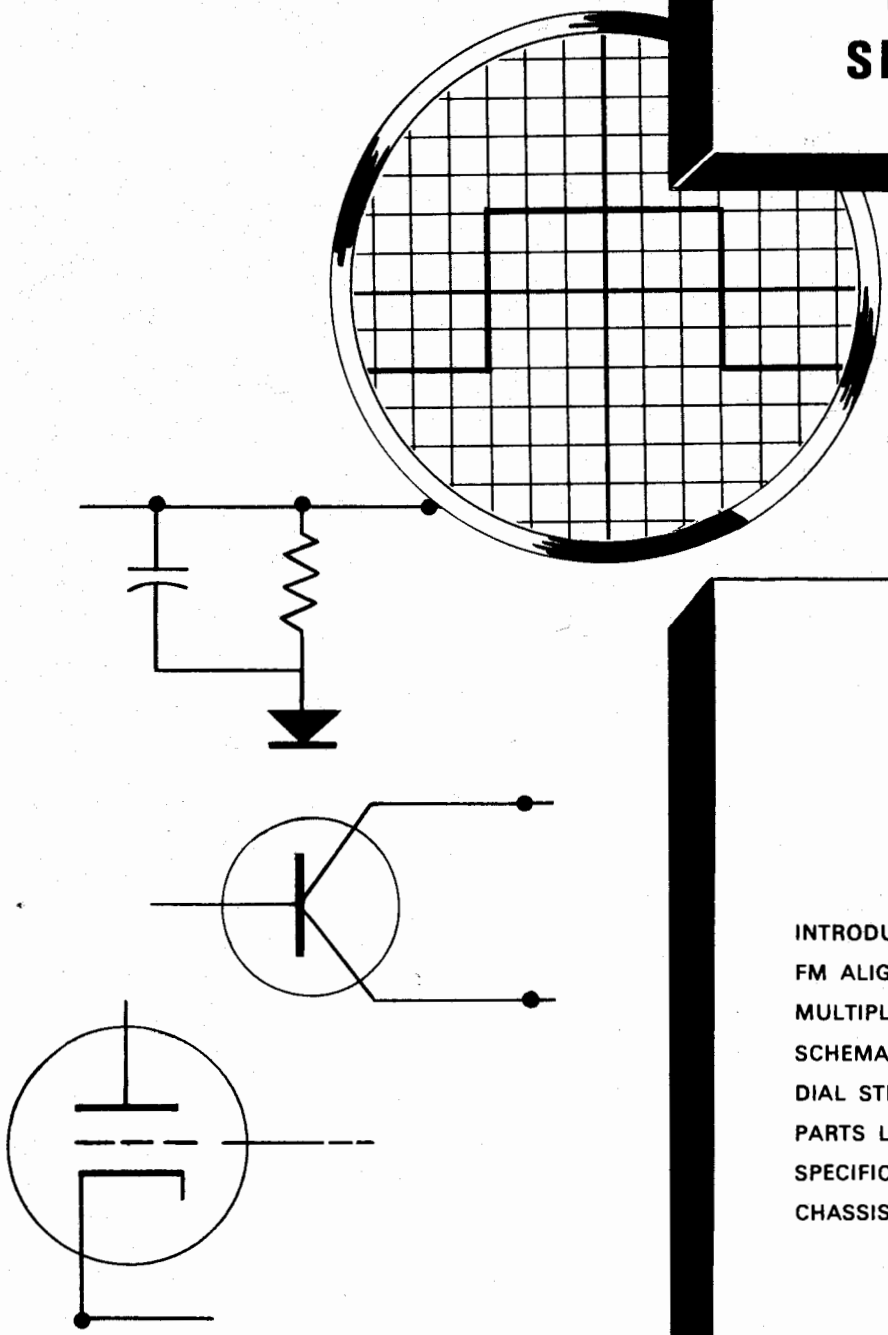
Bert Samuel

# FM STEREO TUNER

## WARRANTY STATION
# MR 71
## SERVICE MANUAL



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McIntosh LABORATORY INC.

2 CHAMBERS ST.
BINGHAMTON, N.Y.


McIntosh MR 71

# MR 71 FM STEREO TUNER

## INTRODUCTION

All McIntosh tuners are carefully aligned and tested at the factory using the finest available test equipment. All McIntosh tuners will meet their published specifications when shipped from the factory.

After extensive operation, especially when tubes have been replaced, it may be desirable to realign the tuner circuits for best performance. This manual gives complete information on the circuit realignment procedure for the MR 71 stereo tuner.

The test equipment listed below (or its equivalent) is necessary to properly align an MR 71. The accuracy of the alignment will be directly related to the accuracy and calibration of the test equipment used.

FM Signal Generator (Measurements 210A or equivalent)

VTVM

Multiplex Generator (RCA WR-51A or equivalent)

10.7 MC Generator (Preferably crystal controlled)

Oscilloscope (Hewlett-Packard 120B or equivalent)

Harmonic Distortion Analyzer, desirable but not essential—(Hewlett-Packard 330B or equivalent)

If the necessary test equipment is not available, alignment should not be attempted. You may contact the McIntosh Customer Service Department for additional information.

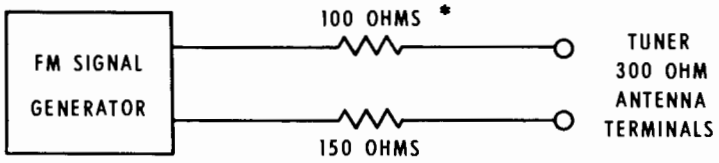
Customer Service
McIntosh Laboratory, Inc.
2 Chambers Street
Binghamton, New York

