



**Product Bulletin - Interpoint**

**Crane Aerospace & Electronics Power Solutions**

**NEW FMCE EMI Filters  
Fully Interchangeable with  
Interpoint Heritage Filters**



# FMCE EMI Filters Fully Interchangeable with Heritage Filters

## FILTERS MEET MIL-STD-461C (CE03 & CS01) AND MIL-STD-461D, E AND F (CE102 & CS101)

**FMCE EMI filters are fully interchangeable with existing products. The improved FMCE-1528, FMCE-0828, FMCE-0528 and FMCE-0328 EMI Filters meet MIL-STD-461D, E and F (CE102 and CS101) while continuing to meet MIL-STD-461C (CE03 and CS01). Each filter delivers the full throughput current over the full temperature range of -55° to +125°C.**

## INTRODUCTION

The Interpoint brand EMI filter line has been a solid product line for many years. The FMCE EMI filters have been developed as drop-in replacements for heritage Interpoint filters. To satisfy the demands of current and future requirements, when used with Interpoint's converters, the FMCE filters will comply with the latest revision of MIL-STD-461C (CE03, CS01), D, E and F (CE102, CS101) for conducted emissions and susceptibility while continuing to meet MIL-STD-461C CE03 and CS01

Key requirements of this product development effort were to insure that the new products continue to satisfy the requirements of MIL-PRF-38534; to meet or exceed our heritage filters' respective SMDs and datasheets; to improve the specified performance and to remain a seamless drop-in product for our customers. This document explains the steps that have been taken to ensure that the FMCE filters will pose neither risk nor nuisance in existing customer applications.

The FMCE filters demonstrate improved performance compared to our FME28-461, FMD28-461, FMC-461 and FMH-461 heritage filters but meet the form, fit and function of those filters. In the model numbers, the first two numbers are the throughput current and the next numbers are the nominal input voltage. e.g. FMCE-0828 has an 8 amp throughput current and nominal 28 Vin.

## Electronic Performance

### Refer to Performance Figures, starting on page 4, for specific information

The new filter designs included two major improvements over our existing "Heritage" filters:

1. Improved thermal management and design margin in current capability. All four new filters—FMCE-1528, FMCE-0828, FMC-0528 and FMCE-0328—have increased throughput current with the FMCE-0328 having a 100% increase over the FMH-461 heritage filter. All of the FMCE filters' currents derate linearly from 100% at 125°C to 80% at 135°C. Even with these higher currents the internal hotspot temperatures of all magnetics has been reduced when compared with the heritage product. The previous and improved currents ratings are:
  - FMCE-1528 up to 15 A with improved margin (compare FME28-461)
  - FMCE-0828 up to 8 A (compare FMD28-461 at 7 A)
  - FMCE-0528 up to 5 A (compare FMC-461 at 2.7 A)
  - FMCE-0328 up to 3 A (compare FMH-461 at 1.5A)
2. Improved stability when interfacing with Interpoint converters. High current capability filters such as FMCE-1528 and FMCE-0828 have been carefully designed with an extra damping network on the output to pass the latest CE102 specification. Similarly the other filters, FMCE-0528 and FMCE-0328 have been designed to improve stability for use with multiple converters even at the lowest input line voltage.
3. All filters provide continuous operation over the input voltage range of -0.5 to +50 VDC.

These major design improvements have been carefully managed with our customers in mind to be backward compatible with existing filters. DC resistance, attenuation, case capacitance and output impedance are no greater than the existing product, and in some cases have been reduced from the values in the existing filters. The worst case analyses and mean time between failures (MTBF) analyses updates are available upon request.

## DC Resistance

The DC resistance test is performed on 100% of the products shipped to ensure build consistency. The results and test limits for this DC resistance test remain similar to the heritage filters as indicated on the FMCE datasheets and SMDs.

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## **Power Dissipation**

The power dissipation is naturally increased due to the higher capability of output current. The DC resistance is lower or remains the same as the heritage filters. When using the same throughput current, the power dissipation will not increase if a heritage filter is replaced with a new filter.

## **Quality**

### **Process Qualification**

New process qualification requirements per MIL-PRF-38534 have been completed as applicable.

### **Component Qualification**

New component qualifications per MIL-PRF-38534 have been completed as applicable.

## **Reliability**

### **Life Testing**

As part of product development assurance, HALT (highly accelerated life test) was performed to demonstrate robustness under extreme conditions.

## **Radiation**

Not applicable.

## **Interchangeability**

### **Electrical**

Electrically the user will see improvements in meeting CE102 and major improvements in thermal management. Internal power dissipation, output impedance, noise attenuation, and current capacity have been improved.

### **Mechanical**

Mechanically the user will not see any difference, all FMCE filters will be drop-in replacements for their corresponding heritage filter.

## **Mechanical**

### **Size**

The package sizes of all the filters remain the same as the heritage filters. Additionally the FMCE-0828 down-leaded filter is available in a non-flanged case (the heritage filter, FMD28-461 did not offer that option).

### **Vibration and Acceleration**

Vibration and constant acceleration qualification levels per MIL-PRF-38534 and /883 test methods referenced by Interpoint's internal QA procedure have been applied to the new filters successfully. FMCE filters passed an additional random vibration test of 31.5g rms.

### **Thermal Performance**

Case temperature rises at the maximum rated current for the filters were measured and correlated with our thermal electrical stress analysis. Under the same conditions the temperature rise of the FMCE filters is lower than the temperature rise of their respective heritage filters.

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## **Weight**

The FMCE filters weights are either equal to, or less than, the heritage filters maximum weight.

## **Marking**

The FMCE filters introduce new marking in a dark green ink with the variable characters (serial number, date code, etc.) in black ink stamped directly on the metal cover.

## **Packaging**

The packaging has not been changed except for the new FMCE-0828 down-leaded product. The heritage FMD28-461 is not a QML product. In order to improve the FMCE-0828 down-leaded product for submittal to qualification for QML status, the package was changed to a “bathtub” design. The dimensions and pinout remain the same as the heritage filter but the package and lead finish as well as the seal method are different. Additionally, the FMCE-0828 will be available in a non-flanged down-leaded case. Refer to the datasheets links below for more information.

Mechanical, Specification: The changes are within the envelope of the heritage filter SMD and/or datasheet documents.

## **Documentation**

Control Procedures or Records: No changes

Changes to SMD, datasheets or application notes: New SMDs will be applied for through DSCC and new FMCE datasheets are available. The FMCE SMDs and datasheets will follow the heritage filters but will reflect the improved performance.

## **SUMMARY**

Interpoint’s new line of FMCE filters provides the opportunity to procure a product with improved performance that exceeds the requirements of our heritage filters. Interpoint has been very conscious of its customers’ needs and has performed extensive testing to ensure seamless use in existing applications.

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## **PERFORMANCE FIGURES: COMPARISON PLOTS AND FMCE SCHEMATICS**

Figures on the following pages show the FMCE EMI filters’ performance plots and schematics.

