

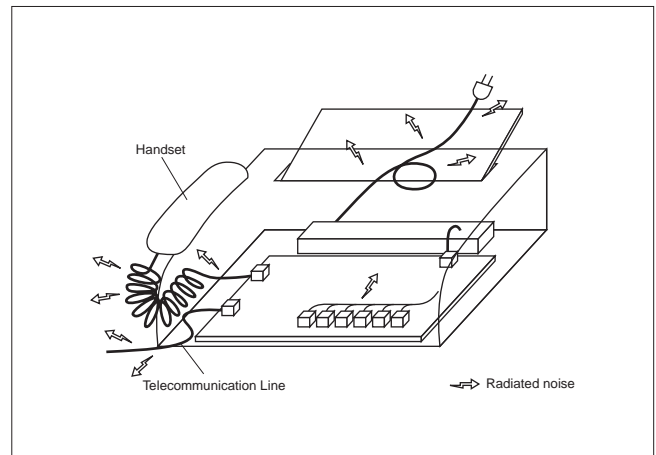
# 7 Example of Noise Suppression in Fax Machines

## Noise Emission Status :

Digital noise generated from the main board of the facsimile machine is conducted to the handset cable, sensor signal input cable, and power supply cable. The noise is then radiated using the cables as antennas.

With a facsimile machine, the main board is not shielded by a case or similar protection. Therefore, it is important to decrease the noise level from the board itself.

Since many kinds of cables are connected to the board, an EMI filter is installed on each cable.

