B&W PRODUCTIONS · CREW TRAINING · MODULE 19

Wireless RF and In-Ear Monitors

A wireless mic is a tiny radio station on a person. When it drops out during a speech, the whole room hears it. Nearly every dropout comes from one of five causes, and all five are in your control. This module covers how wireless works, picking clean frequencies, antennas, batteries, fitting mics on people, in-ear monitors and the walk test.

B&W Productions · Proper Planning, Prevents Poor Performance



01 How wireless works



The cable is replaced by a radio link. Each transmitter needs its own frequency and its own receiver channel.

TRANSMITTER

Handheld (mic and transmitter in one) or bodypack (belt pack with a headset or lapel plugged in).

RECEIVER

Tuned to the same frequency. Its meters show RF (radio strength) and AF (audio level).

ONE FREQUENCY EACH

Two transmitters on one frequency cancel each other. Two receivers on one transmitter is fine.

THE BAND

Most professional systems here work in the UHF TV band, 470 to 694 MHz. The 700 and 800 MHz bands now belong to cellular networks. Old kit tuned there must not be used.

2.4 GHZ SYSTEMS

Small digital systems share the air with Wi-Fi. They struggle in a room full of phones. Keep them for small, short-range jobs.

LATENCY

Digital wireless adds a few milliseconds of delay. It matters when stacking it with in-ears. Check the manual.

> **FIELD RULE**
> One transmitter, one frequency, one receiver channel. Label all three with the same number.

02 Scan first, then coordinate

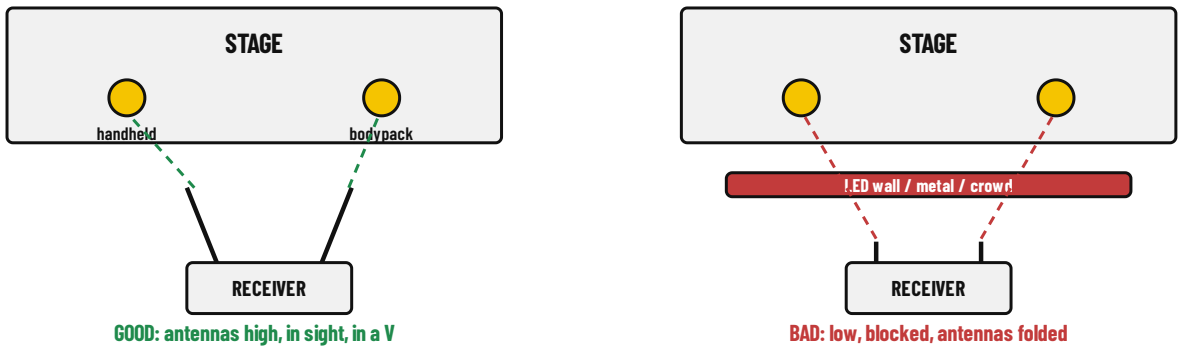
The air in every venue is different. TV transmitters, the band next door, the venue's own wireless and other suppliers all use the same space. You find the gaps on site, on the day.

1. **Transmitters off.** Switch all your own transmitters off before scanning.
2. **Scan** with the receiver's scan function. It finds the quietest frequencies in the room.
3. **Use one group.** Pick all your channels from the same group or use the system's own coordination. Frequencies inside a group are chosen so they do not interfere with each other.
4. **Sync** each transmitter to its receiver (infrared sync or the menu).
5. **Label** mic, transmitter and receiver channel with the same number.
6. **All on together.** Switch every transmitter on at once and watch every receiver. A problem often only shows when all are live.
7. **Ask the neighbours.** If another supplier or the venue runs wireless, swap frequency lists.

> **TAKE CARE**
> Never type in frequencies by hand that "look far apart". Several transmitters together create extra signals between them. The group presets are designed to avoid this.

> **FIELD RULE**
> Scan with yours off. Check with all of yours on.

03 Antennas and line of sight



Radio wants a clear path. Antennas go high, where they can see the transmitters. People, metal and LED walls block and add noise.

