8.4. Possible Compression Trouble Areas

Like any signal processing, compression can be misused, and improper application may cause undesirable side effects in the audio signal. Some of these problems include:

1. **Noise.** If the threshold for compression is set too low, and the output gain is raised substantially to make up for the gain loss of compression, the resulting output signal can be noisy. This is because the overall signal must be raised significantly to produce the same audible level, and the noise floor of your equipment will be amplified unnecessarily. This problem will be exaggerated if the input signal level to the compressor is very low (which will already degrade the signal-to-noise ratio).
2. **Breathing**. In situations where the compression ratio is high, the threshold is low, and the release time of the compressor is short, the noise floor will modulate up and down as the audio signal rises above and falls below the threshold.
3. **Over-compression**. Applying too much compression to a mix can sometimes result in such evened-out dynamics that the "life" of the music or speech has been removed or curtailed. Dynamic variation may be a major component of a performer's message and command of the audience; don't remove dynamics, just control them. This may be particularly true for percussive musical instruments such as drums.

8.5. Release & Knee Settings

Two other important compressor variables are ***release time*** and ***knee***. Release time adjusts the speed with which compression stops and output gain returns to unity with input gain, once the input signal falls below the compression threshold. Knee refers to the degree with which the full ratio of compression is imposed once the input level threshold is approached and exceeded. A "hard knee" changes from no compression to maximum compression exactly and immediately at the threshold crossing; a "soft knee" gradually imposes the full compression ratio as the input gain approaches and exceeds the threshold. In Sabine products, the "softness" of a knee can vary from 1-40, with the higher level representing the "softest" character. In such a setting, slight compression will begin well below the compression threshold, increase as the input gain crosses the threshold, and reach full compression well above the nominal threshold.

Values for release time and knee are set at the factory: default release time is 250 mSec, and the default knee setting is a "soft" setting of 20. These defaults can be temporarily changed or reprogrammed using the Sabine True Mobility™ Remote Software (see Section 13 for details).

9. DE-ESSER

9.1. De-mystifying De-essers

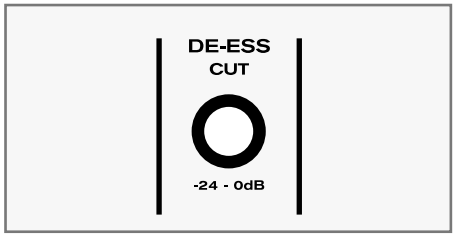
Certain consonant sounds produced by the human voice contain more energy than others, and have the potential to overload a microphone capsule. This can produce a disproportionately harsh result when amplified through a sound system, and/or recorded to analog or digital storage media. The most common and obvious of these sounds (in English and many languages) is the “ssss” sound, associated with pronunciation of both “s” and soft “c” consonants, also the consonants “t,” “f,” “x” and sometimes “d.” The technical term for this particular vocal sound is “sibilance,” and the devices that control such sounds are typically called “de-essers” (or sometimes sibilance controllers). The frequency range of sibilance will vary depending on the singer/speaker, the consonant involved, the orientation to the microphone, the microphone itself, and the normal variations in human vocalization. Cardioid- pattern condenser microphones are especially susceptible to sibilance problems, but the problem can also occur with other types and patterns of microphones. The range of frequencies affected by sibilance starts above 2 KHz, and generally tapers off above 10 KHz; in other words, sibilance is primarily a problem associated with higher frequencies (though not the upper octave of human hearing).

9.2. The Sabine De-esser

The Sabine De-esser is essentially a type of frequency-band compressor, active in the 2-10 KHz range, and inactive below 2KHz and above 10 KHz. Sabine’s algorithm works by dynamically comparing band-specific and associated harmonic energy levels to the total signal energy. When spikes are detected that correspond to sibilance, a shelving filter is imposed on the appropriate frequency bands, and remains in place only for the duration of the sibilance. High frequency energy levels that remain below the comparison threshold do not trigger de-essing, and lows and highs outside the sibilance range are also passed unprocessed and unaffected. This means the Sabine De-esser is effective but transparent.

9.3. Using the De-esser

Using the Sabine De-esser is simplicity itself. Turning the knob labeled “DE-ESS CUT” counterclockwise will increase the amount of sibilance reduction, by increasing the maximum depth of the shelving filter. The maximum allowable cut is 24 dB.



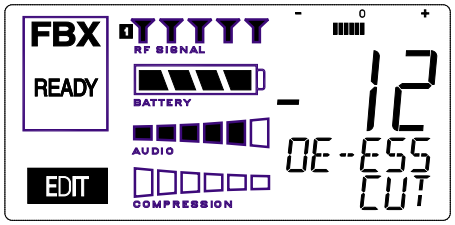


Fig. 9a: De-esser

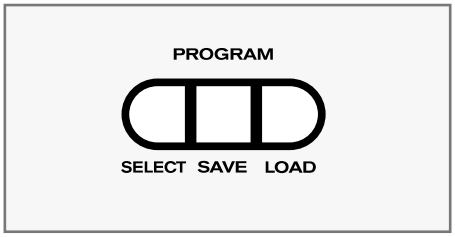


Fig. 10a: Program Front Panel Buttons

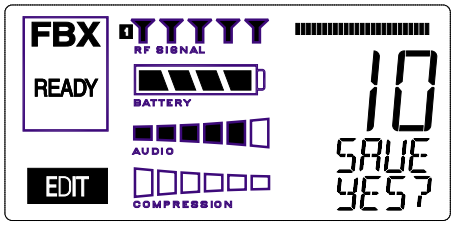


Fig. 10b: Program SAVE YES?

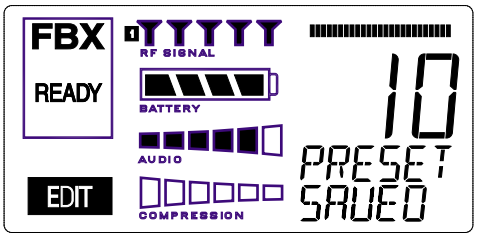


Fig. 10c: Program PRESET SAVED

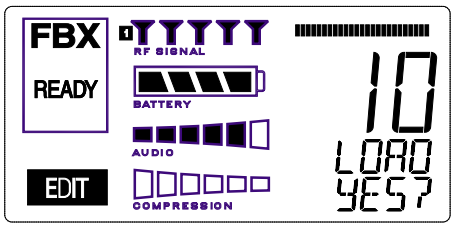


Fig. 10d: Program LOAD YES?

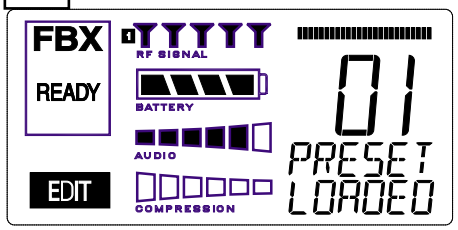


Fig. 10e: Program PRESET LOADED

10. PROGRAM SAVE & RECALL

Most wireless microphone systems provide control of one or two settings (RF channel and maybe gain). With so little to remember, the ability to save and recall system settings has not been necessary. With the Sabine SWM7000 series, however, you get a very sophisticated processor with a variety of adjustable parameters. The ability to save and recall your carefully programmed setups can be a tremendous time-saver. Your SWM7000 allows you to store and recall up to 10 different presets.

10.1. Saving a Preset

To save a program, press the SELECT button. The last preset used (numbered 01 - 10) will be shown in the LCD Display (see Fig. 10b). If you want to replace an existing program, press SELECT until you reach that program's number. Then press the SAVE button. The function display will show "YES?". If you are ready to save, immediately press the SAVE button again, and your settings will be saved to that program number. The message PRESET SAVED will be shown for four seconds in the text display to confirm this action, as the LCD Display continues to show the number (01-10) of the preset (see Fig. 10c). After four seconds, the LCD Display will revert to an indication of the RF channel.

10.2. Loading a Preset

Loading a program is just as easy. Press SELECT until you locate the program number you wish to load. Press LOAD. The function display will show "LOAD YES?" (see Fig. 10d). Immediately press the LOAD button again and your new program, including all the parameters, will be loaded for that channel. The message PRESET LOADED will appear in confirmation (see Fig. 10e).

10.3. Naming a Preset

Presets, channels and receivers can be named using the Sabine True Mobility Remote Software. Refer to Section 13 for details.

10.4. Power Off Memory

The SWM7000 retains in memory all settings in effect at the time of being powered off, and returns to those settings when powered on.

PRESET NOTES

1. Preset 01 is the System Default (SYSDEF on the front panel) and you cannot save a preset here. Load this setting when you want to return the receiver to the factory default settings.

2. Preset names will appear on the LCD only after you name the preset using the remote control software.

11. MULTIPLE SYSTEMS OPERATION

11.1. Overview

In many circumstances a single wireless microphone system is all that will be in use at any one time. Larger applications (church, concert hall, theater stage, conference room, etc), however, can often require a large array of wireless microphones, all demanding flawless uninterrupted simultaneous operation.

Multiple system operation presents at least two important operational challenges: interference among transmission channels, and setup complexity. The Sabine SWM7000 provides powerful solutions to both, particularly the interference problems associated with two or more RF channels at work at the same time, at the same location.

11.1.1. Multiple System Interference

Sabine's SWM7000 addresses multiple system interference with two strategies. First, greater available bandwidth in the 2.4-2.4835 GHz range means more channels can occupy the band, i.e., the expanded range can be divided into a greater number of separate transmission/reception bands. Second, with Smart Spectrum transmission and reception, channels are more tolerant of interference. The net result is that the SWM7000 offers the potential for many more simultaneous transmission channels than conventional UHF or VHF systems.

While such performance benefits are one of the major advantages of the SWM7000, more systems working at the same time leads to a greater potential for complexity. Fortunately, the SWM7000 also offers tools to simplify setup and operation.

11.1.2. Setup Complexity

Multiple wireless systems in a large installation are of course more complicated than a single transmitter/receiver. More space is needed, and the sheer quantity of transmitters and receivers that may be in use at a single installation can prove difficult to manage. The SWM7000 series helps manage such potential complexity with four strategies and/or system accessories:

1. First, the SW72 and SW72-NDR receivers offer a 50% space-saving advantage with 2-channel receivers that occupy the same 1U space as single channel receivers. Each channel in a 2-channel system shares the true diversity operation of the two antennas connected to the single receiver chassis.
2. Second, the optional SWA6SS (six-system antenna distribution amplifier) greatly reduces the complexities of multiple receiver antenna deployment. Since each receiver has two (diversity) antennas, which can be mounted on either the rear or front panel, multiple receivers at one location can potentially create a forest of antennas protruding from the front or back of a rack. The SWA6SS Antenna Distributor reduces the number of antennas to as few as 1/6 what would otherwise be needed. An added important advantage of using the SWA6SS is its distributed signal boost provided to all the antenna outputs, delivered while maintaining diversity in all attached reception channels.
3. Third, large installations often entail long distances from transmitters to receivers, or the presence of obstacles (walls, for example) in the transmission path that can interfere with clear reception. While the SWM7000 series is designed to minimize these kinds of problems without accessories, the SWASS-EXT (set of two extension antennas, shown in figure 12b on page 36) may prove helpful or even necessary in some situations. In addition to providing remote and/or desirable low profile positioning with improved reception, the SWASS-EXT also adds another 18 dB of antenna gain for even more reliable system performance. The Extension Antenna and Distribution Amplifier components are also designed to operate in tandem, with the Extension Antenna plugged directly into the amp, which can then feed (via cable)

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the antenna inputs of 6 receivers. A combination of 2-channel receivers (SW72-R or SW72-NDR), a set (2 pieces) of SWASS-EXT, and one SWA6SS, would reduce the antenna clutter of 12 transmission channels to a single pair of extension antennas. See Section 12 for more information about setup and use of the SWASS-EXT.

4. Fourth, software control for the ND series receivers allows up to 70 receiver channels to be controlled from a single computer. This quick and powerful control methodology means you can monitor and change transmission channels, mic modeling, compression and de-essing — in short, all front panel controls — from a remote laptop or desktop. In addition to simplifying multiple unit operation with remote front panel controls, the remote software provides additional features and functions not available from front panel control. See Section 13 for more information about setup and use of the Remote Software.

