

INVESTIGATION OF THE CHARACTERISTICS OF VIBRATION ISOLATORS OF AIRCRAFT

ENTIRETY @ HAW

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Department Fahrzeugtechnik und Flugzeugbau

M.Sc. Ashish Chodvadiya

Prof. Dr.-Ing. Benedikt Plaumann

M.Sc. Eugen Hein

Fakultät Technik und Informatik

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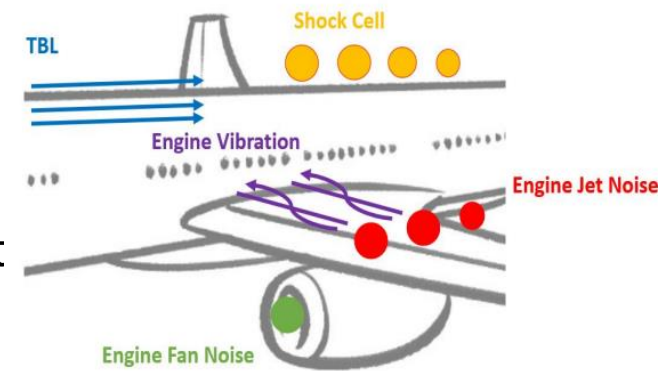
MOTIVATION

ENTIRETY Project

Project Partners : Lufthansa Technik, ZAL (Zentrum für Angewandte Luftfahrtforschung), HAW Hamburg

Goals :

- Identification and quantification of airborne and structure-borne sound transfer paths in VIP aircraft cabins, which have been insufficiently researched to date
- Development of optimized sound reduction concepts for VIP cabins without increasing the weight

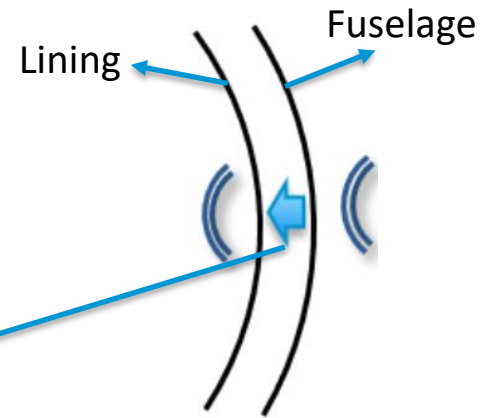


Noise sources in cabin[1]

(1) Untersuchung und Optimierung der Schallpfade in die VIP-Kabine, DAGA2023, Prof. B. Plaumann

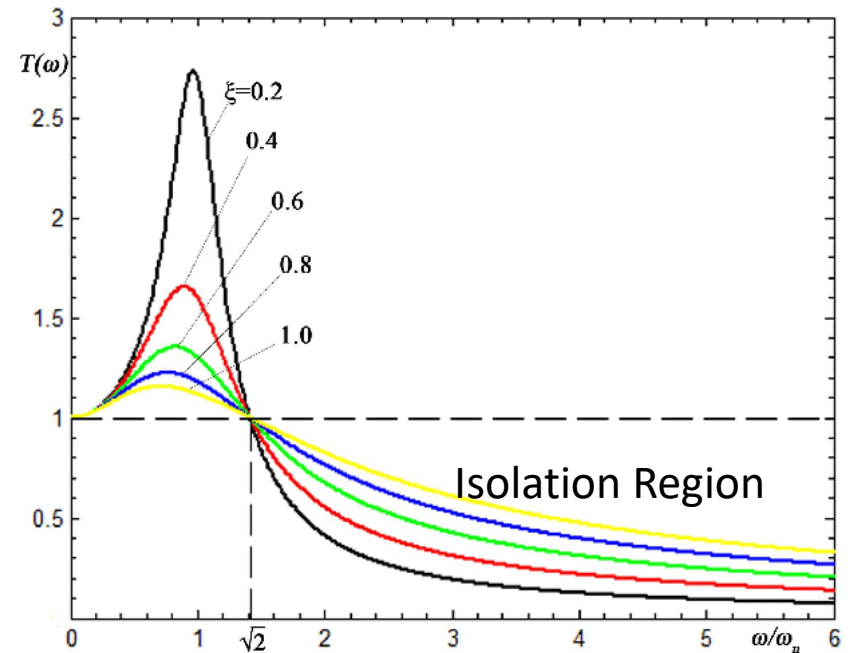
MOTIVATION

- There are two ways for the sound transfer from outside of aircraft into the cabin
 - Airborne sound path
 - Structure borne sound path
- Different Isolators are used for preventing the structure borne sound to the cabin



MOTIVATION

How is the Isolation behavior of different Isolators, which are used in Aircrafts?



