

# MHF<sup>®</sup> 5 Connector

Part No. Plug: 20711-001R-81 Receptacle: 20566-001E-01

## Product Specification

Qualification Test Report No. TR-15062

3	S21521	October 27, 2021	K. Ikeshita		M. Takemoto
2	S21133	March 22, 2021	N.Miyashiro	K.Ikeshita	M.Takemoto
1	S18475	August 8, 2018	M.Nomoto	K.Yufu	K.Yotsutani
0	S15358	August 21, 2015	T.Yayoshi	K.Yotsutani	E.Kawabe
Rev.	ECN	Date	Prepared by	Checked by	Approved by

## 1. Scope

This product specification defines the test conditions and the performances of the MHF 5 Connector AWG#36  $\phi$ 0.81 Cable.

## 2. Product Name and Parts No.

### 2.1 Product Name

MHF 5 PLUG  
MHF 5 RECEPTACLE

### 2.2 Parts No.

Plug: 20711-001R-81  
Receptacle: 20566-001E-01

## 3. Rating

### 3.1 Applicable Cable

#### (1) Description

Inner conductor: AWG#36(7/0.05) ,Silver plating annealed copper wire  
Dielectric core: Fluoro-plastics ,diameter 0.4(+0.04,-0.02)mm , nominal thickness 0.125mm  
Outer conductor: Nominal diameter 0.65mm , silver plating annealed copper wire or tin plating annealed copper wire  
Jacket: Fluoro-plastics, diameter 0.81(+0.04,-0.02)mm , nominal thickness 0.08mm

#### (2) Requirements

Characteristic impedance: 50(+3,-3)ohm by TDR method  
Nominal capacitance (Reference value): 96 pF/m  
Conductor resistance of inner conductor at 293K (20°C): 1400 ohm/km MAX.  
Insulation resistance: 1000 mega-ohm·km MIN.  
Dielectric withstand voltage: no breakdown at AC1000V for 1 minutes.

### 3.2 Operating Conditions

Voltage: 60 Vr.m.s AC  
Operating Temperature: 233~363K(-40°C~+90°C)  
(Containing temperature rise by current)

Nominal characteristic impedance: 50 $\Omega$

Frequency: DC~12 GHz

VSWR: [Plug] 1.3 MAX at 0.1~3 GHz  
1.5 MAX at 3~6 GHz  
1.6 MAX at 6~9 GHz  
1.7 MAX at 9~12 GHz

[Receptacle] 1.3 MAX at 0.1~3 GHz  
1.4 MAX at 3~6 GHz  
1.5 MAX at 6~9 GHz  
1.5 MAX at 9~12 GHz

### 3.3 Storage Conditions

Storage temperature: 248 to 333K(-25°C to 60°C)  
Storage humidity: 85% max. (Non-condensing)

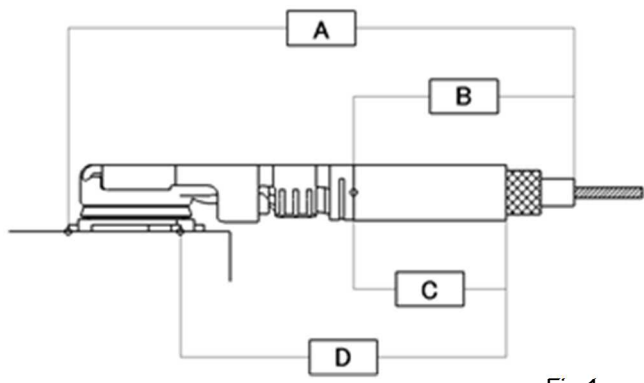
## 4. Test and Performance

### Test Condition

Unless otherwise specified, all tests and measurements shall be performed under the following conditions in accordance with MIL-STD-202.

Temperature: 288K to 308K(15°C to 35°C)  
Pressure: 866hPa to 1066hPa(650mmHg to 800mmHg)  
Relative humidity: 45 to75% R.H.

## 4.1. Electrical Performance

1. Contact Resistance	
Reference standard:	MIL-STD-202-307
Test conditions:	Solder the receptacle connector to the test board and mate the plug connector together, then measure the contact resistance as shown in Fig. 1 by the four terminal methods. Apply the low level condition. Open circuit voltage: 20mV MAX. Circuit current: 10mA MAX.
	
<div style="border: 1px dashed black; padding: 5px; display: inline-block;">                 Main contact =A-B                  Ground contact =D-C             </div>	
Fig.1	
Pass criteria:	Inner contact Initial : 20mΩ MAX. After testing : ΔR20mΩ MAX. Ground contact Initial : 20mΩ MAX. After testing : ΔR100mΩ MAX.

2. Insulation Resistance	
Reference standard:	MIL-STD-202-302
Test conditions:	Mate the plug and receptacle connector together, and then apply DC 100 V between the inner contact and the ground contact.
Pass criteria:	Initial: 500 MΩ MIN. After testing: 100 MΩ MIN.

3. D. W. Voltage	
Reference standard:	MIL-STD-202-301
Test conditions:	Mate the plug and receptacle connector together, then apply AC 200V(rms) between the inner contact and the ground contact for a minute.
Pass criteria:	No abnormalities such as creeping discharge, flashover, insulator breakdown occur.

## 4.1. Electrical Performance

### 4. VSWR

Reference standard: -

Test conditions: Measure the VSWR as shown in Fig. 2 by the network analyzer.  
Frequency: 100MHz~6GHz

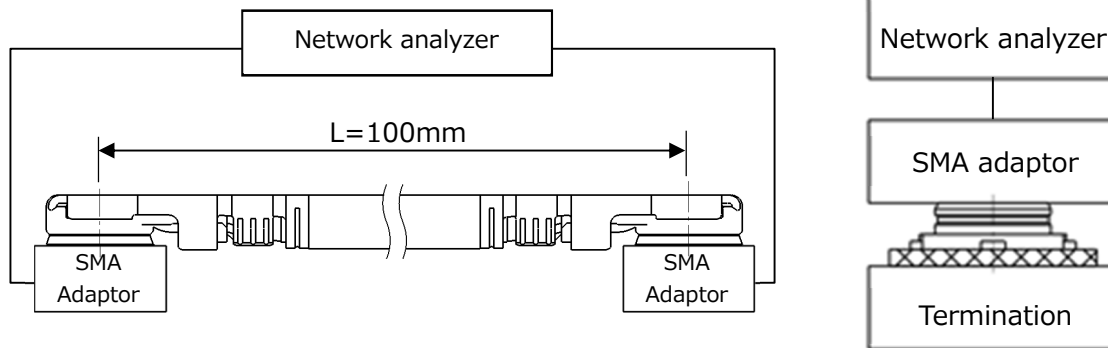


Fig. 2

Pass criteria:

PLUG:	1.3 MAX. at 0.1~3GHz, 1.5 MAX. at 3~6GHz 1.6 MAX. at 6~9GHz, 1.7 MAX. at 9~12GHz
RECEPTACLE:	1.3 MAX. at 0.1~3GHz, 1.4 MAX. at 3~6GHz 1.5MAX. at 6~9GHz, 1.5 MAX. at 9~12GHz

## 4.2. Mechanical Performance

### 1. Unmating force

Reference standard: -

Test conditions: Solder the receptacle connector to the test board, then place the board and plug on push-on/pull-off machine, measure of initial and un-mating 30 cycles at a speed  $25\pm 3$ mm/min. along the mating axis.

Pass criteria: Initial: 4 N MIN. After 30cycles: 2 N MIN.

### 2. Durability

Reference standard: -

Test conditions: Solder the receptacle connector to the test board, then place the board and plug on the push-on/pull-off machine, and repeat mating and un-mating 30cycles at a speed  $25\pm 3$ mm/min. along the mating axis.

Pass criteria: Contact resistance: Shall meet 4.1.1.  
Appearance: No abnormality adversely affecting the performance shall occur.

### 3. Crimp Strength

Reference standard: -

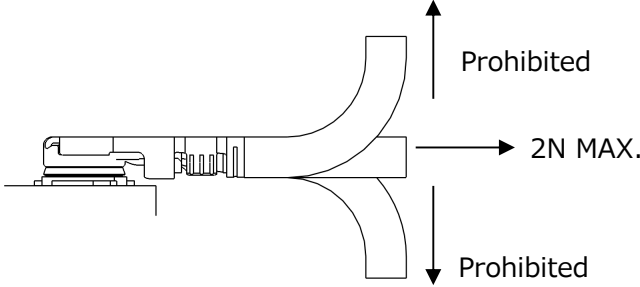
Test conditions: Pull the cable as shown in Fig-3 at speed of  $25\pm 3$ mm/minutes by the tensile strength machine and measure the retention force.



Fig. 3

Pass criteria: 7N MIN.

## 4.2. Mechanical Performance

4. Cable Retention Force	
Reference standard:	-
Test conditions:	Apply force to the cable as shown in Fig. 4. During the testing, run 100mA DC to check electrical discontinuity.
 <p>Fig. 4</p>	
Pass criteria:	Electrical discontinuity: No electrical discontinuity greater than 1 $\mu$ s shall occur. Appearance: Looseness between the parts, chipping, breakage or other abnormality shall not occur.

5. Vibration	
Reference standard:	-
Test conditions:	Apply the following vibration to the mating connector. During the testing, run 100mA DC to check electrical discontinuity. Frequency: 10Hz $\rightarrow$ 100Hz $\rightarrow$ 10Hz / approx. 15 minutes. Half amplitude, Peak value of acceleration: 1.5mm or 59m/s <sup>2</sup> (6G) Directions, cycle: 3 mutually perpendicular direction 5 cycles (approx. 75min) about each direction
Pass criteria:	Contact resistance: Shall meet 4.1.1. Electrical discontinuity: No electrical discontinuity greater than 1 $\mu$ s shall occur. Appearance: No abnormality adversely affecting the performance shall occur

6. Shock	
Reference standard:	MIL-STD-202-213, Test condition B.
Test conditions:	Apply the following vibration to the mating connector. During the testing, run 100mA DC to check electrical discontinuity. Peak value of acceleration : 735m/s <sup>2</sup> (75G) Duration: 11msec Wave Form: half sinusoidal Directions, cycle: 6 mutually perpendicular direction, 3 cycles about each direction
Pass criteria:	Contact resistance: Shall meet 4.1.1. Electrical discontinuity: No electrical discontinuity greater than 1 $\mu$ s shall occur. Appearance: No abnormality adversely affecting the performance shall occur

**4.3. Environmental Performance**

<b>1. Humidity (Steady state)</b>	
Reference standard:	MIL-STD-202-103, Test condition B.
Test conditions:	Solder the receptacle connector to the test board, then mate plug connector, and expose them to the following environment. Temperature: $313\pm 2\text{K}$ ( $40\pm 2^\circ\text{C}$ ) Humidity: 90~95%RH Duration: 96 hours
Pass criteria:	Contact resistance: Shall meet 4.1.1. Insulation resistance: Shall meet 4.1.2. Dielectric withstanding voltage: Shall meet 4.1.3. Appearance: No abnormality adversely affecting the performance shall occur

<b>2. Thermal Shock</b>	
Reference standard:	MIL-STD-202-107, Test condition A.
Test conditions:	Solder the receptacle connector to the test board, then mate plug connector, and expose them to the following environment. Temperature: $218\text{K}(-55^\circ\text{C}), 30\text{min.} \rightarrow 358\text{K}(85^\circ\text{C}), 30\text{min.}$ Transition time: 5min. MAX. Cycle: 5 cycles
Pass criteria:	Contact resistance: Shall meet 4.1.1. Insulation resistance: Shall meet 4.1.2. Dielectric withstanding voltage: Shall meet 4.1.3. Appearance: No abnormality adversely affecting the performance shall occur

<b>3. High Temperature Life</b>	
Reference standard:	-
Test conditions:	Apply the following environment to the mating connector. Temperature : $363\pm 2\text{K}$ ( $90\pm 2^\circ\text{C}$ ) Duration : 96 hours
Pass criteria:	Contact resistance: Shall meet 4.1.1. Appearance: No abnormality adversely affecting the performance shall occur

<b>4. H<sub>2</sub>S Gas</b>	
Reference standard:	-
Test conditions:	Apply the following environment to the mating connector. Temperature: $313\pm 2\text{K}$ ( $40\pm 2^\circ\text{C}$ ) Relative Humidity: $80\pm 5\%$ RH Gas: H <sub>2</sub> S $3\pm 1\text{ppm}$ Duration: 96 hours
Pass criteria:	Contact resistance: Shall meet 4.1.1. Appearance: No abnormality adversely affecting the performance shall occur

## 4.3. Environmental Performance

<b>5. Salt Water Spray</b>	
Reference standard:	MIL-STD-202-101, Test condition B.
Test conditions:	Solder the receptacle connector to the test board, then mate plug connector, and expose them to the following environment. Temperature: $308 \pm 2\text{K}$ ( $35 \pm 2^\circ\text{C}$ ) Saltwater density: $5 \pm 1\%$ [by weight] Duration: 48 hours
Pass criteria:	Contact resistance: Shall meet 4.1.1. Appearance: No abnormality adversely affecting the performance shall occur

## 4.4. Others

<b>1. Solder ability</b>	
Reference standard:	MIL-STD-202-208
Test conditions:	Immerse the contact soldering part to flux of RMA or R type for 5 to 10 seconds, then dip the part into the solder bath of $518 \pm 5\text{K}$ ( $245 \pm 5^\circ\text{C}$ ) for $5 \pm 0.5$ seconds.
Pass criteria:	More than 95% of the dipped surface becomes wet and the pinhole that should not gather at one point is less than 5%.

<b>2. Soldering Heat Resistance</b>																
Reference standard:	-															
Test conditions:	Reflow temperature profile: Fig. 5 The number of reflow is 2 times.															
<table border="1" style="float: right; margin-top: 10px;"> <thead> <tr> <th>Condition</th> <th>Temperature</th> <th>Time [s]</th> </tr> </thead> <tbody> <tr> <td>Condition 1</td> <td>403~453K (130~180°C)</td> <td>120MAX.</td> </tr> <tr> <td>Condition 2</td> <td>493K (220°C)</td> <td>60MAX.</td> </tr> <tr> <td>Condition 3</td> <td>503L (230°C)</td> <td>50MAX.</td> </tr> <tr> <td>Condition 4</td> <td>523K 250°C</td> <td>10</td> </tr> </tbody> </table>		Condition	Temperature	Time [s]	Condition 1	403~453K (130~180°C)	120MAX.	Condition 2	493K (220°C)	60MAX.	Condition 3	503L (230°C)	50MAX.	Condition 4	523K 250°C	10
Condition	Temperature	Time [s]														
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Condition 4	523K 250°C	10														
<b>Fig. 5</b>																
Pass criteria:	No deformation nor defect adversely affecting the performance occur.															

## 4.5 Test Sequence and Specimen Quantity

**Table.1 Test Sequence and Sample Quantity**

Test Item	Group													
	A	B	C	D	E	F	G	H	J	K	L	M	N	P
Contact Resistance			1, 3			1, 3	1, 3	1, 5	1, 5	1, 3	1, 3	1, 3		
Insulation Resistance								2, 6	2, 6					
D. W. Voltage								3, 7	3, 7					
VSWR	1													
Unmating force		1												
Durability			2											
Crimp Strength				1										
Cable Retention Force					1									
Vibration						2								
Shock							2							
Humidity (Steady State)								4						
Thermal Shock									4					
High Temperature Life										2				
H2S Gas											2			
Salt Water Spray												2		
Solder ability													1	
Soldering Heat Resistance														1
Specimen quantity	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Numbers indicate sequence in which tests are performed.

## 5. Recommended Metal Mask

Refer to drawing for the recommended metal mask thickness and opening dimension