CE03 plots (MIL-STD-461C), Figures 1 - 8

CE02 plots (MIL-STD-461D, E and F), Figures 9 - 12

Compare output impedance with heritage filters, Figures 13 - 20

FMCE schematics, Figures 21 - 24

For full specifications, download the datasheets

FMCE-1528 [www.interpoint.com/F09](http://www.interpoint.com/F09)

FMCE-0828 [www.interpoint.com/F10](http://www.interpoint.com/F10)

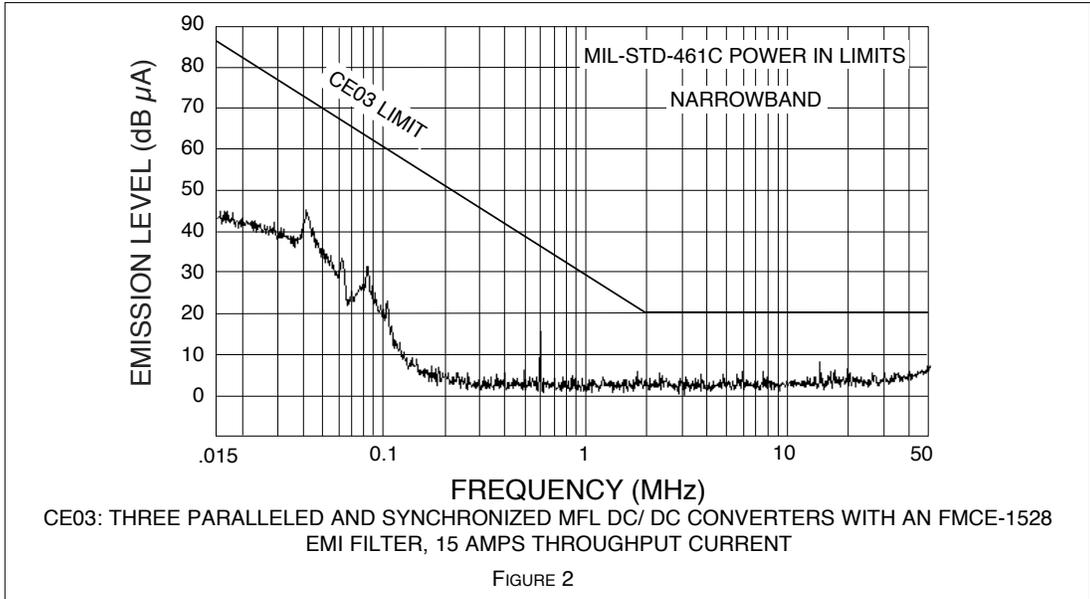
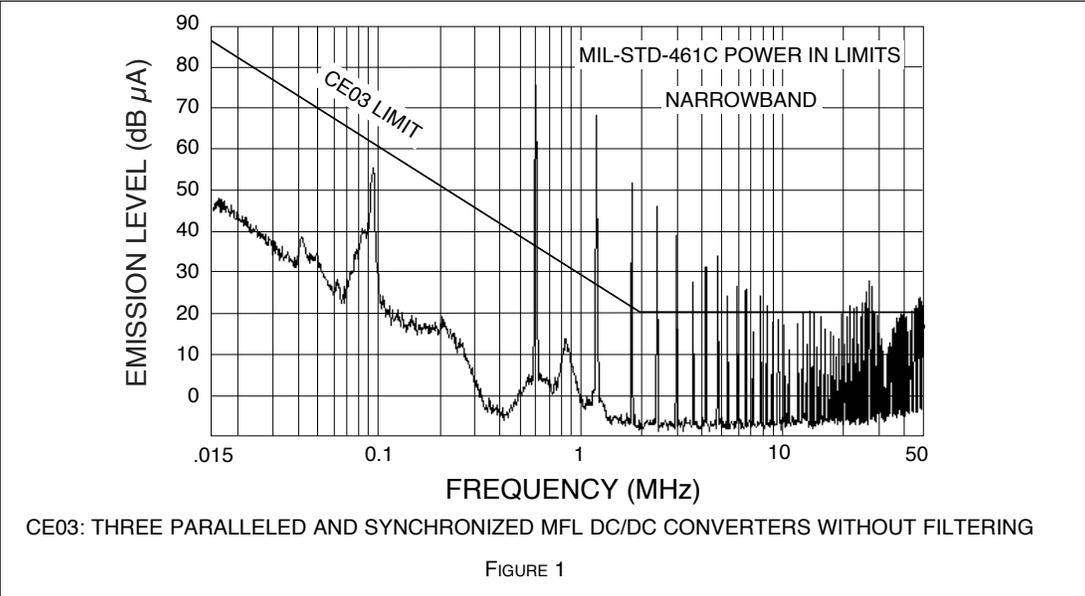
FMCE-0528 [www.interpoint.com/F11](http://www.interpoint.com/F11)

FMCE-0328 [www.interpoint.com/F12](http://www.interpoint.com/F12)

