tellabs
technical manual
76-826920
rev C

practice section 826920

6920 Echo Suppressor

contents

1. general description

1.01 The 6920 Echo Suppressor (figure 1) is a voice-switched, split-type echo suppressor intended for use near the end points of 4wire transmission facilities characterized by appreciable propagation delay. Echos caused by signal reflections at impedance discontinuities and interface points, such as 4wire-to-2wire interface points, are suppressed during voice frequency transmission by the 6920.

1.02 As stated above, the 6920 is a split-type echo suppressor, i.e., one module is required at each end of the circuit. Each of the two modules protects the opposite end of the circuit from echo.

1.03 A signal in the receive channel causes the 6920 to insert suppression loss into the transmit portion of the 4wire voice facility, thus preventing echo from being transmitted back to its source (this is the suppression mode). When a transmit signal consisting of interrupting speech energy greater than or equal to the signal being received is detected at the transmit input port of the 6920, the break-in mode is activated and the suppression loss is removed. During the break-in mode, a 6dB loss is inserted into the receive path to provide nominal attenuation of echo signals and to bias the 6920's sensing circuitry by 6dB to ensure retention of the break-in mode for the duration of the interrupting speech.

1.04 To accommodate simultaneous bidirectional transmission of data signals, an optional Tone Disabler subassembly (Tellabs model 9904) that plugs into connectors on the 6920's printed circuit board is available. The 9904 overrides both the suppression and break-in functions of the 6920, rendering the 6920 transparent in both directions for data transmission.

1.05 Receive loss hangover time circuitry allows the 6920 to be used in both terrestrial and synchronous-orbit satellite circuits. Option switches provide for 150ms (terrestrial), 600ms (single-hop satellite), or 1200ms (double-hop satellite) receive loss hangover time (see paragraph 2.05).

1.06 The 6920 Echo Suppressor accommodates a variety of interface transmission levels. A three-position slide switch permits selection of primary interface levels of +7 receive and −16 transmit, +4 receive and −4 transmit, or 0 receive and 0 transmit. Two DIP switches permit variation of primary interface transmission levels by ±1 or ±2dB. All ports of the 6920 provide balanced 600 ohm terminating impedance.

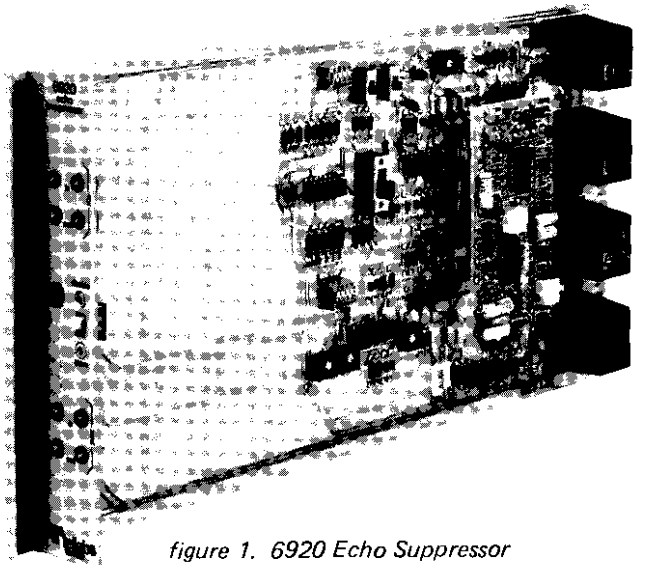


figure 1. 6920 Echo Suppressor

1.07 Break-in tracking is accurate (±1.0dB) from −27 to +5dBm0. The 6920 meets or exceeds all CCITT standards for performance in this and other performance parameters.

1.08 A front-panel light-emitting diode on the 6920 lights whenever the module is disabled. The front panel also contains a full set of transmission monitoring test points and a disable switch used in alignment and testing. (Early Issue 2 6920's have a diasable test point instead of a switch.)

1.09 An internal power regulation circuit provides the 6920 with regulated operating and reference potentials from −23 to −56Vdc input, ground referenced. Power for the 9904 Tone Disabler subassembly is also derived from this regulation circuitry. The 6920 requires 40mA of current, and the optional 9904 requires an additional 20mA.

1.10 The 6920 mounts in one position of a Tellabs Type 16 Mounting Shelf. Type 16 Shelves are available in versions for 19 inch and 23 inch relay rack installation. Both versions mount 12 modules and occupy 4 vertical mounting spaces (7 inches) in a standard relay rack.

