TRUE MOBILITY®
WIRELESS SYSTEMS

Sabine 2.4 GHz Smart Spectrum™ Wireless Systems

Operating Guide

(Beta 02.10.22)

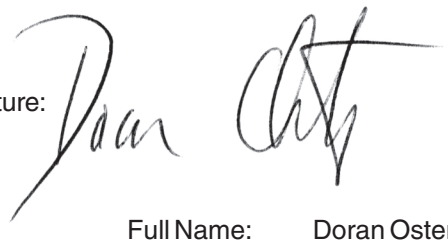
DECLARATION OF CONFORMITY

Application of Council Directive: 73/23/EEC and 89/336/EEC

Standards to which conformity is declared:
EN 60065: 1993
EN 60742: 1995
EN 55103-1: 1997
EN 55022: 08:94 + a1:05:05
EN 55103-2: 1997

Manufacturer's Name:	Sabine, Inc.
Manufacturer's Address:	13301 NW US Highway 441 Alachua, FL 32615 USA
Type of Equipment:	Wireless Microphone Systems
Model No.:	SWM7000
Serial No.:	
Year of Manufacture:	2002

I, the undersigned, hereby declare that the equipment specified above conforms to the above Directive and Standard.

Place: Alachua, Florida, USA Signature: 

Date: October 31, 2002 Full Name: Doran Oster, Sabine President

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1. INTRODUCTION

Congratulations on purchasing a Sabine 2.4 GHz Smart Spectrum True Mobility™ Wireless System. True Mobility™ Wireless Systems give you all the built-in processing you need on every microphone, and offer unique and powerful features unavailable with any other wireless microphone

1.1. Section Contents

Section 1 **Introduction** — explains the use of this operating guide and the features found on Sabine 2.4 GHz Smart Spectrum systems. Describes common problems with wireless microphone operation, and the unique solutions offered by the SWM7000 series. Concludes with a brief description of 2.4 GHz Smart Spectrum operation.

Section 2 **Product Views** — illustrates system components (front & back panel views, transmitters, accessory lists and part numbers).

Section 3 **Quick Setup** — gives the Quick Setup procedures for Receiver & Transmitter Operation and using the FBX Feedback Exterminator®. Note that there is also a quick-start label on top of your True Mobility receiver for the Sabine FBX Feedback Exterminator®, Compressor/Limiter and De-Esser functions.

Section 4 **Transmitter Operation** — details transmitter setup and operation.

Section 5 **Receiver Operation** — details receiver installation and setup.

Section 6 **Mic SuperModeling™** — explains the use of the Sabine Mic SuperModeling™ and lists the microphones modeled.

Section 7 **FBX Feedback Exterminator®** — explains how to set up your FBX filters.

Section 8 **Compressor/Limiter** — explains the use of the Compressor.

Section 9 **De-Esser** — details operation of the True Mobility's De-Esser.

Section 10 **Program Save & Recall** — explains how to save and recall individual program settings.

Section 11 **Multiple Systems** — how multiple systems interface, computer control of multiple systems, suggestions for maximum number of collocated systems.

Section 12 **Antenna Distribution Amplfiers & Extension Antennas** — how to get maximum performance using a Sabine Antenna Distribution Amplifier and Extension Antennas.

Section 13 **Sabine Remote Control Software** — how to control up to 70 units from one PC.

Section 14 **Feedback Control Theory** — explains the how and why of Sabine's FBX technology and FBX filter setup.

Section 15 **Tips & Troubleshooting** — gives tips on how to get the best performance from your Sabine Wireless, and describes some possible operating problems and their solutions.

Section 16 **Appendices** — has wiring diagrams, frequency charts, speficications, typical system diagrams and dip switch settings for Sabine 2.4 GHz Wireless systems.

Section 17 **Cautions & Warranties** — states caution and warranty information for your True Mobility™ Wireless system.

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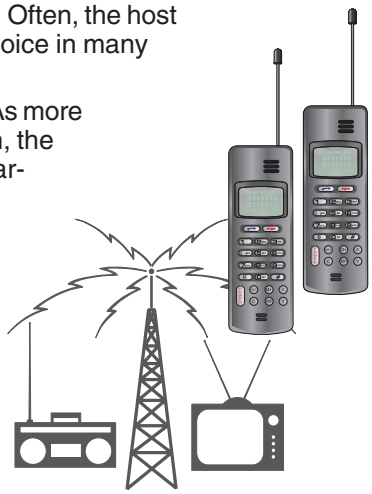
1.2. Wireless Microphones

1.2.1. The Challenge

One of the more subtle technological revolutions of the last 30 years has been the development of wireless communication. The airwaves of the world are alive with invisible signals — radio and television broadcast, mobile telephones, satellite communication, wireless local area computer networks, garage door openers, baby monitors, radio-controlled toy cars and airplanes, and so on. In the world of professional audio, the use of wireless microphones has become extremely common, owing in large part to the attraction of the dream of freedom from the limitations of cables. Unfortunately, this dream comes at a price, paid with the diminished performance and reliability of wireless microphones. Often, the host of problems with wireless usage renders wired microphones the first choice in many situations. Here are some of the challenging problems:



1. **Available Spectrum.** The radio frequency spectrum is a finite thing. As more and more technology uses some form of RF transmission/reception, the spectrum has become increasingly crowded, particularly in those areas where the hardware required to use the spectrum is affordable and easy to manufacture. Wireless microphones have long suffered as a "secondary service," relegated to a meager share of the spectrum, and forced to work in the frequencies left in the wake of airwave gluttons like television and radio broadcasts. How do we solve this problem of diminished space and the resulting by-product of interference?
2. **Transmission and reception are not 100% reliable**. Dropouts and interference from other radio signals can interrupt the audio signal and/or impair its fidelity. Interference can come from a variety of radio sources, from on-site transmitters (including other wireless microphone systems) to off-site high-power broadcasts such as television (including the new digital television frequency bands).
3. **Battery failure**. Because wireless transmitters require batteries to operate, wireless users live in fear of battery failure. Battery failure is catastrophic — the audio signal completely disappears — and is difficult to predict. Consequently, many wireless users resort to frequent battery replacement, often at the beginning of each use, a solution both expensive (at some point battery purchases can exceed the cost of the wireless unit itself) and environmentally damaging (toxic waste from battery acid).
4. **Increased feedback potential of wireless microphones**. A very important problem arises from the very nature of the extra freedom gained by use of a wireless. Unleash performers from cable microphones and they will invariably put themselves — and their microphones — into dangerous "feedback zones." A stationary, wired microphone has only one set of fixed conditions that might create feedback, whereas a moving microphone offers an infinite number of possible disastrous mic-to-speaker location combinations.
4. **Governmental regulations.** The freedom promised by wireless microphones may also be severely compromised by governmental regulation — legal UHF and VHF frequencies vary from country to country. You might even need a license to legally operate UHF and VHF wireless microphones, or may find your "legal status" changing as you move from one country to another, or even within the same country.
6. **Wireless microphone fidelity and frequency response.** A wireless connection is fine for a portable telephone, where poor frequency response is the norm, but may not be ideal for quality live sound or audio recording. For example, most wireless microphones have a significant low-end roll-off.
7. **Proprietary technology and limited interchangeability.** Knowledgeable (or at least opinionated) microphone users often have a "favorite" microphone, and, of course, such opinions are not only strongly held, but completely at odds with other equally strong preferences. Moreover, different microphones are better suited to different applications and vocal sounds. In the case of wired microphones, it's relatively easy to swap a microphone — just plug a new one in. In the case of wireless mics, it's often not possible to change the mic without changing the entire wireless system.

1.2.2. The Solution: Sabine 2.4 GHz Smart Spectrum™ Wireless Systems

Sabine's new 2.4 GHz Smart Spectrum is a ground-breaking new wireless microphone system that addresses these problems. The SWM7000 packs more innovative features into one rack space than any other available system, addressing not just one, but **all** of the problems identified above.

1. **Better reception and reduced interference.** Unlike conventional systems, the SWM7000 Series operates in the 2.4 GHz band. This is well above the spectrum range of high power RF broadcasts like digital television, and thus less susceptible to interference from such sources.

Up till now, wireless microphones manufacturers have sought their "clear space" niche at increasingly higher frequencies, starting in the low VHF range (below 100 MHz), moving up to higher frequency VHF (100-300 MHz), and ultimately settling at "Ultra High Frequency" (UHF) ranges as high as 900+ MHz. Now, this UHF frequency band is being encroached upon by the proliferation of digital television (DTV) broadcasts.

The SWM7000 series operates at an even higher frequency range. The 2.4 GHz band (actually covering frequencies from 2.4 GHz to 2.4835 GHz) has been reserved by international agreement for worldwide license-free operation of low power, short range wireless devices, including wireless microphones. Aside from avoiding the interference of high power RF sources, which are restricted to below 1 GHz, the 2.4 GHz range requires less spectrum space and power to transmit and receive (just as high frequency audio waves require less power and take up less spectrum than bass frequencies). Thus, more users can reliably share the same bandwidth, and an increased number of simultaneous wireless systems can operate in one location. You can have up to 70 simultaneous users on stage, not the usual ten or fifteen. Think of the advantages this offers for large venues, such as large stage productions, sports stadiums, congress halls, conferences rooms or convention centers.

Fig. 1a - SW72-R Dual Channel Receiver & SW70-H Handheld Microphone

2. **The SWM7000 Tireless Wireless™ system solves battery life problems**. Each transmitter comes with a rechargeable NiMH battery, which can be charged by plugging an SWCPOWR charger directly into either the handheld and beltpack transmitters — just like your cell phone. Or you can simply park the handheld microphone in its Sabine microphone clip — the clip contains a built-in charger that will top off the charge, even while the mic is in use. All SWM7000 transmitters and receivers also report battery voltage. The transmitters provide a cumulative run time count for active battery usage, and both receivers and transmitters flash warnings when battery voltage approaches a critical threshold. All of these warnings and indications are designed to help prevent surprise battery death. Finally, the Tireless Wireless™ Charger circuit increases rechargeable battery life by, first, periodically discharging the battery prior to recharge (to prevent elasticity), and second, by preventing overcharging once a battery is fully charged. Together, these innovative features mean Tireless Wireless™ batteries will last for hundreds of recharges, provide reliable performance, and ultimately save the significant expense of repeated single charge battery purchases.
3. **Free signal processing!** Superior RF performance is only the beginning of the SWM7000 story. Every receiver comes with five digital signal processors built in at no extra charge. This processing has been specifically tailored to help you realize the finest fidelity and performance when amplifying voice or instrument. The first of these, Sabine's patented **FBX Feedback Exterminator®** uses transparent, super-narrow filters to provide automatic feedback control, maximum gain, and increased clarity on every mic channel. Furthermore, using the included Sabine software and a computer, FBX filters can be changed into **Parametric filters** and fine tuned to help solve the most demanding acoustic situations. The **Compressor/Limiter** provides useful gain management you can customize for different performers and applications. The adaptive **De-esser** removes unwanted sibilance (esssss sounds), using an algorithm that adapts automatically to match a particular voice.
4. **Mic SuperModeling™**. We could have provided you a kit of detachable, interchangeable capsule assemblies for your handheld transmitter — but at a serious cost to your bank balance. Instead, we've provided you with the functional digital equivalent — a library of virtual microphone capsules you can dial in with the flick of your wrist, at no extra cost. Skeptical purists who raise eyebrows at such digital hocus-pocus will be pleased with the high-quality sound of the SWM7000 series dynamic or condenser handheld mics just the way they are. But if your application calls for another mic "personality," you'll discover that the Mic SuperModeling™ feature is as simple as turning a knob to dial up the sound of many of your favorite microphones. (NOTE: Mic SuperModeling™ works only with handheld systems. The other DSP processing works with all systems.)
5. **Sound quality and fidelity.** OK, so the mic capsule is capable of chameleon behavior and offers excellent quality, but a system is only as strong as its weakest link. Do you want to then take your wonderful microphone and transmit its signal with reduced low frequency response? That's what you get with most of the wireless microphone systems on the market today. It's a different story with Sabine's SWM7000 series, which provides transmission and reception frequency response that is flat from 20 Hz to 20 KHz — ideal for use with both voice and musical instruments. Try one with a guitar interface and a 5-string bass (lowest string is B, down around 30 Hz) for a dramatic demonstration of the improved low end — or hear the benefits with a standard guitar, male vocalist or speaker.

