Components, materials and assemblies

Television tuners
Coaxial aerial input assemblies
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Coaxial aerial input assemblies
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## TELEVISION TUNERS

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<td>46 to 110</td>
<td>38,9</td>
<td>256 or 64</td>
<td>+12 V ± 10%</td>
<td>+0,8 to +28 V</td>
<td>+2,5 V to +7 V</td>
<td>20 dB</td>
<td>7 dB</td>
<td>147 x 20 x 55</td>
<td>IEC</td>
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<td>25</td>
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<td></td>
<td>E5 to E12</td>
<td>L21 to L69</td>
<td>48 to 68</td>
<td>32,7</td>
<td>256</td>
<td>+12 V ± 1 V</td>
<td>+0,5 to +28 V</td>
<td>+8,25 to +0,85 V</td>
<td>32 dB</td>
<td>8 dB</td>
<td>94 x 24 x 73</td>
<td>coaxial female plug on cable</td>
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<td>121</td>
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<td>E2 to E4*</td>
<td>M4 to E12</td>
<td>54 to 88</td>
<td>45,75</td>
<td>256</td>
<td>+12 V ± 10%</td>
<td>+0,65 to +28 V</td>
<td>+10 to 0 V</td>
<td>26 dB</td>
<td>5 dB</td>
<td>86 x 23 x 81</td>
<td>phono</td>
<td>no</td>
<td>39</td>
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<tr>
<td></td>
<td>E7 to E13</td>
<td>A14 to A83</td>
<td>44 to 92</td>
<td>38,9</td>
<td>256</td>
<td>+12 V ± 10%</td>
<td>+1 to +28 V</td>
<td>+9,2 to +0,85 V</td>
<td>27 dB</td>
<td>5 dB</td>
<td>95 x 23 x 77</td>
<td>phono or IEC</td>
<td>no</td>
<td>133</td>
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<td>167 to 224</td>
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<td>+1 to +28 V</td>
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</table>

* cable: S01 to S1, S2 to S20
* cable: C to Q

**Note:** The table above provides a summary of the features of different television tuners, including their system and channel coverage, frequency ranges, I.F. and A.G.C. voltage specifications, and overall dimensions. Each tuner has specific parameters that cater to different needs, such as voltage tolerances, tuning voltages, and I.F. frequencies. The table also includes information on supply voltage, divider ratio, and standard compliance. The details regarding aerial input plugs and compliance with Amtsblatt DBP69/1981 are also noted. The dimensions provided give an idea of the physical size of each tuner, which is crucial for integration into various systems.
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<th>UV418/MK2</th>
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<th>UV461</th>
<th>UV462</th>
<th>UV471</th>
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<th>UV616</th>
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<tr>
<td></td>
<td>E2 to C*</td>
<td>A2 to A6</td>
<td>0 to 4</td>
<td>4 to 13</td>
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<td>E5 to E12</td>
<td>A7 to A13</td>
<td>5 to 11</td>
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<td>E5 to E12</td>
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<td>E21 to E69</td>
<td>A14 to A83</td>
<td>28 to 63</td>
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<tr>
<td></td>
<td>47 to 111</td>
<td>55,25 to 83,25</td>
<td>45 to 101</td>
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<td>111 to 300</td>
<td>175,25 to 211,25</td>
<td>101 to 222</td>
<td>222 to 254</td>
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<td>470 to 860</td>
<td>471,25 to 885,25</td>
<td>526 to 814</td>
<td>814 to 860</td>
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<td>Frequency ranges</td>
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<td>I.F. frequency (MHz)</td>
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<td>—</td>
<td>256</td>
<td>—</td>
<td>256</td>
<td>—</td>
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<td>—</td>
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<td></td>
<td>(UV418 only)</td>
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<td>(UV462 only)</td>
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<tr>
<td></td>
<td>Supply voltage</td>
<td>+ 12 V ± 10%</td>
<td>+ 12 V ± 10%</td>
<td>+ 12 V ± 10%</td>
<td>+ 12 V ± 10%</td>
<td>+ 12 V ± 10%</td>
<td>+ 12 V ± 10%</td>
<td>+ 12 V ± 10%</td>
<td>+ 12 V ± 10%</td>
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<tr>
<td></td>
<td>Tuning voltage</td>
<td>+ 1 to + 28 V</td>
<td>+ 1 to + 28 V</td>
<td>+ 1 to + 28 V</td>
<td>+ 1 to + 28 V</td>
<td>+ 1 to + 28 V</td>
<td>+ 1 to + 28 V</td>
<td>+ 1 to + 28 V</td>
<td>+ 1 to + 28 V</td>
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<tr>
<td></td>
<td>A.G.C. voltage</td>
<td>+ 9,2 to + 0,85 V</td>
<td>+ 9,2 to + 0,85 V</td>
<td>+ 9,2 to + 0,85 V</td>
<td>+ 9,2 to + 0,85 V</td>
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<td>+ 9,2 to + 0,85 V</td>
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<tr>
<td>Amplification, typical</td>
<td>18 dB</td>
<td>26 dB</td>
<td>24 dB</td>
<td>24 dB</td>
<td>40 dB</td>
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<td></td>
<td></td>
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<tr>
<td>Noise figure, typical</td>
<td>8 dB</td>
<td>5 dB</td>
<td>7 dB</td>
<td>6 dB</td>
<td>6 dB</td>
<td></td>
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</tr>
<tr>
<td>Overall dimensions</td>
<td>I x w x h (mm)</td>
<td>95 x 23 x 77</td>
<td>95 x 23 x 77</td>
<td>95 x 23 x 77</td>
<td>95 x 23 x 77</td>
<td>84 x 20 x 55</td>
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</tr>
<tr>
<td></td>
<td>Aerial input plug</td>
<td>phono or IEC</td>
<td>phono</td>
<td>phono or IEC</td>
<td>phono</td>
<td>IEC</td>
<td></td>
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<tr>
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<td>Meets Amtsblatt</td>
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<td>no</td>
<td>yes</td>
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<td>DBP80/1981</td>
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<td>Page</td>
<td>165</td>
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<td>193</td>
<td>209</td>
<td>223</td>
<td></td>
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</tbody>
</table>

* cable: S01 to S1, S2 to S20
* cable + hyper-band: S01 to S1, S2 to S20, S21 to S41
## Television tuners

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<th>UVF10</th>
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<td>UV636</td>
<td>UVF10A</td>
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<thead>
<tr>
<th></th>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
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<td>A2 to A6</td>
<td>A to E4</td>
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<td>E5 to E12</td>
<td>06 to 10*</td>
<td>A7 to A13*</td>
<td>M4 to E12</td>
</tr>
<tr>
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<td>L21 to L69</td>
<td>A14 to A69</td>
<td>E21 to E69</td>
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<tr>
<td>48 to 110</td>
<td>55 to 64</td>
<td>55 to 115</td>
<td>41 to 68</td>
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<tr>
<td>111 to 300</td>
<td>128 to 297</td>
<td>121 to 277</td>
<td>162 to 230</td>
</tr>
<tr>
<td>470 to 860</td>
<td>470 to 881</td>
<td>283 to 403</td>
<td>470 to 881</td>
</tr>
</tbody>
</table>

|            |                |                |                |
| E5 to 860   | E21 to E69     | E21 to E69     |                |
| 38,9        | 32,7           | 45,75          | 32,7           |
| 33,4        | 39,2           | 41,25          | 39,2           |
| 256         | 256            | 256            | 256            |

### (UV618 only)

|            |                |                |                |
| + 12 V ± 10%| + 12 V ± 10%   | + 12 V ± 10%   | + 12 V ± 1 V   |
| + 0,8 to + 28 V| + 0,8 to + 28 V| + 0,8 to + 28 V| + 0,5 to + 28 V|
| + 9,2 to + 0,85 V| + 9,2 to + 0,85 V| + 9,2 to + 0,85 V| + 8,25 to + 0,85 V|
| 40 dB      | 40 dB          | 45 dB          | 22 dB          |
| 6 dB       | 6 dB           | 6,5 dB         | 6 dB           |

### (UV628 only)

|            |                |                |                |
| + 12 V ± 10%| + 12 V ± 10%   | + 12 V ± 10%   | + 12 V ± 1 V   |
| + 0,8 to + 28 V| + 0,8 to + 28 V| + 0,8 to + 28 V| + 0,5 to + 28 V|
| + 9,2 to + 0,85 V| + 9,2 to + 0,85 V| + 9,2 to + 0,85 V| + 8,25 to + 0,85 V|
| 40 dB      | 40 dB          | 45 dB          | 22 dB          |
| 6 dB       | 6 dB           | 6,5 dB         | 6 dB           |

### (UV636 only)

|            |                |                |                |
| + 12 V ± 10%| + 12 V ± 10%   | + 12 V ± 10%   | + 12 V ± 1 V   |
| + 0,8 to + 28 V| + 0,8 to + 28 V| + 0,8 to + 28 V| + 0,5 to + 28 V|
| + 9,2 to + 0,85 V| + 9,2 to + 0,85 V| + 9,2 to + 0,85 V| + 8,25 to + 0,85 V|
| 40 dB      | 40 dB          | 45 dB          | 22 dB          |
| 6 dB       | 6 dB           | 6,5 dB         | 6 dB           |

### (UVF10A only)

|            |                |                |                |
| + 12 V ± 10%| + 12 V ± 10%   | + 12 V ± 10%   | + 12 V ± 1 V   |
| + 0,8 to + 28 V| + 0,8 to + 28 V| + 0,8 to + 28 V| + 0,5 to + 28 V|
| + 9,2 to + 0,85 V| + 9,2 to + 0,85 V| + 9,2 to + 0,85 V| + 8,25 to + 0,85 V|
| 40 dB      | 40 dB          | 45 dB          | 22 dB          |
| 6 dB       | 6 dB           | 6,5 dB         | 6 dB           |

| 84 x 20 x 55 | 84 x 20 x 55   | 84 x 20 x 55   | 94 x 23,5 x 73 |
| IEC          | IEC            | phono          | coaxial female, plug on cable |

| yes          | yes            | no             | no             |

| 235          | 247            | 250            | 271            |

* cable:
  - S01 to S1
  - S2 to S20
  - C to Q

* cable:
  - A—2 to A—1
  - A to I
  - J to T
  - U to W
  - AA to RR
  - SS to EEE

65 and 66
<table>
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<th>V.H.F. TUNERS</th>
<th>U.H.F. TUNERS</th>
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<td>V431</td>
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<td>Channels</td>
<td>A2 to A6</td>
<td>A2 to A6</td>
</tr>
<tr>
<td>Frequency ranges (MHz)</td>
<td>54 to 88</td>
<td>54 to 88</td>
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<tr>
<td>I.F. frequency (MHz)</td>
<td>45,75</td>
<td>45,75</td>
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<tr>
<td>picture</td>
<td>41,25</td>
<td>41,25</td>
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<td>sound</td>
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<td>41,25</td>
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<tr>
<td>Divider ratio</td>
<td>-</td>
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<tr>
<td>Supply voltage</td>
<td>+ 12 V ± 10%</td>
<td>+ 12 V ± 10%</td>
</tr>
<tr>
<td>Tuning voltage</td>
<td>+ 0,5 to + 28 V</td>
<td>+ 1 to + 28 V</td>
</tr>
<tr>
<td>A.G.C. voltage</td>
<td>+ 5 to + 3 V</td>
<td>+ 9,2 to + 0,85 V</td>
</tr>
<tr>
<td>Amplification, typical</td>
<td>27 dB</td>
<td>26 dB</td>
</tr>
<tr>
<td>Noise figure, typical</td>
<td>7 dB</td>
<td>5 dB</td>
</tr>
<tr>
<td>Overall dimensions I x w x h (mm)</td>
<td>99 x 29 x 59</td>
<td>95 x 23 x 77</td>
</tr>
<tr>
<td>Aerial input plug</td>
<td>pin</td>
<td>phono</td>
</tr>
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<td>Page</td>
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<td>285</td>
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* Channels 1 to 40 according to WARC77.
** The data on this type will be issued separately.
### U.H.F. TUNERS

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<th>U411/U412</th>
<th>U743/U744</th>
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<td>E21 to E69</td>
<td>E21 to E69</td>
<td>E21 to E69</td>
</tr>
<tr>
<td>470 to 860</td>
<td>470 to 860</td>
<td>470 to 860</td>
</tr>
<tr>
<td>38,9 (G,H)</td>
<td>38,9 (G,H)</td>
<td>39,5</td>
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<td>39,5 (I,K)</td>
<td>39,5 (I,K)</td>
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<tr>
<td>33,4 (G,H)</td>
<td>33,4 (G,H)</td>
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<td>256 (U344 only)</td>
<td>256 or 64 (U412 only)</td>
<td>256 (U744 only)</td>
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<td>+ 12 V ± 10%</td>
<td>+ 12 V ± 10%</td>
<td>+ 12 V ± 10%</td>
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<tr>
<td>+ 1 to + 28 V</td>
<td>+ 1 to + 28 V</td>
<td>+ 1 to + 28 V</td>
</tr>
<tr>
<td>+ 9,2 to + 1 V</td>
<td>+ 9,2 to + 0,85 V</td>
<td>+ 9,2 to + 1 V</td>
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<tr>
<td>42 dB</td>
<td>25 dB</td>
<td>40 dB</td>
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<tr>
<td>6,5 dB</td>
<td>7 dB</td>
<td>6,5 dB</td>
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<td>83 x 18 x 52</td>
<td>94 x 23,5 x 60,5</td>
<td>66 x 20 x 38</td>
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<td>85</td>
<td>97</td>
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# COAXIAL AERIAL INPUT ASSEMBLIES

With mains separation

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<th>Frequency range</th>
<th>Impedance</th>
<th>Input connector</th>
<th>Safety requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>40 to 890 MHz</td>
<td>75 Ω asymmetrical</td>
<td>meets the demands of IEC 169.2 and DIN 45325 (dia. 9.5 mm), and of SNIR (dia. 9.0 mm)</td>
<td>IEC 65; approbation approvals have been received or sought from BSI, DEMKO, EI, FEMKO, KEMA, LCEE, NEMKO, SEMKO, SEV and VDE.</td>
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<table>
<thead>
<tr>
<th>cable length mm</th>
<th>insertion loss at frequency MHz dB</th>
<th>catalogue number</th>
<th>page</th>
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<tr>
<td>90</td>
<td>40-700 dB ≤ 1,5 700-890 dB ≤ 2</td>
<td>3122 127 01240 3122 127 03500* 3122 127 05900</td>
<td>303</td>
</tr>
<tr>
<td>145</td>
<td>40-890 dB ≤ 1 50-230 dB ≤ 1 470-850 dB ≤ 1</td>
<td>3122 127 10260 3122 127 10450</td>
<td>307</td>
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<tr>
<td>250</td>
<td>50-230 dB ≤ 1 470-850 dB ≤ 1,5</td>
<td>3122 127 14730</td>
<td>307</td>
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<td></td>
<td>40-300 dB ≤ 1 470-890 dB ≤ 1</td>
<td>3122 127 21300**</td>
<td>313</td>
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<tr>
<td></td>
<td>40-230 dB ≤ 1 230-300 dB ≤ 1,5 470-890 dB ≤ 1,5</td>
<td>3122 127 24140</td>
<td>317</td>
</tr>
</tbody>
</table>

* These assemblies comply with the requirements of immunity from radiated interference of Amtsblatt DBP69/1981.

** This assembly complies with the requirements of immunity from radiated interference of BS905.
Pin Compatibility

All tuners of our 600-series and 700-series, and the tuner parts of our 600-series front-ends are pin-compatible, i.e. the pins for the same function are situated at the same place. However, the position of the mounting tab at the aerial input side of the tuners in the 700-series (MT4) is different, because these tuners are smaller. For this reason these tuners are also available with a longer aerial connector for interchangeability purposes. The front-ends have an extra mounting tab (MT3).

![Diagram showing pin compatibility and terminal connections]

Fig. 6.

**Terminal**

- **A** = aerial input connector
- **5** = a.g.c. voltage
- **6** = supply voltage, +12 V
- **7** = supply voltage, low v.h.f., +12 V
- **8** = supply voltage, high v.h.f., +12 V
- **9** = supply voltage, hyperband, +12 V
- **10** = supply voltage, u.h.f., +12 V
- **11** = tuning voltage
- **12** = supply voltage, frequency divider, +5 V
- **13, 14** = balanced output voltage of frequency divider
- **15** = earth
- **16** = i.f. output
- **17** = i.f. output (UV tuners)

**Mounting tabs**

- 600-series tuners: MT1, MT2
- 700-series tuners: MT4, MT2
- 600-series front ends: MT1, MT2, MT3
TELEVISION TUNERS
V.H.F. TELEVISION TUNER

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Systems</th>
<th>C.C.I.R. systems M and N (R.T.M.A.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channels</td>
<td>A2 to A6 (low v.h.f. band)</td>
</tr>
<tr>
<td></td>
<td>A7 to A13 (high v.h.f. band)</td>
</tr>
<tr>
<td>Intermediate frequencies</td>
<td></td>
</tr>
<tr>
<td>picture</td>
<td>45.75 MHz</td>
</tr>
<tr>
<td>sound</td>
<td>41.25 MHz</td>
</tr>
</tbody>
</table>

APPLICATION

Designed to cover the v.h.f. channels of C.C.I.R. systems M and N (R.T.M.A.).
Thanks to its good signal-handling properties, the tuner is especially suited for strong signal areas.
DESCRIPTION
The ELC3082 is a v.h.f. tuner with electronic tuning and band switching, covering the low v.h.f. band (frequency range 54 to 88 MHz) and the high v.h.f. band (frequency range 174 to 216 MHz).
Mechanically, the tuner is built on a low-loss printed-wiring board, carrying all components, in a metal housing made of a rectangular frame and front and rear covers (see Fig. 2). The aerial connection is on one of the frame sides, all other connections (supply voltages, a.g.c. voltage, tuning and switching voltages) are made via terminals in the under side. The mounting method is shown in Figs 3 and 4.
Electrically, the tuner consists of v.h.f. and i.f. parts. The aerial signal is fed to the input filters, providing i.f. rejection and band selection. The filters are followed by a P-I-N diode attenuator, equipped with two diodes BA379. The output of the attenuator is connected to the emitter of the input transistor BF480, operating as r.f. amplifier in grounded base configuration. The same transistor also delivers the current drive for the P-I-N diode attenuator, controlled by an a.g.c. voltage fed to the transistor base. The combination of the diode attenuator with this high current transistor (Iₜ at normal gain about 10 mA) has excellent signal-handling properties within the whole a.g.c. range.
The collector load of the input transistor is formed by a double tuned circuit, transferring the signal to the emitter of the mixer transistor BF324. Good signal-handling properties of this stage are achieved by high osillator injection. The oscilator is equipped with a transistor BF324. In the low v.h.f. position, self-detection of the oscilator signal is used to back-bias the five switching diodes BA482/483/484, required for band switching between low and high v.h.f. channels. Three capacitance diodes BB809 provide tuning of the r.f. circuits. The collector of the mixer transistor is connected to a single tuned i.f. resonant circuit (about 20 MHz bandwidth), the output of which is fed to the i.f. output stage, equipped with another transistor BF3324 in grounded base configuration. The stage has also been designed especially for good signal-handling properties. The collector load of the i.f. output transistor is formed by a single tuned i.f. circuit, at the low end of which the i.f. signal is capacitively coupled out of the tuner.
The tuner can be used in combination with a u.h.f. tuner. In this case the u.h.f. i.f. signal is fed to the emitter of the i.f. output transistor, which acts as i.f. amplifier for u.h.f. as well as for v.h.f.
The u.h.f. i.f. input terminal can be used as an i.f. injection point for aligning the i.f. output circuit together with the i.f. amplifier of the television receiver. For the same purpose a separate i.f. injection point has been provided at the collector of the mixer.
The tuner requires transistor supply voltages of +12 V, a switching voltage of +12 V, a.g.c. voltages, variable from +5 V (normal operating point) to about +2,5 V (maximum a.g.c.) and a tuning voltage, variable from +0,5 V to +28 V.
The aerial input of the tuner is asymmetrical. For use in symmetrical aerial systems, aerial transformers (baluns) are available (see ACCESSORY).
test point

Fig. 1.
MECHANICAL DATA

Dimensions in mm

Fig. 2.

Terminal 1 = u.h.f. i.f. input
2 = a.g.c. voltage, +5 to +2,5 V
3 = switching voltage, +12 V
4 = common supply voltage, +12 V
5 = v.h.f. supply voltage, +12 V
6 = tuning voltage, +0,5 to +28 V
7 = i.f. output
E = earth

November 1980
Mounting

The tuner may be mounted by soldering it on to a printed-wiring board, using the piercing diagram shown in Fig. 3. (The tuner may also be mounted by means of a bracket. Information will be supplied upon request.)

The tuner may be mounted anywhere in the receiver and there are no restrictions on orientation.

Fig. 3 Piercing diagram viewed from solder side of board: \( e = 2.54 \text{ mm (0.1 in).} \)

Fig. 4 Recommended fixing method of the aerial cable. Use a self-tapping screw.
ELECTRICAL DATA

Unless otherwise specified all electrical values apply at an ambient temperature of 25 ± 5 °C and a supply voltage of 12 ± 0,3 V.

Semiconductors

- P-I-N attenuator: 2 x BA379
- r.f. amplifier: BF480
- mixer: BF324
- oscillator: BF324
- tuning diodes: 3 x BB809
- switching diodes: 5 x BA482/483/484
- i.f. amplifier: BF324

Ambient temperature range

- operating: +5 to +55 °C
- storage: −25 to +85 °C

Supply voltage

- Current drawn from +12 V supply at nominal gain:
  - low band: 46,5 mA ± 10%
  - high band: 63,5 mA ± 10%

Notes — At 40 dB gain reduction the currents decrease about 5 mA.
- The supply voltage at terminal 4 should be carefully filtered to avoid hum modulation in one of the P-I-N diodes when the attenuator is biased to higher attenuation ratios. Under most unfavourable conditions a ripple voltage of 3 mV (p-p) may produce a disturbance which is just visible.

A.G.C. voltage (Figs 5 and 6)

- low band, at nominal gain at 40 dB gain reduction: +5 ± 0,2 V *
- high band, at nominal gain at 40 dB gain reduction: +3,3 V (typical)

A.G.C. current

- at nominal gain with a.g.c.: max. 1 mA

Tuning voltage range (Figs 7 and 8)

- Current drawn from 28 V tuning voltage supply: max. 0,5 μA

Note — The source impedance of the tuning voltage, offered to terminal 6, must be max. 100 kΩ at tuning voltages below 5 V.

Switching voltage

- low band: open circuit
- high band: +12 V ± 10%

Note — In the low band position the tuner produces a negative voltage (1 to 5 V) at terminal 3; this terminal must not be loaded with an external resistance below 50 MΩ.

* This value may be increased to 5,5 V if a certain deterioration of signal handling is accepted. At voltages above 5,5 V the cross-modulation in band may deteriorate rapidly.
V.H.F. television tuner, with diode tuning

Fig. 5.

Fig. 6.

Fig. 7.

Fig. 8.
Frequency ranges
low band

high band

channel A2 (picture carrier 55,25 MHz) to channel A6 (picture carrier 83,25 MHz).
Margin at the extreme channels: min. 2 MHz.
channel A7 (picture carrier 175,25 MHz) to channel A13 (picture carrier 211,25 MHz).
Margin at the extreme channels: min. 3 MHz.

Intermediate frequencies
picture
45,75 MHz
sound
41,25 MHz

Input impedance, asymmetrical
75 Ω

V.S.W.R. (between picture carrier and sound carrier)

<table>
<thead>
<tr>
<th></th>
<th>v.s.w.r. at nom. gain</th>
<th>max. v.s.w.r. during gain control</th>
</tr>
</thead>
<tbody>
<tr>
<td>low band</td>
<td>max. 3,5</td>
<td>max. 3,5</td>
</tr>
<tr>
<td>high band</td>
<td>max. 4</td>
<td>max. 4</td>
</tr>
</tbody>
</table>

A.G.C. range
low band
min. 40 dB (typ. 54 dB)

high band
min. 40 dB (typ. 50 dB)

R.F. curves
bandwidth, low band
typ. 7 to 10 MHz

high band
typ. 8 to 10 MHz

tilt, low band
max. 3 dB

high band
max. 3 dB

Power gain (see also MEASURING METHOD OF POWER GAIN)
low band
min. 24 dB

canal A2
typ. 27 dB

canal A6
typ. 29 dB

high band
min. 25 dB

canal A7
typ. 28 dB

canal A13
typ. 31 dB

Noise figure
low band
max. 9,5 dB (typ. 7 dB)

high band
max. 9,5 dB (typ. 7,5 dB)

I.F. rejection
low band, channel A2
min. 54 dB

canal A3
min. 57 dB

channels A4 to A6
min. 60 dB

high band
min. 60 dB
**V.H.F. television tuner, with diode tuning**

Image rejection
- Low band: min. 56 dB
- High band: min. 50 dB

Signal handling
Minimum input signal (e.m.f.) producing cross-modulation (1%)
- In channel
  - Wanted signal: picture carrier frequency
  - Interfering signal: sound carrier frequency
- In band
  - Wanted signal: picture carrier frequency
  - Interfering signal: picture carrier frequency of channel N.
  - Interfering signal: picture carrier of channel N ± 2
  - Interfering signal: picture carrier of channel > N ± 3

Maximum gain: typ. 20 mV
Typ. > 500 mV with a.g.c.

Minimum input signal (e.m.f.) producing overloading,
at nominal gain:
- Low band: typ. 50 mV
- High band: typ. > 500 mV

Minimum input signal (e.m.f.) at nominal gain producing a shift of the oscillator frequency of 10 kHz,
- Low band: typ. 50 mV
- High band: typ. 30 mV

Detuning of the i.f. output circuit as a result of band switching and tuning: max. 150 kHz

Shift of oscillator frequency at a change of the supply voltage of 5%
- Low band: max. 300 kHz
- High band: max. 300 kHz

During warm-up time (measured between 5 s and 15 min after switching on)
- Low band: max. 150 kHz
- High band: max. 150 kHz

*This e.m.f. (open voltage) is referred to an impedance of 75 Ω.
1% cross-modulation means that 1% of the modulation depth of the interfering signal is transferred to the wanted signal.

**This e.m.f. (open voltage) is referred to an impedance of 75 Ω.
Criterion of overloading: 30% compression of the synchronization pulses of a standard television signal or a noticeable deterioration of the picture quality.

▲ This e.m.f. (open voltage) is referred to an impedance of 75 Ω.
Drift of oscillator frequency
   at a change of the ambient temperature from 25 to 50 °C
25 to 50 °C
   low band  max. 500 kHz
   high band max. 500 kHz

Oscillator radiation
   The tuner is in conformity with the radiation requirements of C.I.S.P.R. Recommendation No. 24/2 and the corresponding F.C.C. rules, provided the tuner is installed in a professional manner.

Microphonics
   If the tuner is installed in a professional manner, there will be no microphonics.

Surge protection
   Protection against voltages max. 5 kV

   Note: Three discharges of a 470 pF capacitor into the aerial terminal.
ALIGNMENT OF THE I.F. CIRCUIT
For i.f. injection the u.h.f. i.f. input (terminal 1) or the i.f. injection point at the collector of the mixer transistor (at the top of the tuner, Fig. 2) can be used. The aligning can be done with any channel tuned. A probe as shown in Fig. 9 should be used.

![Diagram](image)

The signal attenuation between the i.f. generator and the i.f. output of the tuner is about 4 dB when injection is done via the injection point, and about 8,5 dB in the case of injection via the u.h.f. i.f. input. The i.f. output circuit is detuned about +300 kHz* or -150 kHz* when injection is done via the injection point or via the u.h.f. i.f. input respectively.

MEASURING METHOD OF POWER GAIN
The i.f. output of the tuner should be terminated with the RC-circuit given in Fig. 10.

![Diagram](image)

The RC-circuit roughly matches the i.f. output impedance to 75 Ω at the resonant frequency of the i.f. output circuit, which should be tuned to 43,5 MHz. The bandwidth should be approx. 4,5 MHz.

Because the input and output impedances of the tuner are now 75 Ω, the power gain can be measured in the conventional manner by inserting tuner and RC-circuit between a 75 Ω source and a 75 Ω detector (or between a 50 Ω source and matching pad 50/75 Ω and a 50 Ω detector).

* Reference: normal operation with r.f. signal via aerial input.
V.H.F./U.H.F. TELEVISION TUNER AND I.F. DEMODULATOR

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Systems</th>
<th>C.C.I.R. systems B, G and H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channels</td>
<td></td>
</tr>
<tr>
<td>low v.h.f.</td>
<td></td>
</tr>
<tr>
<td>high v.h.f.</td>
<td></td>
</tr>
<tr>
<td>u.h.f.</td>
<td></td>
</tr>
<tr>
<td>Intermediate frequencies</td>
<td></td>
</tr>
<tr>
<td>picture</td>
<td>38.90 MHz</td>
</tr>
<tr>
<td>colour</td>
<td>34.47 MHz</td>
</tr>
<tr>
<td>sound 1</td>
<td>33.40 MHz</td>
</tr>
<tr>
<td>sound 2</td>
<td>33.16 MHz</td>
</tr>
<tr>
<td>Video output signal</td>
<td></td>
</tr>
<tr>
<td>peak-to-peak voltage</td>
<td>2.1 to 2.8 V</td>
</tr>
<tr>
<td>top sync level</td>
<td>2.2 to 2.6 V</td>
</tr>
<tr>
<td>Intercarrier sound output</td>
<td></td>
</tr>
<tr>
<td>output signals</td>
<td></td>
</tr>
<tr>
<td>5.50 MHz</td>
<td>200 to 500 mV r.m.s.</td>
</tr>
<tr>
<td>5.74 MHz</td>
<td>90 to 225 mV r.m.s.</td>
</tr>
</tbody>
</table>

APPLICATION

Designed to cover the tuner function according to the C.C.I.R. systems B, G and H with extended v.h.f. frequency ranges, combined with a quasi split sound i.f. function to demodulate the video signal and to convert the sound signal.

The tuner part of the FE618Q(M)/256 is equipped with a frequency divider, which makes it suitable for digital tuning systems based on frequency synthesis; for the remainder it is equal to type FE617Q(M).

Available versions

<table>
<thead>
<tr>
<th></th>
<th>aerial input connector</th>
<th>frequency divider (IC)</th>
<th>catalogue number</th>
</tr>
</thead>
<tbody>
<tr>
<td>FE617Q</td>
<td>IEC</td>
<td>t.b.f.</td>
<td>3122 237 10170</td>
</tr>
<tr>
<td>FE617QM</td>
<td>IEC</td>
<td></td>
<td>3122 237 10030</td>
</tr>
<tr>
<td>FE618Q/256</td>
<td>IEC</td>
<td>1:256</td>
<td>3122 237 10020</td>
</tr>
<tr>
<td>FE618QM/256</td>
<td>IEC</td>
<td>1:256</td>
<td></td>
</tr>
</tbody>
</table>

These types comply with the requirements of radiation, signal handling capability, and immunity from radiated interference of Amtsblatt DBP69/1961, and for Finland E.I.S. bulletin T33-82, section 4, when installed professionally in an adequate TV receiver.
Fig. 1 Tuner part.
For types FE617Q and QM delete: C71, C72, C86, C87, C88, R71, R72, IC2.
For connections see Fig. 3.
DESCRIPTION

The front ends contain v.h.f./u.h.f. tuners with electronic tuning and band switching, covering the low v.h.f. band (frequency range 46 to 110 MHz), the high v.h.f. band (frequency range 111 to 300 MHz), and the u.h.f. band (frequency range 470 to 860 MHz).

Mechanically, the front ends consist of a tuner part and an i.f. part built on separate low-loss printed-wiring boards, carrying all components, in a housing made of a rectangular diecast metal frame and front and rear covers (see Fig. 3). The common IEC coaxial aerial connector (75 Ω) is integrated in one of the frame sides of the housing, all other connections (supply voltages, a.g.c. voltage, tuning and switching voltages, i.f. output) are made via terminals in the underside. The mounting method is shown in Fig. 4.

Electrically, the tuner part consists of v.h.f. and u.h.f. parts (see Fig. 1). They are equipped with a common aerial input and provided with r.f. MOSFET input stages. The v.h.f. mixer, v.h.f. oscillator and i.f. amplifier functions are provided by a tuner IC. This IC has terminals between mixer and i.f. amplifier to connect the i.f. preselection.

The r.f. band pass filter and oscillator circuits are tuned by 7 tuning diodes; band switching is achieved by 4 switching diodes.

The u.h.f. part of the tuner has a high-pass input circuit connected to gate 1 of an input MOSFET tetrode (with internal gate protection against surge). The drain load of this MOSFET tetrode is formed by a double tuned circuit transferring the r.f. signal to the Schottky barrier mixer diode. The i.f. signal from the mixer diode is amplified by the i.f. pre-amplifier of the tuner I.C.

The r.f. band pass filter and oscillator circuits are tuned by 4 tuning diodes.

In all bands the tuner is gain-controlled via gate 2 of the input MOSFET tetrode.

A test point TP1 is provided for i.f. injection.

The electrical circuit of the FE618Q(M)256 is extended with a frequency divider (division ratio of 256), with inputs connected to the v.h.f. and u.h.f. oscillators. The symmetrical ECL outputs are connected to terminals 13 and 14.

The i.f. part is of the quasi-split sound type. It has separate ICs for video demodulation and sound conversion (see Fig. 2).

The demodulated (CVBS—) video signal is available at the video output of the front end and the converted sound signal, with intercarrier frequencies of 5.50 MHz and 5.74 MHz, is available at the sound output.

In the i.f. part of the QM versions a video identification signal is also generated. This can be used to mute the sound in case of "no video" and is available at the video identification output.

Terminal designations in Fig. 3

| A       | = aerial input (IEC female 75 Ω)                        | 15 = earth                       |
| 6       | = supply voltage, tuning part, + 12 V                  | 22 = switching voltage a.f.c.    |
| 7       | = supply voltage, low v.h.f., + 12 V                   | 23 = a.f.c. output              |
| 8       | = supply voltage, high v.h.f., + 12 V                  | 24 = i.f. sound                 |
| 10      | = supply voltage, u.h.f., + 12 V                       | 27 = earth                      |
| 11      | = tuning voltage, + 0.48 to + 28 V                     | 28 = video output               |
| 12      | = supply voltage, frequency divider, + 5 V             | 29 = video identification output, |
|         |                                                           | QM versions only                |
| 13, 14  | = balanced output voltage of frequency divider (1 kΩ)  | 30 = supply voltage, i.f.,      |
|         |                                                           | demodulation part, + 12 V       |
Fig. 3 Unless otherwise stated the tolerance is ± 0.05 mm.
Mounting

The unit may be mounted by soldering it on to a printed-wiring board (using the piercing diagram shown in Fig. 4). The construction and positioning of the 3 mounting tags is such that a 'click' indicates the correct seating of the unit on the printed-wiring board. The unit may be mounted anywhere in the receiver and there are no restrictions on orientation.

The solderability of the terminals and mounting tags is according to IEC 68-2, test Ta (235 ± 5 °C, 2 ± 0,5 s). The resistance to soldering heat is according to IEC 68-2, test Tb (260 ± 5 °C, 10 ± 1 s).

In order to withstand vibrations, shocks and bumps that could damage the solder joints of the mounting tags, the front end should be mounted and soldered without clearance between the supporting area and the printed-wiring board.

This can be achieved by:
- twisting the mounting tags 18° (−3°); or
- pressing the front end against the printed-wiring board during soldering; or
- supporting the front end at its aerial connector.

If the aerial connector is used as a direct input to the television set, it should be supported to prevent the printed-wiring board from stress.
V.H.F./U.H.F. television tuner and i.f. demodulator

ELECTRICAL DATA

Unless otherwise specified all electrical values apply at an ambient temperature of 25 ± 5 °C, a relative humidity of 60 ± 15%, supply and band switching voltages of 12 ± 0.3 V.

General

Semiconductors, v.h.f. bands
  r.f. amplifier
  mixer
  oscillator
  tuning diodes
  switching diodes
  d.c. blocking diodes

Semiconductors, u.h.f. bands
  r.f. amplifier
  oscillator
  mixer
  tuning diodes

Frequency divider

Semiconductors, i.f.
  i.f. amplifier and demodulator
  quasi-split-sound circuit
  synchronization circuit
  video output transistor

S.A.W. filter

Ambient temperature range
  operating
  storage

Relative humidity

Volatges and currents

Supply voltages (tuner and i.f. part)

Current drawn from + 12 V supply
  v.h.f. bands
  u.h.f. bands
  bandswitching
  i.f. part

For operation in all bands the terminals 6 and 30 are permanently connected to their voltage supplies. Additionally the supply voltage for band switching is connected to:

  terminal 7 for operation in low v.h.f. band
  terminal 8 for operation in high v.h.f. band
  terminal 10 for operation in u.h.f. bands
Tuning voltage range
Current drawn from 28 V tuning voltage supply
- at $T_{amb} = 25^\circ C$ and 60% R.H.
- at $T_{amb} = 25^\circ C$ and 95% R.H.
- at $T_{amb} = 60^\circ C$ and 60% R.H.
Note: The source impedance of the tuning voltage offered to terminal 11 must be maximum 47 Ω.

Aerial input characteristics
Input impedance
V.S.W.R. and reflection coefficient
values between picture and sound carrier, as well as values at picture carrier

<table>
<thead>
<tr>
<th>v.s.w.r.</th>
<th>at nominal gain and during gain control</th>
</tr>
</thead>
<tbody>
<tr>
<td>v.h.f. bands</td>
<td>max. 4</td>
</tr>
<tr>
<td>u.h.f. bands</td>
<td>max. 5</td>
</tr>
<tr>
<td>reflection coefficient</td>
<td>max. 60%</td>
</tr>
<tr>
<td>v.h.f. bands</td>
<td>max. 66%</td>
</tr>
<tr>
<td>u.h.f. bands</td>
<td></td>
</tr>
</tbody>
</table>

Gain limited sensitivity level
C.C.I.R. channels and u.h.f. channels
S-channels
A.G.C. limited aerial input level
v.h.f. bands
u.h.f. bands

Oscillator voltage level (fundamental and harmonics up to 1000 MHz) at the input
v.h.f. bands
u.h.f. bands

Surge protection
max. 5 kV

Tuning characteristics
Frequency ranges
low v.h.f. band
high v.h.f. band
u.h.f. bands

channel E2 (picture carrier 48,25 MHz) to channel S1 (picture carrier 105,25 MHz).
channel S2 (picture carrier 112,25 MHz) to channel S20 (picture carrier 294,25 MHz).
channel E21 (picture carrier 471,25 MHz) to channel E69 (picture carrier 855,25 MHz).

The frequency ranges remain valid under the specified operating conditions during the entire life time of the unit.
The oscillator frequency is higher than the aerial signal frequency.
V.H.F./U.H.F. television tuner and i.f. demodulator

Slope of tuning characteristic
- low v.h.f. band, channel E2
- high v.h.f. band, channel S2
- u.h.f. bands
- channel E21
- channel S20
- channel S1
- channel E69

Tuning voltage range within which the divided oscillator frequency increases monotone with the tuning voltage (FE618 versions only)

- 0.45 to 30 V

Slope of tuning characteristic
- low v.h.f. band
- high v.h.f. band
- u.h.f. bands

Tuning voltage range within which the tuning frequency increases monotone with the tuning voltage

- 0.45 to 30 V

Time constant of varicap voltage

- 1.5 ms

Aerial input level causing detuning
- v.h.f. bands
- u.h.f. bands

Oscillator characteristics

Shift of oscillator frequency at a change of the supply voltage of 5%
- v.h.f. bands
- u.h.f. bands

Drift of oscillator frequency during warm-up time (after the tuner has been completely out of operation for 15 min, measured between 5 s and 15 min after switching on)

- max. 250 kHz

Drift of oscillator frequency during warm-up time (after the input stage is in operation for 15 min, measured between 2 s and 15 min after band switching)

- max. 250 kHz

Drift of oscillator frequency at a change of the ambient temperature from +25 to +50 °C and from +25 to +0 °C

- v.h.f. bands
- u.h.f. bands

- max. 500 kHz

Drift of oscillator frequency at a change of humidity from 60 ± 15% to 93 ± 2%, at T_{amb} = 25 ± 5 °C

- low v.h.f. band
- high v.h.f. band
- u.h.f. bands

- max. 500 kHz
- max. 1000 kHz
- max. 1500 kHz
Frequency divider characteristics (FE618Q/256 and FE618QM/256 only)

Supply voltage + 5 V ± 5%
Current drawn from + 5 V supply max. 35 mA; typ. 25 mA
Output voltage, unloaded, measured with probe 10 MΩ/11 pF min. 0,5 V(p-p)
Output impedance typ. 1 kΩ
Output imbalance max. 0,1 V

A.F.C. output characteristics
Output capacitance typ. 1,2 nF
Output voltage, when loaded with 25 kΩ 6 V
A.F.C. switched off
A.F.C. switched on
   voltage for an aerial input of 50 dB (µV) 6 V
   correctly tuned max. 1,5 V
   detuning of + 100 kHz min. 10,5 V
   detuning of −100 kHz
A.F.C. output slope at $V_{a fc} = 6$ V and
$V_{aerial} = 50$ dB (µV) min. 50 V/MHz, max. 150 V/MHz
A.F.C. voltage when no aerial input min. 3 V, max. 8 V

Video output characteristics
Measuring conditions: video output (terminal 28) loaded with 155 Ω, decoupling of i.f. supply (terminal 30) with 220 µF.
Video peak-to-peak voltage, video modulation 100%, rest carrier 10%

---
Top sync level
No-signal level
Video signal expansion for a change of the aerial input signal level from 40 dB (µV) to 90 dB (µV) max. 0,5 dB
Unweighted video signal to noise ratio for an aerial input level of 50 dB (µV)
   v.h.f. C.C.I.R. channels typ. 36 dB, min. 33 dB
   S-channels typ. 34 dB, min. 31 dB
   u.h.f. channels typ. 32 dB, min. 29 dB
V.H.F./U.H.F. television tuner and i.f. demodulator

Unweighted video S/N-ratio for $V_{aerial} = 70$ dB ($\mu$V)
- v.h.f. C.C.I.R.-channels typ. 46 dB
- S-channels typ. 44 dB
- u.h.f. channels typ. 46 dB

Flatness (0,1 - 3,5 MHz)
- v.h.f./u.h.f. for $V_{aerial}$ up to 70 dB ($\mu$V) max. 3 dB
- v.h.f. for $V_{aerial} = 100$ dB ($\mu$V) max. 4 dB
- u.h.f. for $V_{aerial} = 90$ dB ($\mu$V) max. 4 dB

Group delay time deviation (0,1 - 3,5 MHz)
- for $V_{aerial}$ up to 70 dB ($\mu$V)
  - v.h.f., channels E3 and up; u.h.f. channels max. 50 ns
  - v.h.f., channel E2 minus 1 MHz max. 60 ns

Gain drop at colour carrier for
- $V_{aerial} = 70$ dB ($\mu$V); 1 MHz reference
  - at 4,43 MHz typ. 5 dB max. 8,5 dB
  - at 4,00 MHz typ. 2 dB
  - at 4,80 MHz typ. 11 dB

Group delay time deviation
- at colour carrier frequency (4,43 MHz) typ. 60 ns

2T-impulse response
  - top level referred typ. 105% min. 85% max. 125%
  - to black-white response min. 180 ns max. 220 ns
  - 50% level width max. 4%
  - K-rating

Differential gain
  typ. 4% max. 10%

Differential phase
  typ. $2^\circ$ max. $10^\circ$

Field time waveform distortion
  max. 10%

Line time waveform distortion
  max. 10%

1,07 MHz sound-chroma interference level conditions
  - gain control typ. 30 dB
  - picture carrier/colour carrier ratio 16 dB
  - picture carrier/sound carrier ratio 10 dB
  - 40 dB interference distance at video output typ. 90 dB ($\mu$V)

---

November 1986 35
Sound carriers rejection
  5.48 MHz to 5.52 MHz
  5.74 MHz
Level residual i.f. carrier and harmonics
  min. 50 dB
  min. 35 dB
Frequency divider interference distance for
  $V_{\text{aerial}} = 50 \text{ dB (\mu V)}$ (referred to 1 MHz)
  min. 40 dB
Image rejection for $V_{\text{aerial}} = 70 \text{ dB (\mu V)}$
  v.h.f. bands
  min. 66 dB
  min. 53 dB
  u.h.f. bands
First repeat spot interference aerial input level
  v.h.f. bands
  min. 75 dB (\mu V)
  min. 63 dB (\mu V)
  u.h.f. bands
Unwanted aerial input level for 1% cross modulation at
a wanted signal level of 50 dB (\mu V)
  $N \pm 1 \text{ v.h.f.}$
  min. 74 dB (\mu V)
  min. 74 dB (\mu V)
  $N \pm 1 \text{ u.h.f.}$
  typ. 92 dB (\mu V)
  typ. 92 dB (\mu V)
  In-band v.h.f.-low, $N \pm 2$
  typ. 100 dB (\mu V)
  typ. 100 dB (\mu V)
  In-band v.h.f.-high, $N \pm 3$
  Out-of-band
  typ. 80 dB (\mu V)
  typ. 80 dB (\mu V)
Ripple susceptibility
  at pins 7, 8 and 10
  min. 5 mV (p-p)
  min. 30 mV (p-p)
  at pins 6 and 30
V.H.F./U.H.F. television tuner and i.f. demodulator

**Video identification (QM versions only)**

- **Load impedance**: 100 kΩ
- **Output voltage (terminal 29)**
  - no video: min. 10 V, max. 0,5 V
  - video
- **Line frequency for guaranteed video identification**: min. 15,0 kHz; max. 16,2 kHz
- **Aerial input sensitivity level**: typ. 25 dB (µV)

**Sound carrier output characteristics**

**Measuring conditions:**
- **Sound output load impedance (via d.c. block capacitor)**: 3 kΩ
- **Sound carrier levels related to picture carrier level**:
  - first sound carrier (5,50 MHz): typ. -13 dB
  - second sound carrier (5,74 MHz): typ. -20 dB
- **Nominal r.m.s. signal level**
  - 5,50 MHz: min. 200 mV; max. 500 mV
  - 5,74 MHz: min. 90 mV; max. 225 mV
- **D.C. voltage level (terminal 24)**: min. 4,8 V; max. 7 V

Signal to noise ratio weighted according to C.C.I.R. 468-3, determined after f.m.-detection for aerial input signal level 70 dB (µV) and video contents:

<table>
<thead>
<tr>
<th>Contents</th>
<th>typ. dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>black, 5,50 MHz</td>
<td>50</td>
</tr>
<tr>
<td>black, 5,74 MHz</td>
<td>55</td>
</tr>
<tr>
<td>5 kHz sine wave, 5,50 MHz</td>
<td></td>
</tr>
<tr>
<td>5 kHz sine wave, 5,74 MHz</td>
<td></td>
</tr>
<tr>
<td>250 kHz sine wave, 5,50 MHz</td>
<td></td>
</tr>
<tr>
<td>250 kHz sine wave, 5,74 MHz</td>
<td></td>
</tr>
</tbody>
</table>
Miscellaneous
Radio interference
Oscillator radiation and oscillator voltage at the aerial terminal

Within the limits of C.I.S.P.R. 13 (1975) + amendment 1 (1983), VDE0872/7.72., Amtsblatt DBP69/1981, and for Finland E.I.S., bulletin T33-82, section 4, when applying the unit in an adequate TV receiver

Microphonics

There will be no microphonics, provided the unit is installed in a professional manner.

Surge protection of aerial input against voltages
Note: 10 discharges of a 470 pF capacitor into the aerial terminal.

Protection against flashes
Note: A flashover circuit producing flashes with frequencies of 1 to 20 Hz for 30 s is connected to the aerial terminal.

max. 5 kV

max. 30 kV, 400 mWs
V.H.F./U.H.F. TELEVISION TUNERS

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Systems</th>
<th>R.T.M.A. systems M and N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channels</td>
<td></td>
</tr>
<tr>
<td>low v.h.f. band</td>
<td>A2 to A6</td>
</tr>
<tr>
<td>high v.h.f. band</td>
<td>A7 to A13</td>
</tr>
<tr>
<td>u.h.f. bands</td>
<td>A14 to A83</td>
</tr>
<tr>
<td>Intermediate frequencies</td>
<td></td>
</tr>
<tr>
<td>picture</td>
<td>45.75 MHz</td>
</tr>
<tr>
<td>sound</td>
<td>41.25 MHz</td>
</tr>
<tr>
<td>colour</td>
<td>42.17 MHz</td>
</tr>
</tbody>
</table>

APPLICATION

Designed to cover the v.h.f. and u.h.f. channels of R.T.M.A. systems M and N.
The tuner is provided with a frequency divider (1 : 256 or 1 : 64), which makes it suitable for digital tuning systems based on frequency synthesis.

Available versions

<table>
<thead>
<tr>
<th>tuner type</th>
<th>aerial input connector</th>
<th>frequency divider ratio</th>
<th>catalogue number</th>
</tr>
</thead>
<tbody>
<tr>
<td>M33</td>
<td>phono</td>
<td>-</td>
<td>3122 127 09710</td>
</tr>
<tr>
<td>M34</td>
<td>phono</td>
<td>64</td>
<td>3122 127 09750</td>
</tr>
<tr>
<td>M34/256</td>
<td>phono</td>
<td>256</td>
<td>3122 237 00070</td>
</tr>
</tbody>
</table>
DESCRIPTION

The M34 is a combined v.h.f./u.h.f. tuner with electronic tuning and band switching, covering the low v.h.f. band (frequency range 54 to 88 MHz), the high v.h.f. band (frequency range 174 to 216 MHz), and the u.h.f. bands (frequency range 470 to 890 MHz).

Mechanically, the tuner is built on a low-loss printed-wiring board, carrying all components, in a metal housing made of a rectangular frame and front and rear covers (see Fig. 2). The common coaxial phono aerial connector (75 Ω) is on one of the frame sides. The coaxial i.f. output is at the top. All other connections (supply voltages, a.g.c. voltage, tuning and switching voltages, prescaler outputs) are made via terminals in the underside. The mounting method is shown in Fig. 3.

Electrically, the tuner comprises v.h.f. and u.h.f. parts (see Fig. 1). The v.h.f. aerial signal is fed via switchable low and high v.h.f. tuned input filters to gate 1 of an input MOSFET tetrode (with internal gate protection against surge).

The input filters are provided with an i.f. and f.m. supression circuit. The drain load of the MOSFET tetrode is formed by a double tuned switchable bandpass filter, transferring the r.f. signal to the emitter of the mixer transistor. The oscillator signal is also fed to the emitter of the mixer transistor.