Our telephone number is 723-5491

The direct dial area code is 607

| STEPS | TUNER DIAL SETTING | SIGNAL GENERATOR | | | INDICATOR | |
|---|---|---|---|---|---|---|
| | | FREQ | COUPLING | MODULATION | TYPE | CONNECTED TO |
| 1 | Point of no interference or signal | 10.7MC | Through external .01MF cap to pin 7 of 12AT7 mixer | CW | VTVM | TP #1 |
| 2 | SAME | SAME | SAME | SAME | SAME | Pin 6 of T5 |
| 3 | SAME | SAME | SAME | SAME | SAME | Junction of D4 and R42 |
| 4 | SAME | SAME | SAME | SAME | SAME | T6, Pin 6 |
| 5 | SAME | SAME | SAME | SAME | SAME | TP #2 |
| 6 | 105MC | 105MC | 300 ohm antenna terminals with *matching network | 400 cycles 75KC deviation (100% modulation) | VTVM connected to TP1 and scope connected to L or R audio output | |
| 7 | 90MC | 90MC | SAME | SAME | | SAME |
| 8 | 105MC | 105MC | SAME | SAME | | SAME |
| 9 | 90MC | 90MC | SAME | SAME | | SAME |
| 10 | Point of no interference | | | | Scope | L or R output |
| 11 | 105MC | 105MC | SAME | 400 cycles 75KC deviation (100% modulation) attenuated to 2.5 microvolts output | VTVM connected to TP #1 and Scope connected to L or R audio output | |

ANTENNA MATCHING NETWORK






* IF SIGNAL GENERATOR HAS OTHER THAN 50 OHM INTERNAL IMPEDANCE, USE A RESISTOR OF 150 OHMS, LESS INTERNAL GENERATOR IMPEDANCE.

# ALIGNMENT

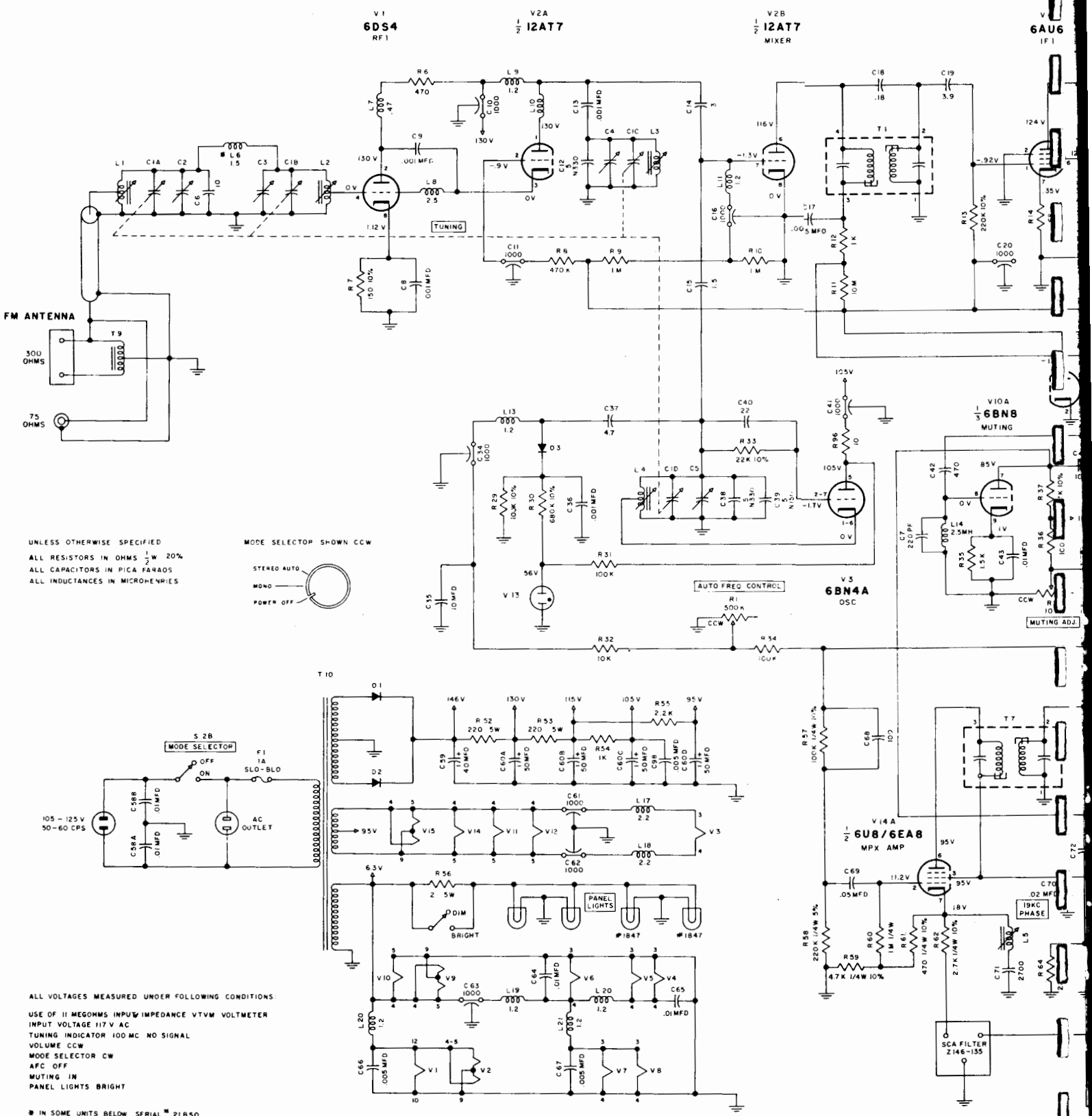
| ADJUST | TEST LIMITS | REMARKS |
|---|---|---|
| Top (Secondary) and bottom (Primary) cores of T1, T2, T3, and T4 | Maximum possible negative voltage | Shunt to ground the winding not being adjusted with a .01MF capacitor in series with a 1K resistor. Attenuate signal generator until output voltage at TP #1 is less than 1.5 volts with one IF transformer winding shunted. IF transformers have terminal #1 marked with a green dot and are numbered clockwise. |
| T5 Primary (Bottom core) | Same as above | |
| T5 Secondary (Top core) | Adjust for 0 volts | |
| T6 Primary (Bottom core) | Maximum negative voltage | If a distortion analyzer is available, omit this step at this time. Adjust T6 primary after step 9. At that time, use a strong signal from FM generator, modulate 100%, and use 75KC deviation. Adjust primary for minimum distortion. Should be no greater than 0.5%. |
| T6 Secondary (Top core) | Adjust for 0 volts | |
| Oscillator Trimmer | Maximum negative voltage | As output increases, attenuate signal generator to keep maximum output at TP #1 to a low level. By doing so, precise alignment can be achieved. |
| Oscillator Coil | SAME | Repeat steps 6 and 7 until dial calibration is accurate. |
| Mixer trimmer, RF trimmer, and Antenna trimmer | SAME | |
| Mixer, RF, and Antenna coil Tuning slugs | SAME | Repeat steps 8 and 9 until output is as high as possible. |
| Muting adj. control | | Turn muting switch to "in" position. Adjust muting control until background noise just disappears. |
| | IHFM sensitivity 2.5 microvolt for 3% total noise and distortion | Step 11 is an overall sensitivity check, and requires a distortion analyzer and FM signal generator with attenuator.<br>With 2.5 microvolts input at the 300 ohm antenna terminals, TP #1 voltage should be 3.0 volts or more. |