6. **Freedom from governmental regulation.** The 2.4 GHz band has been reserved around the world for low power radio transmission and reception, and does not require governmental licensing. Moreover, because of the nature of Smart Spectrum transmission, our system's power rating falls well below the accepted limits for license-free operation, even in countries with the strictest regulations — at no sacrifice to performance. The SWM7000 microphone system thus offers the ultimate freedom — not only can you roam freely about a stage, conference room, lecture hall, or church, but you can take your system with you and roam to any country in the world, and never worry about buying a license.

Sabine Mic SuperModeling™

SuperModeling™ Dynamic Models*:

- Shure SM-58
- Shure Beta-58A
- Audio-Technica ATM 41a

SuperModeling™ Condenser Models*:

- Shure Beta 87A
- AKG C535 EB
- Audio-Technica ATM 89R

**Company names, product names, and trademarks listed as modeled are the property of their respective owners and are used only to identify evaluated microphones used to develop digital processing; they in no way imply association, endorsement, or approval by any named manufacturer.*

1.2.3. More Benefits & Enhancements

We're not through with the parade of benefits yet. Here are more exciting features that Sabine's SWM7000 offers:

1. **Targeted Input Processing.** Any microphone benefits from processing, and the most useful varieties are included at virtually no extra cost, built right into the receiver. Just as important as this convenience and power is the fact that all this processing power is *totally dedicated to a single microphone*. So you get not only a feedback controller, parametric equalizer, compressor, de-esser, and modeler, but you don't have to share these goodies by diluting them with other mics or channels.
2. **Ergonomic controls and displays** give you quick information and easy control of essential features. Sabine's Tweek 'n' Peek function displays the precise value of every function on the LCD with the touch of any front panel control. Fifteen recallable preset configurations allow you to customize and save your setups. Transmitters also have programmable LCDs and controls, with tamper-protected switches to prevent unauthorized changes. Each receiver has a two-stage lockout to allow complete or programmable disabling of front panel controls.
3. **A whole gamut of peripherals.** Active extension antennas, antenna distribution amplifiers, transmitter battery chargers, and microphone capsule upgrades are available to augment standard single and dual-channel systems. The standard handheld mics are supplied with either an Audix dynamic capsule (OM-3) or a Sabine condenser head. The Audix OM-5 is also available. Lavalier mics are available in cardioid, omni, or miniature omni configurations. Headset mics and instrument systems are also available. In addition, the standard 4-pin mini-XLR connector on the belt pack will allow you to easily connect any lavalier or headset microphones you may already own, or are considering purchasing.
4. **Software control.** All Sabine True Mobility™ systems include the True Mobility™ Remote Software at no extra charge. This software controls one or more Sabine receivers via a serial connection. Software connection allows for control of all front panel features of the receiver, plus offers two additional advantages. First, additional parameter adjustments not available from the front panel can be made from the Remote Software, allowing control of additional compressor (release time and knee) and filter settings (by changing FBX fitlers to adjustable parametric filters). Second, the serial connection allows future receiver firmware updates to be downloaded from Sabine's web site (**www.Sabine.com**) and installed, using Sabine's Upgrade Wizard. This means your receiver operating firmware is effectively "future proof" — every time we make an improvement, you can easily upgrade your receivers, from home, work, or the installation site. (See Section 13 for details on upgrading firmware).
5. **Centralized wireless network control** (ND series)**.** All Sabine True Mobility™ ND-model systems provide an additional powerful application of Sabine's Remote Software. By daisy-chaining receivers (RJ45 connectors using RS485 protocol) from the first receiver connected to your computer, to additional receivers (in series), you gain centralized control of up to 70 RF channels. See Section 13 for details about using this powerful software.
6. **Digital audio outputs** (ND series). All Sabine True Mobility™ ND-model systems provide a digital audio output (in addition to analog), to allow you to maintain a digital signal path when using your wireless microphones with digital mixers or recorders. The back panel of each Sabine ND-series receiver also provides a word-clock input, to assure problem-free digital synchronization with your other digital equipment. Both analog and digital outputs are simultaneously active.

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2. PRODUCT VIEWS

2.1. Receivers

2.1.1. Front panel views

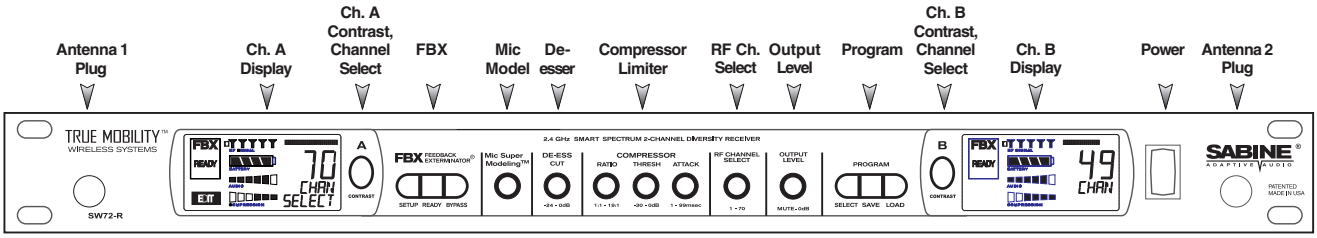


Fig. 2a - SW72-NDR & SW72-R Two-channel Receivers

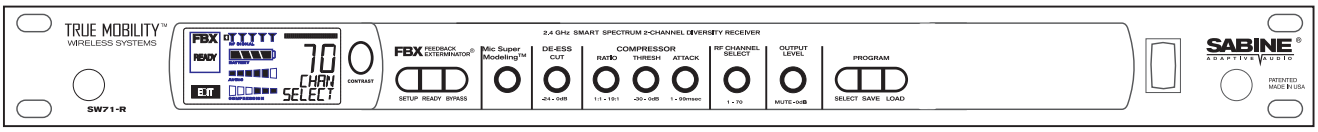


Fig. 2b - SW71-NDR & SW71-R One-channel Receivers

2.1.2. Back panel Views

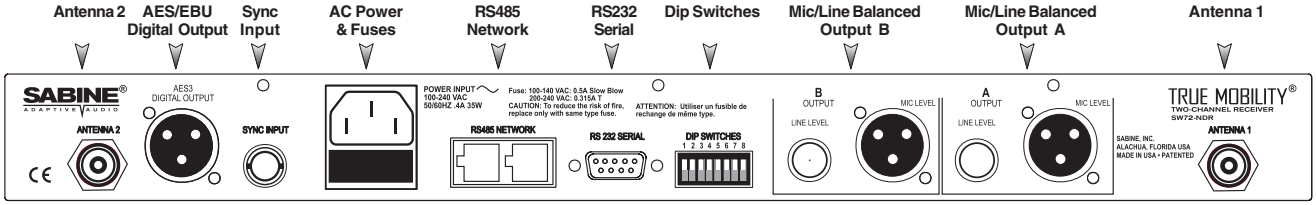


Fig. 2c - SW72-NDR Two-channel Receiver w/Network & Digital Interface

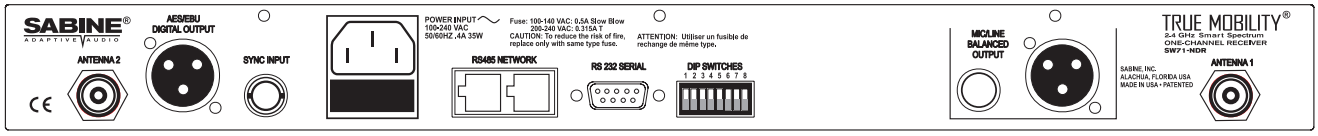


Fig. 2d - SW71-NDR One-channel Receiver w/Network & Digital Interface

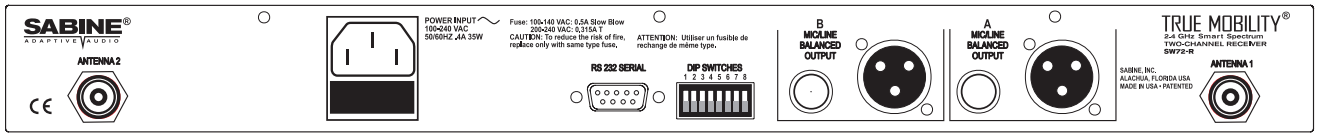


Fig. 2e - SW72-R Two-channel Receiver

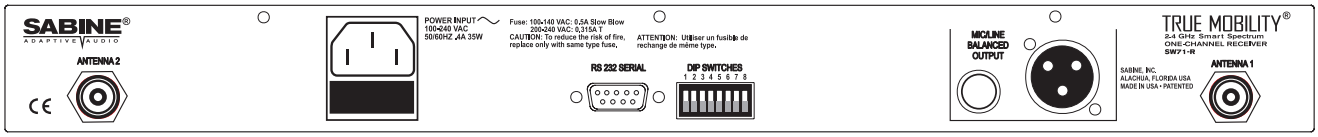
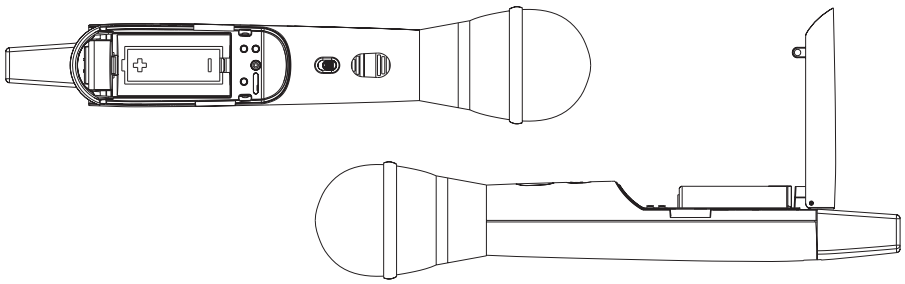


