Halogen Free and Low Transmission Loss Multilayer Material for Next Generation High Speed Applications: "MCL-LW-900G/910G"

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1 Abstract

The information communication terminal devices using communication networks are advancing transmission capacity and speed. As a result, the transmission speed of the network devices also is becoming faster. So, high-speed and high-frequency response of the PWB is also indispensable. Especially in the high-speed digital field, the demand for PWB material with excellent high frequency characteristics than the PWB materials of current low-transmission-loss is increasing[1). In this situation, we have developed a new halogen-free low transmission loss material "MCL-LW-900G" for next generation high-speed networks.

2 Characteristics of MCL-LW-900G/910G

- Unique characteristics that can contribute to the reduction of transmission loss.
- High heat resistance and high glass transition temperature (Tg).
- Environmentally compliant material incorporating halogen-free flame retardant.

3 Background of the development

In recent years as shown in **Figure 1**, transmission capacity, transmission speed and frequency of digital signals handled by information and communication electronics equipment such as computers, servers and routers have become larger, faster and higher, respectively. In response to such technical trends, it is crucial to change the functional performance of printed circuit boards used in such equipment to meet the requirements of high-speed high-frequency communications. So far, our company has introduced MCL-FX-2 and several other multilayer materials used for high-frequency applications.

Under such circumstances, the transmission rate of digital signals handled by network communication equipment for next-generation high-speed applications may come down to 25 Gbps. To satisfy this transmission rate, we estimated a parameter of high-frequency property tp be Df of 0.0035 (at 10 GHz) or less from market requirements, but functional performance of conventional base materials are not good enough to satisfy such Df. Against such a background, we developed base materials that can

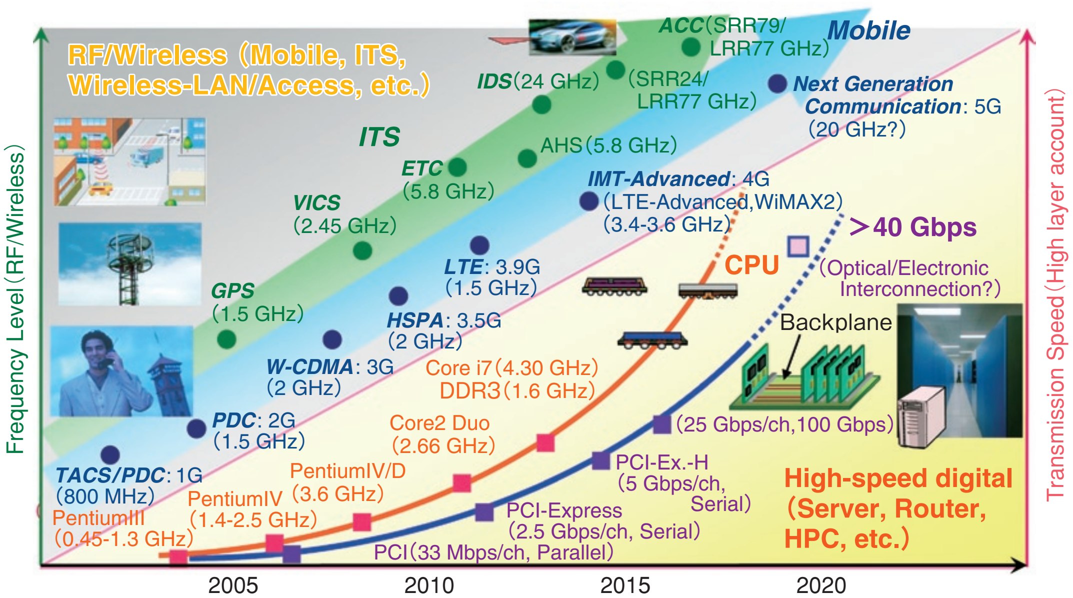

Figure 1 Changes in the transmission rate of the electronic device

accommodate a wide range of requirements for next-generation high-speed and high-frequency applications with the help of our own proprietary resin property modification technology.

