

# TOTOKU TCF Series

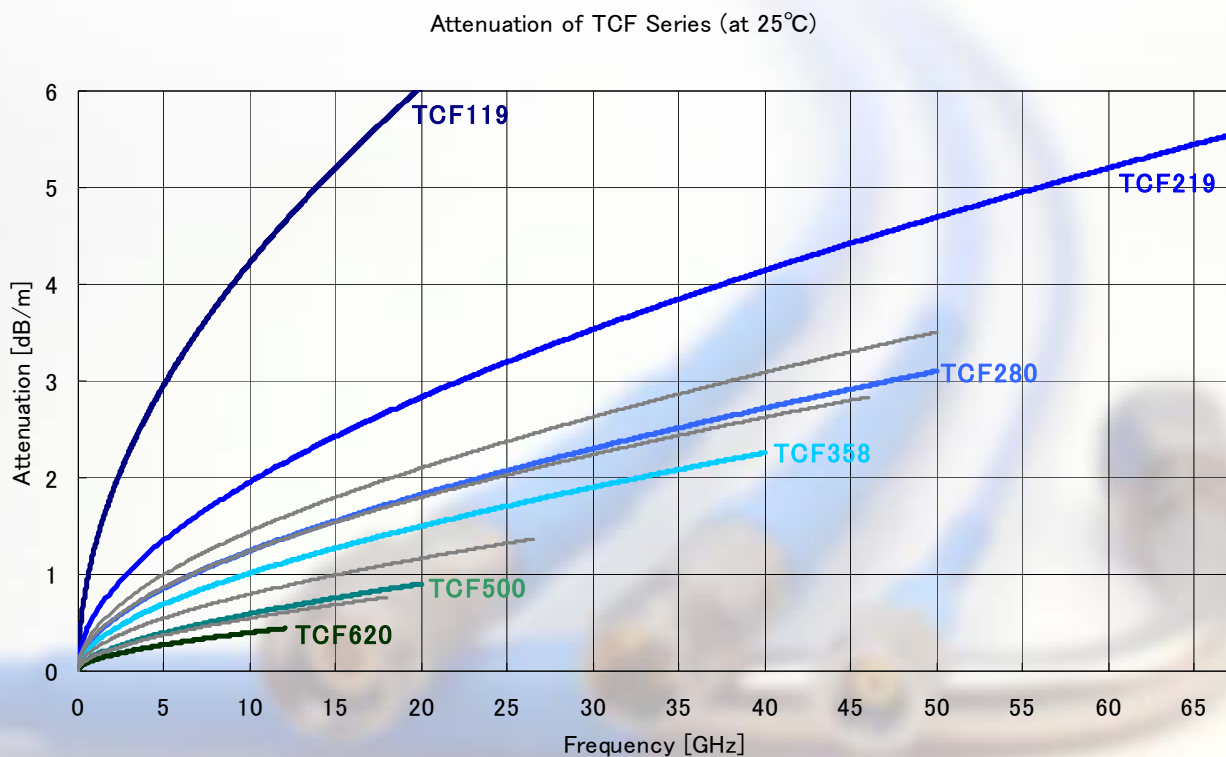
## THE FLEXIBLE

## MICROWAVE CABLE ASSEMBLIES

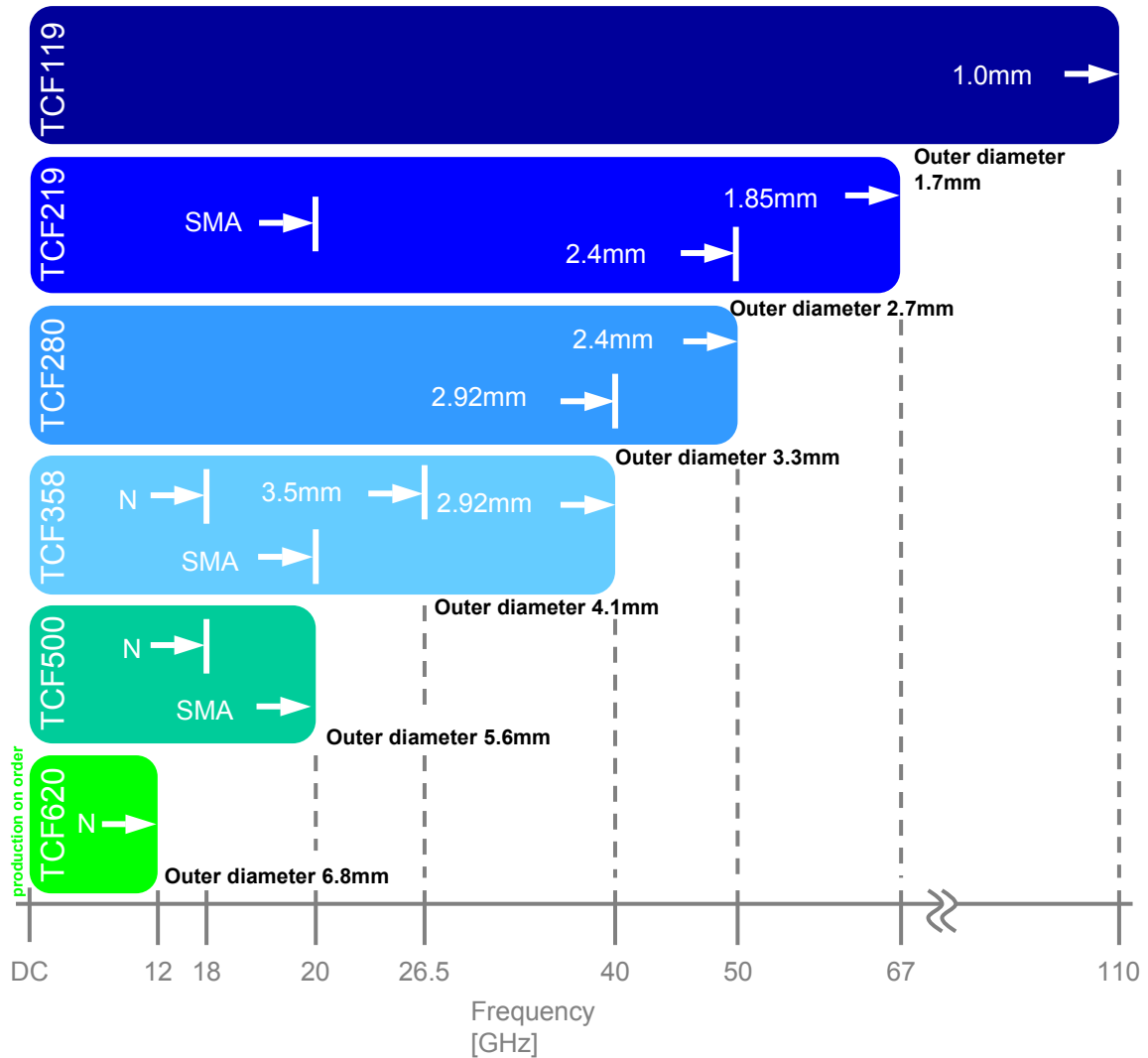


- Highly Flexible
- The World First 110GHz Application
- Mating Flexibility
- Lower Attenuation
- Lower Reflective Characteristic
- Solid Phase Stability over Temperature and Bending
- The TCF series cables can also be used for ultra high-speed digital signal transmission.

