

## Possibility for using Annex 3 limit values for ASEP requirements

### Based on D limit value proposal

Proposal made by Dr. Schade, UBA,  
Modifications made by H. Steven

18.05.2007

# Test area limitations

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- Vehicle speeds between 20 km/h ( $v_{AA'}$ ) and 80 km/h ( $v_{BB'}$ )
- Engine speeds at BB' up to  $2,6 * pmr^{-0,29} * (s - n_{idle}) + n_{idle}$ , but not more than  $0,9 * (s - n_{idle}) + n_{idle}$ 
  - with  $s$  – rated engine speed in  $min^{-1}$ ,
  - $n_{idle}$  – idling speed in  $min^{-1}$
  - $pmr = P_n$  in kW / ( $m_0$  in kg + 75) \* 1000
- Engine speeds at AA not lower than  $0,1 * (s - n_{idle}) + n_{idle}$
- $pmr$  is the power to mass ratio index. This is the rated power of the vehicle ( $P_n$ ) in kW divided by the kerb mass of the vehicle ( $m_0$ ) in kg + 75 (to account for the mass of the driver) and multiplied by 1000.
- Acceleration between AA and BB  $\leq [4] m/s^2$

# Approach

- From ISO 362-1, Annex A:
  - $n/s(L_{90}) = 1,65 \cdot pmr^{-0,32}$ ,  $n(L_{90}) = s \cdot 1,65 \cdot pmr^{-0,32} = n_{urban}$ ,
  - $s$  – rated engine speed,  $L_{90}$  – 90% percentile of noise emission in urban traffic,  $pmr$  – power to mass ratio index,
- $L_{urban} = (1 - kp) \cdot L_{wot\_ref} + kp \cdot L_{crs\_rep}$ 
  - $kp = 1 - a_{urban}/a_{wot\_ref}$
- $L_{urban}$  = Limit value (72 dB for  $pmr$  up to 120 and 73 dB for  $pmr > 120$ ) →
  - $L_{wot\_limit} = (\text{limit value} - kp \cdot L_{crs\_rep}) / (1 - kp)$
- **Simplification: use  $L_{roll\_50}$  instead  $L_{crs\_rep}$  →**
- $L_{wot\_limit} = (\text{limit value} - kp \cdot L_{roll\_50}) / (1 - kp)$ ,
- $L_{wot\_prop\_limit} = L_{wot\_limit} \ll \text{minus} \gg L_{roll\_50}$  is used as reference point,
  - $L_{roll\_50}$  is rolling sound emission at 50 km/h.
- $n_{urban}$  is used as reference speed

# Approach

- $a_{\text{urban}} = 0,63 \cdot \log(\text{pmr}) - 0,09,$
- $a_{\text{wot\_ref}} = 1,59 \cdot \log(\text{pmr}) - 1,41 \rightarrow$ 
  - $L_{\text{wot\_limit}} = f(\text{pmr}, L_{\text{roll\_50}}),$  see figure 1
  - $n_{\text{urban}}/s = f(\text{pmr}),$  see figure 2
- **ASEP propulsion sound emission limit:**
  - $L_{\text{prop\_limit}} = L_{\text{wot\_prop\_limit}} + b \cdot (n - n_{\text{urban}})/1000$
  - $b = 3$  for  $n < n_{\text{urban}},$   $b = 6$  for  $n \geq n_{\text{urban}}$
- **ASEP overall sound emission limit:**
  - $L_{\text{wot\_limit}} = \{(L_{\text{prop\_limit}} + b \cdot (n - n_{\text{urban}})/1000) \ll + \gg L_{\text{roll}}(v)\} + [1] \text{ dB},$
  - $L_{\text{roll}}(v) = B_{\text{roll}} \cdot \log(v/50) + L_{\text{roll\_50}}$
- A vehicle fails, if  $L_{\text{max}} - L_{\text{wot\_limit}} \geq 0,5 \text{ dB}$  inside the ASEP test area.

