Research on Process Reliability of RF Coaxial Cable in Spacecraft Assembly

Yougao Fan\textsuperscript{1,2,*}, Peirong Zhao\textsuperscript{1,2}, Guangtong Liu\textsuperscript{1,2} and Shuang Liu\textsuperscript{1}

\textsuperscript{1}Beijing Institute of Spacecraft Environment Engineering, Beijing 100094, China
\textsuperscript{2}Beijing Engineering Research Center of the Intelligent Assembly Technology and Equipment for Aerospace Product, Beijing 100094, China

\textsuperscript{*}Corresponding author E-mail: fanygao@163.com

Abstract. This paper is concerned with the process reliability of RF coaxial cable in the spacecraft assembly. By carrying out some process tests, the effects of coaxially of the inner and outer conductors of the RF coaxial cable assembly, the number of cable winding coils, the bending radius of the RF coaxial cable, and the extreme conditions of the assembly on the performance of the RF coaxial cable are studied. According to the test results, a more comprehensive process method and specific process parameters are obtained, thereby further improving the reliability and safety of the RF coaxial cable in the spacecraft assembly.

1. Introduction

Radio frequency, abbreviated as RF, is an abbreviation for high-frequency alternating-current electromagnetic waves, with a frequency range from 300KHz to 30GHz [1]. Radio frequency technology is widely used in the fields of wireless communications. RF cable is a cable that transmits electromagnetic energy in the radio frequency range. It is an indispensable component in various radio communication systems and electronic equipment. It is widely used in wireless communication and broadcasting, television, navigation and other aspects [2].

The RF cable has the characteristics of transmission frequency bandwidth, strong resistance to external interference, small radiation loss, simple structure, convenient installation, and economical characteristics. The structure of RF cables can be classified according to different forms and uses. For instance, it is classified as RF coaxial cable, symmetrical RF cable, and spiral RF cable according to the structure; solid insulated cable, air insulated cable, and semi-air insulated cable according to the insulation form; flexible cables, semi-rigid cables, and rigid cables according to their flexibility [3].

With the continuous improvement of the spacecraft technology level and capabilities, the use of coaxial radio frequency cable assemblies in spacecraft has become more extensive and deeper. The assembly of the cables and the connectors runs through the various stages of spacecraft assembly, tests, and large-scale tests [4]. RF coaxial cables and RF connectors are mainly used for the connection between high-frequency equipment of spacecraft. It is an important work of the spacecraft during the assembly process. The quality of the assembly is directly related to the spacecraft measurement and control, antennas and transponders whether the sub-system can work normally [5, 6]. Due to the lack of in-depth understanding of the structure and performance of RF coaxial cable assemblies, quality problems caused by the operation of RF coaxial cables and their electrical connectors have occurred.
frequently in recent years, so it is urgent to study their assembly process methods in order to improve the reliability and safety of the assembly of RF coaxial cables and electrical connectors.

The purpose of this paper is to carry out some process tests to study the effects of assembly extreme conditions on the performance of RF coaxial cable assemblies, and to determine the operation methods and specific technical indicators of various types of RF coaxial cables and connectors, so as to further improve the reliability and safety in spacecraft assembly.

2. Overview of RF coaxial cable assemblies installation

A RF coaxial cable assembly is composed of a RF coaxial cable and two RF electrical connectors, and is used to connect radio frequency electronic instruments and related parts (groups). RF coaxial cable assembly is classified as flexible cables, semi-rigid cables, hard cables, etc. according to bending conditions, or general cables, phase-stable cables, low-loss cables, etc. according to performance indicators, and is usually classified according to bendability.