## Comparison of Attenuation with competitor



■ Cable Lineup (and connector lineup)



■ Structure



1                      2                      3a                      3b                      4

- 1: Inner conductor** - Solid silver plated copper
- 2: Insulation** - Porous PTFE
- 3: Outer conductor** - a. Silver plated copper tape  
b. Silver plated copper braid
- 4: Jacket** - FEP (blue)

## Cable specification

### Structure details

	Inner conductor	Dielectric	Outer conductor	Jacket	
	Material	Material	Material	Material	O.D. [mm]
TCF119	Silver plated copper	Porous PTFE	Silver plated copper tape and Braid	FEP (Blue)	1.7
TCF219	Silver plated copper	Porous PTFE	Silver plated copper tape and Braid	FEP (Blue)	2.7
TCF280	Silver plated copper	Porous PTFE	Silver plated copper tape and Braid	FEP (Blue)	3.3
TCF358	Silver plated copper	Porous PTFE	Silver plated copper tape and Braid	FEP (Blue)	4.1
TCF500	Silver plated copper	Porous PTFE	Silver plated copper tape and Braid	FEP (Blue)	5.6
TCF620	Silver plated copper	Porous PTFE	Silver plated copper tape and Braid	FEP (Blue)	6.8

TTK942-004

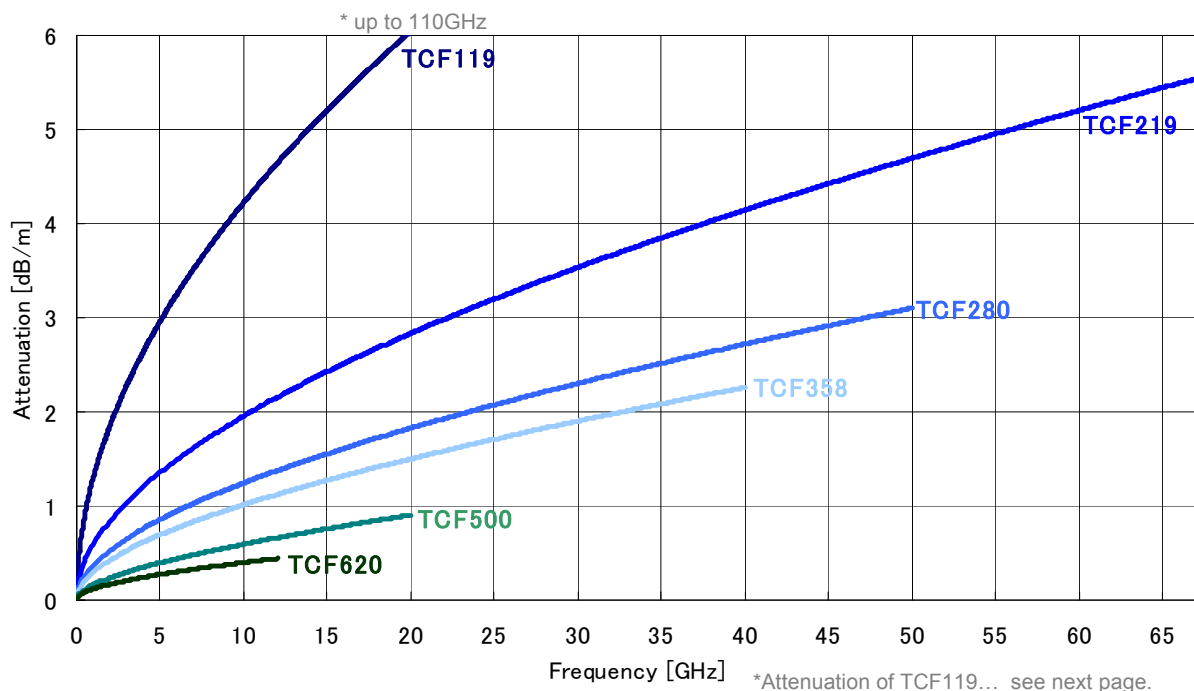
### Electrical, Mechanical characteristics

	Characteristic Impedance [ohm]	Capacitance [pF/m]	Time delay [ns/m]	Transmission rate [% of c]	Moding Frequency [GHz]	Min. bending radius static [mm]	Temp. range [°C]
TCF119	50	85	4.3	78	134	10	-65 ... +125
TCF219	50	85	4.3	78	75	15	-65 ... +125
TCF280	50	85	4.3	78	52	20	-65 ... +125
TCF358	50	85	4.3	78	41	20	-65 ... +125
TCF500	50	85	4.3	78	27	25	-65 ... +125
TCF620	50	85	4.3	78	20	35	-65 ... +125

TTK942-004

## Cable attenuation (Nominal)

Attenuation of TCF Series (at 25°C)



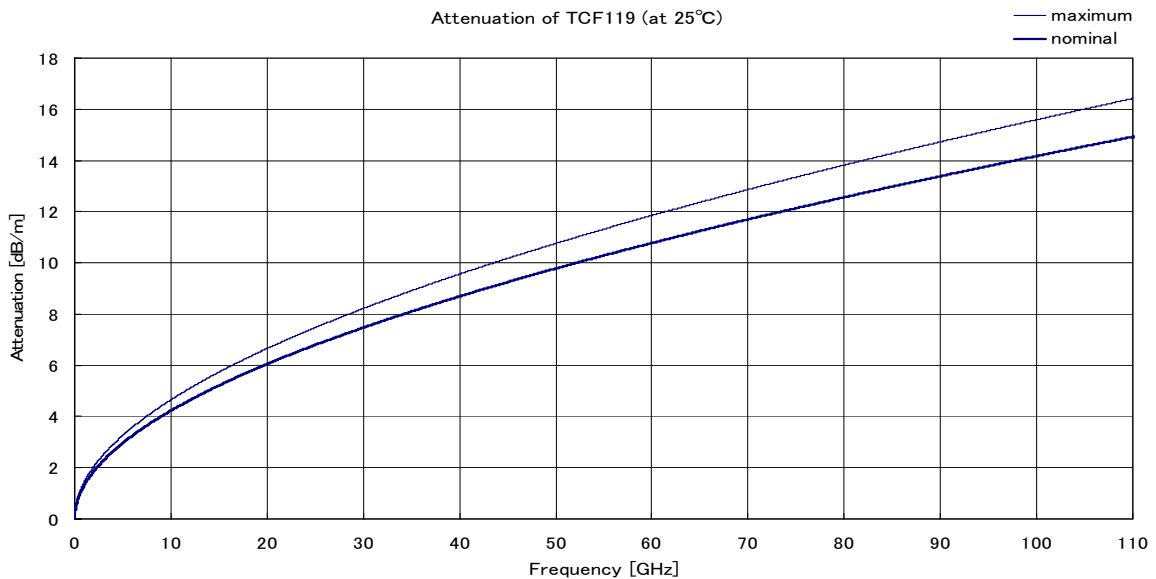
## ■ Cable attenuation

Cable attenuation (25° C) [dB/m]

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

Conductor loss coefficient : 1.300 (Nominal) 1.430 (Maximum)

