PRELIMINARY
Technical Manual

SBSA-50C
50 Watt Agile Transmitter

COMWAVE

INSERT PICTURE HERE, IF APPLICABLE

Created by: Lisa M. Campione 1/29/97	*Checked by:*	*Released by:*

Document #: 97-02022
REV: P1

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Created by: Kimberly Simeone 5/28/98	*Checked by:*	*Released by:*

COMMUNICATION MICROWAVE CORP
TWO YEAR LIMITED WARRANTY

Communication Microwave Corp warrants each product of its manufacture to be free from any defect in material and workmanship for a period of two years after delivery to, and return by the original purchaser. No returns, however, will be accepted unless accompanied by a written factory return authorization.

The limit of liability under this warranty shall be to repair or replace any product, or part thereof, which proves to be defective after inspection by Communication Microwave Corp with the exception of tubes, semiconductor devices, lamps, fuses or equipment (i.e. modulators) manufactured by others, which are subject to only such loss adjustment as Communication Microwave Corp may obtain for the suppliers thereof.

This warranty shall not apply to any Communication Microwave Corp product which has been modified, physically or electrically damaged, or to modules which seals have been broken, or any product which has been subjected to conditions exceeding the applicable specifications or ratings or improper service techniques.

Communication Microwave Corp will not be liable for any direct or consequential injury, loss or damage incurred through the use, or the inability to use, any Communication Microwave Corp product.

Communication Microwave Corp reserves the right to make design changes to any Communication Microwave Corp product without incurring any obligation to make the same changes to previously purchased units.

This warranty is the full extent of the obligation and liability assumed by Communication Microwave Corp with respect to any and all Communication Microwave Corp products. Communication Microwave Corp neither makes, nor authorizes any person to make, any other guarantee or warranty concerning Communication Microwave Corp products.

TOP LEVEL DESCRIPTION

The model SBSA-50C, 50 watt frequency agile television transmitter, generates a high quality vestigial sideband television signal on all MMDS and ITFS channels. Advanced circuit design which includes broadband gallium arsenic microwave amplifiers, high efficiency switching power supply, extensive monitoring capability, EMI shielding, and easy access compact design are but a few of the unit's features.

This transmitter consists of an IF processor, a UHF upconverter, an aural ALC, three final amplifiers, a synthesizer, a precorrector, two drivers and two bandpass filters.

The modulator accepts composite video and audio signals and provides an AM modulated visual carrier at 45.75 MHz and an FM modulated aural carrier at 41.25 MHz. The modulator provides these carriers separately to a UHF upconverter (350 MHz). This second IF frequency is then upconverted to microwave and amplified for the desired power level output. The second IF frequency was chosen so that the upconverted microwave image frequency would be outside the microwave bandpass filter pass range.

The visual and aural final amplifier microwave outputs are combined in a passive combiner to form a single six MHz wide television channel output.

SPECIFICATIONS

Visual Performance

Output Power	1 to 50 Watts
Output Frequency	Any 6,7, 8 MHz Channel 2000-2700 MHz
Emission	Visual: 5M75C3F
Impedance/Connector	Input: 75 Ohms/BNC Output: 50 Ohms/N
Input Level	Video 1V P-P ± 6 dB
Frequency Stability	±500 Hz (higher stability options available)
Harmonics	-70 dB
Differential Gain	3%
Differential Phase	2°
Spurious Products	-60 dB

Aural Performance

Emission	Aural: 250KF3E
Output Power	1.5 Watts
Pre-Emphasis	75 Microseconds (50 Microseconds PAL)
Deviation:	± 25 KHz (±50 KHz PAL)

General

Power Requirements	117/220 VAC 50/60 Hz (factory set)
Ambient Temperature	-30° C to +50° C
Dimensions	
Weight	

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**Specifications subject to change without notice*

Document #: 95-01044
REV: P1

THEORY OF OPERATION

SBSA-50C 50 Watt Agile Transmitter

The SBSA-50C transmitter receives an Intermediate Frequency (IF) AM modulated visual and two FM modulated aural carriers which are converted to S-band frequency. These signals are sent through driver and final amplifiers for a combined RF output signal. The transmitter provides a visual output of 50 watts peak sync and a 15 dB ratio of visual to aural power.

The SBSA-50C receives a visual (-8 dBm) carrier and auxiliary (-23 dBm) carrier which proceed to the IF Processor where precorrection is introduced to eliminate amplitude distortions of the visual final amplifiers. An aural (-8 dBm) carrier is also received and enters, along with the visual carrier. The UHF upconverter module carries out an upconversion function from a TV IF to a second IF at around 350 MHz.

After being upconverted, the visual signal enters a mixer/driver where the IF signal is heterodyned with a local oscillator (LO). The aural signal enters an aural ALC (Automatic Level Control) module. After amplitude distortions are eliminated in the aural carrier, the signal continues onto its own mixer/driver. Bandpass filters follow the mixers to prevent out-of-band products from being amplified and transmitted. The signals then go back to the drivers, where they are amplified.

From the driver, the visual signal is amplified further by a pre-amplifier, it then splits and enters one of two 2 drive 6 final amplifiers which are broad band, fixed gain linear amplifiers that do not require any tuning. Following the mixer driver, the aural signal enters directly into a one drive two final amplifier.

After final amplification, the visual and aural signals are combined by a combiner and a series of couplers to provide +47 dBm peak visual and +32 dBm aural power for the RF output. Refer to Document # HG2-01012 for a signal path diagram.

SBSA-50C Front & Rear Panel Descriptions

This section explains the SBSA-50C front and rear panel features. Figures accompany the text providing numerical indexed references.

Front Panel

1. METER: Provides an indication of transmitter status and performance of +11 V_{DC} switching power supply, reflected power, or forward average power. The meter is calibrated to display relative measurements. Its function is controlled by the six position rotary function switch.

2. FUNCTION SWITCH: A six position, user selectable, rotary switch controls front panel analog meter monitoring. The following parameters are selectable for monitoring by the function switch.

STANDBY: Disables transmitting. Power remains applied to all circuits. Meter will read approximately 0%.
METER OFF: Transmitter is enabled. Metering disabled. Meter will read approximately 0%.
+ 11 VPS: Provides status of main switching power supply. Meter reads 100 % indicating proper power supply voltage.
REF PWR: Relative reflected power measurement. Readings less than 10% are typical.
AUR PWR: Relative average aural output power measurement. 100% meter reading confirms .63 watts average output power.
VIS PWR: Relative average visual output power measurement. 100% meter reading confirms 50 watts average output power.

3. LEDs: Status monitoring LEDs, which provide indication of operating parameters and internal diagnostics. The following status monitoring LEDs illuminate GREEN during normal operation. Absence of an LED indicates a missing signal or parameter, which results in a controlled automatic transmitter shut down.

IN SIGNAL: Presence of an input signal.
INTERLOCK: Interlock logic conditions are satisfied.
TRANSMIT: In transmit mode.

The following status monitoring RED LEDs remain OFF during normal operation. When a failure is detected, the appropriate LED will illuminate RED. Controlled automatic transmitter shut down is a function of failure severity. Presence of a RED status LED with normal meter readings and/or normal transmitter operation indicates an out of tolerance condition with that circuit.

TEMPERATURE: Internal chassis temperature has exceeded + 160 degrees Fahrenheit (71 degrees Celsius). Transmitter shut down occurs. Allow transmitter to cool. Transmitter reset can beattempted by rotating the front panel function switch to STANDBY.

VIS DRIVER: A failure or an out of tolerance condition with the driver module. Transmitter usually operates at reduced output power.

VIS PRE-FINAL: A failure or an out of tolerance condition with the pre-final module. Transmitter typically operates at reduced output power.

VIS FINAL A/B: A failure or an out of tolerance condition with a final module(s). Transmitter usually operates at reduced output power.

RF POWER: Transmitter average output power has decreased to less than 50% of full output. Transmitter shut down occurs.

PWR SUPPLY: A failure in the +11 volt DC main switching power supply or an out of tolerance condition has been detected by the diagnostic and monitoring circuitry. Transmitter shut down occurs.

LOCAL OSC: Absence of the local oscillator reference signal. Transmitter shut down occurs.

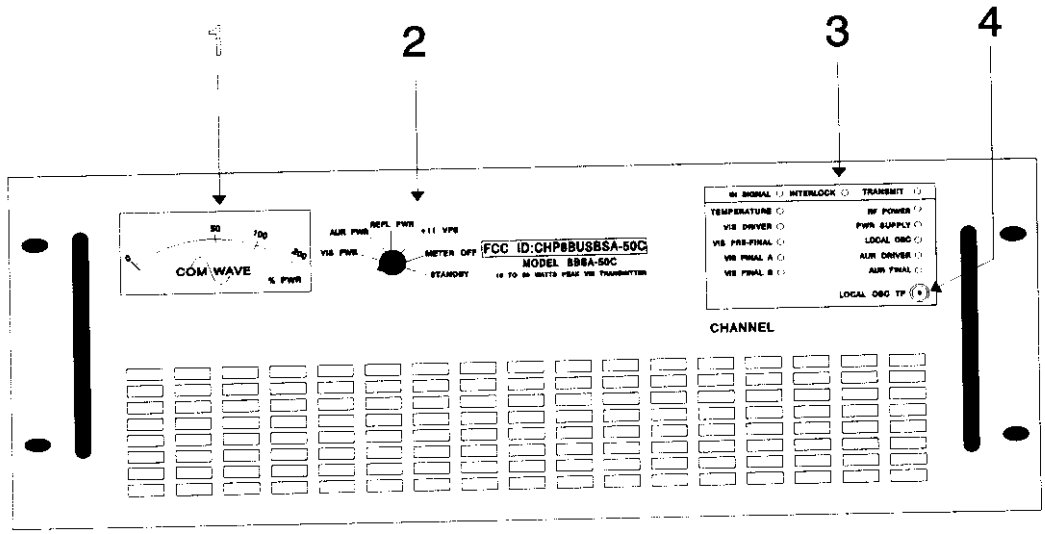
AUR DRIVER: A failure or an out of tolerance condition with the aural driver module(s). The transmitter usually operates at reduced visual output.

AUR FINAL: A failure or an out of tolerance condition with the aural final module(s). The transmitter usually operates at reduced visual output.

4. OSC TP: A front panel mounted VCXO local oscillator test point at + 5 dBm

COMWAVE
A Thomcast Company
SBSA-50C Front View

SBSA-50C FRONT VIEW



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Document #: HG3-01002
REV:P1

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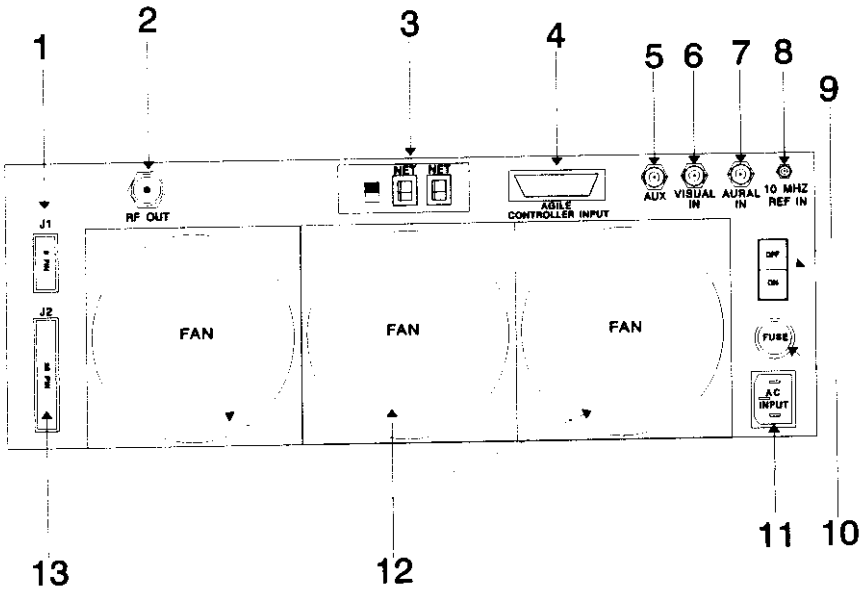
Rear Panel

1. J1:	9 pin connector that supplies a video presence signal between the modulator and the SBSA-50C transmitter.
2. RF OUT:	RF output female N type connector.
3. COMVIEW:	Two jacks in parallel to serve as either an input or output for the ComView Monitoring System.
4. AGILE CONTROLLER:	Synthesizer agile controller input.
5. AUX:	75 ohm termination option.
6. VISUAL IN:	Provides -8dBm of visual input coming from the TVM-102 modulator.
7. AURAL IN:	Provides -8dBm of aural input coming from the TVM-102 modulator.
8. 10 MHZ REF IN:	An external 10 MHz reference signal input connector (female F connector).
9. Power Switch:	Main chassis ON/OFF power switch.
10. Fuse:	Main line fuse location.
11. AC Input:	AC Line input power cord connector.
12. Fans:	Three rear mounted fans provide for cooling. Fans are wired for 117 V_{AC} or 230 V_{AC} depending upon the user application.
13. J2:	25 pin connector for diagnostics and module voltage level monitoring.

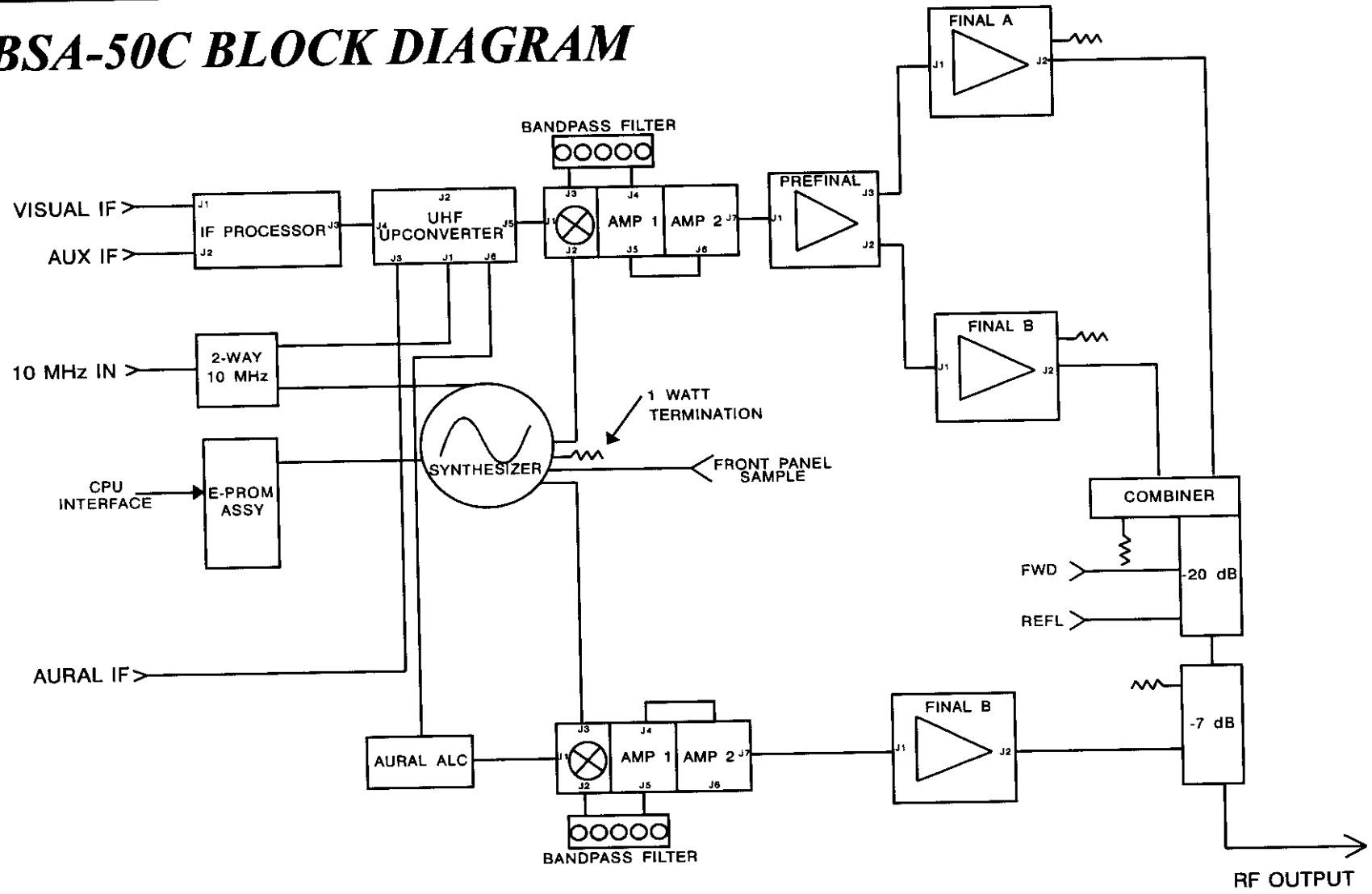
SBSA-50C REAR VIEW



Created by: SBSA-50C Rear View	*Checked by:*	*Released by:*

Document #: HG3-01003
REV: P1

SBSA-50C BLOCK DIAGRAM



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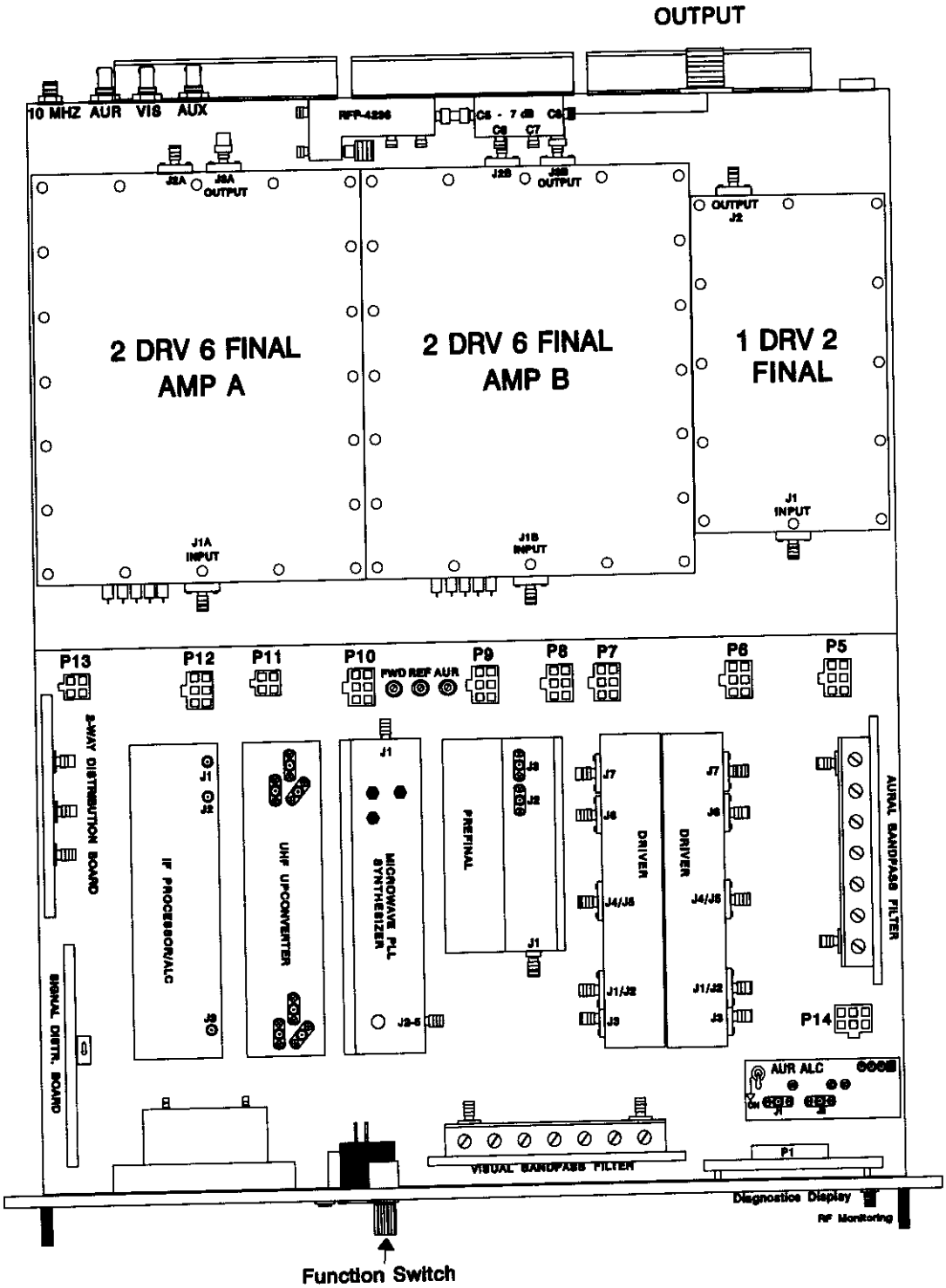
Document #:HG2-01012