The collector circuit of the mixer transistor is a single tuned i.f. resonant circuit. The i.f. signal is coupled out via an additional i.f. amplifier. A test point (T.P.) is provided for i.f. injection to align the i.f. output circuit of the tuner together with the i.f. amplifier of the television receiver.

The test point is accessible through a hole in the top of the tuner and is connected to the collector of the mixer transistor.

The single tuned input, the r.f. band pass filter and oscillator circuits are tuned by 4 tuning diodes; band switching is achieved by 5 switching diodes.

The u.h.f. part of the tuner consists of a single tuned input circuit connected to gate 1 of an input MOSFET tetrode (with internal gate protection against surge). The drain load of this MOSFET tetrode is formed by a double tuned circuit transferring the r.f. signal to the Schottky barrier mixer diode.

The i.f. signal from the mixer diode is amplified by the v.h.f. mixer transistor, now operating as an i.f. amplifier.

The r.f. bandpass filter and oscillator circuits are tuned by 3 tuning diodes.

In all bands the tuner is gain-controlled via gate 2 of the input MOSFET tetrode.

The electrical circuit contains a frequency divider (division ratio 256 or 64), with inputs from the v.h.f. and u.h.f. oscillators. The complementary outputs are connected to terminals 12 and 13.
MECHANICAL DATA

Dimensions in mm

Terminal
1 = aerial
2 = supply voltage, u.h.f., +12 V
3 = a.g.c. voltage, +10 to +1 V
4 = supply voltage, low v.h.f., +12 V
5 = supply voltage, high v.h.f., +12 V
6 = earth
7 = supply voltage, v.h.f./u.h.f., +12 V
8 = tuning voltage, 0.65 to 28 V
9 = earth
10 = earth
11, 12 = balanced output voltage of frequency divider
13 = supply voltage, frequency divider, +5 V
14 = i.f. output
V.H.F./U.H.F. television tuners

Fig. 2b I.F. output coil.
Torque for alignment: 2 to 20 mNm.
Press-through force: ≤ 10N.

Mass approx. 125 g

Mounting
1,14 mm (0,045 in) square pins of the Molex 2161 series must be inserted in holes with a diameter of 1,5 mm in a printed-wiring board of which the piercing diagram is given in Fig. 3. Pins in holes marked A are to protect the tuner against reversed mounting. Height of the pins above the component side of the board should be 10 ± 1 mm.
The tuner can be mounted anywhere in the receiver and fixed by means of bolts and nuts, e.g. M5. There are no restrictions on orientation.

Fig. 3 Piercing diagram viewed from solder side of board.

Marking
The tuner is provided with a label, stuck on the top face, on which the following data are printed:
- type number M34
- catalogue number
- letter code for origin
- change code
- data code (year and week), a belt number can be added.
ELECTRICAL DATA

Unless otherwise specified all electrical values apply at an ambient temperature of 25 ± 5 °C, a relative humidity of 60 ± 15%, an air pressure of 86 to 106 kPa, a supply voltage of 12 ± 0.3 V and an a.g.c. voltage of 10 ± 0.2 V.

General

Semiconductors, v.h.f. bands
- r.f. amplifier
- mixer/i.f. amplifier
- oscillator
- tuning diodes
- switching diodes
- d.c. blocking diode

BF982
2 x BF324
BF926
4 x BB809
3 x BA482, 1 x BA483, 1 x BA484
1N4148 or BAS15

Semiconductors, u.h.f. bands
- r.f. amplifier
- oscillator
- mixer
- tuning diodes
- frequency divider

BF980
BF970
1SS99
4 x OF643
SP4632 (∓ 64), SP4653 (∓ 256)

Ambient temperature range
- operating
- storage

0 to + 60 °C
-25 to + 70 °C

Relative humidity

max. 95%

UL/CSA requirements

All insulating material is UL and CSA recognized.
All parts meet the flammability specification UL94HB.

Voltages and currents

Supply voltage ($V_B$)

$+ 12 \text{ V} \pm 10\%$

Current drawn from $+ 12 \text{ V}$ supply
- v.h.f. bands
- u.h.f. bands

max. 50 mA; typ. 44 mA
max. 50 mA; typ. 44 mA

$+ 12 \text{ V} \pm 10\%$, deviation
from $V_B$ less than $+10/-5\%$

Bandswitch voltages ($V_S$)

<table>
<thead>
<tr>
<th>band</th>
<th>terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
</tr>
<tr>
<td>low v.h.f.</td>
<td>0</td>
</tr>
<tr>
<td>high v.h.f.</td>
<td>0</td>
</tr>
<tr>
<td>u.h.f.</td>
<td>+ 12 V</td>
</tr>
</tbody>
</table>

Ripple susceptibility of $V_B$ and $V_S$

min. 5 mV p-p

Frequency divider supply voltage

$5 \text{ V} \pm 0.5 \text{ V}$
A.G.C. voltage (Figs 4 to 9)
- Voltage range: +10 to 0 V
- Voltage at maximum gain: +10 ± 0,2 V
- Voltage at minimum gain: +1 V
- Voltage:
  - V.H.F. band at 50 dB gain reduction: +1 to +5 V
  - U.H.F. band at 30 dB gain reduction: +1 to +5 V
- A.G.C. current: max. 20 μA
- Slope of a.g.c. characteristic, within channel A2 to A69: max. 200 dB/V
- A.G.C. time constant (when driven from a 10 kΩ source): max. 8 ms
- Tuning voltage range (Figs 10, 11 and 12): +0,65 to +28 V
- Max. permissible tuning voltage: 35 V (max. 100 μA)

**Tuning voltages**

<table>
<thead>
<tr>
<th>Channel</th>
<th>Typical</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>A2</td>
<td>3 V</td>
<td>2 V</td>
<td>4 V</td>
</tr>
<tr>
<td>A6</td>
<td>15 V</td>
<td>12 V</td>
<td>19 V</td>
</tr>
<tr>
<td>A7</td>
<td>11 V</td>
<td>8 V</td>
<td>17 V</td>
</tr>
<tr>
<td>A13</td>
<td>22 V</td>
<td>20 V</td>
<td>26 V</td>
</tr>
<tr>
<td>A14</td>
<td>1,5 V</td>
<td>1 V</td>
<td>3 V</td>
</tr>
<tr>
<td>A83</td>
<td>24 V</td>
<td>20 V</td>
<td>27 V</td>
</tr>
</tbody>
</table>

**Current drawn from 28 V tuning voltage supply**

- At T_{amb} = 25 °C, R.H. = 60%: max. 0,5 μA
- At T_{amb} = 25 °C, R.H. = 95%: max. 2 μA
- At T_{amb} = 55 °C, R.H. = 60%: max. 2 μA

**The frequency divider operates at tuning voltages between 0 and 30 V.**

**Tuning voltage time constant**

- Max. 1,5 ms

**Frequencies**

**Frequency ranges**

- **Low V.H.F.**
  - Channel A2 (picture carrier 55,25 MHz) to channel A6 (picture carrier 83,25 MHz).
  - Margin at the extreme channels: min. 2,75 MHz
- **High V.H.F.**
  - Channel A7 (picture carrier 175,25 MHz) to channel A13 (picture carrier 211,25 MHz).
  - Margin at the extreme channels: min. 3,75 MHz
- **U.H.F.**
  - Channel A14 (picture carrier 471,25 MHz) to channel A83 (picture carrier 885,25 MHz).
  - Margin at channel A14: min. 3 MHz.
  - Margin at channel A83: min. 4 MHz.

**Intermediate Frequencies**

- **Picture**: 45,75 MHz
- **Sound**: 41,25 MHz

*The oscillator frequency is higher than the aerial signal frequency.*

* When driven from a 10 kΩ source.
Typical a.g.c. characteristics

Fig. 4 Channel A2.

Fig. 5 Channel A6.

Fig. 6 Channel A7.

Fig. 7 Channel A13.
V.H.F./U.H.F. television tuners

**Fig. 8** Channel A14.

**Fig. 9** Channel A70.
Typical tuning characteristics

Fig. 10 Low v.h.f. band.

Fig. 11 High v.h.f. band.

Fig. 12 U.H.F. bands.
**V.H.F./U.H.F. television tuners**

**Wanted signal characteristics**

**Input impedance**

75 Ω

**V.S.W.R. and reflection coefficient**

(values between picture and sound carrier, as well as values at picture carrier)

<table>
<thead>
<tr>
<th>v.s.w.r.</th>
<th>at nominal gain</th>
<th>during gain control</th>
</tr>
</thead>
<tbody>
<tr>
<td>v.h.f. bands</td>
<td>max. 5</td>
<td>max. 5</td>
</tr>
<tr>
<td>u.h.f. bands</td>
<td>max. 5</td>
<td>max. 5</td>
</tr>
</tbody>
</table>

| reflection coefficient | max. 60% | max. 66% |
| v.h.f. bands          |          |          |
| u.h.f. bands          |          |          |

<table>
<thead>
<tr>
<th>R.F. curves, bandwidth</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>low v.h.f.</td>
<td>typ. 11 MHz</td>
</tr>
<tr>
<td>high v.h.f.</td>
<td>typ. 13 MHz</td>
</tr>
<tr>
<td>u.h.f.</td>
<td>typ. 20 MHz</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>R.F. curves, tilt</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>on any channel the amplitude difference between the top of the r.f. resonant curve and the picture frequency, the sound frequency, or any frequency between them will not exceed 3 dB at nominal gain, and 4 dB in the a.g.c. range between nominal gain and 20 dB gain reduction.</td>
<td></td>
</tr>
</tbody>
</table>

**A.G.C. range**

<table>
<thead>
<tr>
<th>v.h.f. bands</th>
<th>min. 50 dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>u.h.f. bands</td>
<td>min. 30 dB</td>
</tr>
</tbody>
</table>

**Power gain (see also Measuring method of power gain)**

| low v.h.f., 55 MHz | 83 MHz |
| high v.h.f., 175 MHz | 211 MHz |
| u.h.f., 471 MHz | 579 MHz |
|                 | 885 MHz |

**Power gain (see also Measuring method of power gain)**

| low v.h.f., 55 MHz | 83 MHz |
| high v.h.f., 175 MHz | 211 MHz |
| u.h.f., 471 MHz | 579 MHz |
|                 | 885 MHz |

**Maximum gain difference**

- between any two v.h.f. channels
- between any two u.h.f. channels
- between any v.h.f. and u.h.f. channel

<table>
<thead>
<tr>
<th>typ. 3 dB</th>
<th>typ. 4 dB</th>
<th>typ. 5 dB</th>
</tr>
</thead>
</table>

**Noise figure**

| low v.h.f., 55 MHz | max. 6 dB |
| 83 MHz            | max. 7 dB |
| high v.h.f., 175 MHz | max. 6 dB |
| 211 MHz           | max. 6 dB |
| u.h.f., 471 MHz | max. 10 dB |
| 801 MHz           | max. 10 dB |
| 885 MHz           | max. 12 dB |

**Input signal producing 1 dB gain compression at nominal gain**

| min. 80 dB (μV) |
Unwanted signal characteristics

Image rejection (measured at picture carrier frequency)
- v.h.f. bands
- u.h.f. band, channels A14 to A69
- u.h.f. band, channels A70 to A72

I.F. rejection (measured at picture carrier frequency)
- v.h.f. bands
- u.h.f. bands

¾ i.f. interference
- v.h.f. bands
- u.h.f. bands

920 kHz beat
- channels A2 to A69 (a.g.c. from 0 to 30 dB)
- channels A55 to A69 (a.g.c. from 0 to 20 dB)

FM rejection
- channel A6, 90.5 MHz
- channel A6, 93 MHz to 100 MHz

Colour beat, channel A6

CB susceptibility

Breakthroughs

Cross modulation
(1% modulation transfer from unwanted to wanted signal).

The undesired carrier level shall be equal to or exceed the desired carrier level for all gain values between maximum gain and 40 dB (v.h.f.), 30 dB (u.h.f.) gain reduction or be:
- in v.h.f. channel
- in u.h.f. channel
- in v.h.f. band (± 12 MHz)
- in u.h.f. band (± 5 channels)
Oscillator characteristics

Pulling

Input signal of tuned frequency producing a shift of the oscillator frequency of 10 kHz, at nominal gain

Shift of oscillator frequency at a change of the supply voltage of 5%

v.h.f. bands
u.h.f. channels A14 to A69
u.h.f. channels A70 to A83

Drift of oscillator frequency during warm-up time (after the tuner has been completely out of operation for 15 min, measured between 5 s and 15 min after switching on)
during warm-up time (after the input stage is in operation for 15 min, measured between 2 s and 15 min after band switching)
at a change of the ambient temperature from +25 to +50 °C (measured after 3 cycles from +25 to +55 °C)

v.h.f. bands
u.h.f. bands

Drift of oscillator frequency at a change of humidity from R.H. = 60 ± 2% to R.H. = 93 ± 2%

T_{amb} = 25 ± 5 °C
low v.h.f.
high v.h.f.
u.h.f. channel A14
u.h.f. channel A83

Shift during a.g.c.

v.h.f.
u.h.f. channels A14 to A69
u.h.f. channels A70 to A83

Frequency divider characteristics

Supply voltage

Current drawn from +5 V supply

Output voltage, output loaded with 62 Ω and 18 pF in series

Interference signal on the i.f. output
Miscellaneous
Radio interference
Oscillator radiation
- low v.h.f. band, max. 50 µV/m
- high v.h.f. band, max. 150 µV/m
- u.h.f. bands, any single frequency, max. 750 µV/m
- u.h.f. bands, average of ten individual frequencies, max. 350 µV/m
Microphonics
- There will be no microphonics, provided the tuner is installed in a professional manner.

Surge protection
Protection against voltages
- max. 5 kV
Note: 10 discharges of a 470 pF capacitor into the aerial terminal.
Protection against flashes
- max. 30 kV, 400 mWs
Note: A flashover circuit producing flashes with frequencies of 1 to 20 Hz for 30 s is connected to the aerial terminal.

ADDITIONAL INFORMATION
I.F. injection
The test point (T.P.) connected to the collector of the v.h.f. mixer transistor can be used for i.f. injection via a capacitance of 0.3 pF.
The tuner can be switched to either a v.h.f. or a u.h.f. band, with a tuning voltage of at least 5 V.
Attenuation of injected signal is 20 dB.

Connection of the i.f. amplifier
No special precautions are required to load and to match the i.f. output of the tuner.

Connection of supply voltages

Fig. 13.
Method of measuring power gain
The i.f. output of the tuner should be terminated with 75 Ω.

No further i.f. alignment is necessary.

Alignment of the i.f. output coil
The i.f. output coil should be adjusted with a brass tool with a blade as shown in Fig. 14. A suitable tool is available under catalogue number 7122 005 47680.
U.H.F. TELEVISION TUNERS

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Systems</th>
<th>C.C.I.R. systems I (United Kingdom), G, H and K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channels</td>
<td>E21 to E69</td>
</tr>
<tr>
<td>Intermediate frequencies</td>
<td></td>
</tr>
<tr>
<td>picture</td>
<td>39.5 MHz</td>
</tr>
<tr>
<td>sound</td>
<td>33.5 MHz</td>
</tr>
<tr>
<td>systems I and K</td>
<td>38.9 MHz</td>
</tr>
<tr>
<td>systems G and H</td>
<td>33.4 MHz</td>
</tr>
</tbody>
</table>

APPLICATION

These tuners are for use in u.h.f. single-standard receivers. In combination with v.h.f. tuner V317 or V334 they can be used in v.h.f./u.h.f. receivers.

The tuners meet the special requirements of the United Kingdom.

The U341LO Mark 2 is a special version of the U341 Mark 2; an output voltage sample from the local oscillator is available for driving digital tuning systems. Apart from this the tuners are identical.

The tuners are pin-compatible with tuners U341 and U341LO; the a.g.c. circuit is voltage driven.
DESCRIPTION

These are u.h.f. tuners with electronic tuning, covering the u.h.f. band from 470 to 860 MHz (channels E21 to E69). The tuner circuit is built on a printed-wiring board and enclosed in a metal housing comprising a rectangular frame and front and rear covers (see Fig. 2a). The shielded aerial connection is on one of the shortest frame sides, all other connections (supply voltages, a.g.c., tuning voltage, i.f. injection, i.f. output) are made via terminals on the underside. The mounting method is shown in Figs. 3 and 4.

Tuner U341LO Mark 2 has a coaxial socket on the top of the frame for the oscillator output sample.

Electrically, the tuners consist of an input circuit with a high-pass characteristic and a MOS-FET tetrode BF980. This tetrode operates at a drain current of about 10 mA, and has good noise figures and signal handling properties. It also acts as an a.g.c. device, controlled by an a.g.c. voltage fed to gate 2. This combination has good signal handling properties throughout the a.g.c. range. The drain load of the MOS-FET tetrode is formed by a double tuned circuit which transfers the signal to the mixer diode 1SS99. The selectivity of this circuit at the image frequency has been improved by special means. The mixer diode is driven by an oscillator transistor BF970. For the U341LO Mark 2 the oscillator sample is fed out of the oscillator via a resistor.

The i.f. signal, from the mixer is amplified by a transistor BF324 in grounded-base configuration. The combination of the Schottky-barrier diode 1SS99 and the i.f. transistor BF324 ensures good noise figures and signal handling properties. Three capacitance diodes OF643 tune the double tuned circuit and the oscillator.

The i.f. output circuit is single tuned with output coupling from the low impedance side. A d.c. path to earth for the collector current of the i.f. transistor BF324 must be provided outside the tuner, preferably by a choke of about 5 µH. Damping of the i.f. output circuit and matching to the i.f. circuit of the receiver can be achieved by connecting a series resistance and a parallel capacitance outside the tuner.

An i.f. injection point is provided at the collector of the i.f. transistor, connected to terminal 7. U341LO Mark 2 has a special connection to provide an oscillator output for driving digital tuning systems.
Fig. 2a The oscillator sample socket, drawn with dotted lines, applies only to tuner U341LO Mark 2.

Terminal 1 = aerial connection
2 = r.f. supply voltage, +12 V
3 = a.g.c. voltage, +9.2 to +1 V
4 = tuning voltage, +1 to +28 V
6 = oscillator/i.f. supply voltage, +12 V
7 = i.f. injection point
10 = i.f. output

Note: When the tuner is operated together with a v.h.f. tuner, only the supply voltage at terminal 6 should be switched off during v.h.f. operation.

Fig. 2b I.F. output coil.
Torque for alignment: 2 to 15 mNm
Press-through force: > 10 N

Mass approx. 75 g
Mounting

The tuner may be mounted by soldering it on to a printed-wiring board with connections as shown by the piercing diagram in Fig.3. (The tuner may also be mounted in a socket. See under accessories. It is recommended that the tuner be installed in a cool part of the receiver cabinet and not exposed to the vibrations of the loudspeaker. There are no restrictions on orientation.

The solderability of the terminals and mounting tabs is according to IEC 68-2, test Ta (230 ± 10 °C, 2 ± 0.5 s). The resistance to soldering heat is according to IEC 68-2, test Tb (260 ± 5 °C, 10 ± 1 s).

A coaxial plug has to be used for connection to the socket on the top of tuner U341LO Mark 2; type 3/2-50 (manufacturer: Daut und Rietz) is recommended. (See under accessories).

The aerial cable should be connected as follows:

- strip the cable according to Fig. 4B;
- fix the cable as indicated in Fig. 4C and solder the inner conductor on the aerial tag;
- insert the lugs on immunity shield under the tabs on tuner body, push the shield into position so that the locating tags snap into place in the tuner body.

The recommended cable is: DAVU wire CX4004 (outer sheath diameter 5.32 mm).
ELECTRICAL DATA

The electrical values are measured on the u.h.f. tuner alone, but they are also valid for the u.h.f. tuner when used with a v.h.f. tuner V317 or V334. Unless otherwise specified all electrical values apply at an ambient temperature of 25 ± 5 °C, a relative humidity of 60 ± 15%, a supply voltage of 12 ± 0.3 V and an a.g.c. voltage of 9.2 ± 0.2 V.

Within the given tolerance range of supply voltage and a.g.c. voltage only insignificant deviations from the specified values can be expected. Under the extreme conditions of temperature and humidity as given below, the tuner will function normally, but some specified limits may be exceeded.

General

Semiconductors
- r.f. amplifier: BF980
- mixer diode: 1SS99
- oscillator: BF970
- tuning diodes: 3 x OF643
- i.f. amplifier: BF324
- surge protection diode: BAV10

Ambient temperature range
- operating: -10 to + 60 °C
- storage: -25 to + 85 °C

Relative humidity
max. 90%

Voltages and currents

Supply voltage
+ 12 V ± 10%

Note: The supply voltage at terminal 2 (input stage) should be filtered to avoid hum modulation.

Ripple susceptibility

Defined as the peak-to-peak value of a sine wave signal (20 Hz — 500 kHz) on the supply voltages causing an amplitude modulation with a modulation depth of 0.28% on the picture carrier after passing the Nyquist curve of the i.f. filter of a tv receiver.

ripple susceptibility
min. 3 mV peak-to-peak

Current drawn from +12 V supply
- r.f. amplifier, at nominal gain: typ. < 21 mA
- r.f. amplifier, at 30 dB gain reduction: typ. 11 mA
- oscillator/i.f. amplifier: max. < 16 mA

A.G.C. voltage (Fig.5)
- voltage at nominal gain: + 9.2 ± 0.5 V
- voltage at 30 dB gain reduction: min. + 1 V

Note: A.G.C. voltages between 0 and +10 V may be applied without risk of damage.

A.G.C. current (Fig.5)
- during gain control (0 to 30 dB): max. + 1 mA
- at nominal gain: typ. + 0.9 mA
- at 30 dB gain reduction: typ. + 0.1 mA
Tuning voltage range (Fig.6) + 1 to + 28 V

Current drawn from + 28 V tuning voltage supply
- max. 0.15 μA
- max. 0.6 μA
- min. 4 MHz/V

Slope of tuning characteristic

Note: The source impedance of the tuning voltage offered to terminal 4 must be maximum 47 kΩ at tuning voltages below 3 V.

Oscillator sample signal; only valid for U341LO Mark 2
- typ. 90 dB (μV) into 75 Ω
- min. 80 dB (μV) into 75 Ω
- max. 105 dB (μV) into 75 Ω

Note: A tuning voltage higher than + 28 V will not damage the tuner and may be applied at the user's own risk. Under this condition the published reverse voltage limit of the oscillator tuning diode will be exceeded; the oscillator frequency will never decrease with increasing tuning voltage.
Frequencies

Frequency range
channel E21 (picture carrier 471.25 MHz) to channel E69 (picture carrier 855.25 MHz).
Margin at the extreme channels: min. 3 MHz.

Intermediate frequencies

<table>
<thead>
<tr>
<th>picture</th>
<th>sound</th>
</tr>
</thead>
<tbody>
<tr>
<td>39.5 MHz</td>
<td>38.9 MHz</td>
</tr>
<tr>
<td>33.5 MHz</td>
<td>33.4 MHz</td>
</tr>
</tbody>
</table>
The oscillator frequency is higher than the aerial signal frequency.

Note: The tuner is aligned in such a way that the i.f. frequencies of the four systems can be applied.

Wanted signal characteristics

Input impedance
asymmetrical 75 Ω

Output impedance at the oscillator sample socket; only valid for U341LO Mark 2
asymmetrical 75 Ω

V.S.W.R. and reflection coefficient
at picture carrier frequency, at nominal gain and at 30 dB gain reduction
v.s.w.r. max. 6
reflection coefficient max. 71%

V.S.W.R. and reflection coefficient* at oscillator sample socket; only valid for U341LO Mark 2
v.s.w.r. at fosc 80 MHz — 900 MHz max. 3.5
reflection coefficient at fosc 80 MHz — 900 MHz max. 56%

R.F. curves, bandwidth
typ. 20 MHz

R.F. curves, tilt (only for i.f. 39.5/33.5 MHz)
on any channel the amplitude difference between the top of the r.f. resonant curve and the picture frequency, the sound frequency, or any frequency between them will not exceed 3 dB at nominal gain, and 4 dB in the a.g.c. range between nominal gain and 20 dB gain reduction.

A.G.C. range
min. 30 dB

*Measured in operational and non-operational condition of the tuner.
U.H.F. television tuners

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Min.</th>
<th>Typ.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power gain (see also Measuring method of power gain)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>channel E21</td>
<td>20 dB</td>
<td>27 dB</td>
</tr>
<tr>
<td>channel E40</td>
<td>25 dB</td>
<td>27 dB</td>
</tr>
<tr>
<td>channel E69</td>
<td>25 dB</td>
<td>27 dB</td>
</tr>
<tr>
<td>Gain difference between any two channels</td>
<td></td>
<td>4 dB</td>
</tr>
<tr>
<td>Noise figure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>channel E21</td>
<td>10 dB</td>
<td>5.5 dB</td>
</tr>
<tr>
<td>channel E40</td>
<td>6.5 dB</td>
<td>7 dB</td>
</tr>
<tr>
<td>channel E69</td>
<td>6.5 dB</td>
<td>7 dB</td>
</tr>
<tr>
<td>Overloading</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input signal producing 1 dB gain compression at nominal gain</td>
<td>90 dB (µV) into 75 Ω</td>
<td></td>
</tr>
<tr>
<td>Input signal producing either a detuning of the oscillator of + 300 kHz or -1000 kHz or stopping of the oscillations at nominal gain</td>
<td>100 dB (µV) into 75 Ω</td>
<td></td>
</tr>
<tr>
<td>1.6 MHz moiré rejection (for i.f. 39.5/33.5 MHz)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wanted signal level of a tv signal (picture to sound ratio of 7 dB and picture to chroma ratio of 16 dB), produces an unwanted i.f. component (37.8 MHz) 52 dB below the i.f. picture carrier, when the tuner is 30 dB gain controlled. I.F. output circuit should be loaded and tuned to 36.15 MHz.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>tv (picture carrier)</td>
<td>100 dB (µV)</td>
<td></td>
</tr>
<tr>
<td>Unwanted signal characteristics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Image rejection (measured at picture carrier frequency)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>at nominal gain, channels E21 to E60</td>
<td>53 dB</td>
<td>60 dB</td>
</tr>
<tr>
<td>at 20 dB gain reduction, channels E21 to E60</td>
<td>50 dB</td>
<td>55 dB</td>
</tr>
<tr>
<td>Harmonic content of oscillator sample; only valid for U341LO Mark 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suppression of harmonics which fall into the frequency range below 1200 MHz (second harmonics of fundamentals below 600 MHz)</td>
<td>15 dB (typ 20 dB) below oscillator fundamental</td>
<td></td>
</tr>
<tr>
<td>R.F. rejection at oscillator sample socket; only valid for U341LO Mark 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signal voltage at oscillator sample socket (input signals of wanted frequency 70 dB (µV) into 75 Ω; tuner operating at nominal gain)</td>
<td>20 dB (typ 24 to 40 dB) below oscillator fundamental</td>
<td></td>
</tr>
<tr>
<td>I.F. rejection (measured at picture carrier and colour sub-carrier frequency)</td>
<td>80 dB</td>
<td></td>
</tr>
<tr>
<td>I.F. rejection at oscillator sample socket; only valid for U341LO Mark 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I.F. signals at oscillator sample socket (converted from input signals of wanted frequency 70 dB (µV) into 75 Ω; tuner operating at nominal gain)</td>
<td>20 dB (typ 27 up to 35 dB) below oscillator fundamental</td>
<td></td>
</tr>
</tbody>
</table>
1st repeat spot rejection (for i.f. 39.5/33.5 MHz)

Defined as the input level of the picture carrier of channel N + 2, the sound carrier of which produces an i.f. signal (35.0 MHz), which is 52 dB below the picture carrier of the wanted signal N (picture to sound ratio 7 dB; wanted signal 60 dB (µV), tuner operating at nominal gain.

interfering signal	typ. 80 dB (µV)

N ± 4 rejection

Interference signal for an interference ratio of 53 dB referred to wanted picture carrier (picture to sound carrier ratio of 7 dB; wanted signal 60 dB (µV); tuner operating at nominal gain)

N + 4 rejection	typ. 80 dB (µV) into 75 Ω
N − 4 rejection	typ. 78 dB (µV) into 75 Ω

Cross modulation

Input signal producing 1% cross modulation, i.e. 1% of the modulation depth of the interfering signal is transferred to the wanted signal.

In channel cross modulation (wanted signal: picture carrier frequency, interfering signal, sound carrier frequency)

at nominal gain (wanted input level 60 dB (µV))

at 26 dB gain reduction (wanted input level 86 dB (µV))

typ. 80 dB (µV) into 75 Ω
typ. 94 dB (µV) into 75 Ω

In band cross modulation (wanted signal: picture carrier of channel N; interfering signal: picture carrier of channel N ± 3 and N ± 5)

at nominal gain (wanted input level 60 dB (µV))

at 26 dB gain reduction (wanted input level 86 dB (µV))

typ. 92 dB (µV) into 75 Ω
typ. 95 dB (µV) into 75 Ω

Out of band modulation, at nominal gain

v.h.f. I	min. 108 dB (µV) into 75 Ω
v.h.f. III	min. 108 dB (µV) into 75 Ω

Unwanted signal handling capability

The tuner operates together with a standard tv receiver with normal A.G.C. for tuner and i.f. amplifier. Unwanted tv signal 3 channels higher or lower than wanted. Unwanted signal level adjusted for just not visible interference.

Unwanted picture carrier signal
typ. 96 dB (µV)
Oscillator characteristic

Pulling
Input signal of tuned frequency producing a shift of the oscillator frequency of 10 kHz, at nominal gain

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typ.</td>
<td>85 dB (µV) into a 75 Ω</td>
</tr>
<tr>
<td>Max.</td>
<td>500 kHz</td>
</tr>
</tbody>
</table>

Shift of oscillator frequency (ΔF)
at a change of the supply voltage of 5%

Drift of oscillator frequency
during warm-up time (after the tuner has been completely out of operation for 15 min, measured between 5 s and 15 min after switching on)
during warm-up time (after the input stage is in operation for 15 min, measured between 2 s and 15 min after switching on oscillator/i.f. stage)
at a change of the ambient temperature from +25 to +50 °C and +25 °C to 0 °C (measured after 3 cycles from +25 to +55 °C)
channels E21 to E69
at a change of humidity from 60% ± 15% to 93% ± 2% measured at T_{amb} 25 °C ± 5 °C,

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max.</td>
<td>250 kHz</td>
</tr>
<tr>
<td>Max.</td>
<td>250 kHz</td>
</tr>
<tr>
<td>Max.</td>
<td>1000 kHz</td>
</tr>
<tr>
<td>Max.</td>
<td>1500 kHz</td>
</tr>
</tbody>
</table>

I.F. characteristics

Bandwidth of i.f. output circuit

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5 ±1 MHz</td>
</tr>
</tbody>
</table>

Note: I.F. output of the tuner terminated with the circuit shown in Fig.9, tuning voltage 15 V.

Bandwidth variation of i.f. output circuit as a result of r.f. tuning

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max.</td>
<td>500 kHz</td>
</tr>
</tbody>
</table>

Note: I.F. output of the tuner terminated with a modified circuit of Fig.9, i.e. a 100 pF capacitor is connected in parallel with C1; tuning voltage 15 V.

Detuning of the i.f. output circuit as a result of r.f. tuning

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max.</td>
<td>500 kHz</td>
</tr>
</tbody>
</table>

Note: I.F. output of the tuner terminated with a modified circuit of Fig.9, i.e. a 100 pF capacitor is connected in parallel with C1; tuning voltage 15 V.

Minimum tuning range of i.f. output coil

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>33 to 40 MHz</td>
</tr>
</tbody>
</table>

Note: I.F. output of the tuner terminated with the circuit shown in Fig.10, tuning voltage 15 V.

Attenuation between i.f. injection point and i.f. output of the tuner

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typ.</td>
<td>23 ± 3 dB</td>
</tr>
</tbody>
</table>
Miscellaneous
Radio interference
Oscillator radiation and oscillator voltage at the aerial terminal

Within the limits of C.I.S.P.R. 13 (1975). Use is made of the relaxed limit of 3 mV/m (70 dB (μVm)).

Immunity from radiated interference

Aerial terminal meets requirements of BS905, provided the aerial cable is connected in a professional manner.

Microphonics

There will be no microphonics, provided the tuner is installed in a professional manner.

Surge protection
Protection against voltages

max. 5 kV

Note: Ten discharges of a 470 pF capacitor into the aerial terminal.

Protection against flashes

max. 30 kV, 400 mWs

Note: A flashover circuit producing flashes with frequencies of 1 to 20 Hz for 30 s is connected to the aerial terminal.
U.H.F. television tuners

ADDITIONAL INFORMATION

I.F. injection

The tuner has an i.f. injection point at the collector of the i.f. transistor (coupled via a small capacitor to terminal 7). The i.f. generator can be connected directly to this point (Fig.7). The tuner needs normal supply voltages and a tuning voltage of 15 V; the i.f. output should be loaded with the circuit shown in Fig.9.

![i.f. generator diagram](M1196 72774x51)

**Fig.7**

Connection of the i.f. amplifier

The tuner needs a d.c. path from the i.f. output terminal (10) to earth, preferably via a choke of approx. 5 μH outside the tuner (Fig.8). Where the tuner is used in combination with a V.H.F. tuner, this choke can be common for both tuners; a resistor in series with the choke can inhibit the i.f. output circuit of the switched-off tuner. For damping the i.f. output circuit and matching the i.f. output impedance of the tuner to the receiver i.f. amplifier, a series resistor and a parallel capacitor as shown in Fig.8 should be used.

![i.f. output connection diagram](M1197)

*Eventually the two separate damping resistors may be replaced by a common one.*

**Fig.8**
Measuring method of power gain

The i.f. output of the tuner should be terminated with the RC-circuit given in Fig.9.

![Fig.9]

The RC-circuit roughly matches the i.f. output impedance to 75 Ω at the resonant frequency of the i.f. output circuit, which should be tuned to 36.5 MHz; the bandwidth should be approx. 5 MHz (Fig.10).

Because the input and output impedances of the tuner are now 75 Ω, the power gain can be measured in the conventional manner by inserting tuner and RC-circuit between a 75 Ω source and a 75 Ω detector.

![Fig.10]
Alignment of the i.f. output coil

The i.f. output coil should be adjusted with a plastic tool, which has a cross head according to Fig. 11. A suitable tool for automatic alignment is available under catalogue number 8104 004 11040.

ACCESSORIES

Immunity shield, catalogue number 3122 121 24910
Connector assembly for use of tuner U341 Mark 2 or U341LO Mark 2 in combination with v.h.f. tuner V317 or V334:
connector, catalogue number 3112 200 20720
clamp holder, catalogue number 3122 121 29260
clamp, catalogue number 3112 274 13220
U.H.F. TELEVISION TUNERS

QUICK REFERENCE DATA

<table>
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<td>E21 to E69</td>
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<td>Intermediate frequencies</td>
<td></td>
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<td>picture</td>
<td>systems G and H</td>
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<tr>
<td>sound</td>
<td>systems I and K</td>
</tr>
<tr>
<td>38.9 MHz</td>
<td>39.5 MHz</td>
</tr>
<tr>
<td>33.4 MHz</td>
<td>33.5 MHz</td>
</tr>
</tbody>
</table>

APPLICATION

These tuners are designed to cover the u.h.f. channels E21 to E69 of C.C.I.R. systems G, H, I and K.

In combination with a suitable v.h.f. tuner, e.g. V317 or V334, they can be used in v.h.f./u.h.f. receivers.

The aerial inputs and i.f. outputs of both tuners can then be connected in parallel.

The U342LO is a special version of the U342; an output voltage from the local oscillator is made available for driving digital tuning systems. Apart from this the tuners are identical.
DESCRIPTION

The tuners are u.h.f. tuners with electronic tuning, covering the u.h.f. band from 470 to 860 MHz. Mechanically, the tuners are built on a printed-wiring board, carrying all components, in a metal housing made of a rectangular frame, and front and rear covers (see Fig. 2a). All connections (aerial, supply voltages, a.g.c. voltage, tuning voltage, i.f. injection, i.f. output) are made via terminals on the underside. The mounting method is shown in Fig. 3. Tuner U342LO has a coaxial socket on the top of the frame for coupling out the oscillator sample.

Electrically, the tuners consist of an input circuit with a high-pass characteristic and a MOS-FET tetrode BF980. This tetrode operates at a drain current of about 10 mA, featuring good noise figures and good signal handling properties. It also acts as an a.g.c. device, controlled by an a.g.c. voltage fed to gate 2. This combination has good signal handling properties throughout the a.g.c. range. The drain load of the MOS-FET tetrode is formed by a double tuned circuit, transferring the signal to the mixer diode 1SS99. The selectivity of this circuit at the image frequency has been improved by special means. The mixer diode is driven by an oscillator, equipped with a transistor BF480. At the U342LO the oscillator sample is coupled out of the mixer via a small capacitor in series with a resistor.

The i.f. signal, originated in the mixer, is amplified by a transistor BF324 in grounded-base configuration. The combination of the Schottky-barrier diode 1SS99 and the i.f. transistor BF324 also features good noise figures and good signal handling properties. Three capacitance diodes BB405B tune the double tuned circuit and the oscillator.

The i.f. output circuit of the tuner is a single tuned one, at the low end of which the i.f. signal is coupled out of the tuner. A d.c. path to earth for the collector current of the i.f. transistor BF324 has to be provided outside the tuner, preferably by a choke of about 5 µH. Damping of the i.f. output circuit and matching of the i.f. output to the i.f. circuit of the receiver can be achieved by connecting a series resistance and a parallel capacitance outside the tuner.

An i.f. injection point has been provided at the collector of the i.f. transistor, connected to terminal 7.
Fig. 1.
Fig. 2a The oscillator sample socket, drawn with dotted lines, applies only to tuner U342LO.

Terminal 1 = aerial
2 = r.f. supply voltage, +12 V
3 = a.g.c. voltage, +9.2 to +1 V
4 = tuning voltage, +1 to +28 V
6 = oscillator/i.f. supply voltage, +12 V
7 = i.f. injection point
10 = i.f. output

Note: When the tuner is operated together with a v.h.f. tuner, only the supply voltage at terminal 6 should be switched off during v.h.f. operation.

Fig. 2b I.F. output coil.
Torque for alignment: 2 to 15 mNm
Press-through force: > 10 N

Mass approx. 75 g
Mounting

The tuner may be mounted by soldering it on to a printed-wiring board, using the piercing diagram shown in Fig. 3. (The tuner may also be mounted into a socket. Information will be supplied upon request.)

It is recommended that the tuner be installed in the cool part of the receiver cabinet and not exposed to the vibrations of the loudspeaker. There are no restrictions on orientation.

The solderability of the terminals and mounting tabs is according to IEC 68-2, test Ta (230 ± 10 °C, 2 ± 0,5 s). The resistance to soldering heat is according to IEC 68-2, test Tb (260 ± 5 °C, 10 ± 1 s).

Fig. 3 Piercing diagram viewed from solder side of board.

For connection to the socket on the top of tuner U342LO a coaxial plug has to be used; type 3/2-50 (manufacturer: Daut und Rietz) is recommended.
ELECTRICAL DATA

The electrical values are measured on the u.h.f. tuner alone, but they are also valid for the u.h.f. tuner in combination with a v.h.f. tuner V317 or V334. Unless otherwise specified all electrical values apply at an ambient temperature of 25 ± 5 °C, a relative humidity of 60 ± 15%, a supply voltage of 12 ± 0,3 V and an a.g.c. voltage of 9,2 ± 0,2 V.

Within the given tolerance range of supply voltage and a.g.c. voltage only insignificant deviations from the specified values can be expected. Under the extreme conditions of temperature and humidity as given below, the tuner will function normally, but some specified limits may be exceeded.

General

Semiconductors
- r.f. amplifier
- mixer diode
- oscillator
- tuning diodes
- i.f. amplifier
- surge protection diodes

BF980 (3SK87)
1SS99
BF480
3 x BB405B
BF324
2 x BAV10

Ambient temperature range
- operating + 5 to + 55 °C
- storage -25 to + 85 °C

Relative humidity max. 90%

Voltages and currents

Supply voltage + 12 V ± 10%

Note: The supply voltage at terminal 2 (input stage) should be filtered to avoid hum modulation.

Current drawn from + 12 V supply
- r.f. amplifier, at nominal gain typ. 21 mA
- r.f. amplifier, at 30 dB gain reduction typ. 10 mA
- oscillator/i.f. amplifier max. 16 mA

A.G.C. voltage (Fig. 4), at nominal gain + 9,2 ± 0,5 V
A.G.C. voltage, at 30 dB gain reduction min. + 1 V

Note: A.G.C. voltages between 0 and + 10 V may be applied without risk of damage.

A.G.C. current (Fig. 4)
- during gain control (0 to 30 dB) max. + 1 mA
- at nominal gain typ. + 0,9 mA
- at 30 dB gain reduction typ. + 0,1 mA

October 1982
U.H.F. television tuners

Tuning voltage range (Fig. 5)

Current drawn from +28 V tuning voltage supply
- at 25 °C: max. 0.15 μA, min. 0.6 μA
- at 55 °C: max. 0.15 μA, min. 0.6 μA

Slope of tuning characteristic

Note: The source impedance of the tuning voltage offered to terminal 4 must be maximum 47 kΩ at tuning voltages below 3 V.

Oscillator sample signal; only valid for U342LO
- at +12 V supply voltage and T_{amb} = +25 °C
- within the given tolerance range of supply voltage and given operating temperature range,
- and within the tuning voltage range +0.5 to +30 V

Note: A tuning voltage higher than +28 V will not be harmful for the tuner and may be applied at the user's own risk. Under this condition the published reverse voltage limit of the oscillator tuning diode will be exceeded; the oscillator frequency will never decrease with increasing tuning voltage.
Frequencies
Frequency range

Intermediate frequencies
picture sound

channel E21 (picture carrier 471.25 MHz) to channel E69 (picture carrier 855.25 MHz).
Margin at the extreme channels: min. 3 MHz.

<table>
<thead>
<tr>
<th></th>
<th>systems G, H</th>
<th>systems I, K</th>
</tr>
</thead>
<tbody>
<tr>
<td>38.9 MHz</td>
<td>39.5 MHz</td>
<td></td>
</tr>
<tr>
<td>33.4 MHz</td>
<td>33.5 MHz</td>
<td></td>
</tr>
</tbody>
</table>

The oscillator frequency is higher than the aerial signal frequency.

Note: The tuner is aligned in such a way that the i.f. frequencies of the four systems can be applied.

Wanted signal characteristics

Input impedance
asymmetrical 75 Ω

Output impedance at the oscillator sample socket; only valid for U342LO
asymmetrical 75 Ω

V.S.W.R. and reflection coefficient
at picture carrier frequency, at nominal gain and at 30 dB gain reduction

<table>
<thead>
<tr>
<th></th>
<th>max.</th>
<th>typ.</th>
</tr>
</thead>
<tbody>
<tr>
<td>v.s.w.r.</td>
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<td>6</td>
</tr>
<tr>
<td>reflection coefficient</td>
<td>71%</td>
<td>71%</td>
</tr>
</tbody>
</table>

V.S.W.R. and reflection coefficient* at oscillator sample socket: only valid for U342LO

<table>
<thead>
<tr>
<th></th>
<th>max.</th>
<th>typ.</th>
</tr>
</thead>
<tbody>
<tr>
<td>v.s.w.r. at f_{osc} &lt; 600 MHz</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>v.s.w.r. at f_{osc} &gt; 600 MHz</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>reflection coefficient at f_{osc} &lt; 600 MHz</td>
<td>60%</td>
<td>60%</td>
</tr>
<tr>
<td>reflection coefficient at f_{osc} &gt; 600 MHz</td>
<td>50%</td>
<td>50%</td>
</tr>
</tbody>
</table>

R.F. curves, bandwidth

R.F. curves, tilt (only for i.f. 38.9/33.4 MHz)
on any channel the amplitude difference
between the top of the r.f. resonant curve and
the picture frequency, the sound frequency,
or any frequency between them will
not exceed 3 dB at nominal gain, and 4 dB in
the a.g.c. range between nominal gain and
20 dB gain reduction.

A.G.C. range

min. 30 dB

* Measured in operational and non-operational condition of the tuner.
Power gain (see also Measuring method of power gain)

- channel E21: min. 20 dB, typ. 25 dB
- channel E40: min. 24 dB, typ. 27 dB
- channel E69: min. 27 dB

Gain difference between any two channels: typ. 4 dB

Noise figure

- channel E21: max. 10 dB, typ. 6 dB
- channel E40: typ. 6 dB
- channel E69: typ. 6.5 dB

Overloading

Input signal producing 1 dB gain compression at nominal gain: typ. 90 dB (µV) into 75 Ω

Input signal producing either a detuning of the oscillator of +300 kHz or -1000 kHz or stopping of the oscillations at nominal gain: typ. 100 dB (µV) into 75 Ω

Unwanted signal characteristics

Image rejection (measured at picture carrier frequency)

- channels E21 to E60: min. 46 dB; typ. 53 dB

Harmonic content of oscillator sample; only valid for U342LO

Suppression of harmonics which fall into the frequency range below 1200 MHz (second harmonics of fundamentals below 600 MHz): min. 15 dB (typ. 20 dB) below oscillator fundamental

R.F. rejection at oscillator sample socket; only valid for U342LO

Signal voltage at oscillator sample socket (input signals of wanted frequency 70 dB (µV) into 75 Ω; tuner operating at nominal gain): min. 17 dB (typ. 24 to 34 dB) below oscillator fundamental

I.F. rejection (measured at picture carrier and colour sub-carrier frequency): min. 60 dB

I.F. rejection at oscillator sample socket; only valid for U342LO

I.F. signals at oscillator sample socket (converted from input signals of wanted frequency 70 db (µV) into 75 Ω; tuner operating at nominal gain): min. 20 dB (typ. 35 dB) below oscillator fundamental
N ± 4 rejection
Interference signal for an interference ratio of
53 dB referred to wanted picture carrier (picture
to sound carrier ratio of 10 dB; wanted signal
60 dB (μV); tuner operating at nominal gain)  \(\text{typ. } 80 \text{ dB (μV)} \text{ into } 75 \Omega\)

Cross modulation
Input signal producing 1% cross modulation, i.e. 1% of the modulation depth of the interfering signal
is transferred to the wanted signal.

In channel cross modulation (wanted signal: picture carrier frequency; interfering signal: sound carrier
frequency)
  - at nominal gain (wanted input level 60 dB (μV))  \(\text{typ. } 80 \text{ dB (μV)} \text{ into } 75 \Omega\)
  - at 26 dB gain reduction (wanted input level 86 dB (μV))  \(\text{typ. } 100 \text{ dB (μV)} \text{ into } 75 \Omega\)

In band cross modulation (wanted signal: picture carrier of channel N; interfering signal: picture carrier
of channel N ± 5)
  - at nominal gain (wanted input level 60 dB (μV))  \(\text{typ. } 92 \text{ dB (μV)} \text{ into } 75 \Omega\)
  - at 26 dB gain reduction (wanted input level 86 dB (μV))  \(\text{typ. } 100 \text{ dB (μV)} \text{ into } 75 \Omega\)

Out of band cross modulation, at nominal gain
  - v.h.f. I  \(\text{min. } 108 \text{ dB (μV)} \text{ into } 75 \Omega\)
  - v.h.f. III  \(\text{min. } 108 \text{ dB (μV)} \text{ into } 75 \Omega\)

Oscillator characteristics
Pulling
Input signal of tuned frequency producing a shift of the
oscillator frequency of 10 kHz, at nominal gain  \(\text{typ. } 80 \text{ dB (μV)} \text{ into } 75 \Omega\)
Shift of oscillator frequency
  - at a change of the supply voltage of 5%  \(\text{max. } 550 \text{ kHz}\)
Drift of oscillator frequency
- during warm-up time (after the tuner has been completely out of operation for 15 min, measured between 5 s and 15 min after switching on) max. 250 kHz
- during warm-up time (after the input stage is in operation for 15 min, measured between 2 s and 15 min after switching on the oscillator/i.f. stage) max. 250 kHz
- at a change of the ambient temperature from +25 to +40°C (measured after 3 cycles from +25 to +55°C)
- channels E21 to E60 max. 500 kHz
- channels E61 to E65 max. 650 kHz
- channels E66 to E69 max. 750 kHz

I.F. characteristics
Bandwidth of i.f. output circuit 5\(+1\)\(^{-0.5}\) MHz
Note: I.F. output of the tuner terminated with the circuit shown in Fig. 6; tuning voltage 15 V.

Bandwidth variation of i.f. output circuit as a result of r.f. tuning max. 500 kHz
Note: I.F. output of the tuner terminated with a modified circuit of Fig. 6, i.e. a 100 pF capacitor is connected in parallel with C1; tuning voltage 15 V.

Detuning of the i.f. output circuit as a result of r.f. tuning max. 500 kHz
Note: I.F. output of the tuner terminated with a modified circuit of Fig. 6, i.e. a 100 pF capacitor is connected in parallel with C1; tuning voltage 15 V.
Minimum tuning range of i.f. output coil 33 to 40 MHz
Note: I.F. output of the tuner terminated with the circuit shown in Fig. 6; tuning voltage 15 V.

Attenuation between i.f. injection point and i.f. output of the tuner typ. 23 ± 3 dB

Miscellaneous
Radio interference
Oscillator radiation and oscillator voltage at the aerial terminal Within the limits of C.I.S.P.R. 13 (1975) and VDE 0872/7.72*

Microphonics There will be no microphonics, provided the tuner is installed in a professional manner.

Surge protection
Protection against voltages max. 5 kV
Note: Three discharges of a 470 pF capacitor into the aerial terminal.

Protection against flashes max. 30 kV, 400 mWs
Note: A flashover circuit producing flashes with frequencies of 1 to 20 Hz for 30 s is connected to the aerial terminal.

* For U342LO: when the oscillator sample socket is either open or terminated with a coaxial plug (75 Ω impedance, e.g. type 3/2-50, Daut und Rietz).
ADDITIONAL INFORMATION

I.F. injection

The tuner is provided with an i.f. injection point at the collector of the i.f. transistor (coupled via a small capacitor to terminal 7). The i.f. generator can be connected directly to this point (Fig. 7). The tuner needs normal supply voltages and a tuning voltage of 15 V; the i.f. output should be loaded with the circuit shown in Fig. 6.

---

![Fig. 7.](image)

Connection of the i.f. amplifier

The tuner needs a d.c. path from the i.f. output terminal (10) to earth, preferably via a choke of approx. 5 µH outside the tuner (Fig. 8). Where the tuner is used in combination with a v.h.f. tuner, this choke can be common for both tuners; a resistor in series with the choke can make ineffective the i.f. output circuit of the switched-off tuner. For damping the i.f. output circuit and matching the i.f. output impedance of the tuner to the i.f. amplifier, a series resistor and a parallel capacitor as shown in Fig. 8 should be used.

---

![Fig. 8.](image)
Measuring method of power gain

The i.f. output of the tuner should be terminated with the RC-circuit given in Fig. 6.