11.2. Antenna Distribution Amplifier

Sabine's optional accessory SWA6SS Antenna Distribution Amplifier is ideal for simplifying antenna set up when multiple receivers are used, by using a single pair of antennas to replace pairs for up to 6 different receivers. Standard equipment packed with each Antenna Distributor includes an AC power cable, and 6 pairs of 1-meter long jumper cables (RG-58 AU foam core) for connecting the Antenna Distributor to receivers (2 cables provide true diversity reception to each receiver).

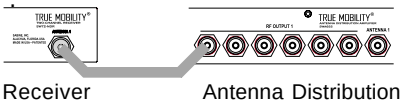
For best results, the Antenna Distribution Amplifier should be positioned close enough to the receivers to minimize cable runs. In most applications, you can use the standard Sabine 2.4 GHz antennas supplied with any of the receivers to connect to the terminals on the Antenna Distributor, and then connect (in matching pairs) the jumpers to all your receiver antenna connections (up to 6 receivers, 1 pair per receiver).

Care should be exercised when using longer cables, due to possible transmission signal loss (approximately 1.7 dB/meter). Using the "rule-of-thumb" that a signal loss no greater than 6 dB will prove acceptable in many circumstances, you may be able to use RG-58 cable up to 3 meters or so in length. However, a better strategy than moving the Antenna Distributor to a better position, and risking excessive transmission loss back to the receivers or requiring an upgrade to more expensive cable, is to utilize a pair of Sabine Extension Antennas (SWASS-EXT). These will connect to the antenna inputs of the Antenna Distribution Amplifier, and offer increased range, better rear-source RF rejection, an expanded 180 degree forward sensitivity, flexible mounting options, and signal boost (see Section 12).

For more details regarding specifications and operation of the SWA6SS Antenna Distribution Amplifier, please refer to the operating guide included with that product.

11.3. Antenna Distribution Amplifier Connection

1 Connect receiver Antenna 1 input to any RF Output 1 connector on the SWA6SS.

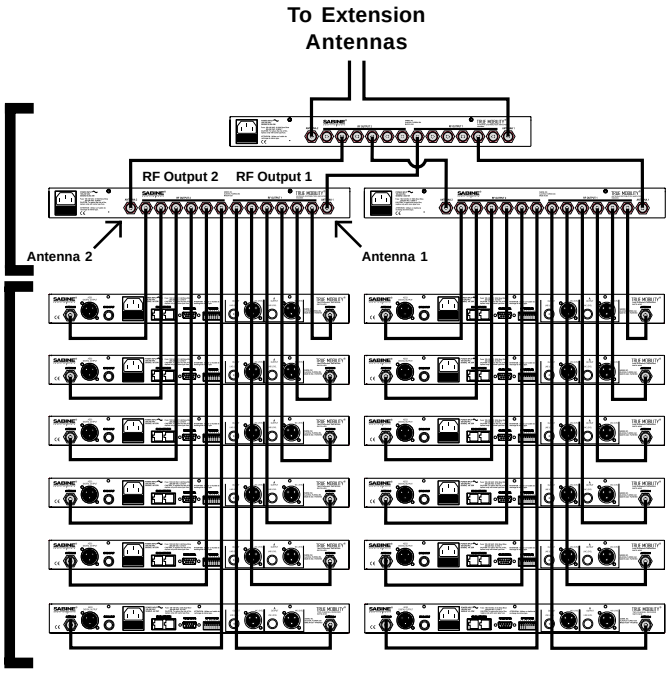


Receiver — Antenna Distribution Amplifier (SWA6SS)

2 Connect any receiver Antenna 2 to any RF Output 2 connector on the SWA6SS.

Receiver — Antenna Distribution Amplifier (SWA6SS)

3 Continue with remaining receivers



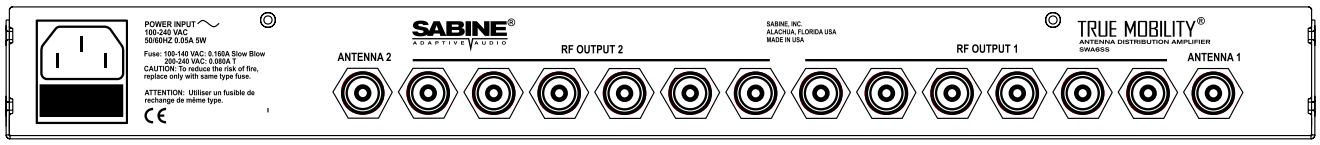


Fig. 12a: SWA6SS Antenna Distribution Amp Back Panel

⚠ IMPORTANT ⚠

Active Electronics Antenna

Sabine wireless receivers provide antennas with active electronics. The inputs to the receiver & antenna distributor amplifier have phantom ower available for this purpose.

DO NOT SHORT TO GROUND

⚠ IMPORTANT ⚠

Antenna Cabling Impedence must be 50 Ohm.

Fig. 12b SWASS-EXT Mic-stand mount and wall-mount extension antennas

12. EXTENSION ANTENNAS

12.1. Overview

Sabine's SWM7000 series receivers are designed for easy interface with Sabine's SWA-SSEXT Extension Antenna Kit (figure 12b). This triangular, attractive wood-grained unit is designed to mount easily and unobtrusively on a wall (allowing either a through-the-wall or out-the-bottom connection), or (by threading) atop a microphone stand for a more portable or temporary positioning. Each package contains 2 Extension Antennas, all necessary mounting hardware (screws and mic stand thread connectors) and both right-angle and straight connectors for mating with RG-58 cable (for connections to a receiver or Antenna Distribution Amplifier).

12.2. Antenna Cabling & Cable Loss

While an extension antenna affords the opportunity to increase the distance from transmitter to receiver, there is a loss of signal in the interconnecting cable that limits that distance. The maximum connection length is determined by the type of cable used, and the degree of signal attenuation acceptable.

Let's presume that an acceptable degree of loss over the total cable run is 6 dB. Without external signal boosts, the different cables shown in the table would then allow maximum lengths ranging from less than 4 M (RG-58) to 24 M (RG8/U). Thus, for a passive extension antenna, your choices are to limit the cable run, or increase your budget and buy the more expensive, thicker cable.

Coaxial Cable Attenuation Table - 2.4 GHz

Cable Type	Belden #	Insulation	Center Conductor	10 Meter Attenuation (dB)	Maximum Practical Distance Using SWASS-EXT (meters)	Connector Type
RG58	9203	Polyethylene	#20 Stranded	-16.29	14	TNC
RG58/AU	9311	Foam Polyethylene	#20 Stranded	-11.10	20	TNC
RG212/U	9861	Polyethylene	#15.5 solid, Silver Plated	-6.11	36	N
RG8/U	9913	Semi-solid Polyethylene	#10 Solid	-2.50	88	N
RG142	83242	Teflon	#18 Solid, Silver Plated	-6.54	34	TNC

Fig. 12c Coaxial Cable Attenuation Table

⚠ IMPORTANT ⚠

Antenna Cabling Impedance must be 50 Ohm.

Fortunately, Sabine's SWASS-EXT Active Extension Antenna offers a far better, more cost-effective solution, due to its built-in active 18 dB signal boost. In the case of low-cost RG-58 cable, adding an SWASS-EXT to your setup increases the acceptable maximum cable run by more than 4 times, to 14 meters. With RG-8 cable, the maximum length is extended to 88 meters!

Power for the Extension Antenna is delivered from any Sabine SWM7000 series receiver or SWA6SS Antenna Distribution Amplifier (see Section 11).

An additional advantage of using Sabine's SWASS-EXT Extension Antenna stems from its more focused, directional nature. Sabine receiver's coaxial dipole antennas (standard equipment that mount directly on the front or rear panels of the receiver or SWA6SS) are more omni directional in nature. In contrast, the Sabine's Extension Antenna is sensitive to RF reception in a 180-degree arc in front of its mounted position. It extends sensitivity to the front and off-axis side locations as it increases rear RF rejection.

The multiple functions (relocation of antenna, boost of signal, directional sensitivity) of Sabine's Extension Antenna mean there are many applications in which its addition to your system can greatly enhance performance. Here's a short list of such applications:

1. **Antenna repositioning.** Provides solutions when receiver placement options are limited or challenging. Sabine's Extension Antenna's multiple mounting options allow higher placement (wall mount or microphone stand mount).
2. **Barriers interrupting transmission.** Anytime a barrier interferes with transmission and reception, Sabine's SWA-SSEXT can be mounted on the transmitter side of the barrier with cable connections made on the receiver side. Perhaps the most common situation of this nature would arise when receiver and transmitter are located in separate rooms.
3. **Expanded or directional sensitivity required.** Sabine's Extension Antenna picks up in a 180-degree arc, focused towards the front. Reception in this arc is enhanced.
4. **Rear RF rejection required.** Because Sabine's Extension Antenna is less sensitive to signals received from the rear, it can be positioned to reject any such directional RF interference.
5. **Extended operational range.** Given a potential maximum cable length of almost 100 meters from Extension Antenna to receiver, Sabine's SWASS-EXT allows more options for extending the distance between transmitter and receiver. (It should be noted that the typical range of Sabine's SWM7000 series systems without the Extension Antenna is already 100 meters in typical circumstances). Consider that RF signal strength through the air is diminished by the square of the distance (twice as far away = ¼ the signal strength), while signal loss through cable is (roughly) inversely proportional (twice as far away = ½ the signal). That means you can use an extension antenna to replace transmission-through-air with transmission-through-cable, to help minimize signal loss.

   The SWASS-EXT provides the following benefits:

   - Wall mount or mic-stand mount
   - Straight and right angle TNC connectors
   - 180 degree reception pattern
   - +18 dB boost in RF
   - Matched pairs
   - Wood-tone finish
   - Phantom-powered from either the receiver or the distribution amp

⚠ IMPORTANT ⚠

Active Electronics Antenna

Sabine wireless receivers provide antennas with active electronics. The inputs to the receiver & antenna distributor amplifier have phantom ower available for this purpose.

DO NOT SHORT TO GROUND

13. REMOTE CONTROL OPERATION

13.1. Overview

In many circumstances you will adjust and control your Sabine SWM7000 wireless microphone system using the front panel controls, as outlined in previous sections of this operating guide. In circumstances where an enhanced level of control over a single receiver is desired, or to enable simultaneous computer-based control of multiple receivers, you will need to install (on either a laptop or desktop computer) the free Sabine SWM Remote Control Software included with your system. Only receivers may be remotely controlled; handheld and belt pack transmitters cannot be remotely controlled.

For online instructions for any function in the software, you may also refer to the Help menu.

NOTE: Some SWM7000 receivers may not have a USB port. In this case, simply use a USB to RS-232 9-pin adaptor. Go to Sabine.com for a list of suggested adapters.

13.1.1. Single vs. Multiple Receiver Control

All SWM7000 series receivers have an RS-232 9-pin serial COMM Port and a USB port. Thus, any single receiver can be controlled remotely. Control over multiple receivers from a single computer is possible only with ND-series receivers (SW71-NDR and SW72-NDR). These units have additional RS-485 network connections (RJ-45 jacks) for daisy-chain connection from one receiver to the next. Up to 35 receivers (70 transmission channels if all receivers are 2-channel) may be connected in this network, all under the control of a single computer. Single- and dual-channel receivers can be mixed in the same network. The first receiver in such a network can be connected to the computer via an RS-232 9-pin serial cable or USB cable. The remaining units connect via an RS-485 cable.

NOTE: It is not possible to upgrade/retrofit a standard receiver to make it an ND-series unit.