REV: P1

SBSA-50C TOP VIEW

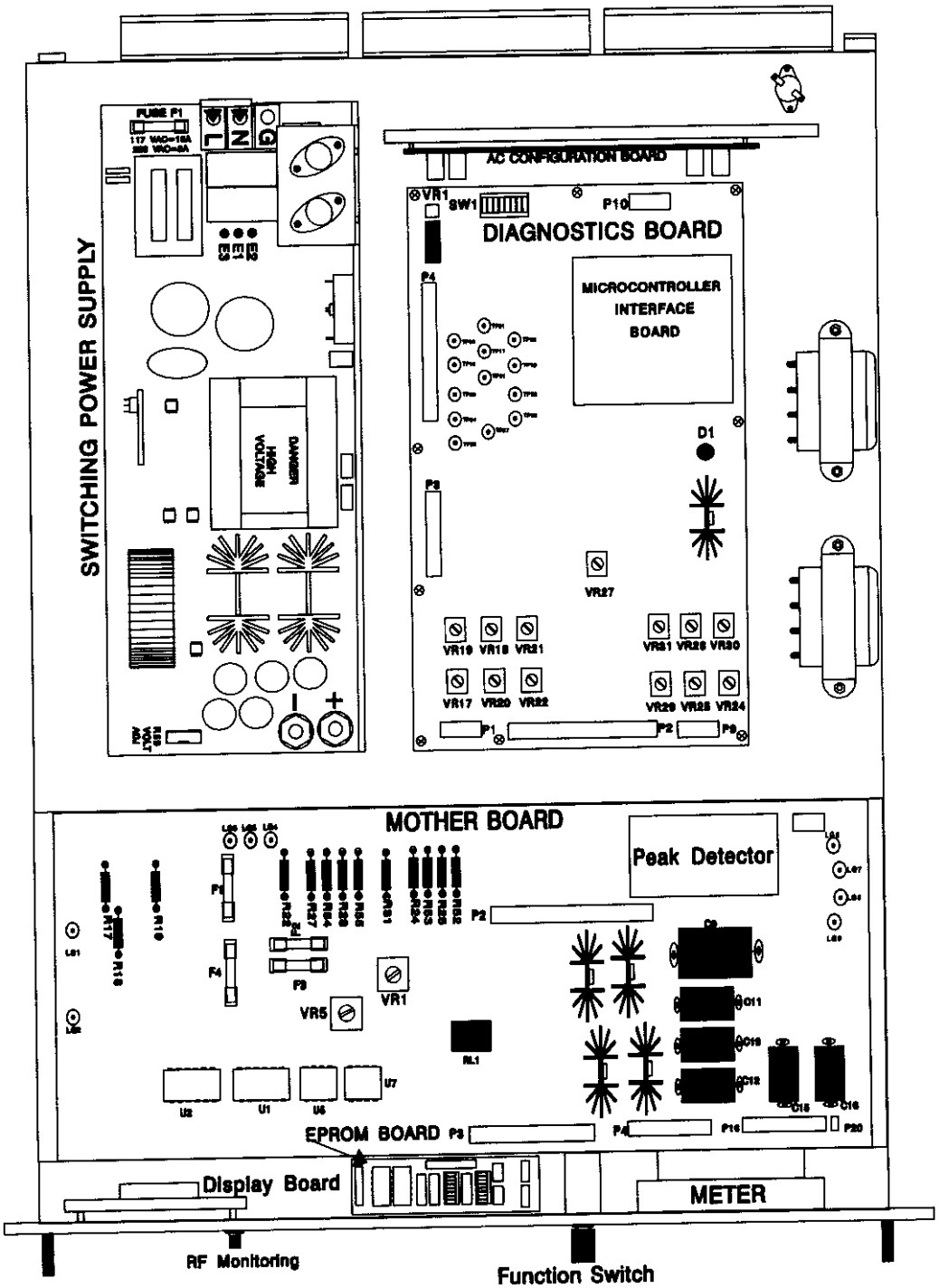


Created by: Kimberly Simeone 5/27/98	*Checked by:*	*Released by:*

Document #: HG3-01004

REV: P1

SBSA-50C BOTTOM VIEW



Created by: Kimberly Simeone 5/27/98	*Checked by:*	*Released by:*

Document #: HG3-01005

REV: P1

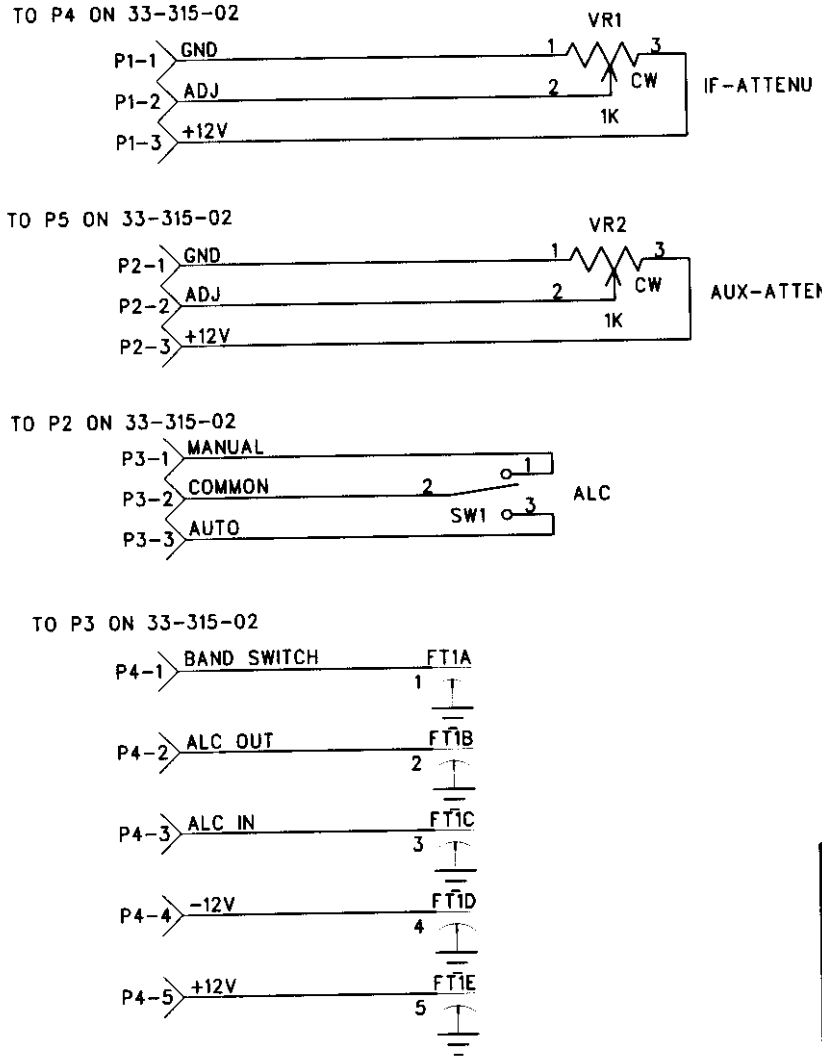
IF PROCESSOR

The IF Processor contains linearity correction circuitry and automatic level control (ALC) circuits, as well as an IF amplifier.

The linearity corrector is a proprietary circuit. It corrects all non-linearities developed in the solid state final amplifiers. It is factory adjusted and no field adjustment is needed, however, a switch is provided to turn the corrector off.

The ALC circuitry compares a voltage proportional to peak output power to a pre-set reference and adjusts a variable attenuator as needed to make the two voltages equal. The ALC voltage is brought into the module and amplified by an integrated circuit (IC) and compared to the reference voltage in a second IC. The reference voltage is set by a potentiometer. The error voltage is produced by the second IC and sent to a variable attenuator consisting of two pin diodes. A potentiometer sets the proper attenuation when the second switch is open. The ALC circuit may be turned off with this switch.

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:
B	97-045	C.SPARKES	2/27/97



SCHEMATIC OF ISSUE 1 PC BOARD.

COMMUNICATION MICROWAVE CORP.
CRESTWOOD INDUSTRIAL PARK
MOUNTAINTOP PA. 18707

TITLE:
SCHEMATIC,VISUAL IF,AUX IF & ALC ADJUST PRECORRECTOR & ALC ON/OFF

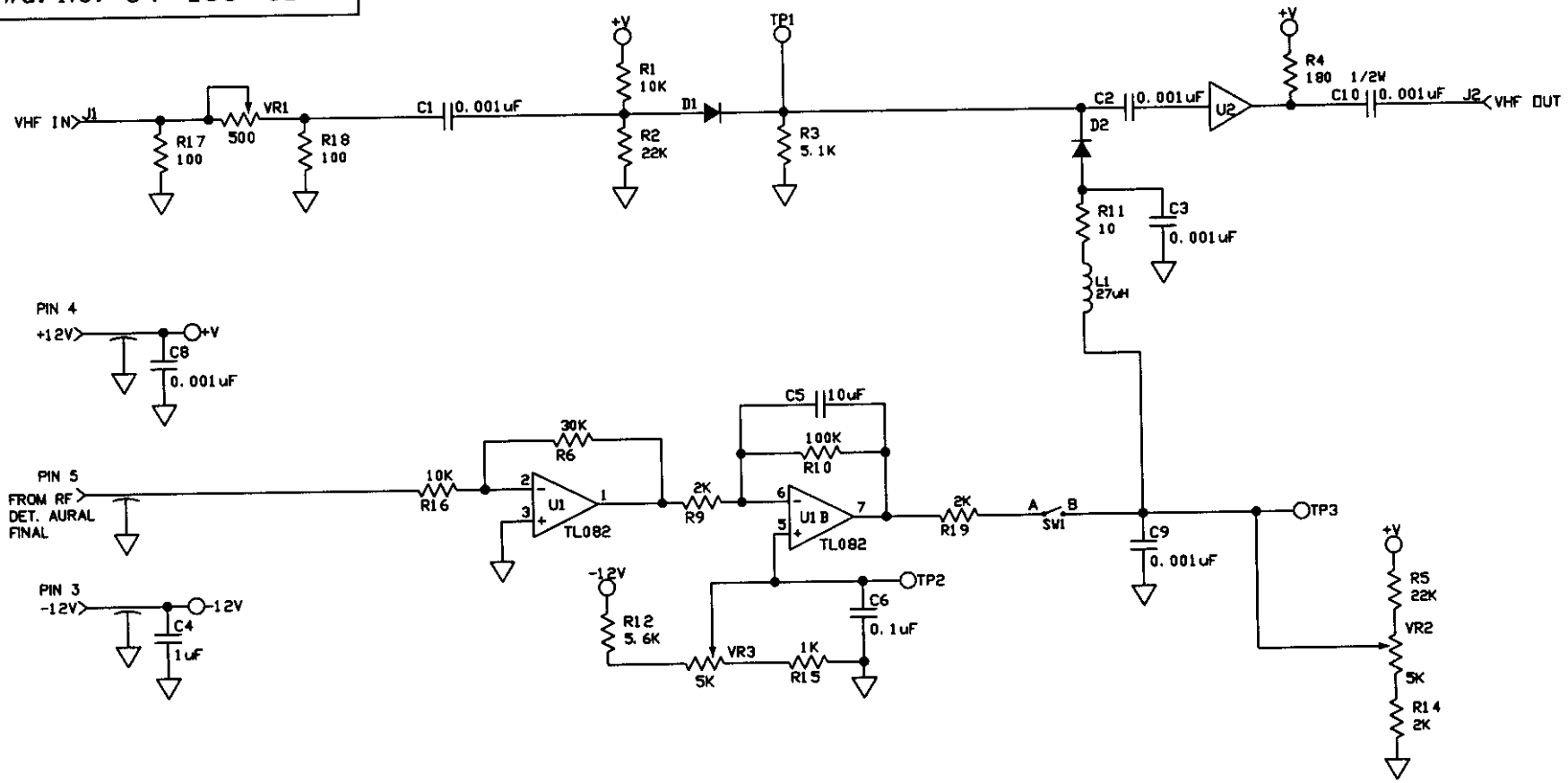
DRAWN: A.BRAGALONE	DATED: 11-15-95	DRAWING NO: A-33-318-01
CHECKED: A.BRAGALONE	3-6-97	
ELEC. ENGR:		SHEET: OF
RELEASED: A.BRAGALONE	3-6-97	SCALE: REV: B

AUTOMATIC LEVEL CONTROL (ALC)

A DC voltage originating in the aural peak detector (proportional to the RF level at the aural final) is brought into the ALC module from the motherboard and is amplified by an op amp. It is then compared to the reference voltage which is generated by two resistors and a potentiometer from -12 V. A difference results in an error voltage which is sent to the variable attenuator consisting of two pin diodes, four resistors, and a capacitor. A switch allows the ALC to be disabled at any time.

In order to adjust the ALC for optimum control, an attenuator is set to the mid-attenuation range of the first diode with the ALC switch off. (This does not require readjustment). Another attenuator is then adjusted for 100% output power reading. Finally, ALC is enabled with the switch; and the potentiometer is adjusted to restore 100% reading.

DWG. NO. 04-100-01



NOTES:
ALL RESISTORS 1/4W UNLESS NOTED.
SCHEMATIC OF ISSUE 2 PC BOARD.

REV	DATE	DESCRIPTION	ECO No.
SCALE: NONE	TOLERANCE UNLESS NOTED	FRAC.?	DEC.? ANG.?

COMMUNICATION MICROWAVE CORP
CRESTWOOD INDUSTRIAL PARK
MOUNTAINTOP, PA., 18707

TITLE:
SCHEMATIC, ALC MODULE

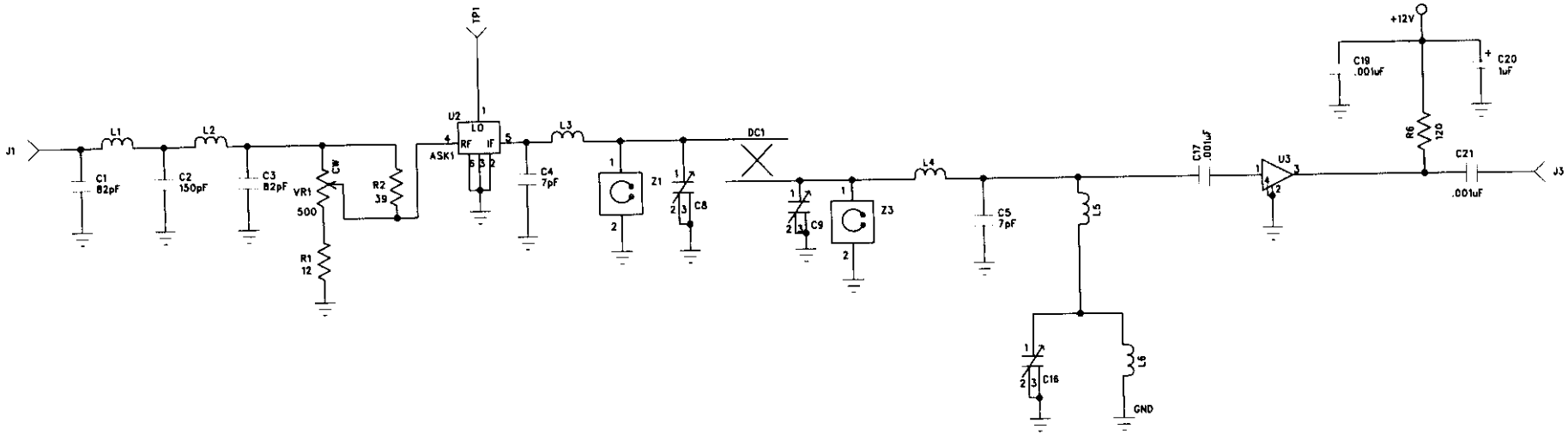
	DATE	NAME
DRAWN	6-3-91	A.BRAGALONE
CHECKED		
MECH. ENGR. RELEASE		
ELEC. ENGR. RELEASE		
RELEASE TO PRODUCTION		

DWG. NO. A-04-100-01
1 OF 1
NEXT ASSY. D6
REV. D

UHF UPCONVERTER

The UHF upconverter module carries out an upconversion function from a TV IF to send an IF at around 350 MHz. This second IF frequency, when mixed with the LO, produces the desired microwave frequency. The second IF is necessary to make filtering of the microwave LO and other undesired signals manageable in broadband agile systems. The visual and aural TV IFs are treated separately through the module, each chain providing the necessary filtering to get rid of the image frequency and the UHF Local Oscillator. Features of the module include adjustable bandpass filters, LO notches, phase lock indication, LO sample, adjustable aural carrier level, and access of all user adjustments from the exterior of the module.

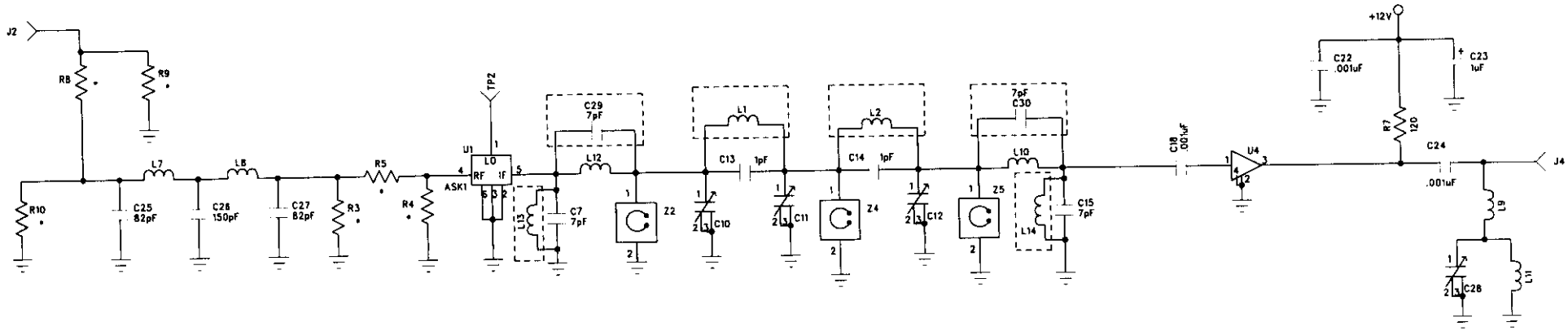
REVISION RECORD			
LTR	ECO NO:	COMPLETED:	DATE:
B	96-072	C.SPARKES	2-26-96
C	96-177	D.SCHOCK	4-23-96



SCHEMATIC OF ISSUE 3 PCB.

COMMUNICATION MICROWAVE CORP.			
CRESTWOOD INDUSTRIAL PARK MOUNTAINTOP PA. 18707			
TITLE: SCHEMATIC,UHF UPCONVERTER, 2 POLE.			
DRAWN: C.SPARKES	DATED: 12/21/95	DRAWING NO: B-33-313-01	
CHECKED: D.PAWSKI	5-7-96	SHEET: 1 OF 1	
ELEC. ENGR:		SCALE:	REV: C
RELEASED: A.BRAGALONE	5-8-96		

REVISION RECORD			
LTR	ECO NO:	COMPLETED:	DATE:
B	96-072	C.SPARKES	2-26-96
C	96-177	D.SCHOCK	4-24-96
D	98-051	A.Bragalone	4-29-98



NOTES:

- Values change per module assembly.

TO BE DETERMINED BY TEST:

LOW PASS FILTER: INSTALL C7, L12 & C15, L10.

HIGH PASS FILTER: INSTALL C29, L13 & C30, L14.

L1, L2 8MHz Bandwidth

C13, C14 all other

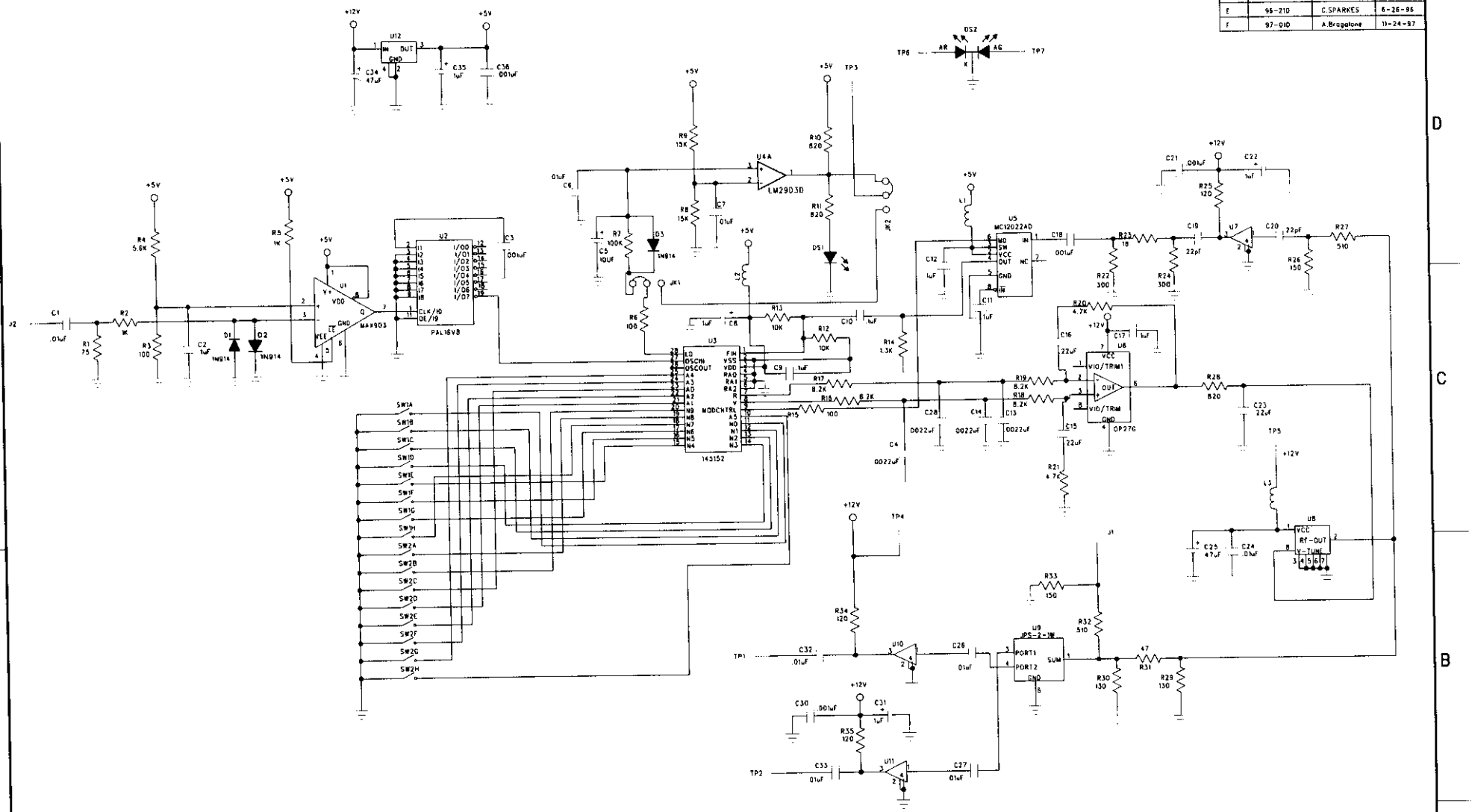
COMMUNICATION MICROWAVE CORP.
CRESTWOOD INDUSTRIAL PARK
MOUNTAINTOP PA. 18707

TITLE:

SCHEMATIC,UHF UPCONVERTER, 3 POLE

DRAWN: C.SPARKES	DATED: 12/21/95	DRAWING NO: B-33-323-01
CHECKED: K.Harding	5-28-98	
ELEC. ENGR:		SHEET: OF
RELEASED: A.Bragalone	5-28-98	SCALE: REV: D

LTR	ECO NO	APPROVED:	DATE:
G	98-051	A.Bragalone	5-13-98
E	96-210	C.SPARKES	8-26-96
F	97-010	A.Bragalone	11-24-97



COMMUNICATION MICROWAVE CORP.
CRESTWOOD INDUSTRIAL PARK
MOUNTAINTOP PA. 18707

TITLE:
UHF SYNTHESIZER/UPCONVERTER

DRAWN: C.SPARKES	DATED: 9-20-95	DRAWING NO: C-34-007-01
CHECKED: K.Harding	5-28-98	
ELEC. ENGR:		SHEET: OF
RELEASED: A.Bragalone	5-28-98	SCALE: REV: G

EPROM BOARD

The 16 bit EPROM Board contains two specially programmed EPROM's that interface the channel thumb wheel selector switch, synthesizer, and an external chassis called the Frequency Agile Auto Controller. These EPROM's contain specific data that control programming of the synthesizer according to the selections made manually with the thumb wheel selector or from inputs received from the Frequency Agile Auto Controller.

