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**Transformer:**

- **T01, 202**
  - 0-20306A53
  - 2T 32 on 3B bead

**Integrated Circuit:**

- **U020**
  - 51-0365A16
  - 600-MHz prescaler

- **U023**
  - 51-0365A08
  - Biquinary counter

- **U024**
  - 51-0365A07
  - Phase-locked frequency detector

- **U025**
  - 51-0365A07
  - Operational amplifier

- **U026**
  - 51-0365A06
  - Triple line receiver

- **U027**
  - 51-0365A05
  - Mixer

- **U028**
  - 51-0365A05
  - Operational amplifier

- **U029**
  - 51-0365A32
  - High-speed 1.3 GHz divider

- **U030**
  - 1-8649A60
  - Mixer

- **U031**
  - 51-0365A19
  - 100 Mhz prescaler

- **U032**
  - 51-0365A14
  - Micro circuit, NES54A4N screened low noise operational amplifier

- **U033**
  - 51-0365A4X
  - IRC 800-MHz wideband hybrid amplifier

- **U034**
  - 51-0365A53
  - Dual 1-channel analog multiplexer
demultiplexer

- **U035**
  - 51-0365A53
  - Hex open drain 4-channel buffer
demultiplexer

- **U036**
  - 51-0365A53
  - Operational amplifier
demultiplexer

- **U037**
  - 51-0365A09
  - Operational amplifier
demultiplexer

- **U038**
  - 51-0365A09
  - Differential video wideband amplifier
demultiplexer

- **U039**
  - 51-0322A05
  - Balanced modulator/demodulator

**Canoe diode:**

- 5A, 1/4 W; unless otherwise stated

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**REF. NO.**

- **RTC-4010B**
  - RF synthesizer

- **S44-035A21**
  - PWB, rf synthesizer

- **SM36W48AP3**
  - Solder

- **11-1415A21**
  - Ink, BLK

- **26-002E0006**
  - 0.01 Ohm

- **26-002E0003**
  - 0.01 Microfarad

- **26-002E0001**
  - 0.01 Ohm

- **1-802B5A61**
  - Cable, semi-rigid

- **26-002E0005**
  - Shield, can

- **26-002E0008**
  - 0.01 Ohm

- **51-0365A03**
  - Solder

- **M20355-103-9**
  - INTEGRATOR SLEEVING, 0.080 WHD

- **M20355-205-C**
  - INSULATION SLEEVING, 0.187 CLR

- **M20355-220-A**
  - INSULATION TAPED, 11 IN TEL

- **32-002E0001**
  - Wire, 24
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RF SYNTHESIZER (A05)
RF BOARD
MODEL RTC4010B
SCHEMATIC DIAGRAM, CIRCUIT BOARD
DETAIL, AND PARTS LIST

Motorola No. PEPS-37065-O
(Sheet 5 of 6)
8/12/83-PHI
RF SYNTHESIZER (A05)
RF BOARD
MODEL RTC4010B
SCHEMATIC DIAGRAM, CIRCUIT BOARD
DETAIL, AND PARTS LIST

Motorola No. PEPS-37065-O
(Sheet 6 of 6)
8/12/83- PHI
1. DESCRIPTION

1.1 The receiver demodulates and processes the 10.7 MHz i-f output from the rf module to recovered AM and FM audio signals. The receiver consists of an i-f section, an audio section, a squelch section, frequency counter output circuit, and a microprocessor interface.

1.2 Input signals are subjected to filtering, amplification, limiting, detection, and AGC control. Primary outputs from the receiver board include calibrated audio levels corresponding to deviation and percent of amplitude modulation. A gated 10.7 MHz i-f signal is output to the counter circuits to determine frequency error. The amplifiers in the i-f section are AGC controlled to establish overload alarm signals. Squelch status is applied to the front panel for monitoring. All switching on the receiver is microprocessor-controlled via the data bus.