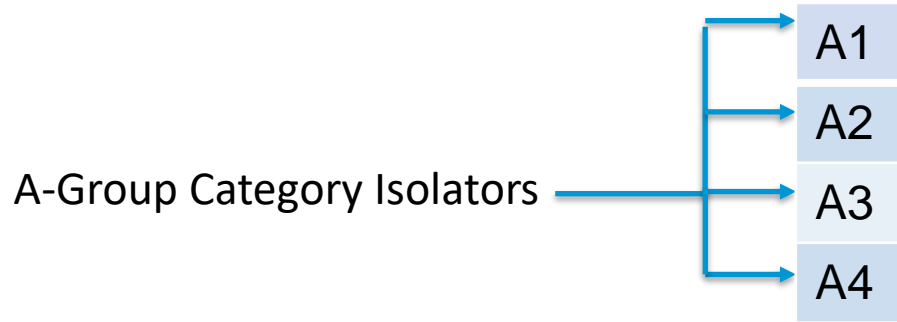
Vibration Transmissibility curve[2]

(2) https://www.researchgate.net/publication/269319894_Study_on_the_auto-leveling_adjustment_vibration_isolation_system_for_the_ultra-precision_machine_tool?_tp=eyJjb250ZXh0Ijp7ImZpcnN0UGFnZSI6Il9kaXJlY3QiLCJwYXWdIljoiX2RpcmVjdCJ9fQ

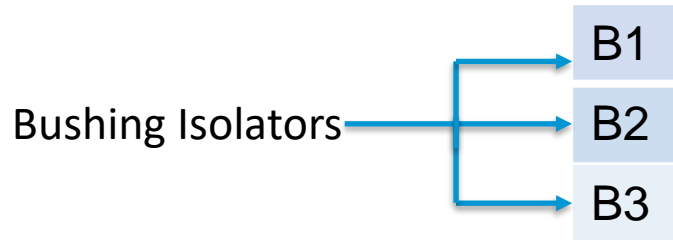
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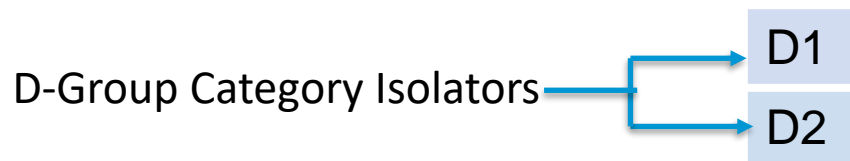
SET OF STUDIED ISOLATORS



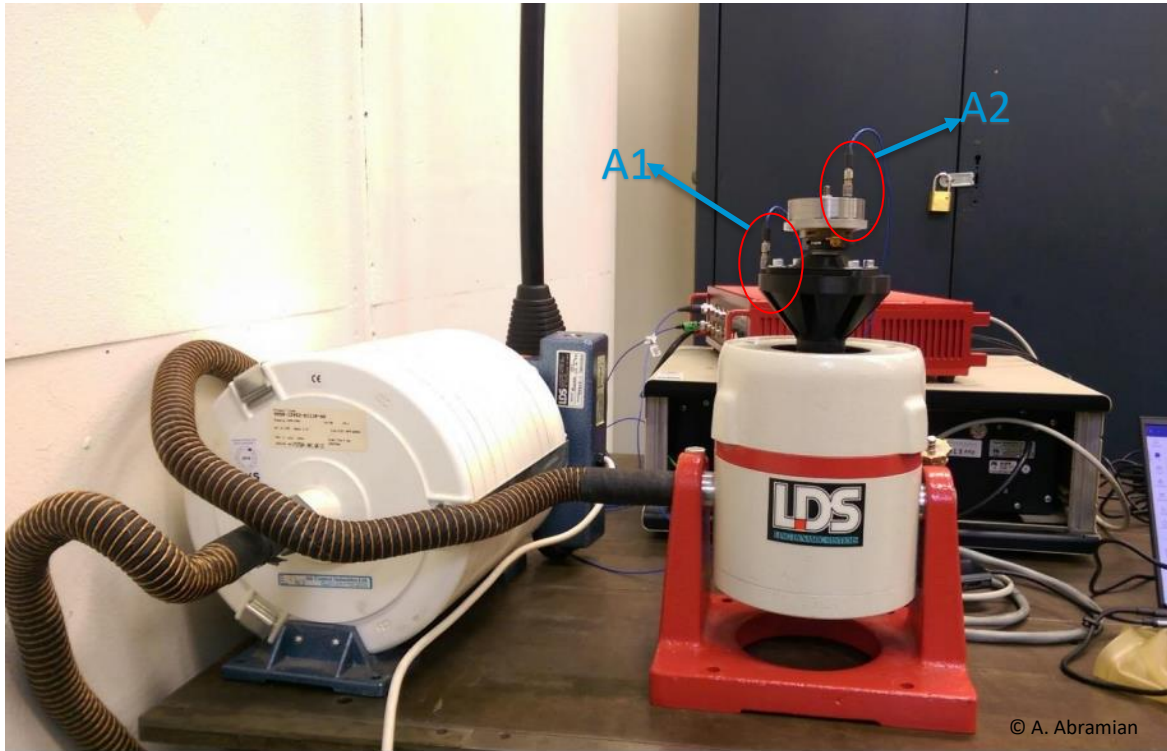
https://www.gmt-gmbh.de/fileadmin/daten/downloads/catalogues/GMT_Product_range_2017_Online.pdf



