

**Technical Cost Analysis for Adjustable 12V DC Pedal Motor**

for  
**Chrysler LLC**

prepared by  
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*Updated May 5, 2008*  
*Updated Dec 9, 2008*

## **I. Goals**

An engineer from Chrysler LLC Core of Competence Powertrain Applications asked Jastech EMC Consulting LLC to investigate possible cost reductions for a DC pedal motor EMC filter design and still maintain current production EMC performance.

## **II. Radiated and Conducted Emissions Performance**

Data supplied in Appendix (1) & (2) shows that radiated and conducted results measured by Jastech EMC Consulting LLC shows that Jastech's concept prototype performed just as good or better than current production EMC filter design.

(Note: Jastech EMC Consulting LLC test set-up is for A-to-B comparison only and should only be used as an indication of actual CISPR 25 results. Test set-up is noted in Appendix (3).)

## **III. Transient Performance**

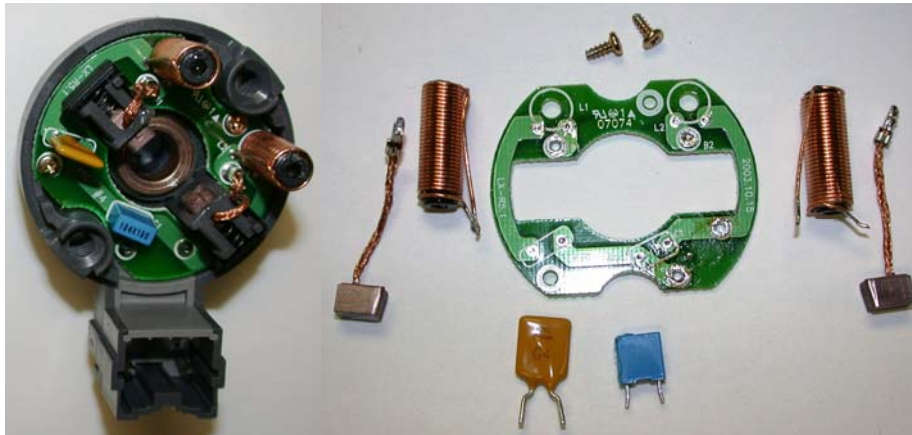
Data supplied Appendix (4) shows that measured start and stop transients in supplied fixture is essentially the same or better for the Jastech prototype EMI filter as current production EMI filter supplied.

#### IV. Cost & Reliability

Fewer components and materials typically results in net cost reduction. Fewer components and solder joints improves reliability.

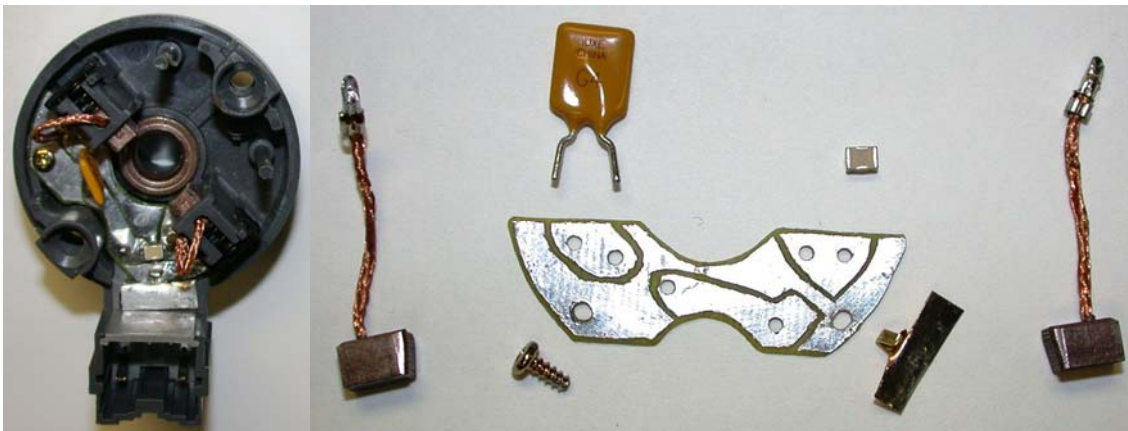
*Current production motor has:*

- a) (3) filter components
- b) (6) solder joints
- c) (2) ground screws
- d) Full PCB



*Jastech's Prototype motor has:*

- a) (1) filter component
- b) (5) solder joints
- c) (1) ground screws
- d) 1/3 PCB
- e) (1) Ground Tab



**V. Pricing/Multi-Sourced of X2Y Technology**

The X2Y Technology is multi-manufacturer licensed technology (<http://www.x2y.com/mfgs.htm>) that is available from Samsung Electro-Mechanics, Yageo Corporation, Syfer Technology LTD, and Johanson Dielectrics Inc. Distribution channels include: Arrow, Digi-Key, Future, and TTI Inc.