# FMCE EMI Filters Fully Interchangeable with Heritage Filters

## PERFORMANCE FIGURES: COMPARISON PLOTS AND FMCE SCHEMATICS

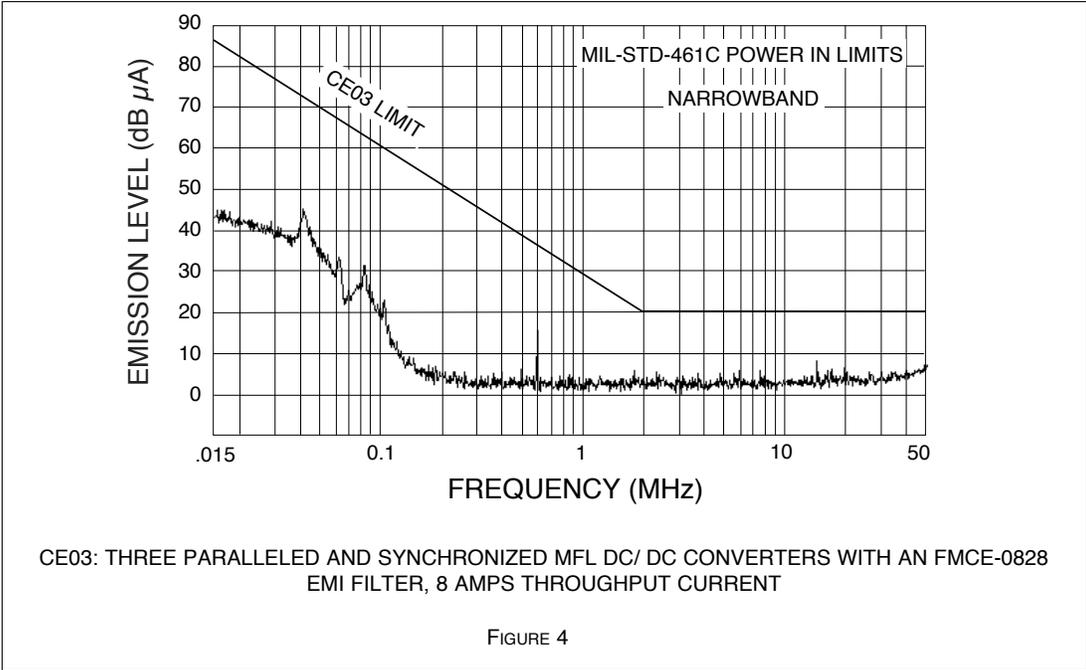
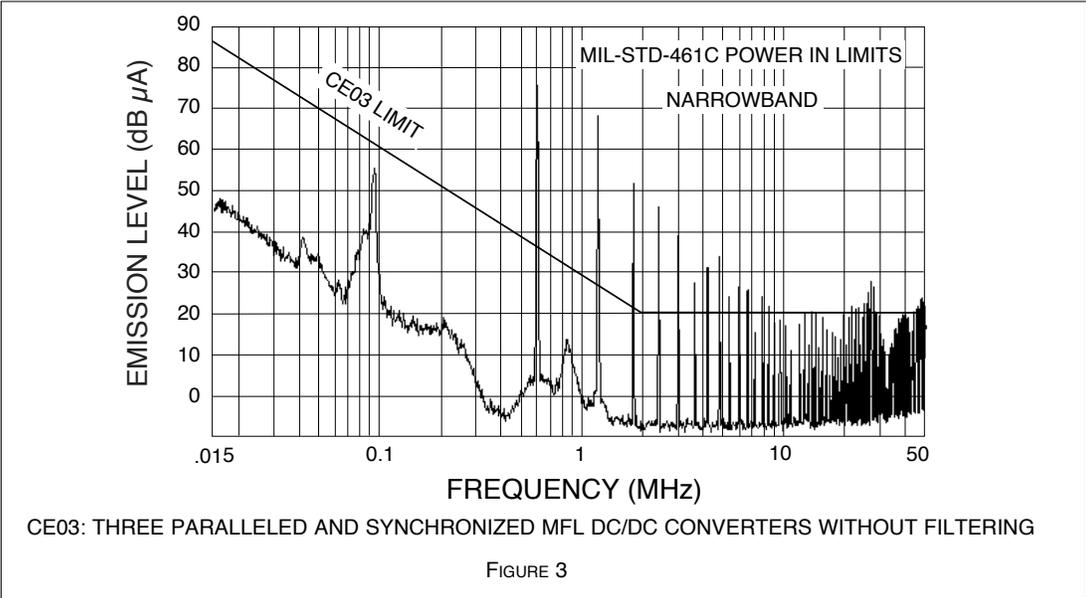
### CE03 performance, meets MIL-STD-461C



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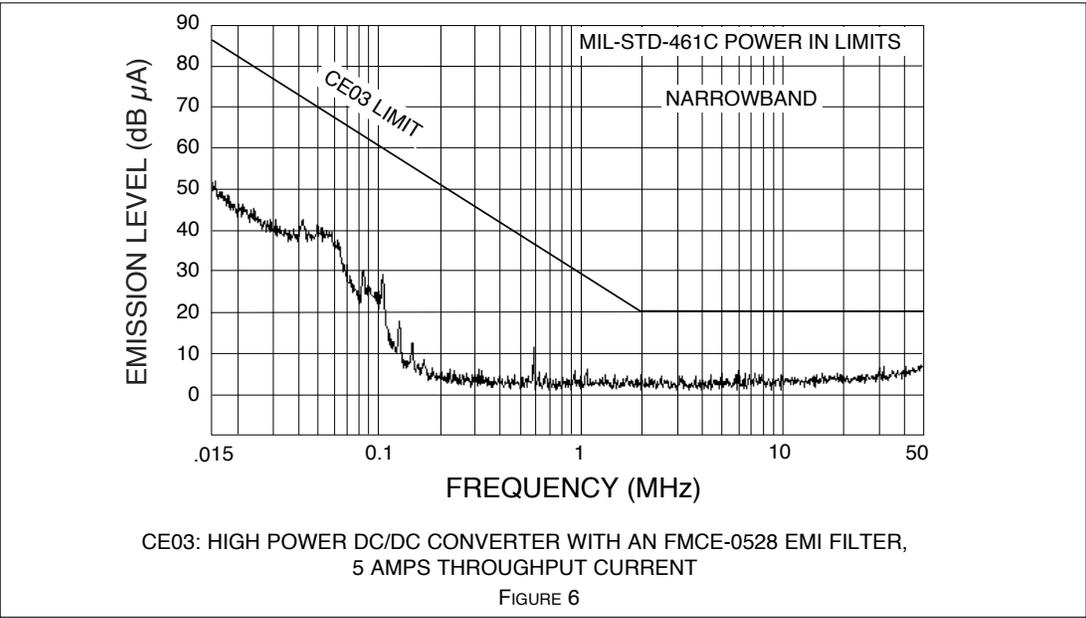
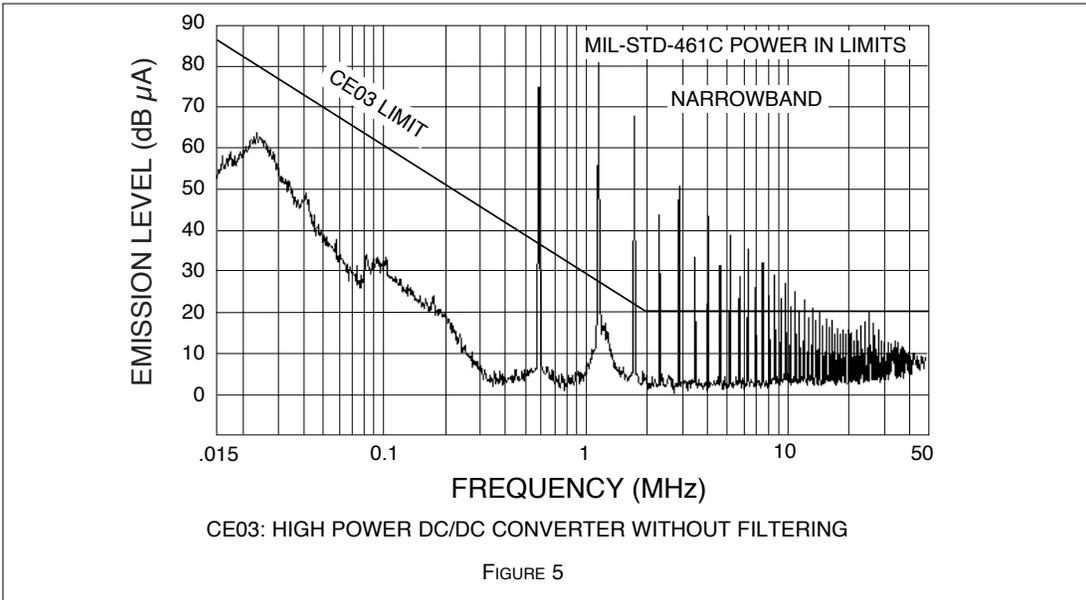
### CE03 performance, meets MIL-STD-461C