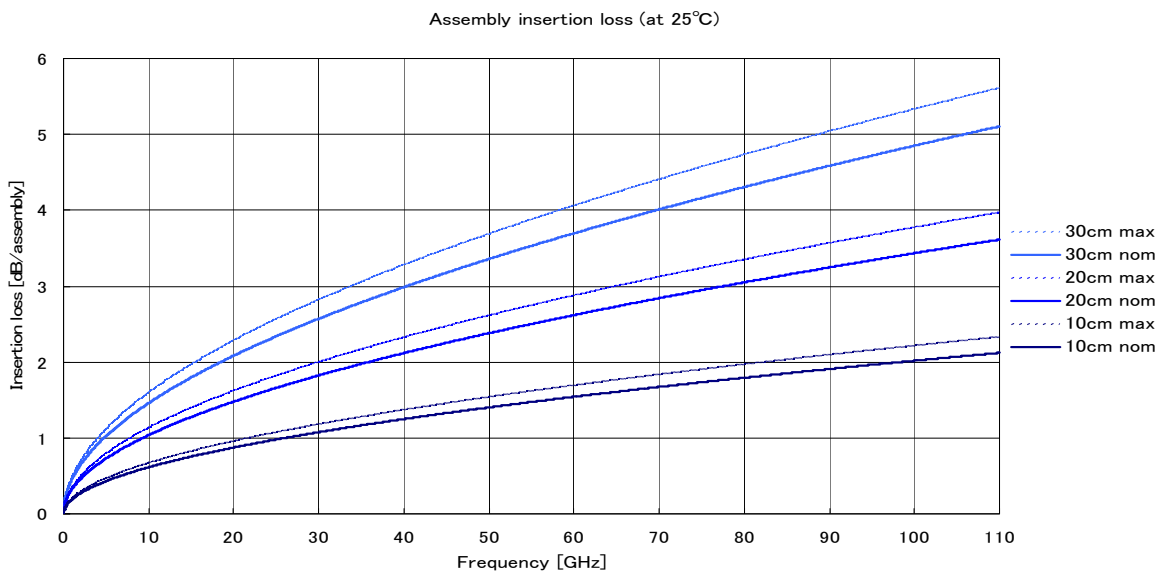
Dielectric loss coefficient : 0.0117 (Nominal) 0.0129 (Maximum)



## ■ Assembly insertion loss

Assembly insertion loss (25° C)

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



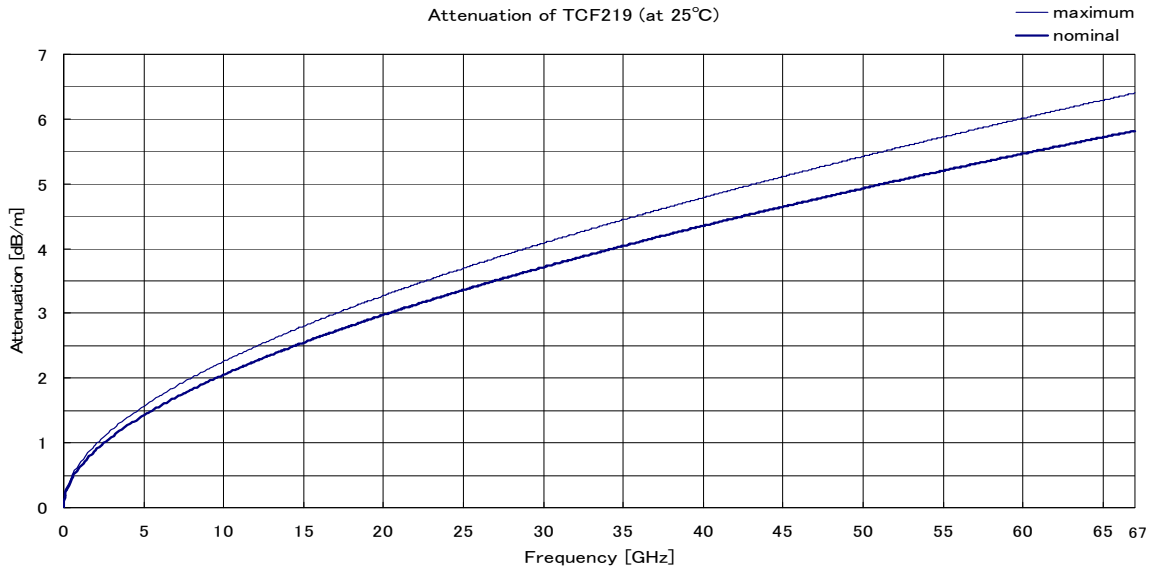
## ■ Cable attenuation

Cable attenuation (25° C) [dB/m]

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

Conductor loss coefficient : 0.610 (Nominal) 0.671 (Maximum)

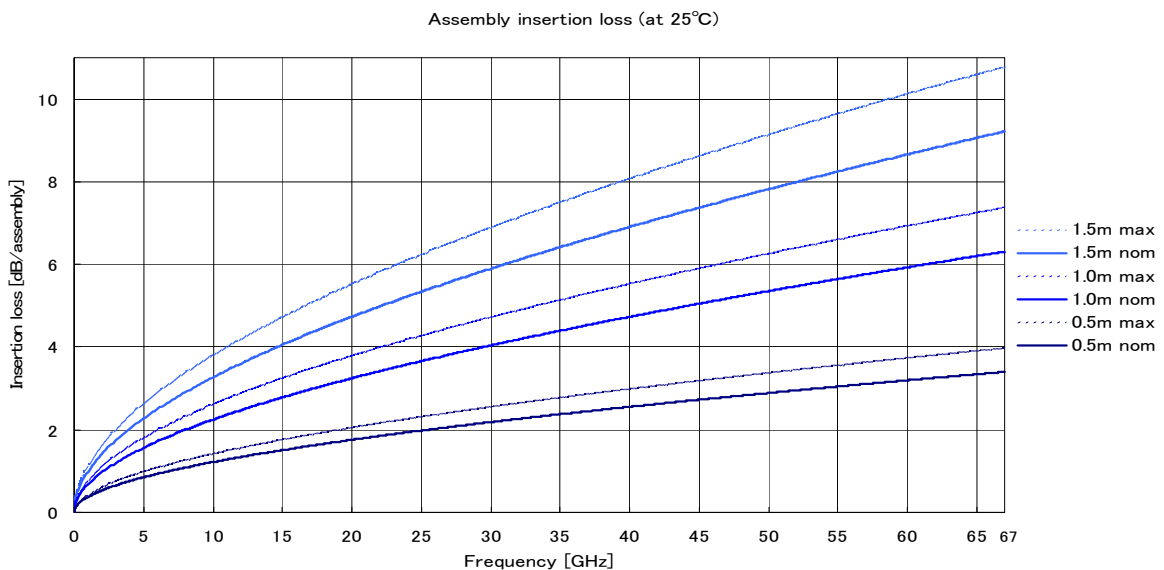
Dielectric loss coefficient : 0.0123 (Nominal) 0.0135 (Maximum)



## ■ Assembly insertion loss

Assembly insertion loss (25° C)

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



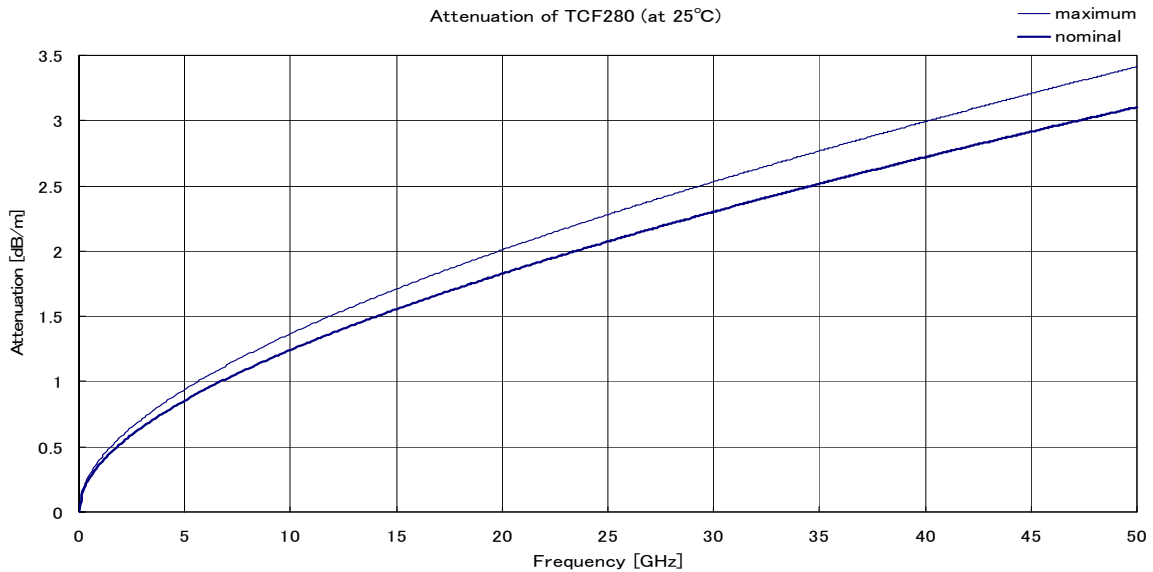
## ■ Cable attenuation

Cable attenuation (25° C) [dB/m]