Fig. 2f - SW71-R One-channel Receiver

2.2. Transmitters

2.2.1. Handheld

Fig. 2g - Handheld Transmitters
SW70-HD3
SW70-HD5
SW70-HDC



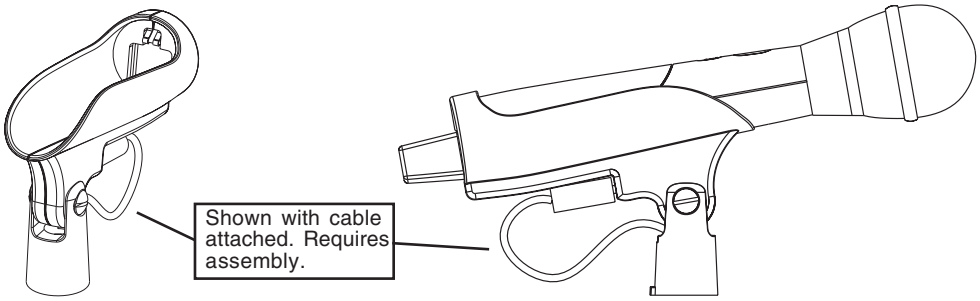


Fig. 2h - SWC70CL - SW70-HD3 & SW70-HD5 Mic Clip with Built-in Charger

2.2.2. Beltpack

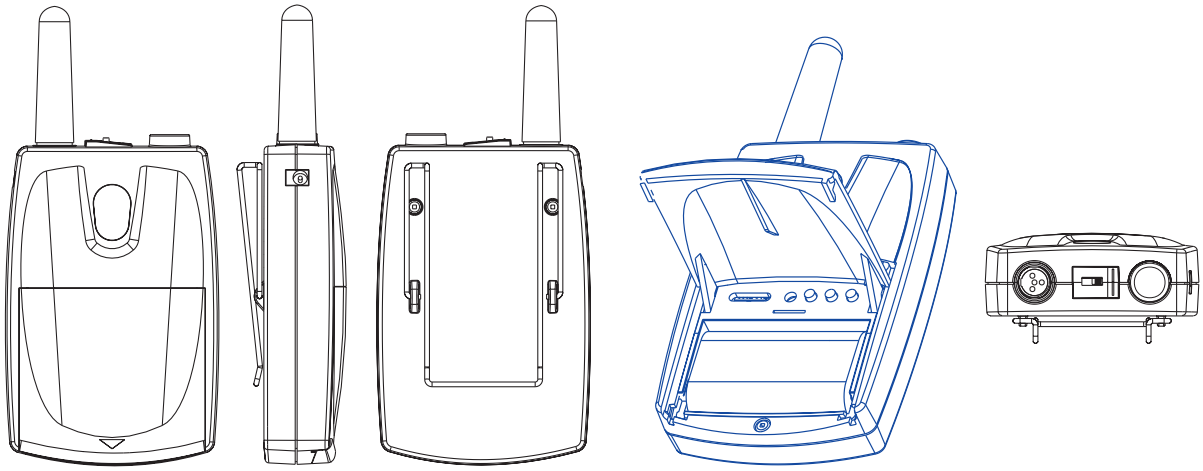


Fig. 2i - **SW70-T** Beltpack Transmitter

2.3. Components

Receivers
SW72-NDR: 2-Ch. Receiver w/Network & Digital Interface
SW71-NDR: 1-Ch. Receiver w/Network & Digital Interface
SW72-R: 2-Ch. Receiver
SW71-R: 1-Ch. Receiver

Microphones
SWT24L-TA4: Cardioid Lavalier Mic
SWT36L-TA4: Omni Lavalier Mic
SWTVT50-TA4: Miniature Omni Lavalier (Voice Technologies)
SWT56W-TA4: Headworn Mic
SWT70G-TA4: Instr. Input w/cable

Transmitters
SW70-T: Beltpack Transmitter
SW70-HD3: Handheld Mic w/Dynamic Element (Audix OM3)
SW70-HD5: Handheld Mic w/Dynamic Element (Audix OM5)
SW70-HC: Handheld Mic w/Condenser Element

Antennas
SWA700: TNC Front to Rear Converter Kit (Set of 2)
SWA6SS: 2.4 GHz S.S. Antenna Distribution Amp for 6 systems
SWASS-EXT: 2.4 GHz S.S. Extension Antenna Kit (Set of 2)

Batteries
SWBC1: Rechargeable NiMH C for SW70-H
SWBAA2: Rechargeable NiMH AA set for SW70-T

Mic & Transmitter Accessories
SWCCLIP-H: SW70-H Mic Holder w/Built-in Charger
SWCCLIP-L: SW56-L Mic Holder
SWCPOWR: Plug-in charger for SW70 Series Transmitters
SWC4P-TA4: Standard Mini-XLR Connector
Wind Screens and Mic Clips available for all mics

READ CAUTION BELOW

⚠ ALKALINE BATTERY CAUTION ⚠ Alkaline batteries must be one of following types:	NEDA: 14A	ANSI: 14A	IEC: LR14

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3. QUICK SETUP

3.1. Receiver & Transmitter

*Please read **Section Four Transmitter Operation** and **Section Five Receiver Operation** for a complete understanding of how to set up your Sabine 2.4GHz Smart Spectrum True Mobility™ Receiver.*

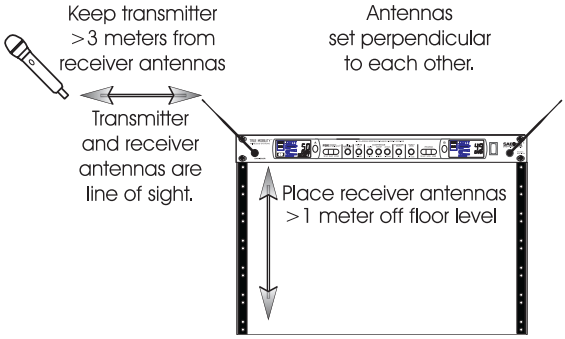

Fig. 3a - Receiver & Antenna placement

Be sure that all transmitters are off.

1. Place the receiver in an open area within visual range of the intended transmitter locations. Note that the range of your transmitters is about100 meters, but that structural objects in the transmission path can reduce that range. For best results, maintain a line-of-sight path between receiver antennas and transmitters. In some instances you may wish to consider using Sabine's SWASS-EXT Extension Antenna Kit (see Section 12).

2. Turn the OUTPUT LEVEL of the 2.4 GHz receiver and mixer gain to the minimum settings.

3. Connect the output (¼-inch or XLR jack) of your 2.4 GHz True Mobility™ receiver to the mic or line input of your mixer or amplifier (the receiver output gain can be adjusted to match the mixer input).

4. Turn on the receiver. Select a channel and check that there is no RF SIGNAL indicated in that channel's display. If RF SIGNAL is indicated before the transmitter is turned on, choose another channel.

5. Turn on the wireless microphone (or transmitter when using a mic plugged into a belt pack). Press the parameter SELECT button until CHANNEL appears in the LED, then use the up or down button until the desired channel appears above CHANNEL. Check that the receiver's RF SIGNAL display now indicates a strong signal.

6. Adjust gain settings.

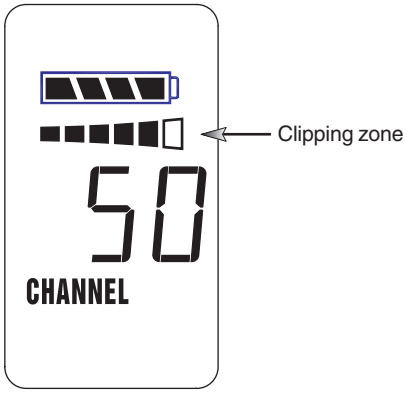

Fig. 3b - Transmitter AUDIO LEVEL setting

   a. Transmitter. While speaking or singing into the microphone, or when using Sabine's beltpack transmitter in conjunction with an instrument, adjust the transmitter PAD, **if necessary**, until the transmitter AUDIO LEVEL display extends to, but does not include the 6th (last) LED bar when source signals reach their loudest levels (see Fig. 3b). Inputs beyond that point will cause clipping. Remember that performance levels often exceed sound check, so err on the side of greater headroom.

   b. Receiver. Adjust the receiver OUTPUT LEVEL to supply a strong input level to the mixer (or, in some cases, directly to the amplifier or active loudspeaker). If your receiver output is connected to a microphone level input on the mixer, keep the receiver output gain lower than when connecting to a line level mixer input.

   c. Mixer. Adjust the output gain of the mixer so that the mixer output meters approach clipping when all the inputs to the mixer are active, and the audio program reaches its peak level.

   d. Amplifier/active loudspeaker/crossover. Finally, adjust the amplifier gain control (and/or crossover gain, if one is used) to provide the desired level of sound pressure in the auditorium or listening area.

3.2. FBX Quick Setup

1. After setting up and verifying your signal path by following steps 1-6 above, place microphones and loudspeakers in the exact locations where they will be used. Make sure your receiver and transmitter are turned on. For now, keep the gain of the mixer or amplifier turned down.
2. With the microphone located in the primary area of use, press and hold the **SETUP button** (Fig. 3d) on the receiver until the LCD **SETUP indicator** (Fig. 3e) flashes 4 times and then stops flashing — then release it. **IMPORTANT:** ***Do not use the microphone for performance in this mode****. Do not talk or make sound into the microphone until the setup is complete. If you do, the FBX section may set incorrect filters.*
3. Slowly raise the gain on the mixer or amp until FBX eliminates the first few feedback tones. With each new feedback frequency, you will hear a short, quiet burst of feedback that will disappear immediately as a filter is set.
4. Pause raising the gain, and move the microphone to another area where it will be used. Resume slowly raising the mixer gain, until FBX eliminates a few more feedback tones.
5. Repeat step 4 until the **SETUP indicator** automatically turns off and the **READY indicator** comes on (Fig. 3f). When choosing microphone setup locations, try to anticipate likely areas where the microphone will be positioned or moved to, or areas that may be especially prone to feedback problems (e.g., under an overhead speaker).

3.2.1. Quitting Setup

You may quit **SETUP** mode at any time prior to its automatic exit by simply pressing the **READY** button (Fig. 3d). This will also enable ready-to-operate status, but with fewer fixed FBX filters in place. In the default factory setting, dynamic FBX filters will still be held in reserve to catch and eliminate new feedback, regardless of how or when SETUP mode is exited. NOTE: If you wish to enable unset fixed filters and/or allow the fixed filters to set deeper, press the READY button a second time. (See Section 14.4.2 for details on the differences between fixed and dynamic FBX filters and Section 14.4.2.3 for instructions on changing the balance of fixed versus dynamic FBX filters.)

3.2.2. FBX Bypass

The **BYPASS button** (Fig. 3d) bypasses only the FBX filters, and not the additional signal processing (de-essing, compression and Mic SuperModeling™) available on the Sabine 2.4 GHz Smart Spectrum True Mobility™ Wireless Receiver. This is a useful button that allows comparison of the sound quality when FBX filters are in place, to the sound with no filters (the quality should be very similar). Before pressing BYPASS, take care to reduce your overall system gain so that you do not release suppressed feedback!

Strong RF input signal
(at least 3 bars)

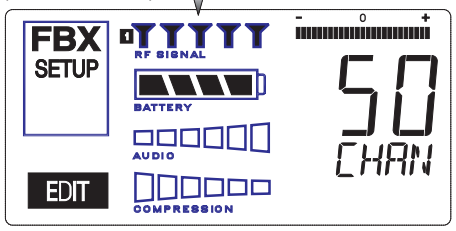

Fig. 3c - Receiver Display for SETUP

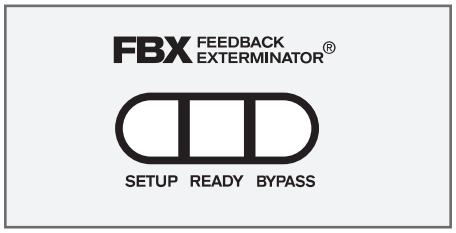

Fig. 3d - FBX: SETUP, READY & BYPASS

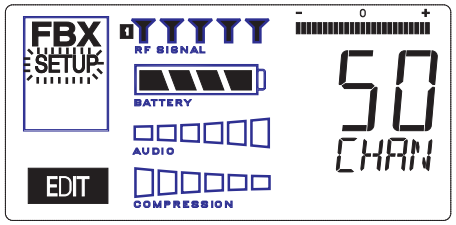

Fig. 3e - SETUP indicator flashing

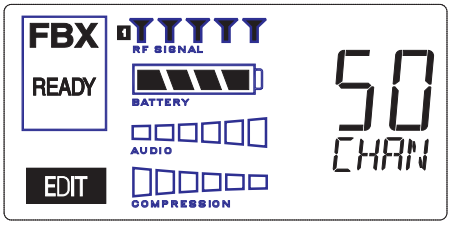

Fig. 3f - READY indicator

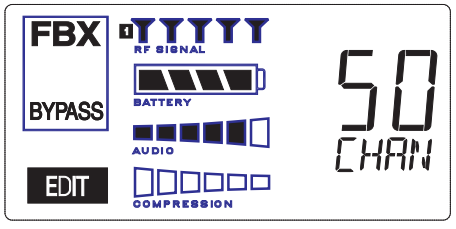

Fig. 3g - BYPASS indicator

⚠ FBX BYPASS CAUTION ⚠

Bypassing FBX filters may allow suppressed feedback to be released!

