SONY

Digital Wireless
Microphone System

System Integration Guide

DWX
DIGITAL WIRELESS

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Quick Reference Guide

The section explains how to set up and operate a digital wireless microphone system. For simplicity, the installation in a mid-size hall is used as an example.

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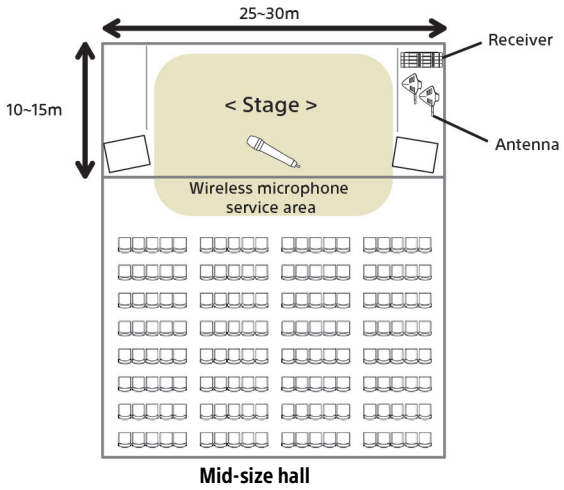


1 Setting up the antennas

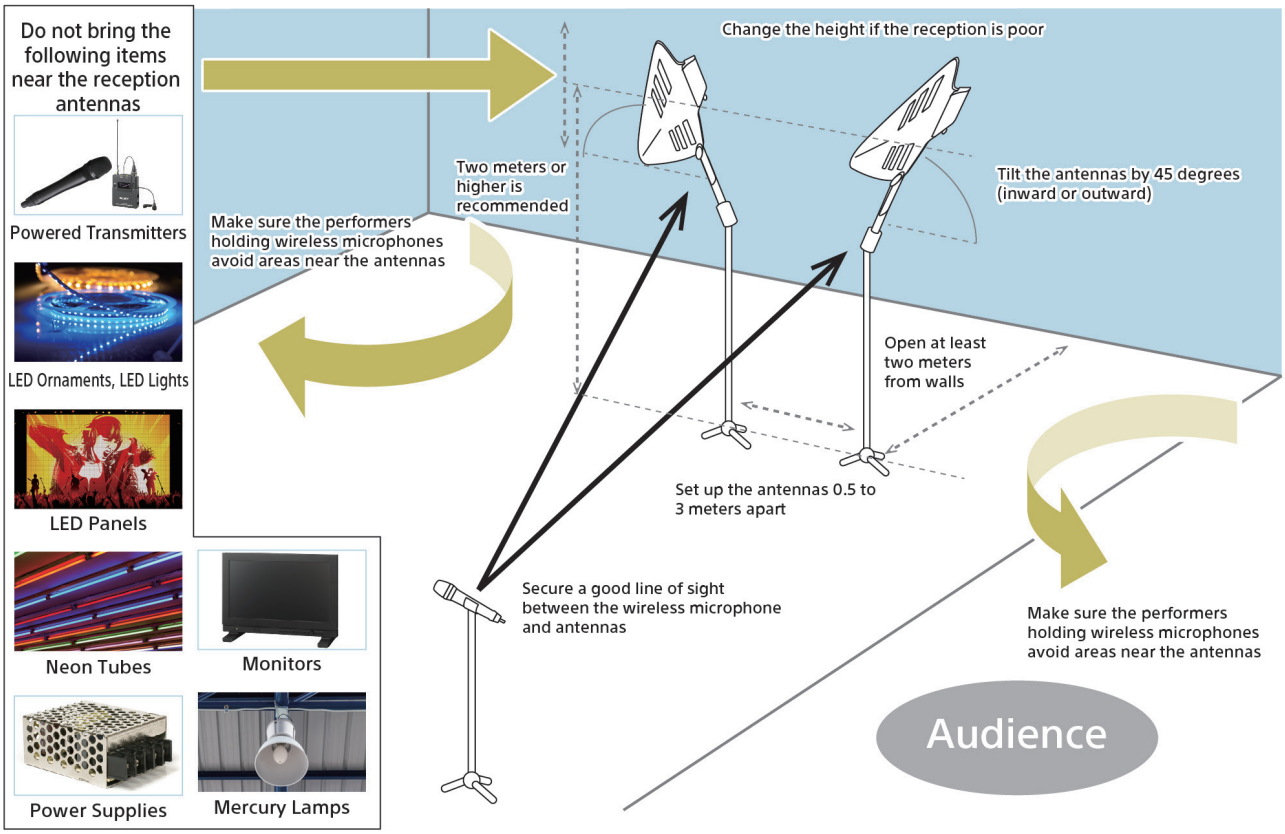
・Install the antennas as high as possible so a clear line of sight is established with the transmitters. Two meters or higher is recommended.

・To obtain the best diversity effect, space the two antennas approximately 0.5 to 3 meters (approximately 2 feet to 9 feet) apart.

・Keep the antennas as far as possible from walls. Two meters or more is recommended.

・Set the antenna booster switch to REMOTE (on certain models, this is indicated as AUTO). Then, in the receiver UTILITY menu, select “RF > ANT DC OUT> 9V (Gain:+10dB)” as the default setting.

＊ Selecting 12V turns the Gain to +18 dB. When using an AN-01 antenna, Make sure that the DC Supply Setting is set to “On”. Setting the antenna divider or receiver to DC Off does not bypass the antenna booster.



*See page 20 to 26 for information on installing the reception antennas.

2 Pairing transmitters and receivers

By pairing transmitters and receivers, you can remotely control transmitter settings (channel, ATT, LCF, RF Power, Sleep Mode) from the receiver.

1. Bring the transmitter you wish to pair within 2 meters from the REM ANT on the rear of the receiver.
   (If you are using the Remote Control Unit RMU-01, bring the transmitter within 2 meters from the RMU-01.)
2. On the receiver to pair, select “RF REMOTE > PAIRING > YES” from the menu.
3. On the transmitter menu, select “RF REMOTE > PAIRING”.
   (You can instantly start the pairing by powering on the transmitter (from power-off state) while holding down the minus button)

* Make sure to complete the pairing within 45 seconds from when the transmitter and receiver start searching. The pairing mode will be cancelled after 45 seconds.
* To change the transmitter settings from the receiver, the transmitter must be within 10 meters from the antenna used for Cross Remote or the RMU-1. Also note that different antennas are used for Cross Remote and audio reception, and they cannot be shared.
* When pairing is performed, the (frequency) channel and CODEC MODE of the receiver will also be applied to the transmitter.
* When using the ST mode, which uses the antenna attached to the REM ANT connector of the receiver unit, the maximum number of controllable transmitters is 6 units. When using 7 or more transmitters simultaneously, connect the Remote Control Unit RMU-01 and use NT mode.
* Transmitters and receivers paired in ST mode must be paired again for use in NT mode. (Conversely, transmitters and receivers paired in NT mode can be used in ST mode without pairing them again.)
* Turning off the power will not disconnect the pairing.

3 Selecting channels using the Clear Channel Scan function

This function detects the RF interference that exists in the surrounding area for the selection of the quietest frequency channels.

1. Turn the transmitter OFF.
2. On the receiver you wish to set a channel, select “RECEIVER > CLEAR CH SCAN > YES” from the menu. The unit will start scanning for available channels and when completed, the recommended channels will appear in the ascending order of their interference. The channel listed on the top is the default selection.
3. Turn On the transmitter you paired and check that a Cross Remote connection is established (the ⇋ icon should appear). Then, rotate the jog dial on the receiver and select the channel you wish to use. The channel information will be sent to the transmitter, completing the selection of the transmitter’s channel.

* To set the channel of the second transmitter, keep the power of the first transmitter On and perform the same procedure.
  To set the channel of the third transmitter, keep the power of the first and second transmitters On and perform the same procedure.
* When the list of recommended channels appears, select the desired channel within 30 seconds. The receiver will return to its previous state if not operated for more than 30 seconds.

The channel information is sent to the paired transmitter

<About setting Groups>

For simultaneous multi-channel operation, make sure to set the Group before performing a clear channel scan by selecting GP/CH in the RECEIVER menu of the receiver.

- When using only digital wireless for simultaneous multi-channel operation, Group DX (X is a number) should usually be selected.
- When using both digital wireless and analog wireless for simultaneous multi-channel operation, or when using only digital wireless but with the transmitters close to each other or the transmitters brought close to the antennas, select Group 0X (X is a number other than 0).
- Do not use Group 00 for simultaneous multi-channel operation.

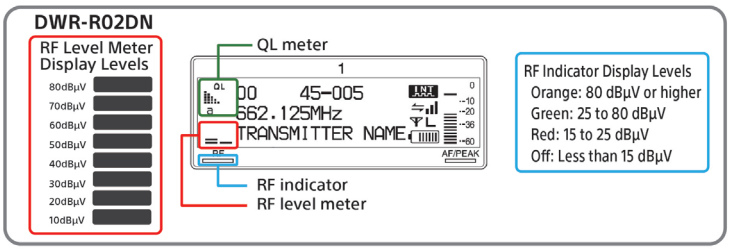
4 Checking the RF reception level

- When checking the RF reception level, make sure that the wireless microphone is set up at the position and condition that it will be actually used.
- In the receiver UTILITY menu, select “RF > ANT ATT a” and set this to “0dB”. In the same way, set ANT ATT b to “0dB” as well. Use these as the default settings.
- To secure stable reception, adjust the settings so the RF indicator lights up in green and displays 6 to 7 segments (60dBμV～80dBμV) .
- If the RF indicator lights up in orange only occasionally, the reception will not be affected. However, if it continues to light up in orange, the RF level is too high and the reception may become unstable.
- When the RF level is too high, set the switch on the booster to 0dB. If the level continues to be too high, set both ANT ATT a and ANT ATT b of the receiver to 5dB or 10dB.

  ＊ Note that when the DWR-R02DN antenna is cascaded, activating the ANT ATT of the first receiver will also attenuate the RF signals received by the receivers that follow.

- When the RF level is too low, set the receiver’s ANT DC OUT to 12V (Gain:+18dB). If the level continues to be too low, use a low-loss antenna cable, shorten the distance between the transmitter and antenna, or set the transmitter’s RF POWER to 50mW.

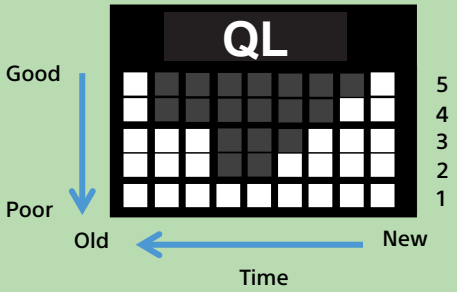
  ⇒ For 50mW operation, see pages 42 to 46.



<Using the QL meter>

The QL meter serves as a reference for judging the quality of the received data. It displays the results of detecting errors in data packets as QL values.

- When all segments are displayed (meter value of “5”), there are no errors in the packets and the transmission is stable. If segments start disappearing from the top, this means that errors in the packets are increasing.
- When only one or two segments occasionally disappear (meter value of ”4” or “3”), the audio will rarely be affected thanks to the error correction function.
- When the meter continues to display ”4” or “3”, or occasionally drops to “2” or lower, the audio is likely to be affected. In this case, re-examine the RF reception level and interference signals, and make the appropriate changes to the antenna, booster gain, and frequency channel accordingly.



- When another transmitter is near the antenna and the receiver’s RF indicator lights up in orange, the QL meter’s indication will still drop. In this case, move the transmitter away from the antenna until the RF indicator changes color from orange to green.

5 Adjusting the AF level

Using the INPUT LEVEL menu, the transmitter can be set to accept LINE or MIC input according to the sound source connected to its audio input connectors. When MIC is selected, the ATT level will start flashing, prompting you to input sound to the connected microphone and select the attenuator level using the [+] or [−] button while checking the input level meter. As a reference, set the ATT between 6 to 18dB when using the CU-F31 with the DWM-02N, and between 9 to 15dB when using the ECM-77BC with the DWT-B01N, and make the appropriate adjustments according to the strength of the sound source.

6 Caution

- The bottom of the handheld microphone is the antenna. Be careful not to hold it.
- Keep the antenna of the bodypack transmitter away from the body as far as possible. Note that the RF level may drop when the antenna touches metal material.
  (The silicon tube supplied with the bodypack transmitter helps prevent the drop of QL level when the antenna connector touches metal material such as folding chairs. Make sure to attach this to the antenna connector.)
- Signal reception may be blocked and become unstable when the bodypack is worn under clothing containing gold thread or other metal material. Attach the unit so the antenna comes outside the clothing.
- When dropout points are found, changing the position or height of the antenna may help solve the problem.
  To obtain a higher D/U ratio*, make sure that the receivers do not pick up RF interference from possible sources.
  Use of the clear channel scan function to avoid signal interference and selection of MODE3 for the codec can be effective.
- Do not bring the transmitter near the antenna. Keep it far enough from the antenna so the RF indicator does not continuously light up in orange.
- Keep the reception antenna away from LED ornaments, LED lights, LED panels, displays, neon tubes/bulbs, mercury lamps, and all types of power supply units.

*D/U ratio: D stands for Desired Signal whereas U stands for Undesired Signal (interference signals, noise)

7 About the codec modes

DWX offers three types of audio codec modes.

MODE1	This mode offers compatibility with the first generation of DWX series
MODE2*	This mode offers low audio latency. (The audio latency is 1.5 msec at the analog output of the DWR-R02DN) Compared to MODE1, the sound quality is also enhanced. It is recommended for systems set up in normal environments.
MODE3*	This mode is optimized for stable signal transmission at longer distance. It incorporates an additional process to suppress noise or audio interruptions caused by unexpected RF interference, thereby securing the reliability of the transmission.

*These modes are not supported in the first-generation DWX series (DWR-R01D, DWR-R02D, DWR-S01D, DWR-S02D, DWT-B01, DWT-P01, DWM-01, DWM-02).

＜Audio latency of each mode＞

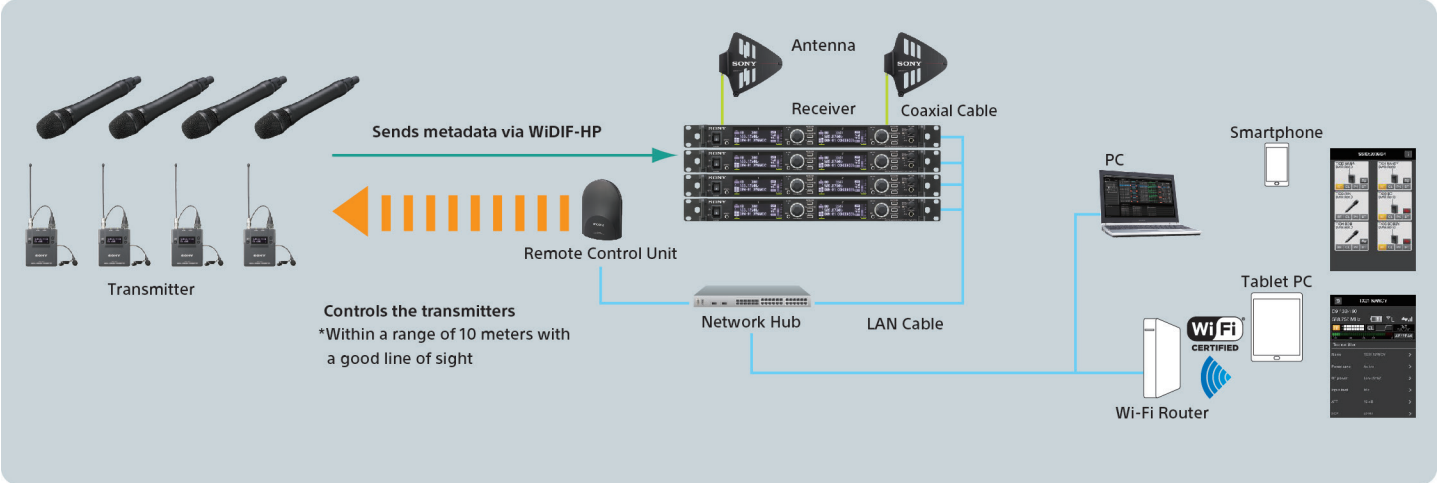
	Audio latency at Analog Outputs (msec)*			Audio latency at Digital Outputs (msec)*		
CODEC mode	MODE 1	MODE 2	MODE 3	MODE 1	MODE 2	MODE 3
DWR-R02DN	3.4	1.5	4.0	3.4	2.5	4.9
DWR-S02DN** + Adaptor	3.6	2.7	5.1	3.4	2.5	4.9

* The total latency between the transmitter and the receiver's audio outputs

** When the DWR-S02DN, DWR-S02D, or DWR-S01D is mounted in an XDCAM receiver slot, the camcorder will adjust the video and audio so there are no delays in their recordings.

8 Using the Wireless Studio PC control software

8-1. Wireless Studio System Diagram



<Setting the IP address>

Make the network settings for the receiver, PC, Remote Control Unit RMU-01 and WiFi router as follows.

IP Address: 192.168.0.XXX (For XXX, set any number that is not used in the network)

Subnet Mask: 255.255.255.0

Setting the network

Receiver: Select "UTILITY > NETWORK > IP ADDRESS" (After setting the IP address, make sure to power the receiver Off and then On again.)

PC: Select "Local area connection properties" > "Internet Protocol Version 4 (TCP/IPv4)" (DHCP is not supported)

RMU-01: Use the RMU-01 Setting Tool. (See the Operation Manual for details on using the RMU-01 Setting Tool.)

WiFi router: To make the settings, see the Operation Manual supplied with the Wi-Fi router.

8-2. Overview of the Wireless Studio (from Ver. 4.4x or later)

Status Viewer

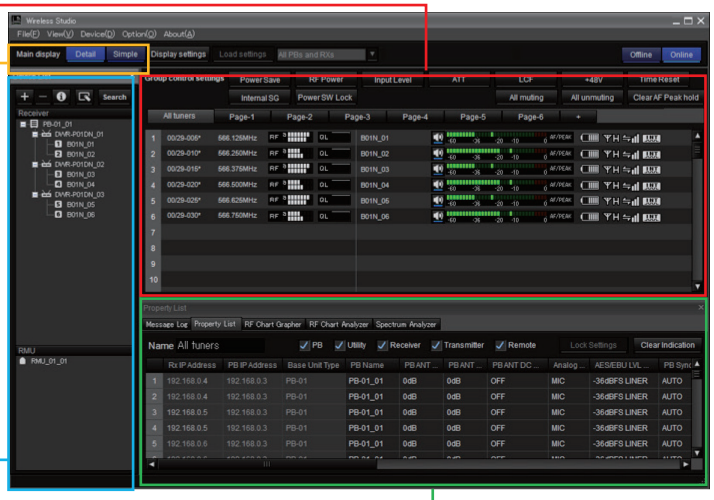
Monitors the status of each channel. The Page function can be used to group specific transmitters and change their settings together as a group.

Switching between Detail and Simple views

Selecting "Detail" displays the Status Viewer in the Main Window, allowing the status of each channel to be monitored in detail. Selecting "Simple" displays the Simple Status Viewer in which you can narrow down the number of parameters shown for each channel for simplified monitoring. The display area for each channel can also be changed.

Device List window

Displays the connection status of each receiver, transmitter, and RMU-01.



Sub Window

This window comprises the Message Log tab, Property List tab, RF Chart Grapher tab, RF Chart Analyzer tab, Spectrum Analyzer tab, and Simple Status Viewer tab. Double-clicking on a tab makes the window float on the screen for repositioning. Double-clicking on the window bar returns the window to its original tab.

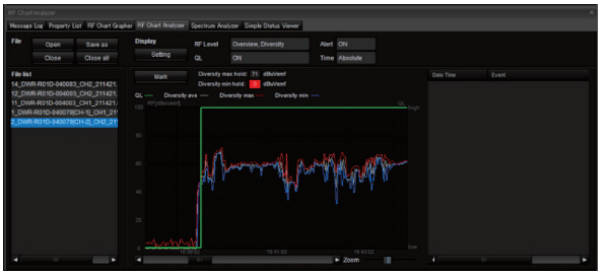
■ Property List tab

Displays a list of the settings made for each receiver channel shown in the Status Viewer. When you change the page displayed in the Status Viewer, the display of the Property List tab will change in association to show the receiver channel settings of that page. You can change setting values in the Property List tab by selecting the cells. By selecting multiple cells, you can change the settings of multiple receiver channels together.

RF Chart Grapher tab*

Records information on the signal environment and any alerts that occurred during operation. A Mark function is available for adding memos within the graph of the RF Chart Grapher.

This allows operators to determine the cause-and-effect relationship between the RF signal environment and specific alerts.



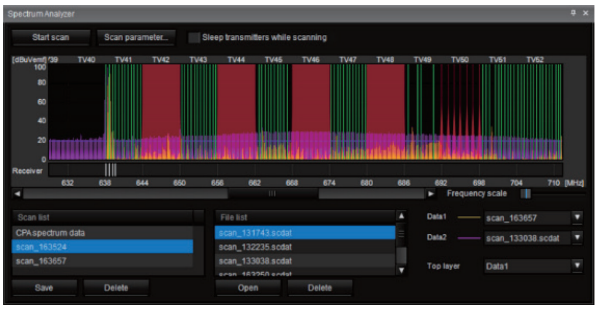
RF Chart Analyzer tab*

Allows operators to view the information in the files recorded using the RF Chart Grapher and analyze the results of monitoring the RF signal environment.

* In the Setting screen, you can change the display for the RF level.
  - To check the RF interference in the environment, select “Detail” and “Individual max” and then check the RF level of each receiver channel.
  - To check that the transmitter RF levels are strong enough when examining the service area, select “Overview” and then check the diversity minimum level.
  - To check that the RF signals received by the antennas are not too strong, select “Overview” and then check the diversity maximum level.