2. application

2.01 Echo signals result from signal reflections at impedance discontinuities or from interpath coupling due to non-ideal terminations at 4wire-to-2wire interface points. Echo suppressors are typically required in 4wire circuits with a round-trip delay of

45ms or more. (In circuits with round-trip delay of less than 45ms, delay-dependent transmission loss is usually sufficient to minimize the effects of the echo.) Long terrestrial circuits may exhibit round-trip delays of 45 to 150ms, while delays of single-hop, synchronous-orbit satellite circuits are approximately 600ms and those of double-hop satellite circuits are approximately 1200ms. Because the 6920 can provide echo control in circuits with propagation delay of up to 1300 ms, it can be used in both terrestrial and satellite circuits.

2.02 In conventional applications, echo suppressors are located on the terminal-equipment side of SF signaling units, where they do not have to contend with transmission of SF tone. This is the case for the 6920. If, however, echo suppressors must be used in "end-link" applications (those in which echo suppressors are located within the signaling link, where SF signaling tone may be present in one or both directions), the Tellabs 6920B Transparent Echo Suppressor must be used instead of the 6920. The 6920B contains the necessary SF tone sensing, filtering, and regeneration circuitry to prevent interference with both signaling and suppression. Refer to the 6920B Practice for details.

2.03 As stated in section 1, the 6920 is a split-type echo suppressor, i.e., one 6920 module is required at each end of the circuit. In the usual arrangement, point A is protected from echo by the 6920 at distant point B, and point B is protected from echo by the 6920 at distant point A.

2.04 The 6920 will accommodate a minimum end-path (i.e., the path through the near-end hybrid) return loss of 6dB and a maximum end-path delay of 25ms.

2.05 While able to accommodate any application normally associated with echo suppressors within CCITT specifications, the 6920 is designed primarily for use on long-delay circuits such as those encountered in synchronous-orbit satellite applications. Receive-loss hangover timing circuitry in the 6920 provides a 600ms delay (after cessation of break-in speech) in the removal of the 6dB loss inserted in the receive path during break-in. This 600ms hangover time maintains loss in the echo path of a long terrestrial or satellite circuit as long as speech energy is present in the transmission path. To accommodate double-hop satellite applications, the receive loss hangover time may be extended to 1200ms by switch option. In addition, while the standard 600ms receive loss hangover time performs perfectly well on terrestrial circuits with 40 to 150ms round-trip delay, the 6920 may be switch-optioned (for terrestrial applications) for receive loss timing identical to break-in timing (approximately 150ms).

2.06 The 6920 Echo Suppressor (Issue 2 or later) provides for operation at conventional tranmission level points (TLP's) of +7 receive and −16 transmit or, via switch option, at interface levels of +4 receive and −4 transmit or 0 receive and 0 transmit.

2.07 Provision is also made in the 6920 for a ±1 or ±2dB variation (via switch option) of each of these primary interface levels in both transmit and receive channels. These adjustments to the primary transmission levels are independent, i.e., the primary TLP's selected may be varied by ±1 or ±2dB in either or both channels as needed. For example, when primary TLP's of +7 receive and −16 transmit are selected, these TLP's may be altered, in 1dB increments, to any TLP between +5 and +9 receive and −18 and −14 transmit. As a further example, when the primary TLP's are set for 0 receive and 0 transmit, the actual interface levels may be adjusted from −2 to +2 transmit and −2 to +2 receive.

2.08 The choice of three primary interface transmission levels, with a ±1 or ±2dB variation about each primary level, permits the 6920 to be used in essentially all transmission environments. Moreover, the ±1 or ±2dB variations can be used to "offset" the echo suppressor sensing circuits to accommodate unusual circuit conditions, such as 2wire end-section loops with abnormally high loss. Altering the transmit-channel primary interface level by −1 or −2dB will lower, by a like amount, the transmit-channel signal level required to acheive break-in. Similarly, altering the transmit primary interface level by +1 or +2dB will raise the transmit signal level required to achieve break-in by 1 or 2dB. In the receive channel, altering the primary interface level by −1 or −2dB will lower, by a like amount, the receive-channel signal level required to achieve suppression. Similarly, altering the receive primary interface level by +1 or +2dB will raise the receive signal level required to achieve suppression by 1 or 2dB.

2.09 Because simultaneous bidirectional transmission is necessary if data is to be transmitted over facilities equipped with echo suppressors, provision is made for optional addition of a 9904 Tone-Disabler subassembly to the 6920. The 9904, which plugs into connectors on the 6920's printed circuit board, renders the 6920 inactive (transparent to transmission in either direction) in response to a tone signal from a data modem or disabling tone source or to a ground signal that may be manually or automatically applied. Data is more tolerant of echo than is voice transmission, and the circuit will function normally without echo suppression in the data mode of operation. The 6920 automatically returns to the enabled state (suppression mode) when data transmission ceases in both directions on the facility.