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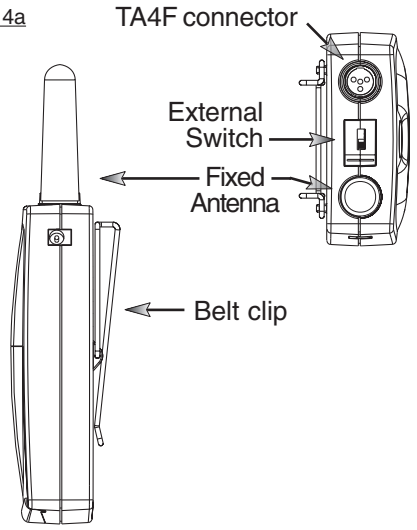
Fig. 4a



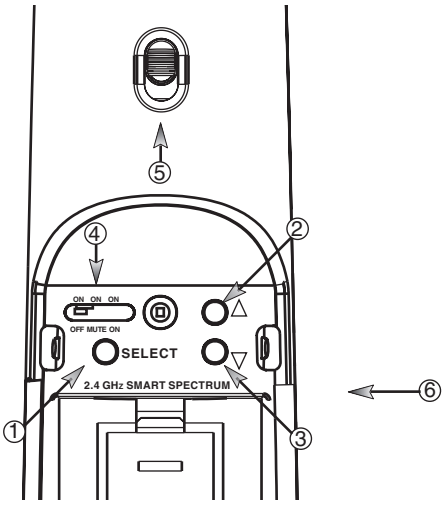


Fig. 4b SW70H Handheld Control Setting Buttons

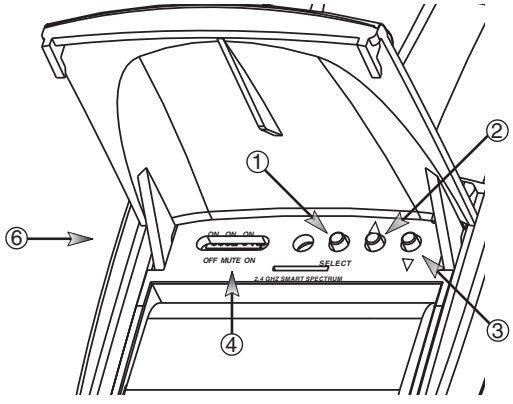


Fig. 4c SW70T Transmitter Control Setting Buttons

1. Parameter Select Button
2. Up Button
3. Down Button
4. Programmable Control of External Switch
5. External Switch
6. Recessed control and battery compartments

4. TRANSMITTER OPERATION

4.1. First step

Before you begin, let's look at a few basics regarding your transmitters. The handheld mic is ready to go — the microphone and transmitter are combined in one unit. To use the belt pack transmitter, however, you will have to connect a lavalier or headworn microphone (or instrument pick up) to its input. Sabine lavalier and headworn mics, and Sabine's guitar/instrument connector (SW70G-TA4) come equipped with the proper TA4F connector, and are ready to plug right in. Be sure to line up the pins properly — do not force the connector into the belt pack.

If you are using a different microphone with the Sabine belt pack, please refer to the **Appendix A** for the required wiring plan. Failure to use the proper wiring scheme may damage your mic or the belt pack, and void your warranty.

Use the clip on the back of the belt pack transmitter to attach it to your belt or clothing. The spring clip can be removed and reversed, to allow the transmitter and antenna to point either up or down in its clipped-on position. You can also remove the clip if you choose to keep the transmitter in your pocket. NOTE: it is essential that transmitters retain a line-of-sight relationship with the receiver antennas.

4.2. Displays and Settings

Your Sabine 2.4 GHz Smart Spectrum handheld microphone and belt pack transmitter have many powerful features, all of which are easily monitored (using the transmitter LCD display) and adjusted. The controls and displays for both handheld and belt pack transmitters are identical in function, though positioning differs (compare figures 4b & 4c). The LCD display and one control switch are located on the exterior of the transmitters. A more powerful set of recessed controls is located under the hinged access panel, to prevent accidental or inappropriate alteration of settings.

4.2.1. LCD Display

When the transmitter is first turned on, it shows an initial test screen (Fig. 4f), followed by the default screen (Fig. 4g). The LCD also reverts to this default display within a few seconds after any programming changes are made with the recessed controls. The default LCD display always shows transmission channel, audio level, and battery voltage level; additional information will appear to indicate important changes caused either by user adjustments, or automatically as transmitter status changes.

4.2.2. Accessing Transmitter Controls

Control of all your transmitter functions is made using the **Select** button and the **Up/Down** buttons. These control buttons are located inside the access compartment on the beltpack or handheld transmitters.

Opening the Beltpack Transmitter Access Compartment:

1. Press down firmly with thumb on door handle (above Sabine logo) and slide away from LCD.
2. Lift bottom edge of door slightly and continue pulling door down away from LCD until the door opens fully (90-degree angle from transmitter body).

Closing the Beltpack Transmitter Access Compartment:

1. Swing door down, flush with transmitter body.
2. With thumb pressing firmly on door handle (above Sabine logo), slide door up toward LCD until door lip catches under main body of transmitter, and bottom of door is flush with bottom of transmitter body.

Opening the Handheld Transmitter Access Compartment:

1. Grip door handles with thumb and index finger and lift up.

Opening the Handheld Transmitter Access Compartment:

1. Fold door closed until flush and locked in place.

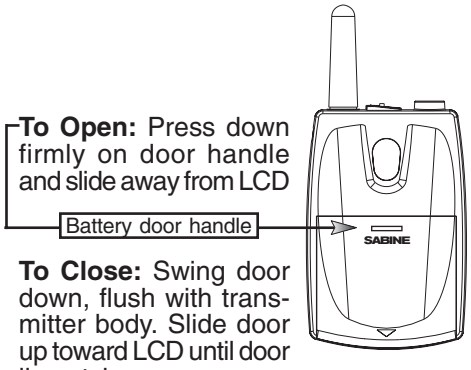


Fig. 4d: SW70-T

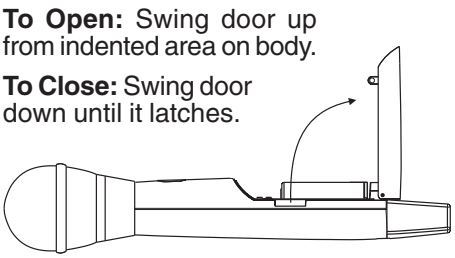
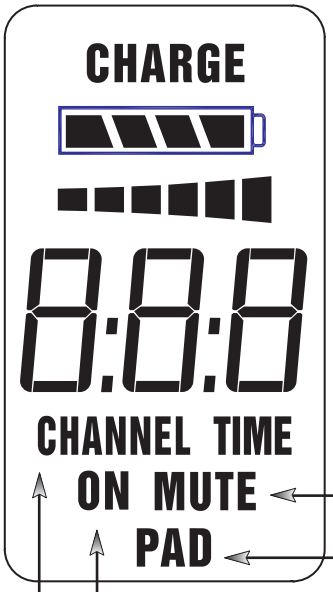


Fig. 4e: SW70-H

Transmitter LCD Display Indicators



CHARGE: Illuminates when the transmitter battery is being charged (i.e., when the charger is connected, either by direct plug-in or by placing the handheld mic in the Sabine charging clip).

BATTERY VOLTAGE LEVEL METER: Indicates measured battery voltage; the more segments illuminated, the higher the voltage, and the greater the remaining battery life.

AUDIO LEVEL METER: Shows the audio output level of the transmitter (affected by the pad setting).

PARAMETER VALUE: In default mode this indicates the RF TRANSMISSION CHANNEL chosen for the transmitter. In conjunction with the Parameter Select button (see figures 4b & 4c), this field will also display battery run-time hours, or when a low frequency roll-off filter or an attenuation (pad) is active (see Fig. 4g).

"**TIME**": Displays when battery run-time hours are being displayed.

"**MUTE**": Indicates output is currently muted.

"**PAD**": Illuminates when the microphone pad is turned on.

"**ON**": Illuminates when either the audio and RF transmission, or the RF transmission only, are turned on.

"**CHANNEL**": Illuminates in default mode to display transmission channel.

Fig. 4f: Start up Transmitter LCD display

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Transmitter LCD Display Cycle - pressing the Parameter Select button cycles the LCD through the following screens. Individual screens appear for approximately 4 seconds, during which the function is editable.

Default Screen → Channel Select → PAD Select → Low Cut → Battery Run-Time Display

Fig. 4g

4.2.3. Adjusting Transmitter Settings

DEFAULT/CHANNEL: Press the Select button to enter Edit Mode, and repeat until the CHANNEL indicator flashes. In this mode, the Up/Down buttons will adjust Transmission Channel (1-70 available).

PAD: Microphone pad setting. Press the Select button until the PAD indicator flashes. The Up/Down buttons will adjust attenuation (0, 10, 20, or 25 dB). When any level of attenuation is programmed, the default screen will illuminate PAD.

TIME: Battery Run-Time Hours. Selecting this option changes the display to indicate the length of power-on time (hours and minutes) since the last battery change or recharge.

NOTE: battery run-time hours will reset when the battery is removed and replaced with the same or a different battery, or the transmitter (with battery in place) is connected to a charger. In the case of the charger, run-time hours will not start again until the charger is disconnected.

LOW FREQUENCY ROLL-OFF: Selecting this option adds a 12 dB/octave low frequency roll-off filter, starting at 75 Hz, to the audio output of the transmitter. A roll-off filter may help reduce microphone handling noise, or other unwanted low frequency content. Pressing the Up or Down button toggles between the conditions of no filter (indicated in the display as L 0) or low roll-off (indicated by L 75).

INTERNAL CONTROL OF EXTERNAL SWITCH: The recessed controls include a 3-position switch, which in turn determines how the transmitter's external two-position switch behaves (see figures 4a, 4b & 4h). From left-to-right, the 3 positions of the internal switch correspond to the following external switch operations:

1. **ON/OFF**. In internal position #1, the external switch acts as a typical on/off switch. Use this setting if you trust the microphone user to switch the microphone on and off as needed, and/or wish to conserve transmitter battery life during down times. In the ON position the transmitter LCD will display ON. Both audio and RF are on. In the OFF position the LCD ON is no longer illuminated. Both RF and audio are off, and the battery run-time hours meter is off. Note that Sabine's squelch system prevents any "popping" when switching the transmitter on and off. However, this protection causes a very short "power-on" delay in the reactivation of the audio when the external switch is turned from OFF to ON.