13.1.2 Features & Controls Added Software

All front panel controls and displays are duplicated in the software. In addition, a deeper level of software control over receiver operation is enabled. These new controls are complete and independent for each transmission/reception channel, meaning there are two sets of controls for dual channel receivers. These controls and displays include:

- **Parametric filter access and control.** FBX filters can be changed to parametric filters, and their width, depth, and frequency can be adjusted. Changes can be made at any time, both before and after FBX filters have been set. Parametric and FBX filters can be mixed in any combination, totaling 10 for each receiver channel.
- **Adjustable FBX parameter control.** Maximum depth of FBX filters can be adjusted globally; filter width can be adjusted globally or individually. Two controls, Sensitivity and Persistence, can be tweaked to tailor the operation of automatic FBX filter placement to match the audio program. Proper settings will optimize the balance between false filtering and delayed response to feedback (the factory default settings should operate excellently in the vast majority of conditions and may never need to be changed).
- **Control over balance of FBX Fixed and Dynamic filters.** Any FBX filter can be set to be either fixed or dynamic.
- **Adjustable high and low cut filters.** (Software only) High Cut Filter, user controllable between 3 KHz and 20 KHz, 12 dB/octave roll-off; Low Cut Filter user controllable between 20 Hz and 1 KHz, 12 dB/octave roll-off.
- **Additional compressor controls.** Aside from adjustments for ratio, threshold, and attack (which duplicate front panel controls), the Remote Software provides control of compressor release time and knee. The effect of compression on the output signal as a function of input signal strength and parameter settings is displayed in Sabine's unique dynamic ColorComp graph, in addition to the traditional opposing-meter indicators.

- **RF Scan and Report,** which measures strength for each of the 70 transmission channels, and displays a hierarchical ordering of the clearest, strongest channels to use during system setup and operation. You can print a copy of the scan results.
- **Additional memory options.** In addition to saving presets in receiver memory, channel configuration settings can be saved to and recalled from disc or hard drive. All parameter settings made with the remote control, including adjustments that are not accessible from front panel controls (e.g., compressor knee and release), are saved with presets. All software settings stored for each of the 10 presets, including settings not accessible from the front panel, will be loaded whether presets are recalled by remote control or from the front panel. Note that all settings made in Off-line/Edit mode can be saved and applied in online operation.
- **Ability to print a report of all parameter settings,** creating hard copy documentation.
- **A receiver channel output mute button.**
- **The ability to custom name each RF channel and receiver.** This name will be displayed in the software only.
- **Display of important transmitter status information.** In addition to duplicating the battery charge status, battery warning message, and transmitter on/off/mute status from the front panel display, the Remote Software displays the number of hours the battery has been in use, the frequency midpoint (in GHz) of the transmission channel chosen, the transmitter pad and low cut filter settings, and a warning indication in the case of low RF signal strength. For handheld transmitters, the software display also shows the type of mic capsule in use.
- **Improved and expanded operational displays.** In addition to organizing all front panel displays on a single computer screen, the Remote Software also displays the exact frequency, width, and depth of FBX filters. The frequency response curve resulting from combined filter settings (including FBX, parametric, and high and low cut) is graphically displayed in the software. Frequency response changes imposed by choosing various microphone models are also shown.
- **Customizable front panel lock settings.** Software control allows you to program selective access to front panel controls to be made available once the Remote Control is disconnected. Customizable front panel lock settings are saved and recalled as part of each receiver's settings. All software-only accessible settings are saved with presets. Careful programming enables some powerful operational features — for example, locking Program Save but enabling other front panel controls (including Program Load) will let front panel users update settings temporarily, yet reload the original settings at the push of a button. Such a temporary adjustment would not permanently alter a setup designed to work in most situations, but would allow tweaking to address unusual situations.

WARNING:
BEFORE DISCONNECTING RECEIVER FROM COMPUTER

Quit all SWM7000 Software functions and close software BEFORE disconnecting the receiver connection to you computer. Failure to do this may cause the receiver to lock up. In case of receiver lock up, restart receiver.

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13.1.3. Software Multiple Unit Control

The true extent of the power of the SWM Remote Software is realized when it is used to control multiple wireless receivers. When ND-series receivers are connected in a network, the additional controls offered by the Remote Software over the entire system include:

- **Simultaneous multiple channel/system monitoring.** The Remote Software "All Channel View" (figure 13h) shows all important status conditions for up to 70 transmission channels. Color-coded warnings and alerts draw attention to potential problems.
- **Detailed, quick access to a single set of controls.** The "Command View" (figure 13c) displays comprehensive information about a single selected RF channel, and easy adjustment of all its controls. Channels are selected by clicking the appropriate All Channel View button. (NOTE: Each channel display in the All Channel View also allows quick access to parameter adjustments, by using the right mouse button to popup a parameter control menu.)
- **Quick, interactive control of wireless network channels.** All or selected parameter settings for a given channel can be copied to one or more additional channels, using the Copy Parameters option.

USB DRIVERS

Your USB enabled SWM7000 receiver requires version 2.0 or above software. Installing this software will also install the necessary USB drivers onto your computer. If at any time you need to re-install USB drivers, use the software CD supplied with your receiver, or download them from Sabine.com.

13.2. Software Installation

13.2.1. Requirements & Recommendations

- **PC Minimum Requirements:** Pentium 266 MHZ CPU or AMD Duron CPU**;** 128 Megabytes of RAM; 20 Megabytes free space on hard drive; Windows 95 or higher.
- **PC Recommended Requirements:** Pentium 1.0 GHZ CPU or AMD Athlon CPU; 512 Megabytes of RAM; 20 Megabytes free space on hard drive; Windows 2000 or XP.
- SVGA or greater resolution graphic card and monitor. Recommended minimum monitor resolution: 1024 x 768 pixels (or 800 x 600 pixels for 15 inch monitors). Select "small fonts" and 16 bit color as defaults for monitor display. Windows XP users select 96 dpi screen settings.
- USB or Serial COMM Port.

NETWORK CABLE CONNECTIONS

Connect the **first receiver** of a network using a USB or RS-232 9-pin connection. All subsequent receivers connect to each other via RS-485 connection.

13.2.2. Connections

There are three types of connections that are used in a remote controlled one-or two-channel Sabine SWM7000 system:

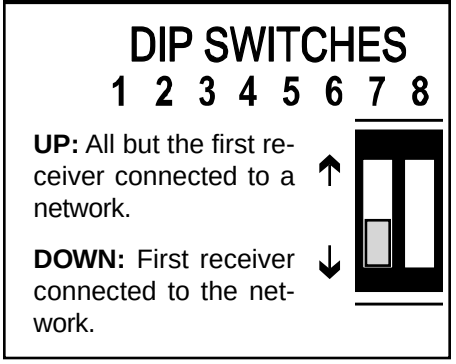
- **Serial port (RS-232 9-pin):** Use this to connect to a single receiver, or the first receiver in a network (multiple receivers). Be sure to use a cable with standard 9-pin D-connectors (male on one end, female on the other) that is a "serial," not a "null modem" cable.
- **USB:** Use this to connect to a single receiver, or the first receiver in a network (multiple receivers).

  NOTE: Some SWM7000 receivers may not have a USB port. In this case, simply use a USB to RS-232 9-pin adaptor. Go to Sabine.com for a list of suggested adapters.
- **Network (multiple SWM7000-ND series receivers):**

  1. Connect the first receiver in your network to the PC using a USB cable or an RS-232 Serial Cable (not supplied).

  2. Connect all other receivers as a chain using RS-485 (or standard Ethernet) cables. There are two such jacks on the back of all ND-series receivers. Either jack can connect to another receiver either "upstream" or "downstream" from the computer remote control. As signals travel in both directions (from computer to receiver and back), it is not necessary to connect the last receiver in a network back to the computer (you do not need to make a "loop").

NETWORK DIP SWITCH SETTINGS



3. IMPORTANT: Set dip switch #7 on the back of the first receiver to the "OFF" (down) position (default). Set dip switch #7 on all other networked receivers to the "ON" (up) position.

4. When all cable connections have been made, open the SWM7000 Remote Control Software program on your PC. The SWM7000 software will find all the receivers in the network and show them in a dialog box (receiver sequence can be reordered). Click "Accept" to control the network. NOTE: Up to 35 2-channel (or 1-channel, or any combination thereof) receivers – totalling up to 70 transmission channels – can be connected in a single network to a single PC.

13.2.3. Installing the Software

Follow these simple instructions for installing the Sabine SWM Remote Software on your computer:

1. Insert the Sabine software CD into your PC's CD ROM drive and wait a few seconds for the auto-start software installer to open.
2. Select the SWM7000 Remote Control Software installation icon and follow the instructions given in the dialog boxes that appear. NOTE: For best results, allow the installation program to install the software within the default directories.

13.3. Launching the software

Launching the software produces the Startup Screen (Fig. 13a).

Fig. 13a Control Software Startup window

13.3.1. Off-Line Edit/Demo

Clicking the right button ("Off-Line Edit/Demo") will open the main software screen regardless of whether any SWM receivers are connected. The software functions in Off-Line mode are completely programmable, and may be saved and downloaded to a connected receiver at a later time. Display settings (e.g., level, compression, transmitter settings) which are dependent on the presence of actual signal are simulated, for demonstration only. You may turn the simulated displays on or off using the OPTIONS menu.

13.3.2. Connecting Receivers.

Clicking "Connect Receiver" will direct the software to poll the bus on the designated COMM Port to detect connected, powered-on receivers. If no receivers are detected, you may change the designated COMM Port by clicking the appropriate button. If this also proves ineffective, check your cables and connections, and make sure the connected receivers are powered on. In very rare instances you may need to reset your COMM Port settings on your computer.

Once polling is completed, the software will display all the receivers detected, in sequence, and the model of each receiver (ND series or standard, 1 or 2-channel). (See figure 13b for a sample opening display)

Once you confirm that the information reported is correct, proceed to the main screen, and you may begin remote control operation.

Fig. 13b - Connection Screen

13.4. Remote Control Operation

13.4.1. Two Views, Two Sets of Controls

Fig. 13c - Control Software Command View

The default main screen appears as shown in figure 13c.

The top portion of the screen (above the "Active Channels" bar and two arrow buttons) is the Command View, showing details and allowing parameter adjustments for a single receiver channel at a time.

The bottom portion (below "Active Channels") is the All Channel View, capable of simultaneously showing the most important (but less detailed) information for multiple channels. Each audio (RF) channel in the system has its own display box, arranged in rows of eight channels each, organized in order to correspond to the string of receivers in the serial bus.

If you have 8 or fewer RF channels, both View Modes will fit on your monitor. For more than 8 channels, there are quick shortcuts for optimizing your display and switching and mixing View Modes:

- Click and drag the Active Channel bar to pull the All Channel View up or down, partially or completely covering the Command View. You cursor will change to a hand icon.
- Use the up/down arrows flanking "Active Channel" to scroll the rows displayed in the space allocated to the All Channel View.
- Click on the Command View or All Channel View button in the upper left menu bar (or use F2 and F3), to immediately change from one to the other.
- To select a channel to edit in either view, left click on a channel in All Channel View (indicated by a red border around the selected channel). This displays the selected channel's settings in the Command View. A right mouse click on a single channel shown in the All Channel View pops up a menu of parameters (see figure 13d). The value of the parameter selected is displayed in the All Channel View for each RF channel, and also pops up an adjustment screen for the selected channel. You can review and compare settings on all channels, one parameter at a time, and adjust any setting on any unit from the All Channel View.
- Parameter adjustments in the Command View can be made by clicking and turning any knob; or by a right-clicking on a parameter to pop up an adjustment window, and keying in a value.

Fig. 13d - All Channel View (after right-clicking and selecting Ratio).

13.4.2. Menus, Icons & Hot Keys

Quick access to the features described above, plus some additional software control, is available from four pull-down menus (File, Select Receiver, Options, and RF Scan) and five icons (FBX, Lock, Command View, All Channel View, and RF Scan) at the top of the screen. The controls associated with the five icons can also be accessed using function keys F2 through F6, respectively. Figure 13e shows the location of the menus and icons, and describes associated controls which are accessed.

13.4.2.1. FBX Settings (F4)

Allows global settings of FBX filter width and maximum allowed FBX filter depth. As filters are set, they will conform to the global width chosen at the time of setting. It is thus possible to mix filter widths by changing the width value in between setting FBX filters. Maximum depth will be common to all FBX filters, and the value will update if the global setting is changed.