The RC-circuit roughly matches the i.f. output impedance to 75 Ω at the resonant frequency of the i.f. output circuit, which should be tuned to 36,15 MHz; the bandwidth should be approx. 5 MHz (Fig. 9).

Because the input and output impedances of the tuner are now 75 Ω, the power gain can be measured in the conventional manner by inserting tuner and RC-circuit between a 75 Ω source and a 75 Ω detector.

Alignment of the i.f. output coil

The i.f. output coil should be adjusted with a brass tool with a blade as shown in Fig. 10. A suitable tool is available under catalogue number 7122 005 47680.

ACCESSORIES

Connector assembly for use of tuner U342 or U342LO in combination with v.h.f. tuner V317 or V334: connector, catalogue number 3112 200 20720;
washer, catalogue number 3112 221 01220;
clamp, catalogue number 3112 274 13220.
U.H.F. TELEVISION TUNERS

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Systems</th>
<th>C.C.I.R. systems I (United Kingdom), G and H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channels</td>
<td>E21 to E69</td>
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<tr>
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<td></td>
</tr>
<tr>
<td>picture</td>
<td>39.5 MHz</td>
</tr>
<tr>
<td>sound</td>
<td>33.5 MHz</td>
</tr>
</tbody>
</table>

APPLICATION

Tuners U343 and U344 are further developments of tuner U341 Mark 2. The U343 is identical to the U344 but without frequency divider, necessary to drive digital tuning systems.

They are meant for use in u.h.f. single standard receivers and have been designed to drive an i.f. surface acoustic wave (SAW) filter. For this purpose the tuners have been provided with a doubled tuned i.f. filter with post-amplifier to compensate for the losses of the SAW filter.

The pinning arrangements of the tuners are compatible with tuner U341 Mark 2 for pins 2, 3, 4, 6 and 10 but differ for pins 7, 8 and 9.

SURVEY OF TYPES

<table>
<thead>
<tr>
<th>tuner type</th>
<th>code number</th>
<th>aerial socket</th>
<th>frequency divider</th>
</tr>
</thead>
<tbody>
<tr>
<td>U344</td>
<td>3122 127 37390</td>
<td>phono</td>
<td>256</td>
</tr>
<tr>
<td>U344/IEC</td>
<td>3122 127 36700</td>
<td>IEC</td>
<td>256</td>
</tr>
<tr>
<td>U343</td>
<td>3122 127 37520</td>
<td>phono</td>
<td>-</td>
</tr>
<tr>
<td>U343/IEC</td>
<td>3122 127 37220</td>
<td>IEC</td>
<td>-</td>
</tr>
</tbody>
</table>

Tuners U343/IEC and U344/IEC are identical to tuners U343 and U344 respectively, but with an IEC aerial socket which meets the IEC 169-2 requirements. It is recommended that plugs which comply with this standard are used.
DESCRIPTION

The tuners are u.h.f. tuners with electronic tuning covering the u.h.f. band from 470 to 860 MHz (channels E21 to E69).

Mechanically the tuners are built on a printed-wiring board and enclosed in a metal housing, comprising a rectangular frame and front and rear covers (see Fig.2). The aerial connection (phono or IEC) is on one of the frame sides, the supply voltage and i.f. connections are on the bottom side and the i.f. injection point on the top side.

Electrically the tuners consist of an input circuit with a high-pass characteristic and a MOS-FET tetrode BF980. The tetrode acts as an r.f. amplifier and as an a.g.c. device controlled by an a.g.c. voltage, fed to gate 2. The drain of the MOS-FET is connected to a double tuned circuit which transfers the signal to the mixer Schottky diode 1SS99. The r.f. selectivity of this circuit at the image frequency has been improved by special means. The mixer diode is driven by an oscillator transistor BF970. The i.f. signal from the mixer is amplified by a transistor BF324, followed by a double-tuned i.f. band-pass filter and a BF370 post-amplifier.

The combination of the Schottky-barrier diode 1SS99 and the i.f. post-amplifier ensures good noise figures and signal handling properties.

Three capacitance diodes OF643 tune the r.f. band-pass filter and oscillator circuit.
only for U344/256 and U344/256/IEC
MECHANICAL DATA

Dimensions in mm

Fig. 2

Terminal 1 = aerial connection
2 = supply voltage, pre-stage, +12 V
3 = a.g.c. voltage, +9.2 to +1 V
4 = tuning voltage, +1 to +28 V
6 = oscillator/i.f. supply voltage, +12 V
7 = balanced frequency divider output
8 = balanced frequency divider output
9 = supply voltage frequency divider, +5 V
10 = i.f. output

*only for U344/256 and U344/256/IEC

Mass approx. 75g

March 1985
Mounting

The tuner may be mounted by soldering it on to a printed-wiring board with connections as shown by the piercing diagram in Fig.3.

It is recommended that the tuner be installed in a cool part of the receiver cabinet and not exposed to the vibrations of the loudspeaker. There are no restrictions on orientation.

The solderability of the terminals and mounting tabs is according to IEC 68-2, test Ta (230 ± 10 °C, 2 ± 0.5 s). The resistance to soldering heat is according to IEC 68-2, test Tb (260 ± 5 °C, 10 ± 1 s).

*only for U344/256 and U344/256/IEC

Fig.3 Piercing diagram viewed from solder side of board.

In cold chasses where no mains isolation is required the tuner is situated such that the IEC serial socket projects beyond the back plate of the cabinet. Direct access from the aerial cable to the tuner input is then possible. In that case it is advised to provide the tuner with a stress relief around the aerial socket fixed to the set frame.
ELECTRICAL DATA

Unless otherwise specified all electrical values apply at an ambient temperature of 25 ± 5 °C, a relative humidity of 60 ± 15%, a supply voltage of 12 ± 0.3 V, an a.g.c. voltage of 9.2 ± 0.2 V, and a divider supply voltage of 5 ± 0.2 V.

Within the given tolerance range of supply voltage and a.g.c. voltage only insignificant deviations from the specified values can be expected. Under the extreme conditions of temperature and humidity as given below, the tuner will function normally, but some specified limits may be exceeded.

General

Semiconductors
- r.f. amplifier: BF980
- mixer diode: 1SS99
- oscillator: BF970
- tuning diodes: 3 x OF643
- i.f. pre-amplifier: BF324
- i.f. post-amplifier: BF370
- frequency divider: SP4653
- surge protection diode: BAV10
- surge protection diode: OF719

Ambient temperature range
- operating: -10 to +60 °C
- storage: -25 to +85 °C

Relative humidity
- max. 90%

Voltages and currents

Supply voltage
- +12 V ± 10% (+10%, −15%)

Note: Supply voltages of +12 V −15% are admissible if a deterioration of gain, noise figure, signal handling, oscillator shift and drift is accepted. In this case the min. a.g.c. voltage has to be decreased to 0.8 V to cover the specified a.g.c. range.

Ripple susceptibility

Defined as the peak-to-peak value of a sine wave signal (20 Hz − 500 kHz) on the supply voltages causing an amplitude modulation with a modulation depth of 0.28% on the picture carrier after passing the Nyquist curve of the i.f. filter of a tv receiver.

ripple susceptibility
- min. 3 mV peak-to-peak

Current drawn from +12 V supply
- r.f. amplifier, at nominal gain: max. 21 mA
- r.f. amplifier, at 30 dB gain reduction: typ. 11 mA
- oscillator/i.f. amplifier: max. 36 mA

A.G.C. voltage (Fig.4)
- voltage at nominal gain: +9.2 ± 0.5 V
- voltage at 30 dB gain reduction: min. +1 V

Note: A.G.C. voltages between 0 and +10.5 V may be applied without risk of damage.

A.G.C. current (Fig.4)
- during gain control (0 to 30 dB): max. +15 μA
- at nominal gain: typ. +11 μA

Ambient temperature range
- operating: -10 to +60 °C
- storage: -25 to +85 °C

Relative humidity
- max. 90%

Note: Supply voltages of +12 V −15% are admissible if a deterioration of gain, noise figure, signal handling, oscillator shift and drift is accepted. In this case the min. a.g.c. voltage has to be decreased to 0.8 V to cover the specified a.g.c. range.

Ripple susceptibility

Defined as the peak-to-peak value of a sine wave signal (20 Hz − 500 kHz) on the supply voltages causing an amplitude modulation with a modulation depth of 0.28% on the picture carrier after passing the Nyquist curve of the i.f. filter of a tv receiver.

ripple susceptibility
- min. 3 mV peak-to-peak

Current drawn from +12 V supply
- r.f. amplifier, at nominal gain: max. 21 mA
- r.f. amplifier, at 30 dB gain reduction: typ. 11 mA
- oscillator/i.f. amplifier: max. 36 mA

A.G.C. voltage (Fig.4)
- voltage at nominal gain: +9.2 ± 0.5 V
- voltage at 30 dB gain reduction: min. +1 V

Note: A.G.C. voltages between 0 and +10.5 V may be applied without risk of damage.

A.G.C. current (Fig.4)
- during gain control (0 to 30 dB): max. +15 μA
- at nominal gain: typ. +11 μA
**Tuning voltage range (Fig. 5)**

Current drawn from +28 V tuning voltage supply
- at 25 °C max. 0.15 μA
- at 60 °C max. 0.6 μA
- at 25 °C (relative humidity 95%) max. 0.6 μA

Slope of tuning characteristic
- min. 4 MHz/V

**Frequencies**

**Frequency range**
- channel E21 (picture carrier 471.25 MHz)
- to channel E69 (picture carrier 855.25 MHz)
- Margin at the extreme channels: min. 3 MHz.

**Intermediate frequencies**

<table>
<thead>
<tr>
<th>System</th>
<th>picture</th>
<th>sound</th>
</tr>
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<tbody>
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</tr>
<tr>
<td></td>
<td>38.9 MHz</td>
<td>33.4 MHz</td>
</tr>
</tbody>
</table>

The oscillator frequency is higher than the aerial signal frequency.

**Note:** The tuner is aligned in such a way that the i.f. frequencies of the three systems can be applied.
Wanted signal characteristics

Input impedance
asymmetrical  
75 Ω

V.S.W.R. and reflection coefficient
at picture carrier frequency, at
nominal gain and at 30 dB gain reduction

v.s.w.r.
reflection coefficient  
max. 6  
max. 71%

R.F. bandwidth  
typ. 20 MHz

Overall curves, tilt R.F. in – I.F. out
on any channel the amplitude difference
between the top of the overall curve and
the picture carrier, the sound carrier, or
any frequency between them will not
exceed 3 dB at nominal gain, and 4 dB
in the a.g.c. range between nominal gain
and 20 dB gain reduction.

A.G.C. range

min. 30 dB

Voltage gain (i.f. load = 1200 Ω in parallel to 15 pF)
channel E21
min. 40 dB
channel E40
typ. 49 dB
channel E69
typ. 47 dB

Noise figure
channel E21
max. 10 dB
typ. 6.0 dB
channel E40
typ. 6.5 dB
channel E69
typ. 7.5 dB

Gain difference between any two channels
typ. 4 dB

Overloading

Input signal producing 1 dB gain
compression at nominal gain
typ. 88 dB (µV) into 75 Ω

Input signal producing either a
detuning of the oscillator of +300 kHz
or –1000 kHz or stopping of the
oscillations at nominal gain
typ. 100 dB (µV) into 75 Ω

1.6 MHz moiré rejection (for i.f. 39.5/33.5 MHz)

Wanted signal level of a tv signal (picture to sound ratio of 7 dB and picture to chroma ratio of 16 dB),
which produces an unwanted i.f. component (37.8 MHz) 52 dB below the i.f. picture carrier, when the
tuner is 30 dB gain controlled.

tv signal (picture carrier)
typ. 100 dB (µV) into 75 Ω
Unwanted signal characteristics

Image rejection (measured at picture carrier frequency)

- at nominal gain, channels E21 to E60
  min. 53 dB; typ. 60 dB
- at 20 dB gain reduction, channels E21 to E60
  min. 50 dB; typ. 55 dB

I.F. rejection (measured at picture carrier and colour sub-carrier frequency)

  min. 80 dB

1st repeat spot rejection (for i.f. 39.5/33.5 MHz)

Defined as the input level of the picture carrier of channel N + 2, the sound carrier of which produces an i.f. signal (35.0 MHz), which is 52 dB below the picture carrier of the wanted signal N (picture to sound ratio 7 dB; wanted signal 60 dB (μV), tuner operating at nominal gain.

  interfering signal  typ. 80 dB (μV) into 75 Ω

N ± 4 rejection

Interference signal for an interference ratio of 53 dB referred to wanted picture carrier (picture to sound carrier ratio of 7 dB; wanted signal 60 dB (μV); tuner operating at nominal gain)

  N + 4 rejection  typ. 80 dB (μV) into 75 Ω
  N − 4 rejection  typ. 78 dB (μV) into 75 Ω

Cross modulation

Input signal producing 1% cross modulation, i.e. 1% of the modulation depth of the interfering signal is transferred to the wanted signal.

In channel cross modulation (wanted signal: picture carrier frequency; interfering signal: sound carrier frequency)

- at nominal gain (wanted input level 60 dB (μV))  typ. 80 dB (μV) into 75 Ω
- at 26 dB gain reduction (wanted input level 86 dB (μV))  typ. 94 dB (μV) into 75 Ω

In band cross modulation (wanted signal: picture carrier of channel N; interfering signal: picture carrier of channel N ± 5).

- at nominal gain (wanted input level 60 dB (μV))  typ. 92 dB (μV) into 75 Ω
- at 26 dB gain reduction (wanted input level 86 dB (μV))  typ. 95 dB (μV) into 75 Ω

Out of band modulation, at nominal gain

  v.h.f. I  min. 108 dB (μV) into 75 Ω
  v.h.f. III  min. 108 dB (μV) into 75 Ω

Unwanted signal handling capability

The tuner operates together with a standard TV receiver with normal A.G.C. for tuner and i.f. amplifier. Unwanted TV signal 3 channels higher or lower than wanted. Unwanted signal level adjusted for just not visible interference.

  Unwanted picture carrier signal  typ. 96 dB (μV)
Oscillator characteristic

Pulling
Input signal of tuned frequency producing a shift of the oscillator frequency of 10 kHz, at nominal gain

Shift of oscillator frequency (ΔF)
at a change of the supply voltage of 5%

Drift of oscillator frequency
during warm-up time (after the tuner has been completely out of operation for 15 min, measured between 5 s and 15 min after switching on)
at a change of the ambient temperature
from +25 to +50 °C and +25 °C to 0 °C (measured after 3 cycles from +25 to +55 °C)
channels E21 to E69
at a change of humidity from 60% ± 15% to 93% ± 2% measured at T_{amb} 25 °C ± 5 °C,

I.F. characteristics

Bandwidth of i.f. output circuit
typ. 11 MHz

Note: I.F. output of the tuner terminated with the circuit shown in Fig.7, tuning voltage 10 V.

IF output impedance
approx. 100 Ω

Attenuation from i.f. injection point to tuner i.f. output
typ. 16 dB

Frequency divider characteristics

Values valid in the tuning voltage range 0.5 to 30 V
Supply voltage
5 V ± 10%
Supply current
max. 35 mA
Output voltages (probe 10 MΩ//11 pF)
open voltage, pin 7
min. 0.5 V peak-to-peak
open voltage, pin 8
min. 0.5 V peak-to-peak
Output unbalance
max. 0.1 V
Signal to interference ratio at an aerial input level of 100 μV
min. 46 dB

Miscellaneous

Radio interference
Oscillator radiation and oscillator voltage
at the aerial terminal
Within the limits of C.I.S.P.R. 13 (1975).
Use is made of the relaxed limit of 3 mV/m (70 dB (μVm)).
U.H.F. television tuners

Immunity from radiated interference
Aerial terminal meets requirements of BS905, provided the aerial cable is connected in a professional manner.

Microphonics
There will be no microphonics, provided the tuner is installed in a professional manner.

Surge protection
Protection against voltages
max. 5 kV

Note: Ten discharges of a 470 pF capacitor into the aerial terminal.

Protection against flashes
min. 30 kV, 400 mWs

Note: A flashover circuit producing flashes with frequencies of 1 to 20 Hz for 30 s is connected to the aerial terminal.

E.S.D. protection
min. 2 kV

Note: acc. to MIL STD 003C

January 1987
ADDITIONAL INFORMATION

I.F. injection

The tuner has an i.f. injection point at the collector of BF324 i.f. transistor located at the top side of the tuner. The i.f. generator can be connected directly to this point (Fig.6), via a 0.3 pF capacitor. The tuner needs normal supply voltages and a tuning voltage of 15 V. A probe according to Fig.6 is available under code 7622 468 17940.

![Diagram of I.F. Sweeper Generator](image)

**Fig.6**

Voltage gain

Since the r.f. input and the i.f. output load impedances differ, the gain of the U343 U344 tuners are expressed in terms of voltage gain. It is defined as the ratio between the i.f. output and the corresponding r.f. input voltage.

The i.f. output of the tuner is loaded with an impedance of 1200 Ω in parallel with a 15 pF capacitor representing a standard replacement of the input impedance of a SAW filter.

To be able to carry out tuner measurements with existing 75 Ω equipment a matching circuit is connected to the i.f. output of the tuner. The input gives the required load to the tuner output while the output represents a source impedance suitable to connect to standard 75 Ω equipment, see Fig.7. Total losses of the circuit are 26 dB.
U.H.F. TELEVISION TUNERS

QUICK REFERENCE DATA

Systems  C.C.I.R. systems I (United Kingdom), G, H and K
Channels  E21 to E69
Intermediate frequencies
  picture  systems G and H  systems I and K
  sound    38,9 MHz  39,5 MHz
            33,4 MHz  33,5 MHz

APPLICATION

Designed to cover the u.h.f. channels of C.C.I.R. systems I, G, H and K in u.h.f. single standard receivers. They meet the special requirements of the United Kingdom. The tuners of the U412 series are equipped with a frequency divider, which makes them suitable for digital tuning systems based on frequency synthesis; for the remainder they are equal to type U411.

Available versions

<table>
<thead>
<tr>
<th></th>
<th>aerial input connector</th>
<th>frequency divider (IC)</th>
<th>division ratio</th>
<th>catalogue number</th>
</tr>
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<tbody>
<tr>
<td>U411</td>
<td>phono</td>
<td></td>
<td></td>
<td>3112 218 51790</td>
</tr>
<tr>
<td>U411/IEC</td>
<td>IEC</td>
<td></td>
<td></td>
<td>3112 218 52400</td>
</tr>
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<td>U412/256</td>
<td>phono</td>
<td>8-pin</td>
<td>256</td>
<td>3112 218 51810</td>
</tr>
<tr>
<td>U412/256/IEC</td>
<td>IEC</td>
<td>8-pin</td>
<td>256</td>
<td>3112 218 52410</td>
</tr>
<tr>
<td>U412/64</td>
<td>phono</td>
<td>8-pin</td>
<td>64</td>
<td>3112 218 52290</td>
</tr>
<tr>
<td>U412/64/IEC</td>
<td>IEC</td>
<td>8-pin</td>
<td>64</td>
<td>3112 218 52420</td>
</tr>
</tbody>
</table>

May 1983
DESCRIPTION

The U411 and U412 are u.h.f. tuners with electronic tuning. They meet the special requirements of the United Kingdom and are pin-compatible with the UV411, UV417 and the UV412 and UV418 respectively. Mechanically, the tuners are built on a low-loss printed-wiring board, carrying all components, in a metal housing made of a rectangular frame and front and rear covers (see Fig. 2a). The coaxial aerial connector (phono or IEC) of 75 Ω is on one of the frame sides, all other connections (supply voltages, a.g.c. voltage, tuning voltage, i.f. output) are made via terminals in the underside. The mounting method is shown in Fig. 3.

Electrically (see Fig. 1), the tuners consist of a bandpass input circuit connected to gate 1 of an input MOSFET tetrode (with internal gate protection against surge). The drain load of this MOSFET tetrode is formed by a double tuned circuit transferring the r.f. signal to the Schottky barrier mixer diode. The selectivity of this circuit at the image frequency is such that it meets the stringent requirements of the U.K.

The i.f. signal from the mixer is amplified by an i.f. transistor connected in grounded-base configuration. The combination of Schottky barrier diode and i.f. transistor ensures good noise figures and good signal handling properties.

The double tuned circuit and the oscillator circuit are tuned by 3 BB405B capacitance diodes. The i.f. output circuit of the tuner is a single tuned circuit, at the low end of which the i.f. signal is coupled out of the tuner. A test point (terminal 4) is provided for i.f. injection to align the i.f. output circuit of the tuner together with the i.f. amplifier of the television receiver. An additional test point, which is accessible through a hole in the top of the tuner, is connected to the collector of the i.f. amplifier transistor. The tuner is gain controlled via gate 2 of the input MOSFET tetrode.

The electrical circuit of the U412 series is extended with a frequency divider (division ratio of 64 or 256) the inputs of which are connected to the oscillator. The outputs are balanced; they are connected to terminals 12 and 13.
Terminal

1 = aerial
4 = supply voltage, +12 V; i.f. injection
5 = a.g.c. voltage, +9.2 to 0.85 V
6 = supply voltage, +12 V
7 = tuning voltage, +1 to +28 V
9 = i.f. output
10 = earth
12, 13 = balanced output voltage of frequency divider
14 = supply voltage, frequency divider, +5 V

only for U412
U.H.F. television tuners

Fig. 2b I.F. output coil.
Torque for alignment: 2 to 15 mNm.
Press-through force: ≥ 10 N.

Mass approx. 99 g

Mounting
The tuner may be mounted by soldering it on to a printed-wiring board, using the piercing diagram shown in Fig. 3. The tuner may be mounted anywhere in the receiver and there are no restrictions on orientation. However it is recommended that it is placed in the cool part of the cabinet and away from loudspeaker vibrations.

The solderability of the terminals and mounting tabs (except cut edges) is according to IEC 68-2, test Ta (230 ± 10 °C, 2 ± 0.5 s). The resistance to soldering heat is according to IEC 68-2, test Tb (260 ± 5 °C, 10 ± 1 s).

Fig. 3 Piercing diagram viewed from solder side of board. Unless otherwise stated the tolerance is ± 0.05 mm.

Dimensions in mm

(1) only for U412.
ELECTRICAL DATA

Unless otherwise specified all electrical values apply at an ambient temperature of 25 ± 5°C, a relative humidity of 60 ± 15%, a supply voltage of 12 ± 0,3 V and an a.g.c. voltage of 9,2 ± 0,2 V.

General

Semiconductors
- r.f. input MOSFET transistor: BF980 (3SK87)
- oscillator transistor: BF970
- i.f. amplifier transistor: BF324
- mixer diode: 1SS99
- tuning diodes: 3 x BB405B
- surge protection diode: BAV10
- frequency divider: SP4653 or SP4632

Ambient temperature range
- operating: 0 to + 55 °C
- storage: −25 to + 70 °C

Relative humidity
- max. 95%

Voltages and currents

Supply voltage: + 12 V ± 10%
Current drawn from + 12 V supply: max. 45 mA; typ. 34 mA
A.G.C. voltage
- voltage range: + 9,2 to + 0,85 V
- voltage at nominal gain: + 9,2 ± 0,5 V
- voltage at 30 dB gain reduction: min. 1 V

Note: A.G.C. voltages between 0 and + 10,5 V may be applied without risk of damage.

A.G.C. current: max. 0,2 mA
Slope of a.g.c. characteristic at end of specified range: typ. 50 dB/V
Tuning voltage range: + 1 to + 28 V
Current drawn from 28 V tuning voltage supply
- at T_{amb} = 25 °C and 60% relative humidity: max. 0,25 μA
- at T_{amb} = 25 °C and 95% relative humidity: max. 1,0 μA
- at T_{amb} = 55 °C and 60% relative humidity: max. 1,0 μA

Slope of tuning characteristic
- channel E21: typ. 22 MHz/V
- channel E69: typ. 5 MHz/V

Note: the source impedance of the tuning voltage must be maximum 47 kΩ.
Fig. 4 Typical a.g.c. characteristics, bands IV and V.

Fig. 5 Typical tuning characteristic, bands IV and V.
Frequencies
Frequency range
bands IV and V

Intermediate frequencies
picture
sound

Wanted signal characteristics
Input impedance
V.S.W.R. and reflection coefficient
(values between picture and sound carrier, as well as values at picture carrier)

v.s.w.r.
reflection coefficient
R.F. curves, bandwidth
R.F. curves, tilt

A.G.C. range
Power gain
Maximum gain difference between any two channels
Noise figure
Overloading:
Input signal producing 1 dB gain compression at nominal gain
Input signal producing either a detuning of the oscillator of + 300 kHz or -1000 kHz or stopping of the oscillations at nominal gain

Unwanted signal characteristics
Image rejection (measured at picture carrier frequency)
I.F. rejection (measured at picture carrier frequency)

Channel E21 (picture carrier 471,25 MHz) to channel E69 (picture carrier 855,25 MHz). Margin at the extreme channels: min. 3 MHz.

systems G and H | systems I and K
38,9 MHz | 39,5 MHz
33,4 MHz | 33,5 MHz
The oscillator frequency is higher than the aerial signal frequency.

at nominal gain during gain control
max. 5 max. 6
max. 66% max. 71%
typ. 24 MHz

on any channel the amplitude difference between the top of the r.f. resonant curve and either the picture frequency, or the sound frequency, or any frequency between them will not exceed 3 dB at nominal gain, and 4 dB in the a.g.c. range between nominal gain and 20 dB gain reduction.

min. 30 dB
min. 20 dB
typ. 4 dB
max. 10 dB

typ. 90 dB (µV) into 75 Ω

typ. 100 dB (µV) into 75 Ω

min. 53 dB; typ. 50 dB
min. 60 dB

May 1983
U.H.F. television tuners

N ± 4 rejection
Interference signal for an interference ratio of 53 dB
referred to wanted picture carrier (picture to sound
carrier ratio of 7 dB; wanted signal 60 dB (μV); tuner
operating at nominal gain)
interfering signal N + 4
interfering signal N — 4
typ. 80 dB (μV) into 75 Ω
typ. 73 dB (μV) into 75 Ω

Cross modulation:
Input signal producing 1% cross modulation, i.e. 1% of the
modulation depth of the interfering signal is transferred to
the wanted signal
Out of band modulation at nominal gain
v.h.f. I
v.h.f. III
typ. 108 dB (μV) into 75 Ω
typ. 108 dB (μV) into 75 Ω

Oscillator characteristics
Pulling:
Input signal of tuned frequency producing a shift of the
oscillator frequency of 10 kHz, at nominal gain
typ. 80 dB (μV) into 75 Ω
Shift of oscillator frequency at a change of the
voltage of 5%
max. 500 kHz
Drift of oscillator frequency during warm-up time
(after the tuner has been completely out of operation
for 15 min, measured between 5 s and 15 min after
switching on).
max. 250 kHz
Drift of oscillator frequency at a change of the
ambient temperature from + 25 to + 50 °C (measured
after 3 cycles from + 25 to + 55 °C)
max. 1000 kHz

Frequency divider characteristics of the U412/64 and U412/256 versions
Supply voltage
+5 V ± 5%
Current drawn from +5 V supply
max. 35 mA; typ. 25 mA
Output voltage, unloaded, measured with probe 10 MΩ/11 pF
min. 0.7 V p-p
Output impedance
typ. 1 kΩ
Output imbalance
typ. 0.1 V
Interference signal on the i.f. output
U412/256
max. 3 μV
U412/64
max. 20 μV

Note: I.F. output of the tuner terminated with the circuit shown in Fig. 6.

![Fig. 6.](image-url)
I.F. circuit characteristics
Bandwidth of i.f. output circuit
5 ± 1 MHz
Note: I.F. output of the tuner terminated with the circuit shown in Fig. 6, tuning voltage 15 V.
Bandwidth variation of i.f. output circuit as a result of r.f. tuning; tuning voltage 15 V
max. 500 kHz

Fig. 7.

Attenuation between i.f. injection point and i.f. output of the tuner
typ. 18 dB

Miscellaneous
Radio interference:
Oscillator radiation and oscillator voltage at the aerial terminal
Within the limits of C.I.S.P.R. 13 (1975)
Immunity from radiated interference
Meets the limits of BS905 (1969) with a reserve of at least 5 dB
Microphonics
There will be no microphonics, provided the tuner is installed in a professional manner.

Surge protection:
Protection against voltages
max. 5 kV
Note: 10 discharges of a 470 pF capacitor into the aerial terminal.
Protection against flashes
max. 30 kV, 400 mWs
Note: A flashover circuit producing flashes with frequencies of 1 to 20 Hz for 30 s is connected to the aerial terminal.

ADDITIONAL INFORMATION
I.F. injection
Terminal 4 (supply voltage) can be used as i.f. injection point, provided the supply voltage is applied to terminal 4 via a resistor of 10 Ω (see Fig. 8). The tuning voltage should be 15 V.
Connection of the i.f. amplifier
Connection to the i.f. amplifier should be either by a printed connection of minimum length or by a shielded connection such as a coaxial cable.

Measuring method of power gain
The i.f. output of the tuner should be terminated with the RC-circuit given in Fig. 6.

The RC-circuit roughly matches the i.f. output impedance to 75 Ω at the resonant frequency of the i.f. output circuit, which should be tuned to 36.5 MHz; the bandwidth is approx. 5 MHz (Fig. 9). Because the input and output impedances of the tuner are now 75 Ω, the power gain can be measured in the conventional manner by inserting tuner and RC-circuit between a 75 Ω source and a 75 Ω detector.

Alignment of the i.f. output coil
The i.f. output coil should be adjusted with a brass tool with a blade as shown in Fig. 10. A suitable tool is available under catalogue number 7122 005 47680.
U.H.F. TELEVISION TUNERS

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Systems</th>
<th>C.C.I.R. systems I (United Kingdom)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channels</td>
<td>E21 to E 69</td>
</tr>
<tr>
<td>Intermediate frequencies</td>
<td></td>
</tr>
<tr>
<td>picture</td>
<td>39,5 MHz</td>
</tr>
<tr>
<td>sound</td>
<td>33,5 MHz</td>
</tr>
</tbody>
</table>

APPLICATION

Tuners U743 and U744 are intended for use in u.h.f. single standard receivers and to drive an i.f. surface acoustic wave (SAW) filter. For this, the tuners have a post-amplifier to compensate for the losses of the SAW filter.

The U743 is identical to the U744 but without frequency divider, necessary to drive digital tuning systems.

The pinning arrangements of the tuners are compatible with the tuners UV615, UV616, UV617, UV618, and the tuner part of the FE617Q(M) and FE618Q(M)/256, see page 9.

SURVEY OF TYPES

<table>
<thead>
<tr>
<th>tuner type</th>
<th>aerial input connector</th>
<th>frequency divider (IC)</th>
<th>catalogue number</th>
</tr>
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<tr>
<td>U743</td>
<td>phono</td>
<td>—</td>
<td>3122 237 00270</td>
</tr>
<tr>
<td>U743/IEC</td>
<td>IEC (14,5 mm)</td>
<td>—</td>
<td>3122 237 00280</td>
</tr>
<tr>
<td>U743/IEC.L</td>
<td>IEC (32,2 mm)</td>
<td>—</td>
<td>3122 237 00290</td>
</tr>
<tr>
<td>U744/256</td>
<td>phono</td>
<td>1 : 256</td>
<td>3122 237 00300</td>
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<td>IEC (14,5 mm)</td>
<td>1 : 256</td>
<td>3122 237 00310</td>
</tr>
<tr>
<td>U744/256/IEC.L</td>
<td>IEC (32,2 mm)</td>
<td>1 : 256</td>
<td>3122 237 00320</td>
</tr>
</tbody>
</table>
DESCRIPTION

The tuners are u.h.f. tuners with electronic tuning covering the u.h.f. band from 470 to 860 MHz (channels E21 to E69).

Mechanically the tuners are built on a printed-wiring board and enclosed in a metal housing, comprising a rectangular frame and front and rear covers (see Fig. 2). The aerial connection (phono or IEC) is on one of the frame sides, the supply voltage and i.f. connections are on the bottom side and the i.f. injection point is accessible through a hole in the cover as shown in Fig. 2.

Electrically the tuners consist of an input circuit with a high-pass characteristic and a MOS-FET tetrode BF990. The tetrode acts as an r.f. amplifier and as an a.g.c. device controlled by an a.g.c. voltage, fed to gate 2. The drain of the MOS-FET is connected to a double tuned circuit which transfers the signal to the mixer transistor 2SC3545. The r.f. selectivity of this circuit at the image frequency has been improved by special means. The mixer transistor is driven by an oscillator transistor BF569. The i.f. signal from the mixer is connected to a tuned i.f. filter and amplified by a BF370 post-amplifier, suitable to drive a surface acoustic wave filter (asymmetric), and to compensate for the SAW losses.

The combination of the r.f. MOS-FET, the 2 GHz mixer transistor and the i.f. post-amplifier ensures good noise figures and signal handling properties.

Three capacitance diodes BB405 tune the r.f. band-pass filter and oscillator circuit.

The electrical circuit of type U744 is extended with a frequency divider (division ratio of 256), the input of which is connected to the oscillator. The symmetrical outputs are connected to terminals 13 and 14.
Fig. 1 For connections see also next page. T.P. = test point (i.f. injection).
**MECHANICAL DATA**

Dimensions in mm

**Fig. 2.**

Terminal:

- **A** = aerial input (phono/IEC female 75 Ω)
- **5** = a.g.c. voltage, +9.2 to 0.85 V
- **6** = supply voltage, prestage, +12 V
- **10** = supply voltage, oscillator, mixer, i.f., +12 V
- **11** = tuning voltage, +1 to +28 V
- **12** = supply voltage frequency divider, +5 V
- **13, 14** = balanced frequency divider output  \( \text{U744 only} \)
- **16** = earth
- **17** = i.f. output

---

112 December 1986
Mass
approx. 45 g

Mounting
The tuner may be mounted by soldering it on to a printed-wiring board (using the piercing diagram shown in Fig. 3) without clearance between tuner supports and board. It may be mounted anywhere in the receiver and there are no restrictions on orientation.

The solderability of the terminals and mounting tabs is according to IEC 68-2, test Ta (230 ± 10 °C, 2 ± 0,5 s). The resistance to soldering heat is according to IEC 68-2, test Tb (260 ± 5 °C, 10 ± 1 s).

(1) Only for U744

1 eb = 0,025 inch

Fig. 3 Piercing diagram viewed from solder side of board.
Unless otherwise stated the tolerance is ± 0,05 mm.

In order to prevent any stress to the printed-wiring board, the tuner should be supported at its aerial connector.
ELECTRICAL DATA

Unless otherwise specified all electrical values apply at an ambient temperature of 25 ± 5 °C, a relative humidity of 60 ± 15%, a supply voltage of 12 ± 0,3 V, an a.g.c. voltage of 9,2 ± 0,2 V, and a divider supply voltage of 5 ± 0,2 V.

Within the given tolerance range of supply voltage and a.g.c. voltage only insignificant deviations from the specified values can be expected. Under the extreme conditions of temperature and humidity as given below, the tuner will function normally, but some specified limits may be exceeded.

General
Semiconductors
  r.f. amplifier BF990
  mixer transistor 2SC3545
  oscillator BF569
  tuning diodes 3 x BB405
  i.f. post-amplifier BF370
  surge protection diode BAV10
  surge protection diode BZX79
Frequency divider SP4653
Ambient temperature range
  operating -10 to + 60 °C
  storage -25 to + 85 °C
Relative humidity max. 100%

Voltages and currents
Supply voltage + 12 V ± 10% (+ 10%, –15%)

Note: Supply voltages of + 12 V –15% are admissible if a deterioration of gain, noise figure, signal handling, oscillator shift and drift is accepted. In this case the min. a.g.c. voltage has to be decreased to 0,8 V to cover the specified a.g.c. range.

Ripple susceptibility
Defined as the peak-to-peak value of a sine wave signal (20 Hz – 500 kHz) on the supply voltages causing an amplitude modulation with a modulation depth of 0,28% on the picture carrier after passing the Nyquist curve of the i.f. filter of a tv receiver.
  ripple susceptibility min. 3 mV peak-to-peak

Current drawn from + 12 V supply
  r.f. amplifier, at nominal gain max. 21 mA
  r.f. amplifier, at 30 dB gain reduction typ. 11 mA
  oscillator/i.f. amplifier max. 36 mA

A.G.C. voltage (Fig. 4)
  voltage at nominal gain + 9,2 ± 0,5 V
  voltage at 30 dB gain reduction min. +1 V

Note: A.G.C. voltages between 0 and + 10,5 V may be applied without risk of damage.

A.G.C. current
  during gain control (0 to 30 dB) max. +15 μA
  at nominal gain typ. +11 μA
U.H.F. television tuners

Fig. 4.

Tuning voltage range (Fig. 5)
Current drawn from +28 V tuning voltage supply
at 25 °C
at 60 °C
at 25 °C (relative humidity 95%)
Slope of tuning characteristic

Frequencies
Frequency range

Intermediate frequencies
picture
sound

+1 to +28 V
max. 0.15 μA
max. 0.6 μA
max. 0.6 μA
min. 4 MHz/V

channel E21 (picture carrier 471.25 MHz)
to channel E69 (picture carrier 855.25 MHz).
Margin at the extreme channels: min. 3 MHz.

39.5 MHz
33.5 MHz
The oscillator frequency is higher than the aerial signal frequency.

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Wanted signal characteristics

Input impedance
asymmetrical

V.S.W.R. and reflection coefficient
at picture carrier frequency, at
nominal gain and at 30 dB gain reduction
v.s.w.r.
reflection coefficient
R.F. bandwidth
Overall curves, tilt R.F. in –I.F. out

75 Ω

typ. 4

typ. 60%
typ. 20 MHz

on any channel the amplitude difference
between the top of the overall curve and
the picture carrier, the sound carrier, or
any frequency between them will not
exceed 3 dB at nominal gain, and 4 dB
in the a.g.c. range between nominal gain
and 20 dB gain reduction.

A.G.C. range
Voltage gain (i.f. load = 1200 Ω/ 15 pF, see Fig. 7)
channel E21
canal E40
canal E69
Gain difference between any two channels
Noise figure
channel E21
canal E40
canal E69
Overloading
Input signal producing 1 dB gain
compression at nominal gain
typ. 85 dB (μV) into 75 Ω
Input signal producing either a
detuning of the oscillator of + 300 kHz
or – 1000 kHz or stopping of the
oscillations at nominal gain
typ. 100 dB (μV) into 75 Ω
1,6 MHz moire rejection (for i.f. 39,5/33,5 MHz)
Wanted signal level of a tv signal (picture to sound ratio of 7 dB and picture to chroma ratio of 16 dB),
which produces an unwanted i.f. component (37,8 MHz) 52 dB below the i.f. picture carrier, when the
tuner is 30 dB gain controlled.
typ. 100 dB (μV) into 75 Ω
Unwanted signal characteristics

Image rejection (measured at picture carrier frequency)
  at nominal gain, channels E21 to E60 min. 53 dB; typ. 60 dB
  at 20 dB gain reduction, channels E21 to E60 typ. 50 dB

I.F. rejection (measured at picture carrier and colour sub-carrier frequency)
  min. 80 dB

1st repeat spot rejection (for i.f. 39.5/33.5 MHz)
  Defined as the input level of the picture carrier of channel N + 2, the sound carrier of which produces an i.f. signal (35.0 MHz), which is 52 dB below the picture carrier of the wanted signal N (picture to sound ratio 7 dB; wanted signal 60 dB (μV), tuner operating at nominal gain.
    interfering signal typ. 80 dB (μV) into 75 Ω

N ± 4 rejection
  Interference signal for an interference ratio of
  53 dB referred to wanted picture carrier (picture to sound carrier ratio of 7 dB; wanted signal 60 dB (μV); tuner operating at nominal gain)
    N + 4 rejection typ. 80 dB (μV) into 75 Ω
    N −4 rejection typ. 78 dB (μV) into 75 Ω

Cross modulation
  Input signal producing 1% cross modulation, i.e. 1% of the modulation depth of the interfering signal is transferred to the wanted signal.

In channel cross modulation (wanted signal: picture carrier frequency; interfering signal: sound carrier frequency)
  at nominal gain (wanted input level 60 dB (μV)) typ. 80 dB (μV) into 75 Ω
  at 26 dB gain reduction (wanted input level 86 dB (μV)) typ. 94 dB (μV) into 75 Ω

In band cross modulation (wanted signal: picture carrier of channel N; interfering signal: picture carrier of channel N ± 5)
  at nominal gain (wanted input level 60 dB (μV)) typ. 92 dB (μV) into 75 Ω
  at 26 dB gain reduction (wanted input level 86 dB (μV)) typ. 95 dB (μV) into 75 Ω

Out of band modulation, at nominal gain
  typ. 100 dB (μV) into 75 Ω

Unwanted signal handling capability

The tuner operates together with a standard tv receiver with normal A.G.C. for tuner and i.f. amplifier.

Unwanted tv signal 3 channels higher or lower than wanted. Unwanted signal level adjusted for just not visible interference.

Unwanted picture carrier signal typ. 96 dB (μV)
Oscillator characteristics

Pulling
Input signal of tuned frequency producing a shift of the oscillator frequency of 10 kHz, at nominal gain

\[ \text{typ. } \frac{85 \text{ dB (µV)}}{75 \Omega} \]

Shift of oscillator frequency
at a change of the supply voltage of 5%

\[ \text{max. } 500 \text{ kHz} \]

Drift of oscillator frequency
during warm-up time (after the tuner has been completely out of operation for 15 min, measured between 5 s and 15 min after switching on)

\[ \text{max. } 250 \text{ kHz} \]

Drift of oscillator frequency
at a change of the ambient temperature from \( +25 \text{ to } +50 \, ^\circ\text{C} \) and \( +25 \text{ to } 0 \, ^\circ\text{C} \) (measured after 3 cycles from \( +25 \text{ to } +55 \, ^\circ\text{C} \))

\[ \text{channels E21 to E69 } \quad \text{max. } 1000 \text{ kHz} \]

Drift of oscillator frequency
at a change of humidity from \( 60\% \pm 15\% \) to \( 93\% \pm 2\% \) measured at \( T_{\text{amb}} = 25 \, ^\circ\text{C} \pm 5 \, ^\circ\text{C} \)

\[ \text{max. } 1500 \text{ kHz} \]

I.F. characteristics

Bandwidth of i.f. output circuit

\[ \text{typ. } 9 \text{ MHz} \]

Note: I.F. output of the tuner terminated with the circuit shown in Fig. 7, tuning voltage 10 V.

I.F. output impedance

approx. \( 100 \Omega \)

Frequency divider characteristics

Values valid in the tuning voltage range 0.5 to 30 V

Supply voltage

\[ 5 \, \text{V} \pm 10\% \]

Supply current

\[ \text{max. } 35 \, \text{mA}, \text{typ. } 25 \, \text{mA} \]

Output voltages (probe 10 MΩ//11 pF)
at pin 7

\[ \text{min. } 0.5 \, \text{V peak-to-peak} \]

at pin 8

\[ \text{min. } 0.5 \, \text{V peak-to-peak} \]

Output unbalance

\[ \text{max. } 0.1 \, \text{V} \]

Signal to interference ratio at an aerial input level of 100 µV, measured at I.F. output

\[ \text{min. } 46 \, \text{dB} \]

Miscellaneous

Radio interference
Oscillator radiation and oscillator voltage
at the aerial terminal

Within the limits of C.I.S.P.R. 13 (1975) + amendment 1 (1983). Use is made of the relaxed limit of 3 mV/m (70 dB (µVm)).

December 1986
U.H.F. television tuners

Immunity from radiated interference

Microphonics

Surge protection
Protection against voltages

Note: Ten discharges of a 470 pF capacitor into the aerial terminal.

E.S.D. protection

Note: acc. to MIL STD 003C

Aerial terminal meets requirements of BS905, provided the aerial cable is connected in a professional manner.

There will be no microphonics, provided the tuner is installed in a professional manner.

max. 5 kV

min. 2 kV
ADDITIONAL INFORMATION

I.F. injection

The tuner has an i.f. injection point at the collector of the mixer transistor (see Figs 1 and 2). The i.f. generator can be connected directly to this point (Fig. 6), via a 0.3 pF capacitor. The tuner needs normal supply voltages and a tuning voltage of 10 V.

![Diagram of i.f. injection](image)

**Fig. 6.**

Voltage gain

Since the r.f. input and the i.f. output load impedances differ, the gain of the U743 U744 tuners are expressed in terms of voltage gain. It is defined as the ratio between the i.f. output voltage and the corresponding r.f. input voltage.

The i.f. output of the tuner is loaded with an impedance of 1200 Ω in parallel with a 15 pF capacitor representing a standard replacement of the input impedance of a SAW filter.

To be able to carry out tuner measurements with existing 75 Ω equipment a matching circuit is connected to the i.f. output of the tuner. The input gives the required load to the tuner output while the output represents a source impedance suitable to connect to standard 75 Ω equipment, see Fig. 7. Total losses of the circuit are 26 dB.

![Diagram of measurement setup](image)

**Fig. 7.**
V.H.F./U.H.F. TELEVISION TUNERS

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Systems</th>
<th>C.C.I.R. systems L and L'</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channels</td>
<td></td>
</tr>
<tr>
<td>low v.h.f.</td>
<td>E2 to E4</td>
</tr>
<tr>
<td>high v.h.f.</td>
<td>C to Q</td>
</tr>
<tr>
<td>u.h.f.</td>
<td>L21 to L69</td>
</tr>
<tr>
<td>Intermediate frequencies</td>
<td></td>
</tr>
<tr>
<td>picture</td>
<td>32.7 MHz</td>
</tr>
<tr>
<td>sound</td>
<td>39.2 MHz</td>
</tr>
</tbody>
</table>

APPLICATION

Designed to cover the v.h.f. and u.h.f. channels of C.C.I.R. systems L and L', with extended v.h.f. range including channels for French cable television (CCETT 12 MHz frequency plan).

The tuner USF10A is equipped with a frequency divider (1 : 256), which makes it suitable for digital tuning systems based on frequency synthesis; otherwise this tuner is equal to type USF10.
DESCRIPTION

The USF10 is a combined v.h.f./u.h.f. tuner with electronic tuning and band switching covering the low v.h.f. band including the European channel E4 (frequency range 48 to 68 MHz), the high v.h.f. band including the Moroccan channel M4 and the European channel E12 (frequency range 128 to 306 MHz) and the u.h.f. band (frequency range 470 to 861 MHz).

Mechanically, the tuner is built on a low-loss printed-wiring board, carrying all components, in a metal housing made of a rectangular frame and front and rear covers (see Fig. 1). The common aerial connection (v.h.f. and u.h.f.) with standard coaxial termination is on one of the frame sides, all other connections (supply voltages, a.g.c. voltage, tuning and switching voltages, i.f. output) are made via terminals in the underside. The mounting method is shown in Fig. 2.

Electrically, the tuner consists of v.h.f. and u.h.f. parts. The v.h.f. aerial signal is fed via switchable v.h.f. band wideband input filters to gate 1 of an input MOSFET tetrode (with internal gate protection against surge).

The drain load of the MOSFET tetrode is formed by a double tuned switchable bandpass filter, transferring the r.f. signal to the emitter of the mixer transistor. The oscillator signal is also fed to the emitter of the mixer transistor.

The collector circuit of the mixer transistor is a single tuned i.f. resonant circuit, at the low end of which the i.f. signal is coupled out of the tuner. A test point (terminal 4) is provided for i.f. injection to align the output circuit of the tuner together with the i.f. amplifier of the television receiver.

The input tuned circuit, the r.f. bandpass filter and oscillator circuit are tuned by 8 tuning diodes, band switching is achieved by 9 switching diodes.

The u.h.f. part of the tuner consists of a tuned input circuit connected to gate 1 of an input MOSFET tetrode (with internal gate protection against surge). The drain load of this MOSFET tetrode is formed by a double tuned circuit transferring the r.f. signal to the Schottky barrier mixer diode. The i.f. signal from the mixer diode is amplified by the v.h.f. mixer transistor, now operating as an i.f. amplifier.

The input tuned circuit, the r.f. bandpass filter and oscillator circuits are tuned by 4 tuning diodes.

In all bands the tuner is gain controlled via gate 2 of the input MOSFET tetrodes.
V.H.F./U.H.F. television tuners

MECHANICAL DATA

Dimensions in mm

Terminal
1 = aerial
2 = supply voltage, low v.h.f., +12 V
3 = supply voltage, high v.h.f., +12 V
4 = supply voltage, u.h.f., +12 V; i.f. injection
5 = a.g.c. voltage, +8,25 to +0,85 V
6 = supply voltage, v.h.f. and u.h.f., +12 V
7 = tuning voltage, +0,5 to +28 V
9 = i.f. output
10 = earth
11/12 = balanced output voltage of frequency divider
13 = supply voltage, frequency divider, 5 V ± 5%

USF10

USF10A

Fig. 1a.

Fig. 1b  I.F. output coil.
Torque for alignment: 2 to 15 mNm
Press-through force: ≥ 10 N.

February 1986
Mass approx. 130 g

Mounting
The tuner may be mounted by soldering it onto a printed-wiring board, using the piercing diagram shown in Fig. 2. (The tuner may also be mounted by means of a socket. Information will be supplied upon request.) The tuner may be mounted anywhere in the receiver and there are no restrictions on orientation.

Fig. 2 Piercing diagram for tuner USF10A viewed from solder side of board. Unless otherwise stated the tolerance is ± 0.05 mm.
V.H.F./U.H.F. television tuners

ELECTRICAL DATA

Unless otherwise specified all electrical values apply at an ambient temperature of 25 ± 5 °C, a relative humidity of 60 ± 15%, a supply voltage of 12 ± 0,3 V and an a.g.c. voltage of 8,25 ± 0,2 V.

Voltages and currents
Supply voltage
+ 12 V ± 1 V
Current drawn from + 12 V supply
low v.h.f. band max. 45 mA; typ. 40 mA
high v.h.f. band max. 80 mA; typ. 76 mA
u.h.f. bands max. 50 mA; typ. 45 mA

Bandswitching
For operation in all bands the supply voltage is permanently connected to terminal 6. Additionally the supply voltage is connected to:
  terminal 2 and -12 V to terminal 3 for operation in the low v.h.f. band
  terminal 3 and -12 V to terminal 2 for operation in the high v.h.f. band
  terminal 4 and -12 V to terminals 2 and 3 for operation in the u.h.f. bands.

A.G.C. voltage (Figs 3, 4 and 5)
  voltage range + 8,25 to + 0,85 V
  voltage at nominal gain + 8,25 ± 0,5 V
  voltage at 40 dB gain reduction typ. 2 V
  low v.h.f. band typ. 1,2 V
  high v.h.f. band

Note: A.G.C. voltages between 0 and + 10,5 V may be applied without risk or damage.

