Packet Spilling of Small Packets After Parity Error/Bad Address for UT200SpW4RTR SpaceWire Router

Table 1: Cross Reference of Applicable Products

<table>
<thead>
<tr>
<th>Product Name:</th>
<th>Manufacturer Part Number</th>
<th>SMD #</th>
<th>Device Type</th>
<th>Internal PIC*</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-PORT SPACEWIRE ROUTER</td>
<td>UT200SpW4RTR</td>
<td>NA</td>
<td>NA</td>
<td>WD41A</td>
</tr>
</tbody>
</table>

Note 1: WD41A will not be sold against the SMD. All SMD shipments will be with Rev B Silicon.
*PIC = Product Identification Code

1.0 Overview
An anomaly with the 4-Port SpaceWire router has been discovered that can cause 8 bytes of a packet following an error packet to be spilled per ECSS-E-ST-50-12C, section 10.5.2.c.

The conditions that will cause the anomaly are a small packet (less than 200 bytes), and a parity error occurs in the look up table space (0x0020 – 0x00FF), or a bad/invalid address (per ESCC-E-ST-50-12C section 11.3.4), combined with the internal receive FIFO flag for the target port being not empty. It should be noted that if a parity error in the look up table space occurs the user should rewrite the look up table configuration space (0x0020 to 0x00FF). See Figure 1 for failure logic diagram.

Figure 1. Logic Diagram of Anomaly

The conditions described will cause 8 bytes of the packet following the error packet to be spilled. There is a chance that the router will continue to spill 8 bytes of a packet following an error packet if parity errors and bad addresses are continuously sent.
Based on preliminary data the probability of this anomaly occurring is once every 9,800 years with the UT200SpW4RTR in operation in a geosynchronous orbit and the Adam’s 90% worst case environment.

2.0 Corrective Action
This anomaly can be prevented by ensuring that the packets on the SpW network are larger than 200 bytes, ensuring that there are no Parity Errors, or Bad Address packets on the network. If the anomaly is encountered two options are offered that will recover the UT200SpW4RTR into normal operation.

2.1 Option #1
The first option is to clear the receive FIFO of the SpaceWire port on which the anomaly has occurred. This can be accomplished by writing to configuration register 0x0115. The following example demonstrates how to reset the faulted FIFO.

Assume that port 2 of the UT200SpW4RTR encountered the anomaly and is spilling packets. The user writes to the bit that corresponds to port 2 in register 0x0115.

**Please note that additional address bytes may be required, depending on the user’s system configuration.

Write the following byte sequence directly into port 5 of the router;
- No Address Bytes are required
- 0x00: for configuration
- Router ID: 00 as default assuming router ID has not been set
- Protocol ID: 00 for no protocol used
- Packet Type: 00 is Write
- Set up Configuration Space:
  - Address LSB: 15 for Receive FIFO Reset
  - Address MSB: 01
- Write in Data:
  - Data LSB: 02 this corresponds to port 2  MSB [0][0][0][1][0] LSB
  - Data MSB: 00
- Checksum: 0x18. This is the sum of the final destination address, router ID, packet type, address, and data bytes.
  0x00+0x00+0x00+0x15+0x01+0x02+0x00 = 0x18
- EOP: 100000000
The SpaceWire packet takes the from shown in Figure 2. Figure 3 shoes the same SpaceWire packet in data character format.

<table>
<thead>
<tr>
<th></th>
<th>00</th>
<th>00</th>
<th>00</th>
<th>15</th>
<th>01</th>
<th>02</th>
<th>00</th>
<th>18</th>
<th>00000000</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 or More Address Bytes</td>
<td>0x00</td>
<td>Router ID</td>
<td>Protocol ID</td>
<td>Packet Type</td>
<td>Address LSB</td>
<td>Address MSB</td>
<td>Data LSB</td>
<td>Data MSB</td>
<td>Check Sum</td>
</tr>
</tbody>
</table>

**Figure 2. Corrective Action #1 packet format**

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>0</th>
<th>0</th>
<th>0</th>
<th>0</th>
<th>0</th>
<th>0</th>
<th>0</th>
<th>0x18</th>
</tr>
</thead>
<tbody>
<tr>
<td>EOP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0x00</td>
</tr>
<tr>
<td>Check Sum</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0x02</td>
</tr>
<tr>
<td>Data MSB</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0x01</td>
</tr>
<tr>
<td>Data LSB</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0x15</td>
</tr>
<tr>
<td>Address MSB</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0x00</td>
</tr>
<tr>
<td>Address LSB</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0x00</td>
</tr>
<tr>
<td>Packet Type</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0x00</td>
</tr>
<tr>
<td>Protocol ID</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0x00</td>
</tr>
<tr>
<td>Router ID</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0x00</td>
</tr>
<tr>
<td>0x00</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0x00</td>
</tr>
</tbody>
</table>

**Figure 3. Corrective Action #1 data character format**

2.2 Option #2

The second option to recover from the anomaly is to reset the router. Resetting the UT200SpW4RTR is accomplished by writing to register 0x0114. A write command to this address will reset the entire router, and the user will need to reconfigure.

The following sequence shows how to reset the entire router. **Please note that additional address bytes may be required, depending on the user’s system configuration.

Write the following byte sequence directly into port 5 of the router.

- No Address Bytes required
- 0x00: for configuration
- Router ID: 00 as default assuming router ID has not been set
- Protocol ID: 00 for no protocol used
- Packet Type: 00 is Write
• Set up Configuration Space:
  o Address LSB: 14 for Receive FIFO Reset
  o Address MSB: 01

• Write in Data:
  o Data LSB: 00
  o Data MSB: 00

• Checksum: 0x15. This is the sum of the final destination address, router ID, packet type, address, and data bytes.
  0x00+0x00+0x00+0x14+0x01+0x00+0x00 = 0x15

• EOP: 100000000

The SpaceWire packet and data character format take the from shown in Figures 4 and 5.

<table>
<thead>
<tr>
<th>0x00</th>
<th>0x00</th>
<th>0x00</th>
<th>0x00</th>
<th>0x14</th>
<th>0x01</th>
<th>0x00</th>
<th>0x00</th>
<th>0x15</th>
<th>0x00000000</th>
</tr>
</thead>
<tbody>
<tr>
<td>O or More Address Bytes</td>
<td>O or More Address Bytes</td>
<td>Router ID</td>
<td>Protocol ID</td>
<td>Packet Type</td>
<td>Address LSB</td>
<td>Address MSB</td>
<td>Data LSB</td>
<td>Data MSB</td>
<td>Check Sum</td>
</tr>
</tbody>
</table>

![Figure 4. Corrective Action #2 packet format](image)

3.0 Rev A vs. Rev B
Revision A of the UT200SpW4RTR contains this anomaly. Revision B will correct this errata.