# Lwot\_limit

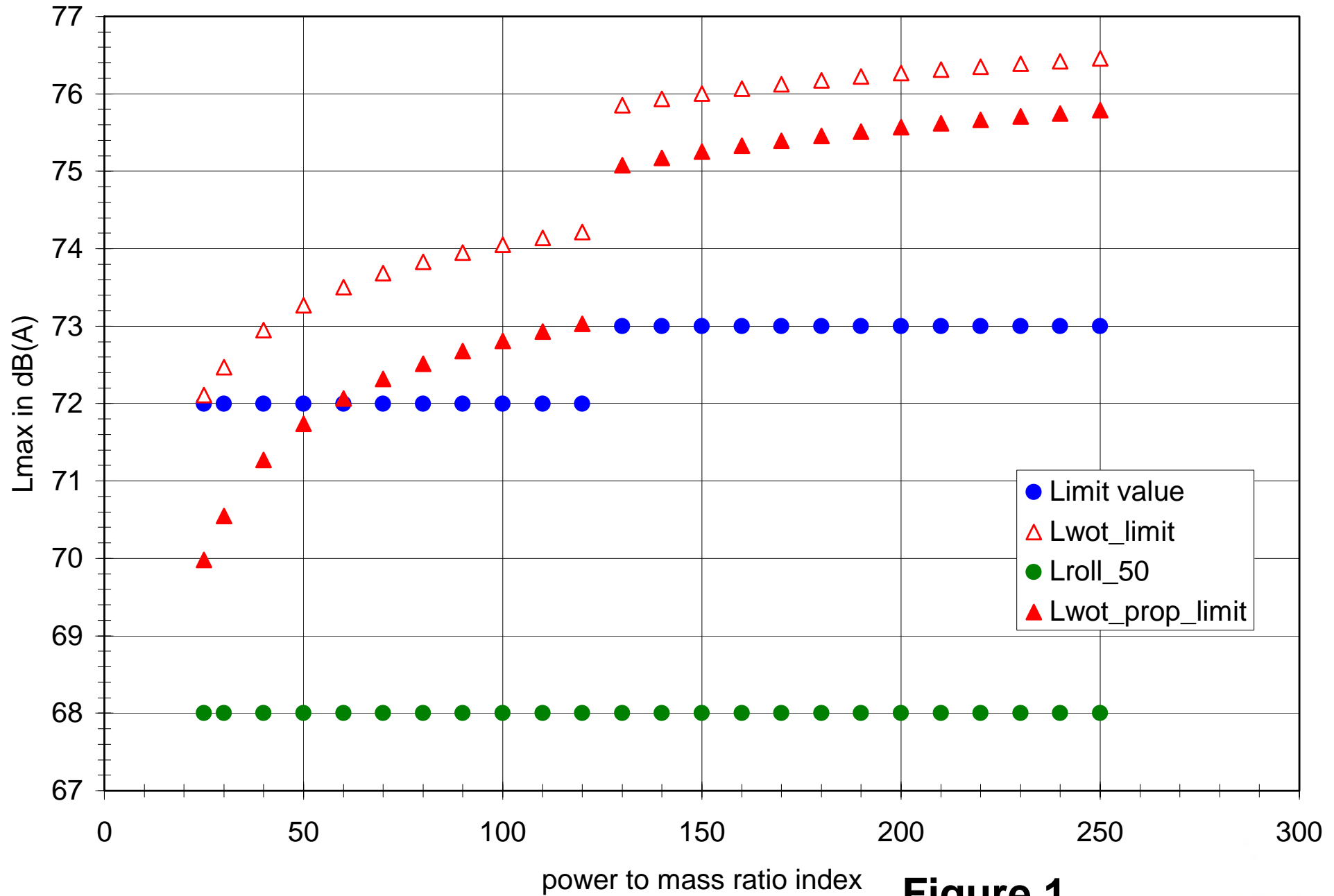


Figure 1

# Lwot\_prop\_limit and n\_urban/s

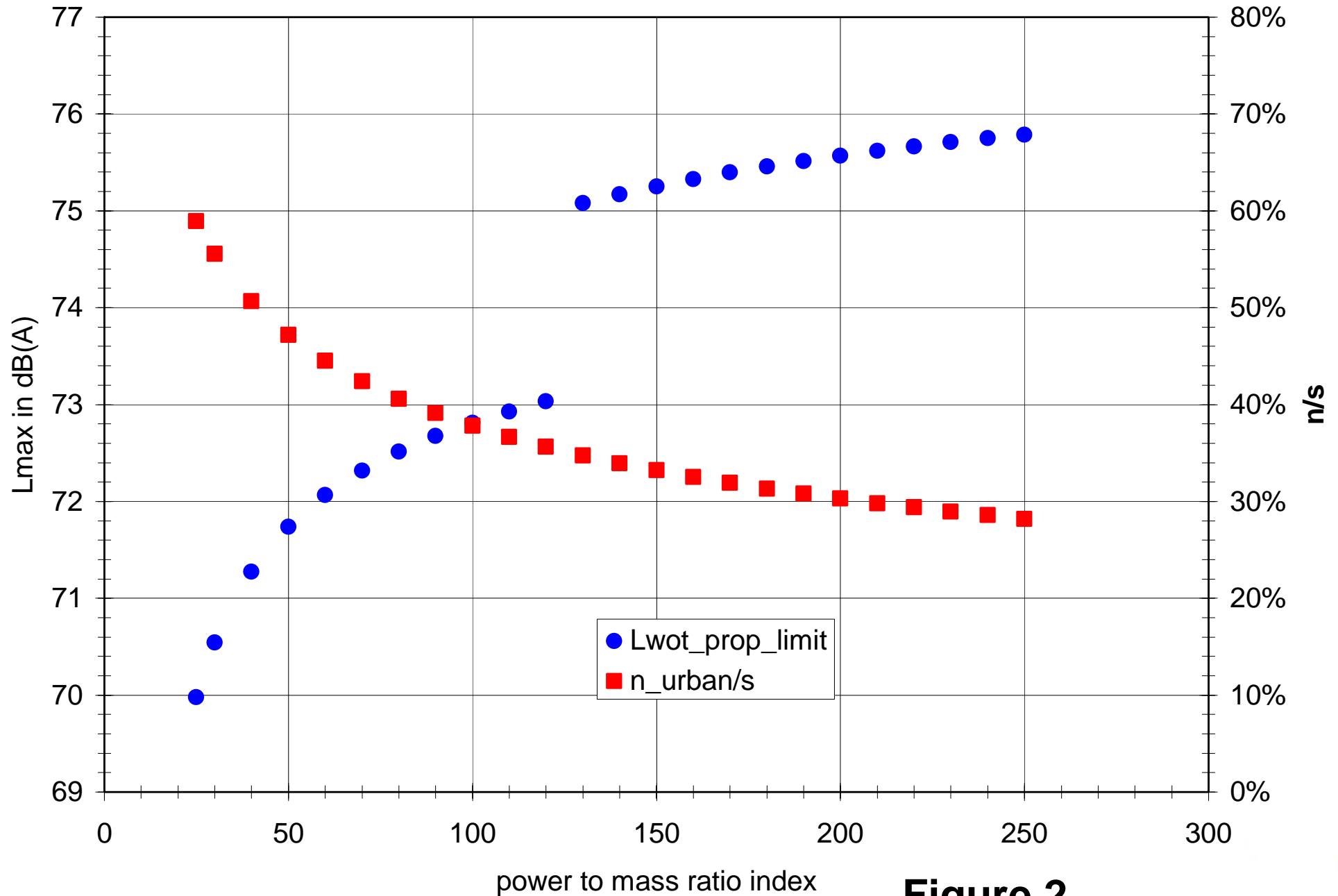


Figure 2

# Lwot\_limit for different pmr values

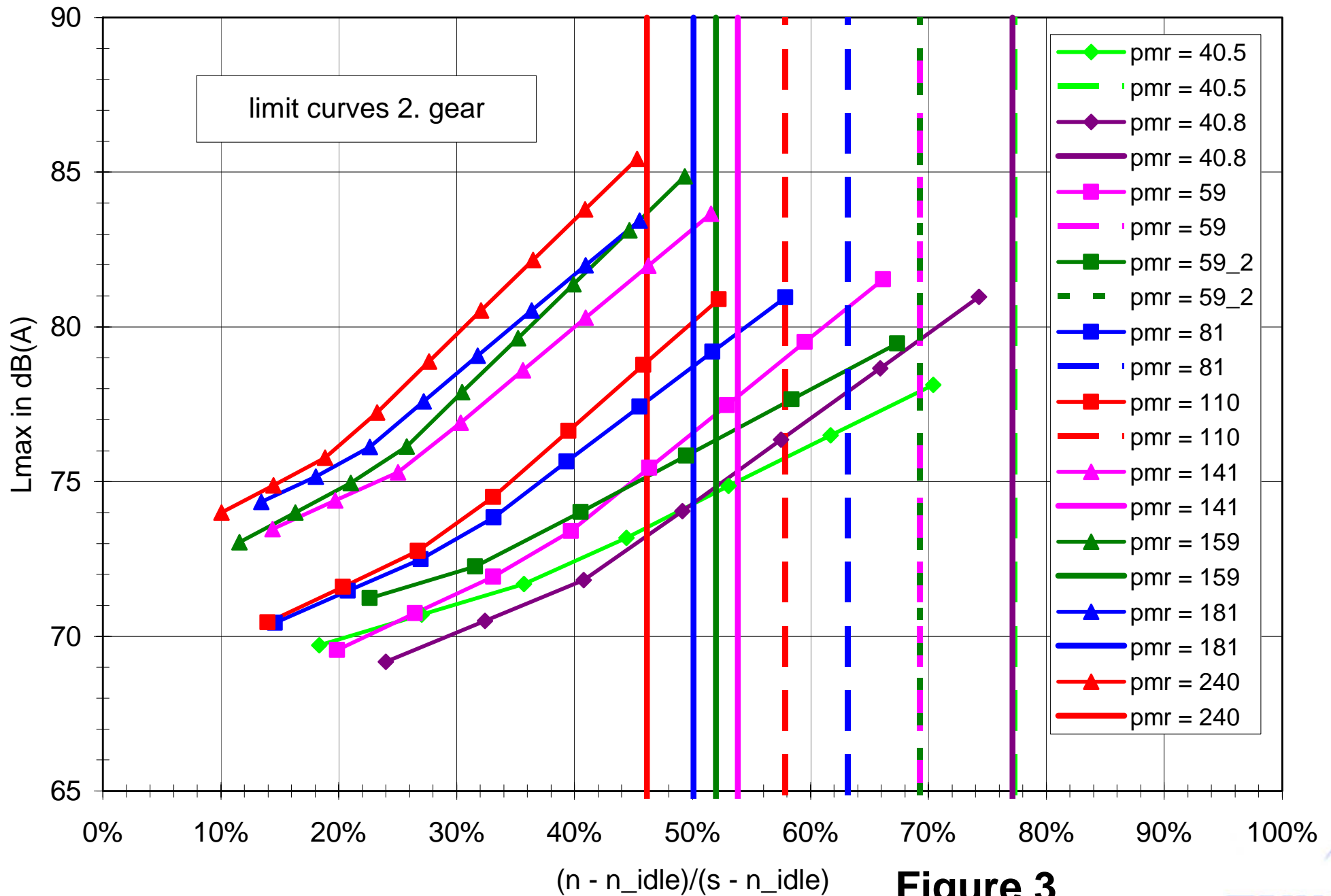


