Section 5
Troubleshooting

page contents

CAUTION

The installation and servicing instructions in this manual are for use by qualified personnel only. To avoid electric shock do not perform any servicing other than that contained in the Operating Instructions unless you are qualified to do so. Refer all servicing to qualified service personnel.

Problems and Possible Causes

Always verify that the problem is not the source material being fed to the 2200, or in other parts of the system.

RFI, Hum, Clicks, Or Buzzes

A grounding problem is likely. Review the information on grounding on page 2-12.

The 2200 has been designed with very substantial RFI suppression on its analog and digital input and output ports, and on the AC line input. It will almost always operate adjacent to high-powered transmitters without difficulty. In the most unusual circumstances, it may be necessary to reposition the unit to reduce RF interference, and/or to reposition its input and output cables to reduce RF pickup on their shields.

Particularly if you are using a long run of coaxial cable between the 2200 and the exciter, a ground loop or other problem may inject noise into the exciter's composite input — particularly if the exciter's input is unbalanced. This problem can almost always be cured by the Orban CIT25 Composite Isolation Transformer (see page 2-12).

Poor Peak Modulation Control

The 2200 ordinarily controls peak modulation to an accuracy of ±3%. This accuracy will be destroyed if the signal path following the 2200 has poor transient response. Almost any link can cause problems. Even the FM exciter can have insufficient flatness of response and phase linearity (particularly at low frequencies) to disturb peak levels. Section 1 of this manual contains a complete discussion of the various things that can go wrong.

Even if the transmission system is operating properly, the FM modulation monitor or reference receiver can falsely indicate peak program modulation higher than that actually being transmitted if the monitor overshoots at high or low frequencies. Many commercial monitors have this problem, but most of these problem units can be modified to indicate peak levels accurately.

Audible Distortion On-Air

Make sure that the problem can be observed on more than one receiver and at several locations. Multipath distortion at the monitoring site can be mistaken for real distortion.

Verify that the source material at the 2200's audio inputs is clean. Heavy processing can exaggerate even slightly distorted material, pushing it over the edge into unacceptability. Refer to Orban's publication *Audio Quality in the FM Plant* (included with your 2200) for hints on how to achieve the cleanest source quality.

The subjective adjustments available to the user have enough range to cause audible distortion at their extreme settings. Advancing the CLIPPING and/or FINAL CLIP controls too far

will inevitably cause distortion. Setting the LESS-MORE control beyond "9" will cause audible distortion of some program material with all but the Protection Limiter structure.

If you are using the 2200 or the analog inputs of a 2200-D, the headroom of the unit's analog-to-digital (A/D) converter must be correctly matched to the peak audio levels expected in your system (using System Setup). If your peak program level exceeds the peak level you have specified on setup, the 2200's A/D converter will clip and distort. (See page 2-20).

If you are using an external processor ahead of the 2200, be sure that it is not causing problems. For example, if a "stereo enhancer" is used, be sure that it does not significantly increase the average level of the stereo difference channel (L−R). This will almost certainly exaggerate multipath distortion.

> The Orban 222A Stereo Enhancer is fully compatible with the 2200 and will not cause this problem.

Amplitude modulation of the carrier that is synchronous with the program ("synchronous AM") can cause subtle distortion, and can exaggerate existing multipath distortion. Synchronous AM should be better than 35dB below 100% modulation as measured on a synchronous AM detector with standard FM de-emphasis (50μs or 75μs).

> The "incidental AM" position on most modulation or stereo monitors is insufficiently wideband to provide an accurate reading of synchronous AM — such metering was designed to indicate non-synchronous AM like hum and noise.

Audible Noise on Air

(See also **RFI, Hums, Clicks, or Buzzes** on page 5-2.)

Excessive compression will always exaggerate noise in the source material. The 2200 reduces this problem with its *compressor gate,* which freezes the gain of the AGC and compressor systems whenever the input noise drops below a level set by the GATE THRESH (Gate Threshold) control, preventing noise below this level from being further increased.

If you are using the 2200's analog input, the overall noise performance of the system is usually limited by the overload-to-noise ratio of the analog-to-digital converter used by the 2200 to digitize the input. (This ratio is slightly better than 90dB.) It is important to correctly specify the AI CLIP level in the System Setup Analog I/O screen to optimize the noise performance available from the analog-to-digital converter. You should specify the level as the highest peak level that will be presented to the 2200 under normal operation. If, in an attempt to build in a "safety factor" or increase headroom, you specify a higher level than this, every 1dB of extra headroom that you gain will be accompanied by a 1dB increase in the 2200's noise floor.

The 2200's optional AES/EBU input is capable of receiving words of up to 20 bits. A 20 bit word has a dynamic range of approximately 120dB. The 2200's digital input will thus rarely limit the unit's noise performance even with very high amounts of compression.

