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# TEST REPORT

FOR THE

2J6726B

ANTENNA

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**AUTHOR(S):**
Jan Larsen

**IRIDIUM DOCUMENT ID**
RPT-05399-IR

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**DOCUMENT APPROVALS**

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1. TEST PURPOSE

The purpose of the test was to characterize the On-Orbit Iridium performance of the 2J6726B Iridium Antenna. The Iridium Technical Support Center (TSC) received one antenna for testing purposes. The antenna was tested with a 9522B. A baseline test was performed in parallel using an Iridium approved Aero Fixed Mast Antenna. The performance characterization tests are shown in the following table.

<table>
<thead>
<tr>
<th>Performance Characterized</th>
<th>Configuration</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voice</td>
<td>180 Second ISU-PSTN Voice Calls</td>
<td>3 Days</td>
</tr>
<tr>
<td>Data</td>
<td>FTP 50k Uploads</td>
<td>6 Days</td>
</tr>
<tr>
<td>Downlink Margin</td>
<td>Dialup 50K Uploads</td>
<td>24 Continuous Hours of FTP Uploads</td>
</tr>
<tr>
<td>Power Control</td>
<td>ISU-PSTN Voice Calls</td>
<td>24 Continuous Hours of 180 second calls</td>
</tr>
</tbody>
</table>

*Table 1-1: Performance Characterization Tests*
2. TEST CONFIGURATION

There are multiple lab configurations available for testing at the TSC. Below are a picture of the 2J6726B antenna and a brief description of the equipment used for testing it.

![2J6726B Antenna](image)

Picture 2-1: 2J6726B Antenna

2.1 Test Equipment – Voice and Data

<table>
<thead>
<tr>
<th>Test Equipment List - UUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antenna: 2J6726B</td>
</tr>
<tr>
<td>Phone Type: 9522B</td>
</tr>
<tr>
<td>IMEI: 300025010703540</td>
</tr>
<tr>
<td>SW Version: ST10001</td>
</tr>
<tr>
<td>Test station: 106</td>
</tr>
<tr>
<td>Antenna Drop: 45</td>
</tr>
<tr>
<td>Total Cable Loss: -1.8 dB</td>
</tr>
</tbody>
</table>

*Table 2.1-1: 2J6726B Antenna Lab Equipment*

<table>
<thead>
<tr>
<th>Test Equipment List - Baseline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antenna: AT1621-142W-TNCF-000-00-00-NM</td>
</tr>
<tr>
<td>Phone Type: 9522B</td>
</tr>
<tr>
<td>IMEI: 300025010509820</td>
</tr>
<tr>
<td>SW Version: ST10001</td>
</tr>
<tr>
<td>Test station: 104</td>
</tr>
<tr>
<td>Antenna Drop: 18</td>
</tr>
<tr>
<td>Total Cable Loss: -1.8 dB</td>
</tr>
</tbody>
</table>

*Table 2.1-2: Aero Baseline Lab Equipment*
2.2 General Test Configurations

The antenna was mounted on a standard antenna stand connected to the rooftop antenna array at the TSC. A low loss cable routes from the antenna to the lab. Within the lab the cable connects to an LBT. The LBT then interfaces to the auto-dialer. The autodialer produces metrics and logs which are used for analysis. Figure 2.2-1 is a diagram of the test configuration.
3. DESCRIPTION OF TESTING

3.1 Voice Mode Testing and Power Control

Voice Mode call performance testing involves making consecutive voice mode calls to the IST Gateway (i.e. ISU-PSTN). These calls are 180 seconds and they accentuate the performance of the call setup and call drop rates. These calls are terminated (answered) by the Digital Answering System (DAS) in the Ericsson Switch at the IST Gateway. The auto-dialer is configured to log binary data and write a statistics file that is used for analysis. The time between successive calls is 20 seconds.

For the purposes of this test, the voice mode is used to gather telephony performance and additionally power control information. During the voice testing, the auto-dialers record the binary logfile information from the LBTs. This data contains the raw SV-ISU power control values throughout the test. This data is post processed to determine the power control efficiency. The data is compared to baseline data to determine if the antenna under test produced a nominal profile as compared to the standard lab performance monitoring antenna during the same time frame. The voice mode configuration is shown in the following figure.

![Figure 3.1-1: Voice Dialer Test Configuration](image-url)
3.2 50K Put File Transfer Protocol Testing
Data Mode testing involves making consecutive data calls to an FTP server at TSC. Each call attempts to transfer a 50K file via the FTP process. Successes are logged if the connection is made and the file is transferred. The data mode configuration is shown in the following figure.

![Diagram of Data Dialer Test Configuration](image)

Figure 3.2-1: Data Dialer Test Configuration

3.3 SV-ISU Link Margin
During the data testing, the auto-dialers record the binary logfile information from the LBT. This data contains the raw SV-ISU power measurement values throughout the test. This data is post processed to determine the SV-ISU link margin. The data is compared to baseline data to show its performance relative to the Aero Baseline Antenna.
4. TEST RESULTS
The following sections detail each of the tests performed and the resulting data from those tests. Baseline dialer data gathered during the same time frame using the Aero Baseline antenna is included for each test.

4.1 Voice Mode Call Performance Testing
The test consisted of 180 second calls being made to the IST Gateway. Table 4.1-1 contains the performance results for the antenna for the test duration.