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

Conductor loss coefficient : 0.356 (Nominal) 0.392 (Maximum)

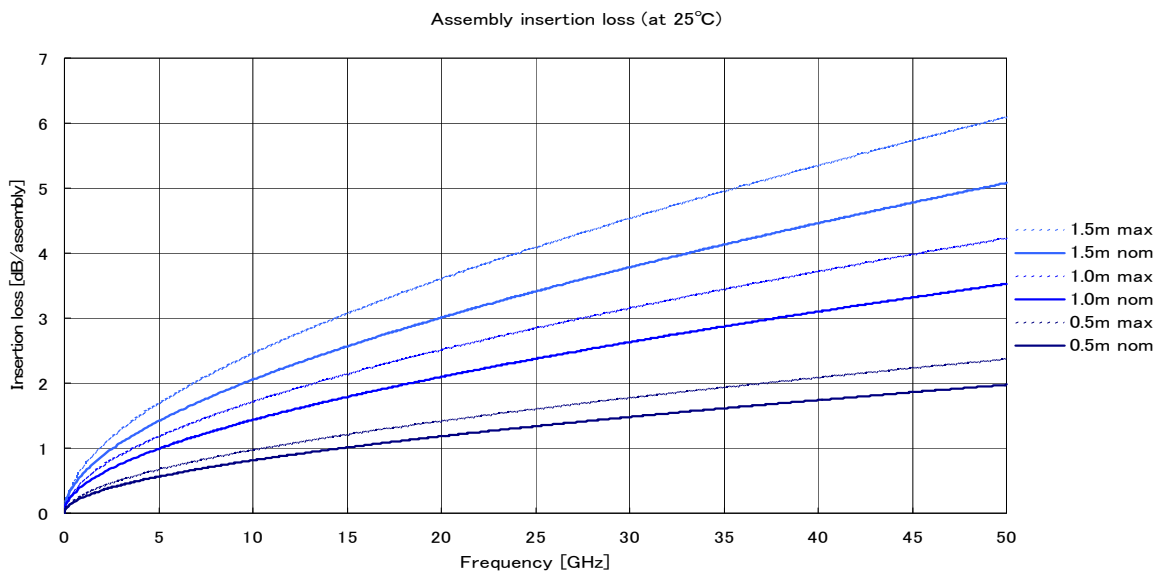
Dielectric loss coefficient : 0.0117 (Nominal) 0.0129 (Maximum)



## ■ Assembly insertion loss

Assembly insertion loss (25° C)

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



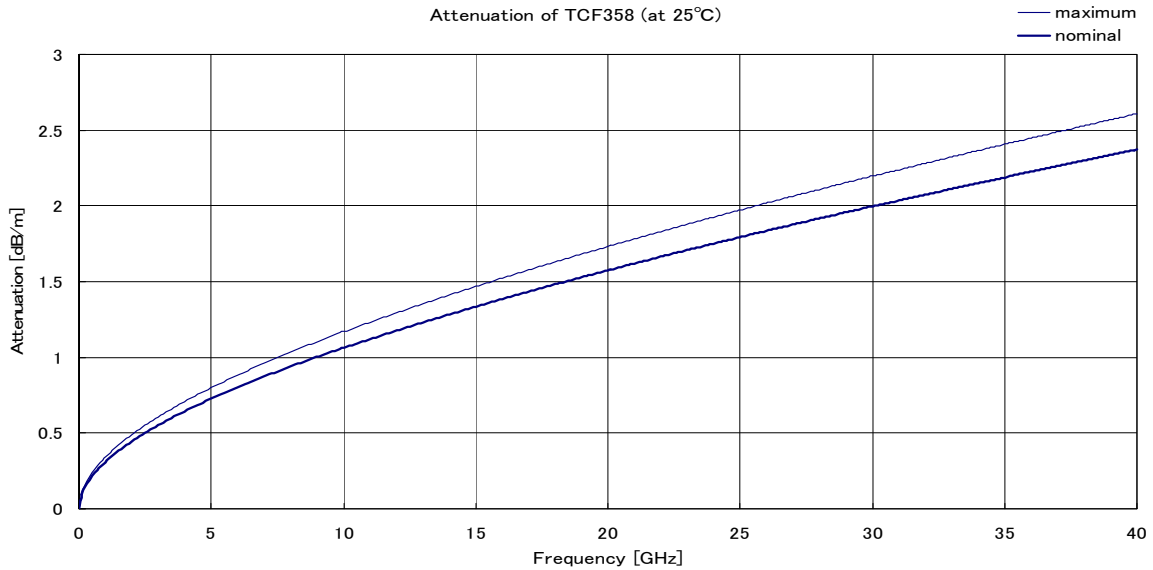
## ■ Cable attenuation

Cable attenuation (25° C) [dB/m]

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

Conductor loss coefficient : 0.297 (Nominal) 0.327 (Maximum)

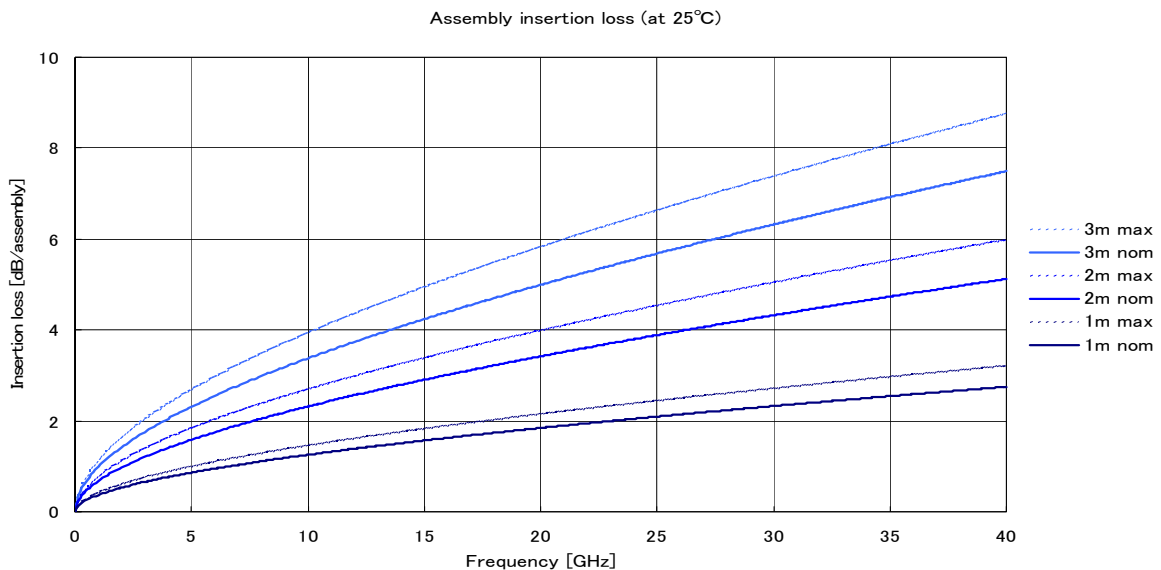
Dielectric loss coefficient : 0.0123 (Nominal) 0.0135 (Maximum)