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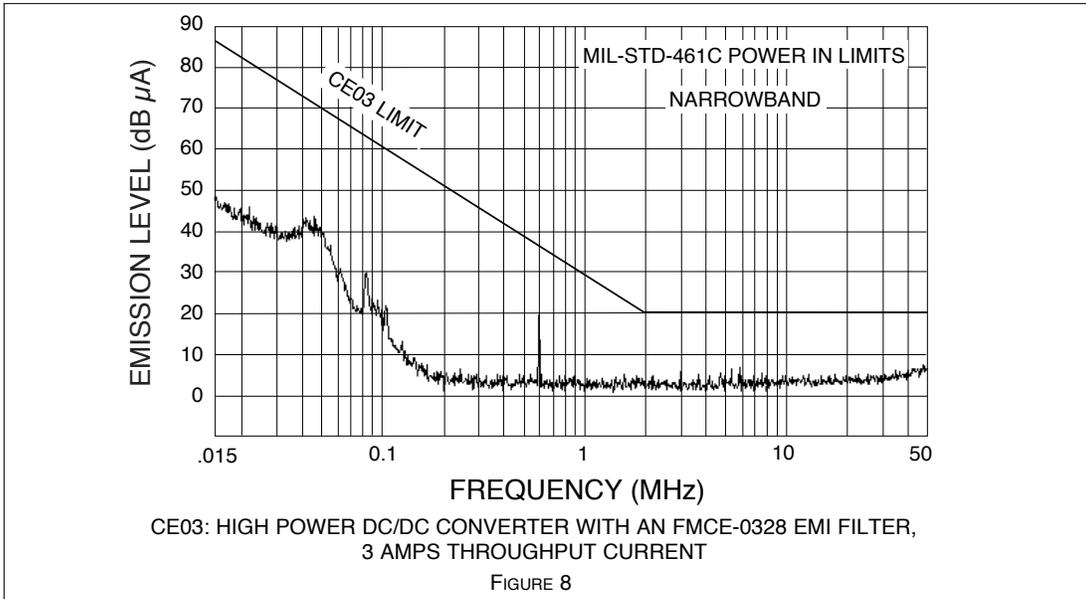
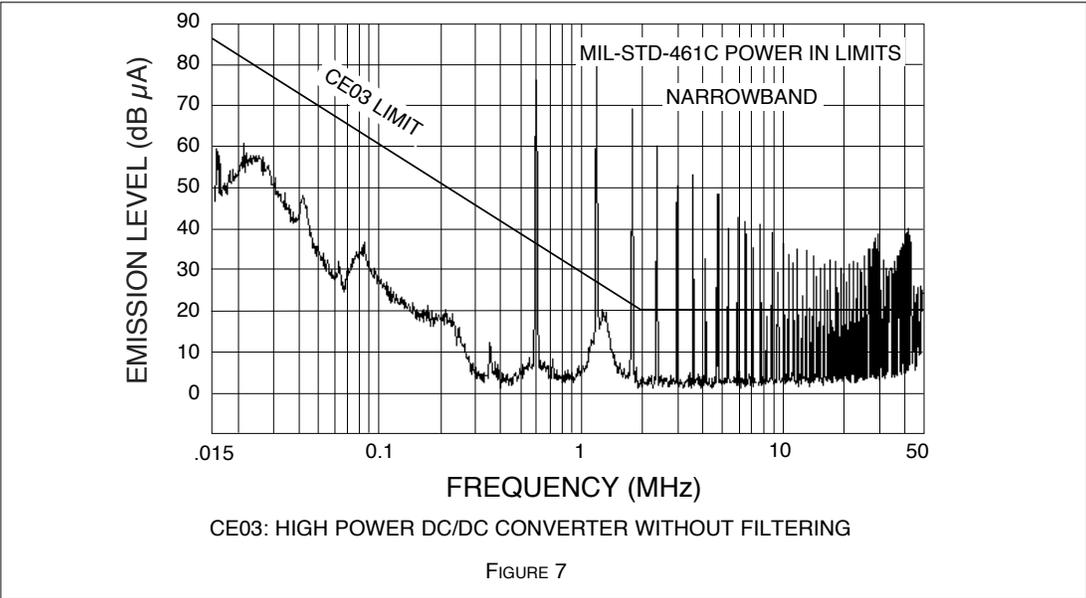
### CE03 performance, meets MIL-STD-461C



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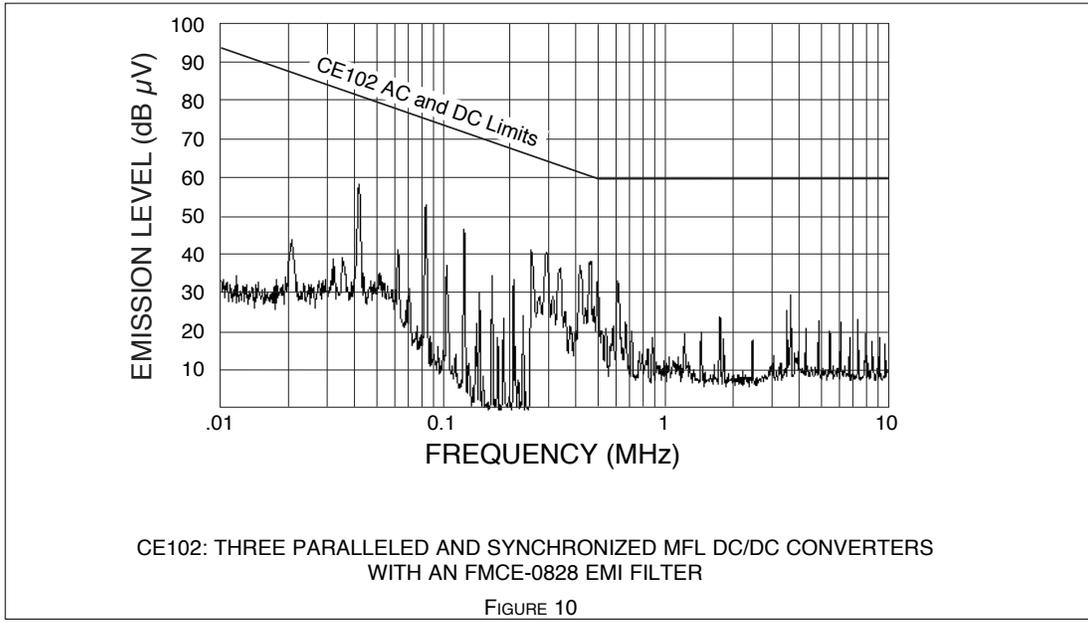
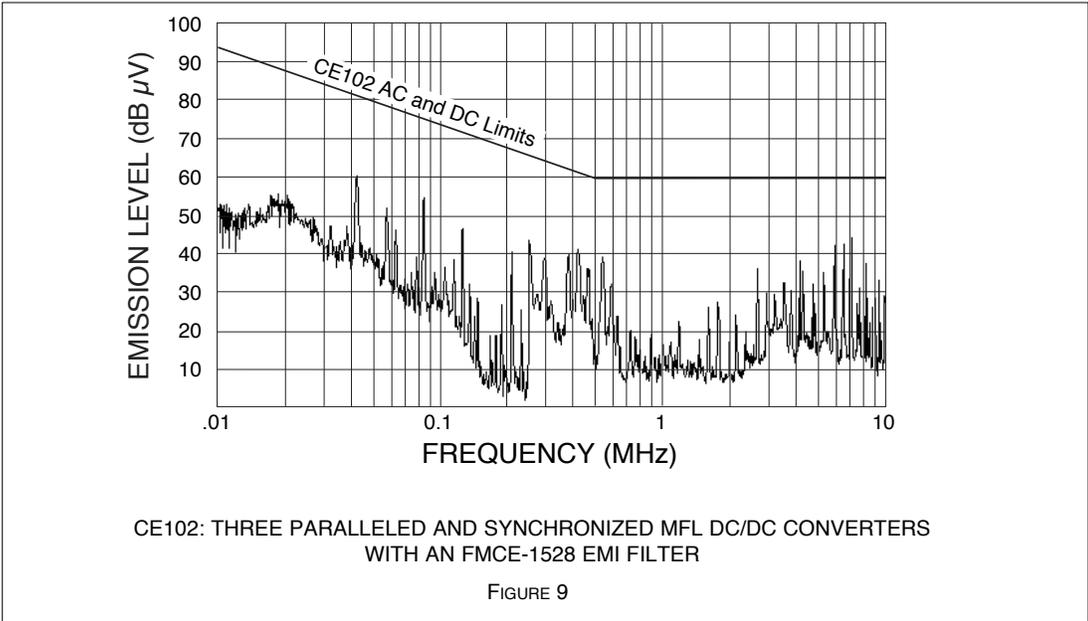
### CE03 performance, meets MIL-STD-461C



