



EMI Filtering of an Automotive Engine Controller Module Connector

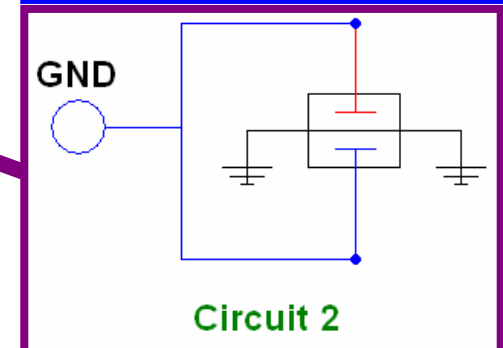
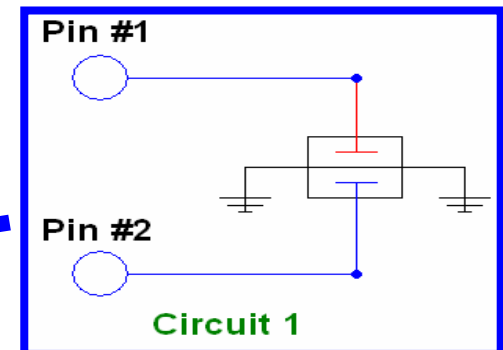
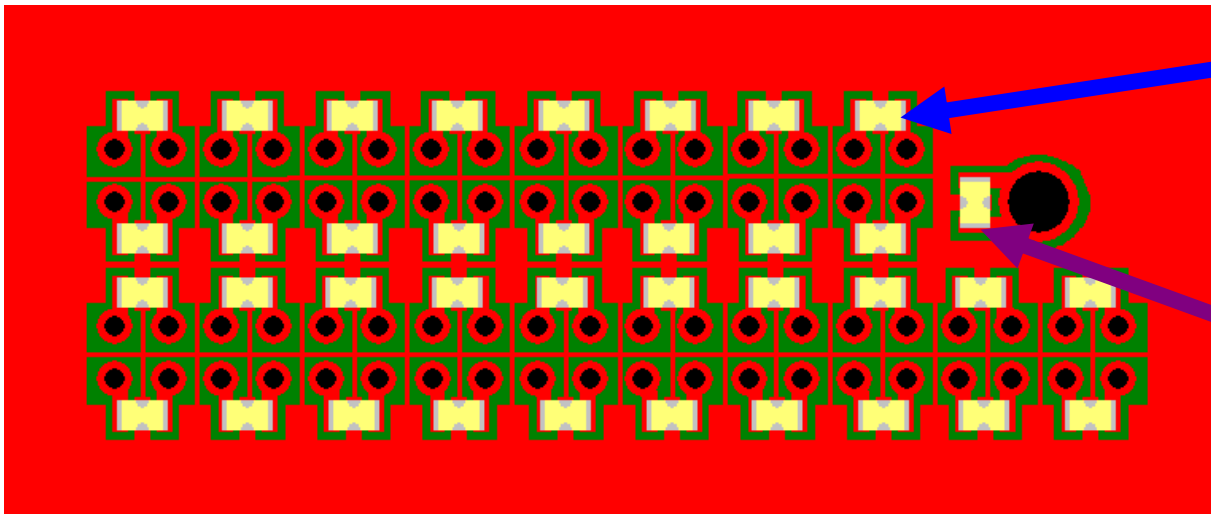
Test Results #TR 2004, v1.0

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- This document presents a collaborative effort to use X2Y[®] Technology for EMI filtering on an automotive engine controller to Reduce Radiated Emissions to meet an OEM's EMC requirements.
- X2Y Attenuators, LLC provided:
 - ✓ A prototype PCB carrier with X2Y[®] components applied and application suggestions.
- The automotive supplier
 - ✓ Applied the X2Y[®] filter to the engine controller and made test measurements at their own facility per an OEM's published specifications/requirements.