## ■ Assembly insertion loss

Assembly insertion loss (25° C)

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



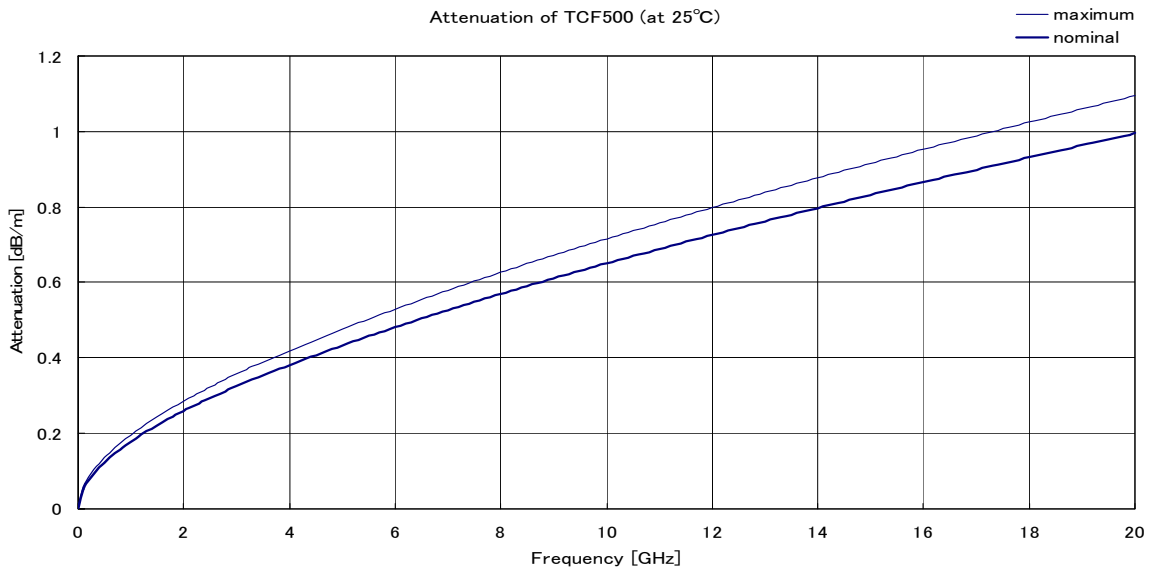
## ■ Cable attenuation

Cable attenuation (25° C) [dB/m]

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

Conductor loss coefficient : 0.165 (Nominal) 0.182 (Maximum)

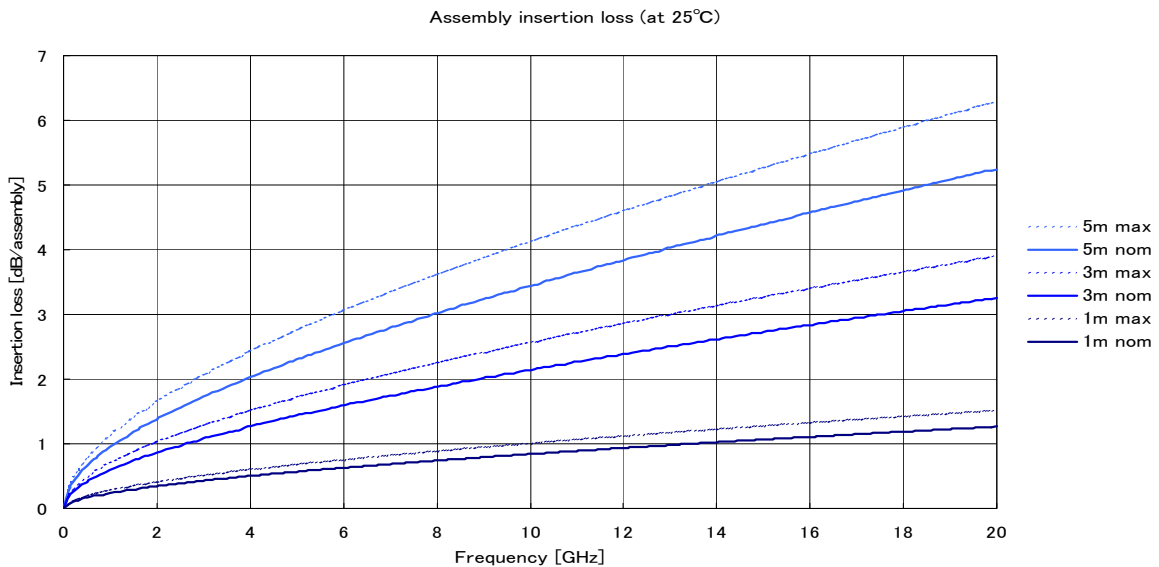
Dielectric loss coefficient : 0.0129 (Nominal) 0.0142 (Maximum)



## ■ Assembly insertion loss

Assembly insertion loss (25° C)

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



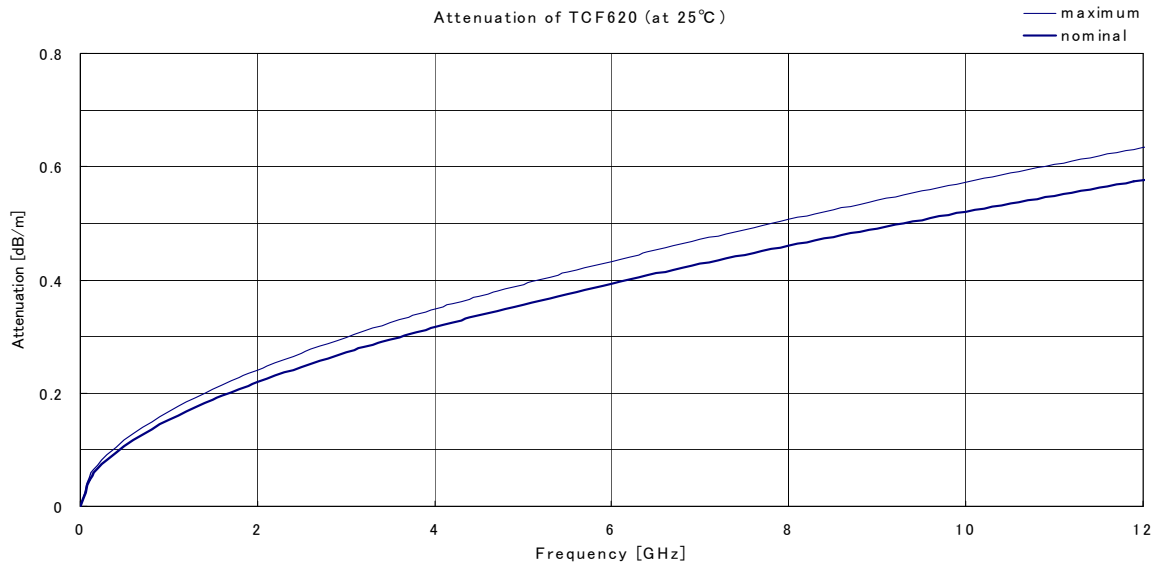
## ■ Cable attenuation

Cable attenuation (25° C) [dB/m]