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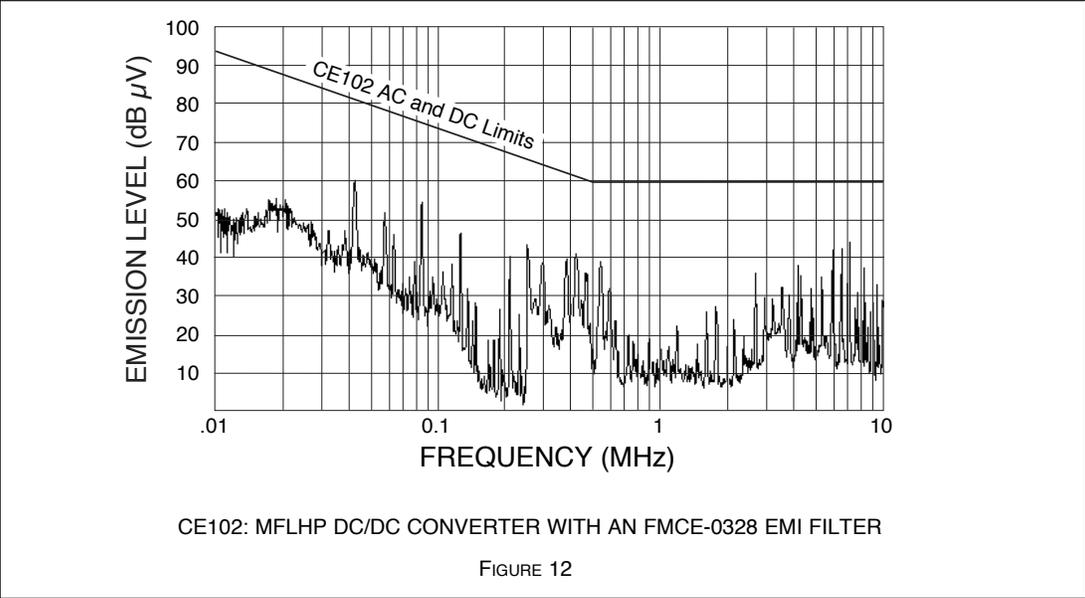
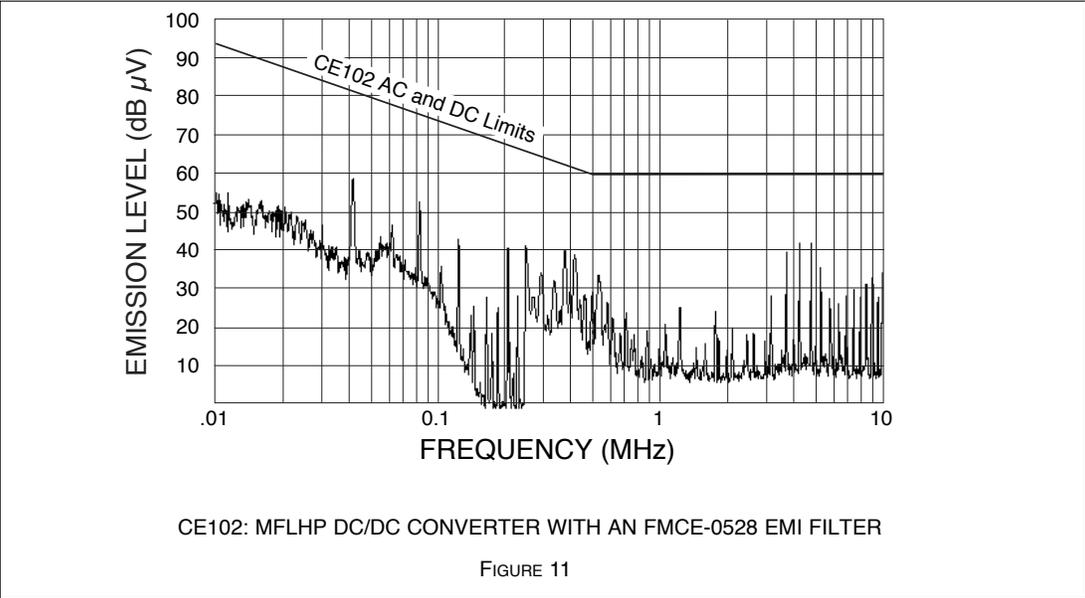
CE102 performance, meets MIL-STD-461D, E and F (heritage filters do not meet CE102)



# FMCE EMI Filters Fully Interchangeable with Heritage Filters

## PERFORMANCE FIGURES: COMPARISON PLOTS AND FMCE SCHEMATICS

CE102 performance, meets MIL-STD-461D, E and F (heritage filters do not meet CE102)

