Section 3
Operation

page contents

8185A Stereo Generator Controls and Indicators

SYNC LOCK indicator lights when the 8185A is locked to your sync signal.

PRO indicator lights when the optional Professional Channel is being transmitted.

STEREO/MONO switch selects stereo or mono mode. In mono, either the left or right channel input will be used according to the setting of a jumper on Card #7. The STEREO indicator lights when the unit is in stereo mode.

POWER indicator lights when −22VDC is present at the unregulated power supply.

VU meter and selector switch display peak signal level at various points in the circuitry (see the block diagram in Section 6 on page 6-57) to aid in diagnosing faults. The meter also displays the −15V and +15V power supply voltages ("100%" corresponds to 15VDC). The METER GAIN switch, when set to EXPANDED, causes the AC signal to the VU meter to be amplified by 20dB. The time-constant of the VU meter can be selected with a jumper on the Meter Resistor Board: the 0ms time-constant makes the VU meter more responsive to insignificant overshoots, while the 1.5ms time-constant results in more realistic indications of peak modulation.

N/R ENCODER switch, when set to IN, inserts a 75µs de-emphasis network and dbx noise reduction encoder into the L−R channel, and a "sum compensator" filter into the L+R channel. The 75µs network removes the pre-emphasis introduced earlier in the system so the dbx encoder will get the required "flat" signal. The sum compensator filter compensates for non-ideal amplitude and phase response in the dbx encoder.

MONITOR N/R DECODER switch, when set to IN, activates a complete stereo matrix decoder with 75µs de-emphasis network and decoder sum compensator in the L+R channel, and a professional dbx decoder in the L−R channel.

PILOT switch turns the 15.734kHz pilot tone on and off. It is left set to ON at all times, except during calibration and maintenance.

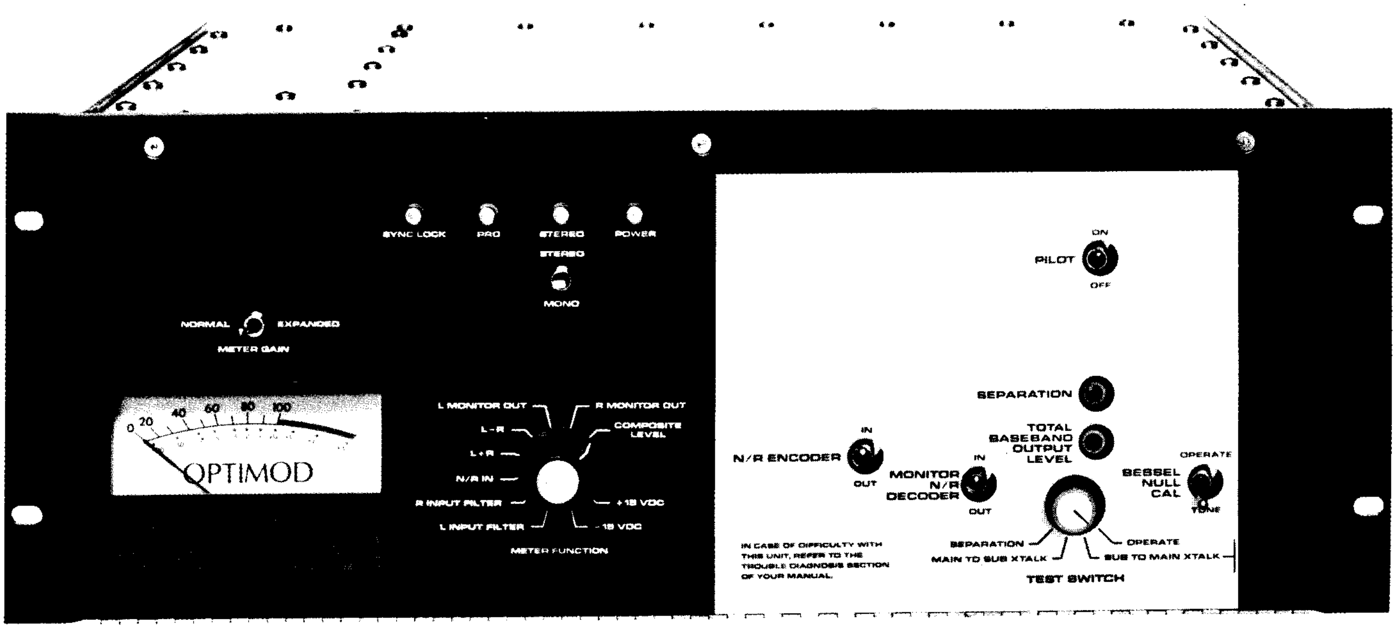
SEPARATION (L+R GAIN) control is used to calibrate the baseband encoder so that the stereo subchannel (L−R) and main channel (L+R) gains are precisely equal. (The BTSC standard requires the L−R gain to be double the L+R gain. This gain ratio is set in the audio circuitry *prior* to the stereo baseband encoder. Calibration of the sum and difference circuitry in the audio circuitry prior to the baseband encoder, although it affects separation, has nothing to do with this SEPARATION control, which calibrates the baseband encoder *only*.)

TOTAL BASEBAND OUTPUT LEVEL control is used to calibrate the noise reduction encoder to the exciter during installation (and should not be touched once set).

TEST SWITCH re-routes the L+R signal for testing, as described in Section 4. The switch should be set to OPERATE for normal operation.

BESSEL NULL CAL switch: When set to TONE, a 7.867kHz calibration tone is applied to the L+R input of the baseband encoder (see Bessel null procedure on page 2-18) and the pilot and L−R modulator are defeated.

SUM PHASE-BALANCE trimmer (on Card #3) adjusts the left channel's phase shift relative to the phase shift of the right channel. Relative phase errors between the left and right channels can affect the frequency response of the mono sum (L+R) as heard on a mono receiver. If the two channels are somewhat out-of-phase at a given frequency, that frequency's level will be lowered when the channels are summed.


SYNC LOCK
PRO
STEREO
POWER
STEREO
MONO
NORMAL
EXPANDED
METER GAIN
0
20
40
60
80
100
OPTIMOD
L MONITOR OUT
R MONITOR OUT
L-R
COMPOSITE LEVEL
L+R
N/R IN
R INPUT FILTER
+15 VDC
L INPUT FILTER
-15 VDC
METER FUNCTION
ON
PILOT
OFF
SEPARATION
TOTAL BASEBAND OUTPUT LEVEL
IN
N/R ENCODER
OUT
IN
MONITOR N/R DECODER
OUT
OPERATE
BESSEL NULL CAL
TONE
IN CASE OF DIFFICULTY WITH THIS UNIT, REFER TO THE TROUBLE DIAGNOSIS SECTION OF YOUR MANUAL.
SEPARATION
MAIN TO SUB XTALK
OPERATE
SUB TO MAIN XTALK
TEST SWITCH

8182A Audio Processor Controls and Indicators

HF LIMIT indicators light when the high-frequency content of audio is being limited.

GATE indicator lights when the input audio level falls below the threshold set by the GATE THRESHOLD control. When this happens, the compressor's recovery time is drastically slowed to prevent noise rush-up during low-level passages.

POWER indicator lights when −22VDC is present at the unregulated power supply.

VU meter and selector switch display signal level at various points in the circuitry (see the block diagram in the 8182A Operating Manual) to aid in diagnosing faults. The meter also displays +15V and −15V power supply voltages (with "100%" corresponding to 15VDC).

LOUDNESS CONTROL switch determines whether the circuitry that controls *subjective* loudness (as opposed to objective level) is activated. This circuitry will control the loudness of most commercials sufficiently well to eliminate viewer annoyance.

INPUT ATTENUATOR controls adjust the signal level going into OPTIMOD-TV.

RELEASE SHAPE switch switch selects either a constant release rate (when set to LINear) or (when set to EXPonential) a rate that automatically becomes faster as the release process progresses.

COMPRESSOR switch (used for testing) disables the dual-band compressor when set to PROOF.

LIMITER switch (used for testing) disables the high-frequency limiter, Hilbert Transform Clipper, and FCS Overshoot Compensator when set to PROOF.

CLIPPING control adjusts signal level going into the Hilbert Transform clippers, and therefore determines the amount of peak limiting done by clipping. This control governs the trade-off between loudness and distortion. Settings at or below "−1" will produce no audible distortion unless the RELEASE TIME control is set much faster than recommended.

H-F LIMITING control determines the amount of high-frequency limiting. When set toward SOFT, the highs are controlled more by limiting, which tends to soften highs but does not produce distortion. When set toward HARD, the highs are controlled more by clipping, which results in brighter sound (but could potentially distort highs).

RELEASE TIME control determines how fast the gain of the master compressor increases when the program material gets quieter.

BASS COUPLING control determines the degree to which the bass band of the compressor tracks the master band. Settings toward WIDEBAND produce an air sound that is more faithful to the spectral balance of the source material. Settings toward INDEPENDENT produce bass balances that are more uniform between program segments (often with increased bass).

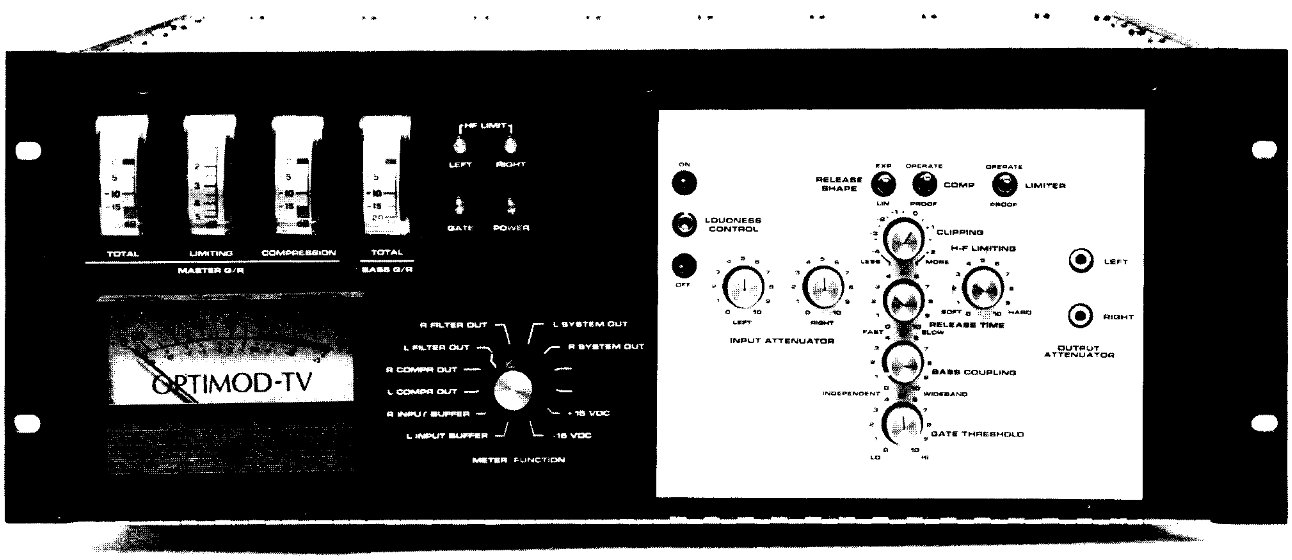
GATE THRESHOLD control determines the lowest input level that the system considers program. Levels below this are considered noise, and cause the AGC/compressor to gate, effectively freezing its gain to prevent noise "breathing" during pauses or low-level passages.

OUTPUT ATTENUATOR controls match the output level to the stereo generator.

MASTER G/R meters show the amount of gain reduction in the "master" compressor, which processes audio above 200Hz.

TOTAL shows peak value of gain reduction in dB. "0" on this meter indicates 10dB of gain reduction. **LIMITING** shows the amount of fast gain reduction above and beyond that provided by slow compression. "0" on this meter indicates no additional limiting, and "3" (for example) indicates an extra 3dB peak-limiting gain reduction over that indicated by the **COMPRESSION** meter, which shows the amount of gain reduction resulting from slow compression in dB. "0" on the **COMPRESSION** meter corresponds to 10dB of gain reduction.

TOTAL BASS G/R meter shows the amount of gain reduction in the "bass" compressor, which processes audio below 200Hz. Because almost all of the bass gain reduction is effected by slow compression, there is no need for separate peak-limiting and compression meters. "0" corresponds to 10dB of gain reduction.



(Corresponding controls on the 8182A/ST ***Studio Chassis*** *have the same functions.)*

NOTE: The following discusses 8182A OPTIMOD-TV Audio Processor controls and functions.

Getting the Sound You Want

If your station has a **general programming format**, the control settings specified at the end of the installation procedure (in Fig. 2-12 or Fig. 2-13) are optimal. *There is no need to read this or the following sections.*

If your station has a **specialized format**, you may prefer to use one of the alternate settings given in the "Recommended Control Settings" chart (Fig. 3-1).

Should you wish to modify any control settings from those recommended, read **"Customizing the Settings"**, since it is important to understand the functions and interactions of the audio processing controls before attempting to customize them. "Customizing the Settings" provides the most thorough discussion of the functions of and interactions between OPTIMOD-TV controls. Read it if you really want to understand the operating controls in detail. However, there is no need to read that section if you will be using the recommended control settings.

Note that trade-offs between openness, consistency, loudness, brightness, and distortion are unavoidable. This is true of any processor.

Best results will be achieved if Engineering, Programming, and Management communicate and cooperate with each other. It is important that Engineering understand well the sound that Programming desires, and that Management fully understand the trade-offs involved in optimizing one parameter (such as consistency) at the expense of others (such as brightness or distortion).

Recommended Settings for the Best Sound

If your station has a general programming format, the control settings specified at the end of the installation procedure (in Fig. 2-13 or Fig. 2-13) are optimal. There is no need to read this or the following section.

If your station has a specialized format, you may prefer to use one of the alternate settings given in Fig. 3-1. Each produces a different sound texture, and each incorporates a different set of trade-offs between openness, consistency, brightness, and distortion.

Start with one of these sets of recommended settings. Spend some time listening critically to your on-air sound. Listen to a wide range of program material typical of your station, and listen on a variety of television receivers (not just on your control room monitor loudspeakers). Then, if you wish to customize your sound, read the following section on "Customizing the Settings", since it is important to understand the functions and interactions of the audio processing controls before attempting to customize them.

The settings for **general programming** provide the best overall processing for a variety of typical television programming. Output levels and frequency spectrum are consistent. Excessive commercial loudness is avoided.

The settings for **fine arts programming** preserve the wider dynamic ranges of classical music and similar programming. These settings result in less consistency of loudness and dynamic range.

The settings for **music video programming** produce a somewhat more heavily processed sound typical of conservatively processed popular music on FM radio. These settings will produce quite consistent results from a wide variety of source material.

	TYPE OF PROGRAMMING		
	General	**Fine Arts**	**Music Videos**
INPUT ATTENUATORs Adjust to produce approximately the indicated gain reduction on typical program material as shown on OPTIMOD-TV's TOTAL MASTER G/R meter:			
G/R Meter:	*0dB*	*0dB*	*−5dB*
CLIPPING	−1	−1	0
H-F LIMITING	5	7	10
RELEASE TIME	3	4	7
BASS COUPLING	8	8	5
GATE THRESHOLD	5	*	0
RELEASE SHAPE	EXP	EXP	LIN
LOUDNESS CONTROL	ON	ON	OFF *
COMPRESSOR	OPERATE	OPERATE	OPERATE
LIMITER	OPERATE	OPERATE	OPERATE

* See discussion on following page.

Fig. 3-1: Recommended 8182A Audio Processor Control Settings

Adjusting the GATE THRESHOLD control for fine arts programming

Fine arts programming usually requires less AGC (automatic gain control) than does "general" programming. However, if AGC is reduced in the obvious way (by turning down the INPUT ATTENUATOR controls to reduce the amount of gain reduction), the gating circuit will tend to further reduce gain below the intended level when it is activated.

A better way to reduce the amount of compression is to set the GATE THRESHOLD control at "6" or higher, and to adjust the INPUT ATTENUATOR controls so that the TOTAL MASTER G/R meter reads "0" when the console or switcher is peaked at 100%. Setting the GATE THRESHOLD control very high like this prevents the 8182A Audio Processor from ever recovering to maximum gain, because the gate comes on when the program level is still high enough to produce gain reduction. For example: to limit the amount of normal compression to 5dB (instead of the usual 10dB), adjust the GATE THRESHOLD control so that the GATE indicator lights whenever the TOTAL MASTER G/R meter reads "+5" or greater.

To summarize, when the GATE THRESHOLD control is set at "6" or higher, it can also function as a dynamic range control which governs the amount of compression that can be achieved.

Setting the LOUDNESS CONTROLLER switch for music videos

Since the loudness controller controls *subjective* loudness, it can sometimes slightly reduce the impact of rock and roll programming — particularly with "heavy metal" cuts or other material that has a great deal of 3kHz energy. In a music video format, the desire for loudness control must therefore be weighed against the possibility of reduced musical impact. (It may be desirable use remote control to switch the loudness controller IN for all breaks, then back OUT for music videos).