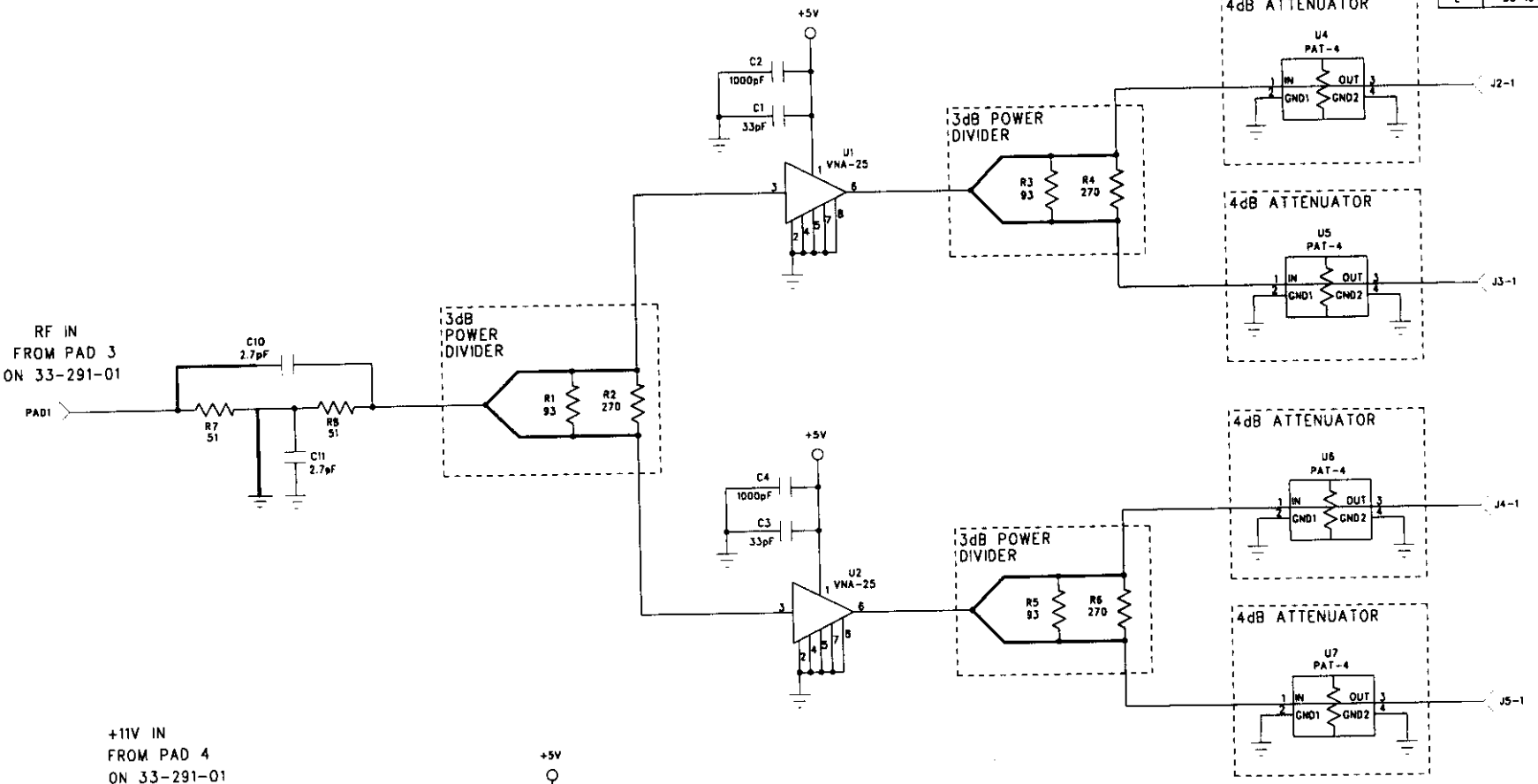
SYNTHESIZER

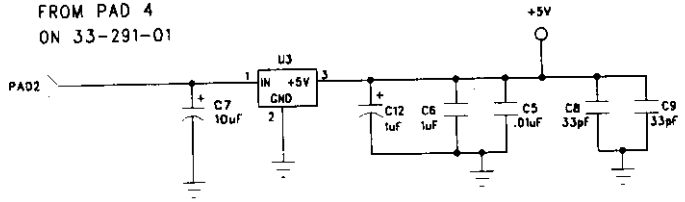
The synthesizer is a voltage controlled oscillator (VCO) which provides the LO (Local Oscillator) frequency of the transmitter. The VCO is phase locked to a high stability reference (10 MHz) in order to achieve a precise microwave carrier. The 10 MHz is then mixed with an Intermediate Frequency (IF) which produces the desired on channel frequency of the transmitter.

The input of the synthesizer is a 10 MHz reference source which can vary between 0 dBm and +15 dBm. The input proceeds through a series of programmable dividers providing a 25 KHz reference frequency at the phase detector. The frequency status of the VCO is continuously monitored through a control loop. This frequency is divided by a microwave prescaler and a dual modulous prescaler. The synthesizer's integrated circuits control the logic level and aquires lock. The final desired output frequency is achieved by the N and A dividers. An error voltage is generated by the integrator if this frequency is unequal to that of the reference. This will pull the VCO back to the desired output frequency.

Following the integrator stage are two active filters which notch the 25 KHz pulses that may cause unwanted spurs.

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:
C	96-018	A.BRAGALONE	01-18-96
D	96-194	A.BRAGALONE	05-03-96
E	96-194	D.SCHOCK	7-2-96





NOTES:

1. ALL RESISTORS ARE IN OHM's & 1/8W CHIP's UNLESS OTHERWISE MARKED
2. HEAVY LINES INDICATE 1/4 WAVE LENGTH LONG LINES AT 2.32GHz
3. SCHEMATIC OF 40-207-04 PCB.

COMMUNICATION MICROWAVE CORP.
CRESTWOOD INDUSTRIAL PARK
MOUNTAINTOP PA. 18707

TITLE:
SCHEMATIC, MICROWAVE SYNTHESIZER W/50KHz STEP, 4 OUTPUT RF BOARD

DRAWN: K.HARDING	DATED: 6-16-95	DRAWING NO: B-13-081-01
CHECKED: C.SPARKES	7-12-96	
ELEC. ENGR:		SHEET: 1 OF 1
RELEASED: D.WIKE	7-16-96	SCALE: REV: E

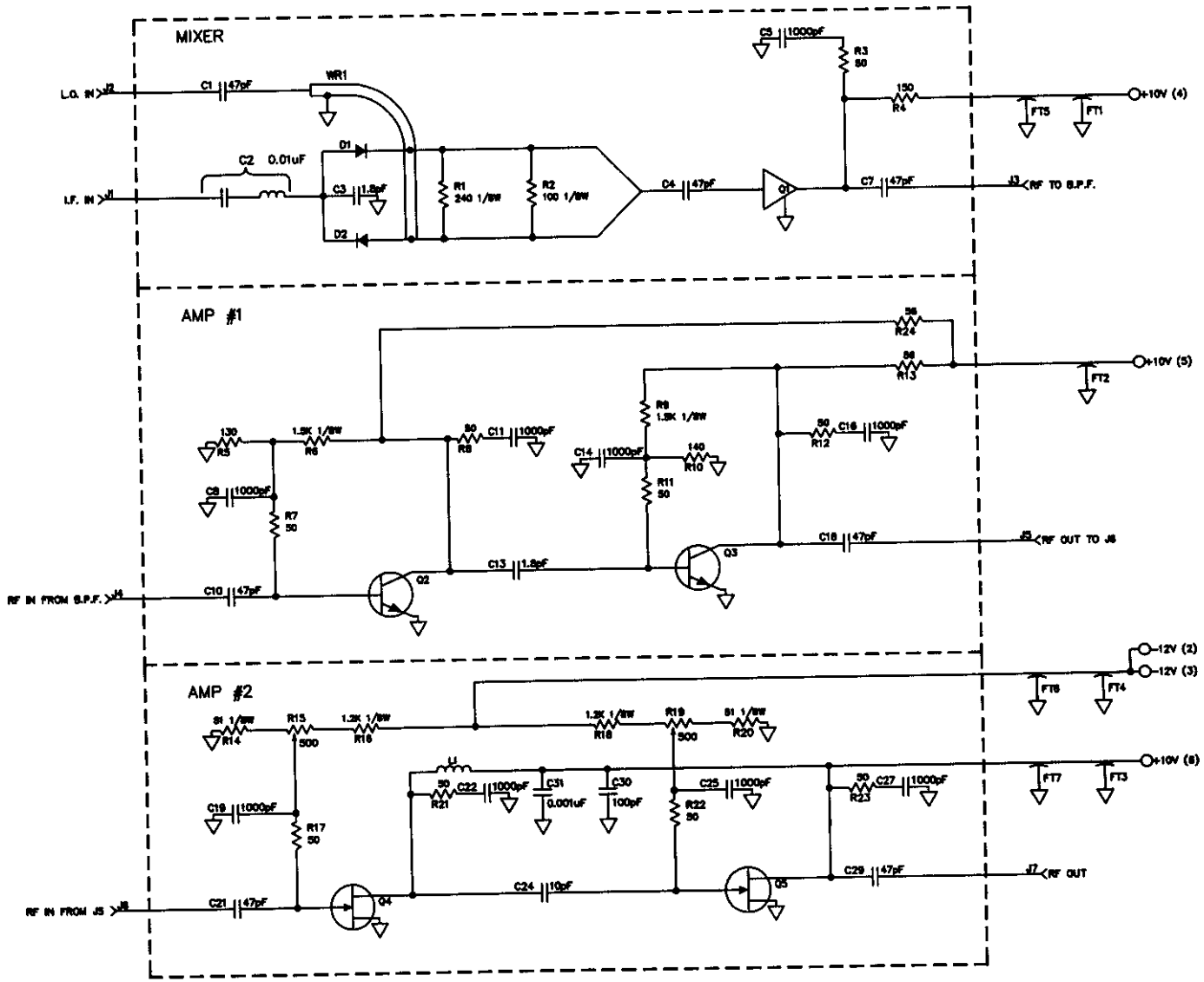
MIXER/DRIVER AMPLIFIER

This module consists of three compartments: a mixer, an intermediate amplifier #1, and a driver amplifier #2. No tuning adjustments are needed or provided.

Mixer: This section consist of a balanced mixer being driven from the LO injection input via the 180° balun and an I.F. signal input via a low pass filter. A microwave short is formed by a capacitor. The heterodyned product is coupled out of the diodes by a printed Wilkinson hybrid. This hybrid will substantially reduce the LO injection signal at the output due to its out of phase cancellation. A low noise, 50 ohm hybrid amplifier is biased by a resistor. Decoupling of the supply is by a printed decoupling line, two capacitors, and a resistor.

Intermediate Amplifier #1: This amplifier consists of two identical bi-polar transistor amplifiers in cascade. A transistor base bias via two resistors is derived from a common collector resistor. As current attempts to rise above the nominal 14 mA, voltage to the base circuit is reduced, thus causing a stabilizing feedback. Base decoupling is provided by a printed decoupling line, two capacitors and a resistor. Collector decoupling is accomplished by a printed line, two capacitors and a resistor.

Drive Amplifier #2: This amplifier consists of two similar FET transistor amplifier stages in cascade. From a common module feedthrough filter, +10 V_{DC} is supplied to each transistor's drain circuit via a drain printed decoupling line and two capacitors. From a common -12 volt feedthrough, negative gate voltage is divided down and calibrated by two resistor networks. The potentiometers set the drain current of each device.



NOTES: UNLESS OTHERWISE SPECIFIED

1. WR1 IS A CALCULATED LENGTH OF COAX CABLE.
2. ALL RESISTORS ARE 1/4W.
3. THE NUMBERS IN THE PARENTHESES ARE CONNECTOR PIN NUMBERS.

REV	DATE/NAME	DESCRIPTION	ECO No.
N	3-5-96 DS	CHG R10 FROM 130 TO 140 OHM.	96-076
M	12-08-95 DS	CHG VALUE OF C1,C4,C7,C9,C18,C21,C28 TO 47pF CHG VALUE OF C5,C6,C11,C14,C16,C19,C22,C25,C27 FROM 100pF TO 1000pF. CHANGED R5 AND R10 TO 130 OHM	95-390
K	3-31-95 DJP	REMOVED '9' 10 uF DECOUPLING CAPS.	95-125

SCALE: TOLERANCE UNLESS NOTED FRAC.? DEC.? ANG.?

COMMUNICATION MICROWAVE CORP
CRESTWOOD INDUSTRIAL PARK
MOUNTAINTOP, PA., 18707

TITLE: SCHEMATIC, DRIVER MODULE

DRAWN	4-22-94	A.BRAGALONE	DWG. NO. B-04-056-01
CHECKED	3-5-96	A.BRAGALONE	SHEET 1 OF 1
ELEC. ENGR. RELEASE			NEXT ASSY.
PRELIMINARY RELEASE			
RELEASE TO PRODUCTION	3-5-96	A.BRAGALONE	REV. N

Mixer/Driver Specifications:

Power Supply Requirements	+10 V @ 1.1 Amp -12 V @ 12 mA
Device Current	Q-1 - 45 mA Q-2 - 14 mA Q-3 - 14 mA Q-4 - 360 mA Q-5 - 720 mA
Sectional Gain	Mixer -1 dB ± 1 dB Amp #1 22 dB +1, -2 dB Amp #2 24 dB ± 1dB
Center Frequency	MDS 2.15 GHz ITFS/MMDS 2.6 GHz
1 dB Bandwidth	MDS 50 MHz ITFS/MMDS 200 MHz/min.
Input/Output Impedance	50 ohms

BANDPASS FILTER

The bandpass filter is used after both the visual and aural mixers to remove out of band mixing products. The filter is a multi-section bandpass filter. The tuned elements are variable length lines inside each cavity. Coupling between each section consists of fixed apertures which set the bandwidth.

SPECIFICATIONS

Bandwidth (1 dB)	186 MHz
Insertion Loss	1 dB ± 0.5 dB
Center Frequency	2593 MHz

Created by: Kimberly Simeone 5/26/98	***Checked by:***	***Released by:***

**Specifications subject to change without notice*

Document #: 95-01046
REV: P1

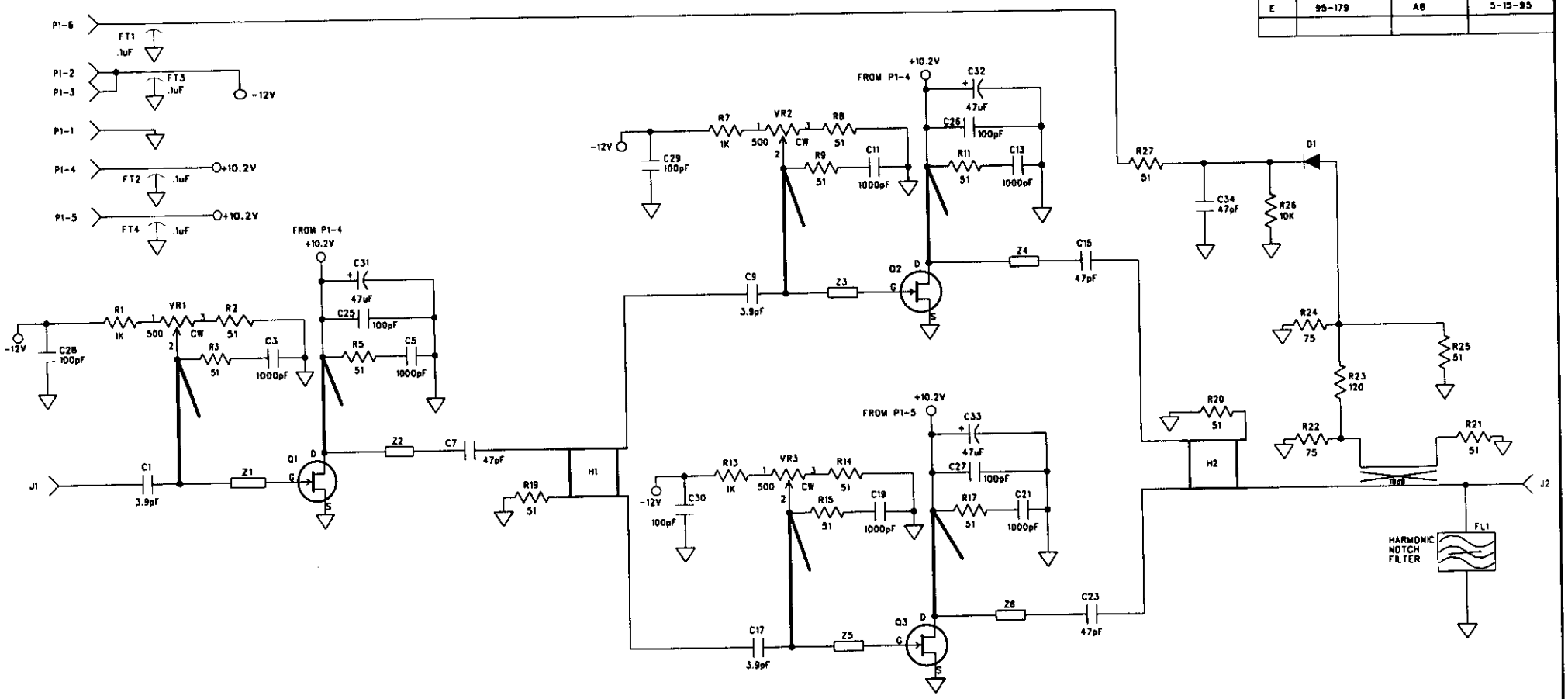
AURAL FINAL AMPLIFIER

The Aural Final Amplifier receives an input signal at J1 from the Aural Driver and the amplified output appears at J2. The amplifier module consists of three identical FET transistors in a one driving two in parallel configuration. Biasing of each transistor is identical, therefore, only one will be discussed.

A housing feed through filter supplies +10 V_{DC} to the drain of the first transistor from a microstrip decoupling line. Negative 12 volts DC gate bias enters the module from a common EMI feed through filter. This voltage is divided down and calibrated by two resistors and a potentiometer. The potentiometer sets the operating drain current of the transistor. A printed decoupling line, consisting of two capacitors and a resistor, decouple the gate bias circuit.

Microstrip hybrids provide signal splitting and combining respectively for the second and third transistors. Aural power sampling is built into the output circuitry for aural metering. The sampling circuit consists of a printed directional coupler, a termination, a rectifier, and a capacitor. The sample is converted to a DC voltage and is used for transmitter aural output metering. No tuning adjustments are needed or provided.

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:
D	95-022	AB	1-23-95
E	95-179	AB	5-15-95



NOTES: UNLESS OTHERWISE SPECIFIED

H1 & H2 ARE PRINTED HYBRIDS.

FL1 IS PRINTED MICROSTRIP LINE.

ALL RESISTORS ARE 1/8W.

COMMUNICATION MICROWAVE CORP.
CRESTWOOD INDUSTRIAL PARK
MOUNTAINTOP PA. 18707

TITLE:
SCHEMATIC, AURAL FINAL SB050B

DRAWN: A.BRAGALONE	DATED: 11-8-94	DRAWING NO: B-04-249-01
CHECKED:		SHEET: OF
ELEC. ENGR:		SCALE:
RELEASED:		REV: E

SPECIFICATIONS

Power Supply Requirements	+10 V_{DC} @ 6.6 Amp -12 V_{DC} @ 20 mA
Drain Current	Q-1 - 2.2 Amp Q-2 - 2.2 Amp Q-3 - 2.2 Amp
Module Gain	16 dB $\pm$ 1 dB
Center Frequency	ITFS/MMDS -2.6 GHz MDS -2.15 GHz
1 dB Bandwidth	ITFS/MMDS -200 MHz/min MDS -50 MHz
Minimum Output Power	+ 41 dBmW
Input/Output Impedance	50 ohm

PRE-FINAL AMPLIFIER

The Pre-Final amplifier module receives an input signal at J1 and provides an amplified output to J2 and J3. The amplifier module consists of one FET device. A signal is amplified and split by printed hybrid, H1, providing equal signal levels to outputs J2 and J3.

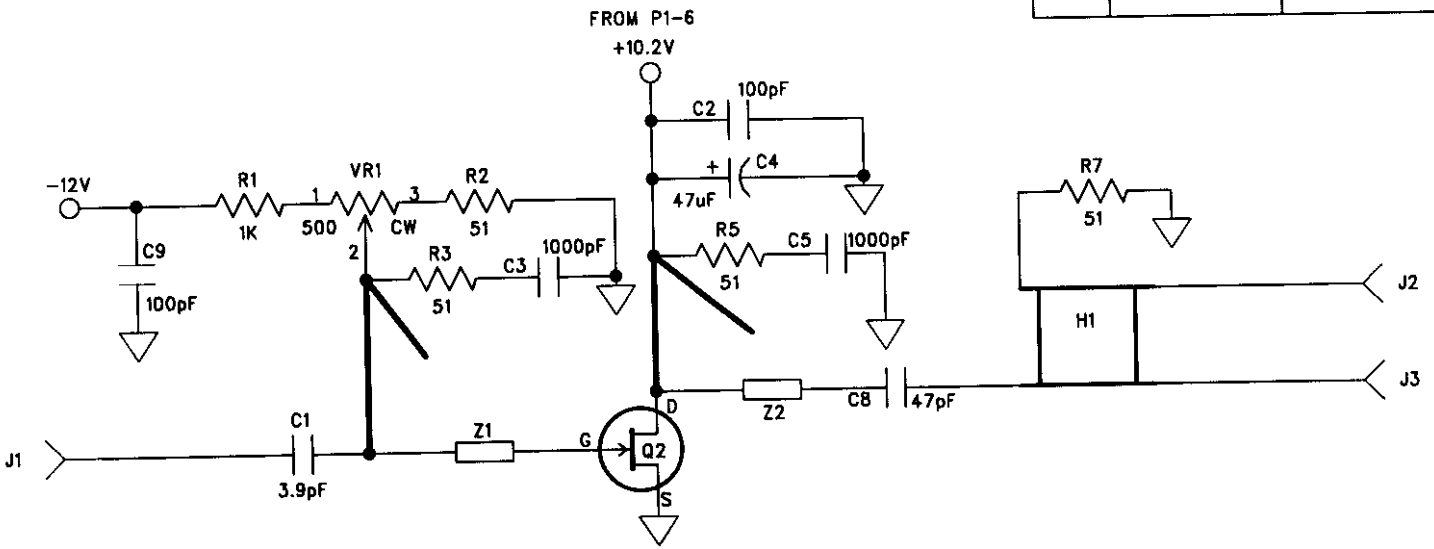
Plus ten V_{DC} is supplied to the drain through an EMI feed through filter. A printed decoupling line decouples the drain circuit. Negative 12 volts DC gate bias enters the module through a common EMI feed through filter. This voltage is divided and calibrated by three resistors and a potentiometer. The potentiometer sets the operating drain current. A printed decoupling line decouples the gate circuit. No tuning adjustments are needed or provided.