<https://novibration.com/products/ring-bushing-mount-series/>



MEASUREMENT SETUP

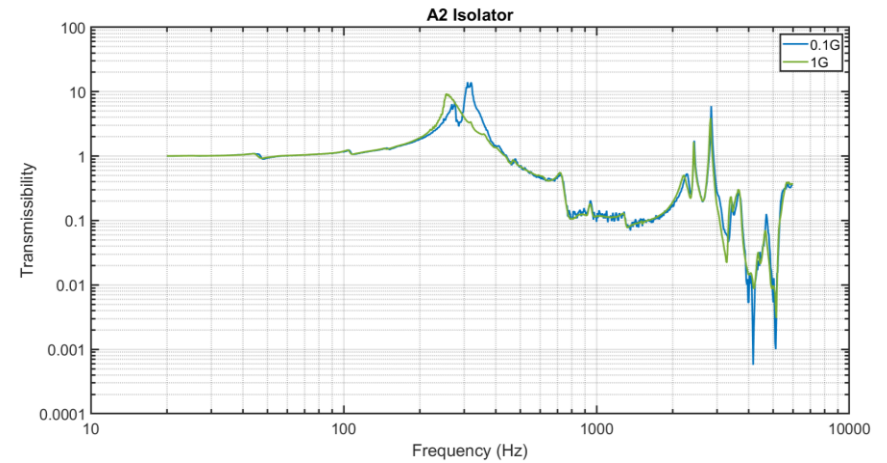
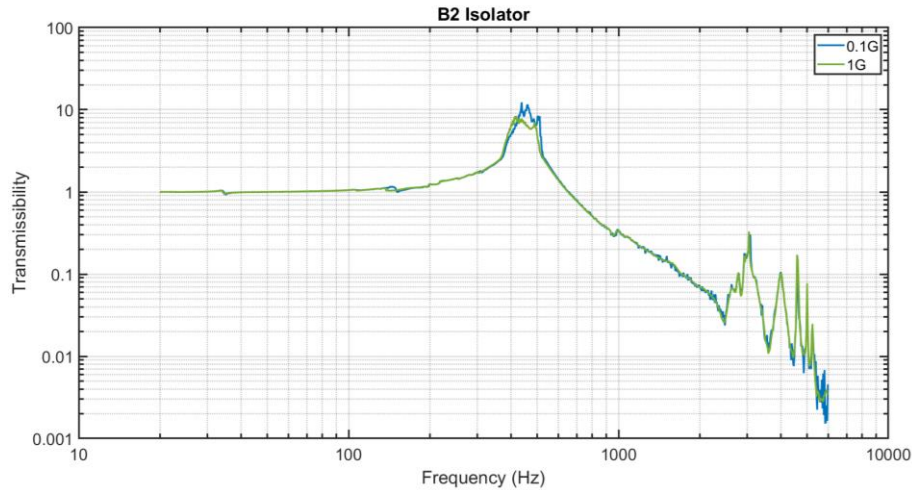