2.1. RF coaxial cable

At present, there are two types of RF coaxial cables used in spacecraft assembly, including flexible cables and semi-rigid cables. The working frequency of RF coaxial cables is about 2GHZ to 35GHZ, and the characteristic impedance is 50Ω. The cable is composed of four parts, including inner conductor, insulation medium, outer conductor or additional shielding and sheath, as shown in Figure 1 and Table 1.

| Name                | Type           | Outer diameter (mm) | Features                                           |
|---------------------|----------------|---------------------|----------------------------------------------------|
| Flexible cable      | UFB205A/UFB311A| 5/8                 | Low loss, small attenuation, easy installation    |
|                     | MCJ205A/MCC-311A | 5/8                 | Superior shielding performance, good stability, easy to form |
| Semi-rigid cable    | SFT-50-3       | 3.6                 | Good radiation resistance, easy to bend          |
| Semi-rigid threaded cable | SFC-50-7-3 | 10                  |                                                    |

Figure 1. Schematic diagram of RF coaxial cable

Table 1. RF coaxial cables commonly used in spacecraft assembly

2.2. RF coaxial electrical connector

RF coaxial electrical connector is mainly composed of contact, insulator, housing, and accessories. Except for accessories, other components should be made of non-magnetic materials, and incompatible metals should not be placed in contact with each other, as shown in Figure 2.

Figure 2. Schematic diagram of RF coaxial electrical connector
At present, the types of RF electrical connectors used in spacecraft assembly include SMA, TNC, SSMA, and so on. The connection method of the electrical connector and the cable is soldered, and the connection method of the plug and the socket is screwed. See Table 2 for common models of spacecraft RF electrical connectors.

| Type  | Frequency range | Features                                                        | Tightening torque of electrical connector |
|-------|-----------------|-----------------------------------------------------------------|------------------------------------------|
| SMA   | 0~18GHz         | Small size, frequency bandwidth, superior electromechanical performance, high reliability, the most widely used RF connector | 0.8Nm~1.2Nm                               |
| TNC   | DC~11GHz        | Small and medium power connectors with strong vibration resistance, high reliability and excellent electromechanical performance | 2.3Nm~2.65Nm                             |
| SSMA  | 0~30GHz         | Small size, high frequency bandwidth, superior electromechanical performance, high reliability, etc. | 0.8Nm~1.2Nm                               |

3. Reliability scheme of RF coaxial cable assembly process

3.1. Research content

At present, the assembly of flexible RF coaxial cable has strong implementation capabilities in terms of technology, operation, inspection and other aspects, but there are still some problems. For instance, the process standards cannot provide strong guidance for the installation of flexible RF coaxial cable assemblies, the level of quantification and refinement are not enough; operators do not have a deep understanding of the performance and installation impact factors of flexible RF coaxial cable, which are mainly reflected in two aspects, (1) the effects of bending radius of flexible RF coaxial cable on installation, and (2) the effects of the number of cable winding coils on installation.

In view of the above-mentioned influencing factors, some process tests were carried out to obtain some refinement and quantitative indicators of process parameters. The specific research content is as follows: (1) verify the reliability and safety of flexible RF coaxial cables commonly used in satellite assembly under various working conditions (bending radius, number of coils, etc.), (2) determine the process parameters of flexible RF coaxial cables and electrical connectors during satellite assembly, and (3) determine the operation methods and quality control requirements of flexible RF coaxial cables and electrical connectors during satellite assembly.

3.2. Process reliability scheme of RF coaxial cable assembly

According to the current installation of flexible RF coaxial cables in satellite assembly, the values of the key performance parameters of the cable assembly (voltage standing wave ratio (VSWR), phase) before and after temperature shock test, shock test and vibration test are compared with the standard requirements, to obtain the reliable process methods and process parameters.

RF coaxial cable assemblies use temperature-stabilized, low-loss aerospace-grade products, operating temperature is -55°C to +125°C, operating frequency is DC to 18GHz, and VSWR is no greater than 1.3.