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

Conductor loss coefficient : 0.147 (Nominal) 0.162 (Maximum)

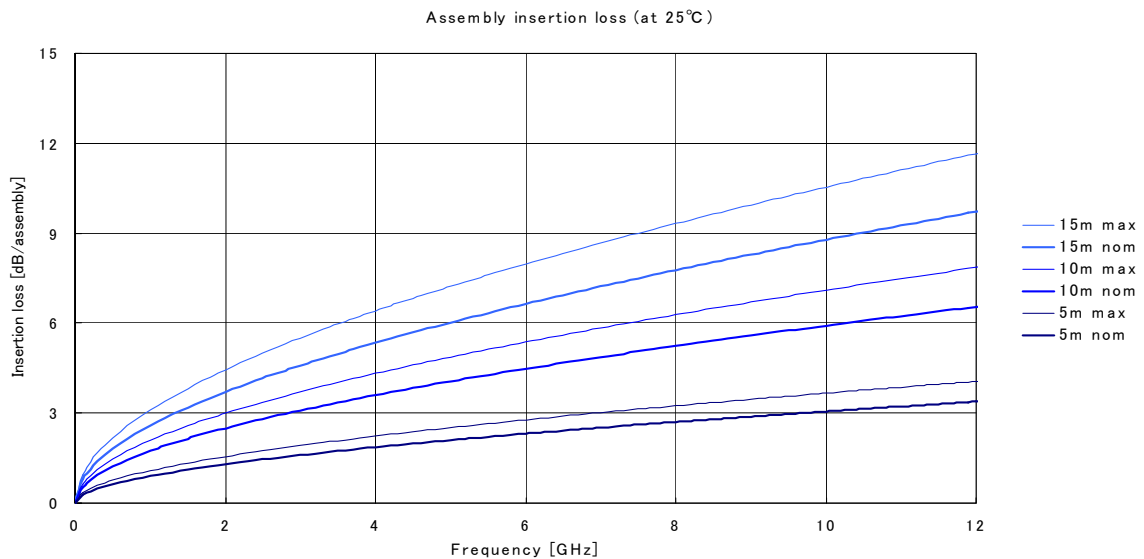
Dielectric loss coefficient : 0.0055 (Nominal) 0.0061 (Maximum)



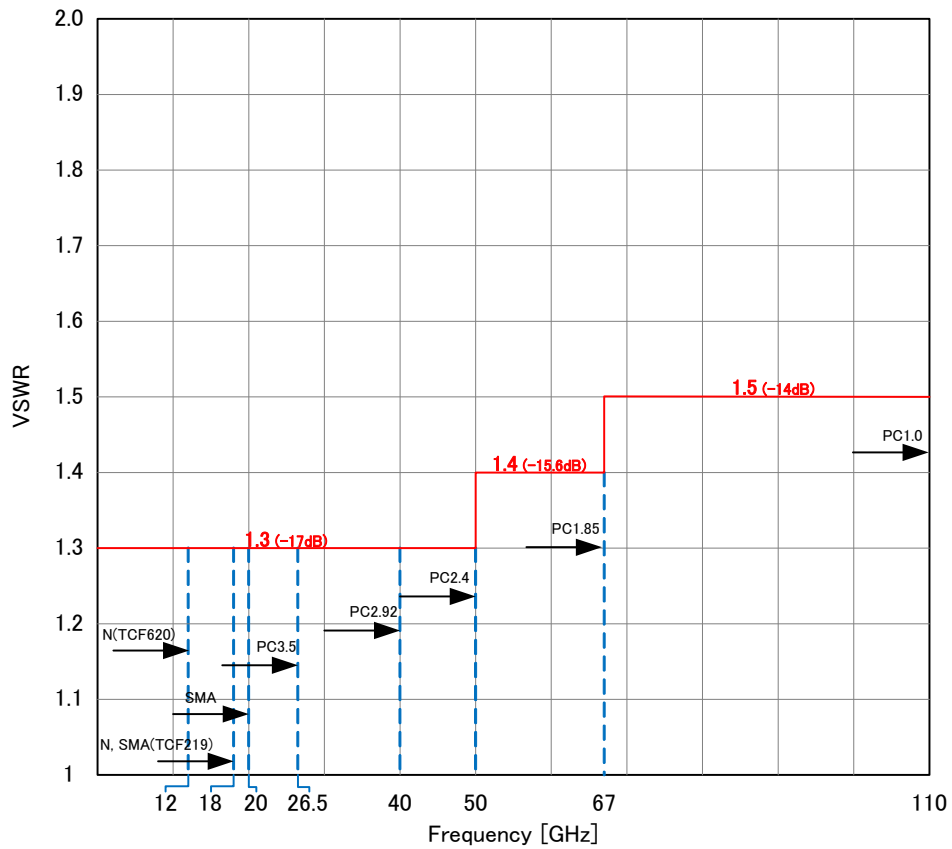
## ■ Assembly insertion loss

Assembly insertion loss (25° C)

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



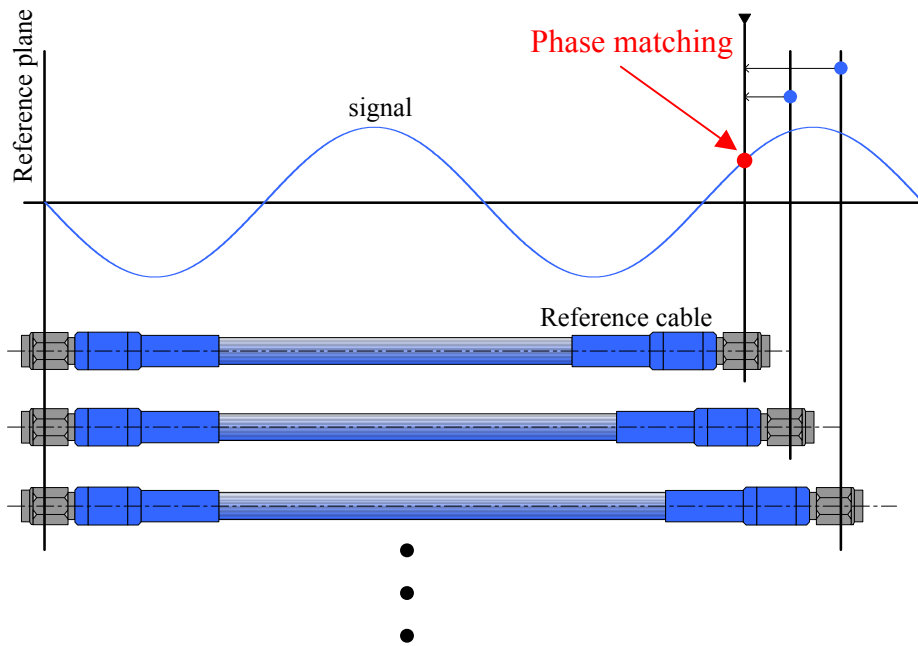
■ VSWR Spec



## 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.



### Example

Phase (Electrical length) matching of 51 assemblies is enumerated as an example.