Customizing the Settings

If your station has a general programming format, the control settings specified at the end of the installation procedure in Fig. 2-12 or Fig. 2-13 (and repeated in Fig. 3-1) are optimal. If your station has a specialized format, you may prefer to use one of the alternate settings given in Fig. 3-1. In either case, there is no need to read this section. Read this section only if you really want to understand the operating controls in detail.

The controls on the 8182A Audio Processor and 8185A Stereo Generator give you the flexibility to customize your station's sound. But, as with any audio processing system, proper adjustment of these controls consists of balancing the trade-offs between consistency, loudness, density, brightness, and audible distortion. The following provides the information you need to understand the functions and interactions of the audio processing controls.

We recommend starting with one of the sets of recommended settings, and then spending some time listening critically to your on-air sound. Listen to a wide range of program material typical of your station, and listen on a variety of television receivers (not just on your control room monitor loudspeakers).

Some audio processing concepts

Compression reduces the difference in level between the soft and loud sounds, resulting in a subjective increase in the loudness of soft sounds and a greater overall consistency in perceived loudness levels.

Limiting increases audio density. Increasing density can result in greater consistency between program segments, but can also result in an unattractive "busier", "flatter", or "denser" sound. It is important to be aware of the many negative subjective side effects of excessive density when setting controls which affect the density of the processed sound.

Clipping sharp peaks does not produce any audible side effects when done moderately. Excessive clipping, however, will be perceived as audible distortion.

Consistent **subjective loudness** is achieved by controlling the average level of the audio according to an model of how the human ear and brain perceive loudness. In the 8182A Audio Processor, this is realized through the complex circuitry of the loudness controller. The carefully designed dual-band compressor in the 8182A Audio Processor also helps achieve consistent loudness.

Gating for unobtrusive processing

***Proper setting of the* GATE THRESHOLD *control is the key to achieving unobtrusive processing.** Inappropriate settings of this control are more likely to cause complaints from viewers and producers about "excessive compression" than are incorrect settings of any other control.*

The **gating** function prevents unnatural level increases of low-level program material. Many TV audio feeds (like ENG and optical soundtracks on film) have poor signal-to-noise ratios. Such material will suffer if the level background noise is audibly increased by the processor. It would also be wrong to pull up underscoring or other background to the level of dialog during pauses in the dialog.

When the 8182A Audio Processor gates (indicated by the GATE indicator lighting), the gain reduction *very slowly* recovers to 10dB ("0" on the meters). When the GATE THRESHOLD control is set as recommended, the unit will be gated during almost all low- to medium-level program material, and average gain reduction will tend to be very close to 10dB.

Only when average program material is somewhat high or low will the gain reduction be different than 10dB. This is because levels close to the nominal 100% level are ordinarily above the threshold of gating, and this allows the gain reduction to recover normally so the unit will "ride gain" appropriately. Yet, because of the gate, the "noise breathing" characteristic of typical unsophisticated compressors will be avoided.

The GATE THRESHOLD control should never be set below "4" for general programming (although such setting may be appropriate for some popular music formats — if listening tests are passed).

Control of dynamic range — gain reduction and release time

The amount of **gain reduction** determines how much the loudness of soft passages will be increased, and, therefore, how consistent overall perceived loudness will be. It is controlled both by the setting of the 8182A Audio Processor's INPUT ATTENUATOR controls and GATE THRESHOLD control, and by the level at which the console VU meter or PPM is being peaked.

10dB gain reduction (= "0dB" on the TOTAL MASTER G/R meter) is recommended for general programming to produce a consistent level from a wide variety of source audio (mostly voice with some music). Using less gain reduction more faithfully preserves the dynamic range of the source audio. Higher levels of gain reduction are recommended for music videos programming to achieve an open, yet reasonably consistent sound more typical of FM audio processing.

In general, increasing the amount of gain reduction decreases the apparent dynamic range of the audio. In extreme cases, this results in excessive pump-up of noise, background music, etc.

Too little gain reduction, on the other hand, will result in inconsistent audio levels: some parts of your programming will seem too loud, others too quiet. Less gain reduction than recommended is likely to result in low-level material's being unacceptably quiet (and therefore difficult to understand or perhaps altogether unintelligible).

The **release time** is the rate at which the gain of the compressor recovers when the program material gets quiet, yet is above the gating threshold. Slow release times are most appropriate for television audio, as they result in output density approximately equal to that of the input audio. (Although the setting of "3" recommended for general programming is nearer the word "FAST" on the panel, when the RELEASE SHAPE control is set to EXP the net effect is a slow release time since gain recovery starts out slowly — see below.)

Faster release times produce a *denser*, louder, more uniform sound that is appropriate for some popular music formats. However, operating with faster release times generally increases the danger of audible side effects, including noise breathing. (Highly competitive radio formats are characterized by this sound, which is really a side effect of trying to maximize loudness at the expense of audio quality. Because television audiences would be more likely to be annoyed than attracted by one station's being louder than another, television has been spared the "loudness wars" that plague radio audio quality.)

There is a point beyond which increasing density (with settings of the RELEASE TIME control between "0" and "3") will simply degrade the punch and definition of the sound. And when OPTIMOD-TV is operated with RELEASE TIME control settings between "0" and "3", the sound will change substantially with the amount of gain reduction. This means that operator gain riding is more critical — you must decide on the basis of listening tests how much gain reduction gives you the dense sound you want without a feeling of overcompression and fatigue.

One of two **release shapes** can be selected: either a constant, *linear* release rate, or an *exponentially* increasing rate that automatically becomes faster as the release process proceeds. The exponential release shape is most useful for general programming, because most gain riding remains slow and unobtrusive, with only large gain corrections producing fast (and therefore more audible) release. For programming in which the levels of the input material are uniformly well-controlled the linear release shape gives a somewhat smoother sound. (We recommend the exponential shape for fine arts programming because such programming typically includes a variety of material in addition to, say, concerts with good level control.)

A note about gain reduction metering

Unlike the metering on some processors, the **red zone** on the OPTIMOD-TV gain reduction meter's scale is a warning that must be observed. When the meter is in the red, it means that the compressor has run out of gain reduction range, that the circuitry is being overloaded, and that various nastinesses are likely to commence.

Because the compressor has 25dB of gain reduction range, the meter should never enter the red zone if OPTIMOD-TV has been set up for a sane amount of gain reduction under ordinary program conditions. But be aware of the different peak factors on voice and music — if voice and music are peaked identically on a VU meter, voice may cause up to 10dB more peak gain reduction than does music! (A peak program meter [PPM] will indicate relative peak levels much more accurately.)

When the gating function is activated, the gain slowly drifts toward 10dB gain reduction. Because the gain reduction meters will therefore sit at 10dB gain reduction in absence of signal, we have calibrated the TOTAL MASTER G/R, COMPRESSION MASTER G/R, and TOTAL BASS G/R meters so that **"0" corresponds to 10dB gain reduction** (and "+10" indicates no gain reduction) to avoid confusing operators who might otherwise think that the compressors were faulty.

Excessive commercial loudness

The **loudness controller** in the 8182A Audio Processor will control the loudness of most commercials sufficiently well to eliminate viewer annoyance. (The basic OPTIMOD-TV processing by itself controls loudness well enough that the loudness controller has no effect on most program material, and will tend to cause additional gain reduction of only 2–3dB on the most extreme material.)

Loudness is subjective. How loud something sounds does not correlate well with VU meter or PPM measurements of signal level. This is because: 1) the absolute levels of some frequency bands are more important than others in determining how loud a sound *seems* to the listener, 2) a sound spread out over a wide frequency range sounds louder than would the same amount of sound energy in a narrower range, and 3) the time-constants of the individual spectral detectors in the ear affect the perceived loudness of a sound, as does 4) the overall duration of the sound.

OPTIMOD-TV's loudness controller is based on a model (developed as a result of twenty years of research at the CBS Technology Center) that analyzes sound with reference to these psychoacoustic factors. When the model indicates that one of these factors will affect the subjective loudness, the loudness control enhances the main gain control signals with its own control signal.

The loudness controller reduces loudness gently and subtly. Since it reduces the audio drive to the peak-limiting section of OPTIMOD-TV, loudness reduction will therefore be accompanied by improvements in high-frequency response and lowered peak-limiting-induced distortion.

Peak control

OPTIMOD-TV controls peaks by Orban's patented Hilbert Transform Clipper circuit. The CLIPPING control adjusts the level of the audio driving the clippers, and therefore adjusts the peak-to-average ratio. The CLIPPING control determines the primary trade-off between consistent loudness and distortion.

Turning up the the CLIPPING control drives the clippers harder, reducing the peak-to-average ratio, and making on-air loudness more consistent. Since the amount of clipping is increased, the audible distortion caused by clipping is increased. Lower settings yield less consistent loudness, but result in the cleanest sound and best high-frequency response.

In our opinion, the best setting for the CLIPPING control is "−1" when used with slower release times (above "3" if the switch is set to EXP; above "6" if the RELEASE SHAPE control is set to LIN). If faster settings of the RELEASE TIME control are used, or if program material is not always clean, use lower settings of the CLIPPING control if even small amounts of audible distortion cannot be tolerated. Ultimately, your ears must judge how much distortion is acceptable. But use worst-case program material like live voice and piano to make your final decision.

The CLIPPING control can be used to adjust your loudness relative to other stations. Achieving inter-station consistency usually requires a conservative CLIPPING control setting (between "−1" and "−4"), which will also give the cleanest sound and best high-frequency response. If the RELEASE TIME control is at a faster setting than recommended, it may be necessary to set the CLIPPING control below "−1" to avoid audible distortion.

High-frequency limiting to reduce distortion

The H-F LIMITING control determines how the processor **avoids high-frequency overloads** due to the pre-emphasis curve. When set toward SOFT, the highs are controlled mostly by limiting (a form of dynamic filtering), which tends to soften highs. When set toward HARD, the highs are controlled mostly by clipping, which could potentially distort highs.

Setting the H-F LIMITING control toward SOFT could **improve the sound of marginally distorted program material** by softening the highs (including the harmonic distortion present in the source material).

Because the OPTIMOD-TV clipper cancels distortion at low frequencies, the H-F LIMITING control will have a different effect on clipping distortion than you might expect. Gross break-up (principally sibilance splatter) will not occur, and you must listen to the upper midrange and the highs to hear the effect of the clipper. Program material containing highly equalized hi-hat cymbals or highly sibilant voice will clearly demonstrate the effect of adjusting the control.

With the recommended settings and clean program material, the control can be set very near HARD without producing audible high-frequency distortion. However, with marginally distorted program material or with CLIPPING control set nearer "+2" than recommended or with the RELEASE TIME control set nearer FAST than recommended, the H-F LIMITING control may need to be set nearer to SOFT to avoid objectionable distortion. Fortunately, the high-frequency limiter "knows" that greater density and level have been produced when these other controls are set this way, and most of the necessary increases in high-frequency limiting will occur automatically. In fact, you will clearly hear a loss of highs when you adjust any control to produce more consistent loudness and greater density — this is a result of the basic processing trade-offs discussed above.

Spectral balance

The compressor processes audio in two bands: a *"master" band* for all audio above 200Hz, and a *bass band* for audio below 200Hz. The BASS COUPLING control determines how closely the **on-air balance between bass and midrange** matches that of the program material. Settings toward WIDEBAND produce an air sound that is more faithful to the spectral balance of the source material. Settings toward INDEPENDENT produce bass balances that are more uniform between program segments (often with increased bass).

Because setting the BASS COUPLING control at WIDEBAND will sometimes cause bass loss, the most accurate frequency balance will often be obtained with this control between "7" and "10". The exact setting depends on release time and the amount of gain reduction. Adjust the BASS COUPLING control until the TOTAL BASS G/R and COMPRESSION MASTER G/R meters track as closely as possible.

Settings toward INDEPENDENT are only appropriate for music video programming. With *slower release times* and the RELEASE SHAPE switch set to LIN, a very open, natural, and non-fatiguing sound is produced. However, these settings will also boost bass on some bass-shy program material, and may pull up stage rumble and other low-frequency noise.

Notes:

Section 4
Maintenance

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.

Routine Maintenance

The 8185A Stereo Generator is a highly stable device which uses solid-state circuitry throughout. Recommended routine maintenance is minimal.

1) Periodically check VU meter readings.

Familiarize yourself with normal VU meter readings. If any meter reading is abnormal, see Section 5 for troubleshooting information.

2) Listen to the demodulated stereo audio.

A good ear will pick up many failures. Familiarize yourself with the "sound" of the 8185A as you have set it up, and be sensitive to changes or deteriorations. But if problems arise, please don't jump to the conclusion that the 8185A is at fault. The troubleshooting information in Section 5 will help you determine if the problem is with the 8185A or is somewhere else in the station's equipment.

3) Check the demodulated stereo separation

Most failures within BTSC hardware will manifest themselves as loss of separation. Therefore, a quick and effective check of the system can be made by muting the left-channel input to the processing chain and then measuring the amount of residual right channel on the meter of your BTSC stereo monitor. If the stereo generator and transmission system are operating correctly, the level of the right channel should be at least 30dB below the level of the left channel. (The 8185A alone is typically capable of 40dB on this test when measured through its own monitor decoder.)

Failures which occur in the circuitry prior to the sum-and-difference matrix in the 8185A will not cause a loss of separation. In most cases, such failures will cause audible aberrations in one channel only.

If you observe such aberrations or separation loss, perform the **Field Audit of Performance** procedure below to determine if the 8185A is at fault. If it is, refer to **Section 5** of this manual for troubleshooting instructions.

4) Periodically check for corrosion.

Particularly in humid or salt-spray environments, check for corrosion at the input and output terminals and at those places where the 8185A chassis contacts the rack.

5) Periodically check for loss of grounding.

Check for loss of grounding due to corrosion or loosening of rack mounting screws.

6) Clean the front panel when it gets soiled.

Wash the front panel with a mild household detergent and water. Stronger solvents should not be used because they may damage plastic parts, paint, or the silkscreened lettering.

Getting Inside the Chassis

Access:

- **Set-up controls** by opening the small door on the 8185A's front panel with the supplied key.
- The AC POWER **switch,** VOLTAGE SELECTOR **switch, and fuse** by opening the 8185A's front panel.
- The **circuit cards** by opening the 8185A's front panel, then removing the subpanel.

Set-up, adjustment, and alignment of the 8185A only requires access to the front and rear panels and to those interior parts of the unit behind the front panel and subpanel.

Further disassembly of the 8185A may be required for some service procedures:

For access to:	See:
Behind front panel	4-5
Behind subpanel	4-5
Behind rear panel	4-6
Beneath top or bottom cover	4-6
Input filter board	4-7
Unregulated power supply chamber	4-8
Power transistors, Card #PS	4-9

NOTE ABOUT SCREWS: This note applies to screws removed in the following disassembly instructions. For best RFI protection, replace *all* screws and tighten normally for firm contact. If screws are lost, replace them with screws of the same length, since longer screws may cause mechanical interference or internal short circuits.

Most screws used in the 8185A are binding head for secure fastening without lockwashers (if a pan head screw is substituted, use an internal star lockwasher to retain this security). Plating on all screws is zinc type II (almost any other plating is also acceptable unless corrosive atmosphere is present).

Front panel — open and close.

To open:

1) Close and lock the set-up controls access door.

2) Remove the three hex-socket screws at the top of the front panel with a 5/64-inch hex wrench (provided with the unit), then tilt the hinged front panel downward to reveal the interior.

To close:

1) Replace the subpanel if it has been removed.

   See below. *The subpanel should always be in place,* since it is an integral part of the chassis RFI protection.

2) Raise the front panel and fasten the three screws that secure it in place with the 5/64-inch hex wrench provided with the unit.

Subpanel — remove, replace.

To remove:

1) Open the front panel (see above).

2) Loosen the four DZUS fasteners on the subpanel by turning each fastener 1/4-turn counterclockwise with a long 3/16-inch or 1/4-inch flat-blade screwdriver.

   The DZUS fasteners turn only 1/4-turn. Don't force them, lest they be damaged in a way that is very time consuming to repair.

3) Taking care not to stress the flat cables beneath it, tilt the top of the subpanel outward and to the left to clear the upper chassis lip and the door support rail at the right.

To replace:

The subpanel should always be in place, since it is an integral part of the chassis RFI protection.

1) Taking care not to stress the flat cables beneath it, tilt the top of the subpanel inward and to the left to clear the upper chassis lip and the door support at the right.

2) Turn the DZUS fasteners 1/4-turn clockwise with a long 3/16-inch or 1/4-inch flat-blade screwdriver.

3) Check that the internal AC POWER switch is set to ON.

Rear panel — remove, replace.

To remove:

1) Disconnect the 8185A and remove it from the rack.