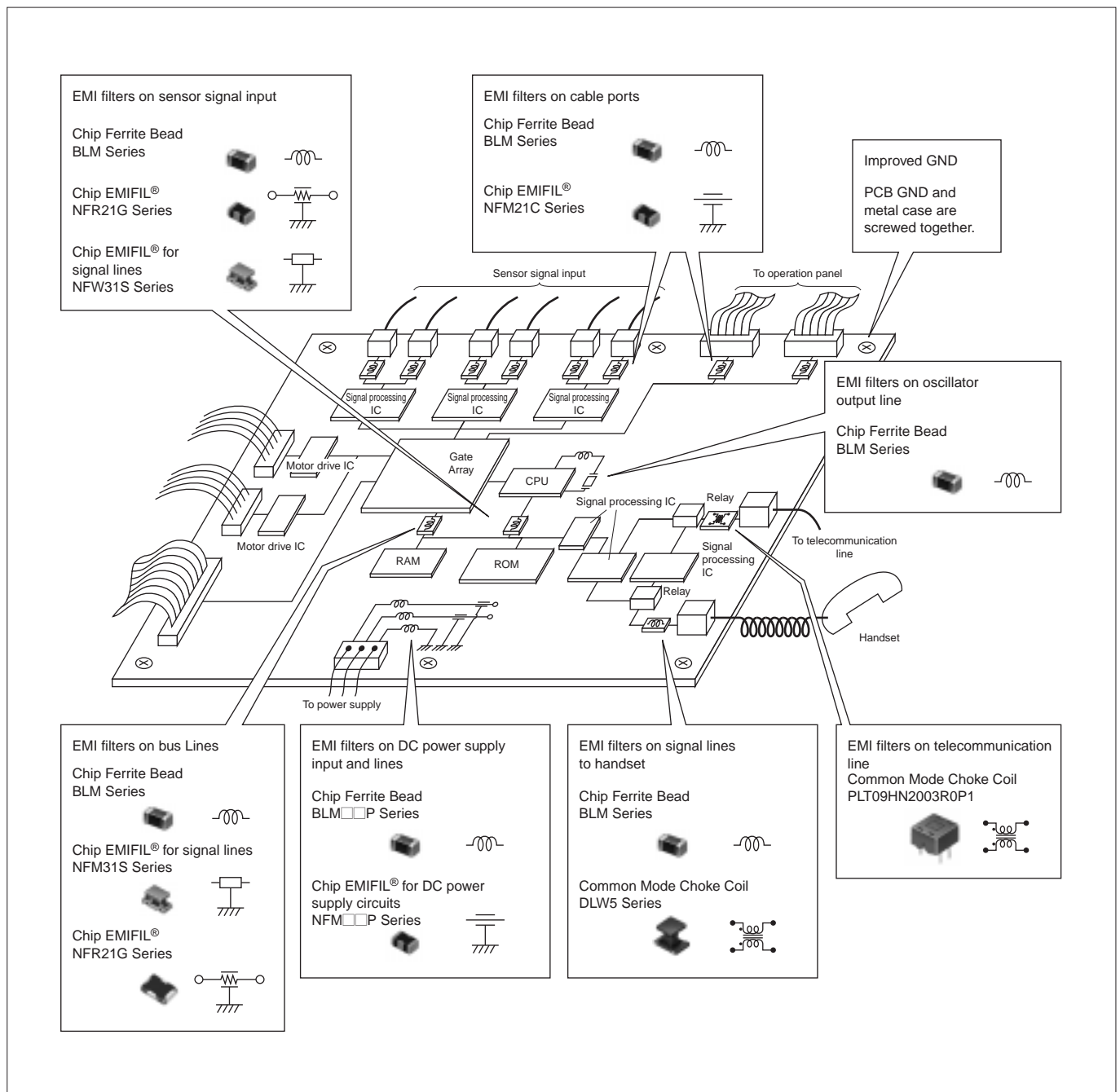


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### Noise Suppression Content in Fax Machines

The example above is a noise suppression model of a fax machine. As shown, there are many cables inside the facsimile which are notorious for generating EMI noise. In most cases, the cables are placed close to the main board. In this condition, the cables are coupled to the main board, causing the noise from the main board to be

emitted through the cable like an antenna. It is necessary to install EMI filters on the cable ports in addition to improving GND connections. It is also necessary to install EMI filters on the main board's digital circuits.



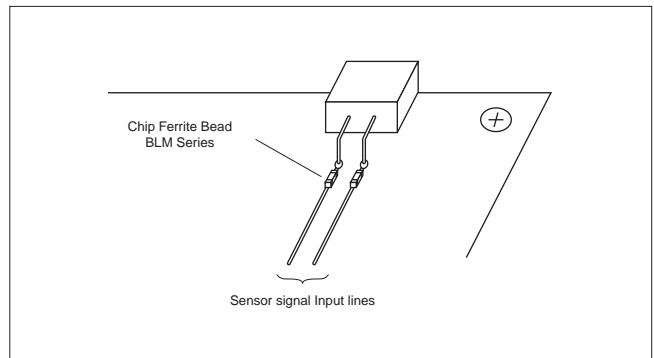
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## Example of Noise Suppression in Fax Machines **7**

### Installing EMI filters on Interface Cable Ports

When noise is conducted to the cable, strong noise is radiated from the cable. Therefore, the BLM series (Chip Ferrite Bead) is installed on the cable connection. Since sensor input signals for detecting the presence or absence of paper are of a low speed and temporary, an EMI filter whose impedance value is as large as possible should be used.

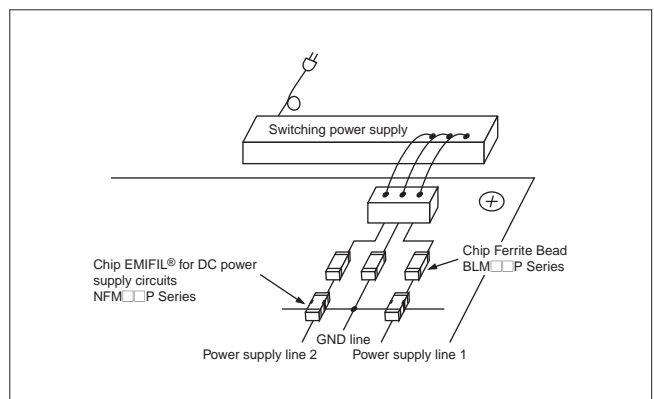
In case that the noise level is high, a capacitor chip EMIFIL® NFM series is used additionally to achieve more noise suppression effect.