A.G.C. current
max. 0,3 μA

Tuning voltage range
+ 0,5 to + 28 V

Current drawn from 28 V tuning voltage supply
  at T_{amb} = 25 °C max. 0,8 μA
  at T_{amb} = 55 °C max. 3 μA

Slope of tuning characteristics (typical values)
  low v.h.f. band, channel 2 2 MHz/V
  channel 4 1,5 MHz/V
  high v.h.f. band, channel C 12 MHz/V
  channel Q 2 MHz/V
  u.h.f. bands, channel L21 30 MHz/V
  channel L69 6 MHz/V

Frequencies
Frequency ranges
low v.h.f. band
  channel E2 (picture carrier 48,25 MHz)
  Margin: min. tuning voltage 2 V
  channel E4 (picture carrier 62,25 MHz)
  Margin: max. tuning voltage 22 V
Fig. 3 Typical a.g.c. characteristic, low v.h.f. band.

Fig. 4 Typical a.g.c. characteristic, high v.h.f. band.

Fig. 5 Typical a.g.c. characteristic, u.h.f. bands.
### V.H.F./U.H.F. television tuners

#### Frequencies (continued)

<table>
<thead>
<tr>
<th>Frequency range</th>
<th>channel C (picture carrier 128.75 MHz)</th>
<th>Margin: min. 0.75 MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>high v.h.f. band (cable)</td>
<td>channel Q (picture carrier 296.75 MHz)</td>
<td>Margin: min. 1.8 MHz</td>
</tr>
<tr>
<td></td>
<td>channel L21 (picture carrier 471.25 MHz) to channel L69 (picture carrier 855.25 MHz)</td>
<td>Margin at the extreme channels: 2 MHz</td>
</tr>
</tbody>
</table>

#### U.H.F. bands

- **Intermediate frequencies**
  - picture: 32.7 MHz
  - sound: 39.2 MHz

#### Wanted signal characteristics

<table>
<thead>
<tr>
<th>Input impedance</th>
<th>75 Ω</th>
</tr>
</thead>
</table>

**V.S.W.R. and reflection coefficient**

<table>
<thead>
<tr>
<th>Frequency range</th>
<th>at nominal gain</th>
<th>during gain control</th>
</tr>
</thead>
<tbody>
<tr>
<td>v.s.w.r.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>v.h.f. bands</td>
<td>max. 4.5</td>
<td>max. 4.5</td>
</tr>
<tr>
<td>u.h.f. bands</td>
<td>max. 5</td>
<td>max. 6</td>
</tr>
<tr>
<td>reflection coefficient</td>
<td></td>
<td></td>
</tr>
<tr>
<td>v.h.f. bands</td>
<td>max. 63%</td>
<td>max. 63%</td>
</tr>
<tr>
<td>u.h.f. bands</td>
<td>max. 56%</td>
<td>max. 56%</td>
</tr>
</tbody>
</table>

**R.F. curves, bandwidth**

<table>
<thead>
<tr>
<th>Frequency range</th>
<th>typ. 16 MHz</th>
<th>typ. 16 MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>low v.h.f. band</td>
<td></td>
<td></td>
</tr>
<tr>
<td>high v.h.f. band</td>
<td>typ. 30 MHz</td>
<td></td>
</tr>
<tr>
<td>u.h.f. bands</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**R.F. curves, tilt**

- on any channel the amplitude difference between the top of the r.f. resonant curve and the picture frequency, the sound frequency, or any frequency between them will not exceed:
  - **nominal gain**
    - low v.h.f. band: 3 dB
    - high v.h.f. band: 3 dB
    - u.h.f. bands: 3 dB
  - **in the first 20 dB**
    - min. 40 dB
  - **of the a.g.c. range**
    - min. 30 dB

**A.G.C. range**

<table>
<thead>
<tr>
<th>Frequency range</th>
<th>min. 40 dB</th>
<th>min. 30 dB</th>
</tr>
</thead>
</table>
**Wanted signal characteristics (continued)**

Power gain (see also measuring method for power gain Figs 7 and 8)

<table>
<thead>
<tr>
<th>Band Type</th>
<th>Minimum Gain</th>
<th>Typical Gain</th>
<th>Maximum Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>v.h.f.</td>
<td>min. 19 dB</td>
<td>min. 19 dB</td>
<td></td>
</tr>
<tr>
<td>u.h.f.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Maximum gain difference

<table>
<thead>
<tr>
<th>Condition</th>
<th>Minimum</th>
<th>Typical</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>between any two v.h.f. channels</td>
<td>min. 19 dB</td>
<td>min. 19 dB</td>
<td></td>
</tr>
<tr>
<td>between any two u.h.f. channels</td>
<td></td>
<td>typ. 6 dB</td>
<td>typ. 6 dB</td>
</tr>
</tbody>
</table>

Noise figure

<table>
<thead>
<tr>
<th>Band Type</th>
<th>Minimum</th>
<th>Typical</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>v.h.f.</td>
<td>max. 9 dB</td>
<td>typ. 6 dB</td>
<td>channel C: max. 10 dB</td>
</tr>
<tr>
<td>low v.h.f. band</td>
<td></td>
<td>typ. 6 dB</td>
<td></td>
</tr>
<tr>
<td>high v.h.f. band</td>
<td></td>
<td>typ. 6 dB, channel C: typ. 7 dB</td>
<td></td>
</tr>
<tr>
<td>u.h.f. bands</td>
<td>max. 10 dB</td>
<td>typ. 5,5 dB</td>
<td></td>
</tr>
<tr>
<td>channel L21</td>
<td></td>
<td>typ. 6,5 dB</td>
<td></td>
</tr>
<tr>
<td>channel L40</td>
<td></td>
<td>typ. 7,5 dB</td>
<td></td>
</tr>
<tr>
<td>channel L69</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Unwanted signal characteristics**

Image rejection (measured at picture carrier frequency)

<table>
<thead>
<tr>
<th>Band Type</th>
<th>Minimum</th>
<th>Typical</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>low v.h.f. band</td>
<td>min. 60 dB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>high v.h.f. band</td>
<td>min. 55 dB, typ. 60 dB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>u.h.f. bands</td>
<td>min. 40 dB, typ. 50 dB</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

I.F. rejection (measured at picture carrier frequency)

<table>
<thead>
<tr>
<th>Band Type</th>
<th>Minimum</th>
<th>Typical</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>low v.h.f. band</td>
<td>min. 20 dB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>channel 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>channel 4</td>
<td>min. 30 dB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>high v.h.f. band</td>
<td>min. 60 dB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>u.h.f. bands</td>
<td>min. 60 dB</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Cross modulation

Input signal producing 1% cross modulation, i.e. 1% of the modulation depth of the interfering signal is transferred to the wanted signal.

In channel cross modulation (wanted signal: picture carrier frequency; interfering signal: sound carrier frequency)

<table>
<thead>
<tr>
<th>Band Type</th>
<th>Minimum</th>
<th>Typical</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>low v.h.f. band</td>
<td>typ. 67 dB (µV) into 75 Ω</td>
<td>typ. 85 dB (µV) into 75 Ω</td>
<td></td>
</tr>
<tr>
<td>at nominal gain (wanted input level 60 dB (µV))</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>at 20 dB gain reduction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>high v.h.f. band</td>
<td>typ. 70 dB (µV) into 75 Ω</td>
<td>typ. 90 dB (µV) into 75 Ω</td>
<td></td>
</tr>
<tr>
<td>at nominal gain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>at 20 dB gain reduction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>u.h.f. bands</td>
<td>typ. 70 dB (µV) into 75 Ω</td>
<td>typ. 90 dB (µV) into 75 Ω</td>
<td></td>
</tr>
<tr>
<td>at nominal gain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>at 20 dB gain reduction</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
V.H.F./U.H.F. television tuners

In band cross modulation (wanted signal: picture carrier of channel N; interfering signal: picture carrier of channel N ± 3 for all bands).

- **high v.h.f. band**
  - at nominal gain (wanted input level 60 dB (μV))
  - typ. 95 dB (μV) into 75 Ω
- **u.h.f. bands**
  - at nominal gain
  - typ. 85 dB (μV) into 75 Ω

**Oscillator characteristics**

- **Shift of oscillator frequency at a change**
  - of the supply voltage of 5%
    - v.h.f. bands
    - max. 500 kHz
    - channel L21
    - typ. 600 kHz
    - channel L40
    - typ. 100 kHz
    - channel L69
    - typ. 200 kHz
- **Drift of oscillator frequency at a change**
  - of the ambient temperature from +25 to +40 °C
    - (measured after 3 cycles from +25 to +55 °C)
    - v.h.f. bands
    - max. 350 kHz
    - u.h.f. bands
    - max. 600 kHz

**I.F. circuit characteristics**

- **Minimum tuning range of i.f. output coil**
  - 32 to 40 MHz

**Miscellaneous**

- **Oscillator voltage at the aerial terminal**
  - Fundamental and harmonic frequencies up to 1000 MHz
    - v.h.f. bands
    - max. 50 dB (μV) into 75 Ω
    - u.h.f. bands
    - max. 66 dB (μV) into 75 Ω
ADDITIONAL INFORMATION

I.F. injection

Terminal 4 (supply voltage u.h.f.) can be used as i.f. injection point, provided the u.h.f. supply voltage is applied to terminal 4 via a resistor of 56 Ω (see Fig. 6). The u.h.f. band should be switched on; a tuning voltage of −12 V is applied to terminal 7.

![Diagram](image)

Connection of the i.f. amplifier

No special precautions are required to load and to match the i.f. output of the tuner.

Measuring method of power gain

The i.f. output of the tuner should be terminated with the circuit given in Fig. 7.

![Diagram](image)

This circuit roughly matches the i.f. output impedance to 75 Ω at the resonant frequency of the i.f. output circuit (Fig. 8).

Because the input and output impedances of the tuner are now 75 Ω, the power gain can be measured in the conventional manner by inserting tuner and the circuit between a 75 Ω source and a 75 Ω detector.
Alignment of the i.f. output coil

The i.f. output coil should be adjusted with a brass tool with a blade as shown in Fig. 9. A suitable tool is available under catalogue number 7122 005 47680.

Fig. 8.

Fig. 9.
V.H.F./U.H.F. TELEVISION TUNERS

QUICK REFERENCE DATA

Systems
C.C.I.R. systems B and G

Channels
v.h.f. I
NZ1 to C
v.h.f. III
M4 to E12
u.h.f.
E21 to E69

Intermediate frequencies
picture
38.9 MHz
sound
33.4 MHz

APPLICATION

Designed to cover the v.h.f. and u.h.f. channels of C.C.I.R. systems B and G, with extended v.h.f. frequency ranges.

The tuners of the UV412 series are equipped with a frequency divider, which makes them suitable for digital tuning systems based on frequency synthesis; for the remainder they are equal to type UV411.

Available versions

<table>
<thead>
<tr>
<th></th>
<th>aerial input connector</th>
<th>frequency divider (IC)</th>
<th>division ratio</th>
<th>catalogue number</th>
</tr>
</thead>
<tbody>
<tr>
<td>UV411</td>
<td>phono</td>
<td>—</td>
<td>—</td>
<td>3122 127 24360</td>
</tr>
<tr>
<td>UV411/IEC</td>
<td>IEC</td>
<td>—</td>
<td>—</td>
<td>3122 127 08870</td>
</tr>
<tr>
<td>UV412</td>
<td>phono</td>
<td>14-pin</td>
<td>256</td>
<td>3122 127 42010</td>
</tr>
<tr>
<td>UV412/256</td>
<td>phono</td>
<td>8-pin</td>
<td>256</td>
<td>3122 127 09060</td>
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<tr>
<td>UV412/256/IEC</td>
<td>IEC</td>
<td>8-pin</td>
<td>256</td>
<td>3122 127 08880</td>
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<tr>
<td>UV412/64</td>
<td>phono</td>
<td>8-pin</td>
<td>64</td>
<td>3122 127 08900</td>
</tr>
<tr>
<td>UV412/64/IEC</td>
<td>IEC</td>
<td>8-pin</td>
<td>64</td>
<td>3122 127 08890</td>
</tr>
</tbody>
</table>
DESCRIPTION

The UV411 and UV412 are combined v.h.f./u.h.f. tuners with electronic tuning and band switching, covering the v.h.f. band I including the New Zealand channel 1, and the Italian channel C (frequency range 44 to 92 MHz), the v.h.f. band III including the Morocco channel M4 (frequency range 162 to 230 MHz), and the u.h.f. band (frequency range 470 to 861 MHz).

Mechanically, the tuners are built on a low-loss printed-wiring board, carrying all components, in a metal housing made of a rectangular frame and front and rear covers (see Fig. 2). The common phono or IEC aerial connector (v.h.f. and u.h.f.) is on one of the frame sides, all other connections (supply voltages, a.g.c. voltage, tuning and switching voltages, i.f. output) are made via terminals in the underside. The mounting method is shown in Fig. 3.

Electrically, the tuners consist of v.h.f. and u.h.f. parts. The v.h.f. aerial signal is fed via switchable v.h.f. band I/III wide band input filters to gate 1 of an input MOSFET tetrode (with internal gate protection against surge).

The input filters are provided with an i.f. and f.m. suppression circuit. The drain load of the MOSFET tetrode is formed by a double tuned switchable bandpass filter, transferring the r.f. signal to the emitter of the mixer transistor. The oscillator signal is also fed to the emitter of the mixer transistor.

The collector circuit of the mixer transistor is a single tuned i.f. resonant circuit, at the low end of which the i.f. signal is coupled out of the tuner. A test point (terminal 4) is provided for i.f. injection to align the i.f. output circuit of the tuner together with the i.f. amplifier of the television receiver. An additional test point, which is accessible through a hole in the top of the tuner, is connected to the collector of the mixer transistor.

The r.f. band pass filter and oscillator circuits are tuned by 3 tuning diodes; band switching is achieved by 5 switching diodes.

The u.h.f. part of the tuner consists of a high-pass input circuit connected to gate 1 of an input MOSFET tetrode (with internal gate protection against surge). The drain load of this MOSFET tetrode is formed by a double tuned circuit transferring the r.f. signal to the Schottky barrier mixer diode. The i.f. signal from the mixer diode is amplified by the v.h.f. mixer transistor, now operating as an i.f. amplifier.

The r.f. band pass filter and oscillator circuits are tuned by 3 tuning diodes.

In all bands the tuner is gain controlled via gate 2 of the input MOSFET tetrode.

The electrical circuit of the UV412 series is extended with a frequency divider (division ratio of 64 or 256), which inputs are connected to the v.h.f. and u.h.f. oscillator. The complementary outputs are connected to terminals 12 and 13.

See Fig. 1c.
* C64 only in versions with IC of Fig. 1b.

Fig. 1c.
MECHANICAL DATA

Dimensions in mm

Fig. 2a.

Terminal
1 = aerial
2 = supply voltage, v.h.f. I, +12 V
3 = supply voltage, v.h.f. III, +12 V
4 = supply voltage, u.h.f., +12 V; i.f. injection
5 = a.g.c. voltage, +9,2 to +0,85 V
6 = supply voltage, v.h.f. and u.h.f., +12 V
7 = tuning voltage, +1 to +28 V
9 = i.f. output
10 = earth
12,13 = balanced output voltage of frequency divider
14 = supply voltage, frequency divider, +5 V

only for UV412
V.H.F./U.H.F. television tuners

Fig. 2b I.F. output coil.
Torque for alignment: 2 to 15 mNm.
Press-through force: ≥ 10 N.

Mass approx. 127 g

Mounting
The tuner may be mounted by soldering it on to a printed-wiring board, using the piercing diagram shown in Fig. 3. (The tuner may also be mounted by means of a bracket. Information will be supplied upon request.) The tuner may be mounted anywhere in the receiver and there are no restrictions on orientation.

The solderability of the terminals and mounting tabs is according to IEC 68-2, test Ta (230 ± 10 °C, 2 ± 0,5 s). The resistance to soldering heat is according to IEC 68-2, test Tb (260 ± 5 °C, 10 ± 1 s).

(1) Only for UV412.

Fig. 3 Piercing diagram viewed from solder side of board. Unless otherwise stated the tolerance is ± 0,05 mm.
ELECTRICAL DATA

Unless otherwise specified all electrical values apply at an ambient temperature of 25 ± 5 °C, a relative humidity of 60 ± 15%, a supply voltage of 12 ± 0,3 V and an a.g.c. voltage of 9,2 ± 0,2 V.

General
Semiconductors, bands I and III
r.f. amplifier
mixer
oscillator
tuning diodes
switching diodes
d.c. blocking diodes

BF982
BF324
BF926
3 x BB809
5 x BA482/483/484
2 x BAW62

Semiconductors, bands IV and V
r.f. amplifier
oscillator
mixer
tuning diodes
surge protection diodes
frequency divider

BF980 (3SK87)
1SS99
3 x BB405B
2 x BAV10
SP4653 or SP4632

Ambient temperature range
operating
storage

0 to + 55 °C
-25 to + 70 °C

Relative humidity
max. 95%

Voltages and currents
Supply voltage
+ 12 V ± 10%

Current drawn from + 12 V supply
bands I and III
max. 55 mA; typ. 44 mA
bands IV and V
max. 50 mA; typ. 40 mA

Bandswitching
For operation in all bands the supply voltage is permanently connected to terminal 6. Additionally the supply voltage is connected to:
terminal 2 for operation in band I,
terminal 3 for operation in band III,
terminal 4 for operation in bands IV and V.

A.G.C. voltage (Figs 4, 5 and 6)
voltage range
+ 9,2 to + 0,85 V
voltage at nominal gain
+ 9,2 ± 0,5 V
voltage at 40 dB gain reduction
band I
typ. 3 V
band III
typ. 1,5 V

voltage at 30 dB gain reduction
typ. 2 V

Note: A.G.C. voltages between 0 and + 10,5 V may be applied without risk of damage.

A.G.C. current
max. 0,3 mA

Slope of a.g.c. characteristic,
at the end of the specified a.g.c. range
bands I and III
typ. 25 dB/V
bands IV and V
typ. 50 dB/V
V.H.F./U.H.F. television tuners

Fig. 4 Typical a.g.c. characteristic, band I.

Fig. 5 Typical a.g.c. characteristic, band III.

Fig. 6 Typical a.g.c. characteristic, bands IV and V.
Fig. 7 Typical tuning characteristic, band I.

Fig. 8 Typical tuning characteristic, band III.

Fig. 9 Typical tuning characteristic, bands IV and V.
V.H.F./U.H.F. television tuners

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Tuning voltage range (Figs 7, 8 and 9) +1 to +28 V
Current drawn from 28 V tuning voltage supply
at $T_{amb} = 25 \degree C$ max. 0,5 $\mu$A
at $T_{amb} = 55 \degree C$ max. 2 $\mu$A

Note: The source impedance of the tuning voltage offered to terminal 7 must be maximum 47 kΩ.

Slope of tuning characteristic

<table>
<thead>
<tr>
<th>Band</th>
<th>Channel</th>
<th>Typical values</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>E2</td>
<td>3 MHz/V</td>
</tr>
<tr>
<td></td>
<td>E4</td>
<td>2 MHz/V</td>
</tr>
<tr>
<td>III</td>
<td>E5</td>
<td>7 MHz/V</td>
</tr>
<tr>
<td></td>
<td>E12</td>
<td>2 MHz/V</td>
</tr>
<tr>
<td>IV and V</td>
<td>E21</td>
<td>22 MHz/V</td>
</tr>
<tr>
<td></td>
<td>E69</td>
<td>5 MHz/V</td>
</tr>
</tbody>
</table>

Frequencies
Frequency ranges

<table>
<thead>
<tr>
<th>Band</th>
<th>Channel</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>NZ1 (picture carrier 45,25 MHz) to C (picture carrier 82,25 MHz).*</td>
</tr>
<tr>
<td></td>
<td>Margin at the extreme channels: min. 1,5 MHz.</td>
</tr>
<tr>
<td>III</td>
<td>M4 (picture carrier 163,25 MHz) to E12 (picture carrier 224,25 MHz).</td>
</tr>
<tr>
<td></td>
<td>Margin at the extreme channels: min. 2 MHz.</td>
</tr>
<tr>
<td>IV and V</td>
<td>E21 (picture carrier 471,25 MHz) to E69 (picture carrier 855,25 MHz).</td>
</tr>
<tr>
<td></td>
<td>Margin at the extreme channels: min. 3 MHz.</td>
</tr>
</tbody>
</table>

Intermediate frequencies

<table>
<thead>
<tr>
<th>Type</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Picture</td>
<td>38,9 MHz</td>
</tr>
<tr>
<td>Sound</td>
<td>33,4 MHz</td>
</tr>
</tbody>
</table>

The oscillator frequency is higher than the aerial signal frequency.

Wanted signal characteristics
Input impedance 75 $\Omega$
V.S.W.R. and reflection coefficient (values between picture and sound carrier, as well as values at picture carrier)

<table>
<thead>
<tr>
<th>V.S.W.R.</th>
<th>at nominal gain</th>
<th>during gain control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bands I and III</td>
<td>max. 4,5</td>
<td>max. 5,5</td>
</tr>
<tr>
<td>Bands IV and V</td>
<td>max. 5</td>
<td>max. 7</td>
</tr>
<tr>
<td>Reflection coefficient</td>
<td>max. 64%</td>
<td>max. 69%</td>
</tr>
<tr>
<td>Bands I and III</td>
<td>max. 66%</td>
<td>max. 75%</td>
</tr>
<tr>
<td>Bands IV and V</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

R.F. curves, bandwidth

<table>
<thead>
<tr>
<th>Band</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Typ. 11 MHz</td>
</tr>
<tr>
<td>III</td>
<td>Typ. 13 MHz</td>
</tr>
<tr>
<td>IV and V</td>
<td>Typ. 20 MHz</td>
</tr>
</tbody>
</table>

* Channel R4 (picture carrier 85,25 MHz) is within the frequency range, but not specified.
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UV412 SERIES

R.F. curves, tilt

<table>
<thead>
<tr>
<th>A.G.C. range</th>
</tr>
</thead>
<tbody>
<tr>
<td>bands I and III</td>
</tr>
<tr>
<td>bands IV and V</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Power gain (see also Measuring method of power gain)</th>
</tr>
</thead>
<tbody>
<tr>
<td>bands I and III</td>
</tr>
<tr>
<td>channel E3</td>
</tr>
<tr>
<td>channel E5</td>
</tr>
<tr>
<td>channel E12</td>
</tr>
<tr>
<td>bands IV and V</td>
</tr>
<tr>
<td>channel E21</td>
</tr>
<tr>
<td>channel E40</td>
</tr>
<tr>
<td>channel E69</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Maximum gain difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>between any two v.h.f. channels</td>
</tr>
<tr>
<td>between any two u.h.f. channels</td>
</tr>
<tr>
<td>between any v.h.f. and u.h.f. channel</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Noise figure</th>
</tr>
</thead>
<tbody>
<tr>
<td>bands I and III, except channels NZ1 and M4</td>
</tr>
<tr>
<td>channels NZ1 and M4</td>
</tr>
<tr>
<td>channel E3</td>
</tr>
<tr>
<td>channel E5</td>
</tr>
<tr>
<td>channel E12</td>
</tr>
<tr>
<td>bands IV and V</td>
</tr>
<tr>
<td>channel E21</td>
</tr>
<tr>
<td>channel E40</td>
</tr>
<tr>
<td>channel E69</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Overloading</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input signal producing 1 dB gain</td>
</tr>
<tr>
<td>compression at nominal gain</td>
</tr>
<tr>
<td>bands I and III</td>
</tr>
<tr>
<td>bands IV and V</td>
</tr>
</tbody>
</table>

| Input signal producing either a detuning |
| of the oscillator of + 300 kHz or      |
| −1000 kHz or stopping of the         |
| oscillations at nominal gain         |
| bands I and III                      | typ. 100 dB (μV) into 75 Ω |
| bands IV and V                       | typ. 100 dB (μV) into 75 Ω |

<table>
<thead>
<tr>
<th>Unwanted signal characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Image rejection (measured at picture carrier frequency)</td>
</tr>
<tr>
<td>bands I and III, except channels C and R4</td>
</tr>
<tr>
<td>channels C and R4</td>
</tr>
<tr>
<td>bands IV and V</td>
</tr>
</tbody>
</table>

on any channel the amplitude difference between the top of the r.f. resonant curve and the picture frequency, the sound frequency, or any frequency between them will not exceed 3 dB at nominal gain, and 4 dB in the a.g.c. range between nominal gain and 20 dB gain reduction.

Minimum Maximum

40 dB min.
30 dB min.
22 dB min.
28 dB min.
28 dB min.
28 dB min.
28 dB min.
28 dB min.
28 dB min.
20 dB min.
26 dB min.
22 dB min.
28 dB min.
28 dB min.
28 dB min.
20 dB min.
10 dB min.
7 dB min.
90 dB typ.
90 dB typ.
90 dB typ.
90 dB typ.
100 dB typ.
100 dB typ.
100 dB typ.
100 dB typ.
60 dB; typ. 70 dB
55 dB
44 dB; typ. 53 dB

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I.F. rejection (measured at picture carrier frequency)
channel NZ1 min. 40 dB
channel E2 min. 45 dB
channels E3 to C min. 50 dB
band III min. 60 dB
bands IV and V min. 60 dB

Note: At colour sub-carrier frequency maximum 6 dB less rejection.

N ± 4 rejection (for u.h.f. only)
Interference signal for an interference ratio of 53 dB referred to wanted picture carrier (picture to sound carrier ratio of 10 dB; wanted signal 60 dB (μV); tuner operating at nominal gain) typ. 75 dB (μV) into 75 Ω

Cross modulation
Input signal producing 1% cross modulation, i.e. 1% of the modulation depth of the interfering signal is transferred to the wanted signal.

In channel cross modulation (wanted signal: picture carrier frequency; interfering signal: sound carrier frequency)
bands I and III
   at nominal gain (wanted input level 60 dB (μV)) typ. 74 dB (μV) into 75 Ω
   at 40 dB gain reduction (wanted input level 100 dB (μV)) typ. 94 dB (μV) into 75 Ω
bands IV and V
   at nominal gain (wanted input level 60 dB (μV)) typ. 74 dB (μV) into 75 Ω
   at 30 dB gain reduction (wanted input level 90 dB (μV)) typ. 94 dB (μV) into 75 Ω

In band cross modulation (wanted signal: picture carrier of channel N; interfering signal: picture carrier of channel N ± 2 for v.h.f. I, or channel N ± 3 for v.h.f. III, or channel N ± 5 for u.h.f.)
bands I and III
   at nominal gain (wanted input level 60 dB (μV)) typ. 82 dB (μV) into 75 Ω
   at 40 dB gain reduction (wanted input level 100 dB (μV)) typ. 94 dB (μV) into 75 Ω
bands IV and V
   at nominal gain (wanted input level 60 dB (μV)) typ. 82 dB (μV) into 75 Ω
   at 30 dB gain reduction (wanted input level 90 dB (μV)) typ. 94 dB (μV) into 75 Ω

Out of band cross modulation at nominal gain
v.h.f. I, interfering from v.h.f. III typ. 94 dB (μV) into 75 Ω
v.h.f. I, interfering from u.h.f. typ. 90 dB (μV) into 75 Ω
v.h.f. III, interfering from v.h.f. I typ. 94 dB (μV) into 75 Ω
v.h.f. III, interfering from u.h.f. typ. 90 dB (μV) into 75 Ω
u.h.f. interfering from v.h.f. I typ. 94 dB (μV) into 75 Ω
u.h.f. interfering from v.h.f. III typ. 90 dB (μV) into 75 Ω

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Oscillator characteristics

Pulling
Input signal of tuned frequency producing a shift of the oscillator frequency of 10 kHz, at nominal gain
bands I and III  
bands IV and V  
Shift of oscillator frequency at a change of the supply voltage of 5%
bands I and III  
bands IV and V  
Drift of oscillator frequency during warm-up time (after the tuner has been completely out of operation for 15 min, measured between 5 s and 15 min after switching on)
during warm-up time (after the input stage is in operation for 15 min, measured between 2 s and 15 min after band switching)
at a change of the ambient temperature from +25 to +40 °C (measured after 3 cycles from +25 to +55 °C)
bands I and III  
bands IV and V  
Frequency divider characteristics of version UV412
Supply voltage  
Current drawn from +5 V supply
bands I and III  
bands IV and V  
Output voltage  
Output current
at output voltage 3.4 V
at output voltage 5 V  
Interference signal on the i.f. output  
Note: I.F. output of the tuner terminated with the circuit shown in Fig. 10.

The output voltage is determined by the external load and the supply voltage, which is connected to this load. They should be chosen such that:
— the output-voltage rating of 10 V is not exceeded;
— the output voltage does not drop more than 1.6 V below 5 V (supply voltage of frequency divider);
— the output-voltage swing does not exceed 1 V.

Radiation by the output signal may be reduced by transporting the two complementary signals via twisted wires or a flat cable, even if only one signal is to be used to drive the subsequent circuit.
Frequency divider characteristics of the UV412/64 and UV412/256 versions
Supply voltage +5 V ± 10%
Current drawn from +5 V supply max. 35 mA; typ. 25 mA
Output voltage, unloaded, measured with probe 10 MΩ/11 pF min. 0,8 V p-p
Output impedance typ. 1 kΩ
Output imbalance typ. 0,1 V
Interference signal on the i.f. output
UV412/256 max. 3 μV
UV412/64 max. 20 μV

Note: I.F. output of the tuner terminated with the circuit shown in Fig. 10.

I.F. circuit characteristics
Bandwidth of i.f. output circuit 5 ± 1 MHz

Note: I.F. output of the tuner terminated with the circuit shown in Fig. 10; tuning voltage 2 V; u.h.f. band switched on.

Bandwidth variation of i.f. output circuit as a result of r.f. tuning and band switching (reference: u.h.f.; tuning voltage 2 V) max. 650 kHz

Note: I.F. output of the tuner terminated with a modified circuit of Fig. 10, i.e. a 100 pF capacitor is connected in parallel with the i.f. output of the tuner.

![Fig. 10.](image)

Detuning of the i.f. output circuit as a result of r.f. tuning and band switching (reference: u.h.f.; tuning voltage 2 V) max. 500 kHz

Note: I.F. output of the tuner terminated with a modified circuit of Fig. 10, i.e. a 100 pF capacitor is connected in parallel with the i.f. output of the tuner.

Minimum tuning range of i.f. output coil 33 to 40 MHz

Note: I.F. output of the tuner terminated with the circuit shown in Fig. 10.

Attenuation between i.f. injection point and i.f. output of the tuner typ. 16 dB
Miscellaneous
Radio interference
Oscillator radiation and oscillator voltage at the aerial terminal

Within the limits of C.I.S.P.R. 13 (1975) and VDE0872/7.72.

There will be no microphonics, provided the tuner is installed in a professional manner.

Microphonics

Surge protection
Protection against voltages
max. 5 kV

Note: 10 discharges of a 470 pF capacitor into the aerial terminal.

Protection against flashes
max. 30 kV, 400 mWs

Note: A flashover circuit producing flashes with frequencies of 1 to 20 Hz for 30 s is connected to the aerial terminal.
V.H.F./U.H.F. television tuners

ADDITIONAL INFORMATION

I.F. injection

Terminal 4 (supply voltage u.h.f.) can be used as i.f. injection point, provided the u.h.f. supply voltage is applied to terminal 4 via a resistor of 10 Ω (see Fig. 11). The u.h.f. band should be switched on; tuning voltage should be 2 V.

Fig. 11.

Connection of the i.f. amplifier

No special precautions are required to load and to match the i.f. output of the tuner.

Connection of supply voltages

Fig. 12.
Measuring method of power gain

The i.f. output of the tuner should be terminated with the RC-circuit given in Fig. 10.

![Fig. 13.](image_url)

The RC-circuit roughly matches the i.f. output impedance to 75 Ω at the resonant frequency of the i.f. output circuit, which should be tuned to 36.15 MHz; the bandwidth is approx. 5 MHz (Fig. 13). Because the input and output impedances of the tuner are now 75 Ω, the power gain can be measured in the conventional manner by inserting tuner and RC-circuit between a 75 Ω source and a 75 Ω detector.

Alignment of the i.f. output coil

The i.f. output coil should be adjusted with a brass tool with a blade as shown in Fig. 14. A suitable tool is available under catalogue number 7122 005 47680.

![Fig. 14.](image_url)
V.H.F./U.H.F. TELEVISION TUNER

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Systems</th>
<th>C.C.I.R. system D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channels</td>
<td></td>
</tr>
<tr>
<td>low v.h.f.</td>
<td>C1 to C5</td>
</tr>
<tr>
<td>high v.h.f.</td>
<td>C6 to C12</td>
</tr>
<tr>
<td>u.h.f.</td>
<td>C13 to C57</td>
</tr>
<tr>
<td>Intermediate frequencies</td>
<td></td>
</tr>
<tr>
<td>picture</td>
<td>37,00 MHz</td>
</tr>
<tr>
<td>sound</td>
<td>30,50 MHz</td>
</tr>
</tbody>
</table>

APPLICATION

Designed to cover the v.h.f. and u.h.f. channels of C.C.I.R. system D.

A tuner UV412HKM/256/IEC with a frequency divider (1 : 256) is available under catalogue number 3122 237 00240. This version is suitable for digital tuning systems based on frequency synthesis.
DESCRIPTION

The UV411 HKM/IEC is a combined v.h.f./u.h.f. tuner with electronic tuning and band switching, covering the low v.h.f. band (frequency range 48 to 92 MHz), the high v.h.f. band (frequency range 167 to 224 MHz), and the u.h.f. band (frequency range 470 to 870 MHz).

Mechanically, the tuner is built on a low-loss printed-wiring board, carrying all components, in a metal housing made of a rectangular frame and front and rear covers (see Fig. 2). The common IEC aerial connector (v.h.f. and u.h.f.) is on one of the frame sides, all other connections (supply voltages, a.g.c. voltage, tuning and switching voltages, i.f. output) are made via terminals in the underside. The mounting method is shown in Fig. 3.

Electrically, the tuner consists of v.h.f. and u.h.f. parts. The v.h.f. aerial signal is fed via switchable wide band input filters to gate 1 of an input MOSFET tetrode (with internal gate protection against surge).

The input filters are provided with an i.f. and f.m. suppression circuit. The drain load of the MOSFET tetrode is formed by a double tuned switchable bandpass filter, transferring the r.f. signal to the emitter of the mixer transistor. The oscillator signal is also fed to the emitter of the mixer transistor.

The collector circuit of the mixer transistor is a single tuned i.f. resonant circuit, at the low end of which the i.f. signal is coupled out of the tuner. A test point (terminal 4) is provided for i.f. injection to align the i.f. output circuit of the tuner together with the i.f. amplifier of the television receiver.

An additional test point, which is accessible through a hole in the top of the tuner, is connected to the collector of the mixer transistor.

The r.f. band pass filter and oscillator circuits are tuned by 3 tuning diodes; band switching is achieved by 5 switching diodes.

The u.h.f. part of the tuner consists of a high-pass input circuit connected to gate 1 of an input MOSFET tetrode (with internal gate protection against surge). The drain load of this MOSFET tetrode is formed by a double tuned circuit transferring the r.f. signal to the Schottky barrier mixer diode.

The i.f. signal from the mixer diode is amplified by the v.h.f. mixer transistor, now operating as an i.f. amplifier.

The r.f. band pass filter and oscillator circuits are tuned by 3 tuning diodes.

In all bands the tuner is gain controlled via gate 2 of the input MOSFET tetrodes.
Fig. 1.
MECHANICAL DATA

Terminal
1 = aerial
2 = supply voltage, low v.h.f., + 12 V
3 = supply voltage, high v.h.f., + 12 V
4 = supply voltage, u.h.f., + 12 V
5 = a.g.c. voltage, + 9,2 to + 0,85 V
6 = supply voltage, v.h.f. and u.h.f., + 12 V
7 = tuning voltage, + 1 to + 28 V
8 = i.f. output
9 = i.f. output
10 = earth

Fig. 2a.

Terminal
1 = aerial
2 = supply voltage, low v.h.f., + 12 V
3 = supply voltage, high v.h.f., + 12 V
4 = supply voltage, u.h.f., + 12 V
5 = a.g.c. voltage, + 9,2 to + 0,85 V
6 = supply voltage, v.h.f. and u.h.f., + 12 V
7 = tuning voltage, + 1 to + 28 V
8 = i.f. output
9 = i.f. output
10 = earth

Dimensions in mm
Mass approx. 127 g

Mounting

The tuner may be mounted by soldering it onto a printed-wiring board, using the piercing diagram shown in Fig. 3. (The tuner may also be mounted by means of a bracket. Information will be supplied upon request.) The tuner may be mounted anywhere in the receiver and there are no restrictions on orientation.

The solderability of the terminals and mounting tabs is according to IEC 68-2, test Ta (230 ± 10 °C, 2 ± 0.5 s). The resistance to soldering heat is according to IEC 68-2, test Tb (260 ± 5 °C, 10 ± 1 s).

Fig. 3 Piercing diagram viewed from solder side of board. Unless otherwise stated the tolerance is ± 0.05 mm.
ELECTRICAL DATA

Unless otherwise specified all electrical values apply at an ambient temperature of 25 ± 5 °C, a relative humidity of 60 ± 15%, a supply voltage of 12 ± 0,3 V and an a.g.c. voltage of 9,2 ± 0,2 V.

General

Semiconductors, v.h.f. bands
  r.f. amplifier          BF982
  mixer                   BF324
  oscillator              BF926
  tuning diodes           3 x BB809
  switching diodes        5 x BA482/483/484
  d.c. blocking diodes    2 x BAW62

Semiconductors, u.h.f. bands
  r.f. amplifier          BF980
  oscillator              BF970
  mixer                   1SS99
  tuning diodes           3 x BB405B
  surge protection diodes 2 x BAV10
  (frequency divider      SP4653 or SP4632)

Ambient temperature range
  operating
  storage

Relative humidity

max. 95%

Voltages and currents

Supply voltage
  + 12 V ± 10%

Current drawn from + 12 V supply
  v.h.f. bands                  max. 55 mA; typ. 44 mA
  u.h.f. bands                  max. 50 mA; typ. 40 mA

Bandswitching

For operation in all bands the supply voltage is permanently connected to terminal 6. Additionally the supply voltage is connected to:
  terminal 2 for operation in low v.h.f. band
  terminal 3 for operation in high v.h.f. band
  terminal 4 for operation in u.h.f. bands

A.G.C. voltage (Figs 4, 5 and 6)
  voltage range               + 9,2 to + 0,85 V
  voltage at nominal gain     + 9,2 ± 0,5 V
  voltage at 40 dB gain reduction
    low v.h.f. band            typ. 3 V
    high v.h.f. band           typ. 1,5 V
  voltage at 30 dB gain reduction
    typ. 2 V

Note: A.G.C. voltages between 0 and + 10,5 V may be applied without risk of damage.

A.G.C. current
  max. 0,3 mA

Slope of a.g.c. characteristic,
  at the end of the specified a.g.c. range
  v.h.f. bands                  typ. 25 dB/V
  u.h.f. bands                  typ. 50 dB/V
V.H.F./U.H.F. television tuner

Fig. 4 Typical a.g.c. characteristic, low v.h.f. band.

Fig. 5 Typical a.g.c. characteristic, high v.h.f. band.

Fig. 6 Typical a.g.c. characteristic, u.h.f. bands.
Fig. 7 Typical tuning characteristic, low v.h.f. band.

Fig. 8 Typical tuning characteristic, high v.h.f. band.

Fig. 9 Typical tuning characteristic, u.h.f. bands.
V.H.F./U.H.F. television tuner

Tuning voltage range (Figs 7, 8 and 9) + 1 to + 28 V
Current drawn from 28 V tuning voltage supply
at T_{amb} = 25 °C max. 0,5 μA
at T_{amb} = 55 °C max. 2 μA

Note: The source impedance of the tuning voltage offered to terminal 7 must be maximum 47 kΩ.

Slope of tuning characteristic
\begin{align*}
\text{low v.h.f. band, channel C1} & \quad 3 \text{ MHz/V} \\
\text{channel C5} & \quad 1 \text{ MHz/V} \\
\text{high v.h.f. band, channel C6} & \quad 6 \text{ MHz/V} \\
\text{channel C12} & \quad 3 \text{ MHz/V} \\
\text{u.h.f. bands, channel C13} & \quad 22 \text{ MHz/V} \\
\text{channel C56} & \quad 4 \text{ MHz/V}
\end{align*}
typical values

Frequencies

Frequency ranges
\begin{align*}
\text{low v.h.f. band} & \quad \text{channel C1 (picture carrier 49,75 MHz) to channel C5 (picture carrier 85,25 MHz). Margin at the extreme channels: min. 1,5 MHz.} \\
\text{high v.h.f. band} & \quad \text{channel C6 (picture carrier 168,25 MHz) to channel C12 (picture carrier 216,25 MHz). Margin at the extreme channels: min. 2 MHz.} \\
\text{u.h.f. bands} & \quad \text{channel C13 (picture carrier 471,25 MHz) to channel C57 (picture carrier 863,25 MHz). Margin at the extreme channels: min. 3 MHz.}
\end{align*}

Intermediate frequencies
\begin{align*}
\text{picture} & \quad 37,0 \text{ MHz} \\
\text{sound} & \quad 30,5 \text{ MHz}
\end{align*}
The oscillator frequency is higher than the aerial signal frequency.

Wanted signal characteristics

Input impedance 75 Ω

V.S.W.R. and reflection coefficient
(values between picture and sound carrier, as well as values at picture carrier)
\begin{align*}
\text{at nominal gain} & \quad \text{during gain control} \\
\text{v.s.w.r.} & \quad \text{at nominal gain} & \quad \text{during gain control} \\
\text{v.h.f. bands} & \quad \text{max. 4,5} & \quad \text{max. 5,5} \\
\text{u.h.f. bands} & \quad \text{max. 5} & \quad \text{max. 7} \\
\text{reflection coefficient} & \quad \text{max. 64%} & \quad \text{max. 69%} \\
\text{v.h.f. bands} & \quad \text{max. 66%} & \quad \text{max. 75%} \\
\text{u.h.f. bands} & \quad & \\
\text{R.F. curves, bandwidth} & \quad \text{typ. 11 MHz} & \quad \text{typ. 13 MHz} \\
\text{low v.h.f. band} & \quad \text{typ. 13 MHz} & \quad \text{typ. 20 MHz} \\
\text{high v.h.f. band} & \quad & \\
\text{u.h.f. bands} & \quad & \\
\end{align*}
R.F. curves, tilt on any channel the amplitude difference between the top of the r.f. resonant curve and the picture frequency, the sound frequency, or any frequency between them will not exceed 3 dB at nominal gain, and 4 dB in the a.g.c. range between nominal gain and 20 dB gain reduction.

A.G.C. range

| v.h.f. bands | min. 40 dB |
| u.h.f. bands | min. 30 dB |

Power gain (see also Measuring method of power gain)

| v.h.f. bands | min. 22 dB |
| channel C2   | typ. 28 dB |
| channel C7   | typ. 28 dB |
| channel C12  | typ. 28 dB |
| u.h.f. bands | min. 20 dB |
| channel C13  | typ. 28 dB |
| channel C27  | typ. 27 dB |
| channel C56  | typ. 26 dB |

Maximum gain difference

| between any two v.h.f. channels | typ. 2 dB |
| between any two u.h.f. channels | typ. 3 dB |
| between any v.h.f. and u.h.f. channel | typ. 4 dB |

Noise figure

| v.h.f. bands | max. 8 dB |
| channel C2   | typ. 4 dB |
| channel C7   | typ. 4 dB |
| channel C12  | typ. 5 dB |
| u.h.f. bands | max. 10 dB |
| channel C13  | typ. 6 dB |
| channel C27  | typ. 6 dB |
| channel C56  | typ. 7 dB |

Overloading

Input signal producing 1 dB gain compression at nominal gain

| v.h.f. bands | typ. 90 dB (μV) into 75 Ω |
| u.h.f. bands | typ. 90 dB (μV) into 75 Ω |

Input signal producing either a detuning of the oscillator of + 300 kHz or −1000 kHz or stopping of the oscillations at nominal gain

| v.h.f. bands | typ. 100 dB (μV) into 75 Ω |
| u.h.f. bands | typ. 100 dB (μV) into 75 Ω |

Unwanted signal characteristics

Image rejection (measured at picture carrier frequency)

| v.h.f. bands, except channel C5 | min. 60 dB; typ. 70 dB |
| channel C5                     | min. 55 dB; typ. 59 dB |
| u.h.f. bands, channels C13 up to C50 | min. 44 dB; typ. 53 dB |
| channels C51 up to C57          | min. 40 dB; typ. 44 dB |
V.H.F./U.H.F. television tuner

I.F. rejection (measured at picture carrier frequency)
- low v.h.f. band
  - channel C1
  - channels C2 up to C5
- high v.h.f. band
- u.h.f. bands

Note: At colour sub-carrier frequency maximum 6 dB less rejection.

Cross modulation
Input signal producing 1% cross modulation, i.e. 1% of the modulation depth of the interfering signal is transferred to the wanted signal.

In channel cross modulation (wanted signal: picture carrier frequency; interfering signal: sound carrier frequency)
- v.h.f. bands
  - at nominal gain (wanted input level 60 dB (μV))
  - at 40 dB gain reduction (wanted input level 100 dB (μV))
- u.h.f. bands
  - at nominal gain (wanted input level 60 dB (μV))
  - at 30 dB gain reduction (wanted input level 90 dB (μV))

In band cross modulation (wanted signal: picture carrier of channel N; interfering signal: picture carrier of channel N ± 2 for low v.h.f., or channel N ± 3 for high v.h.f., or channel N ± 5 for u.h.f.)
- v.h.f. bands
  - at nominal gain (wanted input level 60 dB (μV))
  - at 40 dB gain reduction (wanted input level 100 dB (μV))
- u.h.f. bands
  - at nominal gain (wanted input level 60 dB (μV))
  - at 30 dB gain reduction (wanted input level 90 dB (μV))

Out of band cross modulation at nominal gain
- low v.h.f., interfering from high v.h.f.
- low v.h.f., interfering from u.h.f.
- high v.h.f., interfering from low v.h.f.
- high v.h.f., interfering from u.h.f.
- u.h.f. interfering from low v.h.f.
- u.h.f. interfering from high v.h.f.
Oscillator characteristics

Pulling
Input signal of tuned frequency producing a shift of the oscillator frequency of 10 kHz, at nominal gain
  v.h.f. bands
  u.h.f. bands

Shift of oscillator frequency at a change of the supply voltage of 5%
  v.h.f. bands
  u.h.f. bands

Drift of oscillator frequency
during warm-up time (after the tuner has been completely out of operation for 15 min, measured between 5 s and 15 min after switching on)
during warm-up time (after the input stage is in operation for 15 min, measured between 2 s and 15 min after band switching)
at a change of the ambient temperature from +25 to +40 °C (measured after 3 cycles from +25 to +55 °C)
  v.h.f. bands
  u.h.f. bands

I.F. circuit characteristics

Bandwidth of i.f. output circuit
5 ± 1 MHz

Note: I.F. output of the tuner terminated with the circuit shown in Fig. 10; tuning voltage 2 V; u.h.f. band switched on.

Bandwidth variation of i.f. output circuit as a result of r.f. tuning and band switching (reference: u.h.f.; tuning voltage 2 V)
max. 650 kHz

Note: I.F. output of the tuner terminated with a modified circuit of Fig. 10, i.e. a 100 pF capacitor is connected in parallel with the i.f. output of the tuner. I.F. output adjusted to 33,75 MHz.

![Fig. 10.](7288506)
Detuning of the i.f. output circuit as a result of r.f. tuning and band switching
(reference: u.h.f.; tuning voltage 2 V) max. 500 kHz

Note: I.F. output of the tuner terminated with a modified circuit of Fig. 10, i.e. a 100 pF capacitor is connected in parallel with the i.f. output of the tuner.

Minimum tuning range of i.f. output coil 30 to 39 MHz
Note: I.F. output of the tuner terminated with the circuit shown in Fig. 10.

Attenuation between i.f. injection point and i.f. output of the tuner typ. 16 dB

Miscellaneous
Radio interference
Oscillator radiation and oscillator voltage at the aerial terminal Within the limits of C.I.S.P.R. 13 (1975) and VDE 0872/7.72.

Microphonics
There will be no microphonics, provided the tuner is installed in a professional manner.

Surge protection
Protection against voltages max. 5 kV
Note: 10 discharges of a 470 pF capacitor into the aerial terminal.

Protection against flashes max. 30 kV, 400 mWs
Note: A flashover circuit producing flashes with frequencies of 1 to 20 Hz for 30 s is connected to the aerial terminal.
ADDITIONAL INFORMATION

I.F. injection

Terminal 4 (supply voltage u.h.f.) can be used as i.f. injection point, provided the u.h.f. supply voltage is applied to terminal 4 via a resistor of 10 Ω (see Fig. 11). The u.h.f. band should be switched on; tuning voltage should be 2 V.

![Fig. 11.](image)

Connection of the i.f. amplifier

No special precautions are required to load and to match the i.f. output of the tuner.

Connection of supply voltages

![Fig. 12.](image)
Measuring method of power

The i.f. output of the tuner should be terminated with the RC-circuit given in Fig. 10.

![Diagram of 3.75 MHz with 3 dB and 5 MHz](image)

The RC-circuit roughly matches the i.f. output impedance to 75 Ω at the resonant frequency of the i.f. output circuit, which should be tuned to 33.75 MHz; the bandwidth is approx. 5 MHz (Fig. 13).

Because the input and output impedances of the tuner are now 75 Ω, the power gain can be measured in the conventional manner by inserting tuner and RC-circuit between a 75 Ω source and a 75 Ω detector.

Alignment of the i.f. output coil

The i.f. output coil should be adjusted with a plastic tool which has a cross head as shown in Fig. 14. A suitable tool for automatic alignment is available:

- holder catalogue number 7122 005 47910
- cross-head catalogue number 3122 131 63390.

![Diagram of a cross head with dimensions](image)
# V.H.F./U.H.F. TELEVISION TUNERS

## QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Systems</th>
<th>C.C.I.R. systems B and G</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channels</td>
<td>E2 to S1</td>
</tr>
<tr>
<td>low v.h.f.</td>
<td>S2 to S20</td>
</tr>
<tr>
<td>high v.h.f.</td>
<td>E21 to E69</td>
</tr>
<tr>
<td>u.h.f.</td>
<td></td>
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<tr>
<td>Intermediate frequencies</td>
<td>38,9 MHz</td>
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<tr>
<td>picture</td>
<td>33,4 MHz</td>
</tr>
<tr>
<td>sound</td>
<td></td>
</tr>
</tbody>
</table>

## APPLICATION

Designed to cover the v.h.f. and u.h.f. channels of C.C.I.R. systems B and G, with extended v.h.f. frequency ranges.