Figure 3

# Measurement results, vehicle 1

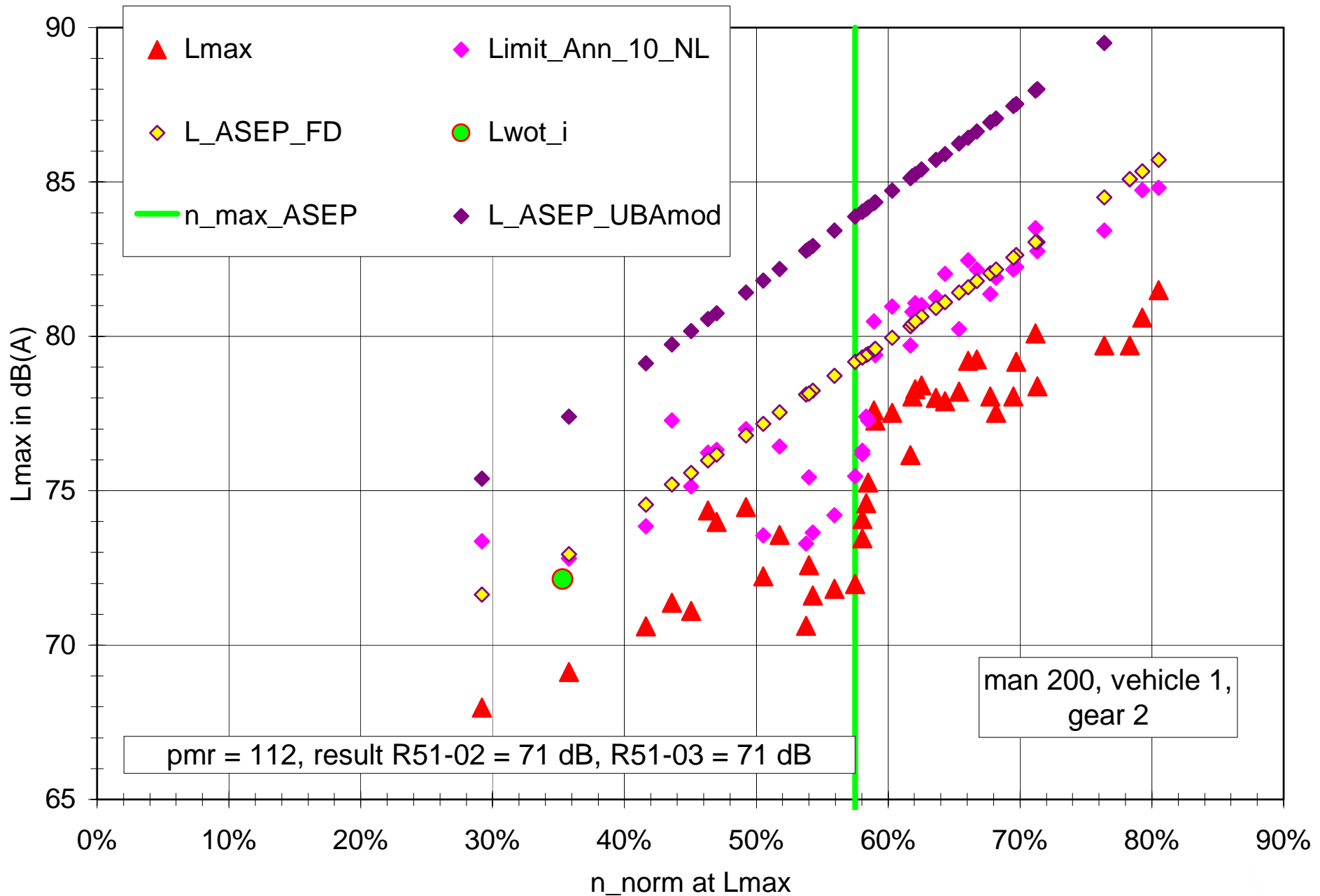


Figure 4



# Measurement results, vehicle 1

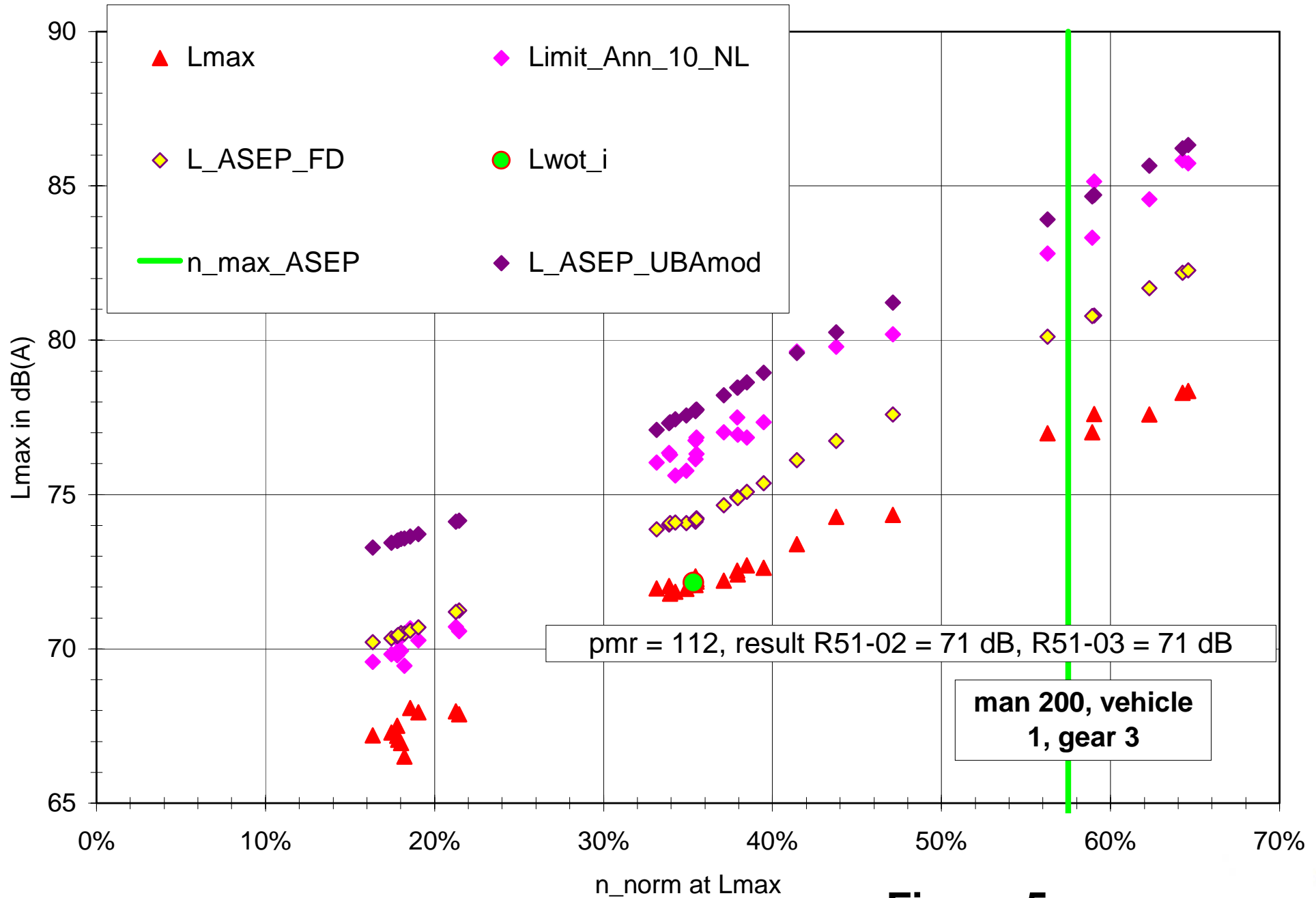