Shaker setup for the Analysis

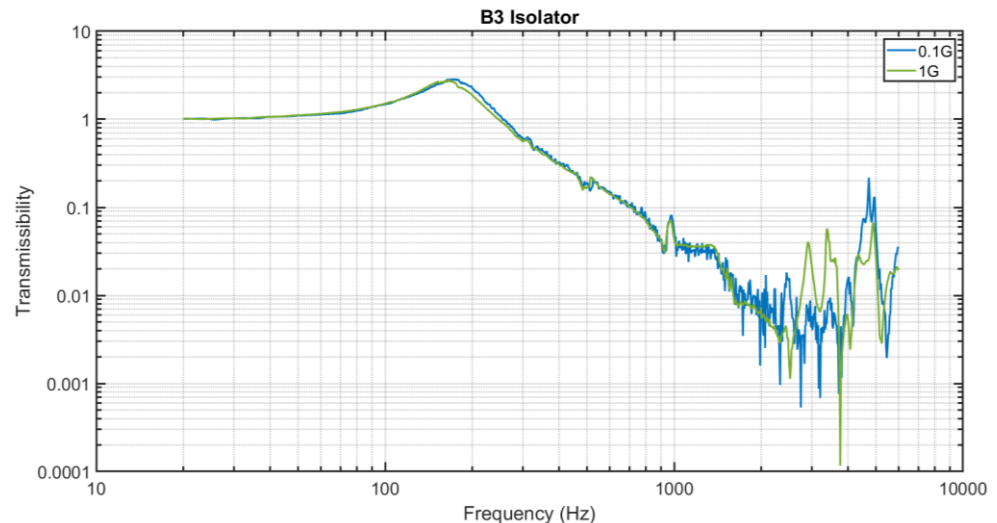
- In this experiment set up, **two Seismic mass are used 60 and 300 gram**
- The isolators are tested with acceleration level 1 and 10 m/s^2
- Accelerometer 1 is for the reference value
- Accelerometer 2 is output, which is used for the transfer function

TRANSMISSIBILITY

Different Isolators with different acceleration level

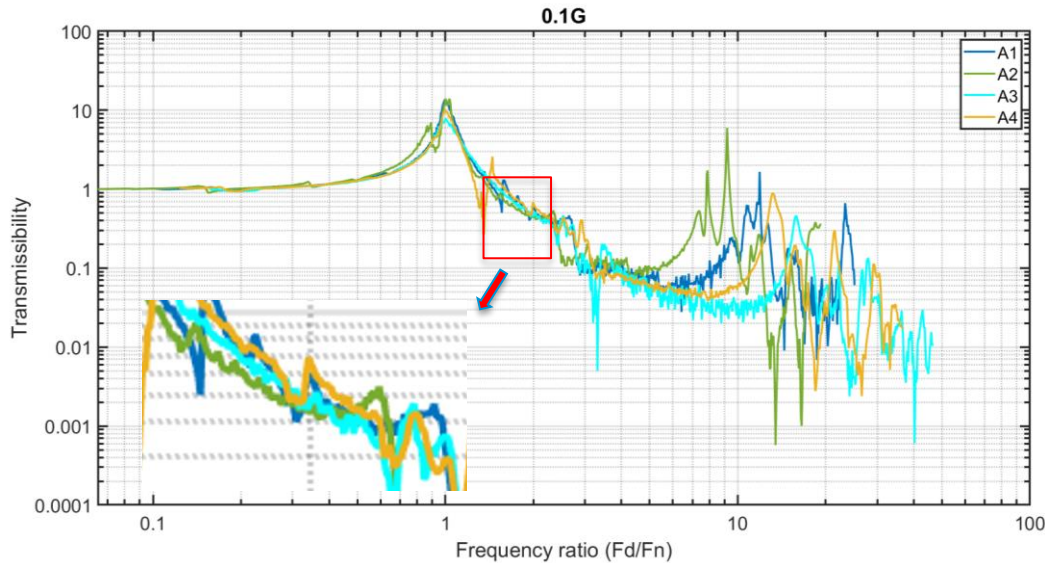


- As an acceleration level is increased the damping of the isolator is also increased
- Isolation behavior is same as an acceleration increased



