



IEEE  
Welcome to



[www.EESeal.com](http://www.EESeal.com)



# A Simple Production Solution: EESeal® Silicone Rubber Inserts for Connectors



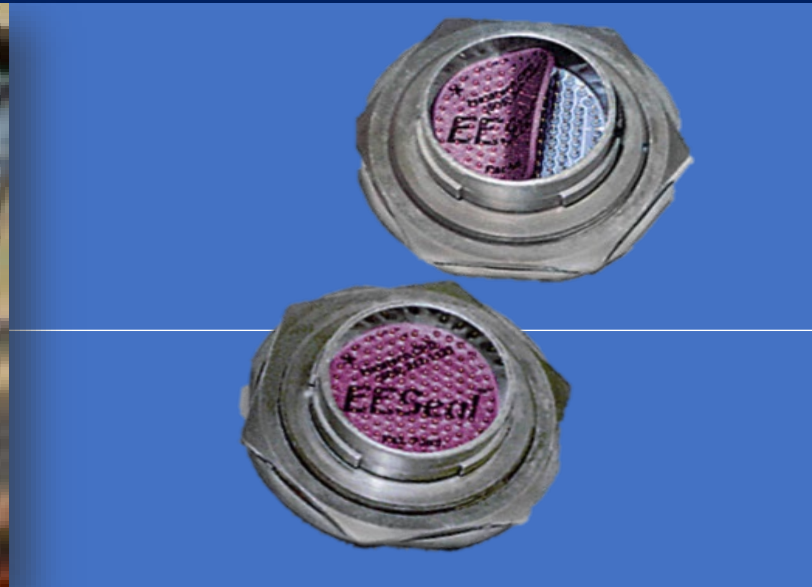
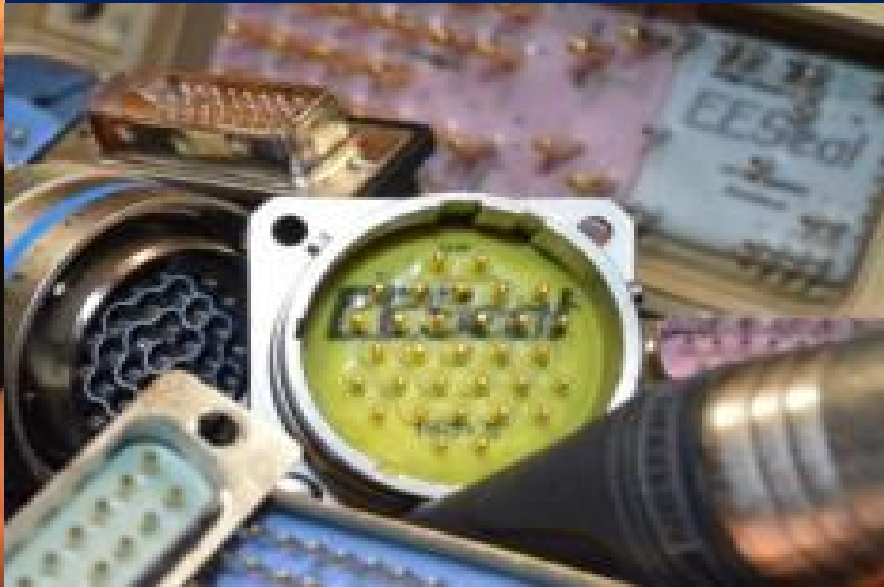
## Scott Lindberg

Mr. Lindberg is the Vice President at Quell Corporation, Albuquerque, NM. Scott has been in electronics industry for over 30 years and previously worked in the semiconductor industry as VP of Sales & Marketing Operations for Microsemi Corporation. Throughout his career he has served on many boards and committees and occupied most of the executive committee positions for the Electronics Representative Association (ERA). He became a Certified Professional Manufacturer's Representative (CPMR) early in the program and then became a member and officer for the Board of Governors that has oversight of the program. He also was a member of the executive committee of the Manufacturer's Representative Educational Research Foundation (MRERF). Lindberg received a B.A. degree in Business Administration from the University of New Mexico

## Content

- About Quell
- Silicone Rubber Packaging Technology
  - How it works
    - EMI Filtering, ESD Protection, etc.
- Applications
- Where to get more information

# Your Quell EESeal Electronic Rep – WI and IL!



Brainard-Nielsen Marketing, Inc.



## About US...

- Quell's mission is to provide the best niche product, delivery, quality & service available in the EMI/ESD/TVS suppression market
- 12,000 sq. ft. facility in Albuquerque
- 50+ dedicated Quellians
- Quality Management System registered to:
  - ISO 9001:2015
  - AS9100D
  - Proudly made in the USA





# History...



1994 – Founded Metatech Commercial Products Div - ABQ



1995 – Applied for EESeal® Patent



2003 – Quell Corporation spun-off from Metatech



2009 – AS9100 quality certification



2012 – Expansion into new 12,000 sq ft facility



2013 – Over 1,000,000 EESeals® sold



2014 – Manufacturers Representatives & Distributors



2015 – EESeal+, EESeal Inside the connector



2016 – Patent received for EESeal+®



2019 – Acquired by HEICO Corporation



# ***EESeal***® is our Silicone Rubber Packaging Technology.

- **EESeal's® unique elastomeric body & adaptive interconnect system\* suspends, isolates & protects discrete electrical components**
  - Entire assembly can radically change shape and size in response to external forces
  - Individual components and interconnections move as body changes shape while maintaining electrical and mechanical integrity
  - Body acts as conformal coat & electrical isolation for suspended components
  - Natural compressive forces exploited to create re-usable electrical contacts that can withstand extreme abuse
    - Severe misalignments, vibration, wrong pin sizes...
  - Environmental seal created for the host location



\* US Pat 5,686,697

# ***EESeal***® is our Silicone Rubber Packaging Technology.

- **EESeal inserts in to any connector in seconds**
  - no soldering
  - no tools required
- **Multiple Uses**
  - EMI/RFI Filtering
  - Transient Protection
  - Add pull up resistors
  - Short pins, redistribute power
  - Add Grounding - Short coax shields

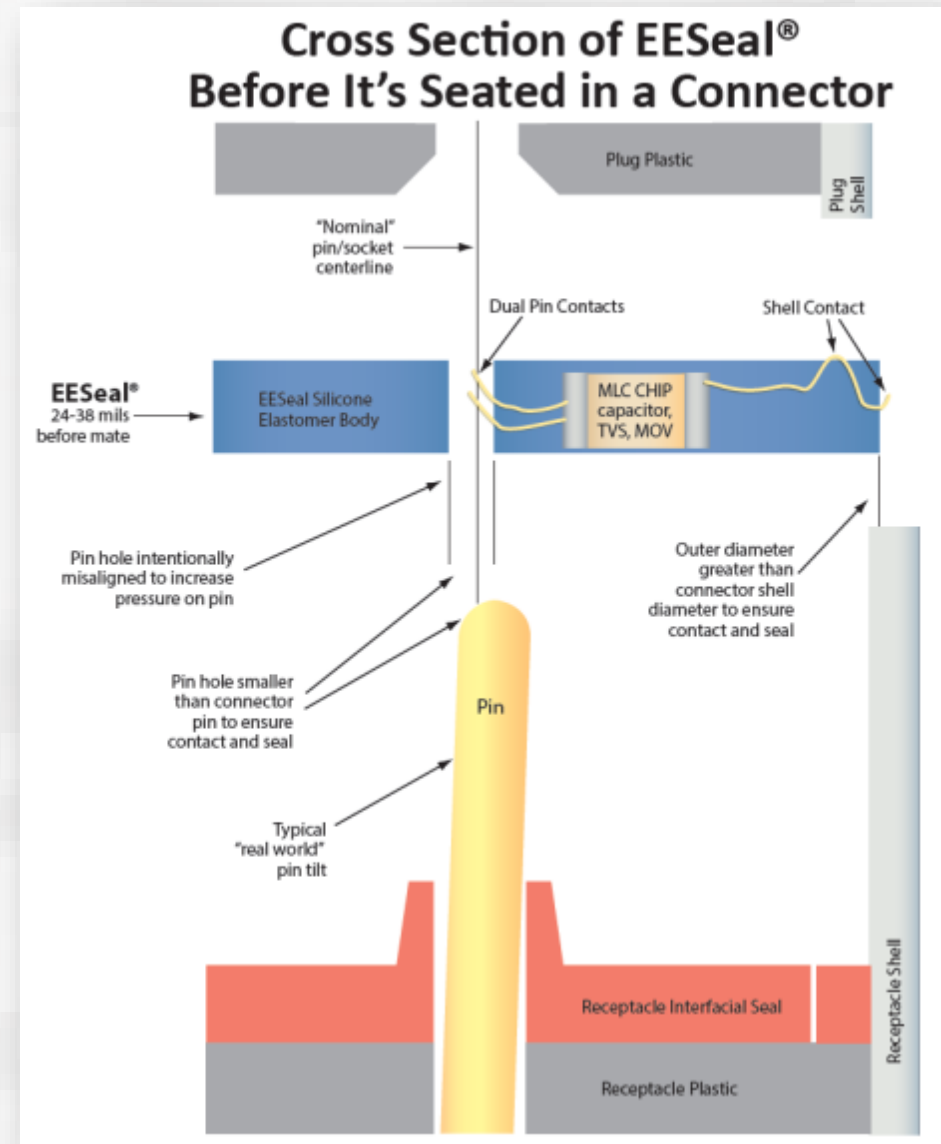




# Patented *EESeal*<sup>®</sup> Design is Unique...

No “brittle” spring metal contacts (e.g., BeCu)