Figure 5

# Measurement results, vehicle 2

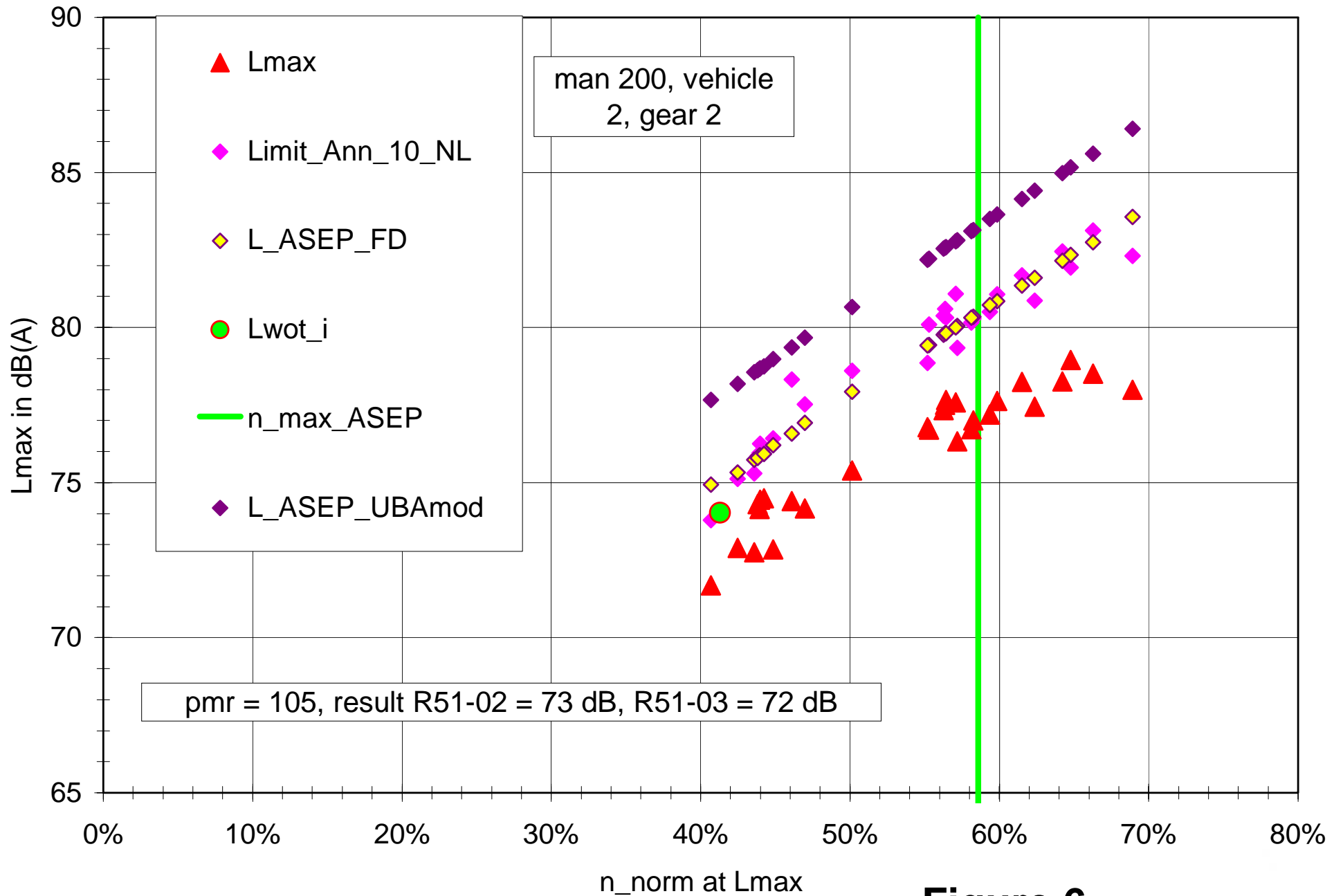


Figure 6

# Measurement results, vehicle 2

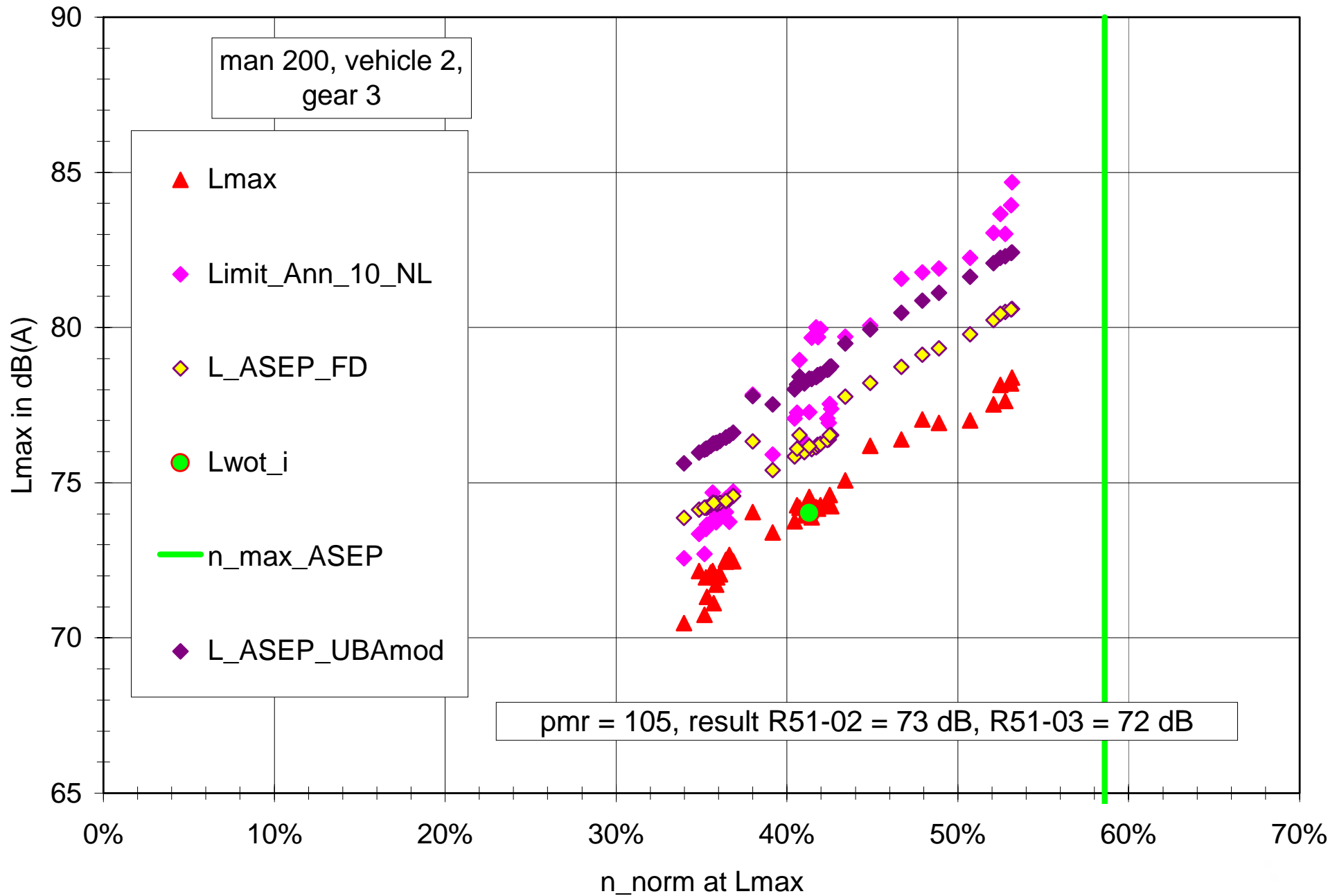
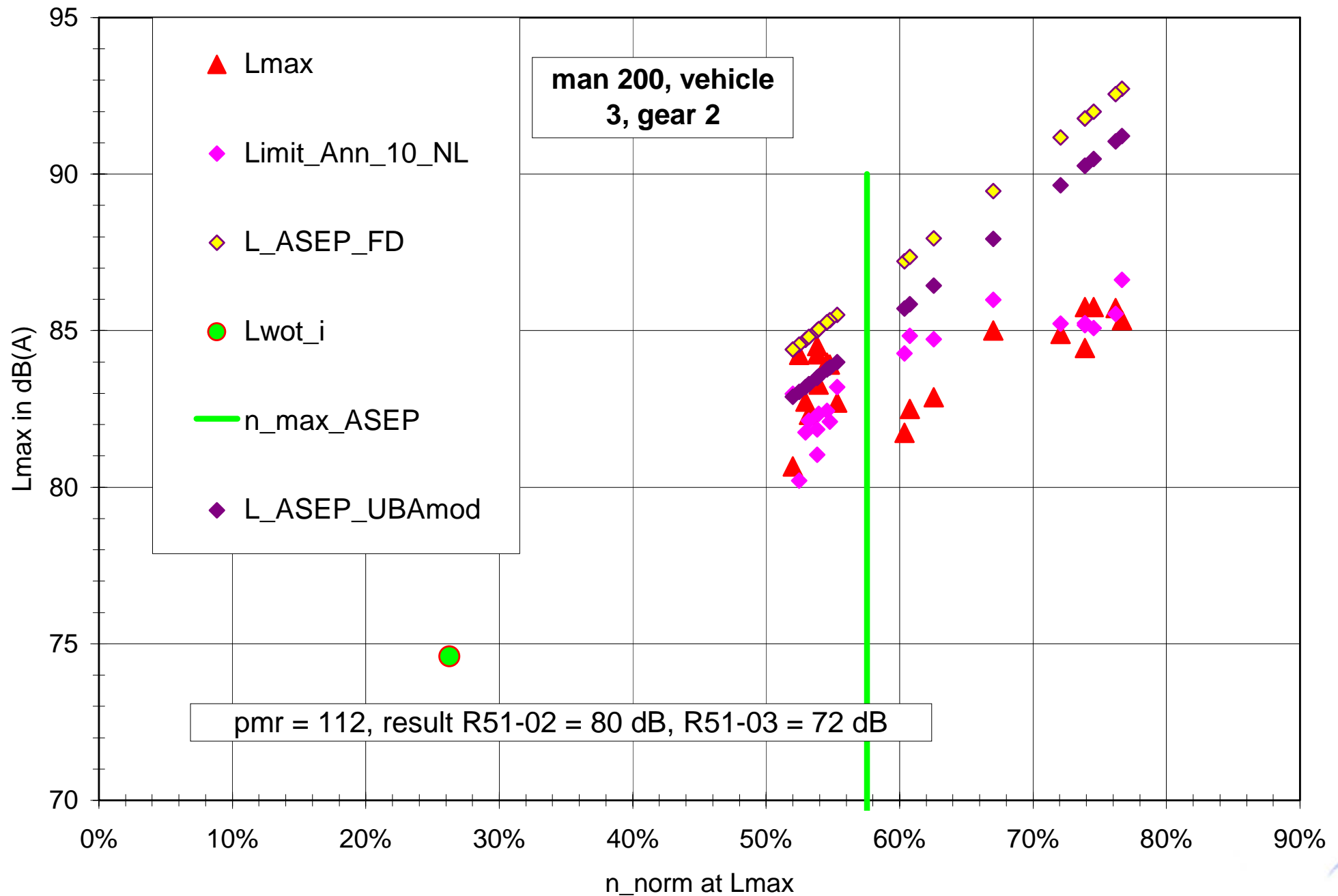