   If the covers are still in place, they don't need to be removed.

2) Remove the eight screws holding the top cover to the flange of the rear panel. Also remove the eight screws holding the bottom cover to the rear panel.

   The rear panel will remain solidly in place.

3) Set the unit upright on a padded surface with the rear panel facing you.

   Leave about 6 inches (15 cm) between the rear panel and the edge of the table. Be sure the AC power cord is unplugged.

4) Remove the three groups of three screws *circled in black* on the rear panel.

5) *Very carefully* pull the rear panel about ¾-inch (2 cm) toward you, and then tilt the top of the rear panel down until the rear panel is horizontal.

   Careful! Watch for snags in the wiring or stress to the ceramic capacitors on the internal divider wall or RF box. These capacitors are very fragile and are difficult to replace.

To replace:

1) *Very carefully* tilt the rear panel up until it is vertical, and then push the rear panel forward into place.

   Take care that no wires are pinched between the panel and the chassis.

2) Replace the nine screws in the three groups of three screw holes circled in black on the rear panel. Also replace the sixteen screws that attach the top and bottom covers to the rear panel.

   Do not tighten screws until all screws are loosely in place, and the flanges of the rear panel are properly aligned with those of the side panels.

3) Return the 8185A to its rack, connect and ground unit.

Covers (top, bottom) — remove, replace.

To remove:

Removing the top or bottom covers is tedious because of the large number of screws necessary to achieve an RF-tight seal. Most servicing can be done without removing either cover.

1) Remove all thirty screws holding the top or bottom cover in place.

2) Lift off the cover.

To replace:

1) Position the cover in place and align it with the screw holes in the chassis.

2) Start, but do not tighten, all thirty screws that attach the cover to the chassis.

   Replace *all* screws to ensure good RFI protection.

3) When all screws are in place, tighten them to normal firm tightness.

   Tighten screws nearer the center of the cover first.

Input filter board, RF filter box — remove, replace.

To open RF filter box and remove input filter board:

1) Open rear panel.

   See page 4-6.

2) Remove the four screws that hold the large, flat, metal RF filter box to the inside of the rear panel.

3) *Very carefully and slowly* tilt the top of the metal RF filter box back to reveal the input filter circuit board.

   Careful! Watch for snags in the wiring or stress to the ceramic capacitors on the internal divider wall or RF box. These capacitors are very fragile and are difficult to replace.

4) Remove the four 4-40 screws that attach the input filter circuit board to the rear panel (optional).

To replace input filter board and RF filter box:

1) If it has been removed, attach the input filter board to the rear panel with the four 4-40 screws.

   If components have been replaced, make sure that reassembly will not crush or otherwise damage the components.

2) *Slowly and carefully* position the metal RF filter box so the screw holes in its flanges line up with the screw holes in the rear panel.

   Take care that no wires or components are pinched between the panel and the chassis. Dress wires appropriately.

3) Replace the four screws that attach the RF filter box to the rear panel.

4) Close the rear panel.

   See page 4-6.

Left side panel — remove, replace.

[Remove the left side panel to access the mains and raw DC power chamber.]

To remove:

1) Open the front panel (see page 4-5).

2) Remove the shoulder screw that attaches the door-support rail at the left.

   Note that there is a nylon washer between the rail and the side panel to prevent scraping.

3) Close the front panel and fasten it with the center screw *only.*

4) Turn the chassis so that the left rack flange faces you.

5) Remove the 5 screws that attach the top cover to the top of the left side panel. Also remove the 5 screws that attach the bottom cover to the left side panel.

   The left panel is to the left as you face the front of the unit — the side nearest the VU meter.

6) Remove the 3 circled screws on the rear panel that attach it to the left side panel.

7) Remove the 6 recessed screws on the left side panel.

8) Gently pull the side panel toward you and remove it.

To replace:

1) Position the left side panel and start (*but do not tighten*) the 6 recessed side-panel screws.

   Make sure the door support rail is positioned properly in its slot.

2) Replace (*but do not tighten*) the 3 circled screws that attach the rear panel to the side panel.

3) Replace (*but do not tighten*) the 5 screws that attach the top cover to the top of the left side panel. Also replace the 5 screws that attach the bottom cover to the left side panel.

4) Tighten all 19 screws.

5) Open the front panel (see page 4-5), and replace the shoulder screw.

   Be sure to position the nylon washer next to the left side panel.

6) Close the front panel (see page 4-5).

Power transistors, Card #PS — remove, replace.

To remove:

Because removal of Card #PS is difficult, the card has been designed to permit many servicing operations to be performed *without* removing the card from the chassis. IC chips are in sockets. Many of those components which are not mounted in sockets can be replaced from the top of the card by tack-soldering the new component to the lead stubs of the old, clipped-out component.

If Card #PS *must* be removed, follow these instructions carefully.

CAUTION

The rear panel is a heat dissipator for the power transistors. Proper contact is necessary to ensure sufficient transistor cooling.

1) Remove the 4 press-fit plastic plugs inside the recesses on the power transistor covers, using a pair of chain-nose pliers.

2) Loosen the 2 screws that attach each power transistor.

   These screws have captive nuts that will not fall into the chassis.

3) Remove the transistor covers and the associated screws and lockwashers from the rear panel.

4) Mark each transistor case to indicate the transistor's location and orientation.

5) *Very carefully and slowly* pull each transistor from its socket.

   If the silicone rubber insulator sticks to the panel, release it from the panel so that it sticks to the bottom of the transistor instead. After you remove each transistor, press its insulator back in close contact with the transistor.

   These insulators form themselves to the bottom surface of each transistor. Since they take a "set", they should not be interchanged or reversed.

6) Open the rear panel (see page 4-6).

7) Release Card #PS from its plastic post mounts by squeezing the tangs at each corner of the card, then pull the card off the posts.

To replace:

1) Replace Card #PS onto its plastic post mounts by pressing it over the 4 tangs at each corner of the card.

   Verify that the transistor sockets are aligned so that they seat in the rear-panel holes.

2) *Very carefully* reinstall the power transistors in their sockets.

   Be careful to replace the transistors in the same positions from which they were removed (refer to the marks made on the transistor cases during removal). Verify that the sockets are exactly aligned in the holes.

   The transistor insulators should not have been interchanged or reversed. If you must replace a power transistor, re-use the insulator if it is in good condition. With care, it will re-form itself as necessary. Otherwise, use a conventional mica insulator and white silicone heat-conducting compound.

3) Insert the screws and lockwashers in the transistor covers, and position them over the transistors.

   There *must* be a *split* lockwasher under the head of each screw to accommodate thermal cycling.

   These plastic covers do not attach in a conventional or readily obvious way. They ride on the circumference of the special split lockwasher and do not (and should not) become captured under the head of the screw. Consequently, the cover may be slightly loose even after screws are tightened securely. This is normal — do *not* try to "correct" it.

4) Tighten the screws.

   The screws mounting the transistors should be tightened *evenly*. For best thermal contact, tighten each screw a small amount, alternating between screws. Tighten securely, but not enough to damage the threads in the sockets.

5) Replace the 4 press-fit plastic plugs in the power transistor covers.

6) Close the rear panel (see page 4-6).

In-Line Performance Verification

Use this procedure for checking 8185A performance while it is on the air in your normal transmission chain. A more comprehensive bench test of performance is detailed in "Field Audit of Performance" starting on page 4-16.

While the FCC does not require periodic Proof-of-Performance measurements, it *does* require the system to meet certain performance standards for stereo operation. These are described in the Office of Science and Technology publication OET-60A and described in the EIA document *Multichannel Television Sound: BTSC System Recommended Practices.* (The 8185A has been designed to substantially exceed these standards.)

Most stations will doubtless want to make periodic equipment performance measurements. The measurements described here are based on the BTSC Recommended Practice. (Normal measurements given in these tests are provided for service guidance only, and are not guaranteed.)

The tests are most accurate when modulating the aural subcarrier with the visual transmitter off.

This performance verification includes measurements of noise floor, distortion, frequency response, and separation.

If the 8185A fails to pass any of these tests, see Section 5 for troubleshooting information.

Follow these instructions in order without skipping steps.

NOTE: These instructions assume you are using the 8185A with the Orban 8182A Audio Processor, but are *not* using the 8182A/ST Studio Chassis. If you are, substitute "8182A/ST Studio Chassis' IN terminals" when the instructions read "8182A's AUDIO IN terminals".

If you are using the 8185A with another make of audio processor, follow the instructions by analogy. When you see a reference to the "audio input terminals of the 8182A", use the audio input terminals of the external audio processor instead.

Most broadcast-quality audio processors have some sort of "Proof" mode which you can invoke when requested to place the 8182A LIMITER PROOF/OPERATE and COMPRESSOR PROOF/OPERATE switches in PROOF.

Equipment required:

Low-distortion audio oscillator

With verified residual distortion below 0.0015%.
Sound Technology 1710B or equivalent preferred.

BTSC-standard stereo modulation monitor

THD test set

With verified residual distortion below 0.0015%.
Sound Technology 1710B or equivalent preferred.

Spectrum analyzer with tracking generator

Tektronix 5L4N plug-in with 5111 bistable storage mainframe, or equivalent. *Alternatively*, a sweep generator with 30–15,000Hz logarithmic sweep can be used with an oscilloscope in X/Y mode.

1) Set the 8182A's COMP and LIMITER switches to PROOF.

2) Connect modulation monitor.

Connect a BTSC-standard stereo modulation monitor to a point in the RF signal chain past the aural/visual combiner (to the notch diplexer, for example).

3) Measure the noise floor of the left and right stereo channels.

The noise floor will be measured with reference to 100% modulation of the Stereo Subchannel (±50kHz deviation without pilot).

A❑ Set 8185A's N/R ENCODER switch to IN.

B❑ Set the stereo modulation monitor's METER SELECTOR switch to LEFT.

C❑ Turn on the stereo modulation monitor's noise reduction decoder.

D❑ Short the 8182A's left and right inputs by connecting the AUDIO IN +, −, and ⏚ terminals together.

E❑ Verify that the stereo modulation monitor meter reads at least 60dB below 100% modulation.

F❑ Repeat the measurement for the right channel.

G❑ Remove the jumper(s) shorting the 8182A's input.

4) Measure left and right channel distortion.

Single-channel total harmonic distortion (THD) should be measured at 50Hz, 100Hz, 400Hz, 1kHz, 2.5kHz, 5kHz, 7.5kHz, 10kHz, and 15kHz, and at 25% and 50% 75µs-equivalent modulation.

A☐ Verify that the 8185A's N/R ENCODER switch is set to IN.

B☐ Verify that the stereo modulation monitor's noise reduction decoder is on.

C☐ Connect a THD test set to the demodulated left-channel audio output of the stereo modulation monitor.

D☐ Connect an audio oscillator to the 8182A's AUDIO IN terminals.

The oscillator can be connected through your console, switcher, or patch panel — it is not necessary to connect it directly to the 8182A.

E☐ Set the audio oscillator to the desired frequency.

50Hz, 100Hz, 400Hz, 1kHz, 2.5kHz, 5kHz, 7.5kHz, 10kHz, and 15kHz.

F☐ Adjust the audio oscillator's output level to produce the desired percentage of modulation as read on the stereo modulation monitor in L+R position.

25% or 50%. Because of the 75µs pre-emphasis curve, it will be necessary to re-adjust the level as frequency is changed.

When only one channel is driven, 100% L+R modulation cannot be achieved through the 8182A because of headroom constraints. 100% L+R modulation is ordinarily produced from stereo material with both channels active (50% left + 50% right = 100% L+R).

G☐ Verify that demodulated left channel distortion in a 20kHz bandwidth is less than 0.5% from 30–15,000Hz.

These are standards from the BTSC Recommended Practice. The performance of the 8185A alone will ordinarily be at least 5–10 times better than this (see TABLE 4-1). Distortion within the system can be caused by STL limitations, by synchronous AM and ICPM (ordinarily caused by narrowband or mis-tuned RF amplifiers and diplexers), by exciter limitations, and, when monitoring remotely, by multipath distortion and/or noise induced into the monitor.

H☐ Reset the audio oscillator's frequency and output level and measure THD for each frequency and percentage of subcarrier modulation to be tested.

I☐ Repeat the measurement for the right channel.

J☐ Disconnect the THD test set and audio oscillator from the equipment.

5) Measure frequency response.

A❑ Verify that the 8185A's N/R ENCODER switch is set to IN.

B❑ Connect the output of a tracking or sweep generator to the 8182A's AUDIO IN terminals. Set the generator for a 30–15,000Hz logarithmic sweep.

C❑ Adjust the sweep generator's output level so that the L+R modulation never exceeds 50%.

Read the modulation level on your stereo modulation monitor with its selector set to L+R. (The maximum level will be seen at 15kHz, due to the effect of the 75µs pre-emphasis.)

D❑ Turn on the stereo modulation monitor's noise reduction decoder.

E❑ Connect the input of a spectrum analyzer or oscilloscope to the demodulated left-channel audio output of the stereo modulation monitor.

F❑ Verify that left channel frequency response is flat ±1.0dB from 50Hz to 15kHz.

This tolerance includes the entire transmission system. The guaranteed tolerance for the Orban 8182A and 8185A system is ±0.75dB, 30–15,000Hz.

G❑ Repeat the measurement for the right channel.

6) Measure swept-sinewave separation.

Swept-sinewave separation measurements verify that the system complies with the requirements in OET-60a. It does not necessarily predict system separation performance under program conditions.

At the end of **Section 4**, we have reprinted an Orban application note called "Evaluating BTSC Stereo Generators: Some Suggestions". This provides instructions for measuring separation by using broadband program material like pink noise for a test signal, and by employing a one-third-octave real-time analyzer or dual-channel FFT analyzer as the measuring instrument. This provides a more realistic assessment of separation performance under operating conditions.

A❑ Continue to drive the right channel input of the 8182A with the tracking generator or sweep generator.

B❑ Adjust the output level of the tracking generator or sweep generator so that 10% L+R modulation (±2.5kHz deviation) is produced by 100Hz.

C❑ Connect the scope or spectrum analyzer to the RIGHT AUDIO OUTPUT of your stereo modulation monitor.

This connection should already exist.

D❑ Measure the level at 1kHz. This level will be used as a "0dB" reference for the separation measurement.

The response at other frequencies should be flat ±0.5dB, as measured above.

E❑ Connect the scope or spectrum analyzer to the LEFT AUDIO OUTPUT of your stereo modulation monitor. Measure the swept output of the left channel. The difference (in dB) between this measurement and the reference measurement provides a good indication of the swept sinewave separation.

Strictly speaking, OET-60a requires that the "10% 75μs equivalent input" separation be measured. This requires you to connect a 75μs de-emphasis filter between the output of the generator and the input of the system, and a complementary 75μs pre-emphasis filter before the measuring instrument. While this is inconvenient, you may want to do it if you want the true "10% 75μs equivalent input" measurement.

F❑ Measure the left-into-right separation by repeating the above steps, but connecting the generator to the left input, using the left monitor output as the level reference, and reading the separation from the right output.

7) Disconnect test instruments from the 8185A.

8) Set the 8185A's COMP and LIMITER switches to OPERATE.

Field Audit of Performance

The following instructions enable TV Stereo Generator users to check the performance of their units on the bench using test equipment likely to be found in a well-equipped TV station. This procedure is a starting point for detecting and diagnosing a problem that you believe is caused by the TV Stereo Generator. It is also useful in routine maintenance.

Equipment required:

Audio Oscillator.

With verified residual distortion below 0.0015%. Sound Technology 1710B is suitable. Other suitable instruments are made by Audio Precision, Hewlett-Packard, and Tektronix, among others.

Noise and Distortion Test Set, including AC voltmeter.

Once again, a high-performance type like the Sound Technology 1710B is preferred, but not required.

General-Purpose Oscilloscope.

DC-Coupled, dual trace, with at least 5 MHz bandwidth.

Spectrum analyzer with tracking generator

Tektronix 5L4N plug-in with 5111 bistable storage mainframe, or equivalent. *Alternatively*, a sweep generator with 30–15,000Hz logarithmic sweep can be used, with an oscilloscope in X/Y mode as the indicating instrument.

Stereo Aural Monitor with built in Noise Reduction decoder.

If a stereo monitor is not available, a 0–100kHz spectrum analyzer such as a Tektronix 5L4N can be used.

Noise Reduction In/Out: Performance limitations in the system are most likely to arise from the noise reduction encoder and decoder circuits. In particular, stereo separation and distortion measurements are limited by the encoder and decoder gain/frequency tracking capabilities and non-linearities.

The noise reduction encoder and decoder can be conveniently switched out of the signal path to help isolate performance variations. When the encoder and decoder are switched out, they are replaced by fixed pre- and de-emphasis, respectively. At the same time the sum-channel compensation circuits are removed from the sum-channel signal path. (This is called "75μs Equivalent Mode".)