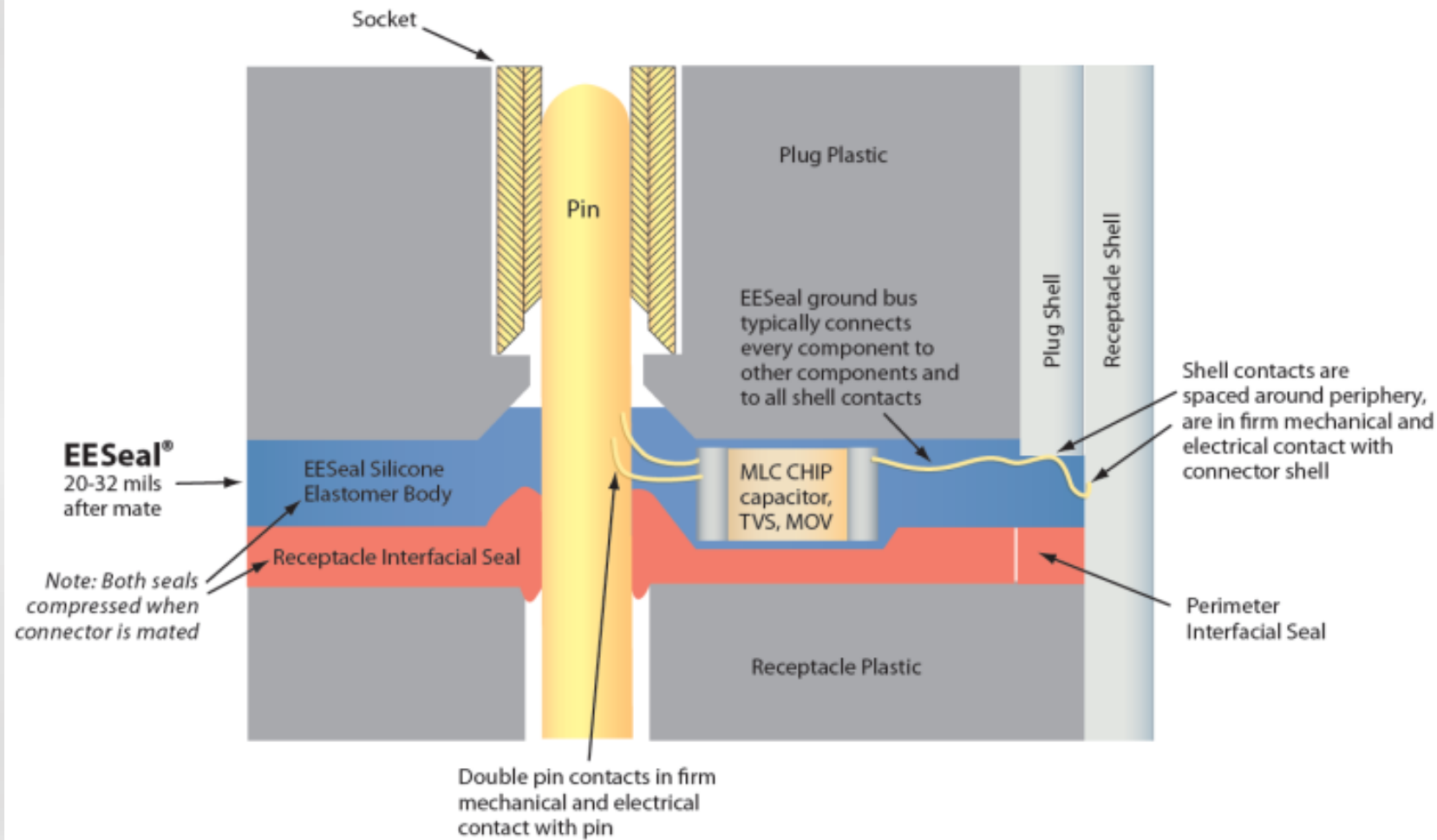
- Designed to accommodate severe misalignment and mismatch
- Will not be over “sprung” by any overstress during installation or use





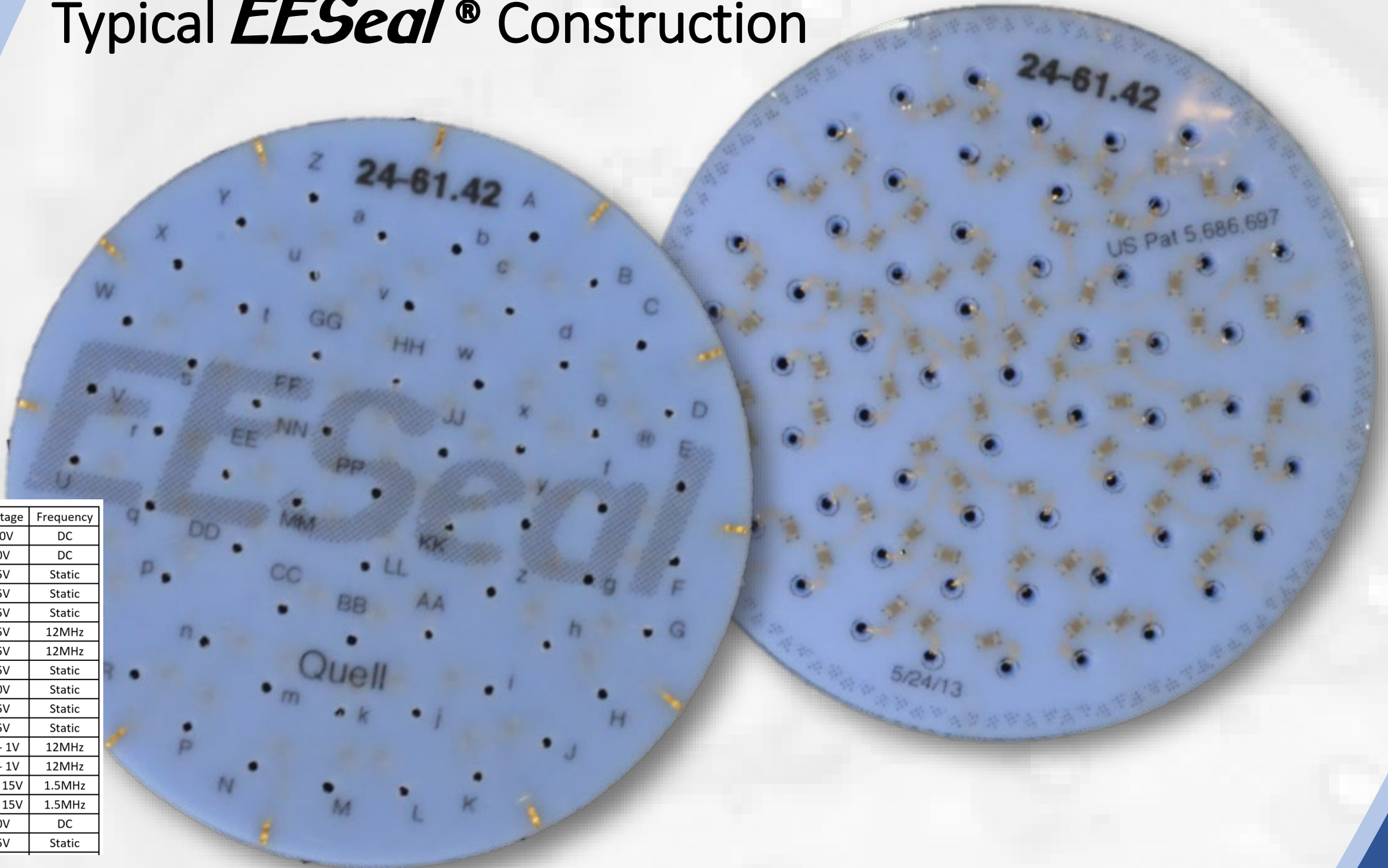
# EESeal® “At Home” at the Connector Interface