If a studio-to-transmitter link (STL) is used to pass unprocessed audio to the 2200, the STL's noise level can severely limit the overall noise performance of the system because compres-

sion in the 2200 can exaggerate the STL noise. For example, the overload-to-noise ratio of a typical analog microwave STL may only be 70–75dB. In this case, it is wise to use the Orban 8200ST Studio Chassis to perform the AGC function prior to the STL transmitter and to control the STL's peak modulation. This will optimize the signal-to-noise ratio of the entire transmission system. Section 1 of this manual has a more detailed discussion. Composite STL systems with marginal paths or co-channel interference can cause noise (hiss) which will be most apparent when listening in stereo.

Whistle on Air, Perhaps Only in Stereo Reception

This could be caused by a number of problems, any of which could present a spurious tone (perhaps supersonic) to the input of the stereo encoder. In any such case, the first thing to do is to examine the left and right analog outputs with a spectrum analyzer to see if any spurious tones are visible.

If the whistle is 6kHz, there could be a beat between the 2200's 32kHz sampling frequency and the 38kHz stereo subcarrier. In this case, the most probable cause is a failure of the 2200's digital-to-analog converter system, including a failure of the reconstruction filter following the converter.

A whistle at another frequency might be associated with power supply oscillation, oscillation of any opamp in the digital-to-analog converter system, or composite STL problems.

Shrill, Harsh Sound

This problem can be caused by excessively high settings of the HF ENHANCE control.

If you are driving an external stereo encoder with built-in pre-emphasis, you must set the 2200's AO PRE-E to flat to prevent double pre-emphasis, which will cause very shrill sound.

You will *always* achieve better peak control by defeating the pre-emphasis and input filters of an external stereo encoder, permitting the 2200 to perform these functions without overshoot. Section 1 of this manual contains a detailed explanation of these, and other, system design considerations.

Dull Sound

If driving an external stereo generator, dull-sounding source material can sound dull on the air.

If the 2200's output is set to flat there will be no pre-emphasis unless it is supplied elsewhere in the system. This will cause very dull sound.

System Will Not Pass Line-Up Tones at 100% Modulation

This is normal. Sine waves have a very low peak-to-average ratio by comparison to program material. The processing thus automatically reduces their peak level to bring their average level close to that of program material, promoting a more consistent and well-balanced sound quality.

The 2200 can generate its own test tones, and these can be triggered from the 2200's optically-isolated remote control terminals, or by recalling a tone preset from the front panel, Page 1-10 provides a further explanation. Recall bypass Test Tone to pass line-up tones transparently.

System Will Not Pass Emergency Alert System ("EAS" USA Standard) Tones at the Legally-Required Modulation Level

See **System Will Not Pass Line-Up Tones at 100% Modulation** (directly above) for an explanation. These tones should be injected into the exciter after the 2200.

Interference from Stereo Into Subcarriers

A properly-operating 2200 generates an immaculately clean baseband, with program-correlated noise below −85dB above 57kHz. If the 2200 and the rest of the transmission system is operating correctly, subcarriers should experience no interference.

Interference from the stereo into a subcarrier is best diagnosed with a spectrum analyzer. First examine the spectrum of the 2200's composite output. If the 2200 is operating properly, program-correlated noise should be below −85dB above 57kHz.

Even the slightest amount of composite clipping will degrade this protection dramatically. Such composite clipping may be intentional (in a composite clipper), or unintentional (you could be over-driving a composite link between the 2200's composite output and the exciter's input).

If the exciter is non-linear, this can cause crosstalk. In general, a properly-operating exciter should have less than 0.1% THD at high frequencies to achieve correct operation with subcarriers.

To prevent truncation of the higher-order Bessel sidebands of the FM modulation, the RF system following the exciter must be wideband (better than ±500kHz) and must have symmetrical group delay around the carrier frequency. An incorrectly-tuned transmitter can exhibit an asymmetrical passband which will greatly increase crosstalk into subcarriers.

Amplitude modulation of the carrier that is synchronous with the program ("synchronous AM") can cause program-related crosstalk into subcarriers. Synchronous AM should be better than 35dB below 100% modulation as measured on a synchronous AM detector with standard FM de-emphasis (50μs or 75μs).

The subcarrier receiver itself must receive a multipath-free signal, and must have a wide and symmetrical IF passband and a linear, low-distortion FM demodulator to prevent program-related crosstalk into subcarriers.

19kHz Frequency Out-of-Tolerance

First, verify that a problem really exists by using a second frequency-measuring device and/or verifying the problem with your monitoring service. If the problem is real, you must replace crystal Y602; there is no frequency trim available.

L–R (Stereo Difference Channel) Will Not Null With Monophonic Input

This is often caused by relative phase shifts between the left and right channels prior to the 2200's input. This will cause innocuous linear crosstalk between the stereo main and subchannels (and *vice versa*). Refer to step 5-K on page 4-13.

