Mating and Unmating Durability Test

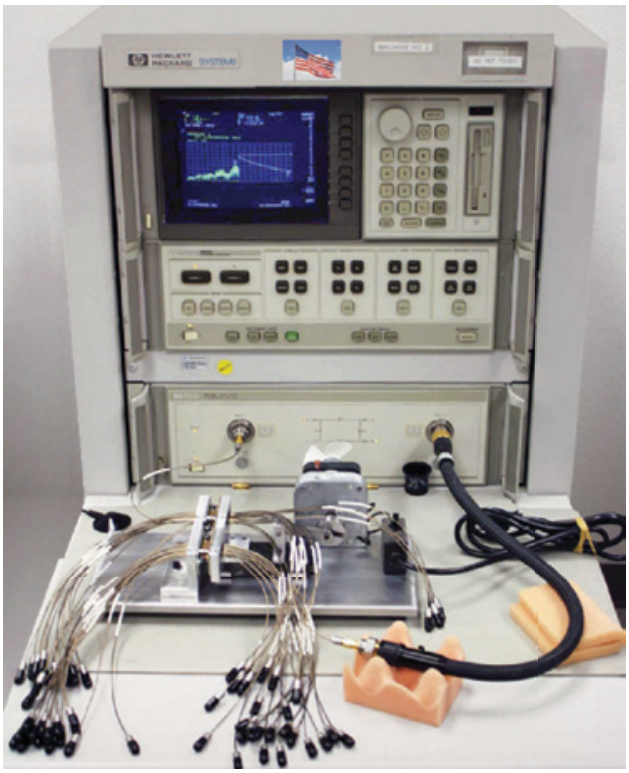
1.0 Abstract

Tests were conducted to evaluate effects of mating/unmating on SSBP-20HD coaxial assemblies. This was done as part of overall in-house qualification testing for SSBP coax assemblies. Connectors were divided into 2 groups:

Group A: To evaluate Electrical/Microwave Parameters after mating/unmating. Criteria for acceptance was maximum VSWR change of 0.10 through 27 GHz for mated assemblies. 30 pairs of SSBP-20HD pin/male and socket/female coaxial assemblies were installed in 2 standard 15-position D-Subminiature connectors and tested to 5,000 mating/unmating cycles. VSWR was measured at initial mating and after 100, 500, 1000, 3000 and 5000 cycles. Maximum VSWR change was under 0.10 VSWR for all mated SSBP-20HD pairs. (Comment: Initial test plan for group A was for 2,500 mating/unmating cycles, but results at 2,500 prompted continuing tests.)

Group B: To examine Physical Mechanical Wear after mating/unmating:
SSBP-20HD coax assemblies were installed in similar 15-position connectors used for Group A testing. One group (B-1) was subject to 500 mating/unmating cycles and another group (B-2) was subjected to 1,000 mating/unmating cycles. Both groups were then subjected to 72 hours of humidity and examined for corrosion. All passed.

SSBP-20 and SSBP-20HD have identical mating interfaces. Therefore based upon these evaluations, both SSBP-20 and SSBP-20HD coax assemblies are confirmed to provide microwave performance for 1,000 mating cycles.



Photograph showing factory mating-cycle test fixtures with mated line of SSBP-20HD coaxes being measured using HD 8510C in Southwest Microwave electrical test lab.

Mating and Unmating Durability Test *(continued)*

2.1 Introduction

SSBP coaxial assemblies are used in industry-standard multi-contact connectors. SSBP coax assemblies are described based upon the "cavity size" for equivalent-sized contacts used for non-microwave signals. (For example SSBP-20 assemblies are used where Size 20 signal contacts would otherwise fit or be used). The SSBP-20HD assemblies are used in D-Subminiature connectors, while SSBP-20, -16, -12, and size -8 are for circular connectors. Although used in different connectors, SSBP-20 and SSBP-20HD have the same mating interface. The SSBP are designed to fit within standard "contact cavities" without respect to specific contact arrangements, shell sizes or mating methods involved. Although initial applications are for commercial test equipment, to simplify describing the types of connectors that may be used, MIL-DTL-24308 and MIL-DTL-38999 are used for reference. Both connector standards require 500 mating/unmating cycles, which was used as the basis for this test. SSBP contacts were installed and removed using the same plastic CIET tools used for the non-coaxial (signal) contacts.