Small volume pricing example of X2Y Technology:

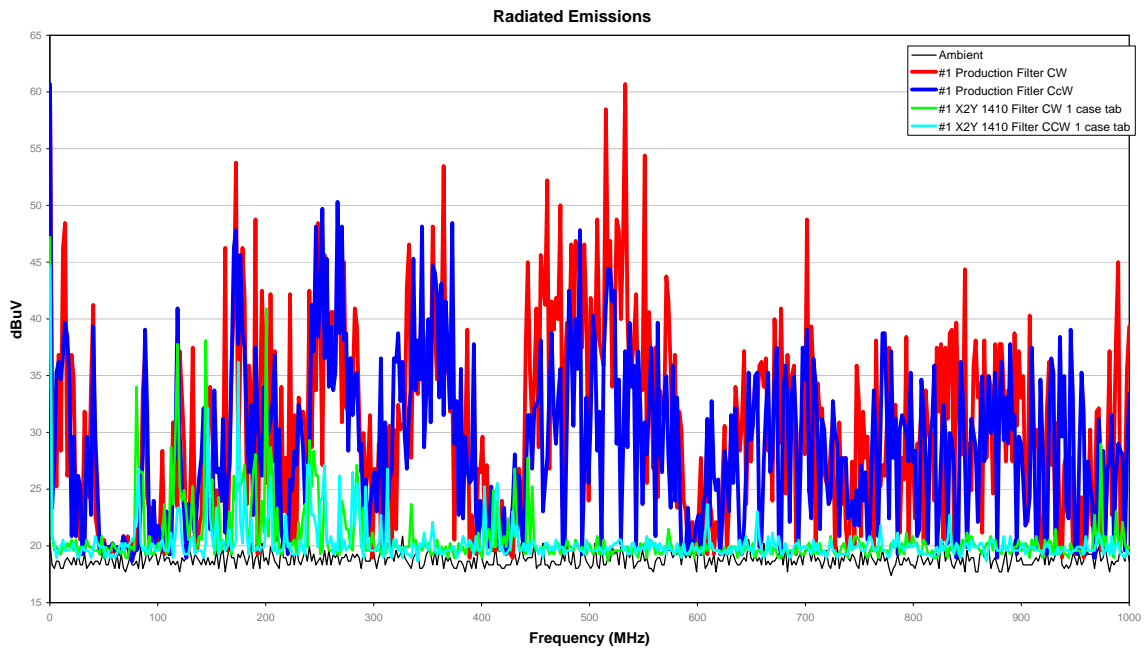
<b>Digi-Key Part Number</b>	CX1410MKX7R9BB394-ND	<b>Price Break</b>	<b>Unit Price</b>	<b>Extended Price</b>
<b>Quantity Available</b>	0 <input type="text" value="Enter Quantity Requested"/>	2,500	0.22300	557.50
<b>Manufacturer</b>	<a href="#">Yageo</a>			
<b>Manufacturer Part Number</b>	CX1410MKX7R9BB394			
<b>Description</b>	CAP X2Y CER .39UF X7R 1410			
<b>Lead Free Status / RoHS Status</b>	Lead free / RoHS compliant			
<b>All prices are in US dollars.</b>				

To further reduce X2Y component cost Chrysler LLC can negotiate high volume pricing and have Tier suppliers order from Chrysler part #.

