

# Technical Comparison of FMVSS 141 and ECE R138

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# Overview

- FMVSS 141 and ECE R138 are both written to provide improved pedestrian safety by requiring minimum sound emissions from electric and hybrid-electric passenger vehicles.
- FMVSS 141 and ECE R138 have similar, but not identical, technical test methods.
  - FMVSS 141 is based on SAE J2889-1, but with changes and modification from the specifications of SAE J2889-1.
  - ECE R138 incorporates the test specifications of ISO 16254, which is a technical mirror of SAE J2889-1.
- This review covers the technical test methods. It does not address the choice of vehicle operating conditions.
- Both SAE and ISO will conduct further technical review and assessments based on the progress of the GTR.



# Technical Assessment Areas

- Background noise
- Background noise compensation
- Selection of performance metrics
- Selection of 1/3 octave band levels
- Tire conditioning
- Vehicle Mass
- Test Facilities

# Background noise

Regulation	Time period	Metric	Comment	Peak to peak ?
FMVSS 141	30 seconds before and after test	Minimum Overall SPL, Minimum 1/3 octave band level	<p>1) Choice of minimum is technically incorrect, leads to increased measurement uncertainty. Potential for compliance mis-assessment.</p> <p>2) Clarification on how 1/3 octave chosen required – minimum 1/3 octave level in each band over entire 60 second measurement interval, 1/3 octave at time of minimum overall level, other?</p>	Not used or checked
ECE R138	10 seconds, representative sample	Maximum overall SPL, 1/3 octave spectrum at time of maximum SPL		Used and checked

# Background noise compensation

Regulation	Overall SPL Compensation permitted?	1/3 Octave band SPL Compensation permitted?	Comment	Peak to peak ?
FMVSS 141	Yes	Yes	1) Compensation based on minimum SPL levels is technically incorrect. Compensation is based on the assumption the background levels are of sufficient stability to allow compensation to apply. 2) 1/3 Octave band levels do not have sufficient stability to apply compensation.	Not used or checked
ECE R138	Yes	No		Used and checked

# Selection of performance metrics

Regulation	Overall SPL	1/3 Octave band SPL	Frequency Shift	Maximum permitted level	Volume increase
FMVSS 141	Measured, but not used for performance assessment	Yes	No, but recommended	Not used	Yes, explicit performance metric
ECE R138	Yes, can be used for full compliance assessment if meets specifications	Yes	Yes	Yes	No, but implied from 1/3 octave levels

# Selection of 1/3 octave band levels

Regulation	How chosen	Averaging
FMVSS 141	Clarification on how 1/3 octave chosen required – minimum 1/3 octave level in each band over measurement interval, 1/3 octave at time of minimum overall level, other?	Not specified. NHTSA verbal guidance in January 2017 to mathematically average 4 individual test runs.
ECE R138	Per procedures in SAE J2889-1 and ISO 16254: 1/3 octave chosen at time of overall SPL.	Per procedures in SAE J2889-1 and ISO 16254: mathematical averaging of 4 individual test runs

# Tire conditioning

Regulation	Specifications	Which tires to be used?	Comment
FMVSS 141	Tires at manufacturer stated pressure. Tire conditioning procedure	Not stated. Implied can be any tire. Field compliance assessment will need to address non-OEM tires.	Tires will influence result, especially at speeds over 20 km/h.
ECE R138	Per procedures in SAE J2889-1 and ISO 16254: 1/3 octave chosen at time of overall SPL.	Selected by manufacturer from offered tires.	



# Vehicle Mass

Regulation	Specifications		
FMVSS 141	Evenly distributed between right and left sides. Vehicle will not exceed GVWR, vehicle test weight is unloaded weight plus 180 kg.	Mass not expected to have effect on test result. Test tolerance helpful as practical matter, hitting test weight exactly is unnecessary.	
ECE R138	Mass in running order with tolerance of +/- 15%	Practical level of tolerance, FMVSS 141 provision not to overload vehicle is sensible.	

# Test Facilities

Regulation	Outdoor	Indoor	Frequency shift
FMVSS 141	Required for NHTSA compliance assessment. Manufacturer can choose any option for self-certification	Not permitted for NHTSA compliance assessment	Not used
ECE R138	Permitted option	Permitted option	Indoor and outdoor test options



# Thank you

- Questions?