Monitor Card: The monitor card (Card #6) provides a means for verifying the performance of the audio signal path up to the stereo baseband generator without requiring a stereo modulation monitor. It includes a noise reduction decoder card in the difference channel, a fixed de-emphasis in the sum channel, and a de-matrix circuit to generate the left and right monitor outputs.

System Performance Tests

Many 8185As are used with the Orban 8182A Audio Processor. To test the performance of the 8185A TV Stereo Generator system independently, you must temporarily strap Card #2 in the 8185A for External Input, if it is not already so strapped. With power off, remove Card #2 from the card cage and set its jumpers as follows:

Jumper	Position
A	EXT
B	IN
C	EXT
D	EXT
E	IN
F	EXT

Connect the audio signal source to the left and right external audio inputs on the 8185A, and measure the left and right monitor outputs on the rear of the 8185A. Connect sync or composite video to the video input on the rear of the TV Stereo Generator. Be sure the stereo and sync lock LEDs are lit steadily.

Sync Card

1) Verify Sync Lock

A❑ Apply a 1V peak-to-peak composite video or sync signal to the VIDEO LOOP THROUGH IN on the rear panel. Set the TERMINATOR switch to 75 Ohms. The SYNC LOCK light on the front panel should light.

B❑ Switch the front-panel STEREO/MONO switch to STEREO. The STEREO lamp should light.

2) Verify Operation of Bessel Null Tone

A❑ Switch the BESSEL NULL CAL switch to TONE.

B❑ Observe the rear-panel COMPOSITE OUTPUT with a scope. Verify that a 7.867kHz sinewave appears at the COMPOSITE OUTPUT.

C❑ *Optionally*, connect a distortion analyzer to the COMPOSITE OUTPUT, and verify that the harmonic distortion of the tone is less than 0.04%.

D❑ Return the BESSEL NULL CAL switch to OPERATE.

Test Audio Processing (Filters and N/R Encoder)

1) Measure Frequency Response

A☐ Set the N/R ENCODER and N/R DECODER switches in.

B☐ Set a manual oscillator, sweep oscillator, or tracking generator to feed 100Hz at −7dBu (0.346Vrms) into the left input of the 8185A.

If you have a tracking generator, observe the response on the matching spectrum analyzer.

If you are using the tracking generator in the Tektronix 5L4N, you will have to use an external amplifier after the tracking generator output to achieve the drive levels specified in the procedure.

If you have a sweep generator, use an oscilloscope with X/Y sweep. Connect the MONITOR OUT to the scope's Y input, and connect the sweep generator's RAMP OUT to the scope's X input.

If you are using a manually-tuned source, observe the response on an AC voltmeter.

C☐ Measure the level at the left monitor output of the TV Stereo Generator at several frequencies between 30Hz and 20kHz.

The response should be ±0.5 dB, 30–14,000Hz, <1dB down at 15kHz.

(**Note:** The frequency response falls off like a "brick wall" beyond 15kHz. If frequency response does not seem to extend to 15kHz, be sure that your oscillator is correctly calibrated.)

D☐ Measure the right channel frequency response similarly.

2) Measure Total Harmonic Distortion

A☐ Turn off power. Remove Card #2, and reset jumpers E and B to out. (This defeats pre-emphasis.) Replace Card #2 and restore power.

B☐ Set a low-distortion oscillator to feed 100Hz at +10dBu (2.45Vrms) into the left input of the 8185A.

C☐ Read distortion with the noise reduction encoder and decoder both in. With the noise reduction in, THD readings should be below 0.2%. Note that the output level will fall with frequency, following the 75µs de-emphasis curve, and that the distortion analyzer's SET LEVEL control must be readjusted at each frequency. Typical distortion figures are listed in Table 4-1.

D☐ Read distortion with the noise reduction encoder and decoder both out. With the noise reduction out, THD readings should be well below 0.1% at all frequencies. Typical distortion figures are listed in Table 4-1.

E☐ Measure the right channel similarly.

	N/R OUT		N/R IN	
FREQUENCY	LEFT	RIGHT	LEFT	RIGHT
50	0.015%	0.015%	0.060%	0.060%
100	0.015%	0.015%	0.050%	0.050%
400	0.014%	0.014%	0.032%	0.032%
1000	0.010%	0.010%	0.020%	0.020%
5000	0.018%	0.018%	0.050%	0.050%
10000	0.035%	0.035%	0.090%	0.090%
15000	0.050%	0.050%	0.130%	0.130%

Table 4.1: Typical Single-Channel Total Harmonic Distortion
100% 75µs Equivalent Input Modulation

3) Measure Noise

Short both inputs to the 8185A. Measure the residual output noise at the Monitor Outputs of the TV Stereo Generator. Noise readings in a 20kHz noise bandwidth should be below −65dBv (this is more than 82dB below the maximum output level). Monitor the output of the noise meter with an oscilloscope to identify hum or RF problems.

4) Measure Swept-Sinewave Separation

Ideally, when only one channel is fed signal, there should be no signal in the output of the other channel. The extent to which one channel "bleeds" into the other is referred to as L into R (or R into L) separation and is specified as the ratio of the undesired signal in the "off" channel to the desired signal in the "on" channel.

In the TV Stereo Generator the separation performance is primarily dependent on the matching of the 11-pole elliptical filters in the sum and difference channels and the tracking of the noise reduction encoder and decoder. Perform the separation measurements with both N/R IN/OUT switches in the IN position.

Separation is measured at 10% 75µs equivalent modulation, which means that the signal at the input to the Stereo Baseband Generator card will produce 10% modulation, independent of frequency, if the dbx N/R encoder is bypassed. This will occur automatically if a oscillator with flat frequency response is connected to the 8185A's EXTERNAL AUDIO INPUT at a level of −10dBu (0.245Vrms) because the pre-emphasis in Card #2 was defeated earlier in this test procedure.

Starting on page 4-44, we have reprinted an Orban application note called **Evaluating BTSC Stereo Generators: Some Suggestions.** This provides instructions for measuring separation by using broadband program material like pink noise for a test signal (instead of swept sinewave), and by employing a one-third-octave real-time analyzer or dual-channel FFT analyzer as the measuring instrument. This provides a more realistic assessment of separation performance under operating conditions.

A☐ Set a tracking generator, sweep generator, or sinewave oscillator to feed -10dBu (0.245Vrms) into the LEFT INPUT of the 8185A. If the source can be swept, set it for 30–14,000Hz. If it provides fixed frequencies, measure the separation at a minimum of 30Hz, 50Hz, 100Hz, 400Hz, 1kHz, 2.5kHz, 5kHz, 7.5kHz, 10kHz, and 14kHz.

Measuring other frequencies in between will provide a clearer picture of the separation performance, as will repeating the measurement at other levels like 30% modulation (-0.46dBu; 0.735Vrms) and 100% modulation (+10dBu; 2.45Vrms).

If you have a tracking generator, observe the response on the matching spectrum analyzer.

If you are using the tracking generator in the Tektronix 5L4N, you will have to use an external amplifier after the tracking generator output to achieve the drive levels specified in the procedure.

If you have a sweep generator, use an oscilloscope with X/Y sweep. Connect the MONITOR OUT to the scope's Y input, and connect the sweep generator's RAMP OUT to the scope's X input.

If you are using a manually-tuned source, observe the response on an AC voltmeter.

B☐ Measure the level at the LEFT MONITOR OUT and the RIGHT MONITOR OUT on the TV Stereo Generator.

The ratio of the right channel signal to the left channel signal (or their difference in dB) is the L into R separation.

The BTSC specification calls for separation of better than 30dB from 100Hz to 8kHz, smoothly decreasing from 30dB at 8kHz to 20dB at 15kHz, and smoothly decreasing from 30dB at 100Hz to 26dB at 50Hz. The performance of the TV Stereo Generator will typically be very much better than this (see **SPECIFICATIONS** on page 6-2).

This concludes tests of the audio processing circuitry.

Test Stereo Baseband Generator

This procedure tests the performance of the stereo baseband generator and other circuitry on the stereo generator card (Card #7). This procedure requires only an audio oscillator, an oscilloscope and a TV Stereo Aural Monitor or baseband frequency spectrum analyzer such as a Tektronix 5L4N.

The performance of the Stereo Baseband Generator is independent of the performance of the audio processing circuits which come before it in the signal chain. A special test switch has been provided on Card #7 to allow easy measurement of stereo generator performance parameters. Note particularly that the separation test described below for the stereo baseband generator is *independent* of the separation measurements described above for the audio processing circuits. In general, separation performance of the Stereo Baseband Generator will far exceed that of the audio processing, and will not be the limiting factor in the stereo performance of the system.

It has been our experience that the 8185A Stereo Baseband Generator is more stable than most monitors. Therefore, accurate measurement and adjustment of 75µs equivalent separation is best done with an oscilloscope. Crosstalk and 2H suppression cannot be conveniently measured on a scope, and must therefore be measured on the stereo monitor or the spectrum analyzer.

1) Prepare the Test Setup

A❑ Turn off power. Remove Card # 2, and reset jumpers E and B to in. (This restores pre-emphasis.) Replace Card #2 and restore power.

B❑ Connect the oscillator to both the 8185A left channel input and the right channel input in-phase. Connect the stereo aural monitor or the spectrum analyzer to the Composite Baseband Output on the rear of the TV Stereo Generator.

C❑ Set the oscillator frequency to 100Hz at 2.45Vrms. Observe the L+R position of the 8185A meter, and trim the oscillator level slightly if necessary to make the meter read "100%".

D❑ Adjust the stereo monitor input sensitivity to produce an indication of 100% on the sum channel, or adjust the input sensitivity on the spectrum analyzer (if used instead of the stereo monitor) to produce a reading of 6 dB below full scale for the 100 Hz sum channel signal.

2) Measure Main-to-Sub Crosstalk

The main-to-sub crosstalk is measured at 100% main channel modulation, which corresponds to 25kHz deviation of the aural subcarrier.

A❑ Put the TEST SWITCH on Card #7 in the MAIN-TO-SUB XTALK position.

This applies the sum channel signal to the main channel only, and grounds the subchannel input of the Stereo Baseband Generator.

B❑ Measure the main-to sub crosstalk at 50, 500 and 15000 Hz.

Note that because of pre-emphasis, the oscillator level must be adjusted substantially to keep the modulation percentage constant as the frequency is varied.

C❑ Verify that the crosstalk does not exceed −40dB below 100% modulation at any frequency.

Typically you will be measuring the performance of the stereo aural monitor in this test. Use of the baseband spectrum analyzer will show that the crosstalk is typically more than 70dB below 100% sum channel modulation.

3) Measure Sub-to-Main Crosstalk

A❑ Put the TEST SWITCH on Card #7 in the SUB-TO-MAIN XTALK position.

This applies the sum channel signal to the stereo subchannel only, and grounds the input to the main channel of the stereo baseband generator.

B❑ Increase the oscillator output to +16dBu (4.887Vrms).

The sub-to-main crosstalk test is performed at 100% subchannel modulation, which corresponds to 50kHz deviation of the aural subcarrier. This is twice the level normally seen in the sum channel (the L+R meter position will pin the meter). For this reason the output level of the oscillator must be increased to perform this test.

C❑ Measure the sub-to-main crosstalk at 50, 500 and 15000 Hz. Verify that the crosstalk does not exceed −40dB below 100% modulation at any frequency.

Typically you will be measuring the performance of the stereo aural monitor in this test. The baseband spectrum analyzer will show that the crosstalk is typically more than 70dB below 100% sum channel modulation.

4) Measure 2H Suppression

A❑ Return the TEST SWITCH to OPERATE.

B❑ Set the oscillator to 7.5kHz and +4dBu (1.228Vrms). Use the stereo aural monitor or the baseband spectrum analyzer to verify that the 2H subcarrier suppression exceeds −40dB below 50kHz deviation.

5) Measure Separation of the Stereo Baseband Generator

A❑ Connect the oscilloscope to the COMPOSITE OUT of the TV Stereo Generator.

DO NOT USE AN ATTENUATOR PROBE; this may compromise the accuracy of the measurement due to mid-band phase shifts often present in these probes.

B❑ Trigger the scope externally from the oscillator.

C❑ Turn the PILOT switch OFF.

D❑ Connect the oscillator to the left input of the TV Stereo Generator.

E❑ Set the scope's vertical sensitivity to 0.5V/div, and DC-couple the input.

F❑ Switch the TEST SWITCH on Card #7 to the SEPARATION position.

G❑ Set the oscillator frequency to 1kHz, and adjust the oscillator output level and the scope sweep rate to produce a scope pattern that looks like Fig. 4-1 below.

Separation is measured by determining the flatness of the baseline. If the 8185A has been tweaked to compensate for a given exciter/RF amplifier/antenna system, then the baseline might not be quite flat. You must decide at this point whether to retain the current adjustment (for the sake of expediency) or whether to readjust the SEPARATION control (to determine the amount of separation which the system is capable of providing). If the baseline is almost flat, this implies that no fault has occurred in the stereo generator, and further tests are not required.

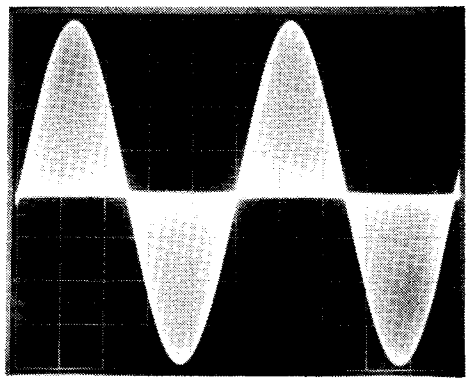


Fig. 4-1: Scope Pattern for Separation Test

The remaining steps describe how to numerically measure separation. They are optional.

H❑ Expand the scope vertical scale to 50mV/div.

I❑ Adjust the 8185A SEPARATION control to achieve the flattest possible baseline.

J❑ Calculate separation by the formula: $S = 20\log(D/P)$, where S is the separation in dB, D is the peak-to-peak deviation of the baseline from flatness in volts, and P is the peak-to-peak deviation of the composite baseband output signal in volts.

The separation should be greater than 45dB, 30–15000Hz, and is typically better than −60dB. (60dB is the practical limit of resolution for the oscilloscope measurement technique.)

Test Remote Control and Logic

This procedure tests the operation of the rear-panel remote control terminals and also verifies that the stereo generator switching logic is responding correctly. To activate a remote control terminal, ground its "−" terminal to the ⏚ terminal on the rear panel barrier strip, and momentarily jumper its "+" terminal to the "+22V" terminal on the barrier strip.

1) Prepare the Setup

A❑ Connect the COMPOSITE OUT of the TV Stereo Generator to the stereo aural monitor or the baseband spectrum analyzer.

B❑ Turn the PILOT switch on and verify ±5kHz deviation. (This is 14dB below 100% sum-channel modulation, or 8dB below 50% sum-channel modulation.)

C❑ Switch the front panel STEREO/MONO switch on the 8185A to STEREO. Verify that the front panel STEREO light is lit.

D❑ Connect the oscillator to the 8185A LEFT INPUT.

E❑ Set the oscillator output level to +10dBu (2.45Vrms).

This produces 100% left-channel only modulation. The L+R meter on the stereo monitor should indicate ±12.5kHz deviation, or 50% L+R modulation.

2) Test MONO LEFT Mode

A❑ Switch the 8185A into MONO LEFT with the rear-panel remote control terminal.

B❑ Verify that the STEREO lamp on the front panel goes out, that the pilot disappears, and that the sum-channel modulation is now ±25kHz (100%).

C❑ Disconnect the oscillator from the left input of the 8182A and connect it to the right input. Verify that the sum-channel modulation is 0%.

3) Test STEREO Mode

A❑ Switch the 8185A into stereo with the rear-panel remote control terminals.

B❑ Verify that the front panel STEREO lamp is on.

C❑ Verify that sum-channel modulation is ±12.5kHz (50%).

4) Test MONO RIGHT Mode

A❑ Switch the 8185A into MONO RIGHT with the rear panel remote control terminals.

B❑ Verify that the STEREO lamp on the front panel goes out, that the pilot disappears, and that the sum-channel modulation is 100%.

C❑ Disconnect the oscillator from the 8185A right input and reconnect it to the left input. Verify that the sum-channel modulation is 0%.

Individual Card Tests

The following provides moderately detailed tests that will let you isolate simple problems to an individual card.

To test each card, turn the power off, remove the card from its slot, insert the extender card in the vacant slot, and plug the card under test into the extender card.

If you are using the 8185A with the 8182A Optimod-TV Audio Processor, disconnect the connecting cable between the two before performing the tests below.

1) Test Card #2

A❑ Strap Card #2 jumpers as follows:

Jumper	Position
A	EXT
B	IN
C	EXT
D	EXT
E	IN
F	EXT

This prepares the 8185A to accept external audio inputs.

B❑ Remove Card #3.

C❑ Inject a 0dBu at 400Hz signal at the 8185A'S LEFT INPUT. Verify flat frequency response at 0dBu at pin F of the card connector.

