PRODUCTS FOR SPACEBORNE APPLICATIONS
INTRODUCTION
L3 Narda-MITEQ has supplied hardware for space-flight missions for over 33 years. Our emphasis is predominantly in technically challenging requirements, particularly in the area of:

- Custom-designed assemblies
- Frequency synthesizers
- High-performance up/downconverters
- Logarithmic amplifiers
- Low-noise amplifiers
- Microwave mixers
- Oscillators
- Receivers

For many years, L3 Narda-MITEQ’s primary area of expertise for space products was in low-noise amplifiers. However, L3 Narda-MITEQ has been able to provide a wide spectrum of products and designs by utilizing mature technology delivered on other high-reliability programs. With our extensive space experience, we have been able to use qualification data from our existing designs while delivering custom-engineered units, thereby offering reduced cost and shorter delivery times to our customers.

CONFORMANCE TO CUSTOMER QUALITY REQUIREMENTS
L3 Narda-MITEQ's involvement in various high-reliability space programs represents a spectrum of programmatic and quality requirements, ranging from a process and test flow similar to that of MIL-PRF-38534 Class H or K to NASA EEE-INST-002.

All open-die, thin-film products are manufactured and tested within L3 Narda-MITEQ’s clean rooms (FED-STD-209, Class 100,000 and Class 10,000) according to program requirements.

In addition to compliance to stringent manufacturing controls, L3 Narda-MITEQ possesses the capabilities to support the program management and extensive documentation requirements of your space contracts, including:

- Configuration Control
- Design Analysis
- Design Reviews
- Dynamic Stress
- EMI/EMC
- FMECA
- MTBF
- Parts Derating
- Parts, Materials and Processes
- Process Documentation
- Radiation Susceptibility
- Thermal Analysis
- Traceability
- WCA

All analysis and support provided is based upon individual custom requirements as set forth in the customer's Statement of Work and/or specifications. L3 Narda-MITEQ has established controls, procedures and a philosophy with the customer in mind. Delivering products that meet requirements has been paramount in all the programs we have supported throughout our history. Our track record of performance and our philosophy have secured our successes in the past, and will guarantee our success in the future.

MANUFACTURING FLOW
L3 Narda-MITEQ has established in-house standards in manufacturing processes and product flow, however, our experience has proven that almost every program has its own set of unique requirements. Thanks to the flexibility of our organization, we have been successful in adapting our existing procedures to meet specific customer requirements where “special” issues need to be addressed.

Traceability of all parts, materials and processes is available through our controlled parts lists and manufacturing, process and flow documents. The extent of traceability can be dictated by the customer, or if required, it can be tailored to support cost-reduction needs.
MANUFACTURING FLOW (CONTINUED)

L3 Narda-MITEQ TYPICAL RELIABILITY PLAN FOR SPACE APPLICATIONS
(ENGINEERING PROCESS)

* Establish Reliability Goals: Testing may include:
  - Reliability Demonstration Test (RDT)
  - Accelerated Life Test (ALT)
  - Highly Accelerated Life Test (HALT)

** Develop Qualification Test:
Qualification Testing consists of mechanical, electrical
and/or environmental inspections as required to verify
specification compliance.

*** Assemble and Test Prototype(s):
NOTE: Prototype testing includes those tests
defined in the Quality Test Plan.

L3 Narda-MITEQ TYPICAL RELIABILITY PLAN FOR SPACE APPLICATIONS
(MANUFACTURING PROCESS)

* Establish Program Requirements:
Key points of consideration are: parts procurement
control, program scheduling & reporting, configuration
control, process control, manufacturing analysis,
inspection requirements (CSI), component screening
requirements and traceability requirements.

** Identify Manufacturing Personnel:
Personnel selected based upon acquired
certification levels as they compare to
program requirements.

*** Pre-cap Inspection:
NOTE: Pre-cap Inspection as per defined
standard. Customer Source Inspection may apply.
L3 Narda-MITEQ has the expertise and knowledge to develop for the space field and earth borne stations the products to keep up with today’s technology. Through various space programs, L3 Narda-MITEQ has gained the trust of its customers worldwide. Some of the spaceborne products that L3 Narda-MITEQ is capable of developing are listed below:

- Amplifiers
- Attenuators – PIN Diode
- Bias Tees
- Diode-Limiters
- Directional Couplers
- Four-Channel Downconverter
- Frequency Discriminators
- Frequency Generation Products
  - Frequency Synthesizers (VHF thru Ka)
  - Oscillators
  - Dual Output Ku-Band Phase-Locked Oscillator
  - Free-Running Oscillator (DROs)
  - Ku-Band Phase-Locked Oscillator
- Hybrid Couplers 90 °/180 °
- IF Logarithmic Amplifier
- Microwave & Millimeter-Wave Conversion
  - Image Rejection Mixers
  - Mixers
- Modulators
- Multipliers
- PIN Diode Switches
- Power Dividers/Combiners
- Receivers
- RF/Microwave Assemblies