# MR 71 MULTIPLEX

| STEPS | TUNER DIAL SETTING | SIGNAL GENERATOR | | | INDICATOR | |
|---|---|---|---|---|---|---|
| | | FREQ. | COUPLING | MODULATION | TYPE | CONNECTED TO |
| 1 | | | | | | |
| 2 | 100MC | 100MC modulated by MPX generator | 300 ohm antenna terminals with approx. 1000 microvolt signal | 19KC pilot only | DC VTVM | Pin 7 of 6U8 (V14B) |
| 3 | | | | | | |
| 4 | SAME | SAME | SAME | 1KC 100% modulation left or right only, pilot on | Audio VTVM | Pin 1 or 2 of 38KC transformer (T8) |
| 5 | SAME | SAME | SAME | SAME | Audio VTVM and scope | L or R output jack |
| 6 | SAME | SAME | SAME | SAME | SAME | SAME |
| 7 | SAME | SAME | SAME | SAME | SAME | SAME |
| 8 | SAME | SAME | SAME | Turn off 1KC audio modulation | SAME | SAME |
| 9 | SAME | Tune to a strong MONO FM station | SAME | | MPX stereo indicator light on tuner | |

# DECODER ALIGNMENT

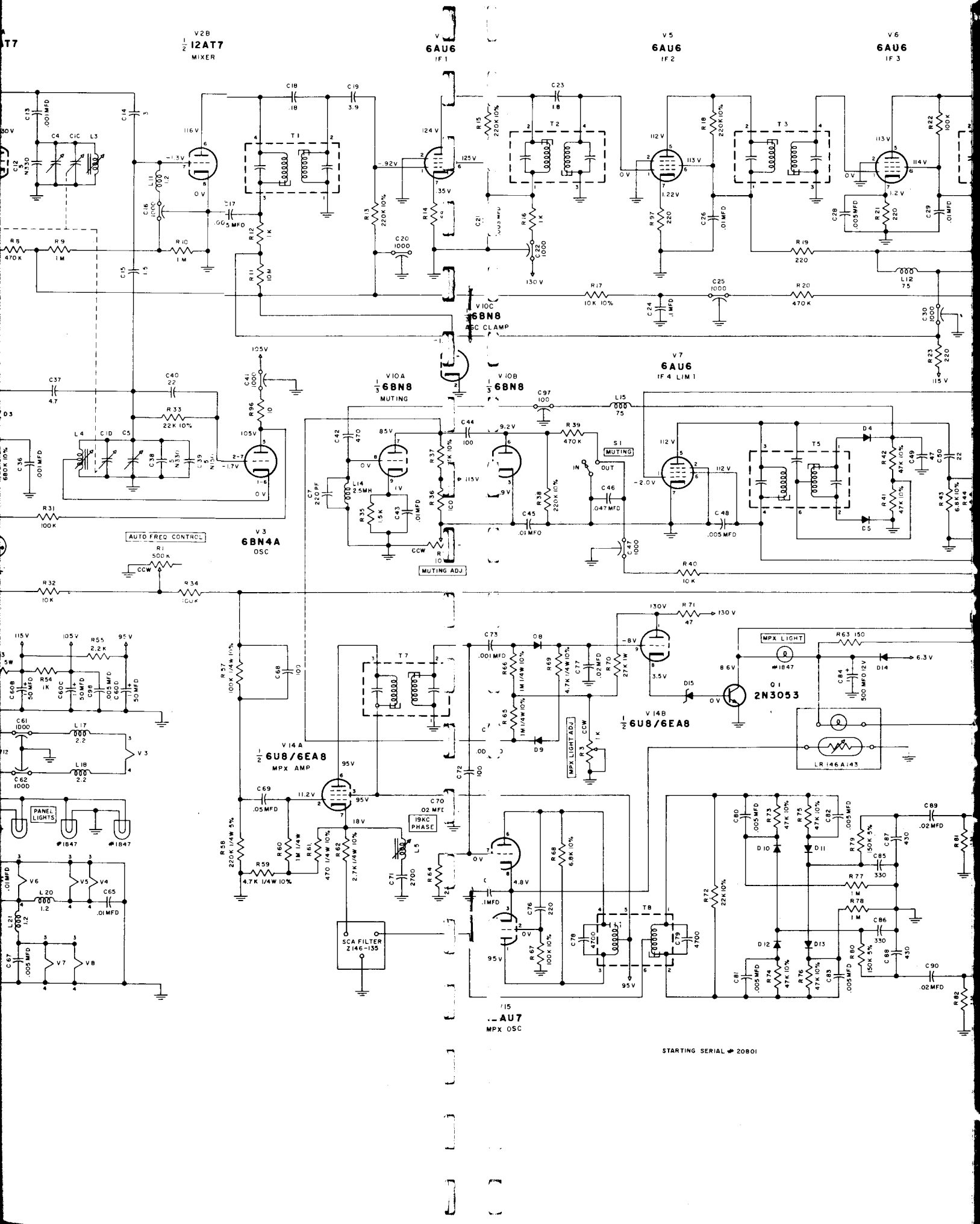
| ADJUST | TEST LIMITS | REMARKS |
|---|---|---|
| | | On the top of the chassis is an opening labeled "MPX Light Adjust." Insert a screw driver into this opening and turn the control completely counterclockwise. |
| 19KC phase coil and 19KC transformer (T7) | Adjust for maximum DC voltage | |
| | | Adjust "MPX Light Adjuster" control completely clockwise. |
| 38KC transformer bottom core | Adjust for maximum voltage | |
| 38KC transformer top core | Adjust for stable scope display | 1. Turn off 19KC pilot on MPX generator.<br>2. Adjust top core of 38KC transformer to obtain a stable and uniform 1KC signal scope display. This adjustment may be critical, so turn core very slowly.<br>3. Turn 19KC pilot back on. |
| 19KC phase coil | 30db separation or more | Modulate left channel and measure right channel output. Adjust 19KC phase coil for minimum right channel output (maximum separation). Remove all test leads from TP #2 for separation checks. |
| | SAME | Modulate right channel and measure left channel output. Separation in steps 5 and 6 should be at least 30db. |
| | This step checks the rejection of 19KC and 38KC frequencies. Residual output should be at least 40db below modulated output. | |
| MPX light adj. control—R3 | | Turn control until light comes on. Then back off just enough to cause the light to go off. Then back off about ⅛ of a turn more. Light should operate ONLY on an MPX signal. |

