A new approach to high speed digital sampling and its use in radio telescope correlator development

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Transceiver Block diagram

Figure 7-1: GTP RX Block Diagram
High-Pass Pole Location: RXEQPOLE[3:0]

MGTRXN
Line Termination

MGTRXP
Reference to 2/3 AVTTRX:
RCV_TERM_GND AND RCV_TERM_VTTRX
Reference to Ground:
RCV_TERM_GND
Reference to AVTTRX:
RCV_TERM_VTTRX
AC Coupling Bypass:
AC_CAP_DIS

V1: 2/3 AVTTRX
V2: AVTTRX

Single-Pole High-Pass Filter

High Pass

High-Pass/Wideband Mixing Ratio:
RXEQMIX[1:0]

Wideband

V1: 2/3 AVTTRX
RCV_TERM_MID

Summation to RX CDR
Simulated sampling of a sine wave
Measured sampling of a sine wave
Future Developments
## Future Developments

<table>
<thead>
<tr>
<th>Device family</th>
<th>MAX Data receive capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertex 5</td>
<td>156 Gb/s</td>
</tr>
<tr>
<td>Vertex 6</td>
<td>585 Gb/s</td>
</tr>
<tr>
<td>Vertex 7</td>
<td>1392 Gb/s</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>configuration</th>
<th>Max Sampling speed With interleaving</th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Roach 1 (Vertex 5)</td>
<td>Roach 2 (Vertex 6)</td>
</tr>
<tr>
<td>1 bit</td>
<td>25 GS/s</td>
<td>105.6 GS/s</td>
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<tr>
<td>2 bit</td>
<td>6.25 GS/s</td>
<td>33 GS/s</td>
</tr>
<tr>
<td>3 bit</td>
<td>3.125 GS/s</td>
<td>13.2 GS/s</td>
</tr>
<tr>
<td>4 bit</td>
<td>6.6 GS/s</td>
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</tr>
</tbody>
</table>
Simulated Auto and Cross correlation

Simulation auto correlation of broadband noise source with single frequency at 700MHz

Simulation cross correlation of broadband noise source with single frequency at 700MHz
Measured Auto and Cross correlation

Auto correlation of 500–1000MHz independent noise with 700MHz correlated signal

Cross correlation of 500–1000MHz independent noise with 700MHz correlated signal