TRU RoHS Products
Test Report

Introduction:

RoHS (Restriction of Hazardous Substances) is a directive that places maximum concentration limits on the use of cadmium (Cd), lead (Pb), hexavalent chromium (Cr+6), mercury (Hg), Polybrominated Biphenyl (PBB) and Polybrominated Diphenyl Ethers (PBDE). TRU Corporation has developed a series of RoHS compliant products to meet the requirements of directive 2002/95/EC.

These products have been specifically designed to utilize RoHS compliant materials and to eliminate / reduce the use of restricted materials to comply with 2002/95/EC Annex C. These RoHS compliant designs feature:

- Redesign of inner / outer conductor joints
  - use of 1 piece inner / outer conductors where possible
  - replace solder / braze joints with mechanically captivated joints
  - RoHS compliant solder for solder/braze joints that can not be completely eliminated
- RoHS compliant base metal alloys
- RoHS compliant precious metal plating

Objective

Test and characterize the performance of RoHS Products as compared to the current equivalent products. Test and characterize the mating durability of RoHS compliant QC interface over an extended number of mating cycles to simulate the lifetime performance of the interface.

Test Samples
Each connector assembly described below was subjected to the test.

Sample 1: **Connector Assembly: QDS(m) to QC(m)**
(1) 7-16(f) to QC(f) connected to (2) QC(m) to QDS(m) connected to
(3) QDS(f) to QC(m) connected to (4) QC(f) to 7-16(m)

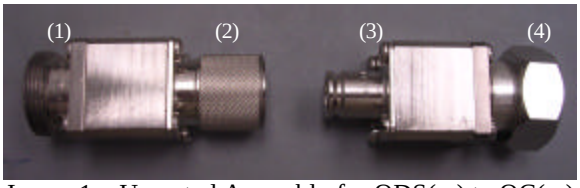

Image 1 – Unmated Assembly for QDS(m) to QC(m)


Image 2 - Mated Test Assembly for QDS(m) to QC(m)

Sample 2: **Connector Assembly: SQS(m) to QC(m)**
(1) 7-16(f) to QC(f) connected to (2) QC(m) to SQS(m) connected to
(3) SQS(f) to QC(m) connected to (4) QC(f) to 7-16(m)

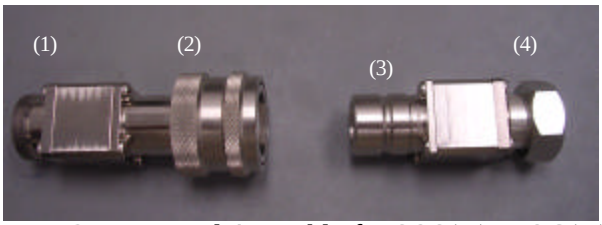

Image 3 – Unmated Assembly for SQS(m) to QC(m)


Image 4 - Mated Test Assembly for SQS(m) to QC(m)

Sample 3: **Connector Assembly: QRM(m) to QC(m)**
(1) 7-16(f) to QC(f) connected to (2) QC(m) to QRM(m) connected to
(3) QRM(f) to QC(m) connected to (4) QC(f) to 7-16(m)

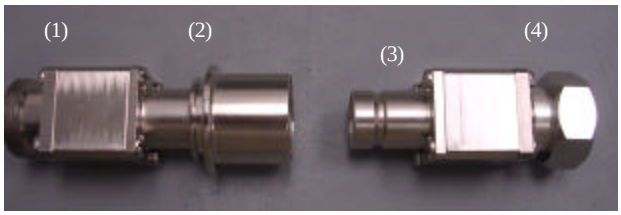

Image 5 – Unmated Assembly for QRM(m) to QC(m)


Image 6 - Mated Test Assembly for QRM(m) to QC(m)

Sample 4: **Connector Assembly: SQS(m-p) to QC(m)**
(1) 7-16(f) to QC(f) connected to (2) QC(m) to SQS(m-p) connected to
(3) SQS(f-p) to QC(m) connected to (4) QC(f) to 7-16(m)

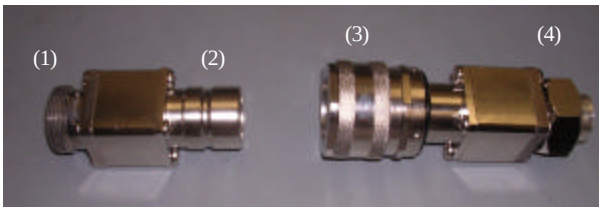

Image 7 – Unmated Assembly for SQS(m-p) to QC(m)


Image 8 - Mated Test Assembly for SQS(m-p) to QC(m)

Sample 5: **LC Right Angle Adapter**
(1) 7-16(f) to QC(f) connected to (2) QC(m) to LC(f) connected to
(3) LC(m) to N(f)