Figure 7

# Measurement results, vehicle 3



# Measurement results, vehicle 3

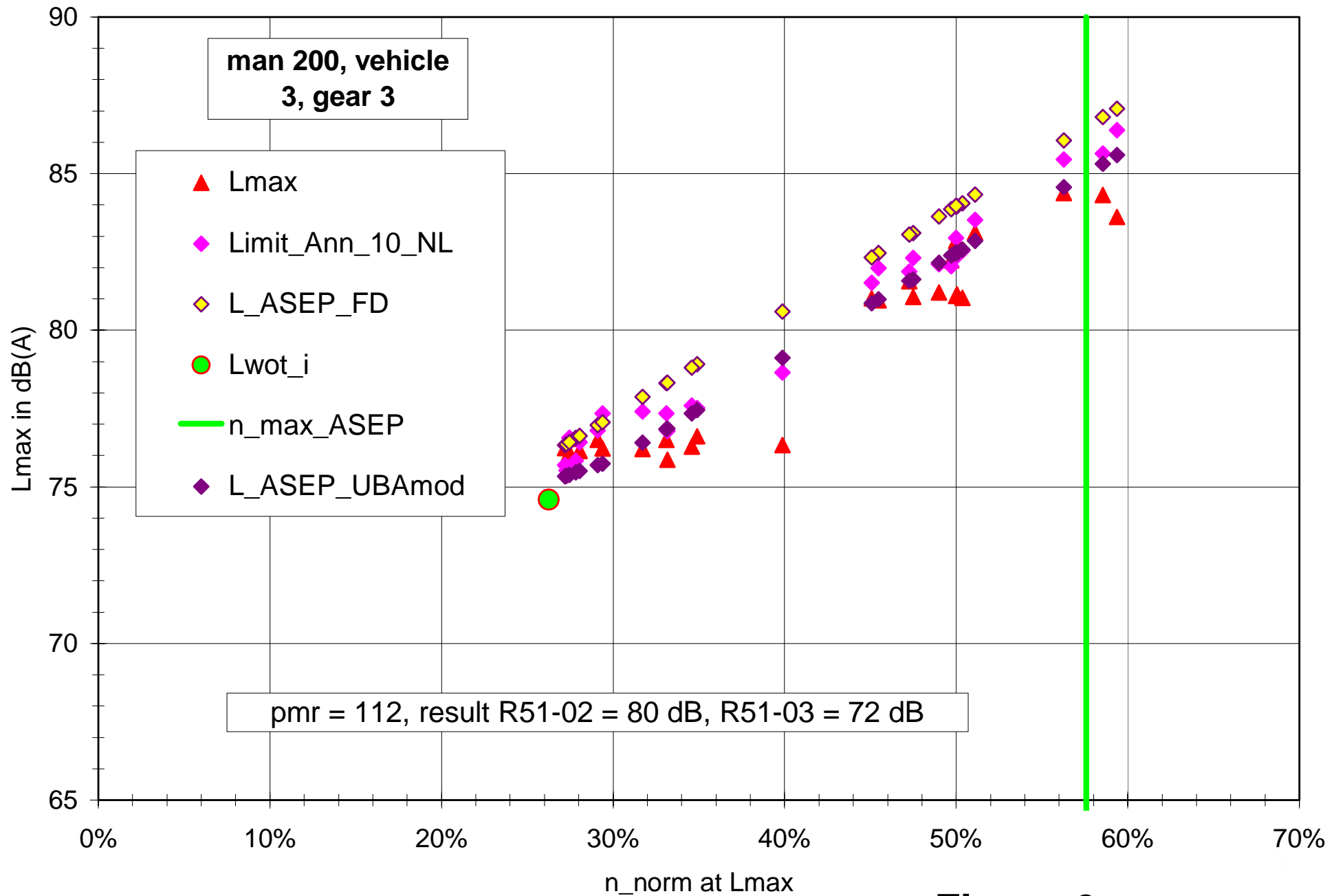


Figure 9

# Measurement results, vehicle 4

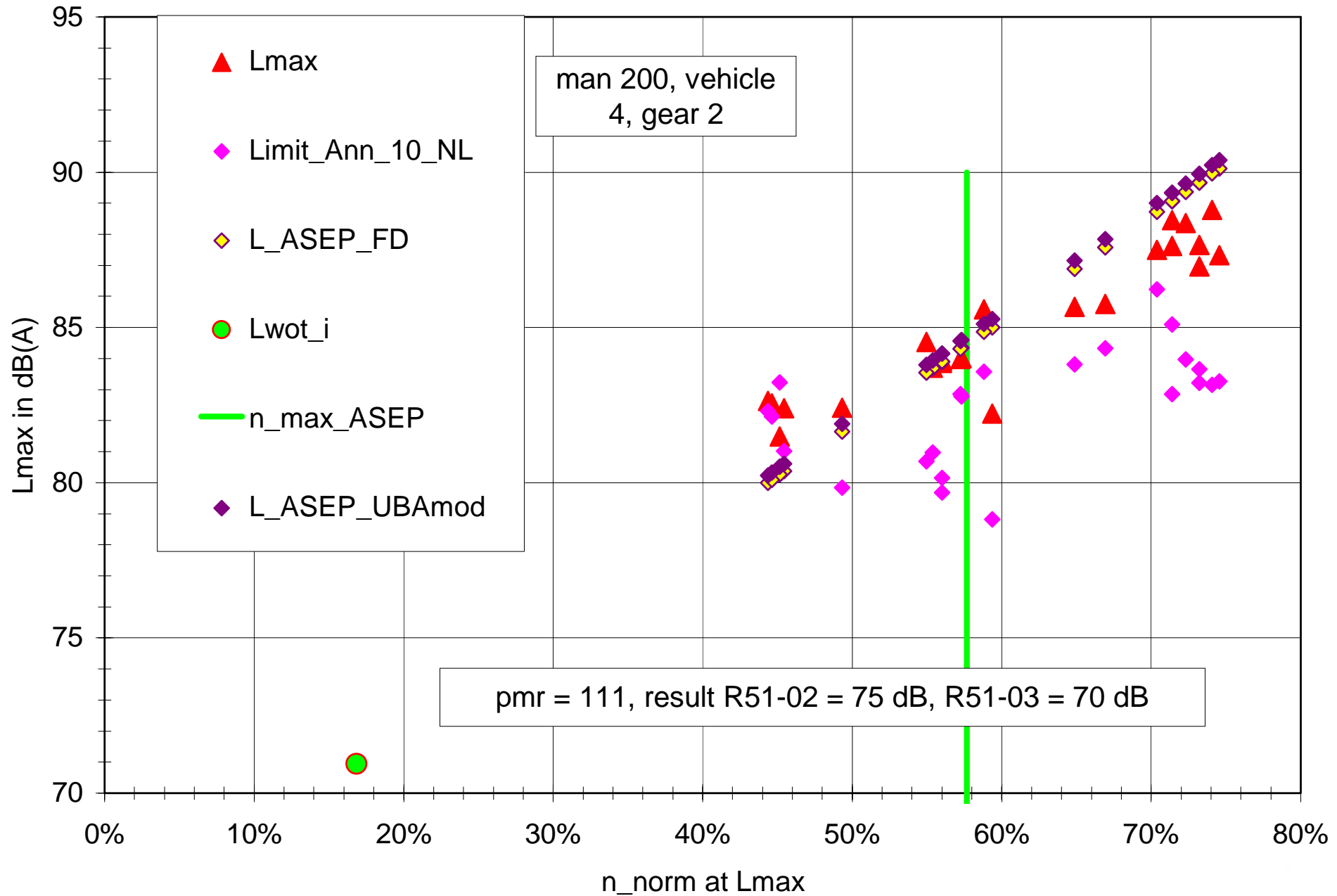