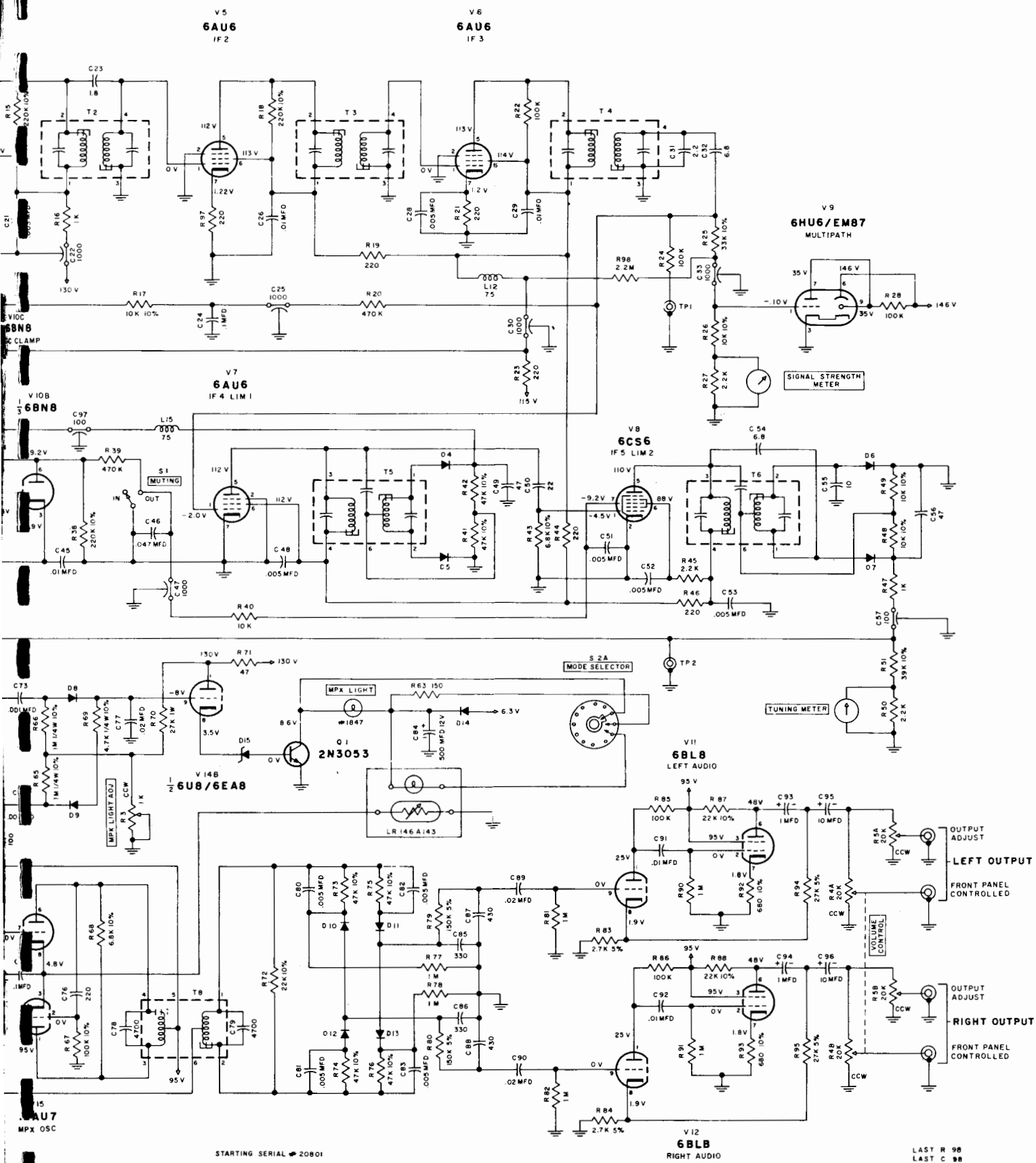



ALL VOLTAGES MEASURED UNDER FOLLOWING CONDITIONS

USE OF 11 MEGOHMS INPUT IMPEDANCE VTVM VOLTMETER
INPUT VOLTAGE 117 V AC
TUNING INDICATOR 100 MC NO SIGNAL
VOLUME CCW
MODE SELECTOR CW
AFC OFF
MUTING IN
PANEL LIGHTS BRIGHT

