as shown in Figure 9A.

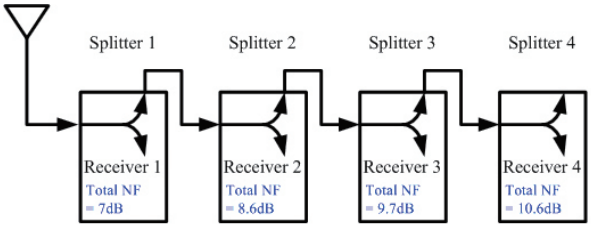

Figure 9A: Four dual-channel receivers with built-in active daisy-chain divider.

Four MIPRO ACT-72 or ACT-727 dual-channel receivers, as shown in Figure 9B, or two MIPRO ACT-74 or ACT-747 quad-channel receivers, as shown in Figure 9C, require only one AD-707a wideband antenna divider to share a pair of antennas. Due to the low noise figure of the divider, the receiving sensitivity has almost no attenuation.

Figure 9B: Four MIPRO ACT-72 dual-channel receivers installed with an AD-707a wideband antenna divider.

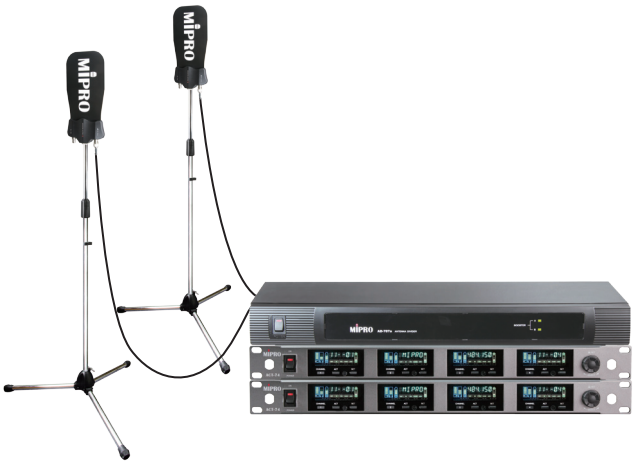

Figure 9C: Two MIPRO ACT-74 quad-channel receivers installed with an AD-707a wideband antenna divider.

3. 16-channel wireless microphone system

If you choose other brands, you must stack up eight dual-channel receivers and connect the antenna input and output of each receiver in order to share one pair of antennas. The result is the sensitivity will decrease more than 6dB (cable loss is not included), as shown in Figure 10A.

If you choose four MIPRO ACT-74 or ACT-747 quad-channel receivers, only one AD-707a wideband antenna divider is required to share a pair of antennas. As shown in Figure 10B.

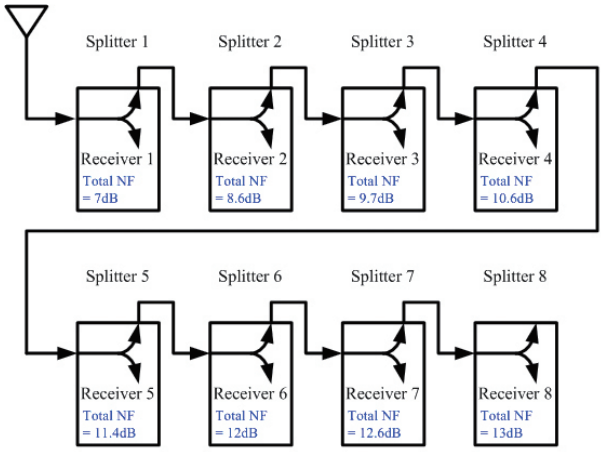

Figure 10A: Eight dual-channel receivers with built-in active daisy-chain divider.

Figure 10B: Four MIPRO ACT-74 quad-channel receivers installed with an AD-707a wideband antenna divider.

4. 32-channel wireless microphone system

It is not recommended to choose dual-channel receivers with built-in active daisy-chain divider of other brands for such large installations.

Use eight MIPRO ACT-74 or ACT-747 quad-channel receivers and two AD-707a wideband antenna dividers (one AD-707 for four receivers) to share a pair of antennas, as shown in Figure 11. The result is the sensitivity of each receiver is averaged and attenuation is limited to within 3dB.

Figure 11: Two AD-707a wideband antenna dividers with eight quad-channel receivers to form a 32-channel system.

5. Conclusion

Using the antenna divider in the antenna installation for multi-channel receivers not only reduces the number of receiving antennas but also simplifies the installation. Most important of all, the antenna short-distance coupling effects can be avoided, maintaining the original antenna radiation pattern and reception efficiency. From the information in this article we know that regardless of the use of internal or external daisy-chain antenna dividers, the number of cascades should be as few as possible to avoid the issue of sensitivity attenuation. Using the parallel antenna divider to avoid the shortcomings of the daisy-chain divider is the best solution for multi-channel receiver antenna installations.

The MIPRO AD-707a wideband antenna divider utilizes ultra-high dynamic, low noise active components and wideband microstrip circuit design, featuring ultra-low intermodulation distortion and signal loss. In parallel mode, it permits four antenna diversity receivers to share a pair of antennas. This can eliminate spurious interference and its output gain is equal to 1. Without any external booster, it can keep the sensitivity of each receiver and its daisy-chain output port allows more channels to be operated. Moreover, the output connectors provide bias for an external booster, making it easy to connect a variety of MIPRO antenna systems for long-distance transmission. Each divider output port has individual characteristics and does not affect the others. To sum up, choosing the AD-707a for a multiple system antenna installation is the best solution.

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