### Installing EMI filters on the DC Power Supply Input and Lines

Noise is conducted from the DC power supply and GND lines to the switching power supply and radiated out using the AC power supply cable as an antenna. To suppress the noise, the BLM series (Chip Ferrite Bead) and NFM series (Chip EMIFIL® for DC power supply circuits) are installed close to the power supply connector.

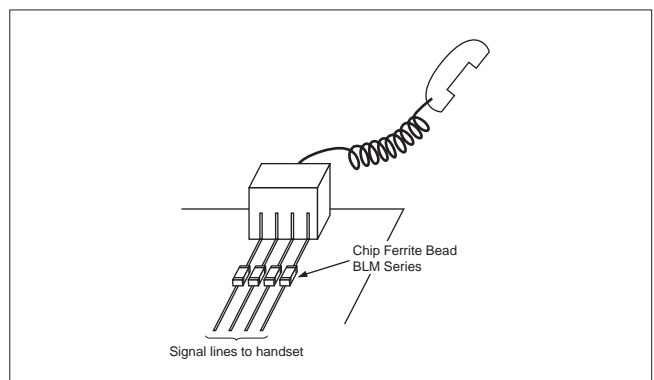
A filter whose rated current is sufficiently larger than the power supply current should be selected.



### Installing EMI filters on Signal Lines to the Handset

Noise from the digital circuit is conducted to the handset cable and radiated from the cable.

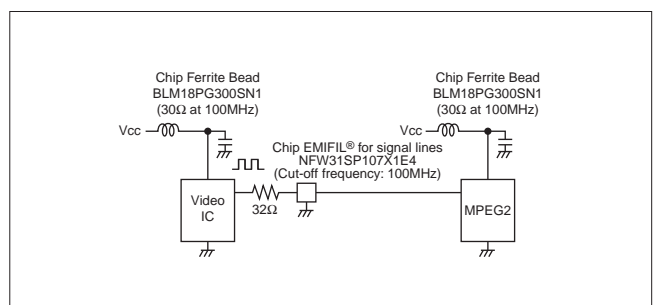
Since the noise is common mode noise, the BLM series (Chip Ferrite Bead) or DLW5BS/AH series (Common Mode Choke Coil) is installed on all four lines to suppress the noise.



### Installing EMI filters on the Clock Line

Clock signals contain noise covering the high frequency range, and in some cases, the clock signal frequency is close to the noise frequency. Therefore, an EMI filter that effectively eliminates noise in high frequency range and provides sharp cutoff, the NFW31S series EMIFIL® for signal lines and the BLM series chip ferrite beads for high-speed signal lines, should be used. In combination with a resistor, the NFW31S series EMIFIL® can suppress overshoot and undershoot in the signal waveform, providing further improved noise suppressing effect.

Because power supply lines, as well as signal lines, conduct a transient current that causes noise emission, the BLM series chip ferrite bead together with a bypass capacitor should be mounted to suppress noise conduction through the power supply lines.