## Cross Section of EESeal® After It's Seated in a Connector



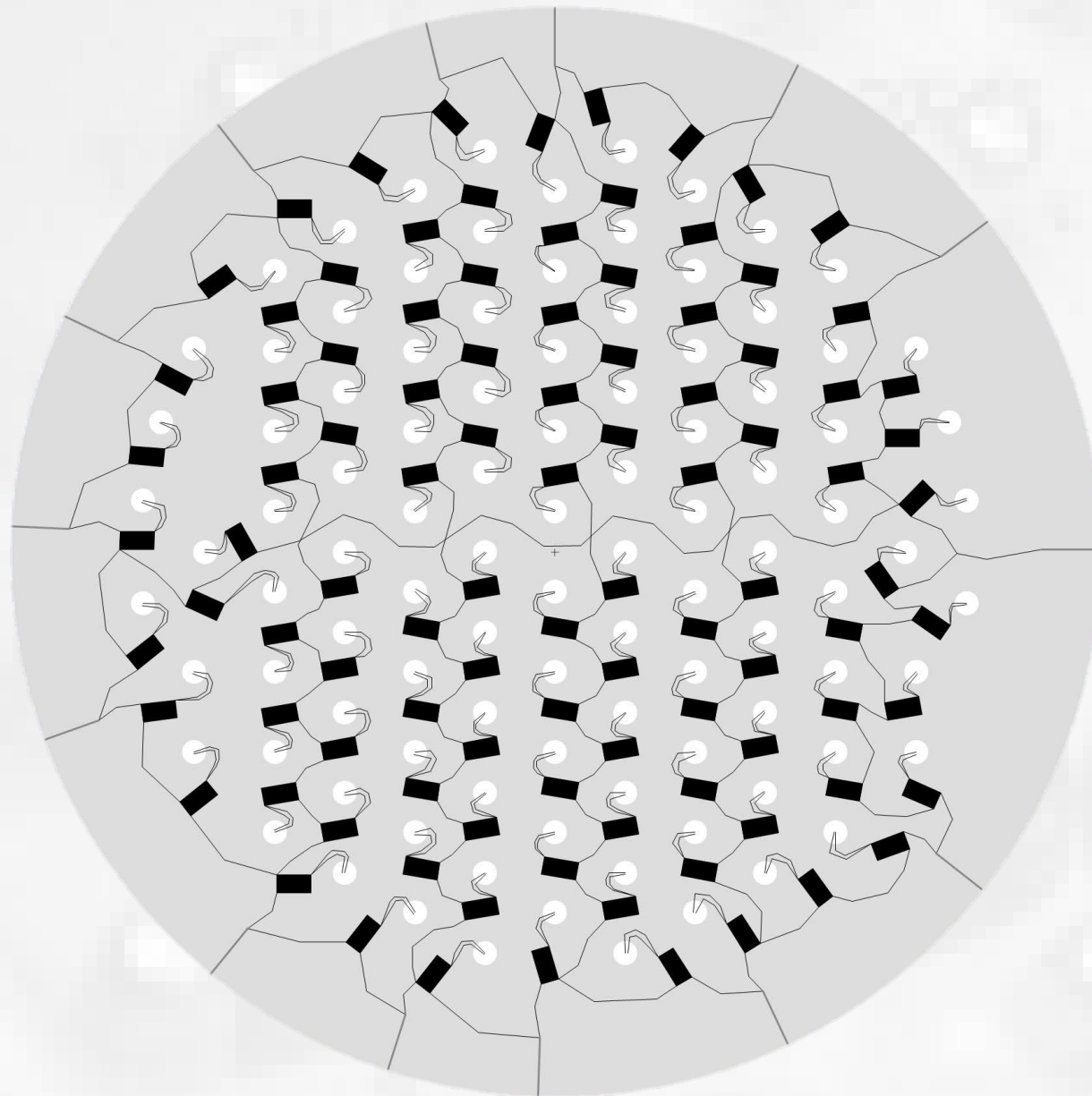


# Typical *EESeal*® Construction



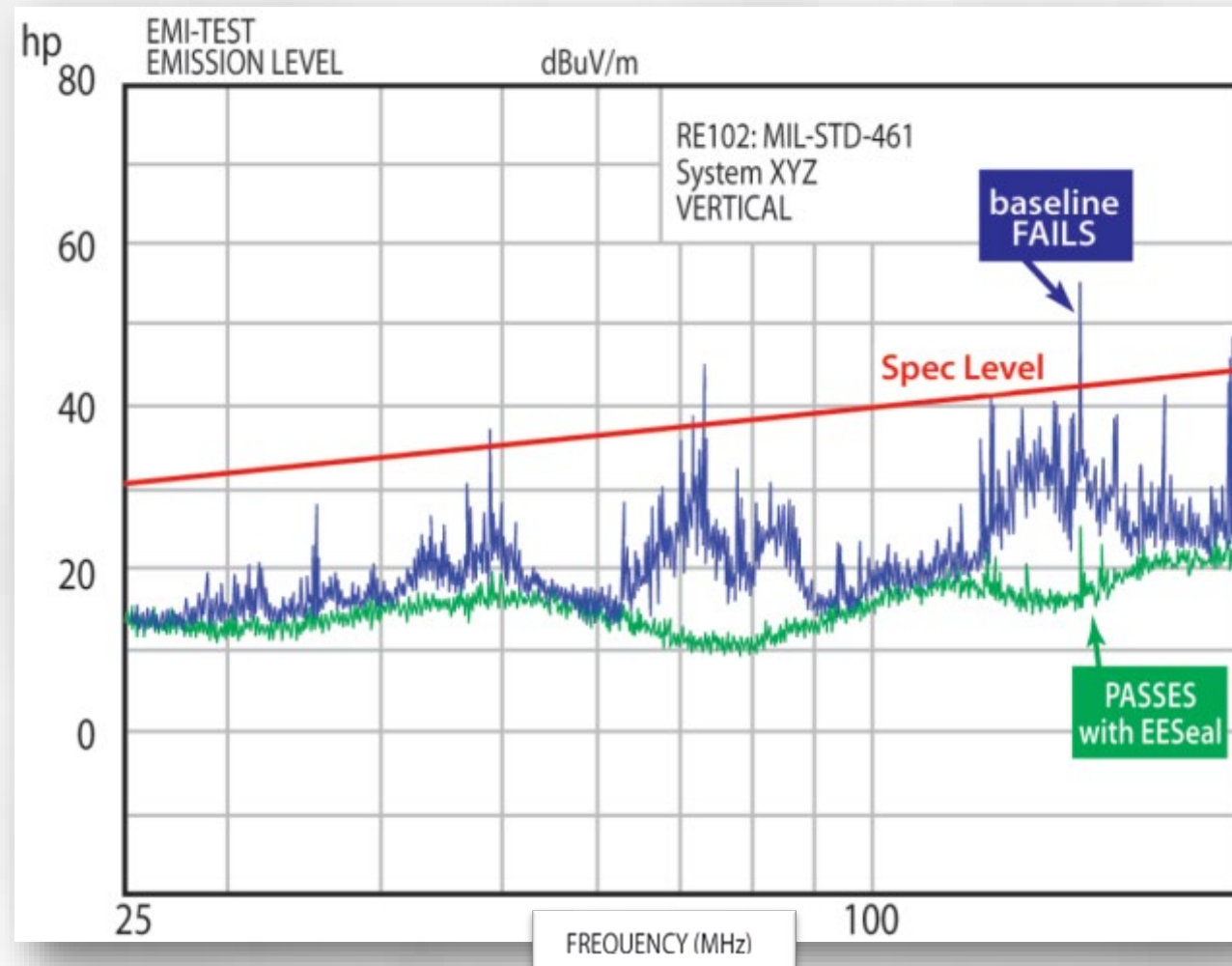
Pin	Signal	Voltage	Frequency
1	PWR	40V	DC
2	PWR_RTN	0V	DC
3	MODE	5V	Static
4	GAIN	5V	Static
5	POL	5V	Static
6	USBP	5V	12MHz
7	USBN	5V	12MHz
8	CONTROL	5V	Static
9	CONTROL_RTN	0V	Static
10	LVL_MODE	5V	Static
11	LVL	5V	Static
12	SDVP	+/- 1V	12MHz
13	SDVN	+/- 1V	12MHz
14	232_RX	+/- 15V	1.5MHz
15	232_TX	+/- 15V	1.5MHz
16	232_RTN	0V	DC
17	G_LOCK	5V	Static

# Typical *EESeal*® Construction



# EESeal<sup>®</sup> in Action...

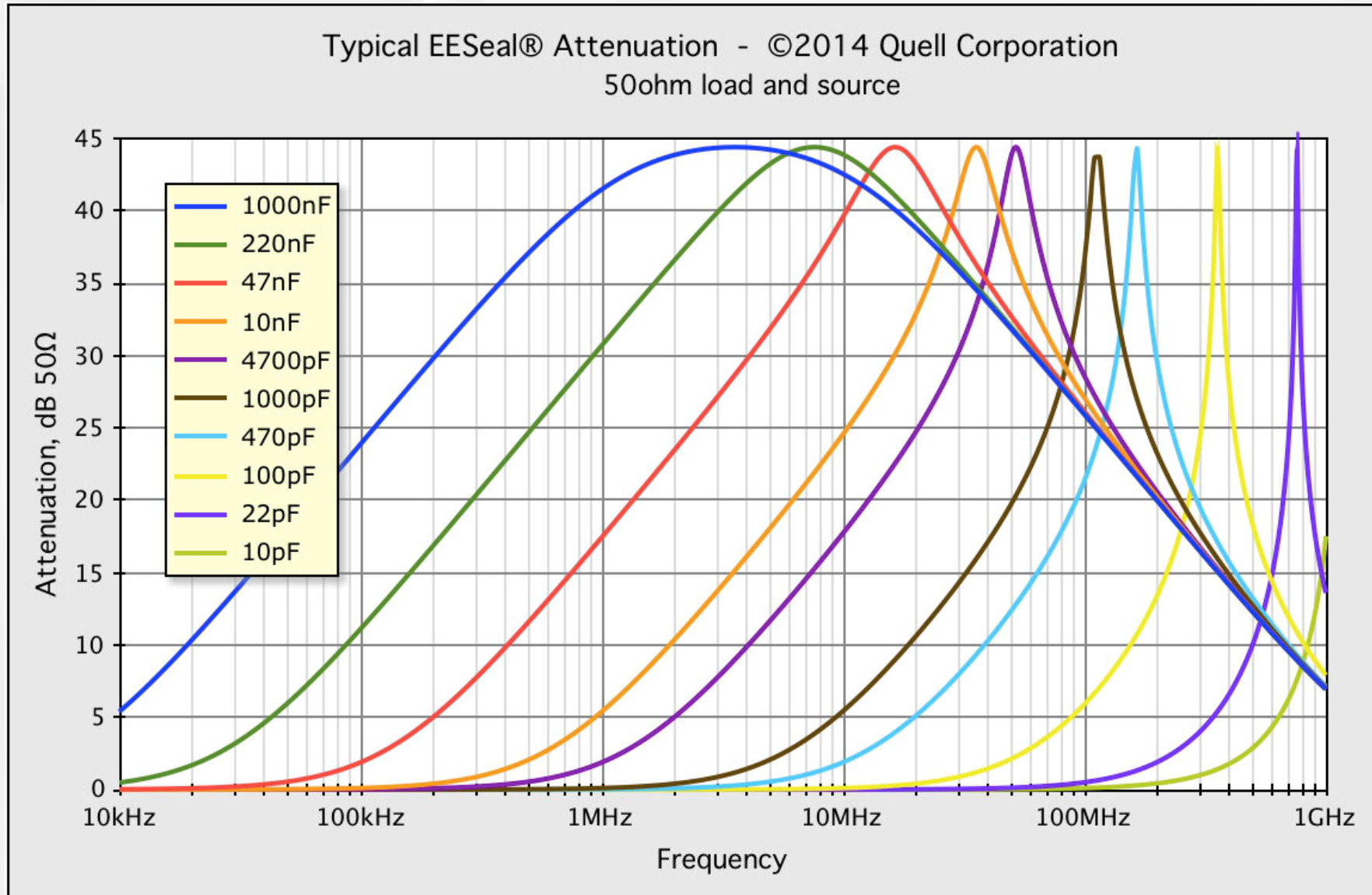
- The EESeal “Quells” the frequencies needed to meet compliance. Fixes MIL-STD-461 Radiated Emissions Problems.