The tuner UV418 is equipped with a frequency divider, which makes it suitable for digital tuning systems based on frequency synthesis; otherwise this tuner is equal to type UV417.

Both tuners comply with the requirements of radiation, signal handling capability, and immunity from radiated interference of Amtsblatt DBP69/1981, when installed professionally in an adequate TV receiver.

## Available versions

<table>
<thead>
<tr>
<th>type number</th>
<th>aerial input connector</th>
<th>frequency divider (IC)</th>
<th>division ratio</th>
<th>catalogue number</th>
</tr>
</thead>
<tbody>
<tr>
<td>UV417</td>
<td>phono</td>
<td></td>
<td></td>
<td>3112 218 52660</td>
</tr>
<tr>
<td>UV417/IEC</td>
<td>IEC</td>
<td></td>
<td></td>
<td>3112 218 52690</td>
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<tr>
<td>UV418/256</td>
<td>phono</td>
<td>8-pin</td>
<td>256</td>
<td>3112 218 52720</td>
</tr>
<tr>
<td>UV418/256/IEC</td>
<td>IEC</td>
<td>8-pin</td>
<td>256</td>
<td>3112 218 52780</td>
</tr>
<tr>
<td>UV418/64</td>
<td>phono</td>
<td>8-pin</td>
<td>64</td>
<td>3112 218 52750</td>
</tr>
<tr>
<td>UV418/64/IEC</td>
<td>IEC</td>
<td>8-pin</td>
<td>64</td>
<td>3112 218 52810</td>
</tr>
</tbody>
</table>
DESCRIPTION

The UV417 and UV418 are combined v.h.f./u.h.f. tuners with electronic tuning and band switching, covering the low v.h.f. band (frequency range 47 to 111 MHz), the high v.h.f. band (frequency range 111 to 300 MHz), and the u.h.f. band (frequency range 470 to 860 MHz).

Mechanically, the tuners are built on a low-loss printed-wiring board, carrying all components, in a metal housing made of a rectangular frame and front and rear covers (see Fig. 2). The common phono aerial connector (v.h.f. and u.h.f.) is on one of the frame sides, all other connections (supply voltages, a.g.c. voltage, tuning and switching voltages, i.f. output) are made via terminals in the underside. The mounting method is shown in Fig. 3.

Electrically, the tuners consist of v.h.f. and u.h.f. parts. The v.h.f. aerial signal is fed via switchable wideband low v.h.f. and high v.h.f. input filters to gate 1 of an input MOSFET tetrode (with internal gate protection against surge).

The input filters are provided with an i.f. suppression circuit. The drain load of the MOSFET tetrode is formed by a double tuned switchable bandpass filter, transferring the r.f. signal to the emitter of the mixer transistor. The oscillator signal is also fed to the emitter of the mixer transistor (T.P.1.).

The collector circuit of the mixer transistor is a single tuned i.f. resonant circuit, where at the low impedance side the i.f. signal is coupled out of the tuner. A test point, which is accessible through a hole in the top of the frame is provided for i.f. injection to align the i.f. output circuit of the tuner together with the i.f. amplifier of the television receiver. An additional test point, which is accessible through a hole in the top of the tuner, is connected to the collector of the mixer transistor (T.P.1.).

The input, the r.f. band pass filter and oscillator circuits are tuned by 5 tuning diodes; band switching is achieved by 5 switching diodes.

The u.h.f. part of the tuner consists of a high-pass input circuit connected to gate 1 of an input MOSFET tetrode (with internal gate protection against surge). The drain load of this MOSFET tetrode is formed by a double tuned circuit transferring the r.f. signal to the Schottky barrier mixer diode. The i.f. signal from the mixer diode is amplified by the v.h.f. mixer transistor, now operating as an i.f. amplifier.

The input, the r.f. bandpass filter and oscillator circuits are tuned by 4 tuning diodes.

In all bands the tuner is gain controlled via gate 2 of the input MOSFET tetrode.

The electrical circuit of the UV418 series is extended with a frequency divider (division ratio of 64 or 256), which inputs are connected to the v.h.f. and u.h.f. oscillator. The complementary outputs are connected to terminals 12 and 13.
Fig. 1 Circuit diagram. For connections see also next page.
V.H.F./U.H.F. television tuners

UV417/MK2

UV418/MK2
MECHANICAL DATA

Dimensions in mm

IEC I connector

Fig. 2b I.F. output coil.
Torque for alignment: 2 to 15 mNm.
Press-through force: ≥ 10 N.

Terminal
1 = aerial
2 = supply voltage, low v.h.f., + 12 V
3 = supply voltage, low v.h.f., + 12 V
4 = supply voltage, u.h.f., + 12 V; i.f. injection
5 = a.g.c. voltage, + 9.2 to + 0.85 V
6 = supply voltage, v.h.f. and u.h.f., + 12 V
7 = tuning voltage, + 1 to + 28 V
9 = i.f. output
10 = earth
12, 13 = balanced output voltage of frequency divider
14 = supply voltage, frequency divider, + 5 V

only for UV418
V.H.F./U.H.F. television tuners

Mass
approx. 127 g

Mounting
The tuner may be mounted by soldering it on to a printed-wiring board, using the piercing diagram shown in Fig. 3. (The tuner may also be mounted by means of a bracket. Information will be supplied upon request). The tuner may be mounted anywhere in the receiver and there are no restrictions on orientation.

The solderability of the terminals and mounting tabs is according to IEC 68-2-20, test Ta (230 ± 10 °C, 2 ± 0.5 s). The resistance to soldering heat is according to IEC 68-2-20, test Tb (260 ± 5 °C, 10 ± 1 s).

(1) Only for UV418.

Fig. 3 Piercing diagram viewed from solder side of board. Unless otherwise stated the tolerance is ± 0.05 mm.

Marking
The tuner is provided with a label showing the following date:
- type number
- catalogue number
- code for factory of origin
- change code
- code for year and week of production
ELECTRICAL DATA

Unless otherwise specified all electrical values apply at an ambient temperature of 25 ± 5 °C, a relative humidity of 60 ± 15%, a supply voltage of 12 ± 0,3 V and an a.g.c. voltage of 9,2 ± 0,2 V.

General

Semiconductors, v.h.f. bands
  r.f. amplifier
  mixer
  oscillator
  tuning diodes
  switching diodes
  d.c. blocking diodes
  BF980
  BF324
  BF926
  4 x BB909, 1 x BB405
  2 x BA482, 2 x BA483, 1 x BA484
  2 x BAW62

Semiconductors, u.h.f. bands
  r.f. amplifier
  oscillator
  mixer
  tuning diodes
  frequency divider ÷ 256
  frequency divider ÷ 64
  BF980
  BF970
  1SS99
  4 x BB405B
  SP4653
  SP4632

Ambient temperature range
  operating
  storage
  0 to + 55 °C
  -25 to + 70 °C
  max. 95%

Relative humidity

Voltages and currents

Supply voltage
  + 12 V ± 10%

The supply voltage of band switching (terminals 2, 3 and 4) may never deviate more than + 10%/-5% from the unswitched supply voltage (terminal 6) within the specified margin of ± 10%.

Ripple susceptibility on supply voltages
  t.b.e.

The ripple susceptibility is defined as the peak-to-peak value of a sinewave signal (20 Hz - 500 kHz) on the supply voltages causing an amplitude modulation with a modulation depth of 0,28% on the picture carrier after passing the Nyquist curve of the i.f. filter of a TV receiver.

Current drawn from + 12 V supply
  v.h.f. bands
    max. 42 mA
  u.h.f. bands
    max. 42 mA

Band switching

For operation in all bands the supply voltage is permanently connected to terminal 6. Additionally the supply voltage is connected to:
  terminal 2 for operation in low v.h.f. band.
  terminal 3 for operation in high v.h.f. band.
  terminal 4 for operation in u.h.f. bands.

A.G.C. voltage (Note: voltages between 0 and + 10,5 V may be applied without risk of damage.)
  voltage range
    + 9,2 to + 0,85 V
  voltage at nominal gain
    + 9,2 ± 0,5 V
  voltage at 40 dB gain reduction
    low v.h.f. band
      typ. 3 V
    high v.h.f. band
      typ. 1,5 V
  voltage at 30 dB gain reduction
    u.h.f.
      typ. 2 V
V.H.F./U.H.F. television tuners

UV417/MK2
UV418/MK2

A.G.C. current
max. 0,3 mA

Slope of a.g.c. characteristic,
at the end of the specified a.g.c. range
v.h.f. bands
typ. 25 dB/V
u.h.f. bands
typ. 50 dB/V

Tuning voltage range
+1 to +28 V

Current drawn from 28 V tuning voltage supply
at \( T_{amb} = 25 \, ^\circ C \) and 60% R.H.
max. 0,5 \( \mu A \)
at \( T_{amb} = 25 \, ^\circ C \) and 85% R.H.
max. 2 \( \mu A \)
at \( T_{amb} = 55 \, ^\circ C \) and 60% R.H.
max. 2 \( \mu A \)

Note: The source impedance of the tuning voltage offered to terminal 7 is maximum 47 k\( \Omega \).

Slope of tuning characteristic
- low v.h.f. band, channel E2
  channel S1
  5 MHz/V
  1 MHz/V
- high v.h.f. band, channel S2
  channel S20
  7 MHz/V
  2 MHz/V
- u.h.f. band, channel E21
  channel E69
  22 MHz/V
  5 MHz/V

Frequencies

Frequency ranges
- low v.h.f. band
- high v.h.f. band
- u.h.f. bands

Intermediate frequencies
picture
38,9 MHz
sound
33,4 MHz

The oscillator frequency is higher than the aerial signal frequency.

Wanted signal characteristics

Input impedance
75 \( \Omega \)

V.S.W.R. and reflection coefficient
(values between picture and sound carrier, as well as values at picture carrier)

<table>
<thead>
<tr>
<th>v.s.w.r.</th>
<th>at nominal gain</th>
<th>during gain control</th>
</tr>
</thead>
<tbody>
<tr>
<td>v.h.f.</td>
<td>max. 4,5</td>
<td>max. 5</td>
</tr>
<tr>
<td>u.h.f.</td>
<td>max. 5</td>
<td>max. 7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>reflection coefficient</th>
<th>max. 63%</th>
<th>max. 69%</th>
</tr>
</thead>
<tbody>
<tr>
<td>v.h.f.</td>
<td>max. 66%</td>
<td>max. 75%</td>
</tr>
<tr>
<td>u.h.f.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**ELECTRICAL DATA (continued)**

**R.F. curves, bandwidth**
- low v.h.f. band
- high v.h.f. band
- u.h.f. bands

Typical bandwidths are:
- **typ. 10 MHz** for low v.h.f.
- **typ. 13 MHz** for high v.h.f.
- **typ. 18 MHz** for u.h.f.

On any channel, the amplitude difference between the top of the r.f. resonant curve and the picture frequency, the sound frequency, or any frequency between them will not exceed 3 dB at nominal gain, and 4 dB in the a.g.c. range between nominal gain and 20 dB gain reduction.

**A.G.C. range**
- **v.h.f.**
- **u.h.f.**

Minimum gain levels are:
- **min. 40 dB**
- **min. 30 dB**

**Power gain (see also Measuring method of power gain)**
- **v.h.f. bands** (channels S2 to S4 excluded)
  - channels S2 and S3
  - channel S4
  - channel E3
  - channel E5
  - channel E12
  - u.h.f. bands
  - channel E21
  - channel E40
  - channel E69

Minimum gain levels are:
- **min. 20 dB**
- **min. 17 dB**
- **min. 19 dB**
- **typ. 27 dB**
- **typ. 27 dB**
- **min. 16 dB**
- **typ. 28 dB**
- **typ. 27 dB**
- **typ. 26 dB**

**Maximum gain difference**
- between any two v.h.f. channels
- between any two u.h.f. channels
- between any v.h.f. and u.h.f. channel

Typical gain differences are:
- **typ. 8 dB**
- **typ. 4 dB**
- **typ. 8 dB**

**Noise figure**
- **v.h.f. bands**
  - E channels
  - S channels
  - channel E3
  - channel E5
  - channel E12
  - u.h.f. bands
  - channel E21
  - channel E40
  - channel E69

Maximum noise figure levels are:
- **max. 8 dB**
- **max. 10 dB**
- **typ. 5 dB**
- **typ. 5 dB**
- **typ. 6 dB**
- **max. 13 dB**
- **typ. 7 dB**
- **typ. 7 dB**
- **typ. 8 dB**

**Overloading**
- **Input signal producing 1 dB gain compression at nominal gain**
  - **v.h.f.**
  - **u.h.f.**

Typical overloading levels are:
- **typ. 90 dB (µV) into 75 Ω**
- **typ. 90 dB (µV) into 75 Ω**

- **Input signal producing either a detuning of the oscillator of +300 kHz or -1000 kHz or stopping of the oscillations at nominal gain**
  - **v.h.f.**
  - **u.h.f.**

Typical overloading levels are:
- **typ. 100 dB (µV) into 75 Ω**
- **typ. 100 dB (µV) into 75 Ω**

December 1986
V.H.F./U.H.F. television tuners

Unwanted signal characteristics

Image rejection (measured at picture carrier frequency)

- v.h.f. bands
- u.h.f. bands, except channels E61 to E69
- channels E61 to E69

I.F. rejection (measured at picture carrier frequency)

- low v.h.f., except channel E2
- channel E2
- high v.h.f.
- u.h.f.

Note: At colour sub-carrier frequency maximum 6 dB less rejection

Cross modulation

Input signal producing 1% cross modulation, i.e. 1% of the modulation depth of the interfering signal is transferred to the wanted signal.

In channel cross modulation (wanted signal: picture carrier frequency; interfering signal: sound carrier frequency)

- v.h.f. bands
  - at nominal gain (wanted input level 60 dB (µV))
  - at 40 dB gain reduction (wanted input level 100 dB (µV))

- u.h.f. bands
  - at nominal gain (wanted input level 60 dB (µV))
  - at 30 dB gain reduction (wanted input level 90 dB (µV))

In band cross modulation (wanted signal: picture carrier of channel N; interfering signal: picture carrier of channel N ± 2 for low v.h.f., or channel N ± 3 for high v.h.f., or channel N ± 5 for u.h.f.)

- v.h.f. bands
  - at nominal gain (wanted input level 60 dB (µV))
  - at 40 dB gain reduction (wanted input level 100 dB (µV))

- u.h.f. bands
  - at nominal gain (wanted input level 60 dB (µV))
  - at 30 dB gain reduction (wanted input level 90 dB (µV))

Out of band cross modulation at nominal gain

- low v.h.f., interfering from high v.h.f.
- low v.h.f., interfering from u.h.f.
- high v.h.f., interfering from low v.h.f.
- high v.h.f., interfering from u.h.f.
- u.h.f. interfering from low v.h.f.
- u.h.f. interfering from high v.h.f.

Unwanted signal handling capability (visibility test)

For the channel combinations

- v.h.f.: N ± 1, N ± 5, N + 11
- u.h.f.: N ± 1, N ± 5, N + 9

The tuner meets the requirements of “Amtsblatt” DBP69/1981, item 5.1.2., when measured in an adequate TV receiver. The a.g.c. circuit of the TV receiver has to be adjusted with an input signal of 74 dB (µV) on channel E60 in such a way, that the gain of the tuner is decreased by 10 dB.
ELECTRICAL DATA (continued)

Oscillator characteristics

Pulling
Input signal of tuned frequency producing a shift of the oscillator frequency of 10 kHz, at nominal gain
v.h.f. bands
typ. 85 dB (μV) into 75 Ω
u.h.f. bands
typ. 85 dB (μV) into 75 Ω

Shift of oscillator frequency at a change of the supply voltage of 5%
v.h.f. bands
max. 400 kHz
u.h.f. bands
max. 500 kHz

When using the supply circuit of Fig. 12 an additional oscillator frequency shift will occur during a.g.c.
v.h.f. bands
max. 150 kHz
u.h.f. bands
max. 150 kHz

Drift of oscillator frequency
during warm-up time (after the tuner has been completely out of operation for 15 min, measured between 5 s and 15 min after switching on)
during warm-up time (after the input stage is in operation for 15 min, measured between 2 s and 15 min after band switching)
at a change of the ambient temperature from +25 to +40 °C (measured after 3 cycles from +25 to +55 °C)
v.h.f. bands
max. 500 kHz
u.h.f. bands
max. 500 kHz

at a change of humidity from 60 ± 15% to 93 ± 2%, at \( T_{amb} = 25 \pm 5 \) °C
low v.h.f.
max. 500 kHz
high v.h.f.
max. 1500 kHz
u.h.f., channel E21
max. 1500 kHz
u.h.f., channel E69
max. 3000 kHz

Frequency divider characteristics of version UV418

Supply voltage
+5 V ± 5%

Current drawn from +5 V supply
max. 35 mA; typ. 25 mA

Output voltage, unloaded, at terminals 12 and 13 with 820 Ω load
min. 0.7 V p-p
min. 0.3 V p-p

Output imbalance
typ. 0.1 V

Interference signal on the i.f. output
max. 3 μV

Note: I.F. output of the tuner terminated with the circuit shown in Fig. 10.
I.F. circuit characteristics

Bandwidth of i.f. output circuit $5,5 \pm 1$ MHz

Note: I.F. output of the tuner terminated with the circuit shown in Fig. 4; tuning voltage 25 V; u.h.f. band switched on.

Bandwidth variation of i.f. output circuit as a result of r.f. tuning and band switching (reference: u.h.f.; tuning voltage 25 V; a.g.c. voltage 1 V; i.f. output circuit adjusted to 36,15 MHz) max. 500 kHz

Note: I.F. output of the tuner terminated with a modified circuit of Fig. 4, i.e. a 100 pF capacitor is connected in parallel with the i.f. output of the tuner.

Minimum tuning range of i.f. output coil 33 to 40 MHz

Note: I.F. output of the tuner terminated with the circuit shown in Fig. 4.

Attenuation between i.f. injection point and i.f. output of the tuner typ. 16 dB

Miscellaneous

Radio interference

Oscillator radiation and oscillator voltage at the aerial terminal Within the limits of C.I.S.P.R. 13 (1975) and VDE 0872/7.72 and Amtsblatt DBP69/1981, when applying the tuner in an adequate TV receiver.

Microphonics

There will be no microphonics, provided the tuner is installed in a professional manner.

Surge protection

Protection against voltages max. 5 kV

Note: 10 discharges of a 470 pF capacitor into the aerial terminal.

Protection against flashes max. 30 kV, 400 mWs

Note: A flashover circuit producing flashes with frequencies of 1 to 20 Hz for 30 s is connected to the aerial terminal.
ADDITIONAL INFORMATION

I.F. injection
An i.f. signal from a generator with an internal resistance of 50 Ω or 75 Ω should be connected to the i.f. injection point at the top of the tuner (see Fig. 2) via a resistor of 68 Ω. The u.h.f. band should be switched on; tuning voltage should be 25 V, a.g.c. voltage 1 V.

Measuring method of power gain
The i.f. output of the tuner should be terminated with the RC-circuit given in Fig. 4.

![Fig. 5.](image)

The RC-circuit roughly matches the i.f. output impedance to 75 Ω at the resonant frequency of the i.f. output circuit, which should be tuned to 36.15 MHz; the bandwidth is approx. 5.5 MHz (Fig. 5). Because the input and output impedances of the tuner are now 75 Ω, the power gain can be measured in the conventional manner by inserting tuner and RC-circuit between a 75 Ω source and a 75 Ω detector.

Alignment of the i.f. output coil
The i.f. output coil should be adjusted with a plastic tool which has a cross head as shown in Fig. 6. A suitable tool for automatic alignment is available under catalogue number 8104 004 11040.

![Fig. 6.](image)
V.H.F./U.H.F. TELEVISION TUNER

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Systems</th>
<th>C.C.I.R. systems M and N (R.T.M.A.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channels</td>
<td></td>
</tr>
<tr>
<td>low v.h.f.</td>
<td>A2 to A6</td>
</tr>
<tr>
<td>high v.h.f.</td>
<td>A7 to A13</td>
</tr>
<tr>
<td>u.h.f.</td>
<td>A14 to A83</td>
</tr>
<tr>
<td>Intermediate frequencies</td>
<td></td>
</tr>
<tr>
<td>picture</td>
<td>45,75 MHz</td>
</tr>
<tr>
<td>sound</td>
<td>41,25 MHz</td>
</tr>
</tbody>
</table>

APPLICATION

This tuner is designed to cover the v.h.f. and u.h.f. channels of C.C.I.R. systems M and N (R.T.M.A.). It can be provided with a frequency divider, which makes this tuner suitable for digital tuning systems based on frequency synthesis.
DESCRIPTION

The UV431 is a combined v.h.f./u.h.f. tuner with electronic tuning and band switching, covering the low v.h.f. band (frequency range 55.25 to 83.25 MHz), the high v.h.f. band (frequency range 175.25 to 211.25 MHz), and the u.h.f. band (frequency range 471.25 to 885.25 MHz).

Mechanically, the tuner is built on a low-loss printed-wiring board, carrying all components, in a metal housing made of a rectangular frame and front and rear covers (see Fig. 2). The common phono aerial connector (v.h.f. and u.h.f.) is on one of the frame sides, all other connections (supply voltages, a.g.c. voltage, tuning and switching voltages, i.f. output) are made via terminals in the underside. The mounting method is shown in Fig. 3.

Electrically, the tuner consists of a v.h.f. and a u.h.f. part. The v.h.f. aerial signal is fed via low pass, high pass, i.f. and f.m. suppression filters to a switchable single tuned input circuit for low and high v.h.f. operation, which is capacitively coupled to the gate 1 of a MOS-FET tetrode (with internal gate protection against surge). The drain load of the MOS-FET tetrode is formed by a double tuned, switchable bandpass filter, transferring the r.f. signal to the emitter of the mixer transistor. The oscillator signal is also fed to the emitter of the mixer transistor.

The collector circuit of the mixer transistor is a single tuned i.f. resonant circuit, at the low end of which the i.f. signal is coupled out of the tuner. A test point (terminal 4) is provided for i.f. injection to align the i.f. output circuit of the tuner together with the i.f. amplifier of the television receiver. An additional test point, which is accessible through a hole in the top of the tuner, is connected to the collector of the mixer transistor.

The single tuned input, the r.f. band pass filter and oscillator circuits are tuned by 4 tuning diodes; band switching is achieved by 5 switching diodes.

The u.h.f. part of the tuner consists of a fixed double tuned band pass filter with a built-in protection diode against surge which is connected to gate 1 of an input MOSFET tetrode (with internal gate protection against surge). The drain load of this MOSFET tetrode is formed by a double tuned circuit transferring the r.f. signal to the Schottky barrier mixer diode. The i.f. signal from the mixer diode is amplified by the v.h.f. mixer transistor, now operating as an i.f. amplifier.

The r.f. band pass filter and oscillator circuits are tuned by 3 tuning diodes.

In all bands the tuner is gain controlled via gate 2 of the input MOSFET tetrodes.
Fig. 1.
MECHANICAL DATA

Dimensions in mm

Fig. 2a

Fig. 2b I.F. output coil.
Torque for alignment: 2 to 15 mNm.  
Press-through force: ≥ 10 N.

Terminal
1 = aerial
2 = supply voltage, low v.h.f., +12 V
3 = supply voltage, high v.h.f., +12 V
4 = supply voltage, u.h.f., +12 V, i.f. injection
5 = a.g.c. voltage, +9.2 to +0.85 V
6 = supply voltage, v.h.f. and u.h.f., +12 V
7 = tuning voltage, +1 to +28 V
9 = i.f. output
10 = earth
Mass  approx. 125 g.

Mounting
The tuner may be mounted by soldering it on to a printed-wiring board, using the piercing diagram shown in Fig. 3. (The tuner may also be mounted by means of a bracket. Information will be supplied upon request.)

It is recommended that the tuner be installed in the cool part of the receiver cabinet and not exposed to the vibrations of the loudspeaker. There are no restrictions on orientation.

The solderability of the terminals and mounting tabs is according to IEC 68-2, test Ta (230 ± 10 °C, 2 ± 0,5 s). The resistance to soldering heat is according to IEC 68-2, test Tb (260 ± 5 °C, 10 ± 1 s).

Fig. 3  Piercing diagram viewed from solder side of board.
Unless otherwise stated the tolerance is ± 0,05 mm.

Marking
The tuner is provided with a label showing the following data:
- type number UV 431
- catalogue number 3112 127 43630
- code for factory of origin
- change code
- code for year and week of production
ELECTRICAL DATA

Unless otherwise specified all electrical values apply at an ambient temperature of 25 ± 5 °C, a relative humidity of 60 ± 15%, a supply voltage of 12 ± 0,3 V and an a.g.c. voltage of 9,2 ± 0,2 V.

General

Semiconductors, v.h.f. bands
- r.f. amplifier: BF982
- mixer: BF324
- oscillator: BF926
- tuning diodes: 4 x BB809
- switching diodes: 5 x BA482/483/484
- d.c. blocking diodes: 2 x BAW62

Semiconductors, u.h.f. bands
- r.f. amplifier: BF980
- oscillator: BF970
- mixer: ISS99
- tuning diodes: 3 x BB405B
- surge protection diodes: BAV10

Ambient temperature range
- operating: 0 to + 55 °C
- storage: -25 to + 70 °C

Relative humidity
- max. 95%

Voltages and currents

Supply voltage
- +12 V ± 10%*

Current drawn from +12 V supply
- low and high v.h.f.
  - max. 55 mA; typ. 42 mA
- u.h.f.
  - max. 50 mA; typ. 42 mA

Bandswitching

For operation in all bands the supply voltage is permanently connected to terminal 6. Additionally the supply voltage is connected to:
- terminal 2 for low v.h.f. operation
- terminal 3 for high v.h.f. operation
- terminal 4 for u.h.f. operation

A.G.C. voltage (Figs 4, 5 and 6)
- voltage range: +9,2 to +0,85 V
- voltage at nominal gain: +9 ± 0,5 V
- voltage at 40 dB gain reduction
  - low v.h.f.: typ. 3,2 V
  - high v.h.f.: typ. 1,5 V
- voltage at 30 dB gain reduction
  - u.h.f.: typ. 1,4 V

Note: A.G.C. voltages between 0 and +10,5 V may be applied without risk of damage.

A.G.C. current
- max. 0,3 mA

Slope of a.g.c. characteristic,
- at the end of the specified a.g.c. range
  - v.h.f.: typ. 25 dB/V
  - u.h.f.: typ. 50 dB/V

* A tolerance of -15% on the supply voltage is admissible, if a deterioration of gain, noise figure, oscillator shift and oscillator drift is acceptable.
Tuning voltage range (Figs 7, 8 and 9) + 1 to + 28 V

Current drawn from 28 V tuning voltage supply
at $T_{\text{amb}} = 25$ °C and R.H. = 60% max. 0,5 μA
at $T_{\text{amb}} = 55$ °C and R.H. = 60% max. 2 μA
at $T_{\text{amb}} = 25$ °C and R.H. = 95% max. 2 μA

Note: The source impedance of the tuning voltage offered to terminal 7 must be maximum 47 kΩ.

Slope of tuning characteristic

<table>
<thead>
<tr>
<th>Type</th>
<th>Range</th>
<th>Typical Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>low v.h.f.</td>
<td>3 MHz/V</td>
<td></td>
</tr>
<tr>
<td>channel A2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>channel A6</td>
<td>2 MHz/V</td>
<td></td>
</tr>
<tr>
<td>high v.h.f.</td>
<td>6 MHz/V</td>
<td></td>
</tr>
<tr>
<td>channel A7</td>
<td>4 MHz/V</td>
<td></td>
</tr>
<tr>
<td>channel A13</td>
<td>21 MHz/V</td>
<td></td>
</tr>
<tr>
<td>u.h.f.</td>
<td>4 MHz/V</td>
<td></td>
</tr>
<tr>
<td>channel A14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>channel A83</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Frequencies

Frequency ranges

<table>
<thead>
<tr>
<th>Type</th>
<th>Range</th>
<th>Channel</th>
<th>Carrier Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>low v.h.f.</td>
<td></td>
<td>channel A2 to A6</td>
<td>55,25 MHz to 83,25 MHz</td>
</tr>
<tr>
<td>high v.h.f.</td>
<td></td>
<td>channel A7 to A13</td>
<td>175,25 MHz to 211,25 MHz</td>
</tr>
<tr>
<td>u.h.f.</td>
<td></td>
<td>channel A14 to A83</td>
<td>471,25 MHz to 885,25 MHz</td>
</tr>
</tbody>
</table>

Intermediate frequencies

<table>
<thead>
<tr>
<th>Type</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>picture</td>
<td>45,75 MHz</td>
</tr>
<tr>
<td>sound</td>
<td>41,25 MHz</td>
</tr>
</tbody>
</table>

The oscillator frequency is higher than the aerial signal frequency.

Wanted signal characteristics

Input impedance

75 Ω

V.S.W.R. and reflection coefficient
(values between picture and sound carrier, as well as values at picture carrier)

<table>
<thead>
<tr>
<th>Type</th>
<th>At Nominal Gain</th>
<th>During Gain Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>v.s.w.r.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>v.h.f.</td>
<td>max. 5</td>
<td>max. 5</td>
</tr>
<tr>
<td>u.h.f., channels A14 to A73</td>
<td>max. 5</td>
<td>max. 7</td>
</tr>
<tr>
<td>channels A74 to A83</td>
<td>max. 5</td>
<td>max. 8</td>
</tr>
<tr>
<td>reflection coefficient</td>
<td></td>
<td></td>
</tr>
<tr>
<td>v.h.f.</td>
<td>max. 66%</td>
<td>max. 66%</td>
</tr>
<tr>
<td>u.h.f., channels A14 to A73</td>
<td>max. 66%</td>
<td>max. 75%</td>
</tr>
<tr>
<td>channels A74 to A83</td>
<td>max. 66%</td>
<td>max. 78%</td>
</tr>
</tbody>
</table>

R.F. curves, bandwidth

<table>
<thead>
<tr>
<th>Type</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>low v.h.f.</td>
<td>typ. 10 MHz</td>
</tr>
<tr>
<td>high v.h.f.</td>
<td>typ. 12 MHz</td>
</tr>
<tr>
<td>u.h.f.</td>
<td>typ. 24 MHz</td>
</tr>
</tbody>
</table>
R.F. curves, tilt

on any channel the amplitude difference between the top of the r.f. resonant curve and the picture frequency, the sound frequency, or any frequency between them will not exceed 3 dB at nominal gain, and 4 dB in the a.g.c. range between nominal gain and 20 dB gain reduction.

A.G.C. range

<table>
<thead>
<tr>
<th></th>
<th>v.h.f.</th>
<th>u.h.f.</th>
</tr>
</thead>
<tbody>
<tr>
<td>min.</td>
<td>40 dB</td>
<td>30 dB</td>
</tr>
</tbody>
</table>

Power gain (see also Measuring method of power gain)

<table>
<thead>
<tr>
<th></th>
<th>v.h.f. bands</th>
<th>channel A4</th>
<th>channel A7</th>
<th>channel A13</th>
<th>u.h.f. bands</th>
<th>channel A14</th>
<th>channel A40</th>
<th>channel A83</th>
</tr>
</thead>
<tbody>
<tr>
<td>min.</td>
<td>22 dB</td>
<td>26 dB</td>
<td>26 dB</td>
<td>27 dB</td>
<td>20 dB</td>
<td>26 dB</td>
<td>26 dB</td>
<td>24 dB</td>
</tr>
<tr>
<td>typ.</td>
<td>26 dB</td>
<td>26 dB</td>
<td>26 dB</td>
<td>27 dB</td>
<td>20 dB</td>
<td>26 dB</td>
<td>26 dB</td>
<td>24 dB</td>
</tr>
</tbody>
</table>

Maximum gain difference

<table>
<thead>
<tr>
<th></th>
<th>between any two v.h.f. channels</th>
<th>typ.</th>
<th>4 dB</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>between any two u.h.f. channels</td>
<td>typ.</td>
<td>4 dB</td>
</tr>
<tr>
<td></td>
<td>between any v.h.f. and u.h.f. channel</td>
<td>typ.</td>
<td>6 dB</td>
</tr>
</tbody>
</table>

Noise figure

<table>
<thead>
<tr>
<th></th>
<th>v.h.f. bands, except channel A6</th>
<th>max.</th>
<th>7 dB</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>channel A6</td>
<td>max.</td>
<td>9 dB</td>
</tr>
<tr>
<td></td>
<td>channel A4</td>
<td>typ.</td>
<td>5 dB</td>
</tr>
<tr>
<td></td>
<td>channel A7</td>
<td>typ.</td>
<td>5 dB</td>
</tr>
<tr>
<td></td>
<td>channel A13</td>
<td>typ.</td>
<td>5 dB</td>
</tr>
<tr>
<td></td>
<td>u.h.f. bands</td>
<td>max.</td>
<td>10 dB</td>
</tr>
<tr>
<td></td>
<td>channel A14</td>
<td>typ.</td>
<td>5 dB</td>
</tr>
<tr>
<td></td>
<td>channel A40</td>
<td>typ.</td>
<td>5.5 dB</td>
</tr>
<tr>
<td></td>
<td>channel A83</td>
<td>typ.</td>
<td>7 dB</td>
</tr>
</tbody>
</table>

Overloading

Input signal producing 1 db gain

<table>
<thead>
<tr>
<th></th>
<th>compression at nominal gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>v.h.f.</td>
<td>typ. 90 dB (μV) into 75 Ω</td>
</tr>
<tr>
<td>u.h.f.</td>
<td>typ. 90 dB (μV) into 75 Ω</td>
</tr>
</tbody>
</table>

Input signal producing either a detuning of the oscillator of + 300 kHz or −1000 kHz or stopping of the oscillations at nominal gain

<table>
<thead>
<tr>
<th></th>
<th>v.h.f.</th>
<th>typ. 100 dB (μV) into 75 Ω</th>
</tr>
</thead>
<tbody>
<tr>
<td>u.h.f.</td>
<td></td>
<td>typ. 100 dB (μV) into 75 Ω</td>
</tr>
</tbody>
</table>

Unwanted signal characteristics

Image rejection (measured at picture carrier frequency)

<table>
<thead>
<tr>
<th></th>
<th>v.h.f.</th>
<th>min. 60 dB; typ. 70 dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>u.h.f.</td>
<td></td>
<td>min. 40 dB; typ. 50 dB</td>
</tr>
</tbody>
</table>
I.F. rejection (measured at picture carrier frequency)

- low v.h.f.
  - channel A2: min. 45 dB
  - channels A3 to A6: min. 50 dB
- high v.h.f.
  - min. 60 dB
- u.h.f.
  - min. 60 dB

Note: At colour sub-carrier frequency maximum 6 dB less rejection.

F.M. rejection, low v.h.f.
Level of an f.m. signal of 91.5 MHz which produces an i.f. signal (47.75 MHz) 57 dB below the level of the wanted picture carrier

- channel A2: typ. 100 dB (μV)
- channel A4: typ. 100 dB (μV)
- channel A6: typ. 60 dB (μV)

F.M. rejection, high v.h.f.
Level of an f.m. signal between 88 and 105 MHz, which produces an i.f. interfering (45.75 MHz) 57 dB below the level of the wanted picture carrier. Level of input picture carrier is 60 dBμV

- channel A8: typ. 95 dB (μV)
- channel A11: typ. 92 dB (μV)
- channel A13: typ. 95 dB (μV)

Channel A6 colour beat
The colour beat is an interference at 42 MHz from picture and sound carrier signals of channel A6 with the oscillator signal (input levels of picture/sound carrier signals 54 dB(μV); tuner operated at nominal gain).

Rejection below IF picture carrier of 45.75 MHz: typ. 45 dB

N ± 7 rejection (for u.h.f. only)
Interference signal for an interference ratio of 53 dB referred to wanted picture carrier (wanted signal 60 dB (μV); tuner operating at nominal gain): typ. 65 dB (μV) into 75 Ω
Cross modulation
Input signal producing 1% cross modulation, i.e. 1% of the modulation depth of the interfering signal is transferred to the wanted signal.

In channel cross modulation (wanted signal: picture carrier frequency; interfering signal: sound carrier frequency)

**v.h.f. bands**
- at nominal gain (wanted input level 60 dB (µV)) typ. 76 dB (µV) into 75 Ω
- at 40 dB gain reduction (wanted input level 100 dB (µV)) typ. 94 dB (µV) into 75 Ω

**u.h.f. bands**
- at nominal gain (wanted input level 60 dB (µV)) typ. 74 dB (µV) into 75 Ω
- at 30 dB gain reduction (wanted input level 90 dB (µV)) typ. 88 dB (µV) into 75 Ω

In band cross modulation (wanted signal: picture carrier of channel N; interfering signal: picture carrier of channel N ± 2 for low v.h.f., or channel N ± 3 for high v.h.f., or channel N ± 5 for u.h.f.)

**v.h.f. bands**
- at nominal gain (wanted input level 60 dB (µV)) typ. 88 dB (µV) into 75 Ω
- at 40 dB gain reduction (wanted input level 100 dB (µV)) typ. 100 dB (µV) into 75 Ω

**u.h.f. bands**
- at nominal gain (wanted input level 60 dB (µV)) typ. 82 dB (µV) into 75 Ω
- at 30 dB gain reduction (wanted input level 90 dB (µV)) typ. 88 dB (µV) into 75 Ω

Out of band cross modulation at nominal gain
- low v.h.f., interfering from high v.h.f. typ. 100 dB (µV) into 75 Ω
- low v.h.f., interfering from u.h.f. typ. 100 dB (µV) into 75 Ω
- high v.h.f., interfering from low v.h.f. typ. 100 dB (µV) into 75 Ω
- high v.h.f., interfering from u.h.f. typ. 100 dB (µV) into 75 Ω
- u.h.f. interfering from low v.h.f. typ. 94 dB (µV) into 75 Ω
- u.h.f. interfering from high v.h.f. typ. 86 dB (µV) into 75 Ω

Oscillator characteristics

Pulling:
Input signal of tuned frequency producing a shift of the oscillator frequency of 10 kHz, at nominal gain
- low v.h.f. typ. 88 dB (µV) into 75 Ω
- high v.h.f. typ. 86 dB (µV) into 75 Ω
- u.h.f. typ. 80 dB (µV) into 75 Ω

Shift of oscillator frequency at a charge of the supply voltage of 5%
**v.h.f. bands**
- channels A14 to A73 max. 200 kHz
- channels A74 to A83 max. 400 kHz

**u.h.f. bands**
- max. 800 kHz
Drift of oscillator frequency
during warm-up time (after the tuner has been
completely out of operation for 15 min, measured
between 5 s and 15 min after switching on)
during warm-up time (after the input stage is in
operation for 15 min, measured between 2 s and
15 min after band switching)
at a change of the ambient temperature from
+25 to +50 °C (measured after 3 cycles
from +25 to +55 °C)
at a change of humidity from 60 ± 15% to 93 ± 2%
(measured at $T_{amb} = 25 ± 5$ °C)
v.h.f. max. 250 kHz
u.h.f. max. 250 kHz
max. 600 kHz
max. 600 kHz
max. 1000 kHz

I.F. circuit characteristics

Bandwidth of i.f. output circuit

5 ± 1 MHz

Note: I.F. output of the tuner terminated with the circuit shown in Fig. 10; tuning voltage 10 V;
u.h.f. band switched on.

Bandwidth variation of i.f. output circuit as a result
of r.f. tuning and band switching (reference: u.h.f.;
tuning voltage 10 V; i.f. output circuit adjusted to
43,5 MHz)
max. 650 kHz

Note: I.F. output of the tuner terminated with a modified circuit of Fig. 10, i.e. a 100 pF capacitor is
connected in parallel with the i.f. output of the tuner.

![Diagram of i.f. output circuit](image)

Fig. 10.

Detuning of the i.f. output circuit as a result of r.f.
tuning and band switching (reference: u.h.f.;
tuning voltage 10 V; i.f. output circuit adjusted
to 43,5 MHz)
max. 650 kHz

Note: I.F. output of the tuner terminated with a modified circuit of Fig. 10, i.e. a 100 pF capacitor is
connected in parallel with the i.f. output of the tuner.

Minimum tuning range of i.f. output coil
41 to 47 MHz

Note: I.F. output of the tuner terminated with the circuit shown in Fig. 10. The tuner is supplied with
the i.f. output circuit adjusted to 43,5 ± 1 MHz.

Attenuation between i.f. injection point
and i.f. output of the tuner

16 dB
Miscellaneous
Radio interference
Oscillator radiation and oscillator voltage at the aerial terminal

Within the limits of C.I.S.P.R. 13 (1975)

Microphonics

There will be no microphonics, provided the tuner is installed in a professional manner.

Surge protection
Protection against voltages
max. 5 kV

Note: 10 discharges of a 470 pF capacitor into the aerial terminal.

Protection against flashes
max. 30 kV, 400 mWs

Note: A flashover circuit producing flashes with frequencies of 1 to 20 Hz for 30 s is connected to the aerial terminal.

ADDITIONAL INFORMATION

I.F. injection
Terminal 4 (supply voltage u.h.f.) can be used as i.f. injection point, provided the u.h.f. supply voltage is applied to terminal 4 via a resistor of 10 Ω (see Fig. 11). The u.h.f. band should be switched on; tuning voltage should be 2 V.

![Fig. 11. Connection of the i.f. amplifier](image)

- By means of a print track as short as possible.
- By means of a shielded track, e.g. a coaxial cable.

Connection of supply voltages

![Fig. 12.](image)
Measuring method of power gain

The i.f. output of the tuner should be terminated with the RC-circuit given in Fig. 10.

![Fig. 10](image)

The RC-circuit roughly matches the i.f. output impedance to 75 Ω at the resonant frequency of the i.f. output circuit which should be tuned to 43.5 MHz; the bandwidth is approx. 5 MHz (Fig. 13).

Because the input and output impedances of the tuner are now 75 Ω, the power gain can be measured in the conventional manner by inserting tuner and RC-circuit between a 75 Ω source and a 75 Ω detector.

Measurement of bandwidth variation and detuning of i.f. output circuit

A sweep signal of 30 to 50 MHz from a frequency sweep generator is connected to the i.f. injection point via a capacitor of 0.5 pF. The coaxial cable is terminated with 75 Ω.

Alignment of the i.f. output coil

The i.f. output coil should be adjusted with a brass tool with a blade as shown in Fig. 14. A suitable tool is available under catalogue number 7122 005 47680.

![Fig. 14](image)
### TESTS AND REQUIREMENTS

<table>
<thead>
<tr>
<th>IEC 68-2</th>
<th>test</th>
<th>procedure</th>
<th>requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ab</td>
<td>cold</td>
<td>$-25 , ^\circ\text{C}, , 96 , h$</td>
<td>Checked within 10 min after all tests mentioned: no catastrophic failures</td>
</tr>
<tr>
<td>Bb</td>
<td>dry heat</td>
<td>$+ , 70 , ^\circ\text{C}, , 96 , h$</td>
<td></td>
</tr>
<tr>
<td>Db</td>
<td>damp heat, cyclic</td>
<td>$+ , 25 , \text{to} , + , 40 , ^\circ\text{C}$, R.H. 90 to 100% 21 cycles of 24 h</td>
<td>After 1 h reconditioning under normal conditions: change of osc. freq.</td>
</tr>
<tr>
<td>Ca</td>
<td>damp heat, steady state</td>
<td>$+ , 40 , ^\circ\text{C}, , \text{R.H.} , 93%$ 21 days</td>
<td>low v.h.f. $\leq 1,5 , \text{MHz}$, high v.h.f. $\leq 2 , \text{MHz}$</td>
</tr>
<tr>
<td>Na</td>
<td>rapid change of temperature</td>
<td>3h $-25 , ^\circ\text{C}/3h + 70 , ^\circ\text{C}$ 5 cycles</td>
<td>change of power gain $\leq 2 , \text{dB}$</td>
</tr>
<tr>
<td>Fc</td>
<td>vibration</td>
<td>10-55-10 Hz, amplitude 0,35 mm 3 directions 30 min per direction</td>
<td>change of tilt r.f. curve $\leq 2 , \text{dB}$</td>
</tr>
<tr>
<td>Eb</td>
<td>bump</td>
<td>1000 bumps, acceleration 25g, in 6 directions</td>
<td>change of tuning current $\leq 0,5 , \mu\text{A}$</td>
</tr>
<tr>
<td>Ea</td>
<td>shock</td>
<td>half sine pulse 11 ms, acceleration 50g in 6 directions 3 times per direction</td>
<td></td>
</tr>
</tbody>
</table>
V.H.F./U.H.F. TELEVISION TUNERS

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Systems</th>
<th>C.C.I.R. systems B and G</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channels *</td>
<td></td>
</tr>
<tr>
<td>low v.h.f. band</td>
<td>0 to 4</td>
</tr>
<tr>
<td>high v.h.f. band</td>
<td>5 to 11</td>
</tr>
<tr>
<td>u.h.f. bands</td>
<td>28 to 63</td>
</tr>
<tr>
<td>Intermediate frequencies</td>
<td></td>
</tr>
<tr>
<td>picture</td>
<td>38,875 MHz</td>
</tr>
<tr>
<td>sound</td>
<td>31,375 MHz</td>
</tr>
</tbody>
</table>

APPLICATION

Designed to cover the Australian v.h.f. and u.h.f. channels of C.C.I.R. systems B and G.

The tuners UV462 are equipped with a frequency divider, which makes them suitable for digital tuning systems based on frequency synthesis; for the remainder they are equal to type UV461.

Available versions

<table>
<thead>
<tr>
<th></th>
<th>aerial input connector</th>
<th>frequency divider (IC)</th>
<th>division ratio</th>
<th>catalogue number</th>
</tr>
</thead>
<tbody>
<tr>
<td>UV461</td>
<td>phono</td>
<td>-</td>
<td>-</td>
<td>3122 127 48460</td>
</tr>
<tr>
<td>UV461/IEC</td>
<td>IEC</td>
<td>-</td>
<td>-</td>
<td>3122 237 00020</td>
</tr>
<tr>
<td>UV462/256</td>
<td>phono</td>
<td>8-pin</td>
<td>256</td>
<td>3122 237 00030</td>
</tr>
<tr>
<td>UV462/256/IEC</td>
<td>IEC</td>
<td>8-pin</td>
<td>256</td>
<td>3122 237 00040</td>
</tr>
</tbody>
</table>

* In accordance with the publications of the Australian Broadcasting Control Board (A.B.C.B.).

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DESCRIPTION

The UV461 and UV462 are combined v.h.f./u.h.f. tuners with electronic tuning and band switching, covering the low v.h.f. band including the New Zealand channel 1, and the Italian channel C (frequency range 44 to 92 MHz), the high v.h.f. band including the Morocco channel M4 (frequency range 162 to 230 MHz), and the u.h.f. band (frequency range 470 to 861 MHz).

Mechanically, the tuner is built on a low-loss printed-wiring board, carrying all components, in a metal housing made of a rectangular frame and front and rear covers (see Fig. 2). The common 75 Ω phono or IEC aerial connector (v.h.f. and u.h.f.) is on one of the frame sides, all other connections (supply voltages, a.g.c. voltage, tuning and switching voltages, i.f. output) are made via terminals in the underside. The mounting method is shown in Fig. 3.

Electrically, the tuner consists of v.h.f. and u.h.f. parts. The v.h.f. aerial signal is fed via switchable low and high v.h.f. wide band input filters to gate 1 of an input MOSFET tetrode (with internal gate protection against surge).

The input filters are provided with an i.f. suppression circuit. The drain load of the MOSFET tetrode is formed by a double tuned switchable bandpass filter, transferring the r.f. signal to the emitter of the mixer transistor. The oscillator signal is also fed to the emitter of the mixer transistor.

The collector circuit of the mixer transistor is a single tuned i.f. resonant circuit, at the low end of which the i.f. signal is coupled out of the tuner. A test point (terminal 4) is provided for i.f. injection to align the i.f. output circuit of the tuner together with the i.f. amplifier of the television receiver. An additional test point, which is accessible through a hole in the top of the tuner, is connected to the collector of the mixer transistor.

The r.f. band pass filter and oscillator circuits are tuned by 5 tuning diodes; band switching is achieved by 5 switching diodes.

The u.h.f. part of the tuner consists of a high-pass input circuit connected to gate 1 of an input MOSFET tetrode (with internal gate protection against surge). The drain load of this MOSFET tetrode is formed by a double tuned circuit transferring the r.f. signal to the Schottky barrier mixer diode. The i.f. signal from the mixer diode is amplified by the v.h.f. mixer transistor, now operating as an i.f. amplifier.

The r.f. band pass filter and oscillator circuits are tuned by 3 tuning diodes.

In all bands the tuner is gain controlled via gate 2 of the input MOSFET tetrodes.

The electrical circuit of the UV462 is extended with a frequency divider (division ratio of 256), which inputs are connected to the v.h.f. and u.h.f. oscillator. The complementary outputs are connected to terminals 12 and 13.
Fig. 1.
Terminal
1 = aerial
2 = supply voltage, low v.h.f., + 12 V
3 = supply voltage, high v.h.f., + 12 V
4 = supply voltage, u.h.f., + 12 V; i.f. injection
5 = a.g.c. voltage, + 9,2 to 0,85 V
6 = supply voltage, v.h.f. and u.h.f., + 12 V
7 = tuning voltage, + 1 to + 28 V
8 = i.f. output
9 = earth
10 = tuning voltage, + 1 to + 28 V
11 = balanced output voltage of frequency divider
12, 13 = balanced output voltage of frequency divider
14 = supply voltage, frequency divider, + 5 V

Dimensions in mm
**V.H.F./U.H.F. television tuners**

Fig. 2b I.F. output coil.
Torque for alignment: 2 to 15 mNm.
Press-through force: ≥ 10 N.

**Mass**
approx. 127 g

**Mounting**
The tuner may be mounted by soldering it on to a printed-wiring board, using the piercing diagram shown in Fig. 3. (The tuner may also be mounted by means of a bracket. Information will be supplied upon request). The tuner may be mounted anywhere in the receiver and there are no restrictions on orientation.

The solderability of the terminals and mounting tabs is according to IEC 68-2, test Ta (230 ± 10 °C, 2 ± 0,5 s). The resistance to soldering heat is according to IEC 68-2, test Tb (260 ± 5 °C, 10 ± 1 s).

---

(1) Only for UV462.

Fig. 3 Piercing diagram viewed from solder side of board.
Unless otherwise stated the tolerance is ± 0,05 mm.
ELECTRICAL DATA

Unless otherwise specified all electrical values apply at an ambient temperature of 25 ± 5 °C, a relative humidity of 60 ± 15%, a supply voltage of 12 ± 0,3 V and an a.g.c. voltage of 9,2 ± 0,2 V.

