

# Noise Suppression Parts Aim at BroadR-Reach Car Network

Amid the accelerating incorporation of electronic components in automobiles, noise countermeasures have been becoming increasingly important in order to ensure safety. In addition, with the trend toward lower fuel consumption accompanying environmental regulations, and the advancement of driver assistance systems, the number of electronic control units (ECUs) incorporated in a vehicle has increased, necessitating faster automotive networks.

Murata Manufacturing Co., Ltd. has been endeavoring to develop highly reliable common mode choke coils (CMCCs) that have excellent noise suppression effects (Fig. 1). CMCCs selectively suppress common mode noise through the use of the difference in propagation characteristics depending on mode.

Murata Manufacturing has been offering CMCCs for automobiles by making the most of the company's proprietary winding technology, in addition to magnetic materials technology, and magnetic circuit design technology that it has nurtured in the production of consumer-use CMCCs.

## Performance to Note when Using Automotive Ethernet

### Severe standard for maintaining transmission signal integrity

The incorporation of automotive Ethernet not only in standard-sized passenger cars but also in long trucks and buses must be taken into consideration, and therefore, it is necessary to assume transmission cable length of up to about 15m. In addition, improvements of transmission speeds to accommodate the

On-vehicle local area network (LAN) cables connected to these ECUs tend to generate jamming radio waves, and are susceptible to the effects of external noise, and therefore, noise countermeasures are indispensable.