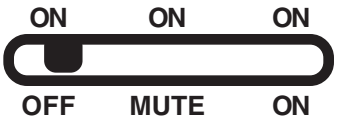


Fig. 4h - Programmable Control of External Switch

2. **ON/MUTE.** In internal position #2, the external switch acts as a typical mute switch. Use this setting if you trust the microphone user to switch the microphone audio output on and off as needed; it will not conserve battery life in MUTE condition, but will allow the receiver to monitor and display the RF signal strength in either switch position. In the on position the default LCD will display ON. Both audio and RF are on. In the off position the word MUTE is displayed in the LCD. The audio is muted but the transmitter is still transmitting the RF signal, and the battery run-time meter is running. There are no audible pops when switching the transmitter between MUTE and ON. Switching from MUTE to ON will instantaneously pass audio signal (there will be NO delay as with internal position #1).
3. **ON/ON.** In internal position #3, the external switch is disabled. The transmitter (both RF and audio) is always on, and the word ON is always displayed in the transmitter LCD screen. Use this setting if you do not want to allow the speaker or performer to turn off the transmitter, or are worried that a transmitter may be accidentally turned off. Caution: When your program is over we suggest you move this switch to another setting so you can turn off the transmitter and save your battery. You may also elect to remove the battery (though replacing the same one will restart the run-time meter and affect its accuracy accordingly).

Once you have completed the transmitter setup, you are ready to work with your receiver (see Section 5). First, however, let's talk about the issues and solutions concerning the source of transmitter power: the battery.

4.2.4 Transmitter Battery Management

4.2.4.1. Battery problems and Sabine solutions

Recharable Battery memory. Batteries that are repeatedly recharged prior to a complete discharge may fail more quickly in subsequent uses. This problem is usually referred to as "battery memory." Fortunately, Sabine's innovative Tireless Wireless™ Charger takes steps to avoid this problem, by automatically reconditioning the battery whenever its intelligent diagnostics determine this is appropriate. **For this process to work best, we recommend that each charger be paired with a specific transmitter for a "monogamous" charging relationship.** If you have multiple pairing options — i.e., multiple channel systems, we recommend color- or number-coded charger/transmitter pairs. With these precautions, use of Sabine's Tireless Wireless™ Charger will insure maximum life per battery charge, and also prolong the useful multiple-charge life span of rechargeable batteries.

Tech Tip

Transmitter/Charger Pairing

For best results, pair each charger with a specific transmitter for a "monogamous" charging relationship.

Rechargeable battery life. This leads nicely to the next concern of the rechargeable battery skeptic: the fact that a fully recharged battery does not last as long as an alkaline disposable battery. Let's first consider what types of batteries might be used to power Sabine's wireless transmitters. Both handheld and belt pack transmitters can work with disposable alkaline, disposable heavy-duty (manganese dioxide-carbon zinc), or rechargeable Nickel Metal Hydride (NiMH) batteries. We specifically caution against using NiCad rechargeables due to well-known battery memory problems, and specifically recommend using Sabine's well-tested SWBC1 (C-cell for the handheld microphone) or SWBAA2 (double-A for the belt pack) batteries. With

Important Battery Information
Acceptible Batteries for use with Transmitters
- Sabine NiMH Rechargable **Handheld: SWBC1 or Beltpack: SWBAA2** - Alkaline - Heavy Duty
Alkaline batteries must be one of following types:
NEDA: 14A ANSI: 14A IEC: LR14

Sabine's rechargeable SWBC1, the typical recharge life of the handheld transmitter battery is 8 hours! If that's not long enough, you can get 15 hours life from an alkaline C-cell. For the beltpack rechargeable SWBAA2 batteries, the results are still impressive — about 10 hours per recharge, and 18 hours from a pair of alkaline AAs. Heavy-duty batteries will fall somewhere in the middle, between rechargeables and alkalines.

Sabine's rechargeable revolution. Here are two more good reasons why you can feel more confident about using rechargeable batteries, as part of Sabine's rechargeable revolution:

1. All transmitters report two types of battery status information. The first report is the all-important voltage the battery is supplying. Second, you'll know how long the battery has been in use (battery run time hours). Each receiver channel also receives telemetry information from its associated transmitter, regarding the battery voltage, and displays the information in the receiver LCD (see figure 5b). When the voltage reaches a level indicating an estimated 30 remaining minutes of useful battery life, both transmitter and receiver automatically flash warnings in their LCD displays. As an alternative means of anticipating battery depletion, you can check the number of hours of use, by checking the transmitter LCD display (see Section 4.2.2 and figure 4g), or the Remote Control Software.
2. The handheld microphone clip that we provide with each handheld transmitter not only holds the microphone — it also can double as an unobtrusive charger housing. Anytime the mic is parked in the clip (and the clip is connected to the charger power supply), the mic is being charged. As an additional safety margin against battery failure, the mic placed in the powered clip gets its power from the charger, not the battery, so it will work perfectly even if the battery is completely dead.

Still more battery solutions. At this point, you might think that we are running out of battery problems to solve. Not quite — we've thought of four more.

First, Sabine's intelligent charger circuitry detects the type of battery in place within the battery compartment, and automatically turns off the charger if the battery is not compatible with the charger.

Second, the Tireless Wireless™ Charger detects when a battery is fully charged, and turns off the charging cycle.

Third, the Tireless Wireless™ Charger prevents futile attempts to resuscitate dead batteries — if the battery is unresponsive, the charging cycle is stopped.

Fourth, we've greatly simplified the process of changing batteries, down to the point where you don't even need to. That's because you can recharge both belt pack and handheld batteries without removing them from the transmitters. Just connect charger plug to the transmitter jack — no muss, no fuss (see figure 4h). Aside from the convenience, minimizing battery removals and replacements saves wear and tear on the contact points, a definite practical advantage.

In the "most discharged" battery condition, a full recharge may take up to 10 hours for a handheld C-cell, or 3 hours for the AA batteries used with the belt pack transmitter. When in doubt, charge the batteries overnight. Sabine's battery-protection circuit will shut the charger down when charging is completed.

4.2.4.2. Charging Your Batteries

Equipment Connections. Each SW70T or SW70H transmitter comes equipped with an SWC-POWR Tireless Wireless™ plug-in charger (see figure 4g). In addition, each SW70H comes with its own battery-charging mic clip (SWC70-CL). The SWC-POWR charger can be plugged directly into either the transmitter or into the clip. A Sabine rechargeable battery (SWBC1) will charge whenever the mic clip is connected to the Sabine SWC-POWR charger and the handheld is properly placed within the mic clip.

Charging Indicators. Much like your cell phone, the transmitters will let you know the charging status of the battery. When the battery is charging, the battery meter will flash to indicate the relative level of the charge — one, two, three or four elements will flash (see figure 4h). Once the battery is fully charged, all four elements in the battery meter will flash. This indicates that the charging circuit is no longer on (see figure 4i).

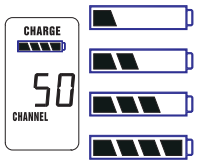


Fig. 4h: Battery Indicator — CHARGING

Battery indicator segments will flash progressively starting from the relative charge state of the battery. This example depicts a fully discharged battery being charged. As the charge progresses, left-side segments will remain visible as right side segments continue to flash, until all segments are visible. At that point, all segments will flash on and off in unison (see figure 4i).

NOTE: indicators may flash in unison for several minutes when charging is first attempted. The lower the battery level, the longer this initial "not charging" flashing sequence will continue. During this time, the Tireless Wireless battery circuit is evaluating the suitability and charge status of the battery in place. When it has completed its evaluation, it will either commence the progressive flashing depicted in figure 4h (CHARGING), or continue to flash in unison (NOT CHARGING). Flashing in unison signifies that the battery is either fully charged, or not suitable for charging.

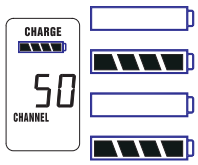


Fig. 4i: Battery Indicator — NOT CHARGING

Battery indicator segments will flash in unison to indicate that the charging is off.

These same indications will also be displayed on the receiver LCD, and on the Remote Control Software screen.

NOTE: the Tireless Wireless battery charger will only charge NiMH rechargable batteries. If you place any other kind of battery in the transmitter, and then attempt to charge it by connecting the charger, the Tireless Wireless circuit will detect the type of battery and will not begin charging. Again, the battery indicator on the transmitter will flash all four elements indicating no charging (see figure 4i).

Battery Warnings. When the transmitter battery voltage drops below a critical threshold, the battery icon (which normally displays the voltage level) will begin to flash. This is an indication that you need to replace the battery, or charge it by placing the handheld mic in the charger clip. NOTE: microphone will still transmit audio when placed in clip.

Alternatively, you can connect the charger directly to the transmitter using the built-in charger jack located on the side of the beltpack transmitter and near the antenna on the handheld transmitter (see figure 4j).

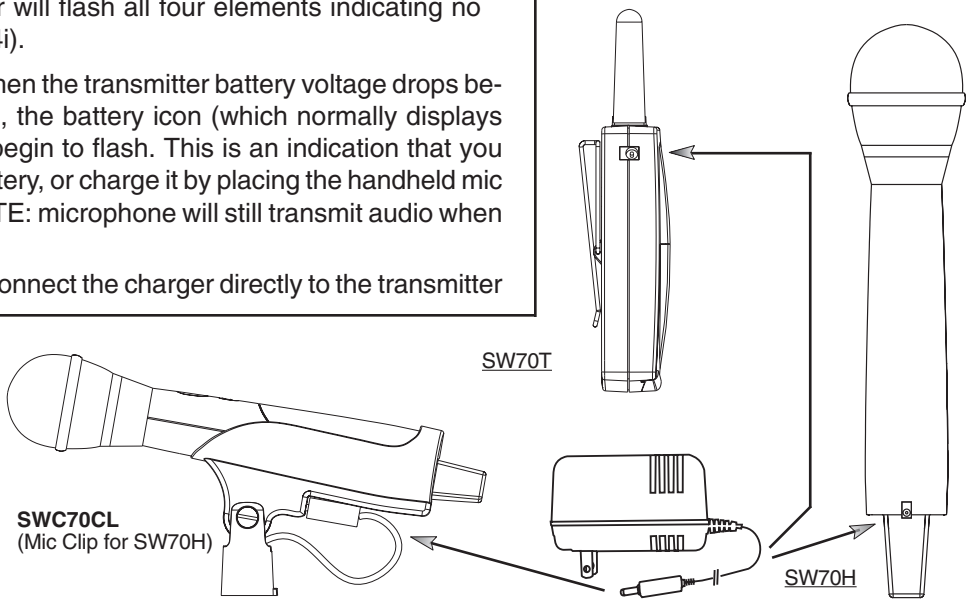


Fig. 4j: SWC-POWR plug-in charger for SW70 Series Transmitters & SWC70CL Mic Clip

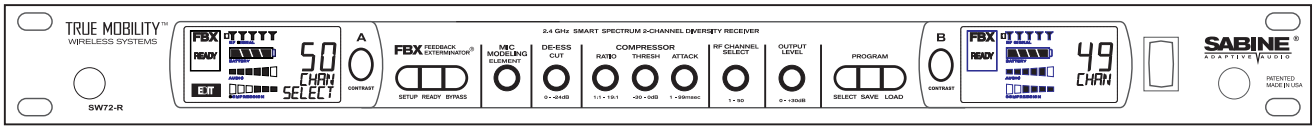


Fig. 5a: SW72R front panel

5. RECEIVER OPERATION

5.1. LCD Display.

The receiver LCD display is shown below(Fig. 5b). Two-channel receivers feature two LCDs, one for each channel. The display provides a snapshot report of the condition of your wireless channel, including battery status information sent from the transmitter by telemetry.