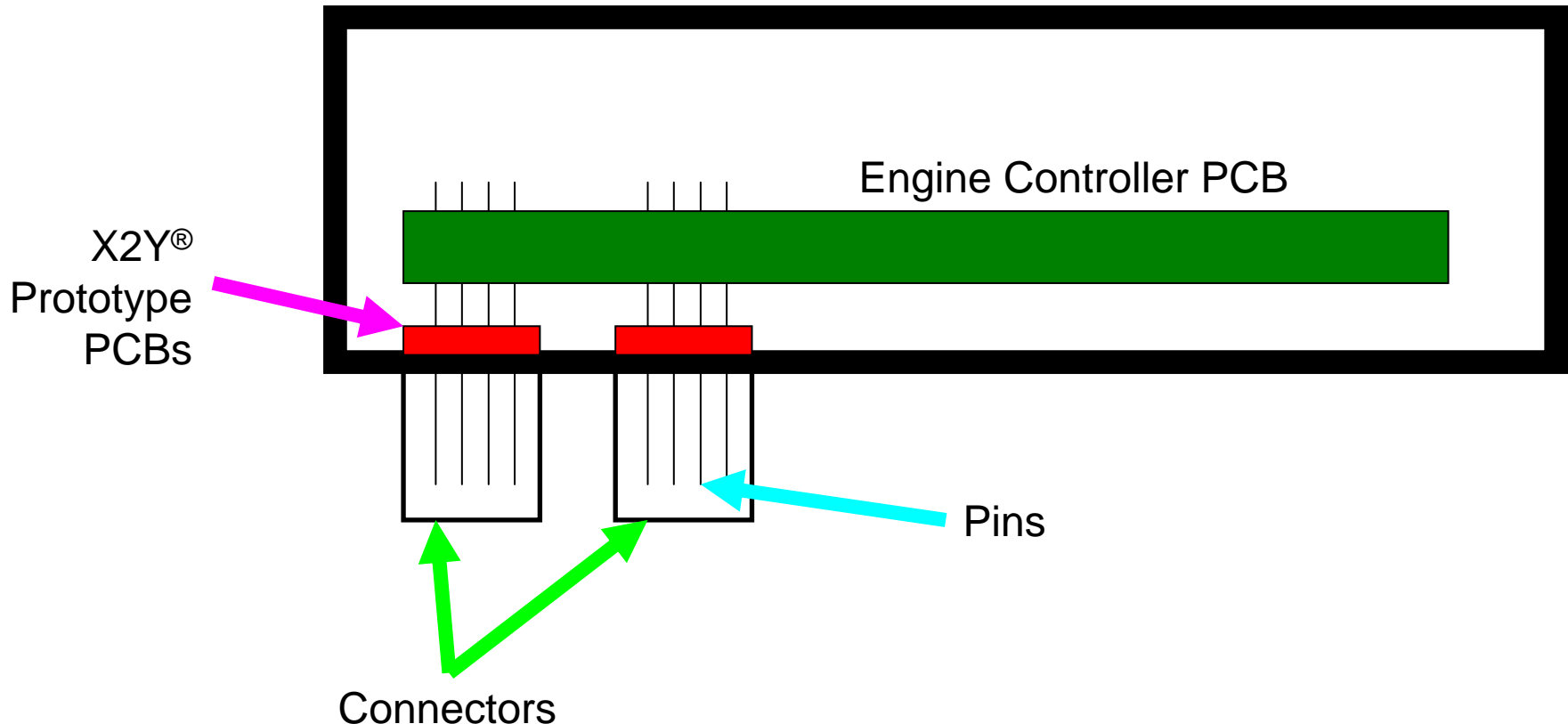
X2Y[®] Prototype PCB Design

- The engine controller module has multi-pin connectors.
- Engineers at X2Y's facility in Farmington Hills, MI constructed a single layer X2Y[®] prototype PCB:
 - ✓ X2Y[®] 0805 5nF components were attached to the PCB using [Circuit 1](#). (This is the recommended circuit configuration for EMI filtering.)
 - ✓ Due to the layout requirements, the large GND pin required the X2Y 0805 5nF component in a [Circuit 2](#) configuration. (This is a filtering alternative to Circuit 1).

