



System Integration Guide

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Sony started in the wireless microphone business in 1974 with the introduction of a 40-MHz band VHF system. This was soon followed by an industry-first PLL Synthesized VHF system in 1983. Continually enhancing its wireless products line, Sony introduced a groundbreaking 800-MHz band PLL Synthesized UHF Wireless Microphone system at the NAB event in 1991. Throughout this period, Sony has been at the forefront of technology – offering the first UHF PLL Synthesized Wireless Microphone system with 282 selectable channels, introducing a space diversity RF reception system, realizing 42 operational channels with a 36-MHz band width, and more. These technologies have been adopted for the range of Sony wireless microphone systems available today. Providing superb audio performance, operational flexibility, and reliability, these systems have been widely accepted in a broad range of professional audio applications from broadcasting, production, and theater to entertainment and conferences.

Sony has consistently developed these systems with the following in mind:

- Superb audio performance with wide dynamic range
- Highly stable signal transmission
- Flexible simultaneous multi-channel operation

While Sony wireless microphone systems have greatly innovated professional audio operations, the growth in popularity of high-definition (HD) content creation and digital audio recording/transmission has called for the development of large-scale, multi-channel wireless microphone systems with improved sound quality. In response to these important requirements, Sony continues to strive to develop a digital audio wireless transmission technology that can match the quality and performance of a wired transmission technology and that can also cope with the increasing need for simultaneous multi-channel operation.

Sony is offering a broad lineup of digital wireless products available as options for various audio systems. Solutions range from electronic news gathering (ENG) systems with a bundled camcorder to full-fledged studio/concert systems supporting simultaneous multi-channel operation. This provides users with the flexibility to configure exactly the digital wireless microphone system they need.



Digital Wireless Outline

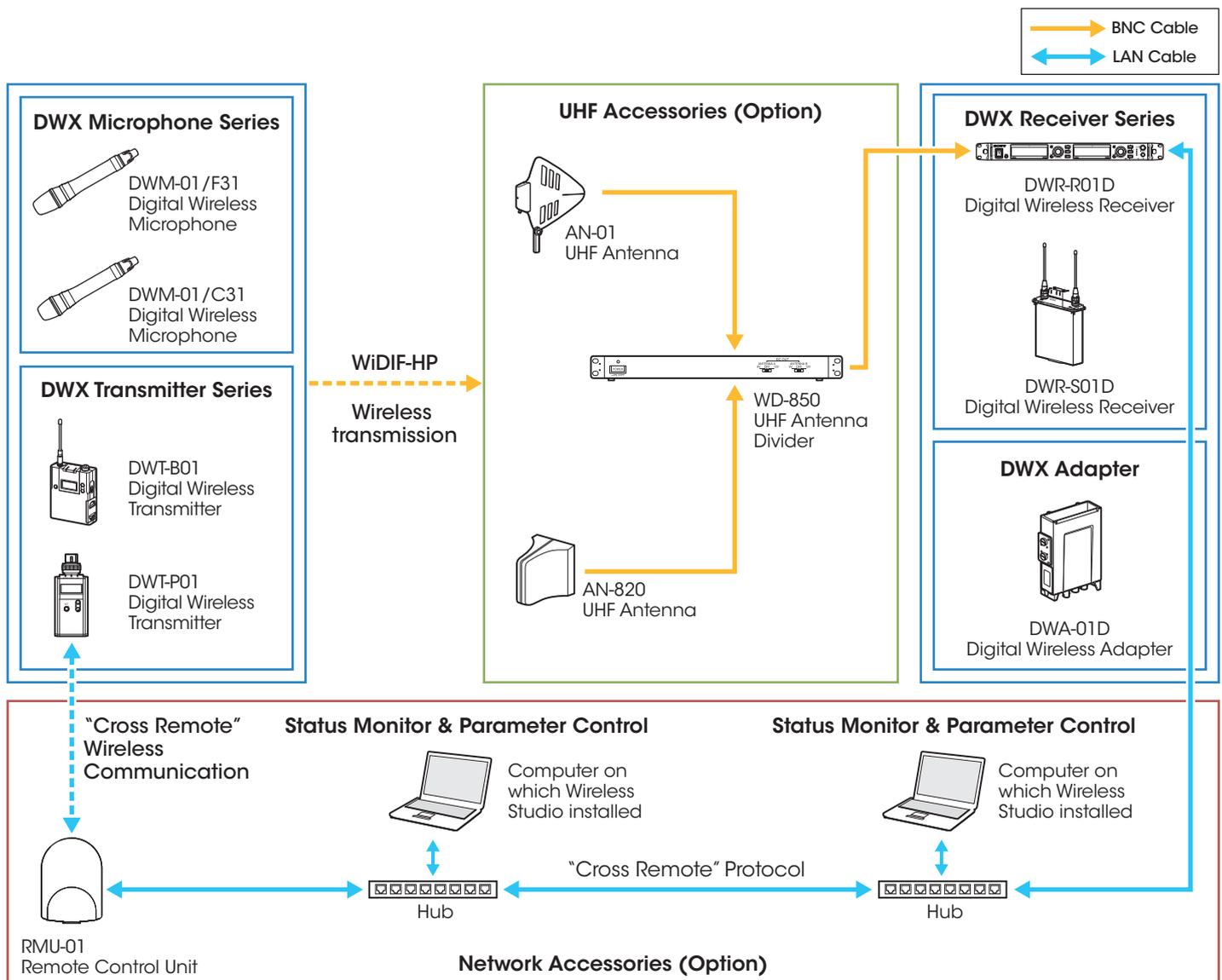
What is DWX?



DWX refers to Sony's new digital wireless microphone system. The DWX series reflects Sony's extensive expertise in professional microphones and sound design. It represents a successful blend of Sony know-how, wireless technology renowned for stability, and cutting-edge digital audio technology.

In addition to realizing the high sound quality possible with a digital system, the DWX series supports multi-channel simultaneous operation, encrypted transmission, and metadata transmission for monitoring the status of multiple transmitters. Using a main link and a separate additional link, remote control of transmitters from the receiver is also possible. With its many advanced features, the system has the potential to revolutionize the workflow of professional applications.

System Configuration Example (Conceptual Diagram)



What Is WiDIF-HP?

WiDIF-HP

WiDIF-HP (WiDIF: Wireless Digital Interface Format, HP: High Profile) is a wireless digital audio interface format developed by Sony.

It enables highly secure transmission with high sound quality and low system latency, and supports simultaneous multi-channel operation.

High Sound Quality Wireless Transmission

WiDIF-HP uses 24 bit/48 kHz sampling, resulting in superb sound that surpasses CD quality. Dynamic range of more than 106 dB, wide frequency response of 20 Hz to 22 kHz, and a low system latency of 3.4 ms** ensure excellent performance. Additionally, there is no compander, resulting in faster response than is possible with conventional analog wireless systems.*

* Unless otherwise specified, this refers to analog wireless systems that include a compander.

WiDIF-HP Specifications	
Sampling frequency	48 kHz
Quantization	24 bit
Frequency response	20 Hz – 22 kHz
Dynamic range	106 dB typ. (A-weighted)
THD	0.03% or better
Occupied bandwidth	192 kHz or less
Modulation principle	$\pi/4$ Shift QPSK
Audio latency	3.4 milliseconds**

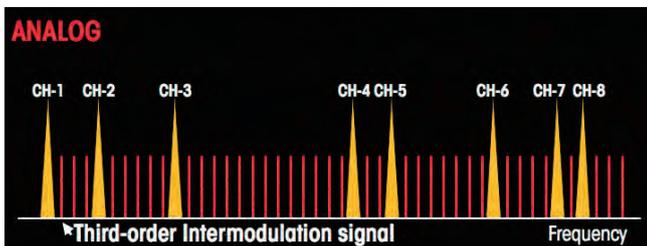
** When DWM-01, DWT-B01, and DWR-R01D are used in combination. When analog output is combined with the DWR-S01D, the latency rating is 3.6 milliseconds.

Simultaneous Multi-Channel Operation

Because WiDIF-HP is highly resistant to interference, about 50 percent more channels can be operated simultaneously, compared to analog systems.

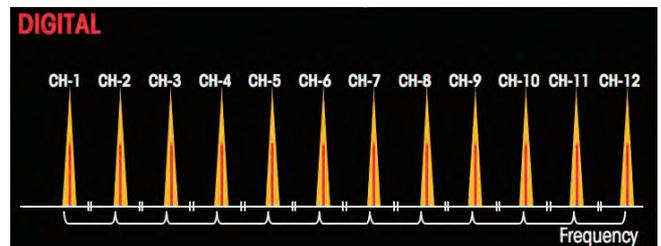
Analog Wireless System

Intermodulation free special channel allocation is necessary.



Digital Wireless System (WiDIF-HP)

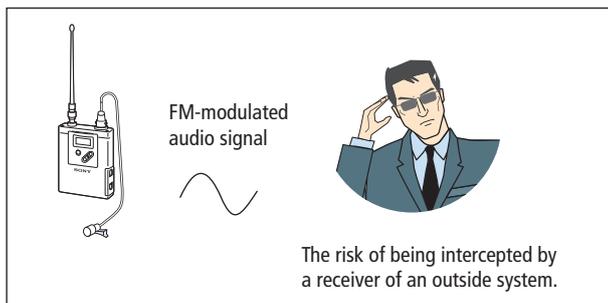
Equally spaced easy channel allocation is available.



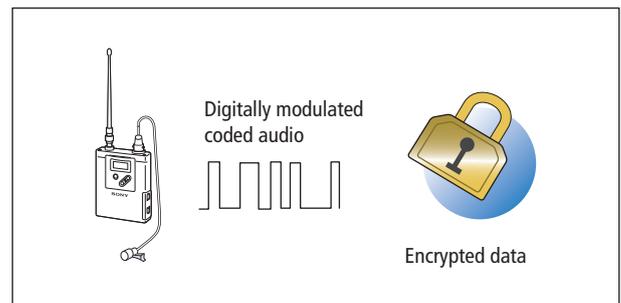
Encrypted Transmission Provides Security

Security is an important requirement for wireless systems handling the transmission of audio signals. In an analog wireless transmission system, the transmitted audio signal is at risk of being intercepted by a receiver of an outside system. When using FM modulation, audio signals can be received by anyone with the right equipment and some technical knowledge. By contrast, the digital audio wireless transmission system transmits encrypted audio data, which mitigates the risk of such interception and provides highly secure transmission for even the most critical applications.

Analog Wireless System



Digital Wireless System (WiDIF-HP)



Digital Wireless Outline

What Is Cross Remote?



Cross Remote is a system that allows transmitters to be monitored and controlled from a receiver and the Wireless Studio control software installed on a computer connected to the receiver. For example, the settings of a transmitter worn under clothing can be easily changed over the wireless link.

Cross Remote Functions

Monitor function

Allows you to monitor transmitter setting and status information sent as metadata in WiDIF-HP format. Monitoring can be performed on the receiver display, camcorder menu screen, or multiple computers on which Wireless Studio is installed that are connected to the network.

Control function

Allows remote control of the transmitter from the receiver and Wireless Studio application via a 2.4 GHz band IEEE802.15.4 wireless communication standard that is separate from the main communication line of the UHF. This is done without affecting the battery life, audio quality, and other features of the wireless microphone. Nearly all of the parameters of a transmitter including those for the attenuator, low-cut filter, power, and frequency can be controlled from the receiver.

Scalable Wireless Remote Control System

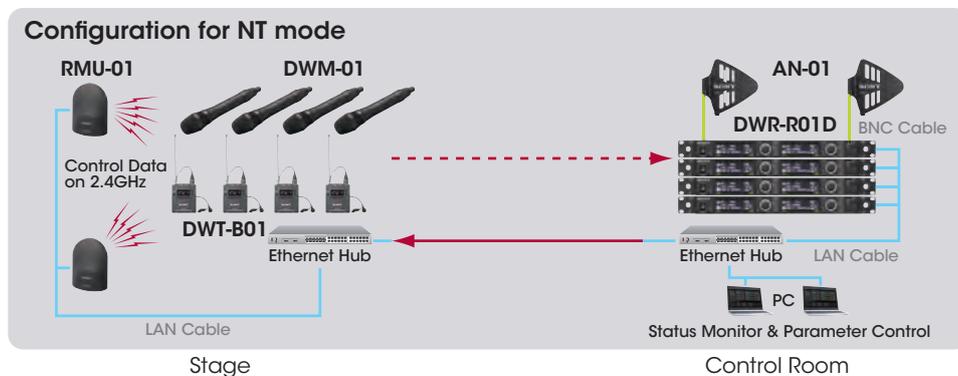
Two types of wireless remote control systems can be configured, to fit the system size and requirements.

ST mode (Standalone mode)

Transmitter and receiver communicate directly in a one-on-one configuration. When the receiver is placed within a main link service area, Cross Remote can be used within a range of about 10 meters from the receiver. To control more than six transmitters, the NT mode system should be used. The DWR-S01D can be used as a receiver only in ST mode.

NT mode (Network mode)

Transmitters and receivers communicate via the Remote Control Unit RMU-01 connected to a network. One remote control unit can control up to 82 transmitters, which allows network-based system management regardless of receiver location. The service area range is about 10 meters from the control unit.

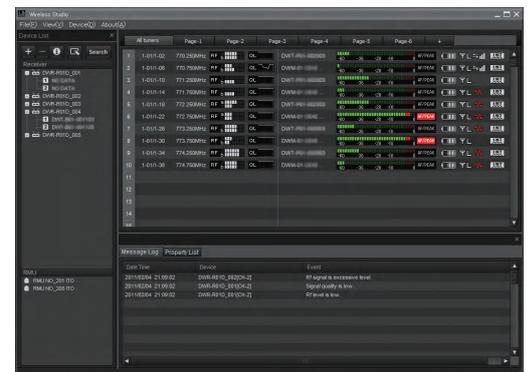


Control Software Wireless Studio

Wireless Studio is a dedicated software application supplied with the Digital Wireless Receiver DWR-R01D. Wireless Studio can be used both in ST mode and NT mode.

Wireless Studio provides the following functions.

- Monitor and control up to 82 transmitters simultaneously.
- Display the status of the receiver and remote control unit, in addition to that of the transmitter, on the computer monitor.
- Save configuration data and monitor setting data. Return configuration data to an earlier state.
- Create an error log, which can be useful, for example, in identifying the cause of reception problems.



WiDIF-HP Technology

A new high-profile format for the digital audio interface on UHF – WiDIF-HP – has been developed for the DWX series. This section provides further details on WiDIF-HP technology.

WiDIF-HP Technology Outline

A digital audio wireless transmission system handles audio after the analog signal has been converted into digital form by an A/D converter.

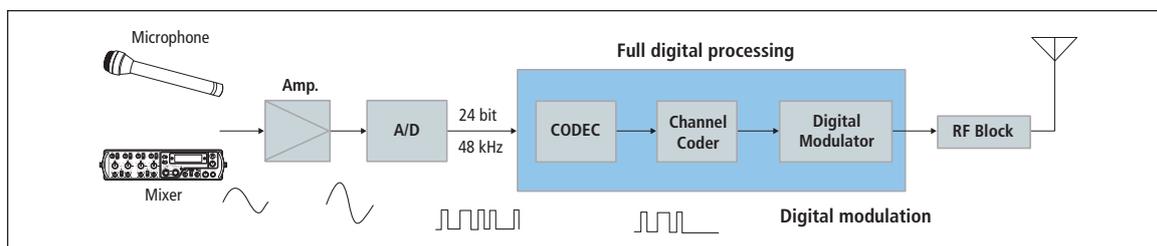
In conventional analog wireless systems, the compander providing compression and expansion is a key component for enabling wide dynamic range. The compander system uses complex analog circuitry for maintaining sound quality and response characteristics. However, this analog system requires advanced techniques to keep performance levels constant, because analog circuits are subject to the performance instability and adjustment tolerances of parts.

By contrast, the digital audio wireless transmission system is free from such instabilities as it does not require a compander system. In short, digital audio wireless transmission is an optimum system to transmit high-quality audio signals without deterioration.

Transmitter

The transmitter in the digital audio wireless transmission system digitizes analog audio signal inputs from microphones and mixers and then wirelessly transmits them as a digital signal. This section describes the processes that occur within the transmitter.

An analog audio signal is first amplified in the amplifier and digitized in the A/D converter. The codec then applies data reduction techniques to the digital signal from the A/D converter and transcodes it into a digital bit stream with a lower bit rate. In the channel coding section, sync data and error processing data required for wireless transmission are added to the audio data, and the resulting data are encrypted. The digital modulator generates the $\pi/4$ QPSK modulation signal used to transmit the channel coded digital stream over the digital wireless link. The modulated signal is supplied to the RF block which amplifies the modulated carrier to the power level required for transmission.

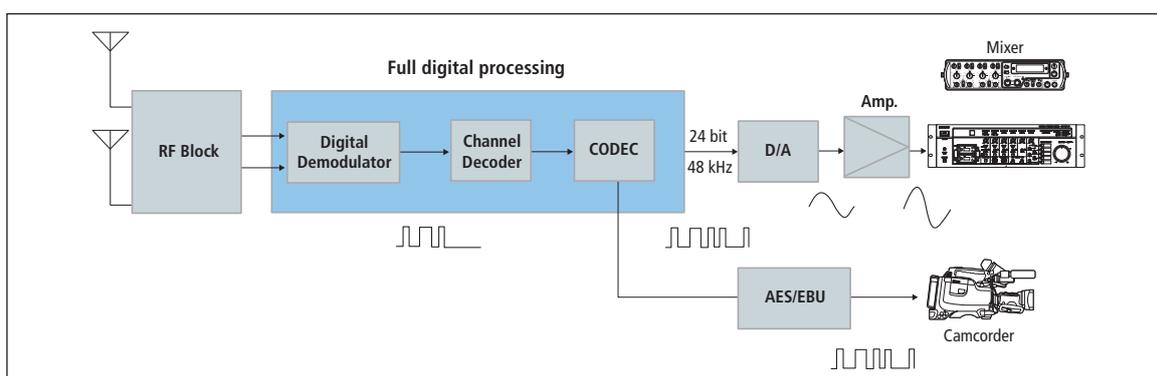


Receiver

Upon receiving the modulated carrier wave from the transmitter, the receiver reproduces the digital audio signal and outputs it as either an analog or digital signal to audio equipment such as an audio mixer or a power amplifier. This section describes the processes that occur within the receiver.

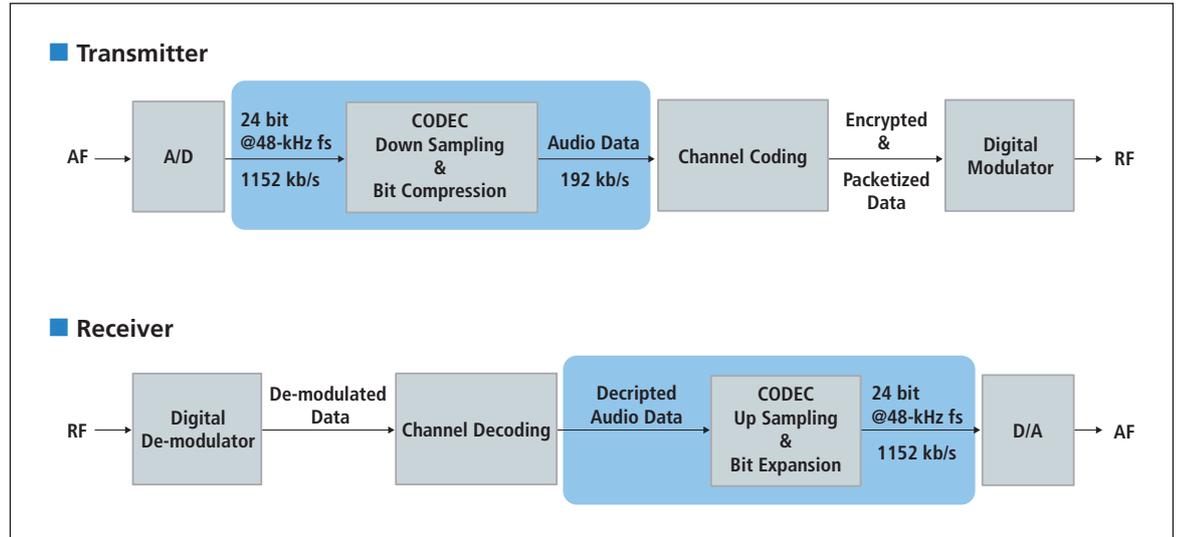
In the RF block, the received signal is digitized by the A/D converter. Similar to the transmitter, three main processes are then performed in the signal processing block: digital demodulation, channel decoding, and codec processing.

After receiving the signal from the RF block, the digital demodulator reproduces the digital stream that was channel coded at the transmitter. Then the channel decoder performs synchronization, decryption, error processing, and audio data extraction. The codec expands the signal that was data reduced to a low bit rate in the transmitter and reconstitutes the digital audio signal. The reconstituted digital audio signal is routed through the D/A converter and amplifier to be output as an analog audio signal or as a digital signal corresponding to standard audio interface specifications such as AES/EBU.



Sony's Proprietary WiDIF-HP Codec

In the wireless system, audio signals have to be transmitted within a limited wireless bandwidth. Transmitting the highest possible quality audio in this limited bandwidth is the major issue for wireless microphone development. In addition, low-latency audio transmission is another requirement of microphone applications. To transmit the best quality audio within limited bandwidth, Sony developed a digital wireless transmission system that employs a proprietary WiDIF-HP codec, which realizes both outstanding sound quality and low latency.



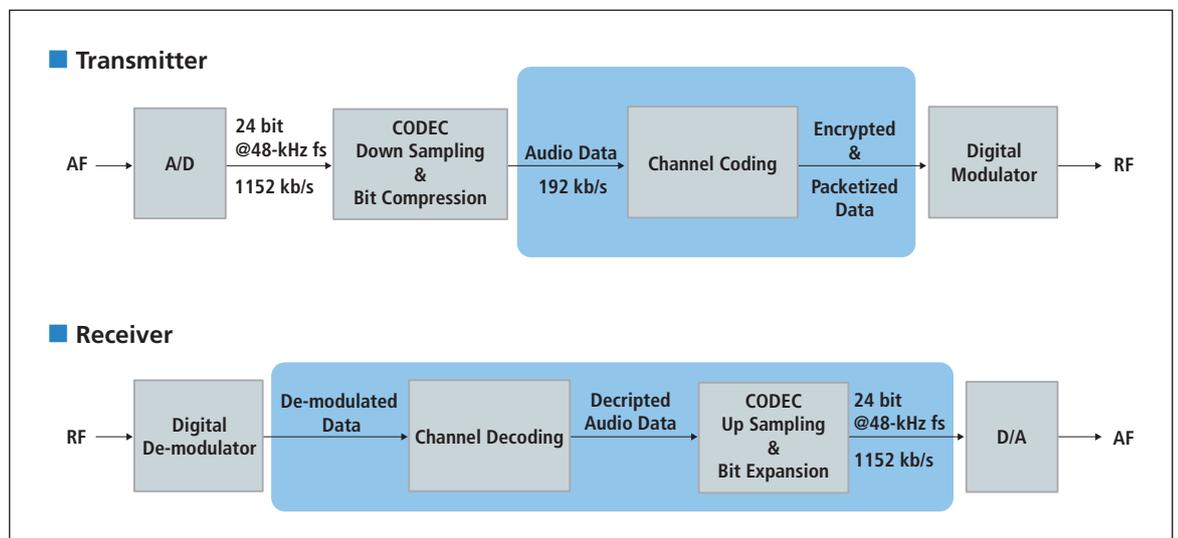
The WiDIF-HP codec is characterized by the following key features.

- Outstanding sound quality with 24-bit/48-kHz sampling
- Low latency
- Secure transmission

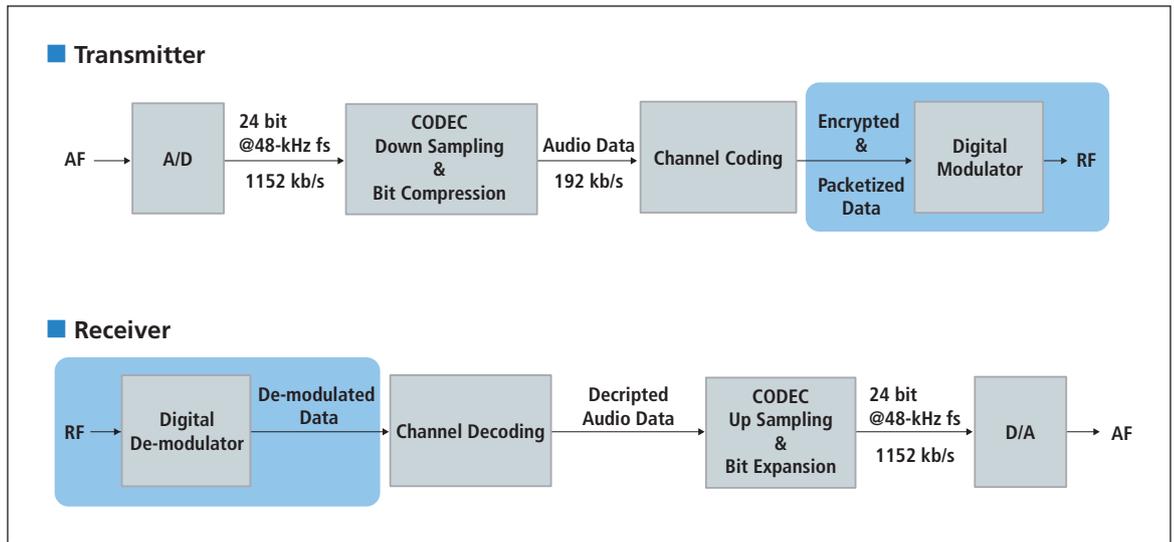
The Sony digital audio codec achieves an optimum balance between sound quality, bit rate, and latency, while having the redundant bit assignment necessary for wireless transmission.

Channel Coding and Decoding

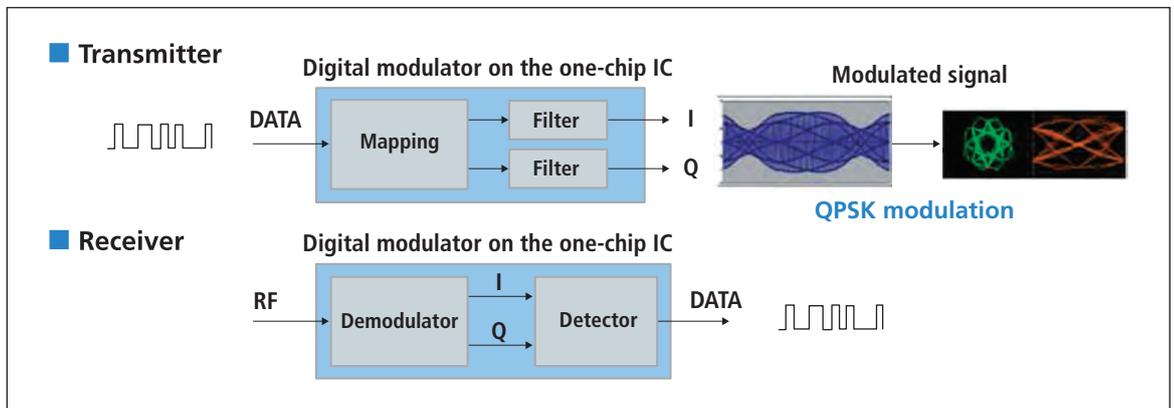
In order to ensure high quality audio signal transmission within the given bit rate limits, WiDIF-HP employs synchronization technology to keep the error count as low as possible, along with error processing technology that minimizes the risk of noise when an error occurs. These techniques were developed and optimized using extensive simulation and field testing programs covering all wireless system operation aspects such as RF signal attenuation, Doppler effect, RF reflections, and more. Signal encryption is also handled at the coding stage.



Digital Modulator and Demodulator (QPSK)



Sony has developed a new digital modulator and demodulator that allows large-scale simultaneous multi-channel operations. In addition to benefiting from advanced RF technology know-how in the field of analog wireless transmission systems, the digital audio wireless transmission system also incorporates a digital modulation system that is less vulnerable to wave interference. These technologies allow highly stable wireless transmission even for a large number of simultaneous multi-channel operations. The newly developed Sony digital modulator and demodulator enables up to 12 channels of simultaneous multi-channel operation in a bandwidth of just 6 MHz. Using a unique algorithm optimized for wireless microphone applications, the digital modulator and demodulator are small enough to be integrated into an FPGA for portable devices.



Technology

Key Features of WiDIF-HP

This section describes the advantages of WiDIF-HP technology.

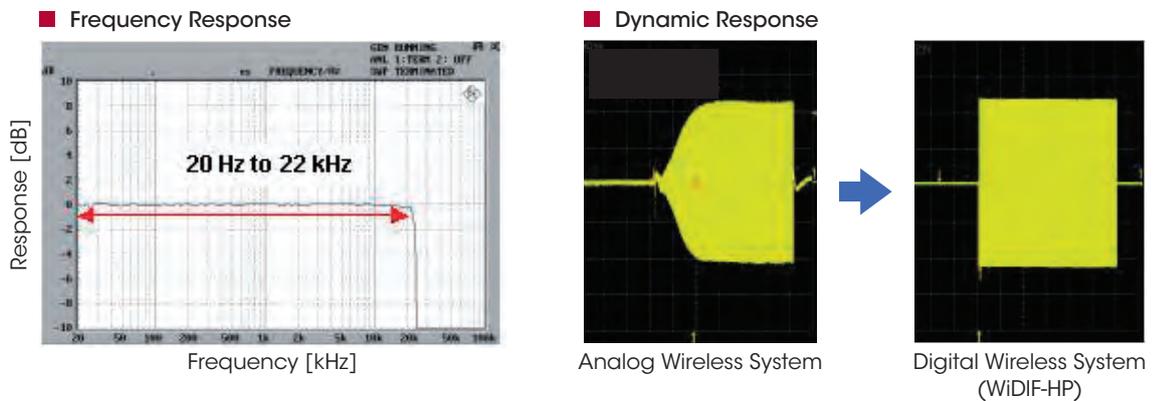
High-Quality Sound Transmission on a Par With Wired Microphones

High sound quality is the most important aspect for a wireless transmission. This is achieved through wide dynamic range, flat frequency response, and excellent transient response performance, factors that are essential for high-performance broadcasting and PA systems.

Analog systems make use of compressors to provide the required dynamic range. However, while compressor systems have improved over time, their inherent problems with regard to sound quality and transient response performance have not been completely solved.

WiDIF-HP technology was developed by Sony to fundamentally improve the transient response performance and therefore further enhance sound quality. It employs 24-bit/48-kHz sampling and provides:

- Wide dynamic range of more than 106 dB
- Wide frequency response of 20 Hz to 22 kHz
- Superb transient response performance



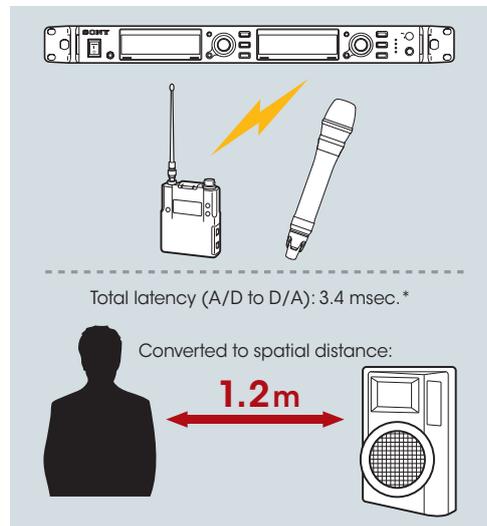
Low latency audio transmission

The second key aspect of the WiDIF-HP codec is low latency. In a digital device, signal delays can often occur due to the sampling, synchronization and calculation process. In particular, when wireless microphones are used for vocals or speech applications, keeping this delay short is crucial.