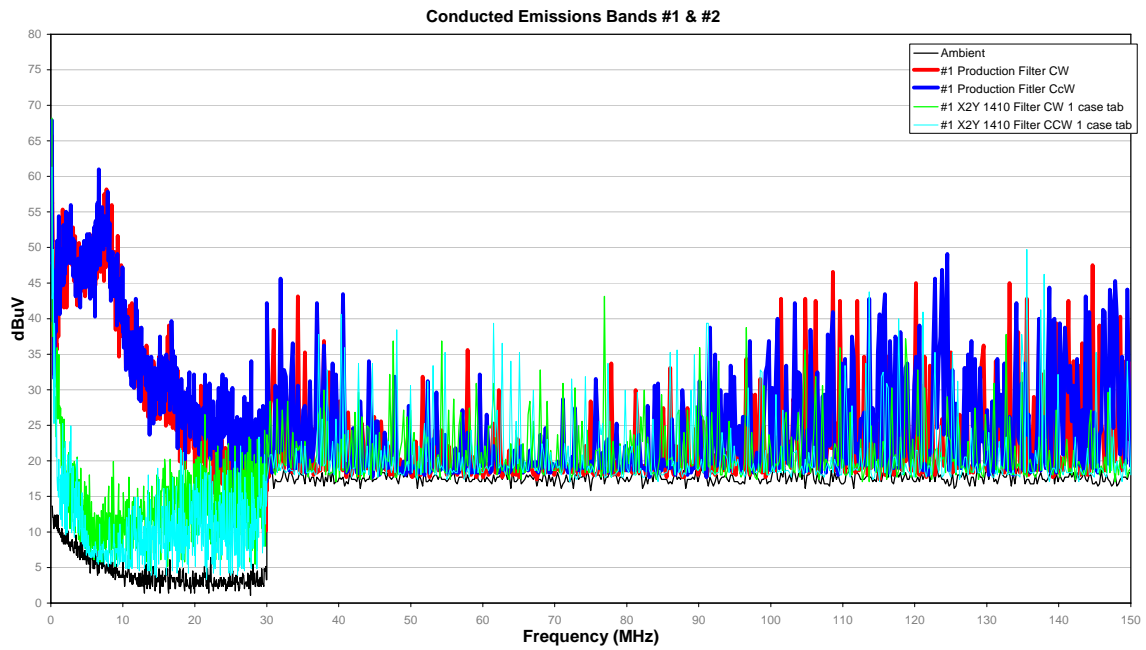
**VI. Additional Resources for EMC Filter Design and Prototyping**

Jastech EMC Consulting LLC (<http://www.jastech-emc.com/>) is capable of motor EMC prototype and design as well as interface with product engineering and EMC test facilities.

