

TDMA Noise Filtering

INTRODUCTION

When designing certain products, especially GSM phones, the effects of EMI can pose a significant challenge. Ideally the microphone should be located away from the GSM antenna, take reference on solid ground plane and minimise the length of any sensitive connection. Allowance should also be made for RF filtering on all input/output connections to reduce the RF coupling. Under severe mechanical constraints, good design rules may not all be possible and a suitable compromise must be made.

This application note will address the issue of TDMA (Time Division Multiple Access) noise filtering for MEMS microphone. External ferrite beads are recommended to bring down any potential TDMA noise presented to the MEMS Microphone without requiring special board design.

IMPLEMENTATION

GSM phones with TDMA technique transmit data between 800MHz to 900MHz or 1800MHz to 1900MHz band in bursts at frequency of 217Hz. As the maximum RF output power level of GSM phones can reach +33dBm (800/900MHz) and +30dBm (1800/1900MHz), a significant level of RF burst can easily couple into the supply and sensitive audio connection regardless of the effort to prevent this from occurring.

The most basic form of EMI protection is a simple shunt capacitor to ground for the sensitive analogue signals. The shunt capacitor provide a low impedance path for the RF energy to ground before it has any opportunity to interact with any nonlinear circuit element in the microphone and induce noise in audio band. However this strategy does not work well for wide frequency range input noise such as TDMA signal.

A ferrite bead is the optimum device to use for TDMA filtering. The ferrite bead should be placed close to the microphone for effective filtering as shown in figure 1. When the ferrite bead is introduced in series, high frequency impedance leads to a strong attenuation of high frequency TDMA currents. Therefore a ferrite bead is ideal for power supply filtering and suppression of TDMA energy for any sensitive input/output connection. There is no degradation of any audio performance as the ferrite bead resistance at DC is very low without extra loading to the microphone output drive.

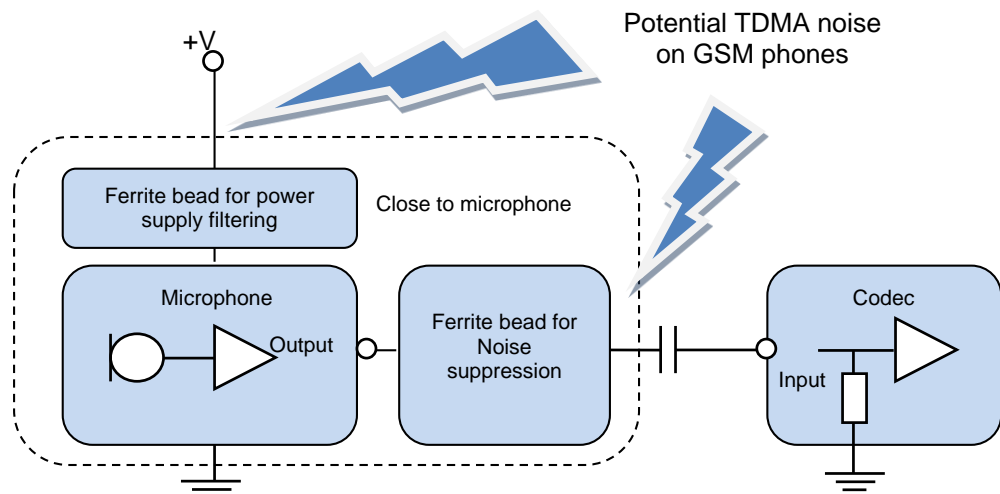


Figure 1 Ferrite Beads Placements around the MEMS Microphone

The choice of ferrite bead for TDMA noise reduction depends on a number of factors:

- The impedance vs. frequency profile for the ferrite bead should cover both 800/900MHz and 1800/1900MHz bands. The ferrite bead should provide higher impedance or stronger attenuation for 800/900MHz frequency band as the phones transmit higher power for the lower GSM frequency band.
- Small ferrite beads are common in the market and physically possible for the limited space in the mobile phones.
- Low DC resistance (less than few Ω s) to minimise any potential audio degradation due to loading.

RESULTS

The FFT results in the audio band can be used to show how effective the ferrite bead with microphone under severe TDMA noise injection at VDD and VOUT, optimum filtering achieved with ferrite bead with no noticeable TDMA noise components in audio band.