# Typical *EESeal*® Attenuation

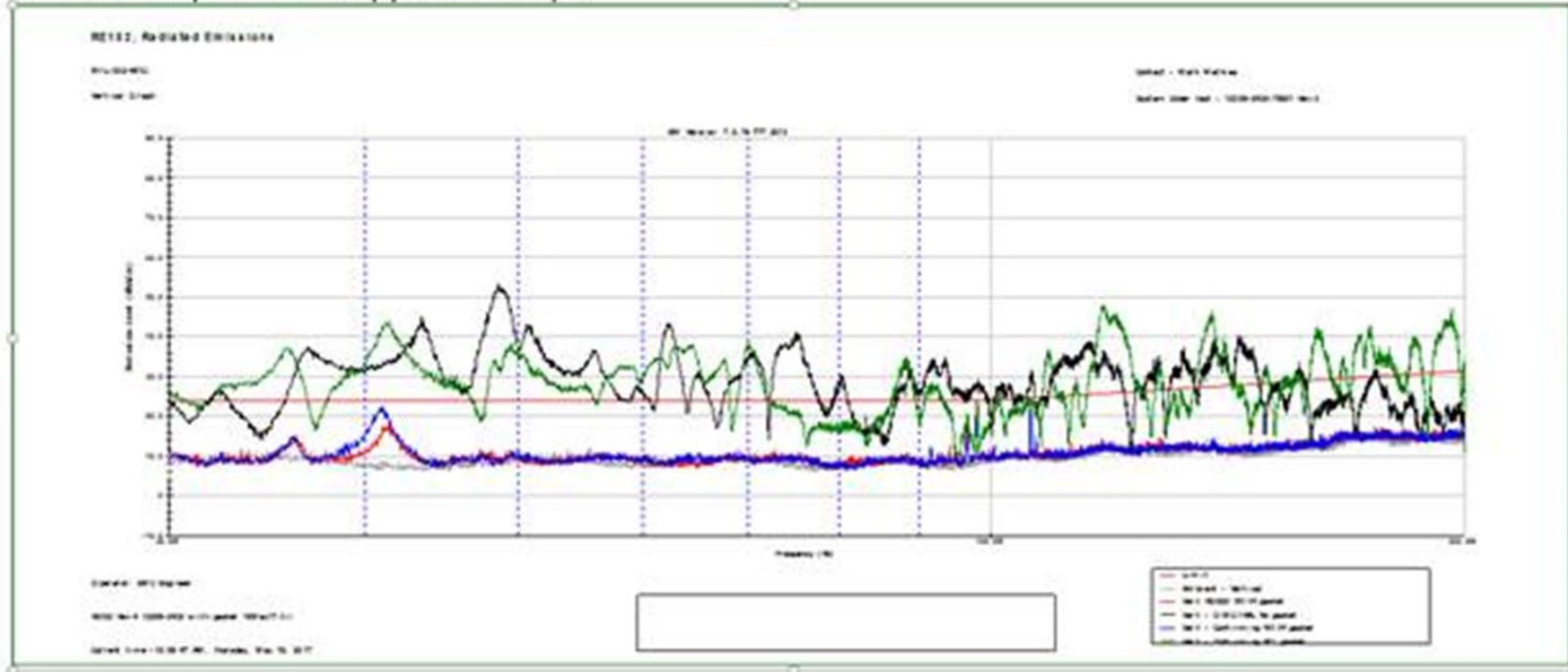
## Single Capacitor – Pin to Shell





# (ABC) Corporation – “WOW!!”

Vertical Only – Gasket approx. 5 amps.



Grey = ambient

Black = ORIGINAL no gasket

Red = RETEST with gasket

Green = Confirming NO gasket

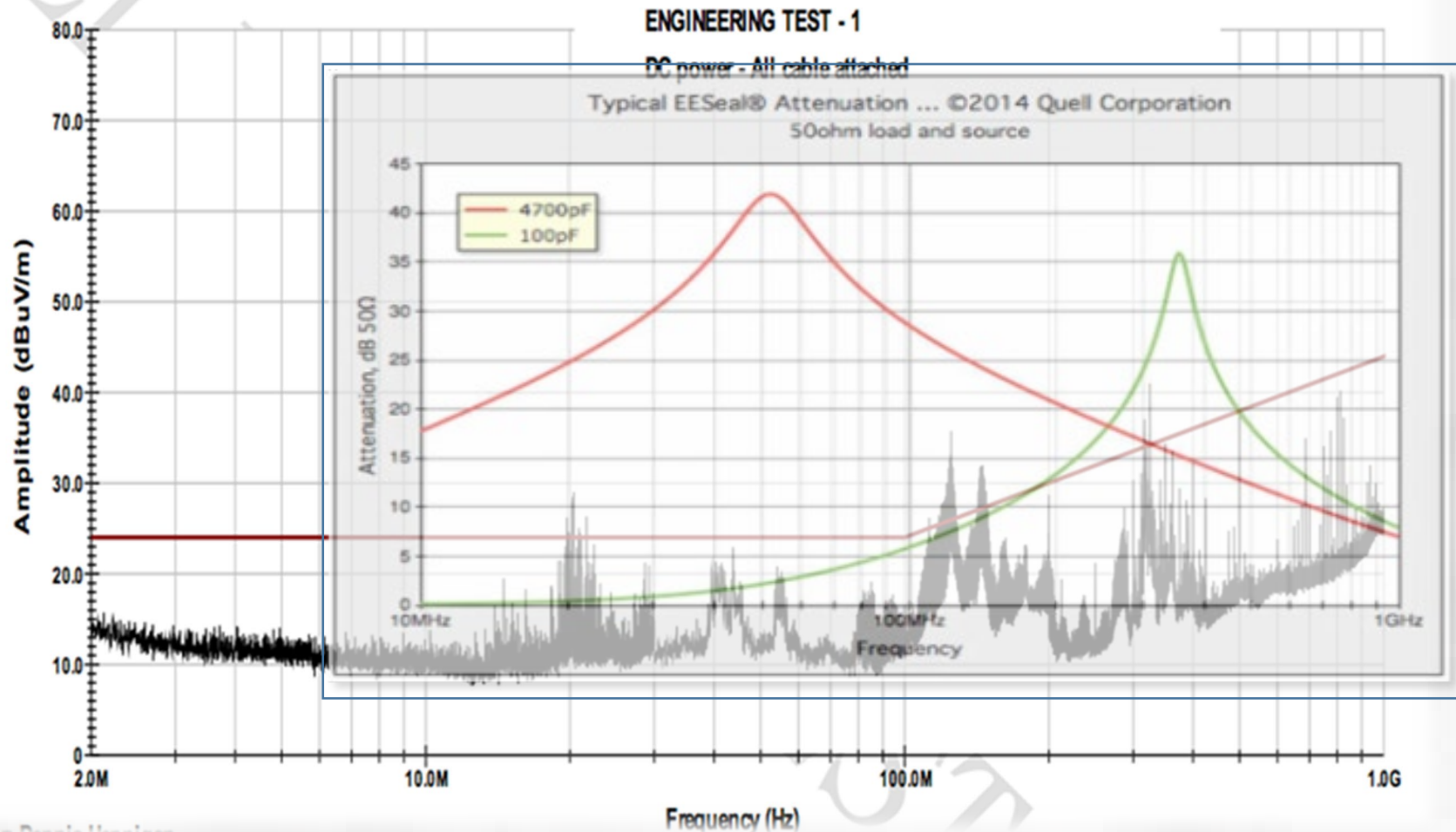
Blue = Confirming with gasket

# Parallel Capacitor Example

CHOMERICS TEST SERVICES

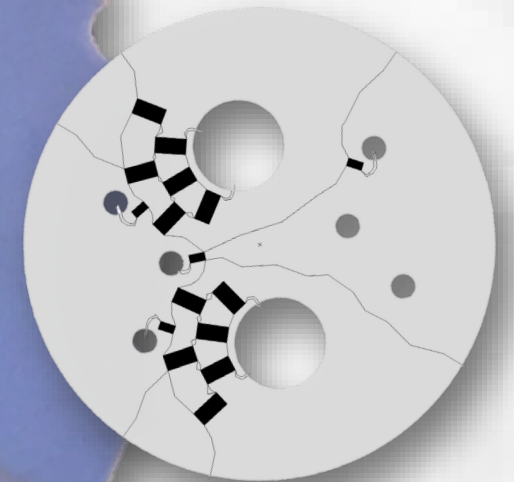
DCS

MIL-STD 461F RE 102-4 Army Ground Vertical Polarity



# Typical *EESeal*® Construction

6 caps  
in Series-parallel  
network of 470nF  
300wvdc capacitors  
(effectively 0.71uF) from  
pins A, G to the  
connector shell



47nF 500wvdc  
capacitor from  
pins B, C, E, H to the  
connector shell.  
All other pins are not  
treated.