Sensitivity and Persistence are controls that allow the speed and analysis of the FBX algorithm to match the type of audio program. Some audio programs, notably certain types of classical music, produce occasional waveforms that are difficult to distinguish from acoustic feedback. The factory default Sensitivity and Persistence values should work in almost all conditions; however, you may change them if necessary to prevent the possibility of triggering a false filter, or to more quickly set the FBX filters. There is a trade-off between speed of filter placement and how carefully the filter is placed. More demanding audio sources may require higher Sensitivity & Persistence settings, which will slightly slow down the speed of filter placement, but decrease any possibility of mistaking program audio for feedback.

FBX Dynamic Filter Time Out This function gives each dynamic filter a time limit, after which the filter automatically resets. A setting of “zero” disables the timer.

Fig. 13f - FBX Parameters window

13.4.2.2. Lock (F5)

You can customize the mix of functions that will be locked when choosing Front Panel Lock 2 (figure 13g). Front Panel Locking can only be activated using the Dip Switches on the receiver back panel. See Appendix D for more information.

Fig. 13g - Front Panel Lock Setup

13.4.2.3. All Channel View (F3)

Shows the All Channel View as a (vertically) resizable window (figure 13h).

13.4.2.4. Command View (F2)

Shows the Command View on the screen (figure 13c).

Fig. 13h - Active Channels Window - All Channel View

13.4.2.5. RF Scan (F6)

Use the RF scan to get a "picture" of the potential RF interference in your location. You should perform a scan before every program so you can see the ambient RF levels on all 70 channels of your system.

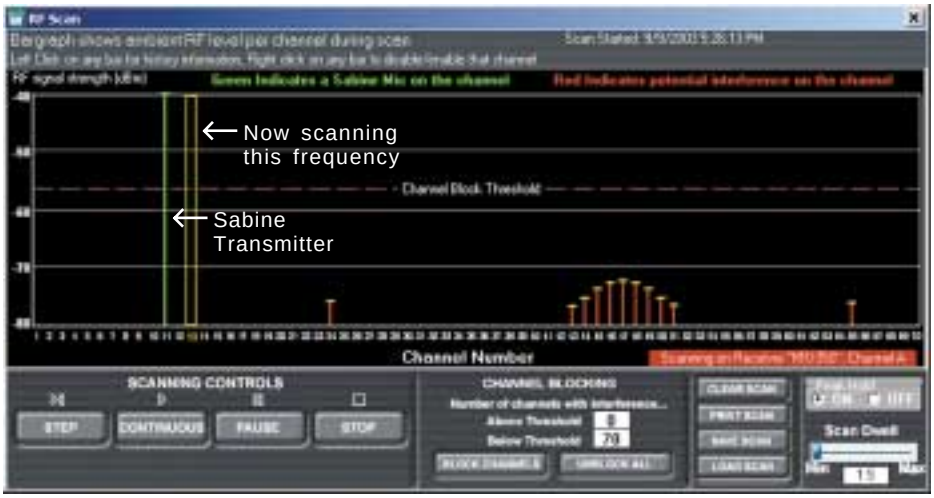
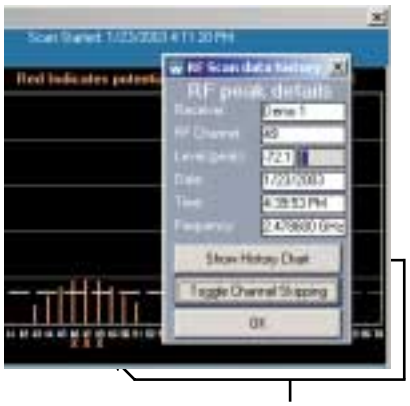


Fig. 13i RF Scanner results: one Sabine Transmitter (will display as a green line) and some low-level RF interference (will display as red lines)

Caution: The RF Scan mutes and takes control of the selected channel. **All other functions are disabled on the selected channel. Do not perform an RF scan on a channel you need during your program!**

Select RF Scan by using the toolbar button, the F6 hot key, or the RF Scan menu item. You will see the screen shown in Figure 13i. Select Single Scan or Continuous Scan if you want to look at the RF levels over time. The software will take control of the selected receiver, and will step through all 70 channels. You can control the speed of the scan using the Dwell Time adjustment.

Fig. 13j RF Scan data history



Click the channel number to open the Scan Data History window. Click the Toggle Channel Skipping button to turn the channel on/off. Channels "skipped" will have a red "**X**" beneath their channel number.

Scan results are shown in several ways. A thick green line indicates a Sabine transmitter is active on the associated channel. Thin green lines on either side of that line show RF signal levels for left and right antennas respectively. This RF Diversity function is especially useful for antenna positioning when using distribution amp. A red line indicates ambient RF is present on the channel, at a level indicated by the scale on the left side of the chart. A dotted red line indicates a previous RF level from an earlier scan, and a small yellow "T" indicates the peak RF level observed over the entire time. Left click on any line or channel number brings up the "RF Scan data history" window, allowing you to disable the specific channel (figure 13J). If you chose Continuous Scan you can also choose to see the Channel Details (figure 13k) and a history of all RF activity on a particular channel for the duration of the Continuous Scan (figure 13k).

Channels with very low RF signals (below -70 dBm) should be considered open channels. We include this low level measurement so you can see the activity in your location, but the Sabine transmitters will overpower and ignore those very low signals.

You can choose to disable all channels with ambient RF levels above a selectable threshold. Click and drag the dotted horizontal purple line to change the threshold (figure 13i). Choose **Block Channels** to disable channels above the threshold. These channels will no longer be available when selecting RF channels from the front panel of the receiver.

Fig. 13k RF Signal Strength History

RF SCAN CAUTION

Do not perform an RF scan during your program!

13.4.2.6. Options Menu

Copy Parameters. This window allows you to copy your settings for all functions to any number of other channels. Select the channel you want to copy from by first selecting the receiver, then the channel. From the Options Menu, choose Copy Parameters. You will see your selected channel displayed in a red field labeled “Copy Parameters From.” Select the channels you want to copy to from the Available Channels list, then check the boxes of the parameters you wish to copy. Once you are sure of your selections, hit Copy Now and your settings will be pasted to the selected channels. Note that RF channel selections cannot be copied.

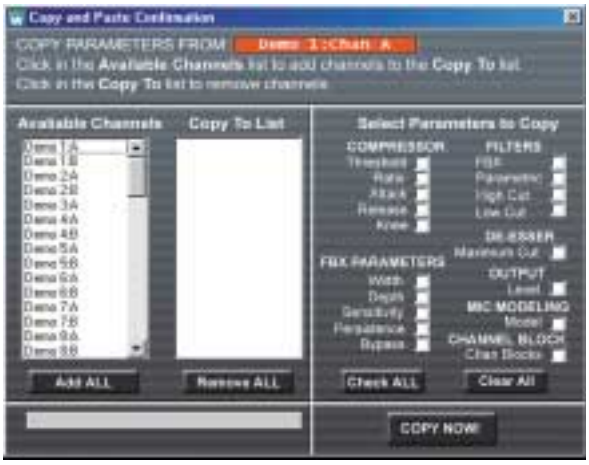


Fig. 13L Copy Parameters window

Reset Parameters. This window allows you to selectively reset any of the functions in your receiver. Choose Reset Parameters from the Options Menu, then check the boxes of the functions you would like to reset to their default settings. In order to reset FBX filters, use the dedicated button on the Command View. If you wish to load the factory default for the entire receiver, choose Preset 00 from the Program drop-down on the Command View and select the Load button.

Fig. 13m Reset Parameters window

WARNING:
BEFORE DISCONNECTING RECEIVER FROM COMPUTER

Quit all SWM7000 Software functions and close software BEFORE disconnecting the receiver connection to you computer. Failure to do this may cause the receiver to lock up. In case of receiver lock up, restart receiver.

14. TIPS & TROUBLESHOOTING

14.1. Tips for Maximum Performance

- Keep a clear and unobstructed path between transmitter and receiver.
- Position receiver antennas at least one meter off the performance floor level.
- Avoid placing receiver antennas near large metallic or other dense materials.
- Keep receiver antennas away from RF signal generating equipment (computers, high-voltage equipment, etc.).
- Position antennas perpendicular to each other.
- Use a Sabine Antenna Distribution System (SWA6SS) for multiple system installation.
- Return transmitters to a charger when not in use.
- Use a Sabine SWASS-EXT Extension Antenna to extend range and/or improve reception.

14.2. Troubleshooting

Problem: True Mobility receiver and transmitter power are on, receiver RF Signal meters and Input Level meters are lighting up, but there is no sound from system.

Solution: Check connection between receiver and mixer/amp. Adjust receiver Output Level control. Check for MUTE status in Remote Control Software. Make sure RF scanner is OFF.

Problem: True Mobility receiver and transmitter power are on, but receiver RF Signal meters and Input Level meters are not lighting up.

Solution: Check transmitter On/Battery Indicator. Recharge transmitter if necessary. Check transmitter and receiver frequency Channel settings (make sure they match). Check receiver antenna connections. Check distance between transmitter and receiver antennas and possible obstructions in path.

Problem: Transmitter is on, but sound is noisy.

Solution: Check transmitter On/Battery Indicator. Replace weak battery with fresh battery from charger unit if necessary. Check for other sources of RF interference (high voltage equipment, lighting equipment, etc.). Check distance between transmitters and receiver antennas.

Problem: Transmitter is off, but noise still coming from receiver.

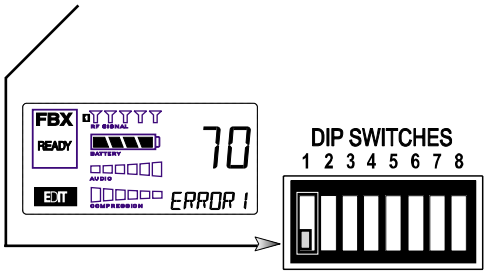
Solution: Check for other sources of RF interference (high voltage equipment, lighting equipment, trolley cars, etc.). Select another frequency. Check connection and position of the receiver antennas. Utilize a Sabine Extension Antenna.

Problem: Noise or humming.

Solution: Check for fluorescent lights — bad ballasts may cause noise or hum in your system.

Problem: “ERROR 1” message displays on receiver:

Solution: Make sure that the #1 dip switch (located on the rear panel of the receiver) is in the down (OFF) position.



14.3. Common Sources of RF Interference

Since Marconi and others pioneered the first radio broadcasts, the radio spectrum has become increasingly crowded with a huge diversity and variety of RF sources. The strength, frequency, location, and timing cycles of these RF sources create a shifting pattern of interfering and overlapping frequencies and coverage patterns, which can render the use of radio microphones a difficult and unpredictable business.

The typical sources of interference for conventional wireless mics can be high-powered broadcasters such as radio stations and TV transmitters, or other short-range wireless devices, including multiple radio microphones operating at the same location (either by design, or by coincidence), that operate in proximate (or harmonically related) bands. Less commonly, interference may arise from spurious outputs emitted by electronic equipment (notably computers, printers, or similar devices with digital clocks), faulty electrical equipment, neon signs, dimmers and lighting controllers, and so forth.

Many UHF and VHF mics are especially vulnerable because they share the RF spectrum with the very high-powered transmitters for television. The coming conversion to digital and high-definition broadcast will increase the problems for UHF and VHF.

The 2.4 to 2.4835 GHz frequency band is not only well above the fundamental (nominal) transmission frequencies of such strong analog and digital broadcasts, but also high enough to escape interference problems occurring at the strong first harmonic of even the highest digital television broadcast. The band is approved worldwide for a variety of uses, including such diverse transmitters as baby monitors, garage door openers, wireless LANs, amateur satellite, cordless telephones, etc. Compared to RF broadcast sources like television and radio stations, these low power devices produce very localized, short range interference; furthermore, many of the devices working in the 2.4 GHz range use spread spectrum transmission and reception. Both of these facts mean such uses of the RF spectrum are less likely to cause interference with, or suffer from interference from the use of, Sabine's systems.

