RTPGE EMC Limit Lines

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RTPGE EMC-Noise Parameters Review

- Differential Channel Impairments
- EMC Channel Transfer Function Modeling
- EMC Noise & Limit Lines
- Alien XTALK
- In-Car Background Noise
- Impulse Noise
- Other Noise sources?

Agenda

- RTPGE EMC Limit Lines
  - Transmit PSD (via **Strip Line** Emissions)
  - RX Immunity (via **BCI** Setup)
  - Connector Measurements (preliminary)
  - Magnetics Measurements (preliminary)

RTPGE EMC Limit Lines for 1-pair UTP

Foreword

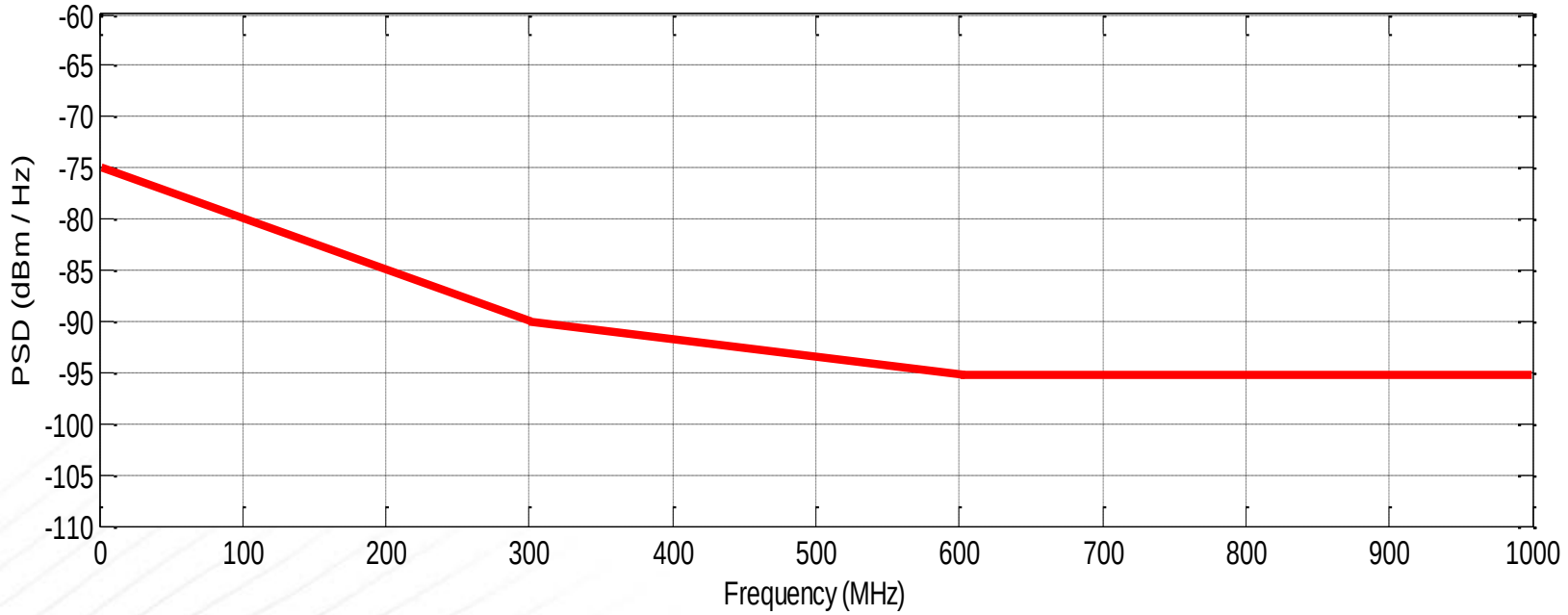
- Limit lines are proposed for RTPGE transceiver design over 1-pair UTP cables to satisfy EMC requirements.
- The following assumptions are made;

1. Single pair UTP cables with gauge 22 are considered in the analysis.
2. Emission is measured using **Strip Line** method for 2m cables with the limit of 15dBuV peak[1].
3. Immunity is measured using **BCI** method for 2m cables at 200mA peak level[2].
4. Analysis is based on methods (presented earlier) measuring emissions transfer function, mode transfer impedance and S4P.

1- 15dBuV flat limit, 30MHz to 1000MHz is worse than CISPR25 limits.

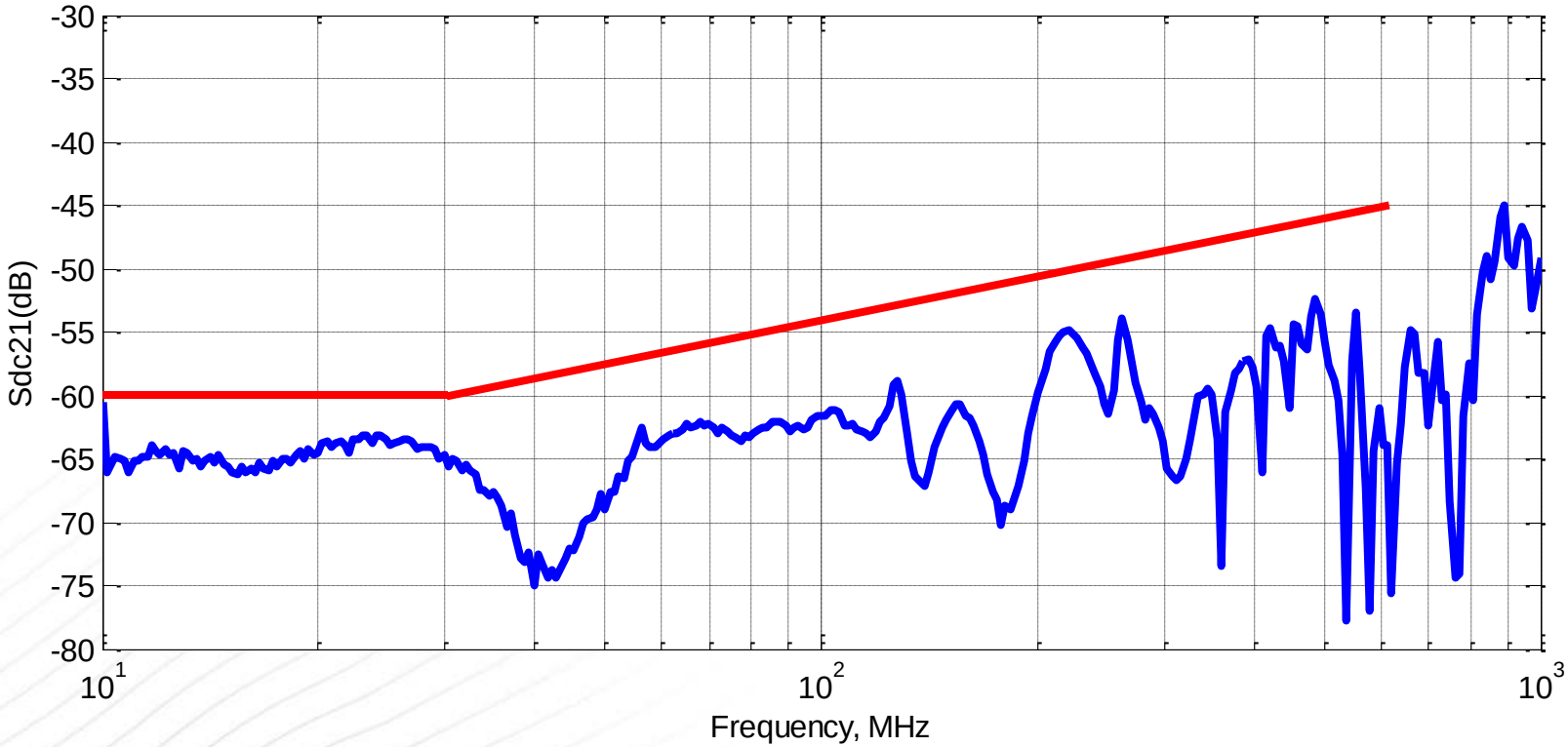
2- 200mA flat noise level, 1MHz to 400MHz is seen worse than some 350mA non-flat noise profiles.