* IN SOME UNITS BELOW SERIAL # 21850
L6 IS NOT USED AND L1 IS LINK COUPLED TO L2


V2B
1/2 12AT7
MIXER
V
6AU6
IF 1
V5
6AU6
IF 2
V6
6AU6
IF 3
V10C
6BN8
AGC CLAMP
V7
6AU6
IF 4 LIM 1
V10A
1/3 6BN8
MUTING
V10B
1/3 6BN8
V3
6BN4A
OSC
AUTO FREQ CONTROL
MUTING ADJ
S1
MUTING
V14A
1/2 6U8/6EA8
MPX AMP
V14B
1/2 6U8/6EA8
MPX LIGHT ADJ
19KC PHASE
SCA FILTER
Z146-135
Q1
2N3053
MPX LIGHT
#1847
LR 146 A 143
PANEL LIGHTS
V15
AU7
MPX OSC
STARTING SERIAL # 20801


V5
6AU6
IF 2
V6
6AU6
IF 3
V9
6HU6/EM87
MULTIPATH
V7
6AU6
IF 4 LIM 1
V8
6CS6
IF 5 LIM 2
V10B
6BN8
V10C
6BN8
AGC CLAMP
V14B
6U8/6EA8
V11
6BL8
LEFT AUDIO
V12
6BLB
RIGHT AUDIO
V15
6AU7
MPX OSC
Q1
2N3053
#1847
LR 146 A143
S1
MUTING
S2A
MODE SELECTOR
SIGNAL STRENGTH METER
TUNING METER
MPX LIGHT
MPX LIGHT ADJ
VOLUME CONTROL
OUTPUT ADJUST
LEFT OUTPUT
RIGHT OUTPUT
FRONT PANEL CONTROLLED
TP1
TP2
STARTING SERIAL # 20801
LAST R 98
LAST C 98
C27 IS NOT USED
SCHEMATIC, MR 71
McIntosh LABORATORY INC
SC147E167

# MR 71 PARTS LIST

## TUBES

| ITEM NO. | USE | IDENTIFICATION NUMBER |
|---|---|---|
| V1 | RF Amplifier 1 | 6DS4 |
| V2 | RF Amplifier 2; Mixer | 12AT7 |
| V3 | Oscillator | 6BN4A |
| V4 | IF Amplifier 1 | 6AU6 |
| V5 | IF Amplifier 2 | 6AU6 |
| V6 | IF Amplifier 3 | 6AU6 |
| V7 | IF Amplifier 4; Limiter 1 | 6AU6 |
| V8 | IF Amplifier 5, Limiter 2; Muting | 6CS6 |
| V9 | Multipath Indicator | 6HU6/EM87 |
| V10 | Muting Amplifier; Muting Detector; AGC Clamp | 6BN8 |
| V11 | Left Audio Amplifier | 6BL8 |
| V12 | Right Audio Amplifier | 6BL8 |
| V13 | Voltage Reference Diode | ST2-27S |
| V14 | MPX Amplifier, MPX Indicator Control | 6U8 |
| V15 | MPX Oscillator | 12AU7 |

## TRANSISTOR

| | | |
|---|---|---|
| Q1 | MPX Indicator Lamp Switch | 2N3053 |

## DIODES

| | | |
|---|---|---|
| D1, D2 | Selenium Rectifiers, High Voltage Power Supply | GE#6RS20PH6RGD1 |
| D3 | Variable Capacitance | Amprex S-254 |
| D4, D5 | Narrow Band Discriminator (Matched Pair) | Type 1N542 Germanium Diode |
| D6, D7 | Wide Band Discriminator (Matched Pair) | Type 1N542 Germanium Diode |
| D8, D9 | Balanced Detector for MPX Indicator (Matched Pair) | Type 1N542 Germanium Diode |
| D10, D12 | Balanced MPX Detectors—Left Channel (Matched Pair) | Type 1N542 Germanium Diode |
| D11, D13 | Balanced MPX Detectors—Right Channel (Matched Pair) | Type 1N542 Germanium Diode |
| D14 | Low Voltage Rectifier | Type 1N1217 Silicon Diode |

## CONTROLS

| ITEM NO. | FUNCTION | RESISTANCE | IDENTIFICATION NUMBER |
|---|---|---|---|
| R1 | Automatic Freq. Control | 500K | R147-A103 |
| R2 | Muting Adj. Pot. | 10K | R50, 000-6F |
| R3 | MPX Light Adj. | 1K | Wirt #807 |
| R4 | Volume Control | 20K (Dual) | R105-164 |
| R5 | Rear Panel Output Adj. Control | 40K (Dual) | R147-A102 |

## SWITCHES

| ITEM NO. | FUNCTION | DESCRIPTION | IDENTIFICATION NUMBER |
|---|---|---|---|
| S1 | Muting | 3 position | S147-B130 |
| S2 | Mode Selector | 3 position with on/off switch | S147-B105 |
| S3 | Panel Light Dim-Bright | SPST | Stackpole SS-26 |

## TRANSFORMERS

| ITEM NO. | FUNCTION | IDENTIFICATION NUMBER |
|---|---|---|
| T1 | FM first IF | T107-134A |
| T2 | FM second IF | T107-133A |
| T3 | FM third IF | T107-133A |
| T4 | FM fourth IF | T107-133A |
| T5 | FM fifth IF, Discriminator | T107-135B |
| T6 | FM Discriminator | T107-135B |
| T7 | 19KC Amplifier | T129-101A |
| T8 | 38KC Oscillator | T129-102A |
| T9 | Balun | |
| T10 | Power | T123-133A |

## CAPACITORS

| ITEM NO. | DESCRIPTION | CAPACITANCE | VOLTAGE | TOLERANCE | IDENTIFICATION NUMBER |
|---|---|---|---|---|---|
| C1 | Variable FM | | | | C147-C101 |
| C2 | Antenna Trimmer | 1-8pf | | NPO | |
| C3 | RF Trimmer | 1-8pf | | NPO | |
| C4 | Mixer Trimmer | 1-8pf | | NPO | |
| C5 | Oscillator Trimmer | 1-8pf | | | |
| C6 | Ceramic Disc | 10pf | | 20% NPO | |
| C7 | Ceramic Disc | 6.8pf | | 20% NPO | |
| C10 | Ceramic Feed Thru | 1000pf | | | |
| C12 | Ceramic Tubular | 5pf | | ±.25pf N330 | |
| C14 | Ceramic Tubular | 3pf | | ±.25pf NPO | |
| C15 | Ceramic Tubular | 1.5pf | | ±.25pf NPO | |
| C16 | Ceramic Feed Thru | 1000pf | | | |
| C18 | Phenolic | .18pf | | 10% | |
| C19 | Phenolic | 3.9pf | | 10% | |
| C20 | Ceramic Feed Thru | 1000pf | | | |
| C22 | Ceramic Feed Thru | 1000pf | | | |

