REFERENCE DESIGN 4172 INCLUDES: \(\checkmark\)Tested Circuit \(\checkmark\)Board Available \(\checkmark\)Description \(\checkmark\)Test Data

MAX2160 ISDB-T Reference Design

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Abstract: This reference design for the MAX2160 tuner plus demodulator IC demonstrates a compact daughter-board solution for the ISDB-T standard (single-segment). This design converts UHF band signals (470MHz to 770MHz) to a MPEG-2 transport stream. The solution is intended for portable applications, such as cell-phone TVs and PDAs.

More Information
- Wireless Home
- Application Notes and Tutorials
- EV Kit Software
- Technical Support
Figure 1. The reference design for the MAX2160 tuner plus demodulator.

Figure 2. System block diagram.
Figure 3. Sensitivity measures better than -97dBm. The tradeoff in sensitivity is also shown when an optional WCDMA or cdma2000® rejection filter is added at the RF input.
Figure 4. A WCDMA blocker rejection filter response. To implement on-board coexistence of ISDB-T with a WCDMA system, additional input filtering is required to reject the cellular transmit-band frequencies. The optional reference-design filtering is a combination of two filters, which provide approximately 47dB of attenuation at the cellular transmit band (marker 4).
Figure 5. CDMA-2000 blocker rejection filter response. To implement on-board coexistence of ISDB-T with a cdma2000 system in a handheld application, additional input filtering is required to reject the cellular transmit-band frequencies. The optional reference-design filter provides approximately 42dB of attenuation at cdma2000 transmit frequencies (marker 4).

### Additional Measurements

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Conditions</th>
<th>Target</th>
<th>Measured</th>
<th>Units</th>
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<tr>
<td>Maximum Input</td>
<td>UHF: Ch. 13, Ch. 33, Ch. 52</td>
<td>0</td>
<td>8.9, 8.2, 7.3</td>
<td>dBm</td>
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<tr>
<td>Adjacent Channel Selectivity</td>
<td>UHF: Ch. 13, Ch. 33, Ch. 52</td>
<td>35</td>
<td>45, 47, 45</td>
<td>dBc</td>
</tr>
<tr>
<td>(Desired: -70dBm)</td>
<td></td>
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<tr>
<td>WCDMA Blocker Performance</td>
<td>UHF: Ch. 13, Ch. 33, Ch. 52</td>
<td>24</td>
<td>23.5, 24, 24</td>
<td>dBm</td>
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<tr>
<td>cdma2000 Blocker Performance</td>
<td>UHF: Ch. 13, Ch. 33, Ch. 52</td>
<td>10</td>
<td>21, 21, 21</td>
<td>dBm</td>
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### ISDB-T Frequency Plan
Figure 6. The ISDB-T RF signal is broadcast in the UHF band, as shown above. The channel spacing is 6MHz.

**Detailed Description**

The MAX2160/MAX2160EGB tuner ICs are designed for use in Japanese mobile digital-TV (ISDB-T single-segment) applications. The devices directly convert UHF band signals to a low-IF by using a broadband I/Q downconverter. The operating frequency range extends from 470MHz to 770MHz.

The MAX2160/MAX2160EGB support both I/Q low-IF interfaces and single low-IF interfaces. The devices are thus universal tuners for various digital demodulator implementations.

The MAX2160/MAX2160EGB integrate LNA, RF and low-IF variable-gain amplifiers (VGAs), I and Q downconverting mixers, and bandpass filters providing in excess of 42dB of image rejection. The parts operate with either high-side or low-side local oscillator (LO) injection. The devices’ VGAs provide in excess of 100dB of gain-control range.

The MAX2160/MAX2160EGB also have fully monolithic VCOs and tank circuits, and a complete frequency synthesizer. A XTAL oscillator and separate TCXO input buffer are also included. The devices operate with XTAL/TCXO oscillators from 13MHz to 26MHz, which enable the shared use of a VC-TCXO in cellular handset applications. Additionally, a divider is provided for the XTAL/TCXO oscillator, thus allowing for a simple and low-cost interface to various channel decoders.

cdma2000 is a registered certification mark and registered service mark of the Telecommunications Industry Association.

**Related Parts**

| MAX2160 | ISDB-T Single-Segment Low-IF Tuners |

**More Information**

For Technical Support: [http://www.maximintegrated.com/support](http://www.maximintegrated.com/support)
For Samples: [http://www.maximintegrated.com/samples](http://www.maximintegrated.com/samples)
Other Questions and Comments: [http://www.maximintegrated.com/contact](http://www.maximintegrated.com/contact)

Application Note 4172: [http://www.maximintegrated.com/an4172](http://www.maximintegrated.com/an4172)