TX PSD and RX EMI Immunity



- There exist single pair UTP cables that pass strip line emission tests with transmit differential signal conforming to the shown PSD limit.
- BCI immunity tests produce differential noise less than 100mVpp using such cables in frequency range of 10MHz to 400MHz.
- In order to allow a wider range of cables, connectors and CMCs, provision for 6dB power back off and noise tolerance at least 6dB should be considered

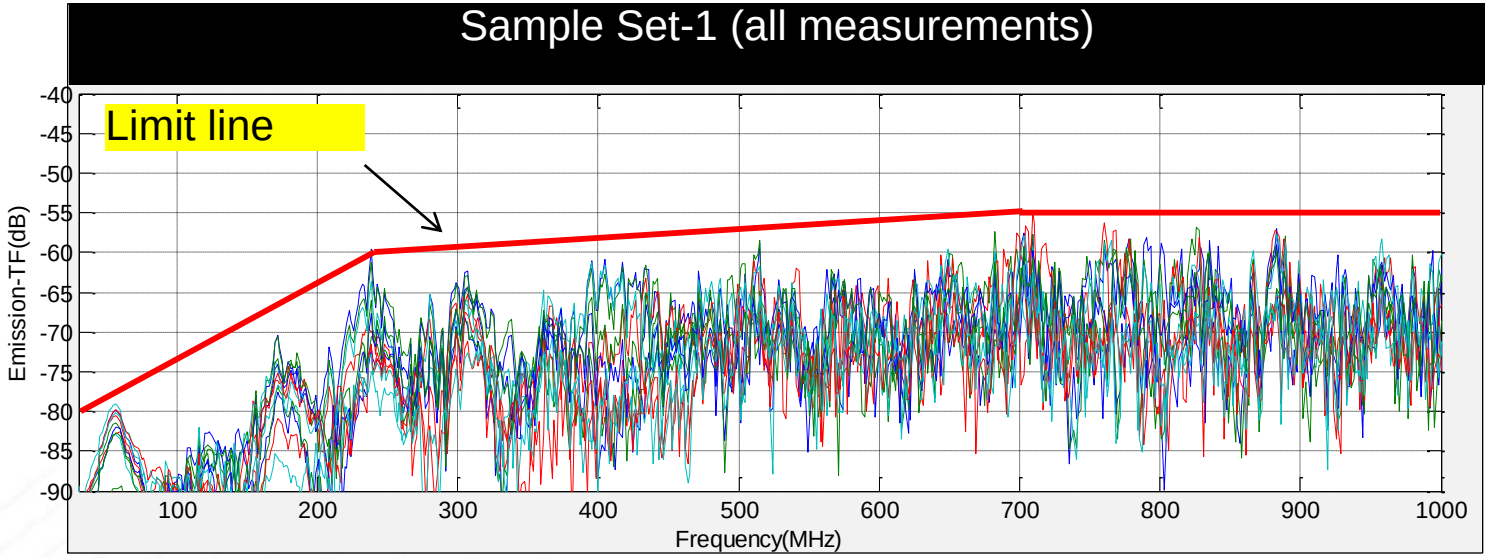
Mode Conversion Limit Line

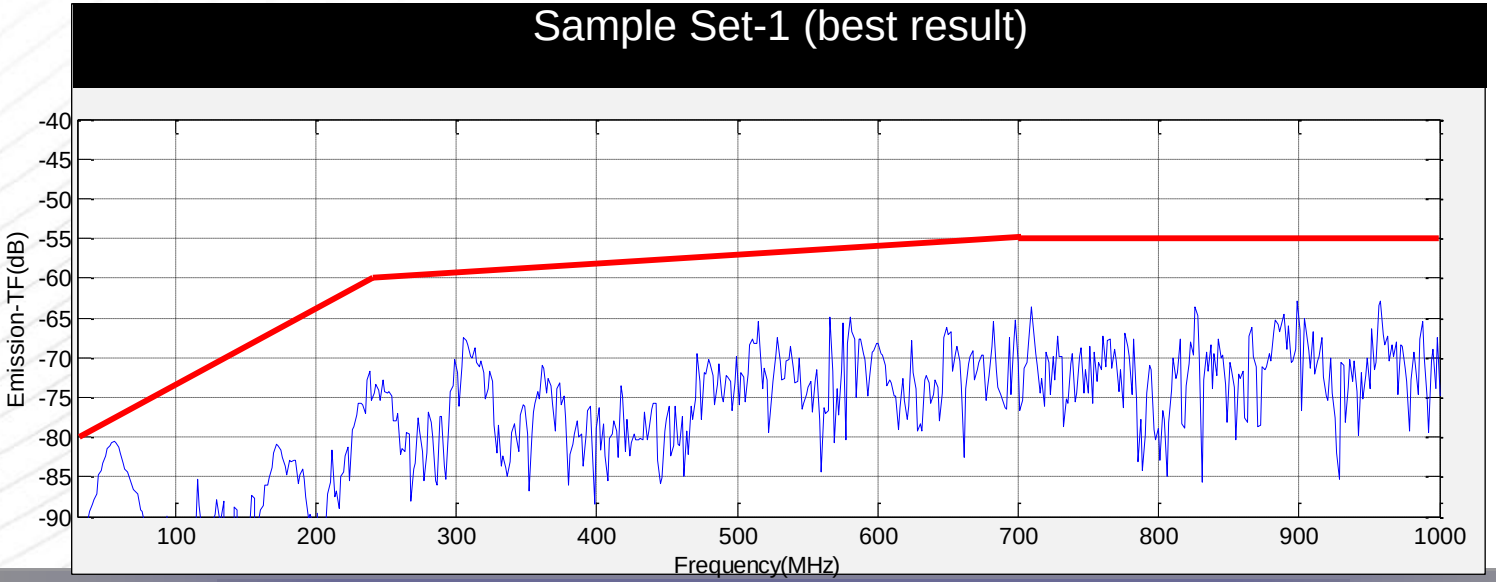


- Mode conversion for 1-pair UTP cable shown is based on measured S4P.
- The limit line shown correlates with the levels suggested for TX PSD and RX BCI immunity levels.
- The same limit can be considered for MDI and inline connectors, CMC and PHY.