1.3 RF from the wideband amplifier is applied via coaxial cable to J1 on the receiver board. The recovered audio is applied to the output via the main interconnect board.

2. THEORY OF OPERATION

2.1 I-F SECTION

2.1.1 General

The i-f section consists of an AGC controlled amplifier, AGC circuit, AM i-f and detector circuit, FM i-f and quadrature detector circuit, and bandpass filtering. The output from the rf module is connected via coaxial cable to J1. Amplifier U1 is an AGC controlled input amplifier that is matched to the narrow bandpass and wide bandpass filter. U1 gain is determined by the output of U6A. Narrowband or wideband filtering is selected by the i-f bandwidth control lines. The FM i-f signal is sent to the FM i-f circuit and quadrature detector U2 where it is converted into audio.

2.1.2 AGC Controlled Amplifier

I-F input amplifier U1 is an AGC controlled amplifier. The i-f circuit is terminated through J1 by a 50 ohm load. The output of U1 is a 4000 ohm tuned circuit and matched filter.

2.1.3 AGC Circuit

The dc component of the composite AM signal is applied to amplifier U6A where it is amplified and sent to amplifier U1 as the AGC voltage. Feedback circuitry and filtering provide sufficient time for the AGC circuit to respond to changes in signal level inherent with AM signals.

2.1.4 AM I-F and Detector

AM i-f signals are routed through transistor circuits utilizing a high input impedance to avoid loading the i-f filter output. AM detection is accomplished by diode CR13 with the composite signal being developed across C48 and R54.

2.1.5 FM I-F and Quadrature Detector Circuit

The output of the i-f filter is applied to U2. The amplifier combines both amplifier, limiter, and quadrature detector on a single integrated circuit. The tuned network from pin 8 to pin 10 supplies a quadrature i-f signal. The i-f signal and quadrature component are applied to the internal detector of U2. The audio output is sent to audio amplifier U8B.

2.2 AUDIO/SQUELCH SECTION

Composite AM from the AM detector is sent through a 7 kHz low-pass filter prior to being amplified by U9B. The AM audio signal is applied to amplifier U5A where it is amplified and applied to the percent modulation output. AM audio is also applied to gate U7C and is routed through the active filter U12B. If FM select is active, the FM audio signal from amplifiers
U8B and U9A is routed through squelch gate U7C and U7D to the active filter.

2.3 AUDIO/COUNTER SECTION

The audio section consists of an audio inverter and an audio output amplifier. Audio is inverted by U12A. Switching for inversion is determined by U10A, U10B, and U10C. Audio is buffered by transistors Q8 and Q9 before being applied to the output as recovered audio. The i-f signal from amplifier Q7 is buffered by transistor Q10 before being routed off the board as a 10.7 MHz signal. U6B and U16A determine at what input level the 10.7 MHz output is to be enabled. Transistor Q11 enables CR18 to open the 10.7 MHz output line. AGC output from amplifier U6A is inverted by U4A. Squelch comparator U4B applies the squelch gate signal and the signal level voltage to light the front panel indicator.

