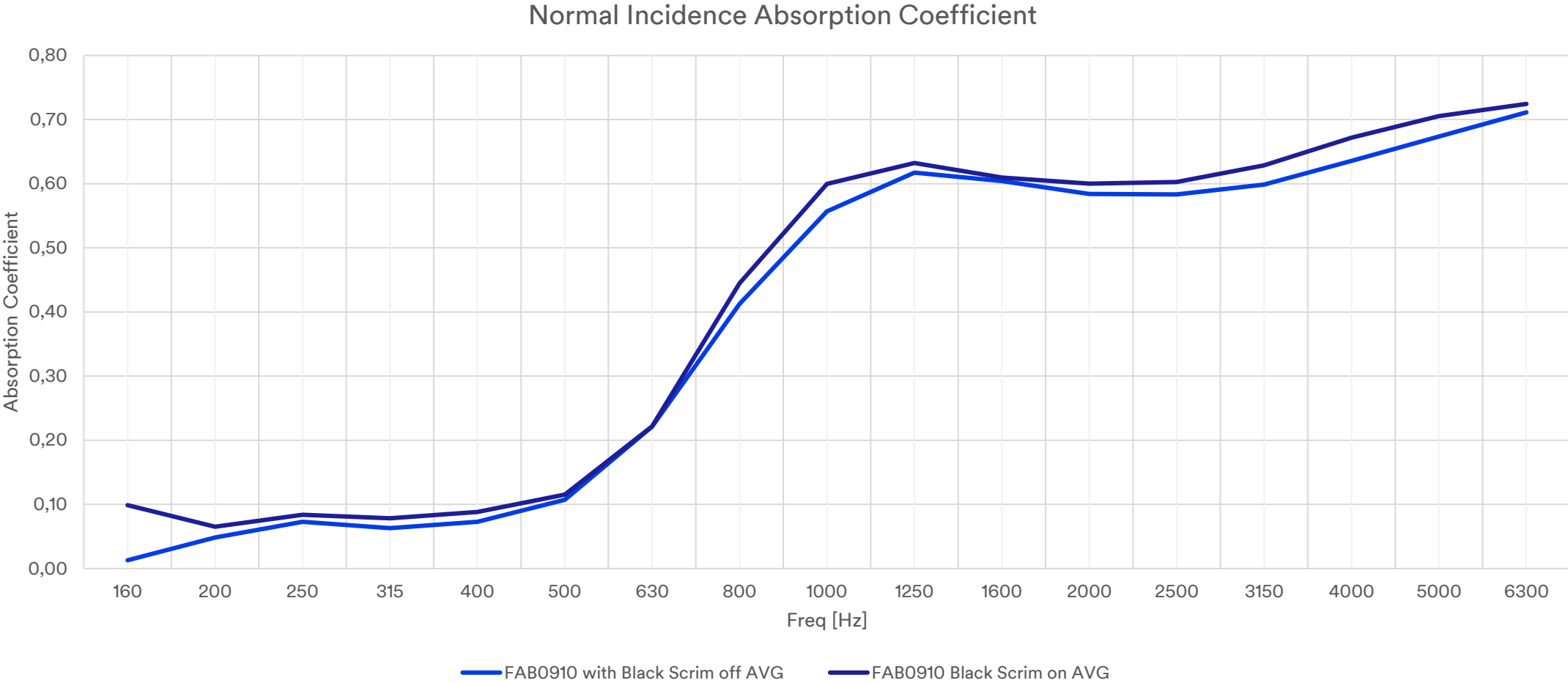


3M™ Flexile Acoustic Material

Modelling parameters fitting study for Audi
February 2022

E-1050 slide with and without the black scrim



Parameter Fitting

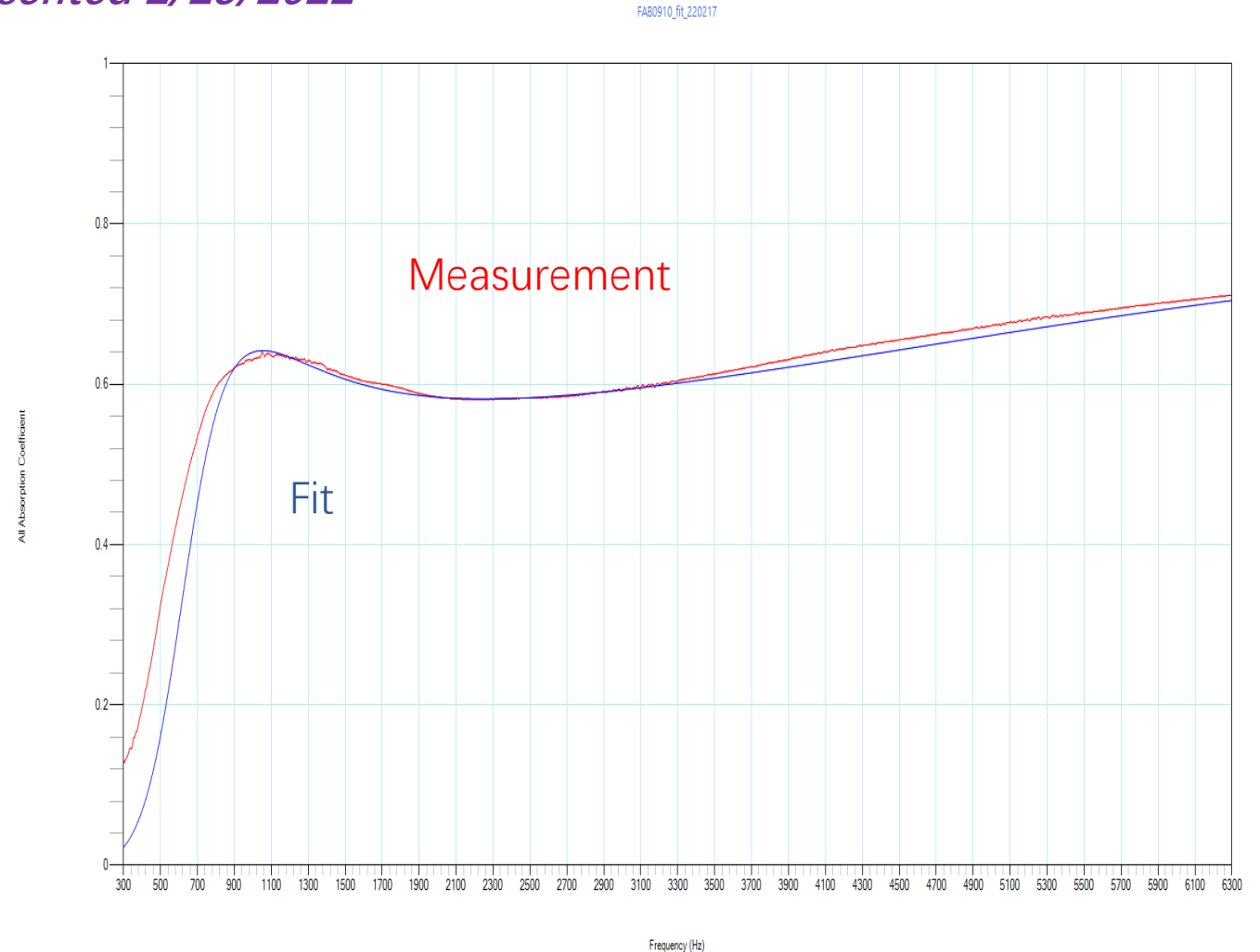
– 3M February 2022 measurements and fit

Presented 2/25/2022

Parameters	Fitted value
σ [rayls/m]	4.3861×10^5
Λ [μm]	66.1
Λ' [μm]	66.1
TOR	4.834
ϕ	0.903
ρ_b [kg/m ³]	82.03

Average absorption coefficient combined for measurements in small and large tube with scrim off, fit conducted 300 – 6300 Hz using Foam-X.

Biot parameters generated from JCA limp model.