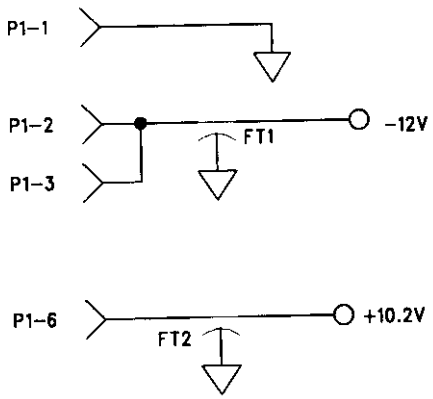
REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:
B	95-022	A.BRAGALONE	1-23-95

NOTES: UNLESS OTHERWISE SPECIFIED

H1 IS PRINTED HYBRID.

ALL RESISTORS ARE 1/8W.





COMMUNICATION MICROWAVE CORP.
CRESTWOOD INDUSTRIAL PARK
MOUNTAINTOP PA. 18707

TITLE:

SCHEMATIC,PRE-FINAL AMP SB050B

DRAWN: A.BRAGALONE	DATED: 11-8-94	DRAWING NO: A-04-250-01
CHECKED:		
ELEC. ENGR:		SHEET: OF
RELEASED:		SCALE: REV: B

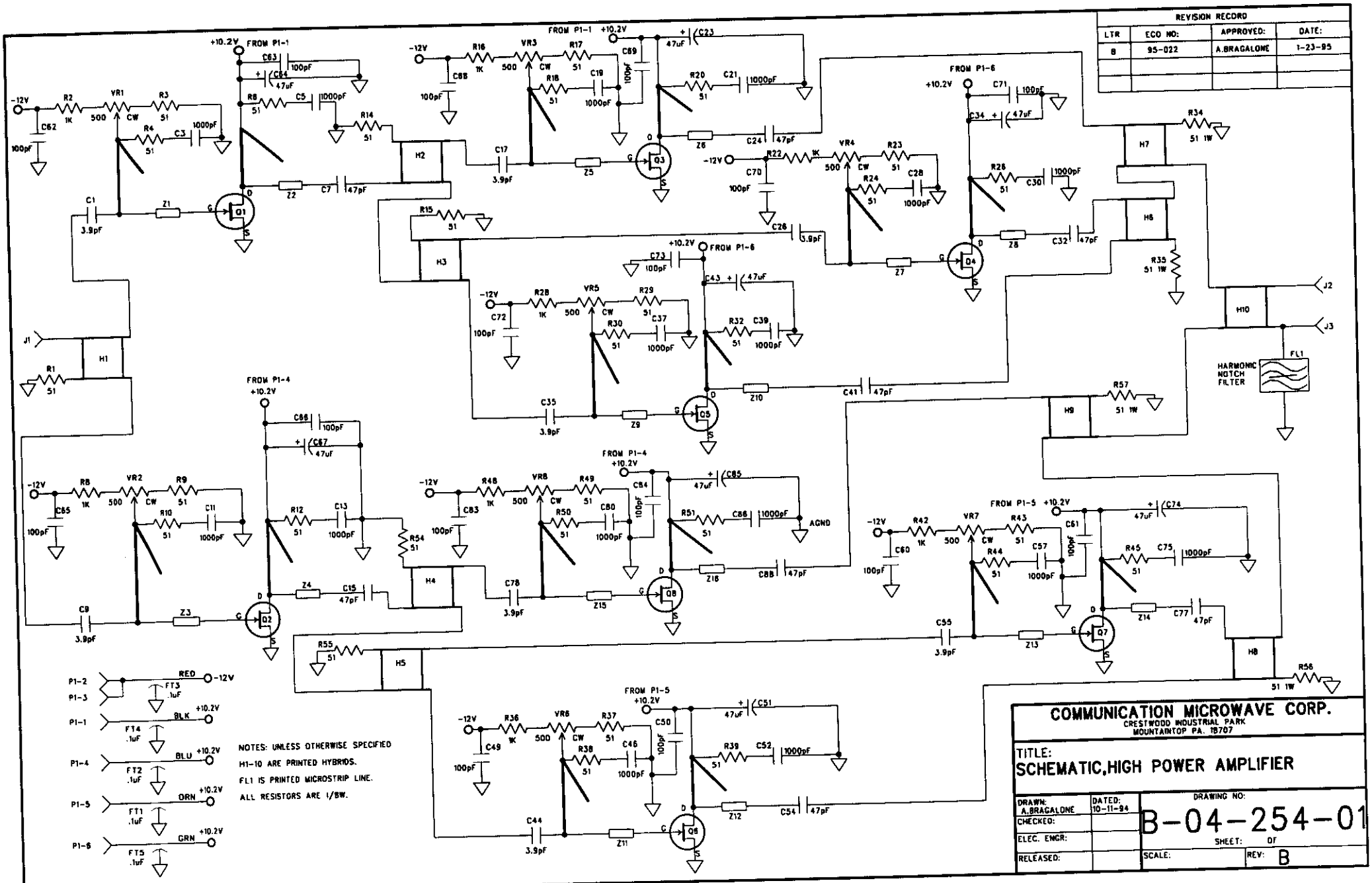
SPECIFICATIONS:

Power Supply Requirements	+10 V_{DC} @ 2.2 Amperes -12 V_{DC} @ 7.5 mA
Drain Current	Q1 2.2 Amperes
Module Gain	5.5 dB ± 1 dB
Center Frequency	ITFS/MMDS -2.6 GHz
1 dB Bandwidth	200 MHz
Minimum Output Power	+ 22 dBm
Input/Output Impedance	50 ohm

VISUAL FINAL AMPLIFIER A/B

The Visual Final Amplifier module receives an input signal at J1 and provides an amplified output at J3. The amplifier module consists of eight FET amplifier transistors operating in a two driving six parallel configuration, a printed input hybrid, H1, splits the input signal to two input FET transistors. These signals are further divided by hybrids H2, H3, H4, and H5) to drive the six transistors equally. Output hybrids (H6, H7, H8, H9 and H10) recombine the amplified signals to a common output.

Biasing of each FET is identical, therefore, only one transistor is discussed. Plus ten V_{DC} is supplied to the drain circuit through an EMI feed through filter. A printed decoupling line and a resistor decouple the drain circuit. Negative 12 volts DC gate bias enters the module through a common EMI feed through filter. This voltage is divided and calibrated by three resistors and a potentiometer. A potentiometer sets the operating drain current. A printed decoupling line and a resistor decouple the gate circuit. No tuning adjustments are needed or provided.


REVISION RECORD
LTR | ECO NO: | APPROVED: | DATE:
B | 95-022 | A.BRAGALONE | 1-23-95
NOTES: UNLESS OTHERWISE SPECIFIED
H1-10 ARE PRINTED HYBRIDS.
FL1 IS PRINTED MICROSTRIP LINE.
ALL RESISTORS ARE 1/8W.
COMMUNICATION MICROWAVE CORP.
CRESTWOOD INDUSTRIAL PARK
MOUNTAINTOP PA. 18707
TITLE:
SCHEMATIC,HIGH POWER AMPLIFIER
DRAWN: A.BRAGALONE
DATED: 10-11-94
CHECKED:
ELEC. ENGR:
RELEASED:
DRAWING NO:
B-04-254-01
SHEET: OF
SCALE:
REV: B
HARMONIC NOTCH FILTER
AGND

SPECIFICATIONS

Power Supply Requirements	+10 V_{DC} @ 17.6 Amp -12 V_{DC} @ 52.5 mA
Drain Current	Q1 to Q8 -2.2 Amp each
Module Gain	17 dB ± 1 dB
Center Frequency	ITFS/MMDS -2.6 GHz
1 dB Bandwidth	200 MHz
Minimum Output Power	+ 43 dBm
Input/Output Impedance	50 ohms

MOTHERBOARD

The Mother Board performs a variety of functions allowing operation for both analog and digital applications. Located on the underside of the transmitter, it provides the majority of the interconnections among other circuit boards and modules. The board contains linear power supplies, current sampling resistors, metering adjustments, one +12 volt power supply fuse, and three +11 volt power supply fuses.

Jumper configurations: The motherboard is factory set with all jumpers positioned in accordance to the system architecture. Changing these jumpers is only necessary if upgrading to/from digital transmission. In the case of Common Amplification, configure as a digital transmitter. The following will help in choosing the proper settings.

Note: If a two position jumper is to be opened, attach the plastic jumper cap to one of the pins so you will not lose it.

- Jumper JK1: (3-pin jumper) Allows for operation with an Aural Final amplifier in analog applications providing the signal path for the power detector, and in the case of digital completes the logic path for the IF Detector module.

Setting	Description
1 & 2	Aural Final
2 & 3	IF Detector

- Jumper JK2: (3-pin jumper) This jumper provides +11 volt power to the aural driver module, or +12 volt power to the IF Equalizer for use in a digital transmitter.

Setting	Description
1 & 2	Aural Driver
2 & 3	Dig, IF. EQ.

- Jumper JK3: (2-pin jumper) Remains shorted in analog and digital applications. However, in a digital repeater system removing the jumper allows for the AGC voltage of the receiver to be monitored.

Settings	Description
shorted	Analog & Digital TX.
Open	Digital Repeater

- Jumper JK4: (3-pin jumper) This high current jumper provides +11 volt power to the Aural final in analog applications and +12 volt power to the IF Detector module in digital operation.

Settings	Description
1 & 2	Aur. Final Pwr.
2 & 3	IF Det. Pwr.

Interconnections: Power and logic signals are routed to/from various module or circuit card assemblies via the motherboard and main harness. Consult the interconnection diagram for guidance. The Synthesizer, IF Processor, and amplifier modules plug directly into this board for DC supply and monitoring.

Linear Power Supplies: -12, + 12, and +5 volt linear power supplies are located on this printed circuit board. These DC power supplies provide power to operational amplifiers, comparitors, gating circuits, and other modules.

- The negative 12 volt circuit consists of a center tapped full wave rectifier, filtering capacitors, and an adjustable regulator. The voltage can be calibrated adjusting VR5 on the board, while monitoring TP1. Short circuit protection is provided internal to the regulator.

Note: This adjustment should only be done in operation mode, due to FET gate pinch off during transmitter turn on. While in a standby or reset condition the negative supply will read approximately -15 vdc. When rotated from standby a small time delay will occur before returning to - 12 volts.

- The positive 12 volt circuit consists of a center tapped full wave rectifier, filtering capacitors, fixed 12 volt regulator and a current boost transistor. The current boost transistor, when conducting, provides a parallel path for added current to the 1.5 amp. regulator. A fuse (F4) is provided on the motherboard for short circuit protection. A voltage test point (TP2) is provided for monitoring.

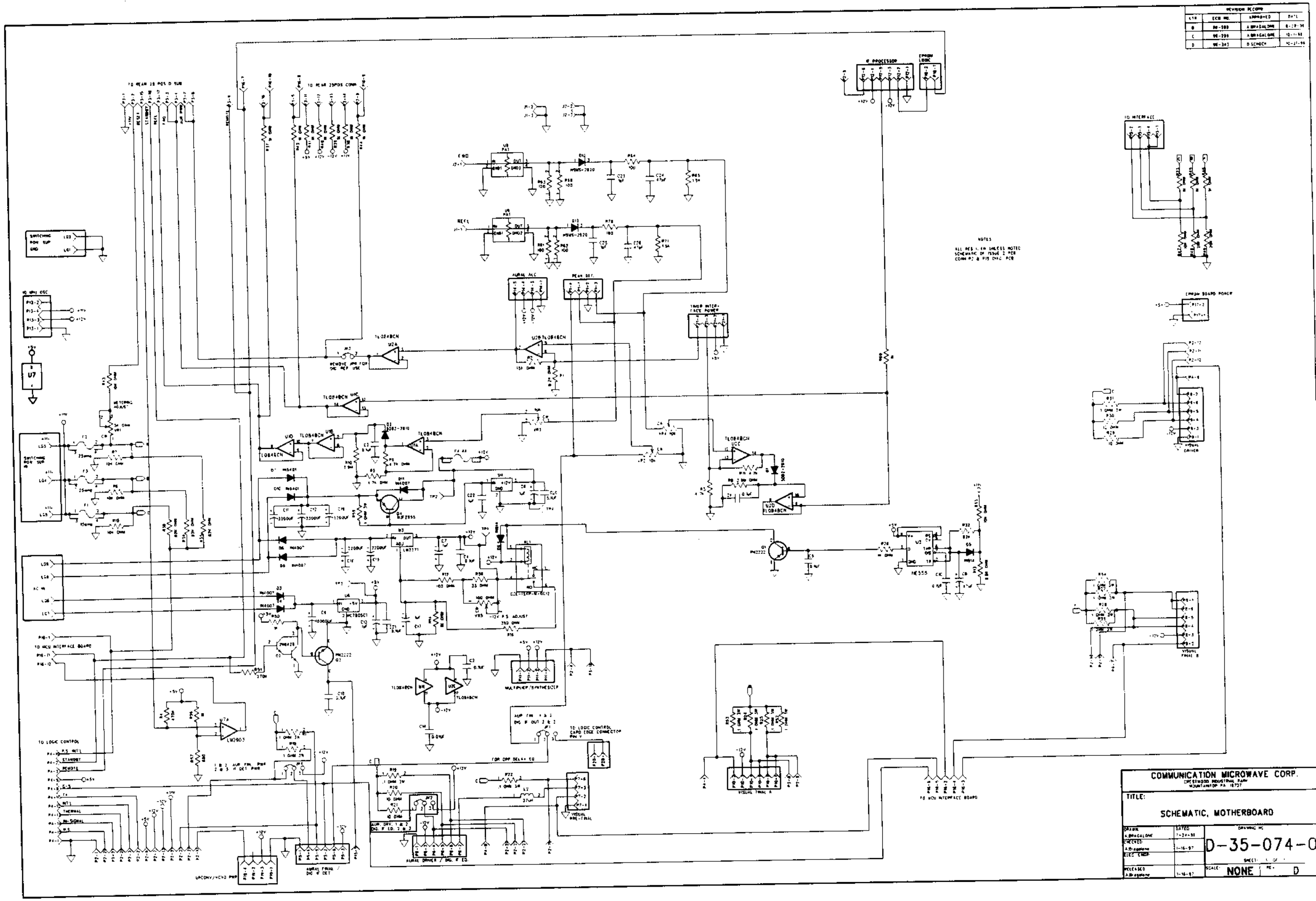
- The positive 5 volt circuit consists of a full wave rectifier, filtering capacitor, and a fixed 5 volt regulator. Short circuit protection is provided internal to the regulator. A voltage test point (TP3) is provided for monitoring.

Sampling Resistors: The +11 volt switching power supply connects to screw terminals 3, 4, & 5 to distribute power to the driver, prefinal, and final A/B amplifier modules. Power is distributed through series current sample resistors. These resistors develop voltage drops proportional to the supplied drain current. Samples are routed to the diagnostics board for processing.

+11 Volt Power Supply Fusing: The motherboard contains three fuses that protect the switching power supply. F1 (15 Amperes) provides power to the driver and prefinal.

F2 (25 Amperes) provides power to final amplifier B and F3 (25 Amperes) to final amplifier A.

Metering Calibration: The front panel analog meter or LCD display is calibrated by trim potentiometers located on the motherboard. These adjustments calibrate the +11 V_{DC} switching power supply (VR1), Aural (VR2) when applicable, Reflected (VR3), and Forward (VR4). These potentiometers are accessible when the transmitter's cover is removed. Consult the Calibration section of the manual for detailed procedure.


COMMUNICATION MICROWAVE CORP.
TITLE:
SCHEMATIC, MOTHERBOARD
D-35-074-0
SCALE NONE
REV D
NOTES
ALL RES 1/4 W UNLESS NOTED
U7
TO REAR 25 POS D SUB
TO REAR 25POS CONN
TO LOGIC CONTROL
TO MCU INTERFACE BOARD
SWITCHING PWR SUP
AC IN
NE555
PN2222
LM2903
VISUAL FINAL A
VISUAL FINAL B
VISUAL DRIVER
AURAL DRIVER / DIG. & EQ.
MULTIPLIER/SYNTHESIZER
UPCONV/VCXO PWR
EPROM BOARD POWER
TO INTERFACE

POWER SUPPLIES

There are four power supplies within the transmitter chassis: +12 V_{DC}, +5 V_{DC}, and -12 V_{DC} linear power supplies as well as a +11 V_{DC} switching power supply.

+ 12 V_{DC} Power Supply: Transformer T-1, located on the chassis underside, is a 28 volt center taped transformer which supplies power to the linear power supply located on the mother board. Full wave rectifiers supply voltage to two filter capacitors and a series regulator. The +12 volt non-adjustable regulator is short circuit proof and internally thermal protected. This +12 V_{DC} power supply powers the crystal oscillator and microwave multiplier when used or the microwave phase locked oscillator as well as all operation amplifiers.

+5 V_{DC} Power Supply: Transformer, T-2, also located on the chassis underside, is a 12 volt center taped transformer which supplies power to the mother board +5 volt power supply. Two diodes supply unregulated voltage to a capacitor and the fixed voltage regulator. This supply powers all the +5 volt needs for the TTL -logic and synthesis.

-12 V_{DC} Power Supply: In addition, transformer, T-1, also supplies voltage to two rectifiers. Capacitors filter the input to the non-adjustable voltage regulator. This IC is internally current and temperature protected. The voltage regulator supplies power to all FET amplifier gate circuits and all operational amplifiers located in the RF power detectors and IF processor.

+11 V_{DC} Switching Power Supply: This is the largest of the power supplies and is capable of 45 amperes. It powers the RF driver amplifiers, final amplifiers, sections of the diagnostic interface board, and the 10 MHz reference oscillator oven.

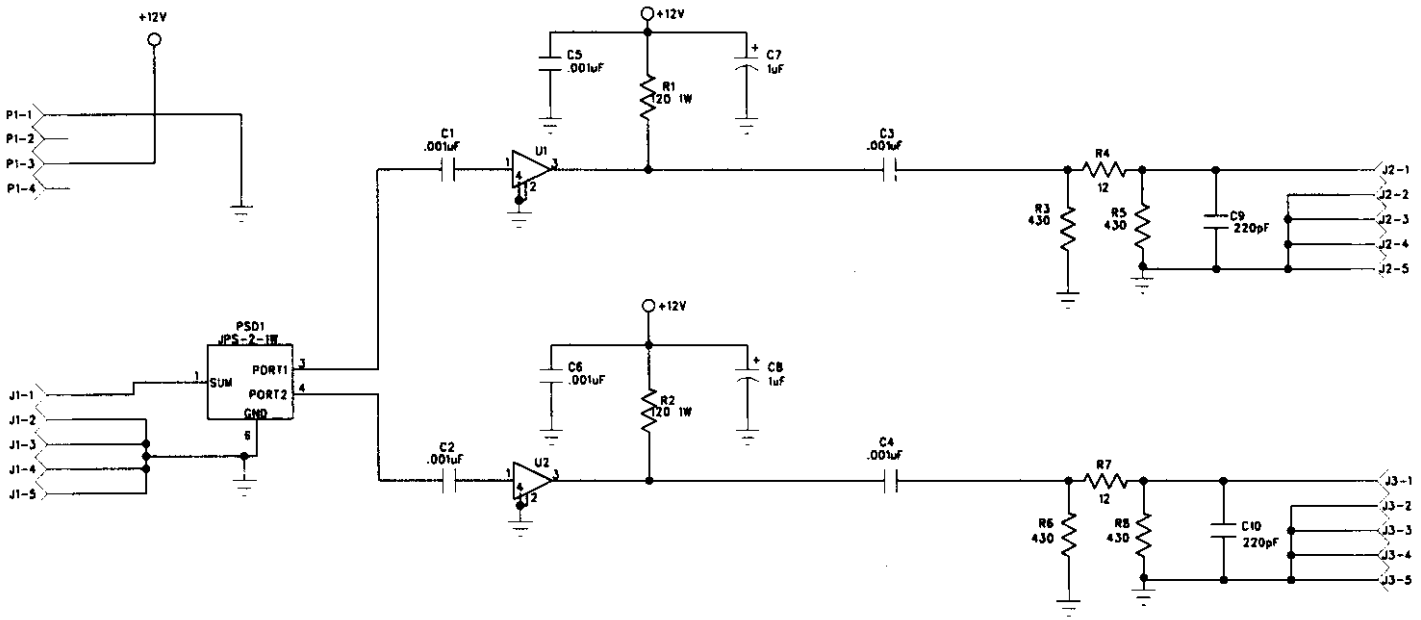
10 MHz DISTRIBUTION BOARD

A 10 MHz two way distribution board receives a 10 MHz reference input signal that is split equally using a 2 port passive divider. Each output signal is amplified providing a common 10 MHz reference signal to the Microwave Synthesized Local Oscillator and the UHF Upconverter.

External Reference:

An external 10 MHz reference source with a distribution amplifier/splitter system provides the 10 MHz distribution board with the 10 MHz reference. The external reference source can be obtained from a precision 10 MHz drawer, LORAN C, or Global Positioning System (GPS). The 10 MHz signal is cabled to each individual transmitter providing a common reference.