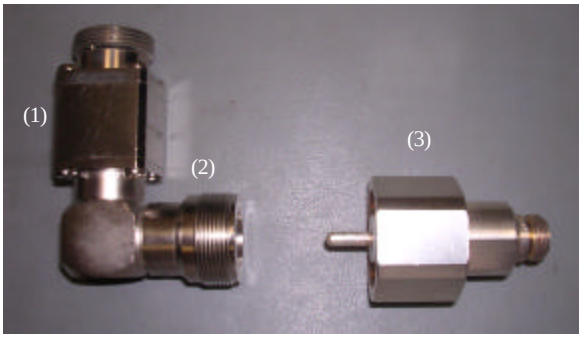

Image 9 – Unmated Assembly for LC Right Angle Adapter

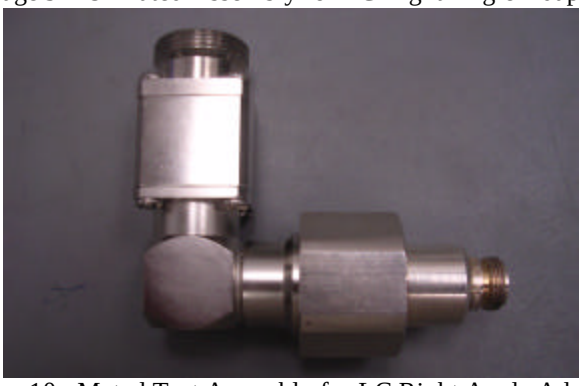
Image 10 - Mated Test Assembly for LC Right Angle Adapter

Test & Inspection Conditions:
All tests and inspections were performed under the following conditions:

Environment:

Temperature:	59°F to 86°F (15°C to 30°C)
Relative Humidity:	20% to 80%
Barometric Pressure:	101.325 kPa (650 to 800mm Hg)

Configuration:
Tests and inspections performed in a well-lit area on a clean flat surface free of debris and foreign objects.

Test & Inspection Equipment:
The following test equipment, tools, and fixtures were used to perform the tests and inspections:

Electrical:
- Vector Network Analyzer (HP 8753E) shown in Image 7
- Applicable test port cables/adapters for each assembly shown in Image 7
- 7-16 Calibration Kit (p/n: Maury Microwave 2750B)
- Vitrek V53 AC Safety Analyzer

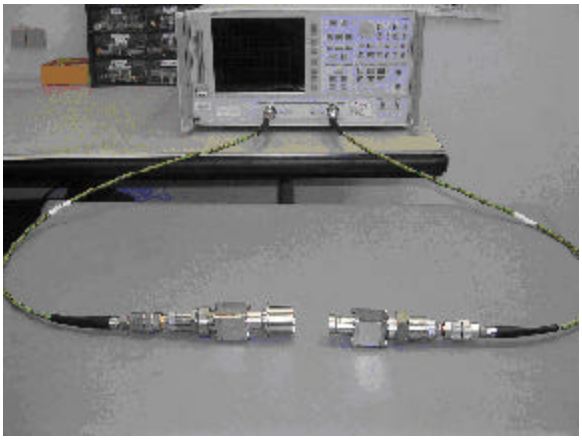

Image 11 – Vector Analyzer (HP 8753E), Test Cables, and Adapters

Test Procedure:
1. Using the 7-16 Calibration Kit perform a full 2 Port Calibration using the Vector Network Analyzer and the following settings:
   - 401 data points
   - 30Hz BW
   - Set Frequency range to 0.3MHz to 1GHz
   - S11 measurements = End 1 of connector assembly
   - S22 measurements = End 2 of connector assembly
2. Take baseline measurements or the following electrical and mechanical properties:
   - VSWR
   - Insertion Loss
   - Electrical Delay
3. Mate connector 250 times then record data. Repeat the above measurements until the connector has been mated 2,500 times.
4. Test original designs and compare.
5. Test the QC Adaptor to the maximum specification of AC voltage (2,700 VAC)

Test Data:

Data (VSWR and Insertional Loss) was taken from the original design and compared to the new design. Shown in the left column is the original adapter, and in the right column is the new design. Both the VSWR and the Insertion Loss is shown for each connector assembly.

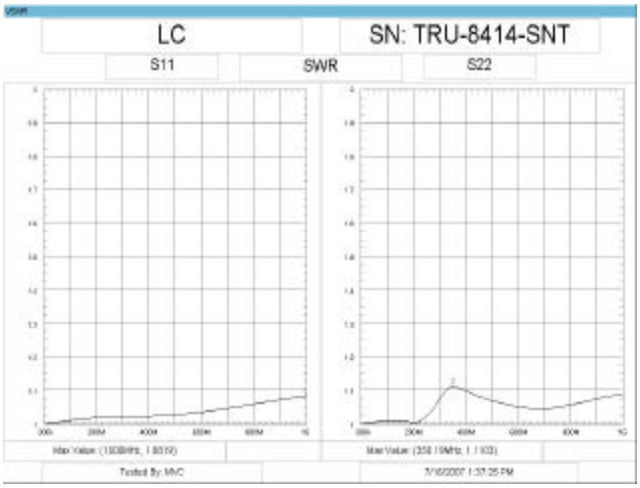

Figure 1 - Typical VSWR for Original LC(f) to QC(m)