# *EESeal*® for Transient Protection

- TVS Diode Arrays

- ESD, IEC61000-4-2,  $\pm 30\text{kV}$  contact,  $\pm 30\text{kV}$  air
- EFT, IEC61000-4-4, 40A (5/50ns)
- Lightning, IEC61000-4-5, 8A ( $t_P=8/20\mu\text{s}$ , SPHV12-C)
- Low clamping voltage & Low leakage current



- Varistors

- Multilayer ceramic construction technology
- $-55^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$  operating temp. range
- Operating voltage range  $V_M(\text{DC}) = 5.5\text{V}$  to  $120\text{V}$
- ESD rated to IEC61000-4-2, Level 4: Air Discharge 15KV and Contact Discharge 8KV
- RoHS compliant

- Others??

- We can incorporate virtually any 0402 or 0603 SMD



# *EESeal*® for Lightning Protection

- Aircraft electronic boxes were sustaining lightning damage – resulting in aircraft grounding
- Box manufacturer needed to protect against 250A lightning on a ground return pin and approached Quell
- After several iterations, an EESeal® design with 15 MOVs in parallel successfully passed lightning test
- Box, with EESeal® installed, environmentally qualified to customer spec
- EESeal® retrofitted into fielded aircraft and EESeal® is now installed in all new production units
- Today, this commercial aircraft has 75-100 EESeals® on board - >92,989 ordered with no reports of failures (as of 02/18/2020)







# Environmental Capabilities...

## EESeal® Withstand **Extreme** Mechanical & Environmental Conditions

- Environmental and mechanical tests conducted by independent laboratories show that even severe environments do not affect the integrity of EESeal® FilterSeal EMI Filter Inserts or the host connectors\*
  - **Shock**
    - MIL-STD-1344A Method 2004.1, Test Condition C (except 150g instead of 100g): 1/2 sine, 6 ms, 6 shocks/axis, total 3 axes
  - **Vibration**
    - MIL-STD-1344A Method 2005.1, Test Condition IV: 10-2000Hz, 20g, 4 hours/axis, total 3 axes *and* MIL-STD-810E paragraph 514.4: 3.75Hz @ 0.07g to 33.75Hz @ 2.5g to 500Hz @ 0.002g<sup>2</sup>/Hz, 4 hours/axis, total 3 axes
  - **Salt Spray**
    - Method 1001.1: 48 hr exposure at 95F
  - **Thermal Cycling**
    - RTCA/DO160C: -55C to +125C, 20 cycles
  - **Humidity Exposure**
    - RTCA/DO160C Category A: 95%RH @ 50C for 24hr, @ 30C for 24hr



\*Nearly every EESeal insert is custom designed for your specific application and connector. Whenever a particular environmental feature is critical to your application, we recommend that you test the specific EESeal and connector combination to verify its suitability for your use.

# Environmental Capabilities...

## EESeal® Withstand **Extreme** Mechanical & Environmental Conditions

- Environmental and mechanical tests conducted by independent laboratories show that even severe environments do not affect the integrity of EESeal® FilterSeal EMI Filter Inserts or the host connectors\*
  - **Temperature-Altitude**
    - MIL-STD-5400 4.6.2.3 Class 1A: -55C to 125C, 30,000 ft
  - **Durability**
    - MIL-STD-1344A Method 2016: 250, 375 & 500 mate/demate cycles
  - **Fluid Immersion**
    - MIL-STD-1344A Method 1016, Fluids a, c, d & e, with connectors mated: 5 minute immersion @ 85C in each of Hydraulic Fluid, 2 Lubricating Oils & JP-5
  - **Removal Re-Use Assessment**
    - 128pin EESeal completely removed from connector and re-inserted 12 times
  - **Porosity**
    - MIL-STD-1344A Method 1017: Contacts exposed to 70% HNO<sub>3</sub> (concentrated reagent grade nitric acid) for 75 minutes at 23C, 10 minutes in air @ 125C, no corrosion observed
  - **Out-gassing**
    - ASTM E-595-07, TML <1%; CVCM <.01%, Post bake required

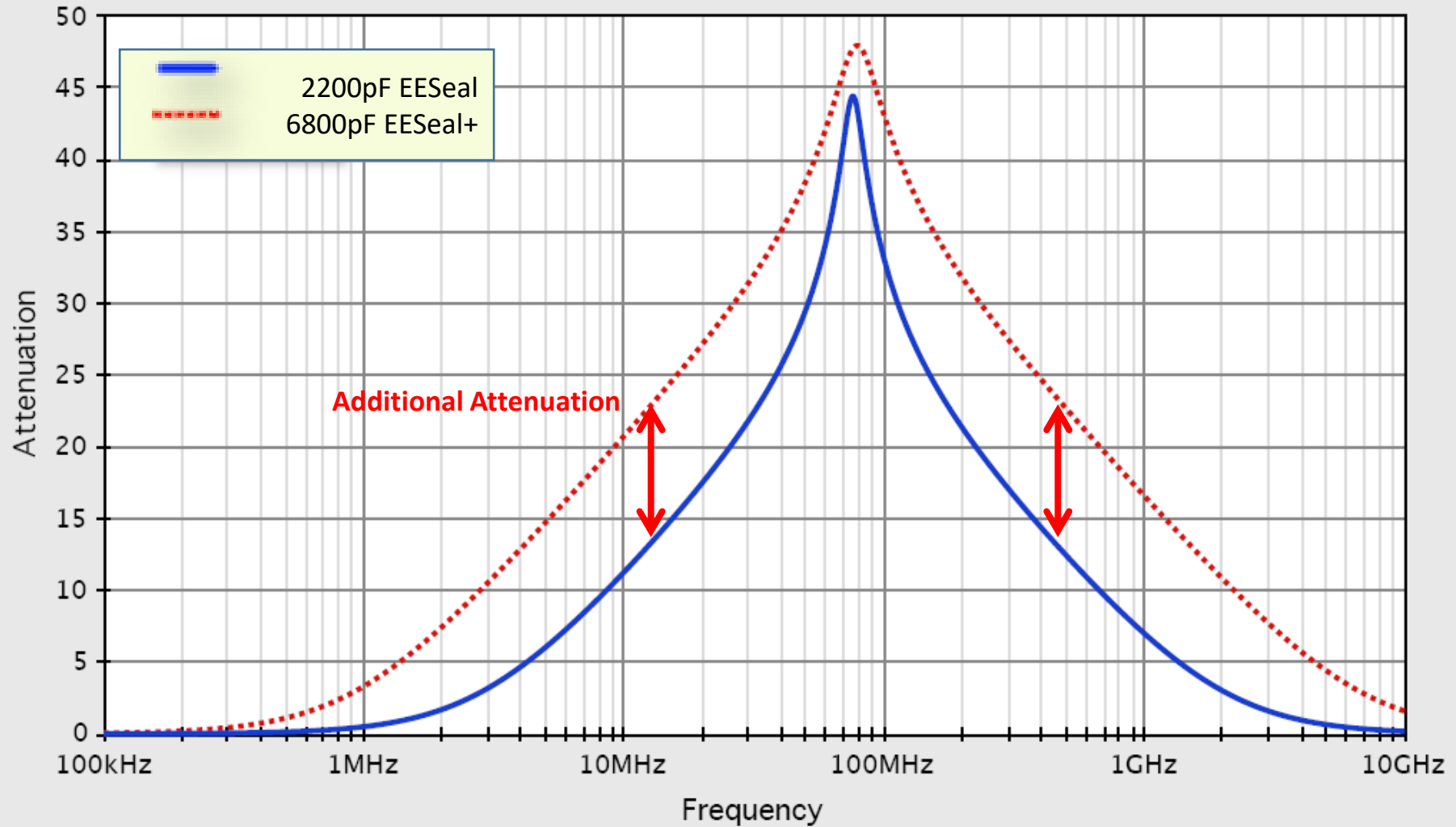


\*Nearly every EESeal insert is custom designed for your specific application and connector. Whenever a particular environmental feature is critical to your application, we recommend that you test the specific EESeal and connector combination to verify its suitability for your use.