In order to address these needs,

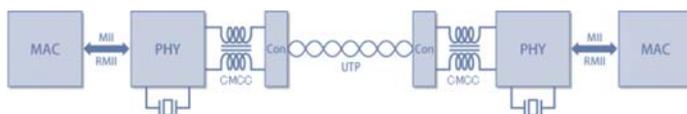


Fig. 1: An example of noise countermeasure for BroadR-Reach®

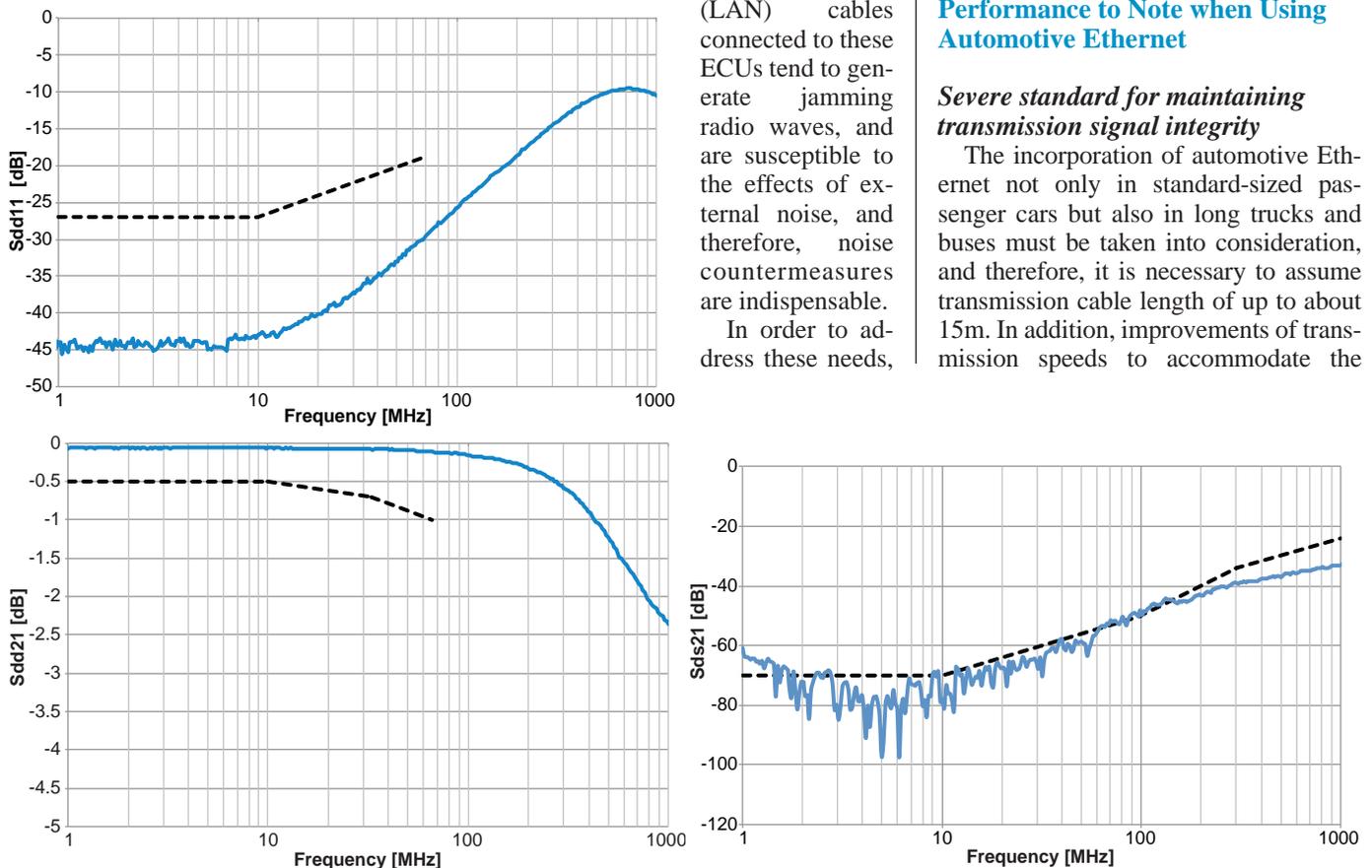
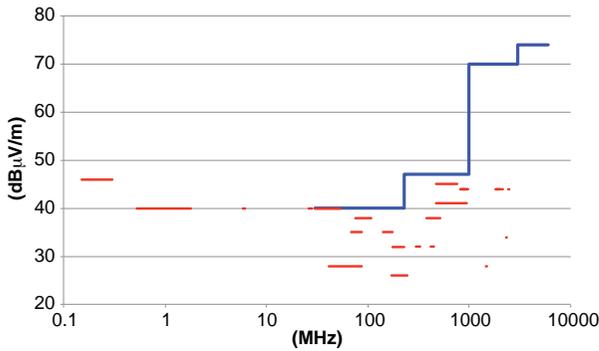
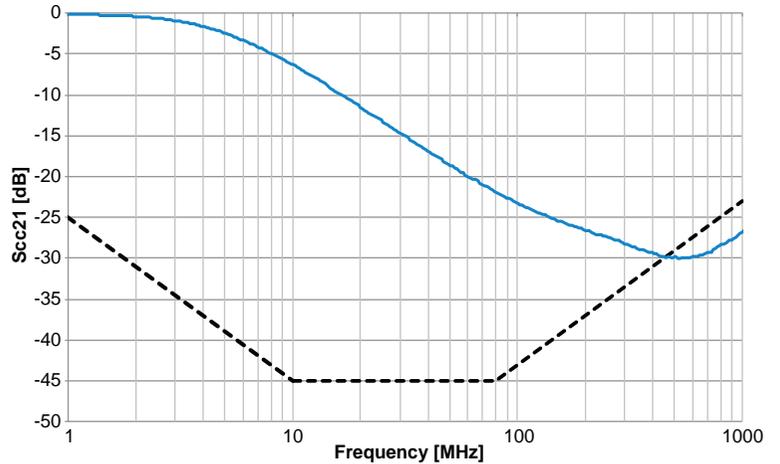


Fig. 2: Transmission standards for automotive Ethernet and characteristics of widely available CMCCs  
Widely available CMCCs for consumer Ethernet do not satisfy transmission standards for automotive Ethernet.  
(Dotted line: Specification limit value, Solid line: CMCC-DLW21SN491XQ)



**Fig. 3: Comparison of values of noise limit between automotive electronics and consumer equipment (radiation noise)**  
 \*As measurement conditions differ, simple comparison is not possible. Nonetheless, limit values for automotive electronics themselves are more severe, and measurement distance for automotive electronics (CISPR25) is shorter and more severe at 1m as compared to 3m of consumer electronics (CISPR22).