Foam-X Fitting Options

General

Fiber

Frame Type

Limp

Bulk Density (kg/m³)

71.67

Transition Frequency (Hz)

0

Uncertainties

on Sample Thickness (mm)

0

on Cavity Depth (mm)

0

Measured Properties

0.9033 ± 0

1 ± 0

3 ± 0

66 ± 0

260 ± 0

1 ± 0

Identified Properties

0.999 ± 0

417151 ± 0

3.905 ± 0

133 ± 0

133 ± 0

90.07 ± 0

Correlation Coefficient (R²)

0.99803

Updated density & free porosity

General

Frequency (Hz)

All Absorption Coefficient

Legend

Auto

X Scale

Allowed fitting of porosity and updated the density

Equivalent fits with very different parameter values

por
sigma

Lambda
Lambda'

General

Fiber

Frame Type

Limp

Bulk Density (kg/m³)

71.67

Transition Frequency (Hz)

0

Uncertainties

on Sample Thickness (mm)

0

on Cavity Depth (mm)

0

Measured Properties

0.9033 ± 0

1 ± 0

3 ± 0

66 ± 0

260 ± 0

1 ± 0

Identified Properties

0.999 ± 0

384930 ± 0

1 ± 0.01

54 ± 0

108 ± 0

43.63 ± 0

Correlation Coefficient (R²)

0.99769

Fiber

Frequency (Hz)

All Absorption Coefficient

Legend

Auto

X Scale

Options

Close

© 3M 2022. All Rights Reserved. 3M Confidential.

3M

Patent Pending 4

Parameter Fitting

– Original parameters with black scrim vs. 3M new fitting with no black scrim

Updated density & free porosity

Parameters	Original data with black scrim	Fitting with no black scrim	<i>General</i> fitting no black scrim	<i>Fiber</i> fitting no black scrim
σ [rayls/m]	4.1677×10^5	4.3861×10^5	417,151	384,930
Λ [μm]	23.3	66.1	133.0	54.0
Λ' [μm]	46.6	66.1	133.0	108.0
Tortuosity	1.417	4.834	3.905	1.0
Porosity ϕ	0.9172	0.9033 *	0.999	0.999
ρ_b [kg/m ³]	76.00 *	82.03 *	71.67 *	71.67 *