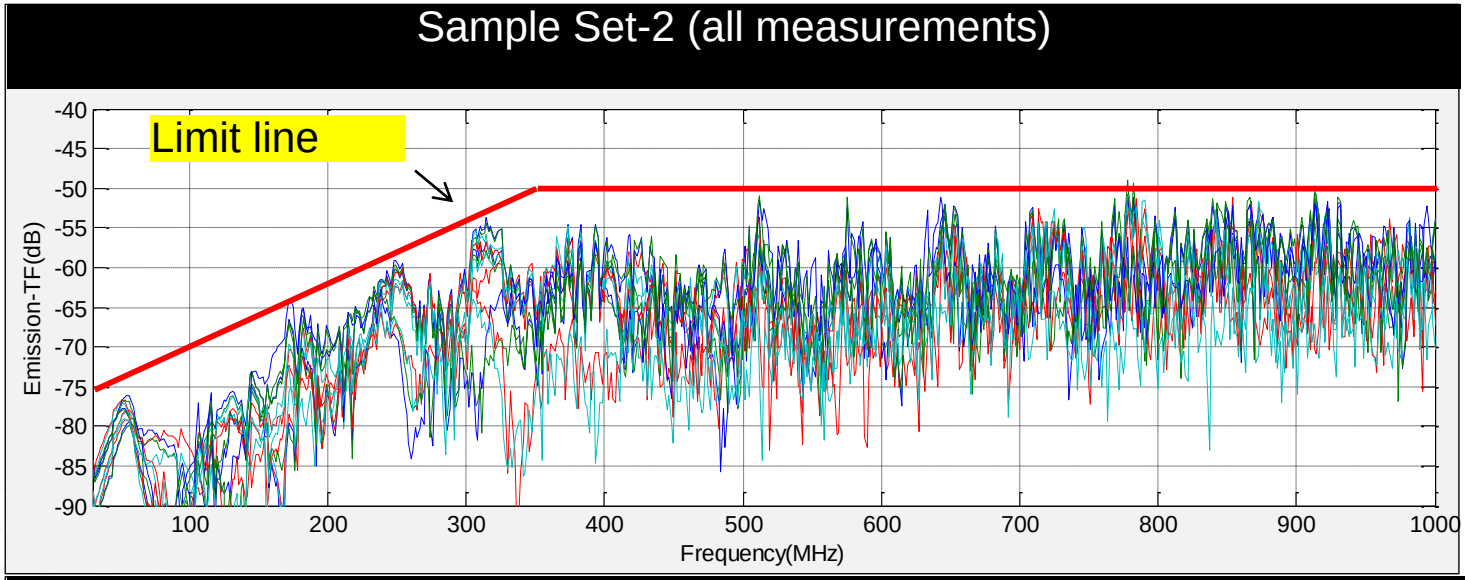
TX PSD Analysis

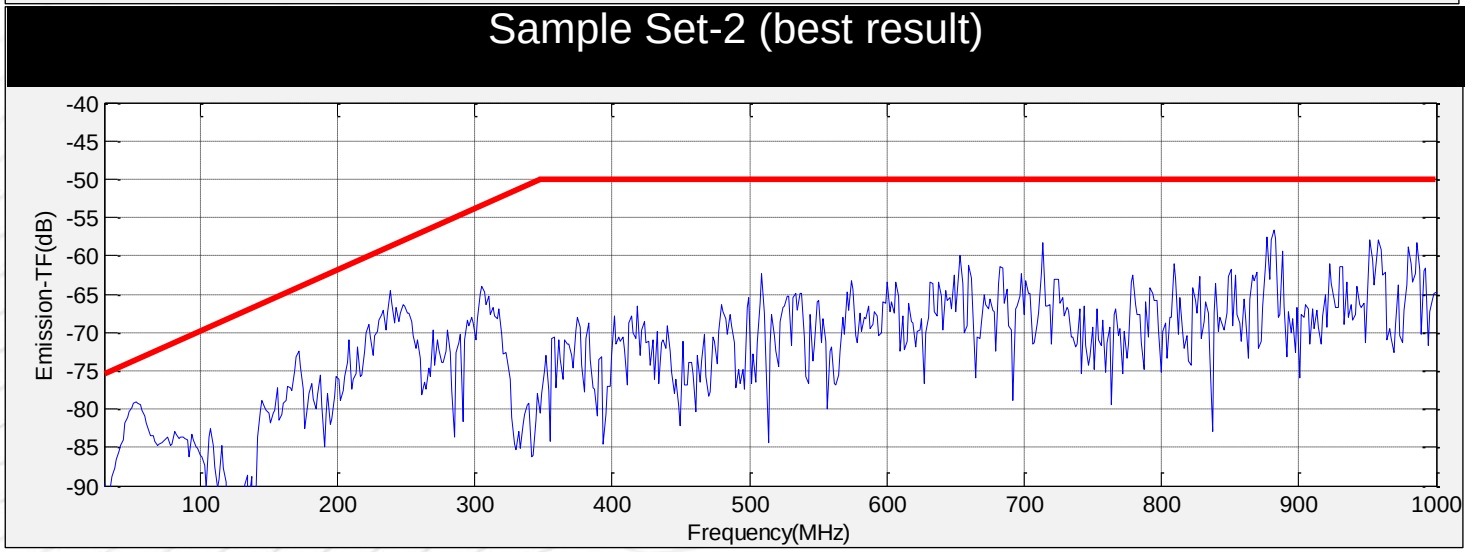
Emission Transfer Function



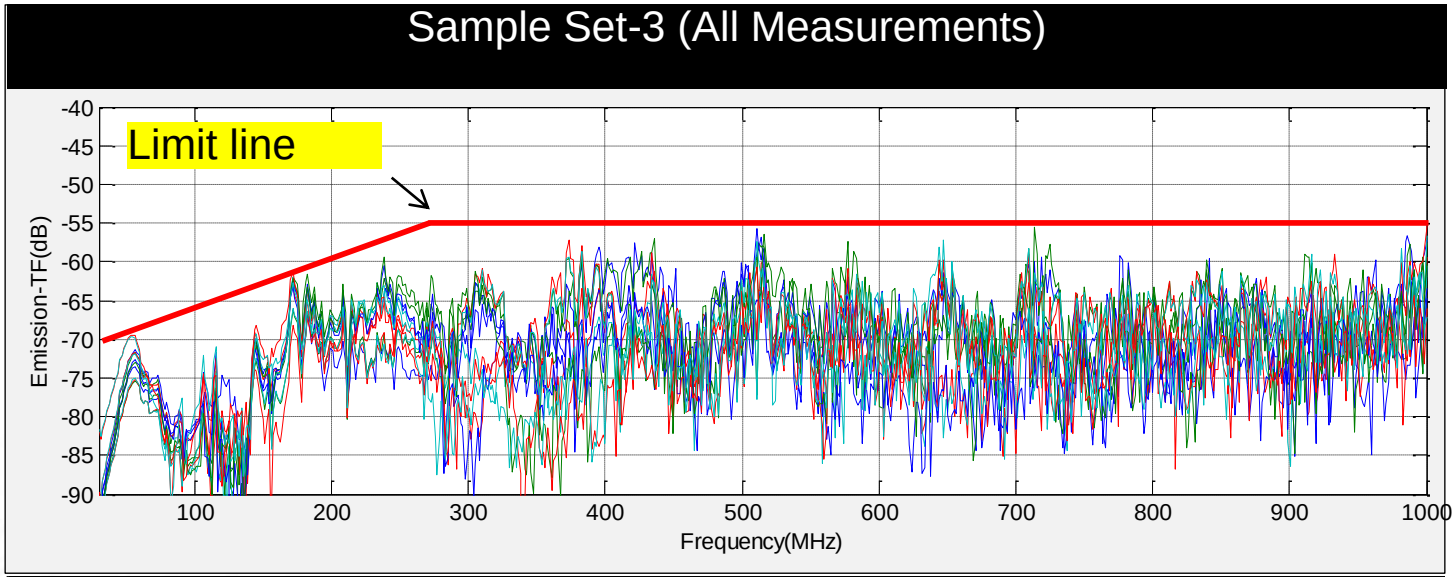


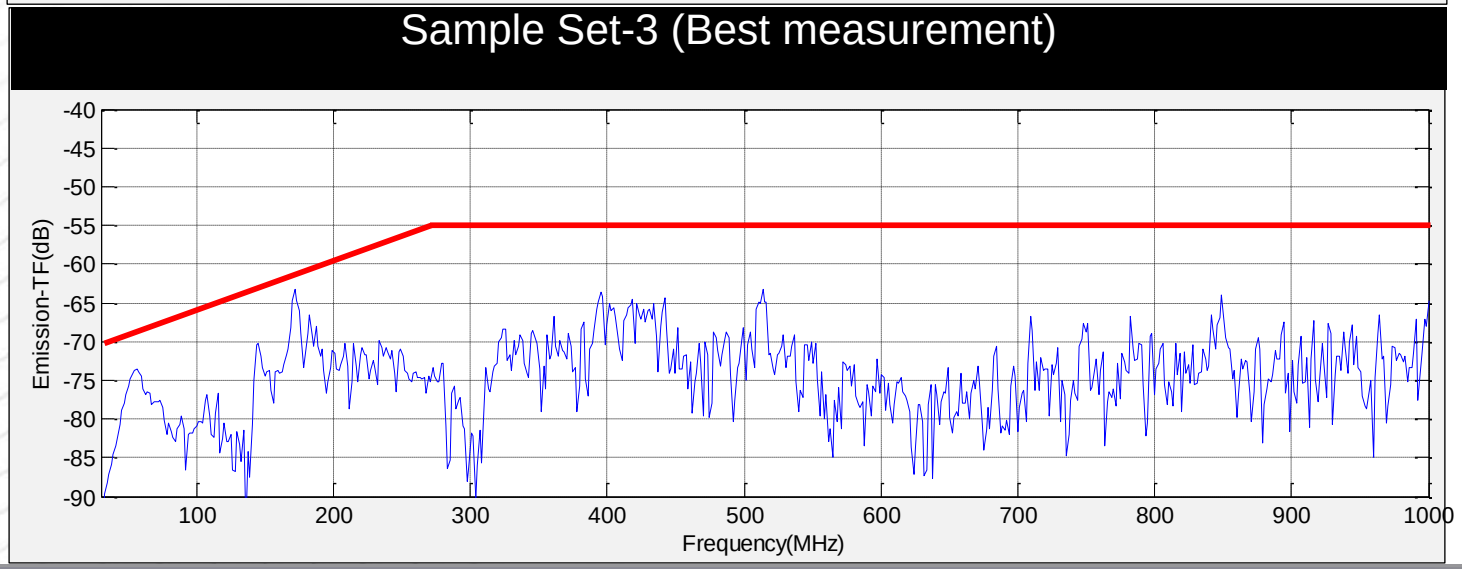
Emission Transfer Function (cntd.)