The left two-thirds of the display primarily shows status information regarding the condition of your receiver channel, as follows:

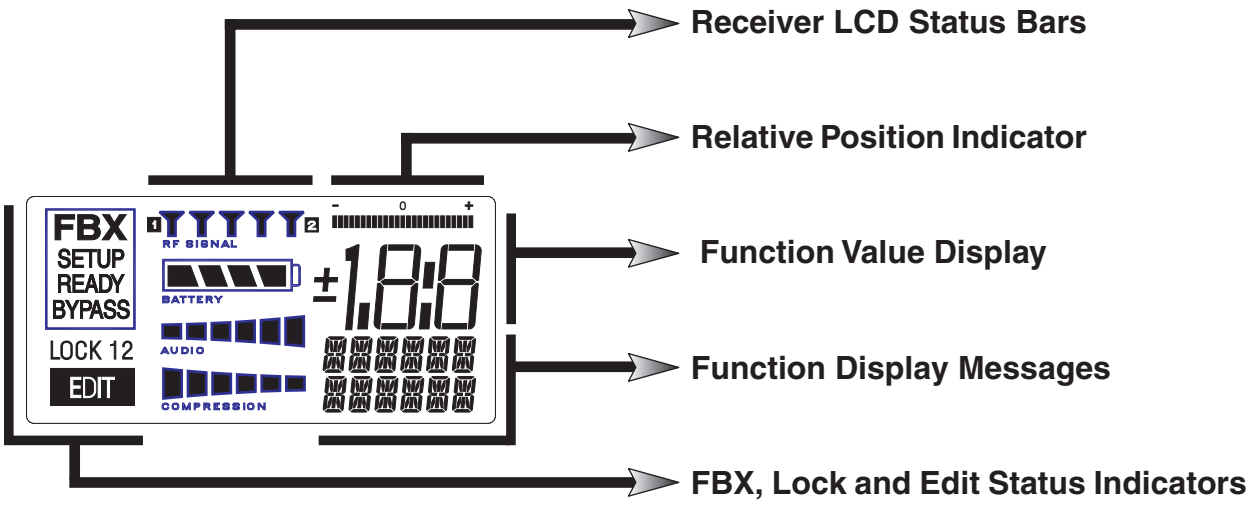
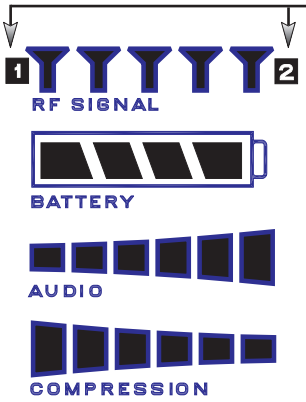


Fig. 5b: Receiver LCD Compete Display

Receiver LCD Status Bars



Diversity Status: Either 1 or 2 is lit, showing the active antenna.

RF Signal Strength Indicator: Indicates presence of RF (from transmitter, or external sources) on the chosen reception channel. The greater the number of illuminated icons, the stronger the RF signal detected.

Battery Voltage Level Meter: Indicates the battery voltage of the corresponding transmitter; the more segments are illuminated, the higher the voltage, and the greater the remaining battery life.

Audio Level Meter: Shows the audio input level (received audio signal).

Compression Meter: Shows the active gain reduction applied to the receiver channel's audio output.

Function Display Messages

Firmware Version: Displays for 2 seconds on power up; shows the receiver firmware version.

Transmitter Battery Low: You have 30 minutes or less to change transmitter batteries.

Mute: Transmitter muted; the transmitter on/off switch is set to mute.

Front Panel Locked: Front Panel is locked and the selected function cannot be edited.

De-Esser: The De-Esser is actively reducing sibilance.

FBX, Lock and Edit Status Indicators

FBX Status: SETUP is illuminated while the receiver is in SETUP MODE. READY is the normal operational mode, indicating SETUP has been performed and FBX filters are active. BYPASS indicates the audio signal is NOT going through FBX filters (but all other DSP processing is active).

Front Panel Lock Status: LOCK 1 indicates all front panel controls are locked to prevent intentional tampering, or accidental programming. LOCK 2 indicates a subset of controls are locked, allowing selected others to be adjusted with software only. Default LOCK 2 setting locks out all functions except FBX and Program Load.

Edit Status: In a 2-channel receiver, this field illuminates when the corresponding Channel Button is pushed, indicating Controls are assigned to this channel.

5.2. Parameter Control & LCD Display

5.2.1 One set of Controls for 1 or 2 Channels

Whether you have a one- or two-channel SWM7000 series receiver is apparent by the number of LCD displays on the front panel. However, only one set of control knobs is provided for either one- or two-channel receivers. Note that in a 2-channel receiver, this set of controls is shared, and assigned to a channel by pushing either the A or B Channel Select / Contrast button (see Seciton 5.2.2). Your SWM7000 Series receiver uses Sabine's Tweek-n-Peek™ digital control system. Whenever you turn a control knob one click, the associated function is shown on two lines of text display in the LCD. The large numeric display will indicate the current parameter value. Additional turns/clicks change the parameter setting and display the value as the change is made. After a few seconds of inactivity, the LCD will revert to its default display (RF channel).

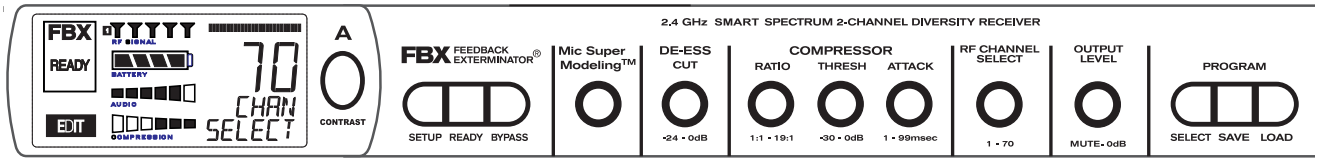


Fig. 5c Sabine Tweek-n-Peek

Sabine's Tweek-n-Peek™

Whenever you turn a control knob one click, the name of the corresponding function is shown and the current edit setting is displayed on the LCD. This applies for all the front panel knobs.

For example, if you turn the Compressor ratio knob one click, you will see the current compression ratio in the Settings Display. The Text display will show COMP on the first line and RATIO on the second. Subsequent turns will edit that setting up or down, depending on the direction you turn the knob.

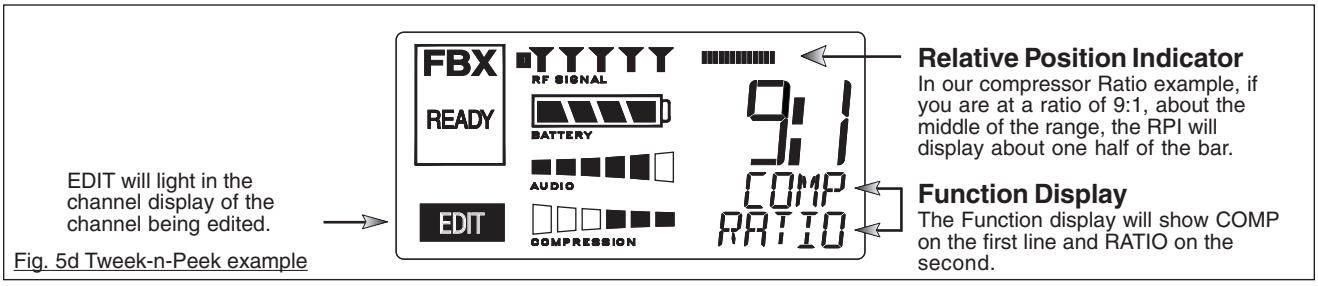


Fig. 5d Tweek-n-Peek example

Since the control knobs are continuous rotary encoders with no end points, the Relative Position Indicator (RPI) is a handy way of seeing where you are in relation to the full range of the knob in question. In our compressor Ratio example, if you are at a ratio of 9:1, about the middle of the range, the RPI will display about one half of the bar. NOTE: The setting range of each control is printed on the front panel below each knob.

5.2.2. Contrast / Channel Select Button.

The elliptical button immediately adjacent to the LCD has multiple functions. First, it adjusts the LCD contrast and viewing angle. Change the degree of angle by pressing and holding the button down. The adjustment range will cycle in a continuous loop, and then start over again at the minimum value, as indicated by a changing value in the LCD contrast. You can stop holding the button down and initiate single button pushes to advance the contrast setting incrementally.

In addition, the Contrast/Channel Select button has another function, in 2-channel receivers only (SWM-52-R or SWM-52ND-R). Such units feature two LCDs and two Contrast/Channel Select buttons. A single (without continuing pressure) push assigns all Parameter Control knobs to the selected channel. The button will light, the associated LCD will brighten, and the word EDIT will appear in the lower left of the LCD, all indicating the active edit channel. For the active channel, turning any Parameter Control knob will first display (one click) and then adjust (subsequent turns) the settings of the function selected, indicating the changes in the Settings Display. For the inactive channel, turning any Parameter Control knob will display the current setting in that channel's Settings Display. **The channel must be activated in order to change settings.**

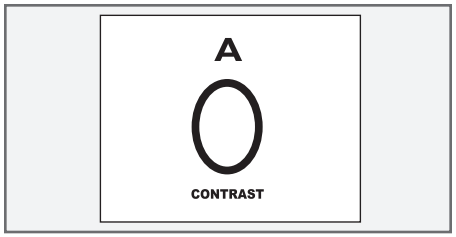


Fig. 5e: Contrast button

Tap to select which chanel to control

Hold to adjust contrast

5.2.3. Special LCD Display Messages.

In addition to the Status and programmable information discussed above, the text lines of the LCD Settings Display may also (under certain circumstances) automatically override other displays. The conditions when this will occur, and the messages displayed, are shown to the right of figure 5b on page 25.

5.3. RF Channel Select

Range = 1 to 70 Choose the RF channel for this system. The transmitter must have the same channel selected. Turn the control knob until the desired channel is displayed on the LCD. See chart (Appendix QQQ) for exact frequency of each channel.

Helpful Hint: Be sure to check the RF Signal meter on your receiver LCD screen. If several "antenna icons" are showing when your transmitter is off, select another channel (see also the RF Scan function of your True Mobility Wireless Remote Control Software in section 13).

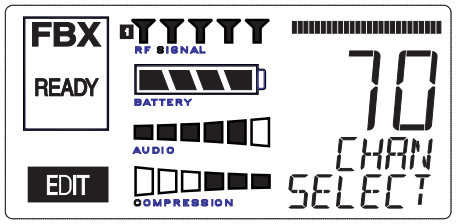


Fig. 5f

5.4. Output Level

Range = MUTE to -0 dB Adjust the output level to match the input characteristics of the downstream component. The output level varies from microphone level to line level, so if you are patching the receiver to the mic level input of a mixer, turn down the level to avoid overdriving the mixer input. Minus 15 dB is a good place to start. If you are patching into a line level device, turn up the receiver output. For best results, follow the golden rule of gain structure: maximize gain at early stages in the signal path, to minimize noise that will be accumulated and amplified by adding late-stage gain.

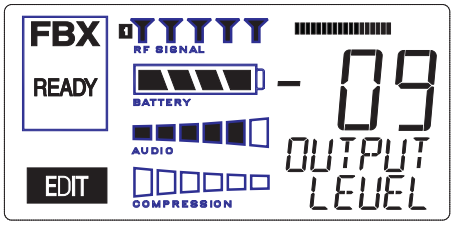


Fig. 5g

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5.5. Receiver Antenna Placement

One of the biggest potential problems in any wireless system is RF interference. Understanding wave interference patterns will help you to place and orient your receivers and antennas properly, and thereby reduce the likelihood of RF interference.

Your SWM7000 series receiver ships with two standard coaxial bipole antennas. When aimed straight up, each antenna picks up in a donut-shaped (toroidal) pattern, more or less equally in all directions, with null points directly above and below.