TRANSMISSIBILITY

A-Group Category

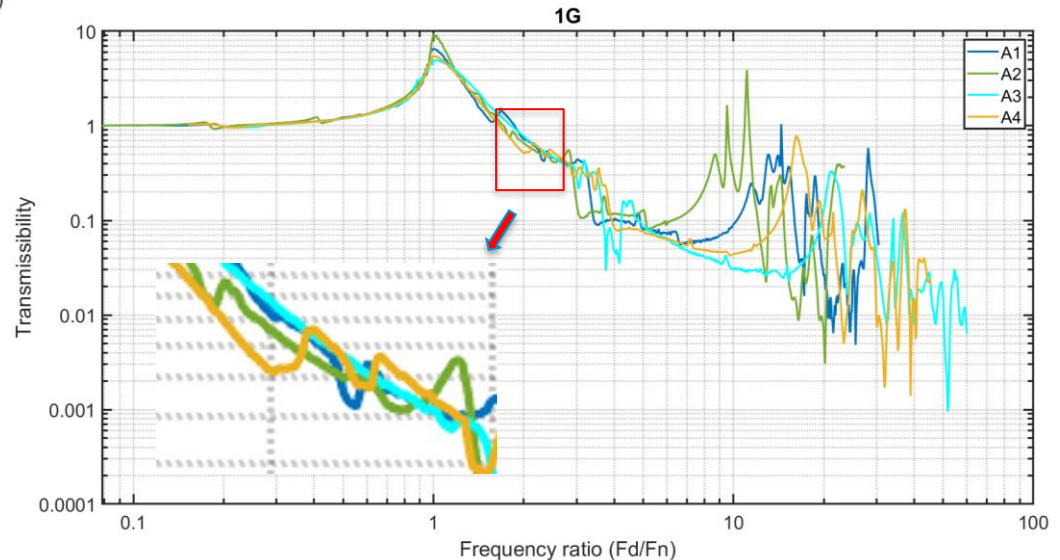


	0,1G	1G
A1	13,89	6,52
A2	14,08	9,29
A3	7,78	4,95
A4	10,2	5,46

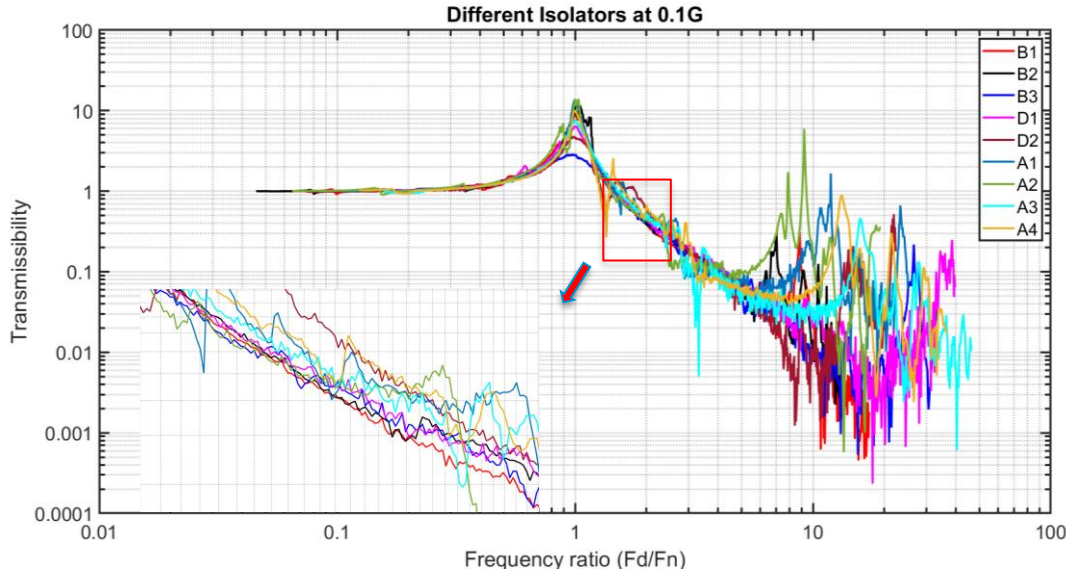
Amplitude at Resonance

Isolation behavior

- All the isolator has nearly same behavior on the isolation area
- The loglog slope for all the isolators in isolation region is nearly -2.5