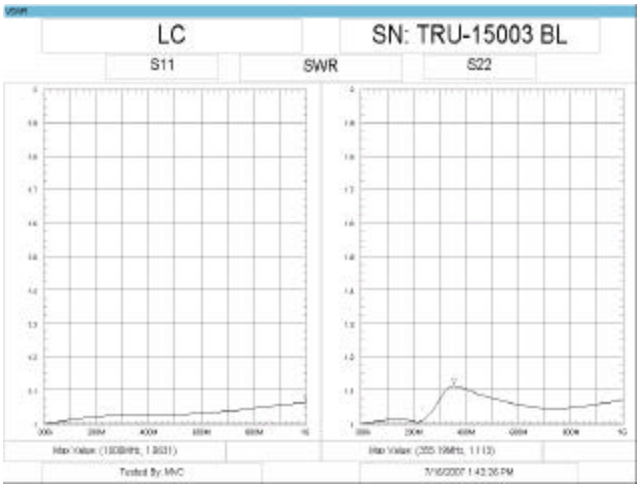

Figure 2 - Typical VSWR for New LC(f) to QC(m)

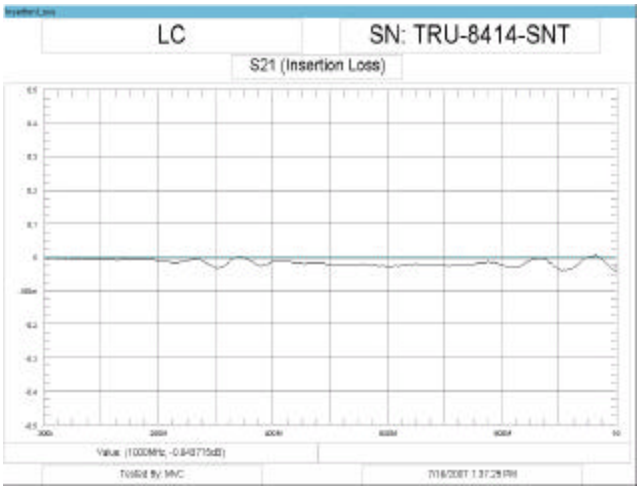

Figure 3 - Typical Insertion Loss for Original LC(f) to QC(m)

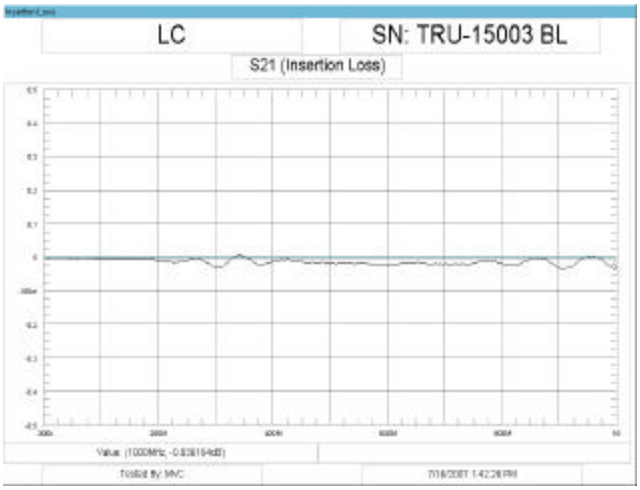

Figure 4 - Typical Insertion Loss for New LC(f) to QC(m)

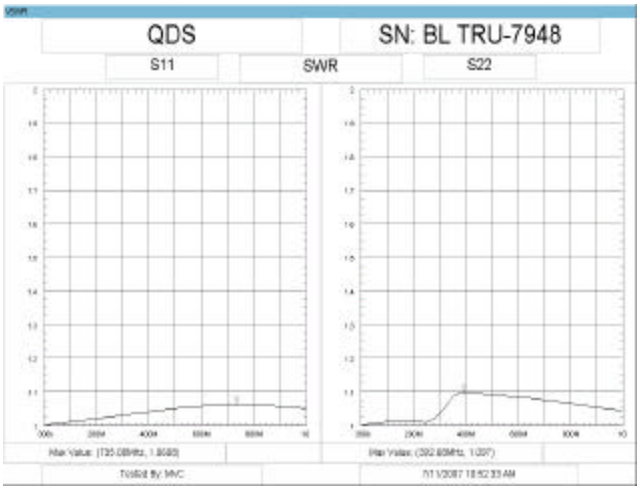

Figure 5 - Typical VSWR for Original QDS(m) to QC(m)