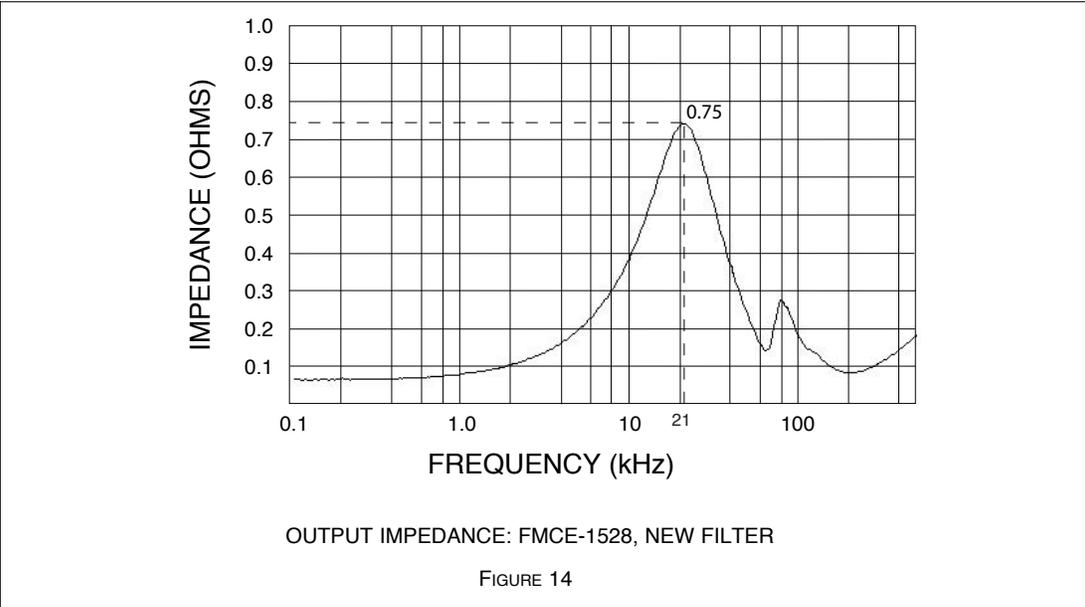
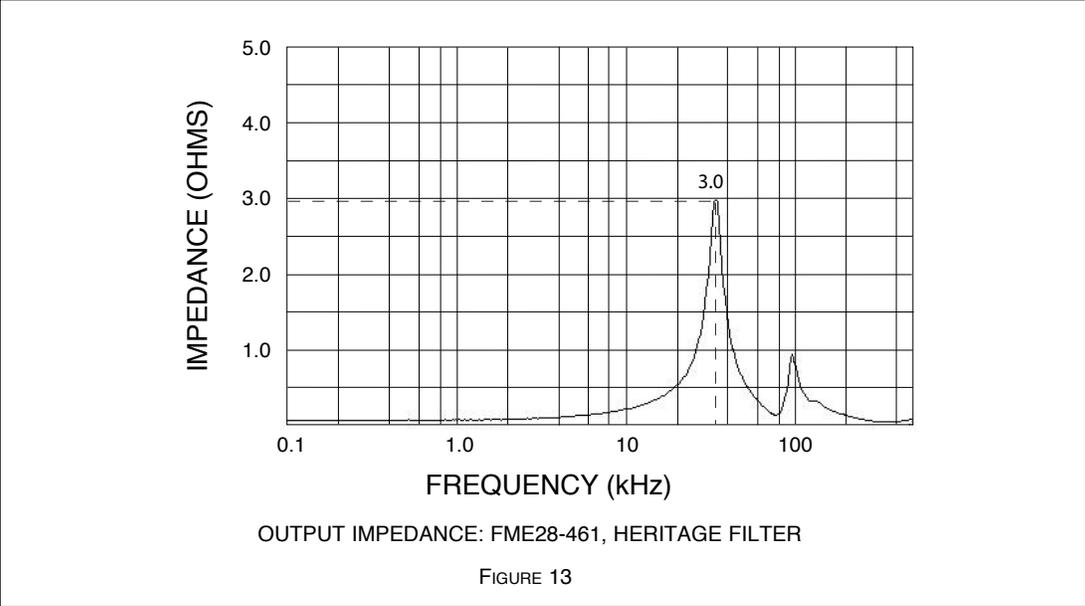


# FMCE EMI Filters Fully Interchangeable with Heritage Filters

## PERFORMANCE FIGURES: COMPARISON PLOTS AND FMCE SCHEMATICS

### Compare output impedance

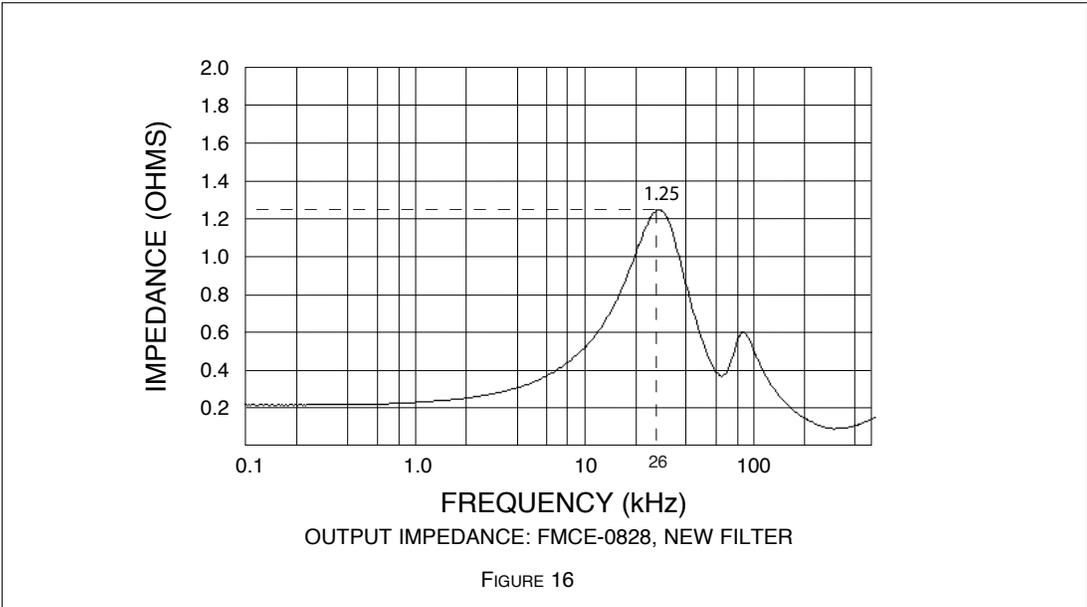
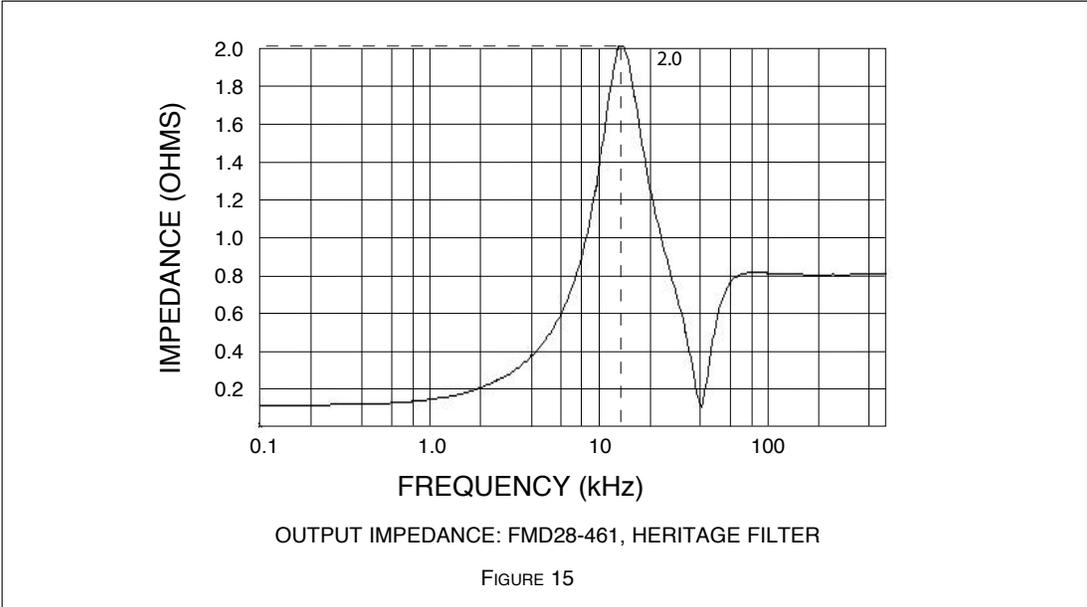
The output impedance over frequency of the new FMCE filters shown below in the spectrum analyzer plots exhibits a resonance point and amplitude much improved over the FME heritage filters, and significantly improved compared to the FMD, FMC and FMH heritage filters. The output impedance is measured at the output with input pins shorted.