In a commonly used codec such as the MPEG AAC, more than 20 milliseconds are required just for decoding. The high processing speed of WiDIF-HP provides a fundamental solution to this problem and further enhances sound quality by realizing a total delay of only 3.4 milliseconds* over the entire path from A/D converter in the transmitter to D/A converter in the receiver.

- High-speed response approaching linear systems
- Low latency of only 3.4 milliseconds* in send/receive path

■ Low latency



Note

When digital mixers or similar equipment are used along with the digital wireless system, their latency values will be added. It is therefore necessary to consider the overall latency of the system.

*This is the combined latency of the Digital Wireless Microphone DWM-01, Digital Wireless Transmitter DWT-B01, and Digital Wireless Receiver DWR-R01D.
When analog output is combined with the Digital Wireless Receiver DWR-S01D, the latency rating is 3.6 milliseconds.

Stable Wireless Operation Highly Resistant to Interference

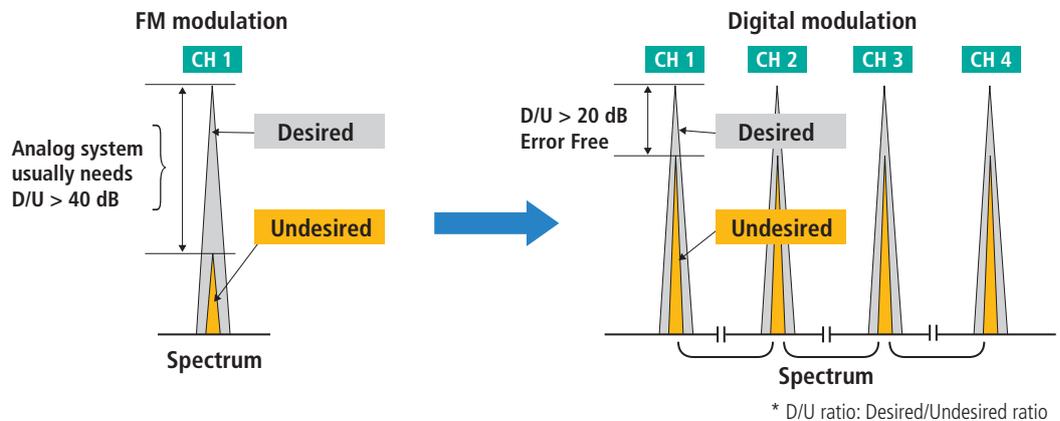
Compared to conventional analog systems, the DWX series employing the WiDIF-HP format provides significantly better rejection of noise, third-order intermodulation, same-frequency interference and other forms of interference. The improvement is on the order of 20 dB or more (more than 10 times better in terms of reception voltage level). This results in improved operation stability.

Analog system

The D/U (Desired/Undesired) signal ratio will be the S/N ratio of the demodulated audio signal. Because interference will be reproduced as noise, the higher the undesired signal level, the higher the noise will be in the modulated signal. Typically, analog systems require a D/U signal ratio of 40 dB or more.

Digital wireless system

Provided that there are no errors, the audio signal quality will not be degraded. In the Sony digital wireless system, an error does not occur provided the D/U signal ratio is 20 dB or more. Therefore sound quality will not be impaired as long as this condition is met.



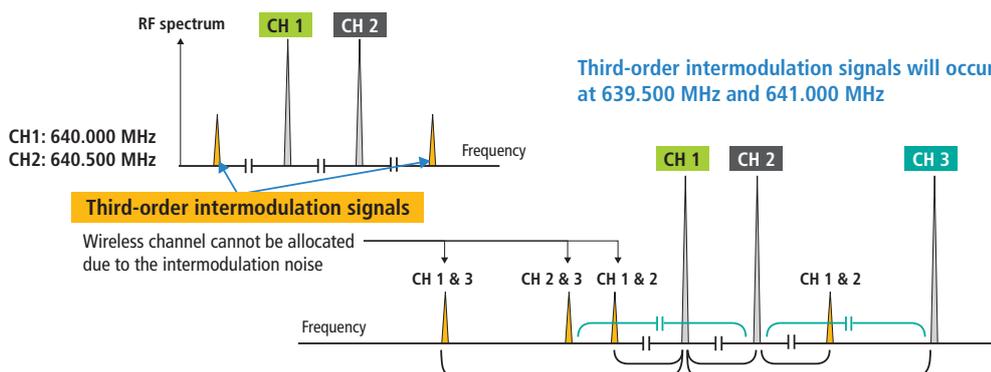
The Sony DWX series of digital wireless microphones employing the WiDIF-HP format provides interference rejection that surpasses conventional analog systems by 20 dB or more (more than 10 times better in terms of reception voltage level), resulting in improved operation stability.

Simultaneous Multi-Channel Operation

With WiDIF-HP, the number of transmitters that can be used within the same band frequency is 1.5 times that of an analog system, allowing for greater operability.

RF and third-order intermodulation

The RF related circuit design is an important aspect for realizing multi-channel operation. In wireless systems with multiple channels, the intermodulation that is generated in the RF amplifier of the transmitter/receiver often causes interference between the wireless channels. The RF block of an analog wireless system must be designed carefully to deal with intermodulation. However, intermodulation cannot be eliminated completely, either in an analog or digital system, as long as the RF part is composed of analog circuits.



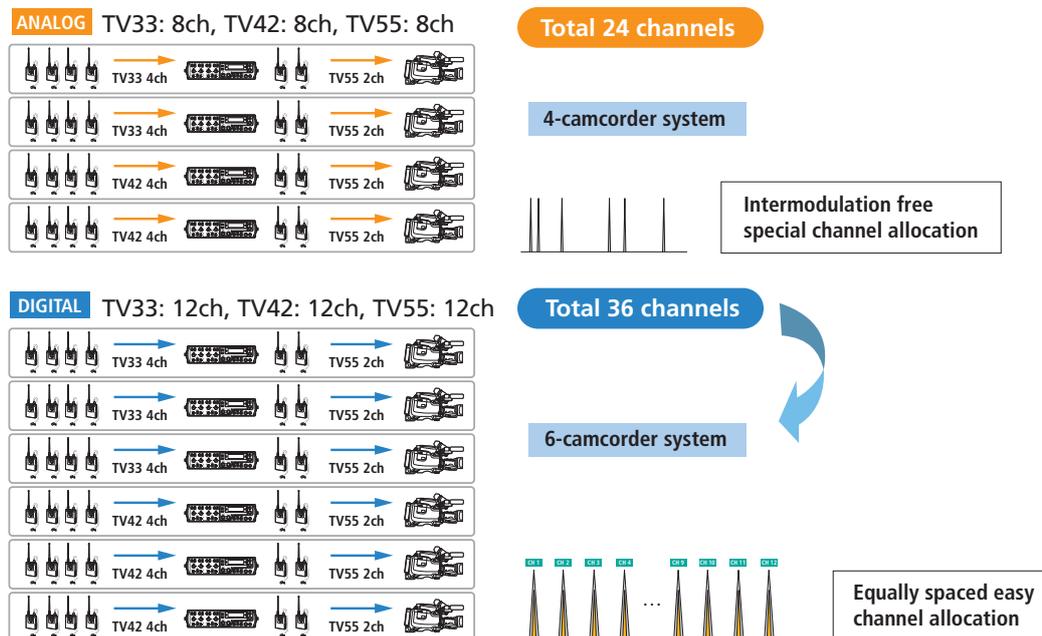
Why are digital wireless systems advantageous to simultaneous multi-channel operation?

In an analog system, the D/U (Desired/Undesired) signal ratio will be the S/N ratio of the demodulated audio signal. The higher the undesired signal level, the higher the noise will be in the modulated signal. Typically, analog systems require a D/U signal ratio of 40 dB or more.

In the Sony digital wireless system on the other hand, an error does not occur provided the D/U signal ratio is 20 dB or more. Therefore sound quality will not be impaired as long as this condition is met. The digital wireless system provides interference rejection that surpasses conventional analog systems by 20 dB or more, and is therefore much less prone to problems caused by intermodulation and is more efficient in handling frequencies within a limited frequency range.

Application Example: Reality TV Show Production

Frequency environment: Clear channels are TV33, TV42, and TV55 only.



Common Frequency Reuse Configuration

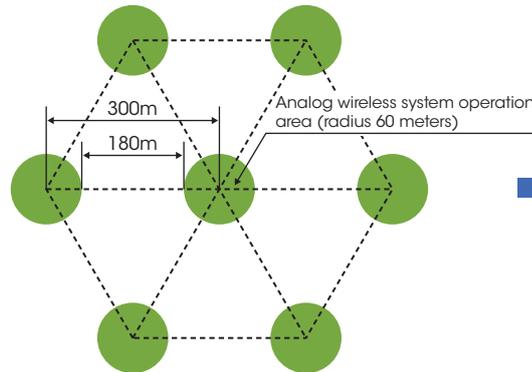
In a digital wireless system, the minimum distance for reusing a common frequency is one sixth of an analog setup. Compared to an analog system or a mixed analog/digital system, the digital wireless system can be configured for a three times bigger operation area which facilitates efficient use of space in convention centers for trade fairs and similar applications.

Common frequency reuse area distances

In digital wireless systems, the minimum distance is one sixth of an analog wireless or mixed analog/digital setup. (With 10 mW output)

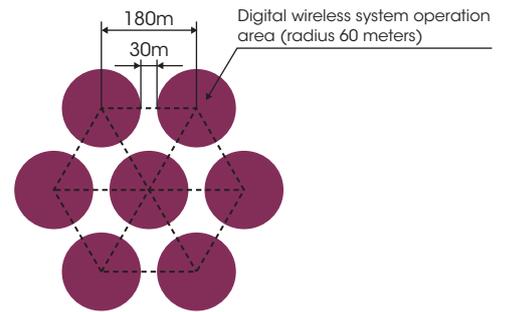
Analog wireless system, or mixed analog/digital system

Minimum area distance: 180 meters



Digital wireless system

Minimum area distance: only 30 meters



Encrypted Transmission

In an analog system, the frequency-modulated (FM) audio signal can be received by anyone with the right equipment and some technical knowledge. By contrast, a digital system allows the use of encryption to make the wireless transmission secure. The signals cannot be decoded by a conventional wideband receiver. This makes it easy to maintain confidentiality for conference rooms, live performance venues and other applications where strong measures against interception are required.

The Sony digital system offers the choice between a secure mode using encryption keys, and a password mode where a secure group comprising multiple transmitters and receivers can be created.

■ Secure key mode

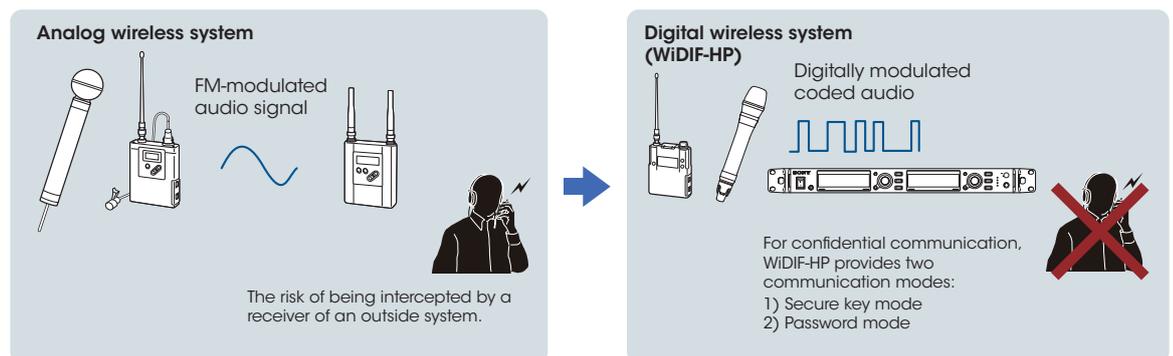
This is a one-on-one arrangement where the encryption key generated by the transmitter is used for a single transmitter/receiver pair only. The mode provides highly secure strong encryption.

■ Password mode

A password that can be freely specified is set for a number of transmitters and receivers, and only equipment using that password can communicate with each other. Connection to equipment without the password set is blocked, resulting in secure operation.

Application example: broadcast station

All pieces of equipment used by the station are assigned the same password, allowing secure operation by staff without having to worry about complicated setup procedures or information leaks. It is also possible to broadcast audio from one transmitter to multiple receivers. Besides applications in the broadcasting sector, this kind of system is also suitable for example for government and other public offices where information must be transmitted securely.



Notes

- Encrypted transmission does not guarantee 100% confidentiality.
- Changing the password on a regular basis is recommended.

Metadata Transmission

Along with the audio signal, comprehensive information about the transmitter is sent as metadata, including audio input level, battery status, attenuator setting, etc. This enhances operation convenience, since the transmitter status can be monitored in any of the following ways:

- On the display of the receiver
- In the viewfinder of the camcorder (when using a slot-mounted camcorder; receiver information can also be monitored)
- In Wireless Studio (a dedicated software application supplied with the Digital Wireless Receiver DWR-R01D)

Metadata transmission principle

Send comprehensive information about transmitter

Transmitter

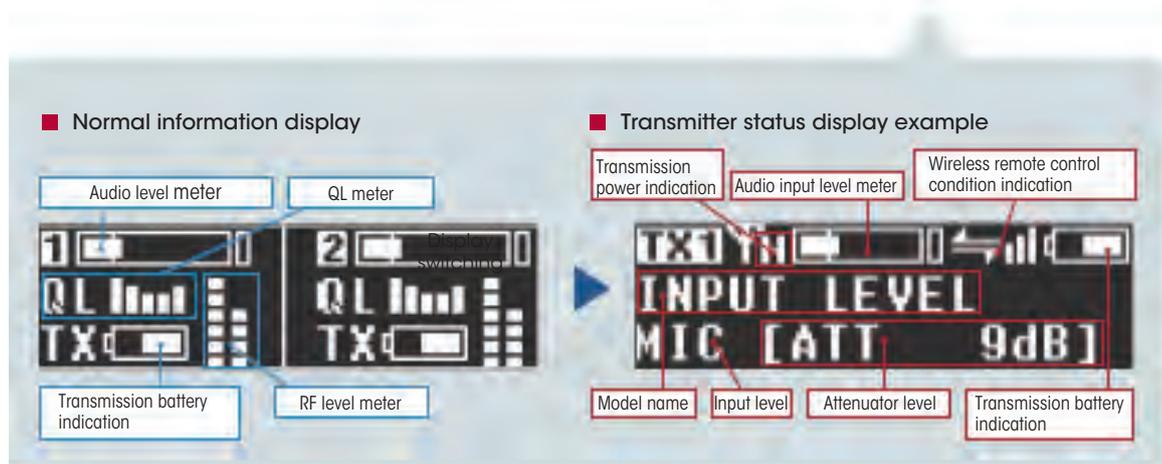


RF signals

Metadata

Receiver uses data to display detailed status information

Receiver



Example for transmitted information (with DWT-B01)

- Transmitter name
- Battery status
- RF power setting
- Attenuator level setting
- Low-cut filter setting
- Continuous operation time

Using metadata

Metadata can be used for setup of other connected equipment.

- Combined delay time of transmitter and receiver can be sent to camcorder for video synchronization, etc.

WiDIF-HP Precautions

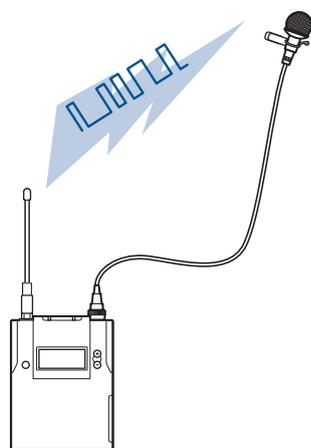
This section provides information about various points to keep in mind when operating a digital wireless system. For details, see “UHF System Configuration” (page 38).

RFI (Radio Frequency Interference) Noise

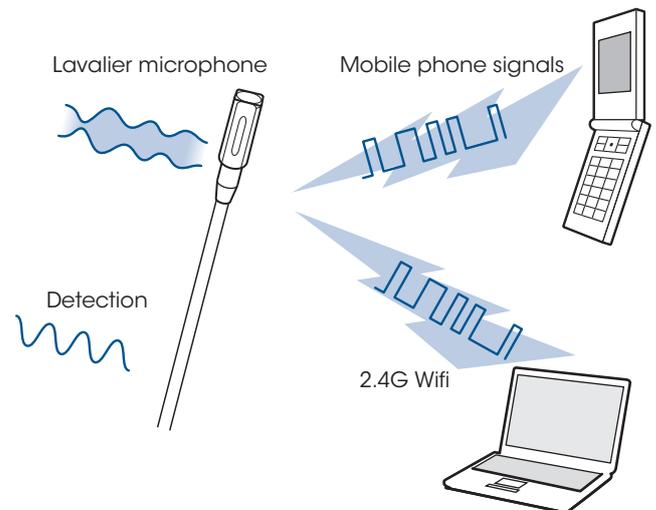
WiDIF-HP performs cyclic packet transmissions similarly to mobile phones, computers, and other digital transmission equipment.

The nonlinear devices (FETs, etc.) in the condenser microphone pick up these other RF signals, and RFI noise may occur according to the packet format as a result. Countermeasures are therefore required. This applies in particular to DWX transmitters set to high output (50 mW).

- The RF signals emitted by WiDIF-HP may affect the lavalier microphone.



- RFI noise may also occur due to RF signals emitted by mobile phones, computers, and other digital equipment.



Noise countermeasures

- Use cables with effective shielding.
- Take measures to implement RF immunity of microphone unit.
- Use lavalier microphones designed to be used together with digital wireless equipment that include RFI noise countermeasures.

Notes

- Dynamic microphones are typically not subject to exhibiting this type of RFI noise.
- Sony professional lavalier and shotgun microphones with a suffix /9X in the model name, such as the ECM-77BC/9X, are certified by Sony to be suitable for use with the DWX digital wireless system. Other Sony professional microphones without a /9X in the model name may not be suitable for use with the DWX system.
- Microphones from Sanken, DPA, or Countryman include models that do not produce RFI noise and can therefore be used with the DWX system. For details on compatible models, contact the manufacturer of each microphone.

Sound Quality Degradation under Weak Field Conditions — Analog and Digital Propagation

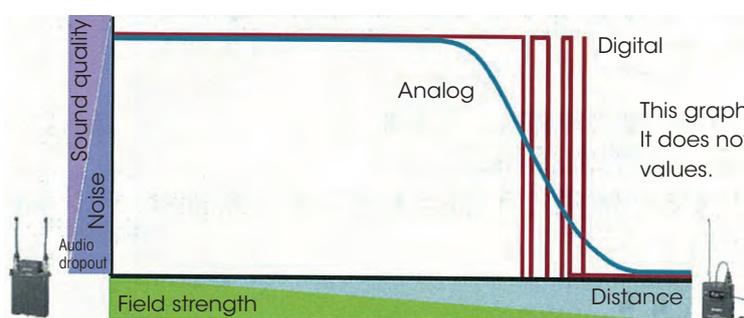
Provided that the transmitter power is the same, the signal level at the receiver at a given distance will be the same for a digital wireless and analog wireless system. This means that both systems can be said to have a service area of the same size.

However, as explained in the preceding sections, the audio quality degradation behavior when field strength becomes low is significantly different for digital wireless and analog wireless.

When compared at an equal transmitter power level, the following differences will occur as correlated to the reception level.

- There will be an area where 1) digital wireless retains high sound quality, 2) analog wireless suffers from deteriorated audio S/N ratio.
- There will be an area where 1) digital wireless starts to exhibit intermittent muting, 2) analog wireless has lower S/N ratio but sound remains audible.

At the same power, the propagation reach is the same, but behavior in the cut-off region is different.



The differences in sound quality degradation under weak field conditions may be experienced as a subjective difference in service area size.

With WiDIF-HP, error processing has been optimized for a digital wireless system where intermittent muting increases as the signal gets weaker. Operation patterns should be decided based on application requirements and an evaluation of characteristics at the service area limit.

Because WiDIF-HP is tuned to maintain voice clarity as much as possible even when errors occur, evaluation of error rates within the service area should be done using the Quality Level (QL) meter on the display of the receiver or of the Wireless Studio application. The QL meter allows observation of transmission quality changes over time.

Mixed Digital/Analog Systems

When digital wireless and analog wireless systems are used together, take the following points into consideration.

Channel plan limitations

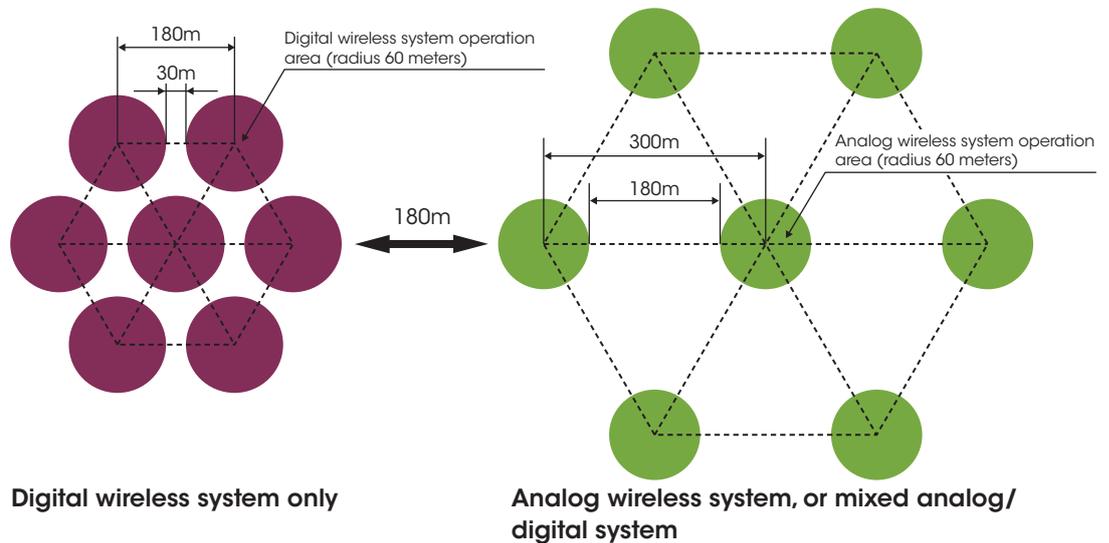
- In a mixed digital/analog wireless system, channel plans designed for analog systems must be used. Equal channel spacing applies only to fully digital wireless systems. Equal channel spacing is not available for analog wireless systems.

Notes

- Refer to Sony digital wireless system frequency lists for further details on pre-programmed groups of frequencies built into every DWX transmitter and receiver.
- Sony's built-in pre-programmed frequency groups provide 500 kHz channel spacing for digital channel plans D1-D9 along with analog channel plans 01-09 (containing irregular channel spacing) to ensure compatibility with Sony analog wireless system channel plans.

Common frequency interference precaution

When operating adjacent to an analog wireless system, the minimum distance for analog wireless systems must be observed.



System Behavior in Case of Interference

To understand how analog and digital systems can have a mutual effect on each other in actual operation, it is important to consider the way in which the demodulated audio signal deteriorates when interference occurs.

Analog → Analog

The stronger the interference, the higher the level of unwanted signals mixed to the audio. This is heard as so-called beat noise, a chirping or squealing sound.

Digital → Analog

As interference gets stronger, a "digital type" hiss noise will gradually be mixed to the audio of the desired signal.

There is no beat noise typical of analog to analog interference. If the receiver has a function for detecting noise and muting the output, the audio will eventually be cut off as the interference noise increases.

Analog → Digital

Behavior is the same as for digital to digital interference.

As interference gets stronger, errors will cause intermittent audio degradation.

When interference increases further, intermittent muting will occur more frequently.

Finally, the output will be completely muted.

Digital → Digital

Behavior is the same as for analog to digital interference.

As interference gets stronger, errors will cause intermittent audio degradation.

When interference increases further, intermittent muting will occur more frequently.

Finally, the output will be completely muted.

With WiDIF-HP, sound quality will not be impaired as long as the D/U signal ratio is 20 dB or more. Unlike with analog systems, there will also be no loud beat noise in case of interference.

The rapid transition characteristics from high sound quality to muting when interference increases are the same as for weak field reception. If the same channel must be used in adjacent areas, suitable measures should be taken to ensure a D/U signal ratio of at least 20 dB. Such measures include maintaining minimum distances, making appropriate settings for transmission power, and appropriate antenna installation design and settings. The RF indicator and QL meter functions of the receiver should be used to determine the final channel plan and equipment settings.

Cross Remote Technology

Cross Remote is a system that allows transmitters to be monitored and controlled from a receiver and the Wireless Studio control software installed on a computer connected to the receiver.

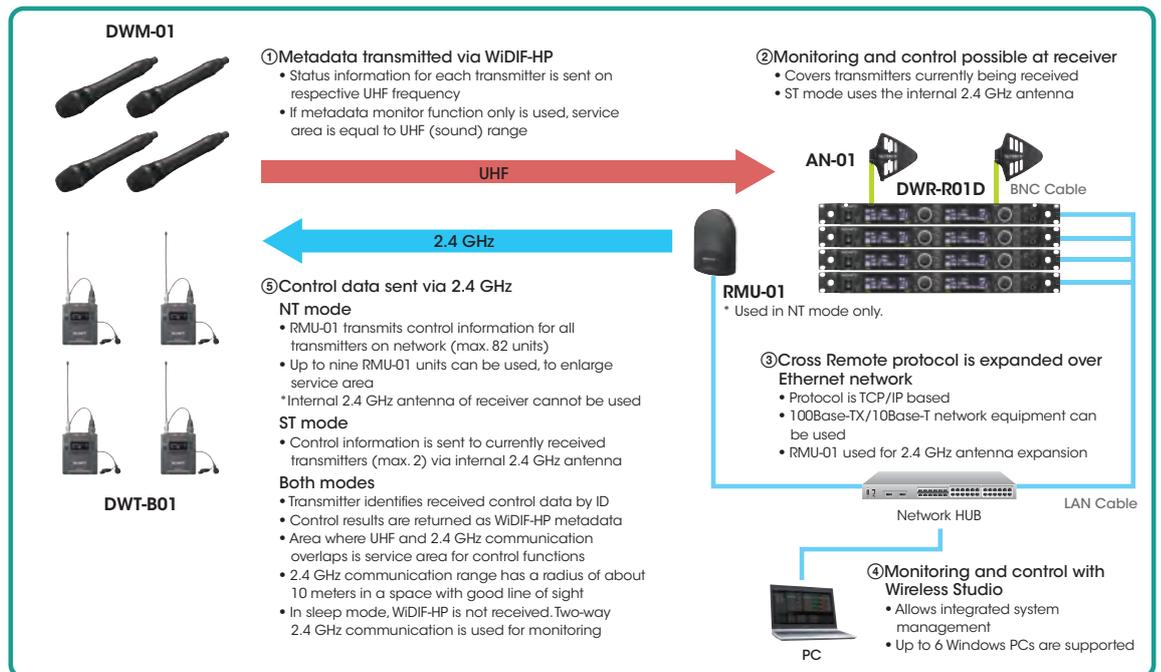
Cross Remote Outline

Compared to analog wireless systems, the DWX series allows more channels to be operated simultaneously. The Cross Remote system for remote control of transmitters from a receiver was developed to facilitate setup and operation of large wireless microphone configurations.

Cross Remote uses an independent 2.4 GHz RF carrier (compliant with the IEEE 802.15.4 standard) to implement remote control that is separate from the UHF main link. This allows simultaneous audio transmission and remote control operation without affecting the battery life, audio quality and other features of the wireless microphone system. Attenuator and low-cut filter settings as well as power, frequency and almost all other transmitter settings can be controlled remotely. Even when the transmitter is worn concealed on the body, Cross Remote makes it easy to change settings remotely.

How Cross Remote works

Cross Remote transmits the data described below, allowing remote monitoring and operation of the transmitter from the receiver side.



*When using the DWR-S01D as receiver, the RMU-01 or a computer cannot be used.

Why does Cross Remote use both UHF and 2.4 GHz frequencies?

Cross Remote is a two-way communication system for transmitters and receivers that uses both UHF and 2.4 GHz frequencies to complement each technology's strengths and advantages.

■ Advantages of 2.4 GHz (over using two-way UHF)

- Two-way UHF would require a built-in receiver on the transmitter and would result in higher power consumption, larger equipment size, and higher cost, making the implementation of this approach impractical.
- Because two-way UHF uses UHF channels for control, the number of channels that can be used simultaneously is reduced. 2.4 GHz control on the other hand does not effect the number of channels that can be used simultaneously.

■ Advantages of UHF (over using two-way 2.4 GHz)

- UHF communication is always on. If an audio link is established, it will always reach the other party. 2.4 GHz on the other hand is not always on, in order to save power.
- 2.4 GHz uses common frequencies on a time sharing basis and connects only when needed.
- The control signal (upstream) sends the same information to 82 units simultaneously, and status information (downstream) can be divided into separate UHF streams.
- In NT mode, up to 82 transmitters can be monitored and controlled together using RMU-01 units and Wireless Studio. With 2.4 GHz, communicating with all 82 transmitters would take time. When using UHF and 2.4 GHz, the combination of 2.4 GHz for upstream and UHF for downstream links results in a communication system that realizes a smooth workflow.

2.4 GHz IEEE 802.15.4 Technology

Cross Remote uses 2.4 GHz band IEEE 802.15.4 communication technology that does not affect the band used for digital wireless audio communication.

IEEE802.15.4 standard

IEEE 802.15.4 is a worldwide standard for close-range communication applications using the 2.4 GHz band. Bands within the 2.4 GHz range are called ISM* bands and are widely used for microwave ovens, WiFi and Bluetooth applications, as well as for data transmission in medical institutions and similar.

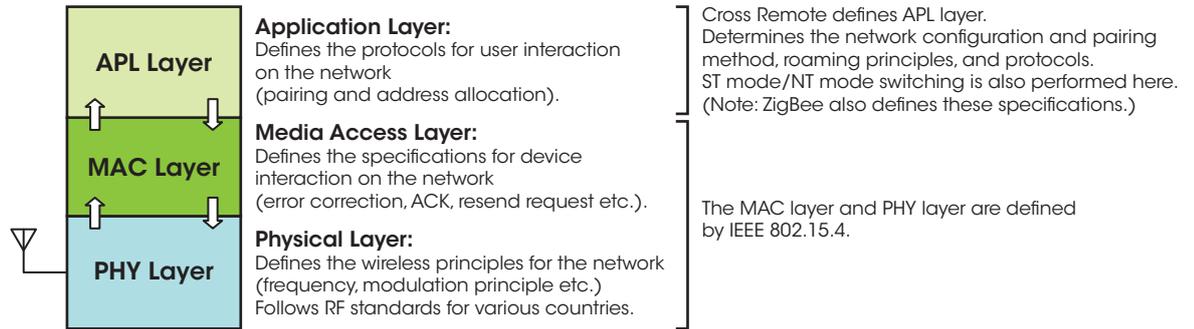
*Abbreviation of "Industrial, Scientific and Medical". Frequency range allocated to wireless communication in these fields, requiring no license to operate.

Notes

- IEEE 802 is a set of network standards developed by the 802 committee of the IEEE (Institute of Electrical and Electronics Engineers). It comprises the following standards:
 - 802.11 Wireless LANs
 - 802.15 Wireless Personal Area Networks (WPANs)
 - 802.15.1 Bluetooth
 - 802.15.3 UWB
 - 802.15.4 Wireless Sensor Network (PAN standard with low power consumption and low transfer rate)
- Reference: About ZigBee
This is a short-range wireless communication standard for domestic appliances. It uses the physical layer interface defined by the IEEE 802.15.4 and newly defines the network layer, security service provider, and application layer. ZigBee is not identical with IEEE 802.15.4.