3.3. Process test scheme for flexible RF coaxial cable

Select two types of flexible RF coaxial cables, UFB205A and UFB311A, and SMA and TNC connectors used with them to simulate their typical conditions on a spacecraft, design different comparison test items, and analyze the test data to obtain correct and reliable process methods and process parameters. It mainly includes related technical parameters such as cable laying and fixing requirements, minimum bending radius and the number of cable winding coils. The installation state of the flexible RF cable test pieces on the vibration test bench are shown in Figure 3.
The temperature shock test conditions are carried out in accordance with article 4.5.5 of the standard GJB1215A-2005 (test temperature -55°C~+100°C, heating and cooling rate no greater than 10°C/min, number of cycles 5 times, ultimate holding time 2 hours). After the test, the flexible RF cable assemblies are left for more than 24 hours for electrical performance testing.

The vibration test conditions are carried out in accordance with the provisions of article 4.5.18 of GJB1215A-2005, and no electrical interruption longer than 1µs is allowed. The test conditions are shown in Table 3.

![Figure 3. Flexible RF cable process test](image)

**Table 3. Conditions for vibration test**

| Sine vibration | Random vibration |
|----------------|------------------|
|                | Frequency Range  | 10Hz~2000Hz |
|                | Acceleration     | 15g         |
|                | Vibration amplitude | 1.5mm   |
|                | Scan speed       | 1 oct/min   |
|                | Test duration    | one cycle, 10Hz~2000Hz~10Hz |
|                | Frequency Range  | 20Hz~2000Hz, 1.5g |
|                | Acceleration     | 15g         |
|                | Power spectral density | 0.1g²/Hz |
|                | Test duration    | 10min, each axis |

4. Test data and analysis

4.1. Effects of bending radius on RF parameters of cable assemblies

4.1.1. Effects of bending radius on RF parameters of cable assemblies under temperature shock test. 1) Effects of bending radius on VSWR of cable assemblies under temperature shock test

It can be seen from Table 4 that there is no regular relationship between the change rate of the VSWR and the cable bending radius for the two types of cable samples (whether equal length or not).

**Table 4. Test data of cable assemblies before and after temperature shock test**

| Cable model | Connector model | Sample No. (length mm) | Bending radius (mm) | Before the test | After the test | Rate of change | Whether to exceed 20% |
|-------------|----------------|------------------------|--------------------|-----------------|---------------|----------------|----------------------|
|             | UFB205A SMA-J210G (DC-16GHz) | No. 1 (520) | 12.7 | 1.279 | 1.407 | 10.01 | No |
|             |                 | No. 2 (580) | 25.4 | 1.254 | 1.529 | 21.9 | Yes |
|             |                 | No. 3 (660) | 38.1 | 1.207 | 1.44 | 19.3 | No |
|             |                 | Additional No. 1 (420) | 12.7 | 1.215 | 1.213 | 0.16 | No |
|             |                 | Additional No. 2 (420) | 25.4 | 1.158 | 1.151 | 0.6 | No |
|             |                 | Additional No. 3 (420) | 38.1 | 1.168 | 1.162 | 0.5 | No |
|             | UFB311A TNC-J311AG (DC-7GHz) | No. 9 (650) | 32 | 1.318 | 1.335 | 1.29 | No |
|             |                 | No. 10 (700) | 40 | 1.159 | 1.257 | 8.46 | No |
|             |                 | No. 11 (950) | 80 | 1.25 | 1.266 | 1.28 | No |
2) Effects of cable bending radius on phase of cable assemblies under temperature shock test

From Table 5, if we only look at the data of sample No. 1, No. 2, No. 3 and No. 9, No. 10, No. 11, it seems that as the cable bending radius increases, the phase change rate of the two cables gradually decreases. However, referring to the data of the additional samples, the phase change rate is irregular. Therefore, it cannot be said that the cable bending radius and the phase change rate have a regular relationship.