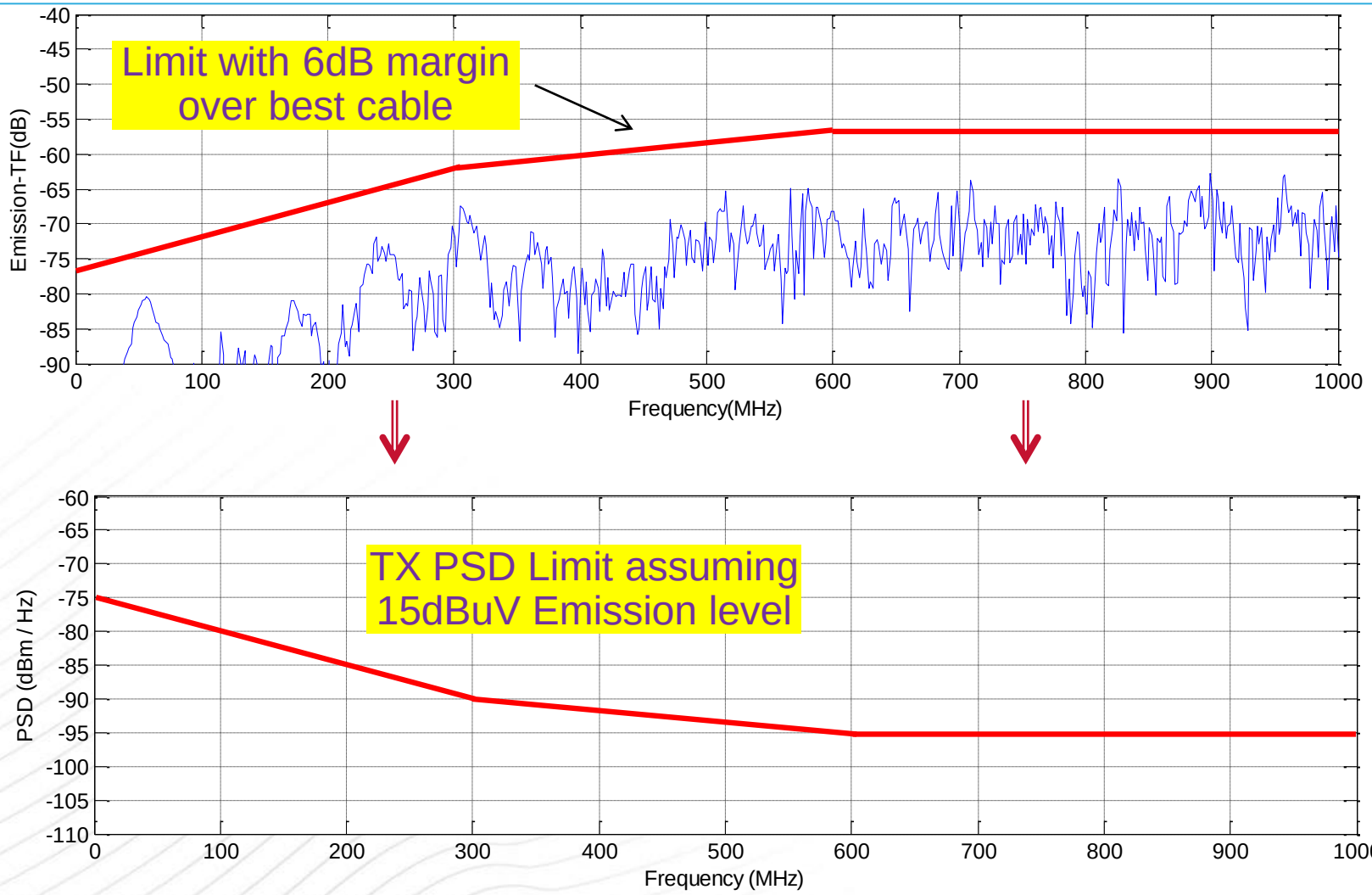


Emission Transfer Function (cntd.)