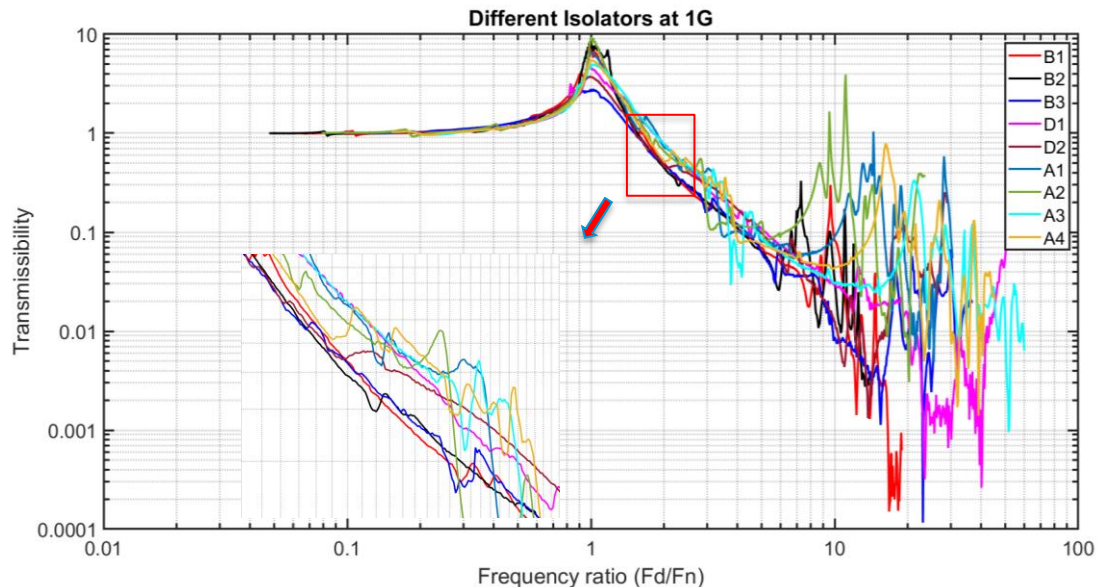
TRANSMISSIBILITY OF ISOLATORS



	0,1G	1G
B2	12,33	8,4
B1	10,39	7,1
B3	2,85	2,7
D1	6,46	4,64
D2	4,73	3,73
A1	13,89	6,52
A2	14,08	9,29
A3	7,78	4,95
A4	10,2	5,46