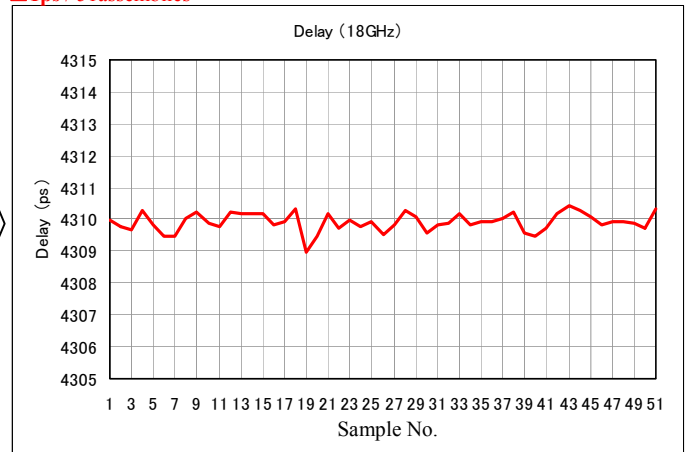
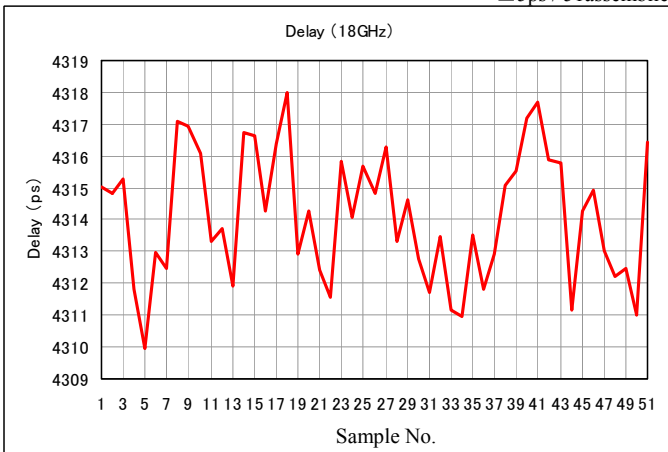
51 assemblies

Assembly length 1m

Measure frequency 18GHz

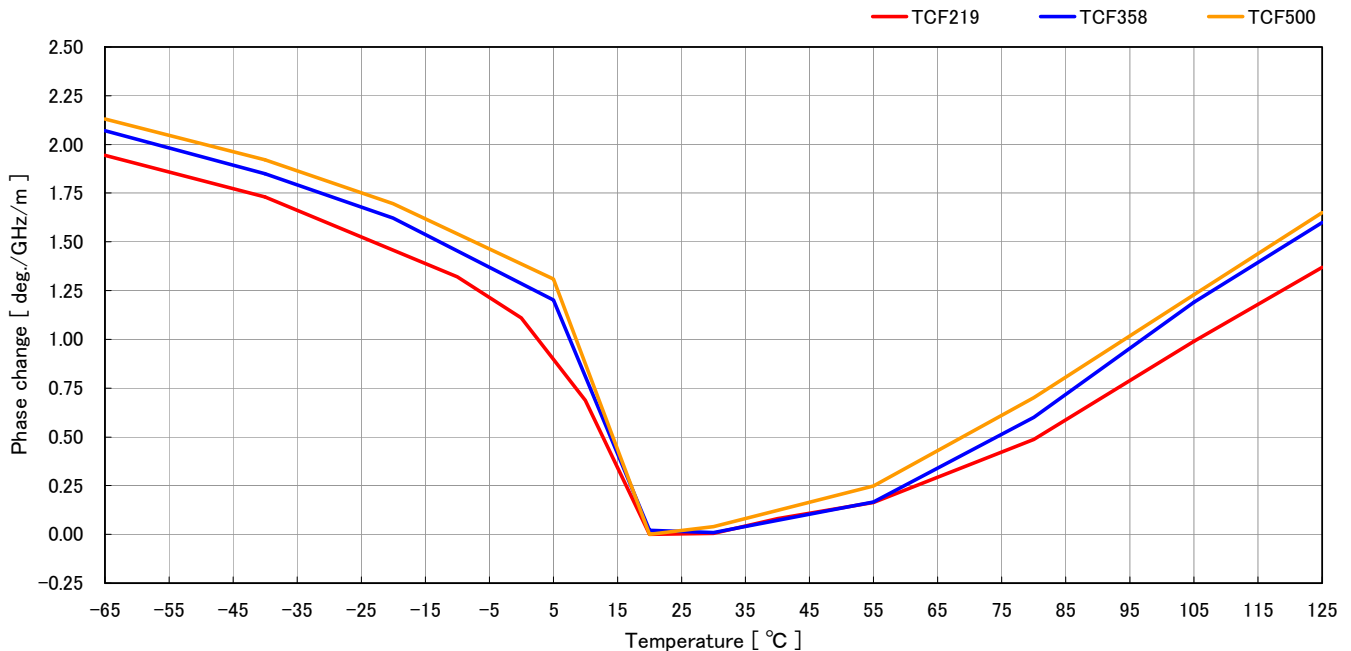
BEFORE phase matching  
 $\pm 5\text{ps} / 51\text{assemblies}$

AFTER phase matching  
 $\pm 1\text{ps} / 51\text{assemblies}$



## Phase variation for temperature change

Phase variation for temperature change of TCF Series



## Phase change After bending

The greatest variation value expected. . .

Bending radius [mm] →	Phase change [deg]		
	R=50	R=30	R=15
<b>【TCF219】</b> at 18.0GHz	1.11	2.98	3.34
at 40.0GHz	2.54	6.86	7.96
at 50.0GHz	3.25	8.96	10.73
at 65.0GHz	4.25	12.31	15.23

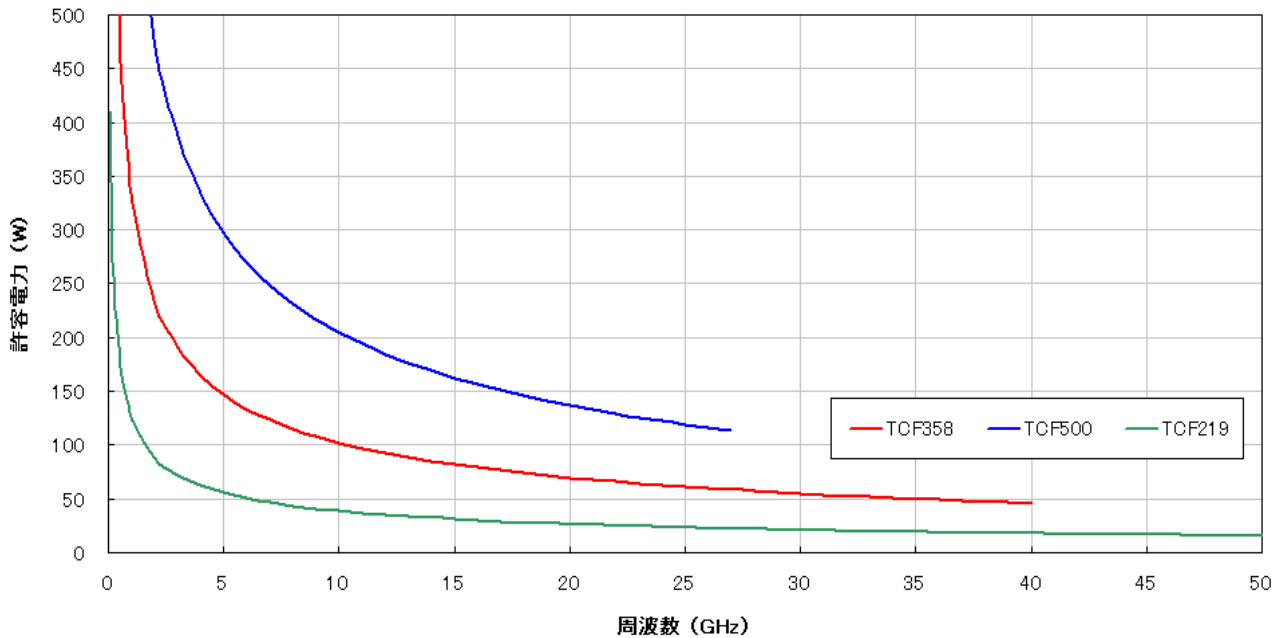
Bending radius [mm] →	Phase change [deg]		
	R=50	R=20	R=15
<b>【TCF358】</b> at 18.0GHz	1.52	3.31	4.07
at 26.5GHz	2.31	4.24	5.84
at 40.0GHz	3.86	5.54	7.23

Bending radius [mm] →	Phase change [deg]		
	R=50	R=30	R=25
<b>【TCF500】</b> at 5.0GHz	0.72	1.27	1.70
at 10.0GHz	1.28	2.30	3.08
at 20.0GHz	1.66	3.28	4.27

\* The cable was bent by 360 degrees every radius 50mm, 30 or 20mm, and 25 or 15mm, the phase was measured in the state one minute later, and the changing value was shown.

