Equipment for Communication Satellite and Quality of EEE parts in International Markets

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NEC TOSHIBA Space Systems, Ltd.
1. Major Products for International Markets
2. Major Equipment for International Markets
3. Supply Records
4. Circumstance in International Markets
5. Requirements to Equipment and EEE parts
6. Design and Production Flow
7. Trend of selection of EEE parts in Equipment
8. Growth in the International Markets
9. Conclusion
1. Major Products for International Markets

Satellite Platform “NEXTAR”

Small Standard Bus applicable to various missions. Enable low cost and short lead time to delivery.

Features
Dry Mass: 450kg (Bus 250kg + Payload 200kg)
Life: 3 – 5 years
Payload Power: 400W
Typical Lead Time: 2 years after mission freeze
1. Major Products for International Markets

Payload and Repeater Subsystem

Have capacity and engineering background to design and integrate Payload and/or Repeater Subsystem

Major Heritages
BSAT-2C / Express-AM1 / WINDS
# 2. Major Equipment for International Markets

## Satellite Bus Components

<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td><strong>ESA</strong></td>
<td>More than 250 units in space</td>
</tr>
<tr>
<td><strong>SAP</strong></td>
<td>More than 800 panels delivered</td>
</tr>
<tr>
<td><strong>SADM</strong></td>
<td>20 units flight proven. 16 units under manufacturing. Qualified in space equivalent to 15 years.</td>
</tr>
<tr>
<td><strong>TCR</strong></td>
<td>TLMTX, CMRX, BCN in S/C/X/Ku/Ka</td>
</tr>
<tr>
<td><strong>IES</strong></td>
<td>Successful Asteroid Sample Return on Hayabusa satellite. Collaboration with Aerojet is in process</td>
</tr>
</tbody>
</table>
## Payload Components

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Description</th>
<th>Units Delivered</th>
</tr>
</thead>
<tbody>
<tr>
<td>LNA</td>
<td>From L-Band to Ka-Band</td>
<td>More than 2400 units</td>
</tr>
<tr>
<td>RCVR DNC</td>
<td>From L-Band to Ka-Band</td>
<td>More than 1700 units</td>
</tr>
<tr>
<td>UPC</td>
<td>Flexible in design according to customer’s needs.</td>
<td>More than 350 units</td>
</tr>
<tr>
<td>SSPA</td>
<td>From L-Band to Ka-Band</td>
<td>More than 300 units. <strong>GaN SSPA is under R&amp;D.</strong></td>
</tr>
<tr>
<td>TWTA</td>
<td>From C-Band to Ka-Band</td>
<td>Currently focusing on domestic government business</td>
</tr>
</tbody>
</table>
2. Major Equipment for International Markets

3. Supply Records

We have been supplying space equipment to many satellite makers in international markets.
4. Circumstance in International Markets

**Background**

- Equipment for communication satellites are used for broadcast or communications.

- Constantly 20 to 30 Satellites are launched a year.

- Frequencies are applied from L-band to Ka-band (30GHz). C and Ku (FSS, BSS)-bands are mainly required repeat production for series satellites.

- Equipment suppliers are always required to improve performance, cost and delivery in international markets.

- On the other hand, the heritage design is regarded as the one of most important factor of equipment design.

Equipment suppliers are required improving design and keeping high reliability / quality of equipment design and parts.
5. Requirements to Equipment and EEE parts

[Overall ]
- Leading advanced Performance
- Short Delivery
- Low Price
- Heritage

[Equipment Design]
- Meet Performance SPEC
- High Reliability (Long term performance, TID, SEE hardness)

[EEE parts]
- To be strongly recommended using MIL/ESA Qualified Parts
- For SCD parts, to apply MIL/ESA STD, strongly
- For SCD parts, to be approved by customers
- Maintain TID, SEE data (Lot by Lot/ Wafer Lot)
- Non-ITAR Parts (to avoid risk of delivery)

Equipment suppliers have to meet above requirements and optimize production flow according to customers SPECs.
6. Design and Production Flow

[Customer]

Satellite Maker

[Requirement]

Equipment Design

Performance

Environment

Product Assurance

Parts, Material and Process (PMP)

Selection

Data sheet

Parts Selection Design

Equipment Production & Test

Approved

Equipment Performance

Approved

Procurement

Quality Reliability Assurance

NSPAR (SCD)

Inspection

Collaboration between Equipment designer and Parts Designer is significant.
### 7. Trend of selection of EEE parts in Equipment

<table>
<thead>
<tr>
<th>Parts</th>
<th>Features</th>
<th>NTS Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MIL Qualified Parts</strong></td>
<td>- Qualified as standard parts by all satellite manufacturers.</td>
<td>- Have been using commonly for semiconductors</td>
</tr>
<tr>
<td></td>
<td>- Many Public data of TID and SEE are existing.</td>
<td>- ESA, JAXA or SCD parts are to be replaced with ITAR parts.</td>
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<tr>
<td></td>
<td>- Restriction of ITAR</td>
<td></td>
</tr>
<tr>
<td><strong>ESA Qualified Parts</strong></td>
<td>- Official parts of international</td>
<td>- Have been using commonly for semiconductors</td>
</tr>
<tr>
<td></td>
<td>- Many Public data of TID and SEE are existing.</td>
<td>- To be replaced ITAR parts.</td>
</tr>
<tr>
<td><strong>JAXA Qualified Parts</strong></td>
<td>- Being qualified as standard parts by all satellite manufacturers.</td>
<td>- Have been using mainly passive parts in Japan</td>
</tr>
<tr>
<td></td>
<td>- Qualified parts in Japan</td>
<td>- Increasing heritage in international market</td>
</tr>
<tr>
<td></td>
<td>- Many Public data of TID and SEE are existing.</td>
<td></td>
</tr>
<tr>
<td><strong>SCD and Custom Parts</strong></td>
<td>- To achieve high performance</td>
<td>- Preferring MIL/ESA/JAXA SPEC matched parts</td>
</tr>
<tr>
<td></td>
<td>- To meet each SPEC of Equipment</td>
<td>- To increase heritage in international market</td>
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</table>
Required EEE parts for international markets

-  Semiconductors with enough public data for space environments

  => They have enough potential to be used immediately in equipment. It will be advantage to save cost, keep schedule, and realize performance.

-  Designed with considering MIL/ESA/JAXA STD.

  => For SCD parts, it is important to have quality as same as MIL, ESA and JAXA qualified parts.

  It is able to replace without modification of equipment. It will be advantage to save cost and keep schedule, adding it will keep the heritage of equipment in the market.
8. Growth in the international markets

Space Industry

Advancement

Competitiveness [Improving]
Heritage [Increasing]

Productivity
Technology
Heritage

Quality
Reliability

MIL・ESA・JAXA as foundation of SPACE Industry

NTSpace Proprietary
9. Conclusion

● NTS have been developing many kinds of equipment of communication satellites for international markets.

● NTS’s customers always require improvement of our equipment such as performance, production and so, on. Because they also have to compete as SPACE industries in the international markets.

● For EEE parts, they also require keeping high reliability and quality based on using MIL, ESA and JAXA standard and qualified parts.

● NTS will continue developing our equipment with best selection of EEE parts for international markets.
9. Conclusion

- Using MIL, ESA and JAXA qualified parts maintain tradition from our customer and take advantage of their merits. It is effective for common design in equipment.

- SCD parts and custom parts will be used to gain our core competence in international market. Then NTS will increase their heritage in SPACE and appeal to international markets.

- We can contribute for development of SPACE industries with supplying our equipment.