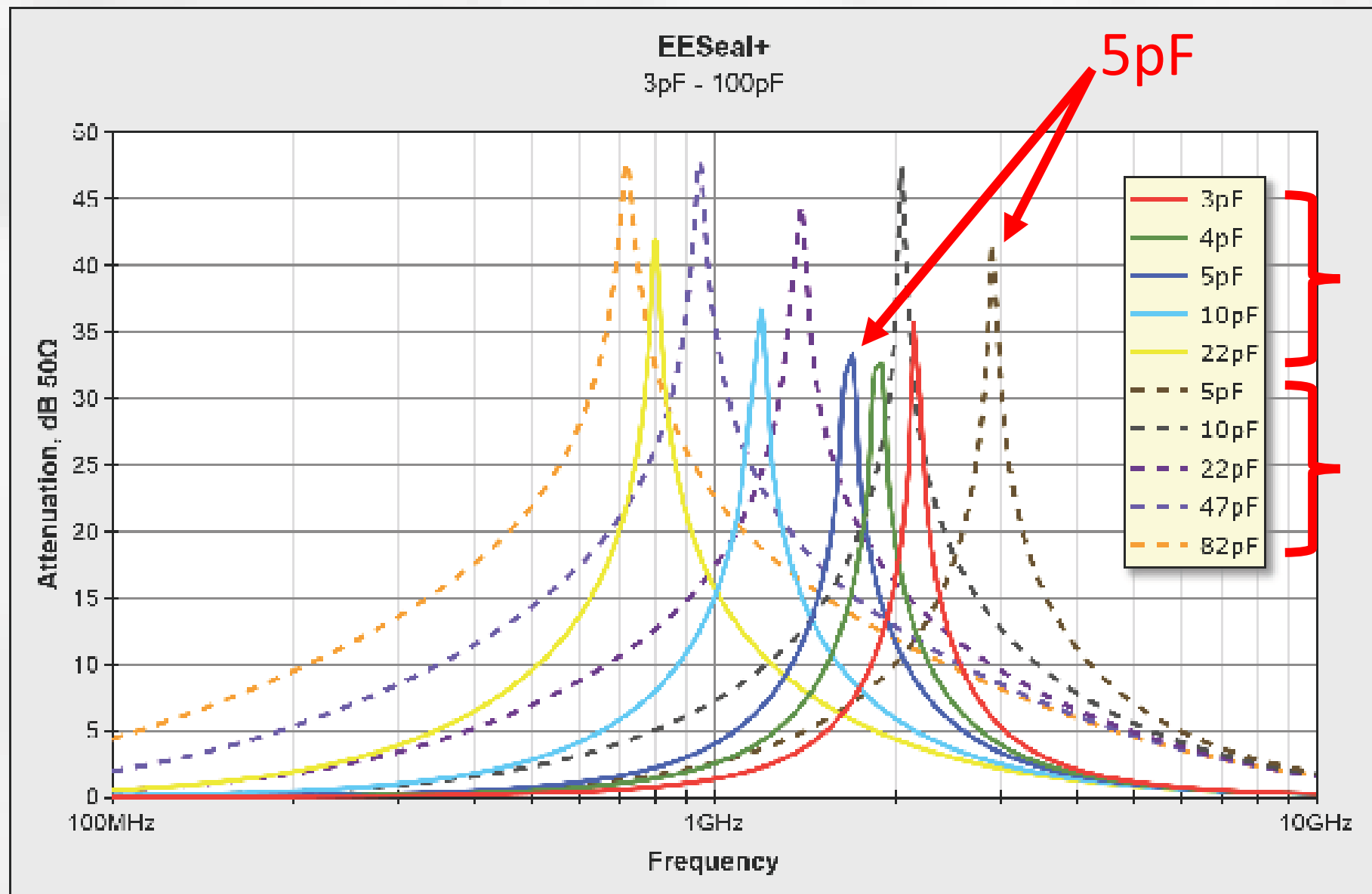


# EESeal<sup>®</sup> vs. EESeal +<sup>®</sup>

Typical EESeal<sup>®</sup> Attenuation - ©2014 Quell Corporation  
50ohm Load and source



# EESeal<sup>®</sup> vs. EESeal +<sup>®</sup>



*EESeal*

*EESeal+*

5pF

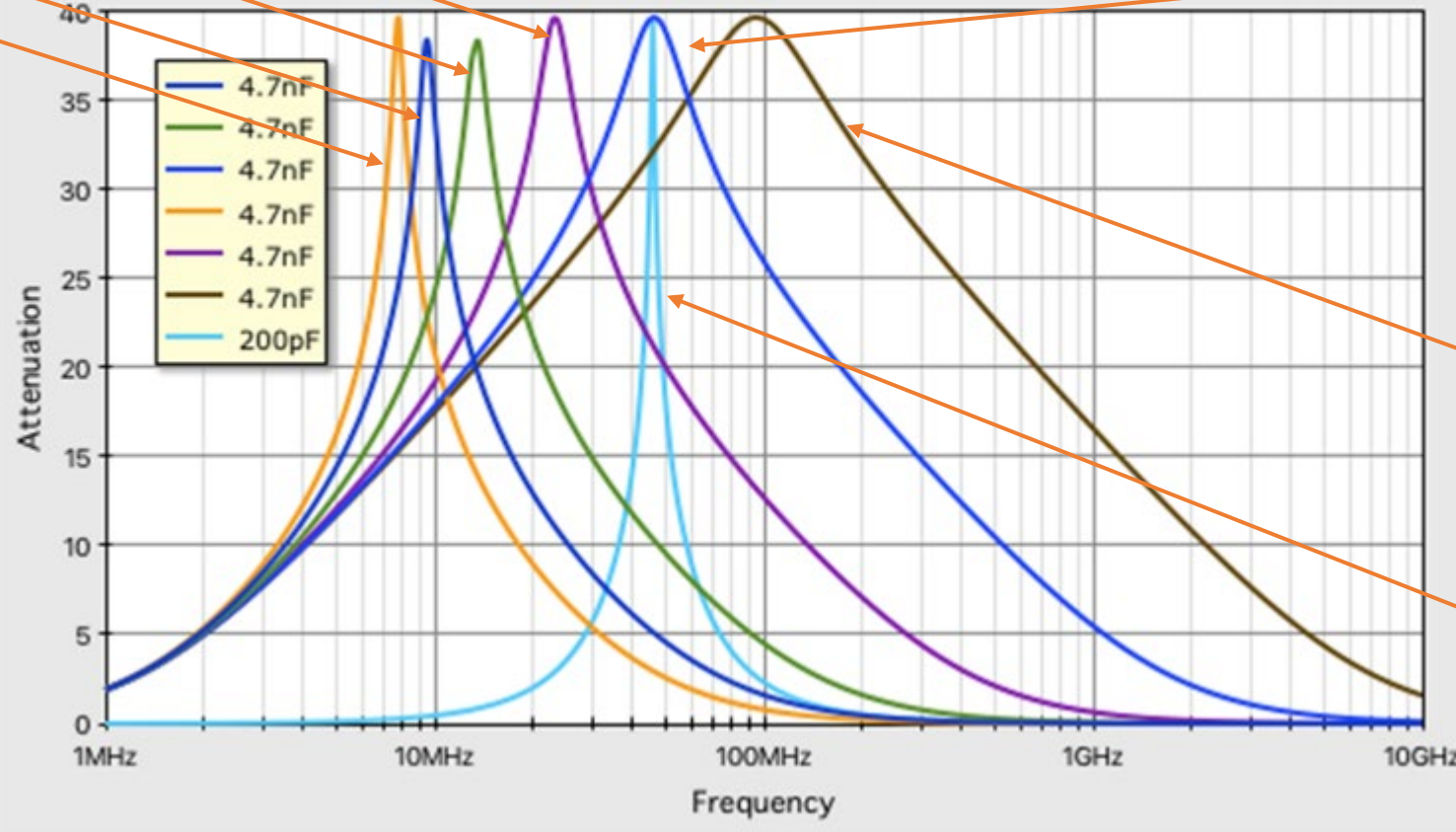


# Lead Length vs. Attenuation for a 4.7nF capacitor

Length of Ground Wire

1/3"  
1"  
2"  
3"

Typical EESeal® Attenuation - ©2014 Quell Corporation  
50ohm Load and source



**EESeal®**  
grounded to the connector shell

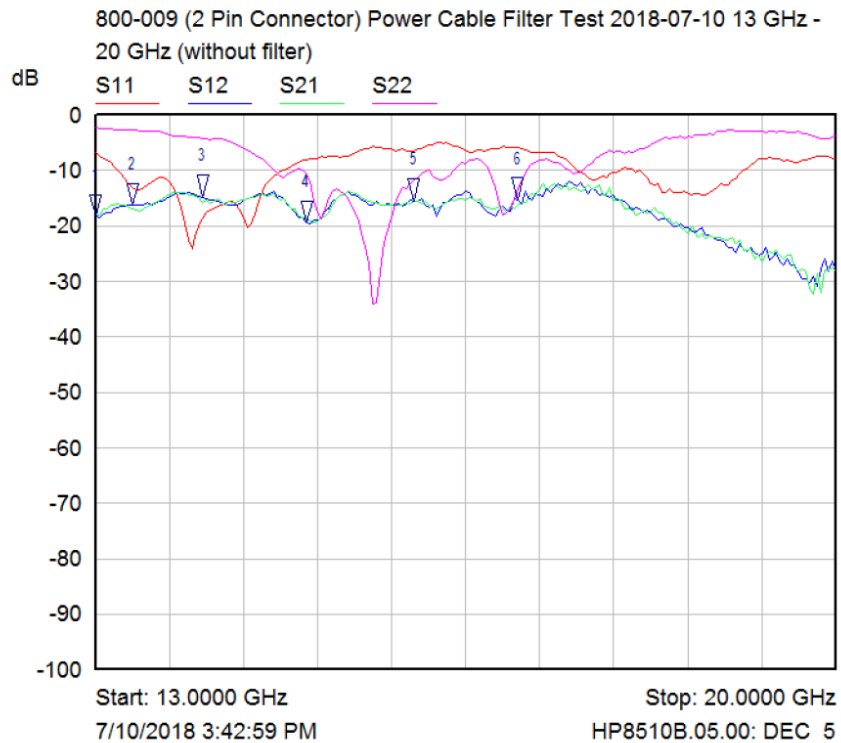
**EESeal+®**  
grounded to the connector shell

220pF w/2" lead

Attenuation plots of our 4.7nF filter with a 1" lead length to ground (green line), 2" lead length to ground (dark blue line), 3" lead length (gold line). The Blue is our standard part grounded to the connector shell. The brown line is the EESeal+® with about 0.5nH of inductance. The light blue line is a 200pF capacitor with a 2 inch lead.