Figure 10

# Measurement results, vehicle 4

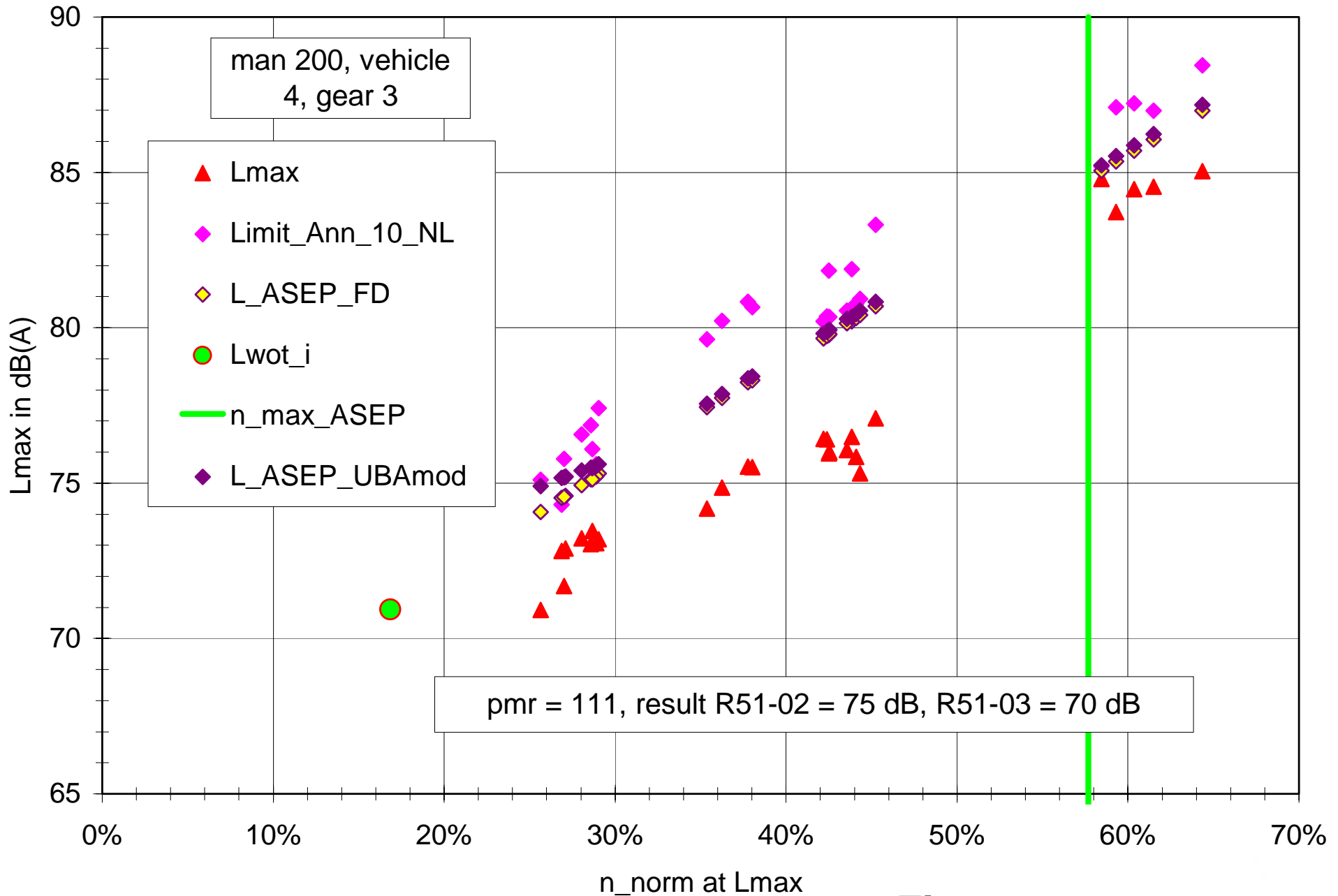


Figure 11

# Measurement results, vehicle 5

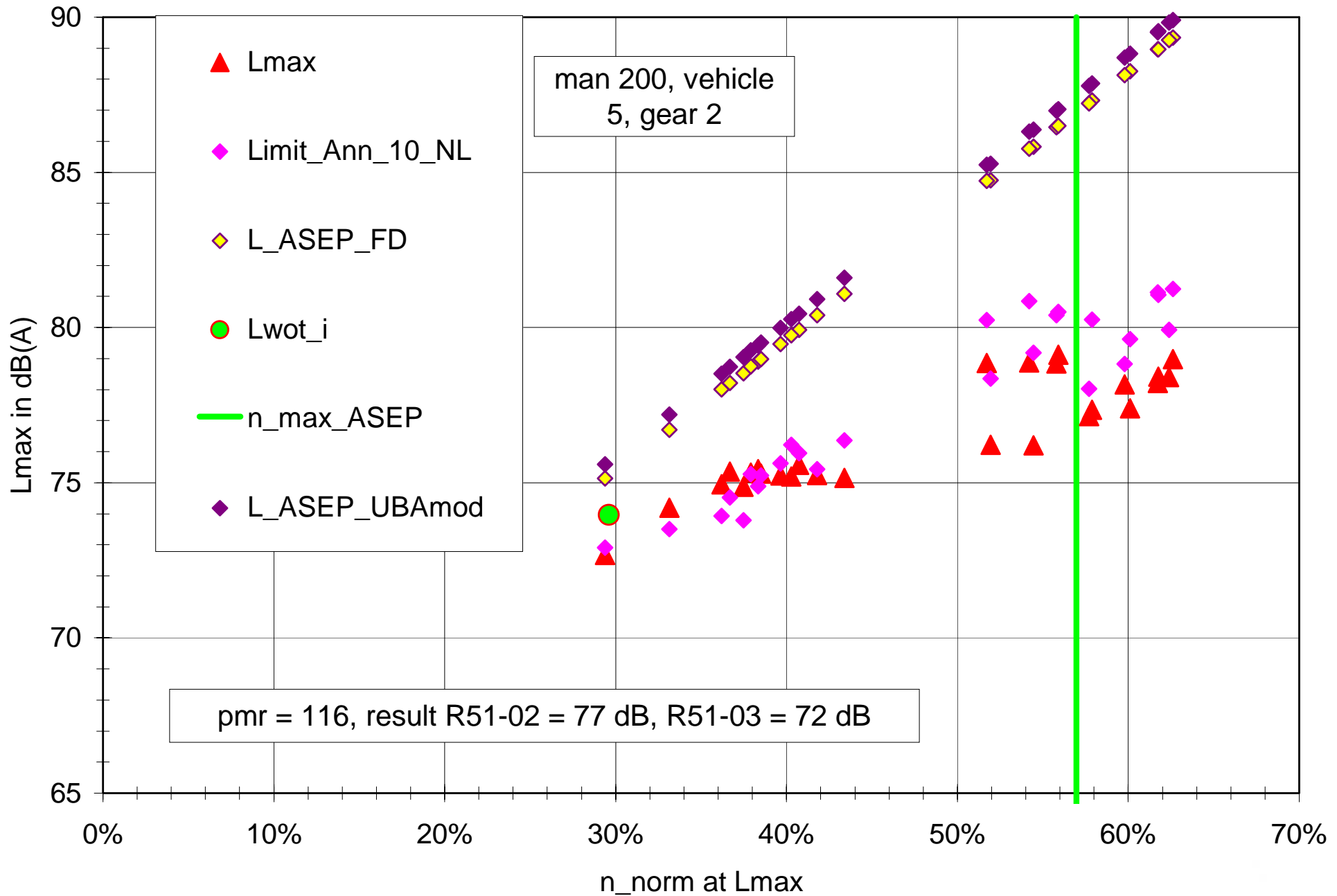


Figure 12