SPACEBORNE PRODUCTS

Amplifiers

Custom Integrated Assemblies

Directional Couplers

Hybrid Couplers
SPACEBORNE PRODUCTS (CONTINUED)

IF Logarithmic Amplifiers

Mixers

Modulators

Multipliers

Oscillators

Power Dividers/Combiners
SPACEBORNE APPLICATIONS

L3 Narda-MITEQ’s involvement with spaceborne projects for over 33 years has included: radar imaging, oceanography, atmospheric, land and polar exploration, as well as the study of sea winds.

The nearby photos and illustrations depict some of the space platforms that L3 Narda-MITEQ supports. Listed below are some products and applications.

**Frequency Generation Products**
- Study the make-up of a comet
- Communication and tracking data in the network
- Navigate spacecraft (Mars Science Laboratory)
- Health telemetry
- Calibration synthesizer covering the 100 MHz to 1700 MHz Band
- Phase-locked oscillator modules covering 0.9 GHz to 19.0 GHz

**IF Signal Processor Products**
- Telemetry
- Range measurements

**Microwave and Millimeter-Wave Conversion Products**
- Low orbit-based Millimeter-Wave Radiometer
- Mix RF signals in C-Band for transmitting and receiving purposes

**Space & High-Reliability Oscillators/Synthesizers**
- Collect Long-Wavelength Infrared Radiation
- Cover spectral range from a far-infrared to Sub-Millimeter Wavelengths

**High-Reliability/Space Amplifiers**
- Communications with Earth Stations and between satellites
- Radiometry

**Passive Power Components**
- Communication with Earth Stations and tracking data
- Spectral processing
- Study in radioastronomy

**Custom Integrated Assemblies**
- Measure microwave radiation emitted by ozone, chlorine compounds and other trace gases
- Wideband downconverter
- High resolution downconverter

**PRODUCTS FOR SPACEBORNE APPLICATIONS**

**AURORA**
Sea surface salinity

**CLOUDSAT & CALIPSO**
Relationships between clouds and climate

**GPM**
Sea surface salinity

Image Disclaimer: As L3 Narda-MITEQ’s products vary on different space programs, the space program images depicted in this brochure are for illustration purposes only. These space program images do not endorse nor depict any particular L3 Narda-MITEQ product being utilized on these missions.
**HERSCHEL**
Infrared Space Telescope observing planets

**JASON 2**
Monitor global ocean circulation

**MARS SCIENCE LABORATORY**
Collect Martian soil and rock samples

**NPOESS**
Monitor Global environmental conditions

**ROSETTA & LANDER**
Study make-up of comet

**SEAWINDS**
Microwave radar that measures near-surface wind velocity

**TANDEM X**
Satellite laser ranging data

**TOPEX**
Observing and understanding the ocean circulation

**TERRASAR-X**
Satellite laser ranging data
L3 Narda-MITEQ’s continued advancements combining state-of-the-art components and unique capabilities have led to a wide acceptance by the microwave community as a leader in spaceborne technology. Our space-qualified components include mixers, oscillators, amplifiers, synthesizers and super-components.

L3 Narda-MITEQ’s Space-Qualified Quality Assurance Plan establishes the actions necessary to provide confidence that the end item will meet the quality, reliability and electrical performance required for space-qualified applications.

Below is a list of space programs which L3 Narda-MITEQ has supported:

<table>
<thead>
<tr>
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<th>END USER</th>
<th>PROGRAM</th>
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<td>NASA</td>
<td>NPOESS</td>
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<tr>
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<td>Corvair</td>
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<td>JAXA</td>
<td>Global Precipitation Measurement</td>
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<td>DLR</td>
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<td>SSMIS, AMSU-B</td>
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<td>Applied Physics Lab</td>
<td>U.S. Navy</td>
<td>Seasat, Spinsat, Topex, Extended Test Bed</td>
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<td>Ball Aerospace</td>
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<td>JHU/APL</td>
<td>NASA</td>
<td>Radiation Belt Storm Probe (RBSP)</td>
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</tbody>
</table>

For additional technical information on our space product capabilities, please contact our Sales Department at (631) 439-9220 or email nardaMITEQ@L3T.com.
L3 Narda-MITEQ owns and occupies three buildings located in Hauppauge on Long Island, New York. Combined, these buildings comprise a total of 215,000 square feet which include the following facilities:

- **Clean Rooms:**
  - Six Class 100K clean rooms
  - Two Class 10K clean rooms (operation to 1K)
- **Manufacturing:**
  - 160,000 sq. ft. of manufacturing space
- **Test Equipment:**
  - Vector network analyzers, spectrum analyzers and phase noise test sets
- **Machine Shop:**
  - 15 CNC machines supporting kovar, copper tungsten, aluminum and other metals
- **Two Glass Sealing Furnaces**
- **Hermetic Sealing:**
  - Seam-welding and projection welding
- **Environmental Labs:**
  - Temperature cycle/shock, mechanical shock and vibration
  - Temperature/humidity, fine and gross leak testing and PIND testing

- **Chemical Facilities:**
  - Chemical plating and etching capability of microwave circuits, including plated-through-hole technology (PTH) and tight tolerance printed filters, immersion silver (Ag) and electroless nickel/immersion gold (ENIG) plating over copper for PCB finish, Trivalent Chromate conversion process for aluminum parts, powder coating process for SATCOM outdoor products and paint systems for L3 Narda-MITEQ products
- **PCB and Thin-Film Lab**
  - In-house automated assembly which includes: two SMT pick and place machines (Mydata 12 with vision and Mydata 9 with vision) and three MRSI 505 automated pick and place machines for chip and wire assembly, test equipment, X-ray, bond pull/die shear equipment
FACILITIES (CONTINUED)

Class 100K Clean Rooms

Class 10K Clean Rooms

Machine Shop
Supporting kovar, copper tungsten, aluminum & other metals

Glass Sealing Furnace
For glass seal feedthroughs

Automated Epoxy And Die Placement

Hermetic Sealing
Seam welding and projection welding

Automated Wire Bonding

Bonding Pull And Die Shear
FACILITIES (CONTINUED)

- **X-Ray Inspection**
- **Automated Test Station**
  - Vector network analyzers
- **Production Test**
- **Microwave Engineering**
  - Vector network analyzers
- **Fiber-optic Test**
- **Thermal Shock**
  - Temperature cycle/shock
- **Environmental Testing**
  - Mechanical shock and PIND testing
- **Environmental Testing**
  - Fine and gross leak testing
# HIGH-RELIABILITY PROGRAM CHECKLIST

## Process Control Requirements
- Process control drawings
- Assembly travelers
- Test plans
- Test procedures

## Parts Procurement Control
- Source control drawings for die and packaged parts only, or including substrates, passive parts, housings, etc.; should also include definition of element evaluation profile (100% and lot basis)
- Traceability logs
- Parts storage requirements
- Age limitations
- Customer parts approval

## Reports
- Status reports (_____ interval)
- Customer interface meetings (_____ interval)
- Design reviews (_____ number)

## Configuration Control

## Reports and Analysis
- Thermal analysis
- Mean time between failure (MTBF)
- Failure analysis
- Failure mode effects analysis (FMECA)
- Worst case analysis (electrical performance)
- Stability analysis
- Parts derating
- Radiation susceptibility analysis/test
- EMI/EMC analysis/test

## Customer Source Inspections
- Production documentation review
- Precap visual
- Final source inspection (testing and documentation review)

## Purchased Elements/Components
- L3 Narda-MITEQ Screening
- L3 Narda-Military Grade (QPL, JAN, ER)
- L3 Narda-MITEQ Element Evaluation similar to MIL-PRF-38534 Class H
- L3 Narda-MITEQ Element Evaluation similar to MIL-PRF-38534 Class K
- Customer-defined

## 100% Unit Screening
- L3 Narda-MITEQ Screening
- MIL-STD-883, Class _____ Similar Test Flow
- MIL-PRF-38534, Class _____ Similar Test Flow
- Customer-defined

## Unit Quality Control Inspection (QCI) Testing
- MIL-STD-883 Group B testing
- Additional testing
- Customer-defined

## Qualification Testing
- MIL-STD-883 Group C and D testing
- Additional testing
- Customer-defined

## Process Qualification
- Process verification testing, (e.g., extended life tests, extended temperature cycles, destructive physical analysis, etc.)

## Lot Requirements
- Manufactured timing constraints (homogeneous lot restrictions)
- Build vs. pass percentage for lot acceptance

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The material presented in this datasheet was current at the time of publication. L3 Narda-MITEQ’s continuing product improvement program makes it necessary to reserve the right to change our mechanical and electrical specifications without notice. If either of these parameters is critical, please contact the factory to verify that the information is current.

This material consists of L3 Narda-MITEQ general capabilities information and does not contain controlled technical data as defined within the International Traffic in Arms (ITAR) Part 120.10 or Export Administration Regulations (EAR) Part 734.7-11.

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