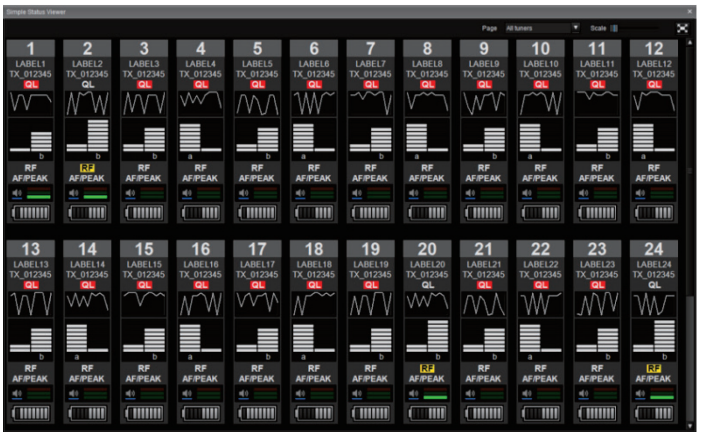
Spectrum Analyzer tab

Using channel 1 of the receiver, you can perform a spectrum scan for a specified frequency band. This allows you to visually confirm the existence of interference on the frequency bands in use. In addition, if you have configured the optimal groups and channels using the Channel Plan Adviser, the Channel Plan Adviser settings will be applied to the Spectrum Analyzer. This allows you to visually confirm the existence of interference on the groups and channels recommended by Channel Plan Adviser.



Simple Status Viewer tab

Allows you to monitor the status of each channel with only the information you need displayed. The size to display channels can be selected in three steps. The channels displayed here are the same as those shown in each Page of the Status Viewer.



8-3. For convenient channel coordination: The Channel Plan Adviser

Open the Channel Plan Adviser by selecting “Device > Channel Plan Adviser”.

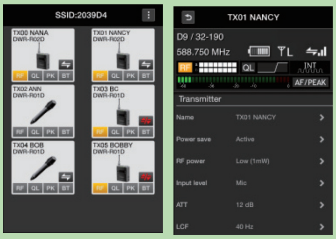
Basic mode: This mode allows you to coordinate a channel plan that avoids RF interference detected by the digital wireless receiver’s channel scan function.

Advanced mode: In addition to performing channel scan as with the Basic mode, this mode allows you to coordinate a channel plan that takes into account frequencies used by known TV broadcasts or other wireless devices.

The channel plan created will be assigned to the receivers. The channel settings will also be sent to, and assigned to transmitters that have been paired with receivers.

For details on operating the Wireless Studio software, see the Operation Manual.

<Using the Wireless Studio Mobile control software on smartphones and tablet PCs>



When PCs are not available, the Wireless Studio Mobile can be used to monitor and control receivers and transmitters from smartphones or tablet PCs via a Wi-Fi connection.

This allows the control of transmitters and detection of errors while listening to the audio at the stage or audience seats.

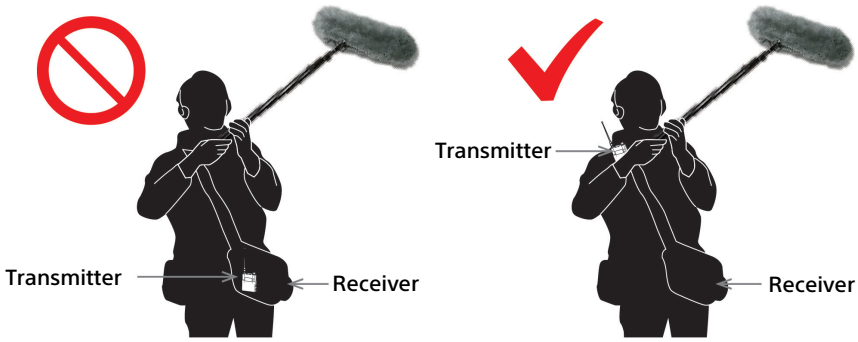
- Connect the LAN cable to the Wi-Fi router’s LAN port. Connection to the WAN port will not work for this operation.
- If the Wi-Fi router is doubling as the HUB, you can connect it directly to the receivers.
- Set the IP address of the Wi-Fi router so it resides on the same network as the receivers.
- Supported OS: Android Ver.4.1.x or later, iOS 8.0 or later

Caution upon using a mixer bag for ENG

When using a portable receiver in a mixer bag and feeding the mixer output to a transmitter for wireless transmission to a camcorder, keep the receiver and transmitter as far from each other as possible.

Mounting the transmitter on the shoulder (opposite side of the receiver) will block the signal by the operator’s body, reducing unwanted effects to the portable receiver.

Another effective solution is to set the RF output to 1mW on the transmitter used for sending audio to the camcorder.



Overview of the Sony Digital Wireless System

1 Introduction

Even since entering the professional wireless microphone market in 1972, Sony has commercialized a range of products under the three-pronged approach of “stable transmission,” ”simultaneous multi-channel operation,” and “dynamic range and sound quality reminiscent of wired microphones.”

Offering outstanding audio performance, operational flexibility, and high reliability, today, the Sony line of wireless microphone systems continue to serve a diverse range of applications from broadcast, production, theater, entertainment, meeting venues and much more.

Released in 2008, the Sony DWX series digital wireless system further made its way into broadcast stations around the world, while also enjoying success in musical applications at national theaters in Europe, which call for simultaneous operation of more than 60 channels.

This system integration guide aims at achieving stable operation of Sony digital wireless systems to take full advantage of the excellent performance and characteristics they provide.

2 Features

------ The benefits of digital transmission ------

WiDIF-HP

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 1.5 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)
Total Harmonic Distortion (T.H.D)	0.03% or better
Occupied bandwidth	192 kHz or less
Modulation principle	π/4 Shift QPSK
Audio latency	1.5 milliseconds*
** When the DWM-02N, DWT-B01N, and DWR-R02DN are used in combination (in MODE2)	

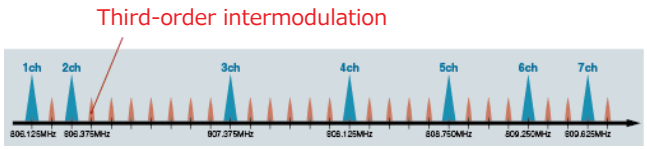
Simultaneous Multi-Channel Operation

Because WiDIF-HP is highly resistant to RF interference, about 50 to 80% more channels can be operated simultaneously, compared to analog systems.

■Wireless Analog System

The channel allocation needs to avoid third-order intermodulation.

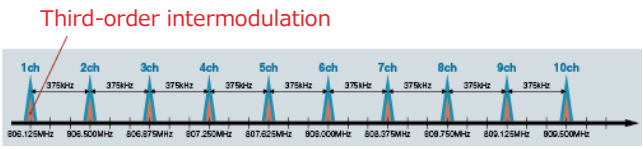
e.g.) Operation of 8 channels within 6 MHz



■Digital Wireless System (WiDIF-HP)

Since third-order intermodulation doesn’t need to be avoided, channels can be spaced at equal frequencies.

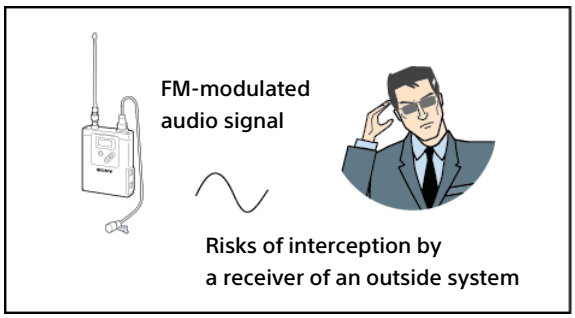
e.g.) Operation of 12 channels within 6 MHz



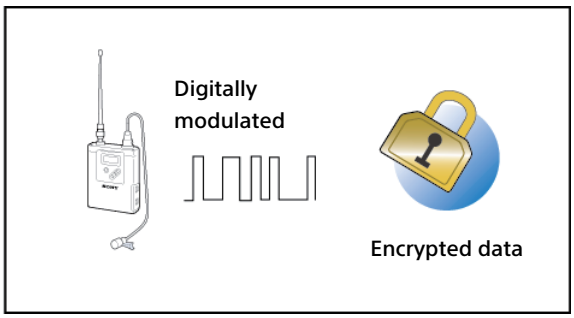
Encrypted Transmission Provides Security

Security is an important requirement for wireless systems that handle 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)



------- What Is Cross Remote? ------

Cross Remote is a system that allows transmitters to be monitored and controlled from a receiver, the Wireless Studio control software running on a computer connected to the receiver, or the Wireless Studio Mobile control software installed on a smartphone or tablet PC. 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 embedded within the WiDIF-HP format. In addition to the receiver display and camcorder menu screen, monitoring can be performed on multiple computers running the "Wireless Studio" software, and multiple smartphones and tablet PCs running the "Wireless Studio Mobile" app.

■ Control function

Allows remote control of the transmitter from the receiver, the Wireless Studio application, or Wireless Studio Mobile application via a 2.4 GHz band IEEE802.15.4 wireless connection that is separate from the main UHF communication line. This is done without affecting the stability of the main UHF communication line, 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)

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 distance of about 10 meters from the receiver. To control 7 or more transmitters, the NT mode system should be used.

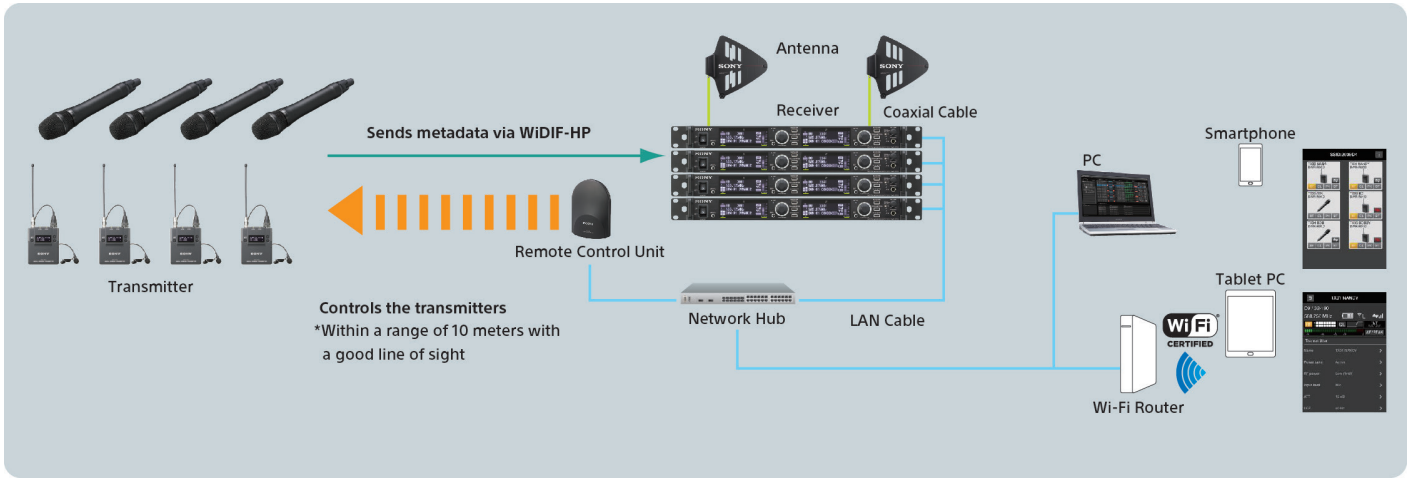
When using the DWR-S02DN, only the ST mode can be used.

■ 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 is about 10 meters from the control unit.

<Wireless Studio System Diagram>



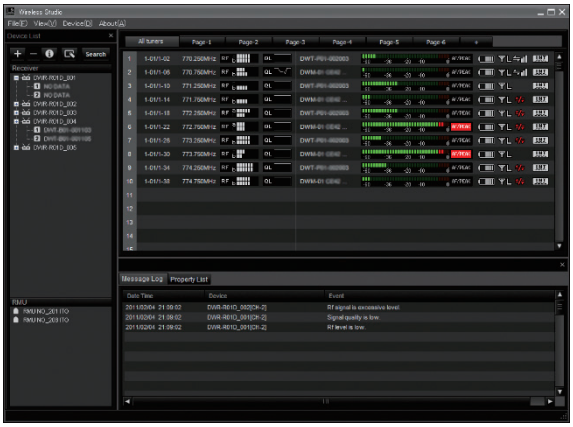
----- Wireless Studio Control Software -----

“Wireless Studio” is a dedicated software application supplied with the Digital Wireless Receiver DWR-R02DN.

It can be used in both ST mode and NT mode.

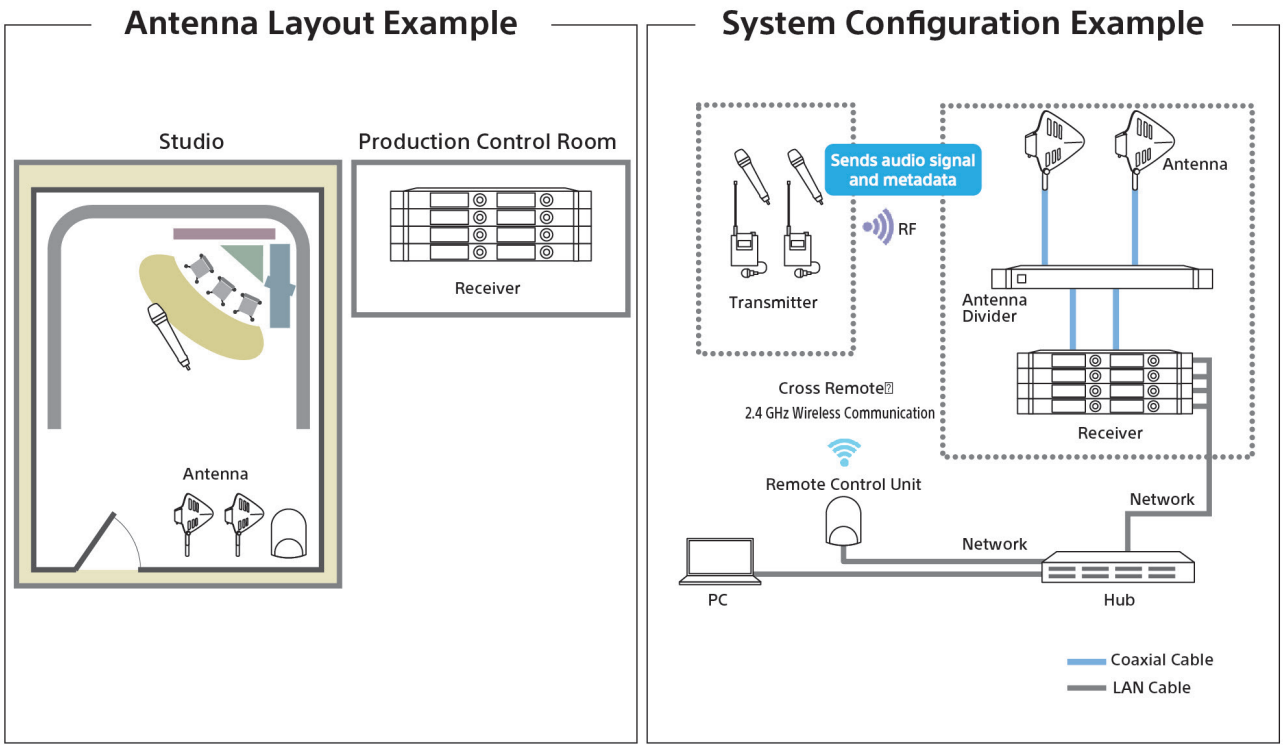
“Wireless Studio” provides the following functions.

- Monitors and controls up to 82 transmitters simultaneously.
- Displays the status of the receiver and remote control unit, in addition to that of the transmitter, on a computer monitor.
- Saves configuration data and monitor setting data. Convenient for restoring configuration data to an earlier state.
- Automatically sets the channel plan by using the channel scan function to detect RF interference as well as taking into account other various conditions.
- Monitors and saves the radio wave environment and alerts information along a timeline.
- Records an error log, which can be useful, for example, in identifying the cause of reception problems.