- **Line of sight.** If the antenna cannot see the mic, expect dropouts. Bodies block radio. A full room is worse than an empty one.
- **High.** Antennas above head height, on a stand at the side of the stage or at front of house.
- **V shape.** Two whip antennas at about 90 degrees to each other. Diversity receivers pick the better one moment by moment.
- **Out of the rack.** A receiver buried in a metal rack with its antennas inside is nearly deaf. Use front-mount kits or remote antennas.
- **Directional (paddle) antennas** point at the stage. Use them for long distances and busy rooms.
- **Short, proper antenna cable.** Long thin cable loses signal. Use the low-loss cable the maker lists.
- **Away from noise:** LED walls, video processors, Wi-Fi routers, switch-mode power supplies. At least a couple of metres.
- **Not too close either.** A transmitter touching the receiver antenna overloads it.

FIELD RULE

Put the antenna where you would stand to watch the speaker.

04 Batteries and the change plan

Low battery is the most common cause of a dead mic, and the easiest to prevent.

TRY IT: BATTERY CHANGE PLAN

Take the battery life from the transmitter's manual for the battery type you use.

- **Fresh for every show.** New alkalines or fully charged rechargeables, in every transmitter, every time.
- **Good brand alkalines** or the maker's own rechargeable pack. Cheap cells sag early and the meter lies.
- **Do not mix** old and new, or two brands, in one transmitter.
- **Change at a break**, not when the meter shows one bar.
- **Used batteries go in the used box**, never back in the fresh box (Module 14).
- **Spare transmitter** on, muted, at the side of the stage, on a tested frequency.

FIELD RULE

A battery costs a few rand. A dead mic in the CEO's speech costs the client.

05 Fitting headsets, lapels and packs



Capsule at the corner of the mouth, about a finger away, out of the breath.

HEADSET

Capsule at the corner of the mouth, a finger width from the skin, not in front of the lips. Adjust the boom, not the head. Loudest and most reliable choice for presenters.

LAPEL

Centre of the chest, about a hand span below the chin. Not under a jacket, a scarf or a lanyard. Quieter than a headset and feeds back sooner.

HANDHELD

Held close, pointed at the mouth, hand below the grille. Tell the speaker: "Hold it like an ice cream."

THE PACK

On the belt or waistband at the back. Antenna hanging free, not folded or coiled, not against bare sweaty skin. A small loop of cable taped as strain relief.



Ask first, explain what you are doing, antenna free, cable looped.

- **Ask before you touch.** "May I clip this to your belt?" Offer to let them thread the cable themselves.
- **Set the transmitter gain** with the person speaking at show level. The AF meter should peak near the top without hitting the red.
- **Lock the pack** so buttons cannot be pressed in a pocket.
- **Mute at the desk**, not on the pack. Tell speakers the pack stays on.
- **Remind them** the mic is live in the toilet and in the passage.

> **FIELD RULE**
> Fit the mic early, on the real person, in the real clothes.

06 Dropouts: five causes, five fixes

YOU SEE OR HEAR	MOST LIKELY	FIX
RF meter falls when the person turns or walks away	Distance or body blocking the path	Move antennas higher and closer, use paddle antennas
Clicks and swishes with good RF on only one channel	Interference on that frequency	Rescan, move that channel, re-sync
Problems only when all mics are on	Frequencies clashing with each other	Use one group or the system coordination, re-sync all
Signal fades over the evening	Battery	Change it. Follow the change plan.
Crackle when the person moves	Cable or connector at the pack, or a loose capsule	Swap the headset or lapel, check the plug is locked
Noise near the screen or the video desk	LED wall or processor noise	Move antennas away, rescan

Read the receiver before you touch anything. RF meter low means a radio problem. RF meter full but audio bad means a mic, cable or gain problem.

> **FIELD RULE**
> RF meter first. It tells you which half of the system to look at.

07 In-ear monitors



A good seal gives clear sound at a lower, safer level.

In-ear monitors (IEMs) are the wireless link in reverse. The transmitter is in the rack. The performer wears the receiver and hears their mix in earphones instead of a wedge speaker.

- **Separate the bands.** IEM transmitters are strong. Keep their frequencies and their antennas well away from the mic receivers' antennas.
- **Start low.** Volume at zero when the earphones go in, then bring it up. A loud pop into a sealed ear does real damage.
- **Limiter on.** Most packs have one. Leave it on.
- **The seal matters.** The right size tip gives bass and blocks stage noise. A poor seal makes people turn up.
- **Both ears in.** One ear out and the other turned up is how hearing gets damaged.
- **Add ambience.** A mic pointed at the audience, fed quietly into the mix, stops the performer feeling cut off.
- **"More me" first.** Each performer mostly wants their own voice or instrument, then the rest underneath.
- **Hygiene.** Earphones are personal. Wipe shared ones with the right wipes and change the tips.