This verifies operation of the left input buffer and left phase corrector for the Six-Pole Filter.

D❑ Inject a 0dBu signal at TP3. Observe signal at pin 1, IC3a, and verify that it is pre-emphasized according to Table 4-2, ±0.5dB.

This verifies operating of the IC3a pre-emphasis circuit. Note that this circuit has −2.92dB gain, so the absolute gain from TP3 to IC3a, pin 1 is 2.92dB lower than the relative gain shown in Table 4-2.

E❑ Observe TP2, then TP4. In relation to the relative gain shown in Table 4-2, note that the signal at TP2 appears -8.94dB lower, and that the signal at TP4 appears -2.92dB lower.

This verifies the operation of the left phase corrector for the 11-Pole Filter IC3b, IC4, and the matrix, IC9.

F❑ Inject a 0dBu signal at the 8185A'S RIGHT INPUT. Verify flat frequency response at 0dBu at pin Y of the card connector.

This verifies operation of the right input buffer and right phase corrector for the Six-Pole Filter.

G☐ Inject a 0dBu signal at TP5. Observe signal at pin 1, IC7a, and verify that it is pre-emphasized according to Table 4-2, ±0.5dB.

This verifies operation of the IC7a pre-emphasis circuit. Note that this circuit has −2.92dB gain, so the absolute gain from TP3 to IC3a, pin 1 is 2.92dB lower than the relative gain shown in Table 4-2.

H☐ Observe TP2, then TP4. In relation to the relative gain shown in Table 4-2, note that the signal at TP2 appears -8.94dB lower, and that the signal at TP4 appears -2.92dB lower.

This verifies the operation of the matrix (IC9), and the right phase corrector for the 11-Pole Filter IC7b, IC8.

FREQUENCY(Hz)	RELATIVE GAIN(dB)
50	0.00
100	0.01
200	0.04
500	0.23
1K	0.87
2K	2.76
3K	4.77
5K	8.16
8K	11.82
10K	13.66
13K	15.86
15K	17.07

Table 4-2: 75μs Pre-emphasis

2) Test Card #3

A☐ To test the left channel, inject signal at TP4 and measure the frequency response at TP1. Fig. 4-2 shows a typical Card #3 frequency response measurement. The scale of Fig. 4-2 is 10dB/div vertical and 2kHz/div linear horizontal.

B☐ To test the right channel, inject signal at TP5 and measure the frequency response at TP2.

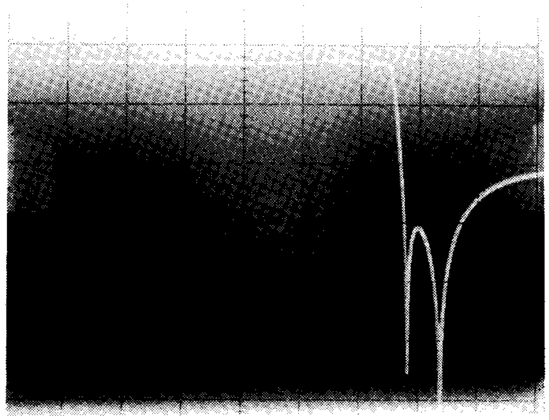


Fig. 4-2: Typical Card #3 Frequency Response

3) Test Card #5

A❑ Unplug Cards #4,#6 and #7.

B❑ To test the left channel, inject signal at TP4 and measure the frequency response at TP2.

Fig. 4-3 shows a typical Card #5 frequency response measurement. The scale of Fig. 4-3 is 10dB/div vertical and 2kHz/div linear horizontal.

C❑ To test the right channel, inject signal at TP3 and measure the frequency response at TP1.

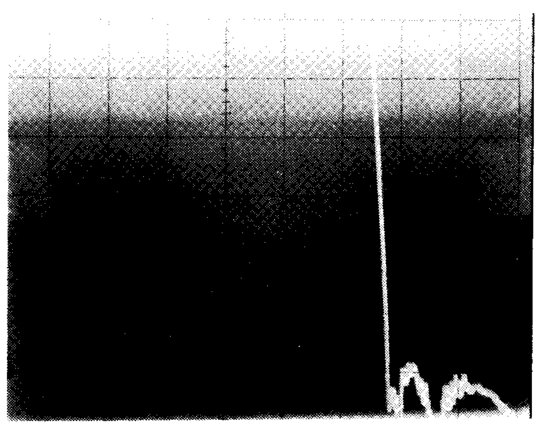


Fig. 4-3: Typical Card #5 Frequency Response

4) Test Card #8

A❑ Apply a 1V peak-to-peak composite video or sync signal to the VIDEO LOOP THROUGH IN on the rear panel.

B❑ Switch the TERMINATOR switch to 75 Ohms.

The SYNC LOCK light on the front panel should light.

C❑ Verify that a pulse wave at 15,734Hz, 15V peak, appears at pin F of the card.

D❑ Verify that a squarewave at 251.7kHz, 15V peak, appears at pin L of the card.

E❑ *(optional)* Verify that a sinewave at 15,734Hz, 2.08Vrms, appears at pin H. THD should be below 0.05%.

This output is not used in the 8185A.

5) Test Card #7

If the system passes the test procedure in **Test Stereo Baseband Generator** (on page 4-20) and **Test Remote Control and Logic** (on page 4-23), you can assume that Card #7 is operating correctly.

These tests require the earlier circuitry on Cards #2, #3, and #5 to be working to deliver a correct signal to the Card #7 L+R input port (TP1; pin #11 of the edge connector). If you doubt that this circuitry is working correctly, you can bypass it and still perform most of these tests. Unplug Card #5 and inject the test signal directly into TP1 on Card #7, using a low-source-impedance ($<10\Omega$) signal generator. In this case, ground TP2 on Card #7.

The generator levels must be set differently if the generator is connected directly to TP1:

Test	Level (Vrms)	Level (dBu)
Main to Sub	1.768	+2.48
Sub to Main	3.536	+8.50
2H Suppression	0.884	−3.54

Table 4-3

6) Test Card #6

A❑ Unplug Cards #3, #4 and #5.

B❑ Switch the N/R IN/OUT switch to OUT.

C❑ Inject signal at TP1. The response at the outputs TP3 and TP4 should be a de-emphasized frequency response.

A typical response is shown in Fig. 4-4. The scale of Fig. 4-4 is 10dB/div vertical and 20kHz log scale horizontal.

D❑ Switch the N/R IN/OUT switch IN. Verify that the card passes signal from TP1 to TP3 and TP4, and that it also passes signal from TP2 to TP3 and TP4.

E❑ The only field test which can be done on the dbx Noise Reduction Decoder card is to verify that it passes signal. No field alignment or calibration should be attempted. Proper gain/frequency response of the Decoder can be verified by the separation measurements described above. If the TV Stereo Generator provides satisfactory separation performance with the N/R IN/OUT switches OUT, but not with them IN, suspect a problem with either the Noise Reduction Decoder (on Card #6) or the Noise Reduction Encoder (on Card #4).

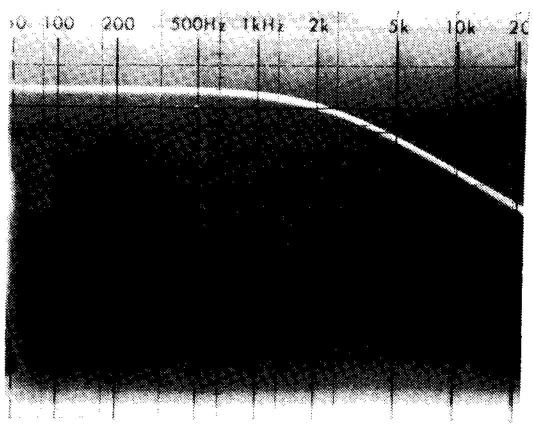


Fig. 4-4: Typical Card #6 Frequency Response

7) Test Card #4

This test requires a working Card #5.

A❑ Unplug Cards #3, #6 and #7.

B❑ Inject signal into the input side of resistor R1 (pin Y of the card edge connector). Verify that there is signal at the card output (pin X on the card edge connector).

C❑ The only field test which can be done on the dbx Noise Reduction Encoder card is to verify that it passes signal. No field alignment or calibration should be attempted. Proper gain/frequency response of the Encoder can be verified by the separation measurements described above. If the TV Stereo Generator provides satisfactory separation performance with the N/R IN/OUT switches OUT, but not with them IN, suspect a problem with either the Noise Reduction Decoder (on Card #6) or the Noise Reduction Encoder (on Card #4).

Field Alignment and Comprehensive Card Test

These field alignment instructions are included primarily for reference — routine alignment is neither necessary nor desirable due to the high stability of the circuitry.

CAUTION

If calibration is necessary, we strongly recommend that the circuit card in question be returned to the factory for alignment by our experienced technicians. They have access to special test fixtures and a supply of exact-replacement spare parts. Only in an emergency should you attempt to align and calibrate the 8185A in the field.

Since the user does not have access to the special test fixtures, the 8185A must therefore be used as a test fixture, and the entire unit must be aligned as a system.

Follow these instructions in order, without skipping steps.

This procedure is organized on a card-by-card basis. Cards should be calibrated in the same order as their order in the signal path, from input to output. If a card later in the signal path is aligned while an earlier card is misaligned, the later card may not be correctly aligned, even if the instructions for that card are followed conscientiously. Note that no calibration is necessary for Cards #2, #4 and #6.

Refer to the drawings in **Section 6** for the locations of components and test points.

Equipment required:

Audio Oscillator.

With verified residual distortion below 0.0015%. Sound Technology 1710B is suitable. Other suitable instruments are made by Audio Precision, Hewlett-Packard, and Tektronix, among others.

Noise and Distortion Test Set, including AC voltmeter.

Once again, a high-performance type like the Sound Technology 1710B is preferred, but not required.

General-Purpose Oscilloscope.

DC-Coupled, dual trace, with at least 5 MHz bandwidth.

Spectrum analyzer with tracking generator

Tektronix 5L4N plug-in with 5111 bistable storage mainframe, or equivalent. *Alternatively*, a sweep generator with 30–15,000Hz logarithmic sweep can be used, with an oscilloscope in X/Y mode as the indicating instrument.

Frequency counter, accurate ±0.005%.

1) Prepare the unit.

A❑ Remove the 8185A from its rack and place it on a test bench away from RF fields.

B❑ Record the settings of all 8185A controls.

C❑ Connect the 8185A ⏚ and ⊥ together.

D❑ Open up the 8185A's front panel and remove its subpanel. See page 4-4 for instructions.

E❑ Power the 8185A.

2) Calibrate 15-volt power supply on Card #PS

A❑ Observe the voltage at terminal post #6 on Card #PS (or at another convenient point on the +15-volt bus) with a well-calibrated digital voltmeter.

B❑ Adjust trimmer R106 until the digital voltmeter reads "+15.00-volts".

C❑ Verify that the voltage at terminal post #8 on Card #PS (or other convenient point on the −15-volt bus) is between −14.85 and −15.15 volts.

If not, see the troubleshooting information in Section 5.

> **IMPORTANT**
>
> **Always turn off AC power** to the 8185A before removing or installing circuit cards. Allow the 8185A to stabilize for two minutes after turning the power back on.

Comprehensive Test of Card #2

1) Prepare Card

A❑ Set jumpers A and D to EXTERNAL

B❑ Set jumpers B and E to OUT

C❑ Set jumpers C and F to EXTERNAL

2) Test signal path.

A❑ Drive the 8185A LEFT EXTERNAL INPUT with 400Hz at a level of 0dBu. Verify a level of -9.0dBu ±0.2dB at TP2.

B❑ Common-mode rejection test: Connect the high side of the oscillator to the "+" and "−" terminals of the 8185A LEFT EXTERNAL INPUT in parallel. Verify that the level is less than −59dBu at TP2.

C❑ Drive the 8185A RIGHT EXTERNAL INPUT with 400Hz at a level of 0dBu. Verify a level of -9.0dBu ±0.2dB at TP2.

D❑ Common-mode rejection test: Connect the high side of the oscillator to the "+" and "−" terminals of the 8185A RIGHT EXTERNAL INPUT in parallel. Verify that the level is less than −59dBu at TP2.

3) Test pre-emphasis.

A❑ Drive the 8185A LEFT EXTERNAL INPUT with 400Hz at a level of +2.92dBu and verify that the level at TP4 is 0dBu ±0.2dB.

B❑ Change the oscillator to 15kHz and verify that the level at TP4 is 0dBu ±0.2dB.

C❑ Move jumper B to IN and verify that the level at TP4 is +17.1dBu ±0.5dB.

D❑ Drive the 8185A RIGHT EXTERNAL INPUT with 400Hz at a level of +2.92dBu and verify that the level at TP4 is 0dBu ±0.2dB.

E❑ Change the oscillator to 15kHz and verify that the level at TP4 is 0dBu ±0.2dB.

F❑ Move jumper E to IN and verify that the level at TP4 is +17.1dBu ±0.5dB.

G❑ Return jumpers B and E to OUT.

4) Test noise and distortion

A❑ Drive the LEFT EXTERNAL INPUT with the oscillator set to +10dBu and monitor TP2.

B❑ Measure the THD at 20Hz, 400Hz, and 5kHz. Verify that the THD in a 20–20kHz bandwidth is below 0.015%. Measure the THD at 15kHz and verify that the distortion is below 0.025%.

C❑ Mute the signal and measure the residual noise. Verify that it is below -75dBu. Observe the oscilloscope to verify that no "popcorn noise" exists.

D❑ Drive the RIGHT EXTERNAL INPUT with the oscillator set to +10dBu and monitor TP2.

E❑ Measure the THD at 20Hz, 400Hz, and 5kHz. Verify that the THD in a 20–20kHz bandwidth is below 0.015%. Measure the THD at 15kHz and verify that the distortion is below 0.025%.

F❑ Mute the signal and measure the residual noise. Verify that it is below -75dBu. Observe the oscilloscope to verify that no "popcorn noise" exists.

G❑ Set the oscillator for 400Hz at a level of 0dBu. Drive the LEFT EXTERNAL INPUT and then the RIGHT EXTERNAL INPUT while monitoring TP2. Verify that the output remains exactly the same (±0.1dB)

H❑ Set the oscillator for 400Hz at a level of 0dBu. Drive the LEFT EXTERNAL INPUT and then the RIGHT EXTERNAL INPUT while monitoring TP4. Verify that the output remains exactly the same (±0.1dB)

5) Test the matrix.

A❑ Drive the LEFT EXTERNAL INPUT with 400Hz at a level of +2.92dBu. Monitor TP2 and verify that the level is 0dBu ±0.2dB.

B❑ Monitor the TP4 and verify that the level is +6.02dBu ±0.2dB.

C❑ Drive the LEFT EXTERNAL INPUT and RIGHT EXTERNAL INPUT in parallel and in phase and verify that the level at TP2 is +6.02dBu ±0.2dB.

D❑ Monitor TP4, and verify that the level is less than −46dBu.

Card #3 Calibration

1) Prepare test setup.

A❑ Remove Card #3 and plug the extender board into the Card #3 slot. Plug Card #3 into the extender board.

B❑ Unplug Card #7.

2) Calibrate left input filter

A❑ Connect the low distortion oscillator to the test point labeled TP4.

B❑ Connect the oscillator ground to TP3.

C❑ Set the oscillator frequency to 15,734 Hz (±20 Hz).

D❑ Set the oscillator amplitude to approximately 3 Volts rms.

E❑ Connect the AC VTVM to the output of the filter at TP1.

F❑ Connect the AC VTVM ground to TP3.

G❑ Adjust trimmer R13 for a minimum reading (null) on the AC VTVM. The null will typically be better than 60 dB below the input level.

3) Calibrate right input filter

A❑ Connect the low distortion oscillator to the test point labeled TP5.

B❑ Connect the oscillator ground to TP3.

C❑ Set the oscillator frequency to 15,734 Hz (±20 Hz). Verify the oscillator frequency with a frequency counter.

D❑ Set the oscillator amplitude to approximately 3 Volts rms.

E❑ Connect the AC VTVM to the output of the filter at TP2.

F❑ Connect the AC VTVM ground to TP3.

G❑ Adjust trimmer R38 for a minimum reading (null) on the AC VTVM. The null will typically be better than 60 dB below the input level.

H❑ Remove the oscillator from the filter input.

4) Calibrate sum phase balance control on Card #3 (optional)

This procedure requires a working and calibrated 8182A. Skip to step M below if you are not using the Orban 8182A OPTIMOD-TV Audio Processor. Refer to **Appendix D (Field Audit-of-Performance)** in your OPTIMOD-TV Operating Manual if you suspect that your OPTIMOD-TV is not functioning properly.