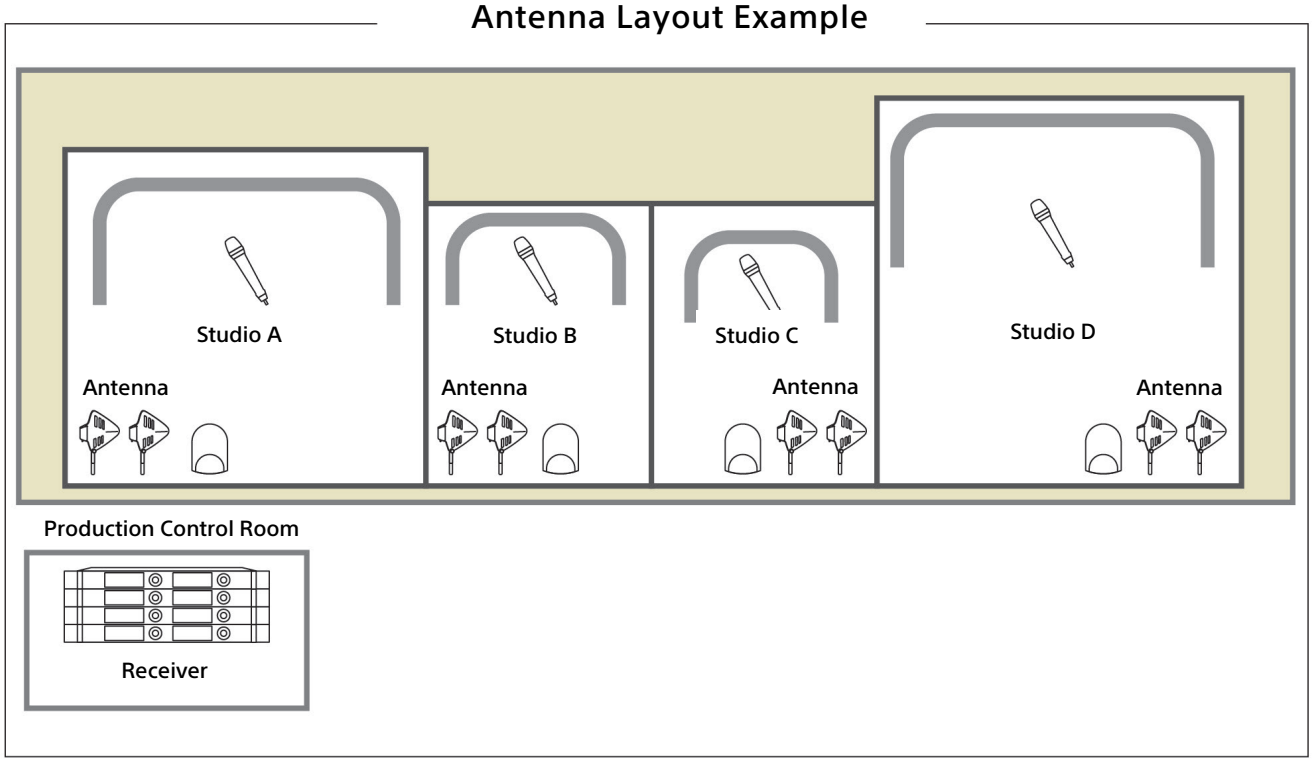
3 Typical System Examples

1. Broadcast Station - Studio

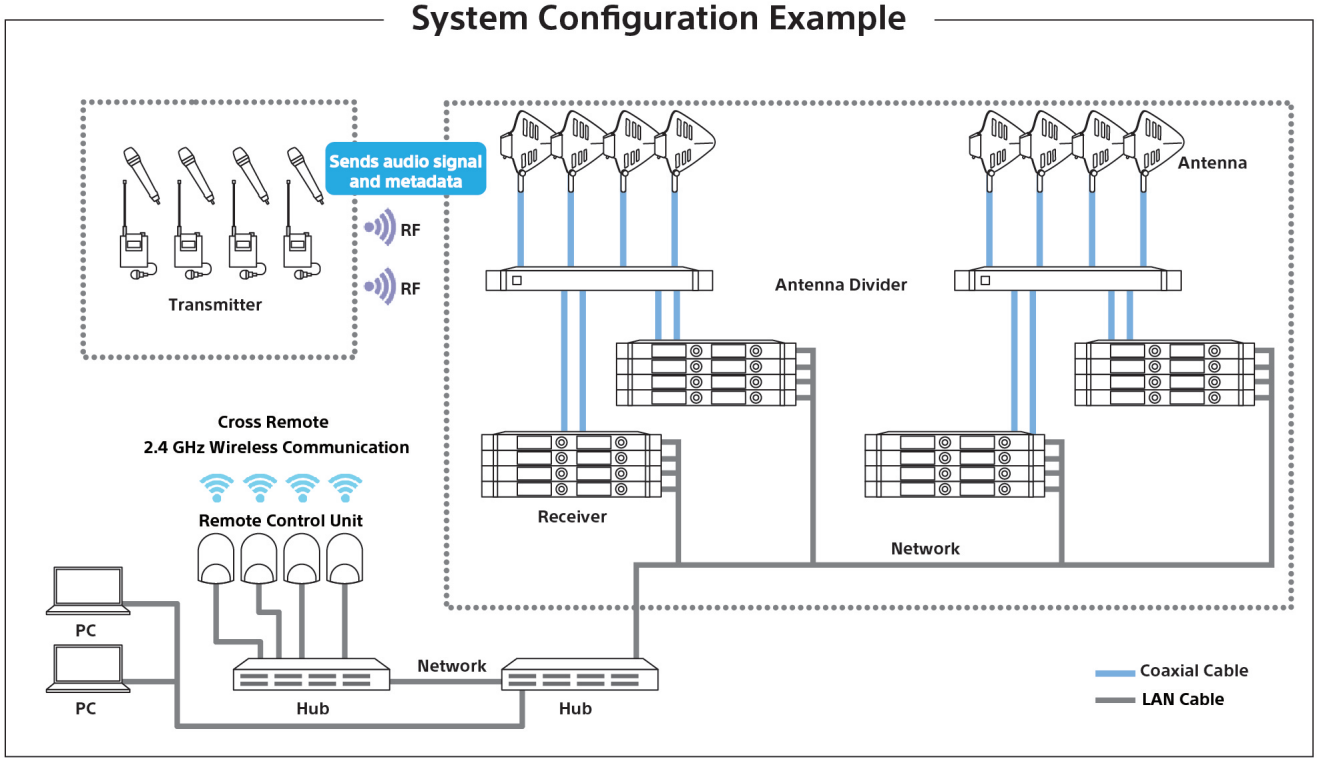


2. Broadcast Station - Studio (Multiple)

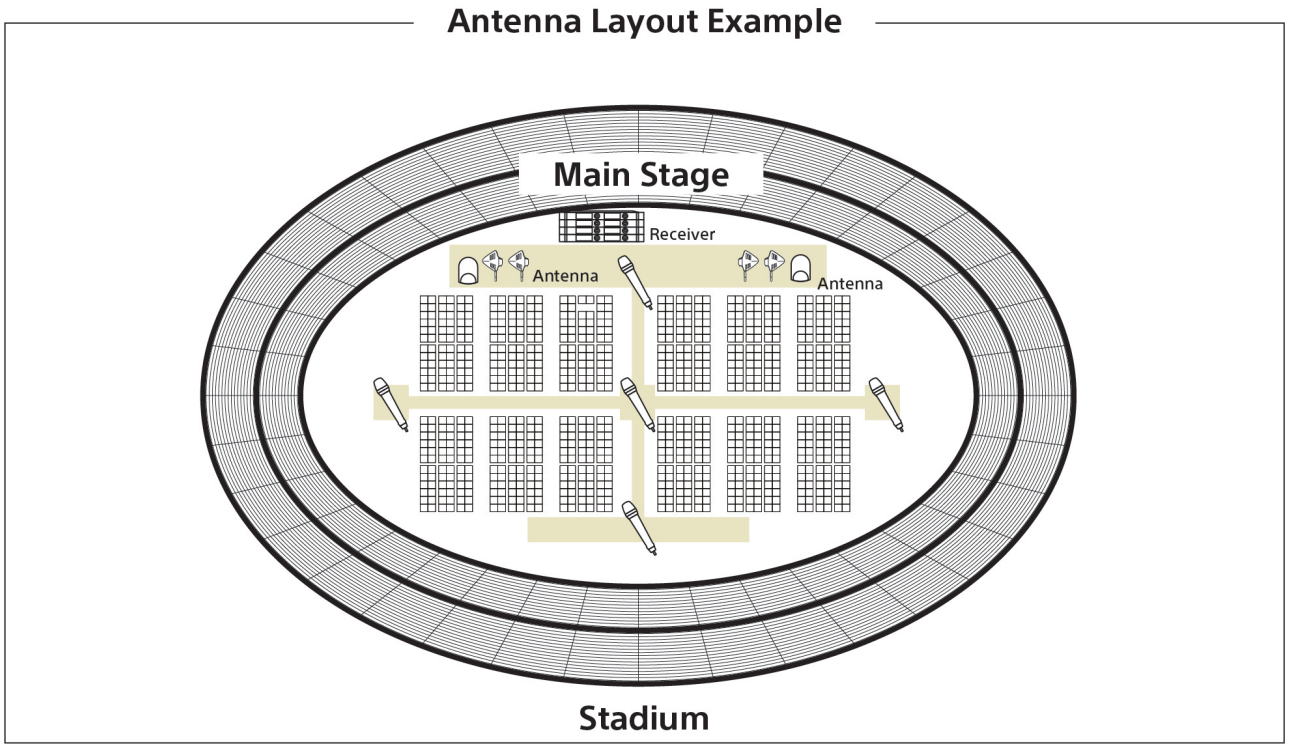
Antenna Layout Example

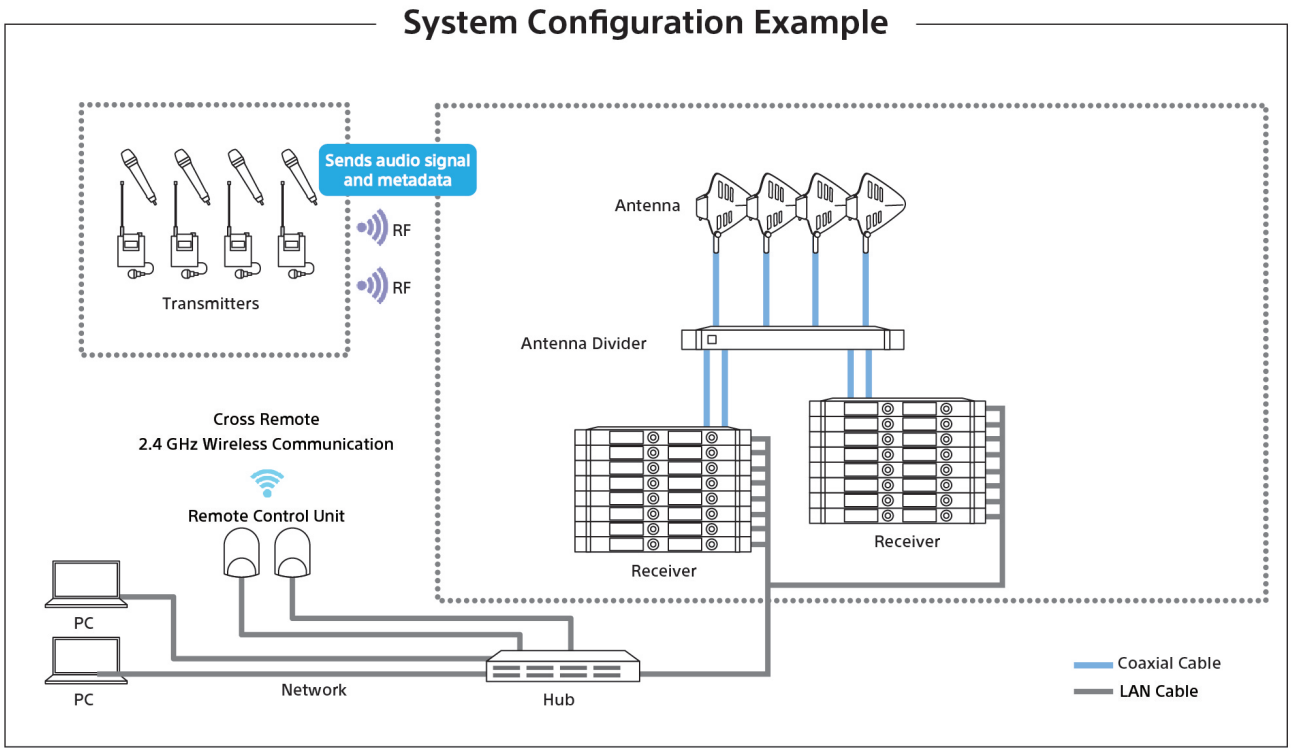


System Configuration Example

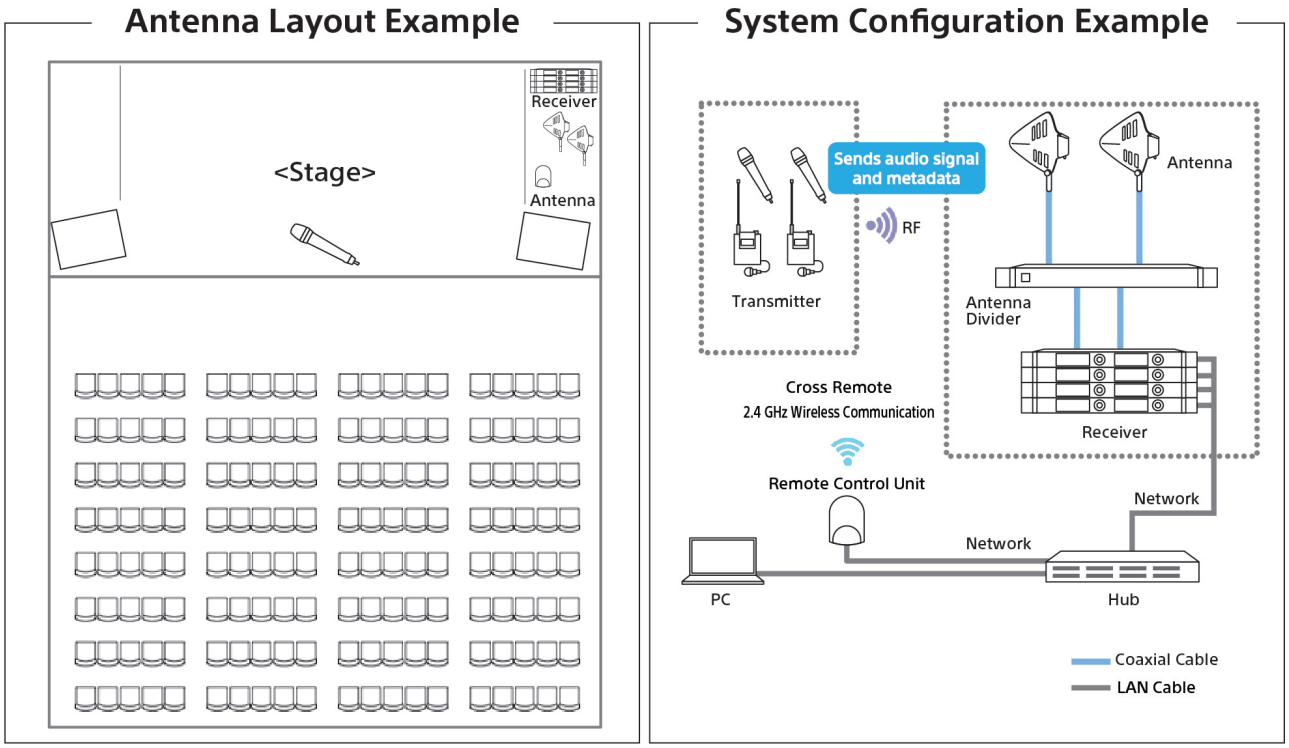


3. Large Concert Venue

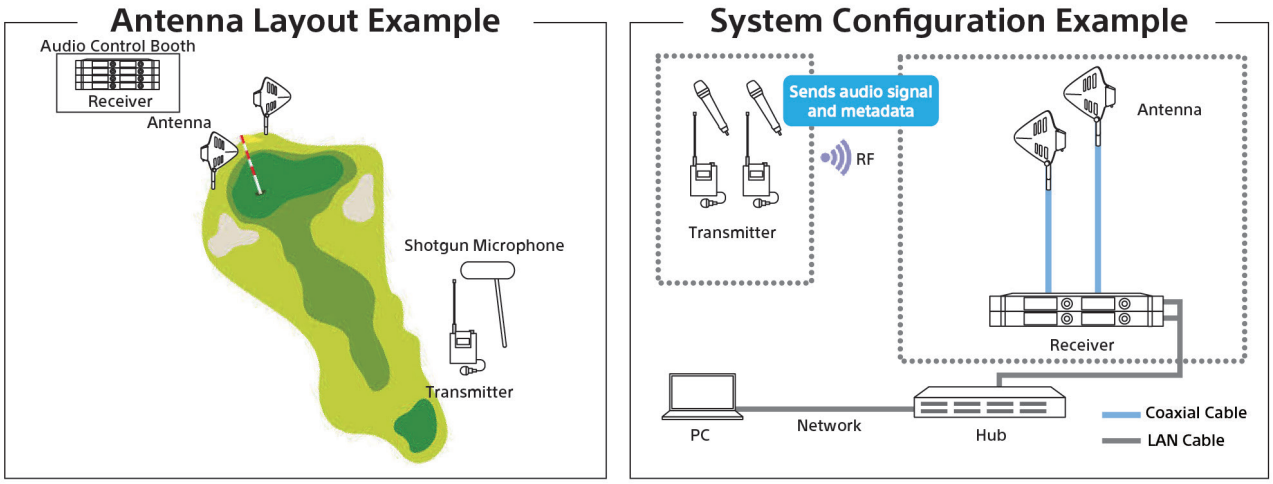




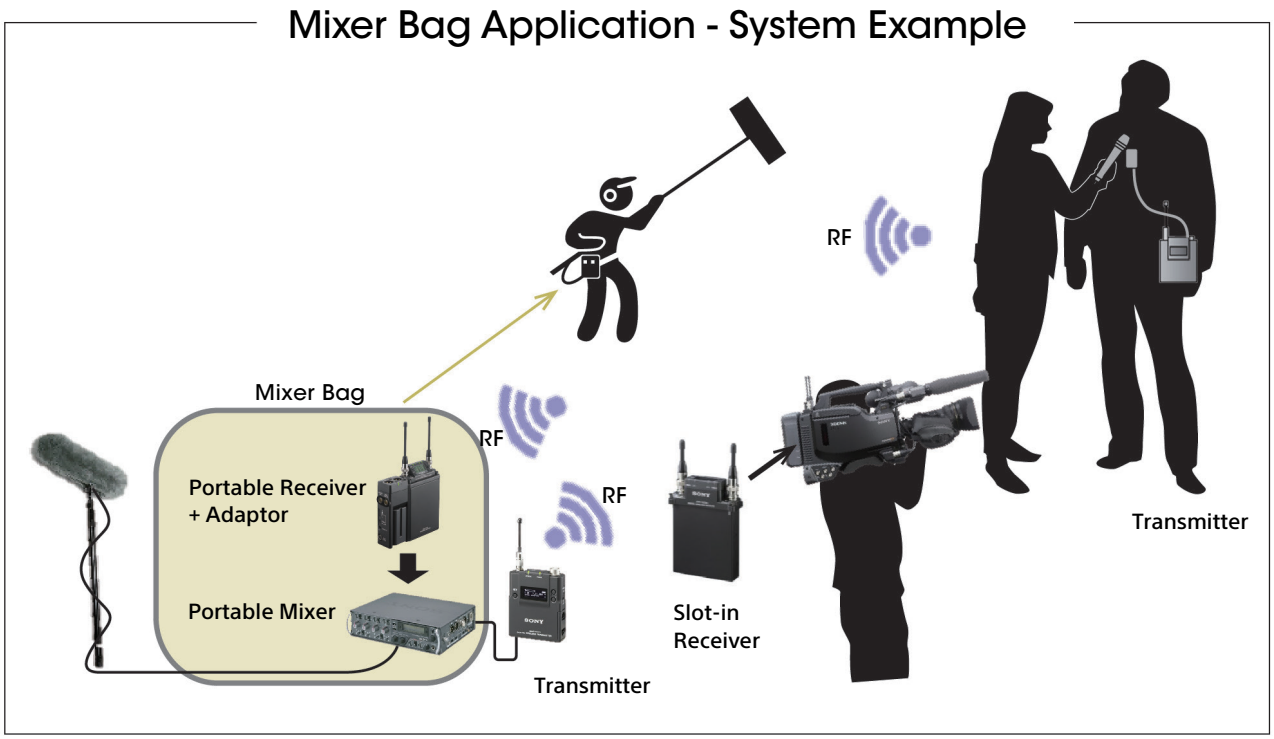
4. Hall and Theater



5. Golf Coverage

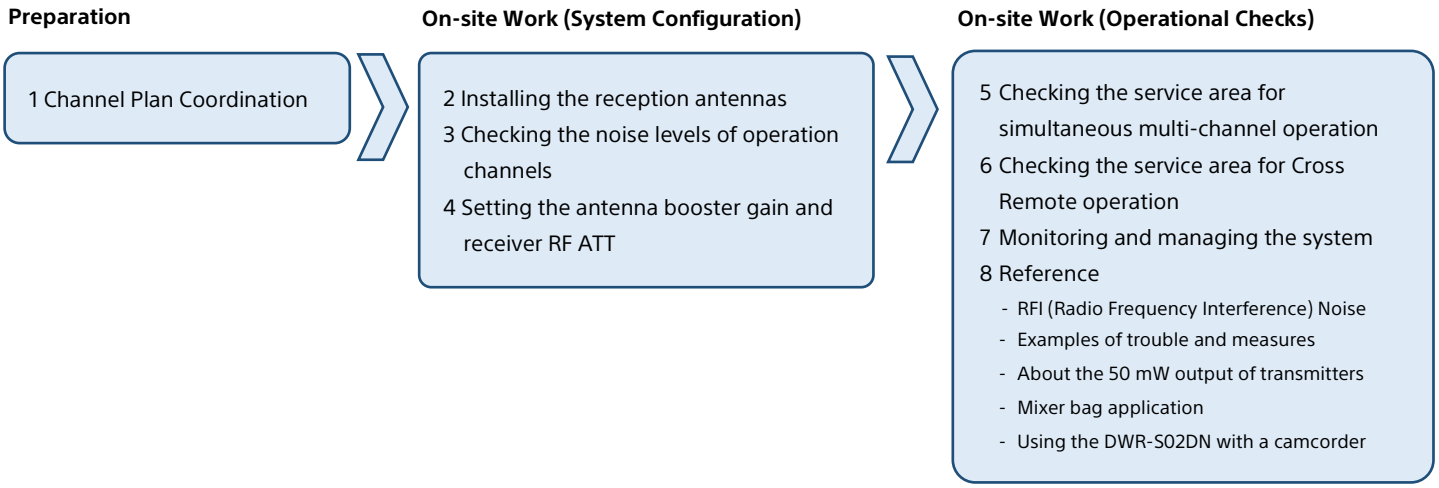


6. ENG and EFP (News Coverage, Drama Location)



Configuring the System

System Integration – Flowchart



1 Channel Plan Coordination

■ Procedure for creating a channel plan

1. Confirm the TV channels that can be used in the location where the wireless microphone system will be operated.
2. Use the “Frequency Lists” supplied with the receiver or transmitter to find the appropriate channel group.
3. Assign the number of channels necessary for each service area, for example, for each studio.

[Caution]

・Note that a guard band must be considered if the adjacent TV channel is in use.

・When using only digital wireless for simultaneous multi-channel operation, Group DX (X is a number) should usually be selected. (Do not use Group 00 for multi-channel operation.)

・When using both digital wireless and analog wireless for simultaneous multi-channel operation, or when using only digital wireless but with the transmitters close to each other or the transmitters brought close to the antennas, select Group 0X (X is a number other than 0).

■ For more stable simultaneous multi-channel operation

The Sony digital wireless system is highly resistant to third-order intermodulation, allowing channels to be equally spaced. However, for challenging setups, such as when transmitters are brought within 30 cm (within one meter for WL models) from each other, or when they come within 6 meters from the reception antennas, the use of Sony's analog wireless channel plan or 750 kHz channel spacing provides for more stable multi-channel operation.

1) Analog wireless channel plan
2) 750 kHz spaced channel plan *1
3) 500 kHz spaced channel plan
4) 375 kHz spaced channel plan *2

*1 The 750 kHz spaced channel plan must be set manually

*2 The transmitter-to-transmitter or transmitter-to-reception antenna distances must be increased. Use this only when there is no other choice.

・When more channels are needed than offered by the given channel spacing, multiple groups can be used simultaneously by taking advantage of the RF shield effect between operational areas and shifting the channel frequencies. For example, when using a channel plan with 500 kHz equal spacing, shift the channels by 250 kHz for operation in a different area.
(In this case, the shadow loss between the areas must be at least 30 dB)

■ Reference: Example of calculating maximum number of channels

<TV channel: When one channel is 6 MHz>

	CH 14	CH15		CH 16	CH 17		CH 18	CH 19			CH 20	CH 21		CH 22		CH 23
Usable TV channels at operation site		Usable		Usable	Usable			Usable				Usable		Usable		
Guard bands and usable frequency bands		1 MHz guard band	5 MHz, 10 channels	6 MHz, 12 channels	5 MHz, 10 channels	1 MHz guard band		1 MHz guard band	4 MHz, 8 channels	1 MHz guard band		1 MHz guard band	5 MHz, 10 channels	5 MHz, 10 channels	1 MHz guard band	
Number of usable channels		-	10 + 12 + 10 = 32 channels			-		-	8 channels	-		-	10 + 10 = 20 channels		-	

*When adjacent to an unusable channel, a guard band of 1 MHz must be considered.

<TV channel: When one channel is 8 MHz>

	CH 21	CH 22		CH 23	CH 24		CH 25	CH 26			CH 27	CH 28		CH 29		CH 30
Usable TV channels at operation site		Usable		Usable	Usable			Usable				Usable		Usable		
Guard bands and usable frequency bands		1 MHz guard band	7 MHz, 14 channels	8 MHz, 16 channels	7 MHz, 14 channels	1 MHz guard band		1 MHz guard band	6 MHz, 12 channels	1 MHz guard band		1 MHz guard band	7 MHz, 14 channels	7 MHz, 14 channels	1 MHz guard band	
Number of usable channels		-	14 + 16 + 14 = 44 channels			-		-	12 channels	-		-	14 + 14 = 28 channels		-	

*When adjacent to an unusable channel, a guard band of 1 MHz must be considered.

2 Installing the reception antennas

■ Check for RF interference and noise sources

For proper operation, it's crucial to check for any signal interference and noise sources within the frequency band and channels you plan to use.

Typical examples of external noise

- Unpredictable pulse noise
- Other wireless microphones used in the vicinity (interference of RF signals using the same frequency band)

  Give special attention to concerts, coverage of large sporting events, etc.
- Street lights (mercury lamps, etc.)
- Truck radios

  Give special attention when installing the antenna near expressways or distribution centers

Examples of on-site noise

- Mobile phone jammers
- LED, neon tube ornaments and converter transformers
- TV monitors
- Mercury lamps
- Other equipment

■ Keep the reception antennas away from any noise sources

- Windows and doors separating the inside and outside of rooms without proper shielding
- The following lighting devices
  - Mercury lamps: These lamps can have extremely high noise levels between power On to stabilization

    Also note that close-to-dead or close-to-broken mercury lamps emit pulse noise across a wide spectrum.
  - LED lights (ornaments), monitors, neon tube ornaments:
  - LED monitors emit different levels of noise depending on the image on the screen. Check the noise level of the monitor with the actual image displayed (black images produce almost no noise).

    The source of noise from lighting devices may be the illuminant or the power supply. Check the presence of noise by switching On and Off the lighting device.

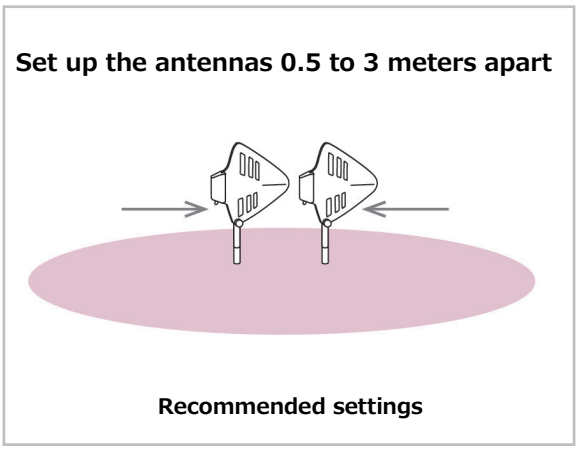
- Other equipment in the system
  - Studio monitors
  - Mobile phone jammers (halls, theaters)
  - Equipment that flashes strobes for incoming telephone calls
  - HDMI converters
  - Prompter cameras

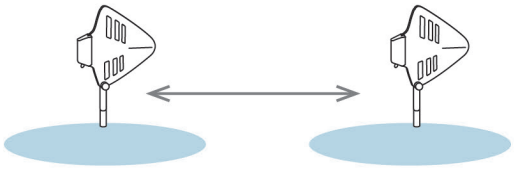
■ **For correct installation of the reception antennas**

<About the distance between antennas>

・Make sure to use two antennas in a pair and space them about 0.5 to 3 meters apart. Install them at positions that offer the best line of sight to the wireless microphones and transmitters within the service area.