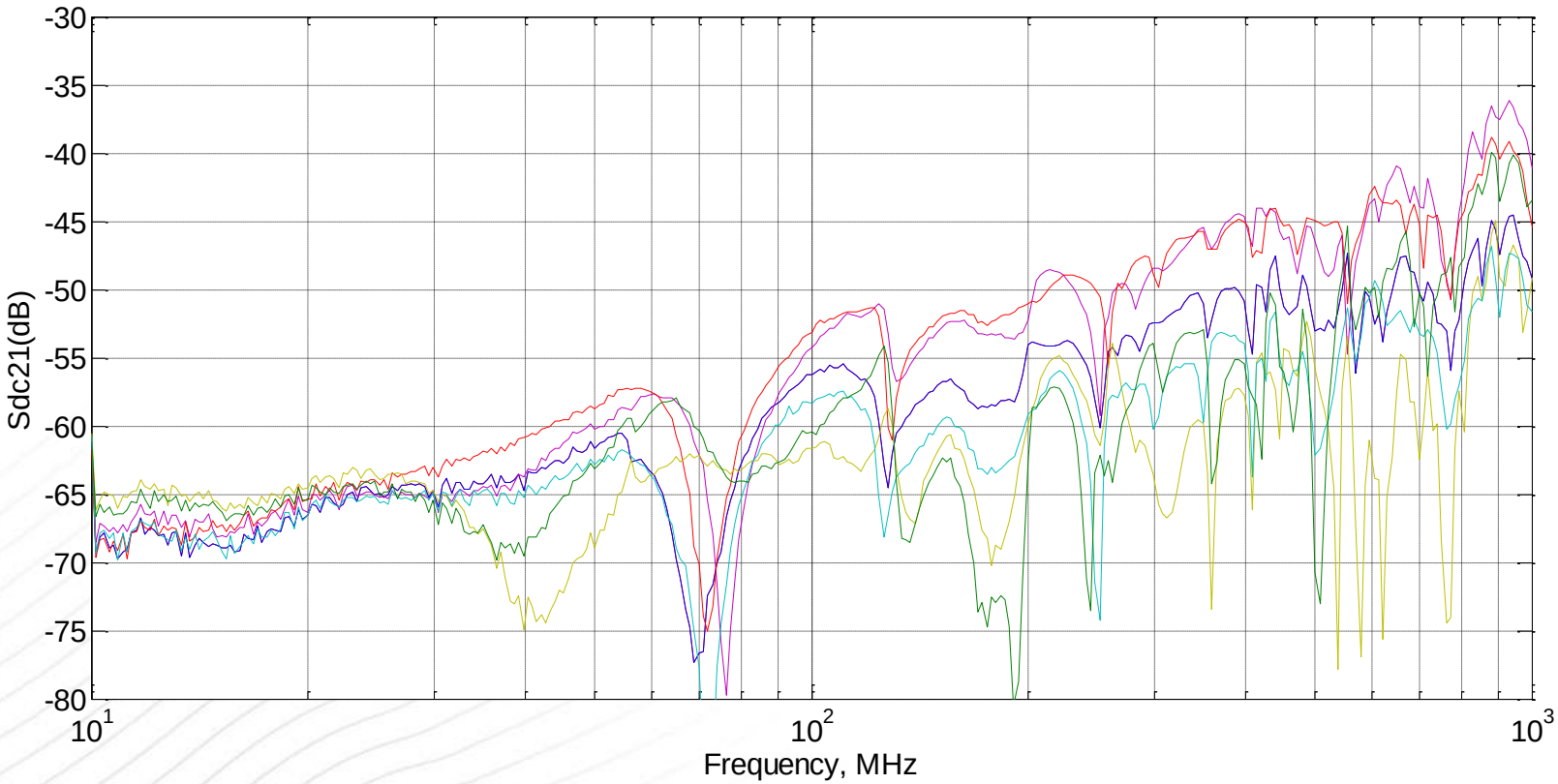


TX PSD Limit Line

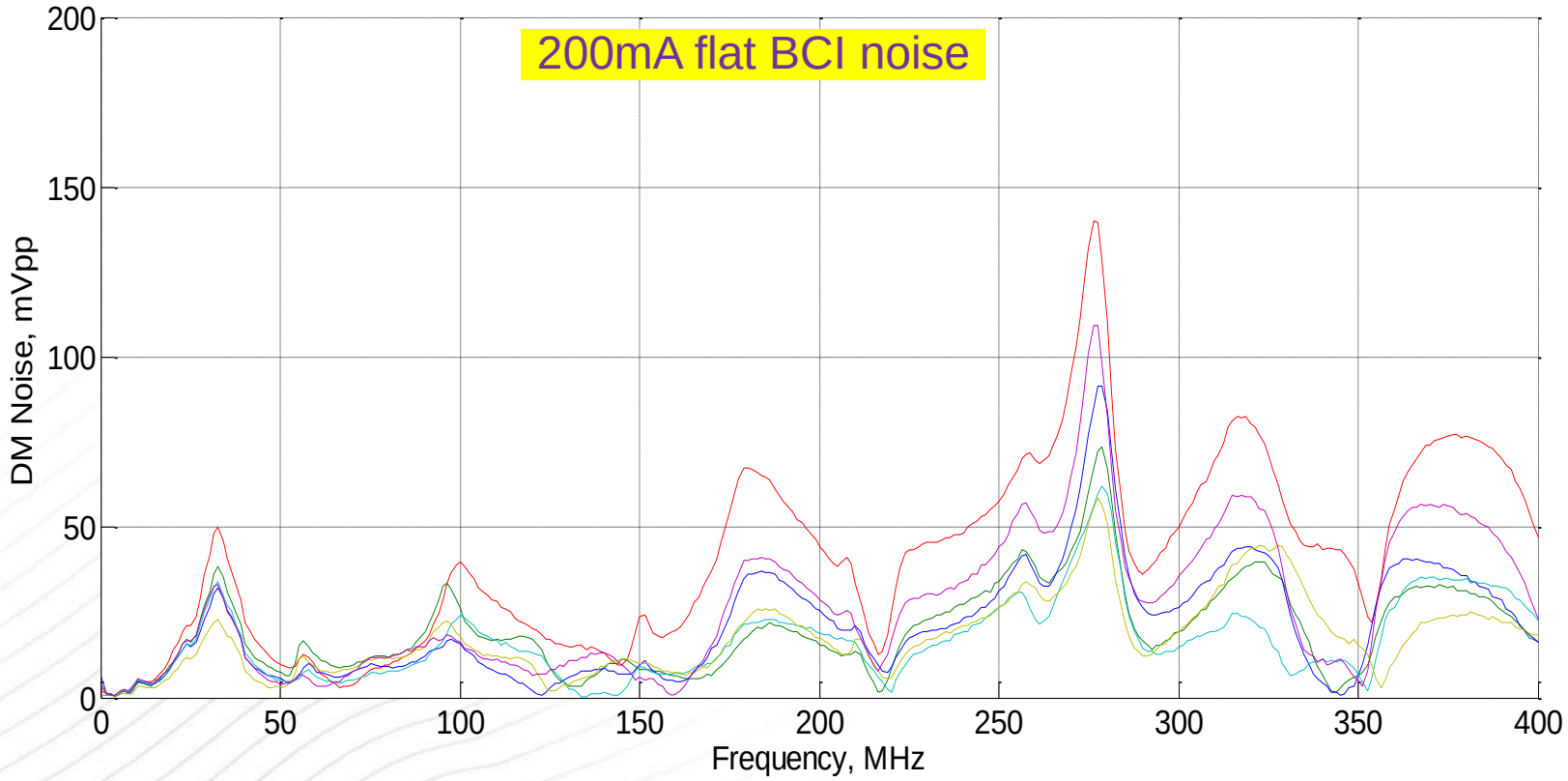


RX EMI Immunity

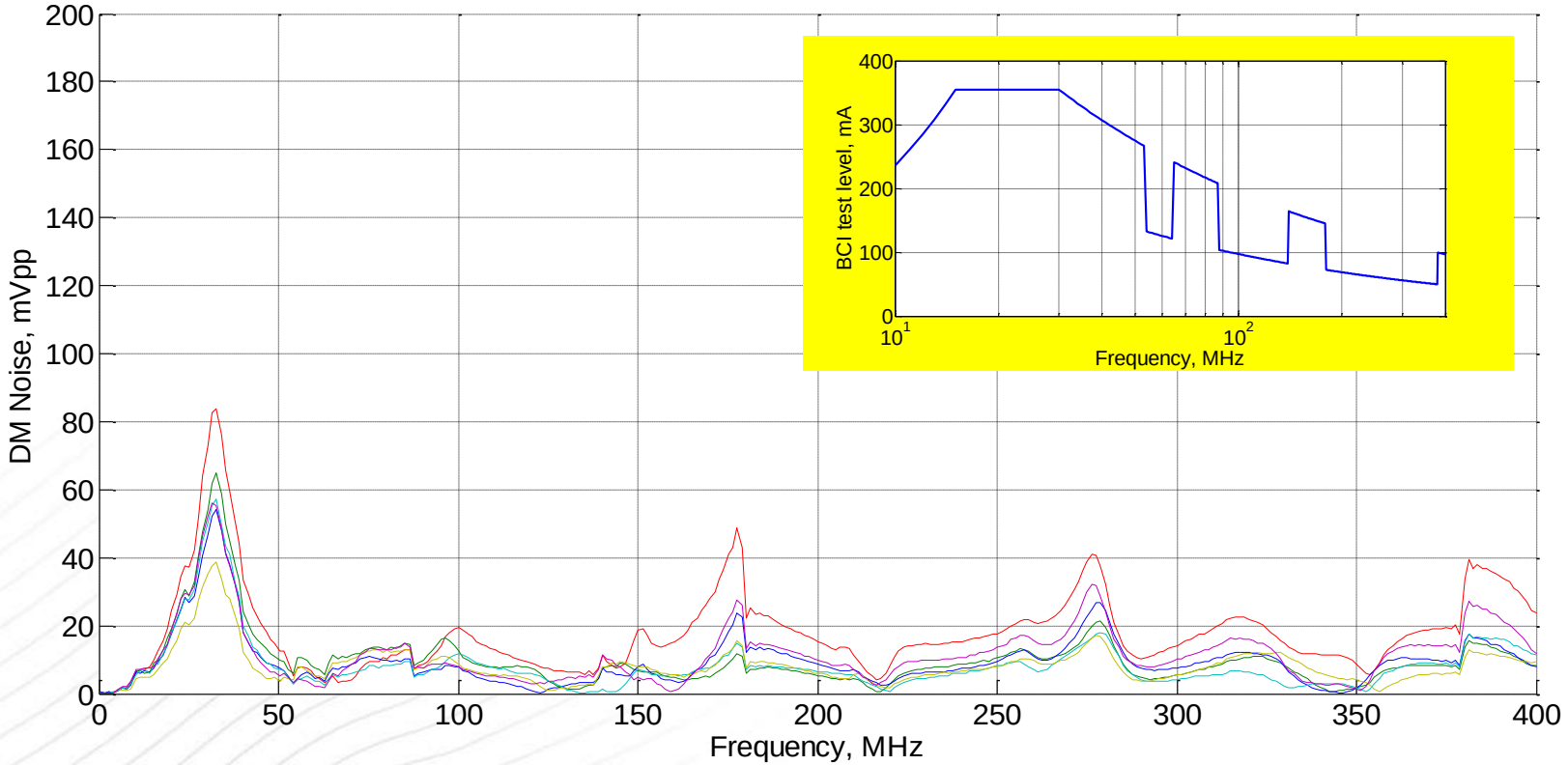
Mode Conversion for Sample Set-1



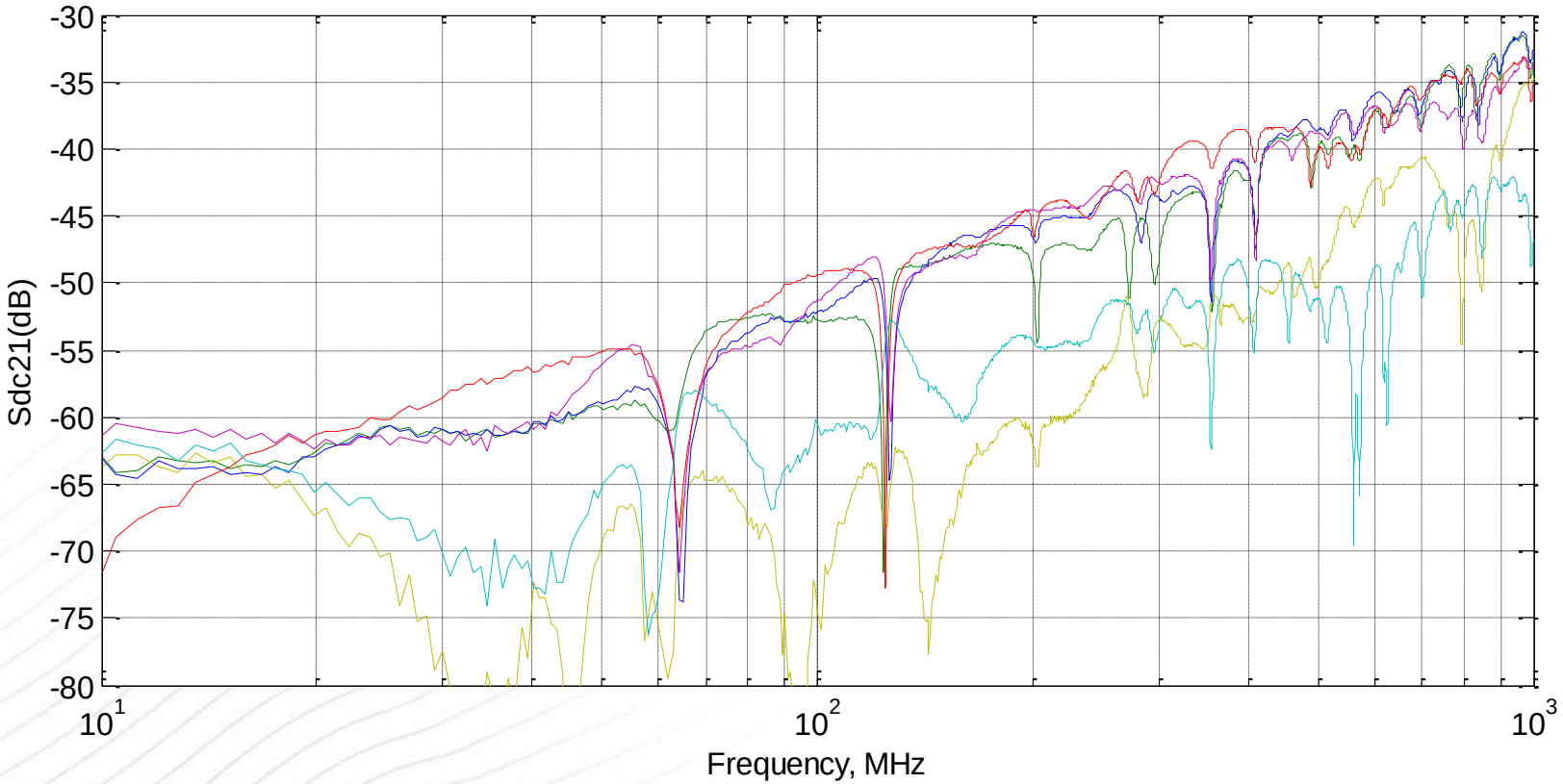
DM Noise for Sample Set-1(OEM Mask-1)