2.4 INTERFACE SECTION

The interface section consists of an address decoder, data latch, and i-f bandwidth control line switch. The address decoder receives address input on A0 through A3 address lines and applies a data strobe to data latch U14. The data strobe gates data from data lines D0 through D3 into U14 to generate AM/FM select, audio invert, and i-f bandwidth gain signals. The i-f bandwidth control line switch applies narrow band or wideband select signals to the i-f input audio amplifier and filter circuit.
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<td>R70</td>
<td>18-3435F14</td>
<td>variable; 10k</td>
</tr>
<tr>
<td>R71</td>
<td>6-124A63</td>
<td>3.9k</td>
</tr>
<tr>
<td>R72</td>
<td>6-124B06</td>
<td>220</td>
</tr>
<tr>
<td>R73, 74</td>
<td>6-124A73</td>
<td>10k</td>
</tr>
<tr>
<td>R75</td>
<td>18-3435F18</td>
<td>variable; 50k</td>
</tr>
<tr>
<td>R76</td>
<td>6-124A37</td>
<td>39k (note 2)</td>
</tr>
<tr>
<td>R77</td>
<td>18-3435F17</td>
<td>variable; 50k</td>
</tr>
<tr>
<td>R78, 80</td>
<td>5-124A09</td>
<td>11k (note 2)</td>
</tr>
<tr>
<td>R81, 82</td>
<td>6-124A75</td>
<td>12k</td>
</tr>
<tr>
<td>R83</td>
<td>6-124A89</td>
<td>47k</td>
</tr>
<tr>
<td>R84</td>
<td>6-124A88</td>
<td>43k</td>
</tr>
<tr>
<td>R85</td>
<td>6-124A25</td>
<td>100</td>
</tr>
<tr>
<td>R86, 87</td>
<td>6-124A72</td>
<td>9.1k</td>
</tr>
<tr>
<td>R88</td>
<td>6-124A25</td>
<td>100</td>
</tr>
<tr>
<td>R89</td>
<td>6-124A09</td>
<td>22</td>
</tr>
<tr>
<td>R90</td>
<td>6-124A09</td>
<td>68k</td>
</tr>
<tr>
<td>R91</td>
<td>6-124A73</td>
<td>330</td>
</tr>
<tr>
<td>R92</td>
<td>6-124A01</td>
<td>10</td>
</tr>
<tr>
<td>R93</td>
<td>6-124A77</td>
<td>15k</td>
</tr>
<tr>
<td>R94</td>
<td>6-124A45</td>
<td>660</td>
</tr>
<tr>
<td>R95</td>
<td>6-124A45</td>
<td>4k</td>
</tr>
<tr>
<td>R96</td>
<td>6-124A39</td>
<td>2.7k</td>
</tr>
<tr>
<td>R97</td>
<td>6-124B14</td>
<td>470k</td>
</tr>
<tr>
<td>R98</td>
<td>6-124A44</td>
<td>920</td>
</tr>
<tr>
<td>R99</td>
<td>5-124A07</td>
<td>100k</td>
</tr>
<tr>
<td>R100</td>
<td>6-124A07</td>
<td>2.2k</td>
</tr>
<tr>
<td>R101, 102</td>
<td>6-124A06</td>
<td>220k</td>
</tr>
<tr>
<td>R103, 104</td>
<td>18-3435F13</td>
<td>variable; 10k</td>
</tr>
<tr>
<td>R105, 106</td>
<td>6-124A77</td>
<td>15k</td>
</tr>
<tr>
<td>R107</td>
<td>6-124B02</td>
<td>150k</td>
</tr>
<tr>
<td>R108 thru 112</td>
<td>5-124A71</td>
<td>8.2k</td>
</tr>
<tr>
<td>R110, 111</td>
<td>5-124A07</td>
<td>0.6k</td>
</tr>
<tr>
<td>R115, 116</td>
<td>6-124A01</td>
<td>10</td>
</tr>
</tbody>
</table>

Integrated circuit: (see note 1)

U1 51-80966G01 I-f amplifier
U2 51-8456L65 quad detector
U3 51-8284L48 quad bilateral switch
U4 51-8497L46S dual operational amplifier
U5, 6 51-8038A07 dual operational amplifier
U7 51-8284L48 quad bilateral switch
U8 9 51-8038A07 dual operational amplifier
U10 51-8284L48 quad bilateral switch
U11 NOT USED
U12 51-8038A07 dual operational amplifier
U13 NOT USED
U14 51-8284L15 quad clocked D-Flip
U15, 16 51-8437L67 quad comparator
U17 51-8456L42 dual 1 of 4 decoder/demultiplexer

VR1, 2 46-82206C46 Zener type; ± 5%; 3.9 V

<table>
<thead>
<tr>
<th>REFERENCE SYMBOL</th>
<th>MOTOROLA PART NO.</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y1</td>
<td>9T-80377A94</td>
<td>ceramic filter (see note 1)</td>
</tr>
<tr>
<td>Y2</td>
<td>9T-80377A29</td>
<td>crystal filter</td>
</tr>
</tbody>
</table>

Notes:
1. For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.
2. R55, R76, and R77 may be selected at the factory from the values indicated.