> **STOP**
> Never unplug or power-cycle anything in an in-ear chain while performers are wearing them. Tell them, wait for ears out, then do it.

FIELD RULE

Ears in at zero. Bring it up slowly. Limiter on.

08 The walk test

The last check before doors. One person walks, one person watches the receivers.

1 ☐ **ALL TRANSMITTERS ON, ALL AT ONCE**
The way they will be in the show, including in-ears and the spare.

2 ☐ **WALK EVERY POSITION**
Lectern, stage edges, the aisle, the awards table, backstage. Talk the whole way.

3 ☐ **WATCH THE RF METERS**
Note any spot where a meter dips or a channel clicks.

4 ☐ **TURN YOUR BACK**
Stand with your body between the pack and the antennas at the far point.

5 ☐ **FIX AND REPEAT**
Move antennas or change frequency, then walk it again.

6 ☐ **FRESH BATTERIES IN**
After the test, before doors.

7 ☐ **FREQUENCIES WRITTEN DOWN**
On the patch sheet, with the mic numbers and who wears what.

8 ☐ **SPARE READY**
On, muted, labelled, at the side of the stage.

FIELD RULE
Walk it with every mic on. An empty-room test with one mic proves nothing.

09 Check what you learnt

Ten questions. Circle one answer for each. The answer key is on the last page. Pass mark: 8 out of 10.

1. Two transmitters are set to the same frequency. What happens?

- ○ **A** Both work, louder
- ○ **B** They interfere and cancel each other
- ○ **C** The receiver picks the best
- ○ **D** Nothing

2. What do you do before scanning for frequencies?

- ○ **A** Switch all your transmitters on
- ○ **B** Switch all your transmitters off
- ○ **C** Turn the speakers up
- ○ **D** Unplug the receiver

3. Why pick all channels from one group?

- ○ **A** It looks neat
- ○ **B** Frequencies in a group are chosen not to interfere with each other
- ○ **C** Groups are louder
- ○ **D** It saves batteries

4. **Where do receiver antennas go?**

- ○ **A** Inside the rack
- ○ **B** On the floor behind the LED wall
- ○ **C** High, with a clear view of the stage
- ○ **D** Next to the Wi-Fi router

5. **Which band must not be used for wireless mics any more?**

- ○ **A** 470 to 694 MHz
- ○ **B** The 700 and 800 MHz bands
- ○ **C** Anything UHF
- ○ **D** None

6. **When do you change transmitter batteries?**

- ○ **A** When the mic dies
- ○ **B** At one bar
- ○ **C** At a planned break, before they run low
- ○ **D** Next week

7. **Where does a headset capsule sit?**

- ○ **A** In front of the lips
- ○ **B** At the corner of the mouth, about a finger away
- ○ **C** On the cheekbone
- ○ **D** Under the chin

8. **RF meter is full but the audio crackles when the speaker moves. Where do you look?**

- ○ **A** Antennas
- ○ **B** The mic, its cable and the plug at the pack
- ○ **C** The frequency
- ○ **D** The amplifier

9. **How do in-ears go in?**

- ○ **A** At show volume
- ○ **B** With the volume at zero, then brought up
- ○ **C** One ear only
- ○ **D** With the limiter off

10. **What makes a walk test valid?**

- ○ **A** One mic, empty room
- ○ **B** Every transmitter on, every position walked
- ○ **C** Standing next to the receiver
- ○ **D** Doing it after doors

Answer key

1. **B**. One transmitter per frequency. Two on one frequency interfere.
2. **B**. Scan with your own transmitters off so the receiver sees the room, not you.
3. **B**. Group presets are coordinated so the channels do not clash.
4. **C**. High and in line of sight, away from metal and noise sources.
5. **B**. The 700 and 800 MHz bands now belong to cellular networks.
6. **C**. Fresh for every show and changed at a planned break.
7. **B**. Corner of the mouth, a finger width away, out of the breath.
8. **B**. Good RF with bad audio points to the mic, cable or connector.
9. **B**. Start at zero, bring it up slowly, limiter on, both ears in.
10. **B**. All transmitters on together, walking every position, watching the meters.

Photos: scene photographs are AI-generated illustrations and do not show B&W Productions equipment or events. This module is crew training, not a substitute for the manufacturer's manual, the venue's rules or the event safety officer's instructions.