＊ The antennas must be properly spaced from one another to attain the diversity effect.



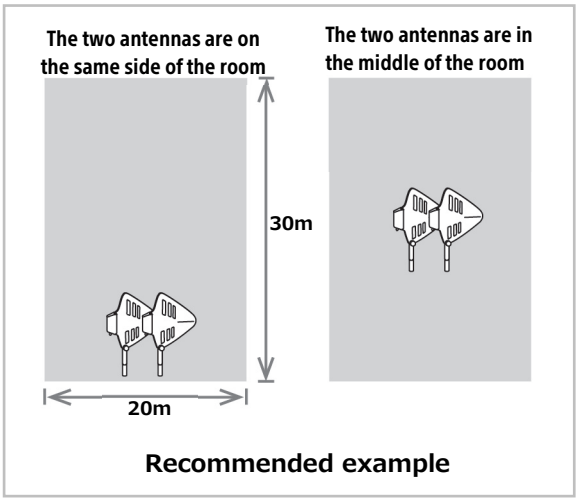


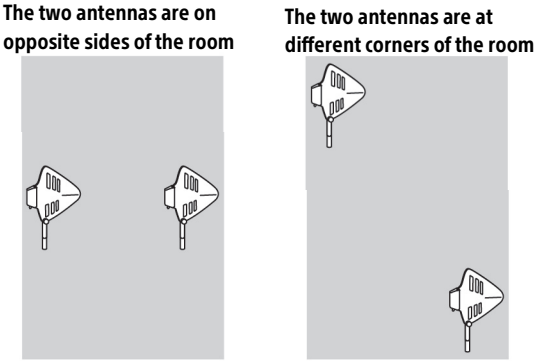
In the case of spacing the antennas further apart than the recommended setting

Check the system so that the actual RF levels at the receivers are sufficient, the diversity effect is appropriate (the antennas are frequently switched between a or b), and there are no drastic RF dropouts.

＊ To obtain the appropriate diversity effect, do not space the antennas more than 20 meters apart.

<About the position of the reception antennas>



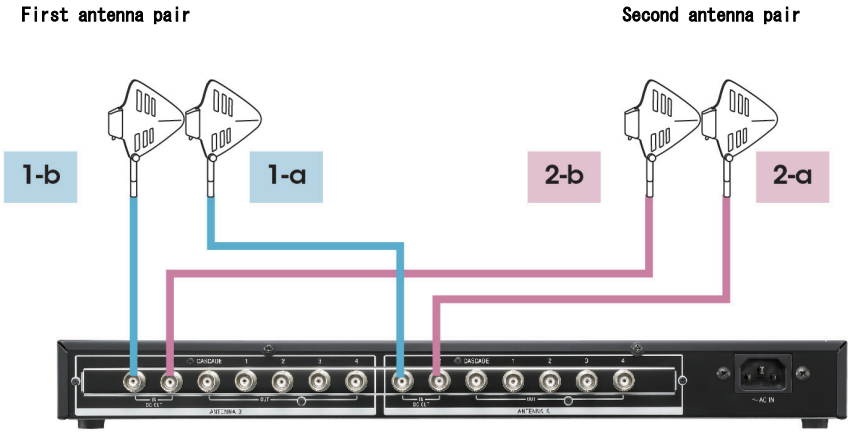


Do not space the antennas more than 20 meters apart when they are set up at opposite sides of the room or opposite corners of the room (as in the illustration) due to the building's structure or operational reasons. Try to bring the antennas closer together as much as possible.

In the case you cannot avoid spacing the antennas far apart, check and operate the system so that the actual RF levels at the receivers are sufficient, the diversity effect is appropriate (the stronger RF level of antenna a or b is selected), and there are no drastic RF dropouts.

■ When using two pairs of antennas

Example of connecting antennas to the Antenna Divider WD-850



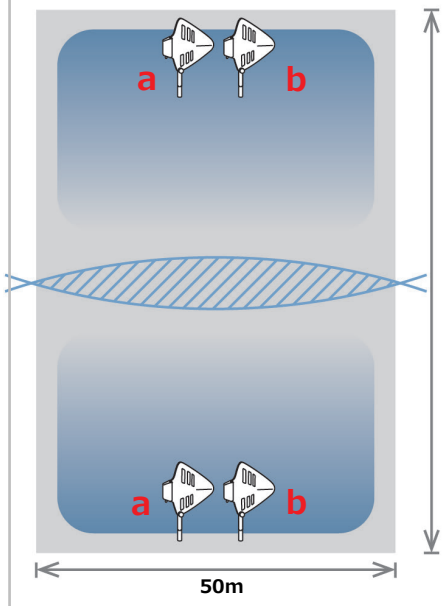
*Be cautious of the connections

・The Antenna Divider combines the RF signals received by 1-a and 2-a into one and does the same for those received by 1-b and 2-b. When the level difference between 1-a and 2-a or 1-b and 2-b is less than 20 dB, phase shifts (especially reverse phase) due to radio wave propagation may cause the level of the combined signals to fall, resulting in dropouts of the audio.

・For small rooms, use only one pair of antennas.

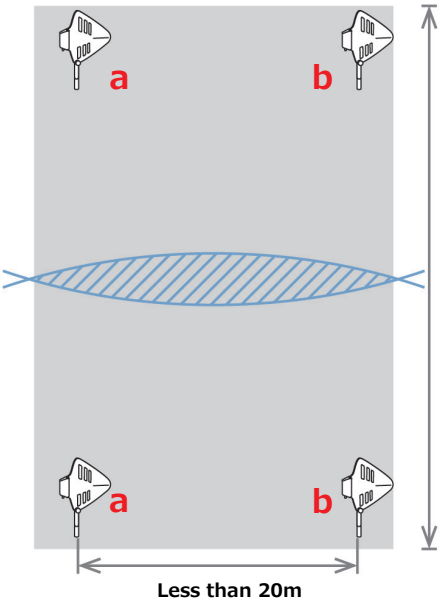
・When using two pairs of antennas in a large room, the difference of RF levels at equal distances from the first and second pair of antennas can possibly fall below 20 dB, resulting in dropouts in the audio. If this happens, change the gain settings of the antennas' boosters to move the area which is at risk of audio dropouts.

Two pairs of antennas in a large room



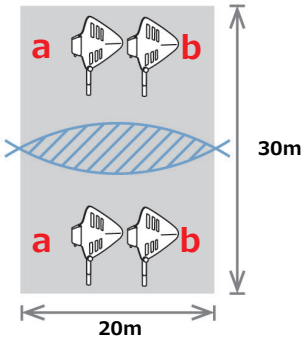
Recommended example

When the antennas can only be set up in the 4 corners of the room



When the antennas can only be set up in the 4 corners of the room, keep the distance between antennas a and b within 20 meters.

Two pairs of antennas in a small room



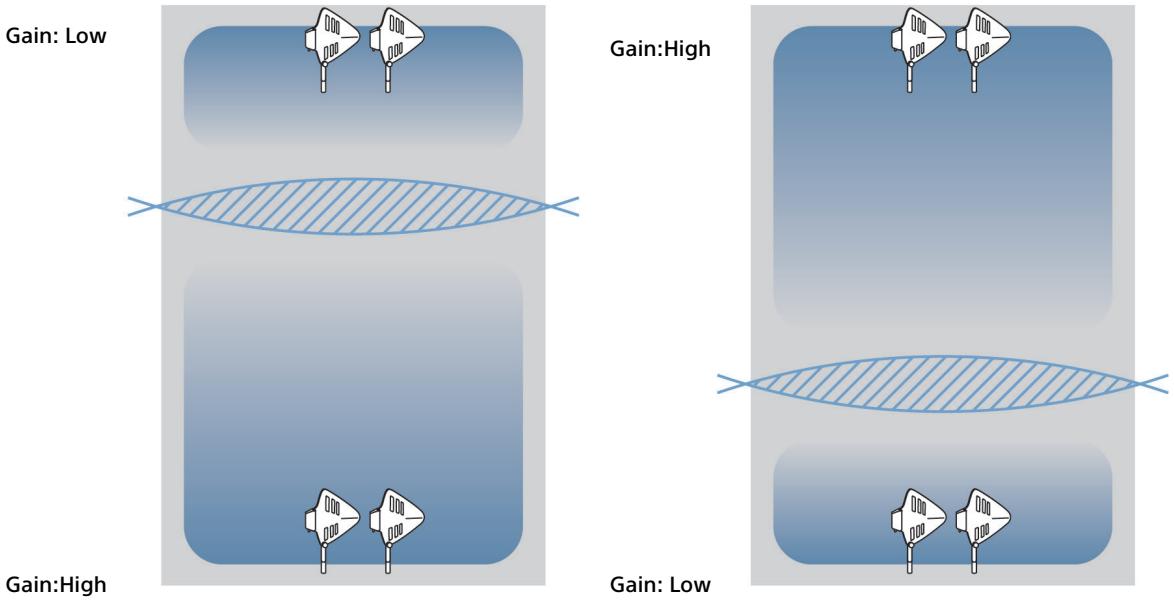
For small rooms, it is recommended to use only one pair of antennas (two antennas). In some cases, however, a second pair of antennas may be required to cover areas where the field strength may drop due to using transmitters behind objects or the shield effect.

When using two pairs of antennas (4 antennas) under the conditions in the above illustration, be cautious of the following points.

- Set up antennas a and b of the same pair as close as possible. (See page 22)
- Check and operate the system so that the actual RF levels at the receivers are sufficient, the diversity effect is appropriate (the antennas are frequently switched between a or b), and there are no drastic RF dropouts.
- If the diversity effect is not working, change the booster gain of each antenna in consideration of the service area.

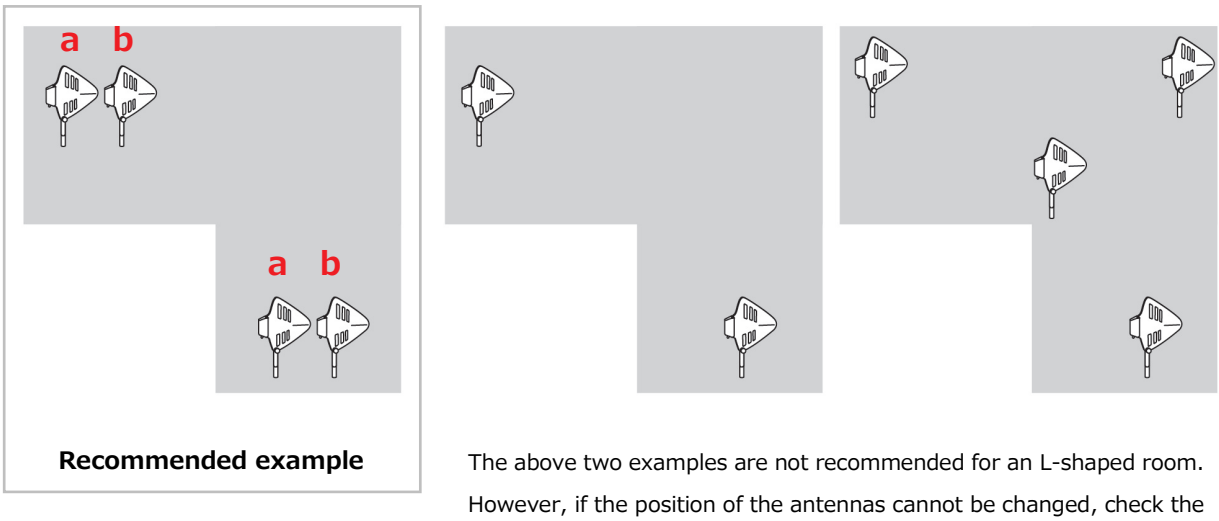
The area where the difference of RF levels from the first and second pair of antennas can possibly fall below 20 dB, making audio dropouts easier to occur.

<Example of moving the service area by changing booster gain>



The area where the difference of RF levels from the first and second pair of antennas can possibly fall below 20 dB, making audio dropouts easier to occur.

・When two areas are connected as one service area, use each pair separately to cover each area.



Recommended example

The above two examples are not recommended for an L-shaped room. However, if the position of the antennas cannot be changed, check the system so that the actual RF levels at the receivers are sufficient, the diversity effect is appropriate (the antennas are frequently switched between a or b), and there are no drastic RF dropouts.

■ Checking the diversity effect

Checking the RF signal reception of antennas a and b in Wireless Studio

An example of the diversity effect not working due to the antennas spaced too far apart (20 meters of more)

When antennas a and b are too far apart, the relation between the antennas' spacing and RF signal's wavelength is completely lost, and the RF levels at both antennas become random. As a result, the RF levels of both antennas a and b may drop at the same time. However, regardless of dropouts occurring, operation is possible as long as a sufficient RF field strength (D/U ratio of 20 dB or larger) can be obtained.

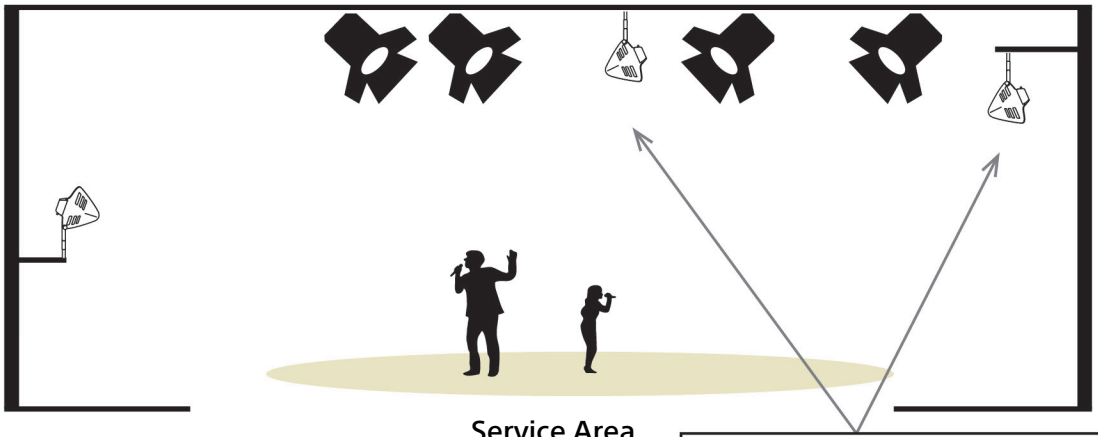
An example of the antennas being properly spaced (0.5 meter to 3 meter) and the diversity effect working

When the antennas are properly spaced, the appropriate relation between the antennas' spacing and RF signal's wavelength is established, and diversity effect allows stable reception to be secured.

■ Caution upon installing the antennas

<Direction of the antennas>

- When ceiling- or catwalk-mounted: downward
- When wall-mounted with sufficient space from the ceiling: upward
- When wall-mounted with little space from the ceiling: downward



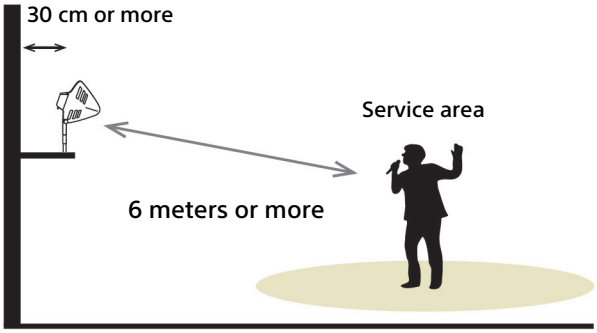
<Distance from transmitters>

・Secure at least 6 meters

<Distance from walls>

・Secure at least 30 cm (11.8 inches)

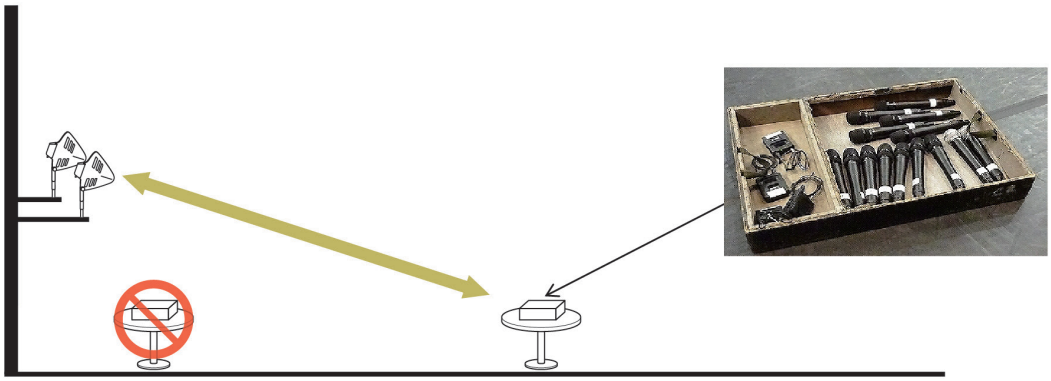
・For metal walls, secure as much distance as possible (2 meters(6 feet 6.7 inches) or more is recommended)



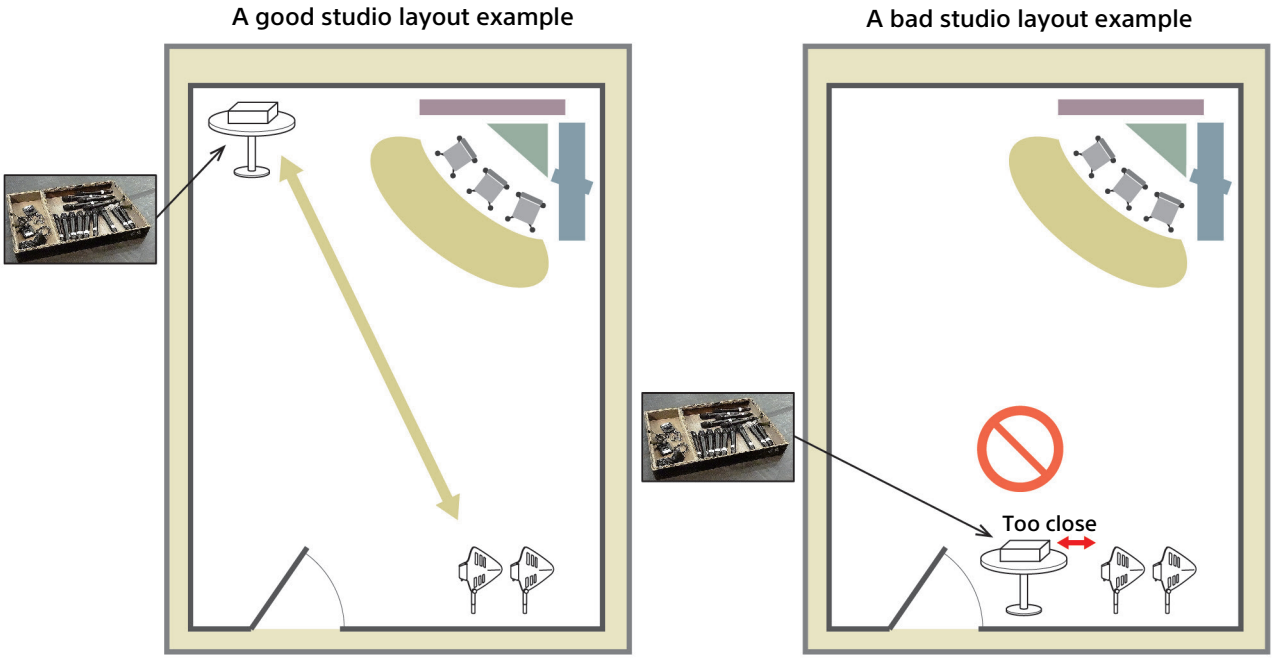
<Other important points>

・Do not bring metal materials close to the antenna.

・Do not place powered transmitters directly beneath the reception antennas.



・Do not place powered transmitters near the reception antennas.



＊ See page 36 for details on the distance between reception antennas and transmitters.

3 Checking the noise levels of operation channels

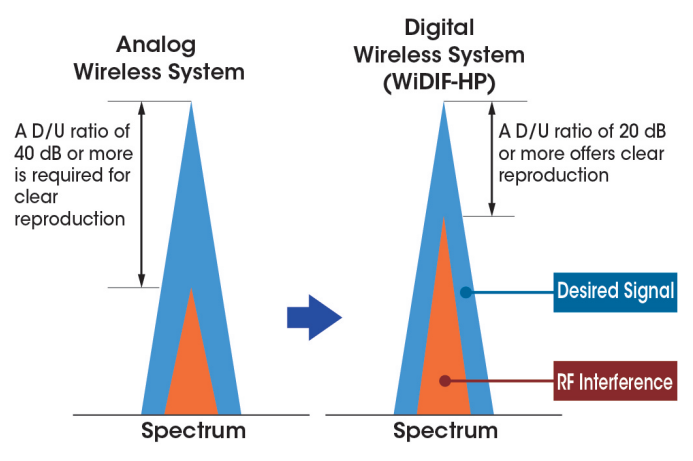
<Evaluating D/U ratio>

■ In the case of digital transmission

For stable transmission, it is crucial to secure and maintain an optimized D/U ratio, which is defined as the ratio between the desired signal and interference signals (including noise).

D/U ratio: D stands for Desired Signal whereas U stands for Undesired Signal (interference signals, noise)

Audio signals are clearly decoded as long as a D/U ratio of 20 dB or higher is secured.



When configuring a system:

1) Keep potential noise levels in the environment as low as possible.
2) Keep the level of the Desired Signal as high as possible.