Technology

System configuration



Why was IEEE802.15.4 adopted?

Among alternatives such as 2.4 GHz wireless LAN, Bluetooth, and UWB, Cross Remote has chosen IEEE 802.15.4 for the following reasons.

- Very low power consumption avoids degradation of battery life for the main communication link.
- Very fast wakeup from sleep state. Intermittent operation further contributes to power savings, while posing no inconvenience for users.
- Communication speed and range are suitable for control requirements.
- In addition to point-to-point communications, network can be expanded, allowing control of multiple transmitters from multiple computers.

Cross Remote uses the physical layer and MAC layer specified by IEEE 802.15.4, and defines the application layer according to the requirements of convenient on-site use.

Notes

Why RF wireless rather than infrared?

Whereas infrared wireless becomes unusable when there are screens or other obstacles, RF wireless allows remote control of a transmitter even when worn under clothing.

Why 2.4 GHz band?

Among the frequencies covered by IEEE 802.15.4, namely 868 MHz, 915 MHz, and 2.4 GHz, the 2.4 GHz band was chosen because it allows worldwide use. It is suitable as a common platform for devices to be used globally.

Used frequencies

Cross Remote selects the optimal frequency for communication based on the system and the environment. If interference is detected on a currently used frequency, the system automatically switches to another frequency and continues communication. This assures stable operation even under congested 2.4 GHz conditions.

Cross Remote frequency bands

IEEE 802.15.4 comprises the following specifications, but because of RF regulations, only the 2.4 GHz band can be used worldwide.

- 868 MHz (BPSK, 20 kbps)
- 915 MHz (BPSK, 40 kbps)
- 2.4 GHz (O-QPSK, 250 kbps)

Cross Remote uses the 2.4 GHz band to allow identical specifications for all global regions.

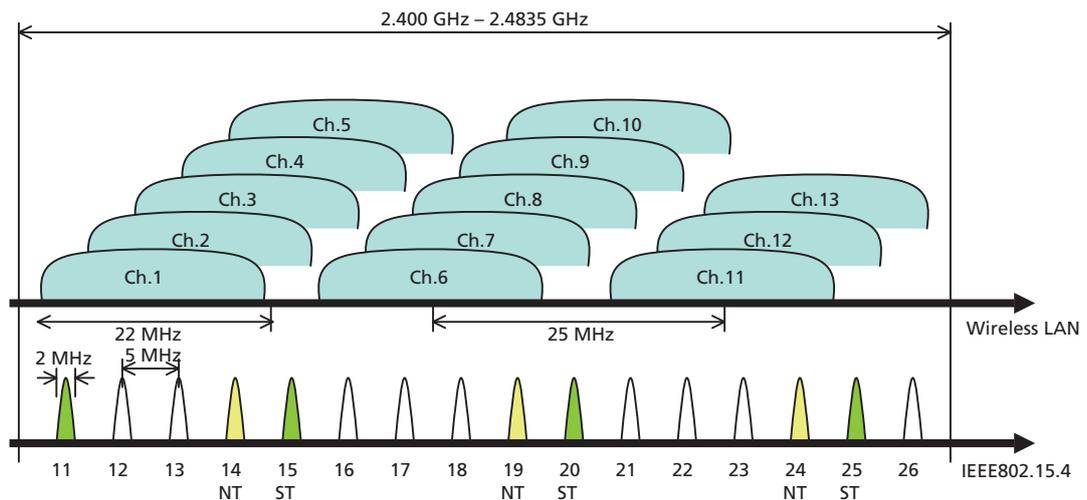
The 2.4 GHz band comprises 16 channels spaced at 5 MHz, from 2.405 GHz (channel 11) to 2.480 GHz (channel 26).

Out of these, Cross Remote uses the following frequencies.

- ST mode: 2.405 GHz (11ch), 2.425 GHz (15ch), 2.450 GHz (20ch), 2.475 GHz (25ch)
- NT mode: 2.420 GHz (14ch), 2.445 GHz (19ch), 2.470 GHz (24ch)

■ Wireless LAN and channel allocation

Channels 1, 6, and 11 are commonly used for wireless LANs.



■ Conditions for frequency switching

Channels are switched when the following conditions occur:

- A wireless LAN starts to operate on the currently selected channel and remote control communication is no longer possible.
- Interference is detected at the receiver. The network is reconfigured.
 - A reset is performed, and the system starts scanning for an empty channel.
 - When a channel is found, the system waits for transmitter reconnection.
- When the connection is interrupted, the transmitter scans all channels and looks for a reconnection target.
 - When the paired equipment is found on another channel, the reconnection process is initiated.

Note

Channel switching does not necessarily occur for all types of interference.

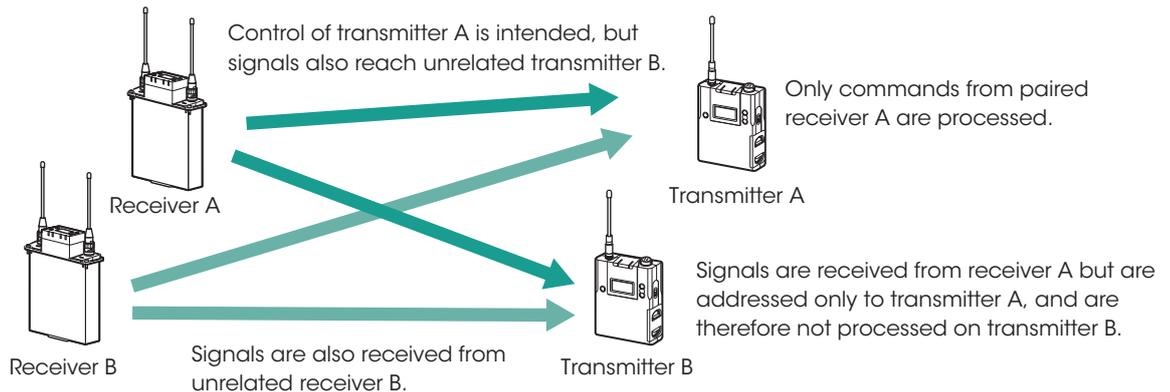
- Short, sporadic interference cannot be avoided by this technique.
- Channel switching is effective for prolonged interference caused by streaming or similar operations on the wireless LAN.
- The receiver controls whether channel switching is performed. Even if subject to interference, the transmitter does not initiate channel switching.

Pairing

Prior to being able to use the Cross Remote control functions, the transmitter and receiver must be assigned to each other in a process called pairing. The relationship between transmitter and receiver is that of Coordinator to Device. When NT mode is used, the Remote Control Unit RMU-01 is the Coordinator.

Pairing requirement

Because Cross Remote uses only three frequencies to control multiple transmitters (up to 82 in NT mode), it is not possible to identify devices by frequency assignment, as for the main communication link. As the control signal reaches all transmitters within the service area, pairing is necessary to establish which receiver is operating which transmitter.



Transmission content for pairing

- **Establish Coordinator/Device allocation**
 - Exchange ID information
 - The MAC address is used as ID.
 - In NT mode, the Ethernet IP address is also registered in the transmitter.
- **Exchanging abbreviated ID information for communication**
- **Sending basic transmitter information (transmitter → receiver)**

The following information is sent.

 - dB range available for attenuation
 - Phantom power supply present/absent, etc.
- **Setting the frequency (transmitter → receiver)**

Notes

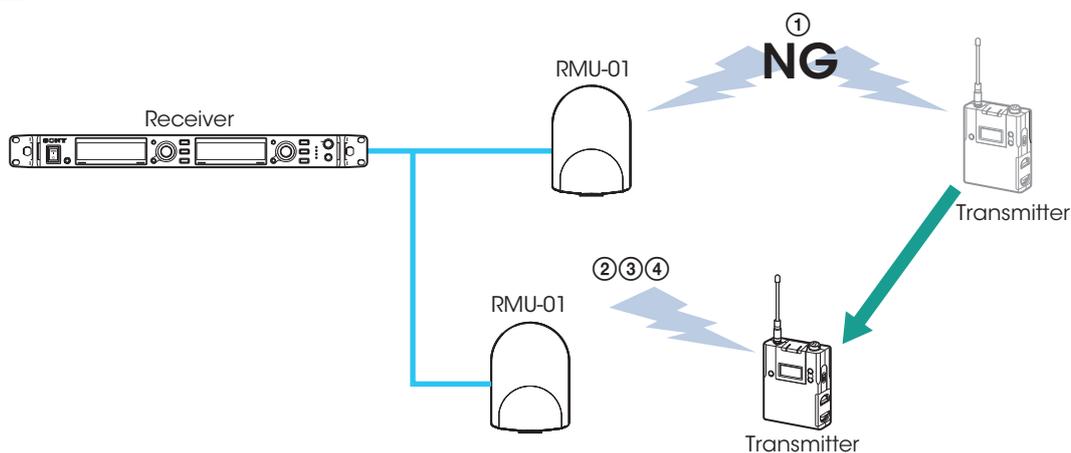
- If pairing was established in ST mode, renewed pairing is necessary when NT mode is to be used subsequently (because the Ethernet IP address information is not registered in ST mode).
- The receiver can display up to 8 candidates for pairing. As the ninth and subsequent transmitters will not be displayed, do not set too many transmitters to pairing mode at the same time.

Roaming

In NT mode, when the connection between transmitter and remote control unit is interrupted, the transmitter automatically searches for another remote control unit to connect to.

If found, the transmitter connects to that remote control unit, and the connection to the paired receiver is established again. This process is called roaming. The Cross Remote service area can be enlarged by using multiple remote control units and maintaining communication through roaming.

Roaming in NT mode



- ① When communication with connected RMU-01 is interrupted...
- ② ...the transmitter scans all channels looking for a RMU-01.
(The RMU-01 connected immediately prior is assigned a lower priority. When other RMU-01 units are found, the transmitter connects to them in the order they are found.)
- ③ When a RMU-01 is found, a connection request is sent.
- ④ Same sequence as during startup is performed.

Notes

- Roaming is only carried out if current communication is interrupted.
- The number of antenna bars displayed in the "Cross Remote" control condition indication, indicates the communication quality, and not the field strength.
- Interruption can be caused by insufficient number of antennas, even if RMU-01 is in close proximity.
- During roaming, connection requests are issued in the order that RMU-01 units are found. The connection is not necessarily established with the closest RMU-01 unit. The RMU-01 unit with which communication was interrupted immediately before will have a lower priority for reconnecting.
- The scan is carried out for not only for NT mode but also for ST mode. When there is a mix of ST mode and NT mode systems or when there are multiple NT mode systems, the roaming process will take longer.

Roaming times

■ When one transmitter performs roaming in a normal communication environment

The number of operation channels does not significantly change the roaming time.

- 1-channel system: approx. 1 second
- 82-channel system: approx. 1.5 seconds

■ When multiple transmitters are performing roaming

- Time per unit x number of units (approximate calculation)
- For example, when 50 transmitters are roaming concurrently, all connections will be established after about 50 seconds. (In-house data)

Note

When there is a mix of ST mode and NT mode systems or when there are multiple NT mode systems, the roaming time may change, depending on the installation environment.

Cross Remote Features

Cross Remote can be operated in two modes, ST mode and NT mode, to fit different system requirements.

This section explains the features of ST mode and NT mode, and of the Wireless Studio application designed for monitoring and controlling transmitters.

ST Mode Features

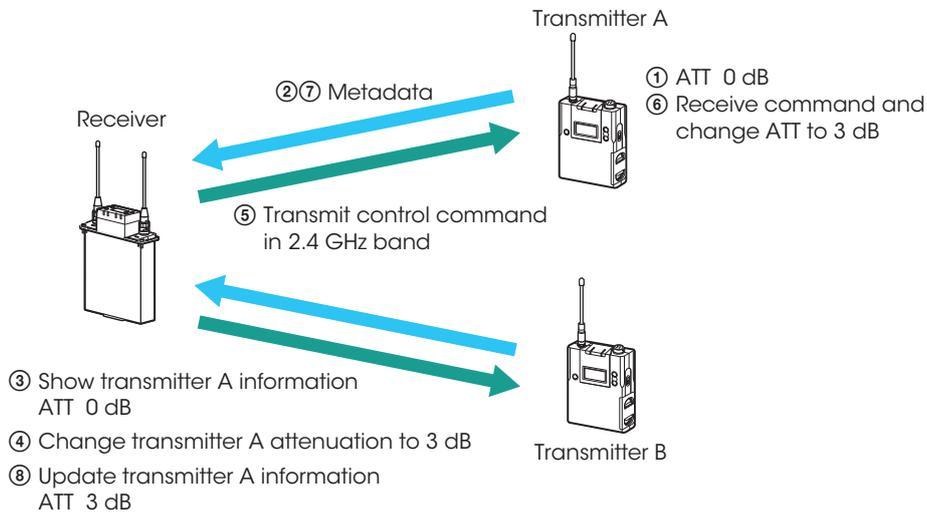
In ST mode, the transmitter and receiver communicate directly in a one-on-one configuration. When the receiver is placed within a main link service area, Cross Remote can be used within a range of about 10 meters from the receiver.

Note

Because the number of channels will increase when more equipment is introduced in ST mode, the NT mode should be selected when more than six transmitters are to be controlled.

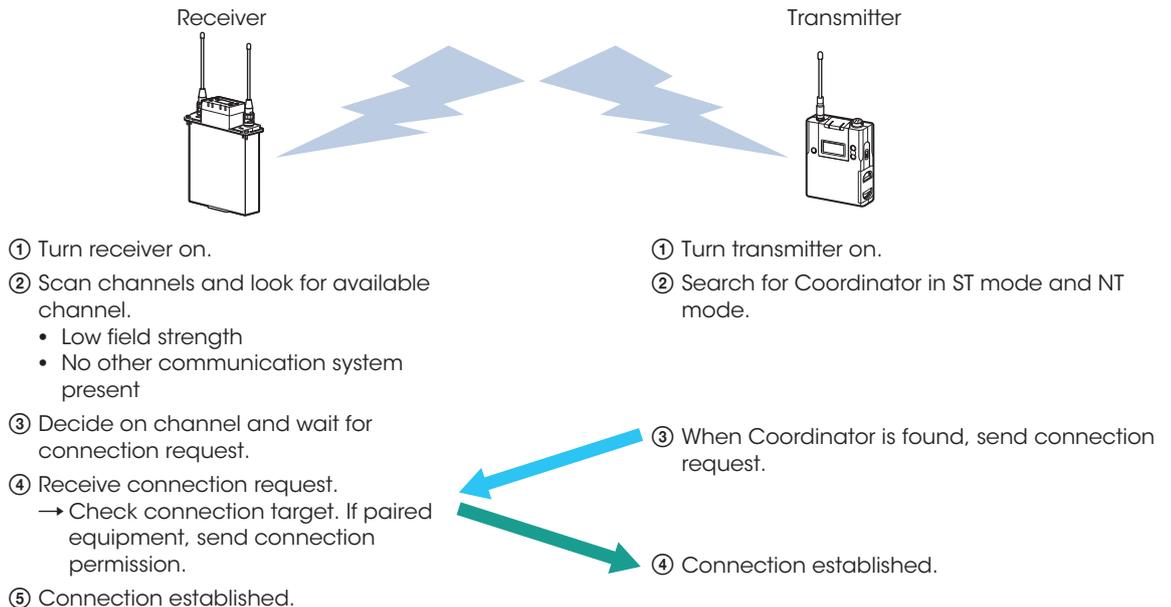
General communication flow

In ST mode, the receiver and transmitter communicate as shown below.



ST mode startup

In ST mode, the connection between receiver and transmitter is established as follows.



NT Mode Features

In NT mode, transmitters and receivers communicate via the Remote Control Unit RMU-01 connected to a network. This enhances convenience during simultaneous multi-channel operation.

In ST mode, a paired receiver and transmitter operate in a one-on-one configuration. This will lead to channel congestion when the equipment count increases. In NT mode on the other hand, the transmitter and receiver communicate via the RMU-01. Because the RMU-01 controls the overall communication volume on the remote control channels, congestion can be avoided also when equipment count increases.

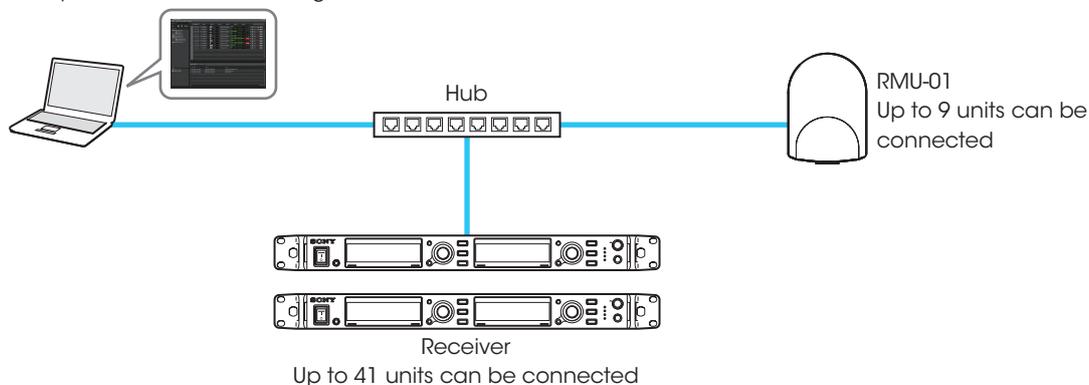
Features of Remote Control Unit RMU-01

Connection to receiver is established via Ethernet (wired LAN).

By installing the Wireless Studio application (supplied with DWR-R01D) on a computer and connecting this computer to the network, multiple transmitters can be monitored and controlled from the computer.

Connection diagram (simplified)

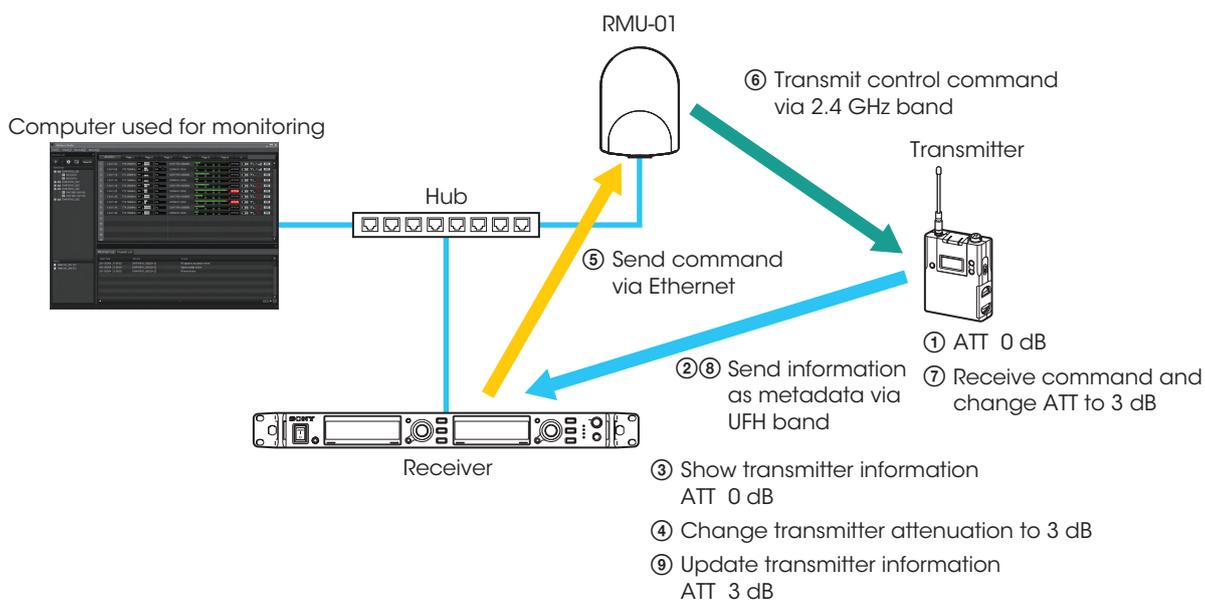
Computer used for monitoring



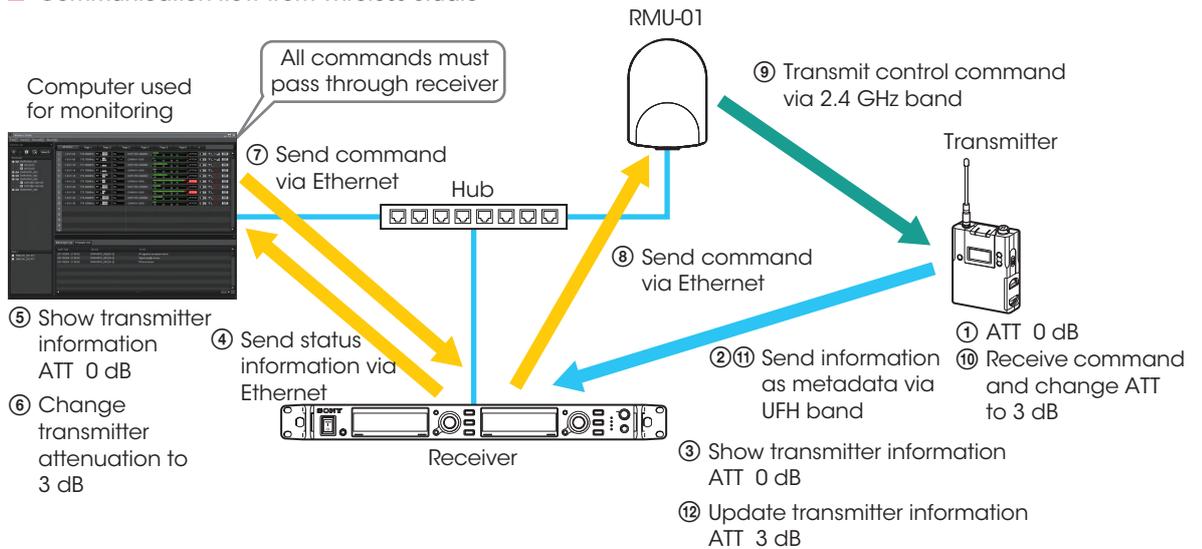
General communication flow

In NT mode, the receiver and transmitter communicate via the RMU-01, as shown below.

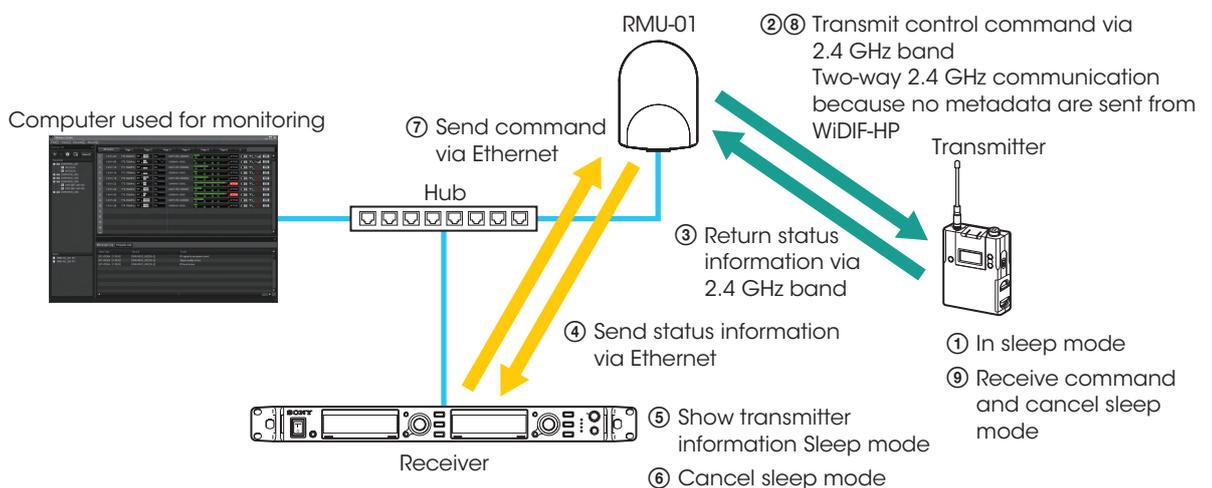
■ Communication flow from DWR-R01D



■ Communication flow from Wireless Studio

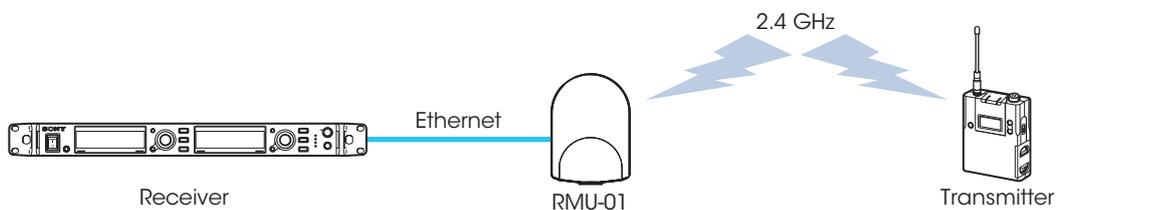


■ Communication flow when no RF signal is present (sleep mode etc.)



NT mode startup

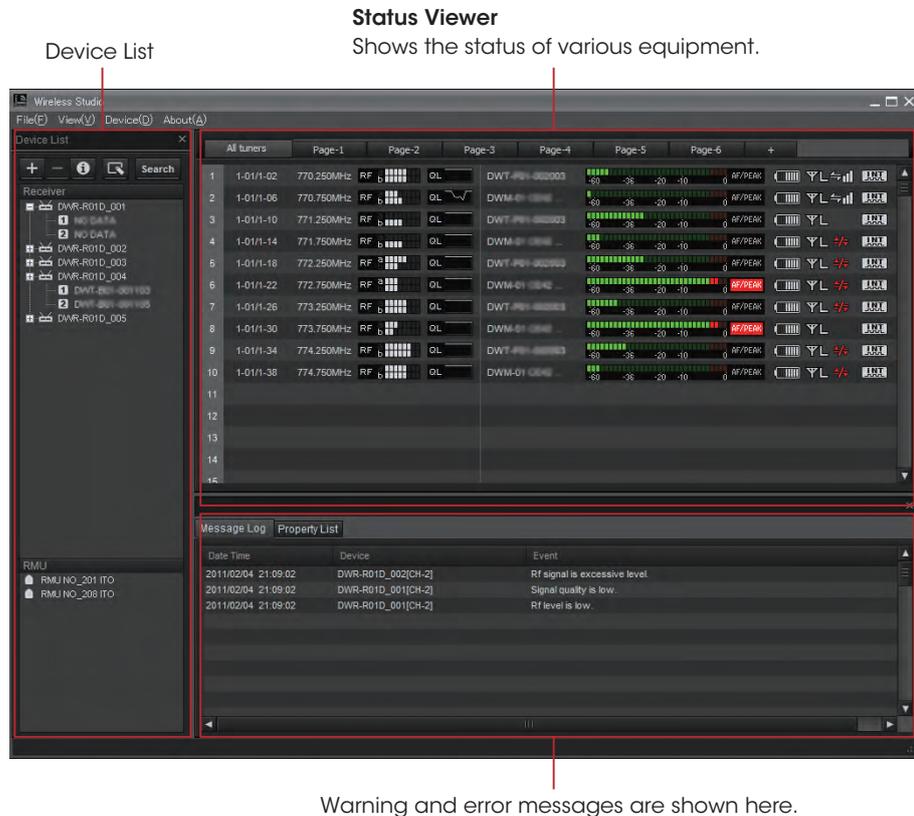
In NT mode, the connection between receiver and transmitter is established as follows.



- ① Turn receiver on.
 - ② Identify pairing target and establish match
 - ③ When connection request is received, enable connection.
 - ④ Request transmitter pairing information (IP address of connection target).
 - ⑤ Check with receiver whether IP address and pairing target are correct.
 - ⑥ When correct target is found, send communication enabled information.
 - ⑦ Start communication.
 - ① Turn RMU-01 on.
 - ② Scan channels and start network.
 - ③ When connection request is received, enable connection.
 - ④ Request transmitter pairing information (IP address of connection target).
 - ⑤ Check with receiver whether IP address and pairing target are correct.
 - ⑥ When correct target is found, send communication enabled information.
 - ⑦ Start communication.
 - ① Turn transmitter on.
 - ② Search for Coordinator in ST mode and NT mode.
 - ③ When RMU-01 is found, send connection request.
 - ④ Establish connection provisionally. (Antenna is still disabled)
 - ⑤ Send pairing information.
 - ⑥ Start communication.
- If IP address changes, communication is no longer possible
→ Repeat pairing process

Features of Wireless Studio

Using the Wireless Studio software application supplied with the Digital Wireless Receiver DWR-R01D, up to 82 transmitters can be simultaneously monitored and controlled. By recording the operation log, operational errors can be examined later.



Information displayed in Status Viewer

- Reception channel information (group/channel/frequency)
- Reception data quality
- Audio signal level
- Transmitter RF power setting
- Synchronization status of output signal at DIGITAL OUT connector of DWR-R01D
- Transmitter communication status
- Transmitter battery status
- Transmitter name
- RF input level

Setup file

Settings required for monitoring with the Wireless Studio application can be saved in a setup file and recalled later.

Note

Wireless Studio identifies the DWR-R01D and RMU-01 by IP address. The DWM-01 /DWT-B01 are mutually identified by the DWR-R01D and MAC address. In order to allow later reloading and 100% restoring of setting information saved in Wireless Studio, all equipment must be the same, and IP address settings also must match. If a piece of equipment is replaced for repairs, for example, be sure to configure the same IP address for the replacement equipment.

Log file

The log begins recording as soon as Wireless Studio enters online mode and is saved automatically in CSV format.

You can view the contents of a saved log by using a text editor to open the log file stored in the Start > My Documents > Wireless Studio folder.

Cross Remote Precautions

This section provides information about various points to keep in mind when setting up and operating a Cross Remote system.

Ensuring a Stable Service Area

- In the Cross Remote service area, the two wireless signals for the main (UHF) link and remote control (2.4 GHz) link must be available together.
- Equipment must be installed in such a way as to ensure that the main (UHF) link and remote control (2.4 GHz) link wireless signals will not be interrupted in the Cross Remote service area.
- When installing main link equipment including antenna, receiver, and remote control unit, the possibility of interference from other equipment should be taken into consideration.
- Design the installation so as to minimize the risk of interference from TV broadcast transmission, other wireless systems, and common frequency channels within the same wireless microphone system. If interference is occurring, increase the distance between the interference source and the wireless microphone system, turn power to the interference source off, or take other suitable measures.
- Regarding the remote control link, the interference risk from other equipment using the 2.4 GHz band should be taken into consideration. Increase the distance of the wireless microphone system to possible interference sources and select equipment to avoid the possibility of simultaneous operation of other 2.4 GHz equipment.
ST mode: Uses 2.405 GHz (11ch), 2.425 GHz (15ch), 2.450 GHz (20ch), and 2.475 GHz (25ch). When there is other equipment that uses the 2.4 GHz band, these channels should be avoided.
NT mode: Uses 2.420 GHz (14ch), 2.445 GHz (19ch), and 2.470 GHz (24ch). When there is other equipment that is using the 2.4 GHz band, these channels should be avoided.
- 2.4 GHz band radio wave propagation is highly linear and not easily deflected. When people or objects are present in the path between the remote control unit and transmitter, reception field strength may decrease drastically. Always try to ensure a direct line of sight between remote control unit and the wireless microphone and transmitter.
- To ensure stable transmission of 2.4 GHz band signals and prevent adverse influences from blocking by obstacles, it is recommended to use a minimum of two RMU-01 remote control units. When multiple units are used, the distance between installation locations should be about 10 to 20 meters. Up to nine remote control units can be used within one system.
- When multiple remote control units are used simultaneously, they should be spaced at least 10 meters apart. The equipment should be kept as far as possible from wireless LAN access points or other equipment using the 2.4 GHz band.
- In NT mode, the whip antennas supplied with the Digital Wireless Receiver DWR-R01D cannot be used. (When the receiver detects a remote control unit, it automatically switches to NT mode.) When there is an adjacent system using NT mode, add a remote control unit to the current system and also operate it in NT mode.