A❑ Re-strap the jumpers on Card #2 of the 8185A as follows:

Jumper	Position
A	8182A
B	OUT
C	8182A
D	8182A
E	OUT
F	8182A

B❑ Strap the jumpers on Card #7 of the 8182A as follows:

Jumper	Position
A	OUT
B	OUT
C	SUM OUT
D	DIFFERENCE OUT

C❑ Connect the 8185A to the 8182A with the multi-conductor connecting cable.

D❑ Place both 8182A PROOF/OPERATE switches in PROOF. Switch the 8182A's LOUDNESS CONTROLLER switch to OFF. Allow at least two minutes for the gain to settle.

E❑ Connect the output of the tracking generator in the spectrum analyzer to both the left and right audio inputs of the OPTIMOD-TV in parallel and in phase.

F❑ Connect the spectrum analyzer input to the left AUDIO TEST JACK (J1) on the rear panel of the OPTIMOD-TV. Switch the STEREO GENERATOR IN/OUT switch to the IN position. (On earlier 8182A units this switch is labeled NOISE REDUCTION IN/OUT.)

G❑ Set the spectrum analyzer for a 0–20kHz sweep. Set the vertical sensitivity to 10dB/division. Set the input sensitivity to −10dB. Set the output level of the tracking generator to obtain an on-screen trace.

(You may have to readjust one or both of the OPTIMOD-TV INPUT ATTENUATORS if gain is insufficient). You are now looking at the pre-emphasized SUM output of the OPTIMOD-TV. You should see a rising high frequency response.

H❑ Connect the spectrum analyzer input to the right AUDIO TEST JACK (J2) on the rear panel of the OPTIMOD-TV. You are now looking at the pre-emphasized DIFFERENCE output of the OPTIMOD-TV.

I❑ Adjust the RIGHT INPUT ATTENUATOR on the OPTIMOD-TV to obtain a minimum output level (null) in the midband (around 800Hz). This null will typically be more than 40dB below the SUM signal.

J❑ Adjust trimmer R24 on the 8185A Card #3 to obtain a minimum output level (null) at high frequencies (around 15kHz). This null will typically be more than 35 dB below the sum signal.

K❑ It may be possible to improve the high frequency null by *slightly* adjusting trimmer R618 (RIGHT PRE-EMPHASIS TRIM) on Card #6 in the 8182A OPTIMOD-TV.

L❑ Disconnect the 8182A from the 8185A.

M❑ Re-strap Card #2 in the 8185A as follows:

Jumper	Position
A	EXT
B	IN
C	EXT
D	EXT
E	IN
F	EXT

N❑ Strap Card #7 in the 8182A as follows:

Jumper	Position
A	OUT
B	OUT
C	L
D	R

O❑ This completes the alignment of Card #3.

(Do not) calibrate Card #4 (dbx N/R Encoder)

There is no alignment necessary for Card #4.

IMPORTANT

The dbx Noise Reduction Encoder card cannot be calibrated in the field. If a problem is suspected with the Noise Reduction Encoder, the entire card #4 must be returned to the Orban factory. Refer to Field Audit of Performance (above) to determine if the encoder is faulty.

Calibrate Card #5 (11-Pole Filters)

WARNING

Changing the alignment of Card #5 according to this procedure will almost certainly require that sum compensator components on Card #5 be re-selected for best separation. This can only be done at the factory. NEVER perform this alignment in the field except in the most dire emergency. If you do, you will eventually need to return the matched set of Cards #4, #5. and #6 to the factory for recalibration. This recalibration is labor-intensive, expensive, and is not ordinarily covered under your warranty.

1) Prepare Test Setup

A❑ Remove Card #5 and plug the extender board into the Card #5 slot. Plug Card #5 into the extender board.

B❑ Unplug Card #2, #4, Card #6 and Card #7.

2) Calibrate Sum 11-Pole Filter

A❑ Connect the low distortion oscillator to the test point labeled TP4.

B❑ Connect the oscillator ground to TP5.

C❑ Set the oscillator frequency to 15,772 Hz (±20 Hz). Verify the oscillator frequency with a frequency counter.

D❑ Set the oscillator amplitude to approximately 3 Volts rms.

E❑ Connect the AC VTVM to TP2 (the output of the filter).

F❑ Connect the AC VTVM ground to TP5.

G❑ Adjust trimmer R17 for a minimum reading (null) on the AC VTVM. The null will typically be better than 60 dB below the input level.

H❑ Set the oscillator frequency to 16,135Hz (±20Hz).
Verify the oscillator frequency with the frequency counter.

I❑ Adjust trimmer R22 for a minimum reading (null) on the AC VTVM. The null will typically be better than 60 dB below the input level.

J❑ Set the oscillator frequency to 15,000Hz (+0,−20Hz).

K❑ Adjust trimmer R15 for 0.00dB (±.03dB) gain from TP4 to TP2.

3) Calibrate Difference 11-Pole Filter

A❑ Connect the low distortion oscillator to the test point labeled TP3.

B❑ Connect the oscillator ground to TP5.

C❑ Set the oscillator frequency to 15,772 Hz (±20 Hz).

D❑ Set the oscillator amplitude to approximately 3 Volts rms.

E❑ Connect the AC VTVM to the output of the filter at TP1.

F❑ Connect the AC VTVM ground to TP5.

G❑ Adjust trimmer R67 for a minimum reading (null) on the AC VTVM. The null will typically be better than 60 dB below the input level.

H❑ Set the oscillator frequency to 16,135Hz (±20Hz).

I❑ Adjust trimmer R72 for a minimum reading (null) on the AC VTVM. The null will typically be better than 60 dB below the input level.

J❑ Set the oscillator frequency to 300Hz (±50Hz).

K❑ Adjust trimmer R80 for 0.00dB (±0.03dB) gain from TP3 to TP1.

L❑ Set the oscillator frequency to 15,000Hz (+0,-20Hz).

M❑ Adjust trimmer R65 for 0.00dB (±0.03dB) gain from TP3 to TP1.

4) Match the 11-Pole Filters for best separation

Note the **WARNING** above!

A❑ Plug in Cards #2, #3, #4, #6, and #7.

B❑ Connect the output of the tracking generator in the spectrum analyzer to the LEFT EXTERNAL INPUT of the 8185A.

C❑ Connect the spectrum analyzer input to the LEFT MONITOR OUTPUT on the rear panel of the TV STEREO GENERATOR.

D❑ Switch both N/R IN/OUT switches in the TV STEREO GENERATOR to IN.

E❑ Extend Card #5 in the TV STEREO GENERATOR with the extender card.

F❑ Set the output level of the tracking generator −10dBu. If the tracking generator cannot produce this large a level, set the level to maximum.

G❑ Set the spectrum analyzer for a 0–20kHz sweep. Set the vertical sensitivity to 10dB/division. Set the input sensitivity to achieve an on-screen trace.

You should see a flat frequency response.

H❑ Connect the spectrum analyzer input to the RIGHT MONITOR OUTPUT on the TV STEREO GENERATOR.

The trace should be 30–40dB below the LEFT MONITOR OUTPUT trace at low frequencies, rising slightly at higher frequencies. The difference between the two traces at any given frequency is the stereo separation (left into right) at that frequency.

I❑ Slightly adjust R80 (LOW FREQ GAIN TRIM) on Card #5 to get the maximum separation at low frequencies.

J❑ Alternately adjust trimmers R17, R22 and R15 on Card #5 to get the best possible separation at high frequencies. These controls are interactive, and some experimentation may be necessary to see how each control affects the separation. It should be possible to achieve separation better than 30dB at 14kHz.

K❑ This completes alignment of Card #5.

(Do Not) Calibrate Card #6 (dbx N/R Decoder)

There is no alignment necessary for Card #6.

IMPORTANT

The dbx Noise Reduction Decoder card can not be calibrated in the field. If a problem is suspected with the Noise Reduction Decoder, the entire card #6 must be returned to the Orban factory. Refer to the **Field Audit of Performance** on page 4-16 to determine if the decoder is faulty.

Calibrate and Test Card #7 (Stereo Baseband Generator)

1) Test +5-volt supply.

A❑ Measure the +5-volt supply with the DVM. Verify the presence of 5 volts (±0.5V).

The +5-volt supply appears across C22.

B❑ Measure the −5-volt supply with the DVM. Verify the presence of 5 volts (±0.5V).

The −5-volt supply appears across C23.

2) Null 6H.

A❑ Re-strap the jumpers on Card #2 as follows:

Jumper	Position
A	EXT
B	OUT
C	EXT
D	EXT
E	OUT
F	EXT

B❑ Plug in all circuit cards.

C❑ Connect a low-distortion audio oscillator to the LEFT EXTERNAL INPUT and RIGHT EXTERNAL INPUT of the 8185A in parallel and in-phase.

D❑ Set the oscillator for 5kHz ±500Hz and +10dBu (2.45Vrms) ±5%.

E❑ Place the TEST switch in the SEPARATION position.

F❑ Connect the spectrum analyzer to the 8185A's COMPOSITE OUTPUT. Adjust its span to 100kHz linear. Adjust its vertical scale to 10dB/division. Adjust its sensitivity so that the 5kHz spur is 6dB below the top of the screen.

The top of the screen now corresponds to 100% stereo modulation (±50kHz deviation).

G❑ Adjust trimmer R18 (6H NULL) for minimum 6H component. 6H is 6 times the horizontal line rate or 94,404Hz. The 6H component will typically be >70dB below the top of the screen.

3) Null Subchannel-to-Main Channel crosstalk.

A❑ Place the TEST switch in the SUB-TO-MAIN XTALK position.

B❑ The 5kHz component you see on the spectrum analyzer is sub- to-main cross-talk. Adjust trimmer R12 (SUB:MAIN XTALK) to null the 5kHz as much as possible (typically >-75dB)

Setting the spectrum analyzer to 5kHz per division will make the crosstalk easier to see.

4) Measure 2H null.

A❑ Mute the oscillator.

B❑ Place the TEST switch in the OPERATE position.

C❑ Verify that the 2H component is >−70dB.

(2H refers to twice the horizontal line rate, or 31,468Hz).

5) Test pilot tone.

A❑ Be sure that the oscillator is still muted.

B❑ Turn the PILOT ON/OFF switch ON, and verify that the unit is in STEREO.

C❑ Verify that the pilot component is 14dB below the top of the screen.

D❑ Monitor the composite output with the frequency meter and verify that the pilot frequency is 15,734Hz (±0Hz).

E❑ Monitor the composite output with the THD analyzer and verify that the THD of the pilot is below 0.25%.

6) Verify DC offset null.

A❑ Connect the COMPOSITE OUTPUT to a DC voltmeter.

B❑ Place the TEST switch in the MAIN-TO-SUB XTALK position.

C❑ Verify that the observed DC output voltage is 0.00V (±5mV.).

7) Calibrate high frequency separation.

A❑ Place the TEST switch in the SEPARATION position.

B❑ Turn the PILOT ON/OFF switch OFF.

C❑ Set the oscillator frequency to 14kHz (±150Hz) at 2.45Vrms (±0.1V).

D❑ Observe the COMPOSITE OUTPUT with the scope. Trigger the scope externally from the oscillator. Set the scope sensitivity to 0.5V/div, and input coupling to "DC". Set the horizontal timebase to 0.2ms/div.

E❑ Adjust R42 (8185A OUTPUT LEVEL control) until the composite output is 4V p-p.

F❑ Adjust R35 on Card #7 (HIGH FREQUENCY SEPARATION/TILT) and R14 (SEPARATION) to obtain the flattest baseline possible. Verify that these controls are approximately centered with a flat baseline. To make the final adjustment accurately, expand the vertical scale by a factor of ten and re-adjust R14 if necessary.

Variation from horizontal will typically be undetectable by eye. It must be less than 1/2 of a minor division on the scope graticule.

8) Check low-frequency separation.

A❑ Adjust the oscillator to 400Hz.

B❑ Verify that the baseline is still flat.

9) Check composite meter.

A❑ Adjust the oscillator for 1kHz at 1.767 volts.

B❑ Switch the 8185A to STEREO with the front-panel switch.

C❑ If it is not already, turn the PILOT switch ON.

D❑ Switch the METER FUNCTION switch to COMPOSITE LEVEL and the TEST switch to SEPARATION. Verify that the meter reads "40%" (±5%).

Calibrate Card #8

CAUTION

It is very unlikely that this procedure will be required because the circuitry is very stable. The procedure calibrates the amplitude of the Bessel Null tone. If this calibration is incorrect, it is impossible to achieve optimum system separation. Do not perform this procedure unless you have access to an AC voltmeter that is known to be accurate ±0.05% at 7.5kHz. This implies a $4^1/_2$-digit digital voltmeter recently calibrated at a reputable calibration laboratory.

1) Apply composite video or sync to the SYNC input on the 8185A's rear panel. Set the TERMINATION switch IN.

2) Extend Card #8. Plug in all other cards.

3) Apply power, and switch the 8185A to STEREO. Verify that the STEREO lamp is lit.

4) If there is a signal source connected to the 8185A's LEFT EXTERNAL INPUT or RIGHT EXTERNAL INPUT, disconnect it.

5) Switch the BESSEL NULL CAL switch to TONE.

6) Connect an AC voltmeter between TP2 and TP1 (ground).

   The AC voltmeter must have a verified accuracy of ±0.05% at 7.5kHz.

7) Adjust R48 on Card #8 (MOD CAL) until the meter reads 1.338Vrms ±0.1%.

8) Measure the harmonic distortion of the tone at TP2, and verify that it is less than 0.03%.

Calibrate Meter Card

1) Turn off power, and adjust the VU meter's mechanical zero control (the screw on the bezel below the meter face) so that the meter reads "0%".

2) Turn on power.

3) Using a recently-calibrated DVM accurate ±0.1%, measure the 8185A's +15-volt power supply. If the supply is not providing +15.00VDC ±0.1%, adjust R106 on Card #PS (mounted on the rear panel) to make it so.

   +15-volts can be measured from pin B (+15) to pin C (ground) at any circuit card's edge connector.

4) Set the METER GAIN switch to NORM.

5) Set the METER SELECTOR switch to "+15".

6) Adjust R24 (METER CAL) on the meter card so that the meter reads "100%".

   The meter card is located on the back of the hinge-down front panel. When you make the adjustment, keep the panel as vertical as possible so that the abnormal angle will not affect the meter's accuracy.

This concludes the Field Alignment.

APPENDIX: Evaluating BTSC Stereo Generators and Audio Processors: Some Suggestions

Stereo Generator

1) Evaluating Separation

The noise reduction system used in BTSC stereo compresses the dynamic range and high frequency content of the stereo difference signal (L–R) prior to its encoding in the stereo subchannel. This means that low-amplitude program material is increased in level by the compressor, and therefore the average modulation of the subchannel always remains high. At the receiver, an expander selectively reduces the level of the compressed program material to (ideally) restore the original program dynamics. Simultaneously, the expander reduces noise introduced during transmission.

There is one vital concept to remember when evaluating separation in BTSC: *BTSC stereo is a non-linear system.* The presence of the noise reduction compressor in the stereo generator and the expander in the receiver, both non-linear (although ideally complementary), makes this so.

The total system created by connecting the compressor and expander back-to-back appears to be linear if the compressor and expander have ideal performance (are completely complementary). However, as we shall see below, the intrinsic non-linearity of the compressor or expander can exaggerate imperfections in the signal path connecting the compressor output to the expander input.

Testing For Linearity:

You can test a system for linearity as follows.

1) Apply an input signal *a* to the system and measure its output. Let *x* be the output signal caused by input *a*.

2) Remove *a* from the input and apply another signal *b*. Let *y* be the output signal caused by the input *b*.

The system is linear if the following things happen:

3) If you multiply the input waveform by a factor *k* to scale it, the output waveform also becomes multiplied by a factor of *k*, but its shape is not distorted by this scaling process.

4) If you apply inputs *a* and *b* to the system simultaneously, the system's output is $x+y$ — nothing more or less. (This is called *superposition.*)

It is clear that the compressor, *when considered by itself,* is non-linear. The output is not scaled proportionally to the input; it is compressed. Similarly, when two signals are applied to the compressor, the output is not the same as the sum of the compressor's response to either signal individually — superposition does not hold. The expander is similarly non-linear.

Sinewave Measurements and Linearity:

When you predict a system's response to program material by measuring its response to individual sinewaves, you are making some assumptions. The first assumption is that you can adequately represent program material as a sum of sinewaves (Fourier analysis). The second assumption is that superposition holds, so that the response of the system to single sinewaves also applies when several sinewaves are summed together at the system's input. That way, you can extrapolate the sinewave results to program material.

Now we come to the payoff: *In the BTSC system, swept sinewave separation measurements do not accurately predict separation with broadband program material because superposition and scaling do not hold in the noise reduction compressor and expander.*

Sinewave vs. Broadband Separation Measurements:

Physically, the explanation is straightforward. A sinewave concentrates all the program energy at just one discrete frequency. When the system is measured with sinewave, any slight frequency response errors in the transmission channel cause the compressor and expander level detector to see different levels. Their action is no longer complementary. Thus, sinewave measurements can exaggerate channel frequency response errors by 2–3x (depending on frequency).