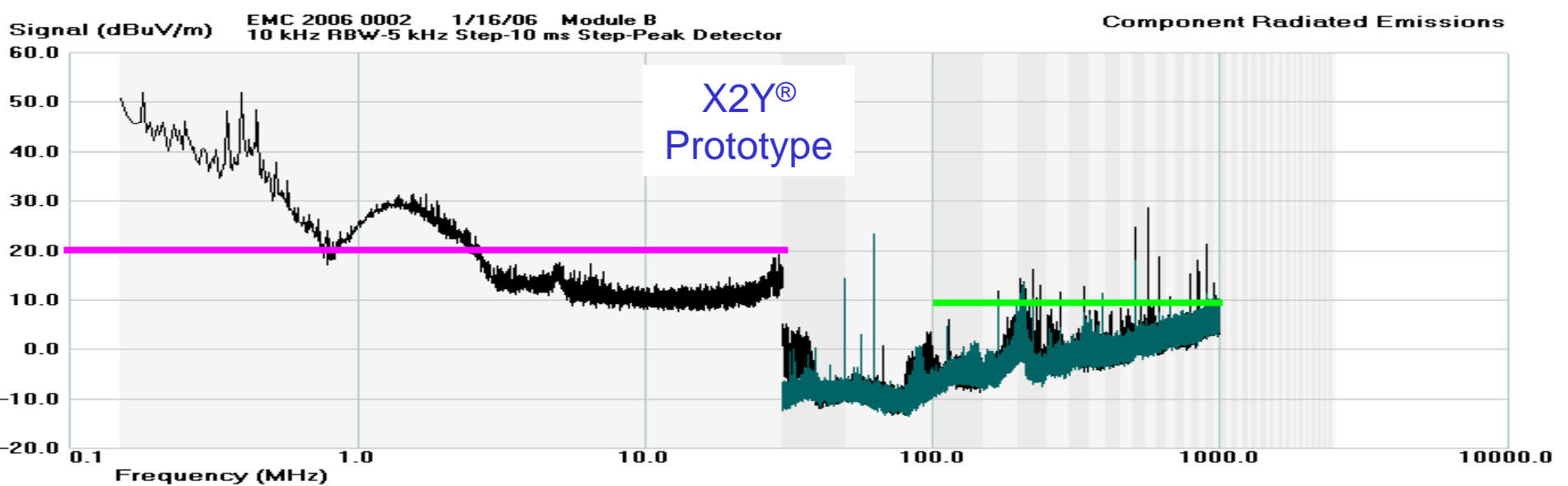
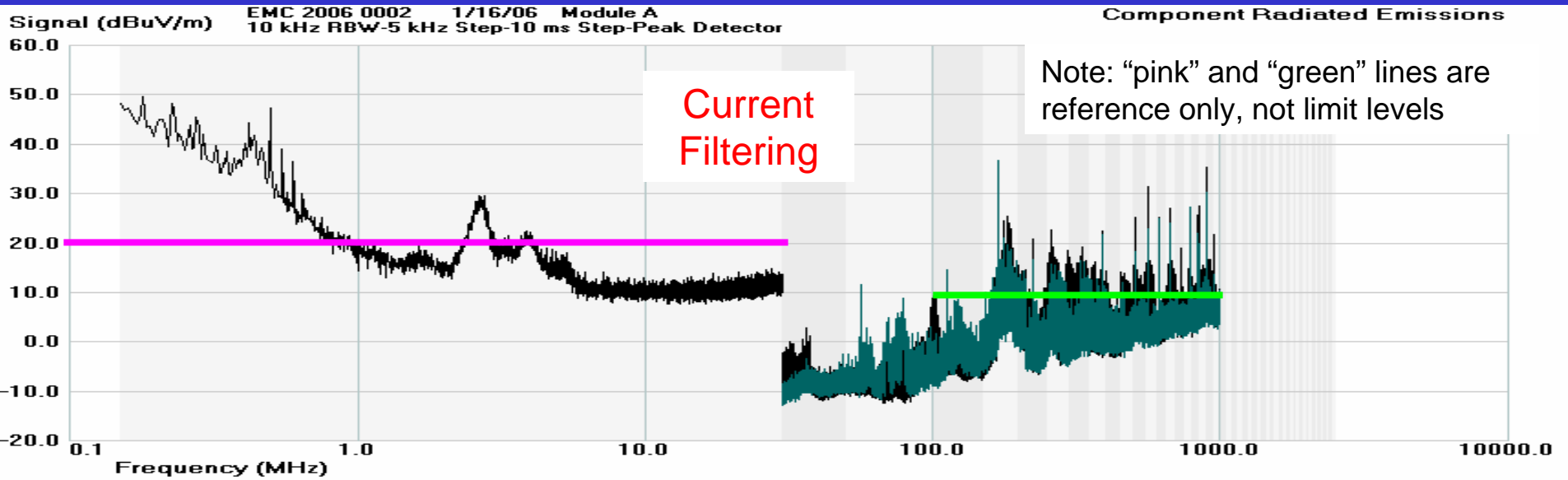