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:
B	95-377	A.BRAGALONE	11-29-95



COMMUNICATION MICROWAVE CORP.
CRESTWOOD INDUSTRIAL PARK
MOUNTAINTOP PA. 18707

TITLE: 10 MHz 2-WAY DISTRIBUTION BOARD

DRAWN: O.PAJSKI	DATED: 10-18-95	DRAWING NO: B-33-317-01
CHECKED:		SHEET: 1 OF 1
ELEC. ENGR:		SCALE: NONE REV: B
RELEASED:		

SIGNAL DISTRIBUTION BOARD

The Signal Distribution Board receives and distributes various interlock and turn on signals that control transmit operation. The board contains 3 LEDs and a switch. Under normal operating conditions all LEDs illuminate.

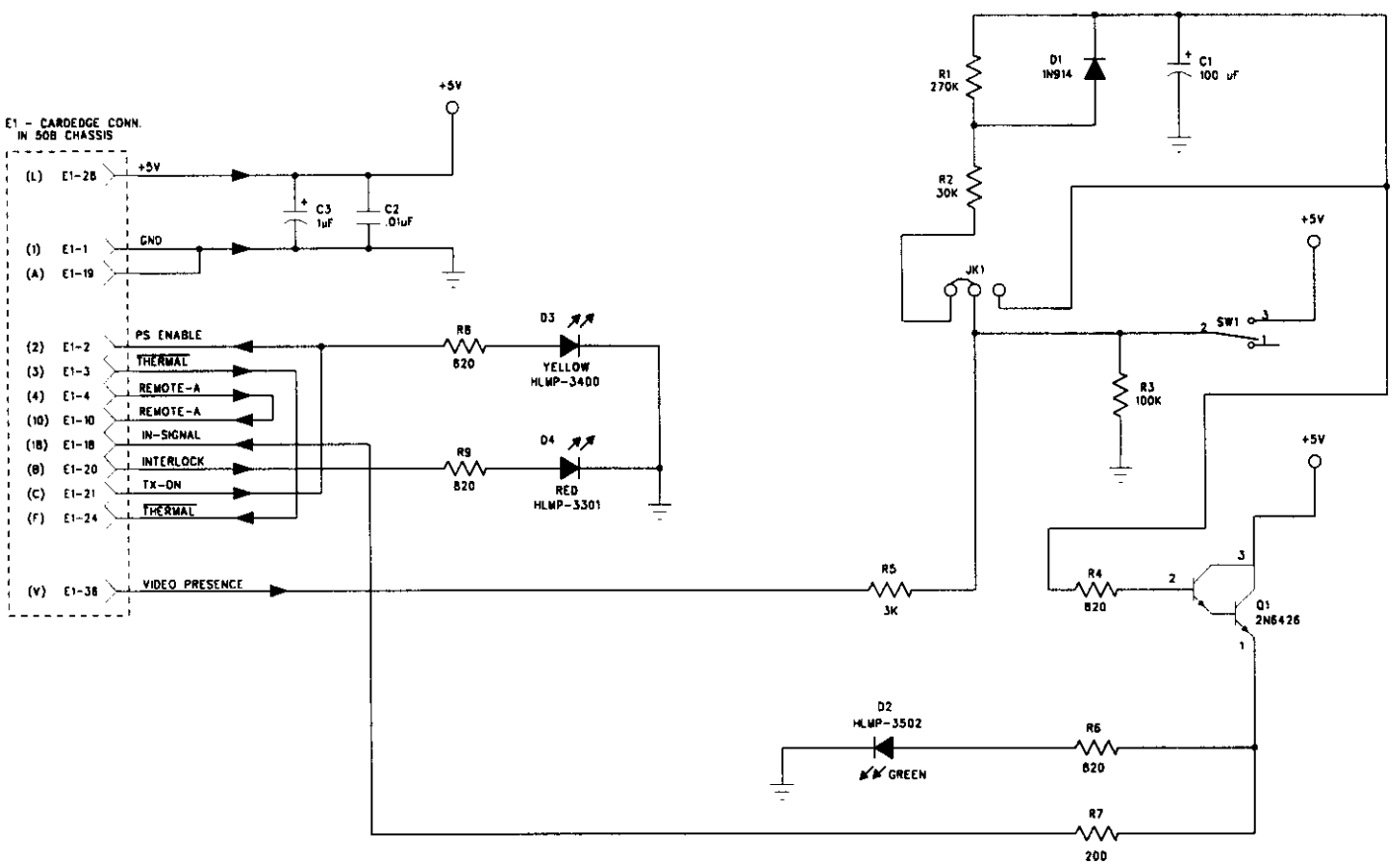
DS2	green:	Video input signal is present.
DS3	yellow:	Power supply enable present.
DS4	red:	Interlock conditions present.

Switch, SW1, is a video bypass enable switch. It provides +5 V_{DC} to bias Q1 on, thereby enabling DS2. The normal position for the switch is OFF. When the switch is OFF, an external input video presence signal must be supplied to turn the transmitter ON. This signal typically originates from a video presence board contained inside the modulator. When this switch is positioned ON, this places the transmitter into
BYPASS mode or in a constant ON condition. This enables the transmitter to continue transmitting even though there is no video signal present.

The following chart cross references these input/output signals.

SIGNAL	*INPUT*	*OUTPUT*	*ORIGIN/DESTINATION*
PS Enable		X	Switching Power Supply
Thermal	X		Thermal Relay
Remote A	X		External connector J1-2
PS Interlock	X		Motherboard P4-10
Remote A		X	Motherboard P4-15
IN-Signal		X	Motherboard P4-14
Interlock	X		Motherboard P4-12
TX-ON	X		Motherboard P4-11
Stand-by	X	X	Motherboard P4-2
Thermal		X	Motherboard P4-13
+5 V_{DC}	X		Motherboard P4-5
Gate 5	X		Motherboard P4-9
Gate 4	X		Motherboard P4-8
Gate 3	X		Motherboard P4-7
Gate 2	X		Motherboard P4-6
Gate 1	X		Motherboard P4-4
Remote B	X		Motherboard P4-3
Video Presence	X		External Connector J1-1

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:
B	96-023	D.PAJSKI	1-25-96
C	96-023	D.PAJSKI	1-25-96



SCHEMATIC OF ISSUE 2 PCB

COMMUNICATION MICROWAVE CORP.
CRESTWOOD INDUSTRIAL PARK
MOUNTAINTOP PA. 18707

TITLE:
SCHEMATIC, SIGNAL DISTRIBUTION BRD, SB050B COMVIEW SYSTEM

DRAWN: K.HARDING	DATED: 10-04-95	DRAWING NO: B-33-312-01
CHECKED:		SHEET: 1 OF 1
ELEC. ENGR:		
RELEASED:		SCALE: REV: C

MICROCONTROLLER INTERFACE BOARD

The optional Microcontroller interface board is a second generation diagnostic and control interface function. It, along with the GCB-11, provides full diagnostics and control, along with network communications capabilities required to support the ComView monitoring system.

The Microcontroller Interface Board controls the front panel LED or LCD display, MUX addressing, and interlock, transmit functions through octal latches. The MCU receives various input signals, scales these inputs, and forwards them over a multiplex buss to the Microcontroller unit (MCU, GCB11) for processing. The scaling amplifiers receive current converted voltage samples from amplifier modules, amplifying them by appropriate factors for common working levels. Scaled outputs are sent to 16 channel analog multiplexers. The multiplexers receive addressing information from the Microcontroller through a hex level translator. The multiplexed output is further scaled (reduced by a voltage divider network and is sent to the Microcontroller for processing).

The following chart cross references the signal, scaling amp, and multiplex output.

INPUT SIGNAL	*SCALING AMP*	*MULTIPLEX OUTPUT*
Final A (Q2, 6, 7)	U1D	MUXBUS1 11
Final A (Q1, 3, 4, 5)	U2A	MUXBUS1 12
Final B (Q2, 6, 7)	U3A	MUXBUS1 14
Final B (Q1, 3, 4, 5)	U3C	MUXBUS1 13
Driver #1 (Q2, 3)	U2C	MUXBUS1 08
Driver #2 (Q4, 5)	U2D	MUXBUS1 07
Mixer (Q1)	U2B	MUXBUS1 09
PreFinal (Q2)	U3D	MUXBUS2 03
LO Locked	U1A	MUXBUS1 05
ALC IN	U1B	MUXBUS1 10
+12 V_{DC}	U1C	MUXBUS2 04
-12 V_{DC}	U3B	MUXBUS2 08
+11 V_{DC}	U4B	MUXBUS2 02
Thermal	U5D	MUXBUS2 01
IN SIGNAL	U5C	MUXBUS2 00
PS INTERLOCK	U17A	MUXBUS1 06
Gate 1	U17B	MUXBUS2 09
Gate 2	U17C	MUXBUS2 10
Gate 3	U17D	MUXBUS2 11
Gate 4	U18A	MUXBUS2 12
Gate 5	U18B	MUXBUS2 13
Forward Power	U18C	MUXBUS2 07
N/A	U18D	MUXBUS2 06
REFL Power	U19A	MUXBUS2 05

Created by: Kimberly Simeone 5/26/98	*Checked by:*	*Released by:*

RS-485 COMMUNICATIONS BOARD

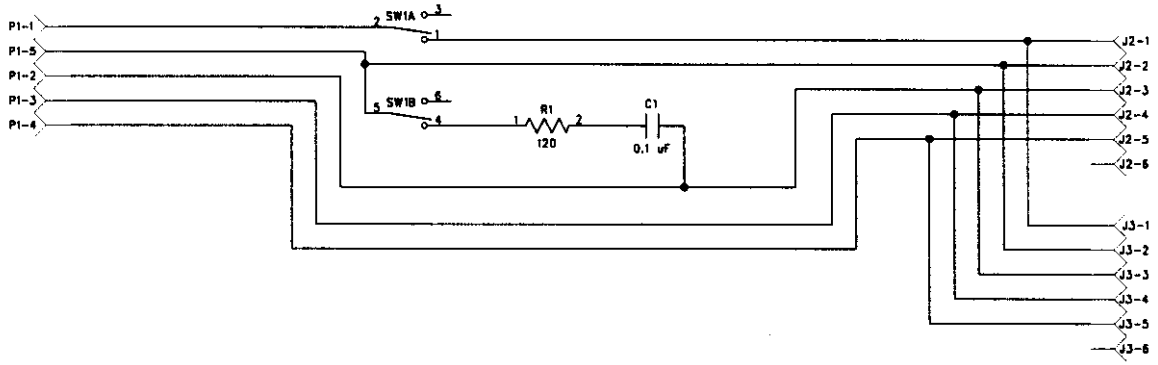
An RS-485 communications board is mounted to the inside rear of the chassis. The communications board has two functions. It receives and forwards Driver information for use with an Agile Controller and interfaces each transmitter's Microcontroller Unit (MCU) to a communication buss for status monitoring to a common computer/Master Control Station. The system is capable of monitoring up to 32 individual transmitters.

The board has two 5 pin board mounted connectors, J1 and J4, with connections to three rear panel mounted 6 pin telephone type receptacles J9, J10, and J11. J1 functions as the interface between the transmitter's MCU, the daisy chain communication buss, and a computer monitoring system connected to J9 and J10. The buss consists of a double twisted shielded pair cable which daisy-chain links (parallels) transmitters to a common computer for complete system status monitoring.

A board mounted mini DPDT DIP switch labeled as NETWORK END TERMINATION is accessible at the rear of the chassis. When a status monitoring computer system is used, all transmitter ordinarily have this switch set to the "OUT" position with the exception of the last transmitter in the daisy chain series. The last transmitter normally has the switch set to "TERM". This action terminates the communication buss at the last transmitter of the daisy link chain establishing proper buss impedance.

J4 provides a feed through path to receptacle J11. Driver information (GND, TURN-OFF, INSIGNAL, ALC, and PWR) is available for use with an optional Agile Controller.

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:



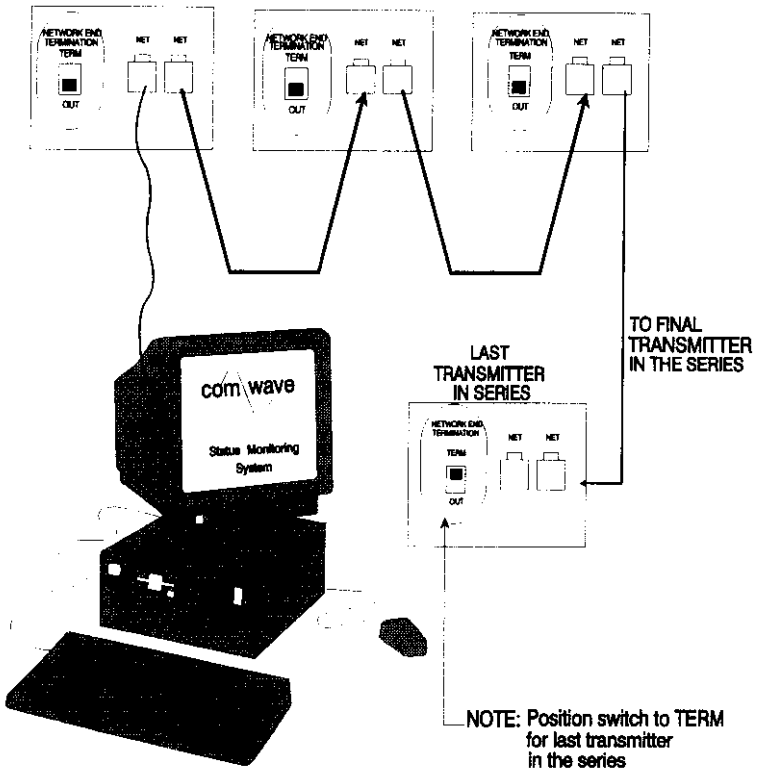
NOTES:

1. DPDT SWITCH SW1 IS CLOSED ONLY AT LAST UNIT IN NETWORK TO TERMINATE PC TX NET & PROVIDE FRAME GND.

2. SCHEMATIC OF ISSUE 1 PC BOARD.

COMMUNICATION MICROWAVE CORP. CRESTWOOD INDUSTRIAL PARK MOUNTAINTOP PA. 18707		
TITLE: RS-485 COMMUNICATIONS INTERFACE, SB050B PS CHASSIS		
DRAWN: D. PAJSKI	DATED: 6-20-95	DRAWING NO: B-33-304-01
CHECKED:		SHEET: OF 1
ELEC. ENGR:		SCALE: REV: A
RELEASED:		

COMVIEW STATUS MONITORING INTERCONNECTION



IBM COMPATIBLE
WITH RS-485 CARD

METERING

Front panel metering of +11 V_{DC} power supply, forward power, and reflected power are provided by a panel switch and a meter. The meter is a 2 V_{DC} full scale meter.

+11 V_{DC} Power Supply:

Voltage from the switching power supply is metered from the mother board via a resistor and a calibration potentiometer. The meter will read 100% for normal operation.

Forward Power:

A sample of the RF power from the output -20 dB directional coupler and 3 dB attenuator is envelope detected by a diode and a capacitor in the detector module assembly located on the top rear side of the chassis. The video and DC component from this assembly is delivered to a connector on the mother board. A buffer amplifier drives a diode and a capacitor to the peak value of the signal. Another buffer amplifier then buffers this voltage to a meter calibration potentiometer. This voltage is approximately 1.4 V_{DC} for a 100% meter reading and is present at the first buffer amplifier and at a connector for delivery to the front panel meter rotary switch. In addition, the output voltage from the second buffer amplifier is delivered to the visual IF processor.

Reflected Power:

A sample of the reflected power from the -20 dB port of the output directional coupler via a 3 dB attenuator is envelope detected by a diode and a capacitor in the detector module assembly. This voltage is applied to the motherboard. On the motherboard, a buffer amplifier drives the diode and capacitor to the peak of the reflected signal. Another amplifier buffers the resulting voltage to a meter calibration potentiometer. A third amplifier buffers the adjusted voltage which is output to the meter rotary switch.

The forward power and reflected power metering voltages are also output through a current limiting resistor to the rear panel connector for external diagnostic monitoring, as in a COMWAVE Agile Transmitter System.

DIAGNOSTIC LED DISPLAY

The Diagnostic Display consists of three green and seven red LEDs which provide a status of various parameters. LED drive signals are received from the Diagnostic Interface Board. All green LEDs (In Signal, Interlock, and Transmit) continuously illuminate verifying normal operation. Absence of a green LED indicates a missing signal or parameter. The remaining LEDs illuminate red to indicate a fault or a parameter that has deviated beyond a set tolerance.

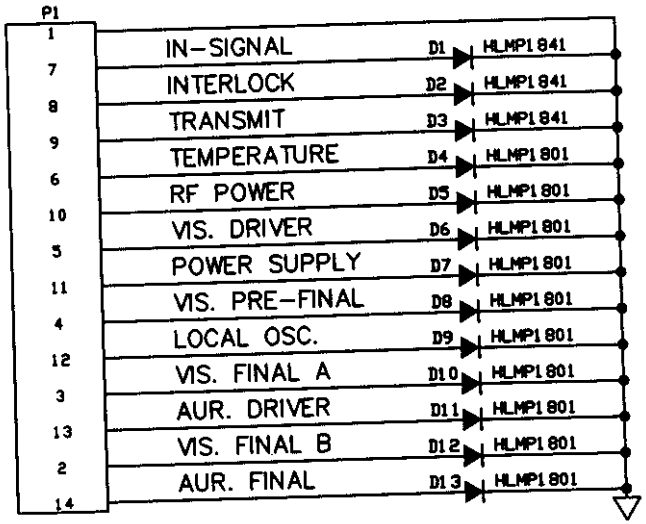
GREEN:

IN SIGNAL	D1
INTERLOCK	D2
TRANSMIT	D3

RED:

TEMPERATURE	D4	RF POWER	D5
DRIVER	D6	PWR SUPPLY	D7
FINAL A	D10	LOCAL OSC	D11
FINAL B	D12		

DWG. NO. 33-118-01



NOTES:
SCHEMATIC OF ISSUE 2 PC BOARD.

REV	DATE	DESCRIPTION	ECO No.
B	12-17-93 KH	ENLARGED PADS ON SOLDERMASK LAYER	93-233

SCALE:

TOLERANCE UNLESS NOTED FRAC.? -DEC.? -ANG.?

COMMUNICATION MICROWAVE CORP
CRESTWOOD INDUSTRIAL PARK
MOUNTAINTOP, PA., 18707

TITLE:
SCHEMATIC, DISPLAY BOARD SB050B

	DATE	NAME
DRAWN	4-25-91	A.BRAGALONE
CHECKED		
MECH. ENGR. RELEASE		
ELEC. ENGR. RELEASE		
RELEASE TO PRODUCTION		

DWG. NO.
A-33-118-01
1 OF 1
NEXT ASSY.
REV. B

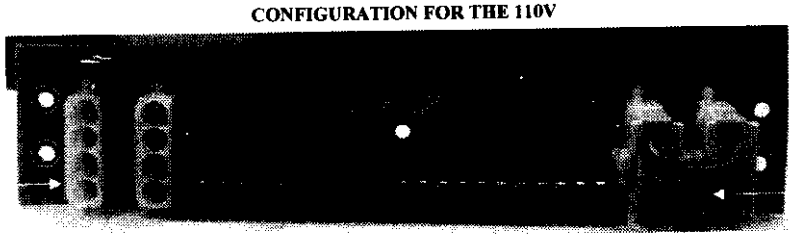
AC CONFIGURATION BOARD

The AC Configuration Board is responsible for configuring the fans, MOVs, and transformer, to accept a 117v or 230v AC signal. This is accomplished via a Molex jumper located on the board.

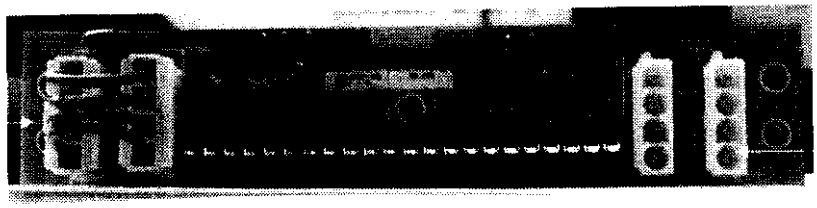
COMWAVE
A Thomcast Company
AC Configuration Board

AC CONFIGURATION BOARD

CONFIGURATION FOR THE 110V



CONFIGURATION FOR THE 220V



Created by: Kimberly Simeone 5/27/98	*Checked by:*	*Released by:*

Document #: HG3-01006
REV: P1

Created by: Kimberly Simeone 5/28/98	*Checked by:*	*Released by:*

Document #: 10-10C03
REV: P1

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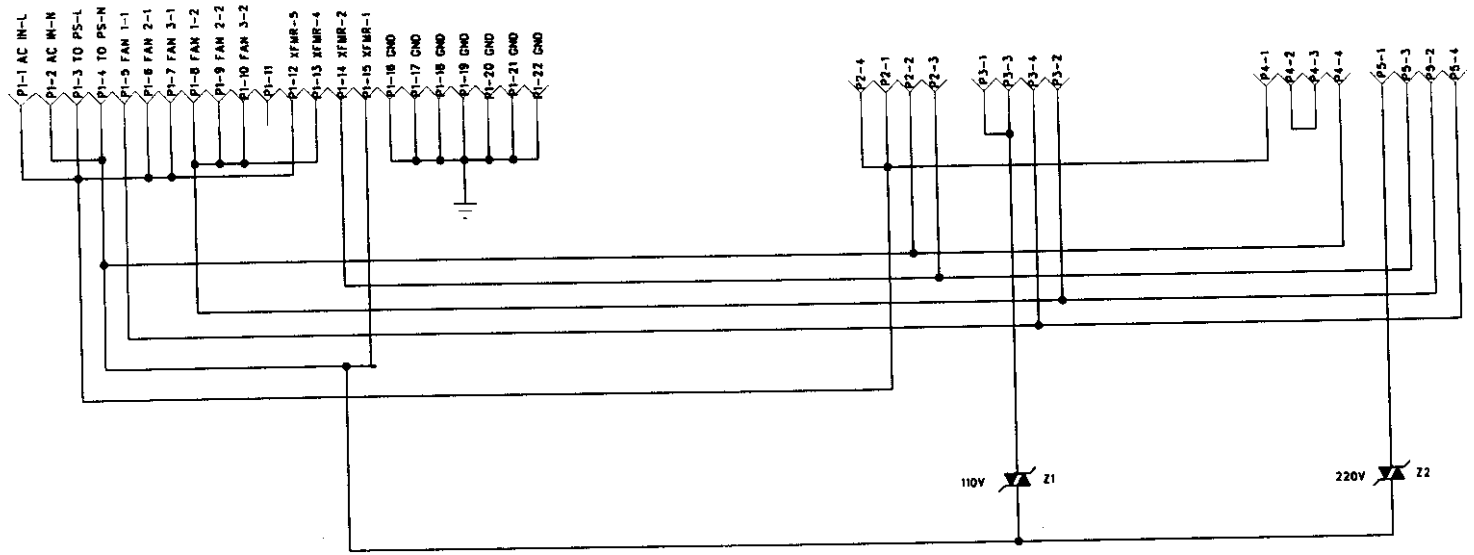
REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:
B	96-348	C.SPARKES	10-9-96
C	96-367	A.BRAGALONE	1017-96



NOTES:

SCHEMATIC OF ISSUE 2 BOARD

INSERT JUMPER INTO P2 & P3 FOR 110v OPERATION

INSERT JUMPER INTO P4 & P5 FOR 220v OPERATION

COMMUNICATION MICROWAVE CORP.
CRESTWOOD INDUSTRIAL PARK
MOUNTAINTOP PA. 18707

TITLE:

SCHEMATIC, AC CONFIGURATION BOARD

DRAWN: C.SPARKES	DATED: 5-13-96	DRAWING NO: B-33-344-01
CHECKED: D.SCHOCK	10-17-96	SHEET: OF
ELEC. ENGR:		SCALE: REV: C
RELEASED: A.BRAGALONE	10-17-96	

INSTALLATION

Unpacking Information

While unpacking, carefully compare packing list with the equipment, checking for in-transit damage at the same time. Should any damage be noted, notify the freight carrier at once to file a freight claim. Do not discard any packing material until told to do so by the carrier. Also, notify Communication Microwave Corp (COMWAVE) of any damages or of missing materials from the shipment.