2.10 The 6920 is physically designed to plug into one module position of a Tellabs Type 16 (or equivalent) Mounting Shelf. These Shelves are normally used in relay rack installations.

3. installation

inspection

3.01 Each 6920 module should be visually inspected upon arrival in order to find possible damage incurred during shipment. If damage is noted,

a claim should immediately be filed with the carrier. If stored, the module should be visually inspected again prior to installation.

mounting

3.02 The 6920 module mounts in one position of the Tellabs Type 16 Shelf, which is available in configurations for both 19 inch and 23 inch relay rack installation. The 6920 module makes electrical contact through a 56-pin connector at the rear of the Type 16 Shelf.

installer connections

3.03 Before making any connections to the Mounting Shelf, ensure that power is **off** and modules are **removed**. Modules should be put into place only **after** optioning and wiring are completed.

3.04 Table 1 lists connections to the 6920 Echo Suppressor when mounted in a Tellabs Type 16 (or equivalent) Shelf. All connections are made to wire-wrap pins on the 56-pin connector at the rear of the Shelf. Pin numbers are printed on the body of the connector.

connect:	to pin:
–V IN (–23 to –56Vdc input)	15
GND (input ground)	25
XMT IN (4wire transmit input from term set)	5 and 7
RCV OUT (4wire receive output toward term set)	49 and 51
XMT OUT (4wire transmit output to sf or carrier)	1 and 3
RCV IN (4wire receive input from sf or carrier)	53 and 55
EXT GND (external ground) DISABLE	47

table 1. External connections to 6920

options

3.05 Six option switches (four slide switches and two 4-position DIP switches) must be set before the 6920 is placed in service. Locations of these switches on the module are shown in figure 2.

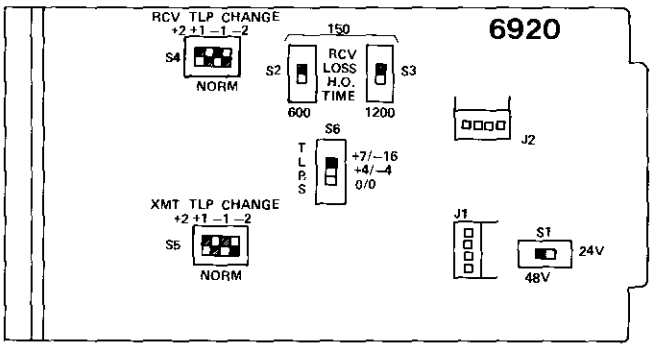


figure 2. switch locations

3.06 Input Power Selection. To minimize power dissipation in the 6920's integral voltage regulator, an option switch (*S1*) is provided to place a 220 ohm resistor in the power feed path when nominal –48Vdc powering is used. When the input powering voltage is between –40 and –56Vdc, set switch *S1* to the *48V* position, and for input potentials between –23 and –40Vdc, set switch *S1* to the *24V* position.

3.07 Primary Transmission Interface Levels. Option switch *S6*, a three-position slide switch, is used to select one of three sets of primary transmission interface levels. Set *S6* to the *+7/–16* position to accommodate conventional North American interface levels (TLP's) of +7 receive, –16 transmit. Set *S6* to the *+4/–4* position to accommodate interface levels of +4 receive, –4 transmit. Set *S6* to the *0/0* position to accommodate interface levels of 0 receive, 0 transmit.

3.08 Transmission Level Variation. Switches *S4* and *S5*, both four-position DIP switches, are used to vary the primary transmission interface levels by ±1 or ±2dB. Switch *S4* varies the receive-channel TLP; switch *S5* varies the transmit-channel TLP. With all four switch positions of both *S4* and *S5* set to the *off* (open) position, the 6920's transmission interface levels are the primary levels set via switch *S6* (i.e., there is **no** variation from the primary levels). Each position of *S4* and *S5*, when set to the *on* (closed) position, alters the primary TLP of the respective channel by a fixed amount. These amounts are listed in table 2 and screened on the 6920's printed circuit board as well. The primary TLP of each channel may be altered independently as required in a given application.