Errors in the level detectors themselves can make the measurements even worse. Yet these same frequency response and level detector errors are likely to "average-out" with broadband program material, because the average power seen by the level detectors is unlikely to be significantly affected by localized frequency response errors in the channel or the detectors themselves.

Upon de-matrixing into L and R, the errors introduced into the companded L–R signal translate into apparent loss of separation with swept sinewave. However, the separation may be very different (and usually better) with broadband, real-life program material.

If swept sinewaves represented a "worst-case" condition, we could probably forgive their exaggerating system errors unrealistically. However, there are important system errors to which swept sinewaves are completely insensitive! Because a sinewave has a constant envelope, it can't exercise the dynamic response of the RMS detectors in the compressor and expander. Yet our research has shown that dynamic mistracking between the compressor and expander time constants is the primary source of separation loss with broadband program material in BTSC stereo. *Sinewave tests are completely insensitive to this loss.*

Orban optimizes each Model 8185A Stereo Generator for best separation with pink noise, not swept sinewaves. In fact, we have found that the adjustments that optimize the system with pink noise are often substantially different than those that optimize it with sinewave. Further, we have shown by extensive experimentation that optimizing system separation with pink noise also optimizes it for actual speech or music material.

To reiterate the point: if you measure BTSC separation with swept sinewave, you will be measuring how well the system is able to keep a single sinewave out of the undesired audio channel, *nothing more*. You will *not* be measuring how well it keeps speech or music out of the undesired audio channel.

Decoder Accuracy — the "Separation Floor" in Measurement:

A measuring instrument must have about 10x less residual error than the system being measured to achieve accurate results. It is very difficult to create a BTSC *decoder* (containing the noise reduction expander) whose intrinsic separation, assuming an ideal input signal, exceeds 40dB. This means that it is very difficult to measure BTSC system separation greater than about 35dB even approximately. Measured results may be worse or better, depending on whether the decoder errors add to, or complement, the errors in the encoder being measured.

Fortunately, we can accurately measure the swept sinewave "separation floor" in a given BTSC decoder by using the RE Instruments Model 540 BTSC Test Generator. This instrument digitally synthesizes a BTSC-encoded sinewave signal with intrinsic separation of 60dB or better. It can thus measure a decoder to 40dB of separation with high confidence, and to 50dB of separation with moderate confidence.

Every Orban Stereo Generator includes a full monitor decoder, including noise reduction expander. We measure the performance of every decoder with the Model 540 at the Orban factory, and include a computer printout of the results with each Orban generator. Knowing the "separation floor" of the built-in decoder, you can readily judge whether your overall separation measurements accurately characterize the encoder, or if they are "in the noise". If you measure the separation of the Orban Stereo Generator with any other decoder, be sure that its separation floor is fully characterized. Otherwise, you don't know what you are measuring.

> Please note that the Model 540 test set has several limitations: 1) Any residual phase or amplitude errors in its output will be exaggerated 2–3x by the expander, because of the intrinsic expander non-linearity, 2) because it only provides sinewave outputs, the Model 540 does not exercise the time constants in the RMS detectors of the expander and thus does not detect dynamic mistracking, and 3) the Model 540 does not synthesize the slight low-frequency distortion that is inherent in the official FCC description of the compressor in document OET-60A. The expander creates complementary distortion to cancel much of the compressor distortion. Because the Model 540 output is undistorted at low frequencies, this cancellation does not occur, and the distortion appearing at the expander output is unrealistically high at low frequencies.

Instrumentation to Measure Dynamic Separation:

Orban uses a dual-channel FFT analyzer (HP 3562A) to measure dynamic separation. For example, to measure left-into-right separation, we connect pink noise (or program material) to the left input of the stereo generator while grounding its right input. We adjust the output level of the pink noise generator to produce about 30% peak baseband modulation, because we feel this is a reasonable representation of the average modulation produced by processed program material in television. Of course, you can use any modulation level you desire: measuring dynamic separation at several modulation levels tells you how well the separation holds up as program dynamics vary.

The left channel output of an accurate BTSC decoder is connected to CHANNEL A input of the FFT analyzer; the right channel output of the decoder is connected to CHANNEL B input of the FFT analyzer.

The analyzer is set to measure the "transfer function" between its A and B inputs. Conceptually, this is the ratio between the B and A inputs (B÷A) as a function of frequency. So that all octaves contribute equally, it is displayed on a logarithmic frequency axis. (If a linear frequency scale is used, the highest frequency octave will occupy about half the screen, and it will be very difficult to see the separation in the midrange frequencies that are most crucial to the stereo effect, because these will be bunched-up to the left of the screen.) Averaged 10 times or so, the magnitude of this "log-frequency transfer function" measurement provides a well-smoothed separation vs. frequency curve.

Dual-channel FFT analyzers are still fairly exotic beasts (although a serious evaluation of BTSC separation may justify renting one for a day or two). A useful alternative measurement technique uses a 1/3-octave "real-time" analyzer.

Use a pink noise generator to drive the left channel of the stereo generator. To obtain a "0dB" reference on the analyzer, first observe the left channel output of the BTSC decoder with the 1/3-octave analyzer. Adjust the analyzer's input attenuator so that the various bands of the analyzer read "0dB". Because the readings will bounce around a bit, you will have to "eyeball" this. (The frequency response should be essentially flat to 15kHz.) Then measure the right channel output with the 1/3-octave analyzer. The analyzer will directly indicate separation vs. frequency on the desired log frequency scale.

Another potentially useful instrument for separation measurement is a spectrum analyzer with a 20–20kHz logarithmic sweep (the Tek 5L4N comes to mind). Again, use a pink noise generator to drive the left channel of the stereo generator. To obtain a "0dB" reference, first observe the left channel output of the BTSC decoder with the spectrum analyzer. The trace should be essentially flat, although a bit jagged, provided you are using a logarithmic frequency sweep. Then measure the right channel output with the spectrum analyzer. Make a separation vs. frequency measurement by measuring the distance (in dB) between the "0dB" reference and the right channel measurement.

(Aside: although we have seen the Tek 7L5 used for BTSC separation measurements more often than we would like, this instrument does not have log sweep, and therefore cannot make psychoacoustically meaningful separation measurements.)

5) Other Stereo Generator Measurements

Other measurements are less tricky. Noise, harmonic distortion, IM distortion, and frequency response can be measured in the conventional way, with due attention to possible ground loops between bench instruments and other well-understood measurement problems.

To most accurately evaluate the performance of the Orban 8185A Stereo Generator, measure it through its own monitor outputs. This technique prevents inaccuracies in the external BTSC decoder from affecting your results. Although this technique does not include Orban's stereo baseband encoder in the measurement loop, you can verify on a spectrum analyzer that the noise and distortion floor of Orban's Hadamard

Transform Stereo Encoder™ is substantially below that of the audio encoding which precedes it. Use the main-to-sub and sub-to-main crosstalk test modes in the 8185A. These respectively drive the main channel and subchannel inputs of the 8185A's baseband encoder with the L+R audio signal, eliminating and noise or distortion that might otherwise be introduced by the noise reduction encoder in the L–R channel.

Please note that the frequency response of an external BTSC decoder may begin to roll off at a lower frequency than the 8185A itself. So you may have to measure the 8185A's frequency response through its monitor output terminals to verify our ±0.5dB to 15kHz frequency response spec.

Audio Processor and Subjective Tests

Proof of Performance:

Subjective tests are tricky. Small differences in level and in setup can give misleading results in A/B comparisons between different audio processors, or between the processed audio and the source. It is therefore wise to make objective proof-of-performance tests of the entire test bed *before any subjective testing is done.* At least sweep the system for frequency response and gain (processor in proof mode), and spot-check THD at a few frequencies. This should be a full-system source-to-loudspeaker-input-terminals check. Don't risk invalid subjective results because of measurable problems in the test bed!

Be Realistic About Typical Viewing and Listening Conditions:

Orban's Optimod-TV® audio processing is optimized for real-world conditions. This means sound which, above all, must be intelligible on sets with under-powered amplifiers and tiny speakers, located in environments with substantial acoustic noise levels. Viewers almost never complain about compression. They do complain if they can't understand the dialog, or if excessive dynamic range causes the sound to blast at one moment, yet be reduced to inaudibility at the next.

Optimod-TV is artfully designed to produce a *highly consistent, comfortably listenable sound* from source to source. This aspect of the processing cannot be assessed with an A/B test: it can only be appreciated by listening to the processed audio for long periods of time, over transitions between various types and quality of program material — music and voice, entertainment, news, and commercials. It is easy to design a processor that sounds great on only one kind of program material. The difficult task is to design one that sounds very good on everything.

Don't get us wrong — Optimod-TV processing is very smooth and subtle, and sounds excellent on high-quality monitors. But the proof of the pudding is not how the processed audio sounds on high-quality studio monitors, or even on Auratones. It is how well the sound holds up on a 15" portable mono TV set (a majority of consumer sets are still mono), volume adjusted for 70–75dBA, with acoustic background noise at the 55–60dBA level. If you can't provide the viewer with intelligible sound in this situation, then you have irritated a substantial portion of your real-world audience. We feel that Optimod-TV is uniquely effective at processing sound to work under these adverse conditions, without introducing artifacts that would be objectionable to viewers with higher-quality sound systems.

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.

Troubleshooting Technique

This section is the first place you should go to obtain information on what to do if the 8185A Stereo Generator develops a fault. Many problems experienced in the field can be resolved or conclusively diagnosed with the following diagnostic routines. Even if the repair cannot be done in the field, the information provided by these diagnostic routines can speed the work of the factory service department in making the repair.

Please perform these routines and make notes if you observe anything exceptional or unusual.

- See "Getting Inside the Chassis" on page 4-4 for instructions on opening up the unit, removing the subpanel, and getting to the less accessible parts of the interior. See the assembly drawings in **Section 6** for locations of components and test points.

IMPORTANT

Always turn off AC power to the 8185A before removing or installing circuit cards. Allow the 8185A to stabilize for two minutes after turning the power back on.

1) Use systematic troubleshooting techniques to positively determine that the problem is in fact being caused by the 8185A and not by other equipment.

A❑ Check the controls and connections.

Could the problem have been caused by someone changing the control settings? Are the controls in their normal operating positions? Have phone lines, patch bays, or other audio components of your chain, STL, or transmitter/antenna system been recently maintained or modified?

B❑ Check the audio signal going into the 8185A.

If a standby stereo generator is available, it should be substituted for the supposedly faulty unit to see if the problem vanishes. If a standby generator is *not* available, audio quality at the 8185A audio input terminals should be checked with a high-quality monitor system.

If the 8185A is being used with the Orban 8182 Optimod-TV, the "audio input terminals" are the audio input to the 8182A audio processor, because the processor and generator are tightly coupled. (If the input is driven by a processor other than the 8182A and this processor has a pre-emphasized output, be sure to apply de-emphasis to the processor's output signal when listening to it.)

Note that even slight distortion can be seriously exaggerated by "heavy" audio processing prior to the 8185A, and that this sort of processing can only be successful if the input audio is extremely clean. A relatively minor problem which develops in the station's audio chain or STL can therefore be magnified by the action of audio processor, even if the processor or stereo generator are in no way defective.

C❑ Check the audio signal coming out of the 8185A.

If the audio is clean going into the 8185A, problems can still arise in the aural exciter. If a standby exciter is available, it should be substituted to see if the problem vanishes. If no standby exciter is available, you can connect the baseband output of the 8185A directly into the baseband input of a BTSC stereo *monitor* to see if the problem can still be heard at the aural output of the monitor. If the problem vanishes, then the exciter (or phase-linear STL, if used) is strongly suspect.

If the problem can be heard at the aural output of the BTSC monitor, but not at the 8185A's rear-panel MONITOR OUTPUT terminals, then the 8185A's internal stereo baseband generator (Card #7) is probably faulty. However, before making a final determination, check to see that the 8185A is receiving a clean sync reference and that the BTSC *monitor* is working correctly.

D❑ Check grounding.

Changes in or deterioration of grounding and/or exterior lead dress can sometimes cause RFI or hum problems to appear in a correctly-operating 8185A. If the system has a tendency to buzz or hum, we recommend installing the Orban ACC-025 Composite Isolation Transformer ahead of the exciter. This transformer will usually cure even the most stubborn cases of ground-loop hum or buzz.

If it seems impossible to conclusively isolate the problem to the 8185A, yet no other definite cause is found, then performing the Field Audit-Of-Performance procedure in **Section 4** may help diagnose a problem.

If the fault has been positively isolated to the 8185A, the Problem Localization Routine described below should be performed to identify the faulty PC card.

2) About the Diagnostic "VU" Meter.

The VU meter on the front panel is electronically conditioned to be peak-, not average-reading. Although it no longer meets ANSI VU meter standards and cannot, strictly speaking, be called a "VU meter", this is nevertheless what we shall informally call it in the procedures below.

The meter driver circuitry is located on the meter resistor card on the 8185A's swing-down front panel. This circuitry is reasonably complex, and, like any electronic circuitry, is subject to failure. **Because the test techniques described below rely heavily on the meter, it is important to know that the meter is operating correctly.**

A❑ For the purposes of these tests, if the meter reads "100%" ±5% when switched to the +15V and −15V positions, then you can assume that the meter is operating correctly.

> If it does not read as expected, either the meter driving circuitry, the meter itself, or the power supply is faulty. If the +15 and −15V supplies read normally on an external voltmeter, yet the meter reads abnormally, you should diagnose and repair the meter before proceeding further with the diagnostic tests.
>
> The +15V supply can be measured from pin B to pin C of any circuit card; the −15V supply from pin E to pin C.

3) Power Supply Tests.

A❑ Gross changes in power supply voltage can be detected with the "+15VDC" and "−15VDC" positions on the VU meter. Normal readings are 0VU ±0.5VU.

> If normal readings are obtained, skip to the next section on VU Meter Techniques.
>
> If either "+" or "−" power supply output is significantly low, it could indicate a defect in the supply itself. But it is more likely to indicate a shorted IC or capacitor somewhere in the circuit that is overloading the supply and causing it to current-limit.

B❑ The power supply is electronically protected against excessive current demand by other parts of the circuitry. If a failure causes a high current demand on the power supply, its output voltage will drop as far as necessary to reduce output current to approximately 0.75A. If the power supply voltage is abnormally low, unplug each circuit card in turn and check if the power supply recovers by observing the "−15VDC" meter position.

(A normal "−15VDC" reading assures a normal "+15VDC" reading because the negative regulator tracks the +15V supply. So the −15V supply will go down if the +15V supply does, even if the −15V supply or load is completely normal.)

If recovery occurs, then troubleshoot the unplugged board. Ordinarily, the defective component will become very hot, and is easily detected by touch. (Wet your finger first to avoid burns!)

If all cards are removed and an undervoltage problem does not disappear, examine the meter card, motherboard, and chassis wiring before suspecting the supply itself. (A wiring problem will be indicated by an ohmmeter's indicating very low resistance between the "+15V" or "−15V" power busses with AC power OFF.)

c❑ Even if power supply voltages appear normal on the VU meter, the supply may still have subtle problems such as hum, noise, or oscillation. To check for this, test the regulated DC with a well-calibrated DVM, scope, and AC VTVM with 20-20kHz bandpass filter. Voltages should be +15.00V ±0.075V, −15.00V ±0.15V. Ripple must be less than 2mV r.m.s., 20-20,000Hz. There must be no high frequency oscillation.

The +15V supply can be measured from pin B to pin C of any circuit card; the −15V supply from pin E to pin C.

D❑ The +5V supply (on Card #7) is used as a reference to determine the pilot tone level in the Stereo Baseband Generator. If the +5V supply drifts, it will cause proportional drift in the pilot tone level. See step 1 on page 4-39 for a test procedure for the +5V supply.

4) Signal Tracing With the Diagnostic VU Meter.

General Principles:

The most powerful and general technique for localizing a problem within OPTIMOD-TV is *signal tracing*. This simply means that the signal is observed at various points as it passes from OPTIMOD-TV's input to its output. If the signal is normal at some point "A" in the circuit, and is abnormal at a point "B" further towards the output, then the problem clearly lies in circuitry between points "A" and "B".

Signal tracing in OPTIMOD-TV is facilitated by the fact that much of the circuitry is duplicated for stereo, either in discrete Left and Right form (L/R) or in Sum-and-Difference form (L+R/L−R). Often, the bad channel can be readily compared with the good one, which serves as a "normal" reference.

To create equal signals in the Left and Right channels, drive the 8185A (or 8182A Audio Processor, if used) LEFT INPUT and RIGHT INPUT with identical source material.

To create equal signals in the L+R and L−R channels, drive only the LEFT INPUT, short out the RIGHT INPUT, and operate the 8185A in 75µs equivalent mode (N/R ENCODER switch OUT).