*Presented
2/25/2022*

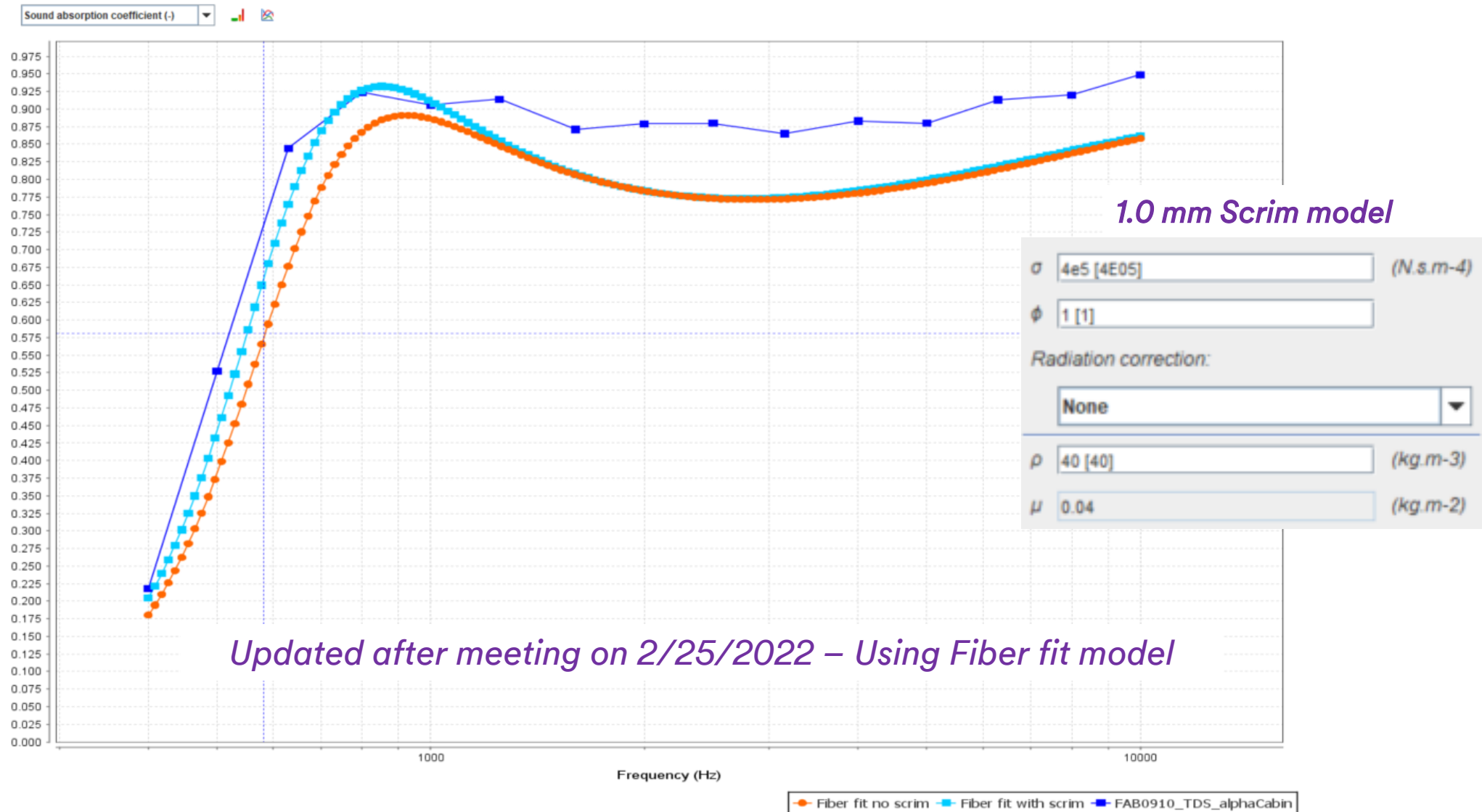
*Updated after meeting on
2/25/2022*

* Values were assigned and not fit.