Retain original boxes and internal packing materials in order to adequately protect equipment to be returned to the factory for repairs, upgrades, or modifications.

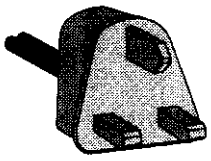
Environmental Considerations

The equipment can be safely operated in ambient temperatures of -30 to +50 degrees Celsius (-22 to +122 degrees Fahrenheit). However, moderate temperatures generally extend equipment life. Although the equipment may be operated with relative humidity of up to 95%, the equipment must be protected from conditions which cause condensation within the equipment.

If a rear door is used to secure the rack cabinet, forced ventilation through the cabinet is required (600 cfm minimum per transmitter is recommended). An air or temperature interlock should be incorporated for protection against interruption of ventilation. The area should be kept dry and clean.

There should be sufficient space in front of the transmitter cabinet for the serviceman and test equipment, plus the full extension of the racked 27" deep chassis. A minimum of 36" behind the cabinet should be free for rear cabinet access and air movement. Also, ample room must be available at the cabinet rear for cable placement.

Safety Considerations

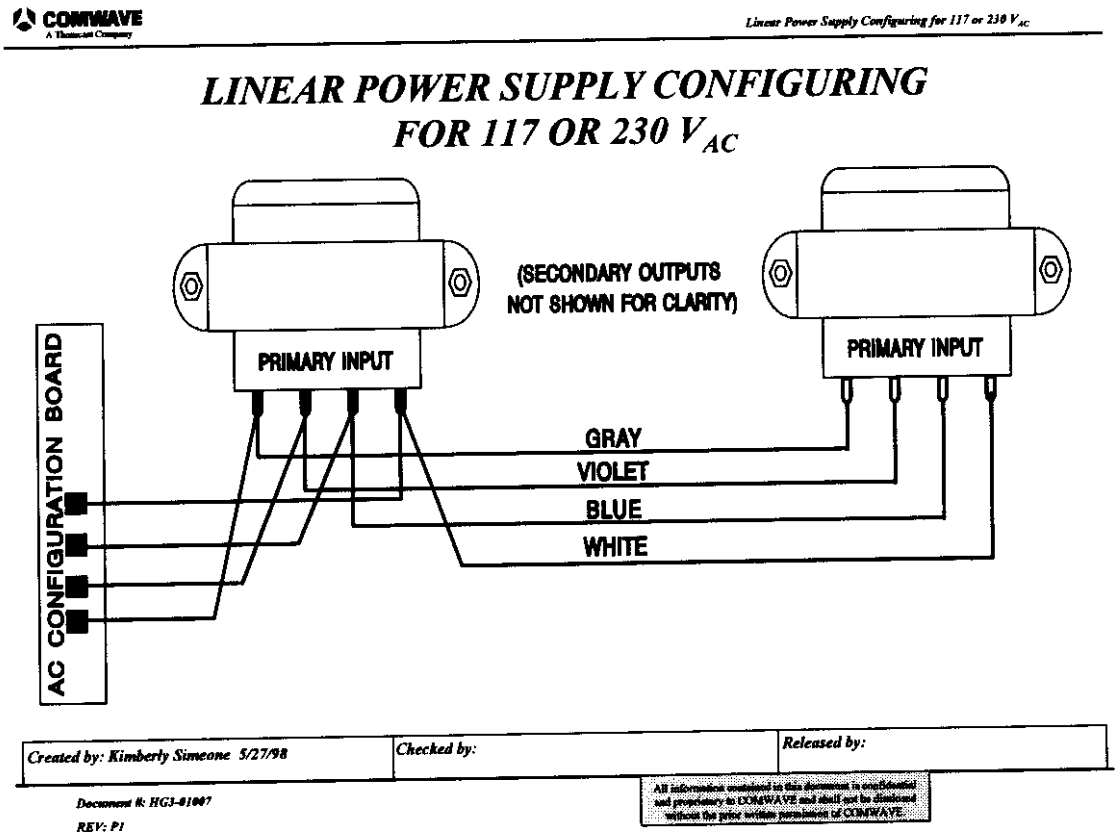


This equipment utilizes a grounding plug on all power cords. For personal safety, do not defeat this safety feature. As with all similar types of equipment, high voltage can be accessed when the chassis cover is removed. Special care should be given in areas of fuses, line switches, and power supplies.

Modern high power solid state equipment contain low output voltage power supplies with very high current capability. To prevent severe burns, avoid contact of rings, watches etc., with these circuits. When servicing the transmission line and antenna, care must be taken to avoid exposure to high energy microwave.

Input Line Voltage Configuring

This transmitter can be configured to operate at 117 to 230 V_{AC}. The transmitter is normally configured by the factory for the user's AC operating line voltage. However, circumstances may develop that dictates using the transmitter at a different input AC line voltage. The following information describes how to reconfigure a transmitter for a different input AC line voltage. Note, this procedure is only applicable to Deltron Switching Power Supplies.



Switching Power Supply

The transmitter is easily converted to accept a 117v or 230v AC signal by changing two jumpers to the desired operating voltage and changing two fuses to the required current rating. To reconfigure the transmitter to a different input line voltage, perform the following:

1. Turn off transmitter's AC power and disconnect the AC line cord from the power receptacle. Locate the switching power supply.

2. Refer to attached figure to reconfigure the main switching power supply jumper. If necessary, remove power supply to gain access. Locate the wire jumper. Using needle-nosed pliers, carefully pull jumper from stud mount labeled either E2 or E3. Move jumper to stud mount corresponding to desired AC line input voltage.

3. Replace switching power supply input line fuse, F1, with an appropriate ampere rating depending upon the input voltage selected. Use an eight-ampere fuse for 117 V_{AC} and a four-ampere fuse for 230 V_{AC}. See Document # HG3-01008, below.

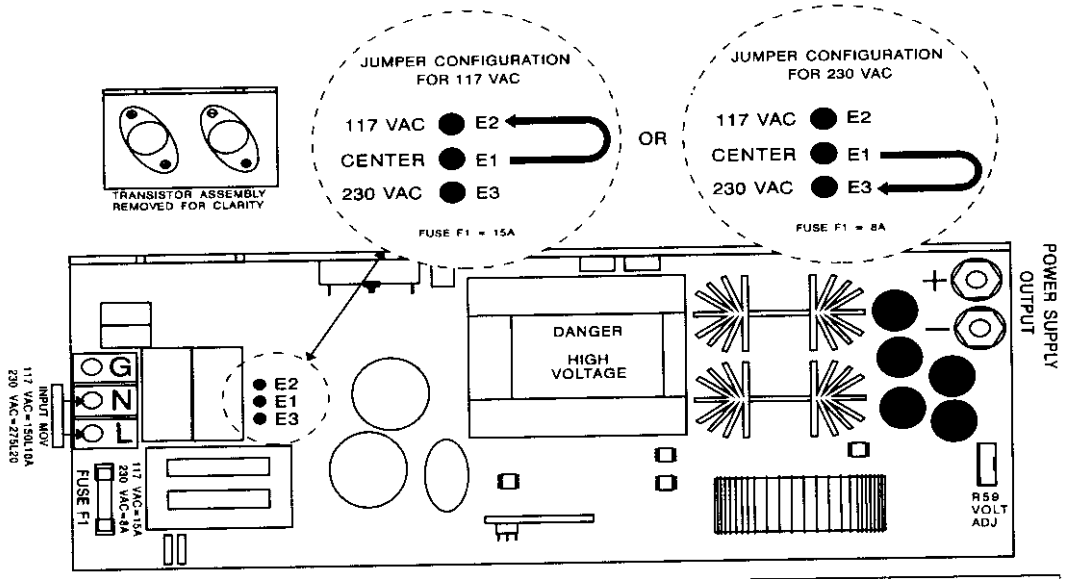
4. Locate the AC configuration board.

5. Refer to Document # HG3-01006, located on Document # 10-10C03, to reconfigure the AC configuration board. If necessary, remove board to gain access. Locate the Molex jumper and move the jumper to the desired voltage according to the diagram.

6. Replace rear panel AC input fuse with a fuse of an appropriate ampere rating depending upon the input voltage selected. Use a six and a quarter ampere fuse for 117 VAC and a four-ampere fuse for 230 VAC.

COMWAVE
A Thomcast Company
SBSA-50C Switching Power Supply 117/230 V_{AC} Jumper/Mov Configuring

SBSA-50C SWITCHING POWER SUPPLY 117/230 V_{AC} JUMPER/MOV CONFIGURING



Created by: Kimberly Simeone 5/27/98	*Checked by:*	*Released by:*

Document #: HG3-01008
REV: P1

Physical Installation

COMWAVE transmitters have been designed to accept standard 19 inch rackmounts with slide rails. Slide rails enable easy access to internal adjustable controls and other maintenance/adjustments. In most cases, COMWAVE provides a system equipment rack layout diagram that will assist in the proper installation and orientation of equipment.

The SBSA-50C transmitter system requires 8.75 inches of vertical rack space (including a modulator). Generally, all equipment is mounted in close proximity in the same rack for the convenience of cabling. Mount the slide rails into the rack with the hardware supplied. Use tapered screws for mounting the front brackets (tapered screws allow the drawer to be fully seated).

Pull slide rails outward until they lock into place. Carefully align drawer with slide rails and mate. Unlock slide rails by depressing the lock button on each rail while pushing drawer inward. Drawer should slide easily into rack. If binding occurs, rail mounting brackets are in need of adjustment. Loosen brackets and manipulate drawer to seat rails to match transmitter drawer. Tighten brackets once free sliding motion has been achieved.

System Grounding

For proper system operation, it is imperative that the system be adequately grounded. Each individual equipment rack requires grounding to the main building ground. When bolting ground wires to racks, sand finish to remove paint ensuring a good bond.

SBSA-50C SYSTEM CABLING

This section explains cabling and interconnections between the SBSA-50C transmitter and the TVM-102 or the Barco modulator. Refer to the diagrams for cabling.

TVM-102 Modulator

INPUT:
The modulator requires a baseband video input program source signal. Connect the baseband input source to the modulator VIDEO IN using RG59/U 75 ohm cable.

IF OUTPUT:
The IF OUTPUT is the visual IF signal Cable using a male to male BNC RG-59/U 75 ohm cable directly to the Visual In (VIS IN) jack of the SBSA-50C transmitter.

VIDEO IF LOOP:
A small coaxial RG-59/U jumper is provided and is required to loop the VIDEO IF OUT back into the VIDEO IF INPUT.

AUDIO IF LOOP:
AUDIO IF LOOP IN is typically not used.

Cable AUDIO IF LOOP OUT using RG-59 directly to the Aural In (AUR IN) of the SBSA-50C transmitter.

Connect the Audio input from the satellite receiver to small screw connectors labeled as +Audio, -Audio, and GND for the shield.

INTERLOCK SIGNAL:
A signal presence interlock is established by a pre-made cable assembly provided by COMWAVE. Connect the two pre-tinned bare wires to the small screw type terminals labeled ALT IF (RED wire)/GND (BLACK wire) and the remaining end to the 9 pin connector J1 of the SBSA-50C transmitter.

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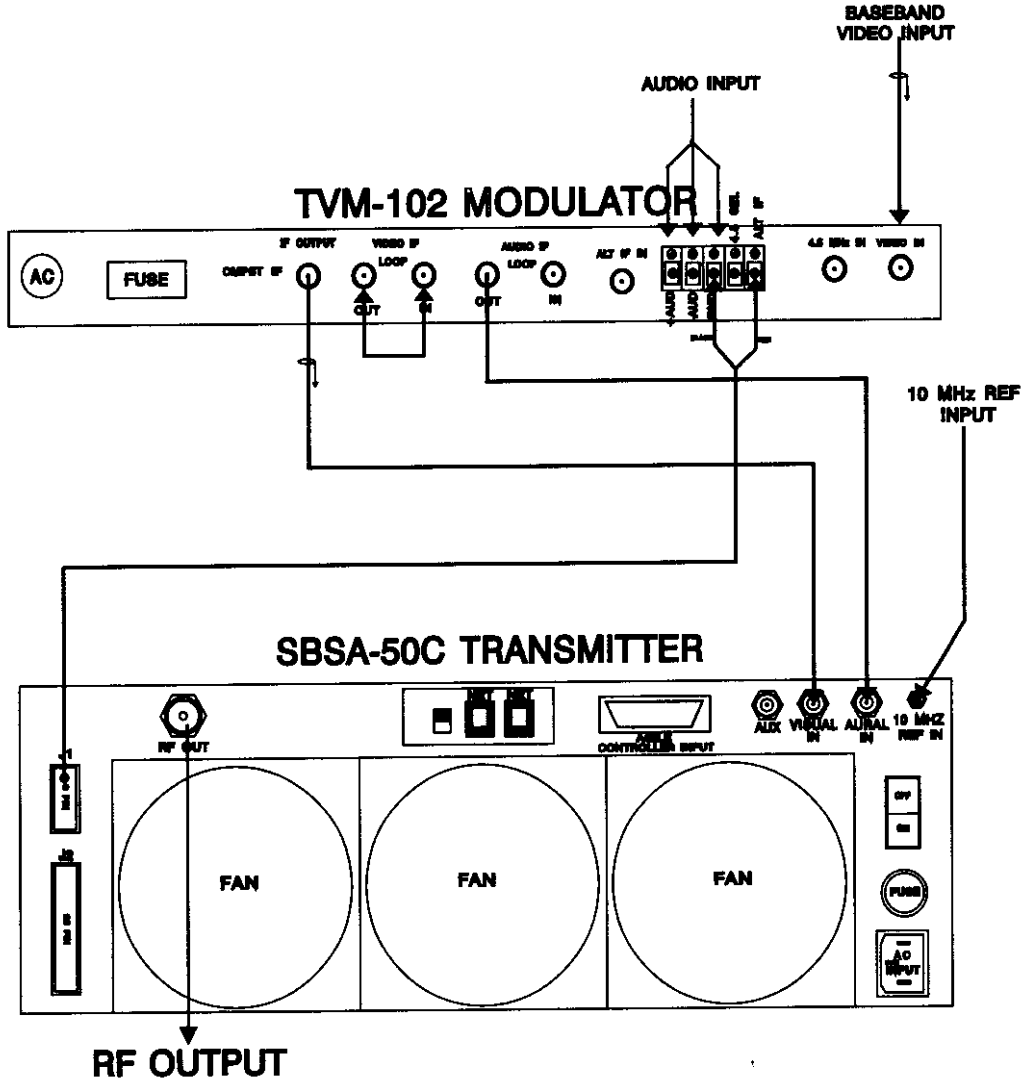
A Thomcast Company

SBSA-50C System Interconnections w/TVM-102 Modulator

SBSA-50C SYSTEM INTERCONNECTIONS WITH TVM-102 MODULATOR



Created by: Kimberly Simeone 5/27/98	*Checked by:*	*Released by:*

Document #: HG3-01009

REV: P1

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Barco Modulator

INPUT:
The Barco Modulator provides an optional Alternate IF (ALT IF) input connector. If used, connect the ALT IF source with a BNC connector.

The modulator requires a baseband video input program source signal. This video input usually originates from a satellite receiver system. Apply this input signal to a rear mounted BNC connector labeled as VIDEO PROG INPUT.

Connect the Audio input from the satellite receiver to AUDIO PROG IN using a 6 pin plug.

VIDEO OUTPUT:
The Intermediate Frequency Video (IFV) is cabled from the Barco Modulator to the Visual IF (Vis IF) of the SBSA-50C transmitter using an RG-59/U cable.

AURAL OUTPUT:
The Intermediate Frequency Sound 1 (IFS1) is cabled from the Barco Modulator to the Aural In (AUR IN) of the SBSA-50C transmitter using a RG-59/U cable.

The Intermediate Frequency Sound 2 (IFS2) is cabled from the Barco Modulator to the Auxiliary In (AUX IN) of the SBSA-50C transmitter using an RG-59/U cable.

Video Presence Cable is established by a pre-made cable assembly by COMWAVE. It is connected from the 9 pin connector of the Barco Modulator to the 9 pin connector of the SBSA-50C Transmitter.

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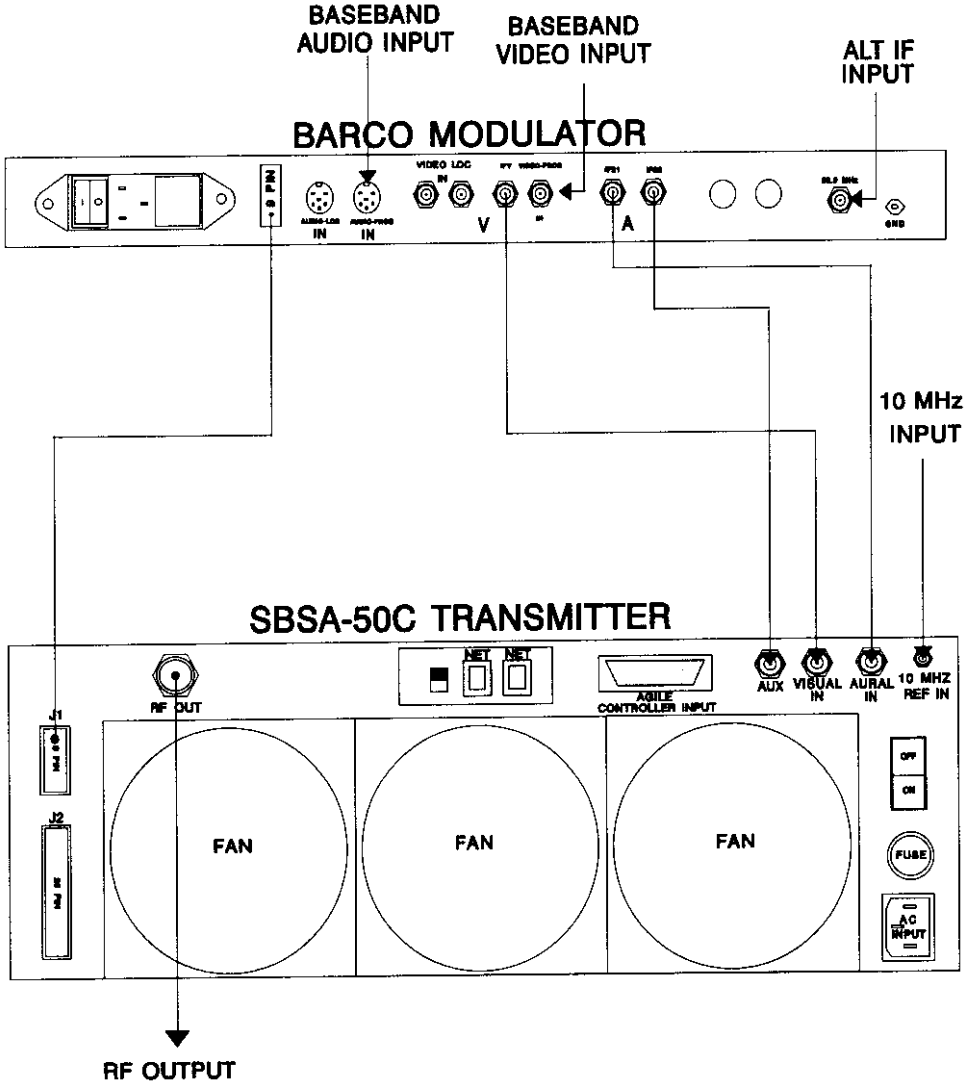
A Thomcast Company

SBSA-50C System Interconnections w/Barco Modulator

SBSA-50C SYSTEM INTERCONNECTIONS WITH BARCO MODULATOR



Created by: Kimberly Simeone 5/28/98	*Checked by:*	*Released by:*

Document #:HG3-01010

REV: P1

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SBSA-50C Transmitter

RF OUTPUT:
Cable the microwave RF output signal from the SBSA-50C Transmitter to the antenna system (channel combiner, coax, or wave guide). Use 1/2 inch super flex cable.

10 MHZ REF IN:
An externally applied 10 MHz reference signal is an option. This signal can originate from an optional 10 MHz Reference Drawer, Loran C, GPS receiver, or from another transmitter which contains a 10 MHz reference oscillator internally. An internal 10 MHz reference can drive up to three additional transmitters. Use RG-59/U 75 ohm cable.

Reference signals

An external reference drawer is used to apply 10 MHz reference signals to phase lock a transmitter system. A 10 MHz two-way distribution board receives the 10 MHz reference from the external drawer and splits the signal equally. The reference signal level should be +10 dBm +5 dB/-10dB.