General

Semiconductors, v.h.f. bands
- r.f. amplifier: BF980
- mixer: BF324
- oscillator: BF926
- tuning diodes: 5 x BB909B
- switching diodes: 5 x BA482/483/484
- d.c. blocking diodes: 2 x IN4148

Semiconductors, u.h.f. bands
- r.f. amplifier: BF980
- oscillator: BF970
- mixer: 1SS99
- tuning diodes: 3 x OF643
- surge protection diodes: 1 x BAV10
- frequency divider: SP4653

Ambient temperature range
- operating: 0 to + 55 °C
- storage: -25 to + 70 °C

Relative humidity: max. 95%

Voltages and currents

Supply voltage: + 12 V ± 10%

Current drawn from + 12 V supply
- v.h.f. bands: max. 55 mA; typ. 39 mA
- u.h.f. bands: max. 50 mA; typ. 40 mA

Bandswitching

For operation in all bands the supply voltage is permanently connected to terminal 6. Additionally the supply voltage is connected to:
- terminal 2 for operation in the low v.h.f. band
- terminal 3 for operation in the high v.h.f. band
- terminal 4 for operation in the u.h.f. bands

A.G.C. voltage (Figs 4, 5 and 6)
- voltage range: + 9,2 to + 0,85 V
- voltage at nominal gain: + 9,2 ± 0,5 V
- voltage at 40 dB gain reduction
  - low v.h.f. band: typ. 3 V
  - high v.h.f. band: typ. 2 V
  - voltage at 30 dB gain reduction, u.h.f. bands: typ. 1,6 V

Note: A.G.C. voltages between 0 and + 10,5 V may be applied without risk of damage.

A.G.C. current: max. 0,3 mA

Slope of a.g.c. characteristic,
- at the end of the specified a.g.c. range
  - v.h.f. bands: typ. 25 dB/V
  - u.h.f. bands: typ. 50 dB/V
V.H.F./U.H.F. television tuners

Fig. 4 Typical a.g.c. characteristic, low v.h.f. band.

Fig. 5 Typical a.g.c. characteristic, high v.h.f. band.

Fig. 6 Typical a.g.c. characteristic, u.h.f. bands.
Fig. 7 Typical tuning characteristic, low v.h.f. band.

Fig. 8 Typical tuning characteristic, high v.h.f. band.

Fig. 9 Typical tuning characteristic, u.h.f. bands.
V.H.F./U.H.F. television tuners

Tuning voltage range (Figs 7, 8 and 9) + 1 to + 28 V

Current drawn from 28 V tuning voltage supply
at $T_{amb} = 25 \, ^\circ C$ max. 0,5 $\mu A$
at $T_{amb} = 55 \, ^\circ C$ max. 2 $\mu A$

Note: The source impedance of the tuning voltage offered to terminal 7 must be maximum 47 k$\Omega$.

Slope of tuning characteristic

<table>
<thead>
<tr>
<th>Band Type</th>
<th>Channel</th>
<th>Typical Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>low v.h.f.</td>
<td>channel 0</td>
<td>5 MHz/V</td>
</tr>
<tr>
<td></td>
<td>channel 2</td>
<td>4 MHz/V</td>
</tr>
<tr>
<td>high v.h.f.</td>
<td>channel 5A</td>
<td>8 MHz/V</td>
</tr>
<tr>
<td></td>
<td>channel 11</td>
<td>3 MHz/V</td>
</tr>
<tr>
<td>u.h.f. bands</td>
<td>channel 28</td>
<td>19 MHz/V</td>
</tr>
<tr>
<td></td>
<td>channel 63</td>
<td>10 MHz/V</td>
</tr>
</tbody>
</table>

Frequencies

Frequency ranges

channel 0 (picture carrier 46.25 MHz) to channel 5 (picture carrier 102.25 MHz).
Margin at the extreme channels: min. 1.5 MHz.
channel 5A (picture carrier 138.25 MHz) to channel 12 (picture carrier 224.25 MHz).
Margin at the extreme channels: min. 2 MHz.
channel 21 (picture carrier 471.25 MHz) to channel 69 (picture carrier 855.25 MHz).
Margin at the extreme channels: min. 3 MHz.

Intermediate frequencies

<table>
<thead>
<tr>
<th>Type</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>picture</td>
<td>36,875 MHz</td>
</tr>
<tr>
<td>sound</td>
<td>31,375 MHz</td>
</tr>
</tbody>
</table>

The oscillator frequency is higher than the aerial signal frequency.

Wanted signal characteristics

Input impedance

75 $\Omega$

V.S.W.R. and reflection coefficient
(values between picture and sound carrier, as well as values at picture carrier)

<table>
<thead>
<tr>
<th>Band Type</th>
<th>v.s.w.r.</th>
<th>Reflection Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>v.h.f. bands</td>
<td>max. 4</td>
<td>max. 60%</td>
</tr>
<tr>
<td>u.h.f. bands</td>
<td>max. 5</td>
<td>max. 66%</td>
</tr>
<tr>
<td>reflection</td>
<td>max. 5</td>
<td>max. 66%</td>
</tr>
<tr>
<td>coefficient</td>
<td>max. 7</td>
<td>max. 75%</td>
</tr>
</tbody>
</table>

R.F. curves, bandwidth

| Band Type       | Typ. | 
| low v.h.f. band | 10 MHz |
| high v.h.f. band | 12 MHz |
| u.h.f. bands    | 17 MHz |
R.F. curves, tilt

on any channel the amplitude difference between the top of the r.f. resonant curve and the picture frequency, the sound frequency, or any frequency between them will not exceed 3 dB at nominal gain, and 4 dB in the a.g.c. range between nominal gain and 20 dB gain reduction.

A.G.C. range

<table>
<thead>
<tr>
<th>Range</th>
<th>Min.</th>
<th>Typ.</th>
</tr>
</thead>
<tbody>
<tr>
<td>v.h.f. bands</td>
<td>40 dB</td>
<td>22 dB</td>
</tr>
<tr>
<td>u.h.f. bands</td>
<td>30 dB</td>
<td>22 dB</td>
</tr>
</tbody>
</table>

Power gain (see also Measuring method of power gain)

<table>
<thead>
<tr>
<th>Range</th>
<th>Min.</th>
<th>Typ.</th>
</tr>
</thead>
<tbody>
<tr>
<td>v.h.f. bands</td>
<td>20 dB</td>
<td>22 dB</td>
</tr>
<tr>
<td>channel 0</td>
<td></td>
<td>27 dB</td>
</tr>
<tr>
<td>channel 5</td>
<td></td>
<td>28 dB</td>
</tr>
<tr>
<td>channel 5A</td>
<td></td>
<td>27 dB</td>
</tr>
<tr>
<td>channel 11</td>
<td></td>
<td>29 dB</td>
</tr>
<tr>
<td>u.h.f. bands</td>
<td>20 dB</td>
<td>28 dB</td>
</tr>
<tr>
<td>channel 28</td>
<td></td>
<td>28 dB</td>
</tr>
<tr>
<td>channel 40</td>
<td></td>
<td>28 dB</td>
</tr>
<tr>
<td>channel 63</td>
<td></td>
<td>26 dB</td>
</tr>
</tbody>
</table>

Maximum gain difference

<table>
<thead>
<tr>
<th>Difference</th>
<th>Min.</th>
<th>Typ.</th>
</tr>
</thead>
<tbody>
<tr>
<td>between any two v.h.f. channels</td>
<td>3 dB</td>
<td>3 dB</td>
</tr>
<tr>
<td>between any two u.h.f. channels</td>
<td>3 dB</td>
<td>4 dB</td>
</tr>
<tr>
<td>between any v.h.f. and u.h.f. channel</td>
<td>3 dB</td>
<td>4 dB</td>
</tr>
</tbody>
</table>

Noise figure

<table>
<thead>
<tr>
<th>Range</th>
<th>Max.</th>
<th>Typ.</th>
</tr>
</thead>
<tbody>
<tr>
<td>v.h.f. bands</td>
<td>8 dB</td>
<td>5 dB</td>
</tr>
<tr>
<td>channel 0</td>
<td></td>
<td>5 dB</td>
</tr>
<tr>
<td>channel 5</td>
<td></td>
<td>4 dB</td>
</tr>
<tr>
<td>channel 5A</td>
<td></td>
<td>5,5 dB</td>
</tr>
<tr>
<td>channel 11</td>
<td></td>
<td>5,5 dB</td>
</tr>
<tr>
<td>u.h.f. bands</td>
<td>10 dB</td>
<td>6 dB</td>
</tr>
<tr>
<td>channel 28</td>
<td></td>
<td>6 dB</td>
</tr>
<tr>
<td>channel 40</td>
<td></td>
<td>6 dB</td>
</tr>
<tr>
<td>channel 63</td>
<td></td>
<td>7 dB</td>
</tr>
</tbody>
</table>

Overloading

Input signal producing 1 dB gain compression at nominal gain

<table>
<thead>
<tr>
<th>Range</th>
<th>Typ.</th>
</tr>
</thead>
<tbody>
<tr>
<td>v.h.f. bands</td>
<td>90 dB (µV) into 75 Ω</td>
</tr>
<tr>
<td>u.h.f. bands</td>
<td>90 dB (µV) into 75 Ω</td>
</tr>
</tbody>
</table>

Input signal producing either a detuning of the oscillator of + 300 kHz or −1000 kHz or stopping of the oscillations at nominal gain

<table>
<thead>
<tr>
<th>Range</th>
<th>Typ.</th>
</tr>
</thead>
<tbody>
<tr>
<td>v.h.f. bands</td>
<td>100 dB (µV) into 75 Ω</td>
</tr>
<tr>
<td>u.h.f. bands</td>
<td>100 dB (µV) into 75 Ω</td>
</tr>
</tbody>
</table>
Unwanted signal characteristics

Image rejection (measured at picture carrier frequency)
- **v.h.f. bands**: min. 60 dB; typ. 70 dB
- **u.h.f. bands, channels 21 to 27**: min. 40 dB; typ. 46 dB
- **channels 28 to 62**: min. 44 dB; typ. 53 dB
- **channels 63 to 69**: min. 40 dB; typ. 46 dB

I.F. rejection (measured at picture carrier frequency)
- **v.h.f. bands**: min. 60 dB
- **u.h.f. bands**: min. 60 dB

**Note:** At colour sub-carrier frequency maximum 6 dB less rejection.

**N ± 4 rejection (for u.h.f. only)**
Interference signal for an interference ratio of 47 dB referred to wanted picture carrier (picture to sound carrier ratio of 10 dB; wanted signal 60 dB (μV); tuner operating at nominal gain)

- **typ. 70 dB (μV) into 75 Ω**

Cross modulation
Input signal producing 1% cross modulation, i.e. 1% of the modulation depth of the interfering signal is transferred to the wanted signal.

In channel cross modulation (wanted signal: picture carrier frequency; interfering signal: sound carrier frequency)
- **v.h.f. bands**
  - at nominal gain (wanted input level 60 dB (μV)): typ. 74 dB (μV) into 75 Ω
  - at 40 dB gain reduction (wanted input level 60 dB (μV)): typ. 94 dB (μV) into 75 Ω
- **u.h.f. bands**
  - at nominal gain (wanted input level 60 dB (μV)): typ. 74 dB (μV) into 75 Ω
  - at 30 dB gain reduction (wanted input level 90 dB (μV)): typ. 94 dB (μV) into 75 Ω

In band cross modulation (wanted signal: picture carrier of channel N; interfering signal: picture carrier of channel N ± 2 for low v.h.f., or channel N ± 3 for high v.h.f., or channel N ± 5 for u.h.f.)
- **v.h.f. bands**
  - at nominal gain (wanted input level 60 dB (μV)): typ. 82 dB (μV) into 75 Ω
  - at 40 dB gain reduction (wanted input level 100 dB (μV)): typ. 94 dB (μV) into 75 Ω
- **u.h.f. bands**
  - at nominal gain (wanted input level 60 dB (μV)): typ. 82 dB (μV) into 75 Ω
  - at 30 dB gain reduction (wanted input level 90 dB (μV)): typ. 94 dB (μV) into 75 Ω

Out of band cross modulation at nominal gain
- **low v.h.f., interfering from high v.h.f.**
  - typ. 94 dB (μV) into 75 Ω
- **low v.h.f., interfering from u.h.f.**
  - typ. 90 dB (μV) into 75 Ω
- **high v.h.f., interfering from low v.h.f.**
  - typ. 94 dB (μV) into 75 Ω
- **high v.h.f., interfering from u.h.f.**
  - typ. 90 dB (μV) into 75 Ω
- **u.h.f., interfering from low v.h.f.**
  - typ. 94 dB (μV) into 75 Ω
- **u.h.f., interfering from high v.h.f.**
  - typ. 86 dB (μV) into 75 Ω
Oscillator characteristics

Pulling
Input signal of tuned frequency producing a shift of the oscillator frequency of 10 kHz,
at nominal gain
- v.h.f. bands
- u.h.f. bands

Shift of oscillator frequency at a change of the supply voltage of 5%
- v.h.f. bands
- u.h.f. bands

Drift of oscillator frequency during warm-up time (after the tuner has been completely out of operation for 15 min, measured between 5 s and 15 min after switching on)
during warm-up time (after the input stage is in operation for 15 min, measured between 2 s and 15 min after band switching)
at a change of the ambient temperature from +25 to +50 °C (measured after 3 cycles from +25 to +55 °C)
- v.h.f. bands
- u.h.f. bands

Frequency divider characteristics (UV462)

Supply voltage
Current drawn from +5 V supply
Output voltage, at terminals 12 and 13 unloaded
with 820 Ω load
Output impedance
Output imbalance
Interference signal on the i.f. output

Note: I.F. output of the tuner terminated with the circuit shown in Fig. 10.
I.F. circuit characteristics
Bandwidth of i.f. output circuit
5 ± 1 MHz
Note: I.F. output of the tuner terminated with the circuit shown in Fig. 10; tuning voltage 18 V; u.h.f. band switched on.

Bandwidth variation of i.f. output circuit as a result of r.f. tuning and band switching (reference: u.h.f.; tuning voltage 18 V) max. 500 kHz
Note: I.F. output of the tuner terminated with a modified circuit of Fig. 10, i.e. a 100 pF capacitor is connected in parallel with the i.f. output of the tuner.

Fig. 10.

Detuning of the i.f. output circuit as a result of r.f. tuning and band switching (reference: u.h.f.; tuning voltage 18 V) max. 500 kHz
Note: I.F. output of the tuner terminated with a modified circuit of Fig. 10, i.e. a 100 pF capacitor is connected in parallel with the i.f. output of the tuner.

Minimum tuning range of i.f. output coil 
<31.5 to >37.5 MHz
Note: I.F. output of the tuner terminated with the circuit shown in Fig. 10.

Attenuation between i.f. injection point and i.f. output of the tuner typ. 16 dB

Miscellaneous
Radio interference
Oscillator radiation and oscillator voltage at the aerial terminal

Microphonics
There will be no microphonics, provided the tuner is installed in a professional manner.

Surge protection
Protection against voltages max. 5 kV
Note: 10 discharges of a 470 pF capacitor into the aerial terminal.

Protection against flashes max. 30 kV, 400 mWs
Note: A flashover circuit producing flashes with frequencies of 1 to 20 Hz for 30 s is connected to the aerial terminal.
ADDITIONAL INFORMATION

I.F. injection

Terminal 4 (supply voltage u.h.f.) can be used as i.f. injection point, provided the u.h.f. supply voltage is applied to terminal 4 via a resistor of 10 Ω (see Fig. 11). The u.h.f. band should be switched on; tuning voltage should be 18 V.

![Diagram of I.F. injection](image)

Fig. 11.

Connection of the i.f. amplifier

No special precautions are required to load and to match the i.f. output of the tuner.

Connection of supply voltages

![Diagram of supply voltages](image)

Fig. 12.
Measuring method of power gain

The i.f. output of the tuner should be terminated with the RC-circuit given in Fig. 10.

![Diagram](image)

**Fig. 13.**

The RC-circuit roughly matches the i.f. output impedance to 75 Ω at the resonant frequency of the i.f. output circuit, which should be tuned to 36.15 MHz; the bandwidth is approx. 5 MHz (Fig. 13).

Because the input and output impedances of the tuner are now 75 Ω, the power gain can be measured in the conventional manner by inserting tuner and RC-circuit between a 75 Ω source and a 75 Ω detector.

Alignment of the i.f. output coil

The i.f. output coil should be adjusted with a plastic tool, which has a crosshead as shown in Fig. 14. A suitable tool for automatic alignment is available under catalogue number 8104 004 11040.

![Diagram](image)

**Fig. 14.**
V.H.F./U.H.F. TELEVISION TUNERS

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Systems</th>
<th>C.C.I.R. system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channels (South African channel distribution)</td>
<td></td>
</tr>
<tr>
<td>v.h.f.</td>
<td>4 to 13</td>
</tr>
<tr>
<td>u.h.f.</td>
<td>21 to 69</td>
</tr>
<tr>
<td>Intermediate frequencies</td>
<td></td>
</tr>
<tr>
<td>picture</td>
<td>38.9 MHz</td>
</tr>
<tr>
<td>sound</td>
<td>32.9 MHz</td>
</tr>
</tbody>
</table>

APPLICATION

Designed to cover the South African v.h.f. and u.h.f. channels of C.C.I.R. system I. The tuners UV472 are equipped with a frequency divider, which makes them suitable for digital tuning systems based on frequency synthesis; for the remainder they are equal to type UV471.

Available versions

<table>
<thead>
<tr>
<th>Available versions</th>
<th>aerial input connector</th>
<th>frequency divider (IC)</th>
<th>catalogue number</th>
</tr>
</thead>
<tbody>
<tr>
<td>UV471</td>
<td>phono</td>
<td>–</td>
<td>3122 127 03310</td>
</tr>
<tr>
<td>UV472/256</td>
<td>phono</td>
<td>1:256</td>
<td>3122 237 00340</td>
</tr>
<tr>
<td>UV472/64</td>
<td>phono</td>
<td>1:64</td>
<td>3122 237 00360</td>
</tr>
</tbody>
</table>
DESCRIPTION

The UV471 and UV472 are combined v.h.f./u.h.f. tuners with electronic tuning and band switching, covering the television bands used in South Africa in accordance with the publications of the South African Bureau of Standards (S.A.B.S.).

Mechanically, the tuners are built on a low-loss printed-wiring board, carrying all components, in a metal housing made of a rectangular frame and front and rear covers (see Fig. 2). The common 75 Ω aerial connector (v.h.f. and u.h.f.) is on one of the frame sides, all other connections (supply voltages, a.g.c. voltage, tuning and switching voltages, i.f. output) are made via terminals in the underside. The mounting method is shown in Fig. 3.

Electrically, the tuners consist of v.h.f. and u.h.f. parts. The v.h.f. aerial signal is fed via a tuned input circuit to gate 1 of an input MOSFET tetrode (with internal gate protection against surge). The drain load of the MOSFET tetrode is formed by a double tuned filter, transferring the r.f. signal to the emitter of the mixer transistor.

The collector circuit of the mixer transistor is a single tuned i.f. resonant circuit, at the low end of which the i.f. signal is coupled out of the tuner. A test point (terminal 4) is provided for i.f. injection to align the i.f. output circuit of the tuner together with the i.f. amplifier of the television receiver.

An additional test point (T.P.), which is accessible through a hole in the top of the tuner, is connected to the collector of the mixer transistor.

The r.f. band pass filter and oscillator circuits are tuned by 4 tuning diodes.

The u.h.f. part of the tuners consist of a high-pass input circuit connected to gate 1 of an input MOSFET tetrode (with internal gate protection against surge). The drain load of this MOSFET tetrode is formed by a double tuned circuit transferring the r.f. signal to the Schottky barrier mixer diode. The i.f. signal from the mixer diode is amplified by the v.h.f. mixer transistor, now operating as an i.f. amplifier.

The r.f. band pass filter and oscillator circuits are tuned by 3 tuning diodes.

In all bands the tuners are gain controlled via gate 2 of the input MOSFET tetrode.

The electrical circuit of the UV472 is extended with a frequency divider (division ratio of 256 or 64), which inputs are connected to the v.h.f. and u.h.f. oscillator. The complementary outputs are connected to terminals 12 and 13.
Fig. 1. Circuit diagram of the UV471.
MECHANICAL DATA

Fig. 2a.

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>aerial</td>
</tr>
<tr>
<td>3</td>
<td>supply voltage, v.h.f., + 12 V</td>
</tr>
<tr>
<td>4</td>
<td>supply voltage, u.h.f., + 12 V; i.f. injection</td>
</tr>
<tr>
<td>5</td>
<td>a.g.c. voltage, + 9.2 to + 0.85 V</td>
</tr>
<tr>
<td>6</td>
<td>supply voltage, v.h.f. and u.h.f., + 12 V</td>
</tr>
<tr>
<td>7</td>
<td>tuning voltage, + 1 to + 28 V</td>
</tr>
<tr>
<td>9</td>
<td>i.f. output</td>
</tr>
<tr>
<td>10</td>
<td>earth</td>
</tr>
<tr>
<td>12, 13</td>
<td>balanced output voltage of frequency divider</td>
</tr>
<tr>
<td>14</td>
<td>supply voltage, frequency divider, + 5V</td>
</tr>
</tbody>
</table>

Dimensions in mm

UV472 only
V.H.F./U.H.F. television tuners

Fig. 2b  I.F. output coil.
Torque for alignment: 2 to 15 mNm.
Press-through force: \( \geq 10 \) N.

Mass  approx. 127 g

Mounting

The tuner may be mounted by soldering it on to a printed-wiring board, using the piercing diagram shown in Fig. 3. (The tuner may also be mounted by means of a bracket. Information will be supplied upon request). The tuner may be mounted anywhere in the receiver and there are no restrictions on orientation.

The solderability of the terminals and mounting tabs is according to IEC 68-2, test Ta \((230 \pm 10 \degree C, 2 \pm 0.5 \text{s})\). The resistance to soldering heat is according to IEC 68-2, test Tb \((260 \pm 5 \degree C, 10 \pm 1 \text{s})\).

Fig. 3  Piercing diagram viewed from solder side of board. Unless otherwise stated the tolerance is \( \pm 0.05 \text{ mm} \).
ELECTRICAL DATA

Unless otherwise specified all electrical values apply at an ambient temperature of 25 ± 5 °C, a relative humidity of 60 ± 15%, a supply voltage of 12 ± 0,3 V and an a.g.c. voltage of 9,2 ± 0,2 V.

General
Semiconductors, v.h.f. band
  r.f. amplifier  BF980
  mixer          BF324
  oscillator     BF926
  tuning diodes  4 x BB405B
  switching diodes 1 x BA482
Semiconductors, u.h.f. band
  r.f. amplifier  BF980
  oscillator     BF970
  mixer          ISS99
  tuning diodes  3 x BB405B
  surge protection diodes 1 x BAV10
Frequency divider
  SP4653 or SP4632

Ambient temperature range
  operating  0 to + 55 °C
  storage    -25 to + 70 °C
Relative humidity
  max. 95%

Voltages and currents
Supply voltage
  + 12 V ± 10%
Current drawn from + 12 V supply
  v.h.f. band  max. 50 mA; typ. 31 mA
  u.h.f. band  max. 50 mA; typ. 37 mA

Bandswitching
For operation in all bands the supply voltage is permanently connected to terminal 6. Additionally the supply voltage is connected to:
  terminal 3 for operation in the v.h.f. band
  terminal 4 for operation in the u.h.f. band
A.G.C. voltage (Figs 4 and 5)
  voltage range  + 9,2 to + 0,85 V
  voltage at nominal gain  + 9,2 ± 0,5 V
  voltage at 40 dB gain reduction  typ. 1,5 V
  voltage at 30 dB gain reduction  typ. 2 V
  (v.h.f. band)

Note: A.G.C. voltages between 0 and + 10,5 V may be applied without risk of damage.

A.G.C. current
  max. 0,3 mA
Slope of a.g.c. characteristic,
  at the end of the specified a.g.c. range
  v.h.f. band  typ. 25 dB/V
  u.h.f. band  typ. 50 dB/V
V.H.F./U.H.F. television tuners

Fig. 4 Typical a.g.c. characteristic, v.h.f. band.

Fig. 5 Typical a.g.c. characteristic, u.h.f. band.

Fig. 6 Typical tuning characteristic, v.h.f. band.

Fig. 7 Typical tuning characteristic, u.h.f. band.
UV471
UV472

Tuning voltage range (Figs 6 and 7) + 1 to + 28 V

Current drawn from 28 V tuning voltage supply
at \( T_{\text{amb}} = 25^\circ \text{C} \)
max. 0,5 \( \mu \text{A} \)
at \( T_{\text{amb}} = 55^\circ \text{C} \)
max. 2 \( \mu \text{A} \)

Note: The source impedance of the tuning voltage offered to terminal 7 must be maximum 47 k\( \Omega \).

Slope of tuning characteristic

\begin{align*}
\text{v.h.f. band, channel 4} & \quad 7 \text{ MHz/V} \\
\text{channel 8} & \quad 6 \text{ MHz/V} \\
\text{channel 13} & \quad 1,8 \text{ MHz/V} \\
\text{u.h.f. band, channel 21} & \quad 22 \text{ MHz/V} \\
\text{channel 69} & \quad 4 \text{ MHz/V} \\
\end{align*}

Frequencies

Frequency ranges

\begin{align*}
\text{v.h.f.} & \quad \text{channel 4 (picture carrier 175,25 MHz) to channel 13 (picture carrier 247,43 MHz).} \\
\text{u.h.f. band} & \quad \text{Margin at the extreme channels: min. 2 MHz.} \\
\end{align*}

Intermediate frequencies

\begin{align*}
\text{picture} & \quad 38,9 \text{ MHz} \\
\text{sound} & \quad 32,9 \text{ MHz} \\
\end{align*}
The oscillator frequency is higher than the aerial signal frequency.

Wanted signal characteristics

Input impedance

\( 75 \ \Omega \)

V.S.W.R. and reflection coefficient

(values between picture and sound carrier, as well as values at picture carrier)

\begin{align*}
\text{v.s.w.r.} & \quad \text{at nominal gain} \\
\text{v.h.f. band,} & \quad \text{max. 4} \\
\text{u.h.f. band} & \quad \text{max. 5} \\
\text{reflection coefficient} & \quad \text{during gain control} \\
\text{v.h.f. band} & \quad \text{max. 60\%} \\
\text{u.h.f. band} & \quad \text{max. 66\%} \\
\text{R.F. curves, bandwidth} & \quad \text{max. 75\%} \\
\text{v.h.f. band} & \quad \text{typ. 10 MHz} \\
\text{u.h.f. band} & \quad \text{typ. 17 MHz} \\
\text{R.F. curves, tilt} & \quad \text{on any channel the amplitude difference between the top of the r.f. resonant curve and the picture frequency, the sound frequency, or any frequency between them will not exceed 3 dB at nominal gain, and 4 dB in the a.g.c. range between nominal gain and 20 dB gain reduction.}
\end{align*}
V.H.F./U.H.F. television tuner

A.G.C. range
- v.h.f. band: min. 40 dB
- u.h.f. band: min. 30 dB

Power gain (see also Measuring method of power gain)
- v.h.f. band:
  - channel 4: typ. 31 dB
  - channel 7: typ. 30 dB
  - channel 10: typ. 31 dB
  - channel 13: typ. 31 dB
- u.h.f. band:
  - channel 21: typ. 32 dB
  - channel 40: typ. 31 dB
  - channel 69: typ. 32 dB

Maximum gain difference
- between any two v.h.f. channels: typ. 4 dB
- between any two u.h.f. channels: typ. 4 dB
- between any v.h.f. and u.h.f. channel: typ. 6 dB

Noise figure
- v.h.f. band:
  - channel 4: max. 8 dB
  - channel 7: typ. 4,5 dB
  - channel 10: typ. 4,5 dB
  - channel 13: typ. 4,5 dB
- u.h.f. band:
  - channel 21: typ. 6 dB
  - channel 40: typ. 6 dB
  - channel 69: typ. 7 dB

Overloading
- Input signal producing 1 dB gain compression at nominal gain
  - v.h.f. band: typ. 90 dB (µV) into 75 Ω
  - u.h.f. band: typ. 90 dB (µV) into 75 Ω

- Input signal producing either a detuning of the oscillator of + 300 kHz or -1000 kHz or stopping of the oscillations at nominal gain
  - v.h.f. band: typ. 100 dB (µV) into 75 Ω
  - u.h.f. band: typ. 100 dB (µV) into 75 Ω

Unwanted signal characteristics
- Image rejection (measured at picture carrier frequency)
  - v.h.f. band: min. 60 dB; typ. 75 dB
  - u.h.f. band: min. 44 dB; typ. 53 dB

- I.F. rejection (measured at picture carrier frequency)
  - v.h.f. band: min. 60 dB
  - u.h.f. band: min. 60 dB

Note: At colour sub-carrier frequency maximum 6 dB less rejection.
N ± 4 rejection (for u.h.f. only)
Interference signal for an interference
eratio of 53 dB referred to wanted picture
carrier (picture to sound carrier ratio
of 10 dB; wanted 60 dB (μV); tuner
operating at nominal gain)

typ. 75 dB (μV) into 75 Ω

Cross modulation
Input signal producing 1% cross modulation, i.e. 1% of the modulation depth of the interfering signal is transferred to the wanted signal.

In channel cross modulation (wanted signal: picture carrier frequency; interfering signal: sound carrier frequency)

v.h.f. band
- at nominal gain (wanted input level 60 dB (μV))
  typ. 74 dB (μV) into 75 Ω
- at 40 dB gain reduction (wanted input level 100 dB (μV))
  typ. 94 dB (μV) into 75 Ω

u.h.f. band
- at nominal gain (wanted input level 60 dB (μV))
  typ. 74 dB (μV) into 75 Ω
- at 30 dB gain reduction (wanted input level 90 dB (μV))
  typ. 94 dB (μV) into 75 Ω

In band cross modulation (wanted signal: picture carrier of channel N; interfering signal: picture carrier of channel N ± 3 for v.h.f. or channel N ± 5 for u.h.f.)

v.h.f. band
- at nominal gain (wanted input level 60 dB (μV))
  typ. 82 dB (μV) into 75 Ω
- at 40 dB gain reduction (wanted input level 100 dB (μV))
  typ. 94 dB (μV) into 75 Ω

u.h.f. band
- at nominal gain (wanted input level 60 dB (μV))
  typ. 82 dB (μV) into 75 Ω
- at 30 dB gain reduction (wanted input level 90 dB (μV))
  typ. 94 dB (μV) into 75 Ω

Out of band cross modulation at nominal gain

v.h.f. interfering from u.h.f.
  typ. 90 dB (μV) into 75 Ω

u.h.f. interfering from v.h.f.
  typ. 86 dB (μV) into 75 Ω

Oscillator characteristics

Pulling
Input signal of tuned frequency producing a
shift of the oscillator frequency of 10 kHz,
at nominal gain
v.h.f. band
  typ. 80 dB (μV) into 75 Ω
u.h.f. band
  typ. 80 dB (μV) into 75 Ω

Shift of oscillator frequency at a change
of the supply voltage of 5%
v.h.f. band
  max. 200 kHz
u.h.f. band
  max. 400 kHz

Drift of oscillator frequency
during warm-up time (after the tuner
has been completely out of operation
for 15 min, measured between 5 s and
15 min after switching on)
during warm-up time (after the input
stage is in operation for 15 min,
measured between 2 s and 15 min
after band switching)
  max. 250 kHz
V.H.F./U.H.F. television tuners

Drift of oscillator frequency
at a change of the ambient temperature
from +25 to +50 °C (measured after
3 cycles from +25 to +55 °C)
v.h.f. band
u.h.f. band

max. 600 kHz
max. 1000 kHz

Frequency divider characteristics (UV472 only)
Division ratio 256 or 64
Supply voltage +5 V ± 10%
Current drawn from +5 V supply max. 55 mA
Output voltage, unloaded, measured with probe 10 MΩ/11 pF min. 0,5 V p-p
typ. 1 kΩ
Output impedance max. 0,1 V
Output imbalance max. 3 μV
Interference signal on the i.f. output
Note: I.F. output of the tuner terminated with 10 MΩ/11 pF

I.F. circuit characteristics
Bandwidth of i.f. output circuit 5 ± 1 MHz
Note: I.F. output of the tuner terminated with the circuit shown in Fig. 8; tuning voltage 25 V; u.h.f. band switched on.

Bandwidth variation of i.f. output circuit as a result of r.f. tuning and band switching (reference: u.h.f.; tuning voltage 25 V) max. 500 kHz

Note: I.F. output of the tuner terminated with a modified circuit of Fig. 8, i.e. a 100 pF capacitor is connected in parallel with the i.f. output of the tuner.

Fig. 8.

Detuning of the i.f. output circuit as a result of r.f. tuning and band switching (reference: u.h.f.; tuning voltage 25 V) max. 500 kHz

Note: I.F. output of the tuner terminated with a modified circuit of Fig. 8, i.e. a 100 pF capacitor is connected in parallel with the i.f. output of the tuner.

Minimum tuning range of i.f. output coil 32,5 to 40 MHz
Note: I.F. output of the tuner terminated with the circuit shown in Fig. 8.

Attenuation between i.f. injection point and i.f. output of the tuner typ. 16 dB
Miscellaneous

Radio interference
Oscillator radiation and oscillator voltage at the aerial terminal

Within the limits of C.I.S.P.R. 13 (1975) and S.A.B.S. requirements
There will be no microphonics, provided the tuner is installed in a professional manner.

Microphonics

Surge protection
Protection against voltages
Note: 10 discharges of a 470 pF capacitor into the aerial terminal.

Protection against flashes
Note: A flashover circuit producing flashes with frequencies of 1 to 20 Hz for 30 s is connected to the aerial terminal.

Surge protection
Protection against voltages

Protection against flashes

ADDITIONAL INFORMATION

I.F. injection
Terminal 4 (supply voltage u.h.f.) can be used as i.f. injection point, provided the u.h.f. supply voltage is applied to terminal 4 via a resistor of 10 Ω (see Fig. 9). The u.h.f. band should be switched on; tuning voltage should be 25 V.

![Fig. 9.](image)

Connection of the i.f. amplifier
No special precautions are required to load and to match the i.f. output of the tuner.

Connection of supply voltages

![Fig. 10.](image)
Measuring method of power gain

The i.f. output of the tuner should be terminated with the RC-circuit given in Fig. 8.

![Diagram](image1)

**Fig. 11.**

The RC-circuit roughly matches the i.f. output impedance to 75 Ω at the resonant frequency of the i.f. output circuit, which should be tuned to 36,15 MHz; the bandwidth is approx. 5 MHz (Fig. 11). Because the input and output impedances of the tuner are now 75 Ω, the power gain can be measured in the conventional manner by inserting tuner and RC-circuit between a 75 Ω source and a 75 Ω detector.

Alignment of the i.f. output coil

The i.f. output coil should be adjusted with a plastic tool, which has a cross head as shown in Fig. 12. A suitable tool for automatic alignment is available under catalogue number 8104 004 11040.

![Diagram](image2)

**Fig. 12.**
V.H.F./U.H.F. TELEVISION TUNERS

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Systems</th>
<th>C.C.I.R. systems B, G and H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channels</td>
<td>off-air</td>
</tr>
<tr>
<td>low v.h.f.</td>
<td>E2 to C</td>
</tr>
<tr>
<td>high v.h.f.</td>
<td>E5 to E12</td>
</tr>
<tr>
<td>hyperband</td>
<td>E21 to E69</td>
</tr>
<tr>
<td>u.h.f.</td>
<td></td>
</tr>
<tr>
<td>Intermediate frequencies</td>
<td></td>
</tr>
<tr>
<td>picture</td>
<td>38.90 MHz</td>
</tr>
<tr>
<td>colour</td>
<td>34.47 MHz</td>
</tr>
<tr>
<td>sound 1</td>
<td>33.40 MHz</td>
</tr>
<tr>
<td>sound 2</td>
<td>33.16 MHz</td>
</tr>
</tbody>
</table>

APPLICATION

Designed to cover the v.h.f. and u.h.f. channels of C.C.I.R. systems B, G and H with extended v.h.f. frequency ranges, including the hyperband.

The i.f. output is designed for direct drive of a variety of SAW filters.

The tuner UV616/256 is equipped with a frequency divider, which makes it suitable for digital tuning systems based on frequency synthesis; for the remainder it is equal to type UV615.

Available versions

<table>
<thead>
<tr>
<th></th>
<th>aerial input connector</th>
<th>frequency divider (IC)</th>
<th>catalogue number</th>
</tr>
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<tr>
<td>UV615</td>
<td>IEC</td>
<td>—</td>
<td>3112 218 53600</td>
</tr>
<tr>
<td>UV616/256</td>
<td>IEC</td>
<td>1 : 256</td>
<td>3112 218 53420</td>
</tr>
</tbody>
</table>

Both tuners comply with the requirements of radiation, signal handling capability, and immunity from radiated interference of Amtsblatt DBP69/1981, when installed professionally in an adequate TV receiver.
Fig. 1 Circuit diagram.
DESCRIPTION

The UV615 and UV616/256 are combined v.h.f./u.h.f. tuners with electronic tuning and band switching, covering the low v.h.f. band (frequency range 46 to 110 MHz), the high v.h.f. band (frequency range 111 to 300 MHz), the hyperband (frequency range 300 to 470 MHz), and the u.h.f. band (frequency range 470 to 860 MHz).

Mechanically, the tuners are built on a low-loss printed-wiring board, carrying all components, in a die-cast metal housing made of a rectangular frame and front and rear covers (see Fig. 2). The common IEC coaxial aerial connector (75 Ω) is integrated in one of the frame sides of the housing, all other connections (supply voltages, a.g.c. voltage, tuning and switching voltages, i.f. output) are made via terminals in the underside. The mounting method is shown in Fig. 3.

Electrically, the tuners consist of v.h.f., hyperband and u.h.f. parts (see Fig. 1). They are equipped with a common aerial input and provided with tuned r.f. MOSFET input stages. The v.h.f. mixer, v.h.f. oscillator and i.f. amplifier functions are provided by a tuner IC. This IC has terminals between mixer and i.f. amplifier to connect i.f. preselections, a 40,4 MHz trap is provided to improve the selectivity of common SAW filters for adjacent channel N - 1 (system B). Output impedance of the symmetrical i.f. terminals is approx. 75 Ω to insure sufficient triple transient suppression of the SAW filter.

The r.f. band pass filter and oscillator circuits of the v.h.f. part are tuned by 7 tuning diodes; band switching is achieved by 4 switching diodes, those of the hyperband by 4 tuning diodes and 1 switching diode respectively.

The u.h.f. part of the tuner has a high-pass input circuit connected to gate 1 of an input MOSFET tetrode (with internal gate protection against surge). The drain load of this MOSFET tetrode is formed by a double tuned circuit transferring the r.f. signal to the Schottky barrier mixer diode. The i.f. signal from the mixer diode is amplified by the i.f. pre-amplifier of the tuner I.C.

The r.f. band pass filter and oscillator circuits are tuned by 4 tuning diodes.

In all bands the tuner is gain-controlled via gate 2 of the input MOSFET tetrode.

A test point TP1 is provided for i.f. injection.

The electrical circuit of the UV616/256 is extended with a frequency divider (division ratio of 256), with an input connected to the v.h.f., hyperband and u.h.f. oscillators. The symmetrical ECL outputs are connected to terminals 13 and 14.
Fig. 2.

**Terminal**

- **A** = aerial input (IEC female 75 Ω)
- **5** = a.g.c. voltage, +9.2 to +0.85 V
- **6** = supply voltage, tuning part, +12 V
- **7** = supply voltage, low v.h.f., +12 V
- **8** = supply voltage, high v.h.f., +12 V
- **9** = supply voltage, hyperband, +12 V
- **10** = supply voltage, u.h.f., +12 V
- **11** = tuning voltage, +0.8 to +28 V
- **12** = supply voltage, frequency divider, +5 V
- **13, 14** = balanced output voltage of frequency divider (1 kΩ) only for UV616/256
- **15** = earth
- **16** = i.f. output, symm. (approx. 75 Ω)
- **17** = i.f. output, symm. (approx. 75 Ω)

Unless otherwise stated the tolerance is ±0.05 mm.
Mass approx. 99 g

Mounting
The tuner may be mounted by soldering it on to a printed-wiring board (using the piercing diagram shown in Fig. 3) without clearance between tuner supporting surface and board. The connection pins should be bent according to Fig. 4. The tuner may be mounted anywhere in the receiver and there are no restrictions on orientation.

The solderability of the terminals and mounting tabs is according to IEC 68-2, test Ta (230 ± 10 °C, 2 ± 0,5 s). The resistance to soldering heat is according to IEC 68-2, test Tb (260 ± 5 °C, 10 ± 1 s).

(1) Only for UV616/256

Fig. 3 Piercing diagram viewed from solder side of board. Unless otherwise stated the tolerance is ± 0,05 mm.

Fig. 4.

In order to prevent any stress to the printed-wiring board, the tuner should be supported at its aerial connector.
V.H.F./U.H.F. television tuners

ELECTRICAL DATA

Unless otherwise specified all electrical values apply at an ambient temperature of 25 ± 5 °C, a relative humidity of 60 ± 15%, a supply voltage of 12 ± 0,3 V and an a.g.c. voltage of 9,2 ± 0,2 V.

General

- Semiconductors, v.h.f. bands
  - r.f. amplifier: BF992
  - mixer: TDA5030
  - oscillator: 7 x OF633
  - tuning diodes: 4 x BA482/483/484
  - switching diodes: 2 x BAS15

- Semiconductors, hyperband
  - r.f. amplifier: BF990
  - oscillator: BF569
  - mixer: 1SS99
  - tuning diodes: 5 x OF643
  - switching diodes: 1 x BA482
  - d.c. blocking diodes: 2 x BAW62

- Semiconductors, u.h.f. bands
  - r.f. amplifier: BF990
  - oscillator: BF970
  - mixer: 1SS99
  - tuning diodes: 4 x OF643

Frequency divider: SP4653

Ambient temperature range
- operating: -10 to + 60 °C
- storage: -25 to + 70 °C

Relative humidity: max. 95%

Voltages and currents

Supply voltage: + 12 V ± 10%

Current drawn from + 12 V supply
- v.h.f. bands: max. 50 mA
- u.h.f. bands: max. 45 mA

Bandswitching: max. 15 mA (hyperband max. 20 mA)

For operation in all bands the supply voltage is permanently connected to terminal 6. Additionally the supply voltage is connected to:
- terminal 7 for operation in low v.h.f. band
- terminal 8 for operation in high v.h.f. band
- terminal 9 for operation in the hyperband
- terminal 10 for operation in u.h.f. bands
A.G.C. voltage
  voltage range  + 9,2 to 0,85 V (max. 30 μA)
  voltage at nominal gain  + 9,2 ± 0,5 V
  voltage at 40 dB gain reduction
  low v.h.f. band  typ. 3 V
  high v.h.f. band  typ. 2 V
  voltage at 30 dB gain reduction
  u.h.f. band  typ. 2 V

Note: A.G.C. voltage between 0 and + 10,5 V may be applied without risk of damage.

→  A.G.C. current
  max. 0,03 mA

Slope of a.g.c. characteristic
at the end of the specified a.g.c. range
  low v.h.f. band  typ. 40 dB/V
  high v.h.f. band  typ. 80 dB/V
  hyperband  typ. 50 dB/V

→  Tuning voltage range
  + 1 to + 28 V

Current drawn from 28 V tuning voltage supply
  at T_{amb} = 25 °C and 60% R.H.  max. 0,5 μA
  at T_{amb} = 25 °C and 95% R.H.  max. 2 μA
  at T_{amb} = 60 °C and 60% R.H.  max. 2 μA

Note: The source impedance of the tuning voltage offered to terminal 11 must be maximum 47 kΩ.

Slope of tuning characteristic
  low v.h.f. band, channel E2
    channel S1     5 MHz/V
    channel S20   1 MHz/V
  high v.h.f. band, channel S2
    channel S21   10 MHz/V
    channel S20   2 MHz/V
  hyperband
    channel H21   8 MHz/V
    channel H41   14 MHz/V
  u.h.f. bands
    channel E21   22 MHz/V
    channel E69   5 MHz/V

Frequencies
Frequency ranges
  low v.h.f. band
  high v.h.f. band
  hyperband
  u.h.f. bands

Intermediate frequencies
  picture 38,90 MHz
  colour 34,47 MHz
  sound 1 33,40 MHz
  sound 2 33,16 MHz
The oscillator frequency is higher than the aerial signal frequency.
Wanted signal characteristics

Input impedance  
75 Ω

V.S.W.R. and reflection coefficient
(values between picture and sound carrier, as well as values at picture carrier)

V.S.W.R.
- v.h.f. bands
- hyperband
- u.h.f. bands

Reflection coefficient
- v.h.f. bands
- hyperband
- u.h.f. bands

Output impedance (i.f.)
75 Ω approx.

Capacitance between terminals
typ. 3.5 pF

Load impedance
min. 1 kΩ//max. 22 pF

R.F. curves bandwidth
- low v.h.f. band
typ. 10 MHz
- high v.h.f. band
- hyperband
typ. 15 MHz
- u.h.f. bands
- hyperband
typ. 15 MHz

R.F. curves, tilt
on any channel the amplitude difference between the top of the r.f. resonant curve and the picture frequency, the sound frequency, or any frequency between them will not exceed 3 dB at nominal gain, and 4 dB in the a.g.c. range between nominal gain and 20 dB gain reduction.

A.G.C. range
- v.h.f. bands and hyperband
min. 40 dB
- u.h.f. bands
min. 30 dB

Voltage gain
- low v.h.f. band
min. 36 dB; max. 46 dB
- high v.h.f. band
min. 40 dB; max. 50 dB
- channels S2 to S6
- channels S21 to S41
- u.h.f. bands
min. 40 dB; max. 50 dB

Maximum gain difference
off. air channels
max. 5 dB

Noise figure
- v.h.f. bands
typ. 5 dB; max. 8 dB
- E channels
typ. 7 dB; max. 10 dB
- S channels and hyperband channels
typ. 8 dB; max. 11 dB
- u.h.f. bands
Overloading

Input signal producing 1 dB gain
- compression at nominal gain
  v.h.f. bands and hyperband
  typ. 90 dB (μV) into 75 Ω
- u.h.f. bands
  typ. 90 dB (μV) into 75 Ω

Input signal producing either a detuning of the oscillator of +300 kHz or -1000 kHz or stopping of the oscillations at nominal gain
- v.h.f. bands
  typ. 105 dB (μV) into 75 Ω; min. 100 dB (μV)
- u.h.f. bands and hyperband
  typ. 100 dB (μV) into 75 Ω; min. 90 dB (μV)

Unwanted signal characteristics

Image rejection (measured at picture carrier frequency)
- v.h.f. bands
  min. 66 dB; typ. 70 dB
- hyperband
  min. 66 dB; typ. 70 dB
- u.h.f. bands
  min. 53 dB; typ. 65 dB

I.F. rejection (measured at picture carrier frequency)
- all bands
  min. 60 dB

Note: At colour sub-carrier frequency maximum 6 dB less rejection.

Cross modulation

Input signal producing 1% cross modulation, i.e. 1% of the modulation depth of the interfering signal is transferred to the wanted signal.

In channel cross modulation (wanted signal: picture carrier frequency; interfering signal: sound carrier frequency)
- v.h.f. bands and hyperband
  at nominal gain (wanted input level 60 dB (μV))
  typ. 75 dB (μV) into 75 Ω
  at 40 dB gain reduction (wanted input level 100 dB (μV))
  typ. 100 dB (μV) into 75 Ω
- u.h.f. bands
  at nominal gain (wanted input level 60 dB (μV))
  typ. 75 dB (μV) into 75 Ω
  at 30 dB gain reduction (wanted input level 90 dB (μV))
  typ. 100 dB (μV) into 75 Ω

In band cross modulation (wanted signal: picture carrier of channel N; interfering signal: picture carrier of channel N ± 2 for low v.h.f., or channel N ± 3 for high v.h.f., or channel N ± 5 for u.h.f. and hyperband)
- v.h.f. bands and hyperband
  at nominal gain (wanted input level 60 dB (μV))
  typ. 95 dB (μV) into 75 Ω
  at 40 dB gain reduction (wanted input level 100 dB (μV))
  typ. 100 dB (μV) into 75 Ω
- u.h.f. bands
  at nominal gain (wanted input level 60 dB (μV))
  typ. 100 dB (μV) into 75 Ω
  at 30 dB gain reduction (wanted input level 90 dB (μV))
  typ. 100 dB (μV) into 75 Ω

Out of band cross modulation at nominal gain
- each of the v.h.f., u.h.f. or hyperbands
  interfering with any of the other bands mentioned
  typ. 100 dB (μV) into 75 Ω
Unwanted signal handling capability (visibility test)

For the channel combinations
- v.h.f. and hyperband: N ± 1, N ± 5, N ± 11
- u.h.f.: N ± 1, N ± 5, N ± 9

The tuner meets the requirements of “Amtsblatt” DBP/1981, item 5.1.2, when measured in an adequate TV receiver.

Oscillator characteristics

Pulling
Input signal of tuned frequency producing a shift of the oscillator frequency of 10 kHz, at nominal gain
- all bands

Shift of oscillator frequency at a change of the supply voltage of ± 5%
- v.h.f. bands
- hyperband
- u.h.f. bands

Drift of oscillator frequency during warm-up time (after the tuner has been completely out of operation for 15 min, measured between 5 s and 15 min after switching on)

at a change of the ambient temperature from +25 to +50 °C (measured after 3 cycles from +25 to 0 °C)
- v.h.f. bands
- hyperband
- u.h.f. bands

at a change of humidity from 60 ± 15% to 93 ± 2%, at T_{amb} = 25 ± 5 °C
- low v.h.f. band
- high v.h.f. band
- hyperband
- u.h.f. bands

typ. 86 dB (μV) into 75 Ω

max. 250 kHz
max. 500 kHz
max. 500 kHz
max. 500 kHz
max. 500 kHz
max. 750 kHz
max. 1000 kHz
max. 1300 kHz
max. 1500 kHz
Frequency divider characteristics of the UV616/256

- Division ratio
  Supply voltage + 5 V ± 5%
  Current drawn from +5 V supply max. 35 mA; typ. 25 mA
- Output voltage, unloaded, measured with probe 10 MΩ/11 pF
  min. 0,5 V p-p
  typ. 1 kΩ
- Output imbalance
  typ. 0,1 V
  max. 30 dB (µV)
- Interference signal on the i.f. output

Note: I.F. output of the tuner terminated with 10 MΩ/11 pF.

Miscellaneous

Radio interference
Oscillator radiation and oscillator voltage at the aerial terminal

Within the limits of C.I.S.P.R. 13 (1975), VDE0872/7.72, and Amtsblatt DBP69/1981, when applying the tuner in an adequate TV receiver

There will be no microphonics, provided the tuner is installed in a professional manner.

Microphonics

Surge protection
Protection against voltages max. 5 kV
Note: 10 discharges of a 470 pF capacitor into the aerial terminal.