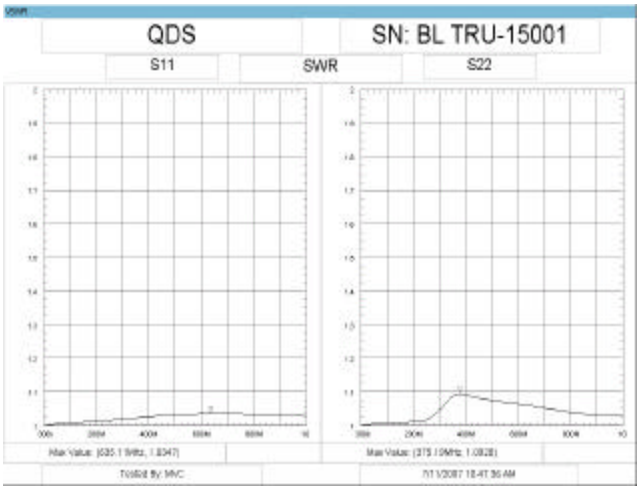

Figure 6 - Typical VSWR for New QDS(m) to QC(m)

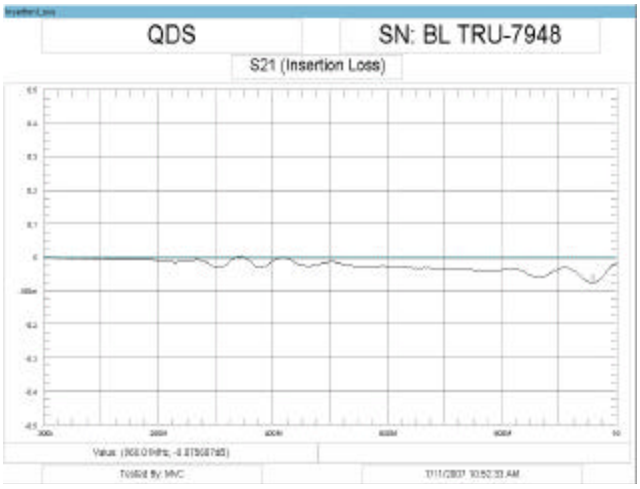

Figure 7 - Typical Insertion Loss for Original QDS(m) to QC(m)

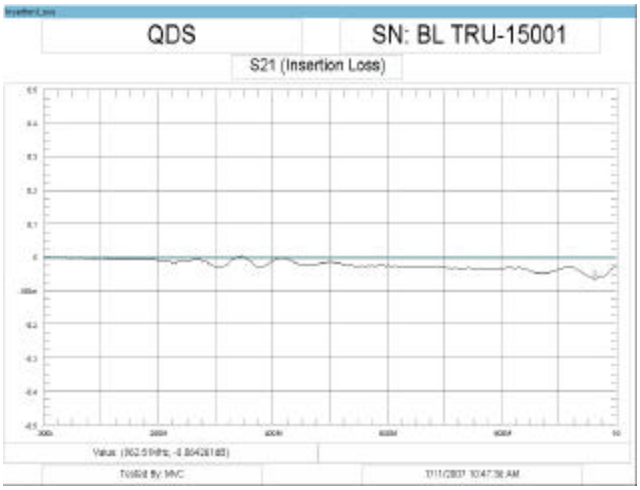

Figure 8 - Typical Insertion Loss for New QDS(m) to QC(m)

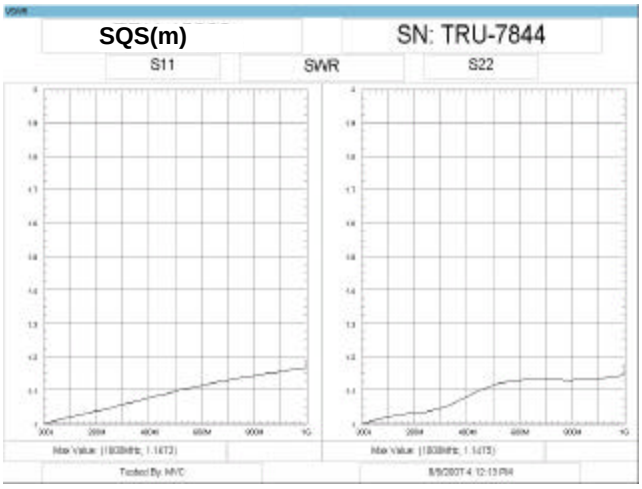

Figure 9 - Typical VSWR for Original SQS(m) to QC(m)

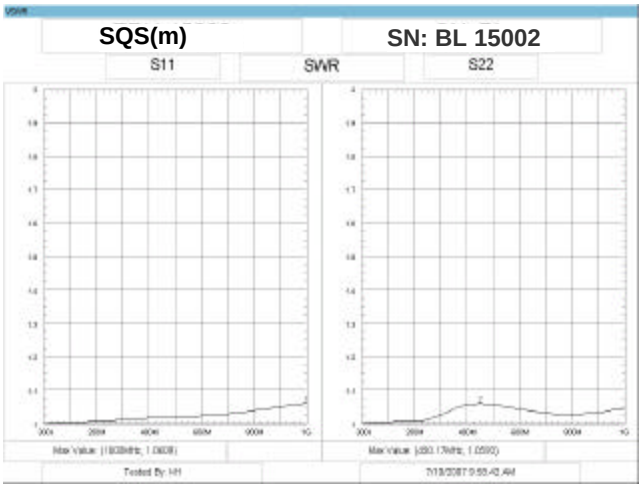

Figure 10 - Typical VSWR for New SQS(m) to QC(m)