Preventing Interference

Main (UHF) link precautions

- Design the installation so as to minimize the risk of interference from TV, other wireless systems, and common frequency channels within the same system.
- Select channels so as to prevent interference
- If interference is occurring, increase the distance between the interference source and the wireless microphone system, turn power to the interference source off, or take other suitable measures.

Remote control (2.4 GHz) link precautions

- Design the installation so as to minimize the risk of interference from other devices that use the 2.4 GHz band, and be wary of close proximity between devices and simultaneous use of multiple devices.
- WiFi and Bluetooth and other applications also use the 2.4 GHz band. Special care must be taken in locations where large numbers of people congregate, such as at trade shows etc.
- Also take care to avoid interference from wireless remote controls for lighting appliances.

Configuring a DWX System

DWX System Configuration

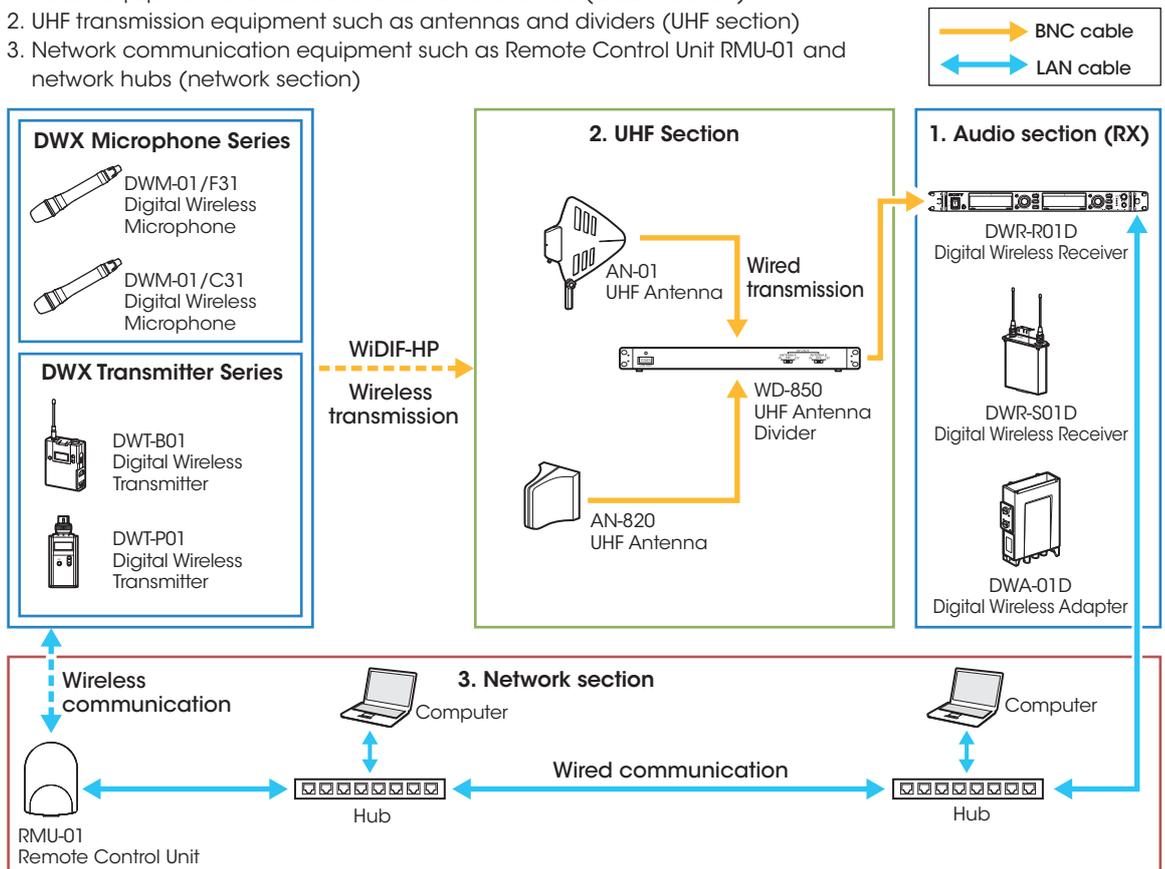
This section describes the process of configuring a system and provides information about limitations, frequency support and other aspects.

System Sections and Configuration Flow

System configuration

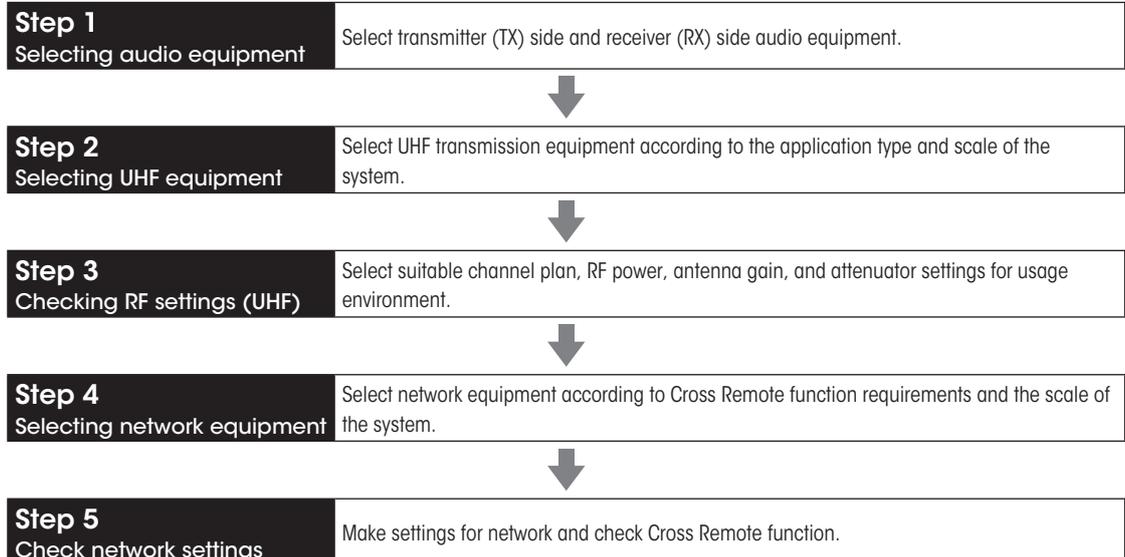
In general, configuring a DWX system will involve the three devices listed below.

1. Audio equipment such as transmitters and receivers (audio section)
2. UHF transmission equipment such as antennas and dividers (UHF section)
3. Network communication equipment such as Remote Control Unit RMU-01 and network hubs (network section)



System configuration flow

Use the following information as a guideline to the steps that are generally required when configuring a DWX system.



Configuring a DWX System

System Limitations

The following limitations apply regarding equipment used in a DWX series system.

Section	Item		Maximum Limit	Remarks
Audio/frequency planning section	Max. number of transmitters	US/Canada	12 channels	Within 1 TV channel (6 MHz)
		EU	16 channels	Within 1 TV channel (8 MHz)
		Japan	18 channels	Within 1 FPU channel (9 MHz)
			10 channels	Within B band (4 MHz)
		82 channels	Within A-B band (40 MHz)	
UHF section	Max. number of DWR-R01D Digital Wireless Receivers (RF cascade)		8 units (16 channels)	
	Number of antenna inputs for UHF Antenna Divider WD-850 Antenna input		4 inputs (2 channels × 2 inputs)	2 diversity inputs
	Number of antenna division outputs for UHF Antenna Divider WD-850 Antenna divider output		8 outputs (2 channels × 4 outputs)	Using DWR-R01D cascade connection, one WD-850 supports up to 64 channels
	Number of cascaded outputs for UHF Antenna Divider WD-850 Cascaded output		1 output (2 channels × 1 output)	Combination of 2 cascaded WD-850 units and DWR-R01D cascade connection supports up to 128 channels
Network section	Max. number of transmitters controlled by Remote Control Unit RMU-01		82 units (82 channels)	Maximum is 82 regardless of number of RMU-01 units
	Max. number of Digital Wireless Receiver DWR-R01D units controlled/monitored from computer with Wireless Studio		41 units (82 channels)	Maximum is 42 regardless of number of computers
	Max. number of RMU-01 Remote Control Units (in one network system)		9 units	
	Max. number of computers with Wireless Studio installed (in one network system)		6 units	

Supported Frequencies

Before selecting equipment, verify the frequency blocks used by the DWX system.

Audio Equipment Selection

When selecting equipment for a DWX series system, please take the features and specifications of the respective models into consideration.

Equipment Features

DWX series equipment is divided into the following categories.

- DWX Microphone Series
- DWX Transmitter Series
- DWX Receiver Series
- DWX Adapter

DWX Microphone Series

- DWM-01/F31 Digital Wireless Microphone (Dynamic type)
- DWM-01/C31 Digital Wireless Microphone (Condenser type)

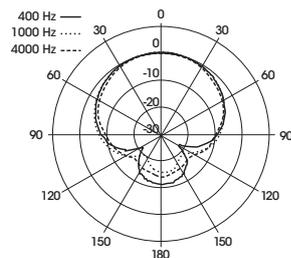
These handheld microphones are suitable for live stage performances and other events, broadcast studios, halls, and theater applications.



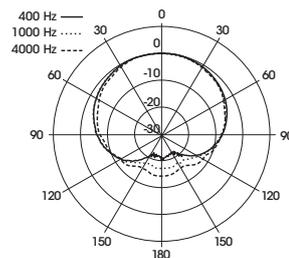
- Handheld digital wireless microphone suitable for vocals, available in two variants, as a dynamic model and a condenser model.
- Three-stage switchable RF output power: 1 mW / 10 mW / 50 mW
- Five continuous hours of operation with two AA-size alkaline batteries at the 10 mW power setting
- Dedicated microphone holder included.

Directional Charts

DWM-01/F31 (Dynamic Capsule)



DWM-01/C31 (Condenser Capsule)



Configuring a DWX System

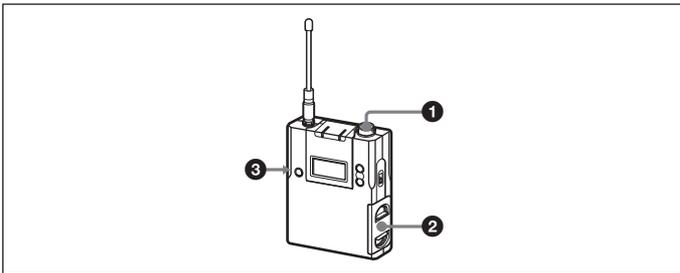
DWX Transmitter Series

■ DWT-B01/E Digital Wireless Transmitter

Compact and lightweight transmitter suitable for a wide range of input levels, from microphone level to line audio level.



- Use with a small, high-performance lavalier microphone equivalent to the ECM-77BC/9X widely used in broadcasting applications or K-1161 GTR adapter.
- Supplied accessories for various applications include soft case with belt clip, XLR input converter cable, etc. (48 V phantom power supply not supported)
- Two-stage switchable RF output power: 1 mW / 10 mW / 50 mW
- Five continuous hours of operation with two AA-size alkaline batteries at the 10 mW power setting

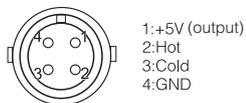


❶ Audio input connector (SMC9-4S)

Connects the output plug from the optional lavalier microphone. This connector also accepts the input from another wired microphone connected through the supplied XLR cable, or the audio output from a mixer, etc.

❷ Battery compartment

Accommodates two LR6 (size AA) alkaline batteries.



❸ USB connector (Micro USB)

Use this connector to connect an optional USB keyboard to carry out menu functions using key operations. By connecting the DWR-S01D to this connector with the supplied USB cable, you can exchange the encryption key for encrypted transmission function.

■ DWT-P01 Digital Wireless Transmitter

The DWT-P01 is a plug-on transmitter that supports a wide range of audio input levels, from microphone level to line level.



- Allows direct connection of dynamic microphones and condenser microphones requiring 48 V phantom powering.
- Three-stage switchable RF output power: 1 mW / 10 mW / 50 mW
- Five continuous hours of operation with two AA-size alkaline batteries at the 10 mW power setting

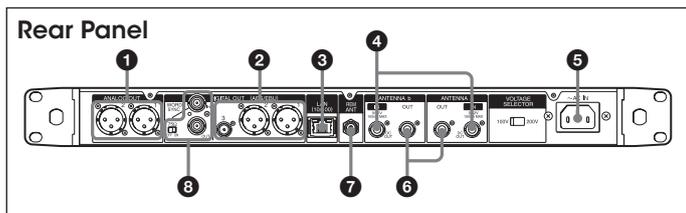
DWX Receiver Series

■ DWR-R01D Digital Wireless Receiver

The DWR-R01D is a 1U-size two-channel rack-mountable receiver with wide bandwidth coverage.



- Large OLED display and JOG dial on the unit make it easy to perform various operations quickly and precisely.
- 3 digital outputs in addition to 2-channel analog output. 32 kHz – 96 kHz word sync input/output connector supports system connection for digital synchronization.
- Support for diversity reception enables dual antenna input/cascaded output.
- 9 or 12 V DC power supply output for powering Sony UHF AN series active antennas.
- Built-in LAN (10/100) port allows configuration of a network system using the Remote Control Unit RMU-01 and Wireless Studio.
- Supplied Wireless Studio application supports monitoring and control of up to 82 transmitters.

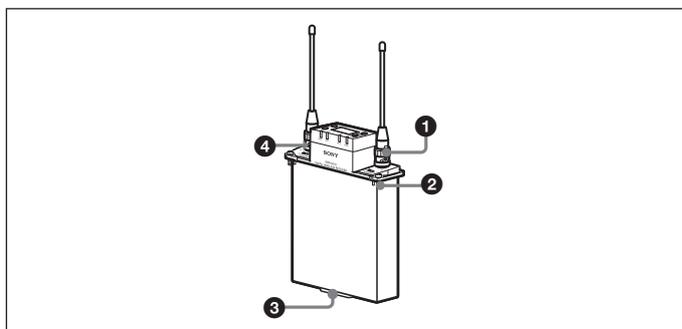


- 1 ANALOG OUT (Analog output) 1/2 connectors (XLR type)**
For connection to the analog input of a mixer, amplifier, etc.
The analog audio output level can be set from a menu.
- 2 DIGITAL OUT (Digital output) 1/2/3 connectors (1/2: XLR type, 3: BNC-R)**
Supply an AES3 format digital audio signal. For connection to the digital input of a mixer, amplifier, etc.
- 3 LAN (Ethernet) (10/100) connector (RJ-45)**
For connection to a 100Base-TX network.
Connect to a Windows computer or hub, for communication using the supplied Wireless Studio software application.
- 4 ANTENNA a/b IN (Antenna a/b input) connectors (BNC-R)**
For connection of the separately available UHF antenna AN-820 or the supplied whip antennas.
Antenna power supply can be set to 9 V or 12 V DC from a menu. The power supply can be switched off when the connected antennas do not require powering.
- 5 AC IN connector**
For connection of the supplied AC power cable.
- 6 ANTENNA a/b OUT (Antenna a/b output) connectors (BNC-R)**
DWR-R01D can be connected to a and b, with support for cascading of up to 8 units.
- 7 REM ANT (ST mode system antenna)**
For connection of an external antenna for the ST mode system.
- 8 WORD SYNC IN/OUT (Synchronization signal input/output) connectors (BNC-R) and 75-ohm termination switch**
An external word clock sync signal can be connected to the WORD SYNC IN connector to synchronize the digital output to external equipment. (Word clock sample rate range: 32 kHz - 96 kHz)
The signal supplied to the WORD SYNC IN connector is passed as is to the OUT connector.
Set only the 75-ohm termination switch on the last DWR-R01D in a cascaded configuration to ON.

DWR-S01D Digital Wireless Receiver
Camcorder slot interface 2-channel receiver



- Can be mounted also on camcorders without mounting slots, by using the Wireless Adapter DWA-01D.



- 1 Antenna and antenna connector (BNC type)**
Connect the supplied antenna here.
- 2 Mounting screw**
Use to attach the receiver to a camcorder or DWA-01D digital wireless adapter.
- 3 Accessory connector**
Use to connect the receiver to a camcorder or DWA-01D digital wireless adapter. Power, audio, and control signals are sent through this connector.
- 4 USB connector**
Connecting a USB keyboard to this connector allows menu operation to be performed on the keyboard. Connecting the transmitter to this connector through the supplied USB cable allows an encryption key to be exchanged with the transmitter.

Configuring a DWX System

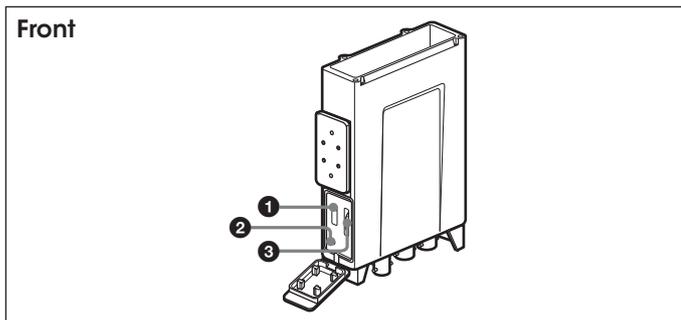
Adapter

■ DWA-01D Wireless Adapter

The DWA-01D can be used as a portable wireless receiver in conjunction with the Digital Wireless Receiver DWR-S01D. It can also be mounted on a camcorder, and two units can be linked for 4-channel operation.



- Audio output can be switched to analog or AES/EBU digital output. AES/EBU digital output carries two channels over a single cable. Channel 1 can be analog, even if channel 2 is used as digital output. (Analog UHF Synthesizer Tuner Unit WRR-855S is also supported, but the AES/EBU digital output and analog output in channel 2 cannot be used.)



1 Monitor output selector

Selects the audio output from the PHONES connector.

1: Outputs the audio from the OUTPUT1 connector to the L/R channels.

1+2: The audio from the OUTPUT1 connector is mixed with the audio from the OUTPUT2 connector (only when the OUTPUT2 connector is set to output analog signal) and output to the L/R channels.

2: Outputs the audio from the OUTPUT2 connector (only when the OUTPUT2 connector is set to output analog signal) to the L/R channels. When the WRR-855 is attached, no audio is output from the PHONES connector.

Note

Monitor output is split from the analog signal output to the OUTPUT1/2 connectors. When audio that is output to the OUTPUT1 connector is changed on the DWR-S01D using the ANALOG OUTPUT1 function, monitor output changes accordingly.

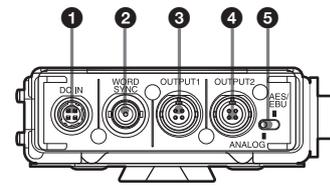
2 PHONES (monitor output)

connector (3.5 mm, TRS jack, tip: L, ring: R, sleeve: ground)
Connect the headphones here. Select the output signal using the monitor output selector.

3 Monitor level control

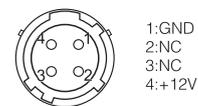
Adjusts the monitor output level.

Bottom



1 DC IN (external power input)

connector (4-pin) Connect to the external power output connector of the camcorder using the supplied DC power cable. This connector accepts the power voltage between 10 V DC and 17 V DC.



2 WORD SYNC (word sync input) connector (BNC type)

Accepts external sync signal. When the DWR-S01D is attached and the sync signal is input, the DWR-S01D can be operated in synchronization with the whole audio system.

Note that this connector does not work when the WRR-855S is attached.

Note

Even when the 75-ohm termination has been added on the DWR-S01D, this connector still works as the high-impedance input connector while the DWR-S01D is turned off.

3 OUTPUT1 (analog audio output) connector (4-pin)

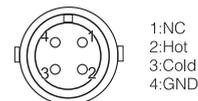
Outputs balanced analog audio signal. When the DWR-S01D is attached, audio from the tuner 1 or 2 can be selected by using the UTILITY menu of the DWR-S01D. The output from this connector is factory-set to the audio from the tuner 1. When the WRR-855S is attached, audio is output from this connector only.



4 OUTPUT2 (analog/digital audio output) connector (4-pin)

When the DWR-S01D is attached, this connector outputs balanced analog audio signal or AES3-format digital audio signal. Output signal can be selected using the ANALOG AES/EBU selector. When this selector is set to ANALOG, audio from the tuner 2 is output.

Note that this connector does not work when the WRR-855S is attached.



5 ANALOG AES/EBU selector

When the DWR-S01D is attached, this selector determines the signal output from the OUTPUT2 connector.

ANALOG: Balanced analog audio signal is output.

AES/EBU: AES3-format digital audio signal is output.

Note that this selector does not work when the WRR-855S is attached.

Note

DWA-01D supplied accessories include two xx inch length XLR adapter cables for the purpose of audio output connection with output 1 and output 2.

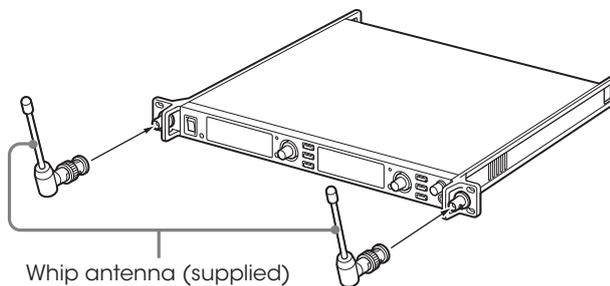
UHF System Configuration

In order to maximize performance of the Digital Wireless Receiver DWR-R01D, select the UHF antenna configuration as described below.

System Configuration

System Requirements

- Because the DWX system uses RF transmission in the UHF band, similar to analog wireless systems, antenna cables of an existing analog wireless system can be used, provided that the frequency matches. When operating the DWX system along with an analog wireless system, antenna cables can be shared.
- The DWR-R01D is supplied with two whip antennas. If the service area is small, you can also use the supplied whip antennas, but for better reception performance, using the optional UHF AN-820 or AN-01 UHF antennas is recommended. Select the antenna system according to the scale and purpose of your application.
- The supplied whip antennas can be mounted either on the front panel or the rear panel.



Notes

- In applications such as on-stage use where the required RF directivity is known, or when used in conjunction with in-ear monitoring where unneeded directions are known, use the directional AN-01 antennas and install them with a suitable orientation.
- When the direction to the area where the transmitter will be used is not pre-determined, use omnidirectional antennas to ensure reception from all directions.

BNC cable splitting

Without a divider, cascaded connection*¹ of up to 8 DWR-R01D units (16 channels) is possible.

If 9 or more DWR-R01D units are to be used, use the Antenna Divider WD-850 to split the BNC connection.

One WD-850 unit allows splitting into 4 outputs, and cascaded connection of two WD-850 units allows splitting into 8 outputs.

- Number of DWR-R01D units
2 to 8: Cascaded connection of DWR-R01D units without using WD-850*²
9 to 32: One WD-850 in conjunction with cascaded DWR-R01D units
33 to 41*³: Configured with two cascaded WD-850 units combined with cascaded DWR-R01D units

*¹ Cascaded DWR-R01D output reflects attenuator settings.

Set ANT DC OUT to [OFF] and ANT ATT a/b to [0dB] on second and subsequent DWR-R01D units to which antennas are not connected directly.

*² When configuring two diversity reception systems, the WD-850 is used to join the systems.

*³ Due to network limits such as RMU-01 control and Wireless Studio combined monitoring capability, the DWX system supports a maximum of 82 channels in a networked configuration. If not configured as a network system, more than 82 channels are possible as far as frequency allocation allows. (In this case, the status of transmitters received by the DWR-R01D can be monitored at the unit itself.)

When two WD-850 units are used, a UHF system with a maximum of 128 channels, using 64 DWR-R01D units, can be configured.

Configuring a DWX System

Equipment Features

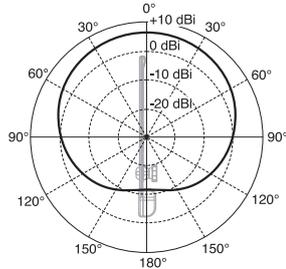
UHF Accessories

■ UHF Antenna AN-01

This is a unidirectional log periodic dipole antenna.



Example of horizontal directivity characteristics



- Built-in low noise and low distortion booster amplifier with three gain settings: 18 dB/10 dB/0 dB.
- Booster amplifier can be powered from connected receiver or divider, using either 9 or 12 V DC.
- Grip with screw allows mounting on a microphone stand.

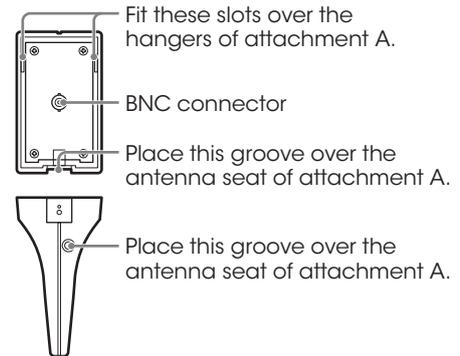
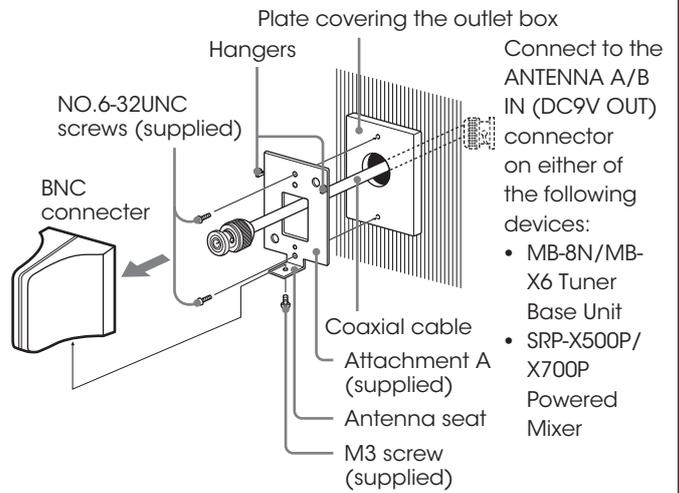
■ UHF Antenna AN-820A

This is a horizontal omnidirectional dipole antenna.

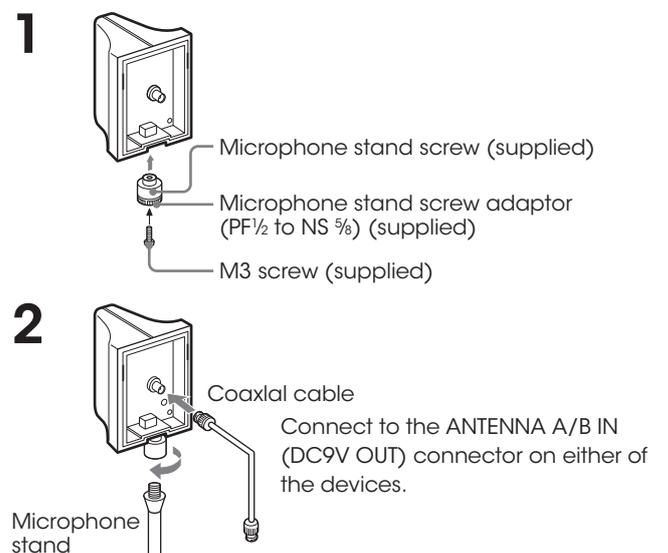


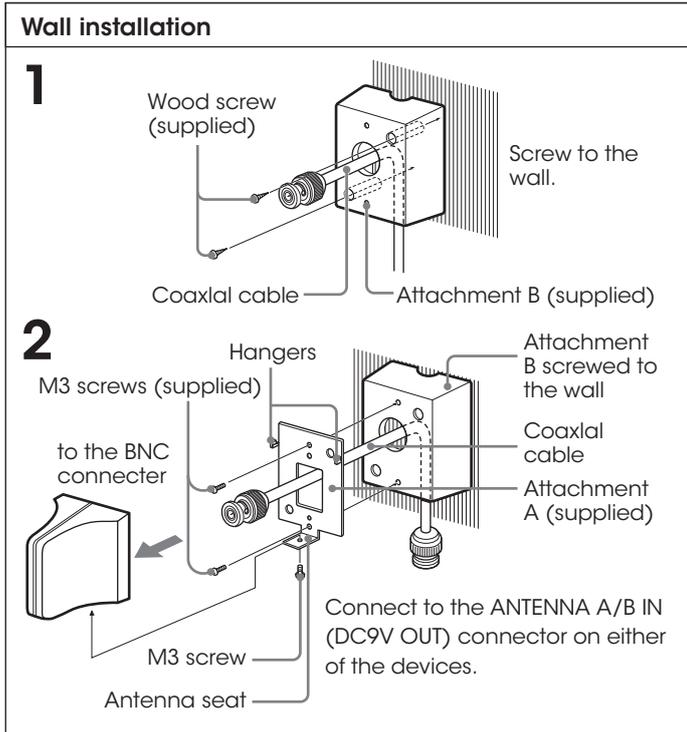
- Built-in booster amplifier provides 18 dB gain (if powered with 12 V DC) or 10 dB gain (if powered with 9 V DC).
- Booster amplifier can be powered from connected receiver or divider, using either 9 or 12 V DC.
- Various supplied accessories enable mounting to a utility box or to a wall, as well as mounting on a microphone stand.
- Splashproof construction allows outdoor installation in a roofed location.

Wall installation using built-in outlet box



Installation on a microphone stand



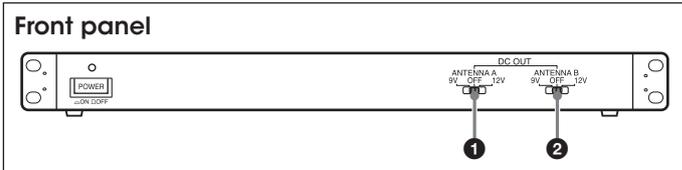


■ **UHF Antenna Divider WD-850**

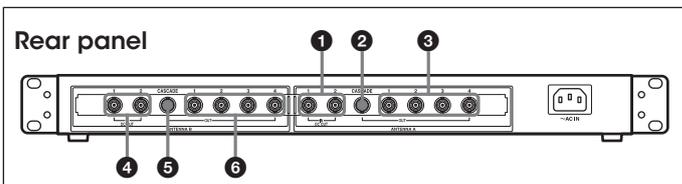
This is a 1U size rack mount antenna divider.



- Incorporates two circuits for supplying the antenna output to a maximum of four outputs, making it easy to configure a diversity reception system for simultaneous multi-channel operation.
- Provides antenna signal cascading outputs, allowing two units to be cascaded for connection of up to eight outputs.
- 9 or 12 V DC power supply output for booster amplifier.



- 1 ANTENNA A DC OUT (power supply to antenna A) switch**
Supplies 9V DC to the Sony UHF antenna connected to the ANTENNA A DC OUT 1 and 2 connectors. If interference or distortion occurs, set to OFF.
- 2 ANTENNA B DC OUT (power supply to antenna B) switch**
Supplies 9V DC to the Sony UHF antenna connected to the ANTENNA B DC OUT 1 and 2 connectors. If interference or distortion occurs, set to OFF.