14.3.1 RF Sources

Your first step in checking for interference should be utilizing the Scan function in the SWM7000 Remote Control Software. See **Section 13.4.2.5 RF Scan** for a complete discussion of the benefits of scanning, which will reveal any potential RF sources in your location and allow you to make an informed choice of channels to use. The scanner can scan for long periods of time and will give you a report of RF activity over time for each of the 70 channels available on your Smart Spectrum system.

1. Microwave ovens

In the vast majority of situations, interference from microwave ovens will not affect performance of your SWM7000 series microphone systems. Since barriers such as walls work to block interference, a microwave oven will likely present a problem only when located in fairly close proximity within the same room as the wireless receiver (or reception antenna). See caution below.

Commercial quality microwave ovens present a bigger potential problem. They sweep over a wider band of frequencies than the limited band affected by consumer units, and use two magnetron tubes which alternate to avoid inactivity during a power cycle. Fortunately, Sabine systems are only affected by such ovens in close proximity to receiver antennas. That protection, plus the availability of 70 different RF channels to choose from, makes serious interference problems arising from microwave ovens avoidable and unlikely. See caution below.

Antenna Placement Caution

As a general precaution, keep 2.4 GHz cordless telephones, microwave ovens, WLAN antennas and 2.4 GHz wireless video camera transmitters twice the distance from your Sabine wireless microphone system antennas as that of your Sabine 2.4 GHz transmitters.

2. Wireless Local Area Networks (WLANS)

These computer network devices allow computers to connect via wireless devices that act as both receivers and transmitters. These low-powered transceivers often have selectable channels and can utilize the entire 2.4 GHz band. In general, Sabine microphones should not be affected by these WLANS because their spread spectrum technology does not present a problem for the Sabine Smart Spectrum™ system. The Sabine wireless system will not interfere with the WLAN. See caution below.

3. Cordless phones

These home telephones broadcast at very low power and should not present interference problems for your Sabine wireless. This is especially true if the telephone uses spread spectrum technology. See caution below.

4. Wireless Video Cameras

Certain wireless video cameras (X10, for example) use the 2.4 GHz band. These devices are also very low power and, in general, should not present a problem when using the SWM7000 system. See **Section 5 Receiver Operation** for methods of optimizing clear reception and minimizing interference. See caution below.

In the event problems still arise, see **Section 5 Receiver Operation** for methods of optimizing clear reception and minimizing interference.

Antenna Placement Caution

As a general precaution, keep 2.4 GHz cordless telephones, microwave ovens, WLAN antennas and 2.4 GHz wireless video camera transmitters twice the distance from your Sabine wireless microphone system antennas as that of your Sabine 2.4 GHz transmitters.

15. FBX THEORY & PRACTICE

15.1. Introduction to FBX®

WHY FBX? Feedback is certainly the most pervasive challenge to the audio industry. The potential appearance of sudden, loud, out-of-control feedback is every sound engineer's and musician's nightmare. Unlike more subtle audio quality problems or shortcomings, feedback is embarrassingly obvious — it disturbs the performer, the audience, and the technician, and can damage equipment and just generally ruin your day.

Feedback is a potential problem in any amplified sound system that places a microphone or pickup in proximity to a loudspeaker. Poor acoustical conditions or misguided use by unsophisticated sound system operators only aggravate the situation. To make matters still worse, a non-Sabine variety of wireless microphone adds yet another level of feedback danger to the picture. Since feedback erupts whenever the distance, location, and gain relationships between a speaker and a microphone reach a critical combination, a mic that can move anywhere results in an ever changing potential for feedback. A step in the wrong direction may change a clear sound to a piercing shriek in less than a second.

This enhanced potential for feedback with a wireless system gets worse if lavalier microphones are used. Such microphones are usually placed farther from the mouth than handheld or head set microphones, thus requiring more gain. Also, the polar pattern of a lavalier microphone is frequently omnidirectional. Thus, the likelihood of feedback increases, due to the microphone's increased off-axis sensitivity to the sound emanating from the loudspeakers.

The Sabine True Mobility® SWM7000 wireless systems solve feedback problems by precise attenuation of very narrow bands of feedback-prone frequencies. The process is automatic, simple to use, adaptable to changing acoustical conditions and relationships, powerful in its application, and has minimal consequences to the audio fidelity of the signal. We call this automatic filter an FBX Feedback Exterminator® filter, or FBX filter for short.

15.2. The Advantages of FBX Filters

Before the invention of FBX, the most common device for controlling feedback was the 31-band graphic EQ. However, an FBX filter offers three distinct advantages over graphic filters.

1. First and most obvious is the automatic nature of FBX filters. When feedback occurs, FBX responds more quickly than even the most experienced engineer. Automatic FBX placement works even in the presence of audio program material, intelligently distinguishing feedback from music or speech.
2. A second advantage is that FBX micro-filters are precisely placed anywhere feedback occurs (with 1 Hz resolution), while graphic EQ filters are limited to 31 fixed center points. An FBX filter represents a direct hit on feedback! In contrast, a graphic EQ filter can only approximate the exact frequency of the feedback, and the filter (or filters) with the closest center frequency must be pulled down. Such filters are deepest at their centers, and such imprecise attenuation takes a big (and unnecessary) chunk out of your sound (see Fig. 15a).
3. Increased clarity and gain-before-feedback are further accomplished by the third and most important advantage of FBX: Sabine's micro-filters are ten times narrower than 31-band EQ filters. Using FBX micro-filters will return up to 90 percent of the power removed by EQ filters.

Here's a good place to make a very important distinction. Graphic EQ filters are typically called "1/3-octave," but it's important to understand that this term refers to the spacing of the filter centers (1/3-octave apart), and not the width of the filter (usually a full octave). Graphic filters thus overlap one another, and affect frequencies well above and below the center point frequency, including frequencies of adjacent bands. This makes graphic equalizers very practical tools for shaping sound "with broad strokes," such as dialing in overall system EQ, but results in destructive audio quality overkill when they are used to elimi-

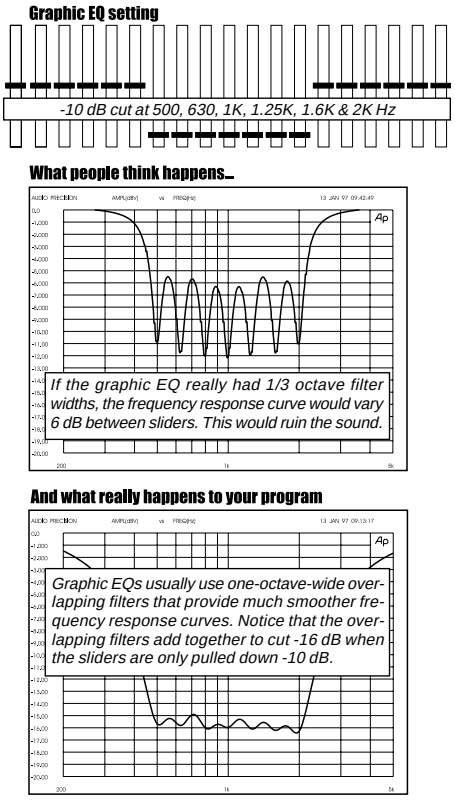


Fig. 15a What a Graphic EQ does to your Program

nate feedback. A graphic equalizer would need more than 10,000 narrow-band sliders to be as precise and powerful as your FBX.

As an example of the power of FBX, figure 15b shows test results measured with a PA set up consisting of a microphone, mixer, FBX Feedback Exterminator®, power amp and two speakers. The system's gain was first raised until the FBX removed nine feedback points. Next, the FBX was replaced with a graphic EQ. The EQ was adjusted while the system gain was raised to the same level achieved with the FBX. The frequency response curves of each device were then plotted and are compared in figure 15b. Note how much more of the program (the "good audio") is eliminated using an EQ — whereas only feedback is eliminated using FBX filters.

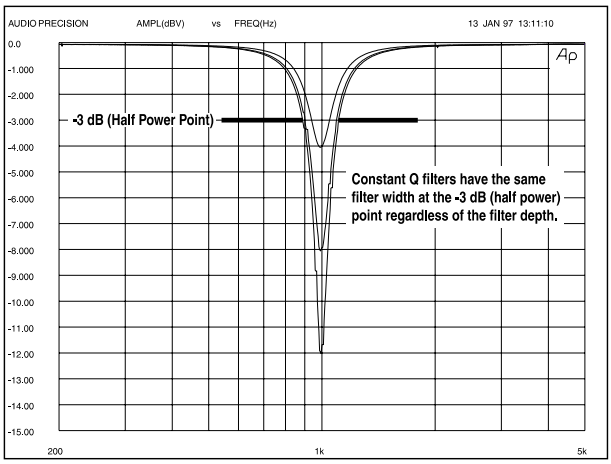


Fig. 15b - Constant Q Filter

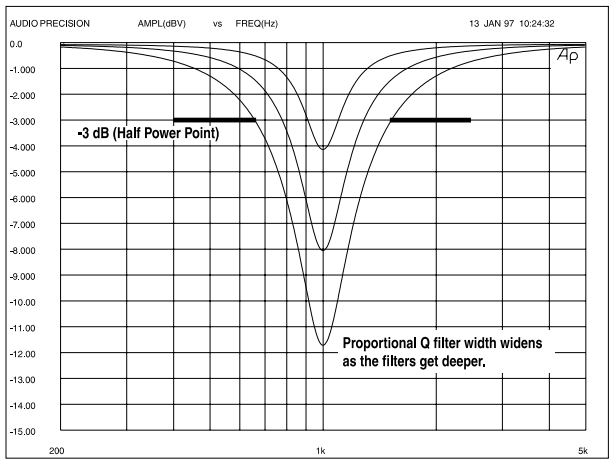


Fig. 15c - Proportional Filter

Sabine Constant Q Filters

It is common to describe a filter's quality factor, or "Q," as the center frequency of the filter divided by the filter width (in Hertz) measured at the -3dB point. Filters that have the same Q, or width, at the -3dB point regardless of the filter's cut or boost are called Constant Q filters (see Fig. 15b). Filters that get wider as the filter gets deeper are called Proportional Q filters (see Fig. 15c). Lately, however, the definition of Constant Q is becoming less distinct. Many equalizer manufacturers claim their equalizers have Constant Q filters, when in fact they get substantially wider as they get deeper. The only way to know for sure if the filters are truly Constant Q is to inspect their frequency response curves. Sabine FBX Filters are true Constant Q filters.

15.3. Parametric Filters and FBX

Of course, many savvy sound engineers, realizing the limitations of graphic equalizers in removing problem feedback, prefer to use a different type of equalizer, called a parametric EQ, for such applications. If you're one such audio engineer, you'll be comforted to know that FBX filters share much in common with parametrics.

Compared to graphic filters, parametrics allow more precise adjustments — specifically, control of filter width, the amount of boost or cut, and the mid-band frequency of the filter. This greater precision, however, comes at a price, as parametric filters are not nearly as intuitive or simple to use as graphic equalizers.

Nothing, however, is easier to use than an FBX filter, which enjoys the precision of a parametric filter, yet deploys instantly and automatically whenever feedback is detected. Effectively, an FBX filter is a parametric filter set to a tenth-octave width, restricted to cut-only activity, and automatic in its choice of frequency band. If you want hands-on control, use the Sabine True Mobility® Remote Software to change FBX filters to parametrics, and tweak frequency, width, and depth to your liking.

15.3.1. The FBX & True Mobility® Advantage

After inventing FBX technology and refining it for over a decade, Sabine has brought our patented automatic feedback control to its fullest realization with the Sabine SWM7000 True Mobility® wireless systems. Our latest advance in maintaining the highest quality audio signal is due to the placement of the signal processing in the input chain of the microphone signal. Many times signal processing (compression and equalization) is placed after the output stage of a mixer, meaning it is applied to a combination of inputs mixed together into one output and passed through the processor. Particularly in the case of equalization and feedback control, one consequence of such placement is that filtering appropriate to only one microphone may be applied to all mics in the same mix bus. In other words, unnecessary filtering may be applied to microphones that, due to variations in position and microphone characteristics, will feedback at a different set of frequencies. Although the filters are very transparent, why add filtering if you can avoid it? And why divide your processing power among multiple signals?