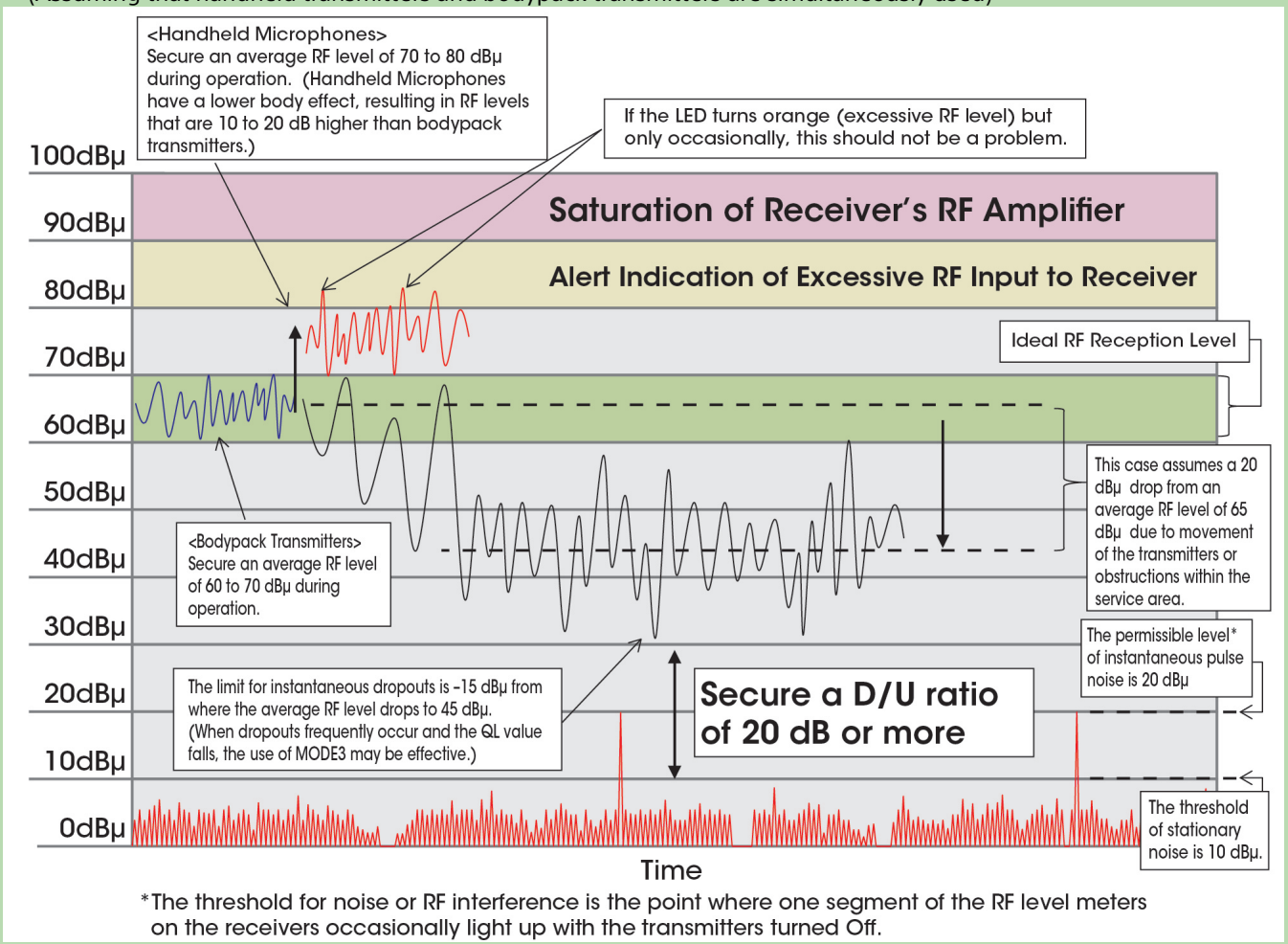
※A misunderstanding:

When noise levels are high, raising the gain of the antenna booster improves D/U ratio because the level of the Desired Signal increases.

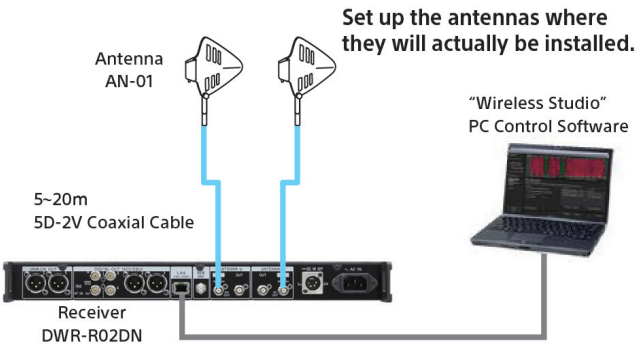
⇒ **This is not true since the relative noise level also increases.**

■ To obtain an optimized D/U ratio —Securing the level of the Desired Signal—

(Assuming that handheld transmitters and bodypack transmitters are simultaneously used)



■ System configuration for checking noise (example)



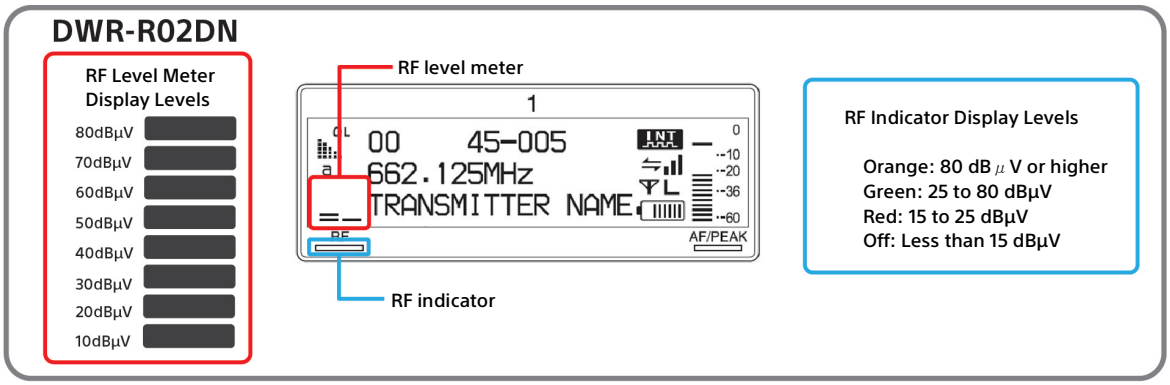
・For simplified measurement, you can use the whip antenna supplied with the receiver.

■ Checking noise and RF interference

The following methods allow you to check for noise and interference signals.

1. Checking the RF level meters on the receiver
2. Using the "Wireless Studio" PC control software
   - 2-1. RF Chart Grapher
   - 2-2. Channel Plan Adviser (when setting channels)
   - 2-3. Spectrum Analyzer (after setting channels, during operation)

<1. Checking the RF level meters on the receiver >



Checking the RF level meters of the operation channels (with the transmitters turned Off)

・Ideally, the RF level meter does not show an indication (does not light up).

Even better if the meter does not light up when experimenting with higher antenna booster gain (10 dB -> 18 dB).

In practical operations, the permissible level is when the RF level meter randomly flashes one segment (the level when the red LED of the RF indicator occasionally blinks).

<2. Using the "Wireless Studio" PC control software >

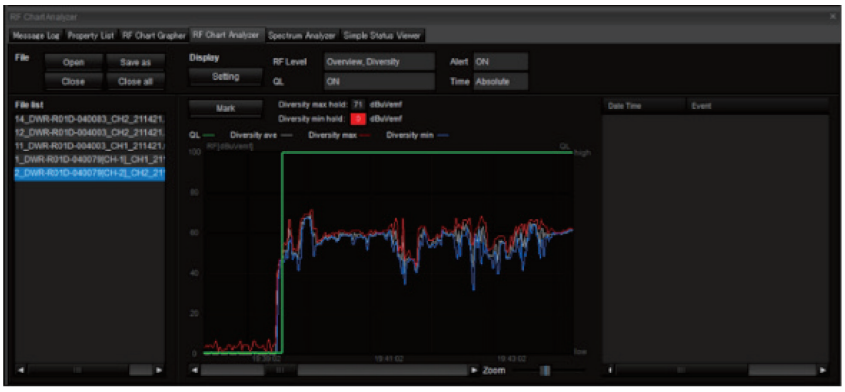
<2-1. Checking the RF Chart Grapher >

・Select the RF Chart Grapher tab in the Sub Window to display the RF Chart Grapher.

・Click the "Setting" button to select the graph type you wish to display.

To see the noise level, select "Individual max" under "Detail".

You can check the peak value of the noise level.



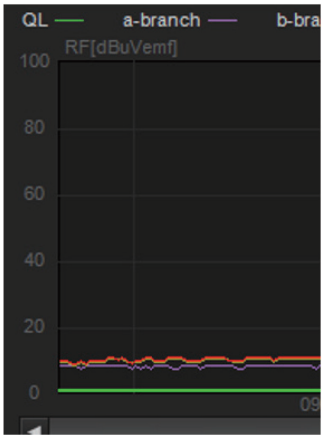
・The noise level of each channel (frequency) is displayed and stored on a timeline.

・When you know the possible sources of noise, turn Off the transmitters and toggle the power of the noise sources ON -> OFF -> On to check how the noise level changes.

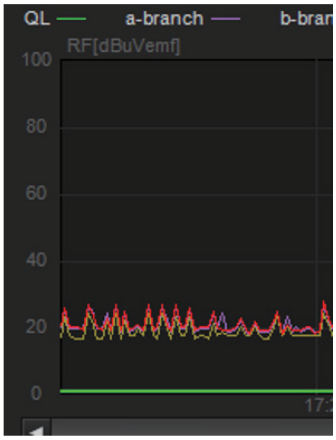
・To know if pulse RF interference is received, check whether the noise level rises in periodic intervals.

The noise level is low, allowing stable operation

The noise level threshold for operation (10dBμ or less)

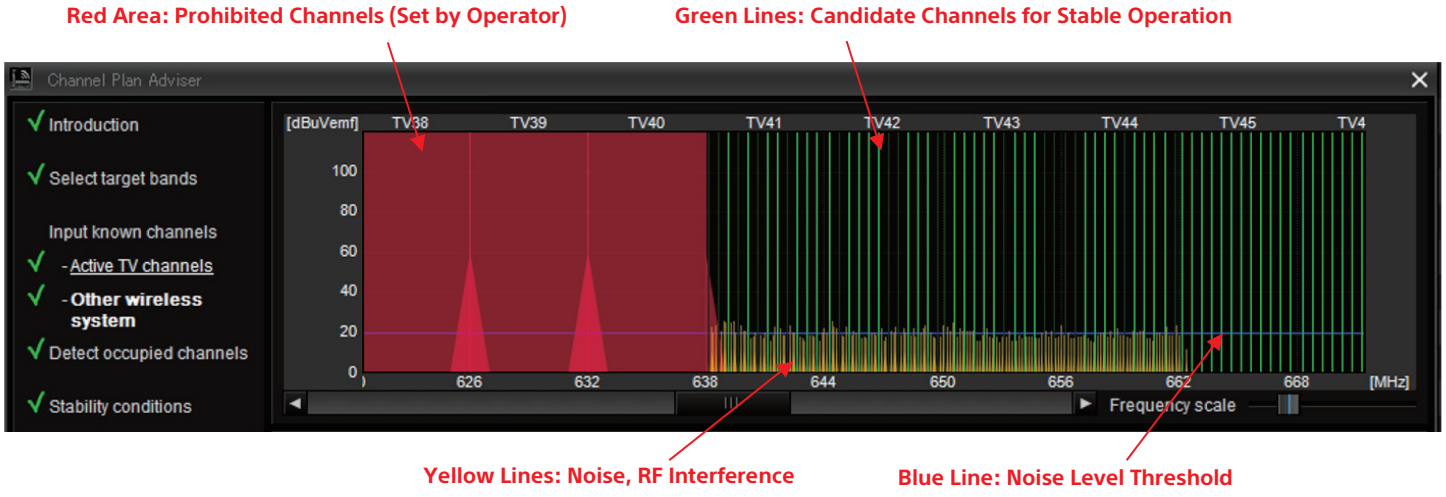


The noise level is too high for operation



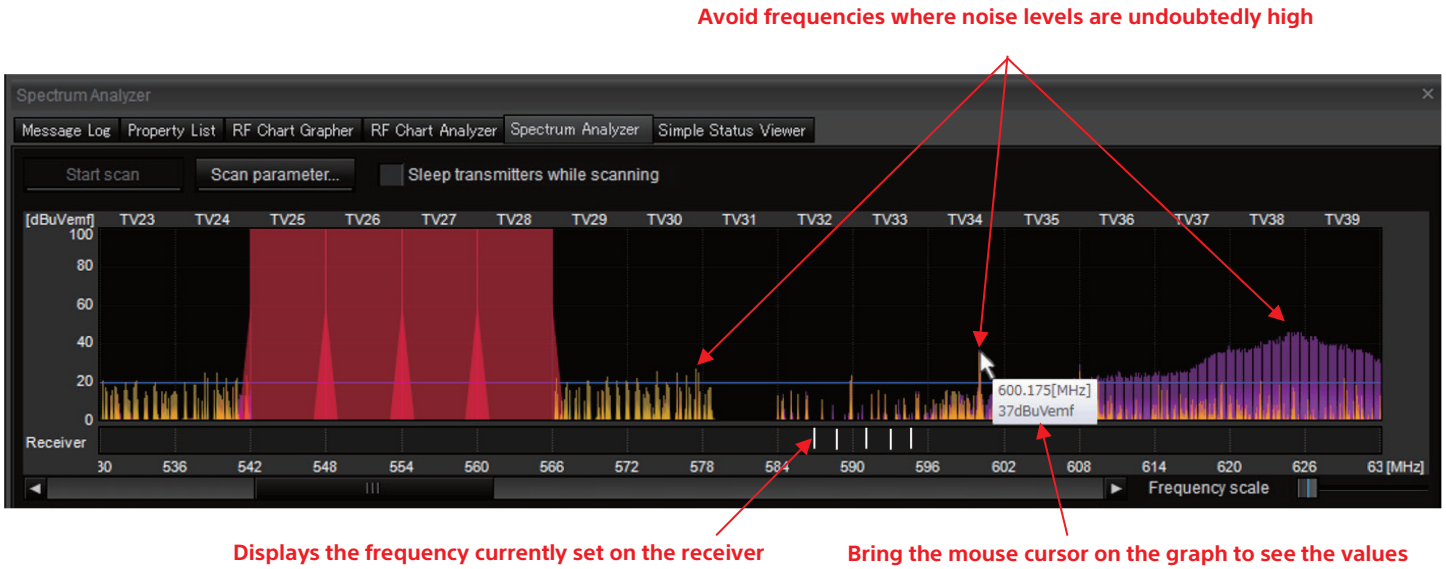
< 2-2. Checking the Channel Plan Adviser (when setting channels) >

- Select “Device menu > Channel Plan Adviser” to display the window. Refer to the guide on the left to make the required settings.
- Use this window to see an overall view of the noise levels in the entire frequency band.
- This feature is convenient for assigning channels in simultaneous multi-channel operation.
- Based on the results of scanning the noise spectrum (yellow lines in the below figure), the channel plan will be configured to avoid frequencies with high noise levels.
- The noise threshold level that determines whether a frequency should be assigned to a channel can be set by the “Detect threshold level”.



< 2-3. Checking the Spectrum Analyzer (after setting channels, during operation) >

- Select the Spectrum Analyzer tab in the Sub Window to display the Spectrum Analyzer.
- This feature is convenient for checking noise or RF interference during operation of the wireless system.
- You can select the frequency intervals for the scans, the number of times to scan, or continuous scanning which runs until the “Stop scan” button is clicked.
- The scanning results can be stored and recalled, and their data can be overlapped on the chart.
- Check the noise spectrum and if high noise levels are found, configure the channels to avoid these frequencies.
- This operation uses channel 1 of the receiver that is selected by the operator. During the scan, you cannot use channel 1 of this receiver for reception from a wireless microphone.
  Note that you cannot set different band blocks for channel 1 and channel 2 of the receiver.



4 Setting the antenna booster gain and receiver RF ATT

■ **What are the antenna boosters used for?**

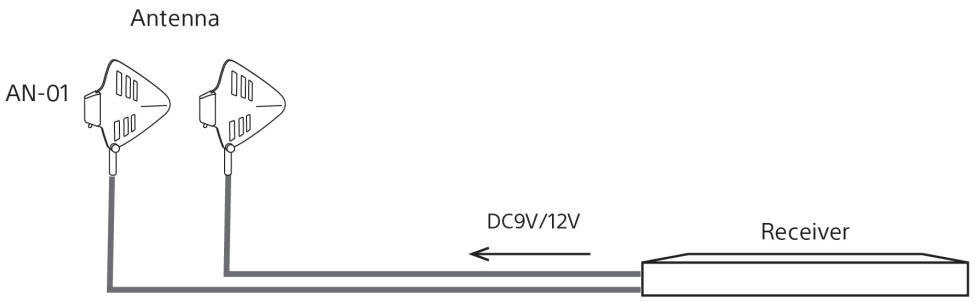
Antennas boosters are used to compensate for the cable loss that occurs in coaxial cables after the booster. Note that they are not for expanding the service area by boosting the gain.

■ **Table of Cable length and loss**

Length of cabele [m]	Cable Loss [dB] (at 600 MHz)	
	RG-58/U	G-212/U
1	0.4	0.3
3	1.2	0.8
10	3.9	2.6
30	11.6	7.7
60	23.2	15.5
100	38.7	25.8

Length of cabele [ft]	Cable Loss [dB] (at 600 MHz)	
	RG-58/U	G-212/U
3	0.4	0.2
10	1.2	0.8
30	3.5	2.4
100	11.8	7.9
200	23.6	15.7
300	35.3	23.6

■ **About the AN-01 booster gain switch**



DC Supply	GAIN switch setting			
	0dB	+10dB	+18dB	Remote (formerly Auto)
DC+9V	0dB	+10dB	+18dB	+10dB
LED	Blue	Green	Orange	Green
DC+12V	0B	+10dB	+18dB	+18dB
LED	Blue	Green	Orange	Orange
DC No Supply	Will not operate	Will not operate	Will not operate	Will not operate
LED	Off	Off	Off	Off

The AN-01 will not operate without supplying DC voltage. Make sure that the DC Supply Setting is set to “On”

Setting the antenna divider or receiver to DC Off does not bypass the antenna booster.

■ Temporary settings for antenna booster gain

Cable loss (from page 23 table)	Temporary settings for antenna booster gain
6 dB or lower	No booster required (bypass) or 0 dB position (LED: blue)
7 to 15 dB	10 dB position or REMOTE position with DC +9 V supply (LED: green)
16 to 25 dB	18 dB position or REMOTE position with DC +12 V supply (LED: orange)

・Antenna boosters can be added between coaxial cables as a relay (a total of two boosters)

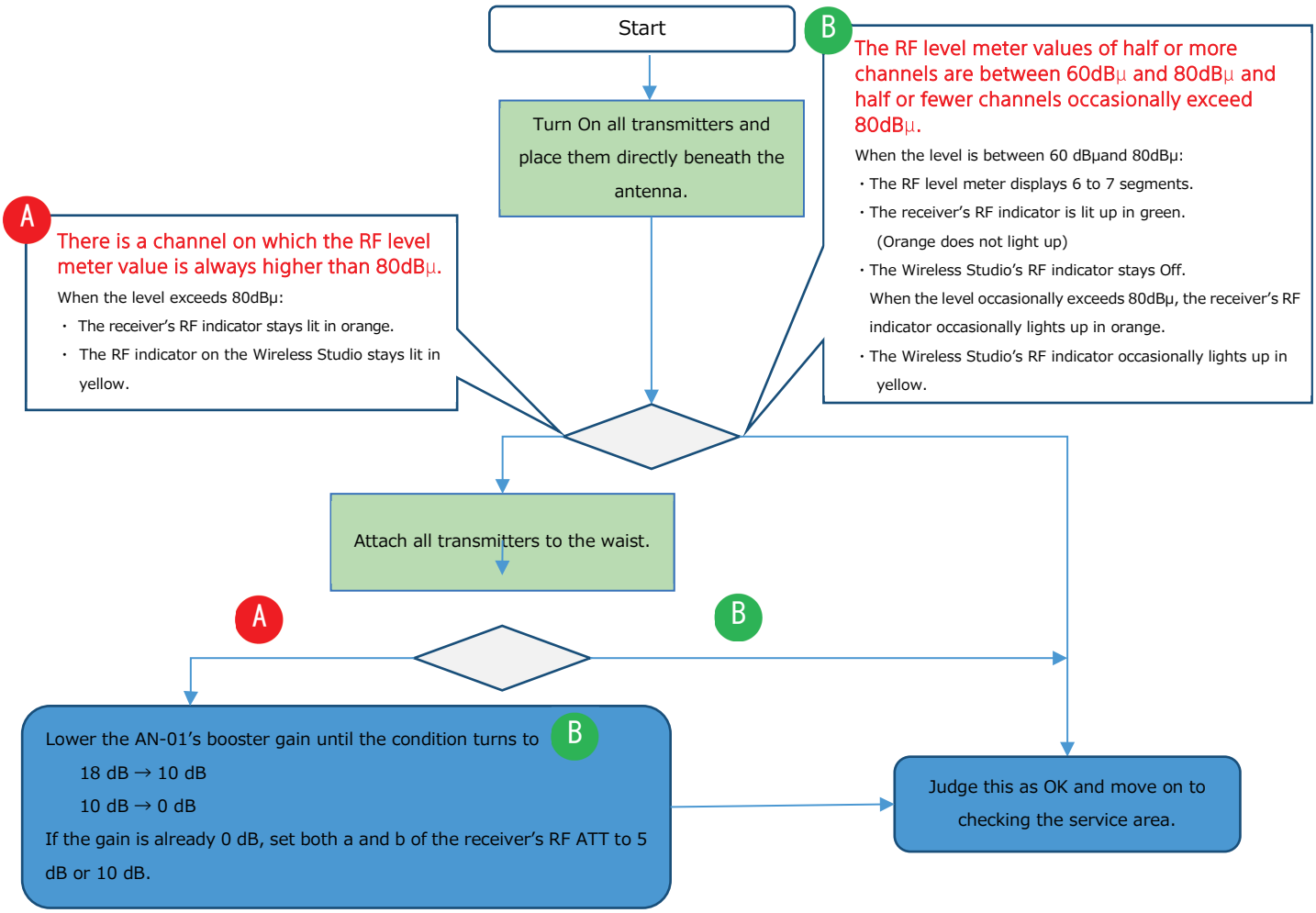
・The coaxial cables connected to the receiver's antenna inputs a and b must have the same lengths.