Table 5. Test data of cable assemblies before and after temperature shock test

| Cable model | Connector model (Test frequency) | Sample No. (length mm) | Bending radius (mm) | Before the test (°) | After the test (°) | Change (°) | Rate of change (°/m) |
|-------------|----------------------------------|------------------------|---------------------|---------------------|--------------------|-----------|---------------------|
| UFB205A     | SMA-J210G (DC-16GHz)             | No. 1 (520)            | 12.7                | -125.16             | -14.16             | 111       | 213.46              |
|             |                                  | No. 2 (580)            | 25.4                | -71.86              | 44.79              | 116.65    | 201.12              |
|             |                                  | No. 3 (660)            | 38.1                | 153.86              | -93.2              | 112.94    | 171.12              |
|             |                                  | Additional No. 1 (420) | 12.7                | 121.44              | -138.61            | 99.95     | 237.98              |
|             |                                  | Additional No. 2 (420) | 25.4                | 130.76              | -39.82             | 189.42    | 451                 |
|             |                                  | Additional No. 3 (420) | 38.1                | 126.04              | -109.71            | 124.25    | 295.83              |
| UFB311A     | TNC-J311AG (DC-7GHz)             | No. 9 (650)            | 32                  | -91.7               | 76.56              | 168.26    | 258.86              |
|             |                                  | No. 10 (700)           | 40                  | 151.32              | -43.44             | 165.24    | 236.06              |
|             |                                  | No. 11 (950)           | 80                  | -60.65              | 106.72             | 167.37    | 176.18              |

4.1.2. Effects of bending radius on RF parameters of cable assemblies under sine vibration test

1) Effects of cable bending radius on VSWR of cable assemblies under sine vibration test

The data in Table 6 shows that the changes of VSWR of the two types of cable assemblies are very small, and the changes of the bending radius and the VSWR are irregular.

Table 6. Test data of cable assemblies before and after sine vibration test

| Cable model | Connector model (Test frequency) | Sample No. (length mm) | Bending radius (mm) | Before the test | After the test | Change (°) |
|-------------|----------------------------------|------------------------|---------------------|-----------------|---------------|------------|
| UFB205A     | SMA-J210G (DC-16GHz)             | No. 1 (520)            | 12.7                | 1.405           | 1.381         | -0.024     |
|             |                                  | No. 2 (580)            | 25.4                | 1.43            | 1.389         | -0.041     |
|             |                                  | No. 3 (660)            | 38.1                | 1.433           | 1.424         | -0.009     |
| UFB311A     | TNC-J311AG (DC-7GHz)             | No. 9 (650)            | 32                  | 1.354           | 1.422         | 0.068      |
|             |                                  | No. 10 (700)           | 40                  | 1.213           | 1.275         | 0.062      |
|             |                                  | No. 11 (950)           | 80                  | 1.215           | 1.273         | 0.058      |

2) Effects of bending radius on phase of cable assemblies under sine vibration test

It can be seen from Table 7 that the phase changes of the two types of cables are not large, and the phase changes of the UFB205A cable are irregular. Combined with the phase change of UFB205A and UFB311A, the bending radius of the cable and the change rate of the phase of the cable assemblies should have no regular relationship.

Table 7. Test data of cable assemblies before and after sine vibration test

| Cable model | Connector model (Test frequency) | Sample No. (length mm) | Bending radius (mm) | Before the test (°) | After the test (°) | Change (°) |
|-------------|----------------------------------|------------------------|---------------------|---------------------|--------------------|------------|
| UFB205A     | SMA-J210G (DC-16GHz)             | No. 1 (520)            | 12.7                | -14.58             | -14.36             | 0.22       |
|             |                                  | No. 2 (580)            | 25.4                | 37.78              | 37.32              | 0.46       |
|             |                                  | No. 3 (660)            | 38.1                | -91.27             | -90.98             | 0.29       |
| UFB311A     | TNC-J311AG (DC-7GHz)             | No. 9 (650)            | 32                  | 73.75             | 74.03             | 0.28       |
|             |                                  | No. 10 (700)           | 40                  | -43.99            | -43.61            | 0.38       |
|             |                                  | No. 11 (950)           | 80                  | 106.45            | 106.96            | 0.51       |
4.1.3. Effects of bending radius on RF parameters of cable assemblies under random vibration test.

1) Effects of bending radius on VSWR of cable assemblies under random vibration test

For the UFB205A cable, it can be seen that the variation of VSWR of samples No. 1 and No. 4 is 0.006. The bending radius of sample No. 2 is twice as large as that of sample No. 1. The variation of VSWR is also larger than that of sample No. 1. It cannot be considered that there is a regular relationship between the bending radius and the change of the VSWR. For the UFB311A cable, it can be seen from Table 8 that the variation of VSWR of the three cable assemblies of samples No. 9, No. 10 and No. 11 is also irregular.

Table 8. Test data of cable samples before and after random vibration test

| Cable model | Connector model (Test frequency) | Sample No. | Bending radius (mm) | Before the test | After the test | Change |
|-------------|----------------------------------|------------|--------------------|----------------|--------------|--------|
| UFB205A     | SMA-J210G (DC-16GHz)            | No. 1 (520)| 12.7               | 1.381          | 1.394        | 0.013  |
|             |                                  | No. 2 (580)| 25.4               | 1.389          | 1.41         | 0.021  |
|             |                                  | No. 3 (660)| 38.1               | 1.424          | 1.456        | 0.032  |
|             |                                  | No. 4 (520)| 12.7               | 1.439          | 1.446        | 0.007  |
| UFB311A     | TNC-J311AG (DC-7GHz)            | No. 9 (650)| 32                 | 1.422          | 1.479        | 0.057  |
|             |                                  | No. 10 (700)| 40                | 1.275          | 1.283        | 0.008  |
|             |                                  | No. 11 (950)| 80                | 1.273          | 1.225        | -0.048 |

2) Effects of cable bending radius on phase of cable assemblies under random vibration test

From Table 9, the amount of phase change is small, and the effects of the bending radius on the phase is irregular.

Table 9. Test data of cable samples before and after random vibration test

| Cable model | Connector model (Test frequency) | Sample No. | Bending radius (mm) | Before the test (°) | After the test (°) | Change (°) |
|-------------|----------------------------------|------------|--------------------|---------------------|-------------------|------------|
| UFB205A     | SMA-J210G (DC-16GHz)            | No. 1 (520)| 12.7               | -14.36              | -14.46            | -0.13      |
|             |                                  | No. 2 (580)| 25.4               | 37.32               | 38.07             | 0.75       |
|             |                                  | No. 3 (660)| 38.1               | -90.98              | -90.85            | -0.13      |
| UFB311A     | TNC-J311AG (DC-7GHz)            | No. 9 (650)| 32                 | 74.03               | 74.65             | 0.62       |
|             |                                  | No. 10 (700)| 40                | -43.61              | -43.38            | 0.23       |
|             |                                  | No. 11 (950)| 80                | 106.96              | 106.95            | -0.01      |

4.2. Effects of cable winding number on RF parameters of cable assemblies

4.2.1. Effects of cable winding number on RF parameters of cable assemblies under temperature shock test.

1) Effects of cable winding number on VSWR of cable assemblies under temperature shock test

From the data in Table 10, there is no regular change rate of VSWR. Moreover, the data of additional samples also prove that there is no regular relationship between the number of cable winding coils and the change rate of VSWR.

Table 10. Test data of cable samples before and after temperature shock test

| Cable model | Connector model (Test frequency) | Sample No. | Cable winding number | Before the test | After the test | Rate of change | Whether to exceed 20% |
|-------------|----------------------------------|------------|----------------------|----------------|--------------|---------------|----------------------|
| UFB205A     | SMA-J210G (DC-16GHz)            | No. 4 (520)| 1                    | 1.219          | 1.41         | 15.7          | No                   |
|             |                                  | No. 5 (950)| 5                    | 1.21           | 1.384        | 14.4          | No                   |
|             |                                  | No. 6 (1530)| 10                  | 1.23           | 1.413        | 14.9          | No                   |
|             |                                  | Additional No. 4 (1250)| 1                 | 1.219          | 1.213        | 0.5           | No                   |
|             |                                  | Additional No. 5 (1250)| 5                 | 1.186          | 1.178        | 0.7           | No                   |
|             |                                  | Additional No. 6 (1250)| 10                | 1.282          | 1.284        | 0.2           | No                   |
| UFB311A     |                                  | No. 12 (650)| 1                  | 1.22           | 1.27         | 4.1           | No                   |
2) Effects of cable winding number on phase of cable assemblies under temperature shock test

From Table 11, the change rate of the phase of the formal sample decreases with the increase of the cable winding number. However, the change rate of the phase of the additional sample does not support this rule. Therefore, it cannot be explained that there is a regular relationship between the phase change rate and the number of cable winding coils under the conditions of the temperature shock test.

**Table 11. Test data of cable samples before and after temperature shock test IV**

| Cable model | Connector model | Sample No. (length mm) | Cable winding number | Before the test (°) | After the test (°) | Change (°) | Rate of change (°/m) |
|-------------|-----------------|------------------------|----------------------|--------------------|-------------------|-----------|-------------------|
| TNC-J311AG  | (DC-7GHz)       | No. 13 (1650)          | 5                    | 1.183              | 1.26              | 6.51      | No                |
|             |                 | No. 14 (2910)          | 10                   | 1.195              | 1.243             | 4.02      | No                |

4.2.2. Effects of cable winding number on RF parameters of cable assemblies under sine vibration test

1) Effects of cable winding number on VSWR of cable assemblies under sine vibration test

From the data in Table 12, there is no regular change rate of VSWR.

**Table 12. Test data of cable samples before and after sine vibration test III**

| Cable model | Connector model | Sample No. (length mm) | Bending radius (mm) | Cable winding number | Before the test | After the test | Change |
|-------------|-----------------|------------------------|---------------------|---------------------|----------------|---------------|--------|
| UFB205A     | SMA-J210G       | No. 4 (520)            | 12.7                | 1                   | 1.443          | 1.439         | -0.004 |
| (DC-16GHz)  |                 | No. 5 (950)            | 12.7                | 5                   | 1.422          | 1.423         | 0.001  |
|             |                 | No. 6 (1530)           | 12.7                | 10                  | 1.414          | 1.455         | 0.041  |
| UFB311A     |                 | No. 12 (650)           | 32                  | 1                   | 1.244          | 1.242         | -0.002 |
| TNC-J311AG  |                 | No. 13 (1650)          | 32                  | 5                   | 1.264          | 1.248         | -0.016 |
| (DC-7GHz)   |                 | No. 14 (2910)          | 32                  | 10                  | 1.248          | 1.251         | 0.003  |

2) Effects of cable winding number on phase of cable assemblies under sine vibration test

It can be seen from Table 13 that although the phase change rate is not large, the phase change rate decreases as the number of cable winding coils increases.

**Table 13. Test data of cable samples before and after sine vibration test IV**

| Cable model | Connector model | Sample No. (length mm) | Bending radius (mm) | Cable winding number | Before the test | After the test | Change (°) | Rate of change (°/m) |
|-------------|-----------------|------------------------|---------------------|---------------------|----------------|---------------|-----------|-------------------|
| UFB205A     | SMA-J210G       | No. 4 (520)            | 12.7                | 1                   | 100.35         | 99.64         | 0.71      | 1.36              |
| (DC-16GHz)  |                 | No. 5 (950)            | 12.7                | 5                   | 163.77         | 163.3         | 0.47      | 0.49              |
|             |                 | No. 6 (1530)           | 12.7                | 10                  | 178.03         | 177.42        | 0.61      | 0.40              |
| UFB311A     |                 | No. 12 (650)           | 32                  | 1                   | 30.17          | 30.54         | 0.37      | 0.57              |
| TNC-J311AG  |                 | No. 13 (1650)          | 32                  | 5                   | 13.93          | 13.61         | 0.32      | 0.19              |
| (DC-7GHz)   |                 | No. 14 (2910)          | 32                  | 10                  | 62.85          | 62.76         | 0.21      | 0.09              |

4.2.3. Effects of cable winding number on RF parameters of cable assemblies under random vibration test

1) Effects of cable winding number on VSWR of cable assemblies under random vibration test

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It can be seen from Table 14 that, whether it is a UFB205A cable or a UFB311A cable, the change in the voltage standing wave ratio is very small, and the change and the number of coil windings are irregular.

**Table 14. Test data of cable assemblies samples before and after random vibration test I**

| Cable model (Connector model) | Sample No. (length mm) | Bending radius (mm) | Cable winding number | Before the test (°) | After the test (°) | Change (°) |
|------------------------------|------------------------|--------------------|---------------------|--------------------|--------------------|------------|
| UFB205A (SMA-J210G)         | No. 4 (520)            | 12.7               | 1                   | 1.439              | 1.446              | 0.007      |
|                              | No. 5 (950)            | 12.7               | 5                   | 1.423              | 1.41               | -0.013     |
|                              | No. 6 (1530)           | 12.7               | 10                  | 1.455              | 1.456              | 0.001      |
| UFB311A (TNC-J311AG)        | No. 12 (650)           | 32                 | 1                   | 1.242              | 1.263              | 0.023      |
| (DC-16GHz)                  | No. 13 (1650)          | 32                 | 5                   | 1.248              | 1.242              | -0.006     |
| (DC-7GHz)                   | No. 14 (2910)          | 32                 | 10                  | 1.251              | 1.239              | -0.012     |

2) Effects of cable winding number on phase of cable assemblies under random vibration test

From Table 15, the rate of change of the phases of the two types of cables is not large and irregular.

**Table 15. Test data of cable assemblies samples before and after random vibration test II**

| Cable model (Connector model) | Sample No. (length mm) | Bending radius (mm) | Cable winding number | Before the test (°) | After the test (°) | Change (°) |
|------------------------------|------------------------|--------------------|---------------------|--------------------|--------------------|------------|
| UFB205A (SMA-J210G)         | No. 4 (520)            | 12.7               | 1                   | 99.24              | 99.18              | -0.06      |
|                              | No. 5 (950)            | 12.7               | 5                   | 163.3              | 163.61             | 0.31       |
| (DC-16GHz)                  | No. 6 (1530)           | 12.7               | 10                  | 178.42             | 178.71             | 0.29       |
| UFB311A (TNC-J311AG)        | No. 12 (650)           | 32                 | 1                   | 30.54              | 30.67              | 0.13       |
| (DC-7GHz)                   | No. 13 (1650)          | 32                 | 5                   | 13.61              | 13.83              | 0.22       |
| (DC-7GHz)                   | No. 14 (2910)          | 32                 | 10                  | 62.76              | 62.35              | -0.41      |

5. Conclusion

This paper studies the process reliability of flexible RF cable assemblies in spacecraft assembly. Due to the small number of test samples, the test data has a certain degree of dispersion, but it does not affect the conclusion of the overall test and achieves the expected effect and purpose. Through the study of this subject, it is concluded that (1) the static bending radius and dynamic bending radius of the RF cable during installation should not exceed the ranges given by the cable manufacturer, and (2) the number of cable winding coils of the RF cable does not affect the performance index of the cable, but in the case of high cable phase requirements, the fewer the number of coils the better.

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