## Appendix (1) RE Emissions



## VIII. Appendix (2) CE Emissions

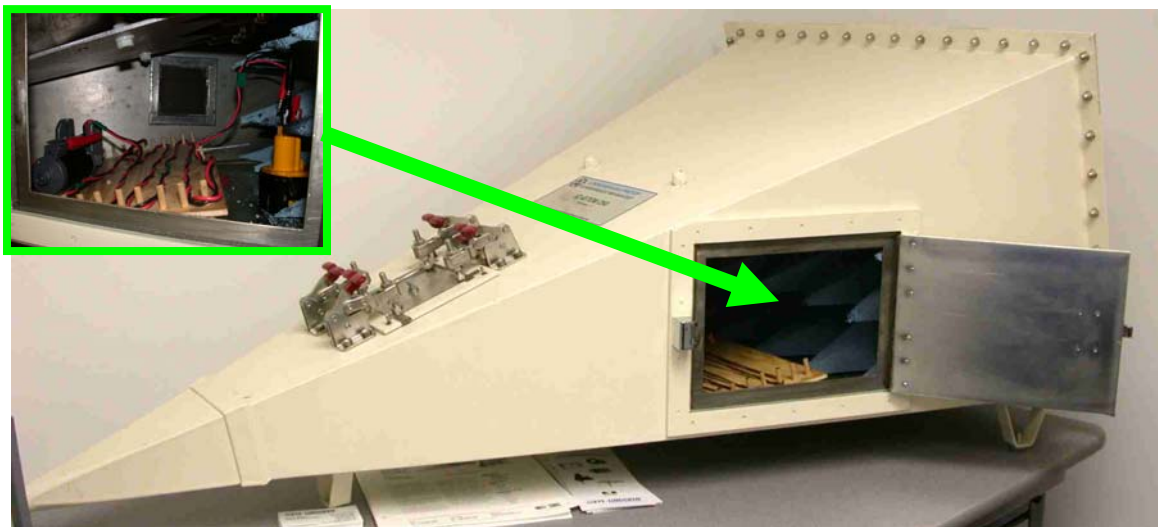


## Appendix (3) Conducted and Radiated Emissions Set-up

### Equipment Set-up

Radiated Emissions Set-up		Conducted Emissions Set-up #1 (150 kHz to 30 MHz)	
Ifr An920 Spectrum Analyzer	---	Ifr An920 Spectrum Analyzer	---
Frequency Range	100 kHz - 1 GHz	Frequency Range	150 kHz - 30 MHz
Sweep	8 x 20 ms	Sweep	8 x 50 ms
Bandwidth	120 kHz	Bandwidth	9 kHz
Video	None	Video	None
Atten	0dB	Atten	0
Gain	0dB	Gain	0 dB (external)
Measurement	dBuV, 500 points	Measurement	dBuV, 500 points
Gtem:Lindgren IC-GTEM 250	---	Shield Box 18" by 29"	---
Preamp AR LN1000	NO	Preamp AR LN1000	NO
		LISN Type 6338-5-TS-50-N ---	---
		Solar Electronics Co.	---
		Conducted Emissions Set-up #2 (30 MHz to 150 MHz)	
		Ifr An920 Spectrum Analyzer	---
		Frequency Range	30 MHz to 150 MHz
		Sweep	8 x 50 ms
		Bandwidth	120 kHz
		Video	None
		Atten	0
		Gain	0 dB (external)
		Measurement	dBuV, 500 points
		Shield Box 18" by 29"	---
		Preamp AR LN1000	NO
		LISN Type 6338-5-TS-50-N ---	---
		Solar Electronics Co.	---

### Radiated Emissions Set-up



- The DUT was placed in an ETS-Lindgren IC-GTEM 250 along with a 12 V power source connected by a 3 meter harness.
  - ➔ Note: the harness is wrapped between wooden pins on a wooden platform for repeatability of measurements.
  - ➔ Note: DUT is **NOT** tested under load conditions.

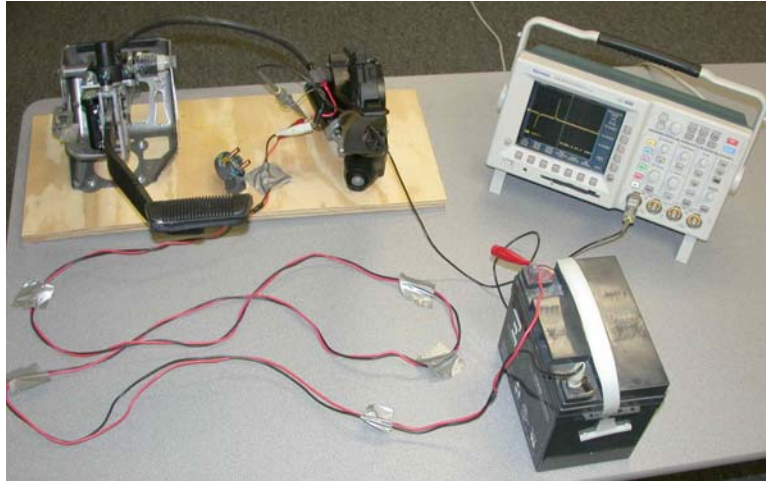
## Conducted Emissions Set-up



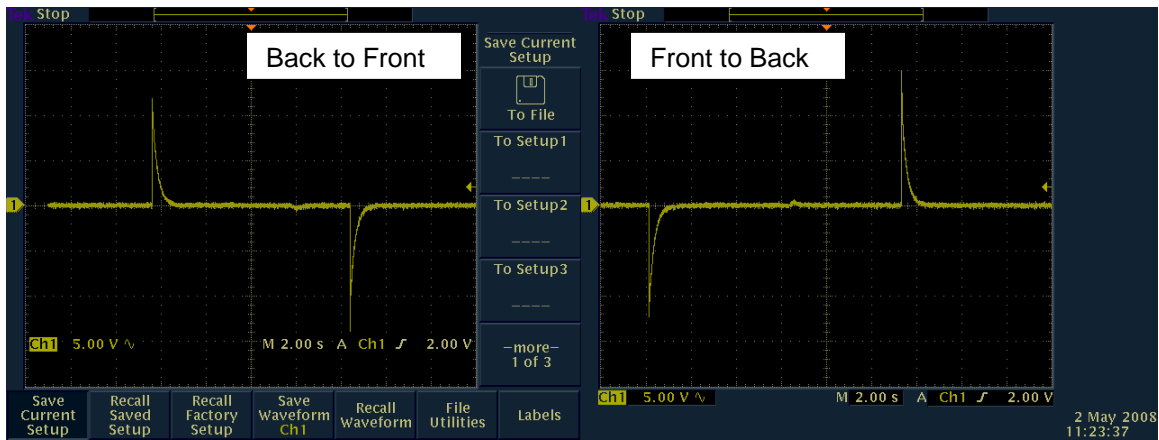
- The DUT was placed in a shield box measuring approx 29 by 18 inches.
- Between the DUT and 12 V power source are (2) LISNs Type 6338-5-TS-50N. (manufactured by solar Electronics Co.)
- There is approx 8 inches of harness between power supply & LISN and LISN & DUT.
- Note: DUT is **NOT** tested under load conditions.

## Appendix (4) Transient Results on Pedal Motor

### Equipment Set-up



### Data Production EMI Filter:



### Data Jastech Prototype EMI Filter