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## PERFORMANCE FIGURES: COMPARISON PLOTS AND FMCE SCHEMATICS

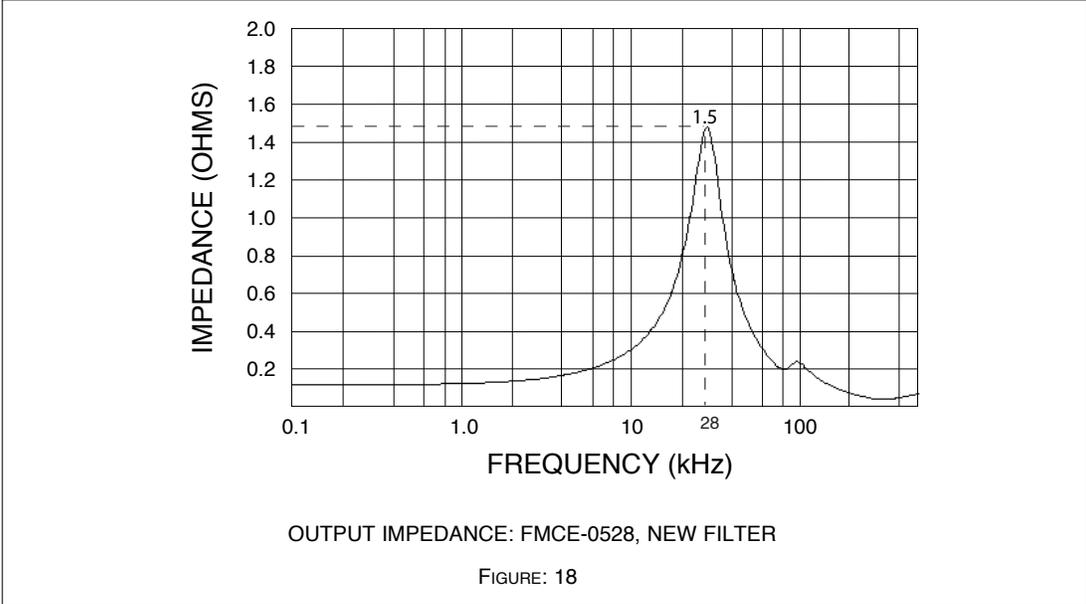
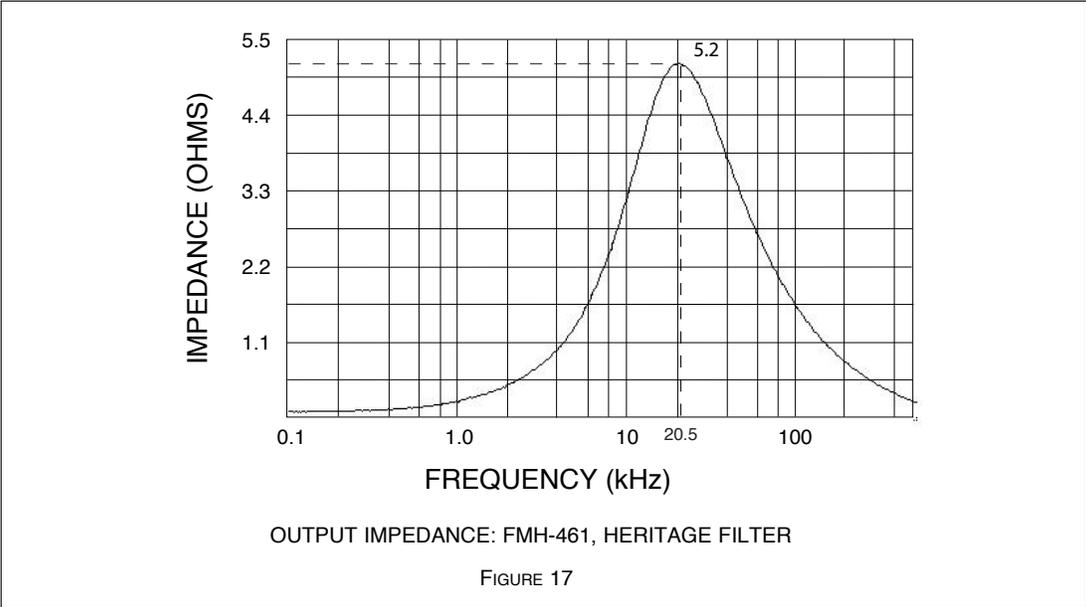
### Compare output impedance