5.5.1. Multi-path Interference

Like sound waves, radio waves are subject to wave interference patterns produced by reflected or delayed waves combining with direct, unreflected waves, converging upon a receiving antenna simultaneously. In the RF world this phenomenon is called **multi-path interference**. As with audio comb filtering, radio waves can combine additively or subtractively. Subtractive combination is the result of phase cancellation, the precise pattern of which is in part a function of the length of a radio wave. The radio wavelength associated with 2.4 GHz operation is approximately 5" (12.7 cm). A one-quarter fraction of this wavelength equates to about 1.25," or a little over 3 cm. Multi-path reflections that correspond to even multiples of this one-quarter wavelength (e.g. $^{2}/_{4}$, $^{4}/_{4}$, $^{6}/_{4}$, or 6 cm, 12 cm, 18 cm) tend to reinforce reception, while odd multiples (3 cm, 9 cm, 15 cm) tend to reduce signal strength. Thus, mounting an antenna close to a reflective surface can result in poor reception. For example, if the receptive part of the antenna (the top 3 cm) is 3, 6, or 9 cm away from the face plate of any rack-mounted equipment, you might improve reception simply by repositioning, or re-aiming, the antennas.

In some situations — for example, those with difficult lines-of-sight, or when transmitters and receivers are separated by a wall, or when receiver placement options are limited — an extension antenna may be necessary to guarantee reliable reception. Please refer to Section 12 for information about the advantages and use of Sabine's SWASS-EXT Extension Antenna Kit.

5.5.2. Receiver & Antenna Placement Tips

1. **Maximize the distance between the receiver and light sources,** such as fluorescent bulbs or neon signs, which may emit very short-range, broadband interference. These light sources should not be a problem in normal circumstances, but, as a cautionary preventative, we recommend a minimum distance of 3 meters (10 feet) between them and any receivers or extension antennas.
2. **Note the placement of any microwave ovens in the immediate vicinity**. Place any receivers or extension antennas as far away as is practical from microwave ovens.
3. **Mount receiver antennas at 90 degrees to one another,** leaning away at 45 degree angles, in the same plane. This will decrease the likelihood that one antenna will be susceptible to the same orientation-specific directional or multi-path problems that may affect the other one.
4. **Decide on front or rear panel antenna mounting.** Antennas typically mount on the rear panel of your receiver, but with the optional accessory SWA-500 front mounting kit, can be screwed onto the front and connected via jumper to the back panel terminals. When mounting receivers in a rack that is deeper than the receiver, move the antennas to the front for improved reception. For any rack mounted receiver, try to keep the top 1.25 " (3 cm) of both antennas extended outside the sides of the rack (see figure 5h).
5. **When using multiple receivers, try to maintain at least 1 foot (30 cm) distance between antennas from different units.** If you are rack-mounting multiple receivers, you may want to avoid spacing them in adjacent rack spaces, to maintain distance between antennas. When such antenna spacing proves difficult or impossible, we recommend using Sabine's Antenna Distribution Amplifier (Sabine SWA6SS), which can help manage antenna configurations and, more importantly, improve system-wide interference rejection. The SWA6SS works with up to six receivers.

6. In very rare instances, **poorly shielded or malfunctioning computers or digital effects units may cause RF interference.** You can test whether such units are the sources of such interference by switching them off one at a time, and determining if interference rejection improves.
7. **When possible, maintain line of sight from transmitter to receiver.** Consider the potential range of transmitter "roaming," and locate your receiver accordingly. If direct line of sight proves impossible or difficult, consider using Sabine's low-profile, active Extension Antenna Kit (SWASS-EXT), which boosts the signal strength, extends the maximum distance from transmitter to receiver, expands and focuses antenna sensitivity, and allows antenna and receiver to be positioned further apart or in separate rooms.
8. **Turn on your system one component at a time, beginning with the first receiver.** If you don't have a computer handy, keep all other receivers and transmitters switched off for the time being. As you turn the RF channel select knob on the first receiver channel, keep an eye on the received RF signal strength indicator on the corresponding LCD. Make note of any channels that indicate the presence of any RF signal. Since nothing in your system is actively transmitting at this time, such a reading is indicative of a potential source of interference. If microwave ovens are present in the vicinity, you should try this test when the ovens are actively operating. After you have scrolled through all 50 RF channels, select any channel that does NOT indicate presence of RF signal as your first channel for operation.
9. **Use the RF Scan function included in the Remote Control Software.** This will give you a picture of the potential interference in your area, both real-time and over time. Please refer to Section 13.4.2.5. for information on Sabine Remote Control Software's Automatic RF Scan function, which will automatically determine the best RF channels to use.
10. **Maintain a minimum distance of at least 3 meters (10 feet) between all transmitters and receivers or extension antennas**. Plug all other microphones or instruments into the associated beltpack transmitters (the Sabine handheld microphone contains its own internal transmitter). Turn on the first transmitter (beltpack or handheld), and set it to transmit on the channel corresponding to the selected receiver channel (see Section 4 for details on setting the transmission channel). Talk into the microphone, or play the instrument, and verify on the transmitter LCD that an audio signal is being transmitted. Check the receiver channel's audio meter — you should see signal indication. Turn up the receiver output gain (take care not to overdrive or clip the input channel), plus any downstream power amplifiers or active speakers, until you can hear the audio signal well enough to make sure the signal is clear, and audio is being received and amplified with full fidelity.
10. **Repeat the process for additional RF channels**, one at a time, keeping all transmitters and receivers already set up turned on and active. Monitor the RF signal strength indicator and audio integrity for all transmission channels**. Be careful not to set more than one transmitter to the same channel**; each paired transmitter and receiver should be set to unique corresponding channels, until all channels are receiving clearly and cleanly.
11. **If interference problems occur** that appear to result from a source located to the rear of a receiver, and repositioning the receiver is difficult, **you can create your own RF shield out of a small piece of metal** (say 6" x 6", or 15 cm x 15 cm) placed behind the antenna (towards the source of the interference). Properly positioned, this shield will not only reduce interfering RF signals arriving from the rear, but can also reinforce front-arrival signals (the transmitter signals). The best distance to achieve such phase-additive reinforcement is about ½ or 2 times the length of a quarter radio wave length. In the case of 2.4 GHz operation, these distances are approximately 1.5 cm (.6 inches) and 6 cm (2.5 inches). You can empirically determine the proper distance by turning on the appropriate transmitter, and varying the distance between the shield and the antenna as you monitor the RF signal strength indicator on the receiver LCD.
12. **Once the physical placement of your receiver(s) and antenna(s) is decided**, proceed with the remainder of the setup process.

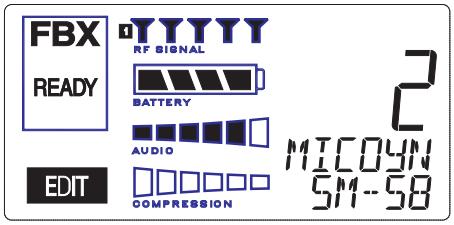


Fig. 6a

6. MIC SUPERMODELING™

6.1. Introduction

Microphones come in a dazzling variety of shapes, sizes, polar patterns, frequency response curves, phase response curves, etc. Few things arouse as much passion amongst audio engineers as discussions about what microphone to use in a given application. Sound rental companies and recording studios proudly tout their impressive microphone collections, and singers frequently favor a certain brand and model number as "perfect for my voice."

The only viable "please everyone" strategy is to stock a wide assortment of microphones. This is far easier for wired microphones than for wireless. Changing a wired microphone is as simple as disconnecting one mic and connecting an alternative — the same cable and same microphone stand allows easy interchangeability. At worst you might have to exchange microphone clips along with the microphones themselves.

For wireless microphones, however, the situation is not so simple. With different transmission frequencies, different proprietary designs, different types of connectors (microphone to belt pack transmitter), and the matched-set nature of transmitters and receivers, changing a microphone/transmitter is far more complex. In the worst case (and most common) scenario, it also entails changing the receiver to a compatible model, which in turn necessitates new connections into the mixer, and a reconfiguring of EQ and gain settings. This is not only time consuming, but also potentially expensive, as purchasing a variety of microphones also necessitates buying a similar number of receivers.

Sabine has a better idea — Sabine's proprietary Microphone SuperModeling™. With digital technology, it's possible to start with the sonic signature of a high quality microphone (such as Sabine's standard condenser and dynamic capsules used in our SWM7000 handheld series systems), and emulate the characteristics of other popular microphones—all at the twist of a knob. You won't have to change microphones, cables, connections, or receivers, interrupt a performance, or even get up from your mixing chair! Best of all, you will have an instant answer to a variety of demands from singers and speakers for their favorite microphone — even if they pass the microphone around.

6.2. Emulation Choices

Each Sabine SWM7000 receiver (SW72-NDR, SW71-NDR,SW72-R, SW71-R) comes equipped with 7 different Super Model microphones available per channel. Four of these (Shure SM-58, Shure Beta 58, Audio Technica ATM 41A, and AKG D-3800)* are designed for use with either of Sabine's dynamic handheld microphone/transmitters (SW70-HD3 or SW70-HD5). The remaining three (Shure Beta 87A, AKG C535EB, and Audio Technica ATM 89R)* are designed for use with Sabine's condenser handheld microphone/transmitter (SW70-HC). In addition to these Super Model choices, you may prefer to use Sabine's high quality microphones "just the way they are;" i.e., without emulation.

Telemetry information sent by the handheld transmitter to the corresponding receiver (or receiver channel for a 2-channel unit) identifies the type of transmitter, and loads the appropriate emulation library. Note

Sabine Mic SuperModeling™

SuperModeling™ Dynamic Models*:

- Shure SM-58
- Shure Beta-58A
- Audio-Technica ATM 41a

SuperModeling™ Condenser Models*:

- Shure Beta 87A
- AKG C535 EB
- Audio-Technica ATM 89R

**Company names, product names, and trademarks listed as modeled are the property of their respective owners and are used only to identify evaluated microphones used to develop digital processing; they in no way imply association, endorsement, or approval by any named manufacturer.*

that beltpack transmitters also send telemetry that turns off the Super Model option, as this feature is designed to work only with handheld microphone/transmitters.

6.3. Mic Modeling Front Panel Control

Simply turn the parameter control labeled “Mic Modeling” to scroll through and select the microphone you wish to emulate. (If you are using a 2-channel receiver, you must first select the channel you wish to edit by pressing the Contrast button. The first click of the knob will show the current setting, without changing it; additional turns will change the emulation that is active. The top text line of the Settings Display will read either MICDYN (dynamic) or MICCON (condenser) depending on the telemetry information sent by the handheld; the bottom line will display the microphone being emulated. Note that one choice is to bypass modeling, and simply utilize the excellent quality of the Sabine microphone capsules. In this case the bottom text line will simply read NONE. Finally, whenever telemetry information indicates that a belt pack transmitter is the RF source, or if a handheld transmitter is replaced by a belt pack with the same receiver (or some such other unpredictable event transpires), the Settings Display will read MICMOD/NONE whenever the Mic Modeling knob is turned.

There are no modeling settings for lavalier or headset microphones — mic placement makes these an unrealistic choice for modeling. NOTE: other lavalier microphones can be used with the Sabine Beltpack Transmitter.

6.4. Future Microphone Modeling Choices

When Sabine adds to the library of “virtual microphones” that are modeled by the receiver DSP, these will be made available as a firmware upgrade from the Sabine web site, www.Sabine.com. See Section 13 for information about the upgrade procedure.

7. FBX FEEDBACK EXTERMINATOR®

For a complete explanation of FBX, see **Section 14**.

7.1. FBX Set Up

Follow these easy steps to obtain the maximum gain and protection from feedback. Sabine FBX employs a very fast and quiet setup mode to make it easy to use.