2.2 Testing

For all tests, mating/unmating was done at a rate of 5 cycles per min. in accordance with EIA-364-9 requirements of 200 ± 100 cycles per hour.

Group A: Although SSBP-20HD coax assemblies have been tested to 110 GHz by other than Southwest Microwave, for these tests the SSBP were cabled to SMA plug connectors for testing to 27 GHz using an HP 8510C VNA. This was done for testing convenience. Prior non-SSBP or standard microwave connector testings over time have shown that surface wear results in increased VSWR. SOLT calibration was performed before each group of measurements using the same VNA (with NIST-tracable calibration date 20/03/09), with air conditioned, stabilized, test room ambient conditions.

2.2.1

Assemblies were measured in-line (SMA plug-to-SSBP-20HD Pin mated to SSBP-20HD Socket-to-SMA plug) at the following conditions: Upon first mating (100%), after 100 cycles (100%), after 500 cycles (6 samples for reference), after 1,000 cycles (6 samples for reference), after 5,000 cycles (100%). The results after 5,000 cycles were then compared to initial readings.

2.2.3

Group B: A total of 60 pairs (SSBP-20HD Pin and 20HD Socket) were examined unmated under 10X magnification and then installed in 4 pairs of 15-position D-Subminiature connectors. Initial (pre-cycle testing) mating/demating forces were measured in accordance with EIA-364-13, and then connectors were installed in the test fixturing. The connectors were split into 2 groups of 2 mating D-Subminiature pairs (30 mating SSBP-20HD Pin and SSBP-20HD Socket coaxes each pair).

Group B-1: Subjected to 500 mating/demating cycles. Connectors were removed from the test fixturing and given 10X physical examination. Contact (SSBP-20HD coax assembly) mating and unmating forces were measured in accordance with EIA-369-13.

Group B-2: Subjected to 1,000 mating/demating cycles. Connectors were removed from the test fixturing and given 10X physical examination.

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Group A Test Results: Differences in the per line VSWR measurements between initial and after 5,000 cycles are shown in Table 2 below.

Group B Test Results: Group B-1: Completed 500 durability mate/unmate cycles in accordance with MIL-STD-1344, Method 2016, on 9/24/09. Following durability cycling, those samples and 2 control sample loose pairs of SSBP-20HD coaxes completed 72 hours of humidity environmental exposure (steady state 85°C at 85% relative humidity) in chamber (calibrated 2/16/09) in an unmated condition. After humidity testing, the SSBP coaxes were removed and examined under 10X power.

Following all mechanical and humidity environmental exposure, all samples passed post durability examination in accordance with MIL-STD-1344, Method 2016, paragraph 3 d. and visual inspection for corrosion or degradation in accordance with MIL-STD 1344, Method 1001.1, paragraph 4.2.6. No evidence of corrosion or degradation was present on/in any of the SSBP-20HD samples. No condition of wear or physical damage that would affect form, fit, or function, including microwave performance, was observed.

3.0 Test Report

Copies of complete Test Report No. 91-3057 will be provided upon request.

Connectors Line	VSWR Difference (If > 0)	Pass? Fail?	Connectors Line	VSWR Difference (If > 0)	Pass? Fail?
Conn 1:			**Conn 2:**		
1	0.03	Pass	16	0	Pass
2	0.02	Pass	17	0.02	Pass
3	0.005	Pass	18	0	Pass
4	0.005	Pass	19	0.03	Pass
5	0	Pass	20	0	Pass
6	0	Pass	21	0	Pass
7	0.01	Pass	22	0.01	Pass
8	0	Pass	23	0	Pass
9	0.01	Pass	24	0.02	Pass
10	0	Pass	25	0.005	Pass
11	0	Pass	26	0.01	Pass
12	0.05	Pass	27	0.01	Pass
13	0.01	Pass	28	0	Pass
14	0	Pass	28	0	Pass
15	0.01	Pass	30	0.04	Pass

Notes: Testing with 2 pairs of DA-15 connectors (15 positions per connector). The SSBP cables for Connector 1 Line 15 and Connector 2 Line 27 were replaced at 100 cycles due to problems found at termination for SMA plugs. Initial readings for removed cables were replaced with readings for the new cables. The replacement cables have data for 4,900 matings instead of 5,000 cycles.

Table 2: SSBP-20 mating/demating VSWR measurement differences initial versus after 5,000 cycles.