Note: *Be certain to set only one position of* S4 *and one position of* S5 *to* on *(closed) at a time. Because the positions of these DIP switches are not cumulative, setting two or more positions of one switch to* on *simultaneously will result in undefined TLP variations.*

Switch S4/S5 position	When set to "on" (closed), alters primary TLP by following amount:
1	+2dB
2	+1dB
3	–1dB
4	–2dB

table 2. Switch S4 and S5 settings to alter primary TLP's

3.09 Receive Loss Hangover Time. Switches *S2* and *S3* are used in combination to establish the receive loss hangover time. Settings of these switches are summarized in table 3.

Note: *Simultaneous setting of* S2 *to* 600 *and* S3 *to* 1200 *will produce an abnormally long hangover time. Only one of these switches at a time should be set to other than the* 150 *position to select 600 or 1200ms hangover time.*

desired receive loss hangover time	switch S2 setting	switch S3 setting
150ms	150	150
600ms	600	150
1200ms	150	1200

table 3. Switch S2 and S3 settings for receive loss hangover time

tone disabler option

3.10 If data transmissions are to be accommodated on the facility, the 6920 should be equipped with the optional 9904 Tone Disabler subassembly

to disable the 6920 while data signals are present. Affix the 9904 to the 6920 by mating the two four-pin plugs on the 9904 with the two receptacles on the 6920. Ensure that the 9904's plugs are firmly and completely seated in the receptacles so that the 9904 does not interfere with an adjacent module.

alignment

3.11 No alignment of the 6920 module is required. All necessary adjustments to the 6920 are preset during assembly and testing at Tellabs. However, the 6920 should be disabled (by applying a ground to pin 47 or setting the front-panel *DISABLE* switch to the *DISABLE* position) during the alignment of external circuitry to prevent inadvertent insertion of suppression or receive loss during the procedure.

4. circuit description

4.01 This circuit description is intended to familiarize you with the 6920 Echo Suppressor module for engineering and application purposes only. Attempts to troubleshoot the 6920 internally are not recommended. Please refer to the associated functional block diagram (section 5 of this Practice) as an aid in understanding this circuit description.

4.02 The 6920 is a split-type Echo Suppressor that senses speech energy in the transmit and receive channels to control insertion and removal of loss in the two channels. Suppression loss is inserted into the transmit channel when speech energy above a preset threshold is detected in the receive channel. The receive speech path comprises an input transformer and isolation pad, a channel amplifier, and an output transformer. Input to the receive channel control path is derived at the receive channel amplifier output. A switchable pad derives a 0 TLP input to an active low pass filter (12dB per octave roll-off above 3800Hz), and the control signal is then full-wave rectified before being supplied to a suppression threshold comparator and a summing amplifier in the break-in control path.

4.03 The full-wave rectified receive signal is smoothed slightly and compared with a stable dc reference potential to enable suppression. A delay timer following the suppression comparator enables suppression as soon as the comparator indicates presence of speech energy above the threshold level, but delays removal of suppression loss for a preset time (usually 70ms) after speech energy in the receive channel has fallen below threshold level.

4.04 The suppression hangover timer controls the suppression switch, which is composed of a pair of field-effect transistors (FET's), one a P-channel and the other an N-channel device, connected in series-shunt in the transmit path. During suppression, the series FET is off and the shunt FET is on; when suppression is removed, these states are reversed.

4.05 The transmit channel in the 6920 comprises an input transformer, a channel amplifier, the suppression switch, a fixed-loss pad, and an output transformer. Input to the transmit channel control path is taken at the output of a switchable level-translation circuit whose output is a 0 TLP. This output is fed to an active low pas filter identical to the filter in the receive control path. The filter output is full-wave rectified (but in opposing phase to the full-wave rectified receive signal) and supplied to a break-in threshold circuit and the summing amplifier previously mentioned.

4.06 The output of the summing amplifier is smoothed slightly and coupled to a comparator whose other input is a stable dc reference potential. Signals more positive than the reference enable the break-in mode, and signals more negative than the reference disable break-in. Transmit-channel signals below a preset level (−30dBm0) disable the break-in comparator through a threshold circuit similar to the suppression threshold circuit previously described.

4.07 The break-in comparator output is positive when the transmit-channel signal level simultaneously exceeds both the break-in threshold level and the receive-channel signal level, and is negative otherwise. When the comparator output is positive, suppression drive is disabled, removing the suppression loss, and a 6dB loss is introduced into the receive speech path. A timing circuit following the break-in comparator initiates the break-in condition within approximately 3 milliseconds of the instant at which the transmit-channel speech level exceeds the receive-channel speech level, and prolongs the break-in condition for nearly 200 milliseconds after the high-level interrupting speech has disappeared.