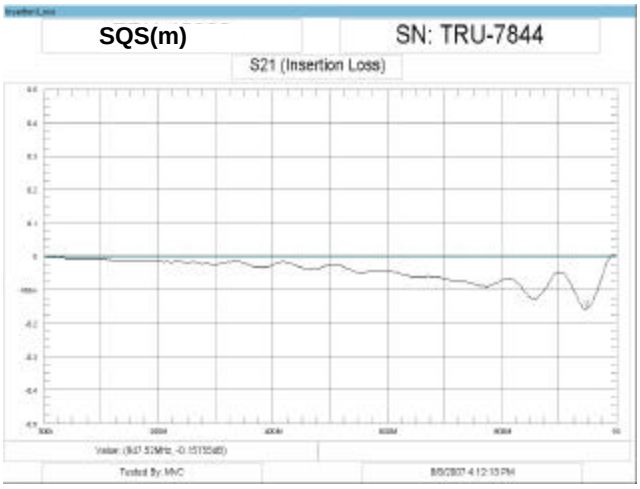

Figure 11 - Typical Insertion Loss for Original SQS(m) to QC(m)

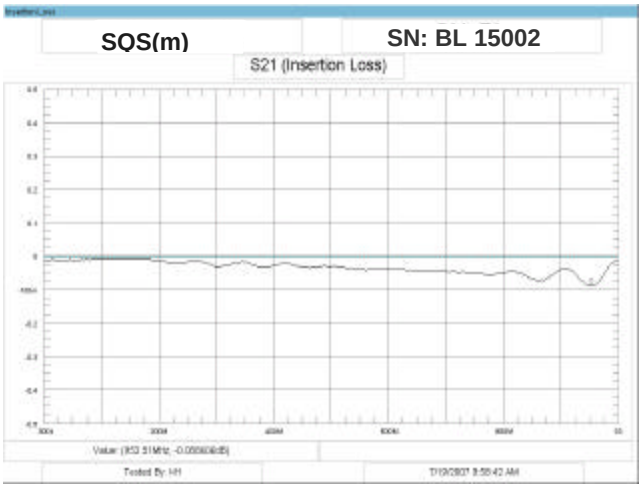

Figure 12 - Typical Insertion Loss for New SQS(m) to QC(m)

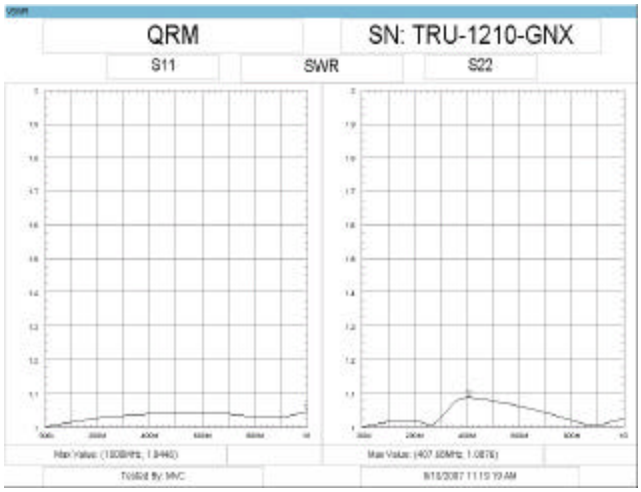

Figure 13 - Typical VSWR for Original QRM(m) to QC(m)

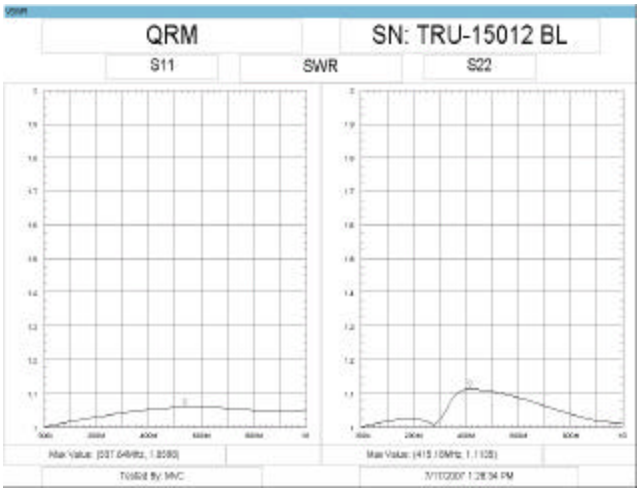

Figure 14 - Typical VSWR for New QRM(m) to QC(m)