- 1 ANTENNA A IN / DC OUT 1 and 2 (antenna A input/DC power output 1 and 2) connectors**
When connected by coaxial cable, the signal is input from the Sony UHF antenna while power is supplied to the antenna's booster amplifier. The power supply can be set to 9V or OFF using the ANTENNA A DC OUT switch on the front panel. Depending on the required range of the wireless microphone, up to two antennas can be connected.
- 2 ANTENNA A CASCADE connector**
During use of two dividers at the same time, connect this connector to the ANTENNA A IN/DC OUT connector 1 or 2 on the second divider.
- 3 ANTENNA A OUT 1 to 4 (antenna A output 1 to 4) connectors**
Connect from ANTENNA A OUT connector on the unit to the ANTENNA A IN connector on the tuner.
- 4 ANTENNA B IN / DC OUT 1 and 2 (antenna B input/DC power output 1 and 2) connectors**
When connected by coaxial cable, the signal is input from the Sony UHF antenna while power is supplied to the antenna's booster amplifier. The power supply can be set to 9V or OFF using the ANTENNA B DC OUT switch on the front panel. Depending on the required range of the wireless microphone, up to two antennas can be connected.
- 5 ANTENNA B CASCADE connector**
During use of two dividers at the same time, connect this connector to the ANTENNA B IN/DC OUT connector 1 or 2 on the second divider.
- 6 ANTENNA B OUT 1 to 4 (antenna B output 1 to 4) connectors**
Connect from ANTENNA B OUT connector on the unit to the ANTENNA B IN connector on the tuner.

Configuring a DWX System

■ Booster power supply

The booster power supply voltage, drive voltage, and supported gain will differ, depending on the equipment. Refer to the table below for details.

Category	Model name	Supply voltage for AN series UHF antennas	Voltage selection method	Drive voltage	Voltage selection method	Support gain/attenuator	Gain/attenuator Voltage selection method
Receiver/Divider	DWR-R01D	0 V/9 V/12 V	Menu*1	—		0 dB/-5 dB/-10 dB*5	Menu
	DWR-S01D	0 V	—			0 dB/-5 dB/-10 dB	Menu
	WD-850	0 V/9 V/12 V	Front-panel switch*2*6			0 dB	—
Antenna/Booster	AN-01	—		9 V/12 V*3	Switch	0 dB/10 dB/18 dB/Auto*6	Trim switch
	AN-820A			9 V/12 V*3*4	None (Auto)	Auto*6	Auto only
	WB-850			9 V - 12 V	—	-10 dB/0 dB/+10 dB	Selector switch

*1 Separate power supply voltage setting for antenna A/antenna B not supported.

*2 Separate power supply voltage setting for antenna A/antenna B supported.

*3 0 V is not supported. Use as a passive antenna is not possible. Power supply must be provided.

*4 Supplying 12 V to legacy models may result in fatal damage. When selecting 12 V, be sure to obtain a new AN-820A. When supplying 12 V to an owned AN-820A, make sure that a label that includes frequency information is affixed next to the LED indicators at the bottom of the unit.

*5 The antenna output level reflects the attenuator setting. In a cascaded connection, set the attenuator on the second unit to 0 dB, to prevent attenuation values from being added up.

*6 In the Auto mode, gain is 10 dB with 9 V DC and 18 dB with 12 V DC.

Antenna Installation Requirements

The antenna installation conditions for the DWX system are basically the same as for analog wireless systems. Consider the following points when planning an installation.

The transmission distance of a wireless system will differ greatly, depending on factors such as how the equipment is worn on the body, the presence of obstacles, etc. Before finalizing an installation, be sure to check the reception condition, as described in "Checking the RF Level (UHF)" (page 45).

BNC cables

The connection between antenna and receiver is made with BNC cables, as in an analog wireless system. If there are existing cable installations from an analog wireless system, these can be used.

■ BNC cable types

- Wireless microphone systems commonly use BNC cables for antenna connections. There are a number of standards for BNC cables, with different specifications for impedance and cable gauge (attenuation characteristics).
- For example, in a standard classification such as "5C-2V" and "8D-2V", the first numeral indicates the cable gauge (thickness), and the subsequent letter indicates the impedance: "C" stands for 75 ohms and "D" for 50 ohms.
- Both for analog wireless systems and digital wireless systems, Sony recommends "5D-2V" – "8D-2V" cables with 50-ohm impedance because these have lower transmission losses.

■ 75-ohm BNC cables can also be used.

- When configuring a system in venues with existing cables, 75-ohm cables can also be used. When a DWX receiver is connected to a 75-ohm cable, in principle there will be a transmission loss due to impedance mismatching, but this loss amounts only to a few decibels. Because this is smaller than the loss introduced by the cable length, it often can be disregarded.
- Not only BNC cables but also BNC connectors come in two types, rated either for 50 ohms or 75 ohms impedance. When a 75-ohm cable is connected to a 50-ohm connector, an impedance mismatch occurs, but in practice this is often disregarded because the influence is small.
- More important than the difference between 50 ohms and 75 impedance are differences in signal losses introduced by two cables of different length. (With a 5D-2V cable, a 10-meter difference amounts to a difference of about 3 dB.)

For information on available distances under different conditions, see "Distance between transmitter and antenna" (page 43).

Note

When configuring a new system, the use of 5D-2V – 8D-2V BNC cables is recommended.

Number of antennas and diversity reception

■ Use two identical antennas

The DWX system, like the conventional analog wireless system, uses the space diversity reception principle. Two antennas are employed to receive the signal, with the system automatically switching to the antenna with the stronger signal.

To ensure stable reception, the two antennas must be identical.

■ Spacing between antennas: 1 to 20 meters (3.2 to 65.6 ft.)

One may think that the further the two antennas are apart, the better the reception performance, but this is not necessarily true. It is usually not necessary to maintain a large distance between the antennas. Of course, if the antennas are too close to each other (less than 1 meter (3.2 ft.)), the advantages of the diversity system will be lost, but since the wavelength of a radio wave in the 600 MHz band is about 50 centimeters (1.6 ft.), ensuring a distance of about 3 to 5 times the wavelength (1.2 to 2 meters (3.9 to 6.6 ft.)) will usually result in good diversity reception. The distance should generally be kept well below the maximum of 20 meters (65.6 ft.), because performance will decrease above this point.

■ Use shorter, thicker BNC cables of identical length

To minimize transmission losses, the BNC cables should be as short and large-gauge as possible. If there is a difference in cable length, differences in cable loss can degrade the diversity effect. Make sure that both BNC cables are of the same length.

■ Use two antenna sets (4 antennas) in large venues

In large venues where two antennas do not provide sufficient coverage, and in cases where there are spots without direct line of sight between transmitter and antenna, the UHF Antenna Divider WD-850 should be used to allow for two sets of antennas (total 4 antennas).

If venues such as banquet halls are partitioned into separate sections, a separate antenna installation should be provided for each section. In some cases, partition panels may incorporate metal plates for sound proofing, which may also block radio transmission. Special care is required in such instances. However, simply increasing the number of antennas is not always the answer, and an excessive number of antennas (such as 3 or 4 sets) may lead to mutual interference and thereby degrade reception performance.

Multiple dividers make it possible to use antennas for other systems, but the number of antennas receiving the same RF signal should be kept to no more than two sets. (In a small venue, even two antenna sets may result in decreased reception performance. Always check actual performance before starting operation.)

Configuring a DWX System

Antenna installation position

■ Distance between transmitter and antenna

Line-of-sight service area ranges for different RF power levels are listed below.

RF power	Transmission distance
10 mW	60 m (196.9 ft.)
1 mW	20 m (65.6 ft.)

If the transmitter is located too close to the antenna, input overload may occur, leading to intermodulation distortion and noise. A distance of at least 2 to 3 meters between transmitter and antennas should always be maintained.

If the transmitter and antenna are too far apart, the service area will become doughnut-shaped.

■ Installation should allow direct line of sight from transmitter to antenna

There should be no obstacles between the transmitter and antennas.

Normally, the antennas should be mounted at a height above average human height, looking up from the transmitter at an inclined angle.

■ Keep away from windows

If wireless systems are operated on several floors of a building, antennas near windows may cause interference between floors.

For installation in high-rise buildings, antennas should be positioned at least 3 meters away from windows. On higher floors, radio signals from other microphones may interfere with reception even over considerable distances.

■ Keep a clearance of several tens of centimeters from the ceiling

Close proximity to the ceiling can cause reflections that negatively affect reception sensitivity. When installing antennas in corners, also keep a clearance of several tens of centimeters from adjacent walls.

■ Locations to avoid

Do not install antennas in the following types of locations. Otherwise signal reception may suffer or noise may occur.

- Behind ceiling or wall finishing layers
- Near windows, metal frames/plates, or electric appliances (lighting fixtures, motors, elevators, power distribution panels, etc.)
- Near electronic equipment (computers, dimmers, TV sets, video cameras, etc.)

■ Install antennas with correct orientation

The sensitivity pattern of an antenna extends in the horizontal direction from the correct mounting orientation. For example, if the AN-820A is mounted to the ceiling pointing down, reception sensitivity may decrease.

Booster gain setting conditions

BNC cables used with UHF antennas should have low losses. To obtain the proper diversity effect, the cables should in principle be kept as short and large-gauge as possible, and should have the same length. If BNC cables need to be run over long distances, you should use an antenna booster to compensate for cable transmission losses.

The table below shows the relationship between BNC cable length and gain settings.

However, depending on usage conditions, RF level may be insufficient even if these recommendations are followed. Always check actual operation before finalizing a setting.

* When transmitter output is 10 mW and the distance between the transmitter and antennas is approx. 30 m (98.4 ft.)

At 5D-2V (50 ohms)

BNC cable length	Gain
0 m – 10 m (0 ft. – 32.8 ft.)	0 dB
10 m – 75 m (32.8 ft. – 246.1 ft.)	10 dB
75 m – 150 m (246.1 ft. – 492.1 ft.)	18 dB

At 5C-2V (75 ohms)

BNC cable length	Gain
0 m – 8 m (0 ft. – 26.2 ft.)	0 dB
8 m – 60 m (26.2 ft. – 196.9 ft.)	10 dB
60 m – 120 m (196.9 ft. – 393.7 ft.)	18 dB

At 8D-2V (50 ohms)

BNC cable length	Gain
0 m – 12 m (0 ft. – 39.4 ft.)	0 dB
12 m – 90 m (39.4 ft. – 295.3 ft.)	10 dB
90 m – 180 m (295.3 ft. – 590.6 ft.)	18 dB

At 7C-2V (50 ohms)

BNC cable length	Gain
0 m – 10 m (0 ft. – 32.8 ft.)	0 dB
10 m – 70 m (32.8 ft. – 229.7 ft.)	10 dB
70 m – 140 m (229.7 ft. – 459.3 ft.)	18 dB

* When transmitter output is 10 mW and the distance between the transmitter and antennas is approx. 60 m (196.9 ft.)

At 5D-2V (50 ohms)

BNC cable length	Gain
0 m – 5 m (0 ft. – 16.4 ft.)	0 dB
5 m – 50 m (16.4 ft. – 164 ft.)	10 dB
50 m – 100 m (164 ft. – 328.1 ft.)	18 dB

At 5C-2V (75 ohms)

BNC cable length	Gain
0 m – 4 m (0 ft. – 13.1 ft.)	0 dB
4 m – 35 m (13.1 ft. – 114.8 ft.)	10 dB
35 m – 70 m (114.8 ft. – 229.7 ft.)	18 dB

At 8D-2V (50 ohms)

BNC cable length	Gain
0 m – 6 m (0 ft. – 19.7 ft.)	0 dB
6 m – 60 m (19.7 ft. – 196.9 ft.)	10 dB
60 m – 120 m (196.9 ft. – 393.7 ft.)	18 dB

At 7C-2V (50 ohms)

BNC cable length	Gain
0 m – 5 m (0 ft. – 16.4 ft.)	0 dB
5 m – 45 m (16.4 ft. – 147.6 ft.)	10 dB
45 m – 90 m (147.6 ft. – 295.3 ft.)	18 dB

Note

Antenna boosters are basically intended only to cover cable losses. High gain settings exceeding the cable loss compensation requirements may actually result in a smaller service area during simultaneous multi-channel operation, due to increased intermodulation. For example, when antenna input level is raised, the range from the antenna to the transmitter increases, but the distance by which the transmitter has to be kept from the antenna also increases. If taking measures to optimize performance when the transmitter is at a maximum distance from the antenna, care must be taken so that the performance of the transmitter when it is closest to the antenna is not impaired. If the antenna booster gain is raised, and a transmitter operating simultaneously is brought in close proximity to the antenna, the reception performance of the distant transmitter may deteriorate. The DWX series provides an array of functions including transmitter RF power switching, antenna booster gain switching, and switching of the RF attenuator integrated in the Digital Wireless Receiver DWR-R01D. This allows flexible optimization of the service area. Use these functions to establish the settings required for the respective application.

Configuring a DWX System

Making and Checking RF Settings (UHF)

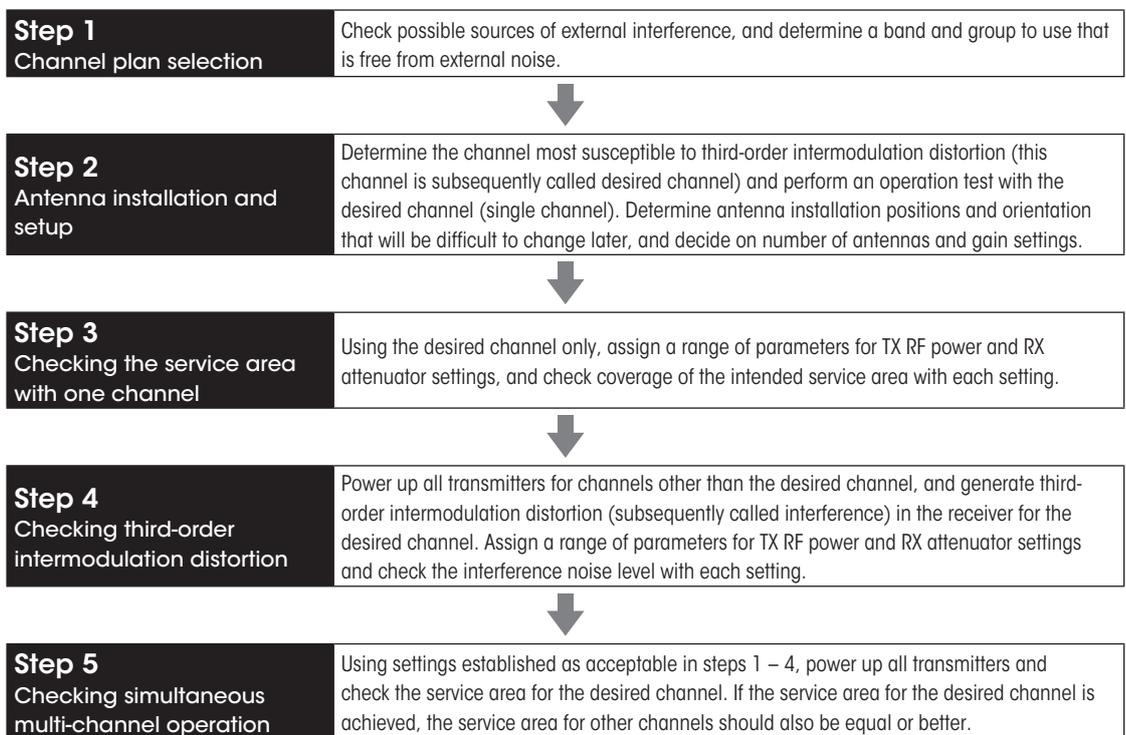
Follow the procedure shown in the flowchart below to establish parameters and check operation.

Parameters to check

1. Band usage: White space TV channel
2. Group usage: See "List of Supported Frequencies" (page 78)
3. Antenna installation location/orientation: distance to TX, height, orientation etc.
4. Antenna gain: 0 dB, 10 dB, or 18 dB
5. Number of antennas: 2, 4
6. TX RF power: 1 mW, 10 mW, or 50 mW
7. RX attenuator: 10 dB, 5 dB, or 0 dB

CH: Channel
TX: Transmitter
RX: Receiver

Flow for making and checking RF settings

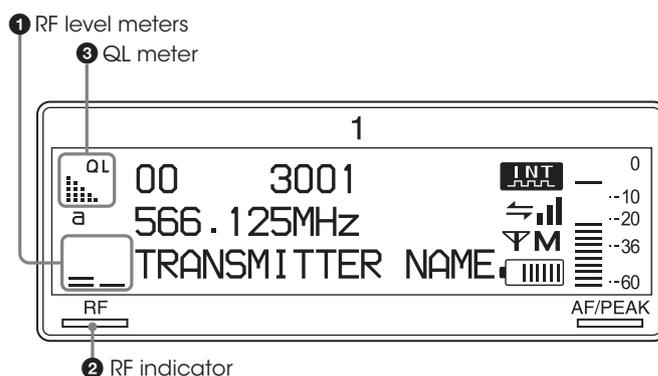


Checking the RF Level (UHF)

The RF level at which the receiver receives signals can be checked using the display of the Digital Wireless Receiver DWR-R01D or the RF level meter of Wireless Studio. See the next section for details.

■ Checking with the DWR-R01D display

You can check whether the transmitter is in the service area by using the display of the Digital Wireless Receiver DWR-R01D.



① RF (radio reception) level meters

Indicates the level of the signal input from the ANTENNA a/b IN connector. The number of segments that light up depends on the input level.

② RF (radio reception) indicator

Lights up to indicate the level of the signal input from the ANTENNA a/b IN connector as follows. Set the RF level so that the indicator lights green.

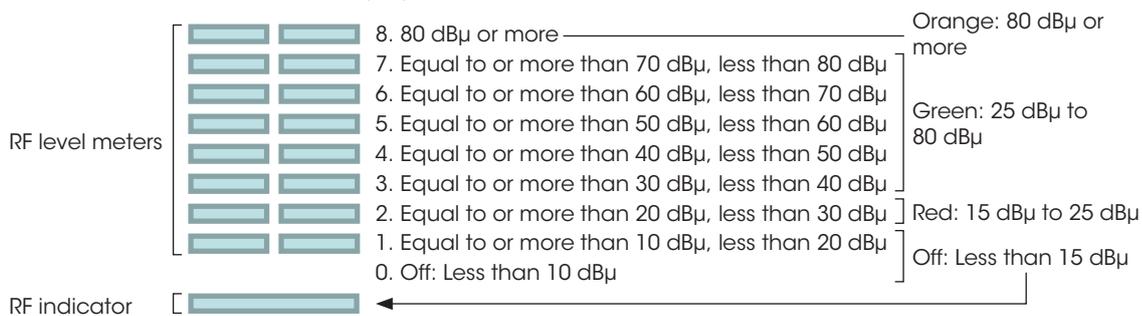
On in orange: 80 dBμ or more

On in green: 25 dBμ to 80 dBμ

On in red: 15 dBμ to 25 dBμ

Off: Less than 15 dBμ

RF level meter and RF indicator display levels

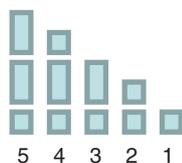


③ QL (signal quality level) meter

Indicates the quality of received data along the time axis, using five steps.

This meter allows you to monitor RF signal quality deterioration that may occur when there is interference or when the transmitter is too far from the receiver.

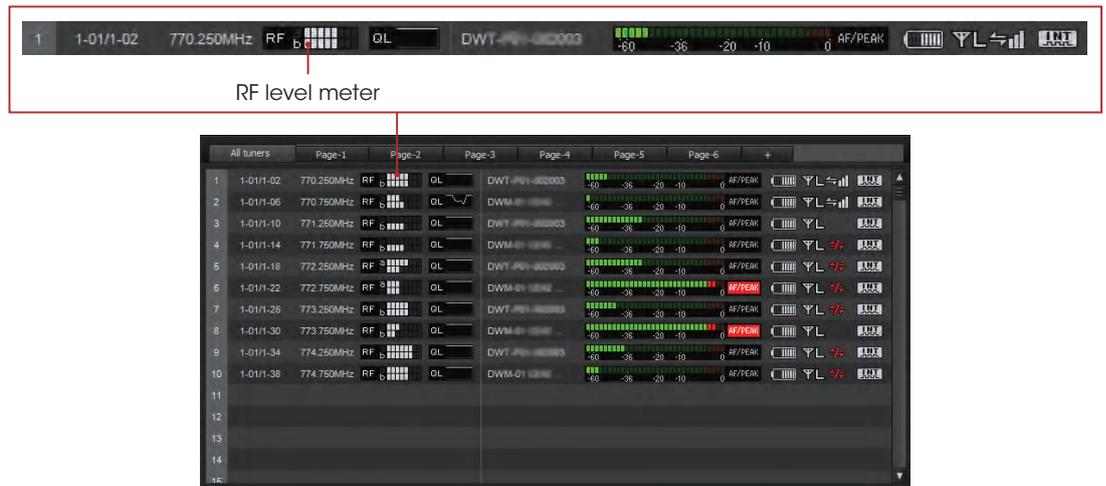
When checking RF levels, the QL meter should always show more than four segments.



Configuring a DWX System

■ Checking with Wireless Studio

The RF level meter of the Wireless Studio application can be used to verify the RF level.



Step 1 Channel Plan Selection

Check possible sources of interference including TV broadcast signals and external interference noise and determine the band and group to use.

Procedure

- 1 Power down all transmitters.
- 2 Determine the channel plan for the receiver.

Select the band

- Select the band based on your intended purpose and your wireless environment (e.g., whether TV broadcast transmissions exist).
* The band is fixed for the DWR-S01D.
- Take factors such as effective use of frequencies and the risk of mutual interference with other wireless equipment and/or analog wireless systems into consideration.

Select the group

- There are groups that are designed for simultaneous multi-channel operation and others that are not. Select an appropriate group according to the intended purpose and the number of channels to be operated simultaneously.
- Groups not specifically designed for simultaneous multi-channel operation are 00 for US models, 00 for EU models, and groups that include TV channel names (e.g., TV62). In order to accommodate flexible channel planning even when using these groups, continuous channel setting is possible in 125-kHz steps (25-K steps for groups that include TV channel names on EU models). When using these, design your own channel plans according to specific requirements.

- 3 Check for external interference.

Sample settings for checking

- ① Band to use: To be established in this step.
- ② Group to use: To be established in this step.
- ③ Antenna installation location/orientation: Install according to requirements described in "Antenna installation position" (page 43).
- ④ Antenna gain: Set according to instructions in "Booster gain setting conditions" (page 44), ensuring that cable losses can be fully covered.
- ⑤ Number of antennas: Determine according to requirements described in "Antenna installation position" (page 43).
- ⑥ TX RF power: TX to be OFF in this step.
- ⑦ RX attenuator: Provisionally set to 0 dB.

Checking procedure

Check the RF level meter indication. Verify that interference is less than 10 dBu (RF level meter is always out.).

4 If there is interference noise that could become a problem, change the channel plan perform the checking procedure again.

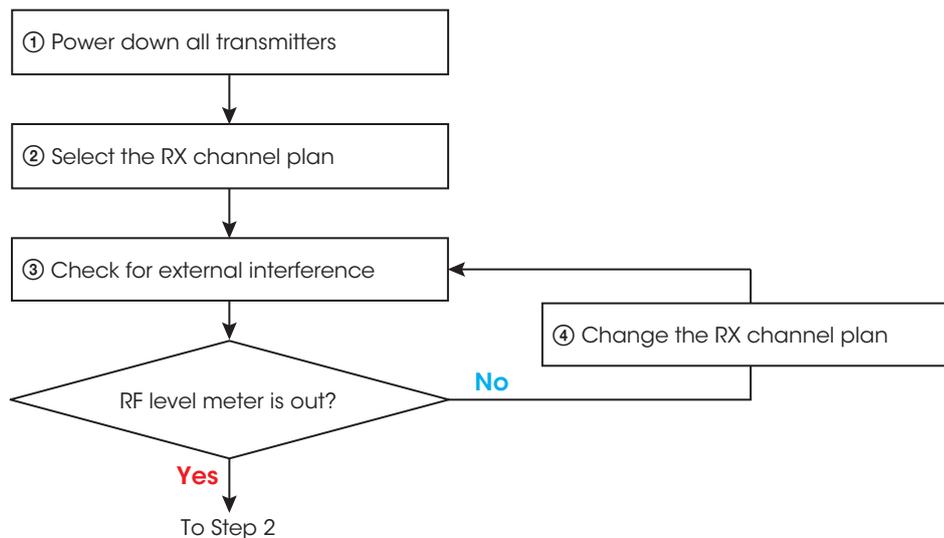
If there is no interference noise, the channel plan can be used.

Note

If the computer on which Wireless Studio is installed, a Bluetooth mouse, or similar device is set up on top of the DWR-R01D and operated, the RF meters on the DWR-R01D may light up due to noise from the computer or other device. In such cases, distance the computer or other device from the DWR-R01D until the RF level meters turn off.

Flowchart for Step 1

■ Channel plan selection



Notes

When using only a digital wireless microphone system

Taking advantage of the fact that digital wireless systems are highly resistant to interference, using groups with a high number of channels that can be operated simultaneously is recommended.

* In this case, when neighboring channels from two bands are used, ensure that channel spacing is at least 375 kHz.

When using analog wireless and digital wireless systems together

Select a group designed for simultaneous multi-channel operation in an environment where analog wireless and digital wireless systems are used.

Groups for environments where analog wireless and digital wireless systems are used together include those intended for single TV band use and those intended for multiple TV band use. Take factors such as the number of bands used and whether TV broadcast transmissions exist into consideration when selecting the group.

For details on the groups that can be selected, see "Sony Digital Wireless Microphone System Frequency Lists" (PDF).

* When simultaneous multi-channel operation is realized with a mix of analog wireless and digital wireless systems, the frequency spacing between the analog and digital systems must be at least 375 kHz. Therefore certain channels will not be available for selection in the digital wireless system.

Configuring a DWX System

Step 2 Antenna Installation and Setup

Select the channel with the most difficult conditions as the desired channel, and perform an operation test with the desired channel (single channel). Determine and optimize antenna installation positions and orientation that will be difficult to change later, and decide on number of antennas and gain settings.

Procedure

- Selecting the desired channel

5 Power up all TX except one, and position the TX within the envisioned service area at the location closest to the antenna.

Example: In a 12-channel system, turn one TX off and turn the eleven other TX on.

* Equipment other than TX (RX, boosters, etc.) should be constantly on.

6 Use the RF level meter on the RX that is being set up to check the level of third-order intermodulation noise in the channel of the TX that is off.

Sample settings for checking (RF raised to make noise easier to detect)

- ① Band to use: Band established in step 1.
- ② Group to use: Group established in step 1.
- ③ Antenna installation location/orientation: Refer to "Antenna installation position" (page 43).
- ④ Antenna gain: Refer to "Booster gain setting conditions" (page 44).
- ⑤ Number of antennas: Refer to "Antenna installation position" (page 43).
- ⑥ TX RF power: 10 mW
- ⑦ RX attenuator: 0 dB

Checking procedure

Check the RF level meter indication.

7 Power down a different TX and repeat steps 5 to 6.

Check all channels.

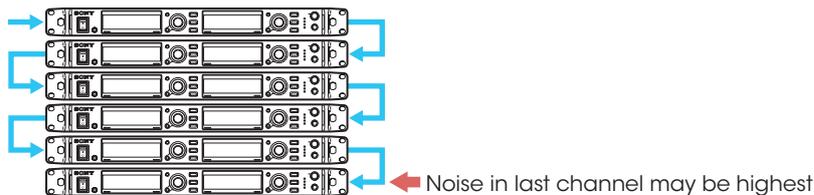
Example: In a 12-channel system, perform the procedure 12 times.

8 Designate the channel with the highest noise level as the desired channel.

Note

When using multiple RX units in a cascaded configuration, the third-order intermodulation noise of each RX will be added up, so that noise may be highest at the last channel.

*However, this depends on the channel plan and the number of channels, and may not always apply.



■ Antenna installation and setup

9 Power up only the desired channel TX and establish a setup simulating the expected conditions during actual operation.

Example: If the TX is the DWM-01, it should be held in the hand, close to the mouth.

If the TX is the DWT-B01, it should be worn on the hip.

*Equipment other than TX (RX, boosters, etc.) should be constantly on.

10 Move the desired channel TX throughout the service area, and check for the presence of obstructions, dropout points, and body effect.

Sample settings for checking

- ① Band to use: Band established in Step 1.
- ② Group to use: Group established in Step 1.
- ③ Antenna installation location/orientation: To be determined in this step.
- ④ Antenna gain: To be determined in this step.
- ⑤ Number of antennas: To be determined in this step.
- ⑥ TX RF power: 1 mW
- ⑦ RX attenuator: 10 dB

Checking procedure

Check that the RF indicator is lit green.

*In this step, we recommend adjusting the setup, direction, and number of antennas to obtain the highest possible RF level.

11 Even at points with weak RF levels, optimize the antenna setup conditions so that the RF level is at its highest, and check the service area again.

- ① Determining the antenna installation location/orientation:
 - As close as possible to service area *¹
 - As far as possible, ensure direct line of sight to TX (directional antennas should be pointed to the farthest point of the desired area)
 - As far as possible, antennas should overlook service area
 Adjust antenna location/orientation to maximize the service area.
- ② Determine antenna gain *²*³: 0 dB, 10 dB, or 18 dB (should cover cable loss but not be excessively high)
- ③ Determine number of antennas: 2, or 4

*¹ Too short distance between TX and antenna can also result in reception degradation, due to RF input overload and third-order intermodulation distortion. Recommended TX to antenna distance for 3-channel operation is about 3 meters, and for 10-channel operation 5 meters or more.

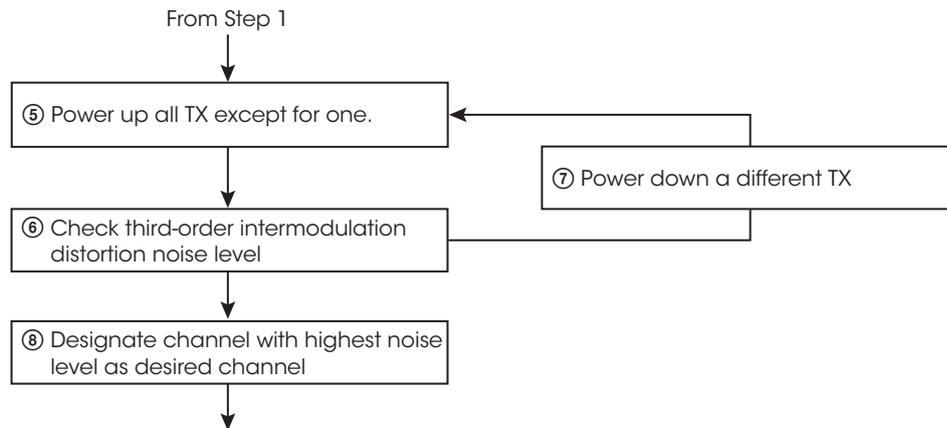
*² Antenna gain must be set to the same value on both antennas, to obtain the diversity effect.

*³ When using the AN-01 antenna, you can set gain on the antenna to "Auto" and control gain by switching the DWR-R01D booster power supply voltage. This makes it easier to change settings also after installation. (AN-820 supports Auto only.)

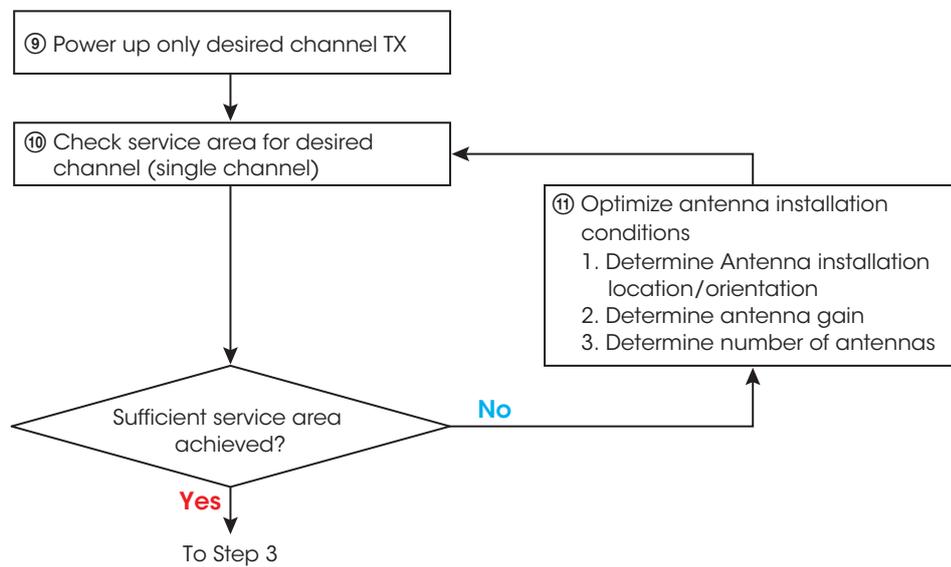
Configuring a DWX System

Flowchart for Step 2

■ Selecting the desired channel



■ Antenna installation and setup



Step 3 Checking the Service Area With One Channel

Using the desired channel subject to severe conditions, assign a range of parameters for TX power output and RX attenuator settings, and check whether the settings result in coverage of the intended service area.