*Without black scrim, the
density should be less than
the original one*

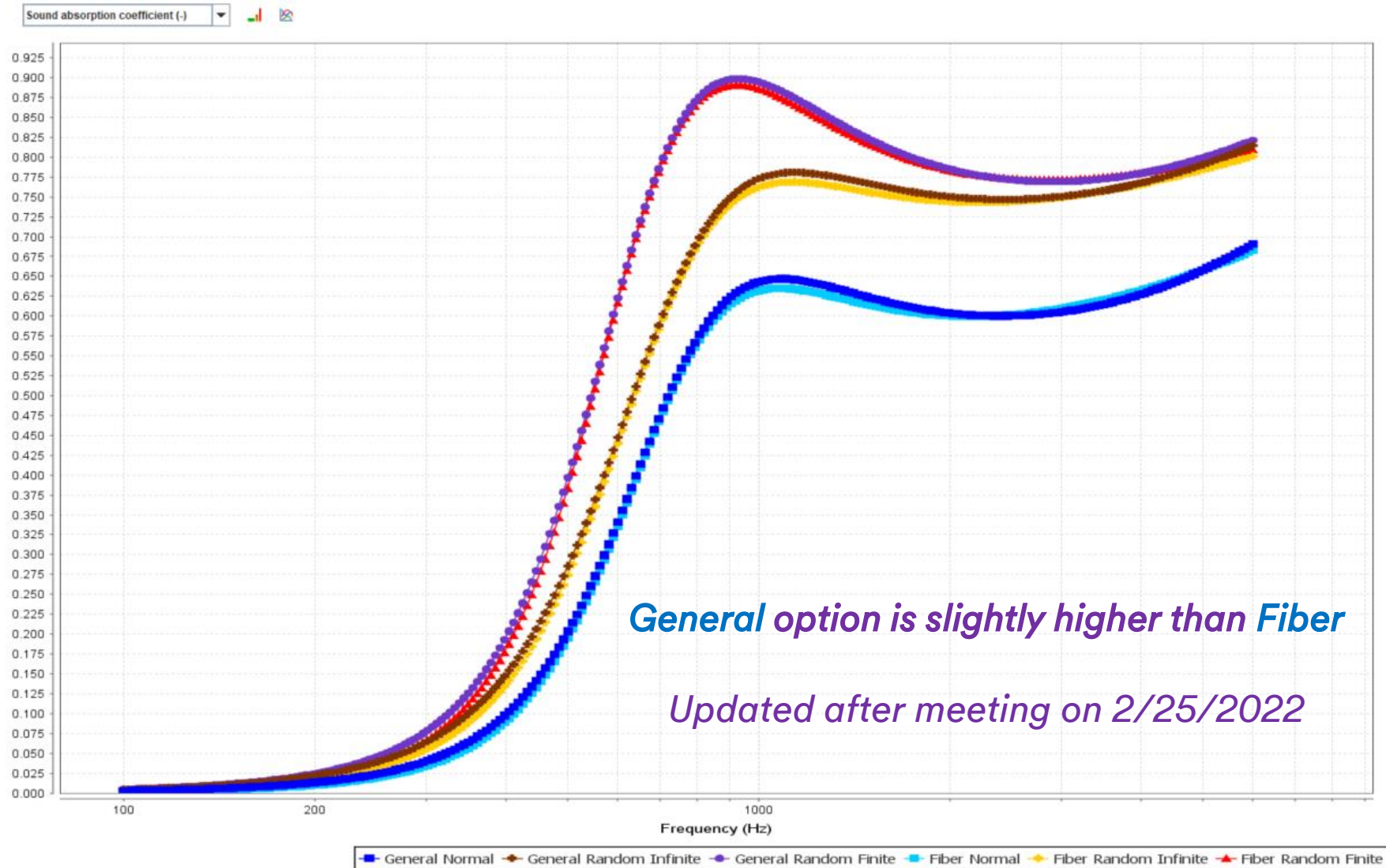
Calculation comparison

– Alpha Cabin random absorption Black scrim added



Effect of random incidence finite size correction

– without scrim



Technical Information: The technical information, guidance, and other statements contained in this document or otherwise provided by 3M are based upon records, tests, or experience that 3M believes to be reliable, but the accuracy, completeness, and representative nature of such information is not guaranteed. Such information is intended for people with knowledge and technical skills sufficient to assess and apply their own informed judgment to the information. No license under any 3M or third party intellectual property rights is granted or implied with this information.

Product Selection and Use: Many factors beyond 3M's control and uniquely within user's knowledge and control can affect the use and performance of a 3M product in a particular application. As a result, customer is solely responsible for evaluating the product and determining whether it is appropriate and suitable for customer's application, including conducting a workplace hazard assessment and reviewing all applicable regulations and standards (e.g., OSHA, ANSI, etc.). Failure to properly evaluate, select, and use a 3M product and appropriate safety products, or to meet all applicable safety regulations, may result in injury, sickness, death, and/or harm to property.

Warranty, Limited Remedy, and Disclaimer: Unless a different warranty is specifically stated on the applicable 3M product packaging or product literature (in which case such warranty governs), 3M warrants that each 3M product meets the applicable 3M product specification at the time 3M ships the product. 3M MAKES NO OTHER WARRANTIES OR CONDITIONS, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OR CONDITION OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR ARISING OUT OF A COURSE OF DEALING, CUSTOM, OR USAGE OF TRADE. If a 3M product does not conform to this warranty, then the sole and exclusive remedy is, at 3M's option, replacement of the 3M product or refund of the purchase price.

Limitation of Liability: Except for the limited remedy stated above, and except to the extent prohibited by law, 3M will not be liable for any loss or damage arising from or related to the 3M product, whether direct, indirect, special, incidental, or consequential (including, but not limited to, lost profits or business opportunity), regardless of the legal or equitable theory asserted, including, but not limited to, warranty, contract, negligence, or strict liability.

Automotive and Aerospace Solutions Division
3M Center
St. Paul, MN 55144-1000
Phone: 1-800-328-1684
Web: <http://www.3M.com/acousticsolutions>

3M is a trademark of 3M Company.
All other trademarks are the property of their respective owners.
Please recycle. Printed in USA © 3M 2021
All rights reserved.