Protection against flashes max. 30 kV, 400 mWs
Note: A flashover circuit producing flashes with frequencies of 1 to 20 Hz for 30 s is connected to the aerial terminal.

ADDITIONAL INFORMATION

I.F. injection
An i.f. signal from a generator (internal resistance 50 Ω or 75 Ω) should be connected to the i.f. injection point TP1, accessible through a hole in the cover (see Fig. 2) via a probe (see Fig. 5).
V.H.F./U.H.F. TELEVISION TUNERS

QUICK REFERENCE DATA

| Systems | C.C.I.R. systems B, G and H |
| Channels | off-air, cable |
| low v.h.f. | E2 - C, S01 to S1 |
| high v.h.f. | E5 - E12, S2 to S20 |
| u.h.f. | E21 - E89 |

Intermediate frequencies

| picture | 38.90 MHz |
| colour | 34.47 MHz |
| sound 1 | 33.40 MHz |
| sound 2 | 33.16 MHz |

APPLICATION

Designed to cover the v.h.f. and u.h.f. channels of C.C.I.R. systems B, G and H with extended v.h.f. frequency ranges.

The tuner UV618/256 is equipped with a frequency divider, which makes it suitable for digital tuning systems based on frequency synthesis; for the remainder it is equal to type UV617.

Available versions

<table>
<thead>
<tr>
<th></th>
<th>serial input connector</th>
<th>frequency divider (IC)</th>
<th>catalogue number</th>
</tr>
</thead>
<tbody>
<tr>
<td>UV617</td>
<td>IEC</td>
<td>—</td>
<td>3122 237 00080</td>
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<tr>
<td>UV618/256</td>
<td>IEC</td>
<td>1 : 256</td>
<td>3122 237 00010</td>
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Both tuners comply with the requirements of radiation, signal handling capability, and immunity from radiated interference of Amtsblatt DBP69/1981, when installed professionally in an adequate TV receiver.
DESCRIPTION

The UV617 and UV618/256 are combined v.h.f./u.h.f. tuners with electronic tuning and band switching, covering the low v.h.f. band (frequency range 46 to 110 MHz), the high v.h.f. band (frequency range 111 to 300 MHz), and the u.h.f. band (frequency range 470 to 860 MHz).

Mechanically, the tuners are built on a low-loss printed-wiring board, carrying all components, in a die-cast metal housing made of a rectangular frame and front and rear covers (see Fig. 2). The common IEC coaxial aerial connector (75 $\Omega$) is integrated in one of the frame sides of the housing, all other connections (supply voltages, a.g.c. voltage, tuning and switching voltages, i.f. output) are made via terminals in the underside. The mounting method is shown in Fig. 3.

Electrically, the tuners consist of v.h.f. and u.h.f. parts (see Fig. 1). They are equipped with a common aerial input and provided with r.f. MOSFET input stages. The v.h.f. mixer, v.h.f. oscillator and i.f. amplifier functions are provided by a tuner IC. This IC has terminals between mixer and i.f. amplifier to connect i.f. preselections, a 40,4 trap is provided to improve the selectivity of common SAW filters for adjacent channel $N - 1$ (system B).

Output impedance of the symmetrical i.f. terminals is approx. 75 $\Omega$ to insure sufficient triple transient supression of the SAW.

The r.f. band pass filter and oscillator circuits are tuned by 7 tuning diodes; band switching is achieved by 4 switching diodes.

The u.h.f. part of the tuner has a high-pass input circuit connected to gate 1 of an input MOSFET tetrode (with internal gate protection against surge). The drain load of this MOSFET tetrode is formed by a double tuned circuit transferring the r.f. signal to the Schottky barrier mixer diode. The i.f. signal from the mixer diode is amplified by the i.f. pre-amplifier of the tuner I.C.

The r.f. band pass filter and oscillator circuits are tuned by 4 tuning diodes.

In all bands the tuner is gain-controlled via gate 2 of the input MOSFET tetrode.

A test point TP1 is provided for i.f. injection.

The electrical circuit of the UV618/256 is extended with a frequency divider (division ratio of 256), with inputs connected to the v.h.f. and u.h.f. oscillator. The symmetrical ECL outputs are connected to terminals 13 and 14.
Fig. 1.

For type UV617 delete: C71, C72, C86, C87, C88, R71, R72, IC2.
For connections see next page.
Unless otherwise stated the tolerance is ± 0,05 mm.

Terminal

A = aerial input (IEC female 75 Ω)
5 = a.g.c. voltage, + 9,2 to + 0,85 V
6 = supply voltage, tuning part, + 12 V
7 = supply voltage, low v.h.f. + 12 V
8 = supply voltage, high v.h.f., + 12 V
10 = supply voltage, u.h.f., + 12 V
11 = tuning voltage, + 0,8 to + 28 V
12 = supply voltage, frequency divider, + 5 V
13,14 = balanced output voltage of frequency divider (1 kΩ) only for UV618/256
15 = earth
16 = i.f. output, symm. (approx. 75 Ω)
17 = i.f. output, symm. (approx. 75 Ω)
V.H.F./U.H.F. television tuners

UV617
UV618/256

Mass
approx. 95 g

Mounting
The tuner may be mounted by soldering it on to a printed-wiring board (using the piercing diagram shown in Fig. 3) without clearance between tuner supporting surface and board. The connection pins should be bent according to Fig. 4. The tuner may be mounted anywhere in the receiver and there are no restrictions on orientation.

The solderability of the terminals and mounting tabs is according to IEC 68-2, test Ta (230 ± 10 °C, 2 ± 0.5 s). The resistance to soldering heat is according to IEC 68-2, test Tb (260 ± 5 °C, 10 ± 1 s).

(1) Only for UV618/256

Fig. 3 Piercing diagram viewed from solder side of board. Unless otherwise stated the tolerance is ± 0.05 mm.

In order to prevent any stress to the printed-wiring board, the tuner should be supported at its aerial connector.
ELECTRICAL DATA

Unless otherwise specified all electrical values apply at an ambient temperature of 25 ± 5 °C, a relative humidity of 60 ± 15%, a supply voltage of 12 ± 0,3 V and an a.g.c. voltage of 9,2 ± 0,2 V.

General
Semiconductors, v.h.f. bands
  r.f. amplifier
  mixer
  oscillator
  tuning diodes
  switching diodes
d.c. blocking diodes
  BF992
  TDA5030
  7 x OF633
  4 x BA482/483/484
  2 x BAS15
Semiconductors, u.h.f. bands
  r.f. amplifier
  oscillator
  mixer
  tuning diodes
  frequency divider
  BF990
  BF970
  1SS99
  4 x OF643
  SP4653
Ambient temperature range
  operating
  storage
  -10 to +60 °C
  -25 to +85 °C
Relative humidity
  max. 95%

Voltages and currents
Supply voltage
  + 12 V ± 10%
Current drawn from + 12 V supply
  v.h.f. bands
  max. 50 mA
  u.h.f. bands
  max. 45 mA
Bandswitching
  max. 15 mA
For operation in all bands the supply voltage is permanently connected to terminal 6. Additionally the supply voltage is connected to:
  terminal 7 for operation in low v.h.f. band
  terminal 8 for operation in high v.h.f. band
  terminal 10 for operation in u.h.f. bands
A.G.C. voltage (Figs 4, 5 and 6)
  voltage range
  + 9,2 to + 0,85 V (max. 30 μA)
  + 9,2 ± 0,5 V
  voltage at nominal gain
  typ. 3 V
  voltage at 40 dB gain reduction
  typ. 2 V
  low v.h.f. band
  typ. 2 V
  high v.h.f. band
  voltage at 30 dB gain reduction
  typ. 2 V
  u.h.f. band
Note: A.G.C. voltage between 0 and + 10,5 V may be applied without risk of damage.
  A.G.C. voltage
  max. 0,03 mA
  A.G.C. current
  typ. 40 dB/V
  Slope of a.g.c. characteristic,
  at the end of the specified a.g.c. range
  low v.h.f. bands
  typ. 80 dB/V
  high v.h.f. bands

240  December 1986
V.H.F./U.H.F. television tuners

Tuning voltage range (Figs 7, 8 and 9) + 0,8 to + 28 V
Current drawn from 28 V tuning voltage supply
at T_{amb} = 25 °C and 60% R.H. max. 0,5 µA
at T_{amb} = 25 °C and 95% R.H. max. 2 µA
at T_{amb} = 60 °C and 60% R.H. max. 2 µA

Note: The source impedance of the tuning voltage offered to terminal 11 must be maximum 47 kΩ.

Slope of tuning characteristic

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Typical Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low v.h.f. band, channel E2</td>
<td>5 MHz/V</td>
</tr>
<tr>
<td>High v.h.f. band, channel S2</td>
<td>10 MHz/V</td>
</tr>
<tr>
<td>U.H.F. bands, channel E21</td>
<td>2 MHz/V</td>
</tr>
<tr>
<td>U.H.F. bands, channel E69</td>
<td>2 MHz/V</td>
</tr>
<tr>
<td>U.H.F. bands, channel E20</td>
<td>20 MHz/V</td>
</tr>
<tr>
<td>Typical Values</td>
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Frequencies

Frequency ranges

- Low v.h.f. band
- High v.h.f. band
- U.H.F. bands

Intermediate frequencies

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Frequency</th>
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</thead>
<tbody>
<tr>
<td>Picture</td>
<td>38,90 MHz</td>
</tr>
<tr>
<td>Colour</td>
<td>34,47 MHz</td>
</tr>
<tr>
<td>Sound 1</td>
<td>33,40 MHz</td>
</tr>
<tr>
<td>Sound 2</td>
<td>33,16 MHz</td>
</tr>
</tbody>
</table>

The oscillator frequency is higher than the aerial signal frequency.

Wanted signal characteristics

Input impedance

- 75 Ω

V.S.W.R. and reflection coefficient (values between picture and sound carrier, as well as values at picture carrier)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Typical Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>V.S.W.R.</td>
<td></td>
</tr>
<tr>
<td>V.H.F. bands</td>
<td>max. 4</td>
</tr>
<tr>
<td>U.H.F. bands</td>
<td>max. 5</td>
</tr>
<tr>
<td>Reflection</td>
<td>max. 60%</td>
</tr>
<tr>
<td>Coefficient</td>
<td>max. 66%</td>
</tr>
</tbody>
</table>

Output impedance (I.F.)

- 75 Ω approx.

Capacitance between terminals

Load impedance

- 3,5 pF
- typ. 1 kΩ//max. 22 pF

between terminals 16 and 17 (min. L: 590 nH)

R.F. curves bandwidth

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Typical Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low v.h.f. band</td>
<td>10 MHz</td>
</tr>
<tr>
<td>High v.h.f. band</td>
<td>10 MHz</td>
</tr>
<tr>
<td>U.H.F. bands</td>
<td>15 MHz</td>
</tr>
</tbody>
</table>
R.F. curves, tilt

on any channel the amplitude difference between the top of the r.f. resonant curve and the picture frequency, the sound frequency, or any frequency between them will not exceed 3 dB at nominal gain, and 4 dB in the a.g.c. range between nominal gain and 20 dB gain reduction.

A.G.C. range
v.h.f. bands
min. 40 dB
u.h.f. bands
min. 30 dB

Voltage gain
low v.h.f. band
min. 40 dB; max. 50 dB
high v.h.f. band
typ. 36 dB; max. 46 dB
channels S2 to S6
typ. 40 dB; max. 50 dB
channels S7 to S20
min. 40 dB; max. 50 dB
u.h.f. bands

Maximum gain difference
between any two v.h.f. channels
typ. 6 dB
between any two u.h.f. channels
typ. 6 dB
between any v.h.f. and u.h.f. channel
typ. 6 dB

Noise figure
v.h.f. bands
typ. 5 dB; max. 8 dB
E channels
typ. 7 dB; max. 10 dB
S channels
typ. 8 dB; max. 11 dB
u.h.f. bands

Overloading
Input signal producing 1 dB gain
compression at nominal gain
typ. 90 dB (μV) into 75 Ω; min. 85 dB(μV)
v.h.f. bands
typ. 100 dB (μV) into 75 Ω; min. 90 dB(μV)
u.h.f. bands

Input signal producing either a detuning
of the oscillator of +300 kHz or
-1000 kHz or stopping of the
oscillations at nominal gain
typ. 110 dB (μV) into 75 Ω; min. 100 dB(μV)
v.h.f. bands
typ. 110 dB (μV) into 75 Ω; min. 100 dB(μV)
u.h.f. bands

Unwanted signal characteristics
Image rejection (measured at picture carrier frequency)
min. 66 dB; typ. 70 dB
v.h.f. bands
min. 53 dB; typ. 60 dB
u.h.f. bands
V.H.F./U.H.F. television tuners

I.F. rejection (measured at picture carrier frequency)

- **low v.h.f. band**: min. 60 dB
- **high v.h.f. band**: min. 60 dB
- **u.h.f. bands**: min. 60 dB

**Note:** At colour sub-carrier frequency maximum 6 dB less rejection.

**Cross modulation**

Input signal producing 1% cross modulation, i.e., 1% of the modulation depth of the interfering signal is transferred to the wanted signal.

In channel cross modulation (wanted signal: picture carrier frequency; interfering signal: sound carrier frequency)

- **v.h.f. bands**
  - at nominal gain (wanted input level 60 dB (µV))
  - at 40 dB gain reduction (wanted input level 100 dB (µV))

- **u.h.f. bands**
  - at nominal gain (wanted input level 60 dB (µV))
  - at 30 dB gain reduction (wanted input level 90 dB (µV))

In band cross modulation (wanted signal: picture carrier of channel N; interfering signal: picture carrier of channel N ± 2 for low v.h.f., or channel N ± 3 for high v.h.f., or channel N ± 5 for u.h.f.)

- **v.h.f. bands**
  - at nominal gain (wanted input level 60 dB (µV))
  - at 40 dB gain reduction (wanted input level 100 dB (µV))

- **u.h.f. bands**
  - at nominal gain (wanted input level 60 dB (µV))
  - at 30 dB gain reduction (wanted input level 90 dB (µV))

Out of band cross modulation at nominal gain

- **low v.h.f., interfering from high v.h.f.**
- **low v.h.f., interfering from u.h.f.**
- **high v.h.f., interfering from low v.h.f.**
- **high v.h.f., interfering from u.h.f.**
- **u.h.f. interfering from low v.h.f.**
- **u.h.f. interfering from high v.h.f.**

**Unwanted signal handling capability (visibility test)**

For the channel combinations

- **v.h.f.**: N ± 1, N ± 5, N + 11
- **u.h.f.**: N ± 1, N ± 5, N + 9

The tuner meets the requirements of “Amtsblatt” DBP/1981, item 5.1.2., when measured in an adequate TV receiver. The a.g.c. circuit of the receiver has to be adjusted with an input signal of 74 dB (µV) on channel E60 in such a way, that the gain of the tuner is decreased by 10 dB.
Oscillator characteristics

Pulling
Input signal of tuned frequency producing a shift of the oscillator frequency of 10 kHz,
at nominal gain
v.h.f. bands
typ. 86 dB (μV) into 75 Ω
u.h.f. bands
typ. 86 dB (μV) into 75 Ω

Shift of oscillator frequency at a change of the supply voltage of 5%
v.h.f. bands
max. 250 kHz
u.h.f. bands
max. 500 kHz

Drift of oscillator frequency
during warm-up time (after the tuner has been completely out of operation for 15 min, measured between 5 s and 15 min after switching on)
during warm-up time (after the input stage is in operation for 15 min, measured between 2 s and 15 min after band switching)
at a change of the ambient temperature from +25 to +40 °C (measured after 3 cycles from +25 to +55 °C)
v.h.f. bands
max. 500 kHz
u.h.f. bands
max. 500 kHz

at a change of humidity from 60 ± 15% to 93 ± 2%, at T_{amb} = 25 ± 5 °C
low v.h.f. band
max. 500 kHz
high v.h.f. band
max. 1000 kHz
u.h.f. bands
max. 1500 kHz
V.H.F./U.H.F. television tuners

Frequency divider characteristics of the UV618/256

Division ratio 256
Supply voltage + 5 V ± 5%
Current drawn from + 5 V supply max. 35 mA; typ. 25 mA
min. 0,3 V p-p
typ. 1 kΩ
Output impedance typ. 0,1 V
Output imbalance max. 30 dB (μV)
Interference signal on the i.f. output
Note: I.F. output of the tuner terminated with 10 MΩ/11 pF

Miscellaneous
Radio interference
Oscillator radiation and oscillator voltage at the aerial terminal
Within the limits of C.I.S.P.R. 13 (1975) , VDE0872/7.72. and Amtsblatt DBP69/1981, when applying the tuner in an adequate TV receiver
There will be no microphonics, provided the tuner is installed in a professional manner.

Microphonics

Surge protection
Protection against voltages max. 5 kV
Note: 10 discharges of a 470 pF capacitor into the aerial terminal.
Protection against flashes max. 30 kV, 400 mWs
Note: A flashover circuit producing flashes with frequencies of 1 to 20 Hz for 30 s is connected to the aerial terminal.

ADDITIONAL INFORMATION

I.F. injection
An i.f. signal from a generator (internal resistance 50 Ω or 75 Ω) should be connected to the i.f. injection point TP1, accessible through a hole in the cover (see Fig. 2) via a probe (see Fig. 5).

---

Figure 5.
V.H.F./U.H.F. TELEVISION TUNERS

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Systems</th>
<th>C.C.I.R. systems L and L'</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channels</td>
<td>off-air</td>
</tr>
<tr>
<td>low v.h.f.</td>
<td>02 to 04</td>
</tr>
<tr>
<td>high v.h.f.</td>
<td>05 to 10</td>
</tr>
<tr>
<td>u.h.f.</td>
<td>L21 to L69</td>
</tr>
<tr>
<td>Intermediate frequencies</td>
<td>32,7 MHz</td>
</tr>
<tr>
<td>picture</td>
<td>39,2 MHz</td>
</tr>
<tr>
<td>sound</td>
<td></td>
</tr>
</tbody>
</table>

(The oscillator frequency is higher than the aerial signal frequency in the low v.h.f. band and lower in all other bands).

APPLICATION

Designed to cover all channels of C.C.I.R. systems L and L' including the cable channels C to Q for French cable television.

The i.f. output is designed for direct drive of a variety of SAW filters.

The tuner UV628/256 is equipped with a frequency divider, which makes it suitable for digital tuning systems based on frequency synthesis; for the remainder it is equal to type UV627.

Available versions

<table>
<thead>
<tr>
<th>aerial input connector</th>
<th>frequency divider (IC)</th>
<th>catalogue number</th>
</tr>
</thead>
<tbody>
<tr>
<td>UV627</td>
<td>IEC</td>
<td>–</td>
</tr>
<tr>
<td>UV628/256</td>
<td>IEC</td>
<td>1 : 256</td>
</tr>
</tbody>
</table>

Both tuners comply with the requirements of radiation of C.I.S.P.R. 13 (1975) including amendment 1 (1983).
FOR UV 627 (3II11 267 10010): DELETE POS 3091, 3092, 2090, 2091, 2092, 2094, 2095, 2005

Fig. 1 Circuit diagram.
V.H.F./U.H.F. television tuners

DEVELOPMENT DATA

UV627
UV628/256

November 1986 249
DESCRIPTION
The UV627 and UV628/256 are combined v.h.f./u.h.f. tuners with electronic tuning and band switching, covering the low v.h.f. band (frequency range 48 to 68 MHz), the high v.h.f. band (frequency range 128 to 304 MHz), and the u.h.f. band (frequency range 470 to 860 MHz).
Mechanically, the tuners are built on a low-loss printed-wiring board, carrying all components, in a die-cast metal housing made of a rectangular frame and front and rear covers (see Fig. 2). The common SNIR (9 mm) coaxial aerial connector (75 £2) is integrated in one of the frame sides of the housing, all other connections (supply voltages, a.g.c. voltage, tuning and switching voltages, i.f. output) are made via terminals in the underside. The mounting method is shown in Fig. 3.
Electrically, the tuners consist of v.h.f. and u.h.f. parts (see Fig. 1). They are equipped with a common aerial input and provided with tuned r.f. MOSFET input stages. The v.h.f. mixer, v.h.f. oscillator and i.f. amplifier functions are provided by a tuner IC. This IC has terminals between mixer and i.f. amplifier to connect i.f. preselections.
Output impedance of the symmetrical i.f. terminals is approx. 75 £2 to insure sufficient triple transient suppression of the SAW filter.
The r.f. band pass filter and oscillator circuits of the v.h.f. part are tuned by 9 tuning diodes; band switching is achieved by 6 switching diodes.
The u.h.f. part of the tuner has a high-pass input circuit, followed by a single tuned circuit connected to gate 1 of an input MOSFET tetrode (with internal gate protection against surge). The drain load of this MOSFET tetrode is formed by a double tuned circuit transferring the r.f. signal to the Schottky barrier mixer diode. The i.f. signal from the mixer diode is amplified by the i.f. pre-amplifier of the tuner IC.
The r.f. band pass filter and oscillator circuits are tuned by 4 tuning diodes.
In all bands the tuner is gain-controlled via gate 2 of the input MOSFET tetrode.
A two-pole filter is used to comply with SCART 109 recommendation regarding i.f. selectivity.
A test point TP1 is provided for i.f. injection.
The electrical circuit of the UV628/256 is extended with a frequency divider (division ratio of 256), with an input connected to the v.h.f. and u.h.f. oscillators. The symmetrical ECL outputs are connected to terminals 13 and 14.
V.H.F./U.H.F. television tuners

MECHANICAL DATA

Dimensions in mm

DEVELOPMENT DATA

Fig. 2.

Unless otherwise stated the tolerance is ± 0.05 mm.

Terminal
A = aerial input, SNIR (9 mm) female 75 Ω
5 = a.g.c. voltage, + 9,2 to 0,85 V
6 = supply voltage, tuning part, + 12 V
7 = supply voltage, low v.h.f., + 12 V
8 = supply voltage, high v.h.f., + 12 V
10 = supply voltage, u.h.f., + 12 V
11 = tuning voltage, + 0,45 to + 30 V

12 = supply voltage, frequency divider, + 5 V
13, 14 = balanced output voltage of frequency divider (1 kΩ)
15 = earth
16 = i.f. output, symm. (approx. 75 Ω)
17 = i.f. output, symm. (approx. 75 Ω)
Mass approx. 95 g

Mounting

The tuner may be mounted by soldering it on to a printed-wiring board (using the piercing diagram shown in Fig. 3) without clearance between tuner supporting surface and board. The connection pins should be bent according to Fig. 4. The tuner may be mounted anywhere in the receiver and there are no restrictions on orientation.

The solderability of the terminals and mounting tabs is according to IEC 68-2, test Ta (230 ± 10 °C, 2 ± 0,5 s). The resistance to soldering heat is according to IEC 68-2, test Tb (260 ± 5 °C, 10 ± 1 s).

(1) Only for UV628/256

1 eb = 0,025 inch

Fig. 3. Piercing diagram viewed from solder side of board. Unless otherwise stated the tolerance is ± 0,05 mm.

In order to prevent any stress to the printed-wiring board, the tuner should be supported at its aerial connector.
ELECTRICAL DATA

Unless otherwise specified all electrical values apply at an ambient temperature of 25 ± 5 °C, a relative humidity of 60 ± 15%, a supply voltage of 12 ± 0,3 V and an a.g.c. voltage of 9,2 ± 0,2 V.

General

Semiconductors, v.h.f. bands
r.f. amplifier  BF992
mixer  
oscillator  TDA5030/C9
tuning diodes  
switching diodes  6 x BB909B, 3 x OF643  6 x BA482

Semiconductors, u.h.f. bands
r.f. amplifier  BF996/S
oscillator  BF979
mixer  1SS99
tuning diodes  4 x OF643

Frequency divider  SP4653

Ambient temperature range
operating  —10 to + 60 °C
storage  —25 to + 85 °C

Relative humidity  max. 95%

Voltages and currents

Supply voltage  + 12 V ± 5%
Current drawn from + 12 V supply  max. 82 mA
Bandswitching  max. 20 mA

For operation in all bands the supply voltage is permanently connected to terminal 6. Additionally the supply voltage is connected to:
terminal 7 for operation in low v.h.f. band
terminal 8 for operation in high v.h.f. band
terminal 10 for operation in u.h.f. bands

A.G.C. voltage

voltage range  + 9,2 to + 0,85 V (max. 30 μA)
voltage at nominal gain  + 9,2 ± 0,2 V
voltage at 40 dB gain reduction
low v.h.f. band  typ. 2,5 V
high v.h.f. band  typ. 1,6 V
voltage at 30 dB gain reduction
u.h.f. band  typ. 1,8 V

Note: A.G.C. voltage between 0 and + 10,5 V may be applied without risk of damage.
A.G.C. current | max. 30 µA
---|---
Slope of a.g.c. characteristic
at the end of the specified a.g.c. range
v.h.f. band | typ. 40 dB/V
u.h.f. band | typ. 80 dB/V
Tuning voltage range | +0.6 to +28 V
Current drawn from 28 V tuning voltage supply
at Tamb = 25 °C and 60% R.H. | max. 1 µA
at Tamb = 25 °C and 85% R.H. | max. 3 µA
at Tamb = 60 °C and 60% R.H. | max. 3 µA
Note: The source impedance of the tuning voltage offered to terminal 11 must be maximum 47 kΩ.
Slope of tuning characteristics
low v.h.f. band, channel 02 | typ. 4,1 MHz/V
channel 04 | typ. 3,5 MHz/V
high v.h.f. band, channel C | typ. 15 MHz/V
channel Q | typ. 1,7 MHz/V
u.h.f. bands, channel 21 | typ. 28,8 MHz/V
channel 69 | typ. 3,6 MHz/V
Frequencies
Frequency ranges
low v.h.f. band
high v.h.f. band, off-air + cable
u.h.f. bands
Intermediate frequencies
picture | 32,7 MHz
sound | 39,2 MHz
The oscillator frequency is higher than the aerial signal frequency in the low v.h.f. band and lower in all other bands.
Wanted signal characteristics
Input impedance | 75 Ω
V.S.W.R. and reflection coefficient
(values between picture and sound carrier, as well as values at picture carrier)
| at nominal gain and during gain control
v.s.w.r.
| max. 4.4
v.h.f. bands
max. 4.4
u.h.f. bands
reflection coefficient
| max. 63%
v.h.f. bands
| max. 63%
u.h.f. bands
V.H.F./U.H.F. television tuners

Output impedance (i.f.)
Capacitance between terminals
Load impedance

R.F. curves bandwidth
   low v.h.f. band
   high v.h.f. band
   u.h.f. bands

R.F. curves, tilt

A.G.C. range
   v.h.f. bands
   u.h.f. bands

Voltage gain
   off-air channels
   cable channels
   gain taper off-air channels

Noise figure
   v.h.f. bands, off-air
   v.h.f. band, cable
   u.h.f. bands

Overloading
Input signal producing 1 dB gain
   compression at nominal gain
      v.h.f. bands
      u.h.f. bands

Input signal producing either a detuning
   of the oscillator of +300 kHz or
   -1000 kHz or stopping of the
   oscillations at nominal gain
      v.h.f. bands
      u.h.f. bands

75 Ω approx.
typ. 3,5 pF
min. 1 kΩ//max. 22 pF

total capacitance load to be tuned to
35,95 MHz by means of an inductance
between terminals 16 and 17 (min. L: 590 nH)
typ. 13 MHz
min. 13 MHz
typ. 18 MHz

on any channel the amplitude difference
between the top of the r.f. resonant curve
and the picture frequency, the sound frequency,
or any frequency between them will not exceed
3 dB at nominal gain, at 4 dB in the a.g.c. range
between nominal gain and 20 dB gain reduction.

min. 40 dB
min. 30 dB
min. 40 dB; max. 50 dB
min. 40 dB; max. 50 dB, channel C min. 38 dB
max. 6 dB

min. 40 dB; max. 50 dB
min. 40 dB; max. 50 dB, channel C min. 38 dB
max. 6 dB

typ. 7 dB; max. 9 dB
typ. 5 dB; max. 11 dB
typ. 7.5 dB; max. 11 dB

t.b.f.
Unwanted signal characteristics

Image rejection (measured at picture carrier frequency)
- low v.h.f. band
- high v.h.f. band
- u.h.f. bands

I.F. rejection (measured at picture carrier frequency)
- all bands, except low v.h.f. band (= min. 55 dB)

Cross modulation
Input signal producing 1% cross modulation, i.e. 1% of the modulation depth of the interfering signal is transferred to the wanted signal.

In channel cross modulation (wanted signal: picture carrier frequency; interfering signal: sound carrier frequency)
- v.h.f. bands
  - at nominal gain (wanted input level 60 dB (μV))
  - at 40 dB gain reduction (wanted input level 100 dB (μV))
- u.h.f. bands
  - at nominal gain (wanted input level 60 dB (μV))
  - at 30 dB gain reduction (wanted input level 90 dB (μV))

In band cross modulation (wanted signal: picture carrier of channel N; interfering signal: picture carrier of channel N ± 2 for low v.h.f., or channel N ± 3 for high v.h.f., or channel N ± 5 for u.h.f.).
- v.h.f. bands
  - at nominal gain (wanted input level 60 dB (μV))
  - at 40 dB gain reduction (wanted input level 100 dB (μV))
- u.h.f. bands
  - at nominal gain (wanted input level 60 dB (μV))
  - at 30 dB gain reduction (wanted input level 90 dB (μV))

Out of band cross modulation at nominal gain
- each of the v.h.f. or u.h.f. bands interfering with any of the other bands mentioned

Oscillator characteristics

Oscillator voltage at aerial input
- v.h.f. bands
- u.h.f. bands

Oscillator voltage at the terminals
- supply and control pins
- i.f. terminals for:
  - v.h.f.
  - u.h.f.

Pulling
Input signal of tuned frequency producing a shift of the oscillator frequency of 10 kHz,
at nominal gain
- all bands

Oscillator voltage at the terminals
- supply and control pins
- i.f. terminals for:
  - v.h.f.
  - u.h.f.

Pulling
Input signal of tuned frequency producing a shift of the oscillator frequency of 10 kHz,
at nominal gain
- all bands
V.H.F./U.H.F. television tuners

**UV627**

**UV628/256**

**DEVELOPMENT DATA**

**Shift of oscillator frequency at a change of the supply voltage of 5%**
- v.h.f. bands: max. 500 kHz
- u.h.f. bands: max. 700 kHz
- during a.g.c.: max. 150 kHz

**Drift of oscillator frequency**
- during warm-up time (after the tuner has been completely out of operation for 15 min, measured between 5 s and 15 min after switching on): max. 300 kHz
- during warm-up time (after the input stage is in operation for 15 min, measured between 2 s and 15 min after band switching): max. 250 kHz
- at a change of the ambient temperature from +25 to +40 °C (measured after 3 cycles from +25 to 0 °C): t.b.f.
- at a change of humidity from 60 ± 15% to 93 ± 2%, at T<sub>amb</sub> = 25 ± 5 °C:
  - low v.h.f. band: 500 kHz
  - high v.h.f. band: 1000 kHz
  - u.h.f. bands: 1500 kHz

**Frequency divider characteristics of the UV628/256**
- Division ratio: 256
- Supply voltage: +5 V ± 5%
- Current drawn from +5 V supply: max. 35 mA
- Output voltage, unloaded, measured with probe 10 MΩ/11 pF: min. 0.5 V<sub>p-p</sub>
- Output impedance: typ. 1 kΩ
- Output imbalance: max. 0.1 V
- Interference signal on the I.F. output: max. 30 dB (µV)

**Note:** I.F. output of the tuner terminated with 10 MΩ/11 pF.
Miscellaneous
Radio interference
Oscillator radiation and oscillator voltage at the aerial terminal

Within the limits of C.I.S.P.R. 13 (1975), amendment 1 (1983), when applying the tuner in an adequate TV receiver there will be no microphonics, provided the tuner is installed in a professional manner.

Microphoniccs

Surge protection
Protection against voltages max. 5 kV

Note: 10 discharges of a 470 pF capacitor into the aerial terminal.

Protection against flashes t.b.f.

Note: A flashover circuit producing flashes with frequencies of 1 to 20 Hz for 30 s is connected to the aerial terminal.

ADDITIONAL INFORMATION
I.F. injection

An i.f. signal from a generator (internal resistance 50 Ω or 75 Ω) should be connected to the i.f. injection point TP1, accessible through a hole in the cover (see Fig. 2) via a probe (see Fig. 5).

![Fig. 5.](image-url)
V.H.F./U.H.F. TELEVISION TUNERS

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Systems</th>
<th>R.T.M.A. systems M and N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channels</td>
<td></td>
</tr>
<tr>
<td>range a, low v.h.f. band</td>
<td></td>
</tr>
<tr>
<td>mid band</td>
<td></td>
</tr>
<tr>
<td>range b, mid band</td>
<td></td>
</tr>
<tr>
<td>high v.h.f. band</td>
<td></td>
</tr>
<tr>
<td>super band</td>
<td></td>
</tr>
<tr>
<td>range c, super band</td>
<td></td>
</tr>
<tr>
<td>hyper band</td>
<td></td>
</tr>
<tr>
<td>range d, hyper band</td>
<td></td>
</tr>
<tr>
<td>ultra band</td>
<td></td>
</tr>
<tr>
<td>u.h.f. band</td>
<td></td>
</tr>
<tr>
<td></td>
<td>off-air</td>
</tr>
<tr>
<td></td>
<td>A2 to A6</td>
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<tr>
<td></td>
<td>cable</td>
</tr>
<tr>
<td></td>
<td>A—2 to A—1</td>
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<tr>
<td></td>
<td>A to I</td>
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<td>A7 to A13</td>
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<td></td>
<td></td>
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<td></td>
<td>J to T</td>
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<tr>
<td></td>
<td>U to W</td>
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<tr>
<td></td>
<td>AA to RR</td>
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<td></td>
<td>SS to EEE</td>
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<tr>
<td></td>
<td>65 and 66</td>
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<tr>
<td>Intermediate frequencies</td>
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</tr>
<tr>
<td>picture</td>
<td>45,75 MHz</td>
</tr>
<tr>
<td>colour</td>
<td>42,17 MHz</td>
</tr>
<tr>
<td>sound</td>
<td>41,25 MHz</td>
</tr>
</tbody>
</table>

APPLICATION

Designed to cover the v.h.f. and u.h.f. channels of R.T.M.A. systems M and N with extended v.h.f. frequency ranges, including the mid band, super band, hyper band and ultra band CATV.

The i.f. output is designed for direct drive of a variety of SAW filters.

The tuner UV636/256 is equipped with a frequency divider, which makes it suitable for digital tuning systems based on frequency synthesis; for the remainder it is equal to type UV635.

Available versions

<table>
<thead>
<tr>
<th></th>
<th>aerial input connector</th>
<th>frequency divider (IC)</th>
<th>catalogue number</th>
</tr>
</thead>
<tbody>
<tr>
<td>UV635</td>
<td>phono</td>
<td>—</td>
<td>t.b.f.</td>
</tr>
<tr>
<td>UV636/256</td>
<td>phono</td>
<td>1 : 256</td>
<td>3122 237 00230</td>
</tr>
</tbody>
</table>

Both tuners comply with the requirements of radiation, signal handling capability, and immunity from radiated interference of FCC.
Fig. 1 Circuit diagram.
DESCRIPTION

The UV635 and UV636/256 are combined v.h.f./u.h.f. tuners with electronic tuning and band switching, covering a large frequency range in four parts: range a, from 55.25 MHz to 115.25 MHz; range b, from 121.25 to 277.25 MHz; range c, from 283.25 to 403.25 MHz; range d, from 409.25 to 801.25 MHz. See also under “Frequencies”.

Mechanically, the tuners are built on a low-loss printed-wiring board, carrying all components, in a die-cast metal housing made of a rectangular frame and front and rear covers (see Fig. 2). The common phono coaxial aerial connector (75 Ω) is situated on one of the frame sides of the housing, all other connections (supply voltages, a.g.c. voltage, tuning and switching voltages, i.f. output) are made via terminals in the underside. The mounting method is shown in Fig. 3.

Electrically, the tuners consist of v.h.f., hyperband and u.h.f. parts (see Fig. 1). They are equipped with a common aerial input and provided with tuned r.f. MOSFET input stages. The mixer and oscillator for the ranges a, b and c, and i.f. amplifier functions are provided by a tuner IC. This IC has terminals between mixer and i.f. amplifier to connect i.f. preselections, a 47.25 MHz trap is provided to improve the selectivity of common SAW filters for adjacent channel N - 1 (system B).

Output impedance of the symmetrical i.f. terminals is approx. 75 Ω to insure sufficient triple transient suppression of the SAW filter.

The r.f. band pass filter and oscillator circuits of the v.h.f. part are tuned by 5 tuning diodes; band switching is achieved by 5 switching diodes, those of the hyperband by 4 tuning diodes and 3 switching diodes respectively.

The u.h.f. part of the tuner has a tuned input circuit connected to gate 1 of an input MOSFET tetrode (with internal gate protection against surge). The drain load of this MOSFET tetrode is formed by a double tuned circuit transferring the r.f. signal to the Schottky barrier mixer diode. The i.f. signal from the mixer diode is amplified by the i.f. pre-amplifier of the tuner I.C.

The r.f. band pass filter and oscillator circuits are tuned by 4 tuning diodes.

In all bands the tuner is gain-controlled via gate 2 of the input MOSFET tetrode.

A test point TP1 is provided for i.f. injection.

The electrical circuit of the UV636/256 is extended with a frequency divider (division ratio of 256), with an input connected to both oscillators. The symmetrical ECL outputs are connected to terminals 13 and 14.
MECHANICAL DATA

Dimensions in mm

Fig. 2.

Terminal

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>aerial input (phono 75 Ω)</td>
</tr>
<tr>
<td>5</td>
<td>a.g.c. voltage, + 9.2 to + 0.85 V</td>
</tr>
<tr>
<td>6</td>
<td>supply voltage, tuning part, + 12 V</td>
</tr>
<tr>
<td>7</td>
<td>supply voltage, range a, + 12 V</td>
</tr>
<tr>
<td>8</td>
<td>supply voltage, range b, + 12 V</td>
</tr>
<tr>
<td>9</td>
<td>supply voltage, range c, + 12 V</td>
</tr>
<tr>
<td>10</td>
<td>supply voltage, range d, + 12 V</td>
</tr>
<tr>
<td>11</td>
<td>tuning voltage, + 0.8 to + 28 V</td>
</tr>
<tr>
<td>12</td>
<td>supply voltage, frequency divider, + 5 V</td>
</tr>
<tr>
<td>13,14</td>
<td>balanced output voltage of frequency divider (1 kΩ)</td>
</tr>
<tr>
<td>15</td>
<td>earth</td>
</tr>
<tr>
<td>16</td>
<td>only for UV636/256</td>
</tr>
<tr>
<td>17</td>
<td>i.f. output, symm. (approx. 46 + j70 Ω)</td>
</tr>
</tbody>
</table>

MT1, MT2 = mounting tabs (to be earthed)
Mass 99 g

Mounting

The tuner may be mounted by soldering it on to a printed-wiring board (using the piercing diagram shown in Fig. 3) without clearance between tuner supporting surface and board. The connection pins should be bent according to Fig. 4. The tuner may be mounted anywhere in the receiver and there are no restrictions on orientation.

The solderability of the terminals and mounting tabs is according to IEC 68-2, test Ta (230 ± 10 °C, 2 ± 0.5 s). The resistance to soldering heat is according to IEC 68-2, test Tb (260 ± 5 °C, 10 ± 1 s).

(1) Only for UV636/256

1 eb = 0.025 inch

Fig. 3 Piercing diagram viewed from solder side of board.
Unless otherwise stated the tolerance is ± 0.05 mm.

Fig. 4.

In order to prevent any stress to the printed-wiring board, the tuner should be supported at its aerial connector.
ELECTRICAL DATA

Unless otherwise specified all electrical values apply at an ambient temperature of 25 ± 5 °C, a relative humidity of 60 ± 15%, a supply voltage of 12 ± 0.3 V and an a.g.c. voltage of 9.2 ± 0.2 V.

General

Semiconductors, ranges a and b
  r.f. amplifier
  mixer
  oscillator
  tuning diodes
  switching diodes
  coupling diodes
  d.c. blocking diodes
  BF992
  TDA5030
  4 x OF633
  4 x BA482/483/484
  BB809 and BB809B
  2 x BAS15

Semiconductors, range c
  r.f. amplifier
  oscillator
  mixer
  tuning diodes
  switching diodes
  coupling diode
  BF990
  TDA5030
  4 x OF633
  2 x BA482
  BB909B

Semiconductors, range d
  r.f. amplifier
  oscillator
  mixer
  tuning diodes
  BF990
  BF970
  1SS99
  4 x OF643

Frequency divider
  SP4653

Ambient temperature range
  operating
  -10 to + 60 °C
  storage
  -25 to + 85 °C

Relative humidity
  max. 95%

Voltages and currents

Supply voltage
  + 12 V ± 10%

Current drawn from + 12 V supply
  max. 60 mA

Bandswitching
  max. 15 mA

For operation in all bands the supply voltage is permanently connected to terminal 6. Additionally the supply voltage is connected to:
  terminal 7 for operation in range a
  terminal 8 for operation in range b
  terminal 9 for operation in range c
  terminal 10 for operation in range d
A.G.C. voltage
- voltage range: +9.2 to 0.85 V
- voltage at nominal gain: +9.2 ± 0.5 V
- voltage at 45 dB gain reduction ranges a and b: typ. 3 V
- voltage at 30 dB gain reduction range c: typ. 2 V
- range d: typ. 2 V

Note: A.G.C. voltage between 0 and +10.5 V may be applied without risk of damage.

A.G.C. current max. 30 μA

Slope of a.g.c. characteristic
at the end of the specified a.g.c. range
- range a: typ. 40 dB/V
- ranges b and c: typ. 70 dB/V
- range d: typ. 80 dB/V

A.G.C. time constant max. 8 ms

A.G.C. source impedance max. 10 kΩ

Tuning voltage range +0.8 to +28 V

Current drawn from 28 V tuning voltage supply
- at Tamb = 25 °C and 60% R.H.: max. 0.5 μA
- at Tamb = 25 °C and 95% R.H.: max. 2 μA
- at Tamb = 60 °C and 60% R.H.: max. 2 μA

Note: The source impedance of the tuning voltage offered to terminal 11 must be maximum 47 kΩ.

Slope of tuning characteristic
- range a: 1 to 6 MHz/V
- range b: 2 to 14 MHz/V
- range c: 3 to 20 MHz/V
- range d: 4 to 25 MHz/V

The tuner has a built-in current limitation (≤ 100 μA per varicap diode) for tuning voltages up to +35 V, which can be applied during search tuning.

Frequencies
Frequency ranges, picture carrier

Off-air
- low v.h.f. band
- high v.h.f. band
- u.h.f. band

channel A2 (55.25 MHz) to channel A6 (83.25 MHz).
Margin at the extreme channels: min. 2 MHz.
channel A7 (175.25 MHz) to channel A13 (211.25 MHz).
Margin at the extreme channels: min. 2 MHz.
channel A14 (471.25 MHz) to channel A69 (801.25 MHz).
Margin at the extreme channels: min. 3 MHz.
V.H.F./U.H.F. television tuners

Cable (CATV)
mid band

superband
hyperband
ultra band

Intermediate frequencies
picture
45.75 MHz
colour
42.17 MHz
sound
41.25 MHz

The oscillator frequency is higher than the aerial signal frequency.

Wanted signal characteristics
Input impedance

V.S.W.R. and reflection coefficient
(values between picture and sound carrier, as well as values at picture carrier)

v.s.w.r.
ranges a and b
range c
range d
reflection coefficient
ranges a and b
range c
range d

Output impedance (i.f.)
46 + j70 Ω

Capacitance between terminals
typ. 3.5 pF

Load impedance
min. 1 kΩ in parallel with max. 22 pF
total capacitance load to be tuned to 43.5 MHz by means of an inductance between terminals 16 and 17 (min. L: 610 nH)

R.F. curves bandwidth
range a
typ. 10 MHz
range b
typ. 13 MHz
range c
typ. 9 MHz
range d
typ. 14 MHz

channel A—2 (109.25 MHz) to channel I (169.25 MHz)
Margin at the extreme channels: min. 3 MHz.
channel J (217.25 MHz) to channel W (295.25 MHz)
Margin at the extreme channels: min. 3 MHz.
channel AA (301.75 MHz) to channel EEE (463.25 MHz).
Margin at the extreme channels: min. 3 MHz.
channel 65 (469.25 MHz) and channel 66 (475.25 MHz)
Margin at the extreme channels: min. 3 MHz.

February 1986
Overall response, tilt

on any channel the amplitude difference between the top of the r.f. resonant curve and the picture frequency will not exceed 3 dB, between the top of the r.f. resonant curve and the sound frequency 5 dB at nominal gain, and in the a.g.c. range between nominal gain and 20 dB gain reduction.

<table>
<thead>
<tr>
<th>A.G.C. range</th>
<th>Voltage gain</th>
<th>Maximum gain difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>ranges a and b</td>
<td>range c</td>
<td>range d</td>
</tr>
<tr>
<td>min. 45 dB</td>
<td>min. 30 dB</td>
<td>min. 30 dB</td>
</tr>
<tr>
<td>Voltage gain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>min. 40 dB, max. 50 dB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. gain difference</td>
<td></td>
<td></td>
</tr>
<tr>
<td>between any two v.h.f. channels</td>
<td></td>
<td></td>
</tr>
<tr>
<td>typ. 6 dB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>between any two u.h.f. channels</td>
<td></td>
<td></td>
</tr>
<tr>
<td>typ. 6 dB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>between any v.h.f. and u.h.f. channel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>typ. 6 dB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noise figure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ranges a and b</td>
<td></td>
<td></td>
</tr>
<tr>
<td>range c</td>
<td></td>
<td></td>
</tr>
<tr>
<td>range d</td>
<td></td>
<td></td>
</tr>
<tr>
<td>max. 8 dB, typ. 6 dB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>max. 10 dB, typ. 6,5 dB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>max. 10 dB, typ. 8,5 dB</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Overloading

Input signal producing 1 dB gain compression at nominal gain
ranges a and b
ranges c and d
min. 100 dB (μV) into 75 Ω
min. 90 dB (μV) into 75 Ω

Input signal producing either a detuning of the oscillator of + 300 kHz or −1000 kHz or stopping of the oscillations at nominal gain
ranges a and b
ranges c and d
min. 100 dB (μV) into 75 Ω
min. 90 dB (μV) into 75 Ω

Unwanted signal characteristics

Image rejection (measured at picture carrier frequency)
ranges a and b
range c
range d
min. 60 dB, typ. 70 dB
min. 60 dB, typ. 65 dB
min. 45 dB, typ. 55 dB

I.F. rejection (measured at picture carrier frequency)
all bands
min.  60 dB

Note: At colour sub-carrier frequency maximum 6 dB less rejection.
V.H.F./U.H.F. television tuners

FM rejection
- at channel A6 (90.5 MHz, aerial input level 60 dB (μV)) min. 50 dB
- at channel A6 (93 to 100 MHz, aerial input level 90 dB (μV)) min. 50 dB

Cross modulation
An undesired carrier level producing 1% cross modulation on the desired carrier will be equal to or exceeds the desired carrier level for all gain values between nominal gain and 20 dB gain reduction or will be:

in channel cross modulation (wanted signal: picture carrier frequency; interfering signal: sound carrier frequency)
- ranges a, b, c and d min. 70 dB (μV) into 75 Ω
in band cross modulation (wanted signal: picture carrier of channel N; interfering signal: picture carrier of channel N ± 2)
- ranges a, b and c min. 78 dB (μV) into 75 Ω
in band cross modulation (wanted signal: picture carrier of channel N; interfering signal: picture carrier of channel N ± 5)
- range d min. 84 dB (μV) into 75 Ω

Oscillator characteristics

Pulling
Input signal of tuned frequency producing a shift of the oscillator frequency of 10 kHz, at nominal gain all bands min. 74 dB (μV) into 75 Ω

Shift of oscillator frequency at a change of the supply voltage of 5%
- ranges a and b max. 250 kHz
- range c max. 500 kHz
- range d max. 500 kHz
during a.g.c., all ranges max. 150 kHz

Drift of oscillator frequency
- during warm-up time (after the tuner has been completely out of operation for 15 min, measured between 5 s and 15 min after switching on) max. 250 kHz
- during warm-up time (after the input stage is in operation for 15 min, measured between 2 s and 15 min after band switching) max. 250 kHz
- at a change of the ambient temperature from +25 to +50 °C (measured after 3 cycles from +25 to 0 °C)
  - ranges a, b and c max. 500 kHz
  - range d max. 1000 kHz
at a change of humidity from 60 ± 15%
to 93 ± 2%, at T_{amb} = 25 ± 5°C

range a  
range b  
range c  
range d

max. 500 kHz
max. 1000 kHz
max. 1500 kHz
max. 1500 kHz

Frequency divider characteristics of the UV636/256

Division ratio  
Supply voltage  
Current drawn from + 5 V supply

max. 35 mA

Output voltage, unloaded,  
measured with probe 10 MΩ in parallel with 11 pF

min. 0.5 V(p-p)

Output impedance

typ. 1 kΩ

Output imbalance

max. 0.1 V

Interference signal on the i.f. output

max. 30 dB (μV)

Note: I.F. output of the tuner terminated with 10 MΩ in parallel with 11 pF

Miscellaneous

Microphonics

There will be no microphonics, provided the tuner is installed in a professional manner.

Surge protection

Protection against voltages

max. 5 kV

Note: 10 discharges of a 470 pF capacitor into the aerial terminal.

Protection against flashes

max. 30 kV, 400 mWs

Note: A flashover circuit producing flashes with frequencies of 1 to 20 Hz for 30 s is connected to the aerial terminal.

ADDITIONAL INFORMATION

I.F. injection

An i.f. signal from a generator (internal resistance 50 Ω or 75 Ω) should be connected to the i.f. injection point TP1, accessible through a hole in the cover (see Fig. 2) via a probe (see Fig. 5).

---

Fig. 5.
V.H.F./U.H.F. TELEVISION TUNERS

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Systems</th>
<th>C.C.I.R. systems L and L’</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channels</td>
<td></td>
</tr>
<tr>
<td>v.h.f. I</td>
<td>A to E4, including A to C</td>
</tr>
<tr>
<td>v.h.f. III</td>
<td>M4 to E12, including 1 to 6</td>
</tr>
<tr>
<td>u.h.f.</td>
<td>E21 to E69</td>
</tr>
<tr>
<td>Intermediate frequencies</td>
<td></td>
</tr>
<tr>
<td>picture</td>
<td>32.7 MHz</td>
</tr>
<tr>
<td>sound</td>
<td>39.2 MHz</td>
</tr>
</tbody>
</table>

APPLICATION

Designed to cover the v.h.f. and u.h.f. channels of C.C.I.R. systems L and L’. The tuner UVF10A is equipped with a frequency divider (1 : 256), which makes it suitable for digital tuning systems based on frequency synthesis; otherwise this tuner is equal to type UVF10.
DESCRIPTION

The UVF 10 is a combined v.h.f./u.h.f. tuner with electronic tuning and band switching covering the v.h.f. band I including the European channel E4 (frequency range 41 to 68 MHz), the v.h.f. band III including the Moroccan channel M4 and the European channel E12 (frequency range 162 to 230 MHz) and the u.h.f. band (frequency range 470 to 861 MHz).