# High Frequency Attenuation Performance

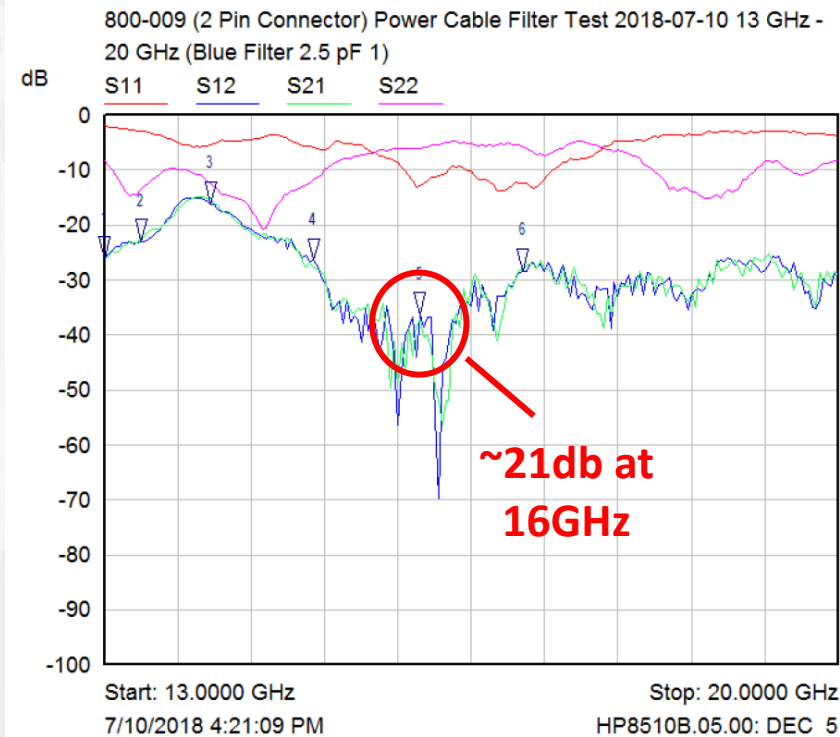
- Baseline Scan



Mkr	Trace	X-Axis	Value	Notes
1 ▾	S12	13.0000 GHz	-18.29 dB	
2 ▾	S12	13.3500 GHz	-16.31 dB	
3 ▾	S12	14.0150 GHz	-14.83 dB	
4 ▾	S12	14.9950 GHz	-19.49 dB	
5 ▾	S12	16.0100 GHz	-15.51 dB	
6 ▾	S12	16.9900 GHz	-15.40 dB	

Figure 5. Baseline Results for Pins 1 & 4

- 6-7.11FC (2.5pF)



Mkr	Trace	X-Axis	Value	Notes
1 ▾	S12	13.0000 GHz	-26.21 dB	
2 ▾	S12	13.3500 GHz	-23.05 dB	
3 ▾	S12	14.0150 GHz	-16.24 dB	
4 ▾	S12	14.9950 GHz	-26.52 dB	
5 ▾	S12	16.0100 GHz	-36.35 dB	
6 ▾	S12	16.9900 GHz	-28.29 dB	

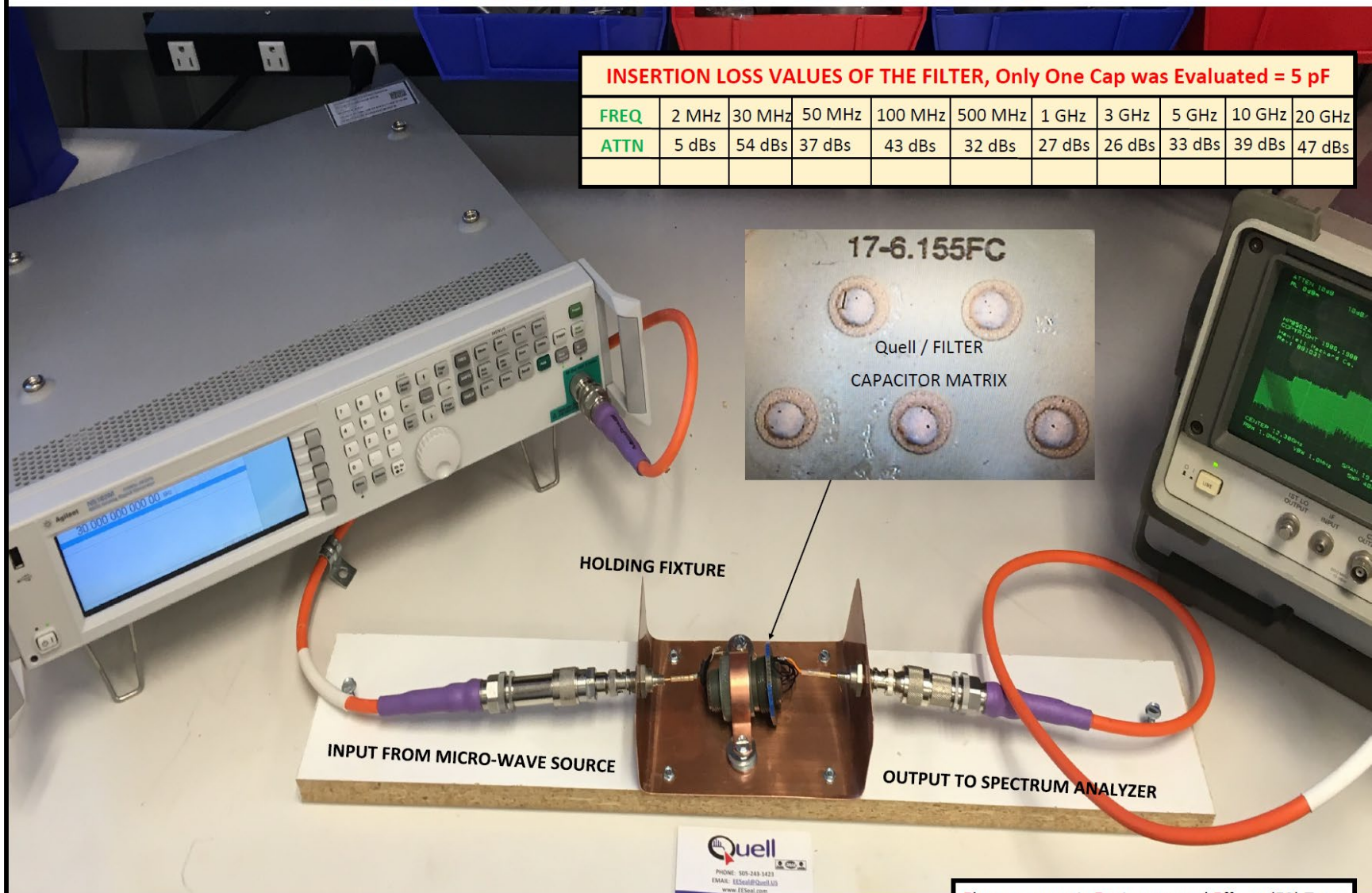
Figure 10. Test Results for EMI Filter 6-7.11FC (1)

Mighty Mouse connector

# FILTERED SAVO CONNECTOR - RF ATTENUATION MEASUREMENT RESULTS

INSERTION LOSS VALUES OF THE FILTER, Only One Cap was Evaluated = 5 pF

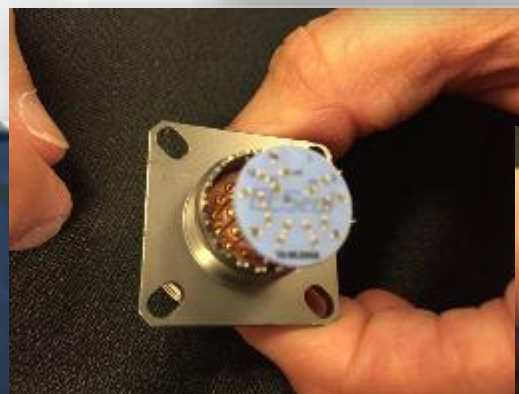
FREQ	2 MHz	30 MHz	50 MHz	100 MHz	500 MHz	1 GHz	3 GHz	5 GHz	10 GHz	20 GHz
ATTN	5 dBs	54 dBs	37 dBs	43 dBs	32 dBs	27 dBs	26 dBs	33 dBs	39 dBs	47 dBs





# *EESeals*<sup>®</sup> Inside...

- Allows for both sockets and pins
- Multiple EESeals
  - More capacitance
  - Higher voltage
  - Wider frequency capabilities
  - Invisible





# *EESeal*® Benefits...

- Custom!
  - Matches your exact application
    - Application dependent
  - Pin to Pin, pin to shell, Capacitors, Resistors, ESD - MOV/diodes, shorts, opens, etc....
  - Every pin exactly the way you need it...
  - No tooling
  - Light weight
    - < 1 gram
  - No additional space needed
  - Field Installable/Replaceable (Retrofit)
  - Custom labeling, colors, etc.



