FLEXIBLE COAXIAL CABLE ASSEMBLIES for microwave
Highlight

- Highly Flexible
- The World First 110GHz Application
- Mating Flexibility
  (Plug-jack conversion, different kinds of connector type conversion etc.)
- Lower Attenuation
- Lower Reflective Characteristic
- Solid Phase Stability over Temperature and Bending
- It can use for ultra high-speed digital signal transmission.
  (For differential transmission, we cope with phase matching upon of plural cables.)
Comparison of Attenuation with competitor

Cable attenuation (at 25°C)
Cable Lineup (and connector lineup)

- CF119
  - Outer diameter: 1.7mm
  - Frequency range: DC to 110 GHz

- F219 (−HS)
  - SMA
  - Outer diameter: 1.7mm
  - Frequency range: DC to 110 GHz

- F280 (−HS)
  - SMA
  - Outer diameter: 2.7mm
  - Frequency range: DC to 110 GHz

- CF358
  - Outer diameter: 3.3mm
  - Frequency range: DC to 110 GHz

- F500
  - SMA
  - Outer diameter: 4.1mm
  - Frequency range: DC to 110 GHz

- F280S (−HS)
  - Outer diameter: 3.3mm
  - Frequency range: DC to 110 GHz

Structure

Normal type:
1: Inner conductor
2: Insulation
3: Outer conductor
4: Jacket (inner sheath)

- Solid silver plated copper (Solid or Stranded)
- Porous PTFE
- Silver plated copper tape
- Silver plated copper braid
- FEP (blue), ETFE (TCF280SHS)

Soft armor type:
5: Armor jacket
6: Outer sheath

- Stainless steel coil (flat wire)
- Stainless steel wire braid
- PVC (blue)
### Cable specification

#### Structure details

<table>
<thead>
<tr>
<th>Material</th>
<th>Dielectric</th>
<th>Outer conductor</th>
<th>(Inner) Sheath</th>
<th>“HS” Armor Outer sheath</th>
</tr>
</thead>
<tbody>
<tr>
<td>F119</td>
<td>Silver plated copper</td>
<td>Porous PTFE</td>
<td>Silver plated copper tape and braid</td>
<td>FEP (blue)</td>
</tr>
<tr>
<td>F219(HS)</td>
<td>Silver plated copper</td>
<td>Porous PTFE</td>
<td>Silver plated copper tape and braid</td>
<td>FEP (blue)</td>
</tr>
<tr>
<td>F280(HS)</td>
<td>Silver plated copper</td>
<td>Porous PTFE</td>
<td>Silver plated copper tape and braid</td>
<td>FEP (blue)</td>
</tr>
<tr>
<td>F280S(HS)</td>
<td>Silver plated copper</td>
<td>Porous PTFE</td>
<td>Silver plated copper tape and braid</td>
<td>ETFE (gray)</td>
</tr>
<tr>
<td>F358</td>
<td>Silver plated copper</td>
<td>Porous PTFE</td>
<td>Silver plated copper tape and braid</td>
<td>FEP (blue)</td>
</tr>
<tr>
<td>F500</td>
<td>Silver plated copper</td>
<td>Porous PTFE</td>
<td>Silver plated copper tape and braid</td>
<td>FEP (blue)</td>
</tr>
</tbody>
</table>

#### Electrical, Mechanical characteristics

<table>
<thead>
<tr>
<th>Characteristic Impedance</th>
<th>Capacitance</th>
<th>Time delay</th>
<th>Transmission rate</th>
<th>Moding frequency</th>
<th>Min. bending radius static</th>
<th>Temp. range</th>
<th>“HS” type temp. range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network</td>
<td>ohm</td>
<td>pF/m</td>
<td>ns/m</td>
<td>% of c</td>
<td>GHz</td>
<td>°C</td>
<td>°C</td>
</tr>
<tr>
<td>F119</td>
<td>50</td>
<td>85</td>
<td>4.3</td>
<td>78</td>
<td>134</td>
<td>-65 … +125</td>
<td>—</td>
</tr>
<tr>
<td>F219(HS)</td>
<td>50</td>
<td>85</td>
<td>4.3</td>
<td>78</td>
<td>75</td>
<td>-65 … +125</td>
<td>-30 … +105</td>
</tr>
<tr>
<td>F280(HS)</td>
<td>50</td>
<td>85</td>
<td>4.3</td>
<td>78</td>
<td>52</td>
<td>-65 … +125</td>
<td>-30 … +105</td>
</tr>
<tr>
<td>F280S(HS)</td>
<td>50</td>
<td>85</td>
<td>4.3</td>
<td>78</td>
<td>48</td>
<td>-65 … +125</td>
<td>-30 … +105</td>
</tr>
<tr>
<td>F358</td>
<td>50</td>
<td>85</td>
<td>4.3</td>
<td>78</td>
<td>41</td>
<td>-65 … +125</td>
<td>—</td>
</tr>
<tr>
<td>F500</td>
<td>50</td>
<td>85</td>
<td>4.3</td>
<td>78</td>
<td>27</td>
<td>-65 … +125</td>
<td>—</td>
</tr>
</tbody>
</table>

#### Cable attenuation (Nominal)

Cable attenuation (at 25℃)

- F119
- F219
- F280
- F280S
- F358
- F500

* Attenuation of F119… Please see next page.
### Cable attenuation

Cable attenuation (25° C) [dB/m]  

\[ = \text{Conductor loss coefficient} \times \sqrt{f \ [\text{GHz}]} + \text{Dielectric loss coefficient} \times f \ [\text{GHz}] \]

Conductor loss coefficient : 1.300 (Nominal) 1.430 (Maximum)  
Dielectric loss coefficient : 0.0117 (Nominal) 0.0129 (Maximum)

![Attenuation of F119 (at 25'C)](image)

### Assembly insertion loss

Assembly insertion loss (25° C)  

\[ = \text{Cable attenuation (25° C)} \times \text{assembly length} + 0.06 \times \sqrt{f \ [\text{GHz}]} \]

![Assembly insertion loss (at 25'C)](image)
### Assembly insertion loss

**Assembly insertion loss (25°C)**

\[
\text{Assembly insertion loss (25°C)} = \text{Cable attenuation (25°C)} \times \text{assembly length} + 0.06 \times \sqrt{f \text{ [GHz]}}
\]

**Cable attenuation**

\[
\text{Cable attenuation (25°C) [dB/m]} = \text{Conductor loss coefficient} \times \sqrt{f \text{ [GHz]}} + \text{Dielectric loss coefficient} \times f \text{ [GHz]}
\]

- **Conductor loss coefficient**: 0.610 (Nominal), 0.671 (Maximum)
- **Dielectric loss coefficient**: 0.0123 (Nominal), 0.0135 (Maximum)
Cable attenuation

\[
\text{Cable attenuation (25° C) [dB/m]} = \text{Conductor loss coefficient} \times \sqrt{\text{f [GHz]}} + \text{Dielectric loss coefficient} \times \text{f [GHz]}
\]

Conductor loss coefficient : 0.356 (Nominal) 0.392 (Maximum)
Dielectric loss coefficient : 0.0117 (Nominal) 0.0129 (Maximum)

Assembly insertion loss

\[
\text{Assembly insertion loss (25° C)} = \text{Cable attenuation (25° C) \times assembly length} + 0.06 \times \sqrt{\text{f [GHz]}}
\]
### Cable attenuation

Cable attenuation \((25^\circ\text{C})\) [dB/m]

\[
\text{Cable attenuation (25°C)} \text{ [dB/m]} = \text{Conductor loss coefficient} \times \sqrt{f \text{ [GHz]}} + \text{Dielectric loss coefficient} \times f \text{ [GHz]}
\]

- Conductor loss coefficient: 0.420 (Nominal) 0.462 (Maximum)
- Dielectric loss coefficient: 0.0140 (Nominal) 0.0154 (Maximum)

![Attenuation of F280S (at 25°C)](image)

### Assembly insertion loss

Assembly insertion loss \((25^\circ\text{C})\)

\[
\text{Assembly insertion loss (25°C)} = \text{Cable attenuation (25°C)} \times \text{assembly length} + 0.06 \times \sqrt{f \text{ [GHz]}}
\]

![Assembly insertion loss (at 25°C)](image)
### Cable attenuation

Cable attenuation (25°C) [dB/m]

\[
\text{Cable attenuation} = \text{Conductor loss coefficient} \times \sqrt{\text{f [GHz]}} + \text{Dielectric loss coefficient} \times \text{f [GHz]}
\]

- Conductor loss coefficient: 0.297 (Nominal) 0.327 (Maximum)
- Dielectric loss coefficient: 0.0123 (Nominal) 0.0135 (Maximum)

### Assembly insertion loss

Assembly insertion loss (25°C)

\[
\text{Assembly insertion loss} = \text{Cable attenuation (25°C)} \times \text{assembly length} + 0.06 \times \sqrt{\text{f [GHz]}}
\]
Cable attenuation

Cable attenuation (25° C) [dB/m]

\[ \text{Cable attenuation (25° C)} = \text{Conductor loss coefficient} \times \sqrt{f \text{ [GHz]}} + \text{Dielectric loss coefficient} \times f \text{ [GHz]} \]

Conductor loss coefficient : 0.165 (Nominal) 0.182 (Maximum)
Dielectric loss coefficient : 0.0129 (Nominal) 0.0142 (Maximum)

Assembly insertion loss

Assembly insertion loss (25° C)

\[ \text{Assembly insertion loss (25° C)} = \text{Cable attenuation (25° C)} \times \text{assembly length} + 0.06 \times \sqrt{f \text{ [GHz]}} \]
VSWR Spec
Phase matching assemblies technology

Phase matching in two or more cable assemblies is available before delivery. An additional work is done by the method of connecting the cable and the connector of original TOTOKU after a strict phase is measured, and the adjustment to the electrical length of hope and two or more phase matching are done.

There is no uselessness of the cable and the connector depending on an original connection method, and the offer by the low price is possible.

Relative phase matching

Phase matching in two or more cable assemblies

Before phase matching

\[ \pm 5 \text{ps} / 51 \text{assemblies} \]

After phase matching

\[ \pm 1 \text{ps} / 51 \text{assemblies} \]

Sample No.

Absolute phase matching

Appoint the electrical length.
■ Phase variation for temperature change

Phase variation for temperature change of TCF Series

-0.25 0.00 0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00 2.25 2.50
Temperature [ ℃ ]
Phase change [ deg./GHz/m ]

■ Phase change After bending

① before the test
② during the test (φ100 360° bending)
③ after the test
② during the test (Φ60 360° bending)
③ after the test
② during the test (φ40 or φ30 360° bending)
③ after the test

Measured each phase change.
Phase characteristics

【F219】

Φ100

Phase change After bending

Frequency [GHz]

- before  - during  - after

Φ60

Phase change After bending

Frequency [GHz]

- before  - during  - after

Φ30

Phase change After bending

Frequency [GHz]

- before  - during  - after

【F280】

Φ100

Phase change After bending

Frequency [GHz]

- before  - during  - after

Φ60

Phase change After bending

Frequency [GHz]

- before  - during  - after

Φ40

Phase change After bending

Frequency [GHz]

- before  - during  - after

* Reference date for Phase change is measured values, not guarantee values.
Phase characteristics

**Reference date for Phase change is measured values, not guarantee values.**

- **Φ100**
  - Frequency vs. Phase change after bending graph.
  - Legend: before, during, after.

- **Φ60**
  - Frequency vs. Phase change after bending graph.
  - Legend: before, during, after.

- **Φ40**
  - Frequency vs. Phase change after bending graph.
  - Legend: before, during, after.

- **Φ50**
  - Frequency vs. Phase change after bending graph.
  - Legend: before, during, after.

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Phase characteristics

【F280S】

Φ100

Phase change After bending

Phase change vs Frequency (GHz)

Φ60

Phase change After bending

Phase change vs Frequency (GHz)

Φ40

Phase change After bending

Phase change vs Frequency (GHz)

【Memo】

* Reference date for Phase change is measured values, not guarantee values.
Maximum C.W. power of cables
(at +25°C ambient temperature and sea level)

Lateral pressure performance
typical (N/cm) *1,2
*1 Data shows typical values, not guaranteed values.
*2 It is the force that the electrical characteristic can secure.
    It is in a condition that the cable or armor was crushed a little.

<table>
<thead>
<tr>
<th>Cable type</th>
<th>armor type</th>
<th>Lateral pressure performance typical (N/cm) *1,2</th>
</tr>
</thead>
<tbody>
<tr>
<td>F358</td>
<td>Normal</td>
<td>47</td>
</tr>
<tr>
<td>F500</td>
<td>Normal</td>
<td>65</td>
</tr>
<tr>
<td>F280</td>
<td>Normal</td>
<td>36</td>
</tr>
<tr>
<td>F219</td>
<td>Normal</td>
<td>29</td>
</tr>
<tr>
<td>F358H</td>
<td>Standard armor</td>
<td>770</td>
</tr>
<tr>
<td>F500H</td>
<td>Standard armor</td>
<td>690</td>
</tr>
<tr>
<td>F280HS</td>
<td>Soft armor</td>
<td>400</td>
</tr>
<tr>
<td>F219HS</td>
<td>Soft armor</td>
<td>430</td>
</tr>
<tr>
<td>F119</td>
<td>Soft armor</td>
<td>330</td>
</tr>
</tbody>
</table>

www.motech-electronics.com  sales@motech-electronics.com
Terminal shape correspondence

Special terminal designation

We cope as well as 90 degrees (standard) in forming of terminal part.

Please feel free to contact our sales department.

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Part Number Designation

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMA-m</td>
<td>SMA-f</td>
<td>N-m</td>
<td>N-f</td>
<td>3.5mm-m</td>
<td>3.5mm-f</td>
</tr>
<tr>
<td>K</td>
<td>M</td>
<td>Q</td>
<td>R</td>
<td>T</td>
<td>U</td>
</tr>
<tr>
<td>2.92mm-m</td>
<td>2.92mm-f</td>
<td>2.4mm-m</td>
<td>2.4mm-f</td>
<td>1.85mm-m</td>
<td>1.85mm-f</td>
</tr>
<tr>
<td>X</td>
<td>Y</td>
<td>1.0mm-m</td>
<td>1.0mm-f</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

"2.92mm connector" is also called "K connector".
"1.85mm connector" is also called "V connector".

Connector type with the sign of the following table

Assembly length in mm

※It is necessary to decide specifications about the special specifications such as absolute phase designation, the angle except terminal 90° each time. Please feel free to contact our sales department.

note 1 "-m" after a connector type shows a straight male connector (also called "PLUG") and "-f" shows a straight female (also called "JACK") connector.

note 2 F cable assemblies are available with armoring. In this case, sign "H" is added after the Cable Outer Diameter. Please ask an applicable type.

note 3 F cable assemblies are available with bending by connector area. In this case, sign "L" is added after the sign of connector type. Please ask an applicable type.

note 4 F cable assemblies are available with Phase matching, in this case, sign "PM" is added after the assembly length. Please ask an applicable type.

note 5 For F cable, many variations in mating connectors are available.
(e.g. F280 series: 2.92mm connector to one end and 2.4mm connector to the other end)

Please ask for details.

Name of assembly (Examples)

F219 TLU 1200 → F219 cable assembly with 1.85mm angle type male connector and 1.85mm straight female connector, 1200mm of assembly length.
F358 AB 500 → F358 cable assembly with SMA straight male connector and SMA straight female connector, 500mm of assembly length.
F280 RK 700 → F280 cable assembly with PC2.4mm straight female connector and 2.92mm straight male connector, 700mm of assembly length.
F358 FF 300 PM → F358 cable assembly with PC3.5mm straight male connector both side, 300mm of assembly length, added phase matching option.
## Connector compatibility

<table>
<thead>
<tr>
<th>Connector type</th>
<th>Inner conductor</th>
<th>Solid</th>
<th>Stranded</th>
<th>Solid</th>
<th>Stranded</th>
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</thead>
<tbody>
<tr>
<td>N-P</td>
<td>500</td>
<td>D</td>
<td>O</td>
<td>O</td>
<td></td>
</tr>
<tr>
<td>N-J</td>
<td>358</td>
<td>E</td>
<td>O</td>
<td>O</td>
<td></td>
</tr>
<tr>
<td>N-LP</td>
<td>280</td>
<td>DL</td>
<td>O</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N-LJ</td>
<td>219</td>
<td>EL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SMA-P</td>
<td>280S</td>
<td>A</td>
<td>O</td>
<td>O</td>
<td></td>
</tr>
<tr>
<td>SMA-J</td>
<td>219H</td>
<td>B</td>
<td>O</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.5-P</td>
<td>280HS</td>
<td>F</td>
<td>O</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.5-J</td>
<td>119</td>
<td>G</td>
<td>O</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.5-LP</td>
<td>219HS</td>
<td>FL</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>3.5-LJ</td>
<td>280S</td>
<td>GL</td>
<td></td>
<td></td>
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<tr>
<td>2.92-P</td>
<td>119</td>
<td>K</td>
<td>O</td>
<td>O</td>
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<tr>
<td>2.92-J</td>
<td>280S</td>
<td>M</td>
<td>O</td>
<td>O</td>
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<tr>
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<td>219HS</td>
<td>KL</td>
<td>O</td>
<td>O</td>
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<td>ML</td>
<td>O</td>
<td>O</td>
<td></td>
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<tr>
<td>2.4-P</td>
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<td>Q</td>
<td>O</td>
<td>O</td>
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<tr>
<td>2.4-J</td>
<td>358</td>
<td>R</td>
<td>O</td>
<td>O</td>
<td></td>
</tr>
<tr>
<td>2.4-LP</td>
<td>280S</td>
<td>GL</td>
<td>O</td>
<td>O</td>
<td></td>
</tr>
<tr>
<td>2.4-LJ</td>
<td>119</td>
<td>RL</td>
<td>O</td>
<td>O</td>
<td></td>
</tr>
<tr>
<td>1.85-P</td>
<td>219</td>
<td>T</td>
<td>O</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.85-J</td>
<td>280</td>
<td>U</td>
<td>O</td>
<td></td>
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</tr>
<tr>
<td>1.85-LP</td>
<td>119</td>
<td>TL</td>
<td>O</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.85-LJ</td>
<td>280S</td>
<td>UL</td>
<td>O</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.0-P</td>
<td>50</td>
<td>X</td>
<td>O</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.0-J</td>
<td>21</td>
<td>Y</td>
<td>O</td>
<td></td>
<td></td>
</tr>
<tr>
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<td>16</td>
<td>XL</td>
<td>O</td>
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<td></td>
</tr>
<tr>
<td>1.0-LJ</td>
<td>9</td>
<td>YL</td>
<td>O</td>
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### Assembly maximum length

<table>
<thead>
<tr>
<th>Length (m)</th>
<th>50</th>
<th>21</th>
<th>16</th>
<th>9</th>
<th>25</th>
</tr>
</thead>
</table>

### Cable standard maximum length

<table>
<thead>
<tr>
<th>Length (m)</th>
<th>20</th>
<th>21</th>
<th>5</th>
<th>2</th>
<th>2</th>
</tr>
</thead>
</table>

When you need an assembly of length more than cable standard maximum length, please inquire to our sales department at each time.
F128 flexible coaxial cable assembly for 110GHz with 1.00mm connector

■ Feature
- World largest broadband area: DC~110GHz
- Easy handling, easy fixing by without armor
- Low-reflection and Low-attenuation realized by means of dedicated connector and unique fixing
- Corresponding to arbitrary length
- Excellent mating reproducibility

■ Application
- Millimeter wave radar
- High-frequency device wiring material
- Measuring instruments lead wire
- Optical device
- Semiconductor tester
- Metal and optical Info-communications device

■ Terminal structure

istribute

Reference data

Data of F128XY254 (L=254mm)
New product

F219 flexible coaxial cable assembly for 70GHz with 1.85mm connector

Feature

○ Cable
  Expanding frequency range up to 70GHz by improved outer conductor

○ Precision connector
  Expanding frequency range up to 70GHz by improved inner structure

Reference data

F219TU1000 (L=1000mm) (Assembly for 70GHz)

<table>
<thead>
<tr>
<th>Trace/Chan</th>
<th>Response</th>
<th>Marker/Analysis</th>
<th>Stimulus</th>
<th>Utility</th>
<th>Help</th>
</tr>
</thead>
<tbody>
<tr>
<td>S11 SWR</td>
<td>0.100U/ 1.00U</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S22 SWR</td>
<td>0.100U/ 1.00U</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S21 LogM</td>
<td>2.000dB/ 0.00dB</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Channel</th>
<th>Frequency</th>
<th>SWR</th>
<th>LogM</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50.000 GHz</td>
<td>1.00U</td>
<td>-4.95 dB</td>
</tr>
<tr>
<td>2</td>
<td>67.000 GHz</td>
<td>1.00U</td>
<td>-5.82 dB</td>
</tr>
<tr>
<td>3</td>
<td>70.000 GHz</td>
<td>1.00U</td>
<td>-6.01 dB</td>
</tr>
</tbody>
</table>

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publication: Oct, 2015