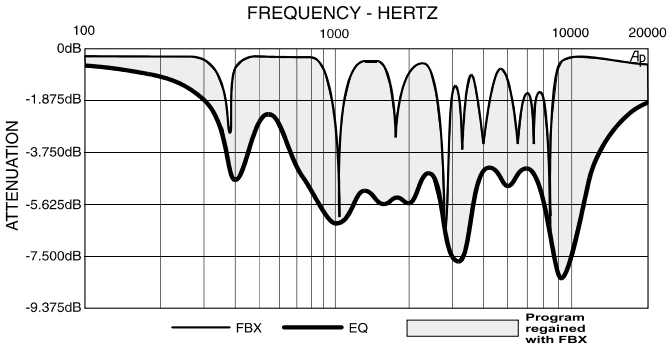


Fig. 15d - FBX at Work: What FBX Gives Back to your Program

Placing the filtering and other signal processing in the input signal path is a concept called Targeted Input Processing. It means each microphone so equipped will have customized, unique signal processing applied — and no unnecessary processing.

With FBX technology, your microphone will finally sound loud enough, everyone in the audience will understand each word, and feedback will be far less likely to make an unwelcome and unexpected visit—and you'll be comfortable knowing that protection is extended to anywhere a wireless microphone might be taken.

14.3.2. FBX Fixed & Dynamic Filters

FBX filters come in two flavors, fixed and dynamic. Both operate automatically. There is no audible difference between fixed and dynamic filters in terms of sonic purity; the difference arises in their application.

14.3.2.1. Fixed FBX Filters

Once they set automatically (see Section 7 for information on setting filters), fixed FBX filters will NOT change frequency. You can think of fixed filters as cures for problem frequencies (the "first-to-feedback" frequencies encountered during normal system operation), common to most locations in the room.

14.3.2.2. Dynamic FBX Filters

Dynamic FBX filters also set automatically, but can change frequency, on a rotating basis, as the need arises. To help distinguish dynamic from fixed filters, consider the example of a speaker using a wireless lavalier microphone, who walks under a ceiling speaker for the first time. In so doing, he enters a location-specific feedback zone, where it's possible that a problem frequency may have escaped detection and notching by a fixed filter. If all fixed filters have been deployed, a dynamic filter will be set automatically as soon as feedback appears, solving the problem. Great! But what happens when the speaker then moves away from the ceiling speaker, and close to a floor monitor? Feedback from the ceiling speaker is no longer a problem, but a new frequency starts to squeal. If all fixed and dynamic FBX filters are already set, a dynamic filter will change, to adjust to the new location. An FBX dynamic filter thus stands guard if new problem feedback arises after all available filters have been set, providing a deeper and more flexible level of protection against the dreaded surprise of feedback.

Other than the ability to change frequency, a dynamic filter is equivalent to a fixed filter.

14.3.2.3. Balancing Fixed & Dynamic Filters

Each channel of your SWM7000 wireless receiver offers a total of 10 FBX filters (combined fixed and dynamic), which can be used as needed to exterminate feedback. After years of experience and experimentation, Sabine has settled upon a default balance of 7 fixed and 3 dynamic filters, set at the factory. This default condition can be changed to 8 fixed and 2 dynamic, by changing a DIP switch on the back of your receiver (see Appendix D FBX Configuration DIP Switch), or to any configuration using the Remote Control software (see Section 13).

If you follow setup instructions for setting FBX filters (see Section 7), your receiver will automatically exit SETUP mode (enter READY status) after all fixed filters, and the first dynamic filter, have set. In the default condition, this means you will have set eight filters (seven fixed and one dynamic), with two dynamic filters still unset and remaining on standby alert. If you wish to set fewer filters, press the READY button before SETUP automatically exits, after you have set enough filters to safely achieve your desired gain level. In that case, in the factory default condition, you will reserve three unset dynamic filters for standby.

14.3.3. FBX Filter Width

Sabine's experience and testing with filters and sound quality along led us to decide upon a default FBX filter width of .10 (one-tenth) octave as the optimal notch width, able to eliminate feedback without affecting music programs. If, with all filters properly set, feedback is still a problem, FBX filters may be set to .20 (one-fifth) octave width. This wider filter setting will help to better eliminate feedback trouble areas, but may also affect music programs slightly. Therefore, the wider setting is generally considered to be appropriate where speech (less demanding than music) is the primary application of the Sabine Wireless system. You can globally change FBX filter width by repositioning a rear panel DIP switch, to change from .10 to .20 octave (see Appendix D FBX Configuration DIP Switch), or by adjusting filter width using the True MobilityTM Remote Software (which allows a range of widths from .01 to 1.0 octave). You may also mix filter widths, either by adjusting individual filter widths using the Remote Software, or by changing the DIP switch position during setup. The width of any set filter will always be determined by the position of the switch at the time the filter is created.

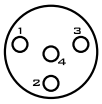
14.3.4. Who Benefits from FBX?

Virtually every sound system will be improved with the Sabine True Mobility® Wireless System. Singers and speakers who do not have sound technicians can now increase their monitor or house system volume so they can hear themselves clearly and with full fidelity, without worrying if their microphones will suddenly squeal if they move to the wrong place.

Auditoriums and churches of all sizes will enjoy reliable feedback control. Hotels and conference centers around the world can offer meeting rooms with microphones that won't howl during programs. The Sabine True Mobility® Wireless System can be installed in theaters, schools, sports arenas, courtrooms, teleconferencing, intercoms or interactive remote classrooms — anywhere one or multiple microphones are used.

15. APPENDICES

Appendix A: Beltpack Connector Wiring Diagrams



1: GND
2: +3.3 VDC
3: AUDIO SIGNAL INPUT (50K OHM IMPEDENCE)
4: 20K TO GND

Fig. A1 - Transmitter Input Connector Wiring Diagram

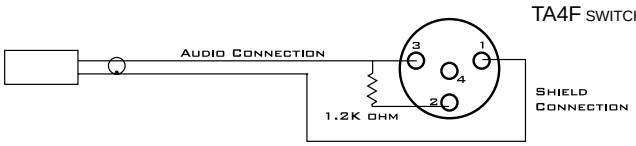


Fig. A2 - 2-conductor Electret Wiring Diagram

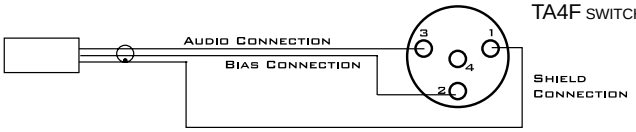


Fig. A3 - 3-conductor Electret Wiring Diagram

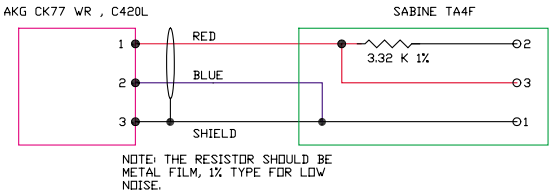


Fig. A5 - AKG CK77 WR, C420L to Sabine SW70-T

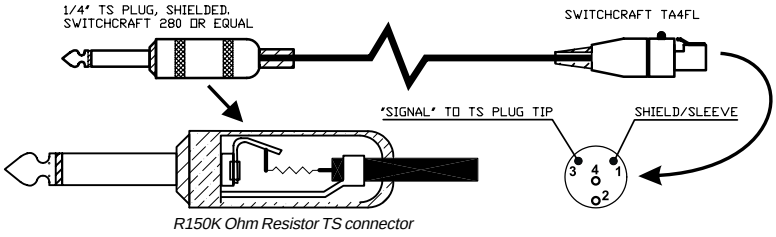
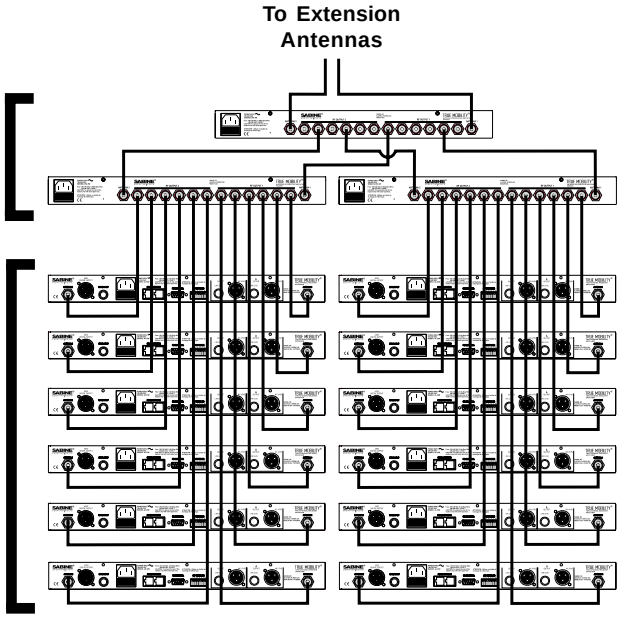


Fig. A4 - Beltpack Instrument Cable

Appendix B: Antenna System Diagrams

NOTE: Connect receiver Antenna 1 input to any RF Output 1 connector on the SWA6SS. Likewise, connect any receiver Antenna 2 to any RF Output 2 connector on the SWA6SS.



Appendix C: Specifications

SW70 Series Receivers, 1- or 2-channel

Carrier Frequency Range: ISM Band 2400 - 2483.5 MHz
Frequencies: 70 pre-programmed
Oscillation Mode: PLL synthesized
Receiving Mode: True diversity
Sensitivity: 6 dBV at S/N over 70 dB
Image Rejection: >63 dB
Spurious Rejection: >76 dB
Stability: < 5 ppm
Maximum Deviation: +/- 150 KHz
Dynamic Range: > 100 dB
S/N Ratio: 95 dB (Typical)
THD: <0.1%
Frequency Response: 20 Hz - 20 KHz +/- 1 dB
Antennas: 2, ¼ wavelength, 50 Ohm
Power Supply: 100-240 VAC 50-60 Hz
Rack-Mount case
Working Range: > 100 meters
Outputs: Balanced XLR and TRS, mic or line level
RS232 & RS485** Serial Interface
Digital Audio Output with Sync Input**
Maximum Undistorted Sinewave Output:

- TRS balanced +20 dBV, +22 dBu, 300 Ohm source impedance
- XLR balanced +2 dBV, +4 dBu, 200 Ohm source impedance
- TRS UN-balanced +14 dBV, +16 dBu, 150 Ohm source impedance
- XLR UN-balanced -4 dBV, -2 dBu, 100 Ohm source impedance

NOTE: Both outputs are available simultaneously. Excessive loading of one of the outputs may affect the output of the other. The XLR output is protected against inadvertent application of Microphone Phantom Power

SW70 Series Handheld Microphones

Dynamic Mic Capsule: Audix OM3 (Optional OM5)
Condenser Mic Capsule: Sabine
Antenna: Internal Fixed
Maximum FM Deviation: +/- 100 KHz
RF Frequency Stability: < 5 ppm
RF Output: < 25 mW
Spurious output: < -50 dB of rated output
Telemetry: Battery Voltage, Mute Status, Capsule Type
Programmable LCD
Programmable On/Off switch
Battery: Sabine Rechargeable or one 1.5V Alkaline C cell
Rechargeable Battery Life: 11 hours per charge,
500 charge cycles (typical)
Alkaline Battery Life: 12 hours (typical)

SW70 Series BeltPack Transmitter

Maximum FM Deviation: +/- 150 KHz
RF Frequency Stability: < 5 ppm
Spurious output: < -50 dB of rated output
RF Output: < 25 mW
Telemetry: Battery Voltage, Mute Status
Programmable LCD
Programmable On/Off switch
Mic input impedance: 47 K Ohms
Mic bias: 3.3V
Mic connector: TA4
Antenna type: Internal Fixed
Battery: Sabine Rechargeable or two 1.5V Alkaline AA cells
Rechargeable Battery Life: 10 hours per charge,
500 charge cycles (typical)
Alkaline Battery Life: 12 hours (typical)