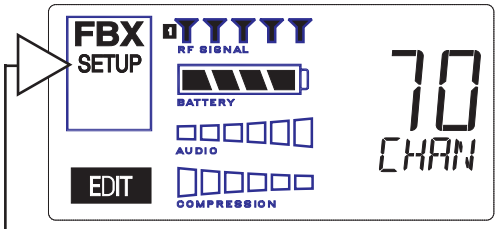


Fig. 7a

SETUP Indicator

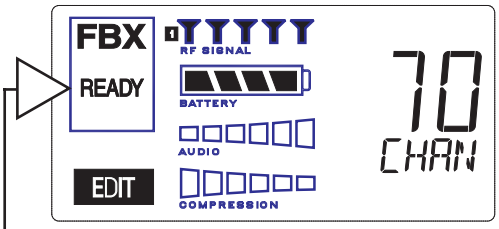


Fig. 7b: READY Indicator

NOTE: make sure READY is displayed before using your system for a performance.

1. Place the speakers in the positions where they will be used during the program.
2. If there is any equipment with a noise gate in the signal path, you MUST DISENGAGE the noise gate(s) prior to the setup procedure. You may reengage these noise gates upon conclusion of your FBX setup.
3. Patch your Sabine receiver into the mixer or amp channel. Set the amp master output gain to a normal operating position.

   NOTE: The level of your power amplifier should be set to a level that allows a healthy gain structure prior to the amplifier. If your amplifier is turned up fully, and your mixer meters show little movement when signal passes through, then your amplifier will have to work harder to process the weak signal. You will improve the performance of your sound system and lower system noise by reducing the gain on your power amp and increasing your mixer gain. FBX response time will also be better with proper gain structure.
4. First, turn on your receiver and select a clear channel (no RF Signal bars showing). Then turn on your wireless transmitter or handheld microphone and select the same channel, Now turn on the mixer (gain low), then any other accessories, and finally the power amp. If you are using a graphic EQ, adjust only for the desired tonal qualities, but DO NOT NOTCH FOR FEEDBACK.
5. With the microphone turned on, raise the OUTPUT LEVEL of the receiver slowly until a strong input signal at the mixer is apparent. The microphone should now be audible.
6. Now you are ready to set FBX filters. Press and hold SETUP (far left button) on the wireless receiver, until the word SETUP in the channel LCD flashes 4 times, then stops flashing. This will clear any FBX filters already in place. NOTE: *You should do this each time you move your sound system, change a sound system component, or relocate your microphone.* Your Sabine True Mobility™ Wireless System will remember its settings from the last time you turned the unit off.
7. **During SETUP mode, do not talk into the microphone or pass audio program through a transmitter**. This may cause the Sabine True Mobility™ system to set inappropriate filters. The only appropriate use of the SETUP mode is to create and filter feedback. **SETUP must be exited prior to normal microphone usage.** This happens automatically after setting FBX filters, or you may exit manually by pressing READY at any time.
8. Identify the primary usage positions, and likely feedback-prone locations, in the potential movement range of the wireless microphone. Take the microphone to the first of these locations.
9. Slowly raise the mixer channel gain to the point of feedback — and then slowly beyond, until you hear the chirping tones of feedback quickly being eliminated by FBX filters setting. Stop raising gain

after 2 or 3 feedback tones have chirped and corresponding FBX filters have set. Rest assured that any feedback that occurs will be at a quiet volume, and very short in duration.

10. Move the microphone to another area of use and slowly raise gain until FBX eliminates a few more feedback tones (2 or 3). Repeat this step until the word SETUP automatically disappears and the word READY appears. This indicates your unit is ready for operation. The total number of filters available for feedback filtering is 10; in the factory default setting, your unit will automatically enter READY mode when the eighth filter is set. Alternatively, you may enter READY status with fewer fixed FBX filters in place, simply by pressing the READY button at any time. **NOTE: be sure that the word READY appears in the FBX section of your receiver LCD during performance or any normal operation.**

    Any feedback that occurs after setup will be eliminated by dynamic filters, which remain in reserve to catch surprise feedback if it occurs during performance/operation.

    In most instances you will experience an additional gain of 6-9 dB before feedback when using the Sabine True Mobility™ System. Precise results will depend on system and acoustical considerations.

    All fixed filters in place will remain set until the SETUP button is pushed and held as described in step 6. All dynamic filters will remain in place until new feedback occurs (when they will move to the new frequency), or until the SETUP button is pushed and held. Your True Mobility receiver will remember its FBX (and all other) settings even if the power is turned off. See Section 14 for a complete discussion of Sabine FBX Feedback Exterminators®.

Fig. 7c: READY Button

Tech Tip

READY & Locked Fixed

READY = Lock Fixed on other Sabine FBX products

7.2. FBX Bypass Button

The BYPASS button bypasses only the FBX Section, and not the additional signal processing (de-essing and compression) available in the Targeted Input Processing section of the Sabine True Mobility™ Wireless Receiver.

NOTE: You can easily bypass Compression signal processing by turning the Compressor Ratio knob fully counter-clockwise, and the De-esser signal processing by turning the De-esser knob fully counter-clockwise.

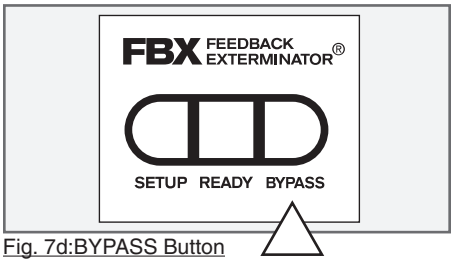


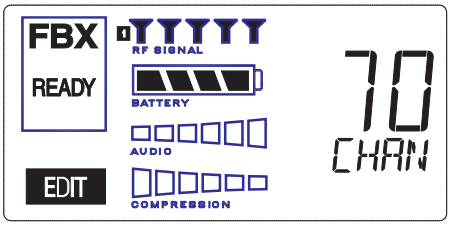
Fig. 7d:BYPASS Button

FBX BYPASS CAUTION

Bypassing FBX filters may allow suppressed feedback to be released!

FBX Power User Tip: Tweaking already-set filters to get more gain before feedback.

When the FBX filter setup procedure finishes, the word READY appears in the FBX section of your receiver LCD and you are ready to use your True Mobility™ wireless. If, however, you need to get **more gain before feedback**, you can allow the **already-set fixed FBX filters to go a little deepe**r by pressing the READY button again and slowly turning up your system gain (READY will disappear from the LCD). Note that the frequencies of these already-set filters will not change, only their depth. Nor will any new filters be set. When you are satisfied with your gain before feedback, press READY again to lock your filters. **Do not play program during this process and be sure that the word READY appears in the FBX section of your receiver LCD during performance.**



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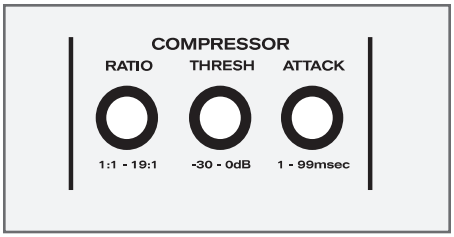

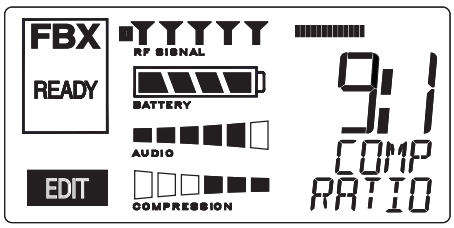

8. COMPRESSOR/LIMITER OPERATION

8.1. Basics of Compression

The dynamic range (how loud we can hear to how quiet a sound we can detect) of the human ear is far greater than the capability of sound systems to reproduce. Although some of this equipment limitation is at the upper extreme of the dynamic range (where too loud a signal will produce distortion), much of the restriction occurs at the low level end, where the signal disappears below the “noise floor” of the circuitry.

A compressor (or in its most powerful form, a limiter) is the most widely used tool for controlling dynamic range. In the simplest terms, a compressor is designed to squeeze the dynamic range of an audio program; i.e., to make quiet signals louder, and loud signals quieter. A compressor becomes a limiter when the compression ratio (the ratio of the input gain change to the output gain change) is so high that the output level effectively won’t rise above a “brick wall” ceiling, regardless of how much the input gain increases (typically a ratio of 10:1 and greater).

A compressor acts like an “automatic mix engineer” with a hand on the fader and an inhumanly fast reaction time. When the input level increases, the “engineer” drops the fader; when the level decreases, the fader is raised. When the amount of fader compensation equals the variation in signal level, the output level of the audio program will sound consistent.

The practical benefits of compression and limiting include:

1. **Speaker protection.** A compressor will control sudden level peaks and prevent your speakers from damage. Most often in this type of application, the compression ratio is high enough to qualify as a limiter.
2. **Perceived increase in loudness.** Because compressed peak levels are kept from rising as high as uncompressed signals, you gain headroom for your audio program and can raise its overall average gain. Compression is often added to the entire audio mix, both in live sound and recording, to increase its perceived loudness.
3. **Achieving more consistent levels**. For expressive instruments or vocals, which may have a large dynamic range, compression can help maintain more consistent mix levels. So a speaker who varies from a whisper to a shout will not disappear or stand out in the mix, relative to other less dynamic instruments or vocals. Vocal level variations are also common when multiple users share a single microphone, due to differences in voice volumes and mic-to-mouth positions from one user to another. Compression will help even out such variations as well.

8.2. Using the Compressor

Compressor knobs are located immediately to the right of the FBX and De-Esser controls. The controls consist of standard Ratio, Thresh (threshold) and Attack knobs, and a horizontal gain ladder in the LED display shows compressor gain reduction.

Ratio: Compression ratio is the ratio of the input gain change to the output gain change. The compression ratio on your Sabine Wireless ranges from 1:1 to 19:1, in increments of 1 dB. Set Ratio to 1:1 to bypass Compressor

Thresh: Compression threshold sets the input level at which the compressor/limiter begins to act on the signal. The input level threshold at which compression is engaged can be adjusted from -30 dBv to 0 dBv, in increments of 1 dBv.

Attack: Compressor attack time sets the speed with which signal compression begins once an input signal exceeds the threshold level. The range may be adjusted from 1 to 99 mS, in 1 mS increments.

Gain: (Output Level) Since the output gain is attenuated whenever the input gain exceeds the compression threshold, the overall output level of a compressed signal will be reduced. Commonly, this reduced output gain is compensated for by raising the level of the output signal (the term is “gain make-up”). Output Level range may be adjusted from mute (minus infinity) to +20 dB, in increments of 1 dB.

8.3. Suggested Compression Settings

8.3.1. Vocal Settings

The renowned expressiveness of the human voice is due in large part to its dynamics. A vocal that varies from a whisper to a scream has a strong emotional impact, but those same dynamics present a challenge to the sound engineer. Ideal vocal compression maintains some dynamic range while keeping the vocal the focal point of the mix.

Ratio: A soft voice might require a ratio of 2:1, whereas a loud voice might require a ratio setting of 6:1.

Thresh: The higher the threshold setting, the more signal is required to initiate compression. Ideally this should be set to reign in peak levels, and allow signals of lower gain to pass uncompressed. Threshold settings will depend on the nature and variety of the signal source. Strong vocalists will require a different threshold than quiet speakers or singers.

Attack: Short attack times usually work well for voice. However, too strong a compression ratio, too low a threshold, and too fast an attack may attenuate speech consonants, which provide important intelligibility cues to the audience, thus compromising clarity.

8.3.2. Guitar Settings

Ratio: A high compression ratio (with gain makeup) will add sustain to held notes and chords.

Thresh: Moving the threshold will change the audible thick/thinness of the guitar tone, but generally you want to compress all the notes played.

Attack: Be wary of too quick an attack, which may reduce the percussive attack of the guitar notes.

In general, be wary of too much gain makeup, and too high a compression ratio, which may make a noisy guitar amplifier more objectionable. Ratio settings might range from 6 to 20:1, threshold variable, slower attack, soft knee, output gain boosted slightly to significantly depending on amount of compression.