＊ The diversity effect will be lost if the lengths are different due to the different sensitivities.

■ Making the actual settings of the antenna booster gain

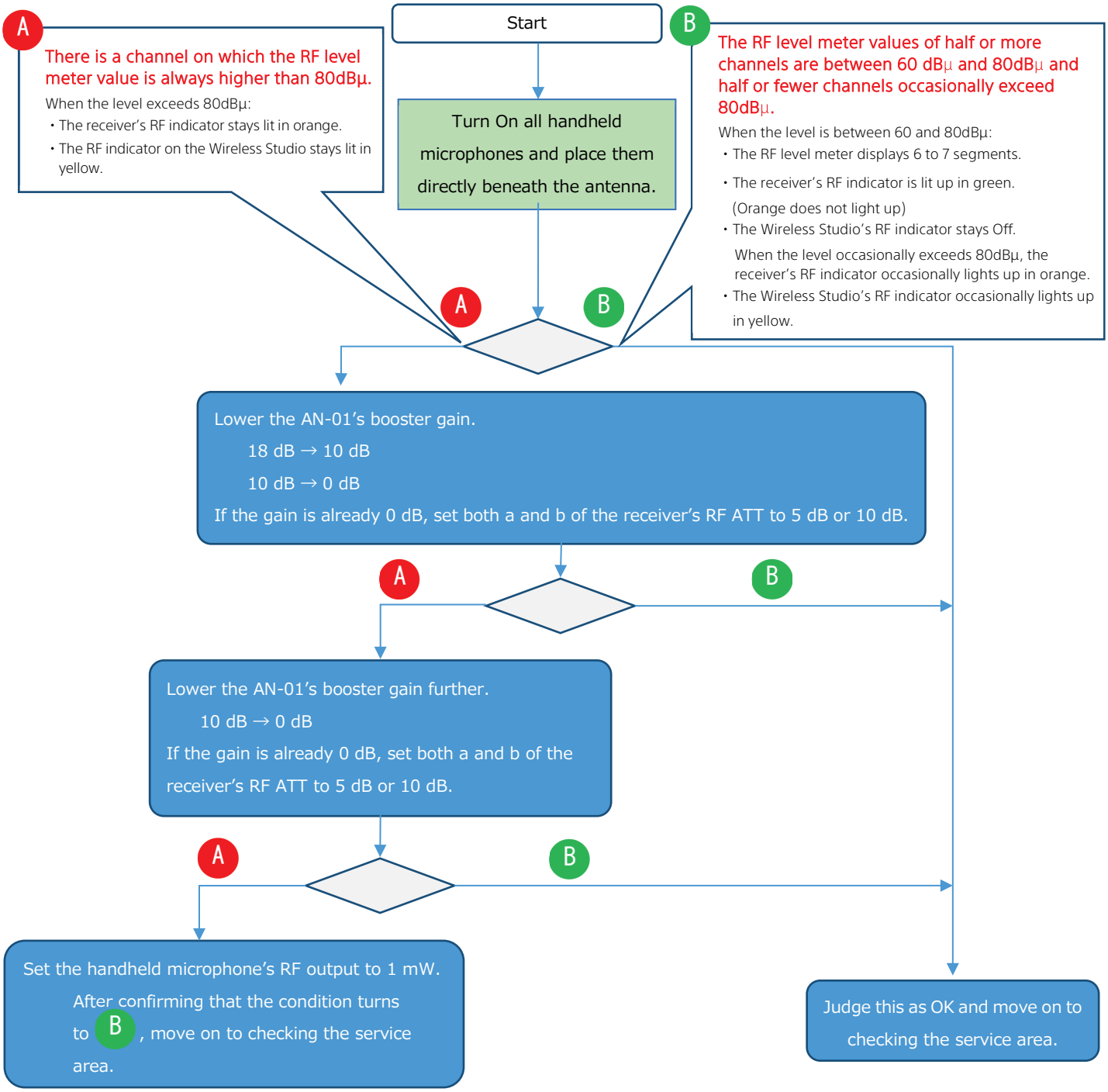
The procedures for setting the booster gain of the reception antenna (AN-01) and RF ATT of the receiver are different depending on the type and combination of transmitters used.

<When using only the Bodypack Transmitter DWT-B01N>



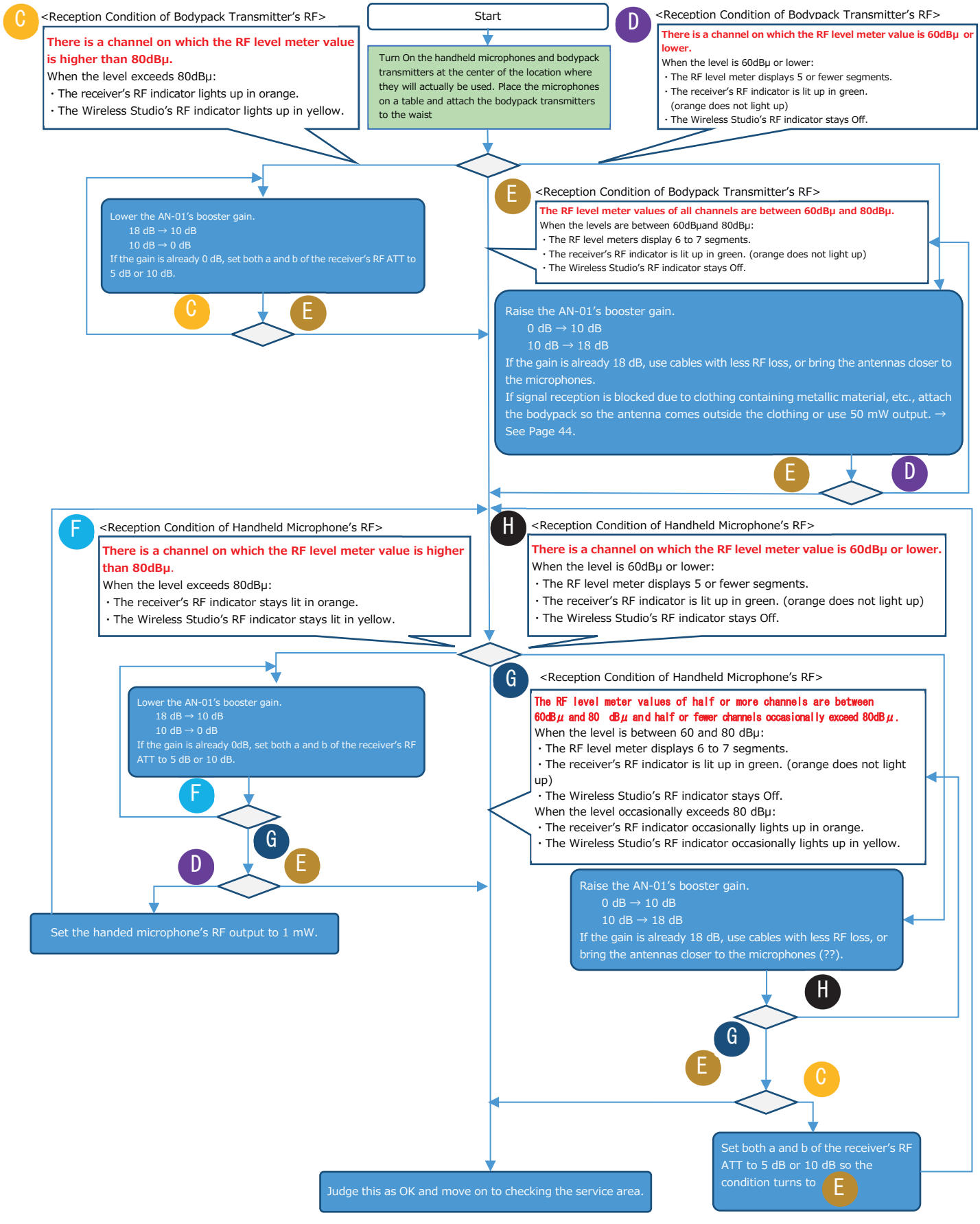
＊ When you cannot decide whether to lower the AN-01 booster gain or turn On the receiver RF ATT → Go to P35

<When using only the Handheld Microphone DWM-02N>



<When using the Bodypack Transmitter DWT-B01N and Handheld Microphone DWM-02N>

Due to the body effect, the handheld microphone has an RF level that averages 10 dB to 20 dB higher than the bodypack transmitter. When using handheld microphones and bodypack transmitters together, the important point is to make their RF levels all fall within 60 to 80 dBμ, despite their level differences, by adjusting the booster gain of the AN-01s, RF ATT of the receivers, and output levels of the transmitters, and giving careful consideration to the operation.

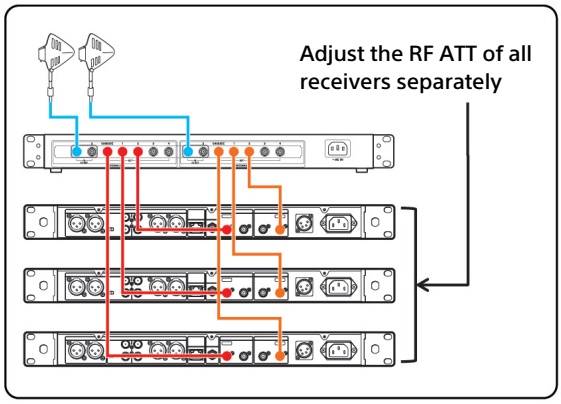


■ **Caution upon setting the RF ATT (attenuator) of receivers**

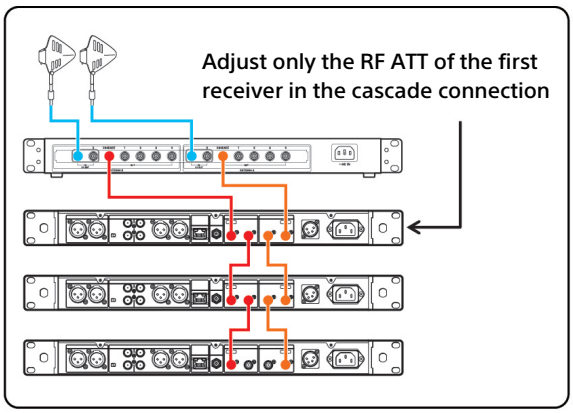
To optimize the reception level, you may have to adjust the RF ATT (attenuator) of the receiver's input.

Note that the receivers to adjust will differ according to the connections of the antenna cables.

① When the RF signal is distributed to all receivers from the WD-850



② When a cascade connection is used between receivers



■ When the receiver's RF level is too high (the RF indicator stays lit in orange) and you cannot decide whether to lower the antenna's (AN-01) booster gain or turn On the receiver's RF ATT:

Using the RF Chart Grapher function of the Wireless Studio, you can determine whether the RF amplifier of the antenna's (AN-01) booster or the RF amplifier of the receiver has saturated by the following procedure.

1. On the other channel of the same receiver, set a frequency (channel) that is 500 kHz away from the frequency selected on the channel showing excessive RF input.
   (E.g. If the RF indicator of receiver channel 1 lights up in orange (excessive input) at 538.750 MHz, set the frequency of channel 2 to 538.250 MHz.)
2. Turn On the transmitter that is using the channel showing excessive RF input, and turn Off all other transmitters.
3. Check the RF level of the frequency (channel) that was set 500 kHz away.

A. If the RF level meter of the channel that was set 500 kHz away exceeds 15 dBμV (the RF indicator lights up in red or green), it can be judged that the excessive input is causing this.

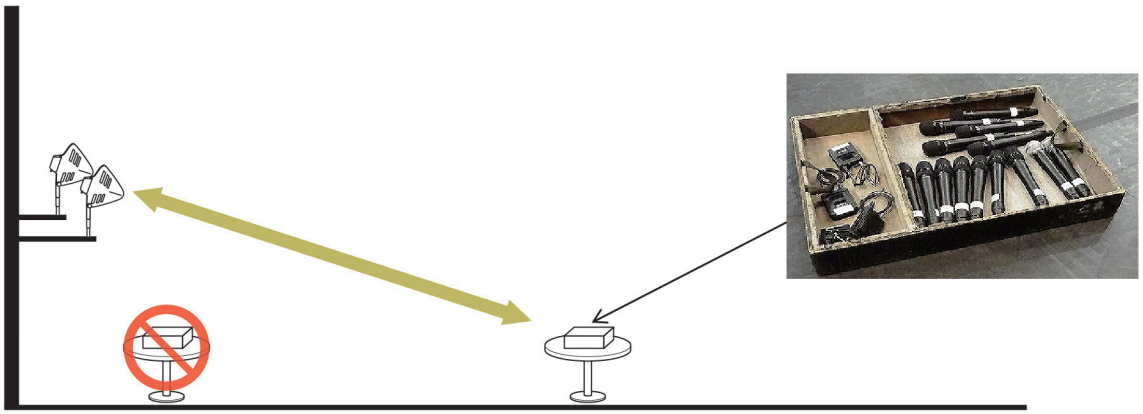
In this case, switch the receiver's RF ATT to 5 dB and then to 10 dB

① If the RF level drops by about 5 dB and then by 10 dB, the RF amplifier of the antenna (AN-01) booster is saturated. Return the receiver's RF ATT to its previous setting. Then, lower the booster gain so the RF level of channel 1 is appropriate (target center value: 60 dBμV to 70 dBμV).

② If the RF level drops significantly more than 5 dB and 10 dB, the RF amplifier of the receiver is saturated. Set the receiver's RF ATT so the RF level of channel 1 is appropriate (target center value: 60 dBμV to 70 dBμV).

B. If the RF level meter of the channel that was set 500 kHz away is 15 dBμV or lower (the RF indicator turns Off), channel 1 may have excessive input, but within the extent of not affecting other channels, and operations can be performed normally.

■ **How far should powered transmitters (on standby) be kept away from the reception antennas?**



1. Turn one of the transmitters Off and all other transmitters On. Check the RF level meter of the channel that was turned Off.
2. Next, turn Off all transmitters. If there is no change to the value of the RF level meter of the channel turned Off in step 1, the transmitters on standby may be kept where they are.
3. If the level in step 2 is smaller than the level in step 1, bring the transmitters further away from the reception antennas.
   Repeat step 1 and 2, and bring the transmitters away from the antennas until the value of the RF level meter does not change.

5 Checking the service area for simultaneous multi-channel operation

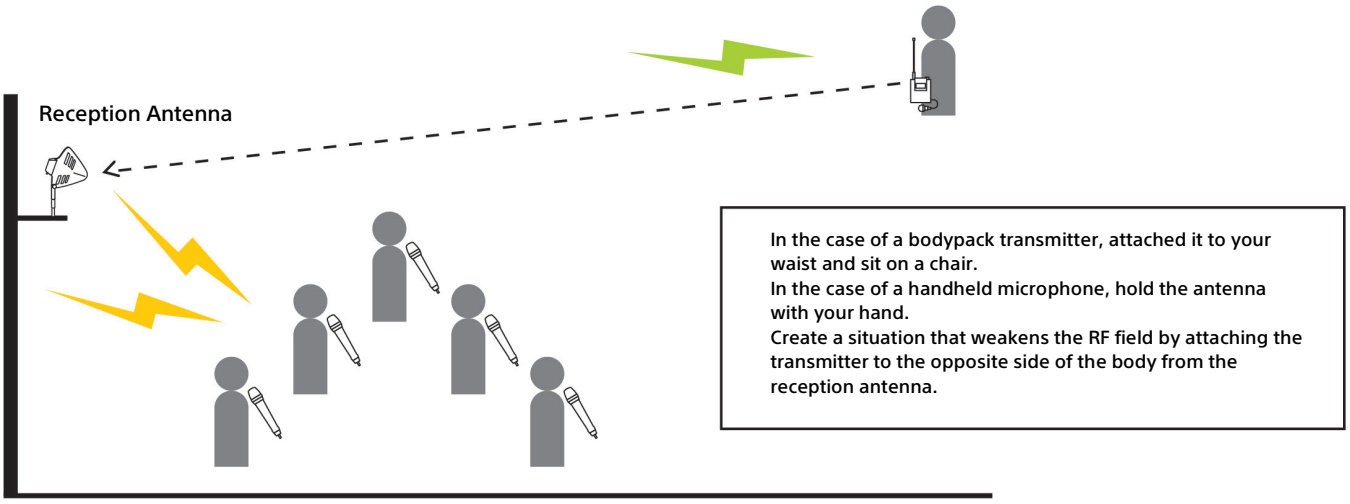
・When a receiver receives an RF signal level that is too high, the RF amplifier may saturate and suppress the sensitivity. When this happens, the receiver may have trouble receiving the RF signal from the transmitter that is further away (weaker signal levels).

・To prevent the sensitivity from being suppressed, conduct tests for simultaneous multi-channel operation as follows:

1) Bring the transmitters to the closest point from the antennas within the service area.

2) Set the transmitter you will use for checking the service area to normal operating state, and carry it to the service area where the field strength becomes weakest (furthest from the antennas).

3) While walking around this area, check the RF level and QL level.



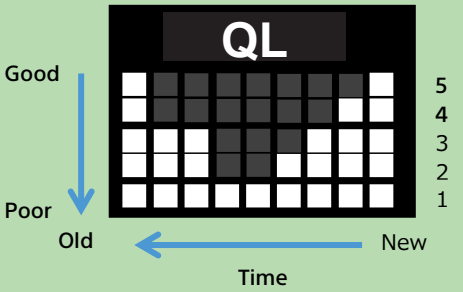
・For this test, set the output of the transmitter you use to check the service area to 1 mW and set the output of all other transmitters to 10 mW. These settings allow you to check the reception under more challenging conditions.
Since 10 mW (theoretically, the reception level is 10 dB higher) will be used for the actual operation, these settings allow you to check the reception with more headroom for operational conditions where the RF level largely fluctuates.

・By placing the transmitters (that are brought near the antennas) directly beneath the antennas, you can perform tests in harsher conditions where the RF level can more easily saturate. In this case, check that the RF indicator does not continue to light up in orange, which is an indication of excessive input. If less than half of the RF indicators of all reception channels repeat switching the orange indication between On and Off (RF level: 80 to 90 dBμ), then the reception is within acceptable level.

・In either case, make sure that there are no large drops (3 dB or more) in the QL meter values.

<Using the QL meter>

The QL meter serves as a reference for judging the quality of the received data. It displays the results of detecting errors in data packets as QL values.



・When all segments are displayed (meter value of “5”), there are no errors in the packets and the transmission is stable. If segments start disappearing from the top, this means that errors in the packets are increasing.

・When only one or two segments occasionally disappear (meter value of ”4” or “3”), the audio will rarely be affected thanks to the error correction function.

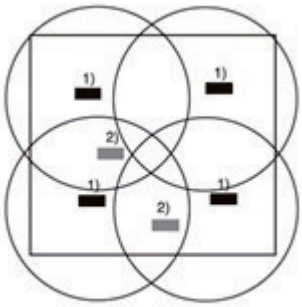
・When the meter continues to display ”4” or “3”, or occasionally drops to “2” or lower, the audio is likely to be affected. In this case, re-examine the RF reception level and interference signals, and make the appropriate changes to the antenna, booster gain, and frequency channel accordingly.

・When another transmitter is near the antenna and the receiver’s RF indicator lights up in orange, the QL meter’s indication will still drop. In this case, move the transmitter away from the antenna until the RF indicator changes color from orange to green.

6 Checking the service area for Cross Remote operation

Check procedures

1. Bring the transmitters to the service area where you wish to have remote control.
2. Try to change an item in the transmitter's menu from the receiver or the Wireless Studio software.
3. Check that the settings of all transmitters can be changed.
4. Hold one transmitter and walk around the entire service area.
5. Check that the "Condition Level" antenna indication does not display within the entire service area. If it does, but only momentarily, there should not be a problem.
6. If the connection is poor, change the position of the antennas (RMU-01) or add more of them to the system.



1) RMU-01
2) Transmitter

Condition Indication

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

Note: Channels that cannot use Cross Remote

When using the following frequencies for the main link, the Cross Remote function cannot be used since its RF carrier (2.4 GHz) will be affected by the high frequency harmonics of the main link RF carriers.