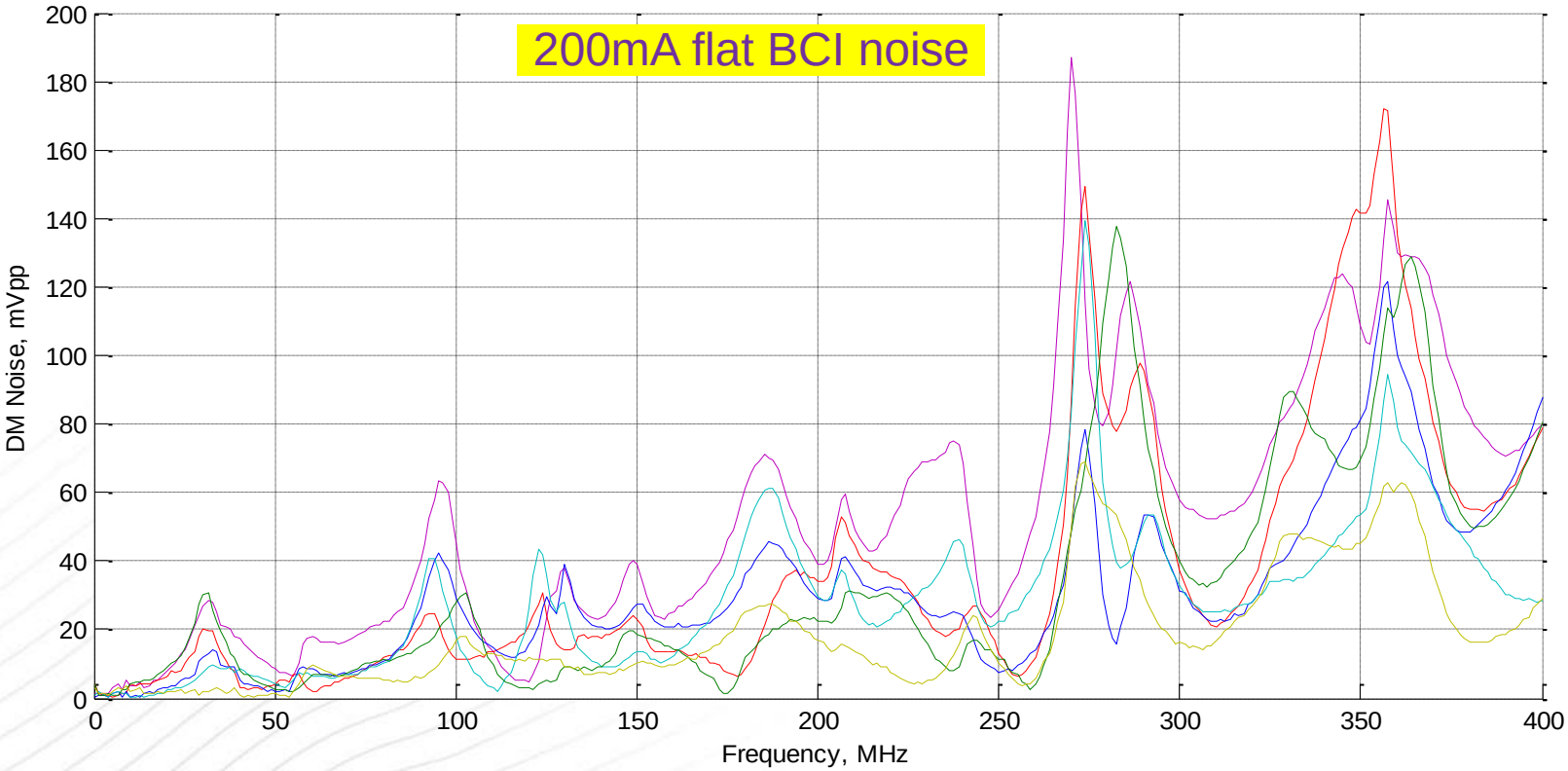
DM Noise for Sample Set-1 (OEM Mask-2)