References:
- SCREW, machine: 4-40 x 1/4"; 7 used
- SHELTER: 26-80378A52
- ACTUATOR, ejection; 2 used
RECEIVER BOARD (A06)
MODEL RTL4091A
SCHEMATIC DIAGRAM, CIRCUIT BOARD DETAIL, AND PARTS LIST

Motorola No. PEPS-36848-O
(Sheet 2 of 5)
8/12/83-PHI
NOTES:
1. Unless otherwise indicated, resistor values are ohms, capacitor microfarads, and inductor values are in microhenries.
2. Input voltages are measured with no i-f input, FM operating mor
   IF, and normal audio squelch open.
3. *10.7 MHz PP voltages are measured at -47.0 dBm input, narrow
   FM, and normal audio squelch open.
4. *10.7 MHz PP voltages are measured at -47.0 dBm input, narrow bi
   audio, 500 kHz deviation, 1000 Hz modulating signal.
5. Integrated circuits on this board are TTL and CMOS devices.
6. IC types and connections for this board are as follows:
7. 10.7 MHz signal flow shown for narrow band i-f.

<table>
<thead>
<tr>
<th>Reference Designation</th>
<th>Mfg's Description</th>
<th>+ 5V</th>
</tr>
</thead>
<tbody>
<tr>
<td>U1</td>
<td>IF Amp</td>
<td></td>
</tr>
<tr>
<td>U2</td>
<td>Quad Detector</td>
<td></td>
</tr>
<tr>
<td>U3</td>
<td>Quad Bif Latch SW</td>
<td></td>
</tr>
<tr>
<td>U4</td>
<td>Dual Op Amp</td>
<td></td>
</tr>
<tr>
<td>U5</td>
<td>Dual Op Amp</td>
<td></td>
</tr>
<tr>
<td>U6</td>
<td>Dual Op Amp</td>
<td></td>
</tr>
<tr>
<td>U7</td>
<td>Quad Op Latch SW</td>
<td></td>
</tr>
<tr>
<td>U8</td>
<td>Dual Op Amp</td>
<td></td>
</tr>
<tr>
<td>U9</td>
<td>Dual Op Amp</td>
<td></td>
</tr>
<tr>
<td>U10</td>
<td>Quad Bif Latch SW</td>
<td></td>
</tr>
<tr>
<td>U11</td>
<td>Quad Op Latch</td>
<td></td>
</tr>
<tr>
<td>U12</td>
<td>Quad Op Latch</td>
<td></td>
</tr>
<tr>
<td>U13</td>
<td>Quad Op Latch</td>
<td></td>
</tr>
<tr>
<td>U14</td>
<td>Quad Comparator</td>
<td>16</td>
</tr>
<tr>
<td>U15</td>
<td>Quad Comparator</td>
<td>3</td>
</tr>
<tr>
<td>U16</td>
<td>Quad Comparator</td>
<td>3</td>
</tr>
<tr>
<td>U17</td>
<td>Dual 14 Decided</td>
<td>16</td>
</tr>
</tbody>
</table>

8. Logic states shown are for FM, narrow band IF, normal audio.
NOTES:

1. Unless otherwise indicated: resistor values are ohms; capacitor values are in microfarads; and inductor values are in microhenries.

2. ** DC voltages are measured with no IF input, FM operating mode, narrow band IF, and normal audio-squelch open.