Procedure

12 Power up only the desired channel TX and establish a setup simulating the expected conditions during actual operation.

Example: If the TX is the DWM-01, it should be held in the hand, close to the mouth.

If the TX is the DWT-B01, it should be worn on the hip.

* Equipment other than TX (RX, boosters, etc.) should be constantly on.

13 Make the parameter settings, and move the desired channel TX throughout the service area, checking at various locations.

Sample settings for checking

- ① Band to use: Band established in step 1.
- ② Group to use: Group established in step 1.
- ③ Antenna installation location/orientation: As determined in step 2.
- ④ Antenna gain: As determined in step 2.
- ⑤ Number of antennas: As determined in step 2.
- ⑥ TX RF power: To be determined in this step *1 (settings 1 to 6 in table below)
- ⑦ RX attenuator: To be determined in this step *1 (settings 1 to 6 in table below)

		TX RF power	
		1 mW	10 mW
RX ATT	10 dB	Setting 1	Setting 4
	5 dB	Setting 2	Setting 5
	0 dB	Setting 3	Setting 6

As 50 mW output of the TX produces high third-order intermodulation distortion, it is not suited for simultaneous multi-channel operation. Therefore, 50 mW output is excluded from the items for checking.

Checking procedure

Check the following:

- No dropouts in audio signal
- RF indicator lit in green
- QL meter shows more than 4 segments

*1 When multiple TX are used in step 4 and following, changing the TX RF power for a high number of channels is time-consuming. On the other hand, changing the RX attenuator setting can be done at the first DWR-R01D of the cascaded configuration and is therefore relatively easy. To simplify the procedure, you can first perform steps 3 to 5 by changing the RX attenuator setting only, and then change the TX RF power and repeat steps 3 to 5.

Sample results		TX RF power	
		1 mW	10 mW
RX ATT	10 dB	Setting 1: Poor	Setting 4: Good
	5 dB	Setting 2: Fair	Setting 5: Good
	0 dB	Setting 3: Good	Setting 6: Good

Configuring a DWX System

Step 4 Checking Third-order Intermodulation Distortion

Power up all transmitters for channels other than the desired channel, and generate third-order intermodulation distortion (subsequently called interference) in the receiver for the desired channel. Assign a range of parameters for TX output power and RX attenuator settings and check the interference noise level with each setting.

Procedure

14 Power up all transmitters for channels other than the desired channel. Establish a setup simulating the expected conditions during actual operation, and have a person with the TX stand in a position closest to the antenna.

Example: If the TX is the DWM-01, it should be held in the hand, close to the mouth.

If the TX is the DWT-B01, it should be worn on the hip, and the person should stand at the rim of the stage, approaching the antenna.

* Equipment other than TX (RX, boosters, etc.) should be constantly on.

15 Using the RF level meter of the RX set to the channel whose TX is switched off, check the third-order intermodulation distortion noise level in the channel.

Setting example for checking

- ① Band to use: Band established in step 1.
- ② Group to use: Group established in step 1.
- ③ Antenna installation location/orientation: As determined in step 2.
- ④ Antenna gain: As determined in step 2.
- ⑤ Number of antennas: As determined in step 2.
- ⑥ TX RF power: Setting that cleared the requirements of step 3.
- ⑦ RX attenuator: Setting that cleared the requirements of step 3.

Check procedure

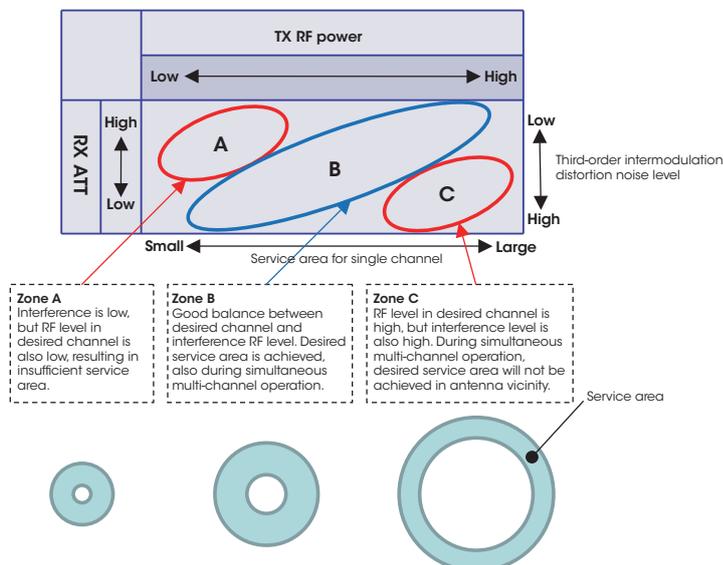
Check the RF level meter indication.

- In principle, the noise level should be less than 10 dBμ (RF level meter should be consistently out).

Sample results		TX RF power			
		1 mW		10 mW	
RX ATT	10 dB	Setting 1		Setting 4	
		Poor	(Good)	Good	Good
	5 dB	Setting 2		Setting 5	
		Fair	(Good)	Good	Good
	0 dB	Setting 3		Setting 6	
		Good	Good	Good	Fair

Note

For stable reception, sufficient RF power levels should be obtained in the desired channel, and at the same time, the D/U ratio between desired channel and interference should be at least 20 dB. Decreasing the system-wide RF level will decrease interference in the desired channel by a factor of 3. Consequently, if the D/U ratio is insufficient, reducing the RF lower will provide an improvement. For example, when a 5 dB attenuation is introduced, the level in the desired channel will decrease by 5 dB, but the interference level will decrease by 15 dB, thereby yielding an improvement in D/U ratio by 10 dB. The same applies to the attenuation of RF power due to distance. If the RF level is too low, the available distance will decrease, resulting in an insufficient service area. But if the RF level is very high, this also can cause problems because the required D/U ratio cannot be obtained in the antenna vicinity. The resulting service area will be shaped like a doughnut, with a large hole in the middle, which also is undesirable. Therefore, 50 mW output of the TX is not suited for simultaneous multi-channel operation.



Step 5 Checking Simultaneous Multi-channel Operation

Using settings established as acceptable in steps 1 – 4, power up all transmitters and check the service area for the desired channel. If the service area for the desired channel is achieved, the service area for other channels should also be equal or better. By checking the service area with multiple sets of parameters, the degree of leeway can be established. You should then select the optimal parameters for operation.

Procedure

16 Power up all transmitters. Establish a setup simulating the expected conditions during actual operation, and have a person with the TX stand in a position closest to the antennas.

Example: If the TX is the DWM-01, it should be held in the hand, close to the mouth.

If the TX is the DWT-B01, it should be worn on the hip, and the person should stand at the rim of the stage, approaching the antenna.

17 Move the desired channel TX throughout the service area and check at various locations.

Setting example for checking

- ① Band to use: Band established in step 1.
- ② Group to use: Group established in step 1.
- ③ Antenna installation location/orientation: As determined in step 2
- ④ Antenna gain: As determined in step 2.
- ⑤ Number of antennas: As determined in step 2.
- ⑥ TX RF power: Setting that cleared the requirements of steps 3 and 4.
- ⑦ RX attenuator: Setting that cleared the requirements of steps 3 and 4.

Operation Check

Check the following:

- No dropouts in audio signal
- At least 2 segments of RF indicator shown throughout
- RF indicator lit in green
- QL meter shows more than 4 segments

18 Check the service area with multiple combinations of TX RF power and RX attenuator settings.

Then select the combination that best matches the anticipated operation conditions.

Sample results		TX RF power					
		1 mW			10 mW		
		Step 3	Step 4	Step 5	Step 3	Step 4	Step 5
RX ATT	10 dB	Setting 1: Zone A			Setting 4: Zone B		
		Poor	(Good)	(Poor)	Good	Good	Good
	5 dB	Setting 2: Zone A			Setting 5: Zone C		
		Fair	(Good)	(Fair)	Good	Good	Good
	0 dB	Setting 3: Zone B			Setting 6: Zone C		
		Good	Good	Good	Good	Fair	(Fair)

For example, with a result such as shown above, settings 3, 4, and 5 will produce a Zone B type service area which meets the requirements. Either of these settings can be chosen. However, with setting 4 the RF level margin is smaller than with setting 5. Taking the possible influence of the body effect into consideration, settings 3 or 5 therefore are a better choice for stable operation.

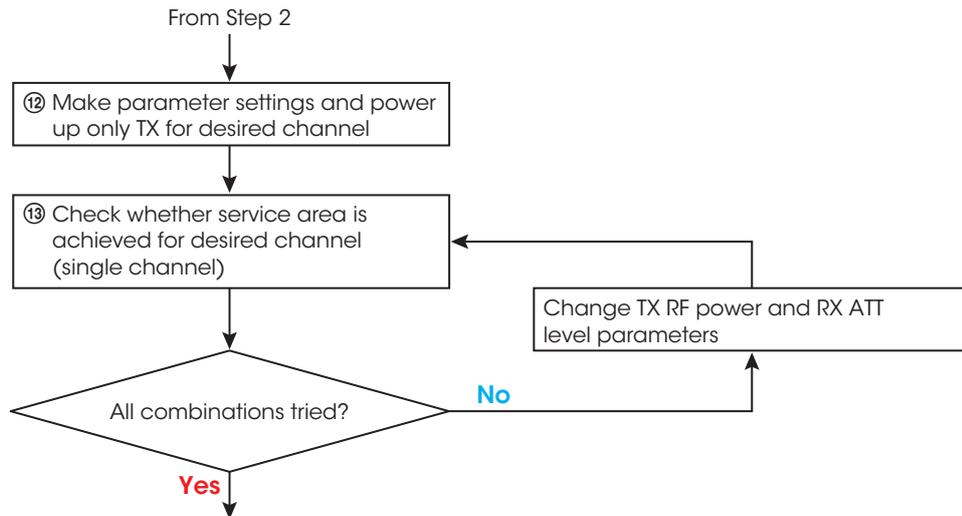
- With setting 3, the transmitter output is 1 mW. Compared to the 10 mW of setting 5, battery life will be extended by about 10 to 20 percent.
- With setting 5, the transmitter output is 10 mW. Compared to the 1 mW of setting 3, the higher RF level is more suitable for situations with a lot of movement.

It is also possible to use setting 3 as a general system setting, and increase the RF level to 10 mW only in one or more specific channels with lots of movement, to enlarge the service area for these channels. However, because third-order intermodulation distortion will increase in this case, and channels that may be affected should be checked beforehand. For safety, operation in all channels should be checked before going into operation.

Configuring a DWX System

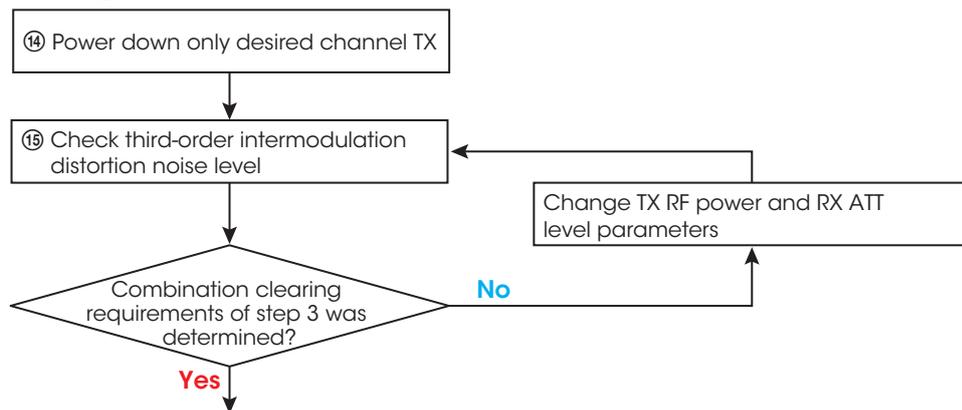
Flowchart for Step 3

■ Checking the service area with one channel



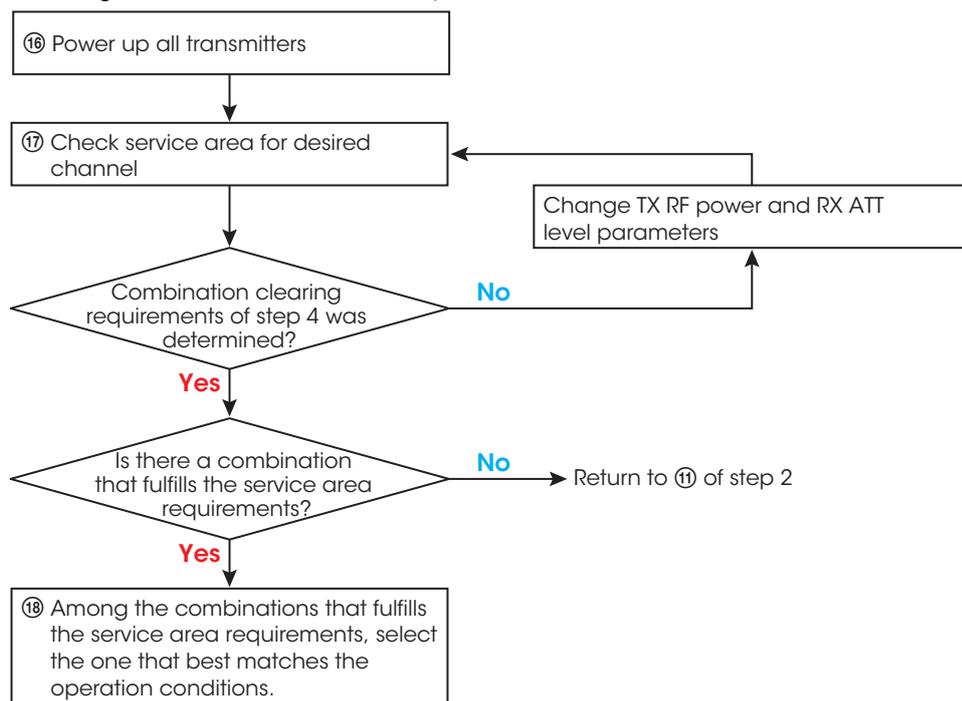
Flowchart for Step 4

■ Checking third-order intermodulation distortion



Flowchart for Step 5

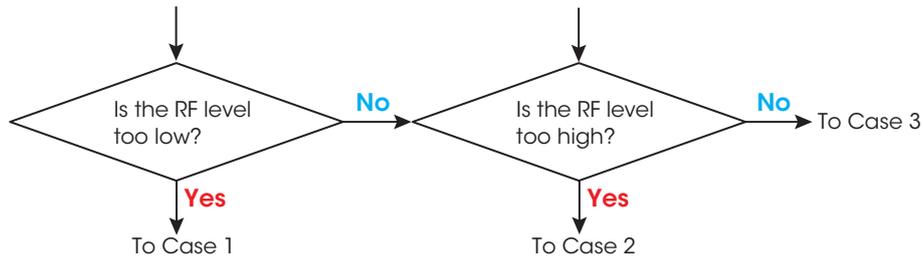
■ Checking simultaneous multi-channel operation



Setup procedure is complete.

Troubleshooting

If noise, audio output dropout, or a decrease in the QL occurs, check the following.



■ Case 1: RF level is too low (15 dBu or less, RF indicator frequently turns red)

- If only the RF level of a specific receiver is low, increase the RF power of the corresponding transmitter.
- If the RF levels of all receivers are low, perform one of the following.
 - Increase the RF power of all the transmitters.
 - Decrease the RF attenuator settings of the DWR-R01D and other peripheral devices.
 - Increase the RF level settings of the AN-01, AN-820A, and other peripheral devices.

■ Case 2: RF level is too high (RF indicator frequently turns orange)*

- If only the RF level of a specific receiver is high, decrease the RF power of the corresponding transmitter.
- If the RF levels of all receivers are high, perform one of the following.
 - Decrease the RF power of all the transmitters.
 - Increase the RF attenuator settings of the DWR-R01D and other peripheral devices.
 - Decrease the RF level settings of the AN-01, AN-820A, and other peripheral devices.

*The indicator turns orange when the RF level is too high (80 dBu or more) only on the DWR-R01D.

■ Case 3: Interference may be picked up

To check this, perform the following steps.

- ① Turn power to all transmitters off.
- ② In this condition, monitor the RF level on the display of the DWR-R01D or in Wireless Studio.
- ③ If the RF level meter registers by one segment or more, take measures to eliminate interference, or change to another available channel within the same group.

Configuring a DWX System

Quick Check

When there is not enough time for a step-by-step configuration of the system, such as during an event or concert, check the following three items to verify that the system has been configured properly.

Conditions for checking

Perform the check after confirming that all antennas and cables are installed, settings for the antenna gain, TX RF power, RX attenuator, and used frequencies are configured, and the RX equipment is turned on.

Items for checking

- ① Turn off all TX equipment, and check that RF level meters for all RX equipment are off (i.e., not lit).
- ② Turn on all TX equipment except one, check that the RF level meters are off (i.e., not lit) for the RX with the same frequency as the TX that is turned off, and repeat this check for each TX.
- ③ Turn on all TX equipment, and check that the RF indicators for all RX equipment are always lit green under all envisioned conditions.

If all the above conditions are met, you can reliably operate the system without concerns.

■ **If there is not enough time to check all envisioned operating conditions**

- ③ Turn on all TX equipment, and check that the RF level meters for all RX equipment show 4 to 6 segments under the normal state (i.e., normal installation at a fixed position).

If the conditions for ①, ②, and ③ are met, you can operate the system with reasonable reliability.

Note

The body effect has an influence of 10 dB to 20 dB. If the body effect is not present under the normal state, the addition of the body effect will result in a drop of 10 dB to 20 dB. If the body effect is present under the normal state, the loss of the body effect will result in an increase of 10 dB to 20 dB. If the RF level meters show 5 segments under the normal state, the addition or loss of the body effect will result in a showing of 3 or 7 segments respectively, leaving you with an RF level that provides reasonable reliability (RF indicator is lit green).

■ **If conditions are not met**

- If condition ① is not met, interference exists. Remove computers, Bluetooth mice, mobile phones, game devices, and other signal transmitting devices away from the area. If the problem persists after removing the above, interference from another system may be present. Perform a clear channel scan, and reselect a frequency without interference.
- If condition ② is not met, third-order intermodulation distortion exists, but as long as condition ③ is met, you can reliably operate the system.
- In addition to checking condition ③ in such cases, check that the QL meter always shows more than 4 segments.
- If time allows, check that conditions ② and ③ are met after adjusting the antenna setup positions, antenna gain, attenuator, and TX output levels to ensure even more reliable operation.

Network System Configuration

Use of the Remote Control Unit RMU-01 and a computer on which Wireless Studio is installed allows configuration of a Cross Remote network with expanded functions.

System Configuration

System Requirements

- Configure a dedicated LAN for the DWX system using 100Base-TX/10Base-T Ethernet equipment. Do not use an existing LAN.
- Make sure that IP addresses of equipment do not conflict.
- Operation is not guaranteed for connections utilizing wireless LAN access points.

ST mode and NT mode

The Sony digital wireless system supports two types of remote control: ST mode where a transmitter and receiver communicate directly in a one-on-one configuration, and NT mode where the transmitter and receiver communicate via the RMU-01 connected to the network.

■ System configuration for ST mode

Transmitter and receiver communicate directly in a one-on-one configuration. When the receiver is placed within a main UHF service area, Cross Remote can be used within a range of about 10 meters from the receiver.

Notes

- Within a single Cross Remote service area, control should be limited to six transmitters (three receivers). To control more than six transmitters, the NT mode system should be used.
- As the DWR-S01D is not equipped with a network terminal, it can only operate in ST mode.
- The DWR-R01D allows connection of a computer and use of Wireless Studio for transmitter monitoring and control also in ST mode.

■ System configuration for NT mode

Transmitters and receivers communicate via the Remote Control Unit RMU-01 connected to a network. One RMU-01 unit can control up to 82 transmitters. The service area range is about 10 meters from the Remote Control Unit RMU-01. Up to nine RMU-01 units can be used within a system, which allows expanding the service area.

Notes

- If at least one RMU-01 unit is connected to the system, remote control always operates in NT mode.
- Keep in mind that the internal 2.4 GHz antenna of the DWR-R01D ceases to operate in NT mode.
- The DWR-S01D does not support NT mode.

Operation from receiver and operation from computer

Transmitter monitoring can be controlled from a receiver or from a computer on which Wireless Studio is installed.

■ Operation from receiver

Transmitter monitoring can be controlled while checking the transmitter settings on the receiver display. When the DWR-S01D is mounted on a camcorder, operation from the camcorder menu screen is also possible.

Note

Although the built-in 2.4 GHz antenna of the DWR-R01D will stop functioning in NT mode, remote control from the DWR-R01D is still possible, without the use of a computer. (Operation in conjunction with a computer is also possible.)

■ Operation from a computer

Transmitter monitoring can also be controlled from a Windows computer that has the Wireless Studio application installed.

Up to 6 computers can be used in a single system.

Note

Transmitter monitoring control is also possible via a connected computer in ST mode (DWR-R01D only). (Refer to Figures 3 and 4 in the "System configuration examples" section.)

Configuring a DWX System

System configuration examples

Configure the system while referring to the following examples.

Configuring an ST mode system

■ When operating from the receiver only

- One DWR-R01D or DWR-S01D unit

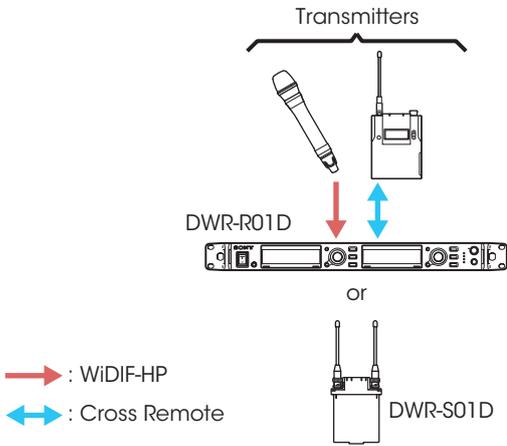


Figure 1

Note

When using the DWR-S01D, a configuration for operation from the receiver is the only option.

- Multiple DWR-R01D or DWR-S01D units (2 to 3)

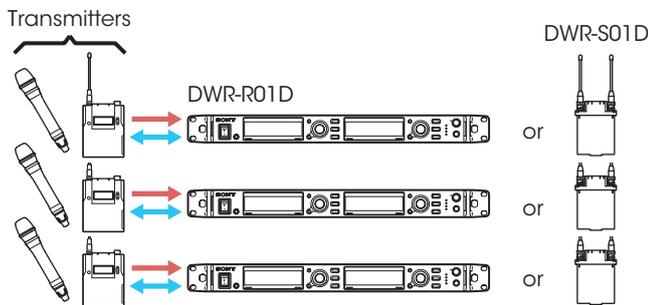


Figure 2

Note

When using the DWR-S01D, a configuration for operation from the receiver is the only option.

■ When operating from the receiver and a computer

- One DWR-R01D unit

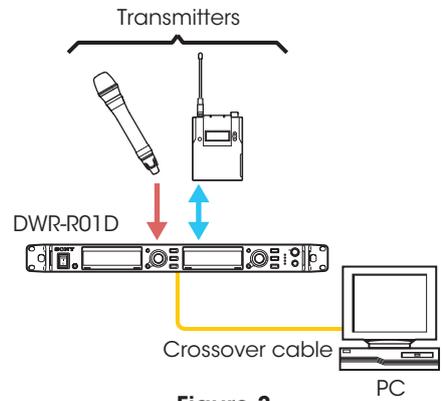


Figure 3

Note

Use a crossover cable to connect the DWR-R01D to the computer.

- Multiple DWR-R01D units (2 to 3)

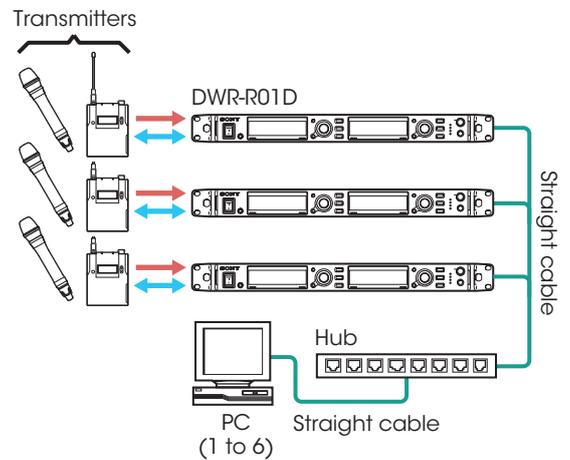


Figure 4

Note

Use straight cables for all connections.

Configuring an NT mode system

- Notes**
- When determining the number of RMU-01 units to use, refer to the "Installation of Remote Control Unit RMU-01" (page 62) section and take the coverage area of the RMU-01 into consideration.
 - When supplying power to the RMU-01 via PoE, refer to the diagrams in the "Power supply (PoE) for RMU-01" section.

- **When operating from the receiver only**
- One DWR-R01D unit

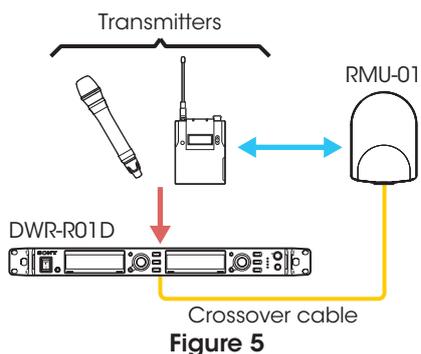


Figure 5

Note
Use a crossover cable to connect the DWR-R01D to the RMU-01.

- **When operating from the receiver and a computer**
- One DWR-R01D unit

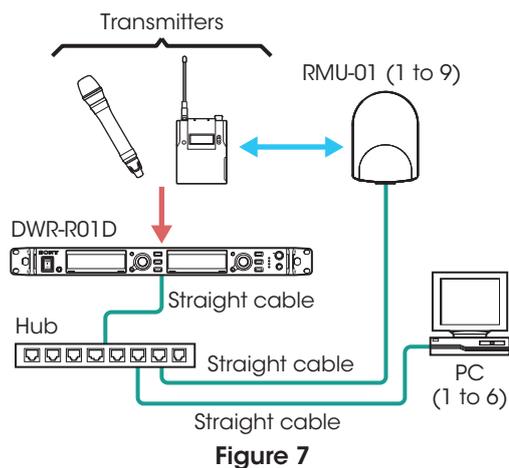


Figure 7

Note
Use straight cables for all connections.

- Multiple DWR-R01D units (2 to 41)

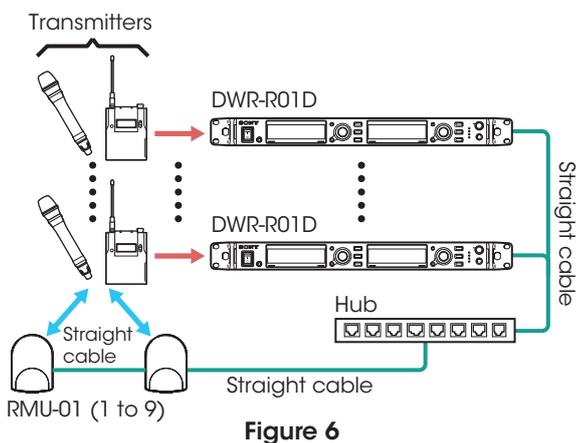


Figure 6

Note
Use straight cables for all connections.

- Multiple DWR-R01D units (2 to 41)

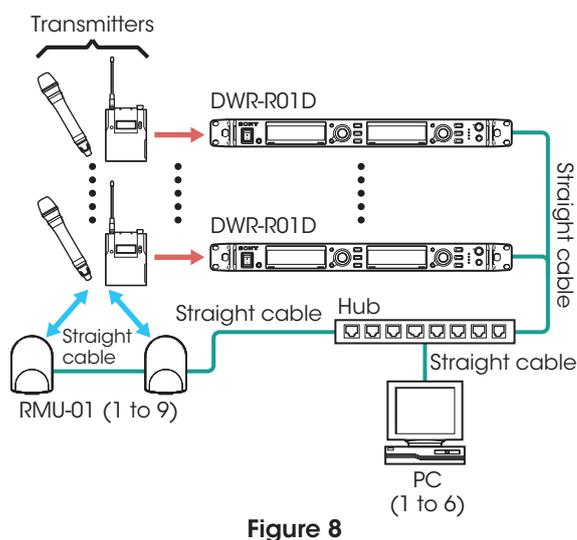


Figure 8

Note
Use straight cables for all connections.

Configuring a DWX System

Equipment Features

DWX Network Accessories

■ Remote Control Unit RMU-01

This is a 2.4 GHz antenna designed specifically for Cross Remote NT mode operation.



- By connecting the unit and the DWR-R01D to a LAN, the transmitter remote control range can be extended, and up to 82 transmitters can be controlled remotely.
- Using multiple RMU-01 units to enlarge the service area is also possible. Up to nine units can be used in one network system.
- Power can be supplied either from the included AC adapter or from a PoE hub supporting PoE (Power Over Ethernet) or a PoE power supply.
- Mounting to a microphone stand is possible.

Bottom side



❶ Hole for attaching the microphone stand

Can be attached to the microphone stand (PF 1/2-inch thread) with this hole.

To attach an NS 5/8-inch or a W 3/8-inch microphone stand, use the supplied screw adapter.

❷ AC adapter connector and POWER indicator

Connect the supplied AC adapter to the AC adapter connector to supply power to this unit.

The POWER indicator lights up green while the power is supplied from the AC power connector or the LAN connector.

For details on power supply to this unit, see "Power supply (PoE) for RMU-01".

❸ LAN connector (RJ-45)

This is a 100Base-TX/10Base-T connector for network connection. Communication speed automatically changes according to the connected device.

Connect to a receiver such as DWR-R01D, Windows PC, or hub.

When a PoE device including PoE hub is connected, the power is supplied through this connector.

■ Computer requirements

The computer on which to install Wireless Studio for use with the DWX system must meet the following requirements.

Item	Condition
Operating system (OS)	Windows XP (SP3 or later) Windows Vista (SP1 or later) Windows 7 (32 bit/64 bit)
CPU	1 GHz or better recommended
RAM	1 GB or more recommended
Graphics card	Video memory of 128 MB or greater recommended
Available hard disk space	1 GB or more
Monitor resolution	1024 x 768 pixels or better recommended
Other	English-language display capability 100Base-TX LAN card CD-ROM drive

■ Ethernet hub information

The RMU-01 supports PoE (Power over Ethernet).

When the RMU-01 is connected to the LAN using an IEEE802.3af compliant PoE hub, the RMU-01 can be powered via the LAN cable.

What is PoE (Power over Ethernet)?

PoE allows powering a device over the Ethernet cables used in a LAN. Because data and power are routed through a single cable, installation of equipment is facilitated even in locations where providing a conventional power supply would be difficult. The RMU-01 can be powered from an IEEE802.3af compliant hub with PoE support, or by connecting a PoE power supply between a regular hub and the RMU-01.