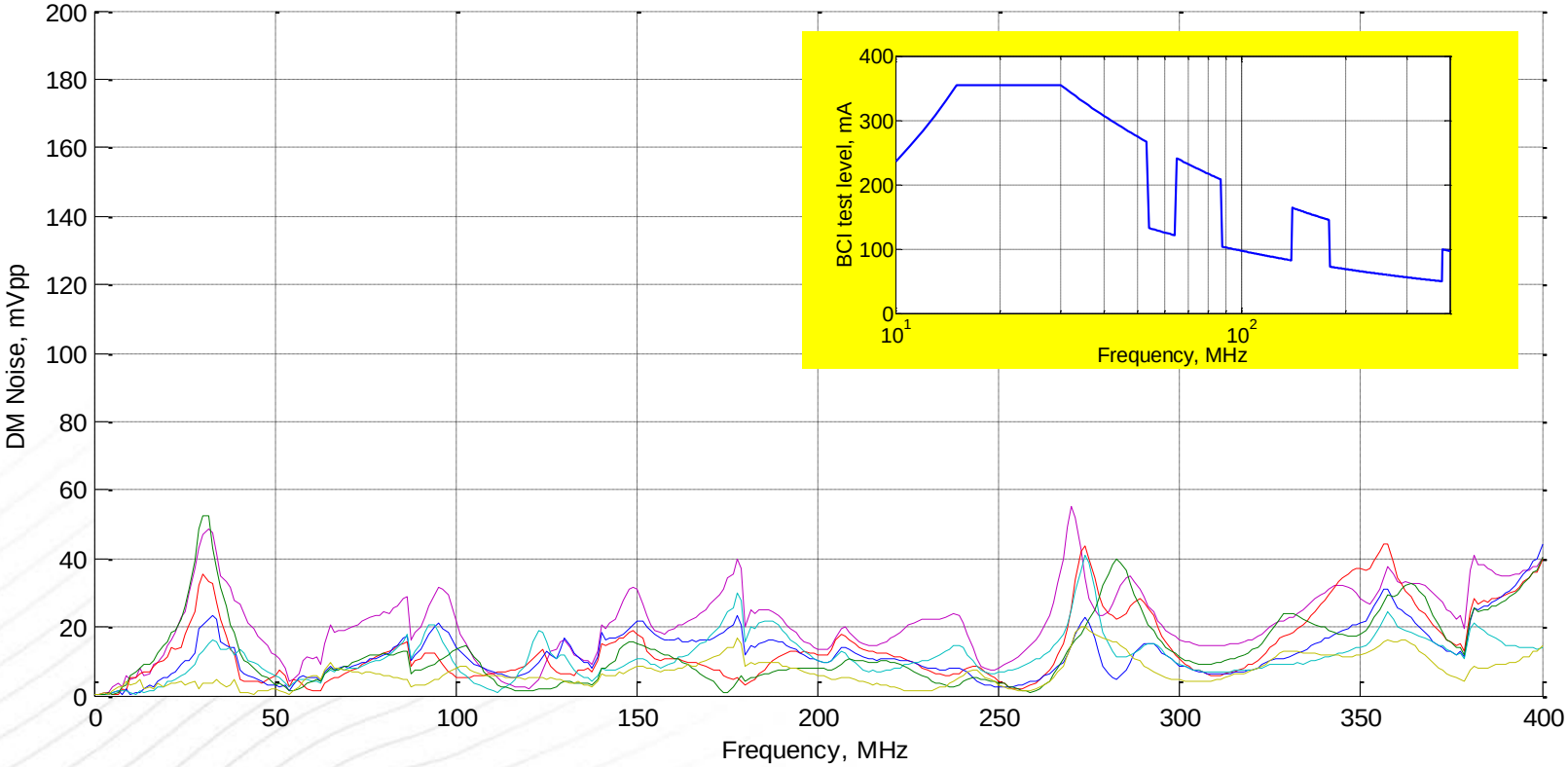
Mode Conversion for Sample Set-2



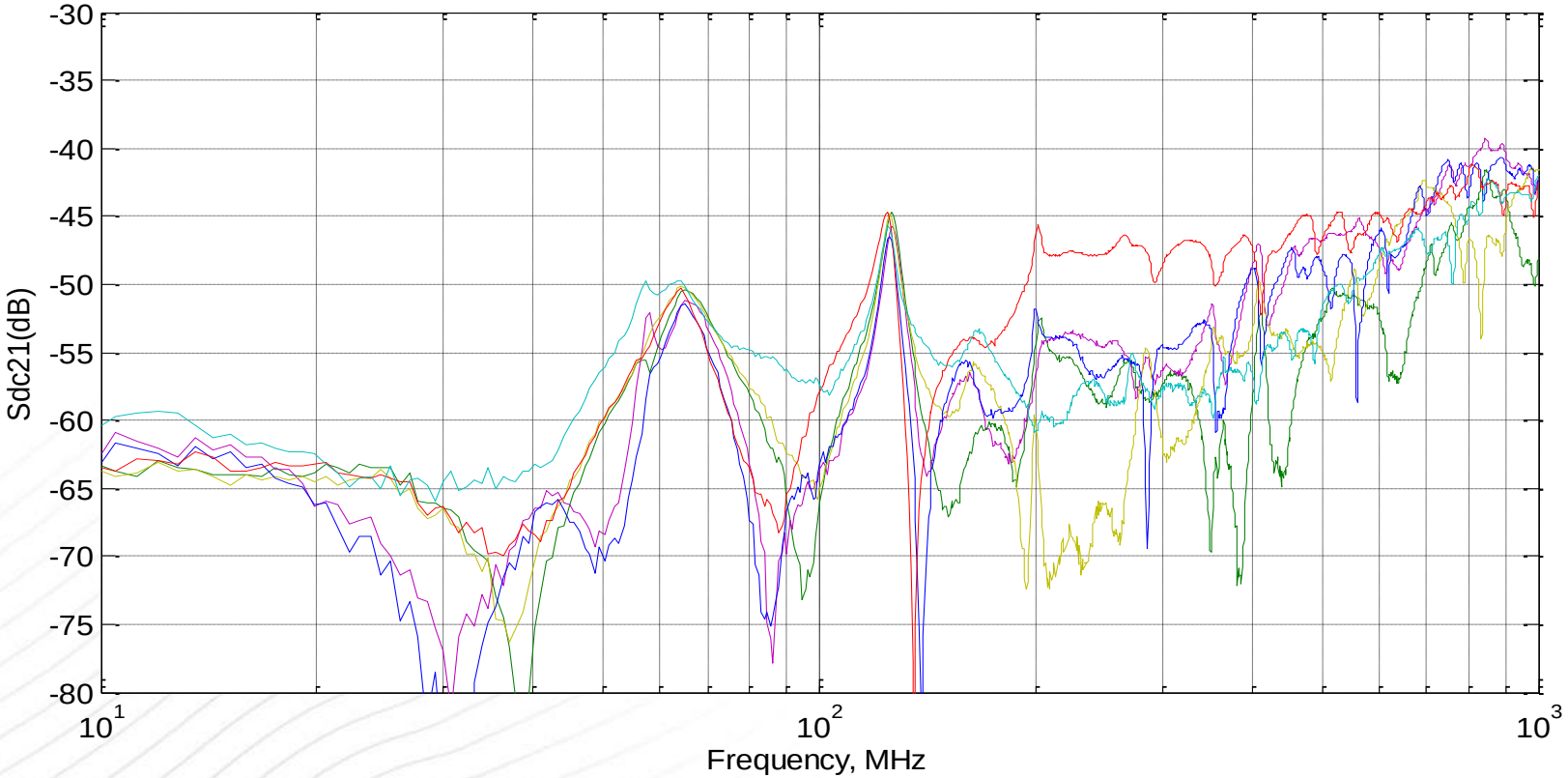
DM Noise for Sample Set-2 (OEM Mask-1)



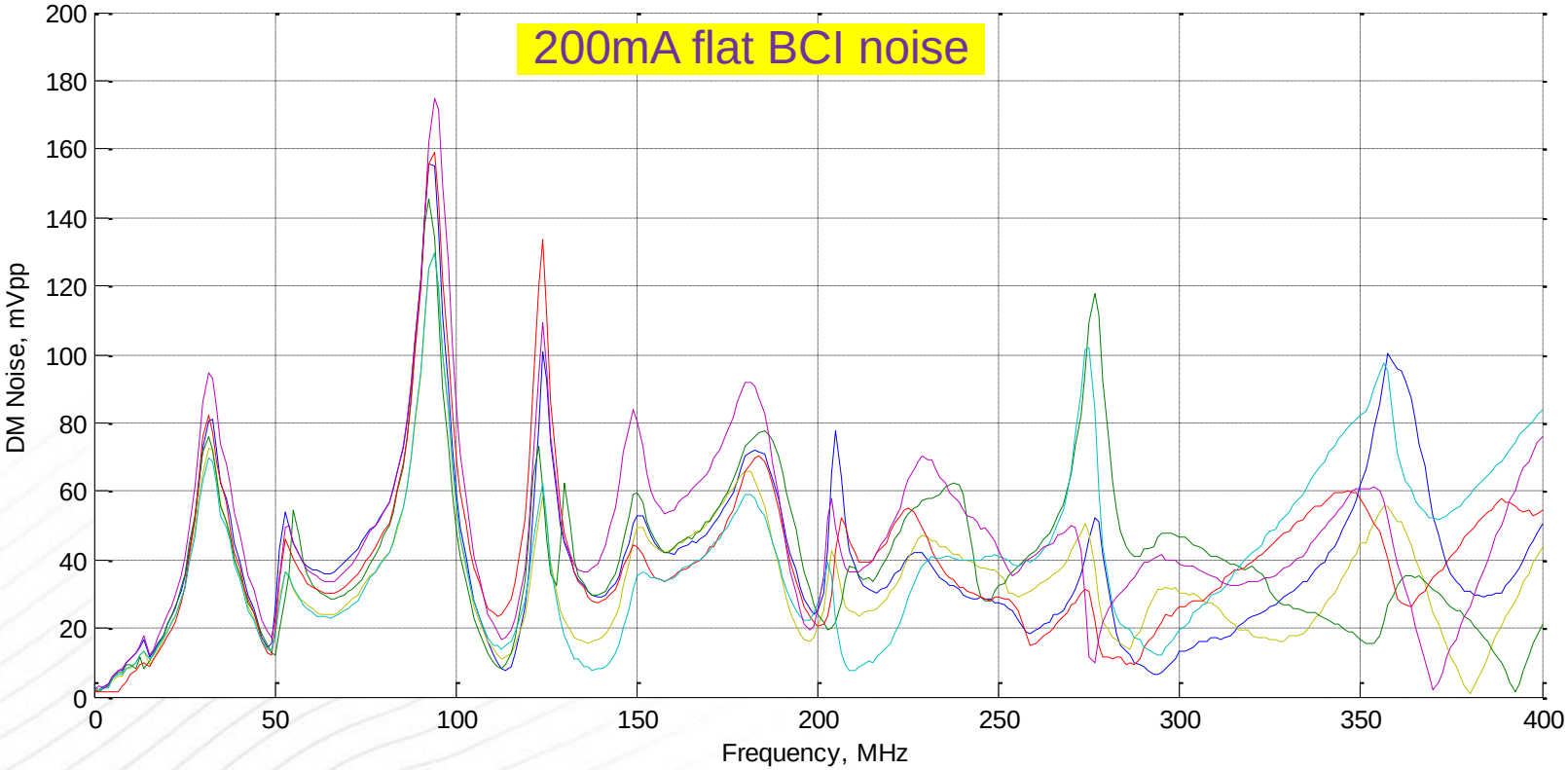
DM Noise for Sample Set-2 (OEM Mask-2)



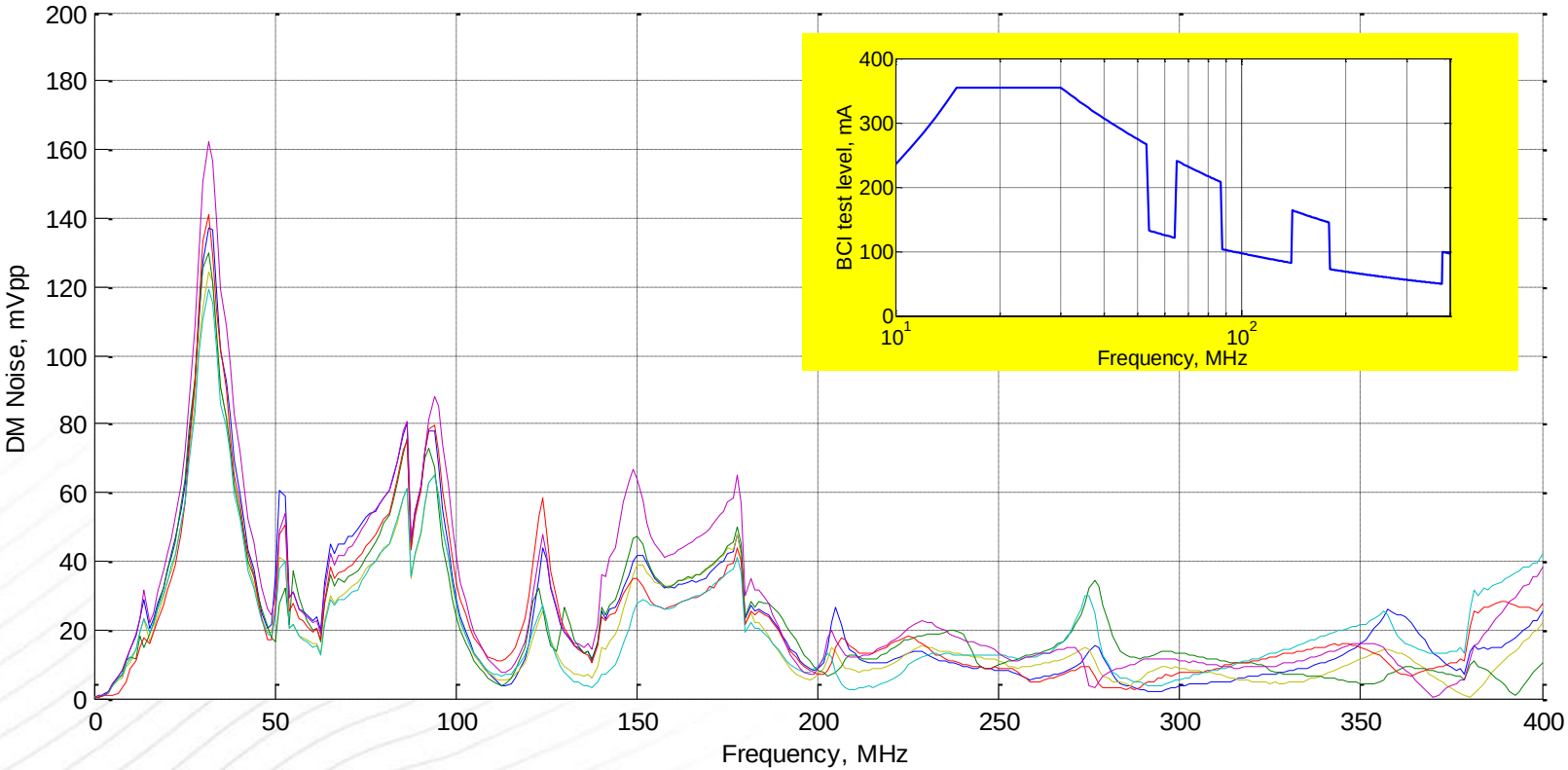
Mode Conversion for Sample Set-3



DM Noise for Sample Set-3 (OEM Mask-1)