<table>
<thead>
<tr>
<th>180 Second I2P Voice Calls</th>
<th>Call Attempts</th>
<th>Call Setup Rate</th>
<th>Call Drop Rate</th>
<th>Avg Channel Assignment Time</th>
<th>Access Rate</th>
<th>Avg Access Time</th>
<th>Avg Setup Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>2J6726B Antenna</td>
<td>1061</td>
<td>99.15%</td>
<td>2.38%</td>
<td>4.69</td>
<td>99.25%</td>
<td>6.89</td>
<td>9.50</td>
</tr>
<tr>
<td>Aero Baseline Antenna</td>
<td>1056</td>
<td>98.67%</td>
<td>1.44%</td>
<td>4.61</td>
<td>98.67%</td>
<td>6.78</td>
<td>9.54</td>
</tr>
</tbody>
</table>

Table 4.1-1: 2J6726B Antenna 180 second I2P Voice Test Results

Figure 4.1-1: 2J6726B Antenna, Percentage of Time, 180 sec I2P
Figure 4.1-2: 2J6726B Antenna, Call Setup Rate vs. Elevation Angle
4.2 Data Mode Performance Testing
Data was collected for one day from data calls performing 50k FTP upload transfers.

<table>
<thead>
<tr>
<th>FTP 50K Upload</th>
<th>Call Attempts</th>
<th>Call Connect Count</th>
<th>Successful Call Connect Rate</th>
<th>Successful Transfer Count</th>
<th>Successful Transfer Rate</th>
<th>Average Throughput (Kb/sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2J6726B Antenna</td>
<td>1437</td>
<td>1332</td>
<td>93.69%</td>
<td>1296</td>
<td>90.19%</td>
<td>2.44</td>
</tr>
<tr>
<td>Aero Baseline Antenna</td>
<td>1550</td>
<td>1439</td>
<td>92.84%</td>
<td>1365</td>
<td>88.06%</td>
<td>2.65</td>
</tr>
</tbody>
</table>

Table 4.2-1: 2J6726B Antenna, Dialup 50k FTP Upload Testing

4.2.1 Downlink Margin Using Analysis Type One
The binary logfile data generated by the LBT during the data calls was used to determine the overall link margin available using the 2J6726B Antenna. Twenty-four hours of binary logdata was processed to determine the average downlink margin. The results of the test analysis are shown in figures 4.2.1-1 and 4.2.1-2.
4.2.2 Downlink Margin Using Analysis Type Two

Figures 4.2.2-1 and 4.2.2-2 depict the link margin on a per beam basis, evaluating only the traffic channel and does not include values that are 0 db or less.
Figure 4.2.2-2: Aero Baseline Antenna, per Beam Downlink Margin
4.3 Power Control Efficiency
The binary logfile data generated by the LBT during 180 sec I2P voice calls was used to determine the SV-ISU power control efficiency. Twenty-four hours of data was processed to determine the efficiency of the power control system.

4.3.1 Power Control Capacity Factor
The results are presented in terms of Capacity Factor (Figure 4.3.1-1), which is a ratio of voice call power to full power. Capacity Factor is calculated by determining the amount of time spent at various power levels during uplink and downlink.

![Figure 4.3.1-1: 2J6726B Antenna, Capacity Factor during 180 second I2P Voice calls](image_url)
Another view of the percentage of time spent at each back-off power level is depicted in figures 4.3.1-2 and 4.3.1-3. The graph shows how the antennas cause the SV to spend time at different power levels.

![Graph showing back-off power percentage of time during downlink](image)

*Figure 4.3.1-2: 2J6726B Antenna, Downlink, Back Off Power Percentage of Time*
Figure 4.3.1-3: 2J6726B Antenna, Uplink, Back Off Power Percentage of Time
4.3.2 Power Control Link Quality Index and Power Control

Figures 4.3.2-1 through 4.3.2-4 show Link Quality Index and the Power control settings, for both uplink and downlink for voice calls.

Figure 4.3.2-1: 2J6726B Antenna, LQI and Power Control 180 Sec I2P
Figure 4.3.2-2: Aero Baseline Antenna LQI and Power Control 180 Sec I2P
Figure 4.3.2-3: 2J6726B Antenna, DTOA/DFOA, 180 Sec I2P
Figure 4.3.2-4: Aero Baseline Antenna, DTOA/DFOA, 180 Sec I2P
5. TEST SUMMARY

5.1 Voice Calls

The 2J6726B Antenna voice call setup success rate is 0.48% higher and the call drop rate is 0.94% higher compared to the Aero Baseline Antenna as depicted in Table 4.1-1. Power Control efficiency is shown in Figure 4.3.1-1. The 2J6726B Antenna supports 2.57 voice calls on the downlink and the Aero Baseline Antenna supports 3.83 voice calls on the downlink per full power Traffic Channel. This means that the 2J6726B antenna requires 33% more power on the SV downlink on average than the Aero Baseline antenna.

5.2 50K FTP Upload

The 2J6726B Antenna data call connect success rate is 0.85% higher compared to the Aero Baseline Antenna. The 2J6726B Antenna successful data transfer rate is 2.13% higher than the Aero Baseline Antenna as depicted in Table 4.2-1. The 2J6726B Antenna average throughput is 2.44 Kb/sec compared to 2.65 Kb/sec for the Aero Baseline Antenna, as shown in Table 4.2-1.

5.2.1 Downlink Margin

Type 1 analysis:

The 2J6726B Antenna link margin is 1.20 db less than the Aero Baseline Antenna as depicted in section 4.2.1.

Type 2 analysis:

The 2J6726B Antenna link margin is 1.72 db less than the Aero Baseline Antenna as depicted in section 4.2.2. The difference between the highest beam power and the lowest beam power for the 2J6726B antenna is 5.02 db while the difference between high and low beam power for the baseline antenna is 5.11.