## CAPACITORS

| ITEM NO. | DESCRIPTION | CAPACITANCE | VOLTAGE | TOLERANCE | IDENTIFICATION NUMBER |
|---|---|---|---|---|---|
| C23 | Phenolic | .33pf | | 10% | |
| C25 | Ceramic Feed Thru | 1000pf | | | |
| C27 | Phenolic | .33pf | | 10% | |
| C30 | Ceramic Feed Thru | 1000pf | | | |
| C31 | Phenolic | 2.2pf | | 10% | |
| C32 | Ceramic Disc | 6.8pf | | 20% NPO | |
| C33 | Ceramic Feed Thru | 1000pf | | | |
| C34 | Ceramic Feed Thru | 1000pf | | | |
| C35 | Non-Polarized Electrolytic | 10mfd | 25V | +100-10% | |
| C37 | Ceramic Disc | .47pf | | 20% NPO | |
| C38 | Ceramic Tubular | 5pf | | ±.25pf N330 | |
| C39 | Ceramic Tubular | 5pf | | ±.25pf N150 | |
| C40 | Ceramic Disc | 22pf | | 20% N470 | |
| C41 | Ceramic Feed Thru | 1000pf | | | |
| C42 | Ceramic Disc | 470pf | | 20% | |
| C44 | Ceramic Disc | 100pf | | 10% N1500 | |
| C46 | Paper | .047mfd | 200V | 20% | |
| C47 | Ceramic Feed Thru | 1000pf | | | |
| C49 | Ceramic Disc | 47pf | | 20% N470 | |
| C50 | Ceramic Disc | 22pf | | 10% NPO | |
| C54 | Ceramic Disc | 6.8pf | | 20% NPO | |
| C55 | Ceramic Disc | 10pf | | 20% NPO | |
| C56 | Ceramic Disc | 27pf | | 20% N470 | |
| C57 | Ceramic Feed Thru | 100pf | | | |
| C58 | Ceramic Disc | 2 x .01 | 900V AC | | |
| C59 | Electrolytic | 40mfd | 200V | | |
| C60 | Electrolytic | 4 x 50mfd | 200V | | |
| C61 | Ceramic Feed Thru | 1000pf | | | |
| C62 | Ceramic Feed Thru | 1000pf | | | |
| C63 | Ceramic Feed Thru | 1000pf | | | |
| C68 | Ceramic Disc | 100pf | | 10% N1500 | |
| C70 | Paper | .0022mfd | 400V | 10% | |
| C71 | Silver Mica | 2700pf | 100V | 5% | |
| C72 | Ceramic Disc | 100pf | | 10% N1500 | |
| C76 | Ceramic Disc | 220pf | | 20% | |
| C78 | Silver Mica | 4700pf | 100V | 5% | |
| C79 | Silver Mica | 4700pf | 100V | 5% | |
| C85 | Ceramic Disc | 330pf | | 10% | |
| C86 | Ceramic Disc | 330pf | | 10% | |
| C87 | Ceramic Tubular | 430pf | | 5% | |
| C88 | Ceramic Tubular | 430pf | | 5% | |
| C93 | Electrolytic | 1mfd | 150V | | C124-129 |
| C94 | Electrolytic | 1mfd | 150V | | C124-129 |
| C95 | Electrolytic | 10mfd | 3V | | |
| C96 | Electrolytic | 10mfd | 3V | | |