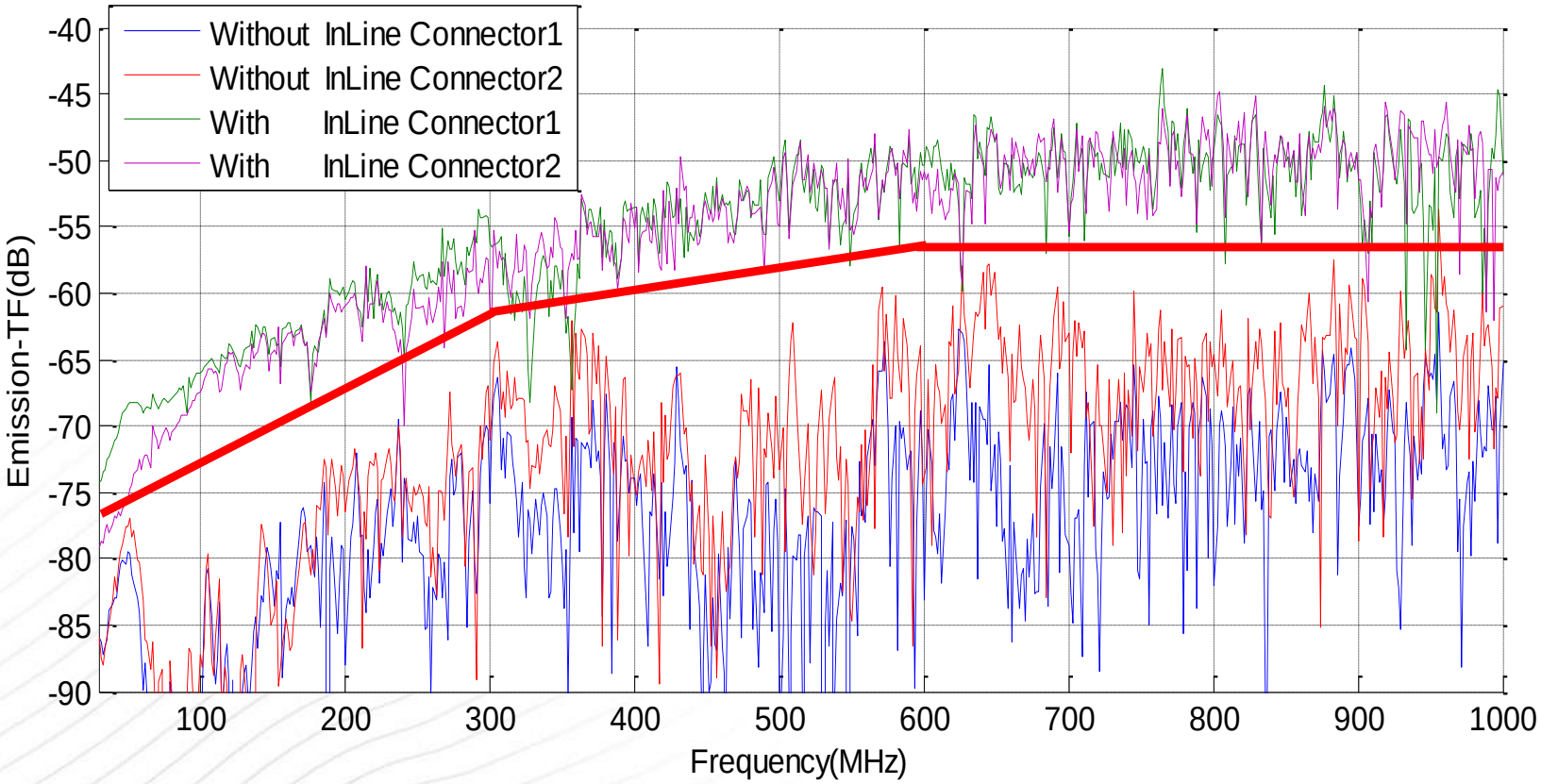


DM Noise for Sample Set-3 (OEM Mask-2)

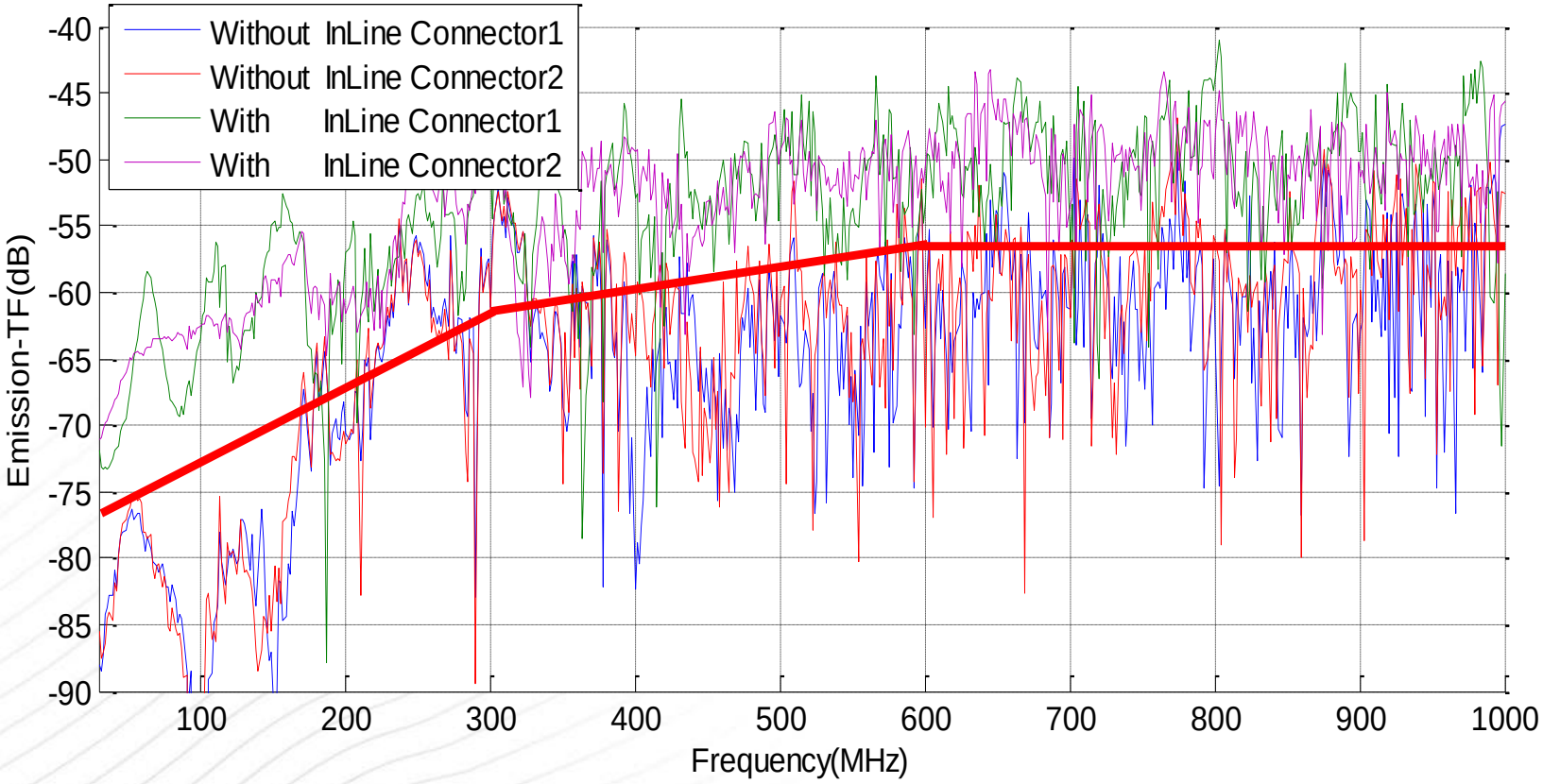


How about the connectors?

Emission Transfer Function for Sample Set-1



Emission Transfer Function for Sample Set-2



How about the magnetics?

Mode Conversion for Sample CMCs