**Fig. 4: Noise elimination characteristics standard for automotive Ethernet and characteristics of widely used CMCCs.**  
 CMCCs for consumer Ethernet that are in wide use cannot satisfy noise elimination characteristics standard for automotive Ethernet. (Dotted line: Standard limit value, Solid line: Consumer-use CMCC-DL-W21SN491XQ)

transmission of non-compressed images from on-board cameras and improvements of response speed by minimizing the frequency of retransmission due to transmission error have been required, as well as standards, have been established.

CMCCs, which are already in wide use, satisfy specification limit values in

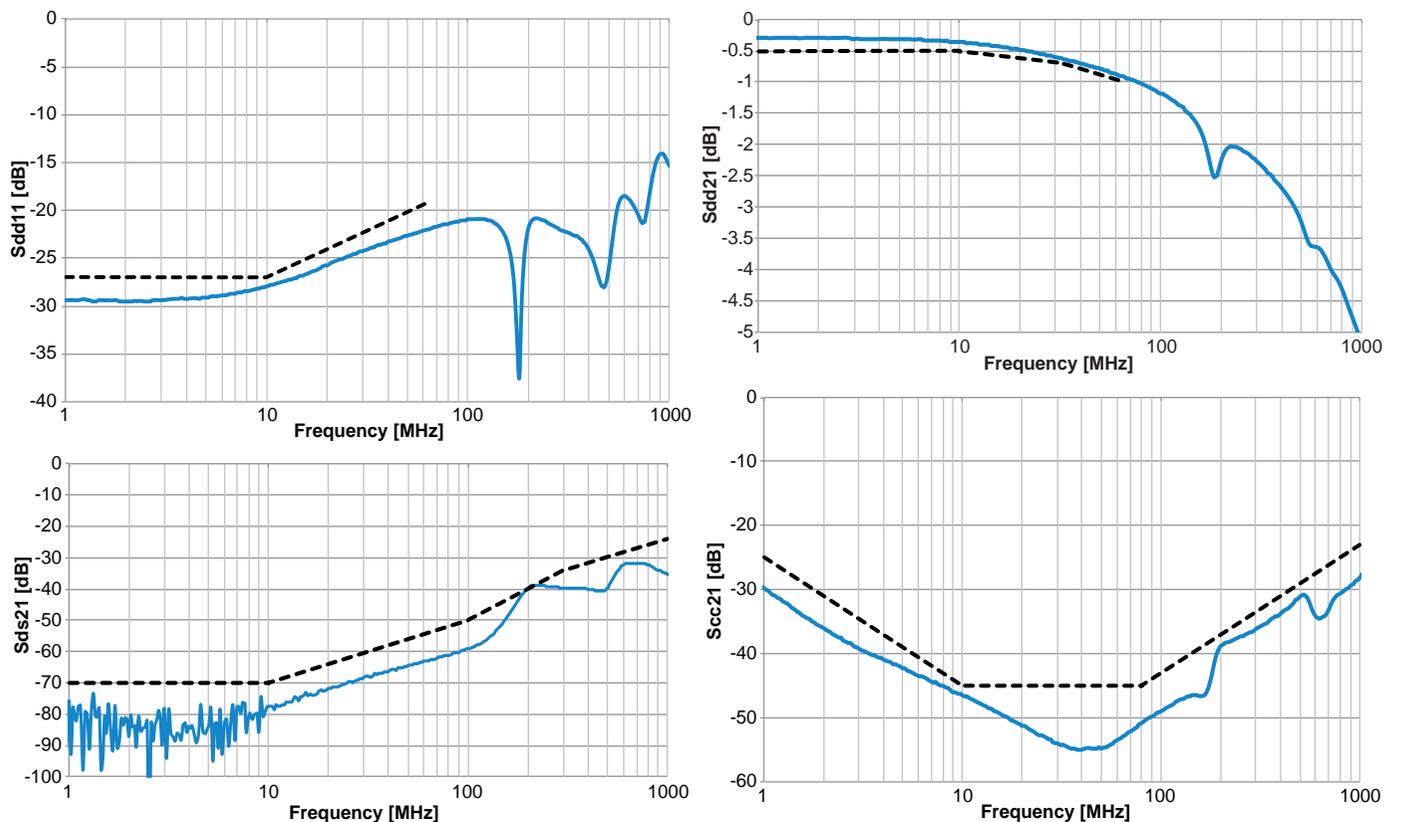
terms of return loss (Sdd11) and insertion loss (Sdd21). However, the reverse is true in terms of balance (Sds21), and transmission signal integrity can deteriorate (Fig. 2).