# Measurement results, vehicle 5

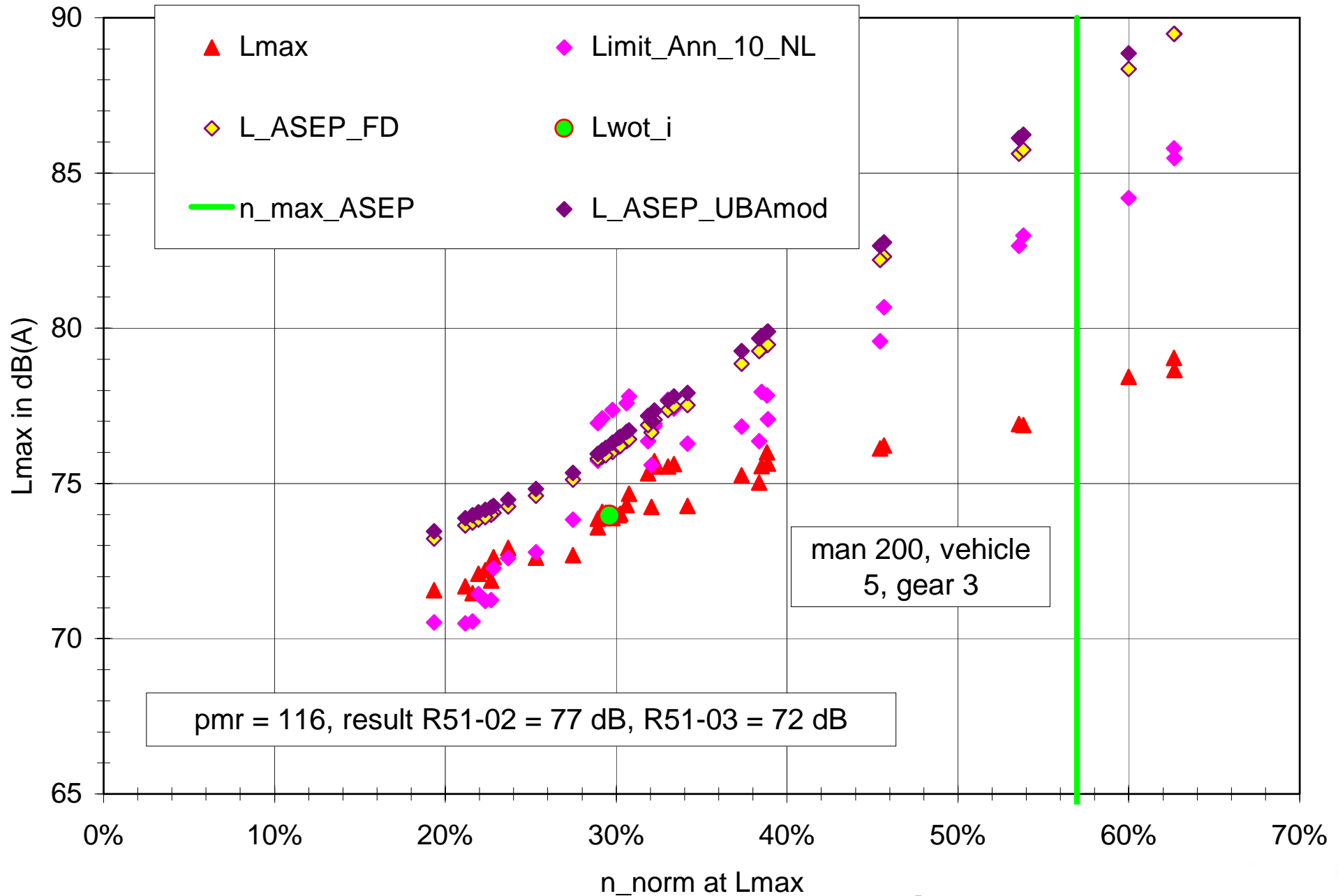


Figure 13

# Measurement results, vehicle 6

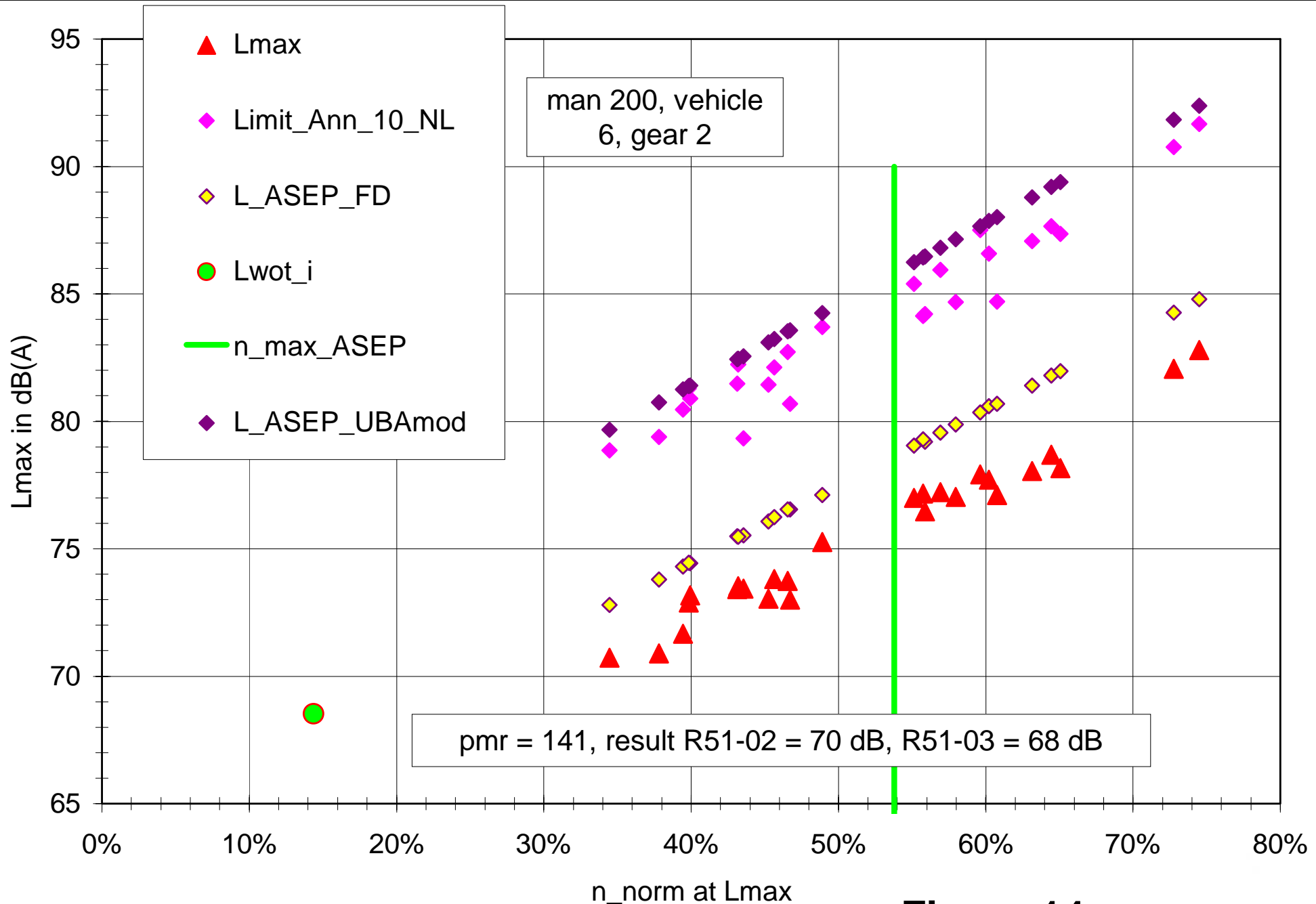


Figure 14

# Measurement results, vehicle 6