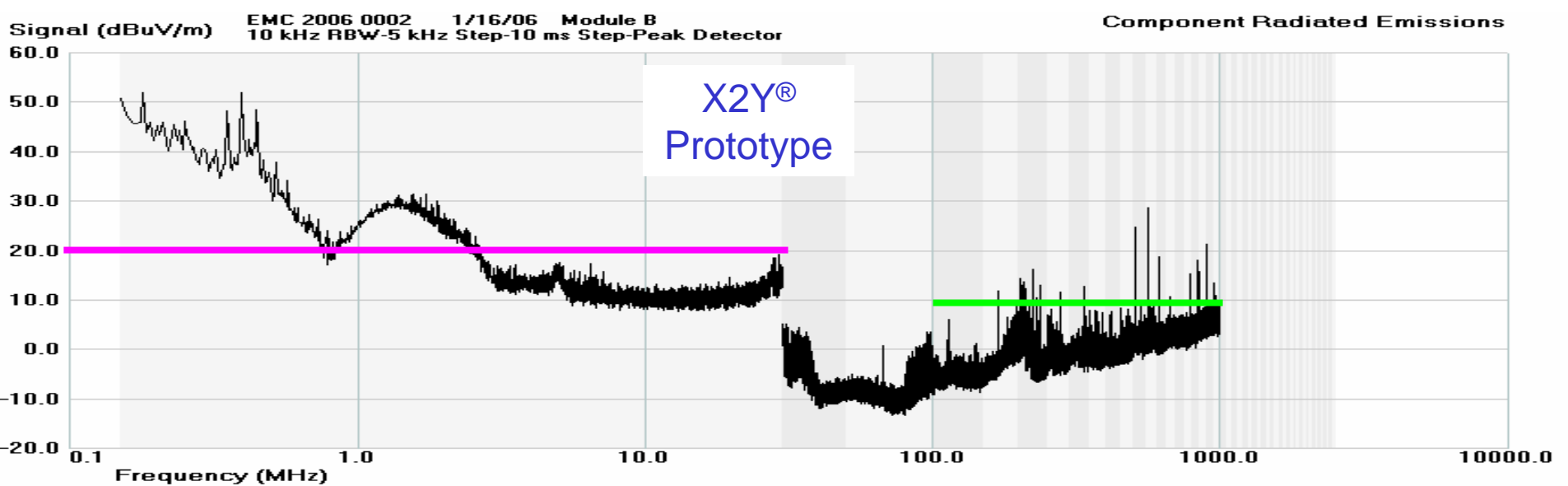
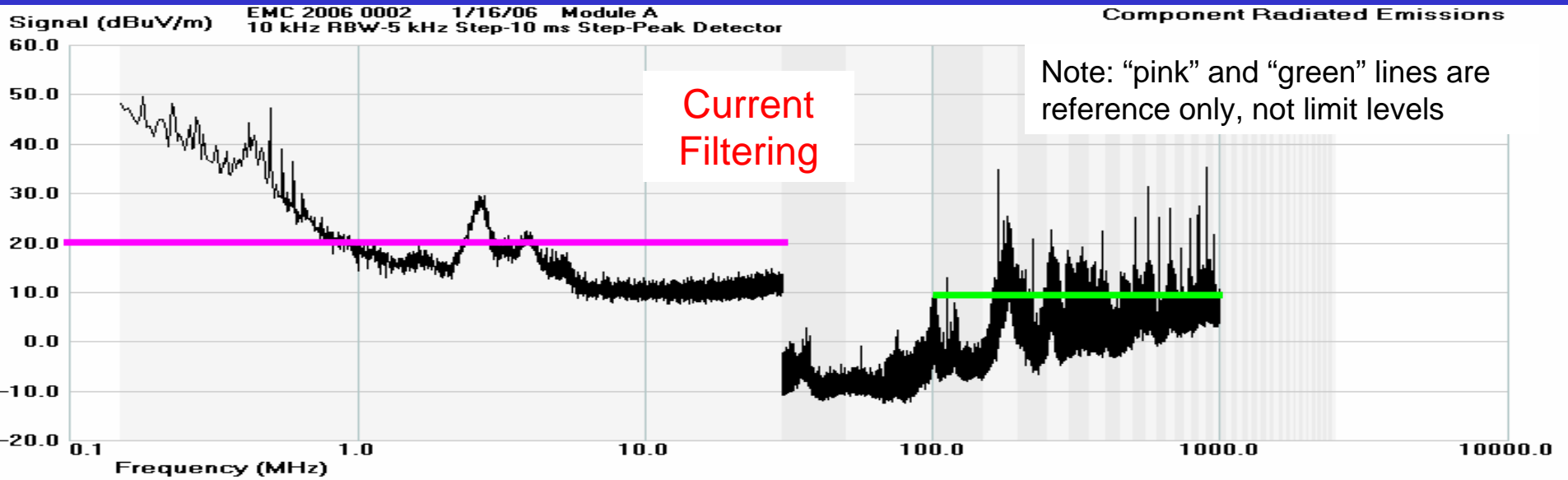
- The automotive supplier placed the X2Y[®] prototype PCB inside the metal module between backside of connector and PCB.
- The X2Y[®] prototype's PCB GND was referenced to metal (aluminum) module (chassis Ground).