4 Technical details

1. MCL-LW-900G design concept

We developed a resin with a low dielectric constant and high heat resistance with the help of our own proprietary resin property modification technology, and we used it for MCL-LW-900G. Then, we selected halogen-free flame retardant with high thermal decomposition temperature, together with small drop in glass transition temperature (Tg) and dielectric constant. We also used copper foil having a finely roughened surface to reduce conductor losses.

2. General characteristics of MCL-LW-900G

General characteristics of MCL-LW-900G are shown in **Table 1**. MCL-LW-900G (E-glass cloth, copper foil: RT foil) has Dk = 3.57 and Df = 0.0044 Dk at 10 GHz. MCL-LW-910G (low-dielectric glass cloth, copper foil: HVLP foil) shows Dk = 3.32 and Df = 0.0028.

Further, MCL-LW-900G shows excellent heat resistance such as TMA Tg: approx. 200°C and T-300 min. ≧ 60.

Table 1 General properties of MCL-LW-900G/910G

Item		Unit	LW-900G	LW-910G	FX-2	Teflon material
Resin system		—	Thermosetting		Thermosetting	Thermoplastic
Glass type		—	E-glass	Low Dk glass	E-glass	E-glass
Falme retardant chemicals		—	Halogen free		Halogen	—
Dk (JPCA-TM001)	10 GHz	—	3.57	3.32	3.45	2.62
Df (JPCA-TM001)	10 GHz	—	0.0044*1	0.0035*1 0.0028*2	0.0058	0.0038
Copper foil peeling strength (18 μm)	RTF HVLP	kN/m	0.75 0.63	0.75 0.63	0.60 —	1.2 (general purpose copper foil) —
Tg	TMA	℃	198	198	185	30
CTE	XY Z (α1) Z (α2)	ppm/℃	13 40 250	13 40 250	15 47 110	18 105 310
Resistance to soldering heat testing	288℃	s	> 300	> 300	> 300	> 300
T-300	TMA	min	> 60	> 60	> 60	—
Flame resistance	UL-94	—	V-0	V-0	V-0	V-0
Reliability (CAF, IST, etc.)		—	Good	Good	Good	—

*1, *2 Values calculated from the results of measured energy loss-rate (RT foil: Rz ≒ 3 μm, HVLP foil: Rz ≒ 1.2 μm).

3. Transmission characteristics of MCL-LW-900G

Results of measured transmission loss of MCL-LW-900G below 20 GHz are shown in **Figure 2**. MCL-LW-900G has excellent transmission characteristics as shown by MCL-LW-910G (HVLP foil) with transmission loss of 32.4 dB/m at 20 GHz which is lower by 15 dB/m than that of MCL-FX-2, suggesting that it can contribute to the reduction of transmission loss.

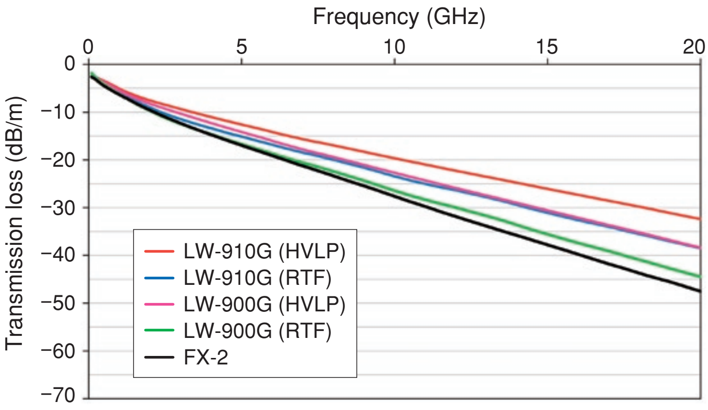

Figure 2 Transmission loss measurement results

5 Future Business Development

・Development of BU film for vehicle mounted millimeter wave radar

【Reference】

1) Kazutoshi Danjobara, *Preliminary Draft Collection of JPCA Show2014NPI Presentation*, pp.21-23