**Severe noise standard**

Noise standard for automobiles (CIS-

PR25), which is far more severe than the standard for general equipment (CIS-PR220), is applied not only to Ethernet, but also to vehicles wherein many ECUs and information devices are packed in a small space (Fig. 3).

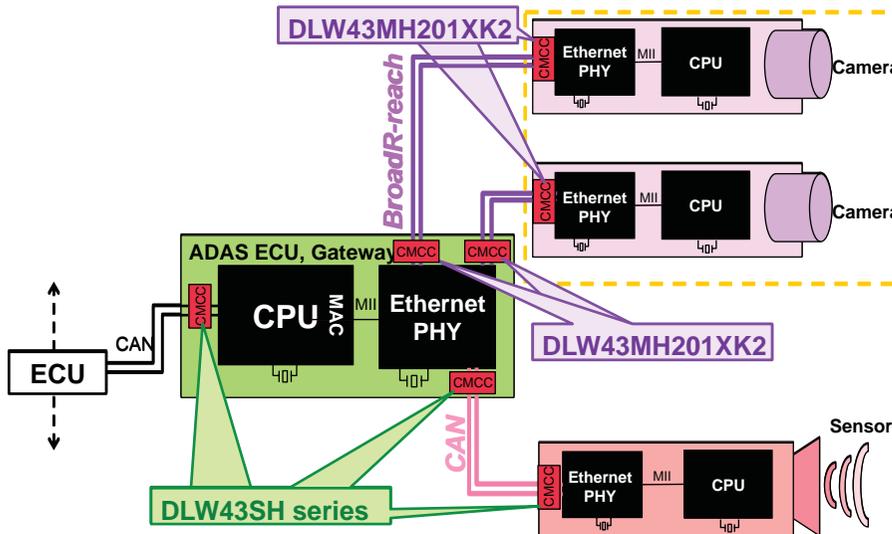
In particular, effects of radio waves to broadcasting waves (AM, FM, TV) and



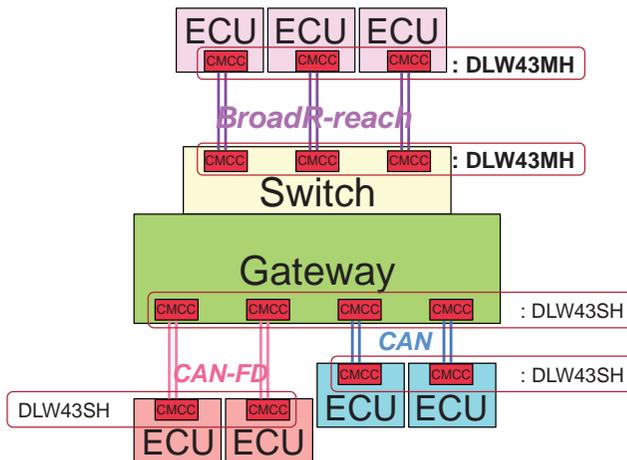
**Fig. 5: Standard limit values for automotive Ethernet and characteristics of DLW43MH**