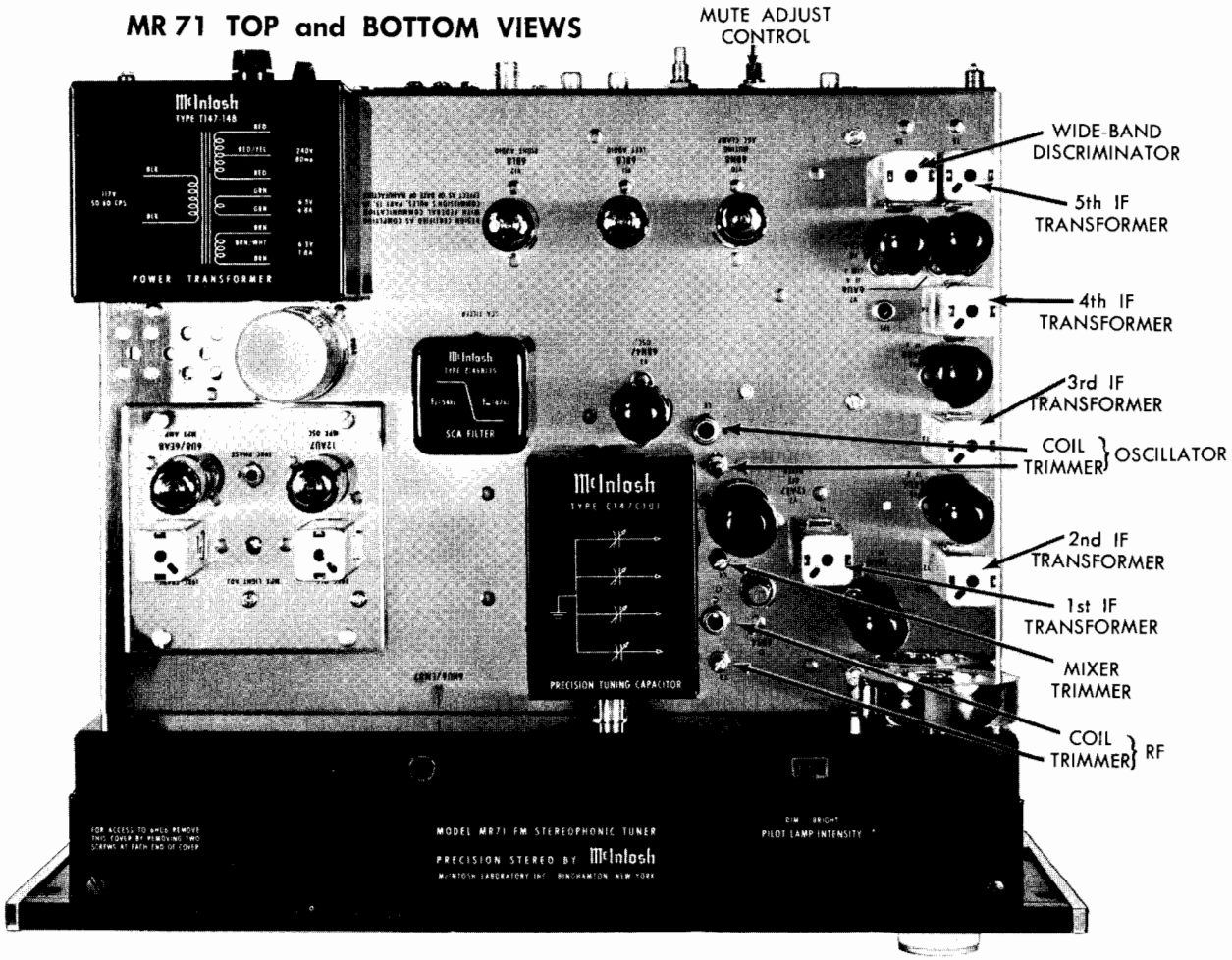
## COILS

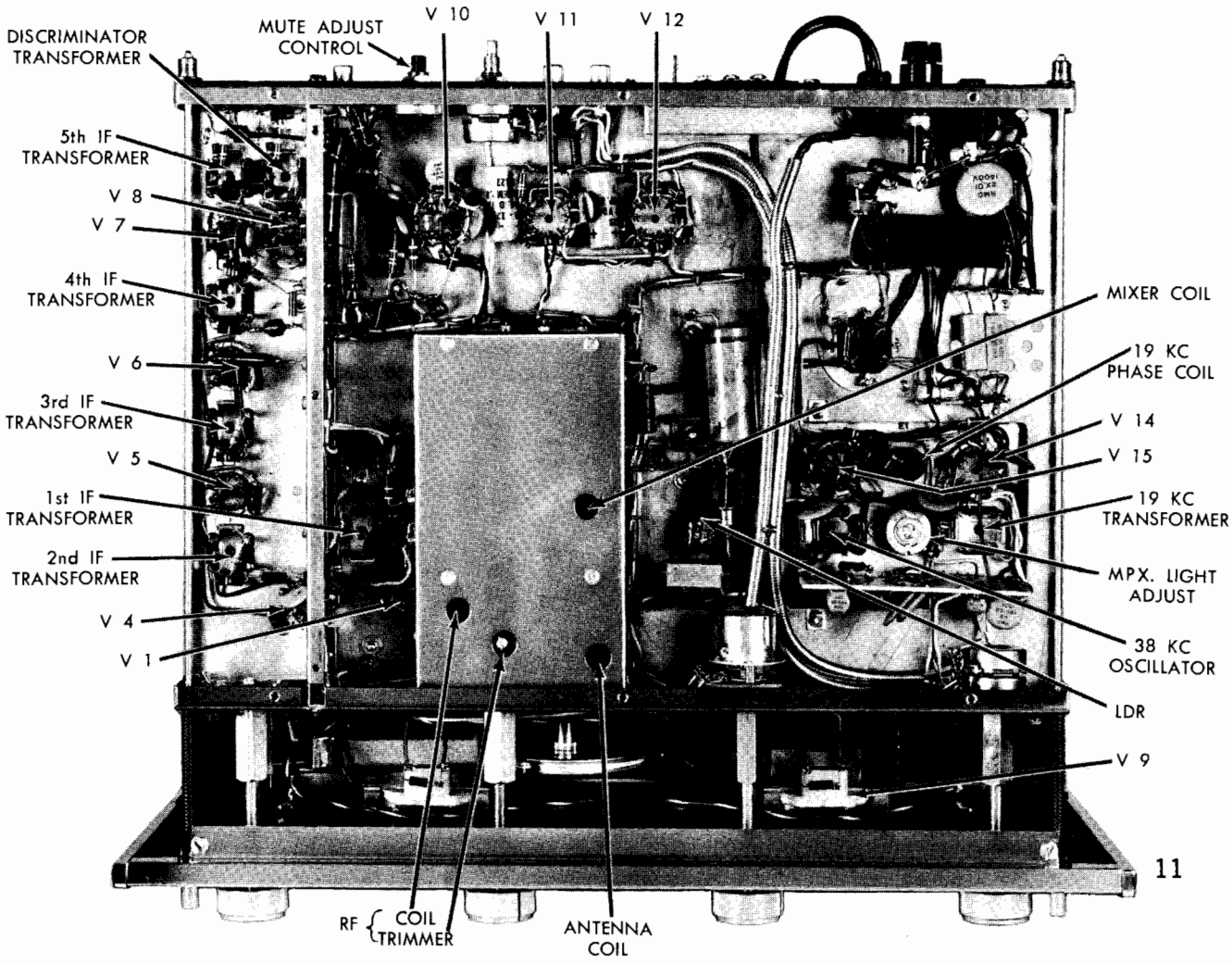
| ITEM NO. | DESCRIPTION | VALUE | IDENTIFICATION NUMBER |
|---|---|---|---|
| L1 | Antenna Coil | | L107A141 |
| L2 | RF Coil | | L107-207A |
| L3 | Mixer Coil | | L107-208B |
| L4 | Oscillator Coil | | L107-206A |
| L5 | 19KC Trap | | L129-103 |
| L6 | Coupling Link | | |
| L7 | RF Choke | .47 Micro H | |
| L8 | RF Choke | 2.2 Micro H | |
| L9 | RF Choke | 1.2 Micro H | |
| L10 | RF Choke | | L10, 004 |
| L11 | RF Choke | 1.2 Micro H | |
| L12 | RF Choke | 75 Micro H | |
| L13 | RF Choke | 1.2 Micro H | |
| L14 | RF Choke | 2.5 Micro H | M-7060 |
| L15 | RF Choke | 75 Micro H | |
| L16 | Peaking Coil | | L129-123 |
| L17 | RF Choke | 2.2 Micro H | |
| L18 | RF Choke | 2.2 Micro H | |
| L19 | RF Choke | 1.2 Micro H | |
| L20 | RF Choke | 1.2 Micro H | |
| L21 | RF Choke | 1.2 Micro H | |