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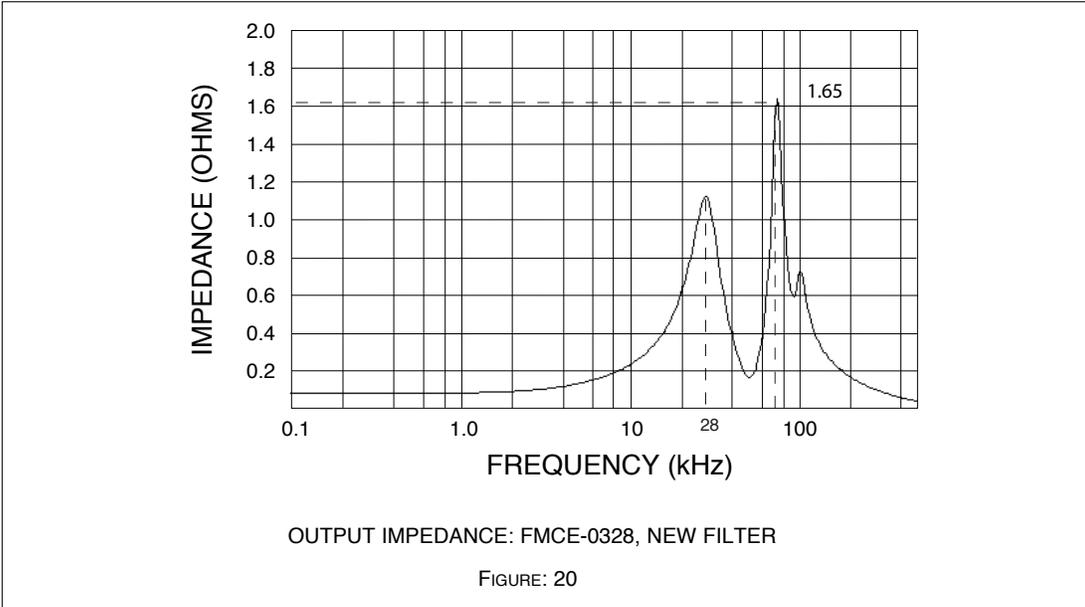
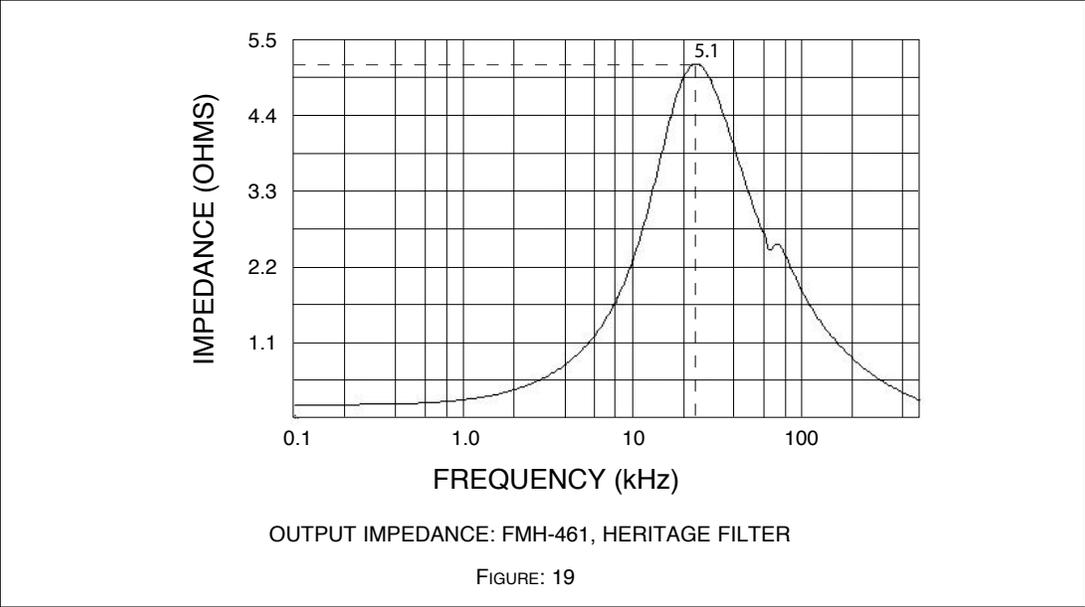
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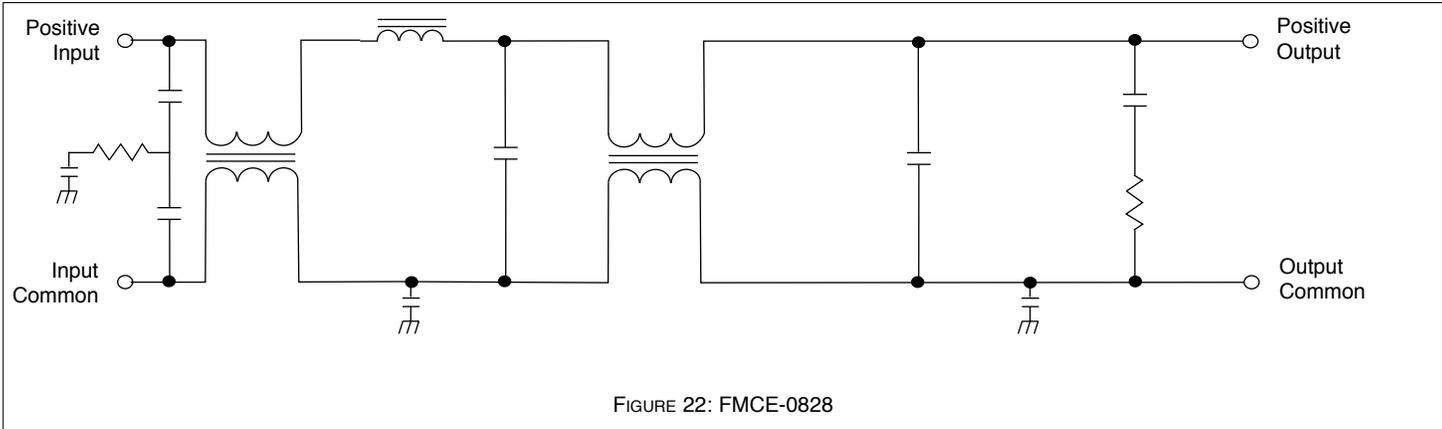
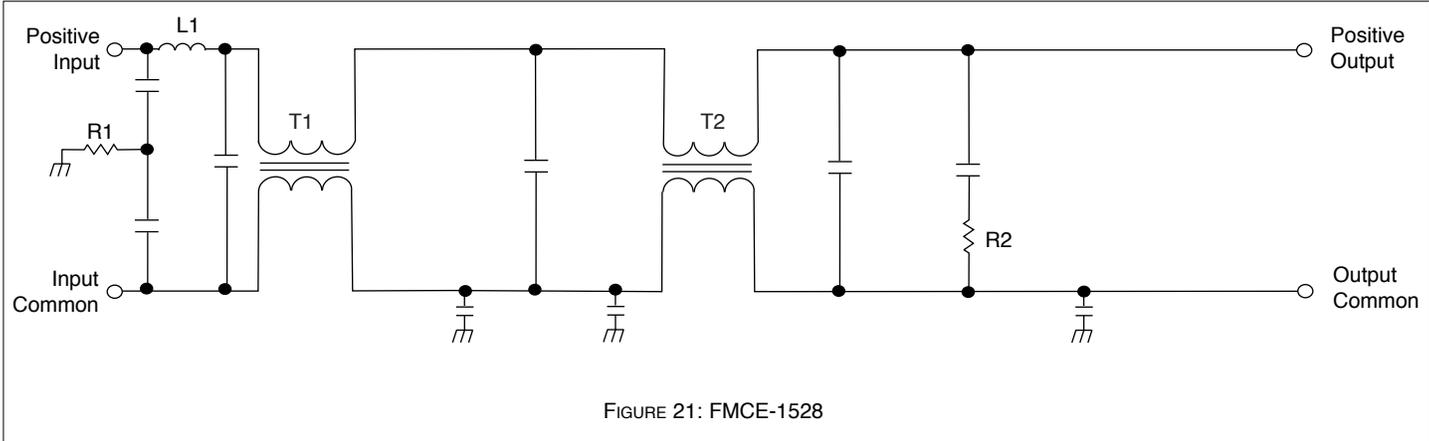
### Compare output impedance



# FMCE EMI Filters Fully Interchangeable with Heritage Filters

## PERFORMANCE FIGURES: COMPARISON PLOTS AND FMCE SCHEMATICS

### FMCE Schematics



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