Digital Signal Processing

FBX Filters

Ten independent digital filters per channel, controlled automatically from 20 Hz to 20 KHz
Filter depth: 3 dB steps from 0 dB to -40 dB
Filter width: .1 or .2 octave*
Resolution: 1 Hz from 20 Hz to 20 KHz
Time required to find and eliminate feedback: typically 0.3 seconds @ 1 KHz

Digital Compressor/Limiter

Threshold: -30 dB to 0 dB
Ratio: 1:1 through infinity
Knee: soft to hard
Attack: 1-99 msec
Release: 10 to 1000 msec

Automatic De-Esser

Cut range: 0 to -30 dB

Microphone SuperModeling

Dynamic Capsules***
Shure SM-58
Shure Beta 58A
Audio Technica ATM 41a
AKG D3800

Condenser Capsules***
Shure Beta 87A
AKG C535 EB
Audio Technica ATM 89R

Presets

10 User Presets – Saves all configurations

Mechanical

Dimensions: 1-U rack-mount, 19 x 1.75 x 9 in.
(48.3 x 4.5 x 21.6 cm)
Weight: 5.3 lb. (2.4 kg)

Operating Temperature

Safe Operating Temperature: 0 - 50 degrees centigrade ambient temperature (32-129F)

Power

Power input rating: 100 – 240 VAC 50/60 Hz 0.4 A 35 W
Fuse: 100 – 140 VAC 0.5A 250V SLOW BLOW
or
200 – 240 VAC 0.315A 250V TYPE T

SWA6SS Antenna Distribution Amplifier (SWA6SS)

Two antenna inputs
Six outputs per antenna to receivers
Filter Bandwidth: 2.40 - 2.483 GHz +/- 3 dB
1 dB Compression Input Level: -20 dBm
Noise Figure: < 3.7 dB (Center Band)
Input/Output Gain: (+)1.6dB (Center Band)
Input/Output Impedence: 50 Ohm
Output Port Isolation: 30 dB minimum
Connector: TNC type, 50 Ohm
Power Supply: 100-130 VAC or 200-240 VAC 50/60 Hz
Safe Operating Temperature: 0 - 50 degrees centigrade ambient temperature (32-129F)

(SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE)

**Below approximately 200 Hz the feedback filters become slightly wider to increase the feedback and rumble capture speed at these low frequencies.*

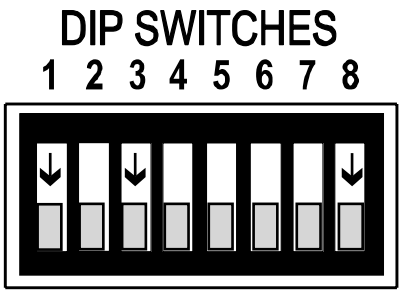
***ND Series Receivers Only*

****Company names, product names, and trademarks listed here 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.*

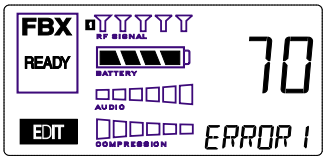
Appendix D: Dip Switch Settings

(Located on the receiver back panel)

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. In addition, the LCD contrast control is not locked in Lock 2.



IMPORTANT: Dip Switches 1, 3,4 & 8 must always be in **down** position! The error message to the right will display on the receiver if the #1 dip switch is not in the **down** position.



NOTE 1: LOCK 1 overrides LOCK 2.

NOTE 2: Down is the default position.

NOTE 3: Lock settings are saved with the Presets.

Networking: The first receiver connected to the PC must have dip switch #7 set to the **down** position (default). All other receivers connected within a network must have dip switch #7 set to the **up** position.

DIP SWITCH STATUS CHART

#	SERIES	DESCRIPTION	UP STATUS	DOWN STATUS
1	ALL	(Always Down)	*Error*	OK
2	ALL	**FBX Filter Width**	1/5 Octave	1/10 Octave
3	ALL	(Always Down)	*Error*	OK
4	ND ONLY	**Digital Output Clock Source**	External Word Clock Input	(Default) Internal Clock Source
5	ALL	**Lock 1**	Lock	Unlock
6	ALL	**Lock 2**	Lock	Unlock
7	ND ONLY	**Network Enable** receivers other than 1st.	Networked or 1st receiver in network.	No networking,
8	ALL	(Always Down)	*Error*	OK

Appendix E: Frequency Chart

Channel Number	Center Frequency	Channel Number	Center Frequency	Channel Number	Center Frequency
1	2400.840000	25	2429.404898	49	2457.969796
2	2401.633469	26	2430.198367	50	2458.763265
3	2403.220408	27	2431.785306	51	2460.350204
4	2404.013878	28	2432.578776	52	2461.143673
5	2405.600816	29	2434.165714	53	2462.730612
6	2406.394286	30	2434.959184	54	2463.524082
7	2407.981224	31	2436.546122	55	2465.111020
8	2408.774694	32	2437.339592	56	2465.904490
9	2410.361633	33	2438.926531	57	2467.491429
10	2411.155102	34	2439.720000	58	2468.284898
11	2412.742041	35	2441.306939	59	2469.871837
12	2413.535510	36	2442.100408	60	2470.665306
13	2415.122449	37	2443.687347	61	2472.252245
14	2415.915918	38	2444.480816	62	2473.045714
15	2417.502857	39	2446.067755	63	2474.632653
16	2418.296327	40	2446.861224	64	2475.426122
17	2419.883265	41	2448.448163	65	2477.013061
18	2420.676735	42	2449.241633	66	2477.806531
19	2422.263673	43	2450.828571	67	2479.393469
20	2423.057143	44	2451.622041	68	2480.186939
21	2424.644082	45	2453.208980	69	2481.773878
22	2425.437551	46	2454.002449	70	2482.567347
23	2427.024490	47	2455.589388		
24	2427.817959	48	2456.382857		

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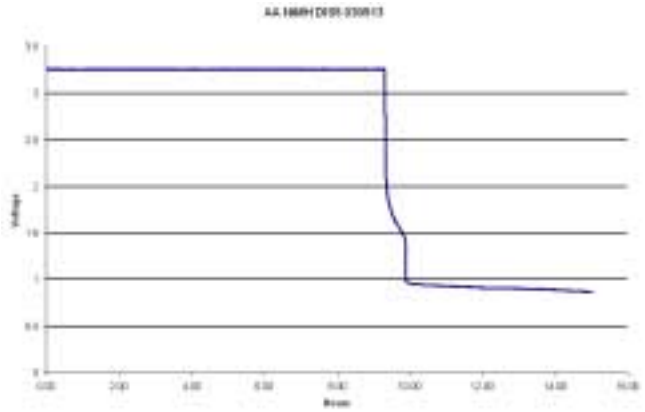
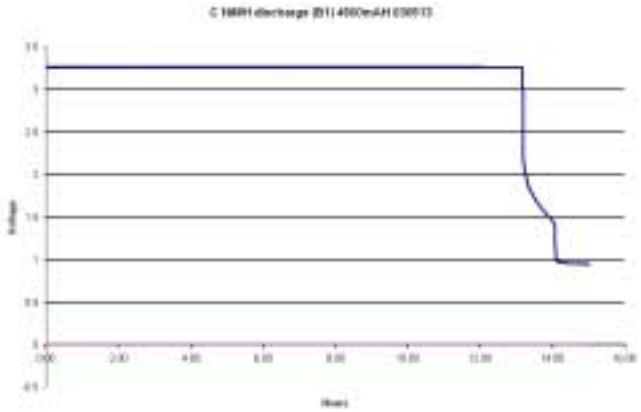
Appendix F: Battery Endurance Tests (Typical)



NiMH AA Battery (SWBC1, Typical)

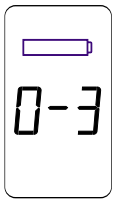


NiMH C Battery (SWAA2, Typical)

Appendix G: Changing Audix Mic Capsules (SW70-H)

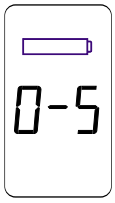
Sabine's Mic SuperModeling™ function requires a baseline characteristic for the capsule in use. Therefore, after changing capsules, you will need to “tell” the transmitter which capsule is now attached. NOTE: this is only necessary when the capsule is changed.

1. Open the handheld mic’s battery door.
2. While holding down the SELECT button, turn on the mic. Continue to hold the select button for about 3 seconds, then let go.
3. One of the screens at right will appear in the transmitter LCD — showing the currently assigned capsule.



Audix OM-3

4. Using the transmitter control up/down buttons, select the capsule you now have attached. Wait a few seconds until the LCD cycles through the transmitter firmware version numbers and returns to the default display (channel number).
5. IMPORTANT: In order for the new capsule selection to be saved, you must now edit the RF channel selection. To do this, press the Select button, then use the up/down buttons to change the RF channel. Wait a few seconds to allow the transmitter screen to return to the default display. NOTE: you can return to the original channel by repeating the channel selection process.



Audix OM-5

16. CAUTIONS & WARRANTY

Warning! This equipment must be earthed.
Caution! Risk of electric shock. Do not open.
Caution! Shock hazard. Do not remove covers. No user serviceable parts inside. Refer servicing to qualified service personnel.
Warning! To reduce the risk of fire or electric shock, do not expose this product to rain or moisture.
Attention! Cet appareil doit être relié à la terre.
Attention! Risque de choc électrique; ne pas ouvrir.
Attention! Risque de choc; ne pas oter les capots. Aucune pièce accessible à l'intérieur. S'addresser à un technicien qualifié.
Attention! Pour réduire le risque d'incendie ou de choc électrique, ne pas laisser l'appareil sous la plouie ou à l'humidité.
Achtung! Dieses Gerät muss schutzgeerdet sein.
Achtung! Gefar eines elektrischen Stormschlags. Gehause nicht öffnen.
Achtung! Gefar eines elektrischen Stormschlags. Gehäuse nicht öffnen. Keine con Benutzer zu bedienenden Teile im Geräteinneren.
Überlassen Sie das Gerät zu Servicezwecken nur geschultem Fachpersonal.
Um Brandgefar oder das Risiko eines elektrischen Schlags auszuschließen, das Gerät vor Nässe und Feuchtigkeit schützen.
Advertencia! Este equipo debe estar conectado a tierra.
Precaución! Reisgo de descarga eléctrica. No abrir.
Precaución! Riesgo de descarga eléctrica. No desmontar las tapas. Piezas interiores no reparables por el usuario. Reparable sólo por personal cualificado.
Advertencia! Para reducir el riesgo de incendio o de descarga eléctrica no exponga este producto a la lluvia o humedad.

FCC Statements

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference; and (2) This device must accept any interference received, including interference that may cause undesired operation. Warning: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio TV technician for help.

SW70-H & SW70-T Transmitters

The Sabine handheld and beltpack transmitters comply with the FCC part 15 section 249 requirements for frequency and field strength: 2400 – 2483.5 MHz.

- Field strength of Fundamental: 50 millivolts per meter when measured at 3 meters distance
- Field strength of Harmonics: 500 microvolts per meter when measured at 3 meters distance

Canadian Compliance Statement

This digital apparatus does not exceed the Class B limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

Le present appareil numerique n'emet pas de bruits radioelectriques depassant les limites applicables aux appareils numeriques de la class B prescrites dans le Reglement sur le brouillage radioelectrique edicte par le ministere des Communications du Canada.

Japanese EMI Compliance Statement

この装置は、第二種情報装置
（住宅地域又はその隣接した地域において使用されるべき情報装置）
で住宅地域での電波障害防止を目的とした情報処理装置等電波障害
自主規制協議会（VCCI）基準に適合しております。
しかし、本装置をラジオ、テレビジョン受信機に近接してご使用に
なると、受信障害の原因となることがあります。
取扱説明書に従って正しい取り扱いをして下さい。

WARNING!