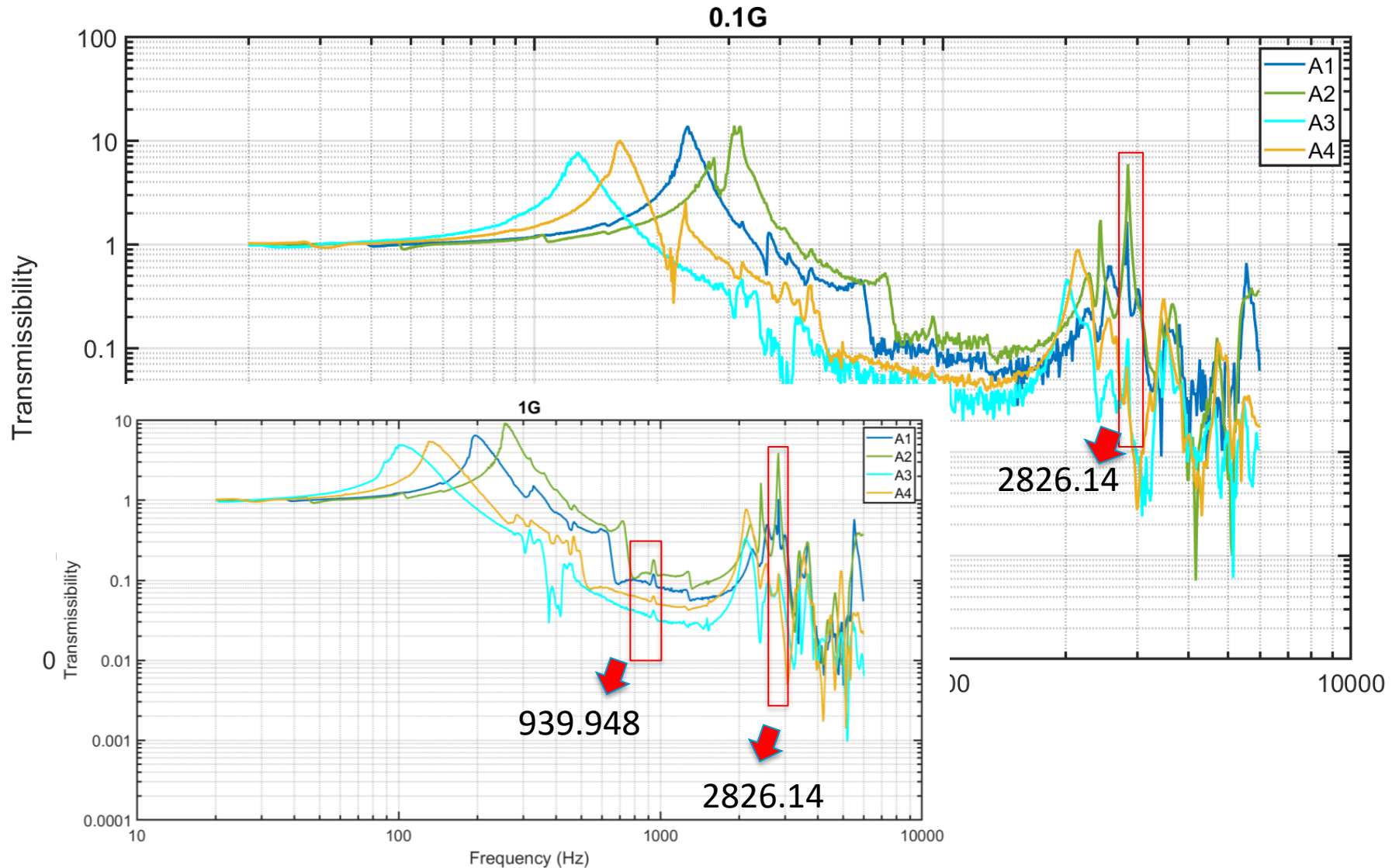
Amplitude at Resonance

- All the isolator has nearly same behavior on the isolation area
- B3 has highest damping at both acceleration level
- As acceleration is increased the damping is also increased



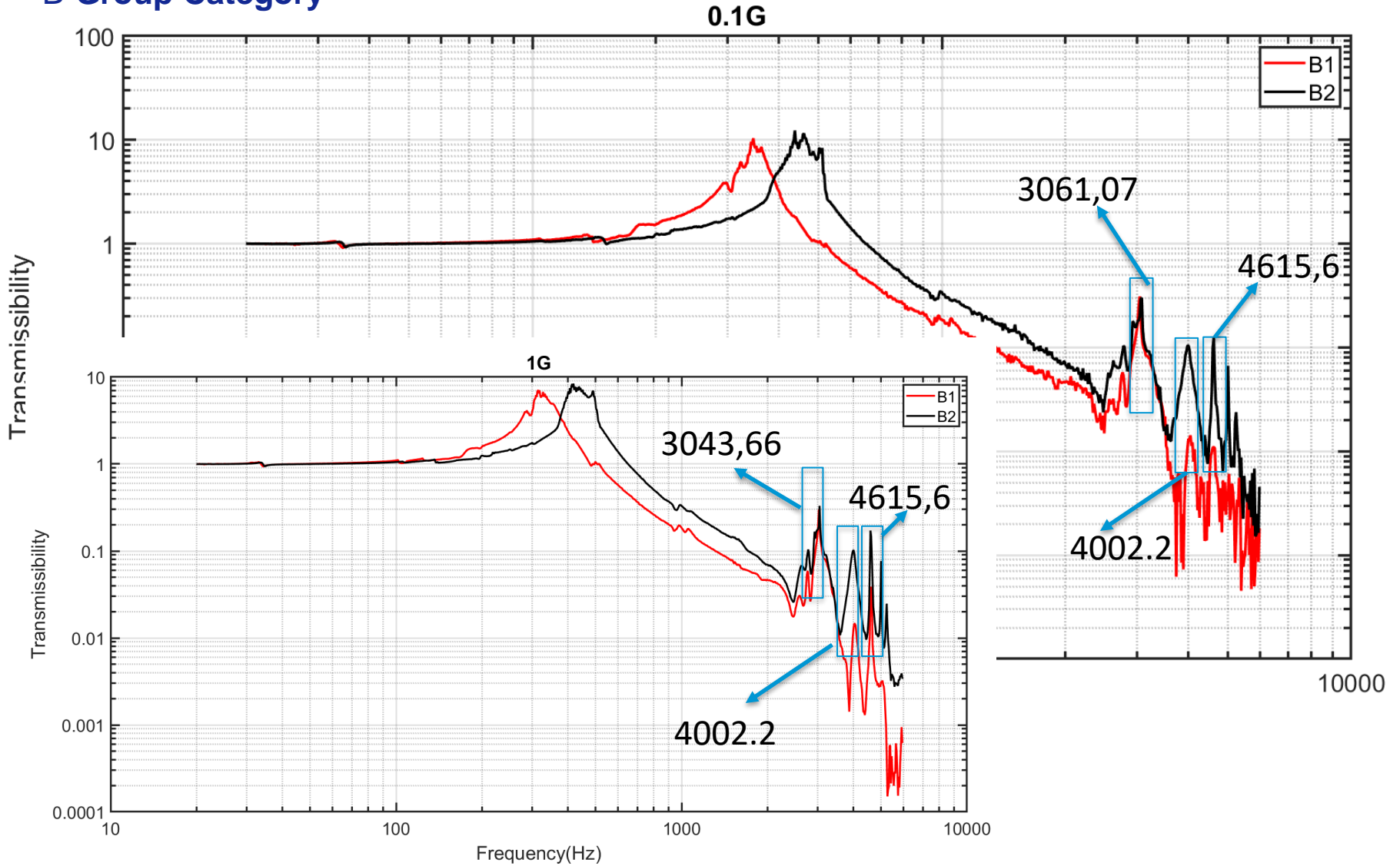
STATIC MODES

A-Group Category



STATIC MODES

B-Group Category



CONCLUSION

- Different isolators are tested on the shaker with an acceleration level of 1 and 10 m/s² by applying a sine-sweep-controlled signal for checking the amplitude linearity and non-linearity
- B3 (B-Category) has a highest damping
- All the isolators has nearly same isolation
- The isolator can be optimized in the area of isolation according to the area of application by using different material and geometry variations