4.08 The break-in timer also provides enable input to a receive loss driver/timer that inserts 6dB of loss in the receive channel during break-in and for about 150, 600, or 1200 milliseconds after the interrupting speech has ended. The 6dB loss is derived through use of a FET switch.

4.09 A power regulation circuit provides operating and reference voltages to the 6920 circuitry. This circuit uses a 20 volt reference zener diode, a series pass transistor, and an active voltage divider to derive the reference potential. A series resistor is switched into the input power path when −48Vdc powering is used to minimize power dissipation in the regulating transistor.

4.10 When data disabling of the 6920 is required, a plug-on 9904 Tone Disabler subassembly is affixed to the unit. The 9904 is a printed circuit board plug-in subassembly that provides tone-activated echo suppressor disabling when data is being transmitted on either channel through the unit. Electrical connection between the 6920 and the 9904 is made via two 4-pin connectors that also provide for physical mounting of the subassembly. Signal input to the 9904 is derived at the output of the transmit and receive channel filters (both 0 TLP's). Disabler thresholds are provided by the suppression and break-in threshold circuits on the

6920. Power is provided to the 9904 from the main (6920) board. The output of the 9904 is at ground potential during disable intervals and negative otherwise. The disabler output ground overrides both suppresion-loss and receive-loss drivers on the 6920, thus placing the 6920 in the quiescent mode of operation (lossless in both directions of transmission). A front-panel-mounted LED lights to indicate that the 6920 has been disabled.

4.11 The input signals from the transmit and receive directions of the echo suppressor are summed at the input of a band-shaping amplifier and subsequent limiter. The gain of the band-shaping amplifier is highest between 700 and 1500Hz. The combination of limiting and band shaping provides signal-to-guard ratio thresholding for the 9904 Tone Disabler. The limiter output is coupled to an amplitude detector through a 2000 to 2250Hz band pass filter.

4.12 The detector output is timed by timing logic, provided that the transmit or receive signal is above the Echo Suppressor threshold. Logic resets the timer if timing is incomplete and the input signal drops below threshold in both transmit and receive channels. After the tone detector timer has completed its 200 millisecond (nominal) timing interval, ground is applied to the 9904 Tone Disabler's output. This ground persists until the combined signal energy drops below detection threshold, nominally −31dBm0. Approximately 250 milliseconds after disappearance of the signal, the disabling ground is removed.

6. specifications

common specifications

primary facility transmission levels
switch-selectable: −16TLP transmit and +7TLP receive, −4TLP transmit and +4TLP receive, or 0TLP transmit and 0TLP receive

variation of primary TLP's
transmit and receive TLP's may be independently varied ±1 or ±2dB about primary levels via switch optioning

port impedances (all ports)
600 ohms ±5%, balanced

noise
20dBrnC0 maximum

amplitude distortion
less than 1% THD for signal levels below +5dBm0

envelope delay distortion
less than 20μs, 400 to 4000Hz

overload point
+5dBm0 , with less than 0.1dB signal compression for signals below +5dBm0

longitudinal balance
greater than 60dB, 300 to 4000Hz

frequency response
±0.3dB, 300 to 4000Hz

crosstalk coupling loss
greater than 65dB

input voltage
−23 to −56Vdc

input current
40mA maximum without 9904 Tone Disabler; 60mA maximum with Tone Disabler

operating environment
20° to 120°F (−7° to 49°C), humidity to 95% (no condensation)

weight
6920: 16 ounces (454 grams)
9904: 1¼ ounces (35 grams)

dimensions
(with or without 9904 subassembly)
6.71 inches (17.04cm) high
1.42 inches (3.61cm) wide
12.94 inches (32.87cm) deep

mounting
19 inch or 23 inch relay rack via one position of Tellabs Type 16 (or Wescom 814 or 824) Mounting Shelf

suppression mode specifications

suppression threshold
−31±1dBm0, 300 to 3600 Hz

suppression loss
greater than 60dB

suppression operate delay
3±2ms

suppression release delay
70±10ms

rcv channel insertion loss
0±0.2dB, at 1200Hz

break-in mode specifications

break-in threshold
−30±1dBm0

break-in tracking
break-in enabled when xmt signal level (referred to 0 TLP) equals or exceeds rcv signal level (also referred to 0 TLP) ±1.0dB, for signals between −27 and +5dBm0