**Table 1: Ratings of DLW43MH**

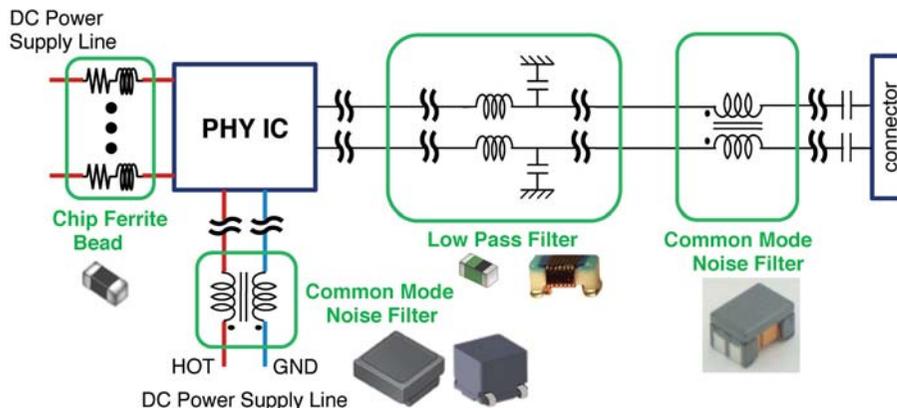
Murata Part Number	Common Mode Inductance at 100kHz	Rated Voltage (Vdc)	Withstanding Voltage (Vdc)	Rated Current (mA)	DC Resistance ( $\Omega$ max.)
DLW43MH201XK2L	200 $\mu$ H	20	50	110	4.5
DLW43MH201XK2K	(-25% +50%)				



**Fig. 6: An example of using Ethernet for on-board cameras**



**Fig. 7: An example of using DLW43MH for gateway**



**Fig. 8: Magnetic components involving automotive Ethernet**

communications equipment compliant with Global Positioning System, 4th-generation Long Term Evolution, are taken into consideration.

The limit value of noise elimination characteristics (Sc21) of the CMCC standard for automotive Ethernet has been set with consideration given to the noise standards for automobiles. Widely available CMCCs for consumer Ethernet cannot satisfy the CMCC standard for automotive Ethernet.

The problem of electromagnetic compatibility (EMC) needs to be overcome using exclusive CMCCs with higher performance in terms of both transmission characteristics and noise elimination characteristics (Fig. 4).

### CMCCs Compatible with BroadR-Reach®

The DLW43MH Series CMCCs from Murata Manufacturing are compliant with BroadR-Reach®, which has the largest potential for widespread use among automotive Ethernet standards. It has achieved high insertion loss characteristics through Murata's proprietary ferrite material technology and minute mode conversion characteristics through advanced winding technology.

Thus, the DLW43MH Series exhibits high noise suppression effects and high immunity performance that satisfy the automotive Ethernet standard (Fig. 5).

A concrete sample circuit using DLW43MH is shown (Figs. 6 and 7). It is sometimes used together with an LC filter.

### Conclusions

BroadR-Reach® has a potential for growing into a network standard indispensable for autonomous driving through the expansion of its use in on-board diagnostics, on-board camera systems, information devices, to gateway that connects these devices, and furthermore to power trains and safety devices. Murata intends to further advance the development of CMCCs for automotive Ethernet that meet various noise countermeasure needs, including miniaturization, high-temperature resistance, accommodation to high-speed transmission, and higher reliability, and at the same time, make efforts to enrich the lineup of other magnetic components as well.

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## Noise Suppression...

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*Note:*

*BroadR-Reach® is an automotive Ethernet standard defined by the OPEN Alliance, and allows multiple in-vehicle applications, such as advanced driver assistance systems and infotainment systems to access information simultaneously over a single unshielded twisted pair cable, reducing cabling cost and weight as cars become ever more connected. BroadR-Reach is a registered trademark of Broadcom Corporation.*

### **About This Article:**

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