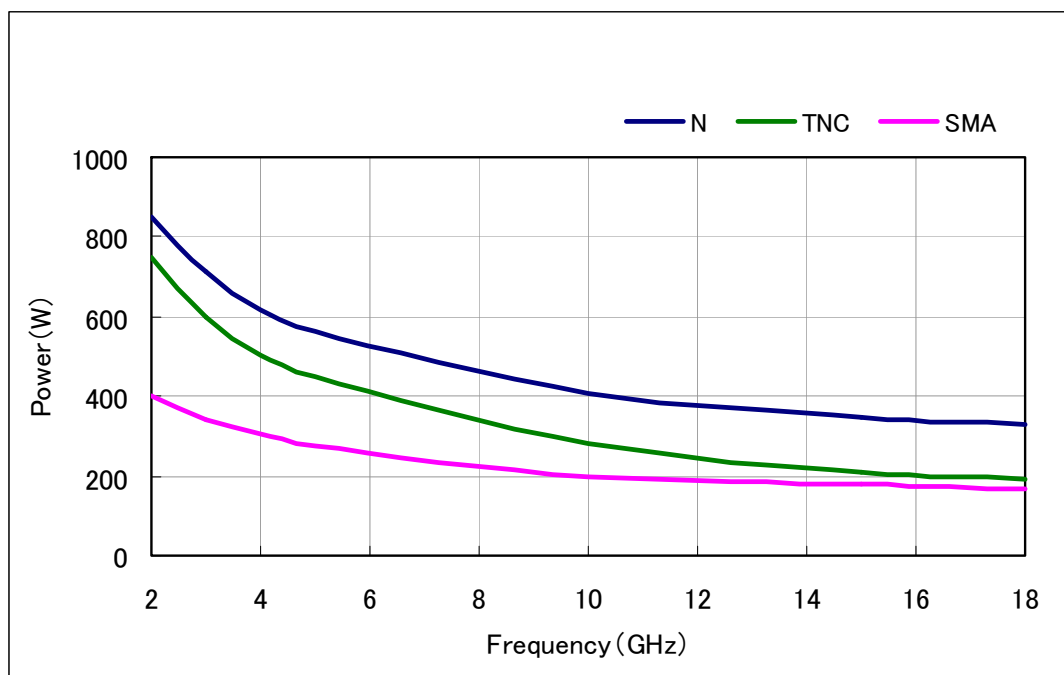
■ Maximum C.W. power of cables

(at +25°C ambient temperature and sea level)

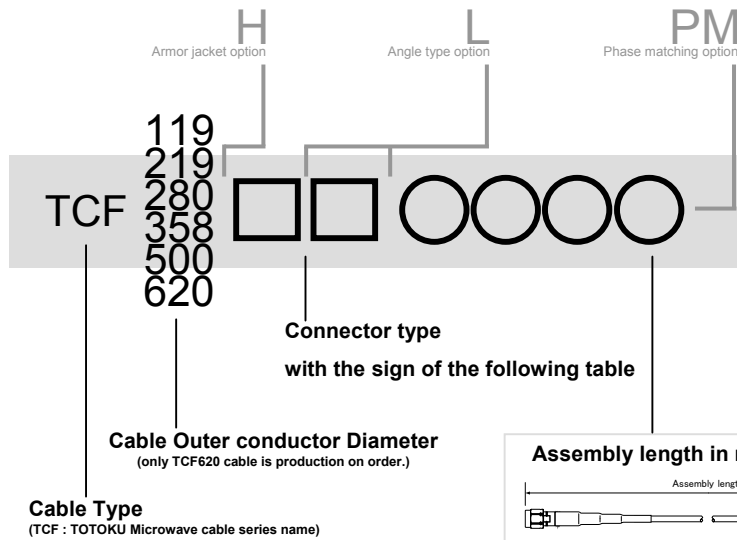


■ Maximum C.W. power of connectors

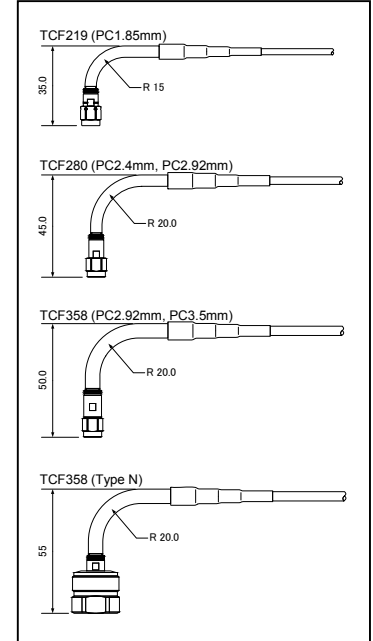
(at +25°C ambient temperature and sea level)



Part Number Designation



Angle type connector dimensions



Connector type with the sign table

A	B	D	E	F	G
SMA-m	SMA-f	N-m	N-f	3.5mm-m	3.5mm-f
K	M	Q	R	T	U
2.92mm-m	2.92mm-f	2.4mm-m	2.4mm-f	1.85mm-m	1.85mm-f
X	Y	"2.92mm connector" is also called "K connector". "1.85mm connector" is also called "V connector".			
1.0mm-m	1.0mm-f				

- 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 TCF 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 TCF 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 TCF 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 TCF cable, many variations in mating connectors are available.  
(e.g. TCF280 series: 2.92mm connector to one end and 2.4mm connector to the other end)

Please ask for details.

Name of assembly (Examples)

- TCF219 TLU 1200 → TCF219 cable assembly with 1.85mm angle type male connector and 1.85mm straight female connector, 1200mm of assembly length.
- TCF358 AB 500 → TCF358 cable assembly with SMA straight male connector and SMA straight female connector, 500mm of assembly length.
- TCF280 RK 700 → TCF280 cable assembly with PC2.4mm straight female connector and 2.92mm straight male connector, 700mm of assembly length.
- TCF358 FF 300 PM → TCF358 cable assembly with PC3.5mm straight male connector both side, 300mm of assembly length, added phase matching option.



Various types of radar



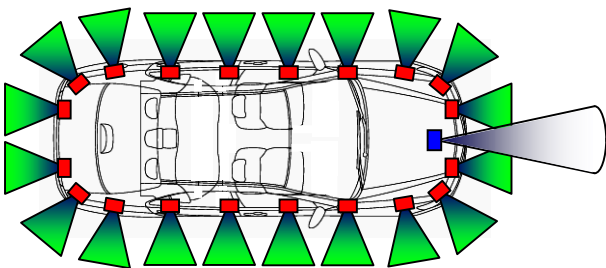
Wireless communications



Measuring instrument lead cables and port cables



Optical devices



Collision avoidance radar modules  
Inspection equipment



Semiconductor tester