Destination	TV Band	Group	Channel	Frequency
EU	TV21-23	00	23- 21	488.625
			23- 22	488.750
			23- 23	488.875
			23- 24	489.000
			23- 25	489.125
			23- 26	489.250
			23- 27	489.375
		D3	23- 22	488.750
			23- 26	489.250
		D5	23- 22	488.750
			23- 26	489.250
		D6	23- 22	488.750
			23- 26	489.250
		D7	23- 21	488.625
			23- 25	489.125
		03	23- 24	489.000
			23- 27	489.375
		07	23- 27	489.375
		23	23- 104	488.600
			23- 105	488.625
			23- 106	488.650
			23- 107	488.675
			23- 108	488.700
			23- 109	488.725
			23- 110	488.750
			23- 111	488.775
			23- 112	488.800
			23- 113	488.825
			23- 114	488.850
			23- 115	488.875
			23- 116	488.900
			23- 117	488.925
			23- 118	488.950
			23- 119	488.975
			23- 120	489.000
			23- 121	489.025
			23- 122	489.050
			23- 123	489.075
			23- 124	489.100
			23- 125	489.125
			23- 126	489.150
			23- 127	489.175
			23- 128	489.200
			23- 129	489.225
			23- 130	489.250
			23- 131	489.275
			23- 132	489.300
			23- 133	489.325
			23- 134	489.350
			23- 135	489.375
			23- 136	489.400

Destination	TV Band	Group	Channel	Frequency
EU	TV38-40	00	39- 24	617.000
			39- 25	617.125
			39- 26	617.250
			39- 27	617.375
			39- 28	617.500
			39- 29	617.625
			39- 30	617.750
			39- 31	617.875
			39- 32	618.000
		D2	39- 26	617.250
			39- 30	617.750
		D4	39- 26	617.250
			39- 30	617.750
		D5	39- 25	617.125
			39- 29	617.625
		D7	39- 26	617.250
			39- 30	617.750
		02	39- 25	617.125
			39- 28	617.500
		04	39- 27	617.375
			39- 32	618.000
		05	39- 30	617.750
		39	39- 120	617.000
			39- 121	617.025
			39- 122	617.050
			39- 123	617.075
			39- 124	617.100
			39- 125	617.125
			39- 126	617.150
			39- 127	617.175
			39- 128	617.200
			39- 129	617.225
			39- 130	617.250
			39- 131	617.275
			39- 132	617.300
			39- 133	617.325
			39- 134	617.350
			39- 135	617.375
			39- 136	617.400
			39- 137	617.425
			39- 138	617.450
			39- 139	617.475
			39- 140	617.500
			39- 141	617.525
			39- 142	617.550
			39- 143	617.575
			39- 144	617.600
			39- 145	617.625
			39- 146	617.650
			39- 147	617.675
			39- 148	617.700
			39- 149	617.725
			39- 150	617.750
			39- 151	617.775
			39- 152	617.800
			39- 153	617.825
			39- 154	617.850
			39- 155	617.875
			39- 156	617.900
			39- 157	617.925
			39- 158	617.950
			39- 159	617.975
			39- 160	618.000

Destination	TV Band	Group	Channel	Frequency
US	TV14-17	00	17- 05	488.625
			17- 06	488.750
			17- 07	488.875
			17- 08	489.000
			17- 09	489.125
			17- 10	489.250
			17- 11	489.375
		D4	17- 06	488.750
			17- 10	489.250
		D6	17- 06	488.750
			17- 10	489.250
		D8	17- 06	488.750
			17- 10	489.250
		D9	17- 06	488.750
			17- 10	489.250
		08	17- 09	489.125
		09	17- 11	489.375
		17	17- 024	488.600
			17- 025	488.625
			17- 026	488.650
			17- 027	488.675
			17- 028	488.700
			17- 029	488.725
			17- 030	488.750
			17- 031	488.775
			17- 032	488.800
			17- 033	488.825
			17- 034	488.850
			17- 035	488.875
			17- 036	488.900
			17- 037	488.925
			17- 038	488.950
			17- 039	488.975
			17- 040	489.000
			17- 041	489.025
			17- 042	489.050
			17- 043	489.075
			17- 044	489.100
			17- 045	489.125
			17- 046	489.150
			17- 047	489.175
			17- 048	489.200
			17- 049	489.225
			17- 050	489.250
			17- 051	489.275
			17- 052	489.300
			17- 053	489.325
			17- 054	489.350
			17- 055	489.375
			17- 056	489.400

■ Troubleshooting using the RF level and QL meter

RF Level	**No problem**	**Too low**	**No problem**
QL meter	**No problem**	**Drops frequently***	**Drops frequently***
Operation	**No problem**	**Problem**	**Problem**
Probable cause	**-**	**The field strength is too weak. Change the settings so an adequate RF level is attained.**	**Various causes**

* No problem if the QL meters drops by only one segment.
* A drop of 2 segments is acceptable as long as it does not continue.

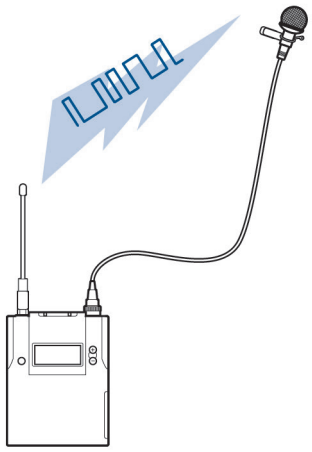
Possible causes of the QL meter dropping despite an adequate RF level

1) RF interference → See page 27, 3. Checking the noise level of operation channels".
2) Internal intermodulation due to saturation of the booster or the receiver's RF amplifier (excessive RF input). This also happens when another transmitter is brought too close to the reception antenna.
   → See page 35, "When the receiver's RF level is too high (the RF indicator stays lit in orange) and you cannot decide whether to lower the antenna's (AN-01) booster gain or turn On the receiver's RF ATT".
3) The antenna connector of the bodypack transmitter is touching metal material such as a folding chair
   → Check whether the antenna is touching a metal part
4) Data transmission error due to reflection or polarization (data slip)
   → See "Example of Trouble 1" on the following page.

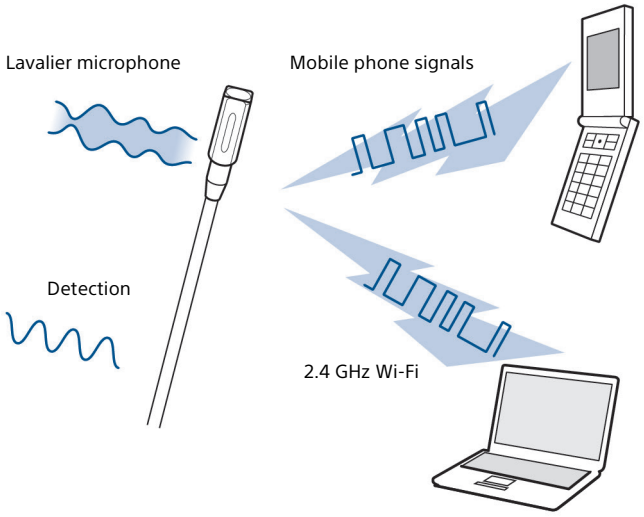
■ RFI (Radio Frequency Interference) Noise

The WiDIF-HP (format) used in the DWX Series performs cyclic packet transmissions similarly to mobile phones, computers, and other digital transmission equipment. However, the nonlinear devices (FETs, etc.) in condenser microphones pick up these other RF signals, and RFI noise may occur according to the packet format as a result. To prevent this from happening, note the following points when operating condenser microphones in a DWX system.

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



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



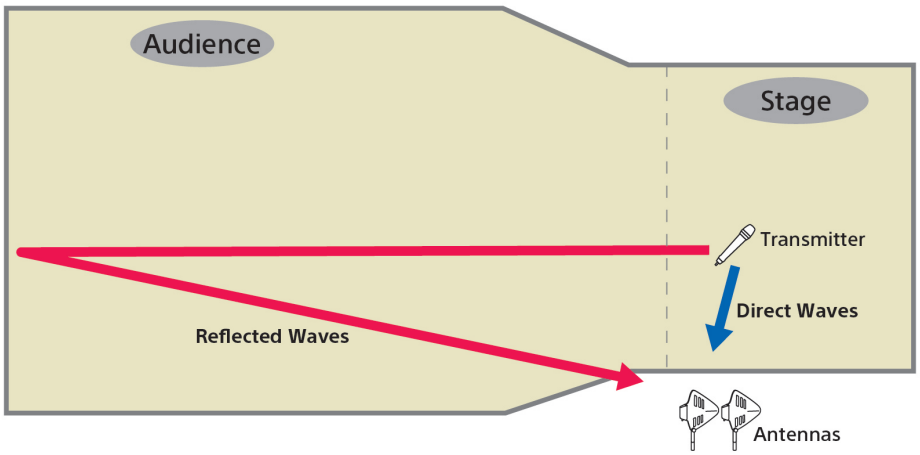
- Make sure to use lavalier microphones that implement RFI noise measures and support digital wireless equipment. The ECM-FT5, or Sony professional lavalier and shotgun microphones containing the suffix "/9X" in their model names (e.g. ECM-77BC/9X) can be used in the DMX system. Note that some Sony professional microphones are not suitable for use in the DWX system.
- In general, dynamic microphones are not affected by this type of RFI noise.
- Some microphones from Sanken, DPA, Sennheiser, and Countryman do not cause RFI noise and can be used in the DWX system. For compatible models, contact the respective microphone maker.

■ Examples of trouble and measures

1. Transmission errors due to reflection or polarization

Transmission errors can happen easier when the influence of reflected waves increases due to metal floors or walls covered with metal.

They can also happen easier when the polarization planes shift due to reflected waves.



Measures to counter this problem

・Set up both reception antennas so their polarization planes are tilted 45 degrees.

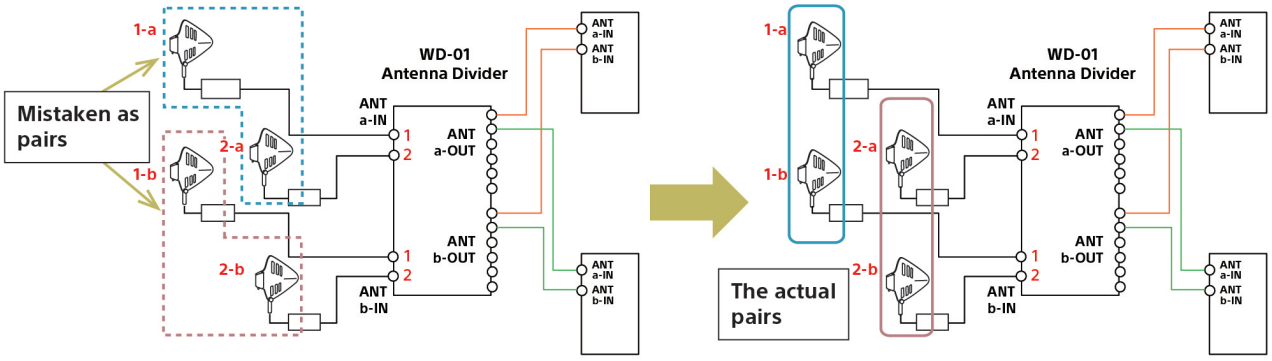
Or use one antenna for vertically polarized waves and the other for horizontally polarized waves.

・Change the height of the antennas.

・Use the more error-resistant MODE3.

2. Incorrect connection to the Antenna Divider WD-850

Diagram shows a typical mistake



■ About the 50 mW output of transmitters

<Main purposes of 50 mW operations >

・To expand the service area when using the system outdoors

Long-distance transmission for Golf coverage, etc.

・To counter RF interference and noise

Secures a higher D/U ratio that prevents the effects of noise and interference signals from LED ornaments, etc.

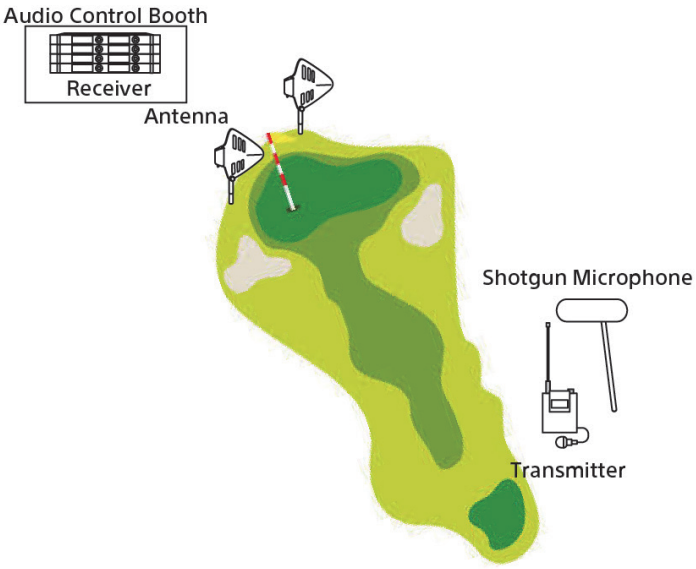
・To counter the drop of RF level due to the body effect or other obstructions

Improves the low RF level of transmitters used in adverse transmission conditions

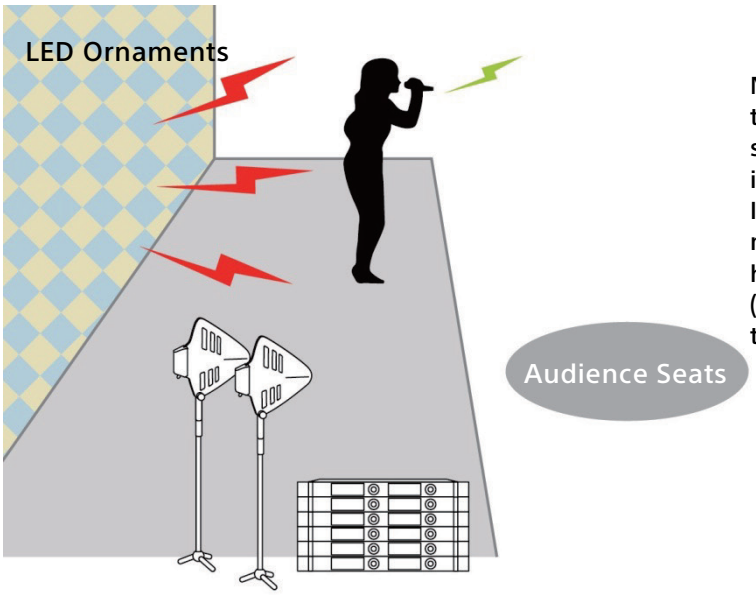
<Typical examples of 50 mW operation >

・Golf coverage

The use of 50 mW output is effective when the transmitters are far from the reception antennas and a large service area needs to be secured such as for golf coverage.



・To improve the D/U ratio against noise from LED ornaments

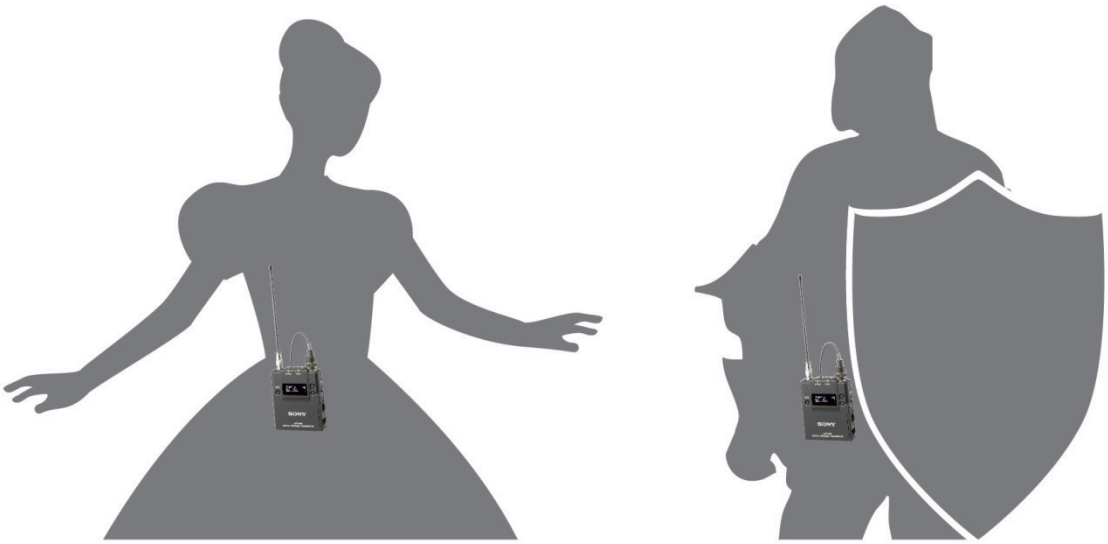


Noise from LED ornaments can cause transmission errors (drop of QL), resulting in sound quality degradation, instantaneous interruptions, and audio noise.
In such cases, setting the wireless microphone output to 50 mW allows a higher D/U ratio to be obtained.
(Especially useful for bodypack transmitters.)

・Measure against RF level drop caused by the body effect or clothing that does not pass signal waves well.

Drop of RF level can occur easier when wearing the bodypack transmitter under armor or sequined clothing due to the shield effect.

In such cases, the use of 50 mW output may make up for the drop of RF level.



It is also effective to attach the unit so the antenna comes outside the clothing

<Tradeoffs of 50 mW operation>

Since the transmission power is stronger:

- ・Bringing the transmitter near the reception antennas may cause distortion due to excessive input to the receiver.
- ・The level at the carrier's side lobes will also increase and may have a larger effect on adjacent channels as RF interference.
- ・Bringing transmitters close together will more easily result in third-order intermodulation.
- ・Battery life will shorten.

* 50 mW is not recommended for simultaneous multi-channel operation. However, if no other choice is available, give utmost care during operation.

<Caution upon using 50 mW operation>

- ・To prevent the RF amplifiers from saturating, do not bring transmitters near the reception antennas.
- ・To prevent third-order intermodulation between transmitters, do not bring transmitters close together.
  (Keep transmitters at least 50 centimeters apart)
- ・Try to avoid operating multiple handheld microphones (more than one channel) in 50 mW.
  (Handheld microphones are less susceptible to the body effect and maintain a high RF level, which can result in excessive RF input to the receiver or more third-order intermodulation between transmitters.)
- ・In simultaneous multi-channel operation, 50 mW operation should be used only when the bodypack is attached to the body. Keep the transmitter-to-transmitter distance and transmitter-to-antenna distance the same as when using 10 mW output on handheld microphones.
- ・When using the handheld microphone on 50 mW output only for the main vocals, make sure to check that there is no third-order intermodulation with the other transmitters.

■ **Mixer bag application**

・The conversation is wirelessly sent to the receiver connected to the mixer and the ambient sound is captured using a wired shotgun microphone.

・The audio from the wireless receiver and shotgun microphone are adjusted in the mixer.

・The adjusted audio is sent from the transmitter connected to the mixer to the slot-in receiver in the camcorder.

・The camcorder records the audio together with the video.

■ Using the DWR-S02DN with a camcorder

When combined with an XDCAM camcorder, the following functions are available.

- The camcorder synchronizes the audio latency - inherent in digital transmission - with the video latency so there are no delays in their recordings.
- The RF levels of the wireless transmission and sound condition can be monitored in the viewfinder.
- Using the Cross Remote function, various parameters of the transmitter can be remotely controlled from the camcorder.

<Menus that the camcorder can control>

Item	Sub-item setting	Selections	Description
WRR Setting	WRR Valid CH Sel	All/CH1	Selects whether to make both channels (CH1 and CH2) of the wireless receiver valid or make only one channel valid (CH1).
	WRR CH Select	TX1/TX2	Selects which reception channel's information should be displayed in the menu. TX1: Information on channel 1 is displayed TX2: Information on channel 2 is displayed.
	WRR Delay Comp	On/Off	Selects whether to activate (On) or deactivate (Off) the latency compensation function for the wireless audio input. (When On is selected, the E-to-E output of all audio signals delays about 8 ms.)
	TX	---	Displays the name of the transmitter communicating on the receiver channel selected in WRR CH SELECT.
	TX Audio Peak	---/Peak	Displays whether the AF level has exceeded the peak level on the transmitter communicating on the receiver channel selected in WRR CH SELECT.
	TX Input Level	---/Mic/Line	Displays whether Mic or Line level is selected for the audio input of the transmitter communicating on the receiver channel selected in WRR CH SELECT.
	TX ATT Level	---	Sets the ATT level of the transmitter communicating on the receiver channel selected in WRR CH SELECT. (The adjustment range may differ according to the type of transmitter.)
	TX LCF Frequency	---	Sets the frequency of the low cut filter of the transmitter communicating on the receiver channel selected in WRR CH SELECT. (The adjustment range may differ according to the type of transmitter.)
	TX System Delay	Auto/0.0ms～8.0ms	Sets the audio latency Auto: Automatically adjusts the latency of the audio sent from the wireless receiver so it is "0". 0.0 ms to 8.0 ms: When multiple wireless systems are configured with audio mixers and other equipment, the latency can be adjusted in accordance with the total latency of the wireless systems.

< Setting up a wireless microphone from a camcorder >

Displaying the menu of the wireless receiver

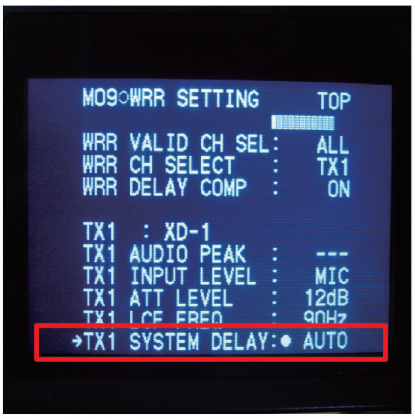
TOP MENU
↓
「MAINTENANCE」
↓
09.WRR SETTING

Changing the attenuator level of the transmitter

TOP MENU
↓
「MAINTENANCE」
↓
09.WRR SETTING
↓
TX ATT LEVEL

Setting the system delay

TOP MENU
↓
「MAINTENANCE」
↓
09.WRR SETTING
↓
TX SYSTEM DELAY



*By selecting AUTO, the delay timing between video and audio is automatically adjusted. (No audio delay)

Network System

By configuring a network around the digital wireless receivers DWR-R02DN, DWR-R02D, and DWR-R01D, you can use the Wireless Studio PC control software to monitor and control your digital wireless system. In addition, by use of an off-the-shelf Wi-Fi router, the Wireless Studio Mobile software, which is available as an Android or iOS application, can be run on smartphones and tablet PCs, for simplified monitoring and control of the digital wireless system.

1 Features of the Wireless Studio (from Ver. 4.4x or later)

Device monitoring function

The software includes a Status Viewer for monitoring the operation statuses of the receivers, RMU-01 Remote Control Units, and transmitters. The status viewer allows you to monitor a list of information that is identical to the information that appears on the initial display of the receiver. The Simple Status Viewer is also available for efficient monitoring of transmitter operation statuses. The Simple Status Viewer narrows down the information displayed for each receiver channel to a certain few items, such as the RF meter, QL meter, and alerts to provide an expanded view of parameters.

Channel plan coordination function

You can coordinate a channel plan that is suitable for your signal environment to ensure stable operations. The Channel Plan Adviser allows you to coordinate a channel plan while taking into account factors such as other TV broadcast waves (that you researched beforehand), frequencies used by other wireless devices in the area, and frequencies detected via the channel scan.

Error logging function

The software automatically saves log files of problems that occur during operation. You can examine the error history at a later time by viewing the saved log files on a text editor.

Device control function

The software allows you to control the receivers and the transmitters that are paired with the receivers. Control operations are performed from the Property window and the Property List tab. The Property window allows you to control a single receiver and its paired transmitter while viewing their operation statuses. The Property List tab allows you to display the settings of multiple receivers and transmitters in a list, and perform fast control operations such as applying the same settings to all the devices simultaneously.

Recalling stored settings and monitoring information

Information such as the setting values of devices and the arrangement of devices in the status viewer can be saved as a file. You can recall such information to the Wireless Studio at a later time by loading these stored files. The setting values recalled in Wireless Studio can be applied to all the devices.

Pairing-assist function

The software includes a pairing wizard to assist in pairing, an operation that is necessary to enable remote control of transmitters via wireless remote control.