General Dissatisfaction With Subjective Sound Quality

The 2200 is a complex processor which can be adjusted for many different tastes. For most users, the gamut offered by the LESS-MORE control is sufficient to find a satisfactory "sound." However, some users will not be satisfied until they have accessed other Modify Processing controls and have adjusted the subjective setup controls in detail to their satisfaction. Such users *must* fully understand the material in Section 3 of this manual to achieve the best results from this exercise.

By comparison to competitive processors, the 2200 offers a uniquely favorable set of trade-offs between loudness, brightness, distortion, and buildup of program density. If your radio station does not seem to be competitive with others in your market, the cause is usually problems with the source material, overshoot in the transmission link (including the FM exciter) following the 2200, or an inaccurate modulation monitor that is causing you to under-modulate the carrier. A station may suffer from any combination of these problems, and they can have a remarkable effect upon the overall competitiveness of a station's sound.

If you are competing with a station that has Orban's high-end 8200 Audio Processor, you will not be able to get the source-to-source consistency and low voice distortion offered by the 8200's Five-Band structure. However, you will still have a loud big-sounding signal. Stations that need the ultimate in state-of-the-art processing should upgrade to the Orban 8200.

Section 1 of this manual provides a thorough discussion of system engineering considerations, particularly with regard to minimizing overshoot and noise. Orban's publication *Audio Quality in the FM Plant* (included with the 2200) provides many suggestions for maximizing source quality.

Troubleshooting IC Opamps

IC opamps are operated such that the characteristics of their associated circuits are essentially independent of IC characteristics and dependent only on external feedback components. The feedback forces the voltage at the (–) input terminal to be extremely close to the voltage at the (+) input terminal. Therefore, if you measure more than a few millivolts difference between these two terminals, the IC is probably bad.

Exceptions are opamps used without feedback (as comparators) and opamps with outputs that have been saturated due to excessive input voltage because of a defect in an earlier stage. However, if an opamp's (+) input is more positive than its (–) input, yet the output of the IC is sitting at −14 volts, the IC is almost certainly bad. The same holds true if the above polarities are reversed. Because the characteristics of the 2200's circuitry are essentially independent of IC opamp characteristics, an opamp can usually be replaced without recalibration.

A defective opamp may appear to work, yet have extreme temperature sensitivity. If parameters appear to drift excessively, freeze-spray may aid in diagnosing the problem. Freeze-spray is also invaluable in tracking down intermittent problems. But *use it sparingly,* because it can cause resistive short circuits due to moisture condensation on cold surfaces.

Technical Support

If you require technical support, contact Orban customer service. Be prepared to accurately describe the problem. Know the serial number of your 2200 — this is printed on the rear panel of the unit.

Telephone: (1) 510/351-3500 or Write: Customer Service
Orban
or Fax: (1) 510/351-0500 1525 Alvarado Street
San Leandro, CA 94577 USA

E-Mail: custserv@orban.com

Factory Service

Before you return a product to the factory for service, we recommend that you refer to this manual. Make sure you have correctly followed installation steps and operation procedures. If you are still unable to solve a problem, contact our Customer Service for consultation. Often, a problem is relatively simple and can be quickly fixed after telephone consultation.

If you must return a product for factory service, please notify Customer Service by telephone, *before* you ship the product; this helps us to be prepared to service your unit upon arrival. Also, when you return a product to the factory for service, we recommend you include a letter describing the problem.

Please refer to the terms of your Limited One-Year Standard Warranty, which extends to the first end user. After expiration of the warranty, a reasonable charge will be made for parts, labor, and packing if you choose to use the factory service facility. Returned units will be returned C.O.D. if the unit is not under warranty. Orban will pay return shipping if the unit is still under warranty. In all cases, transportation charges to the factory (which are usually quite nominal) are paid by the customer.

Shipping Instructions

Use the original packing material if it is available. If it is not, use a sturdy, double-walled carton no smaller than 1.75″ (H) x 14.25″ (D) x 19″ (W) — 4.5 cm (H) x 36.2 cm (D) x 48.3 cm (W), with a minimum bursting test rating of 200 pounds (91 kg). Place the chassis in a plastic bag (or wrap it in plastic) to protect the finish, then pack it in the carton with at least 1.5 inches (4 cm) of cushioning on all sides of the unit. “Bubble” packing sheets, thick fiber blankets, and the like are acceptable cushioning materials; foam “popcorn” and crumpled newspaper are not. Wrap cushioning materials tightly around the unit and tape them in place to prevent the unit from shifting out of its packing. Close the carton without sealing it and shake it vigorously. If you can hear or feel the unit move, use more packing. Seal the carton with 3-inch (8 cm) reinforced fiberglass or polyester sealing tape, top and bottom in an “H” pattern. Narrower or parcel-post type tapes will not withstand the stresses applied to commercial shipments.

Mark the package with the name of the shipper, and with these words in red:

DELICATE INSTRUMENT, FRAGILE!

Insure the package properly. Ship prepaid, not collect. Do not ship parcel post.

Your **Return Authorization Number** must be shown on the label, or the package will *not* be accepted.