■ LAN cable information

Use Category 5 or better LAN cable for connecting the RMU-01 or DWR-R01D to the computer. The maximum allowable cable run is 100 meters. If longer cable runs are required, use a hub between the computer and the RMU-01 or DWR-R01D.

Depending on the connection configuration, use the following type of cable.

Direct connection to computer: Crossover cable

Connection via hub: Straight cable

Installation of Remote Control Unit RMU-01

This section provides information about the coverage area, roaming times etc. when using the RMU-01 for wireless communication.

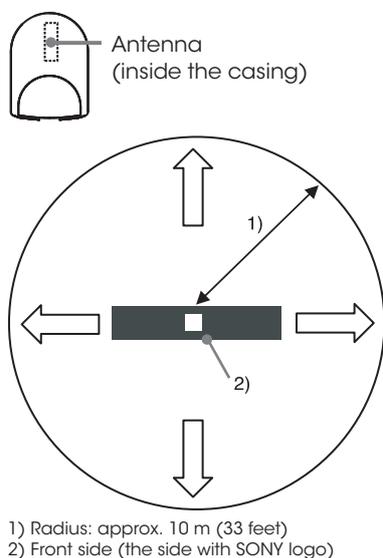
Coverage area of Remote Control Unit RMU-01

The internal antenna of the RMU-01 emits a strong circular-pattern RF signal centered on the antenna axis. 2.4 GHz band radio wave propagation is highly linear and not easily deflected. When people or objects are present in the path between the remote control unit and transmitter, reception field strength may decrease drastically. Always try to install the RMU-01 so that a direct line of sight can be established from the wireless microphone or transmitter.

Note

The maximum number of RMU-01 units in a single network system is nine, but increasing the number of RMU-01 units will not increase the number of transmitters that can be used. Regardless of the number of RMU-01 units, the maximum number of transmitters is 82 per system.

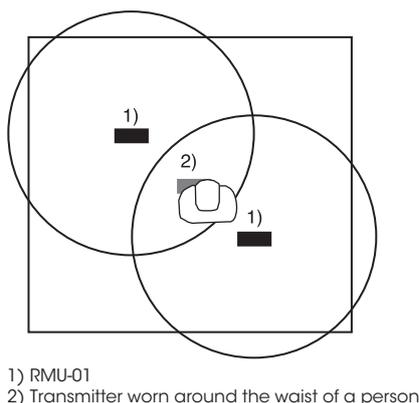
The radius of the area where RF signals are strong is about 10 meters, centered on the antenna. When using multiple RMU-01 units to enlarge the coverage area, these concentric areas should overlap.



When installing multiple RMU-01 units, place them so that strong signal area touches that of adjacent RMU-01 unit.

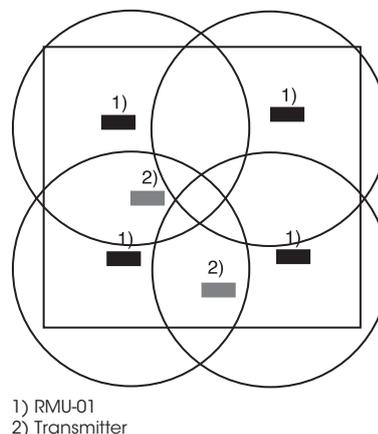
Installation example 1 (plane view)

When two RMU-01 units are installed to control the body-pack transmitter that is worn around the waist of a person, it is recommended that the RMU-01 units be placed across the body-pack transmitter so that there is no obstacle between the transmitter and at least one of the RMU-01 units.



Installation example 2 (plane view)

To increase the total operation area by putting the areas that multiple RMU-01 units cover together, place them so that the area that one RMU-01 covers touches those on others, completely adjacent and with no gaps.

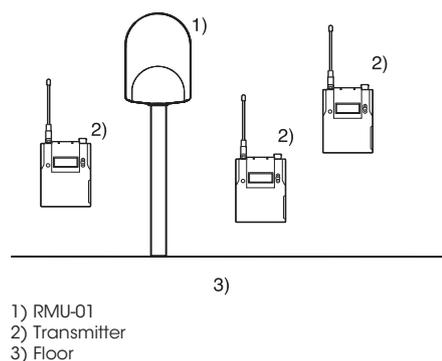


Installation example 3 (section view)

This is an example when this unit is installed to the microphone stand.

Indoors: Because the signal is reflected from the walls, floor, and ceiling, there are no conditions for the installation height of this unit.

Outdoors: Install this unit at the same height as the transmitters.



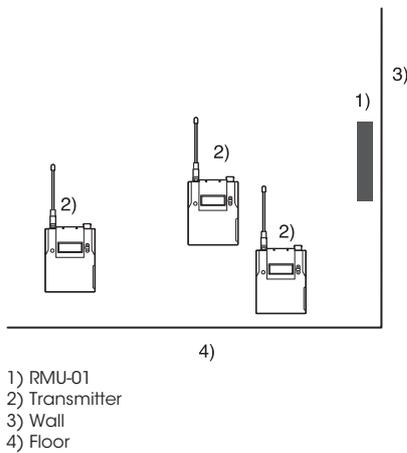
Configuring a DWX System

Installation example 4 (section view)

This is an example when this unit is installed on the wall.

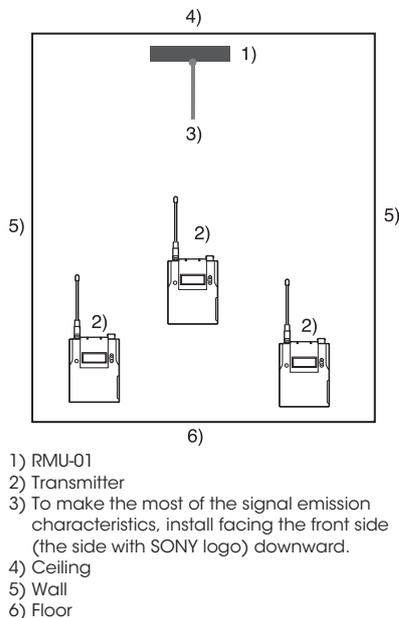
Indoors: Because the signal is reflected from the walls, floor, and ceiling, there are no conditions for the installation height of this unit.

Outdoors: Install this unit at the same height as the transmitters.



Installation example 5 (section view)

This is an example when this unit is installed indoors, near the ceiling.



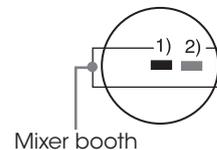
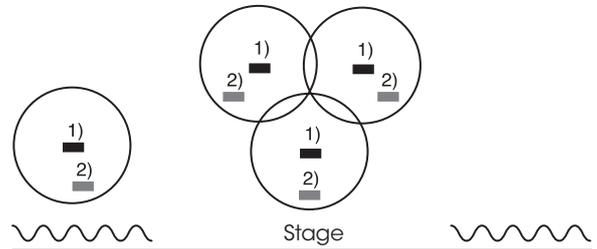
Number of coverage area points

The coverage area can be enlarged by installing multiple RMU-01 units with overlapping coverage areas, but if the number of locations to control is limited, it is not necessary that all areas overlap each other.

Install RMU-01 units in the areas to be controlled, and increase the number of coverage area points.

Installation example 6 (plane view)

If transmitters in locations such as the stage wings or mixing booth are to be controlled in addition to the stage at a concert venue, install RMU-01 units in the vicinity of these locations.



- 1) RMU-01
2) Transmitter

Roaming Times

When two or more RMU-01 units are installed to enlarge the coverage area by overlap, and a transmitter moves out of the service area of one RMU-01 unit, roaming occurs and the connection switches to the other RMU-01 unit. The connection interruption due to the roaming action will occur also if there are no blanks, that is when the coverage area overlaps properly.

Also when the number of coverage area points has been increased, a transmitter leaving the coverage area of one RMU-01 and entering that of another, or re-entering the same RMU-01 coverage area will go through a roaming phase, and some time will be required for reconnection.

The time required for roaming depends on the wireless environment and the number of transmitters. It can range from several seconds to several tens of seconds.

■ When one transmitter performs roaming in a normal communication environment

The number of operation channels does not significantly change the roaming time.

- 1-channel system: approx. 1 second
- 82-channel system: approx. 1.5 seconds

■ When multiple transmitters are performing roaming

- Time per unit x number of units (approximate calculation)
- For example, when 50 transmitters are roaming concurrently, all connections will be established after about 50 seconds. (In-house data)

Note

When there is a mix of ST mode and NT mode systems or when there are multiple NT mode systems, the roaming time may change, depending on the installation environment.

Network Device Connections

This section describes which LAN cables to use and how to supply power (PoE) when connecting each device in a network.

LAN cable information

Use Category 5 or better LAN cable, and keep cable length under 100 meters. If cable runs of more than 100 meters are required, use a hub or other suitable equipment.

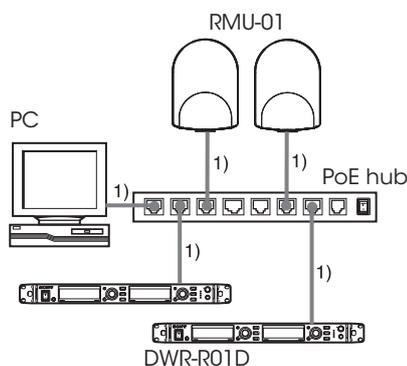
You can also use crossover cables for direct connections between the DWR-R01D, computer, or RMU-01, without the use of a hub. For details, refer to Figures 3 and 5 in the "System configuration examples" section, and to "To supply power from the PoE power supply unit" in the "Power supply (PoE) for RMU-01" section.

Power supply (PoE) for Remote Control Unit RMU-01

The RMU-01 supports PoE (Power over Ethernet).

PoE allows powering a device over the Ethernet cables used in a LAN. Because data and power are routed through a single cable, installation of equipment is facilitated even in locations where providing a conventional power supply would be difficult. When an IEEE802.3af compliant hub with PoE support is connected to the network, or when a PoE power supply is connected between the RMU-01 and a regular hub, the RMU-01 can be powered without requiring another power source.

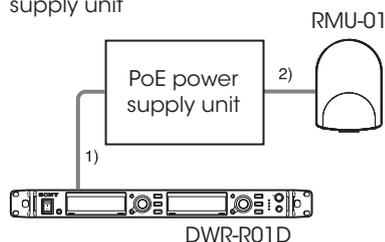
To supply power from the PoE hub



1) Straight cable

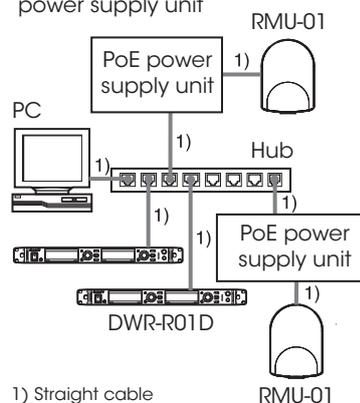
To supply power from the PoE power supply unit

- When only one receiver (such as the DWR-R01D) or the PC is connected to this unit and the power is supplied to this unit from the PoE power supply unit



1) Cross cable
2) Straight cable

- When multiple devices including this unit and the receivers are connected and the power is supplied to this unit from the PoE power supply unit



1) Straight cable

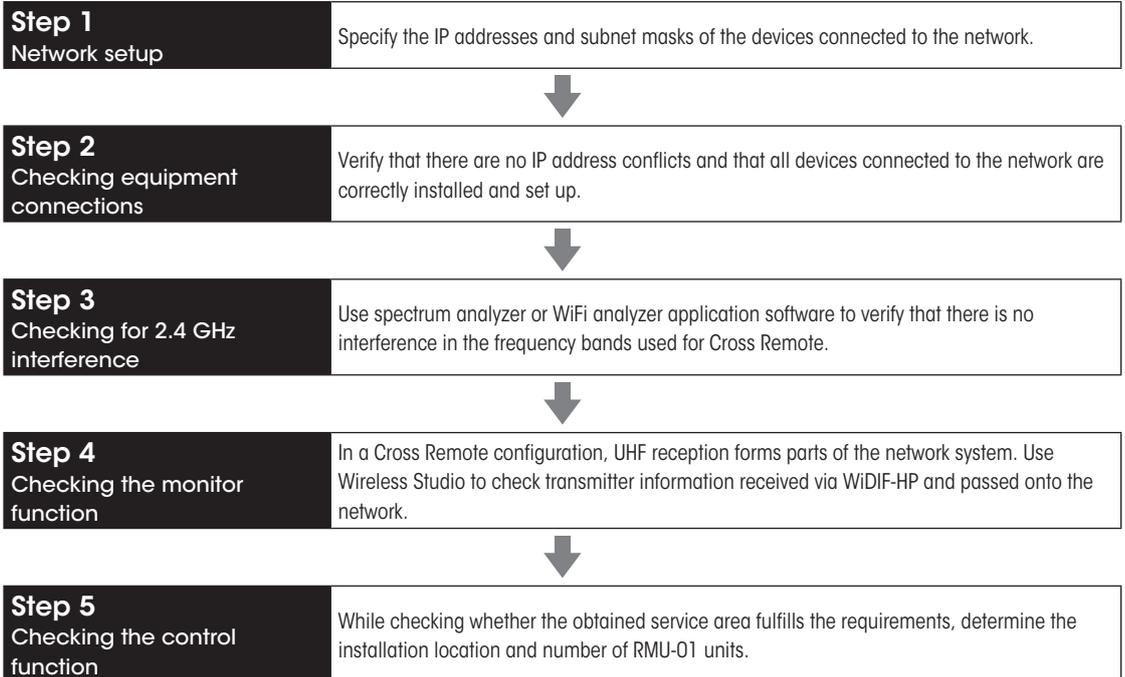
Notes

- The RMU-01 can also be powered from the supplied AC adapter.
- Be sure to use Category 5 or better LAN cable.
- The length of the LAN cable run between the RMU-01 and other equipment (PoE hub, receiver, etc.) should not exceed 100 meters.
- If a PoE power supply without repeater capability is inserted between the RMU-01 and the target equipment (DWR-R01D, hub etc.), the combined LAN cable run to the RMU-01 should not exceed 100 meters.

Configuring a DWX System

Making and Checking Network Settings

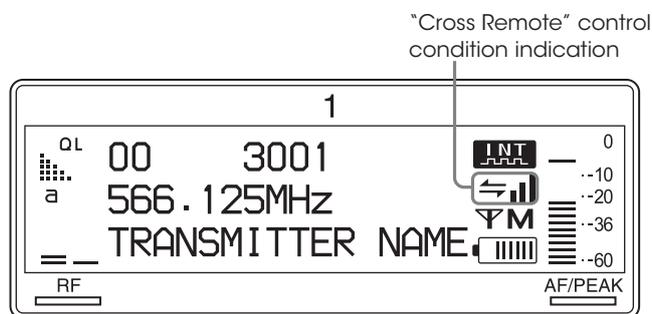
Follow the steps described below to make network settings and check the Cross Remote functions.



2.4 GHz area operation check

■ Checking with the DWR-R01D display

Use the "Cross Remote" control condition indication to check whether the transmitter is in the 2.4 GHz area.



"Cross Remote" control condition indication

Indicates the signal transmission condition of the "Cross Remote" control function (four levels).

- ☑ : Good transmission
- ☑ : Somewhat good transmission
- ☑ : Somewhat poor transmission
- ☑ : Poor transmission
- ☑ : Unable to communicate with paired transmitter

When the "Cross Remote" control function is off, this indication does not appear.

■ Checking with Wireless Studio

Use the "Cross Remote" control condition display to check whether the transmitter is in the 2.4 GHz area.



"Cross Remote" control condition display

Indicates the communication status of the paired transmitter according to four levels.

- ☑ : Good transmission
- ☑ : Somewhat good transmission
- ☑ : Somewhat poor transmission
- ☑ : Poor transmission
- ☑ (red indication): Unable to communicate with paired transmitter

This icon does not appear when the "Cross Remote" function on the DWR-R01D is turned off.

Configuring a DWX System

Step 1 Network Setup

Specify the IP addresses and subnet masks of the devices connected to the network.

■ Network configuration

Configure a dedicated network for the DWX system, using 100Base-TX/10Base-T Ethernet equipment. Do not use an existing network.

■ System precautions and limitations

- Make sure that IP addresses of equipment do not conflict.
- Operation is not guaranteed for connections utilizing wireless LAN access points.

■ IP address setup

IP addresses must be configured for the computer, DWR-R01D, and RMU-01.

The IP addresses should be unique within the same subnet.

The values for the first three sets of numbers are identical for IP addresses (XXX.XXX.XXX.XXX) within the same subnet.

Example:

- For IP addresses in the same subnet

192.168.0.100 and 192.168.0.20

└──────────┘

Values for first three sets of numbers are identical.

- For IP addresses in different subnets

192.168.0.100 and 192.168.2.200

└──────────┘

Values for first three sets of numbers are different.

If IP addresses within different subnets are configured for the devices, the devices will not communicate properly even when connected to the same hub.

Configure identical values for the first three sets of numbers as follows, and configure a unique value between 1 and 255 in the fourth set for each device.

Configuration example:

Computer: 192.168.0.10

DWR-R01D: 192.168.0.100

RMU-01: 192.168.0.200

Set the subnet mask to 255.255.255.0.

Note

The DWR-R01D and RMU-01 do not include a DHCP client function. Each device must have a fixed IP address. If there is an IP address conflict due to identical addresses, the system will not operate properly. Make sure that each device has a unique IP address.

① Computer network settings

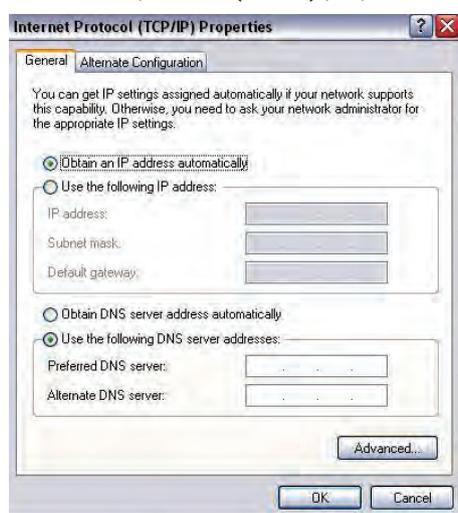
Use the regular procedure for the respective operating system to set the IP address and subnet mask of the computer.

PC network settings

The following procedure explains the setting operations using the Windows XP operating system.

*For details on how to make network settings with other operating systems, refer to the help of the operating system that you use.

- 1 Select "Start>Control Panel>Network and Internet Connections".
- 2 Click "Network Connections".
- 3 Right-click the local area connection icon and then click "Properties".
- 4 Double-click "Internet Protocol 4 (TCP/IP)".
The properties window of the local area connection opens up.
- 5 Double-click "Internet Protocol (TCP/IP)".
The internet protocol (TCP/IP) properties window opens up.



- 6 Click "Use the following IP address", and then enter the IP address in the IP address field.

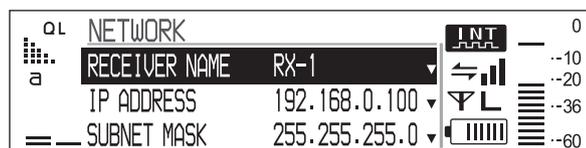
Note

Make sure not to use an IP address that is already assigned to another device on the network.

- 7 Enter "255 255 255 0" into the Subnet Mask field.
- 8 Click "OK" to close the internet protocol (TCP/IP) properties window.
- 9 Click "Close" to close the local area connection properties window.

② DWR-R01D network settings

Configure the IP address and subnet mask for the DWR-R01D in the NETWORK submenu of the UTILITY menu.



Note

When IP address settings are changed, NT mode pairing settings are disabled. Perform the pairing process again.

Configuring a DWX System

③ RMU-01 network settings

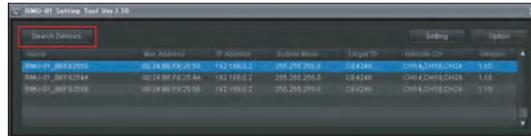
Install the setup tool supplied with the RMU-01 on the computer and make the RMU-01 network settings from the computer.

Procedure

Start the RMU-01 setup tool on the computer.



Click the [Search Devices] button.



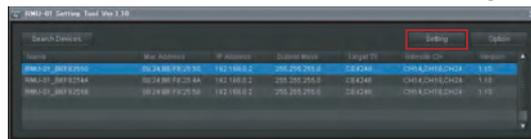
Note

On some computers equipped with multiple LAN ports (either wired or wireless), the RMU-01 units connected to the LAN will not be detected even after you click the [Search Devices] button. In such cases, temporarily disable all ports including those for LAN and IEEE1394 connections via [Network Connections] on the operating system, and enable only the port to which the RMU-01 is connected. Then, restart the RMU-01 setup tool and perform auto detection again.

RMU-01 devices present on the network are detected, and information about them is displayed.

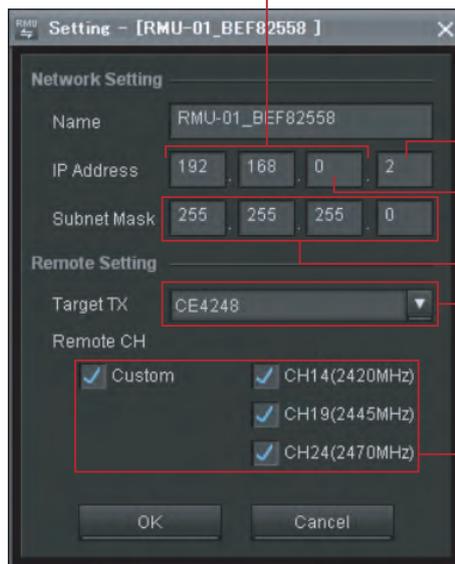


Select the device for which to make the setting, and click the [Setting] button.



Specify the device name, IP address, and subnet mask.

Set the first three fields to the same values for each device.



Use a unique value for the fourth field only.

Specify a different segment from other wireless networks in the vicinity.

Set to 255.255.255.0

Select the model number of the transmitter to be controlled from the RMU-01 in [Target TX]. The optimal remote control channel will be selected based on the specified transmitter and appear in [Remote CH].

You can select [Custom] to freely select the remote control channel. If radio interference exists between the RMU-01 remote control and other systems such as wireless LAN, you may be able to avoid the interference by selecting the remote control channel with [Custom] enabled.

Notes

- When [Custom] is selected, the automatic selection of the optimal remote control channel for the transmitter will be ignored. In such cases, signals from the transmitter may affect remote control. Be sure to verify operation before beginning actual use.
- Depending on the operating environment of your computer, certain operations may be blocked by the firewall or security filter after startup of the RMU-01 setup tool. If LAN communication that is necessary for operation in NT mode is blocked, the system will not operate properly. Therefore, configure the firewall or security filter to allow RMU-01 setup tool operations.

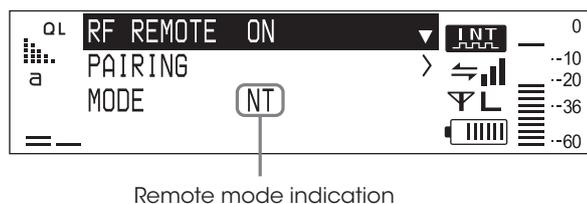
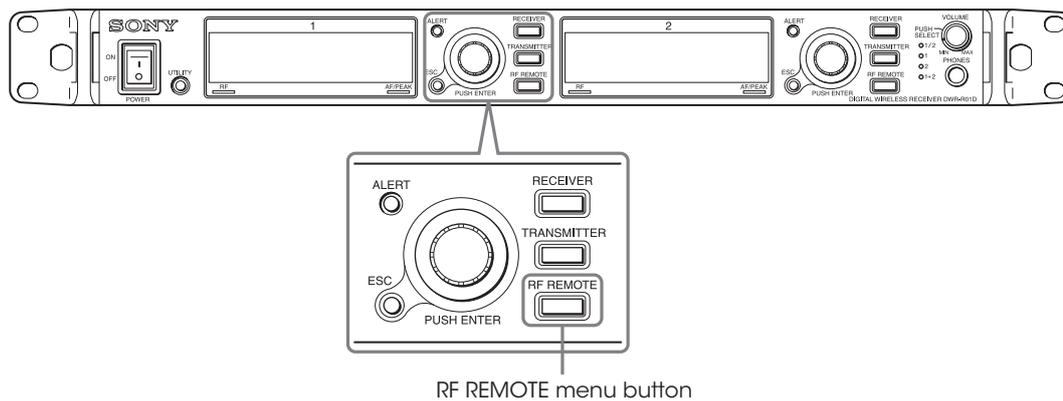
Step 2 Checking Equipment Connections

Verify that all devices connected to the network are correctly installed and set up.

④ Checking the remote mode

The display of the DWR-R01D can be used to check whether the receiver currently operates in ST mode or NT mode.

To show the remote mode on the display, press the RF REMOTE button on the front panel.



Remote mode indication

Display whether the receiver is operating in the ST mode or NT mode. (The mode can only be displayed.)

NT: The receiver has recognized the RMU-01 unit and is operating in NT mode.

ST: The receiver is operating in ST mode.

SEARCH: The receiver is searching for the remote mode state.

Configuring a DWX System

⑤ Checking the equipment count

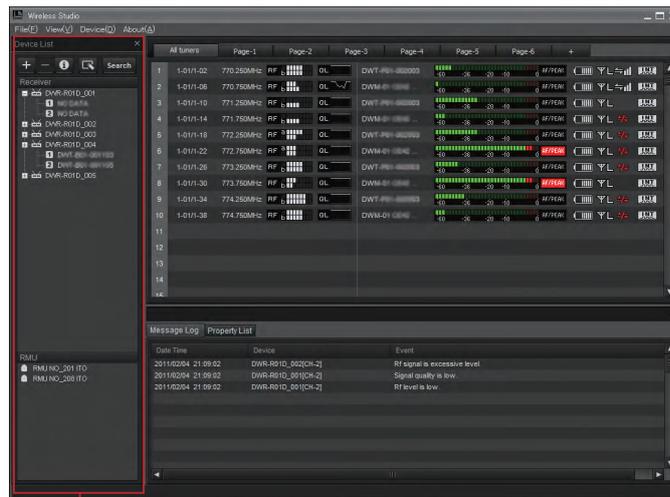
Use Wireless Studio to check the type and number of devices connected to the network. If there are IP address conflicts such as address duplication, the actual number of devices and the number shown in Wireless Studio will not match.

■ Procedure

Power up all devices and set Wireless Studio to the online condition. A list of all devices on the network will be shown.

In cases such as the following, the actual number of devices and the devices shown in the device list will not match: IP address conflicts, IP address settings with overlapping subnet masks, Ethernet cable disconnection, device not powered up, etc.

Check the number of DWR-R01D and RMU-01 units in the device list.



Device List window

■ IP address conflict between DWR-R01D units

The receiver section of the device list will only show one DWR-R01D unit, so that the count does not match the actual number of units.

■ IP address conflict between RMU-01 units

The RMU section of the device list will only show one RMU-01 unit, so that the count does not match the actual number of units.

■ IP address conflict between DWR-R01D and DWR-R01D units

The device list will only show one device, either in the receiver section or the RMU, so that the count does not match the actual number of units.

■ IP address conflict between computer and DWR-R01D, or computer and RMU-01

Wireless Studio cannot be set to the online condition, or the device list does not show the DWR-R01D or RMU-01, so that the count does not match the actual number of units.

■ IP address conflict between computers

When the operating system detects an IP address conflict, an alert message will appear on one or both of the computers.

⑥ IP address re-assignment

Check the settings including those for other LANs and network connections as well as the settings within the same subnet, and verify that there are no IP address conflicts, IP address settings with overlapping subnet masks, or other problems. If necessary, re-assign IP addresses to the computer, DWR-R01D, and RMU-01 units, as described in "IP address setup" (page 67).

Note

Wireless Studio identifies the DWR-R01D and RMU-01 by IP address. The DWM-01/DWT-B01 are mutually identified by the DWR-R01D and MAC address. In order to allow later reloading and complete restoring of setting information saved in Wireless Studio, all equipment must be the same, and IP address settings also must match.

Step 3 Checking for 2.4 GHz Interference

Verify that there is no interference in the frequency bands used for Cross Remote.

■ Procedure

- ⑦ Power down all DWX equipment so that no RF signals in the 2.4 GHz band are emitted by the DWX system.
- ⑧ Use a spectrum analyzer or WiFi spectrum analysis application for PC, smart phone, or tablet PC to verify that there is no interference in the 802.11.4 band on channel 14 (2.420 GHz), channel 19 (2.445 GHz), and channel 24 (2.470 GHz).
- ⑨ If there is interference, increase the distance between the system and interference sources, stop operation of the interference sources or move these to another frequency, to eliminate the interference.

■ Caution

The W-DMX wireless remote control system for lighting equipment and similar systems also may use the 2.4 GHz band. Pay special attention to such devices.

■ Note

If radio interference between wireless LAN or other systems cannot be avoided otherwise, you may be able to avoid interference by selecting the remote control channel with [Custom] enabled in [Setting] of the RMU-01 setup tool. When [Custom] is selected, the automatic selection of the optimal remote control channel for the transmitter will be ignored. In such cases, signals from the transmitter may affect remote control. Be sure to verify operation before beginning actual use.

Step 4 Checking the Monitor Function

In a Cross Remote configuration, UHF reception forms parts of the network system. Use Wireless Studio to check transmitter information received via WiDIF-HP and passed onto the network.

■ Procedure

- ⑩ Make suitable settings for frequency, security mode etc. so that the transmitter WiDIF-HP information can be received by the receiver.
- ⑪ Check the status of received transmitters using the display on the receiver.
- ⑫ Check the status of received transmitters using the Wireless Studio screen.

If the transmitter status cannot be checked even if reception has been set up properly, there may be a problem with the UHF service area.

Return to the channel plan selection and RF level setting stage, and establish other suitable settings.

Step 5 Checking the Control Function

While checking whether the obtained service area fulfills the requirements, determine the installation location and number of RMU-01 units.

■ Procedure

- ⑬ Perform transmitter and receiver pairing and set the control function to ON.
- ⑭ Have a person wear the transmitter as for actual operation and move throughout the service area, to check conditions at various locations.

■ Points to check

- "Cross Remote" control condition is not interrupted
- Control function is operative

- ⑮ If the obtained service area does not fulfill the requirements, change the installation location and number of RMU-01 units to increase the RF reception level, and check the service area again.