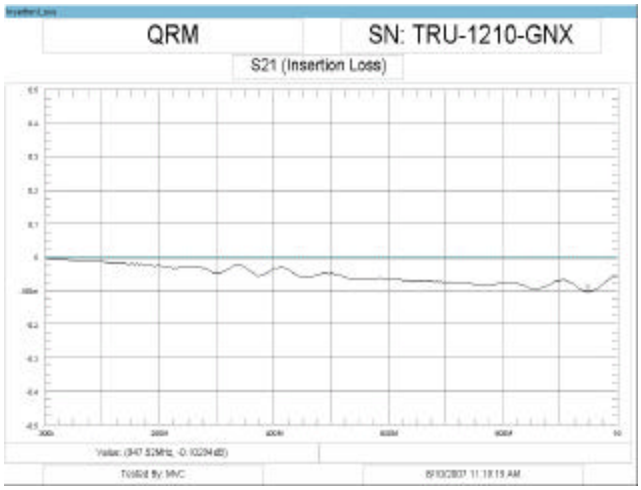

Figure 15 - Typical Insertion Loss for Original QRM(m) to QC(m)

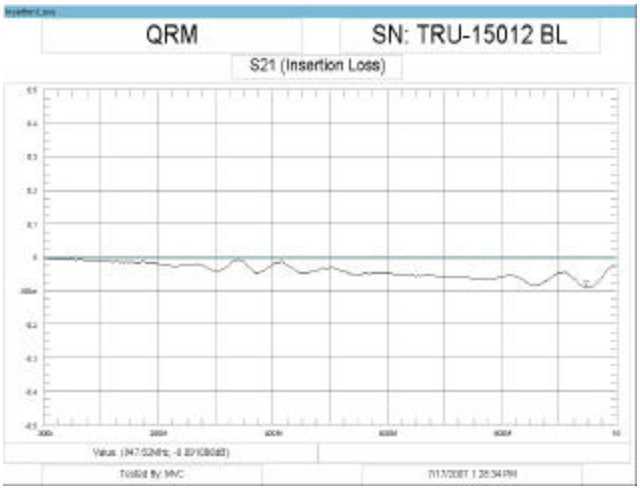

Figure 16 - Typical Insertion Loss for New QRM(m) to QC(m)

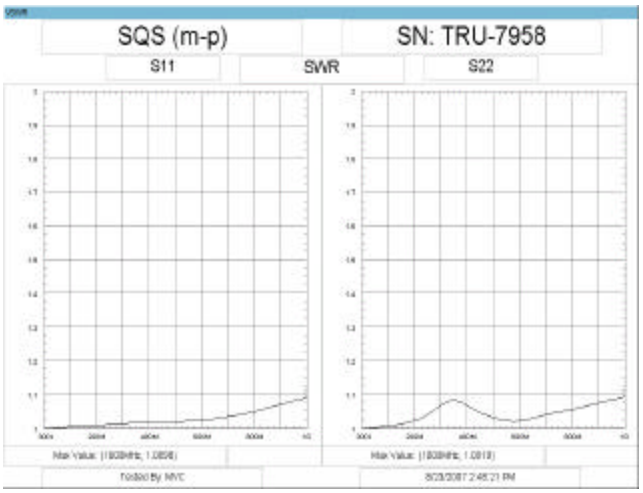

Figure 17 – Typical VSWR for Original SQS(m-p) to QC(m)

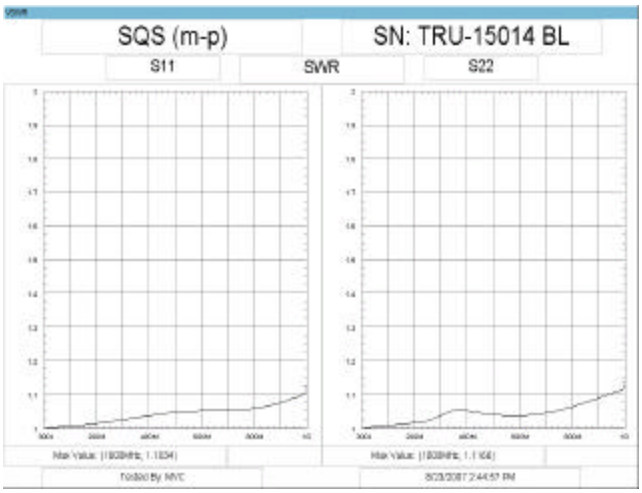

Figure 18 – Typical VSWR for New SQS(m-p) to QC(m)

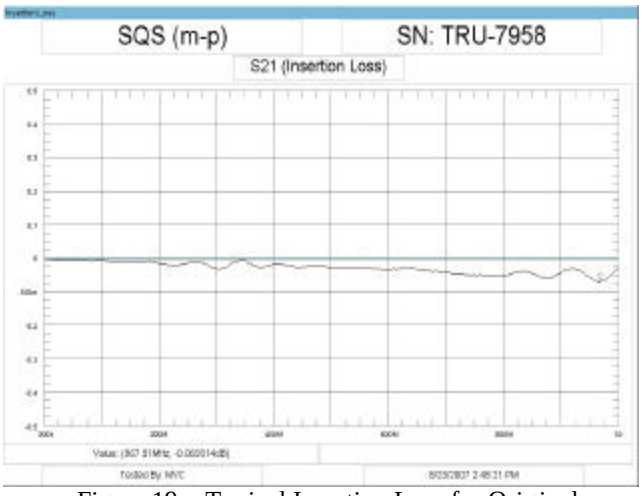

Figure 19 – Typical Insertion Loss for Original SQS(m-p) to QC(m)