3. *10.7 MHz PP voltages are measured at -47.0 dBm input, narrow band FM.

4. ** Audio voltages are measured at -47.0 dBm input, narrow band FM, normal audio, 500 kHz deviation, 1000 Hz modulating signal.

5. Integrated circuits on this board are TTL and CMOS devices.

6. IC types and connections for this board are as follows:

7. 10.7 MHz signal flow shown for narrow band IF.

<table>
<thead>
<tr>
<th>Reference Designation</th>
<th>Mfg's Description</th>
<th>+6 V</th>
<th>-6 V</th>
<th>+12 V</th>
<th>-12 V</th>
<th>Unused</th>
<th>Gnd</th>
</tr>
</thead>
<tbody>
<tr>
<td>U1</td>
<td>IF Amp</td>
<td>-</td>
<td>-</td>
<td>2,8</td>
<td>-</td>
<td>-</td>
<td>3,7</td>
</tr>
<tr>
<td>U2</td>
<td>Quad Detector</td>
<td>-</td>
<td>-</td>
<td>11</td>
<td>-</td>
<td>-</td>
<td>4,5,14,16</td>
</tr>
<tr>
<td>U3</td>
<td>Quad Bi-Lat SW</td>
<td>-</td>
<td>7</td>
<td>14</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>U4</td>
<td>Dual Op Amp</td>
<td>-</td>
<td>-</td>
<td>8</td>
<td>4</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>U5</td>
<td>Dual Op Amp</td>
<td>-</td>
<td>-</td>
<td>8</td>
<td>4</td>
<td>-</td>
<td>4</td>
</tr>
<tr>
<td>U6</td>
<td>Dual Op Amp</td>
<td>-</td>
<td>-</td>
<td>8</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>U7</td>
<td>Quad Bi-Lat SW</td>
<td>14</td>
<td>7</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>U8</td>
<td>Dual Op Amp</td>
<td>-</td>
<td>-</td>
<td>8</td>
<td>4</td>
<td>1,2,3</td>
<td>5</td>
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<tr>
<td>U9</td>
<td>Quad Op Amp</td>
<td>-</td>
<td>-</td>
<td>8</td>
<td>4</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>U10</td>
<td>Quad Bi-Lat SW</td>
<td>14</td>
<td>7</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>U11</td>
<td>Dual Op Amp</td>
<td>-</td>
<td>-</td>
<td>8</td>
<td>4</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>U12</td>
<td>Quad Op Amp</td>
<td>16</td>
<td>6,8</td>
<td>-</td>
<td>-</td>
<td>11,12</td>
<td>-</td>
</tr>
<tr>
<td>U13</td>
<td>Quad Clk D-Latch</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>12</td>
<td>8,9,10,11,13,14</td>
<td>-</td>
</tr>
<tr>
<td>U14</td>
<td>Quad Comparator</td>
<td>3</td>
<td>12</td>
<td>-</td>
<td>-</td>
<td>8,9,10,13,14</td>
<td>-</td>
</tr>
<tr>
<td>U15</td>
<td>Quad Comparator</td>
<td>3</td>
<td>12</td>
<td>-</td>
<td>-</td>
<td>4,5,7,10,11,12</td>
<td>-</td>
</tr>
<tr>
<td>U16</td>
<td>Quad Comparator</td>
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<td>12</td>
<td>-</td>
<td>-</td>
<td>4,5,7,10,11,12</td>
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</tr>
<tr>
<td>U17</td>
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<td>16</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>11,12</td>
<td>-</td>
</tr>
</tbody>
</table>

8. Logic states shown are for FM, narrow band IF, normal audio.
RECEIVER BOARD (A06)
MODEL RTL4091A
SCHEMATIC DIAGRAM, CIRCUIT
BOARD DETAIL, AND PARTS LIST

Motorola No. PEPS-36848-O
(Sheet 4 of 5)
8/12/85-PHI