# *EESeal*® Benefits...

- Fast!
  - FREE Samples in 24-48 hours.
  - Production orders in 6-8 weeks.  
...or better if needed...
- Cost!
  - Competitively priced as a long-term, permanent solution vs. Filtered Connectors.
  - No redesign or schedule delays
  - Ease of assembly



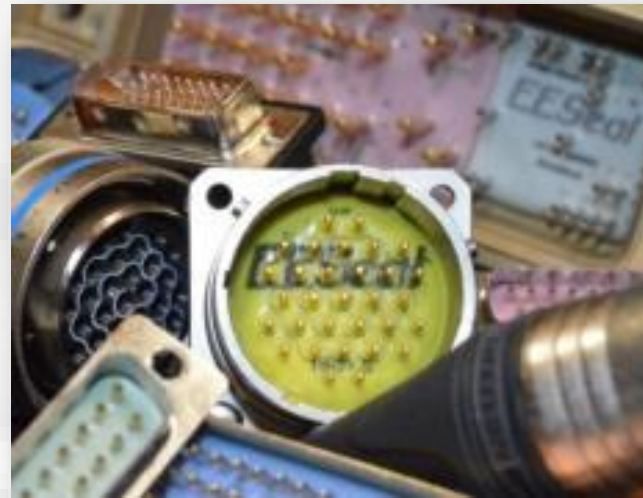




# Where to use an *EESeal*®?

At ANY connector Interface.

- ANY style connector
  - MIL-Circular
    - MIL-C-38999, MIL-C-26482, MIL-C-5015, Mighty Mouse, & many others....
  - D-Subminiature
  - MDM/Micro D
  - ARINC
  - Plastic
  - Non-conductive connectors and more...
- Any Manufacturer
  - Molex, Deutsch, Souriau, Amp, etc.



## Circular Connectors

- MIL-C-38999 s1 plug
- MIL-C-38999 s1 receptacle
- MIL-C-38999 s2 plug
- MIL-C-38999 s2 receptacle
- MIL-C-38999 s3 plug
- MIL-C-38999 s3 receptacle
- MIL-C-38999 s4 plug
- MIL-C-38999 s4 receptacle
- MIL-C-26482 s1&2 plug
- MIL-C-26482 s1&2 receptacle
- MIL-C-5015 plug
- MIL-C-5015 receptacle
- MIL-C-83723 s3 plug
- MIL-C-83723 s3 receptacle
- MIL-C-81511 s2 receptacle
- MIL-C-81511 s3 receptacle
- MIL-C-26500 receptacle
- MIL-C-55181 plug
- JN1003 Eurofighter receptacle
- JN1003 Eurofighter plug
- MIL-C-28840 receptacle

## DSub Connectors

- DSubminiature 9, 15, 25, 37, 50, combos
- Micro-DSub (MDM) 9, 15, 21, 25, 31, 37, 51, 69, 100, combos
- Double & High Density DSub 15, 19, 26, 31, 44, 52, 62, 78, 104 combos
- Combo DSub

## Headers

- Centronix
- Header

## DIN

- circular DIN
- miniDIN
- rectangular DIN

## ARINC & Rack

- ARINC404
- ARINC600
- ITT Cannon DIP/DMA insert

## LEMO

- LEMO various connectors

## Custom Connectors and More

# Who uses *EESeals*®?

- A Few Quell Customers...



The image displays a collection of logos for various aerospace and defense companies, arranged in a grid-like fashion within a rounded rectangular frame. The logos include:

- Raytheon** (Red text)
- Boeing** (Blue italicized text)
- AAI** (Blue text with a checkmark icon, with "TEXTRON Systems" below it)
- Panasonic** (Blue text)
- Eaton** (Blue text with a dot, with "Powering Business Worldwide" below it)
- Curtiss-Wright** (Red text)
- Harris** (Black text with a red diagonal line)
- Northrop Grumman** (Blue text)
- General Dynamics** (White text on a blue background)
- Airbus** (Blue text)
- Rockwell Collins** (Black text)
- BAE Systems** (White text on a red background)
- Honeywell** (Red text)
- UTC Aerospace Systems** (Blue text)
- Eclipse Aerospace** (Small logo with text)
- Lockheed Martin** (Blue text)
- Thales** (Blue text)
- L3 Communications** (Red circle with "L3" and "communications" below it)
- General Atomics** (Blue text with a four-pointed star icon)





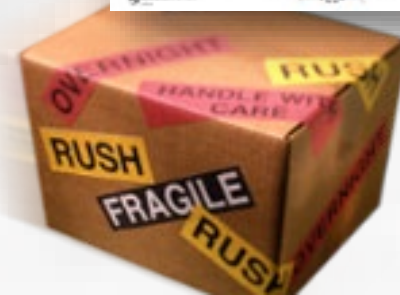
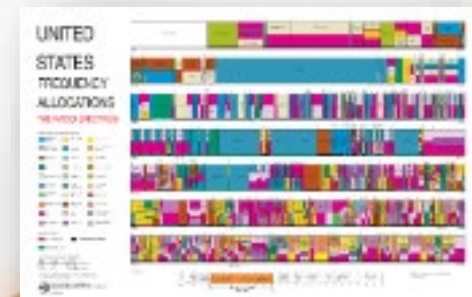
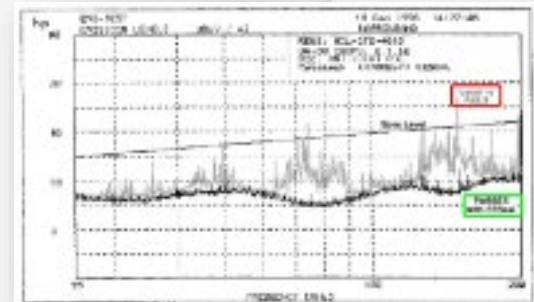
# *EESeals*® on the Ground, in the Air and in Space....



LMCO "Black" Satellite, F-35 Lightning, B1 Lancer, A10 Thunderbolt, A400M, F-18 Growler, C5 Galaxy, Boeing 787, Eclipse 500, Embraer 160/170, Cessna Citation X, AH-64 Apache, UH-60 Seahawk, V-22 Osprey, OH-58 Kiowa, CH-47 Chinook, HH-65 Eurocopter, Humvee 1, MRAP, M1128 Mobile Gun System, M1A Abrams, M109 Paladin Howitzer, Boeing GBU-39 (SDB), TIM-162 Sea Sparrow, RQ-1/MQ-1, Predator, JDAM, NGC X-47B, RQ-4/MQ-4 Global Hawk, MQ-8 Fire Scout, SpaceX Dragon

# What we need...

1. What is the connector p/n?
2. What are the frequency issues, scans and/or Capacitor values you would like?
3. What are the voltages on each of your pins?
4. What is the data rates on each pin? (RS422, ethernet, video, etc.)
5. Any transient or lightning specifications?
6. What is the best shipping address for your FREE EESeal samples?







# Website...

- Free Sample Link
- Videos

CALL TODAY! (505) 243-1423

Home How & Why Products Quality Support About Us Contact Us Request A FREE Sample!

## EESeals in Space for 12+ Years Running!

**How & Why**  
See how it works.  
Why try an EESeal®?

**Products**  
EMI Filters  
Transient & ESD Protection  
Grounding Planes

**FREE!**  
Request your FREE  
Generic or Custom EESeal®

**Fast...**  
EESeal® FilterSeal EMI Filter Inserts install in YOUR connector by hand in seconds, no soldering. Get a FREE sample, designed & built to your needs, in about 24 hours!

**Effective...**

Contact Us

First Name Last Name

Company Name

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## Instructional Videos

Home / Instructional Videos

Quell's Circular EESeal Insertion - 2017

0:06 / 0:56

SKOLNIK

Contact Us

First Name Last Name

Company Name

Phone Number

Email Address

Your Message

Please subscribe me to email updates from Quell.

Please send me a FREE EESeal® Sample!

I'm not a robot

reCAPTCHA Privacy - Terms

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## EMI Filters

Home / EMI Filters

Quell Corporation EMI engineers will be happy to work with you to solve your EMI problems. Contact us today by phone or email — it's easy and you won't be sorry.

First, we will determine what EESeal® EMI Filter Insert design is right for you. Then, we will gladly provide you with a free sample. *We can usually develop, build and ship FREE custom samples within a day or two of your RUSH request.* We believe you will see this is a much better solution to the pricy and bulky EMI Filter Connectors, EMI filter adapters, and other EMI filters of the past.

So why leave your EMI test with a failure on your mind when we can usually fix it immediately?

We manufacture EESeal® FilterSeal EMI Filter Inserts for a wide range of MIL-SPEC (Military Specification), commercial and custom connectors, including MIL-C-38999, MIL-C-26482, MIL-C-5015, MIL-C-83723, ARINC, Lemo, MDM, DSubminiature and custom connectors too.

**Please request a free custom sample and you'll have an EESeal® in your hands within just a few days.**

A Few Common Examples:

MIL-C-26482 Micro-D MIL-C-5015 Custom

D-Subminiature ARINC D-Sub Combo

MIL-C-38999

Contact Us

First Name Last Name

Company Name

Phone Number

Email Address

Your Message

**CALL TODAY! (505) 243-1423**

**Contact Us Request A FREE Sample!**

Please subscribe me to email updates from Quell.

Please send me a FREE EESeal® Sample!

I'm not a robot

Please reach out to **Brainard-Nielsen** at  
[rich@bnmsales.com](mailto:rich@bnmsales.com) if you have a  
Quell EESeal applications...

**Thank You!!!**

Brainard-Nielsen Marketing, Inc.





[www.EESeal.com](http://www.EESeal.com)

Bring out the "Goodness."