xmt insertion loss
0±0.2dB at 1000Hz

break-in operate delay
3±2ms

rcv insertion loss
6±1dB at 1000Hz

break-in release delay
150±25ms

rcv loss hangover time
switch-selectable: 150±25ms, 600±50ms, or 1200±100ms

9904 Tone Disabler specifications

detection band
2000 to 2250Hz

disable operate time
300±100ms

detection threshold
−30±2dBm0

disable release delay
250±100ms

signal/noise ratio to allow disabling
0 to 5dB

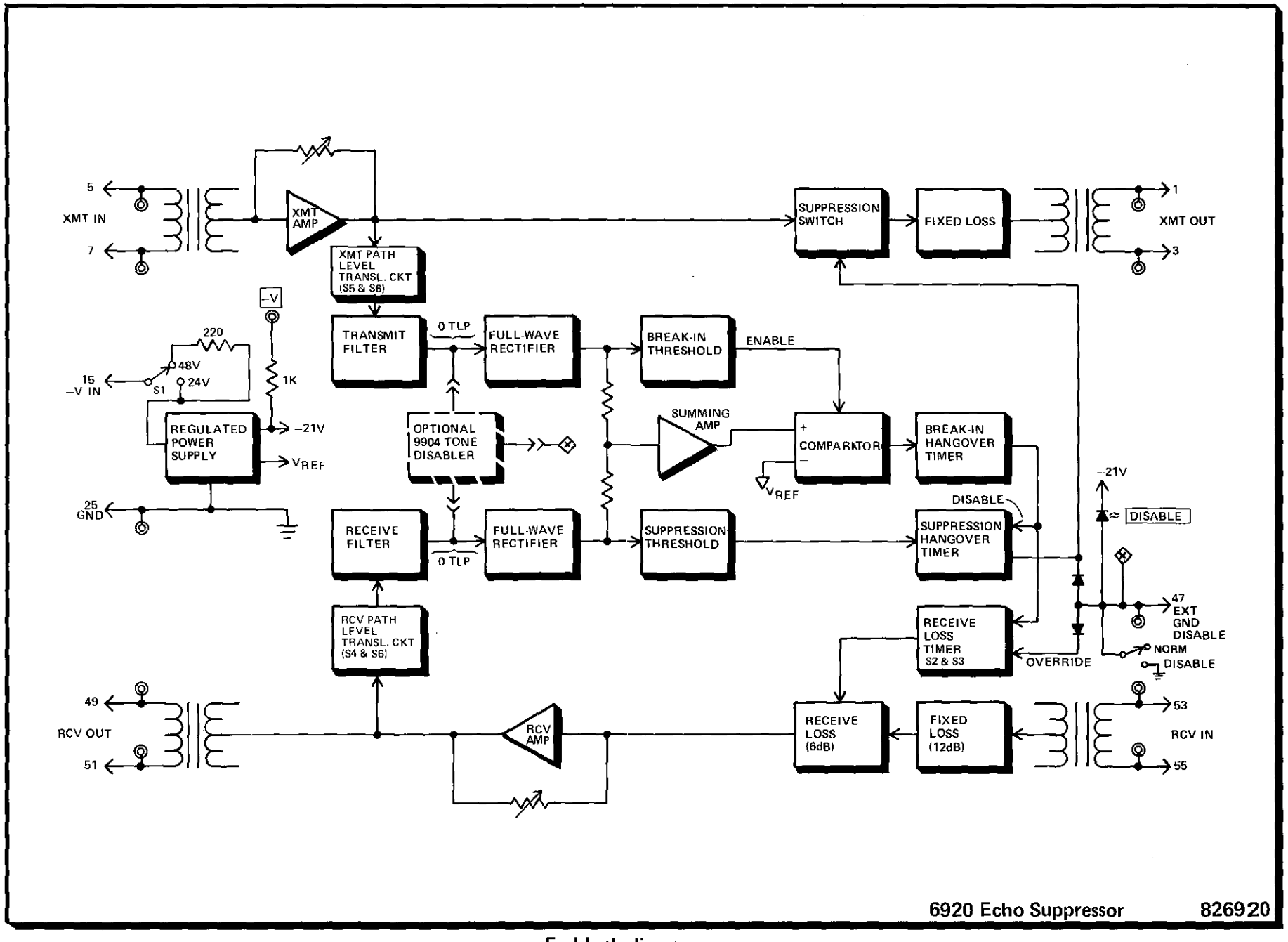
disabler recycle time
30±10ms

holding signal bandwidth after disable
300 to 3800Hz

guard band
500 to 1700Hz

disabled mode specifications

insertion loss
0±0.2dB at 1000Hz, xmt and rcv



5. block diagram

7. testing and troubleshooting

7.01 This Testing Guide may be used to assist in the installation, testing or troubleshooting of the 6920 Echo Suppressor. The Guide is intended as an aid in isolating a fault to the 6920 module or to other equipment in the circuit. If a module is suspected of being defective, a new module should be substituted and the test conducted again. If the substitute module operates correctly, the original module should be considered defective and returned to Tellabs for repair or replacement. It is strongly recommended that no internal (component level) testing or repairs be attempted on the 6920 module. Unauthorized testing or repairs may void the 6920's warranty.