The VU meter provides a fast way of tracing the signal through the circuitry and can indicate the location of gross faults like loss of signal or opamp latchup. The following instructions apply to a system consisting of the Orban 8185A and the

Orban 8182A Optimod-TV audio processor, as interconnected through a rear-panel cable according to the setup instructions in **Section 2** of this manual. [Instructions in brackets apply to an 8185A used with an **external audio processor** connected to the 8185A's left input and right input.]

A❑ If the signal is **normal at the 8182A's** L or R COMPR OUT **positions** [is normal at the left or right output of the external audio processor] but **abnormal at the 8185A's** L or R INPUT FILTER **positions**, then the fault is probably in the faulty channel's Phase Corrector for the Six-Pole Filters on Card #2, or in the Six-Pole Filters on Card #3. (The stereo/mono switching logic on Card #7 could also be faulty.)

B❑ If the signal is **normal at the 8182A's** R SYSTEM OUT position [is normal at the 8185A's L INPUT FILTER and R INPUT FILTER **positions**], but **abnormal at the 8185A's** N/R IN position, then the problem is probably in Card #4 (Noise Reduction Encoder) in the 8185A.

C❑ If the signal is **normal at the 8182A's** L SYSTEM OUT position [is normal at the 8185A's L INPUT FILTER and R INPUT FILTER **positions**], but **abnormal at the 8185A's** L+R position, then the fault is probably in Card #5 (11-Pole Filters) of the 8185A. (The stereo/mono switching logic on Card #7 could also be faulty.)

D❑ If the signal is normal at the 8185A's N/R IN position but abnormal at the 8185A's L-R position, then the fault is probably in Card #4 (N/R Encoder) or Card #5 (11-Pole Filter). To determine which, set the N/R ENCODER IN/OUT switch to OUT. **If the problem vanishes,** Card #4 is faulty. **Otherwise,** Card #5 is faulty (unless a logic problem exists).

E❑ If the signal is **normal at the 8185A's** L+R and L-R **positions**, but **abnormal at the 8185A's** L MONITOR OUT **or** R MONITOR OUT **positions,** then Card #6 (Monitor) is probably faulty. (Note that little separation will be observed if the N/R ENCODER and N/R DECODER switches are not both in or out.)

F❑ If the signal is **normal at the** L+R **and** L-R **positions, but abnormal at the** COMPOSITE LEVEL position, then Card #7 (Stereo Baseband Generator) is probably faulty.

5) Card Swap Technique.

The instructions below provide more detailed information on troubleshooting at the "card exchange" level. Servicing at the "component replacement level" requires a more profound understanding of 8185A circuit operation. This is provided in **Section 6** of this manual. The block diagram on page 6-57 will clarify the techniques described below.

Unlike the 8182A Audio Processor, there are no card-swap techniques available per-se in the 8185A. However, Cards #3 (6-Pole Filter) and #5 (11-Pole Filter) have jumpers which enable their outputs to be individually reversed. This permits diagnosis by observing how the symptom moves. *Note that the system will not operate correctly with either card in the "output-reversed" state.*

The following instructions apply to a system consisting of the Orban 8185A and the **Orban 8182A Optimod-TV audio processor,** as interconnected through a rear-panel cable according to the setup instructions in **Section 2** of this manual. [Instructions in brackets apply to an 8185A used with an **external audio processor** connected to the 8185A's LEFT INPUT and RIGHT INPUT.]

A❑ If the problem **does not move** from one stereo channel to the other when Cards #3 and #4 in the 8182A are swapped [the left and right outputs of the external audio processor are swapped], but **does move** when Jumper "A" on Card #3 of the 8185A is placed in the reverse position, then Card #2 (Phase Corrector for Six-Pole Filters only) or Card #3 in the 8185A is probably faulty (Card #3 is most suspect).

> To perform a further test, note that the MONO L and MONO R modes bypass the opposite-channel 6-Pole Filter. If the problem vanishes when MONO L or MONO R is entered but does not vanish when Card #3 and #4 in the 8182A are swapped, then Card #2 or Card #3 in the 8185A is probably faulty (Card #3 is most suspect).

B❑ If the signal seems **normal emerging from the 8182A's line amplifiers** [normal at the output of the 8185A's Card #3], and if placing Jumper "A" on Card #5 of the 8185A in the reverse position causes the problem to **move from the sum to the difference channel (or vice-versa),** then either Card #4 (Noise Reduction Encoder), Card #5 (11-Pole Filter), or the Matrix on Card #2 of the 8185A is faulty. (Card #4 can only introduce faults into the difference channel, provided that Jumper "A" on Card #5 is in the NORMAL position.)

C❑ If the problem appears **equally in the sum and difference channels** and **does not move when jumper "A" on Card #5 is moved,** then the problem is probably with one of the Phase Correctors for the 11-Pole Filters on Card #2.

D❑ If the problem vanishes when the N/R ENCODER switch is set out, then the problem is in Card #4. Otherwise, the problem is probably in Card #5 or in the logic on Card #7.

E❑ Although quite unlikely, a problem with the **L+R signal only** could be due to the bessel null cal switch on Card #8, since the L+R signal is looped through this switch before it enters Card #5.

Problems and Possible Causes

This troubleshooting guide is a catalog of some possible failure modes in the 8185A. If you are using the Orban 8182A Audio Processor, it should be used in conjunction with the identically-titled section in your 8182A Operating Manual.

[Instructions in brackets apply to an 8185A used with an **external audio processor** connected to the 8185A's left input and right input.]

Poor separation

1) Separation is OK as observed at the 8185A's MONITOR OUTPUT TERMINALS. Possible trouble spots are:

A❑ Misadjustment of separation control on Stereo Baseband Generator. See **Stereo Baseband Generator Tests** in **Section 4** of this manual for instructions on how to verify Stereo Baseband Generator performance using an oscilloscope and audio generator.

B❑ If separation tests are good at the 8185A's composite output, but not at the output of your Wideband Demodulator (you must verify that its performance is adequate for MTS), then check the performance of the transmitter plant. Exciter frequency response must be 30-46,000Hz ±0.05dB. Deviation from linear phase over that frequency range must be less than 0.5°. Diplexer bandwidth must exceed 400kHz at the −3dB points. Group delay should be symmetrical about the aural carrier frequency; preferably constant. RF amplifiers must be correctly tuned and must have at least 1 MHz bandwidth.

C❑ If "equivalent stereo separation" is good through the system when the 8185A's N/R encoder and your stereo monitor's N/R decoder are defeated, yet separation is poor when N/R is enabled, suspect an error in setting the 8185A's composite output atten control to achieve correct modulation gain. Check the adjustment in **Section 2** of this manual called **Match 8185A Stereo Generator to Exciter (Bessel Null)** on page 2-18. If you took the emergency, short-cut approach using your mono modulation monitor, do the adjustment again using the preferred Bessel Null technique.

2) Separation is inadequate as observed at 8185A's MONITOR output terminals.

A❑ The N/R switches on the 8185A are set so that one is IN and the other is OUT.

B❑ N/R encoder or decoder has failed. See if separation is restored by switching both N/R switches out. (This will put the system in "75µs equivalent" mode.)

C❑ Sum-and-difference 11-Pole-Filters are mismatched due to failure or drift. Separation will be poor at high frequencies, regardless of whether N/R is in use. See **Section 4** in this manual for alignment instructions.

D❑ R80 (LOW FREQUENCY GAIN TRIM) on Card #5 is misaligned. (Highly unlikely unless it has been casually tweaked in the field.) If so, separation will be poor at all frequencies.

E❑ Matrix (on Card #2) has failed.

Excessive Main-to-Subchannel or Sub-to-Main Channel Crosstalk

1) The 6-Pole Filter or 11-Pole Filter Left and Right Phase Correctors on Card #2 (8185A) have become unmatched. This can cause a large relative phase shift between the left and right channels without necessarily changing the frequency response of the defective channel.

2) R12 or Q1 on Card #7 (8185A) may be defective.

Excessive Hum or Buzz

1) Ground loop in the transmitter plant. This can be a particular problem if the exciter input is unbalanced. Installation of the Orban ACC-025 Composite Isolation Transformer ahead of the exciter's composite input will usually cure even the most stubborn ground loops.

2) Excessive Incidental Carrier Phase Modulation (ICPM) in the aural transmitter. ICPM must be <5°, with <2°preferred.

Signal is distorted

1) 8182A's rear-panel STEREO GENERATOR IN/OUT switch (labeled N/R IN/OUT in some units) is set OUT. This switch must be IN when the 8185A is plugged into the 8182A.

2) IC opamp failure within one of the filters in the 8185A is causing distortion or severe offset without entirely preventing signal passage.

3) An 8182A PROOF/OPERATE switch has been accidentally left in PROOF.

4) In a dual-chassis installation, level match between the Studio Chassis and the Main Chassis is incorrect. See **Dual-Chassis Alignment in Section 4** of this manual.

5) If the signal is being monitored remotely, check for multipath distortion. Stereo is far more vulnerable to multipath than mono. Also note that some older sets with narrowband discriminators may exhibit distortion due to the higher deviation produced in stereo.

6) Distortion and/or clipping in STL.

7) Exciter is clipping due to inadequate deviation capability or misbiasing of varactor diode. Required deviation is ±55kHz (stereo only); ±73kHz (stereo+SAP+PRO).

8) Miscellaneous circuit failure within 8182A or 8185A. If signal is clean at the LINE OUTPUT terminals of the 8182A (they are pre-emphasized, and in left and right form), but distorted at the 8185A's MONITOR OUTPUT, then the problem is within the audio circuitry of the 8185A. If the signal is clean at the 8185A's MONITOR OUTPUT but distorted at the output of a stereo demodulator connected directly to the 8185A's BASEBAND OUTPUT, then the 8185A's Card #7 (Stereo Baseband Generator) is probably faulty.

Lack of 31.468kHz subcarrier suppression

1) High relative DC offset between left and right channels prior to the Stereo Baseband Encoder that is beyond the range of DC servo IC21a to correct.

2) Failure of IC21a or IC21b DC servo circuits (on Card #7, 8185A).

3) Failure of analog switch IC7 (on Card #7, 8185A).

Separation unstable

(NOTE: All referenced components are on Card #7 of the 8185A.)

1) Drift or failure in Baseband Low-Pass Filter (L1, L2, C3-C9), or in Phase Corrector IC16.

2) R14 intermittent.

3) IC6 or IC16 defective.

4) See also **Poor Separation** above.

Interference to SAP from stereo

1) Exciter cannot linearly modulate to ±73kHz deviation.

2) Notch diplexer has narrower bandwidth than 400kHz (at −3dB points). Diplexer's group delay is non-constant and/or asymmetrical.

3) R18 (6H SIDEBAND NULL) on Card #7 (Stereo Baseband Generator) in 8185A is misadjusted, causing the Baseband Generator to produce excessive spurs at 6H.

4) Power supply oscillation.

Interference to PRO from SAP

1) Unfortunately, this is normal, and is a result of how baseband frequencies are allocated in the BTSC system. The PRO subcarrier is only 23.6kHz removed from the SAP, and is therefore subject to interference from normal second- and third-order Bessel sidebands produced by the SAP. Because the modulation level of the SAP tends to be held constant by dbx compression, changing the drive level to the SAP will not affect SAP modulation enough to make a significant difference in interference to PRO. Limiting SAP bandwidth to less than 10kHz can help; however, this will cause significant loss of audio quality in the SAP.

SYNC LOCK unachievable, or lamp flickers

1) Sync or composite video is probably at wrong level. It must be within a 0.6V to 1.6V p-p window. Most likely cause is incorrect 75 ohm line termination (i.e., line is either unterminated or double-terminated.)

2) Faulty sync stripper and/or phase-lock-loop circuitry on Card #8 of 8185A.

Components: Fault Diagnosis, Replacement

If you want to troubleshoot on the component level instead of returning the unit to the factory for service, read the circuit description in **Section 6** before continuing. Servicing on the component level requires a deeper understanding of 8185A circuitry.

Here are some suggestions for component-level 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 ICs used without feedback (as comparators) and ICs with outputs that have been saturated due to excessive input voltage because of a defect in an earlier stage. However, if an IC'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 8185A's circuitry are essentially independent of IC opamp characteristics, an opamp can usually 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 sparing*, because it can cause resistive short circuits due to moisture condensation on cold surfaces.

Selecting Replacement Parts:

Before ordering parts, read the introduction to the parts list on page 6-41. Nearly all parts used in the 8185A have been very carefully chosen to make best use of both major and subtle characteristics. For this reason, parts should always be replaced with *exact duplicates* if so indicated in the parts list. It is very risky to make "close-equivalent" substitutions because of the possibility of altering performance and/or compliance with regulatory requirements.

Certain parts are selected to tighter than normal specifications (most such parts are noted in the parts list — but it is almost always wiser to return the defective card to the factory for service). The replacement of certain parts requires partial recalibration of the 8185A, and this may or may not be practical in the field (such parts are also noted in the parts list). Some cards have potted modules which must be replaced as a unit (ordinarily, this requires return of the entire card to the factory).

To replace a component:

It is important to use correct technique when replacing components mounted on printed circuit cards. Failure to do so may result in circuit damage and/or intermittent problems. Because solder flows well into the through-holes of the double-sided plated-through circuit boards used in the 8185A, a technique like the following is required.

1) Remove the old component.

It is sometimes easier to cut the offending components from its leads, then remove the leads as described below.

A☐ Clear each lead to be removed by melting the solder *on the solder side* (underneath) of the printed circuit card. When the solder melts, vacuum it away with a spring-actuated de-soldering tool (like the Edsyn Soldapullt®).

Use a **30-watt soldering iron** — do *not* use a soldering gun or a high-wattage iron! DO NOT OVERHEAT the card. Overheating will almost surely cause the conductive foil to separate from the card base.

B☐ Release the component by gently wiggling each of the leads to break solder webs, then lift the component out.

2) Install the new component.

A☐ Bend the leads of the replacement component so they will fit easily into the appropriate circuit card holes.

B☐ Solder each lead to the bottom side of the card.

Use a 30-watt soldering iron and a good brand of *rosin-core* solder. Make sure that the joint is smooth and shiny.

If no damage was done to the plated-through hole when the old component was removed, soldering of the top (component side) pad is not necessary. But if the removal procedure did not progress smoothly, it would be prudent to solder each lead on the component side of the hole to avoid potential problems.

C☐ Cut each lead of the replacement component close to the solder side of the circuit card with a pair of diagonal cutters.

D☐ Remove all residual flux with a swab moistened with solvent.

Suitable solvents include 99% isopropyl alcohol, 1,1,1-trichloroethane (sold as Energine® Fireproof Cleaning Fluid), and naphtha (sold as Energine® Regular Cleaning Fluid).

Make sure that the flux has actually been removed, and not just made less visible by smearing. While most rosin fluxes are not corrosive, they can slowly absorb moisture and become sufficiently conductive to degrade circuit performance.

Technical Support, Service

If the troubleshooting information in this manual doesn't help you solve your problem, contact Orban Customer Service. Be prepared to accurately describe the problem, including the results of diagnostic tests you have performed. Know the serial number (and "M" number, if any) of your 8185A — these are printed on a label attached to the rear panel of the 8185A.

Always contact Customer Service before returning a product to the factory for service. Often, a problem is due to misunderstanding, or is relatively simple and can be quickly fixed after telephone consultation. In any case, products will be accepted for factory service *only* after Customer Service has issued a Return Authorization number. This number flags the returned 8185A for priority treatment when it arrives on our dock, and ties it to the appropriate information file.

Telephone: (1) 510/351-3500

or Fax: (1) 510/351-1001

or Write: Customer Service
Orban
1525 Alvarado Street
San Leandro, CA 94577 USA

To ship a circuit card, use the special carton in which Orban shipped you the loaner card. Do not use a "jiffy bag" or similar padded mailer — it will not provide sufficient protection.

To ship the complete 8185A, use the original packing material if it is available. If it is not, use a sturdy, double-wall carton no smaller than 22 × 15 × 12 inches (56 × 38 × 30 cm) 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 wrap cushioning material around it. Do not pack the 8185A in crumpled newspaper — use bubble sheets, large foam beads, thick fiber blankets, or similar packing materials. Put at least 2 inches (5 cm) of cushioning on all sides of the 8185A, and tape the cushioning in place to prevent shifting during shipment. Close the carton without sealing it and shake it vigorously (if you can hear or feel the 8185A move, use more packing). Seal the carton with 3-inch (8cm) reinforced fiberglass or polyester sealing tape (narrow or paper tapes won't hold), top and bottom in an H pattern. Mark the package with the name of the shipper, and with these words in red:

DELICATE INSTRUMENT, FRAGILE!

Insure the package appropriately. 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.

The terms of the Orban Associates Limited One-Year Standard Warranty are detailed on a separate Warranty Certificate supplied with the 8185A. 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. The repaired 8185A will be returned C.O.D. In all cases, transportation charges (which are usually quite nominal) are paid by the customer.

Notes: