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| DETAIL SPECIFICATION | | |
| REF. : RAD-DET-CABL-002 | | |
| Date: October 28th, 19 | ED/REV: 3/A | PAGE : 1/18 |

RADIALL DETAIL SPECIFICATION FOR SHF COAXIAL CABLE

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DOCUMENTATION CHANGE NOTICE


| REVISION OR ISSUE | DATE | CHANGE |
|-------------------|----------|--|
| 1 - | 12/03/03 | Creation – Replacement of specification R23SHFS-CABL Issue A Dated 20/02/02 |
| 1-A | 12/05/04 | SHF 5MS LW and SHF 8MS LW added |
| 1-B | 15/12/04 | Characteristics of SHF 2.4MS & SHF3 MS changed, comments of Power handling table added |
| 2 - | 20/06/06 | SHF4MS & SHF13MS cancelled, updated of SHF2.4MS. Table of power handling cancelled |
| 2 A | 03/07/09 | Updated with replacement of SHF5MS LW by SHF5MS LW2 Modification of SHF2.4MS manufacturer |
| 2 B | 25/09/09 | Updated to correct some value of the electrical characteristics for SHF5MS. |
| 2 C | 17/06/10 | Updated to add the thickness of silver plated on inner conductor. |
| 2 D | 12/12/12 | Updated to add SHF4.8MS ULL32 to replace SHF5MS LW2 |
| 2 E | 12/09/14 | Updated to correct the outer diameters for SHF3MS, SHF5MS to be in accordance with the TDS. |
| 3 - | 31/08/16 | Added SHF3MS ETFE and SHF8MS ETFE |
| 3 A | 28/10/19 | Updated to correct Storage Temperature for SHF4.8MS cable: +150°C instead of +200°C |



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1. **SCOPE**

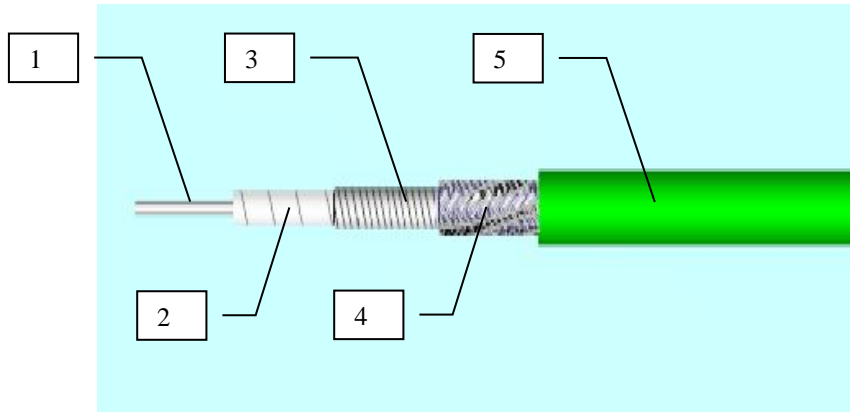
This specification must be considered as a detail specification for RADIALL specification RAD-GEN-CSHF-001

This technical specification describes all the Electrical and mechanical parameters of coaxial cables used for the manufacturing of coaxial cable assemblies for SPACE market.

These cables are specific and cannot be sold separately, they are considered as part of coaxial cable assemblies

2. CABLE CHARACTERISTICS

2.1. SHF 2.4 MS (P/N C291 187 692)



2.1.1. Material and Dimensions

| Designation | Material | mm (max) |
|---------------------|--|----------|
| 1- Center conductor | Solid SPC (Silver Plated Copper) with 2µm of Silver plated min | |
| 2- Dielectric | PTFE tape (Poly TetraFluoroEthylene) | |
| 3- Inner shield | SPC Tape (Silver Plated Copper) | |
| 4- Outer shield | SPC Braid (Silver Plated Copper) | |
| 5- Jacket | Green PFA (PerFluoroAlkoxy) | 2.45 |

2.1.2. Electrical characteristics

| | | |
|--|---|----------------------|
| Frequency Range | DC-40 | GHz |
| Cutt off frequency | 70 | GHz |
| Characteristic impedance | 50 ±1 | Ohm |
| Capacitance at 1 GHz | 87 | pF/m |
| Relative propagation speed | 77 | % |
| Propagation time | 4.3 | ns/m |
| Insulation resistance | >3 x 10 ⁵ | MOhm/m |
| Screening Effectiveness | >90 (at 18 GHz) | dB |
| Attenuation variation with temperature | Att (at X°C) = att (at 20°C) x [1+(X-20) x 0.002] | dB |
| Nominal Phase | 1560 | °/m/GHz |
| Phase stability with temperature | <3 | °/m/GHz (-55/+100°C) |
| Phase stability with bending* | <0.4 | °/360/GHz |
| Corona extinction voltage | - | KV |

* according to IEC 966-2-1

2.1.3. Mechanical characteristics

| | | |
|---------------------------|--------|----------------|
| Maximum mass | 18 | g/m |
| Static bend radius | 15 | mm |
| Dynamic bend radius | 20 | mm |
| Cable connector retention | > 80 | N |
| Crush resistance | > 400 | N/100mm |
| Flexing endurance | > 1000 | Cycles (± 90°) |

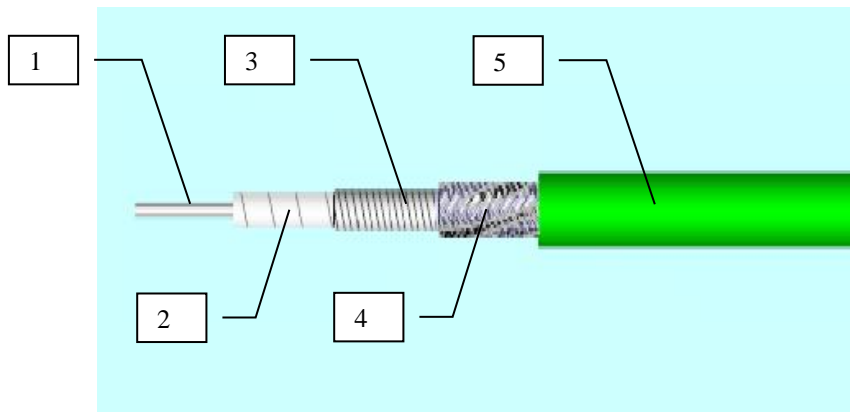
2.1.4. Environmental characteristics

| | | |
|-----------------------|----------|----|
| Operating temperature | -60/+150 | °C |
| Storage temperature | -65/+165 | °C |
| Thermal shock | -60/+150 | °C |
| Moisture at 94% | +25/+65 | °C |

2.1.5. Attenuation at 20°C

| Freq (GHz) | Typical attenuation dB/m |
|---------------|-----------------------------|
| 1 | 0.62 |
| 2 | 0.89 |
| 4 | 1.28 |
| 6 | 1.59 |
| 8 | 1.86 |
| 12.4 | 2.36 |
| 18 | 2.91 |
| 26.5 | 3.62 |
| 40 | 4.59 |

2.2. SHF 3 MS (P/N C291 217 692)



2.2.1. Material and Dimensions

| Designation | Material | mm (max) |
|---------------------|--|----------|
| 1- Center conductor | Solid SPC (Silver Plated Copper) with 2µm of Silver plated min | |
| 2- Dielectric | PTFE tape (Poly TetraFluoroEthylene) | |
| 3- Inner shield | SPC Tape (Silver Plated Copper) | |
| 4- Outer shield | SPC Braid (Silver Plated Copper) | |
| 5- Jacket | Green PFA (PerFluoroAlkoxy) | 3.60 |

2.2.2. Electrical characteristics

| | | |
|--|---|----------------------|
| Frequency Range | DC-40 | GHz |
| Cutt off frequency | 44 | GHz |
| Characteristic impedance | 50 ±1 | Ohm |
| Capacitance at 1 GHz | 88 | pF/m |
| Relative propagation speed | 76 | % |
| Propagation time | 4.4 | ns/m |
| Insulation resistance | >3 x 10 ⁵ | MOhm/m |
| Screening Effectiveness | >90 (18 GHz) | dB |
| Attenuation variation with temperature | Att (at X°C) = att (at 20°C) x [1+(X-20) x 0.002] | dB |
| Nominal Phase | 1590 | °/m/GHz |
| Phase stability with temperature | <3 | °/m/GHz (-55/+100°C) |
| Phase stability with bending* | <0.4 | °/360/GHz |
| Corona extinction voltage | - | KV |

*According to IEC966-2-1

2.2.3. Mechanical characteristics

| | | |
|---------------------------|-------|---------------------------|
| Maximum mass | 35 | g/m |
| Static bend radius | 15 | mm |
| Dynamic bend radius | 25 | mm |
| Cable connector retention | > 100 | N |
| Crush resistance | > 400 | N/100mm |
| Flexing endurance | TBD | Cycles ($\pm 90^\circ$) |

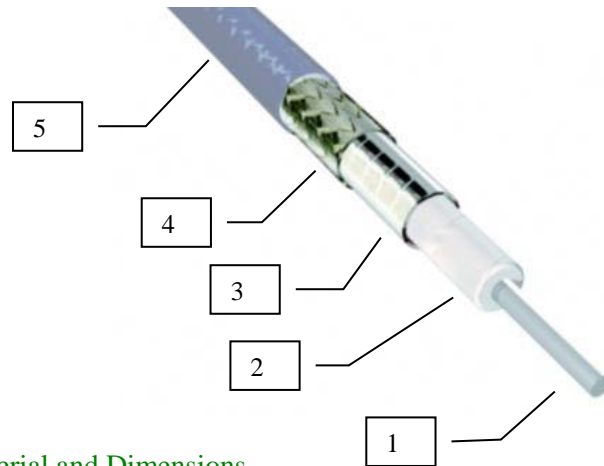
2.2.4. Environmental characteristics

| | | |
|-----------------------|----------|----|
| Operating temperature | -60/+150 | °C |
| Storage temperature | -65/+165 | °C |
| Thermal shock | -60/+150 | °C |
| Moisture at 94% | +25/+65 | °C |

2.2.5. Attenuation at 20°C

| Freq (GHz) | Typical attenuation dB/m | Maximum attenuation dB/m |
|------------|--------------------------|--------------------------|
| 1 | 0.39 | 0.42 |
| 2 | 0.56 | 0.61 |
| 4 | 0.81 | 0.89 |
| 6 | 1.01 | 1.12 |
| 8 | 1.19 | 1.31 |
| 12.4 | 1.53 | 1.69 |
| 18 | 1.91 | 2.1 |
| 26.5 | 2.41 | 2.65 |
| 40 | 3.11 | 3.42 |

2.3. SHF 3 MS ETFE (P/N F1303253)



2.3.1. Material and Dimensions

| Designation | Material | mm (max) |
|---------------------|--|----------|
| 1- Center conductor | Solid SPC (Silver Plated Copper) with 2µm of Silver plated min | |
| 2- Dielectric | PTFE tape (Poly TetraFluoroEthylene) | |
| 3- Inner shield | SPC Tape (Silver Plated Copper) | |
| 4- Outer shield | SPC Braid (Silver Plated Copper) | |
| 5- Jacket | Grey ETFE (Ethylene TetraFluoroEthylene) | 3.64 |

2.3.2. Electrical characteristics

| | | |
|--|---|----------------------|
| Frequency Range | DC-40 | GHz |
| Cutt off frequency | 44 | GHz |
| Characteristic impedance | 50 ±1 | Ohm |
| Capacitance at 1 GHz | 88 | pF/m |
| Relative propagation speed | 76 | % |
| Propagation time | 4.4 | ns/m |
| Insulation resistance | >3 x 10 ⁵ | MOhm/m |
| Screening Effectiveness | >90 (18 GHz) | dB |
| Attenuation variation with temperature | Att (at X°C) = att (at 20°C) x [1+(X-20) x 0.002] | dB |
| Nominal Phase | 1590 | °/m/GHz |
| Phase stability with temperature | <3 | °/m/GHz (-55/+100°C) |
| Phase stability with bending* | <0.4 | °/360/GHz |
| Corona extinction voltage | - | KV |

*According to IEC966-2-1

2.3.3. Mechanical characteristics

| | | |
|---------------------------|-------|---------------------------|
| Maximum mass | 35 | g/m |
| Static bend radius | 15 | mm |
| Dynamic bend radius | 25 | mm |
| Cable connector retention | > 100 | N |
| Crush resistance | > 400 | N/100mm |
| Flexing endurance | TBD | Cycles ($\pm 90^\circ$) |

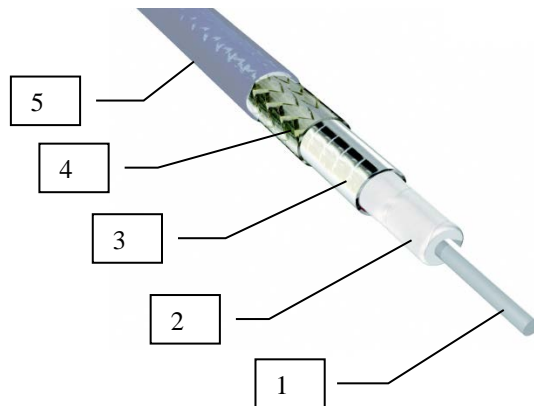
2.3.4. Environmental characteristics

| | | |
|-----------------------|----------|----|
| Operating temperature | -60/+150 | °C |
| Storage temperature | -65/+165 | °C |
| Thermal shock | -60/+150 | °C |
| Moisture at 94% | +25/+65 | °C |

2.3.5. Attenuation at 20°C

| Freq (GHz) | Typical attenuation dB/m | Maximum attenuation dB/m |
|------------|--------------------------|--------------------------|
| 1 | 0.39 | 0.42 |
| 2 | 0.56 | 0.61 |
| 4 | 0.81 | 0.89 |
| 6 | 1.01 | 1.12 |
| 8 | 1.19 | 1.31 |
| 12.4 | 1.53 | 1.69 |
| 18 | 1.91 | 2.1 |
| 26.5 | 2.41 | 2.65 |
| 40 | 3.11 | 3.42 |

2.4. SHF 4.8MS ULL 32 ETFE (P/N C291 289 095)



2.4.1. Material and Dimensions

| Designation | Material | mm (max) |
|---------------------|---|----------|
| 1- Center conductor | Solid SPCCA (Silver Plated Copper Clad Aluminium) with 2µm of Silver plated min | |
| 2- Dielectric | Low density PTFE tape (Poly TetraFluoroEthylene) | |
| 3- Inner shield | SPC Tape (Silver Plated Copper) | |
| 4- Outer shield | SPC Braid (Silver Plated Copper) | |
| 5- Jacket | Grey ETFE (Ethylene TetraFluoroEthylene) | 4.8 |

2.4.2. Electrical characteristics

| | | |
|--|---|----------------------|
| Frequency Range | DC-32.3 | GHz |
| Cutt off frequency | 33.1 | GHz |
| Characteristic impedance | 50 ±1 | Ohm |
| Capacitance at 1 GHz | 80 | pF/m |
| Relative propagation speed | 84 | % |
| Propagation time | 4 | ns/m |
| Insulation resistance | >3 x 10 ⁵ | MOhm/m |
| Screening Effectiveness | >90 (18 GHz) >75 (32.3GHz) | dB |
| Attenuation variation with temperature | Att (at X°C) = att (at 20°C) x [1+(X-20) x 0.002] | dB |
| Nominal Phase | 1440 | °/m/GHz |
| Phase stability with temperature | <2 | °/m/GHz (-55/+100°C) |
| Phase stability with bending* | <1 | °/360/GHz |
| Corona extinction voltage | ➤ 1.9 | KV |

*According to IEC966-2-1

2.4.3. Mechanical characteristics

| | | |
|---------------------------|-------|---------------------------|
| Maximum mass | 41 | g/m |
| Static bend radius | 25 | mm |
| Dynamic bend radius | 50 | mm |
| Cable connector retention | > 100 | N |
| Crush resistance | > 300 | N/100mm |
| Flexing endurance | TBD | Cycles ($\pm 90^\circ$) |

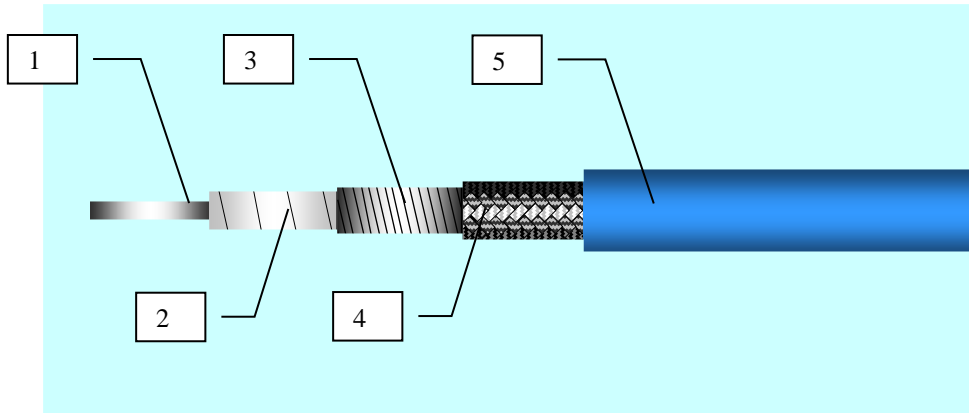
2.4.4. Environmental characteristics

| | | |
|-----------------------|-----------|----|
| Operating temperature | -100/+150 | °C |
| Storage temperature | -100/+150 | °C |
| Thermal shock | -100/+150 | °C |

2.4.5. Attenuation at 20°C

| Freq (GHz) | Typical attenuation dB/m | Maximum attenuation dB/m |
|------------|--------------------------|--------------------------|
| 1 | 0.25 | 0.28 |
| 4 | 0.53 | 0.58 |
| 6 | 0.65 | 0.72 |
| 8 | 0.76 | 0.84 |
| 10 | 0.86 | 0.96 |
| 12.4 | 0.97 | 1.07 |
| 18 | 1.20 | 1.32 |
| 26.5 | 1.51 | 1.66 |
| 32 | 1.68 | 1.85 |

2.5. SHF 5 MS (P/N C291 312 693 / F1703245)



2.5.1. Material and Dimensions

| Designation | Material | mm (max) |
|---------------------|--|----------|
| 1- Center conductor | Solid SPC (Silver Plated Copper) with 2µm of Silver plated min | |
| 2- Dielectric | Low density PTFE tape (Poly TetraFluoroEthylene) | |
| 3- Inner shield | SPC Tape (Silver Plated Copper) | |
| 4- Outer shield | SPC Braid (Silver Plated Copper) | |
| 5- Jacket | Blue FEP (Fluorinated Ethylene Propylene) | 5.5 |

2.5.2. Electrical characteristics

| | | |
|--|---|----------------------|
| Frequency Range | DC-26.5 | GHz |
| Cutt off frequency | 31 | GHz |
| Characteristic impedance | 50 ±1 | Ohm |
| Capacitance at 1 GHz | 82 | pF/m |
| Relative propagation speed | 84.8 | % |
| Propagation time | 4.03 | ns/m |
| Insulation resistance | >3 x 10 ⁵ | MOhm/m |
| Screening Effectiveness | >90 (18 GHz) | dB |
| Attenuation variation with temperature | Att (at X°C) = att (at 20°C) x [1+(X-20) x 0.002] | dB |
| Nominal Phase | 1400 | °/m/GHz |
| Phase stability with temperature | <1 | °/m/GHz (-55/+100°C) |
| Phase stability with bending* | <0.4 | °/360/GHz |
| Corona extinction voltage | >2.3 | KV |

*According to IEC966-2-1

2.5.3. Mechanical characteristics

| | | |
|---------------------------|------|---------------------------|
| Maximum mass | 53.5 | g/m |
| Static bend radius | 25 | mm |
| Dynamic bend radius | 50 | mm |
| Cable connector retention | 40 | N |
| Crush resistance | 200 | N/100mm |
| Flexing endurance | 100 | Cycles ($\pm 90^\circ$) |

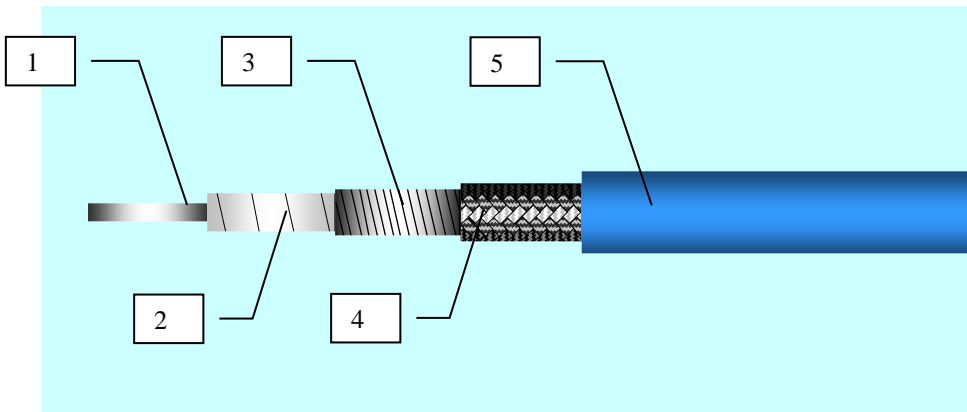
2.5.4. Environmental characteristics

| | | |
|-----------------------|----------|----|
| Operating temperature | -60/+150 | °C |
| Storage temperature | -65/+165 | °C |
| Thermal shock | -60/+150 | °C |
| Moisture at 94% | +25/+65 | °C |

2.5.5. Attenuation at 20°C

| Freq (GHz) | Typical attenuation dB/m | Max. attenuation dB/m |
|------------|--------------------------|-----------------------|
| 1 | 0.23 | 0.25 |
| 2 | 0.32 | 0.35 |
| 4 | 0.46 | 0.50 |
| 6 | 0.57 | 0.62 |
| 8 | 0.66 | 0.72 |
| 10 | 0.75 | 0.81 |
| 12.4 | 0.84 | 0.91 |
| 18 | 1.02 | 1.11 |
| 26.5 | 1.27 | 1.37 |

2.6. SHF 8 MS (P/N C291 461 693 / F1703248)




2.6.1. Material and Dimensions

| Designation | Material | mm (max) |
|---------------------|--|----------|
| 1- Center conductor | Solid SPC (Silver Plated Copper) with 2µm of Silver plated min | |
| 2- Dielectric | Low density PTFE tape (Poly TetraFluoroEthylene) | |
| 3- Inner shield | SPC Tape (Silver Plated Copper) | |
| 4- Outer shield | SPC Braid (Silver Plated Copper) | |
| 5- Jacket | Blue FEP (Fluorinated Ethylene Propylene) | 7.6 |

2.6.2. Electrical characteristics

| | | |
|--|---|----------------------|
| Frequency Range | DC-18 | GHz |
| Cutt off frequency | 20 | GHz |
| Characteristic impedance | 50 ±1 | Ohm |
| Capacitance at 1 GHz | 79 | pF/m |
| Relative propagation speed | 85.1 | % |
| Propagation time | 3.9 | ns/m |
| Insulation resistance | >3 x 10 ⁵ | MOhm/m |
| Screening Effectiveness | >90 (18 GHz) | dB |
| Attenuation variation with temperature | Att (at X°C) = att (at 20°C) x [1+(X-20) x 0.002] | dB |
| Nominal Phase | 1400 | °/m/GHz |
| Phase stability with temperature | <1 | °/m/GHz (-55/+100°C) |
| Phase stability with bending* | <0.4 | °/360/GHz |
| Corona extinction voltage | >3.3 | KV |

*According to IEC966-2-1

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2.6.3. Mechanical characteristics

| | | |
|---------------------------|-------|---------------------------|
| Maximum mass | 118 | g/m |
| Static bend radius | 40 | mm |
| Dynamic bend radius | 80 | mm |
| Cable connector retention | 50 | N |
| Crush resistance | > 200 | N/100mm |
| Flexing endurance | > 100 | Cycles ($\pm 90^\circ$) |

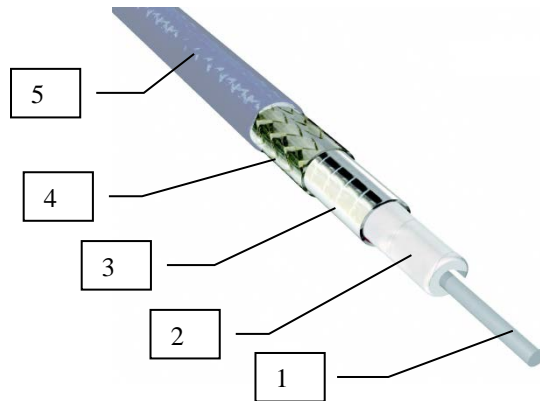
2.6.4. Environmental characteristics

| | | |
|-----------------------|----------|----|
| Operating temperature | -60/+150 | °C |
| Storage temperature | -65/+165 | °C |
| Thermal shock | -60/+150 | °C |
| Moisture at 94% | +25/+65 | °C |

2.6.5. Attenuation at 20°C

| Freq (GHz) | Typical attenuation dB/m | Max. attenuation dB/m |
|------------|--------------------------|-----------------------|
| 1 | 0.15 | 0.16 |
| 2 | 0.21 | 0.23 |
| 3 | 0.26 | 0.28 |
| 4 | 0.30 | 0.33 |
| 5 | 0.34 | 0.37 |
| 6 | 0.37 | 0.41 |
| 8 | 0.44 | 0.48 |
| 10 | 0.49 | 0.54 |
| 12.4 | 0.55 | 0.61 |
| 18 | 0.68 | 0.75 |

2.7. SHF 8 MS ETFE (P/N F1703252)



2.7.1. Material and Dimensions

| Designation | Material | mm (max) |
|---------------------|--|----------|
| 1- Center conductor | Solid SPC (Silver Plated Copper) with 2µm of Silver plated min | |
| 2- Dielectric | Low density PTFE tape (Poly TetraFluoroEthylene) | |
| 3- Inner shield | SPC Tape (Silver Plated Copper) | |
| 4- Outer shield | SPC Braid (Silver Plated Copper) | |
| 5- Jacket | Grey ETFE (Ethylene TetraFluoroEthylene) | 7.6 |

2.7.2. Electrical characteristics

| | | |
|--|---|----------------------|
| Frequency Range | DC-18 | GHz |
| Cutt off frequency | 20 | GHz |
| Characteristic impedance | 50 ±1 | Ohm |
| Capacitance at 1 GHz | 79 | pF/m |
| Relative propagation speed | 85.1 | % |
| Propagation time | 3.9 | ns/m |
| Insulation resistance | >3 x 10 ⁵ | MOhm/m |
| Screening Effectiveness | >90 (18 GHz) | dB |
| Attenuation variation with temperature | Att (at X°C) = att (at 20°C) x [1+(X-20) x 0.002] | dB |
| Nominal Phase | 1400 | °/m/GHz |
| Phase stability with temperature | <1 | °/m/GHz (-55/+100°C) |
| Phase stability with bending* | <0.4 | °/360/GHz |
| Corona extinction voltage | >3.3 | KV |

*According to IEC966-2-1

2.7.3. Mechanical characteristics

| | | |
|---------------------------|-------|----------------|
| Maximum mass | 118 | g/m |
| Static bend radius | 40 | mm |
| Dynamic bend radius | 80 | mm |
| Cable connector retention | 50 | N |
| Crush resistance | > 200 | N/100mm |
| Flexing endurance | > 100 | Cycles (± 90°) |

2.7.4. Environmental characteristics

| | | |
|-----------------------|----------|----|
| Operating temperature | -60/+150 | °C |
| Storage temperature | -65/+165 | °C |
| Thermal shock | -60/+150 | °C |
| Moisture at 94% | +25/+65 | °C |

2.7.5. Attenuation at 20°C

| Freq (GHz) | Typical attenuation dB/m | Max. attenuation dB/m |
|------------|--------------------------|-----------------------|
| 1 | 0.15 | 0.16 |
| 2 | 0.21 | 0.23 |
| 3 | 0.26 | 0.28 |
| 4 | 0.30 | 0.33 |
| 5 | 0.34 | 0.37 |
| 6 | 0.37 | 0.41 |
| 8 | 0.44 | 0.48 |
| 10 | 0.49 | 0.54 |
| 12.4 | 0.55 | 0.61 |
| 18 | 0.68 | 0.75 |