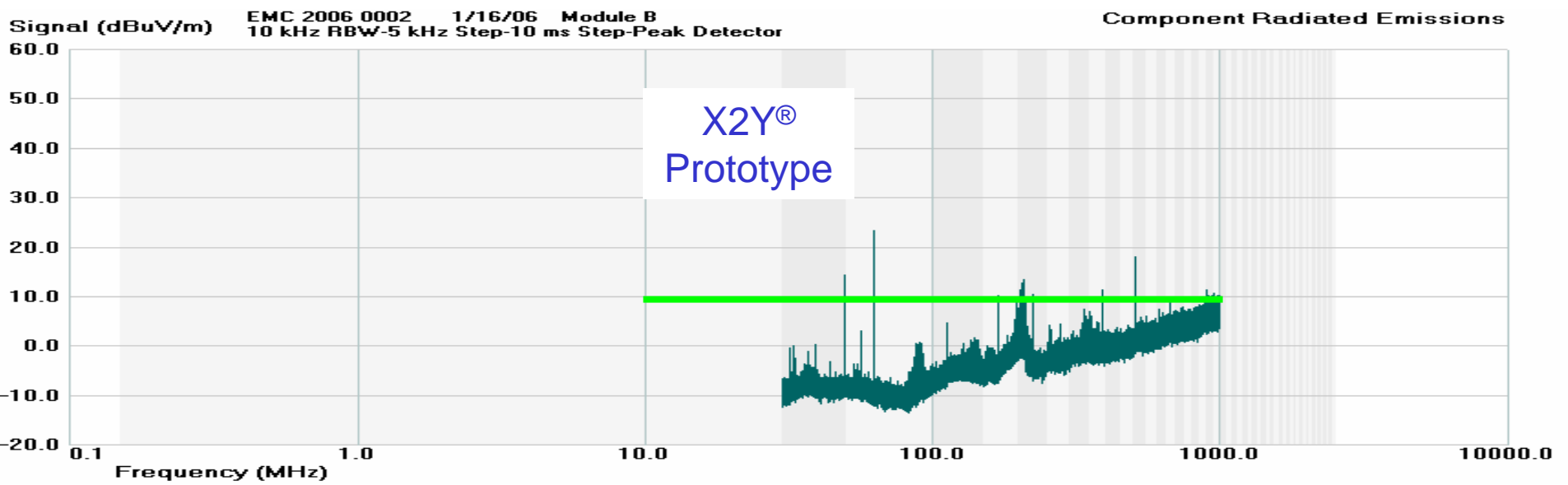
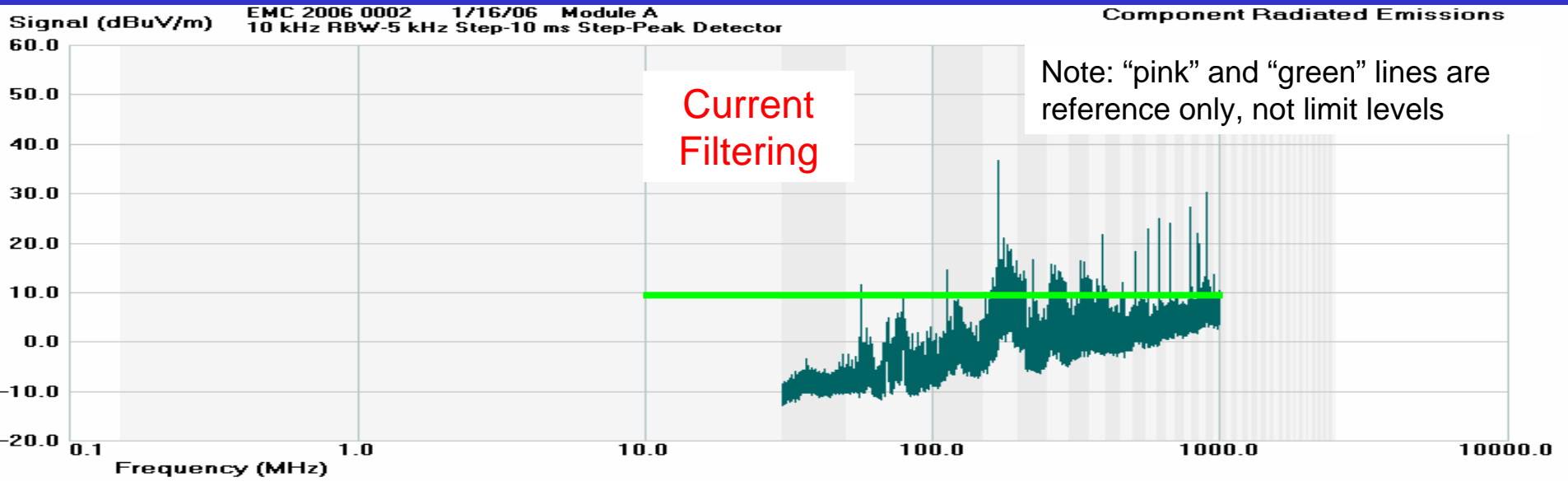
Metal Module (Chassis)



- The black data is for vertical polarization.
- The green data is for horizontal polarization.
- There is no horizontal polarization data below 30MHz because in that band the Rod antenna is used (it is Omni-directional).
- Note: The X2Y[®] prototype PCB filter was applied to a filtered engine controller (conventional filtering was left in)
 - ✓ Typically, X2Y Attenuators LLC, recommends removal of all conventional filtering before applying the X2Y[®] filter to maximize EMC performance.
 - ➔ This reduces the chance of current sneak paths, resonances, and phasing shifts induced by the conventional filtering.
 - ✓ Removing the conventional filtering was not an option for the automotive supplier in this testing.







- Test data shows significant reduction of RE emissions with X2Y[®] filtering.
- Alternative solutions to further improve X2Y[®] filter performance for an engine controller are:
 - ✓ Use a flex PCB inside a connector with X2Y[®] chips applied on the flex substrate
 - ✓ Place the X2Y[®] components at the pin I/O located on the controller PCB.
- The critical parameter is attachment of PCB GND to the chassis ground.

Direct inquiries and questions about Test Reports, Application Notes, or X2Y[®] products, please contact:



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