The True Mobility is designed to operate from standard AC power. Please be sure the power in your area is compatible with the power requirements marked on the rear of the unit. Using the wrong input voltage may cause permanent damage to the unit and will void the warranty.

Power input rating: 100 – 240 VAC 50/60 Hz 0.4 A 35 W
Fuse: 100 – 140 VAC 0.5A 250V SLOW BLOW - *or* -
200 – 240 VAC 0.315A 250V TYPE T

The True Mobility Wireless Microphone system is supplied with one of the following AC power cords:

Japan	100 VAC	United Kingdom	240 VAC
U.S./North America	120 VAC	Australia	240 VAC
Continental Europe	230 VAC		

Battery Caution

DO NOT BURN OR PUNCTURE BATTERY. DOING SO COULD RELEASE TOXIC MATERIALS WHICH COULD CAUSE INJURY.

DO NOT SHORT CIRCUIT

MUST BE RECYLED OR DISPOSED OF PROPERLY.

1. Read all safety and operating instructions before using this product.
2. All safety and operating instructions should be retained for future reference.
3. Obey all cautions in the operating instructions and on the unit.
4. All operating instructions should be followed.
5. Use only shielded audio and data cables.
6. This product should not be used in the presence of moisture or rain, or near any water, i.e., a bathtub, sink, swimming pool, wet basement, etc.
7. This product should be located so that its position does not interfere with proper ventilation. Do not use in direct sunlight. Do not place flat against a wall or in a built-in enclosure that will impede the flow of cooling air.
8. This product should not be placed near a source of heat such as a stove or radiator.
9. Connect only to a power supply of the type marked on the unit adjacent to the power entry module.
10. Never break off the ground pin on the power supply cord.
11. Power supply cords should always be handled carefully. Never walk or place equipment on power supply cords. Periodically check cords for cuts or signs of stress, especially at the plug and the point where the cord exits the unit.
12. The power supply cord should be unplugged when the unit is to be unused for long periods of time.
13. Care should be taken so that objects do not fall and liquids are not spilled into the unit through the ventilation holes or any other openings.
14. This unit should be checked by a qualified service technician if:
    A. The power supply cord or plug has been damaged.
    B. Anything has fallen or been spilled into the unit.
    C. The unit does not operate correctly.
    D. The unit has been dropped or the enclosure damaged.
15. The user should not attempt to service this equipment. All service work should be done by a qualified service technician.

CAUTION - Implanted cardiac pacemakers or AICD devices:
Any source of RF (radio frequency) energy may interfere with normal functioning of the implanted device. All wireless microphones have low-power transmitters (less than 0.05 watts output) that are unlikely to cause difficulty, especially if they are at least a few inches away. However, since a beltpack transmitter typically is placed against the body, Sabine suggests attaching it at the belt, rather than in a shirt pocket where it may be immediately adjacent to an implanted medical device. Note also that any medical-device disruption will cease when the RF transmitting source is turned off. Please contact your physician or medical-device provider if you have any questions, or experience any problems with the use of this or any other RF equipment.

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CAUTION!

EXPOSURE TO EXTREMELY HIGH NOISE LEVELS MAY CAUSE A PERMANENT HEARING LOSS. INDIVIDUALS VARY CONSIDERABLY IN SUSCEPTIBILITY TO NOISE INDUCED HEARING LOSS, BUT NEARLY EVERYONE WILL LOSE SOME HEARING IF EXPOSED TO SUFFICIENTLY INTENSE NOISE FOR A SUFFICIENT TIME. THE U.S. GOVERNMENT'S OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) HAS SPECIFIED THE FOLLOWING PERMISSIBLE NOISE LEVEL EXPOSURES:

DURATION/DAY IN HOURS SLOW RESPONSE	SOUND LEVEL IN dBA	DURATION/DAY IN HOURS SLOW RESPONSE	SOUND LEVEL IN dBA
8	90	1-1½	102
6	92	1	105
4	95	½	110
3	97	¼ or less	115
2	100		

ACCORDING TO OSHA, ANY EXPOSURE IN EXCESS OF THE ABOVE PERMISSIBLE LIMITS COULD RESULT IN HEARING LOSS. EAR PLUGS OR PROTECTORS IN THE EAR CANALS OR OVER THE EARS MUST BE WORN WHEN OPERATING THIS DEVICE IN ORDER TO PREVENT A PERMANENT HEARING LOSS, IF EXPOSURE IS IN EXCESS OF THE LIMITS AS SET FORTH ABOVE. TO ENSURE AGAINST POTENTIALLY DANGEROUS EXPOSURE TO HIGH SOUND PRESSURE LEVELS, IT IS RECOMMENDED THAT ALL PERSONS EXPOSED TO EQUIPMENT CAPABLE OF PRODUCING HIGH SOUND PRESSURE LEVELS SUCH AS THIS DEVICE BE PROTECTED BY HEARING PROTECTORS WHILE THIS UNIT IS IN OPERATION.

THIS LIMITED WARRANTY VALID ONLY WHEN PURCHASED AND REGISTERED IN THE UNITED STATES OR CANADA. ALL EXPORTED PRODUCTS ARE SUBJECT TO WARRANTY AND SERVICES TO BE SPECIFIED AND PROVIDED BY THE AUTHORIZED DISTRIBUTOR FOR EACH COUNTRY.

Ces clauses de garantie ne sont vaiables qu'aux Etats-Unis et au Canada. Dans tous les autres pays, les clauses de garantie et de maintenance sont fixees par le distributeur national et assuree par lui selon la legislation en vigueur.

Diese Garantie ist nur in den USA and Kanada gultig. Alle Export-Produkte sind der Garantie und dem Service des Importeurs des jewelligen Landes untervorfen.

Esta garantia es valida solamente cuando el producto es comprado en E.U. continentales o en Canada. Todos los productos que sean comprados en el extranjero, estan sujetos a las garantias y servicio que cada distribuidor autorizado determine y otrezca en los diferentes paises.

ONE-YEAR LIMITED WARRANTY/REMEDY

SABINE, INC. ("SABINE") warrants this product to be free from defects in material and workmanship for a period of one (1) year from date of purchase PROVIDED, however, that this limited warranty is extended only to the original retail purchaser and is subject to the conditions, exclusions and limitations hereinafter set forth:

CONDITIONS, EXCLUSIONS AND LIMITATIONS OF LIMITED WARRANTIES

1. These limited warranties shall be void and of no effect if:
   a. The first purchase of the product is for the purpose of resale; or
   b. The original retail purchase is not made from an AUTHORIZED SABINE DEALER; or
   c. The product has been damaged by accident or unreasonable use, neglect, improper service or maintenance, or other causes not arising out of defects in material or workmanship; or
   d. The serial number affixed to the product is altered, defaced or removed; or
   e. The power supply grounding pin is removed or otherwise defeated. In the event of a defect in material and/or workmanship covered by this limited warranty, Sabine will repair the defect in material or workmanship or replace the product, at Sabine's option; and provided, however, that, in any case, all costs of shipping, if necessary, are paid by you, the purchaser.
2. NiMH batteries included with the original purchase are warranted for ninety (90) days from date of purchase.

THE WARRANTY REGISTRATION CARD SHOULD BE ACCURATELY COMPLETED, MAILED TO AND RECEIVED BY SABINE WITHIN FOURTEEN (14) DAYS FROM THE DATE OF YOUR PURCHASE.

In order to obtain service under these warranties, you must:

a. Bring the defective item to any Authorized SABINE DEALER and present therewith the ORIGINAL PROOF OF PURCHASE supplied to you by the AUTHORIZED SABINE DEALER in connection with your purchase from him of this product. If the DEALER is unable to provide the necessary warranty service, you will be directed to the nearest other SABINE AUTHORIZED DEALER which can provide such service. OR:

b. Ship the defective item, prepaid, to:
   SABINE, INC.
   13301 NW US HIGHWAY 441
   ALACHUA, FL 32615-8544

Include therewith a complete, detailed description of the problem, together with a legible copy of the original PROOF OF PURCHASE and a complete return address. Upon Sabine's receipt of these items:

If the defect is remedial under the limited warranties and the other terms and conditions expressed have been complied with, Sabine will provide the necessary warranty service to repair or replace the product and will return it, FREIGHT COLLECT, to you, the purchaser.

Sabine's liability to the purchaser for damages from any cause whatsoever and regardless of the form of action, including negligence, is limited to the actual damages up to the greater of $500.00 or an amount equal to the purchase price of the product that caused the damage or that is the subject of or is directly related to the cause of action. Such purchase price will be that in effect for the specific product when the cause of action arose. This limitation of liability will not apply to claims for personal injury or damage to real property or tangible personal property allegedly caused by Sabine's negligence. Sabine does not assume liability for personal injury or property damage arising out of or caused by a non-Sabine alteration or attachment, nor does Sabine assume any responsibility for damage to interconnected non-Sabine equipment that may result from the normal functioning and maintenance of the Sabine equipment.

UNDER NO CIRCUMSTANCES WILL SABINE BE LIABLE FOR ANY LOST PROFITS, LOST SAVINGS, ANY INCIDENTAL DAMAGES OR ANY CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THE PRODUCT, EVEN IF SABINE HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

THESE LIMITED WARRANTIES ARE IN LIEU OF ANY AND ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR USE; PROVIDED, HOWEVER, THAT IF THE OTHER TERMS AND CONDITIONS NECESSARY TO THE EXISTENCE OF THE EXPRESS LIMITED WARRANTIES, AS HEREINABOVE STATED, HAVE BEEN COMPLIED WITH, IMPLIED WARRANTIES ARE NOT DISCLAIMED DURING THE APPLICABLE ONE-YEAR PERIOD FROM DATE OF PURCHASE OF THIS PRODUCT.

SOME STATES DO NOT ALLOW LIMITATION ON HOW LONG AN IMPLIED WARRANTY LASTS, OR THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATIONS OR EXCLUSIONS MAY NOT APPLY TO YOU. THESE LIMITED WARRANTIES GIVE YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH MAY VARY FROM STATE TO STATE.

THESE LIMITED WARRANTIES ARE THE ONLY EXPRESS WARRANTIES ON THIS PRODUCT, AND NO OTHER STATEMENT, REPRESENTATION, WARRANTY OR AGREEMENT BY ANY PERSON SHALL BE VALID OR BINDING UPON SABINE.

In the event of any modification or disclaimer of express or implied warranties, or any limitation of remedies, contained herein conflicts with applicable law, then such modification, disclaimer or limitation, as the case may be, shall be deemed to be modified to the extent necessary to comply with such law.

Your remedies for breach of these warranties are limited to those remedies provided herein, and Sabine gives this limited warranty only with respect to equipment purchased in the United States of America.

INSTRUCTIONS-WARRANTY REGISTRATION CARD

1. Mail the completed WARRANTY REGISTRATION CARD to:
   SABINE, INC.
   13301 NW US HIGHWAY 441
   ALACHUA, FLORIDA 32615-8544 USA
   OR: **Register online at www.Sabine.com**
   a. Keep the PROOF OF PURCHASE. In the event warranty service is required during the warranty period, you will need this document. There will be no identification card issued by Sabine, Inc.
2. IMPORTANCE OF WARRANTY REGISTRATION CARDS AND NOTIFICATION OF CHANGES OF ADDRESS:
   a. Completion and mailing of WARRANTY REGISTRATION CARDS - Should notification become necessary for any condition that may require correction, the REGISTRATION CARD will help ensure that you are contacted and properly notified.
   b. Notice of address changes - If you move from the address shown on the WARRANTY REGISTRATION CARD, you should notify Sabine of the change of address so as to facilitate your receipt of any bulletins or other forms of notification which may become necessary in connection with any condition that may require dissemination of information or correction.
3. You may contact Sabine directly by telephoning (386) 418-2000.
4. Please have the Sabine product name and serial number available when communicating with Sabine Customer Service.

Manufactured by: Sabine, Inc.
13301 NW US Highway 441
Alachua, Florida 32615-8544 USA
Phone: +USA (386) 418-2000
Fax: +USA (386) 418-2001

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ADAPTIVE AUDIO

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