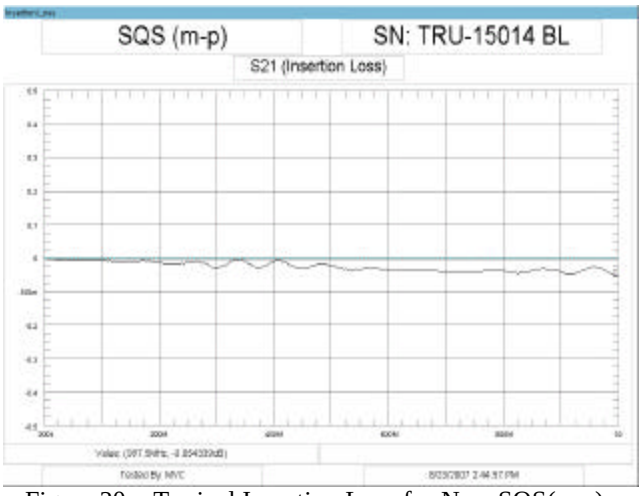

Figure 20 – Typical Insertion Loss for New SQS(m-p) to QC(m)

QC Adaptor Test & Inspection Conditions:
All tests and inspections were performed under the following conditions:

Environment:

Temperature:	59°F to 86°F (15°C to 30°C)
Relative Humidity:	20% to 80%
Barometric Pressure:	101.325 kPa (650 to 800mm Hg)

Configuration:
Tests and inspections performed in a well-lit area on a clean flat surface free of debris and foreign objects.

Test & Inspection Equipment:
The following test equipment, tools, and fixtures were used to perform the tests and inspections:

Electrical:

- Vector Network Analyzer (HP 8753E) shown in Image 12
- Applicable test port cables/adapters for each assembly shown in Image 12
- 7-16 Calibration Kit (p/n: Maury Microwave 2750B)

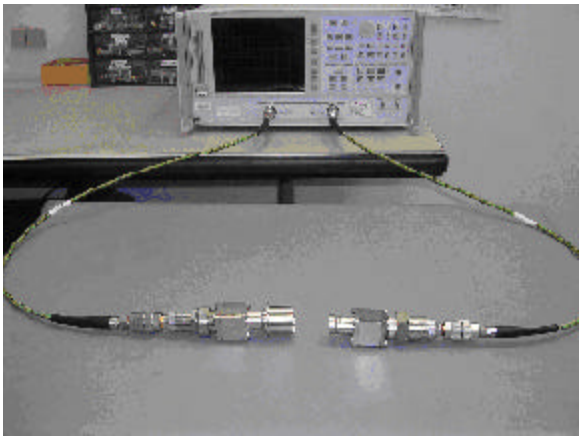

Image 12 – Vector Analyzer (HP 8753E), Test Cables, and Adapters

Mechanical:
Force Gauge: Chatillion DFE 100 lb Force Gauge shown in Image 13.

Image 13 – Chatillion DFE 100 lb Force Gauge

QC Adaptor Test Procedure:

3. Using the 7-16 Calibration Kit perform a full 2 Port Calibration using the Vector Network Analyzer and the following settings:
    - 401 data points
    - 30Hz BW
    - Set Frequency range to 0.3MHz to 1GHz
    - S11 measurements = End 1 of connector assembly
    - S22 measurements = End 2 of connector assembly
4. Take baseline measurements or the following electrical and mechanical properties:
    - VSWR
    - Insertion Loss
    - Electrical Delay
    - Insertional Force
    - Withdrawal Force
6. Mate connector 250 times then record data. Repeat the above measurements until the connector has been mated 2,500 times.
7. Test original design and compare.
8. Test the QC Adaptor to the maximum specification of AC voltage (2,700 VAC)

Sample 6: **QC Adapter**
(1) 7-16(f) to QC(f) connected to (2) QC(m) to QRM(m)

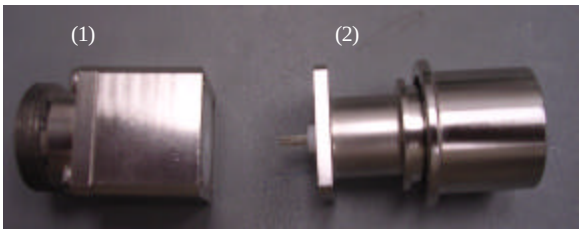

Image 14 - Unmated Assembly for QC Adapter


Image 15 - Mated Test Assembly for QC Adapter

Test Data:

QC Adapter
(refer to Images 14 & 15)

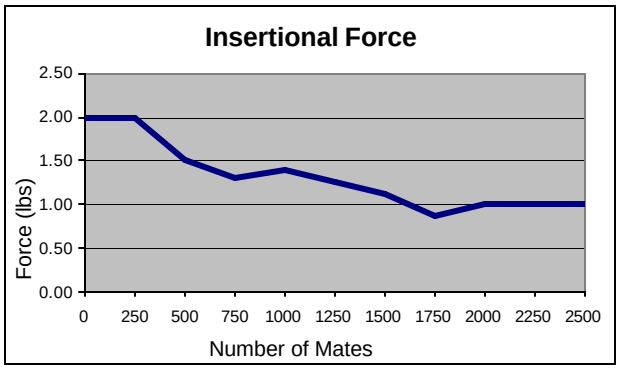

Figure 21 – Insertion Force for the QC Adapter

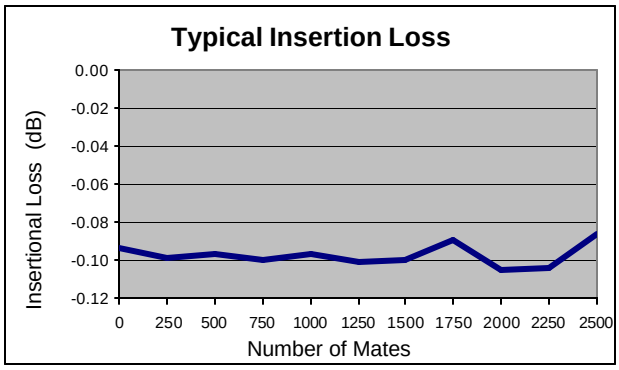

Figure 24 – Typical Insertion Loss for the QC Adapter

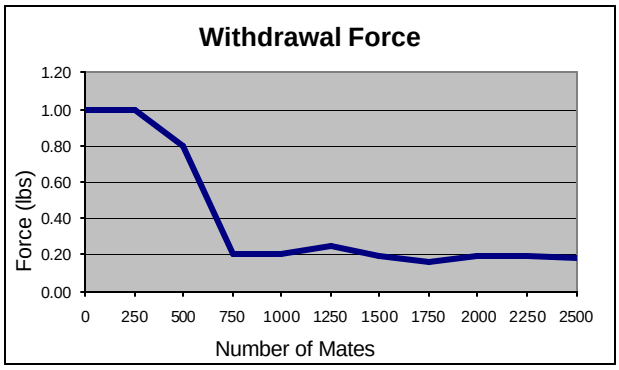

Figure 22 – Withdrawal Force for the QC Adapter

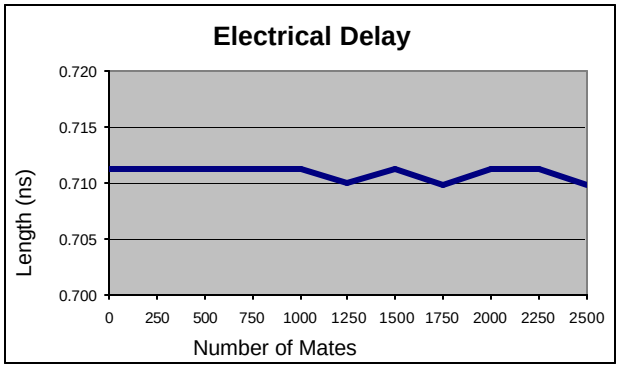

Figure 25 – Electrical Delay for the QC Adapter

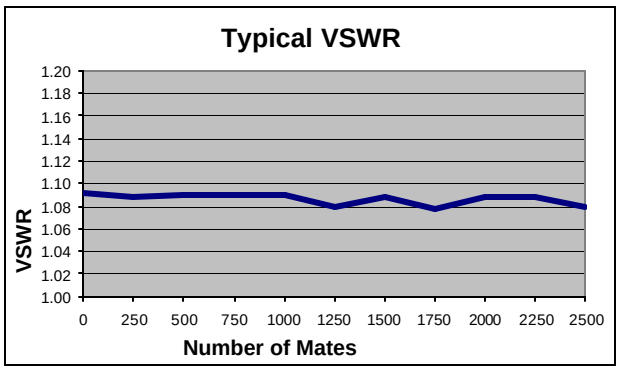

Figure 23 – Typical VSWR for QC Adapter

This adaptor withstand the specified 2,700VAC

Conclusion:

The typical electrical and mechanical performance of the new RoHS products is the same as the current product designs.

The QC interface is rated for 500 mating cycles. The RoHS compliant QC interface meets the 500 mates rating without degradation to the mechanical and electrical properties. The Insertional and Withdrawal forces stabilize and remain fairly constant after the 750 to 1000 mates.

The RoHS compliant QC interface will perform throughout 2500 mates with minimal, if any, influence on the electrical performance parameters.