

Development of Quietness for New Compact SUV with Third Generation 100% Electric Drive Hybrid Powertrain

Riku Sekine¹⁾ Ryo Matsunaga¹⁾ Takayuki Miyakawa¹⁾ Masahiro Kanayama¹⁾ Yukihiro Mori¹⁾

1) Nissan Motor Co., Ltd.

560-1 Okatsukoku, Atsugi, Kanagawa, 243-0192, Japan (E-mail: riku-sekine@mail.nissan.co.jp)

KEY WORDS: Hybrid powertrain, engine noise, road noise, speech intelligibility

A new compact SUV was developed by applying Nissan's third-generation 100% electric-drive hybrid powertrain (e-POWER) to a compact-car platform. The development objective was to provide EV-like driving comfort by enhancing cabin quietness. To achieve this goal, three key targets were established: increasing motor-only driving time by reducing engine start frequency, reducing engine noise when engine starts, and improving vehicle isolation to suppress non-engine noise as road noise.

For reduction engine start frequency, two technologies were applied. The first is engine control based on road-noise estimation, which schedules battery charging during driving conditions where road noise naturally masks engine noise. The second is the adoption of an electric brake booster, eliminating engine starts previously required to generate brake vacuum assistance. As a result, engine start frequency in urban driving was reduced by approximately 95% compared with the previous model, significantly increasing motor-only driving time and improving the EV-like driving experience.

Although engine start frequency is reduced, there are some cases that engine starts. For engine noise reduction to achieve acceptable level, engine revolution is set to lower by approximately 400rpm compared to the previous model in fixed-point generation during city driving and maintain the same engine power by increasing torque. The third-generation 5-in-1 powertrain also improved torsional rigidity by 20%. To suppress booming noise associated with increased engine torque, body stiffness, engine mount, and exhaust system performance were improved. As a result, engine noise during urban driving was reduced by approximately 2.5 dB compared to the previous model.

To achieve a well balanced reduction non-engine noise as road noise, door isolation were improved by sealing hole and gaps. Rear isolation was also improved by reducing leakage around the rear ventilation path and optimizing absorption parts. As a result, tire-noise isolation was reduced by about 2 dB.

As a result of following improvement by applying above techniques. Engine start frequency was reduced and extended motor-only driving time by adopting engine control based on road noise estimation and electric brake booster. Engine noise during urban driving was reduced by adopting third-generation e-POWER, reducing engine revolution while urban driving and improvement of vehicle sensitivity(Fig.1). In addition, speech intelligibility was enhanced by improving body isolation(Fig.2). These contributes to enhancing quietness at starting off and urban driving.

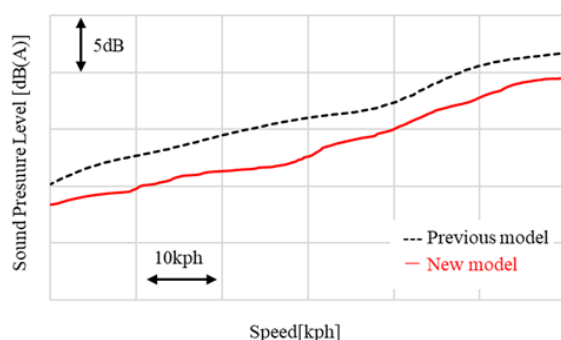


Fig.1 Engine Noise POT

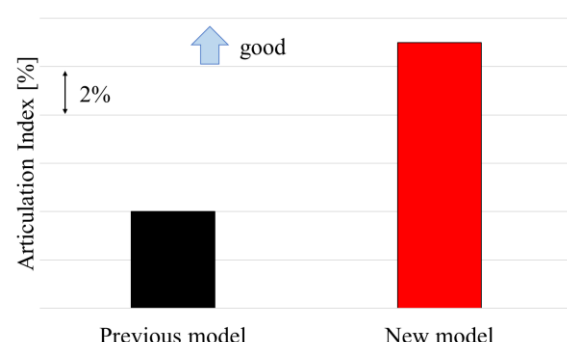


Fig.2 Articulation Index