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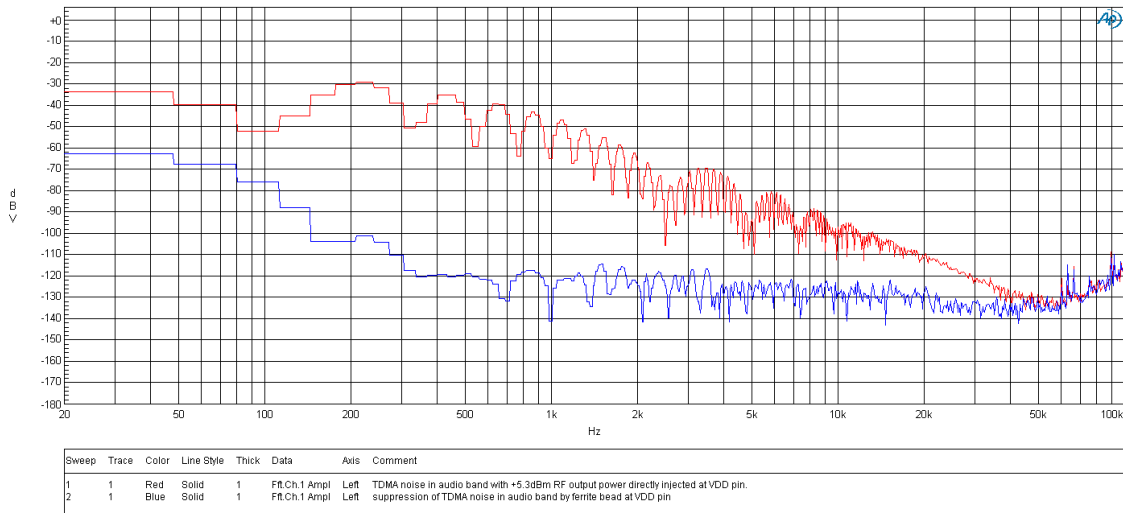


Figure 2 Typical Suppression of TDMA Noise in Audio Band by Ferrite Bead at VDD Pin

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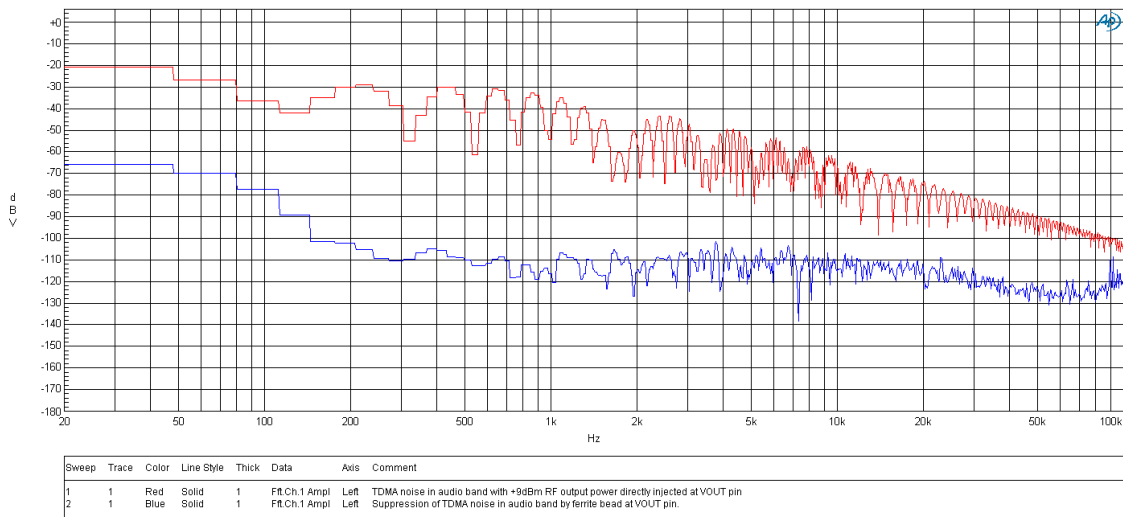


Figure 3 Typical Suppression of TDMA Noise by Ferrite Bead at VOUT Pin

RECOMMENDATIONS**WURTH ELEKTRONIK**1000 Ω at 100MHz 1.0x0.5x0.5mm 742841210**muRata**1800 Ω at 100MHz 1.0x0.5x0.5mm BLM15HD182SN1**CONCLUSIONS**

Audio testing on the MEMS microphone with ferrite beads at the supply and output pins did not show any degradation in audio performance with enhancement on power rejection ratio and suppression of TDMA noise.

There are varieties of ferrite bead available for TDMA noise rejection. With careful choice the cost can be optimised for the size and immunity level.

Contacting Cirrus Logic Support

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To find one nearest you, go to www.cirrus.com.

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