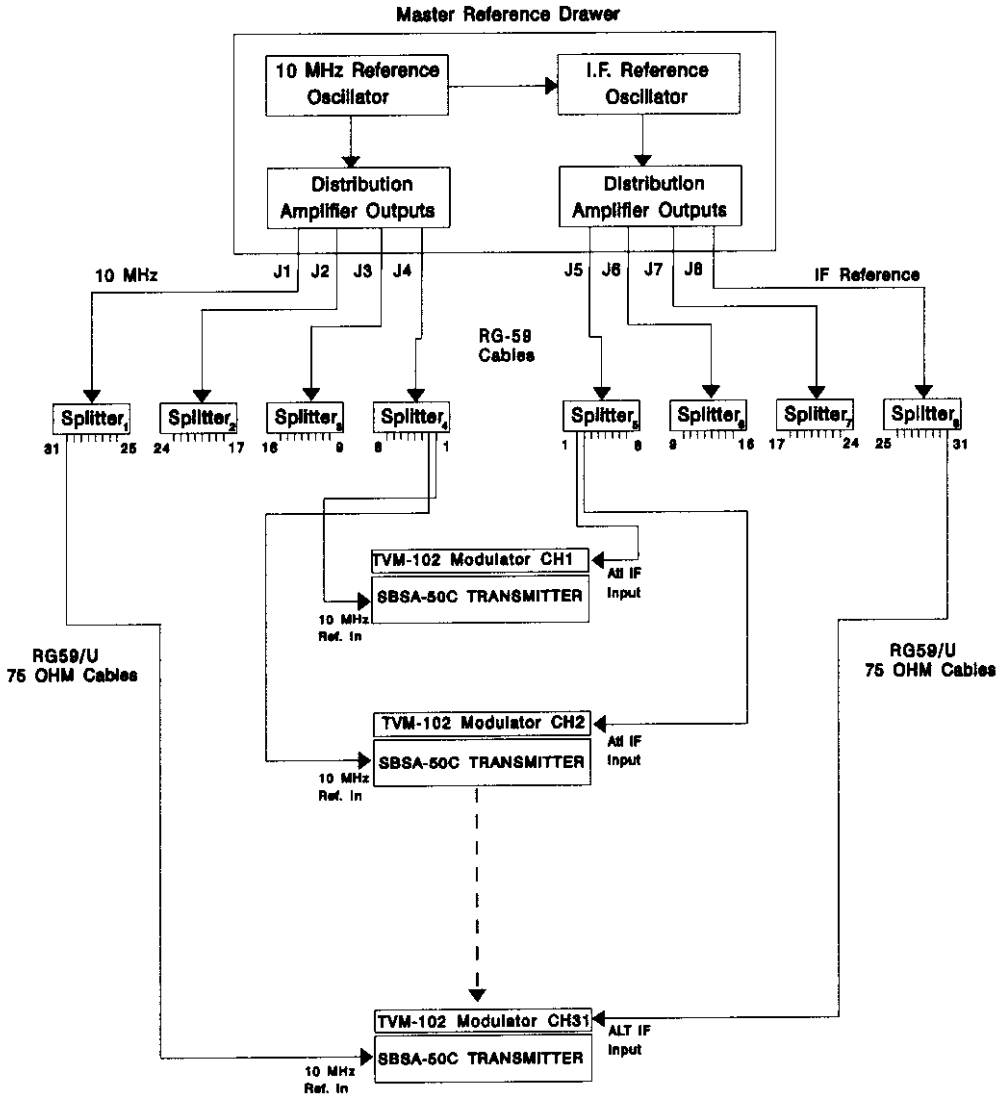
External Phaselocking of Transmitters:

When more than four transmitters are co-located, the 10 MHz reference normally located inside the lowest transmitter channel of the group is removed and an external 10 MHz reference drawer along with a 10 MHz cable kit are used. This drawer contains a precision 10 MHz reference oscillator and distribution system. Located on the reference drawer rear panel are four "F" type female connectors labeled J-1 through J-4. Connectors J-1 through J-4 are 10 MHz at a level of approximately +17 dBm. See diagram for details of reference interconnections.

NOTE: The 10 MHz output signals are of a high level and should NOT be directly cabled to any transmitter/modulator. These signals must first be routed through splitters to reduce the signals to acceptable levels. Located in the 10 MHz cable kit are four 8-way CATV splitters with cable and appropriate connectors. When connected to any rear panel 10 MHz jack of the reference drawer, each output of the 8-way splitter may be connected directly to any transmitter 10 MHz input. The 8-way splitter has -10 dB typical loss.

COMWAVE
A Thomcast Company

10 MHz/IF REFERENCE INTERCONNECTIONS



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Document #: HG3-01011

REV: P1

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OPERATION

This section covers initial unit turn-on and explains normal operation of the SBSA-50C Transmitter. Prior to any initial equipment turn-on, verify that all appropriate wiring interconnections have been accomplished.

Initial Turn-On Procedures

1. Ensure the rear mounted main power ON/OFF switch is in the OFF position.
2. Position the front panel rotary function switch to STANDBY.
3. Insert the power plug into a power outlet.
4. Position the main power switch to ON.
   *Fan noise should be heard.
5. The following GREEN LEDs continuously illuminate verifying successful turn ON.
   *IN SIGNAL (if an input signal is applied; requires modulator operation)
   *INTERLOCK

Normal Operation

Operation is enabled by rotating the function switch from STANDBY to any other position. At that time, the following GREEN LEDs continuously illuminate confirming normal operation.

*IN SIGNAL (must have an input signal applied to transmit; requires modulator operation)
*INTERLOCK
*TRANSMIT

Absence of a green LED indicates a missing signal or parameter. Continuous illumination of any red status LED indicates a failure has been detected by the diagnostic circuitry. Refer to the troubleshooting section for failures.

To verify other transmitter parameters using the front panel meter, rotate the function switch. +11 V PS, VIS PWR and AUR PWR should have meter readings of 100%. REFL PWR is a function of the combiners, transmission line, and antenna. Reflected power readings less than 10% are typical.

FAILURE MODE DISPLAYS

COMWAVE transmitters employ comprehensive diagnostic circuitry that monitor the status of power amplifier modules and critical circuits. Failures can be readily interpreted by observing front panel LED Diagnostic Display and/or monitoring the analog panel meter. By observing the Diagnostic Display and metering, complete transmitter operational status is known. Due to the internal transmitter design, there are no user serviceable modules, parts, or components. Repair of these modules is not recommended or advised. Contact COMWAVE customer support should a failure occur. This section explains the various failure mode displays that may be encountered and possible solutions.

The following status monitoring LEDs continuously illuminate GREEN during normal operation. Absence of an LED indicates a missing signal or parameter which results in a controlled automatic transmitter shut down.

IN SIGNAL: Missing IF input signal from modulator.

Causes:
Defective cabling to modulator baseband video input
Defective cabling from modulator IF output to SBSA-50C Visual IF Modulator
Missing baseband source signal

Solutions:
Check cabling
Verify source signal
Replace modulator
Measure voltages at 25 pin Diagnostic Interface J2
Contact Comwave customer support

INTERLOCK: Missing system Interlock signal.

Causes:
RF module unplugged or shorted

Solutions:
Check for disconnected module(s)
Measure voltages at 25 pin Diagnostic Interface J2
Contact Comwave customer support

TRANSMIT: No transmit.

Causes:
Missing IN SIGNAL
Missing INTERLOCK signal
See other diagnostic LEDs

Solutions:
Check cabling

Troubleshoot per highlighted LEDs
Replace modulator
Measure voltages at 25 pin Diagnostic Interface J2
Contact Comwave customer support

When a failure is detected by the diagnostic circuitry, the appropriate RED status monitoring LED continuously illuminates. Controlled automatic transmitter shut down is a function of the failure and severity. Presence of a RED status LED with normal meter readings and/or normal transmitter operation indicates an out of tolerance condition with that circuit.

TEMPERATURE: Internal chassis temperature exceeded + 160 degrees Fahrenheit (+ 71degrees Celsius).

Causes:
Fans inoperative
Heavy accumulation of debris on fans or heatsinks
Module(s) overheating
Site air conditioning

Remedy:
Check fan operation
Check site air conditioning
Allow transmitter to cool: Reset latched failure logic by rotating function knob momentarily to "STANDBY"
Contact Comwave customer support

VIS DRIVER: Defective visual driver module.

Causes:
Visual driver module(s)
Switching power supply

Remedy:
Measure voltages at 25 pin Diagnostic Interface J2
Contact Comwave customer support

VIS PRE-FINAL: Visual Pre-Final defective.

Causes:
Visual Pre-Final
Switching power supply

Remedy:
Measure voltages at 25 pin Diagnostic Interface J2
Contact Comwave customer support

VIS FINAL A or B: Defective visual final module.

Causes: Visual final module A or B
Switching power supply

Remedy: Measure voltages at 25 pin Diagnostic Interface J2
Contact Comwave customer support

RF POWER: Visual output power has decreased to less than 50 % of full output.

Causes: Visual driver module(s)
Final output module(s)
Power supply

Remedy: Check final output RF power levels
Contact Comwave customer support

PWR SUPPLY: Defective + 11 volt DC switching power supply.

Causes: Main input line fuse
Switching power supply fuse
Power Supply
Shorted module(s)

Remedy: Check fuses
Measure voltages at 25 pin Diagnostic Interface J2
Contact Comwave customer support

LOCAL OSC: Local Oscillator failure.

Causes: Oscillator failure
External cabling
10 MHZ Reference

Remedy: Check external cabling
Measure voltages at 25 pin Diagnostic Interface J2
Contact Comwave customer support

AUR DRIVER: Defective aural driver module(s).

Causes: Aural driver module(s)
Power supply

Remedy: Measure voltages at 25 pin Diagnostic Interface J2
Contact Comwave customer support

AUR FINAL: Defective aural final module(s).

Causes: Aural final module(s)
Power supply

Remedy: Measure voltages at 25 pin Diagnostic Interface J2
Contact Comwave customer support

Diagnostic Interface

To assist in troubleshooting, COMWAVE transmitters employ a 25 pin computer type diagnostic interface connector located at the rear of the chassis. This connector is identified as J2. Critical power supply, module, and motherboard voltage test points can be accessed/monitored at this connector. Should a failure occur, the combination of meter readings, diagnostic LED status lights, and the diagnostic interface voltage test points help identify the failure.

Attached is an example of a diagnostic interface High/Low Window blank data sheet. The High/Low Window data sheet identifies each interface pin, the associated internal test point, nominal value, and the expected voltage range.

The majority of internal assemblies that comprise a transmitter are modular. Modular design enables quick, efficient failure troubleshooting and ease of repair. This concept results in cost effective troubleshooting and less equipment downtime. Once a module has been identified as defective, COMWAVE can send a replacement, which can be easily replaced by the customer.

SBSA-50C TRANSMITTER

TROUBLESHOOTING WORKSHEET

J2: REAR PANEL DIAGNOSTIC PIN	FUNCTION CHECKED	LOW LIMIT "VDC"	NOMINAL VOLTAGE "VDC"	HIGH LIMIT "VDC"	MEASURED VOLTAGE
1	Ground	0	0	0	
2	+12 VDC PS	+11.5	+12	+12.5	
3	-12 VDC PS	-11.8	-12	-12.2	
4	+11 VDC PS	+10.7	+11	+11.1	
5	+5 VDC PS	+4.5	+5	+5.5	
6	Mixer Q1	2.5	4.1	5.74	
7	AMP 1 Q2,3	2.0	4.5	7.0	
8	AMP 2 Q4,5	.9	1.08	1.5	
9	Pre-Final Q2	1.5	2.2	3.0	
10	Final A Q1, 3,4, 5	7.0	8.8	20.6	
11	Final A Q2, 6, 7	4.8	6.6	8.5	
12	Final B Q2, 6, 7	4.8	6.6	8.5	
13	Final B Q1,3, 4, 5	7.0	8.8	10.6	
14	N/A				
15	N/A				
16	N/A				
17	N/A				
18	N/A				
19	Remote off	N/A	+5	N/A	
20	IN SIGNAL	N/A	+5	N/A	
21	LO	N/A	>1.3	N/A	
22	Remote Fault	N/A	0	N/A	
23	Average Power	N/A	1.40	N/A	
24		N/A	N/A	N/A	
25	REFL Power	N/A	.10	N/A	

FILL IN ALL THE ABOVE BLANK SPACES COMPLETELY

COMPANY NAME:_____ CUSTOMER'S NAME:_____
PHONE NUMBER:_____ FAX NUMBER:_____
MODEL:_____CHANNEL:_____ SERIAL NUMBER (REAR PANEL):_____

SEND RESULTS TO:

COMWAVE-ATTENTION
TECHNICAL SUPPORT

TOLL FREE PHONE ("USA" only)

1-800-COMWAVE (1-800-266-9283)
1-717*-474-6751 ***see note on document #18-01001***
1-717*-474-5469 FAX ***see note on document #18-01001***

Analog Metering

The front panel analog meter provides an indication of the +11 V_{DC} Switching Power Supply, Reflected, Aural and Visual output power. The +11 V_{DC} switching power supply, aural and visual output power should indicate 100%. Reflected power meter readings less than 10% are typical. By observing the meter readings, transmitter performance can be interpreted. Analog meter readings in conjunction with the front panel Diagnostic status LEDs help to identify/isolate failures(s). The following information is provided to assist in troubleshooting analog meter anomalies.

+11 VPS: Meter does not indicate 100%.

Causes:
Defective switching power supply
Shorted module
Open switching power supply fuse F2
Open main AC input fuse
Switching power supply out of adjustment
Metering out of adjustment

Solutions:
Replace defective fuse(s)
Check switching power supply output voltage
Troubleshoot per front panel LED Diagnostic display
Adjust switching power supply output voltage per Document #14-04A02
Calibrate meter per Document # HG3-01015
Measure voltages at 25 pin Diagnostic Interface J2
Contact Comwave customer support

REFL PWR: Reflected power is greater than 10%.

Causes:
Loose RF cable connection(s).
RF cable kinked
Wave guide leak/depressurized
Reflected metering out of adjustment

Solutions:
Check integrity of all RF cable connections
Check cabling for kinks or severe bends
Check wave guide pressure
Calibrate reflected metering per Document #14-04A02
Measure voltages at 25 pin Diagnostic Interface J2
Contact Comwave customer support

AUR PWR: Meter does not indicate 100% power.

Causes:
Driver module
Final module(s)
Switching power supply

Metering out of adjustment

Solutions: Confirm output power
Troubleshoot per front panel LED Diagnostic display
Replace defective module
Calibrate forward power metering per Document #'s 14-04A02 & HG3-01014
Measure voltages at 25 pin Diagnostic Interface J2
Contact Comwave customer support

VIS PWR: Meter does not indicate 100% power.

Causes: Driver module
Final module(s)
Switching power supply
Metering out of adjustment

Solutions: Confirm output power
Troubleshoot per front panel LED Diagnostic display
Replace defective module
Calibrate forward power metering per Document #'s 14-04A02 & HG3-01014
Measure voltages at 25 pin Diagnostic Interface J2
Contact Comwave customer support

EQUIPMENT FUSING AND PROTECTION

Fuses:

Location	Name	Value
Mother Board	F1	15 amperes
Mother Board	F2	25 amperes
Mother Board	F3	25 amperes
Mother Board	F4	4 amperes
Power supply	F1	15 amps @ 117 V_{AC} or 8 amps @ 230 V_{AC}
Rear Panel AC		12 amps @ 117 V_{AC} or 7 amps @ 230 V_{AC}

Surge Suppression: COMWAVE transmitters employ a metal oxide varistor (MOV) voltage suppresser across the AC line input for protection from moderate power surges. The surge suppresser value is dependent upon the AC line input voltage. 117 V_{AC} employs a 150 V_{AC} MOV and 230 V_{AC} uses a 275 V_{AC} MOV.

Thermal Protection: Thermal protection is accomplished using thermostats that close when the internal temperature exceeds +160 degrees Fahrenheit (+71 degrees Celsius). When thermal shut down occurs, a logic control board removes power from the final until the unit is sufficiently cooled.

Interlocks: Interlocks are designed for transistor bias protection for both the FET gate and drain power supply voltages. See Document #10-10P03.

MAINTENANCE

COMWAVE products have been carefully designed to be maintenance free. Only periodic inspection and cleaning is necessary.

Inspections:

1. Periodically inspect cooling fans on the rear door of the rack and the heatsinks of the Power Amplifier Segments for heavy accumulations of dirt and/or insects. Heavy accumulation of foreign debris impedes cooling effectiveness and could lead to premature failure. Should any debris be detected, shut down the transmitter and follow the cleaning instructions to remove debris from transmitter. ***NOTE: The Agile Transmitter will automatically recover the channel of the transmitter, which is being cleaned.***

2. Record analog meter readings of each Driver on a monthly basis. This establishes a performance historical database. These entries can identify degraded performance before it becomes a hard failure.

3. After performing routine maintenance, be sure to check the tightness of all cable connections and especially the integrity of crimp type connectors.

Cleaning:

Clean faceplate and outside cover using a damp non-abrasive cloth with a mixture of a mild detergent and water.

MONTHLY MAINTENANCE RECORD

Date	Channel	Analog Metering				Failure LEDs	Comments
		VIS	AUR	REF	+11VPS		

Created by: Kimberly Simeone 5/26/98	Checked by:	Released by:

The following section explains calibration of the SBSA-50C transmitter. The user must be thoroughly familiar with use of applicable test equipment. All calibrations, alignments, and adjustments have been performed at the factory by qualified service personnel prior to shipping. Additional adjustments are not necessary or advised.

SYSTEM POWER CALIBRATIONS

This section covers adjustments of SBSA-50C average output power and calibrations of the front panel output power and reflected metering.

> ***NOTE:** This procedure is applicable for only making **MINOR** adjustments to output power and analog metering. Do **NOT** adjust power more than ± .5 dB. Adjustments more ± .5 dB may result in increased intermodulation distortion products

This procedure sets the transmitter output power while transmitting a modulated signal. Calibration of output power and metering circuitry is a straight forward task. For proper calibration, adjustments are performed in a specific sequence. The following information is provided to assist in proper calibration.

OUTPUT POWER:

Required Equipment:

Spectrum Analyzer	Microwave Power Meter
30 dB Directional Coupler	50 Watt, 50 Ohm Load
Two N to N Male Barrels	Small Flat Blade Screwdriver
N to BNC Adapter	Alignment Tuning Tool
Video Generator	

1. Place the SBSA-50C to STANDBY to disable transmitting.

2. Attach a -30 dB directional coupler to the transmitter output. See Figure 8.0 and 8.0.1. Terminate the coupler output into a 50 watt, 50 ohm load. Connect a microwave power meter to the -30 dB coupled port.

3. Apply a modulated signal to the transmitter IF input. Set video generator to black picture (No set up/0 IRE).

4. Turn IF Precorrector ALC switch S2 to "OFF."

5. Rotate function switch from STANDBY to "FWD PWR" to enable transmit.

6. Calculate power meter reading necessary for 100% output, accounting for the coupler loss.

EXAMPLE

Transmitter Output @ 50 watts	=	+ 47.00 dBm
-30 dB Coupler	=	- 30.00 dBm
		+ 17.00 dBm
Correction Factor (Black picture/no set up) =		2.20 dBm
Expected Power Meter Reading	=	14.80 dBm

7. Adjust motherboard variable potentiometer VR4 and VR2 to indicate 100% visual and aural power output, respectively.

8. Turn ALC switch S2 "ON."

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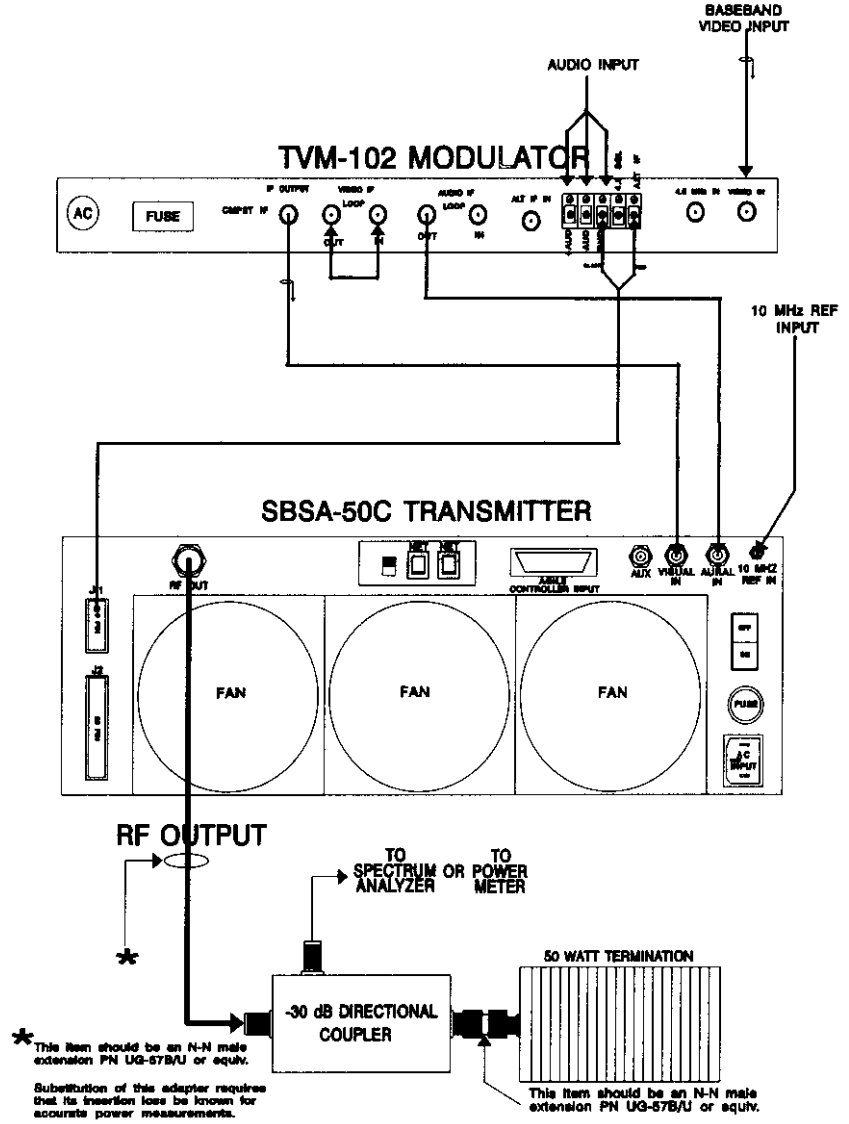
SBSA-50C Transmitter Power Calibration Test Set-Up

