Start Here
Use BTS Over-the-Air (OTA) tests to spot-check a transmitters’ coverage and signal quality. Use the Direct Connect tests to check transmitter power and when the OTA test results are ambiguous.

Troubleshooting Hints
These two tables provide guidance from the first indication of a fault, a poor Key Performance Indicator (KPI), to the BTS or Spectrum Master test, and finally, to the field replaceable unit.

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<tr>
<th>Key Performance Indicators vs. Test</th>
<th>Pilot Power</th>
<th>ACPR SEM</th>
<th>RMS Phase Error</th>
<th>Carrier Feedthrough</th>
<th>Code Noise Floor</th>
<th>Excess PN Codes</th>
<th>OTA Power</th>
<th>OTAnet Power</th>
<th>Excess PN Codes</th>
<th>Multi-path</th>
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<tbody>
<tr>
<td>Call Blocking/Denial</td>
<td>X</td>
<td>X</td>
<td>XX</td>
<td>X</td>
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<td>X</td>
<td>X</td>
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<td>UL Interference</td>
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<td>X</td>
<td>XX</td>
<td>X</td>
<td>X</td>
<td>XX</td>
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<td>Call Drop</td>
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<td>DL Interference</td>
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<td>X</td>
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<td>XX</td>
<td>X</td>
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</table>

Test vs. BTS Field Replaceable Units

<table>
<thead>
<tr>
<th>Freq Ref</th>
<th>Ch Cards</th>
<th>MCFA</th>
<th>Filter</th>
<th>Antenna</th>
<th>Antenna Down Tilt</th>
<th>Uplink Interference</th>
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<tbody>
<tr>
<td>Pilot Power</td>
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<td>X</td>
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<tr>
<td>Adjacent Channel Power Ratio</td>
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<td>Spectral Emission Mask</td>
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<tr>
<td>RMS Phase Error</td>
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<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Frequency Error</td>
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<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Carrier Feedthrough</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
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<tr>
<td>Code Noise Floor</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Rx Noise Floor</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Ex/Ic</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Multipath</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

x = probable, xx = most probable

Locating Over-the-Air Test Spots
To test a BTS Over-the-Air (OTA) it is necessary to find a location with good pilot dominance and low multipath. The BTS Master pilot dominance and multi-path measurements are ideal for this task. OTA testing requires a pilot dominance higher than 10 dB and a multipath number less than 0.3 dB.

To find a good OTA test site, look for a place squarely in the sector, a block or two from the tower, and away from surfaces that may reflect radio waves. A directional antenna for the BTS Master will help to screen out unwanted signals.

In some urban areas, locating a good OTA site can be difficult. In these cases, it may be quicker to hook up to the BTS for testing.

Multiple Sector Coverage Checks
Pilot Scanners, OTA Pilot Power, E/Ic, Pilot Dominance

Pilot Scanners indicate which pilots, identified by PN code, are present at the current location. Too many strong pilots create pilot pollution.

OTA Pilot Power indicates signal strength of the dominant code. E/Ic indicates the quality of the signal from each scrambling code.

Pilot Dominance measures how much stronger the strongest PN code is relative to the others.

Guidelines:
- PN Codes: 3 or fewer codes, within 15 dB of the dominant code, over 95% of the coverage area.
- OTA Pilot Power: Should be higher than -93 dBm over 95% of the coverage area.
- E/Ic: Should be higher than -9 dB over 95% of the coverage area.
- Pilot Dominance: Higher than 10 dB for OTA signal quality testing.

Consequences:
- PN Codes: Low data rate, low capacity, and excessive soft handoffs.
- OTA Pilot Power: Call drop, low data rate, and low capacity.
- E/Ic: Low data rate and low capacity.

Common Faults:
Antenna down tilt and BTS pilot power settings affect all measurements in this category. OTA Pilot Power and E/Ic are also affected by building shadows. In addition, E/Ic is affected by antenna damage, poor BTS Rho, and co-channel interference.

cdmaOne/CDMA2000 1X BTS Block Diagram
Frequency Error

Carrier Feedthrough

Noise Floor & Overhead Channels

- **Frequency Error** is a check to see that the carrier frequency is precisely correct. The BTS Master can accurately measure Carrier Frequency Error OTA if the instrument is GPS enabled or in GPS holdover. **Guideline:** Frequency Error should be less than +/- 0.05 ppm.

- **Common Faults:** First check the reference frequency and the reference frequency distribution system. If a GPS frequency reference is used, check it as well.

- **Carrier Feedthrough** is a measure of how much unmodulated signal leaks through the mixers in the radios and up-converters. This leakage directly lowers Rho. **Guideline:** A typical limit is -25 dBm. Specific models of base stations may require limits as high as -19 dBm.

- **Rx Noise Floor** is the average level of the visible code domain noise floor. This will affect Rho. **Guideline:** -35 dB, or lower, is a typical limit.

- **Consequences:** Dropped calls, low signal quality, low data rate, low sector capacity, and blocked calls. This is the single most important signal quality measurement.

- **Rx Noise Floor (continued)**

- **Guideline:** Less than approximately -90 dBm

- **Consequences:** Call blocking, denial of services, call drops, low data rate, and low capacity.

- **Common Faults:** Receiver de-sense, co-channel interference, in-band interference, or passive intermodulation (PIM).

- **Intermodulation products can cause interference and in turn may be caused by a combination of strong signals and distortion. This distortion can be in the antenna, connectors, or nearby rusty metal. This issue is often called the rusty bolt syndrome.

- **Consequences:** Call blocking, denial of services, call drops, low data rate, low capacity.

- **Rx Noise Floor**

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- **Guideline:** Less than approximately -90 dBm

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