Mechanically, the tuner is built on a low-loss printed-wiring board, carrying all components, in a metal housing made of a rectangular frame and front and rear covers (see Fig. 2). The common aerial connection (v.h.f. and u.h.f.) with standard coaxial termination is on one of the frame sides, all other connections (supply voltages, a.g.c. voltage, tuning and switching voltages, i.f. output) are made via terminals in the underside. The mounting method is shown in Fig. 3.

Electrically, the tuner consists of v.h.f. and u.h.f. parts. The v.h.f. aerial signal is fed via switchable v.h.f. band I/III wideband input filters to gate 1 of an input MOSFET tetrode (with internal gate protection against surge).

The drain load of the MOSFET tetrode is formed by a double tuned switchable bandpass filter, transferring the r.f. signal to the emitter of the mixer transistor. The oscillator signal is also fed to the emitter of the mixer transistor.

The collector circuit of the mixer transistor is a single tuned i.f. resonant circuit, at the low end of which the i.f. signal is coupled out of the tuner. A test point (terminal 4) is provided for i.f. injection to align the output circuit of the tuner together with the i.f. amplifier of the television receiver.

The input tuned circuit, the r.f. bandpass filter and oscillator circuit are tuned by 4 tuning diodes, band switching is achieved by 8 switching diodes.

The u.h.f. part of the tuner consists of a tuned input circuit connected to gate 1 of an input MOSFET tetrode (with internal gate protection against surge). The drain load of this MOSFET tetrode is formed by a double tuned circuit transferring the r.f. signal to the Schottky barrier mixer diode. The i.f. signal from the mixer diode is amplified by the v.h.f. mixer transistor, now operating as an i.f. amplifier.

The input tuned circuit, the r.f. bandpass filter and oscillator circuits are tuned by 4 tuning diodes.

In all bands the tuner is gain controlled via gate 2 of the input MOSFET tetrodes.
Fig. 1 Circuit diagram of tuner UVF10.
MECHANICAL DATA

Dimensions in mm

Fig. 2a. UVF10.

Terminal
1 = aerial
2 = supply voltage, v.h.f. I, +12 V
3 = supply voltage, v.h.f. III, +12 V
4 = supply voltage, u.h.f., +12 V; i.f. injection
5 = a.g.c. voltage, +8,25 to +0,85 V
6 = supply voltage, v.h.f. and u.h.f., +12 V
7 = tuning voltage, +0,5 to +28 V
8 = i.f. output
9 = i.f. output
10 = earth

Fig. 2b I.F. output coil.
Torque for alignment: 2 to 15 mNm
Press-through force: ≥ 10 N.

10,4
V.H.F./U.H.F. television tuners

Mass  approx. 130 g

Mounting
The tuner may be mounted by soldering it onto a printed-wiring board, using the piercing diagram shown in Fig. 3. (The tuner may also be mounted by means of a socket. Information will be supplied upon request.) The tuner may be mounted anywhere in the receiver and there are no restrictions on orientation.

Fig. 3 Piercing diagram for tuner UVF10 viewed from solder side of board. Unless otherwise stated the tolerance is ± 0.05 mm.
ELECTRICAL DATA

Unless otherwise specified all electrical values apply at an ambient temperature of 25 ± 5 °C, a relative humidity of 60 ± 15%, a supply voltage of 12 ± 0,3 V and an a.g.c. voltage of 8,25 ± 0,2 V.

Voltages and currents
Supply voltage + 12 V ± 1 V
Current drawn from + 12 V supply
- band I max. 45 mA; typ. 40 mA
- band III max. 60 mA; typ. 55 mA
- bands IV and V max. 50 mA; typ. 45 mA

Bandswitching
For operation in all bands the supply voltage is permanently connected to terminal 6. Additionally the supply voltage is connected to:
- terminal 2 and −12 V to terminal 3 for operation in band I
- terminal 3 and −12 V to terminal 2 for operation in band II
- terminal 4 and −12 V to terminals 2 and 3 for operation in bands IV and V.

A.G.C. voltage (Figs 4, 5 and 6)
- voltage range +8,25 to +0,85 V
- voltage at nominal gain +8,25 ± 0,5 V
- voltage at 40 dB gain reduction
  - band I typ. 2 V
  - band III typ. 1,2 V

Note: A.G.C. voltages between 0 and +10,5 V may be applied without risk or damage.

A.G.C. current max. 0,3 µA

Tuning voltage range (Figs 7, 8 and 9)
+0,5 to +28 V

Current drawn from 28 V tuning voltage supply
- at T_{amb} = 25 °C max. 0,5 µA
- at T_{amb} = 55 °C max. 2 µA

Slope of tuning characteristics (typical values)
- band I, channel A 2 MHz/V
- band I, channel C 0,8 MHz/V
- band III, channel 1 4,5 MHz/V
- band III, channel 6 2,5 MHz/V
- bands IV and V, channel 21 30 MHz/V
- bands IV and V, channel 69 6 MHz/V

Frequencies
Frequency ranges
- band I channel A (picture carrier 47,75 MHz)
  Margin: min. tuning voltage 0,5 V
  channel E4 (picture carrier 62,25 MHz)
  Margin: min. 800 kHz
V.H.F./U.H.F. television tuners

Fig. 4 Typical a.g.c. characteristic, band I.

Fig. 5 Typical a.g.c. characteristic, band III.

Fig. 6 Typical a.g.c. characteristic, bands IV and V.
Fig. 7 Typical tuning characteristic, band I.

Fig. 8 Typical tuning characteristic, band III.

Fig. 9 Typical tuning characteristic, bands IV and V.
Frequencies (continued)
Frequency range
band III
  bands IV and V

Intermediate frequencies
picture
sound

Wanted signal characteristics
Input impedance
V.S.W.R. and reflection coefficient
(values between picture and sound carrier, as well as values at picture carrier)

v.s.w.r.
  bands I and III
  bands IV and V

reflection coefficient
  bands I and III
  bands IV and V

R.F. curves, bandwidth
  band I
  band III
  bands IV and V

R.F. curves, tilt
  on any channel the amplitude difference between the top of the r.f. resonant curve and the picture frequency, the sound frequency, or any frequency between them will not exceed:

Nominal gain in the first 20 dB of the a.g.c. range

A.G.C. range
  bands I and III
  bands IV and V

channel M4 (picture carrier 163,25 MHz)
  Margin: min. 2 MHz

channel E12 (picture carrier 224,25 MHz)
  Margin: min. 1,8 MHz

channel E21 (picture carrier 471,25 MHz) to channel E69 (picture carrier 855,25 MHz)
  Margin at the extreme channels: 2 MHz

32,7 MHz
39,2 MHz

75 Ω

at nominal gain during gain control

max. 4  max. 4
max. 5  max. 6
max. 63% max. 63%
max. 56% max. 56%
typ. 16 MHz

3 dB  4 dB
3 dB  4,5 dB
3 dB  4 dB

min. 40 dB
min. 30 dB
Wanted signal characteristics (continued)

Power gain (see also measuring method for power gain Figs 11 and 12)
- bands I and III: min. 22 dB
- bands IV and V: min. 19 dB

Maximum gain difference
- between any two v.h.f. channels: typ. 4 dB
- between any two u.h.f. channels: typ. 6 dB

Noise figure
- bands I and III: max. 7.5 dB
- band I: typ. 6 dB
- band III: typ. 5 dB
- bands IV and V: max. 10 dB
- channel E21: typ. 5.5 dB
- channel E40: typ. 6.5 dB
- channel E69: typ. 7.5 dB

Unwanted signal characteristics

Image rejection (measured at picture carrier frequency)
- band I: min. 60 dB
- band III: min. 40 dB
- bands IV and V: min. 40 dB

I.F. rejection (measured at picture carrier frequency)
- band I
  - channel A: min. 12 dB
  - channel B: min. 20 dB
  - channel C: min. 30 dB
- band III: min. 60 dB
- bands IV and V: min. 60 dB

Cross modulation

Input signal producing 1% cross modulation, i.e. 1% of the modulation depth of the interfering signal is transferred to the wanted signal.

In channel cross modulation (wanted signal: picture carrier frequency; interfering signal: sound carrier frequency)
- band I
  - at nominal gain (wanted input level 60 dB (µV))
    - at 20 dB gain reduction typ. 67 dB (µV) into 75 Ω
  - at nominal gain
    - at 20 dB gain reduction typ. 70 dB (µV) into 75 Ω
- band III
  - at nominal gain
    - at 20 dB gain reduction typ. 70 dB (µV) into 75 Ω
  - at nominal gain
    - at 20 dB gain reduction typ. 90 dB (µV) into 75 Ω
- bands IV and V
  - at nominal gain
    - at 20 dB gain reduction typ. 70 dB (µV) into 75 Ω
  - at nominal gain
    - at 20 dB gain reduction typ. 90 dB (µV) into 75 Ω
V.H.F./U.H.F. television tuners

In band cross modulation (wanted signal: picture carrier of channel N; interfering signal: picture carrier of channel N ± 3 for bands I, III, IV and V).

<table>
<thead>
<tr>
<th>Band</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>III</td>
<td>at nominal gain (wanted input level 60 dB (µV)) typ. 95 dB (µV) into 75 Ω</td>
</tr>
<tr>
<td>bands IV and V</td>
<td>at nominal gain                              typ. 85 dB (µV) into 75 Ω</td>
</tr>
</tbody>
</table>

Oscillator characteristics

Shift of oscillator frequency at a change of the supply voltage 5%

<table>
<thead>
<tr>
<th>Band</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>bands I and III</td>
<td>max. 200 kHz</td>
</tr>
<tr>
<td>bands IV and V</td>
<td>max. 1000 kHz</td>
</tr>
<tr>
<td>channel 21</td>
<td>typ. 600 kHz</td>
</tr>
<tr>
<td>channel 40</td>
<td>typ. 100 kHz</td>
</tr>
<tr>
<td>channel 69</td>
<td>typ. 200 kHz</td>
</tr>
</tbody>
</table>

Drift of oscillator frequency at a change of the ambient temperature from +25 to +40 °C (measured after 3 cycles from +25 to +55 °C)

<table>
<thead>
<tr>
<th>Band</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>bands I and III</td>
<td>max. 350 kHz</td>
</tr>
<tr>
<td>bands IV and V</td>
<td>max. 600 kHz</td>
</tr>
</tbody>
</table>

I.F. circuit characteristics

Minimum tuning range of i.f. output coil 32 to 40 MHz

Miscellaneous

Oscillator voltage at the aerial terminal

<table>
<thead>
<tr>
<th>Band</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>bands I and III</td>
<td>max. 50 dB (µV) into 75 Ω</td>
</tr>
<tr>
<td>bands IV and V</td>
<td>max. 66 dB (µV) into 75 Ω</td>
</tr>
</tbody>
</table>
ADDITIONAL INFORMATION

I.F. injection
Terminal 4 (supply voltage u.h.f.) can be used as i.f. injection point, provided the u.h.f. supply voltage is applied to terminal 4 via a resistor of 56 Ω (see Fig. 10). The u.h.f. band should be switched on; a tuning voltage of $-12$ V is applied to terminal 7.

```
I.F. GENERATOR
(Z = 75 Ω)
```

```
1 nF
```

```
TELEVISION TUNER
```

```
+ 12 V
```

Fig. 10.

Connection of the i.f. amplifier
No special precautions are required to load and to match the i.f. output of the tuner.

Measuring method of power gain
The i.f. output of the tuner should be terminated with the circuit given in Fig. 11.

```
i.f output of tuner
```

```
detector probe (75 Ω)
```

Fig. 11.

This circuit roughly matches the i.f. output impedance to 75 Ω at the resonant frequency of the i.f. output circuit (Fig. 12).

Because the input and output impedances of the tuner are now 75 Ω, the power gain can be measured in the conventional manner by inserting tuner and the circuit between a 75 Ω source and a 75 Ω detector.
Alignment of the i.f. output coil

The i.f. output coil should be adjusted with a brass tool with a blade as shown in Fig. 13. A suitable tool is available under catalogue number 7122 005 47680.

Fig. 12.

Fig. 13.
V.H.F. TELEVISION TUNER

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Systems</th>
<th>C.C.I.R. systems M and N (R.T.M.A.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channels</td>
<td></td>
</tr>
<tr>
<td>low v.h.f.</td>
<td>A2 to A6</td>
</tr>
<tr>
<td>high v.h.f.</td>
<td>A7 to A13</td>
</tr>
<tr>
<td>Intermediate frequencies</td>
<td></td>
</tr>
<tr>
<td>picture</td>
<td>45.75 MHz</td>
</tr>
<tr>
<td>sound</td>
<td>41.25 MHz</td>
</tr>
</tbody>
</table>

APPLICATION

This tuner is designed to cover the v.h.f. channels of C.C.I.R. systems M and N (R.T.M.A.).

It can be provided with a frequency divider, which makes this tuner suitable for digital tuning systems based on frequency synthesis.
DESCRIPTION

This v.h.f. tuner has electronic tuning and band switching, covering the low v.h.f. band channels A2 to A6 (frequency range 54 to 88 MHz) and the high v.h.f. band channels A7 to A13 (frequency range 174 to 216 MHz).

Mechanically, the tuner is built on a low-loss printed-wiring board, carrying all components, in a metal housing made of a rectangular frame and front and rear cover (see Fig. 2a). All connections (supply voltage, a.g.c. voltage, tuning voltage, band switching, i.f. output) are made via terminals on the underside, except the coaxial aerial connection of 75 Ω which is on one of the frame sides. The mounting method is shown in Fig. 3.

Electrically the v.h.f. aerial signal is fed via low pass, high pass, i.f. and f.m. suppression filters to a switchable single tuned input circuit for low and high v.h.f. operation, which is capacitively coupled to the gate 1 of a MOS-FET tetrode (with internal gate protection against surge). The drain load of the MOS-FET tetrode is formed by a double tuned, switchable bandpass filter, transferring the r.f. signal to the emitter of the mixer transistor. The oscillator signal is also fed to the emitter of the mixer transistor.

The collector circuit of the mixer transistor is a single tuned i.f. resonant circuit, where the i.f. signal is coupled out at the low impedance side.

A test point (terminal 4) is provided for i.f. injection to adjust the i.f. output circuit of the tuner together with the i.f. amplifier of a television receiver. An additional test point, which is accessible through a hole in the top of the frame, is connected with the collector of the v.h.f. mixer transistor.

The single tuned input, the r.f. bandpass filter and oscillator circuits are tuned by 4 varicap diodes, band switching is achieved by switching diodes.

The tuner is gain controlled via gate 2 of the input MOS-FET tetrode.
Fig. 1.
MECHANICAL DATA

Dimensions in mm

Fig. 2a. I.F. output coil.
Torque for alignment: 2 to 15 mNm
Press-through force: ≥ 10 N

Terminal
1 = aerial
2 = supply voltage, v.h.f. I, +12 V
3 = supply voltage, v.h.f. III, +12 V
4 = i.f. injection
5 = a.g.c. voltage, +9,2 to +0,85 V
6 = supply voltage, +12 V
7 = tuning voltage, +1 to +28 V
9 = i.f. output
10 = earth
V.H.F. television tuner

**Mass**  approx. 125 g.

**Mounting**
The tuner may be mounted by soldering it on to a printed-wiring board, using the piercing diagram shown in Fig. 3. (The tuner may also be mounted by means of a bracket. Information will be supplied upon request.)

It is recommended that the tuner be installed in the cool part of the receiver cabinet and not exposed to the vibrations of the loudspeaker. There are no restrictions on orientation.

The solderability of the terminals and mounting tabs is according to IEC 68-2, test Ta (230 ± 10 °C, 2 ± 0.5 s). The resistance to soldering heat is according to IEC 68-2, test Tb (260 ± 5 °C, 10 ± 1 s).

![Piercing diagram](image)

*Fig. 3 Piercing diagram viewed from solder side of board. Unless otherwise stated the tolerance is ± 0.05 mm.*

**Marking**
The tuner is provided with a label showing the following data:
- type number V431
- catalogue number 3112 218 51830
- code for factory of origin
- change code
- code for year and week of production
ELECTRICAL DATA

Unless otherwise specified all electrical values apply at an ambient temperature of 25 ± 5 °C, a relative humidity of 60 ± 15%, a supply voltage of 12 ± 0.3 V and an a.g.c. voltage of 9.2 ± 0.2 V.

General

Semiconductors
- r.f. amplifier: BF982
- mixer: BF324
- oscillator: BF926
- tuning diodes: 4 x BB809
- switching diodes: 4 x BA482/483/484
- d.c. blocking diodes: 3 x BAW62

Ambient temperature range
- operating: 0 to +60 °C
- storage: -25 to +70 °C

Relative humidity
- max. 95%

Voltage and currents

Supply voltage
- +12 V ± 10%*

Current drawn from +12 V supply
- low v.h.f.: max. 52 mA; typ. 39 mA
- high v.h.f.: max. 52 mA; typ. 39 mA

Bandswitching

For operation in both bands the supply voltage is permanently connected to terminal 6. Additionally the supply voltage is connected to:
- terminal 2 for operation in the low v.h.f. band,
- terminal 3 for operation in the high v.h.f. band,
- terminal 4 for i.f. injection

A.G.C. voltage
- voltage range: +9.2 to +0.85 V
- voltage at nominal gain: +9 ± 0.5 V
- voltage at 40 dB gain reduction
  - low v.h.f.: typ. 3.2 V
  - high v.h.f.: typ. 1.5 V

Note: A.G.C. voltages between 0 and +10.5 V may be applied without risk of damage.

A.G.C. current
- max. 0.1 mA

Slope of a.g.c. characteristic,
  - at the end of the specified a.g.c. range: typ. 25 dB/V

* A tolerance of −15% on the supply voltage is admissible, if a deterioration of gain, noise figure, oscillator shift and oscillator drift is acceptable.
V.H.F. television tuner

Tuning voltage range (Figs 4 and 5) +1 to +28 V

Current drawn from 28 V tuning voltage supply

- at T_{amb} = 25 °C and R.H. = 60% max. 0.3 μA
- at T_{amb} = 25 °C and R.H. = 95% max. 1 μA
- at T_{amb} = 55 °C and R.H. = 60% max. 1 μA

Note: The source impedance of the tuning voltage offered to terminal 7 must be maximum 47 kΩ.

Slope of tuning characteristic
typical values

<table>
<thead>
<tr>
<th>Channel</th>
<th>Slope (MHz/V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A2</td>
<td>3</td>
</tr>
<tr>
<td>A6</td>
<td>2</td>
</tr>
<tr>
<td>A7</td>
<td>6</td>
</tr>
<tr>
<td>A13</td>
<td>4</td>
</tr>
</tbody>
</table>

Frequencies

Frequency ranges

- low v.h.f.

- high v.h.f.

Intermediate frequencies

<table>
<thead>
<tr>
<th>Type</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>picture</td>
<td>45.75 MHz</td>
</tr>
<tr>
<td>sound</td>
<td>41.25 MHz</td>
</tr>
</tbody>
</table>

The oscillator frequency is higher than the aerial signal frequency.

Wanted signal characteristics

Input impedance 75 Ω

V.S.W.R. and reflection coefficient
(values between picture and sound carrier, as well as values at picture carrier)

<table>
<thead>
<tr>
<th>v.s.w.r.</th>
<th>at nominal gain</th>
<th>during gain control</th>
</tr>
</thead>
<tbody>
<tr>
<td>all channels except A6</td>
<td>max. 4</td>
<td>max. 5</td>
</tr>
<tr>
<td>channel A6</td>
<td>max. 5</td>
<td>max. 5</td>
</tr>
<tr>
<td>reflection coefficient</td>
<td>max. 60%</td>
<td>max. 60%</td>
</tr>
<tr>
<td>all channels except A6</td>
<td>max. 66%</td>
<td>max. 66%</td>
</tr>
<tr>
<td>channel A6</td>
<td>max. 66%</td>
<td>max. 66%</td>
</tr>
</tbody>
</table>

R.F. curves, bandwidth

<table>
<thead>
<tr>
<th>Type</th>
<th>Bandwidth (MHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>low v.h.f.</td>
<td>typ. 10</td>
</tr>
<tr>
<td>high v.h.f.</td>
<td>typ. 12</td>
</tr>
</tbody>
</table>
R.F. curves, tilt

on any channel the amplitude difference between the top of the r.f. resonant curve and the picture frequency, the sound frequency, or any frequency between them will not exceed 3 dB at nominal gain, and 4 dB in the a.g.c. range between nominal gain and 20 dB gain reduction, except for channel A6.

A.G.C. range (Figs 6 and 7)

Power gain (see also Measuring method of power gain)

<table>
<thead>
<tr>
<th>Channel</th>
<th>Min.</th>
<th>Typ.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A4</td>
<td>22</td>
<td>26</td>
</tr>
<tr>
<td>A7</td>
<td>26</td>
<td>26</td>
</tr>
<tr>
<td>A13</td>
<td>27</td>
<td></td>
</tr>
</tbody>
</table>

Maximum gain difference between any two v.h.f. channels

typ. 4 dB

Noise figure

<table>
<thead>
<tr>
<th>Channel</th>
<th>Max.</th>
<th>Typ.</th>
<th>Typ.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A6</td>
<td>7</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>A4</td>
<td>9</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>A7</td>
<td></td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>A13</td>
<td></td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

Overloading:

Input signal producing 1 dB gain

compression at nominal gain
typ. 90 dB (µV) into 75 Ω

Input signal producing either a detuning of the oscillator of +300 kHz or -1000 kHz or stopping of the oscillations at nominal gain
typ. 100 dB (µV) into 75 Ω

Unwanted signal characteristics

Image rejection (measured at picture carrier frequency) min. 60 dB; typ. 70 dB

I.F. rejection (measured at picture carrier frequency)

<table>
<thead>
<tr>
<th>Channel</th>
<th>Min.</th>
<th>Typ.</th>
</tr>
</thead>
<tbody>
<tr>
<td>low v.h.f. channel A2</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>low v.h.f. channels A3 to A6</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>high v.h.f.</td>
<td></td>
<td>60</td>
</tr>
</tbody>
</table>

Note: At colour sub-carrier frequency maximum 6 dB less rejection.
Fig. 4 Typical tuning characteristic, low v.h.f.

Fig. 5 Typical tuning characteristic, high v.h.f.

Fig. 6 Typical a.g.c. characteristic, low v.h.f.

Fig. 7 Typical a.g.c. characteristic, high v.h.f.
F.M. rejection, low v.h.f.
Level of an f.m. signal of 91.5 MHz which produces
an i.f. signal (47.75 MHz) 57 dB below the level
of the wanted picture carrier
channel A2
channel A4
channel A6
typ. 100 dB (μV)
typ. 100 dB (μV)
typ. 60 dB (μV)

F.M. rejection, high v.h.f.
Level of an f.m. signal between 88 and 105 MHz, which
produces an i.f. interfering (45.75 MHz) 57 dB below the
level of the wanted picture carrier. Level of input picture
carrier is 60 dBμV
channel A8
typ. 95 dB (μV)
channel A11
typ. 92 dB (μV)
channel A13
typ. 95 dB (μV)

Cross modulation:
Input signal producing 1% cross modulation, i.e. 1% of the modulation depth of the interfering signal
is transferred to the wanted signal.
In channel cross modulation (wanted signal: picture carrier frequency; interfering signal: sound carrier
frequency)
at nominal gain (wanted input level 60 dB (μV))
at 40 dB gain reduction (wanted input level 100 dB (μV))
typ. 76 dB (μV) into 75 Ω
typ. 94 dB (μV) into 75 Ω

In band cross modulation (wanted signal: picture carrier of channel N; interfering signal: picture carrier
of channel N ± 2 for low v.h.f. or channel N ± 3 for high v.h.f.)
at nominal gain (wanted input level 60 dB (μV))
at 40 dB gain reduction (wanted input level 100 dB (μV))
typ. 88 dB (μV) into 75 Ω
typ. 100 dB (μV) into 75 Ω

Out of band cross modulation at nominal gain
low v.h.f., interfering from high v.h.f.
typ. 100 dB (μV) into 75 Ω
high v.h.f., interfering from low v.h.f.
typ. 90 dB (μV) into 75 Ω
Oscillator characteristics

Pulling:
Input signal of tuned frequency producing a shift of the oscillator frequency of 10 kHz, at nominal gain
  low v.h.f.
  high v.h.f.
Shift of oscillator frequency at a change of the supply voltage of 5%
When using supply circuit of Fig. 10 additional shift
Drift of oscillator frequency
during warm-up time (after the tuner has been completely out of operation for 15 min, measured between 5 s and 15 min after switching on)
during warm-up time (after the input stage is in operation for 15 min, measured between 2 s and 15 min after band switching)
at a change of the ambient temperature from +25 to +50 °C (measured after 3 cycles from +25 to +55 °C)
at a change of humidity from 60 ± 15% to 93 ± 2% (measured at $T_{amb} = 25 \pm 5 \, ^\circ\text{C}$)
  low v.h.f.
  high v.h.f.

<table>
<thead>
<tr>
<th>Type</th>
<th>Shift of oscillator frequency at a change of the supply voltage of 5%</th>
<th>Drift of oscillator frequency during warm-up time (after the tuner has been completely out of operation for 15 min, measured between 5 s and 15 min after switching on)</th>
<th>Drift of oscillator frequency during warm-up time (after the input stage is in operation for 15 min, measured between 2 s and 15 min after band switching)</th>
<th>Drift of oscillator frequency at a change of the ambient temperature from +25 to +50 °C (measured after 3 cycles from +25 to +55 °C)</th>
<th>Drift of oscillator frequency at a change of humidity from 60 ± 15% to 93 ± 2% (measured at $T_{amb} = 25 \pm 5 , ^\circ\text{C}$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typ.</td>
<td>typ. 88 dB (µV) into 75 Ω</td>
<td>max. 200 kHz</td>
<td>max. 150 kHz</td>
<td>max. 600 kHz</td>
<td>max. 500 kHz</td>
</tr>
</tbody>
</table>
I.F. circuit characteristics

Bandwidth of i.f. output circuit  
5 ± 0,5 MHz

Note: I.F. output of the tuner terminated with the circuit shown in Fig. 8; tuning voltage 15 V, high v.h.f. band switched on.

Bandwidth variation of i.f. output circuit as a result of r.f. tuning and band switching (reference: high v.h.f., tuning voltage 15 V; i.f. output circuit adjusted to 43,5 MHz)  
max. 650 kHz

Note: I.F. output of the tuner terminated with a modified circuit of Fig. 8, i.e. a 100 pF capacitor is connected in parallel with the i.f. output of the tuner.

![Fig. 8.](image)

Detuning of the i.f. output circuit as a result of r.f. tuning and band switching (reference: high v.h.f., tuning voltage 15 V; i.f. output circuit adjusted to 43,5 MHz)  
max. 300 kHz

Note: I.F. output of the tuner terminated with a modified circuit of Fig. 8, i.e. a 100 pF capacitor is connected in parallel with the i.f. output of the tuner.

Minimum tuning range of i.f. output coil  
41 to 47 MHz

Note: I.F. output of the tuner terminated with the circuit shown in Fig. 8. The tuner is supplied with the i.f. output circuit adjusted to 43,5 ± 1 MHz.

Attenuation between i.f. injection point and i.f. output of the tuner  
typ. 16 dB

Miscellaneous

Radio interference:
Oscillator radiation and oscillator voltage at the aerial terminal  
Within the limits of C.I.S.P.R. 13 (1975)

Microphonics  
There will be no microphonics, provided the tuner is installed in a professional manner.

Surge protection:
Protection against voltages  
max. 5 kV

Note: 10 discharges of a 470 pF capacitor into the aerial terminal.
Protection against flashes: max. 30 kV, 400 mWs

Note: A flashover circuit producing flashes with frequencies of 1 to 20 Hz for 30 s is connected to the aerial terminal.

ADDITIONAL INFORMATION

I.F. injection

Terminal 4 can be used as i.f. injection point. The i.f. generator is connected according to Fig. 9. High v.h.f. should be switched on; tuning voltage should be 15 V.

Fig. 9.

Connection of the i.f. amplifier

- By means of a print track as short as possible.
- By means of a shielded track, e.g. a coaxial cable.

Connection of supply voltages

Fig. 10.
Measuring method of power gain

The i.f. output of the tuner should be terminated with the RC-circuit given in Fig. 8.

![Diagram](image1)

**Fig. 11.**

The RC-circuit roughly matches the i.f. output impedance to 75 Ω at the resonant frequency of the i.f. output circuit which should be tuned to 43.5 MHz; the bandwidth is approx. 5 MHz (Fig. 11).

Because the input and output impedances of the tuner are now 75 Ω, the power gain can be measured in the conventional manner by inserting tuner and RC-circuit between a 75 Ω source and a 75 Ω detector.

Alignment of the i.f. output coil

The i.f. output coil should be adjusted with a brass tool with a blade as shown in Fig. 12. A suitable tool is available under catalogue number 7122 005 47680.

![Diagram](image2)

**Fig. 12.**
## TESTS AND REQUIREMENTS

<table>
<thead>
<tr>
<th>IEC 68-2</th>
<th>test</th>
<th>procedure</th>
<th>requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ab</td>
<td>cold</td>
<td>−25 °C, 96 h</td>
<td>Checked within 10 min after all tests mentioned:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>no catastrophic failures (in operation of 1 or more</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>channels).</td>
</tr>
<tr>
<td>Bb</td>
<td>dry heat</td>
<td>+70 °C, 96 h</td>
<td></td>
</tr>
<tr>
<td>Db</td>
<td>damp heat, cyclic</td>
<td>+25 to +40 °C</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>R.H. 90 to 100%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>21 cycles of 24 h</td>
<td></td>
</tr>
<tr>
<td>Ca</td>
<td>damp heat, steady state</td>
<td>−40 °C, R.H. 93%</td>
<td>After 1 h reconditioning under normal conditions:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>21 days</td>
<td>change of osc. freq.</td>
</tr>
<tr>
<td>Na</td>
<td>rapid change of temperature</td>
<td>3 h −25 °C/3 h + 70 °C</td>
<td>band I &lt; 1,5 MHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 cycles</td>
<td>band III &lt; 2 MHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>change of power gain &lt; 2 dB</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>change of tilt r.f. curve &lt; 2 dB</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>change of tuning current &lt; 0,5 μA</td>
</tr>
<tr>
<td>Fc</td>
<td>vibration</td>
<td>10-55-10 Hz, amplitude 0,35 mm</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 directions,</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>30 min per direction</td>
<td></td>
</tr>
<tr>
<td>Eb</td>
<td>bump</td>
<td>1000 bumps, acceleration 25 g,</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>in 6 directions</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ea</td>
<td>shock</td>
<td>half sine pulse 11 ms, acceleration 50 g</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>in 6 directions</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 times per direction</td>
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COAXIAL AERIAL INPUT ASSEMBLIES
COAXIAL AERIAL INPUT ASSEMBLY

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Frequency range</th>
<th>40 to 890 MHz</th>
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</thead>
<tbody>
<tr>
<td>Impedance</td>
<td>75 Ω asymmetrical</td>
</tr>
</tbody>
</table>

APPLICATION

This coaxial aerial input assembly has been developed for application in TV sets without mains separation and provided with a television tuner of the UV400 family. Thanks to the use of safety capacitors in the assembly, the chassis of the TV set is separated from the aerial input. The input connector of the assembly meets the demands of IEC 169.2 and DIN 45325 (diameter 9.5 mm).

The coaxial aerial input assembly complies with the requirements of immunity from radiated interference of Amtsblatt DBP69/1981. It meets the safety requirements of IEC 65; approbation approval has been sought from VDE.

DESCRIPTION

The assembly is provided with safety capacitors, which are moulded in thermo-setting insulation material, thus forming capacitor blocks. These capacitor blocks are built in a metal housing with cover, and are connected to the housing, coaxial cable and the output plug (see Fig. 1). The coaxial cable is a double insulated, screened 75 Ω cable, which leads to the female input connector on a plastic plate. The output connector (phono) is mounted on the housing and fits the aerial input of the tuner (see Fig. 2).

The assembly can be supplied with three cable lengths:

<table>
<thead>
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<th>free cable length</th>
<th>catalogue number</th>
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<tr>
<td>90 mm</td>
<td>3122 127 01240</td>
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<tr>
<td>145 mm</td>
<td>3122 127 03500</td>
</tr>
<tr>
<td>250 mm</td>
<td>3122 127 05900</td>
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</table>

Fig. 1 Ferrite bead = φ8 x φ3 x 10 mm.

\[
\begin{align*}
C_1 &= 390 \text{ pF} \\
C_2 &= 1000 \text{ pF} \\
C_3 &= 1000 \text{ pF}
\end{align*}
\]
ELECTRICAL DATA

The electrical values are measured at an ambient temperature of 25 ± 5 °C and a relative humidity of 60 ± 15%.

Impedance of input connector

75 Ω, asymmetric

Impedance of output plug

75 Ω, asymmetric

Frequency range

40 to 890 MHz

Reflection at the input connector, output plug

matched with phono connector 3122 128 74660

and 75 Ω

40 to 470 MHz

≤ 25%

470 to 700 MHz

≤ 35%

700 to 890 MHz

≤ 45%

Reflection at the output plug, input

connector matched with IEC plug and 75 Ω

40 to 470 MHz

≤ 25%

470 to 700 MHz

≤ 35%

700 to 890 MHz

≤ 45%

Insertion loss

40 to 700 MHz

max. 1,5 dB, typ. 0,6 dB

700 to 890 MHz

max. 2,0 dB, typ. 1,4 dB

Contact resistance of input connector

inner conductor

≤ 10 mΩ

outer conductor

≤ 5 mΩ

Contact resistance of output plug

inner conductor

≤ 10 mΩ

outer conductor

≤ 10 mΩ

Insulation resistance

≤ 500 MΩ

Immunity from radiated interference

in conformity with requirements of Amtsblatt DBP69/1981 provided the unit is connected to a television tuner of the UV400 family in the right way.

the unit meets the requirements of IEC 65, 4th edition, clause 14.2. Approval approval has been sought from VDE. Quality assessment in production centres is according to the rules of VDE.

ENVIRONMENTAL CONDITIONS

Operating temperature range

0 to + 55 °C

Storage temperature range

-40 to + 70 °C

Relative humidity

≤ 95%

Maximum bump acceleration

245 m/s² (25g)

Maximum shock acceleration

490 m/s² (50g)

Maximum vibration amplitude

0,35 mm
Coaxial aerial input assembly

MECHANICAL DATA

Dimensions in mm

Fig. 2.

Mass  50 g approximately

MOUNTING

The metal housing is connected to the television tuner of the UV400 family by inserting the phono plug into the aerial input plug of the tuner. The plastic plate with input connector can be fixed by means of two M3 screws (13 mm) or by using a snap-in holder.

It is advised not to use aluminium plugs.

Insertion force

input connector max. 50 N
inner conductor of output plug max. 30 N

Pull-out force

input connector 10 to 50 N
inner conductor of output plug min. 3 N

Tensile strength to cable connections at both sides max. 100 N
### TESTS AND REQUIREMENTS

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<th>name of test</th>
<th>procedure</th>
<th>requirements</th>
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<td>IEC 68-2-1</td>
<td>Ab cold</td>
<td>-40 °C, 96 h</td>
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<tr>
<td>IEC 68-2-2</td>
<td>Bb dry heat</td>
<td>+ 70 °C, 96 h</td>
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<td>IEC 68-2-30</td>
<td>Db damp heat, cyclic</td>
<td>+ 25/+ 40 °C, 90/100% R.H., 21 cycles of 24 h</td>
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<tr>
<td>IEC 68-2-3</td>
<td>Ca damp heat, steady state</td>
<td>40 °C, 93% R.H.; 21 days</td>
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<tr>
<td>IEC 68-2-14</td>
<td>Na rapid change of temperature</td>
<td>3 h –40 °C/3 h + 70 °C, 5 cycles</td>
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<td>IEC 68-2-6</td>
<td>Fc vibration</td>
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<td></td>
<td>directions, 30 min per direction</td>
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<td>IEC 68-2-29</td>
<td>Eb bump</td>
<td>1000 bumps, 25 g, 6 directions</td>
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<tr>
<td>IEC 68-2-27</td>
<td>Ea shock</td>
<td>half sinewaves of 11 ms, accel. 50 g, 6 directions, 3 shocks per direction</td>
<td></td>
</tr>
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</table>

### MARKING

Moulded in the front side of the plastic plate (see Fig. 2):
- PHILIPS
- 7106 (safety code)
- 250 V; 390 pF 1x, 1000 pF 2x

### PACKING

The assemblies are supplied in cardboard boxes of 490 x 295 x 153 mm, 64 pieces per box.
COAXIAL AERIAL INPUT ASSEMBLY

APPLICATION

These coaxial aerial input assemblies have been developed for application in television sets with 75 ohm input impedance, for use in v.h.f. as well as in u.h.f. (40-890 MHz). The connectors meet the demands of both the IEC standards (diameter 9.5 mm) and the French standards (diameter 9.0 mm). They have to be used with plugs complying with the properties mentioned in DIN 45325, IEC 169-2 (diameter 9.5 mm) and SNIR (diameter 9.0 mm). The units meet the safety requirements of IEC 65.

AVAILABLE TYPES

Coaxial aerial input assembly 75 Ω

Attenuation : ≤ 1 dB
Reflection, v.h.f. : ≤ 15%
Reflection, u.h.f. : ≤ 25%
Catalogue number : 3122 127 10260

Dimensions in mm

August 1974 307
Recommended fixing of the aerial cable

Soldering conditions: $370 \pm 5^\circ C; 3.5 \pm 0.5$ s

Cable diameter $\geq 5$ mm

Cable diameter $< 5$ mm
Coaxial aerial input assemblies

Coaxial aerial input assembly 75 Ω, with filter

Reflection, v.h.f.  
\[ \leq 25\% \]  
\[ \leq 30\% \]

u.h.f.

Frequency characteristic  
v.h.f., 50 to 230 MHz  
470 MHz  
700 MHz  
u.h.f., 470 to 850 MHz  
230 MHz  
100 MHz

\[ \leq 1 \text{ dB} \]  
\[ \geq 13 \text{ dB} \]  
23 dB (typical value)  
\[ \leq 1 \text{ dB} \]  
\[ \geq 15 \text{ dB} \]  
40 dB (typical value)

Catalogue number  
3122 127 10450

Dimensions in mm

November 1974  309
solder wires into place after PandQ have been bent around the cables

Recommended fixing of the aerial cable
Soldering conditions: 370 ± 5 °C; 3.5 ± 0.5 s

screening fold back over outer cover

tulle made of shrink sleeve or tulle made of outer cover which is removed by stripping

Cable diameter ≥ 5 mm

Cable diameter < 5 mm
Coaxial aerial input assemblies

Coaxial aerial input assembly 75 Ω, with high-pass filter

Attenuation at 1 MHz: 60 dB (typical value)
5 MHz: 40 dB (typical value)
10 MHz: ≥ 25 dB
50 MHz: ≤ 1 dB
230 MHz: ≤ 1 dB
470 MHz: ≤ 1 dB
850 MHz: ≤ 1.5 dB

Reflection:
- v.h.f. I: ≤ 35%
- v.h.f. III: ≤ 15%
- u.h.f.: ≤ 35%

Catalogue number: 3122 127 14730

Dimensions in mm
solder wires into place after P has been bent around the cable

Recommended fixing of the aerial cable
Soldering conditions: $370 \pm 5 ^\circ C; 3.5 \pm 0.5 \, s$

Cable diameter $\geq 5 \, mm$

Cable diameter $< 5 \, mm$
COAXIAL AERIAL INPUT ASSEMBLY

APPLICATION
This coaxial aerial input assembly has been developed for application in TV sets with 75 Ω input impedance, for use in v.h.f. as well as in u.h.f. bands. Thanks to the use of safety capacitors in the assembly, the chassis of the TV set is separated from the aerial input. The connector for the aerial input meets the demands of the IEC standards (diameter 9,5 mm) and the French standards (diameter 9,0 mm).

The coaxial aerial input assembly complies with the requirements of immunity from radiated interference of BS 905. It meets the safety requirements of IEC 65; approbation approvals have been sought from KEMA, VDE, SEV, BSI, DEMKO, NEMKO, SEMKO, EI and LCEE.

DESCRIPTION
The assembly is provided with safety capacitors, which are moulded in thermo-setting insulation material, thus forming a capacitor block. This capacitor block is built in a metal housing, with lid, which is carried by a plastic fixing plate. All points to the safety capacitors are press contacts, achieved by the metal housing. The housing has an outlet for the coaxial cable to the television tuner.
ELECTRICAL DATA
The electrical values are measured at an ambient temperature of 25 ± 5 °C and a relative humidity of 60 ± 15%.

Input impedance of connector 75 Ω, asymmetrical

Frequency ranges
  v.h.f.  40 to 300 MHz
  u.h.f.  470 to 890 MHz

Reflection
  v.h.f.  < 15%
  u.h.f.  < 25%

Insertion loss
  v.h.f.  < 1 dB; typ. 0,2 dB
  u.h.f.  < 1 dB; typ. 0,4 dB

Contact resistance of connector after 1 plug insertion
  inner bush  ≤ 10 mΩ
  outer bush  ≤ 5 mΩ

Insulation resistance
  > 500 MΩ

Immunity from radiated interference
  in conformity with requirements of BS 905, provided the assembly is installed in a professional manner, and a proper coaxial cable is used.

Fig. 1.

ENVIRONMENTAL DATA
Operating temperature range 0 to + 55 °C
Storage temperature range -40 to + 85 °C
Relative humidity ≤ 95%
MECHANICAL DATA

Dimensions in mm

MOUNTING

The assembly can be mounted to the chassis of the TV set with two self-tapping screws, 4N x 9,5. It must be connected to the tuner via a coaxial cable with a diameter of 3 mm. The inner cable conductor should be soldered to the metal plating of the capacitor block, and the cable earth sheath to the metal housing, see Fig. 3.

The soldering conditions are: 340 °C, 2 s.

Plugs to be used with the assembly have to comply with the properties mentioned in DIN 45325, IEC 69-2 (9,5 mm diameter) and SNIR (9 mm diameter).

It is advised not to use aluminium plugs.
Fig. 3 Recommended fixing of the aerial cable.

Fig. 4 Recommended cable stripping.
COAXIAL AERIAL INPUT ASSEMBLY

APPLICATION
This coaxial aerial input assembly has been developed for application in TV sets with 75 Ω input impedance, for use in v.h.f. as well as in u.h.f. bands. Thanks to the use of safety capacitors in the assembly, the chassis of the TV set is separated from the aerial input. The connector for the aerial input meets the demands of the IEC standards (diameter 9,5 mm) and the French standards (diameter 9,0 mm).

The coaxial aerial input assembly complies with the requirements of immunity from radiated interference of BS 905. It meets the safety requirements of IEC 65; approbation approvals have been sought from KEMA, VDE, SEV, BSI, DEMKO, NEMKO, SEMKO, EI and LCEE.

DESCRIPTION
The assembly is provided with safety capacitors, which are moulded in thermo-setting insulation material, thus forming a capacitor block. This capacitor block is built in a metal housing with lid, which is carried by a plastic fixing plate. All points to the safety capacitors are press contacts, achieved by the metal housing. A printed circuit board containing a splitter for v.h.f. and u.h.f. signals is built in the housing. The housing has two outlets for coaxial cables to the television tuner.

Fig. 1 Electrical diagram.
ELECTRICAL DATA

The electrical values are measured at an ambient temperature of 25 ± 5 °C and a relative humidity of 60 ± 15%.

Input impedance of connector 75 Ω, asymmetrical

Frequency ranges
  v.h.f. 40 to 300 MHz
  u.h.f. 470 to 890 MHz

Reflection
  v.h.f.; u.h.f. output terminated with 75 Ω ≤ 30%
  u.h.f.; v.h.f. output terminated with 75 Ω ≤ 30%

Insertion loss
  v.h.f., 40 – 230 MHz ≤ 1 dB; typ. 0.7 dB
  v.h.f., 230 – 300 MHz, u.h.f. terminated with 75 Ω ≤ 1,5 dB; typ. 1,2 dB
  u.h.f., v.h.f. terminated with 75 Ω ≤ 1,5 dB, typ. 0,9 dB

Suppression
  of u.h.f. frequencies at v.h.f. output
    40 – 230 MHz > 15 dB
    230 – 300 MHz > 10 dB
  measured at
    40 MHz typ. 50 dB
    200 MHz typ. 22 dB
    230 MHz typ. 18 dB
    300 MHz typ. 11 dB
  of v.h.f. frequencies at u.h.f. output
    470 – 890 MHz > 13 dB
  measured at
    470 MHz typ. 14 dB
    700 MHz typ. 21 dB
    890 MHz typ. 22 dB

Contact resistance of connector
after 1 plug insertion
  inner bush: ≤ 10 mΩ
  outer bush: ≤ 5 mΩ

Insulation resistance
> 500 MΩ

Immunity from radiated interference
in conformity with requirements of BS 905, provided the assembly is installed in a professional manner, and a proper coaxial cable is used.
Quality assessment in production centres are according to the rules of BSI and VDE.

**ENVIRONMENTAL DATA**
- **Operating temperature range**: 0 to +55 °C
- **Storage temperature range**: −40 to +85 °C
- **Relative humidity**: < 95%
- **Maximum bump acceleration**: 25g
- **Maximum shock acceleration**: 50g
- **Maximum vibration amplitude**: 0.35 mm

**MECHANICAL DATA**

![Diagram showing dimensions in mm]

**Dimensions in mm**

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Max (±0.2 mm)</th>
<th>Min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width</td>
<td>36±0.4</td>
<td>36±0.4</td>
</tr>
<tr>
<td>Height</td>
<td>26.1±0.1</td>
<td>26.1±0.1</td>
</tr>
<tr>
<td>Length</td>
<td>49±0.2</td>
<td>49±0.2</td>
</tr>
<tr>
<td>Thickness</td>
<td>3.4±0.1</td>
<td>3.4±0.1</td>
</tr>
<tr>
<td>Mass</td>
<td>26 g</td>
<td></td>
</tr>
</tbody>
</table>

**Fig. 2.**

![Diagram of coaxial aerial input assembly]

**Coaxial aerial input assembly**

**September 1983**
Connector

Insertion force \( \leq 50 \text{ N} \)

Pull-out force \( 10 \text{ to } 50 \text{ N} \)

Pull-out force of inner bush,
measured with a min. gauge of
2,29 mm dia., after 5 insertions of a
max. plug gauge of 2,43 mm dia.
\( \geq 1 \text{ N} \)

Loading of inner bush in axial direction for 5 s \( \leq 50 \text{ N} \)

Pull-out force of outer bush,
measured with a min. plug gauge of
9 mm dia., after 5 insertions of a
max. plug gauge of 9,5 mm dia.
\( \geq 1,5 \text{ N} \)

Loading of outer bush in 4 radial and
axial directions for 5 s \( \leq 50 \text{ N} \)

Marking

Moulded at the front of the fixing plate:
- PHILIPS
- 7105 (for the National Approbation Offices regarding the safety aspects)
- 250 V~, 390 pF 3x

Punched into one of the side faces of the metal housing:
- letter code for factory of origin
- production date code (year and week)

MOUNTING

The assembly can be mounted to the chassis of the TV set with two self-tapping screws, 4N x 9,5.

It must be connected to the tuner via coaxial cables with a diameter of 3 mm stripped according to
Fig. 3. The inner cable conductors should be soldered to the inputs of splitters which line up with the
cable inlets, the cable earth sheaths soldered to the metal housing.

The soldering conditions are: 340 °C, 2 s.

Plugs to be used with the assembly have to comply with the properties mentioned in DIN 45325,
IEC 69-2 (9,5 mm diameter) and SNIR (9 mm diameter).

It is advised not to use aluminium plugs.

Fig. 3 Recommended cable stripping.
Cable length max. 150 mm.
## CONVERSION LIST

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January 1987
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The Mullard technical handbook system... 
... a comprehensive data library

The Mullard technical handbook is made up of four sets of Books, each comprising several parts:-

- Book 1 (light blue)  Semiconductor devices
- Book 2 (orange)  Electronic tubes
- Book 3 (green)  Components, materials and assemblies
- Book 4 (dark blue)  Integrated circuits

Most of the devices for which full data is given in these books are those around which we would recommend equipment to be designed. Where appropriate, other types no longer recommended for new equipment designs but generally available for equipment production, are listed separately. Data sheets for these types may be obtained on request. Older devices for which data may be obtained on request are also included in the index of the appropriate part of each book.

Because the Technical handbook system forms a comprehensive data reference library the current Mullard Quick Reference Guide should always be consulted for details of the Mullard preferred range.

The data contained in these books is as accurate and up to date as possible at the time of going to press. It must be understood, however, that no guarantee can be given on the availability of the various devices, or that their specifications may not be changed before the next edition is published.

Each part is reviewed regularly, and revised and re-issued where necessary. Revisions to previous data are indicated by an arrow in the margin.

Requests for copies of the Quick Reference Guide and individual data sheets (please quote the type number) should be sent to:-

Technical Publications Department, Mullard Limited,
New Road, Mitcham, Surrey CR4 4XY. Telex 22194.

Prices and availability information for Mullard components should be obtained from Mullard House, or from one of the Mullard Distributors listed on the back cover.
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**The Technical Publication Department, Mullard Limited, New Road, Mitcham, Surrey CR4 4XY.**

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A must for designers, this bi-monthly, newspaper-style publication briefly describes new components and offers further information on subjects of interest.

**Consumer Electronics**

A review, in newspaper style, published every four months. Articles and features of interest to those in the consumer electronics industry, with emphasis on television technology and allied subjects.

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All products marketed by Mullard are listed alphabetically and described briefly in our Quick Reference Guide.

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Subscribers to any or all of the four handbook sections receive all relevant handbooks, looseleaf binders, monthly mailings of new data sheets, and new handbook parts as they are published.
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Mullard Data Base:
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Mullard technical handbook

Book 3 Components, materials and assemblies

Book 3 consists of the following parts:

Part 1a Ceramic capacitors
Part 1b Electrolytic and solid capacitors
Part 1c Fixed resistors
Part 1d Potentiometers, encoders and switches
Part 1e Film capacitors
Part 1f Varistors, thermistors & sensors
Part 2a Ferroxcube cores and components for power applications
Part 3 Vinkor inductor cores
Part 5 Television tuners
Part 6 Loudspeakers