7.02 Exhaustive testing of an Echo Suppressor is difficult except in a laboratory, but sufficient tests can be performed at an installation site to ascertain proper operation. Test equipment required to perform these tests includes two voice frequency oscillators and one or two level meters.

7.03 Before beginning tests, verify all external connections to the 6920, and also verify that power is properly applied to the unit. Measure the voltage between the *−V* and *GND* test points on the module's front panel. This voltage should be −20±1Vdc, and any discrepancy indicates either improper input powering or a defective module. Circuit alignment should also be carfully verified because proper functioning of the suppression and break-in sensing circuits is critically dependent upon operation at the prescribed transmission level points.

7.04 If a situation arises that is not covered in the Testing Guide, contact Tellabs Customer Service at (312) 969-8800 for further assistance.

7.05 If a 6920 is diagnosed as defective, the situation may be remedied by either *replacement* or *repair and return*. Because it is the more expedient method, the *replacement* procedure should be followed whenever time is a critical factor (e.g., service outages, etc.).

replacement

7.06 If a defective 6920 is encountered, notify Tellabs via telephone [(312) 969-8800], letter [see below], or twx [910-695-3530]. Notification should include all relevant information, including the 8X6920 part number (from which we can determine the issue of the 6920 module in question). Upon notification, we shall ship a replacement module to you. If the warranty period of the defective module has not elapsed, the replacement module will be shipped at no charge. Package the defective 6920 in the replacement module's carton; sign the packing list included with the replacement module and enclose it with the defective module (this is your return authorization); affix the preaddressed label provided with the replacement module to the carton being returned; and ship the equipment prepaid to Tellabs.

repair and return

7.07 Return the defective 6920 module, shipment prepaid, to: Tellabs Incorporated
4951 Indiana Avenue
Lisle, Illinois 60532
Attn: repair and return dept.

Enclose an explanation of the module's malfunction. Follow your company's standard procedure with respect to administrative paperwork. Tellabs will repair the module and ship it back to you. If the module is in warranty, no invoice will be issued.

6920 testing guide checklist

Note: *Levels shown in the checklist are referenced to 0TLP, with actual levels for −16 rcv and +7 xmt TLP's also indicated. If interface levels other than −16 rcv, +7 xmt or 0 rcv, 0 xmt are used, appropriate translations must be made.*

test	test procedure	normal result	if normal conditions are not met, verify:
Quiescent Operation	Disable 6920 sensing ckts by placing temporary ground on pin 47 or operating DISABLE switch. Apply 1000Hz tone at 0dBm0 to RCV IN port and, using 600 ohm terminted level meter, measure level at RCV OUT port. (Use bridging level meter if RCV OUT port is terminated in 600 ohms.)	Level at 0±0.2dBm0 ☐.	Ground applied to pin 47 or DISABLE switch properly set ☐. No double terminations at RCV IN and RCV OUT ports ☐. Replace 6920 and retest ☐.
	Remove oscillator from RCV IN port and connect to XMT IN port. Adjust to 0dBm0 (-16dBm) level and, using 600 ohm terminated level meter, measure signal level at XMT OUT port.	Level at 0±0.2dBm0 ☐.	Ground applied to pin 47 or DISABLE switch properly set ☐. No double terminations at XMT IN and XMT OUT ports ☐. Replace 6920 and retest ☐.
	Test complete, remove pin 47 gnd or set DISABLE switch to NORM.		
Suppression Mode Operation	Insert 1000Hz signal at -20dBm0 (−36dBm at −16TLP) into XMT IN port, and 1100Hz signal at −12dBm0 (−5dBm at +7TLP) into RCV IN port. Measure signal levels at both RCV OUT and XMT OUT ports.	Level at XMT OUT port less than −40dBm0 (essentially "in the noise") ☐, and RCV OUT level at −12±0.2dBm0 ☐.	Temporary ground removed from connection pin 47 ☐. DISABLE switch set to NORM ☐. Replace 6920 and retest ☐.
	Remove signal at RCV IN port and observe signal level at XMT OUT port.	When receive signal is removed, XMT OUT signal level increases to −20±0.2dBm0 ☐.	Extraneous signals not connected to RCV IN port ☐. No double terminations at XMT IN and XMT OUT ☐. Replace 6920 and retest ☐.