SBSA-50C TRANSMITTER POWER CALIBRATION TEST SET-UP



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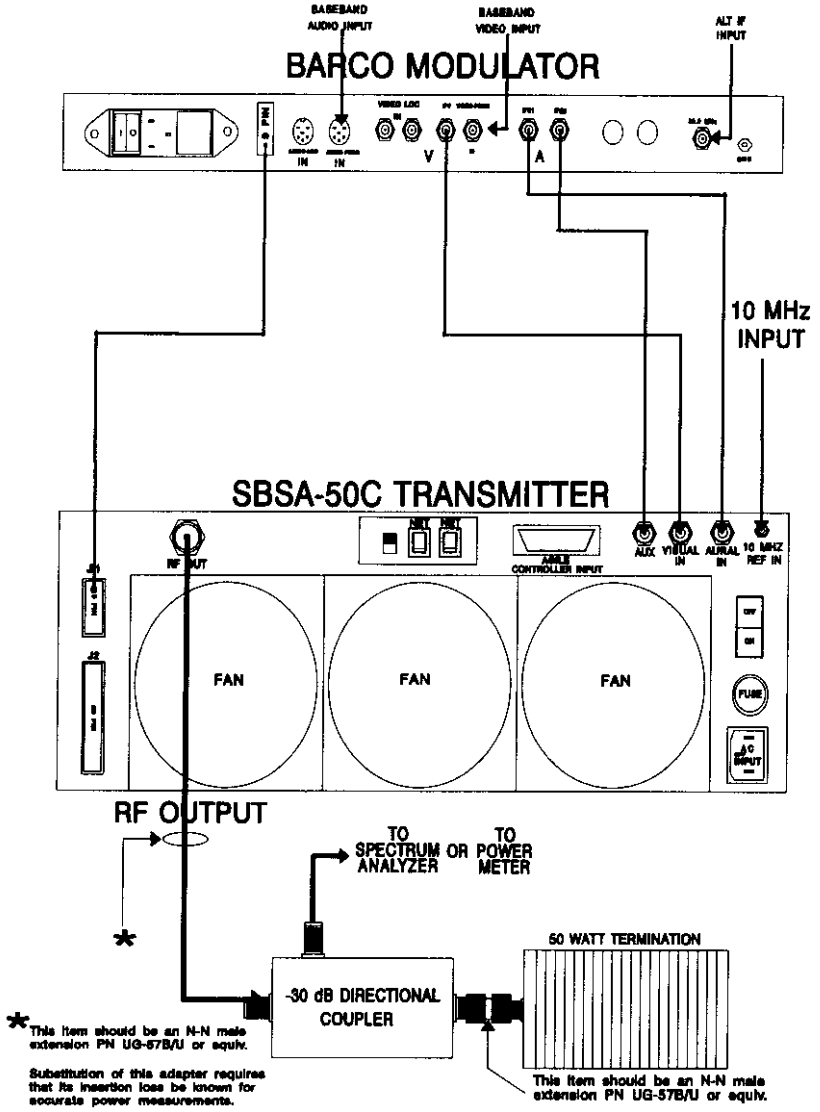
SBSA-50C Transmitter Power Calibration Test Set-Up

SBSA-50C TRANSMITTER POWER CALIBRATION TEST SET-UP



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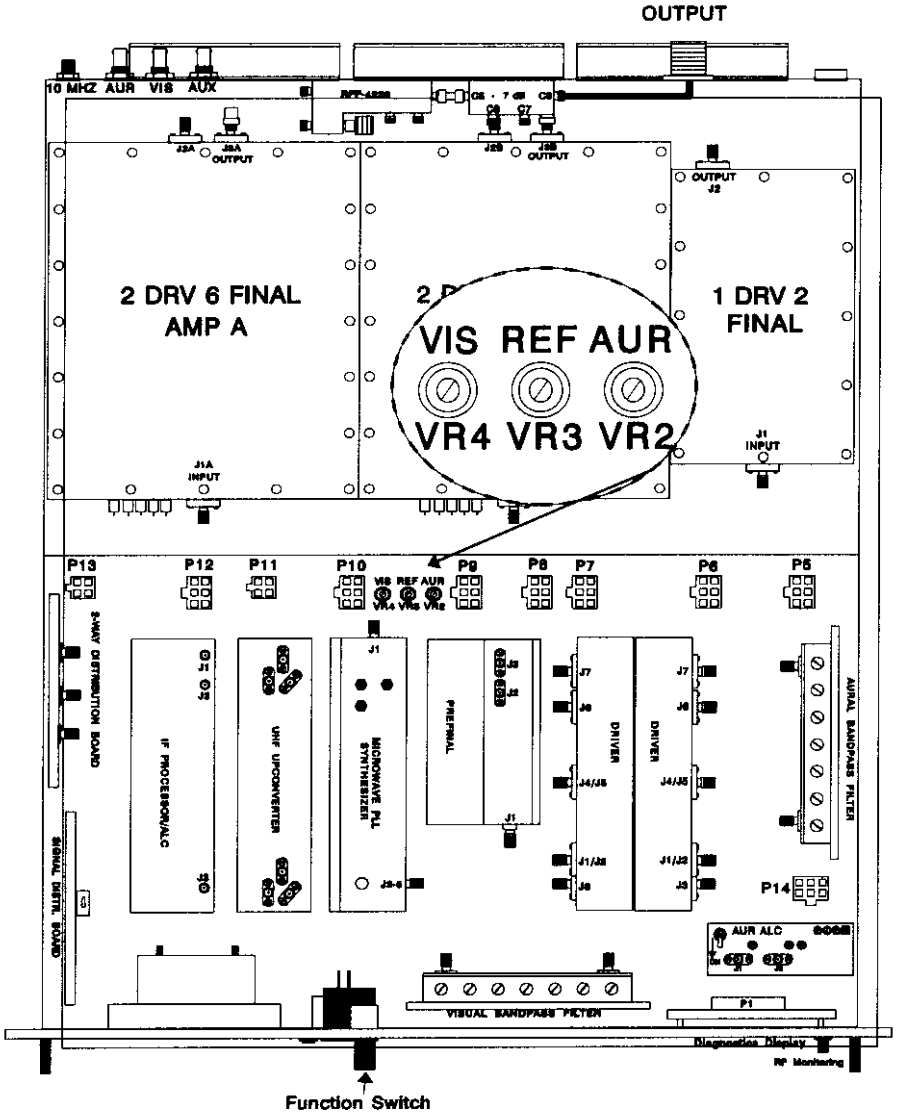
SBSA-50C Metering Adjustment

SBSA-50C METERING ADJUSTMENT



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REFLECTED POWER:

1. Rotate the function switch to STANDBY.
2. Turn the IF Precorrector ALC switch S2 "OFF."
3. Momentarily interchange the coax cables at the Peak Detector ports.
4. Rotate the function knob from STANDBY to REF to enable transmit.
5. Adjust motherboard potentiometer VR3 for 100% reflected power reading.
6. Rotate function knob to STANDBY.
7. Return Peak Detector coax cables to their original configuration.
8. Turn IF Precorrector ALC switch S2 "ON."
9. Rotate the function switch to REF. The meter should indicate less than 7% residual reflected power reading into a resistive termination.

+ 11 VDC SWITCHING POWER SUPPLY METERING:

1. Using a digital voltmeter, measure the switching power supply output.
2. Confirm switching power supply voltage output is + 11 VDC. If required, adjust switching power supply VR59 (Deltron switching power supplies).
3. Rotate function switch to +11 VPS.
4. Adjust mother board potentiometer VR1 to correspond to 100% +11 VPS metering.
5. Connect a voltmeter to TP1 and adjust the potentiometer, VR5, to a -12 V reading.

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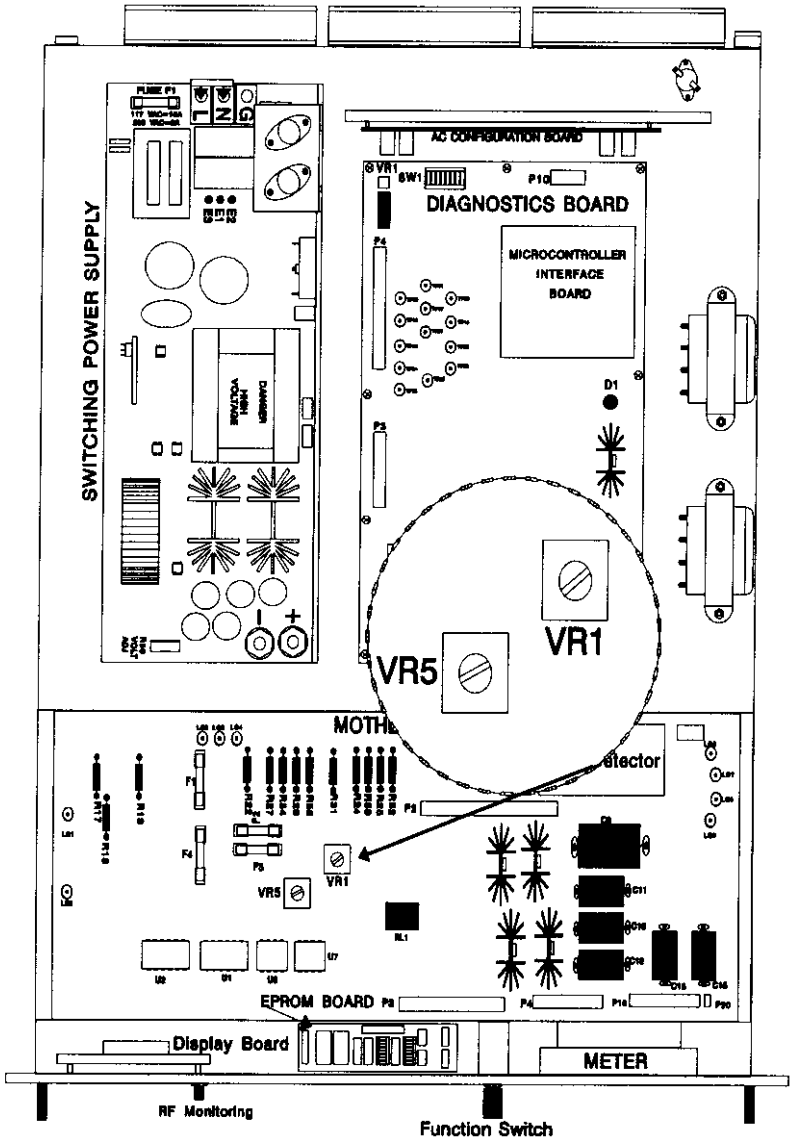
+11 VPS Metering Adjustment

+11 VPS METERING ADJUSTMENT



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CUSTOMER SERVICE

Comwave's customer service personnel are available 24 hours a day to assist with any questions or complications that may arise.

Communication Microwave Corp
Crestwood Industrial Park
395 Oakhill Road
Mountaintop, PA 18707

1-800-266-9283 USA only
1-717-474-6751
(Please note as of 12/98, our area code will change to 507)
1-717-474-5469 FAX
(Please note as of 12/98, our area code will change to 507)

EQUIPMENT RETURNS

In the event the equipment requires return for factory service, please follow the guidelines listed. Comwave cannot be held responsible for damaged equipment received due to improper packing. Contact Comwave with any questions or concerns regarding returning or packaging of equipment.

1. ***Contact Comwave:*** Call Comwave to report the problem and to obtain a "Return Authorization" number (RA). This enables Comwave to accurately track and identify returned equipment for prompt and efficient service.

2. ***Obtain packaging materials:*** Use original boxes and packing materials when returning any equipment. This will safe guard against most in-transit damages. If original boxes and packing materials are not available, contact Comwave to obtain replacement materials. Replacement materials are provided at a nominal cost.

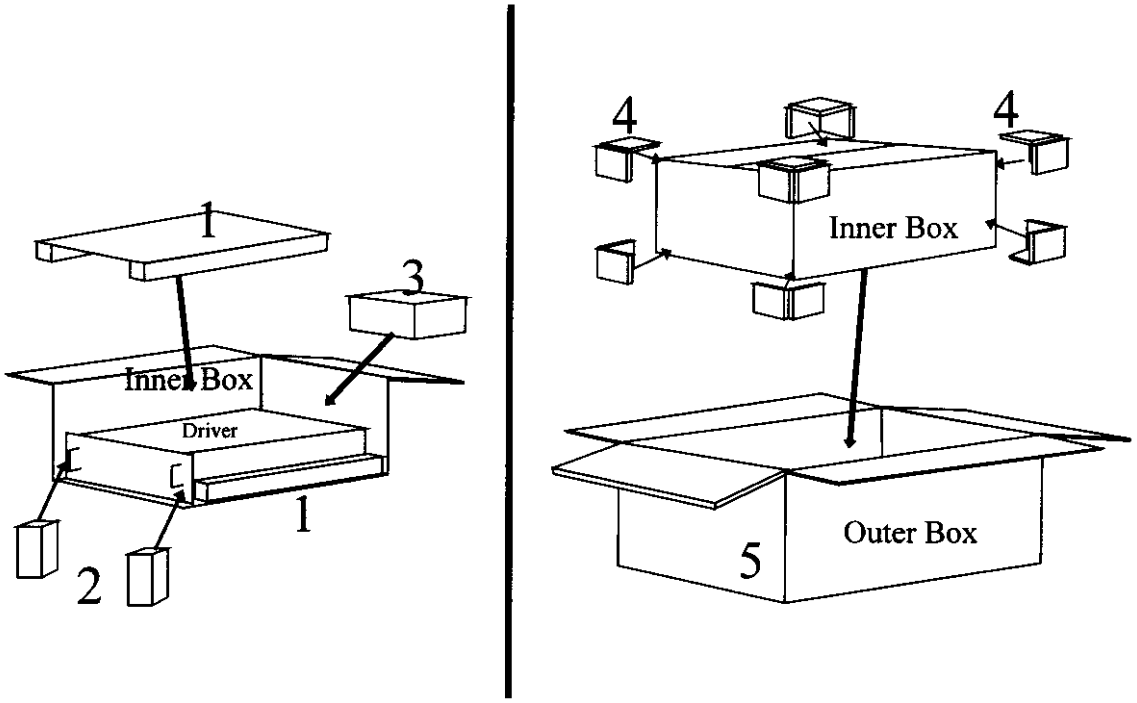
3. ***Pack equipment:*** Using original packing materials, equipment is packed in a box within another box. Double boxing provides maximum protection.

   Caution: Do not pack equipment using "PEANUTS." Equipment packed using "PEANUTS" as filler does NOT provide sufficient protection during shipping. Rough handling by the carrier may cause permanent damage to the equipment being returned.

PACKAGING FOR RETURN

Refer to the diagram below which corresponds to each step.

1. Place the cardboard inserts above and below the equipment.
2. Insert foam against the front panel, between the handle and the corner of the inner box.
3. Insert the foam block securely behind the fans to prevent equipment from shifting upon transit.
4. Place the protective foam pieces on each corner of the inner box.
5. Place the inner box into the outer box.



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DRAWING LIST

SBSA-50C DRAWINGS

Module/Board	*Module #*	*Board #*
IF Processor	04-277-02	33-315-02
ALC	04-129-02	04-100-02
UHF Upconverter	09-058-02	34-007-02
EPROM Board		35-316-02
Synthesizer	09-052-02	35-064-02
		33-291-02
		13-081-02
Visual Driver		04-128-02
Aural Driver		04-060-02
Aural Final Amp		04-249-02
Pre-Final Amp		04-250-02
Visual Final Amp A & B		04-248-02
Mother Board		35-074-02
10 MHz Distribution Board		33-317-02
Signal Distribution Board		33-312-02
Microcontroller Interface Board		34-006-02
RS-485 Communications Board		33-304-02
Diagnostics Board		33-118-02

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INTERNAL SBSA-50C CABLING

CABLE TYPE	*FROM*	*TO*
60-036-430	Visual IF (Rear Panel)	IF Processor (J1)
60-036-430	Aural IF (Rear Panel)	IF Processor (J2)
60-043-380	10 MHz IN (Rear Panel)	10 MHz Distribution Board
60-036-410	Aur IF (Rear Panel)	UHF Upconverter (J3)
60-003-100	10 MHz Distribution Board	UHF Upconverter (J1)
60-003-120	10 MHz Distribution Board	Synthesizer
16-048-390	CPU Interface	EPROM Assembly
16-163-140	EPROM Assembly	Synthesizer
60-003-050	IF Processor (J3)	UHF Upconverter (J4)
60-003-200	UHF Upconverter (J5)	Visual Mixer
60-067-150	Visual Mixer	Synthesizer
60-011-050	Visual Mixer	Visual Bandpass Filter (IN)
60-011-062	Visual Bandpass Filter (OUT)	Visual Amp 1
60-011-050	Visual Amp 1	Visual Amp 2
60-011-100	Visual Amp 2	Pre-Final Amplifier
60-011-070	Pre-Final Amplifier	Final Amplifier A
60-011-102	Pre-Final Amplifier	Final Amplifier B
60-011-090	Final Amplifier A	Combiner/-20 dB Coupler
60-011-052	Final Amplifier B	Combiner/-20 dB Coupler
SF2993-6001	Combiner/-20 dB Coupler	-7 dB Coupler
60-067-300	Combiner/-20 dB Coupler	FWD Power (Front Panel)
60-067-300	Combiner/-20 dB Coupler	REFL Power (Front Panel)
60-003-220	UHF Upconverter (J6)	Aural ALC
60-003-060	Aural ALC	Aural Mixer
60-067-110	Synthesizer	Aural Mixer
60-068-160	Synthesizer	Front Panel Sample (LO OSC)
60-067-080	Aural Mixer	Aural Bandpass Filter (OUT)
60-011-050	Aural Bandpass Filter (OUT)	Aural Amp 1
60-011-050	Aural Amp 1	Aural Amp 2
60-011-062	Aural Amp 2	Aural Final
60-011-060	Aural Final	-7 dB Coupler
60-010-060	-7 dB Coupler	RF Out (Rear Panel)

STANDARD FREQUENCIES NTSC FORMAT 6 MHz

Group	*Bandwidth (MHz)*
A1	2500-2506
A2	2512-2518
A3	2524-2530
A4	2536-2542
C1	2548-2554
C2	2560-2566
C3	2572-2578
C4	2584-2590
E1	2596-2602
E2	2608-2614
E3	2620-2626
E4	2632-2638
G1	2644-2650
G2	2656-2662
G3	2668-2674
G4	2680-2686
B1	2506-2512
B2	2518-2524
B3	2530-2536
B4	2542-2548
D1	2554-2560
D2	2566-2572
D3	2578-2584
D4	2590-2596
F1	2602-2608
F2	2614-2620
F3	2626-2632
F4	2638-2644
H1	2650-2656
H2	2662-2668
H3	2674-2680
MDS1	2150-2156
MDS2	2156-2162
MDS2A	2156-2160

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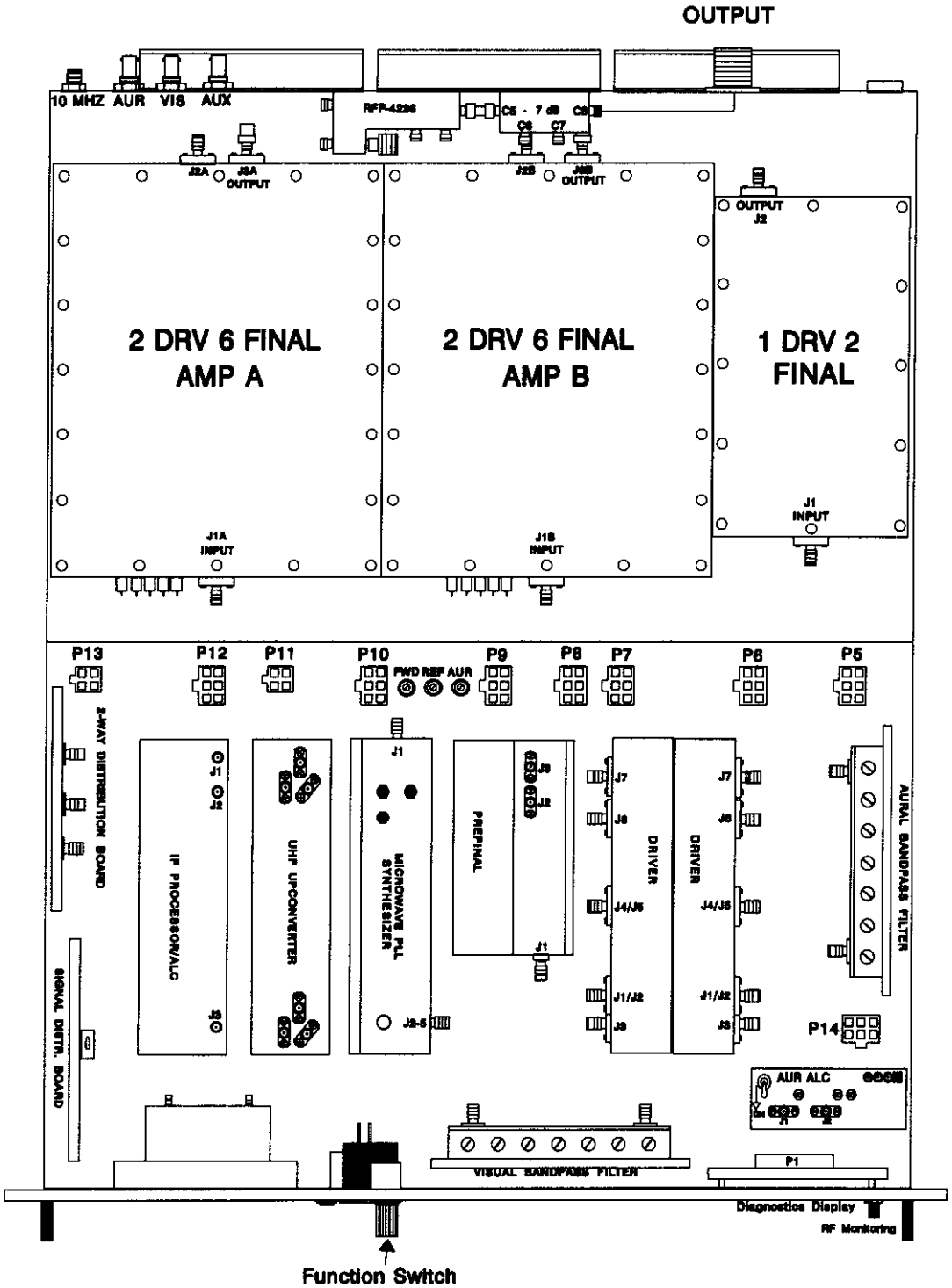
SBSA-50C TOP VIEW



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