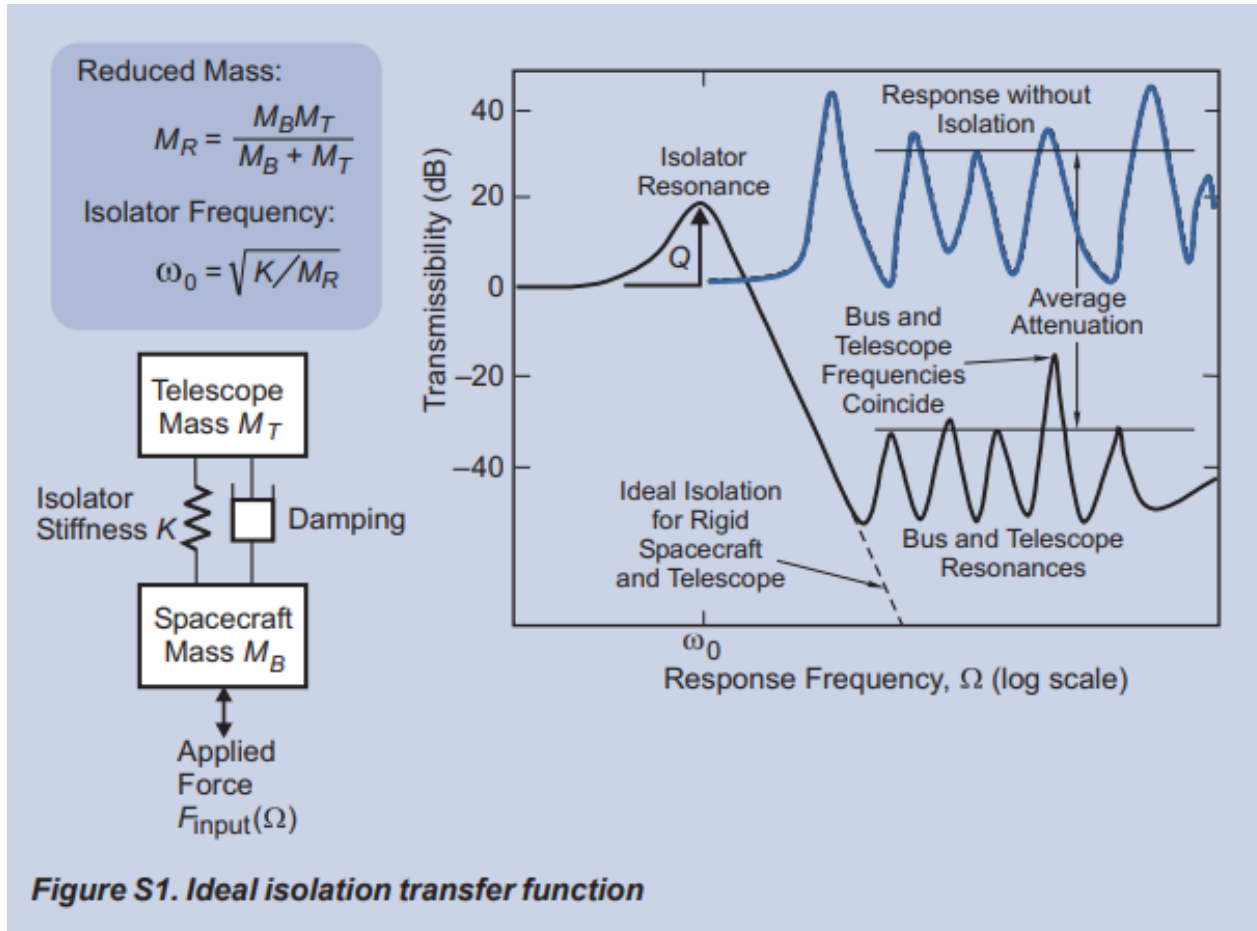
THANK YOU....

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APPENDIX

STATIC MODES



https://www.vibrationdata.com/tutorials_alt/05FW_Bronowicki.pdf