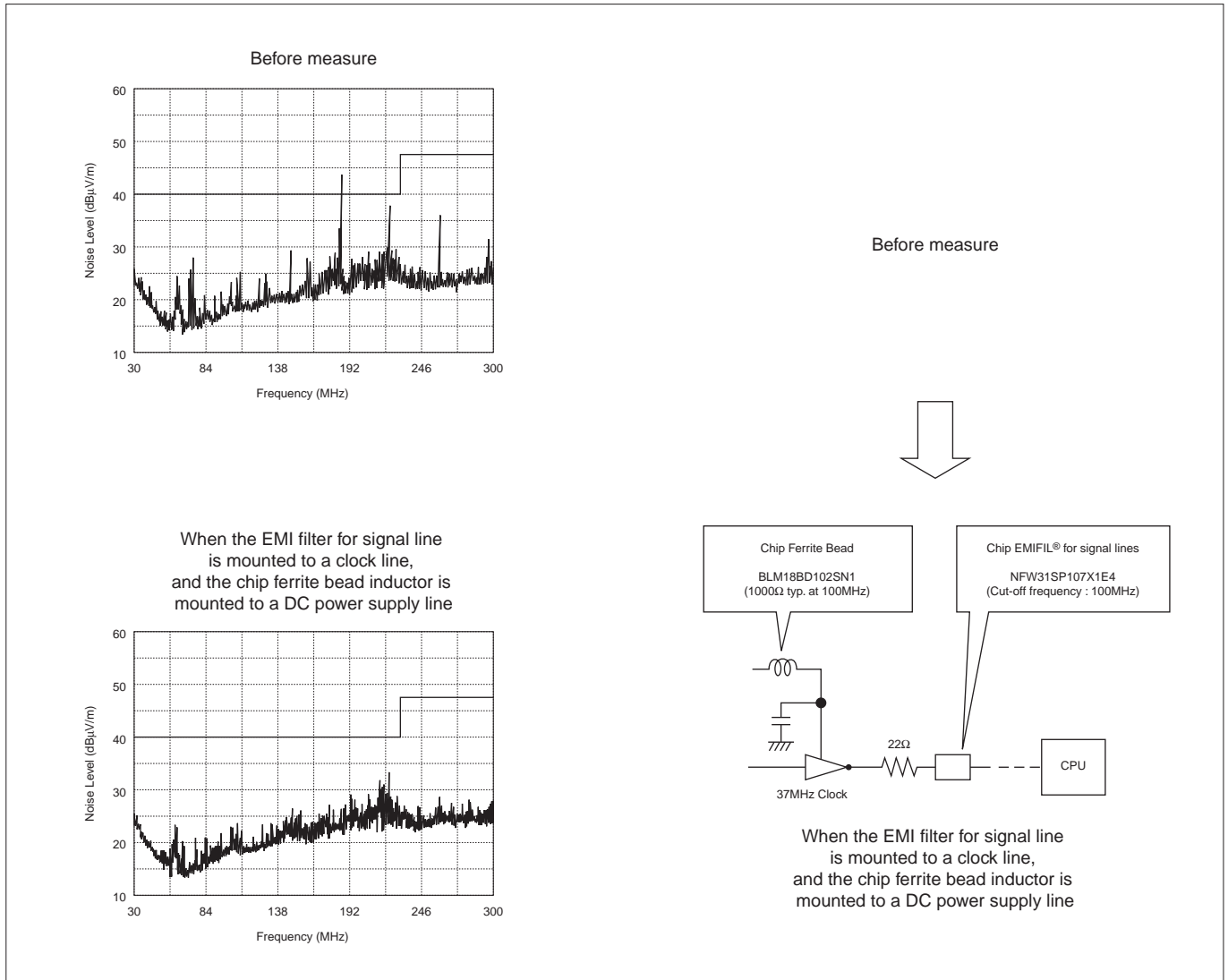


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### Example of effects produced when installing EMI filters on the Clock lines

Noise suppression effects produced when installing the EMI filter on the data clock lines.



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### Installing EMI filters on Bus Lines

The Data and Address bus contain many lines that switch on and off simultaneously. This constant switching causes instantaneous large currents to flow through the GND and power supply lines resulting in unwanted noise. Therefore, it is necessary to suppress the current flow on the signal line. The BLM series (Chip Ferrite Bead) is generally used for this purpose. On the control bus line, especially at high operating speeds, the BLM□□B series (Chip Ferrite Bead for high-speed signal lines that features a steep impedance rising) is used. On bus lines with high-level noise, the NFR21G series (Chip EMIFIL®) may be effective. The radiation spectrum of noise generated from bus lines resembles that of noise generated from the motor. It is important to check which of the motor or bus lines is the source of the noise and then install EMI filters.