test	test procedure	normal result	if normal conditions are not met, verify:
Break-In Mode Operation	Connect 1000Hz signal at -30dBm0 (−46dBm at −16TLP) to XMT IN port, and 1100Hz signal at −20dBm0 (−13dBm at +7TLP) to the RCV IN port. Measure levels at XMT OUT and RCV OUT.	Level at XMT OUT at circuit noise level ☐, and RCV OUT level at −20±0.2dBm0 ☐.	No double terminations at any of four ports ☐. Replace 6920 and retest ☐.
	Increase XMT IN signal level to −19dBm0 (−35dBm at −16 TLP), and measure signal level at XMT OUT and RCV OUT ports.	XMT OUT level at −19±0.2dBm0 ☐, and RCV OUT level at −26±1dBm0 ☐.	Replace 6920 and retest ☐.
	Decrease XMT IN level to −26dBm0 and measure XMT OUT and RCV OUT levels.	Level at XMT OUT at circuit noise level ☐, and RCV OUT level at −20±0.1dBm0 ☐.	Replace 6920 and retest ☐.
	Increase RCV IN signal level to −10dBm0 (−3dBm at +7TLP), and set XMT IN level to −9dBm0 (−25dBm at −16TLP). Measure levels at XMT OUT and RCV OUT.	XMT OUT level at −9±0.2dBm0 ☐, and RCV OUT level at −16±1dB ☐.	Replace 6920 and retest ☐.
	Increase RCV IN signal level to +4dBm0 (+11dBm at +7TLP), and measure signal levels at XMT OUT and RCV OUT.	XMT OUT level at circuit noise level ☐, and RCV OUT level at +4±0.2dBm0 ☐.	Replace 6920 and retest ☐.
	Increase XMT IN level to +5dBm0 (−11dBm at −16TLP) and measure levels at XMT OUT and RCV OUT.	XMT OUT level at +5±0.2dBm0 ☐, and RCV OUT level at −2±1dBm0 ☐.	Replace 6920 and retest ☐.
Receive Loss Hangover Time	Insert signal at 0dBm0 (−16dBm at −16TLP) into XMT IN port, and 1100Hz signal at −10dBm0 (−3dBm at +7TLP) into RCV IN port. Measure levels at XMT OUT and RCV OUT.	XMT OUT level at 0±0.2dBm0 ☐, and RCV OUT level at −16±1dBm0 ☐.	Replace 6920 and retest ☐.
	Remove signal at XMT IN and observe signal level at RCV OUT port.	Approximately 600 milliseconds after removal of XMT IN signal, signal level at RCV OUT increases from −16±1dBm0 to −10±0.2dBm0 ☐.	Replace 6920 and retest ☐.
If the 6920 is equipped with a 9904 Tone Disabler subassembly, perform the following tests to verify performance of the Disabler:			
Disable Sequence	Insert 2100Hz signal at -10dBm0 at 6920 RCV IN port. Approximately one second after insertion of this signal, insert signal at 1000Hz and −20dBm (−36dBm at −16TLP) into XMT IN port. Measure levels at XMT OUT and RCV OUT ports.	RCV OUT signal level at −10±0.2dBm0 ☐, and XMT OUT level at −20±0.2dBm0 ☐.	Disabler subassembly fully seated in two receptacles ☐. Replace 9904 and retest ☐. Replace 6920 and retest ☐.
	Change frequency of RCV IN signal to 1000Hz and measure levels at XMT and RCV OUT.	Same as above ☐.	See above.
Removal of Disable mode	Remove signals from both RCV and XMT IN ports and reinsert signals at levels of 0dBm0 RCV IN and −10dBm0 XMT IN. Measure levels at XMT OUT and RCV OUT.	XMT OUT level at circuit noise level ☐, and RCV OUT level at 0±0.2dBm0 ☐.	Remove 9904 and perform test. If normal result realized, replace 9904 ☐. If normal result not achieved, replace 6920 and retest ☐.
Signal-to-Guard test	Insert signal at −10dBm0 and 1000Hz at XMT IN port, and, *after* insertion of XMT IN signal, insert 2100Hz signal at −8dBm0 level (−1dBm at +7TLP) into RCV IN port. Measure levels at XMT OUT and RCV OUT ports.	XMT OUT level at −10±0.2dBm0 ☐, and RCV OUT level at −14±1dBm0 ☐, indicating break-in rather than disable mode.	Remove 9904 and perform test. If normal result realized, replace 9904 and retest ☐. If normal result not achieved, replace 6920 and retest ☐.