■ Increasing the RF reception level

Change the antenna installation position, aiming for

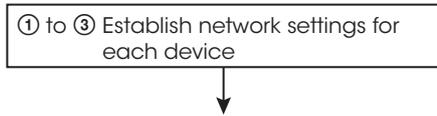
- close proximity to service area
- line of sight to transmitters
- position overlooking service area

Increasing RMU-01 unit count: Up to 9 units are supported

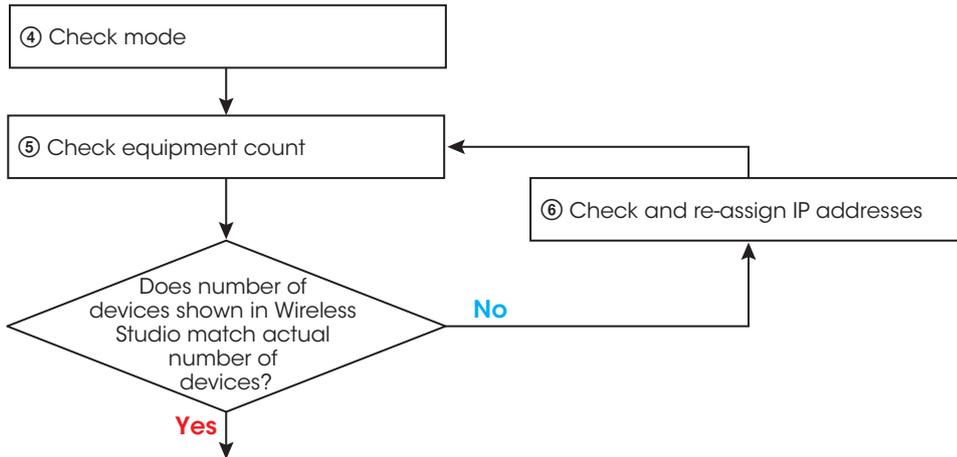
Configuring a DWX System

Flowchart

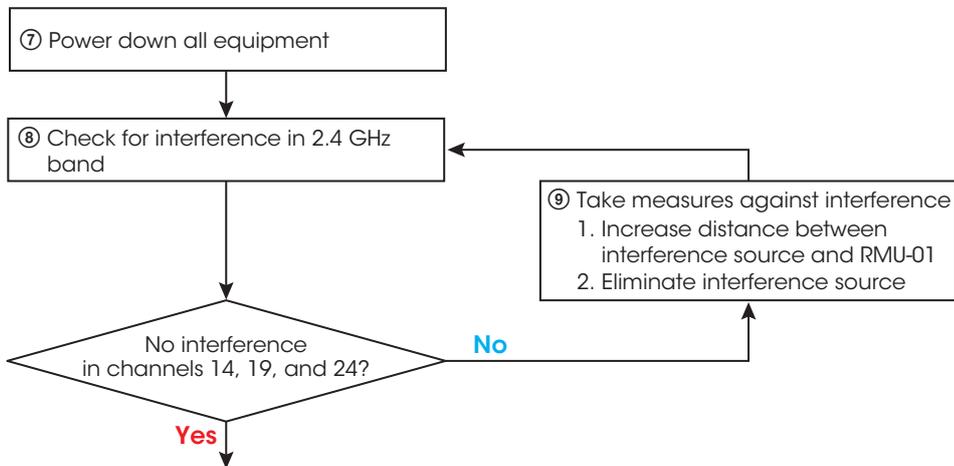
Step 1 Network setup



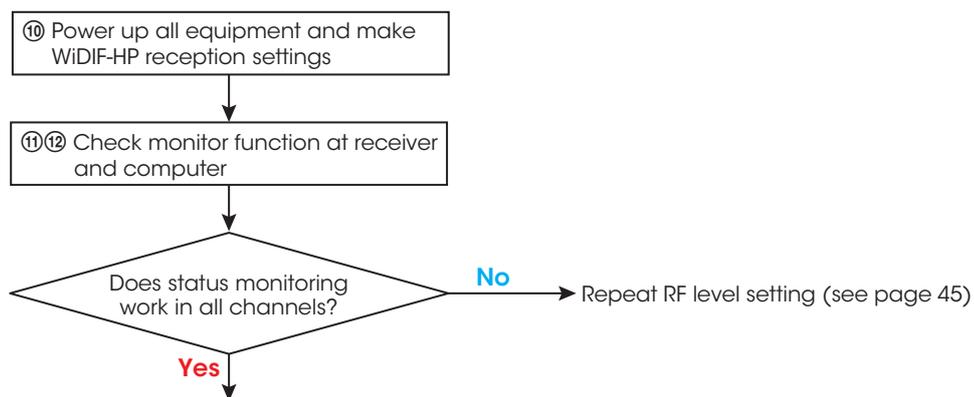
Step 2 Checking equipment connections



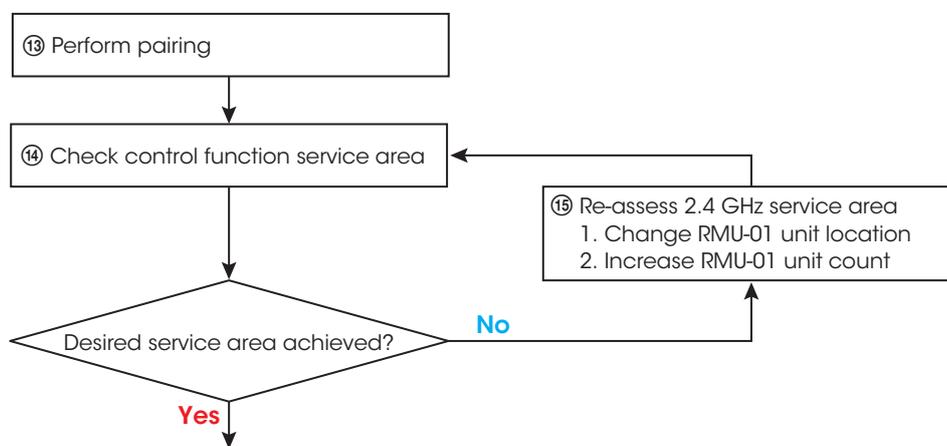
Step 3 Checking for 2.4 GHz interference



Step 4 Checking the monitor function



Step 5 Checking the control function

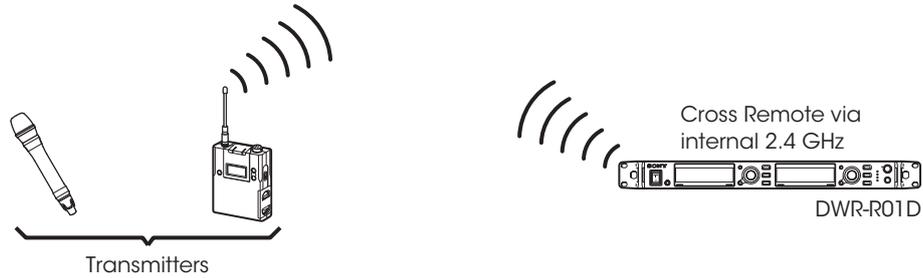


Setup procedure is complete.

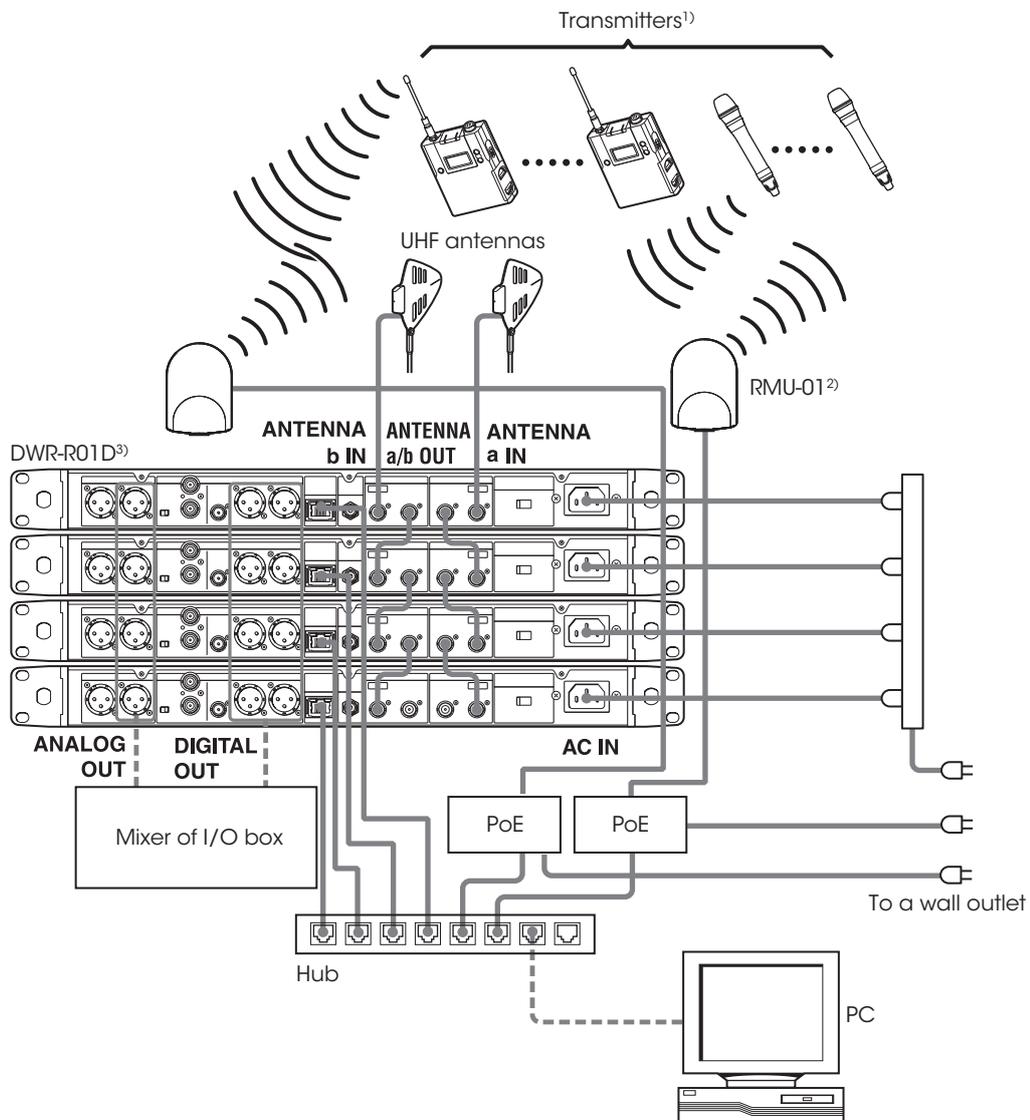
Sample System Configuration

Sample Minimum System Configuration (2 channels)

The Digital Wireless Transmitter DWT-B01 and the Digital Wireless Receiver DWR-S01D are used in a one-on-one configuration.

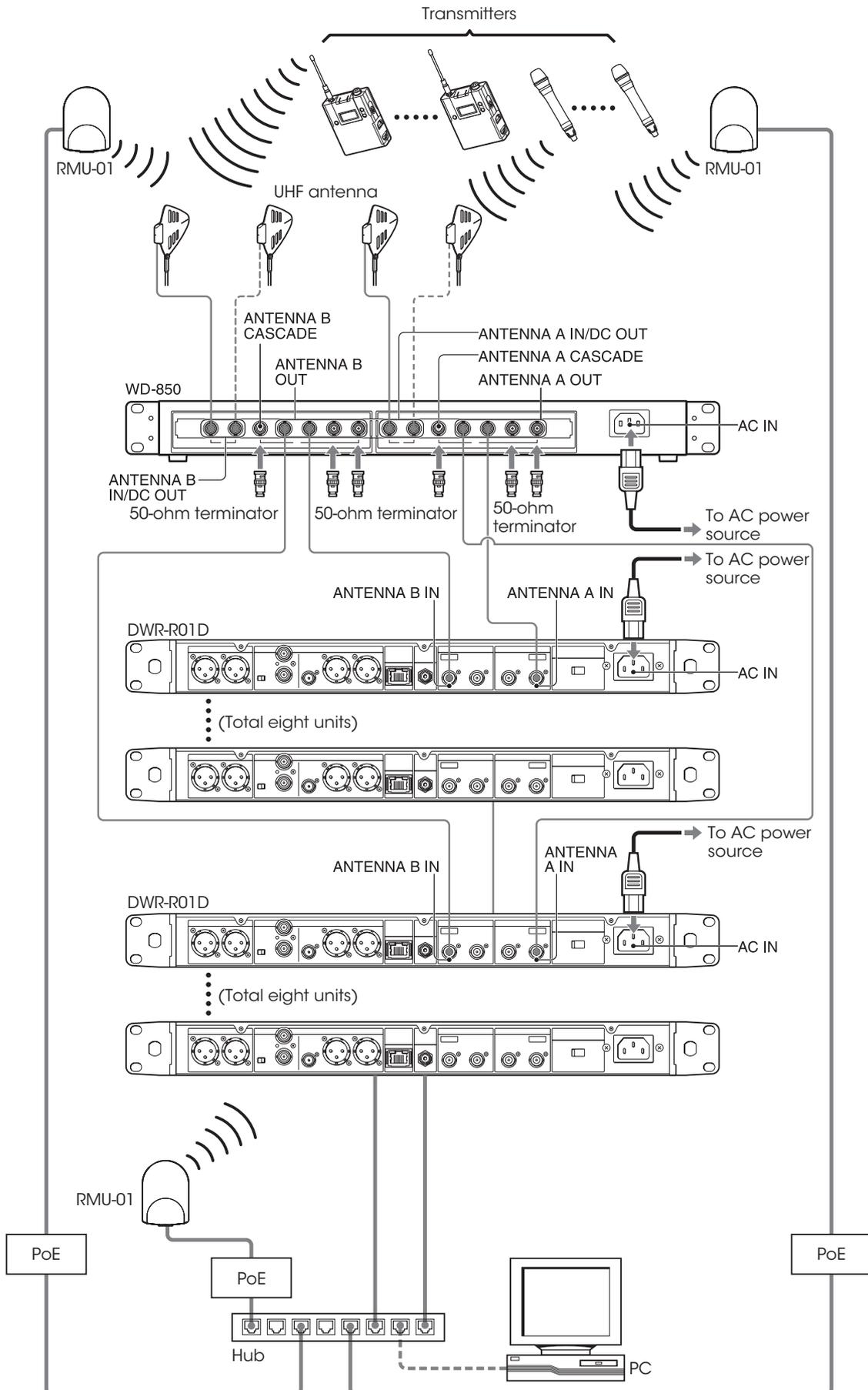


Sample Small-Scale System Configuration Using Remote Control Unit RMU-01 (7 - 16 channels)



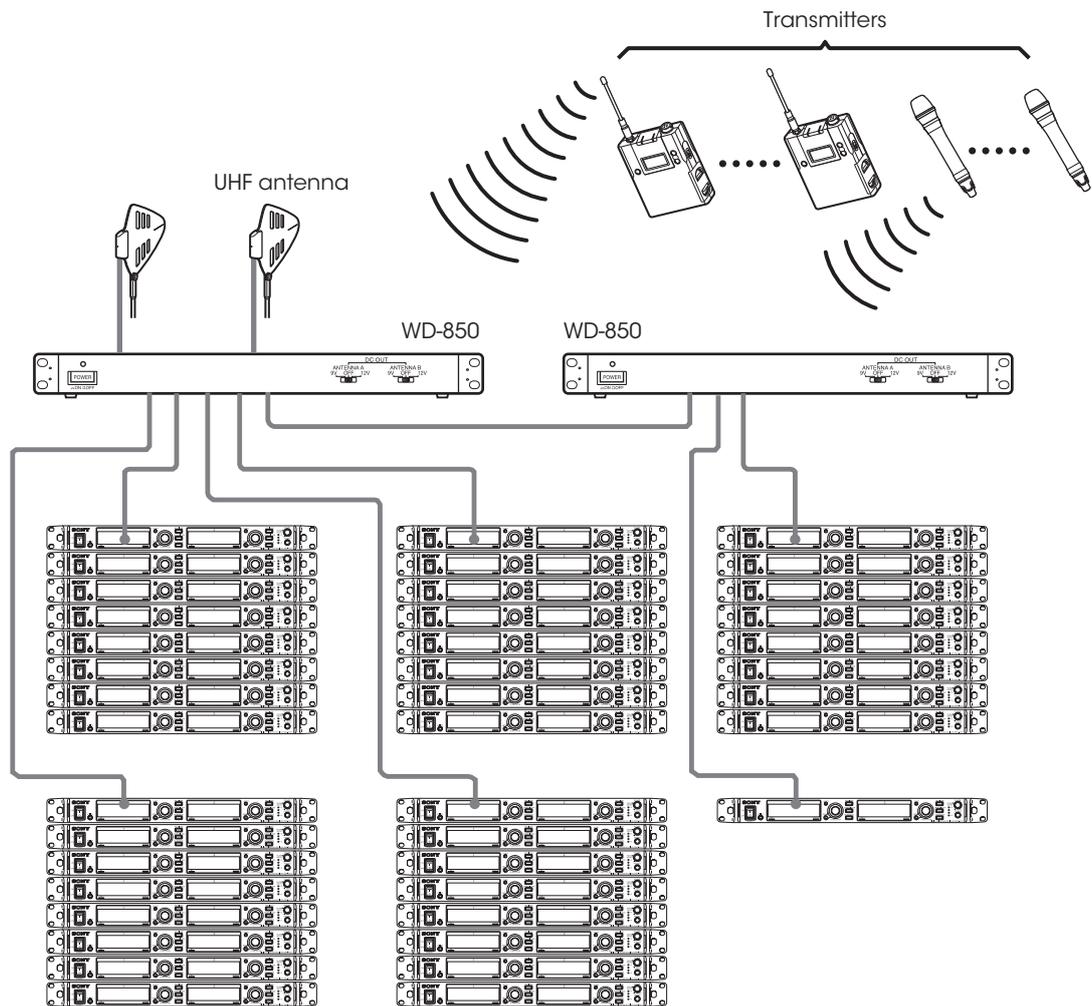
- 1) When 41 DWR-R01D units are used, up to 82 transmitters can be used.
- 2) Up to nine RMU-01 units can be installed to expand the NT mode operation area.
- 3) Up to 41 DWR-R01D units can be used by incorporating optional WD-850.

Sample Medium-Scale System Configuration Using Antenna Divider WD-850 (17 channels or more)



Sample System Configuration

Sample Maximum System Configuration (82 channels)



Network connections are not illustrated here.

References

Equipment Specifications

Design and specifications are subject to change without notice.

■ Digital Wireless Microphone/Digital Wireless Transmitter

	DWM-01 /F31	DWM-01 /C31	DWT-B01 /E	DWT-P01 /E
Transmitter section				
Wireless interface	WiDIF-HP			
Oscillator type	Quartz PLL synthesizer			
Carrier frequencies	See frequency information below.			
Channel step	See frequency information below.			
RF power output	50 mW/10 mW/1 mW, switchable			
Antenna type	Helical antenna		λ/4 flexible wire	Helical antenna
Occupied RF bandwidth	192 kHz or less			
Frequency tolerance	±6.5 ppm			
Type of emission	G1E or G1D			
Modulation principle	π/4 Shift QPSK			
Audio section				
Microphone type	Dynamic unidirectional (super cardioid)	Electret condenser Unidirectional (cardioid)	—	
	SPL 151 dB SPL (with 21 dB attenuation)		—	
Maximum input level	Mic level	—	-22 dBu (with 0 dB attenuation)	
	Line level	—	+24 dB	
Voice attenuator	0 to 21 dB (3-dB steps)			
Microphone input connector	—		SMC9-4S (female)	XLR-3-11C (female)
Input impedance	—		4.7 kilohms or more	
Frequency response	60 Hz to 18,000 Hz	60 Hz to 20,000 Hz	20 Hz to 22,000 Hz	
S/N ratio	70 dB or more (A-weighted, 94 dB SPL, 1 kHz)	66 dB or more (A-weighted, 94 dB SPL, 1 kHz)	—	
Dynamic range	—		106 dB or more (A-weighted)	
THD	—		0.03% or less	
Audio latency	1.5 msec			
Network section				
Wireless remote control	Cross Remote (2.4 GHz band, IEEE802.15.4 compliant)			
General				
Operating voltage	3.0 V DC, with two LR6 (AA) batteries			
Battery life	Continuous operating time 5 hours (Ambient temperature 25 °C, using Sony LR6 AA-size alkaline batteries, 10 mW output, wireless remote control off, DIMMER MODE set to AUTO OFF)			
Operating temperature	0 °C to 50 °C			
Storage temperature	-20 °C to +60 °C			
Dimensions	dia. 47.6 × 257 mm (Diameter × Length)	dia. 47.6 × 249 mm (Diameter × Length)	Approx. 63 × 73 × 17 mm (excl. antenna and other protruding parts) Approx. 63 × 188 × 17 mm (excl. protruding parts) (W × H × D)	Approx. 44 × 78 × 44 mm (excl. protruding parts) (W × H × D)
Mass	Approx. 323 g (incl. batteries)	Approx. 298 g (incl. batteries)	Approx. 125 g (incl. batteries)	Approx. 245 g (incl. batteries)
Supplied accessories	Identification ring (1 set), Microphone holder (1), USB adapter cable (1), USB cable (1), Carrying case (1), Warranty Card (1), Operating Instructions (1), CD-ROM (1)		Lavaliere microphone (with wind screen and horizontal clip) (1), Spare battery case (1), Soft case (1), Microphone cable (4-pin to XLR type) (1), USB adapter cable (1), USB cable (1), Warranty Card (1), Operating Instructions (1)	Spare battery case (1), Soft case (1), USB adapter cable (1), USB cable (1), Warranty Card (1)

DWM-01 /F31, DWM-01 /C31, DWT-B01 /E, DWT-P01 /E				
Carrier frequencies and channel steps				
	Model No.	Frequency band	Frequency	Group/channel (factory setting)
US models Channel step: 125 kHz	U1424	TV14-17	470.125 – 493.875 MHz	00 1801 494.125 MHz
		TV18-21	494.125 – 517.875 MHz	
		TV22-25	518.125 – 541.875 MHz	
	U3040	TV30-33	566.125 – 589.875 MHz	00 3001 566.125 MHz
		TV34-36	590.125 – 607.875 MHz	
		TV37	Not available	
		TV38-41	614.125 – 637.875 MHz	
		TV42-45	638.125 – 661.875 MHz	
	U4250	TV46-49	662.125 – 685.875 MHz	00 4201 638.125 MHz
		TV50-51	686.125 – 697.875 MHz	
	European models Channel step: 25 kHz	CE3338	TV33-35	566.025 – 590.000 MHz
TV36-37			590.025 – 606.000 MHz	
TV38-40			606.025 – 630.000 MHz	
TV42-44			638.025 – 662.000 MHz	
CE4248		TV45-47	662.025 – 686.000 MHz	00 4201 638.125 MHz
		TV48-50	686.025 – 710.000 MHz	
		TV51-53	710.025 – 734.000 MHz	
CE5157		TV54-56	734.025 – 758.000 MHz	00 5101 710.125 MHz
		TV57-59	758.025 – 782.000 MHz	
		TV62-64	798.025 – 822.000 MHz	
		TV65-66	Not available	
CE6267		TV67-69	838.025 – 862.000 MHz	00 6201 798.125 MHz

Digital Wireless Receiver

	DWR-R01D	DWR-S01D
Tuner section		
Wireless interface	WiDIF-HP	
Type of reception	Space diversity	
Circuit system	Double superheterodyne	
Carrier frequencies	See frequency information below.	
Channel step	See frequency information below.	
Oscillator type	Quartz PLL synthesizer	
ANTENNA a/b IN connector	BNC-R, 50 ohms (2)	
ANTENNA a/b OUT connector	BNC-R, 50 ohms (2)	—
Sensitivity	20 dBu or lower (bit error rate 1 × 10 ⁻⁵ , no S/N degradation)	
Audio section		
ANALOG OUT connector	XLR-3-32 type, 47 ohms or lower (2)	D-sub 15-pin connector (female) × 1
DIGITAL OUT connectors	XLR-3-32 type, 110 ohms (2) BNC-R, 75 ohms (1)	
WORD SYNC IN/OUT connector	BNC-R (1 each for input/output) With 75-ohm terminator switch	
External WORD SYNC	32 Hz to 96 Hz	
Reference output level	Mic level -58 dBu Line level -12 dBu	-40 dBu
(0 dBu = 0.775 Vrms)	Digital	-36 dBfs
Dynamic range	106 dB or more (A-weighted)	
THD	0.03% or less	
Audio latency	Analog output 1.9 msec Digital output 1.9 msec	2.1 msec
Network section		
Wireless remote control	Cross Remote (2.4 GHz band, IEEE802.15.4 compliant)	
LAN (10/100) port	RJ-45 modular jack (1)	—
General		
Operating voltage	100 V/120 V AC, switchable	7 V DC
Power consumption/Current consumption	22 W	500 mA or less (at 7 V DC)
Operating temperature	0 °C to 50 °C	
Storage temperature	-20 °C to +60 °C	
Dimensions (W × H × D)	Approx. 482 × 44 × 335 mm	Approx. 88 × 119 × 31 mm (excl. antenna and other protruding parts) Approx. 88 × 204 × 31 mm (excl. protruding parts)
Mass	Approx. 4.1 kg (incl. supplied antenna)	Approx. 280 g (incl. supplied antenna)
Supplied accessories	Whip antenna (2), Antenna mount with BNC connector (2), AC power cord (1), Foot (4), Operating Instructions booklet (1), PC control software (CD-ROM) (1)	Helical antenna (2), Whip antenna (2), USB adapter cable (1), USB cable (1), Warranty Card (1), Operating Instructions (1), CD-ROM (1)

DWR-R01D						
Carrier frequencies and channel steps						
	Model No.	Frequency band	Frequency	Group/channel (factory setting)		
US models Channel step: 125 kHz	U1424	TV14-17	470.125 – 493.875 MHz	00 1801 494.125 MHz		
		TV18-21	494.125 – 517.875 MHz			
		TV22-25	518.125 – 541.875 MHz			
		TV30-33	566.125 – 589.875 MHz			
		TV34-36	590.125 – 607.875 MHz			
	U3040	TV37	Not available	00 3001 566.125 MHz		
		TV38-41	614.125 – 637.875 MHz			
		TV42-45	638.125 – 661.875 MHz			
		U4250	TV46-49		662.125 – 685.875 MHz	00 4201 638.125 MHz
		TV50-51	686.125 – 697.875 MHz			
European models Channel step: 25 kHz	CE3338	TV33-35	566.025 – 590.000 MHz	00 3301 566.125 MHz		
		TV36-37	590.025 – 606.000 MHz			
		TV38-40	606.025 – 630.000 MHz			
		TV42-44	638.025 – 662.000 MHz			
	CE4248	TV45-47	662.025 – 686.000 MHz	00 4201 638.125 MHz		
		TV48-50	686.025 – 710.000 MHz			
		TV51-53	710.025 – 734.000 MHz			
		CE5157	TV54-56		734.025 – 758.000 MHz	00 5101 710.125 MHz
			TV57-59		758.025 – 782.000 MHz	
	TV62-64		798.025 – 822.000 MHz			
	CE6267	TV65-66	Not available	00 6201 798.125 MHz		
		TV67-69	838.025 – 862.000 MHz			

Digital Wireless Adapter

	DWA-01D
Audio section	
Audio output connector	SMC9-4S (female) (OUTPUT1/OUTPUT2)
Analog output impedance	150 ohms or less
AES/EBU output impedance	110 ohms
WORD SYNC input	BNC-R, 75 ohms (when the DWRS01D is attached to the adapter and 75-ohm termination is added)
Monitor output	φ3.5 mm TRS jack
Monitor output level	50 mW (16-ohm load, at T.H.D = 1%)
General	
Power requirements	12 V DC

Remote Control Unit

	RMU-01
Network section	
Radio system	Conforms to IEEE802.15.4
Frequency range of transmission/reception	2.405 GHz to 2.480 GHz
Antenna gain	2 dBi
RF power output	1 mW
Remote control distance	10 m (33 feet) at maximum (per unit)
LAN transmission speed	10M/100Mbps (automatic detection)
Connectors	LAN connector RJ45-type, 8-pin (accepts PoE power) AC adapter connector EIAJ-type4
General	
PoE power reception	Conforms to IEEE802.3af (supports mode A and B)
Supply voltage	When the PoE device is used 48 V DC When the AC adapter is used 12 V DC
Current consumption	When the PoE device is used 50 mA or less When the AC adapter is used 100 mA or less
Operation temperature	When the PoE device is used 0 °C to 50 °C (32 °F to 122 °F) When the AC adapter is used 0 °C to 45 °C (32 °F to 113 °F)
Storage temperature	-20 °C to 60 °C (-4 °F to 140 °F)
Dimensions (W × H × D)	107 × 151 × 30 mm (4 1/4 × 6 × 1 3/16 inch)
Mass	300 g (10.5 oz)
Supplied accessories	AC adapter (1), Bracket (2), Stand adapter (2), Screws (1 set), Safety wire (1), Operating Instructions (1), CD-ROM (1), Warranty booklet (1)

DWR-S01D					
Carrier frequencies and channel steps					
	Model No.	Frequency band	Frequency	Group/channel (factory setting)	
US models Channel step: 125 kHz	U1820	TV18-21	494.125 – 517.875 MHz	00 1801 494.125 MHz	
	U3032	TV30-33	566.125 – 589.875 MHz	00 3001 566.125 MHz	
		U4244	TV42-45	638.125 – 661.875 MHz	00 4201 638.125 MHz
	European models Channel step: 25 kHz	CE38	TV38-40	606.025 – 630.000 MHz	00 3801 606.125 MHz
CE42			TV42-44	638.025 – 662.000 MHz	00 4201 638.125 MHz
CE51			TV51-53	710.025 – 734.000 MHz	00 5101 710.125 MHz
CE62		TV62-64	798.025 – 822.000 MHz	00 6201 798.125 MHz	
		CE67	TV67-69	838.025 – 862.000 MHz	00 6701 838.125 MHz

References

UHF Accessories

	AN-01	AN-820A				WD-850	
		LL	L	M	H		
Antenna section	Directivity	Unidirectional	Horizontal omnidirectional				—
	Antenna type	log periodic dipole array	Dipole				—
	Frequency bands	470 – 862 MHz	470 – 542 MHz	556 – 662 MHz	638 – 758 MHz	758 – 862 MHz	—
	Antenna gain:	5 dBi or more	(0 dB)				—
	VSWR	2.5 or less	—				—
	Half-power angle	Within 150 degrees	—				—
	FB ratio	12 dB or more	—				—
Booster section	Frequency bands	470 – 862 MHz	470 – 542 MHz	556 – 662 MHz	638 – 758 MHz	758 – 862 MHz	770 – 810 MHz
	Booster gain	18 ±2 dB, 10 ±2 dB, 0 +0/-2 dB (switchable)	18 +12 dB (with 12 V DC) 10 ±12 dB (with 9 V DC)				—
	VSWR	3.0 or less	3.0 or less				—
	Noise factor	6 dB or less	4 dB or less				—
	Third-order intermodulation	60 dB or more (95 dB _{μVEMF} input)	60 dB or more (85 dB _{μVEMF} input)				—
	Operating voltage	9 V/12 V DC	9 V/12 V DC				100 V AC, 50/60 Hz 12 V/9 V DC/OFF, switchable
	Current consumption	100 mA or less	50 mA or less				Approx. 14 W (Rated output current 100 mA)
Inputs/Outputs	Antenna input	—	—				BNC-R × 4 (2 connectors × 2 inputs), 50 ohms
	Antenna output	BNC-R, 50 ohms	BNC-R, 50 ohms				BNC-R × 8 (2 connectors × 4 outputs), 50 ohms
	Cascaded output	—	—				BNC-R × 2 (2 connectors × 1 output), 50 ohms
General	Operating temperature	0 to 50 °C	0 to 50 °C				0 to 50 °C
	Storage temperature	-20 to +60 °C	-20 to +60 °C				-20 to +60 °C
	Dimensions (W × H × D)	Approx. 343 × 341 × 36 mm (excl. microphone stand mounting pole/grip)	Approx. 70 × 117 × 132 mm				Approx. 482 × 44 × 300 mm (excl. protruding parts)
	Mass	Approx. 530 g	Approx. 270 g				Approx. 4.6 kg
	Supplied accessories	Microphone stand mounting pole/grip (1 set) Stand adapter PF1/2-W5/8 type (1) PF1/2-W3/8 type (1) Operating Instructions (1) Warranty Card (1)	Power utility box mounting attachment (1), Wall mounting attachment (1), Microphone stand mounting adapter (PF 1/2 screw) (1), Mounting screws (1 set), Operating Instructions (1), Warranty Card (1)				AC power cord (1), 50-ohm terminator (6), 3P-2P adapter (1), Operating Instructions (1), Warranty Card (1)

Note

Old AN-820A's are not suitable for to use with DWR-R01D 12V DC power setting. Damage will occur to old AN-820A's if the DWR-R01D is set to 12V.

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