## MISCELLANEOUS

Lamp, Festoon: 7 volts, 2 watts, 7 x 43mm
Lamp, Stereo: No. 1850
Lamp, Meter: No. 1847
Fuse: 1 Amp. Slo-Blo, 3AG
Meter, Signal Strength: #M146B146
Meter, Tuning: #M146B148
LDR Network: #R146-A143
Cable, Coaxial: 50 ohm, Amphenol #21-598
SCA Filter: #Z146B135

# MR 71 TOP and BOTTOM VIEWS



## SPECIFICATIONS

**Useable Sensitivity**
2.5 microvolts at 100% modulation (±75KC deviation) for less than 3% total noise and harmonic distortion in accordance with IHF standards.

**Audio Frequency Response**
Within ½ db from 20 to 20,000 cycles.

**Distortion**
Less than 0.5% at 100% modulation ±75KC deviation.

**Capture Ratio**
1.5db at 100% modulation.

**Muting**
IF injected ultrasonic muting: at least 60db noise reduction between stations.

**Oscillator Drift**
Less than 25KC with AFC disabled; negligible with AFC in operation.

**Image Rejection**
Better than 80db at 90MC; better than 70db at 105MC.

**Hum**
Better than 70db below 100% modulation.

**Output**
Approximately 2.5 volts; low impedance.

**Antenna Inputs**
300 ohms balanced; 75 ohms unbalanced.

**RF Amplifier**
Cascode with 6DS4 Nuvistor in first stage.

**IF Stages**
Five, with 200KC bandwidth

**Limiters**
Two.

**Radiation**
Substantially below FCC requirements.

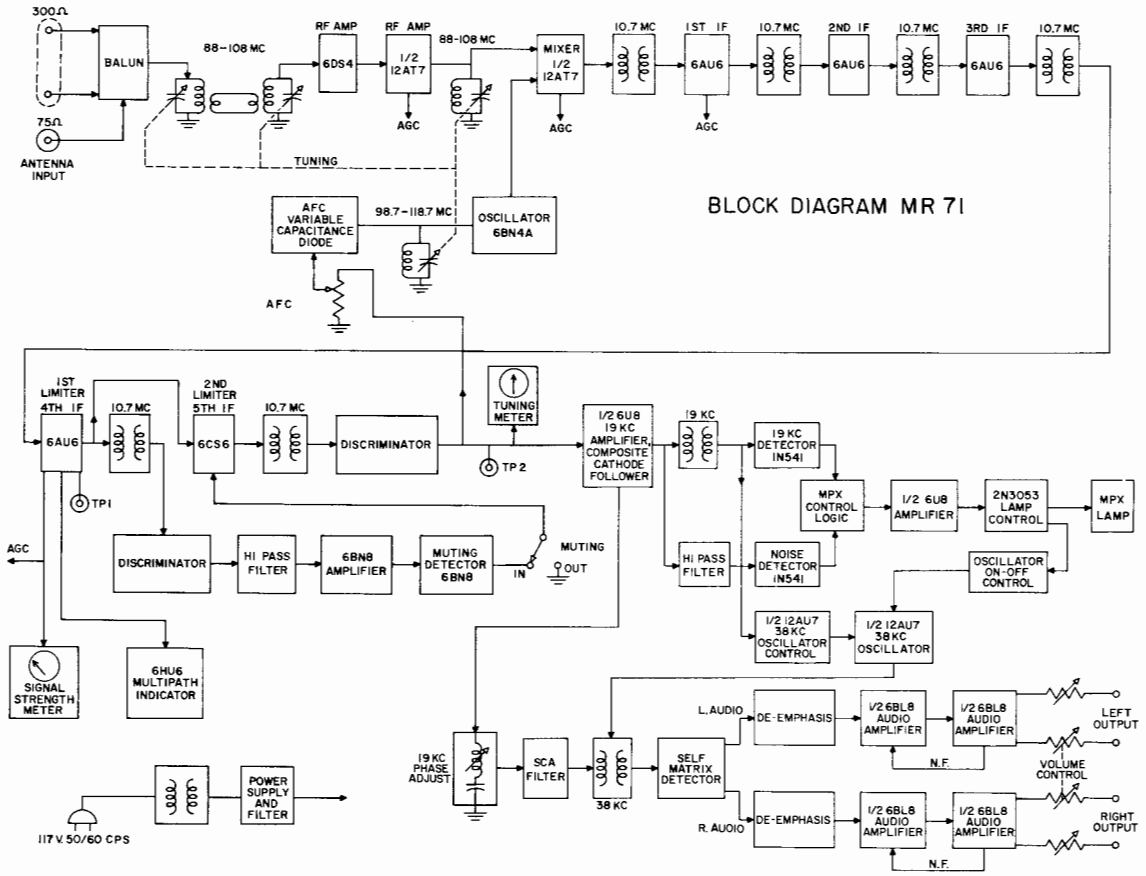
**Multiplex Channel Separation**
Better than 30db at 1000 cycles.

**Multiplex Filter**
Greater than 48db suppression of 19KC pilot and 38KC carrier.

**Multiplex Indicator**
Front panel multiplex stereo light activated by 19KC carrier-only.

**Multiplex Type**
Peak-detecting, self-matrixing detector.

**SCA Filter**
50db down at 67KC to 74KC 275db per octave slope.



# McIntosh

## LABORATORY INC.

**2 Chambers St., Binghamton, N.Y.**

Made in U.S.A.

Phone—Area Code 607-723-5491

Design subject to change without notice.

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