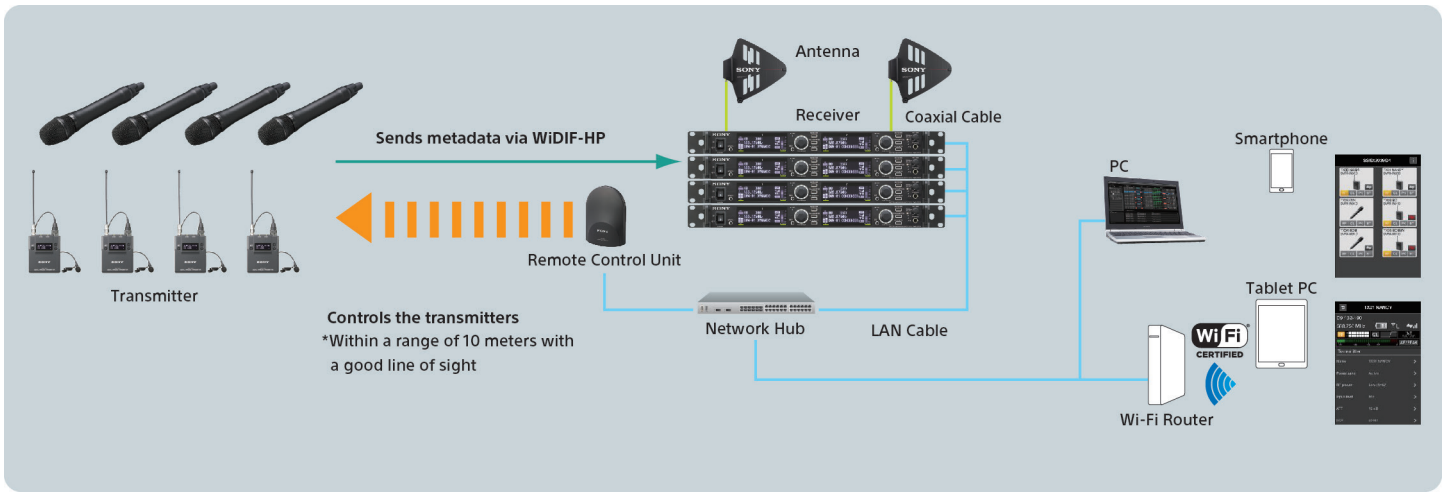
Save and analyze functions for signal environment timelines

The RF Chart Grapher function allows you to monitor and save the signal environment and alert information on a timeline, and the RF Chart Analyzer function allows you to reference the files saved with the RF Chart Grapher. The files can also be saved automatically at intervals set by the operator.

Save and analyze functions for all frequency band signal environments

The Spectrum Analyzer function allows you to use the receivers to perform scanning. The scanning results are displayed as a graph, allowing you to visually confirm the existence of RF interference on the frequency bands. The scanning results can be saved as a file which can be used when comparing scanning results.

2 System Configuration



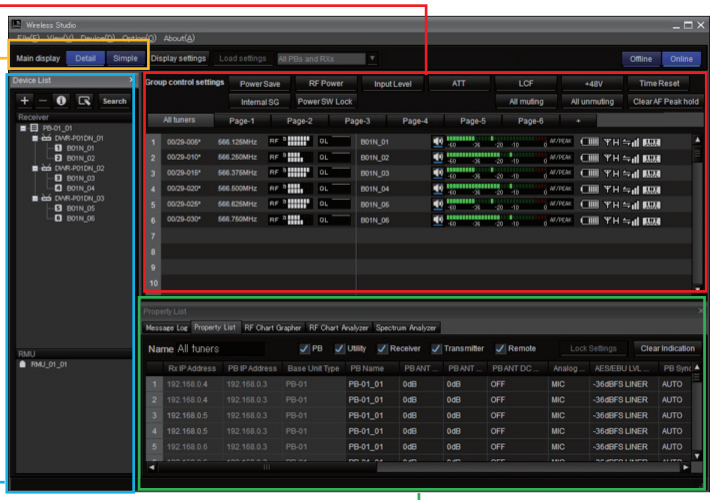
3 Overview of the Wireless Studio (from Ver. 4.4 or later)

Status Viewer

Monitors the status of each channel. The Page function can be used to group specific transmitters and change their settings together as a group.

Switching between Detail and Simple views

Selecting “Detail” displays the Status Viewer in the Main Window, allowing the status of each channel to be monitored in detail. Selecting “Simple” displays the Simple Status Viewer in which you can narrow down the number of parameters shown for each channel for simplified monitoring. The display area for each channel can also be changed.



Device List window

Displays the connection status of each receiver, transmitter, and RMU-01.

Sub Window

This window comprises the Message Log tab, Property List tab, RF Chart Grapher tab, RF Chart Analyzer tab, Spectrum Analyzer tab, and Simple Status Viewer tab. Double-clicking on a tab makes the window float on the screen for repositioning. Double-clicking on the window bar returns the window to its original tab.

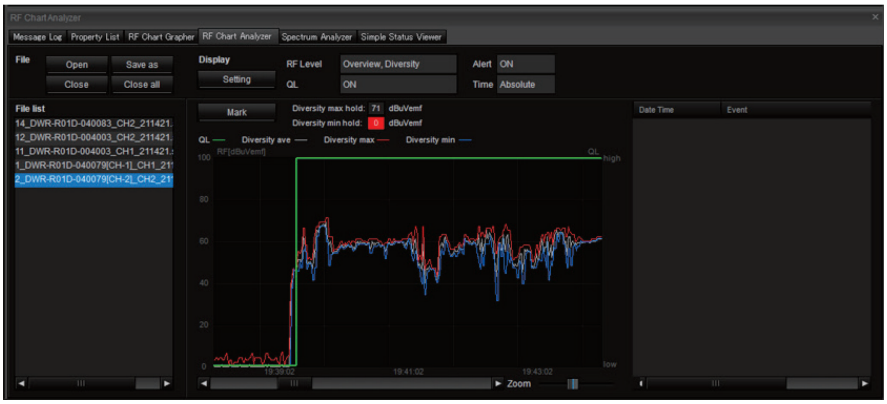
Property List tab

Displays a list of the settings made for each receiver channel shown in the Status Viewer. When you change the page displayed in the Status Viewer, the display of the Property List tab will change in association to show the receiver channel settings of that page. You can change setting values in the Property List tab by selecting the cells. By selecting multiple cells, you can change the settings of multiple receiver channels as a group.

RF Chart Grapher tab*

Records information on the signal environment and any alerts that occurred during operation. A Mark function is available for adding memos within the graph of the RF Chart Grapher.

This allows operators to determine the cause-and-effect relationship between the signal environment and specific alerts.



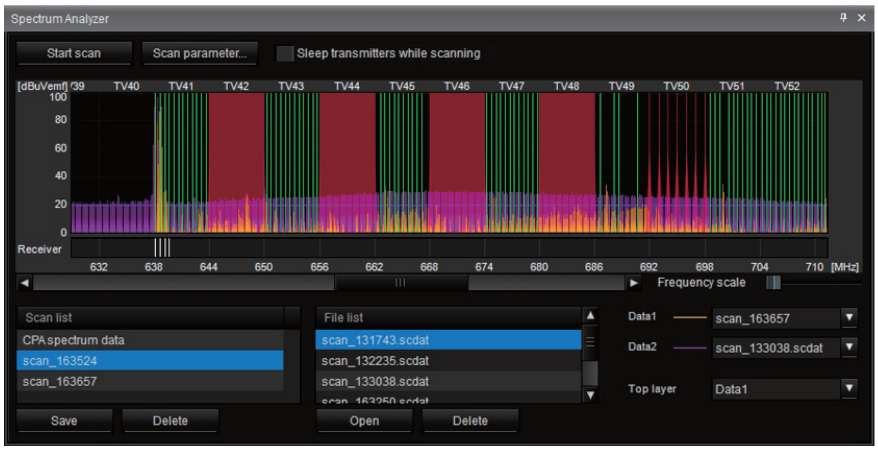
RF Chart Analyzer tab*

Allows operators to view the information in the files recorded using the RF Chart Grapher and analyze the results of monitoring the signal environment.

* In the Setting screen, you can change the display for the RF level.
  - To check the RF interference in the environment, select “Detail” and “Individual max” and then check the RF level of each receiver channel.
  - To check that the transmitter RF levels are strong enough when examining the service area, select “Overview” and then check the diversity minimum level.
  - To check that the RF signals received by the antennas are not too strong, select “Overview” and then check the diversity maximum level.

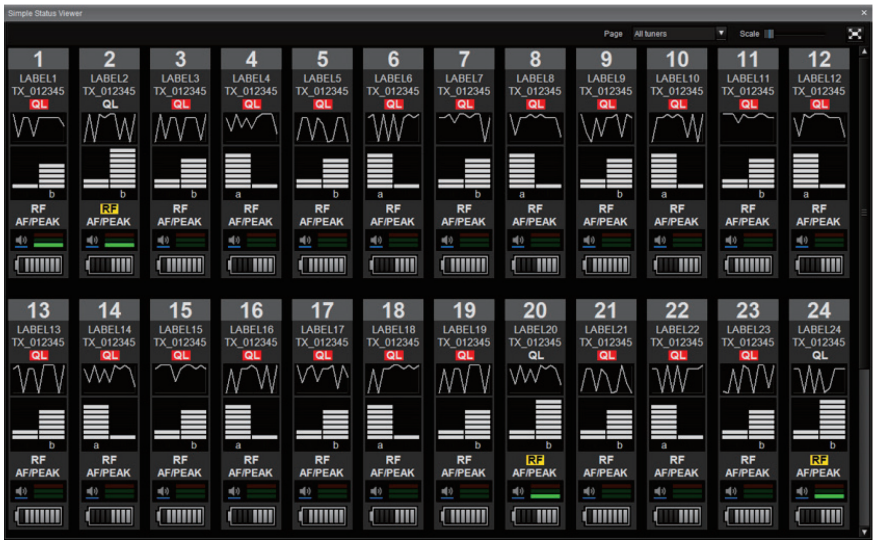
Spectrum Analyzer tab

Using channel 1 of the receiver, you can perform a spectrum scan for a specified frequency band. This allows you to visually confirm the existence of interference on the frequency bands in use. In addition, if you have configured the optimal groups and channels using the Channel Plan Adviser, the Channel Plan Adviser settings will be applied to the Spectrum Analyzer. This allows you to visually confirm the existence of interference on the groups and channels recommended by Channel Plan Adviser.



Simple Status Viewer tab

Allows you to monitor the status of each channel with only the information you need displayed. The size to display channels can be selected in three steps. The channels displayed here are the same as those shown in each Page of the Status Viewer.



4 For convenient channel coordination: The Channel Plan Adviser

Open the Channel Plan Adviser by selecting "Device > Channel Plan Adviser".

Basic mode: This mode allows you to coordinate a channel plan that avoids RF interference detected by the digital wireless receiver's channel scan function.

Advanced mode: In addition to performing channel scan as with the Basic mode, this mode allows you to coordinate a channel plan that takes into account frequencies used by known TV broadcasts or other wireless devices.

The channel plan created will be assigned to the receivers. The channel settings will also be sent to and assigned to transmitters that have been paired with receivers.

*For details on operating the Wireless Studio, see the Operation Manual.

5 Caution upon using the Wireless Studio

・Setting the IP addresses of the receivers

Select "UTILITY menu > NETWORK > IP ADDRESS" and make the following settings.

IP Address: 192.168.0.* (For the value of "*", set a number that is unique within the network.)

Subnet Mask: 255.255.255.0

(After setting the IP address, make sure to power the receiver Off and then On again.)

・Setting the IP addresses of the PCs

Select "Local area connection properties > Internet Protocol Version 4 (TCP/IPv4)" and make the following settings.

IP Address: 192.168.0.* (For the value of "*", set a number that is unique within the network.)

Subnet Mask: 255.255.255.0

DHCP is not supported.

・Setting the IP addresses of RMU-01s

Using the RMU-01 Setting Tool, set the IP addresses as follows:

IP Address: 192.168.0.* (For the value of "*", set a number that is unique within the network.)

Subnet Mask: 255.255.255.0

For details on using the RMU-01 Setting Tool, see the Operation Manual.

・Up to six PCs can be connected within one network.

・System requirements

Item	Requirements
OS	Windows Vista (SP2 or later), Windows 7 (32bit/64bit), Windows 8 (32bit/64bit), Windows 10 (32bit/64bit)
CPU/RAM	The recommended specifications depend on the number of digital wireless receivers connected.
Graphic card	128 MB or more video memory is recommended
Free hard drive space	1 GB or more
Monitor	1024 x 768 dots or more is recommended
Other	English display support 100Base-TX LAN card CD-ROM drive

・Recommended specifications

The following are the recommended specifications for the PC, based on the number of digital wireless receivers connected and the number of displays used.

Refer to these when preparing the PC to be used.

< When using one display >

	CPU	RAM
When up to 24 digital wireless receivers are connected	Celeron 2.20 GHz or higher	2 GB or more
When up to 32 digital wireless receivers are connected	Pentium Dual-Core CPU 2.60 GHz or higher	2 GB or more
When up to 41 digital wireless receivers are connected	Core i5 2.50 GHz or higher	4 GB or more

< When using two displays >

	CPU	RAM
When up to 24 digital wireless receivers are connected	Pentium Dual-Core CPU 2.60 GHz or higher	2 GB or more
When up to 32 digital wireless receivers are connected	Core i5 2.50 GHz or higher	4 GB or more

6 Features of the Wireless Studio Mobile control software for Android or iOS

Regardless of whether or not PCs are connected, Sony digital wireless systems (DWX series) connected to a network can be monitored and controlled from mobile devices such as smartphones and tablet PCs via off-the-shelf Wi-Fi routers.

Device monitoring function

The software offers a screen with icons to simultaneously check the RF level, QL level, AF peak, battery status, and pairing status of multiple channels, and detailed screens, which allow you to check the statuses and parameters of each transmitter and receiver in full-screen.

Device control function

You can change the transmitter's name, power save status, RF transmission power, input level, attenuator setting, low-cut filter setting, built-in signal generator, and power switch lock setting; and the receiver's name, analog audio output level, antenna attenuator setting, antenna DC power supply status, sync signal, and delay adjust. To avoid inadvertent operations, the software also offers a "Read-only mode" which inhibits the control of functions.

Remote operation for checking the service area and audio level

The Wireless Studio Mobile is convenient for checking the audio level at the stage or audience seats while confirming the RF level or QL level on a mobile device. It also allows remote operation of various transmitter and receiver settings.

7 Connecting the Wireless Studio Mobile

1. Connect a Wi-Fi router to the network of the digital wireless receivers.
2. Make the wireless settings for connecting your smartphone or tablet PC to the Wi-Fi router.

   (To protect the security of your system, be cautious when sharing the network key of the Wi-Fi router.)
3. Run the Wireless Studio Mobile application.
4. The software will automatically detect the receivers on the network, and display the receivers and transmitters on the screen.

8 Caution upon using the Wireless Studio Mobile

Supported models: DWR-R02DN, DWR-R02D, DWR-R01D, PB-01+DWR-P01DN

The recommended number of receivers and transmitters is limited to 16 units and 32 units, respectively. Note that this may change depending on the Wi-Fi signal condition.

In the default settings, the Read-only mode is Off.

When using a Custom Channel Plan, the correct Group, Channel, and Frequencies are not displayed.

Set the IP address of the Wi-Fi router as follows. Refer to the Operation Manual of your Wi-Fi router to make these settings.

IP Address: 192.168.0.* (For the value of "*", set a number that is unique within the network.)

Subnet Mask: 255.255.255.0

Connect the LAN cable to the Wi-Fi router's LAN port. Do not use the WAN port since it will not work for this system.

Supported OS: Android Ver. 4.1.x or later, iOS 8.0 or later

The Wireless Studio Mobile application can be downloaded from Google Play or iTunes free-of-charge.

This application does not guarantee operation on all smartphones or tablet PCs.

Supplementary Information

General Terminology

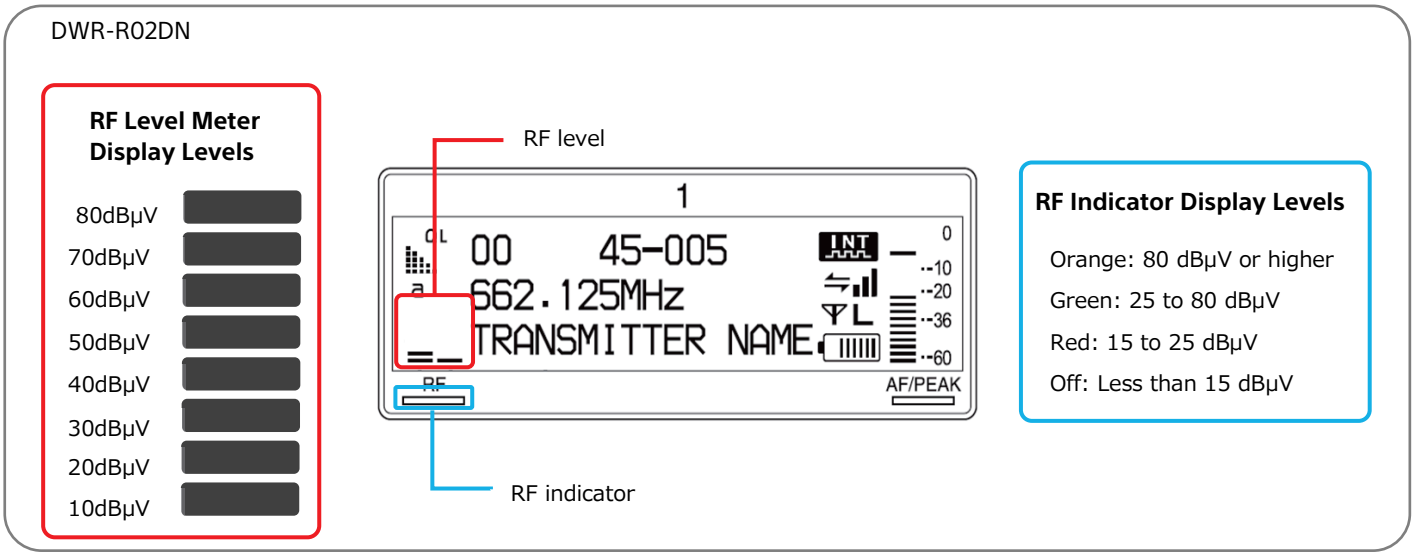
1. Field strength

The strength of the RF signal.

In the context of wireless microphone operations, this term has the same meaning as “reception level” or “RF level”.

*RF = Radio Frequency = radio wave

In the following illustration, dBµV indications refer to dBµVemf.



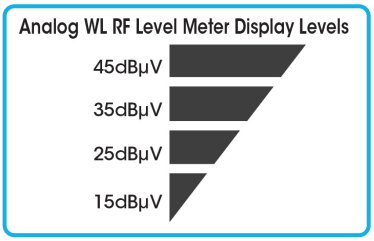
* The level when the RF level meter reaches its maximum indication is different for Sony analog wireless and Sony digital wireless systems.

Digital WL:
80 dBµV at maximum indication

Analog WL:
45 dBµV at maximum indication

The maximum indication on analog WL is only half that of digital WL.

(The RF level may be misinterpreted as being too low.)



2. Service area

The area where the wireless microphones are operated or the area where the signals from the wireless microphones are properly received.

3. Dropouts

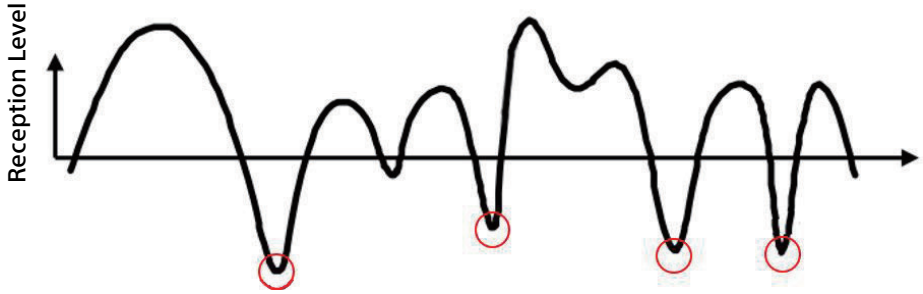
The condition in which the RF signal level drops (field strength drops)

4. Dropout points

Areas where the RF signal level drops (field strength drops)

Such areas are seen when the RF signals from the transmitters and RF signals bouncing off walls or other structural objects establish a specific relationship (Rayleigh fading) that causes the signal levels to drop.

Since this involves the wavelength of the transmitted signal, the position of dropout points may change according to the frequency band used.



5. Third-order intermodulation

The occurrence of unwanted radio waves due to distortion in the amplifier as a result of interference between radio waves.

6. Channel plan

The selection of wireless transmission channels (frequencies) that do not cause intermodulation.

7. CODEC modes

The DWX offers three types of audio codec modes.

MODE1	This mode offers compatibility with the first generation of DWX series
MODE2*	This mode offers low audio latency. (The audio latency is 1.5 msec at the analog output of the DWR-R02DN) Compared to MODE1, the sound quality is also enhanced. It is recommended for systems set up in normal environments.
MODE3*	This mode is optimized for stable signal transmission. It incorporates an additional process to suppress noise or audio interruptions caused by unexpected RF interference, thereby securing the reliability of the transmission.

*These modes are not supported in the first-generation DWX series (DWR-R01D, DWR-R02D, DWR-S01D, DWR-S02D, DWT-B01, DWM-01, DWM-02).

<Audio latency of each mode>

	Audio Latency at Analog Outputs (msec)*			**Audio Latency at Digital Outputs (msec)***		
CODEC mode	MODE 1	MODE 2	MODE 3	MODE 1	MODE 2	MODE 3
DWR-R02DN	3.4	1.5	4.0	3.4	2.5	4.9
DWR-S02DN** + Adaptor	3.6	2.7	5.1	3.4	2.5	4.9

* The total latency between the transmitter and the receiver's audio outputs

** When the DWR-S02DN, DWR-S02D, or DWR-S01D is mounted in an XDCAM receiver slot, the camcorder will adjust the video and audio so there are no delays in their recordings.

8. D/U ratio

D stands for Desired Signal whereas U stands for Undesired Signal (interference signals, noise).

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