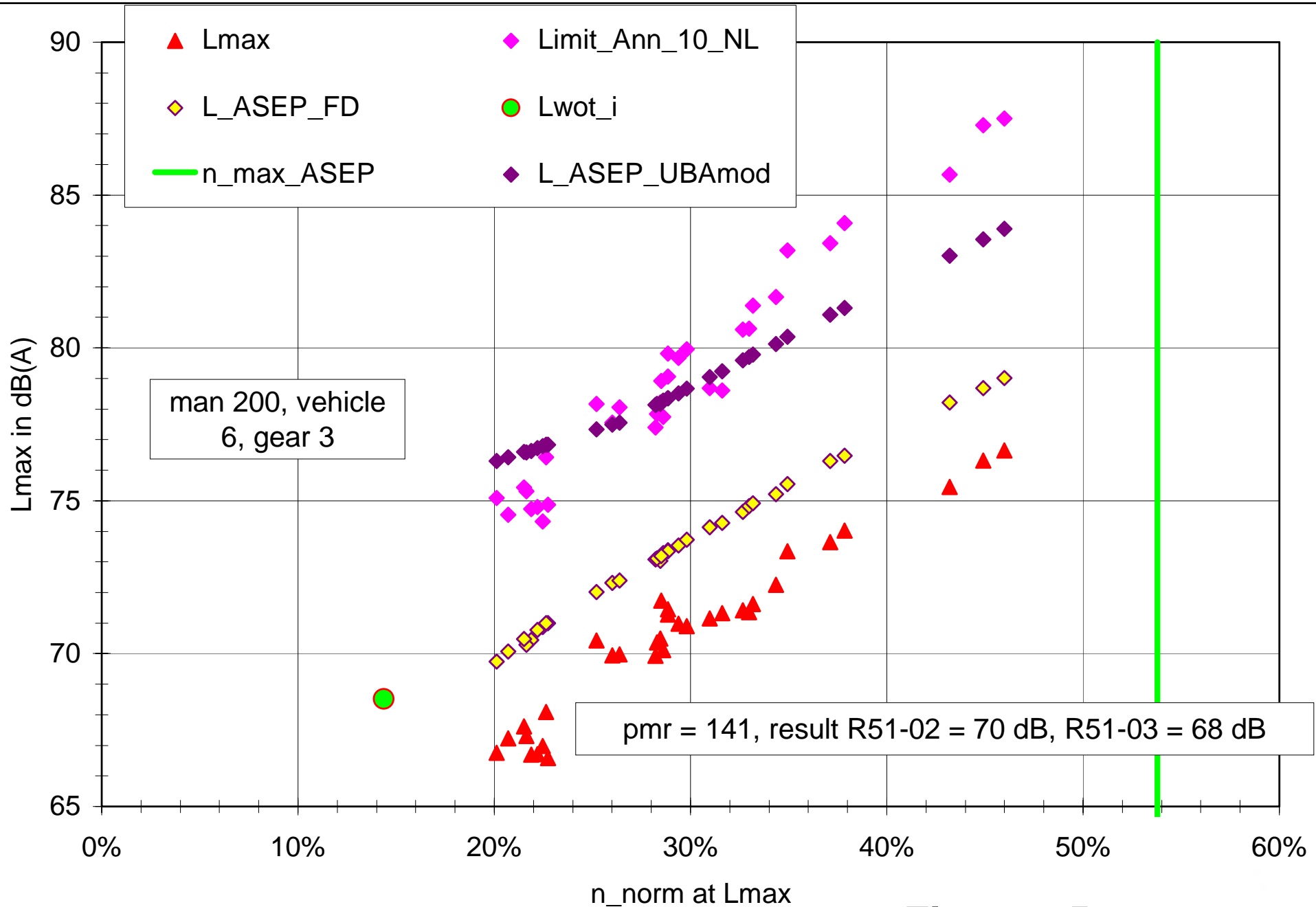


Figure 15

# Measurement results, vehicle 7

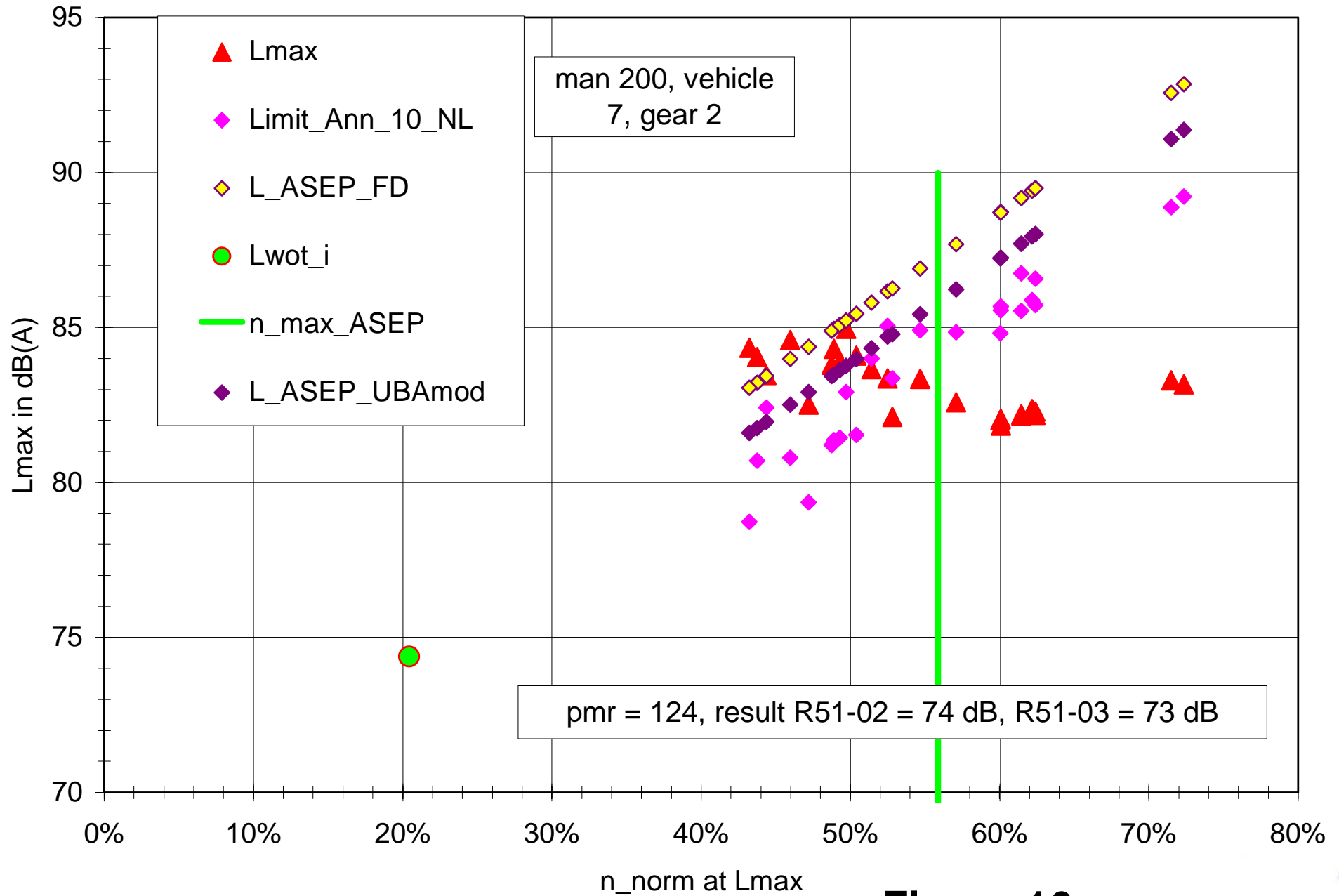


Figure 16

# Measurement results, vehicle 7

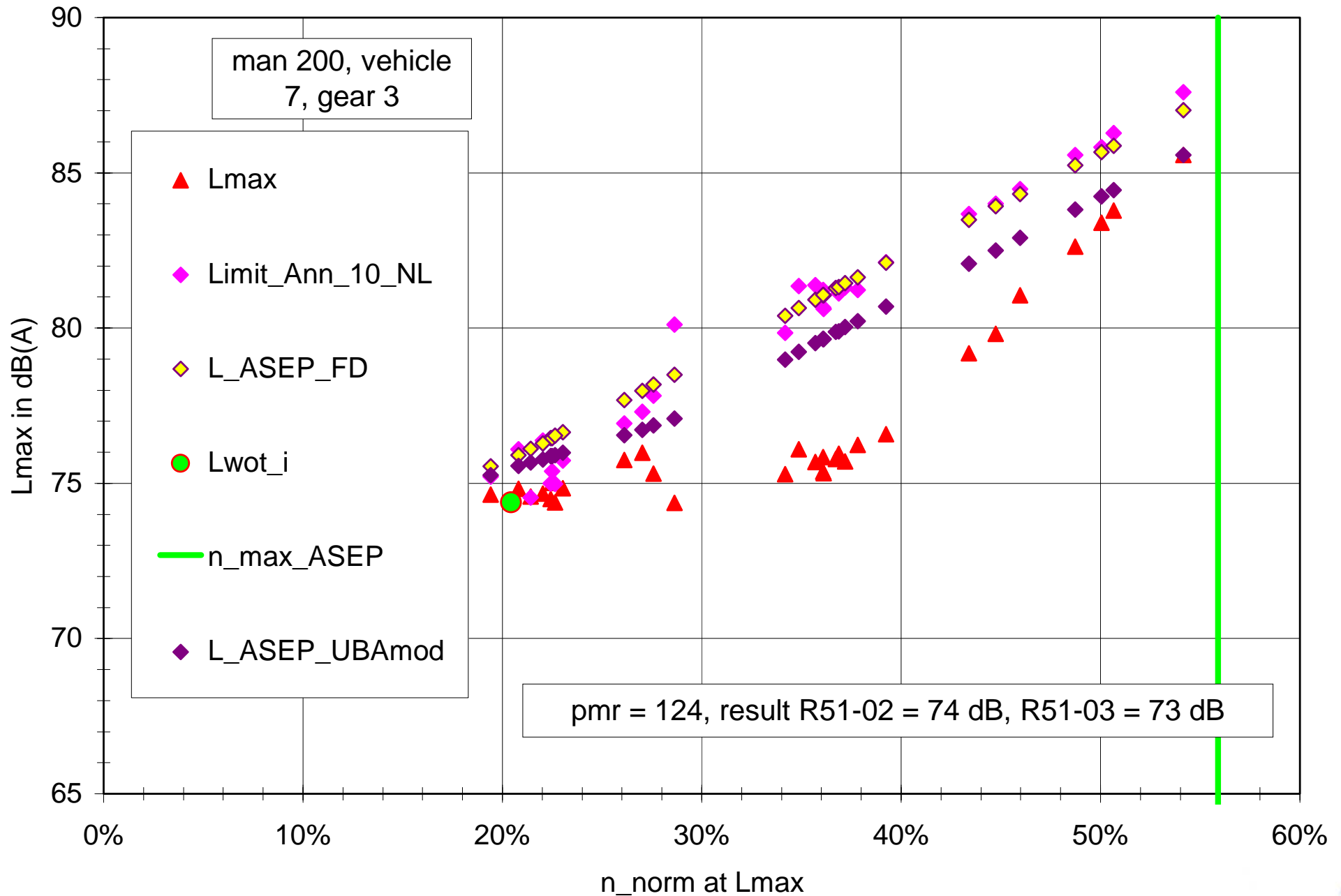
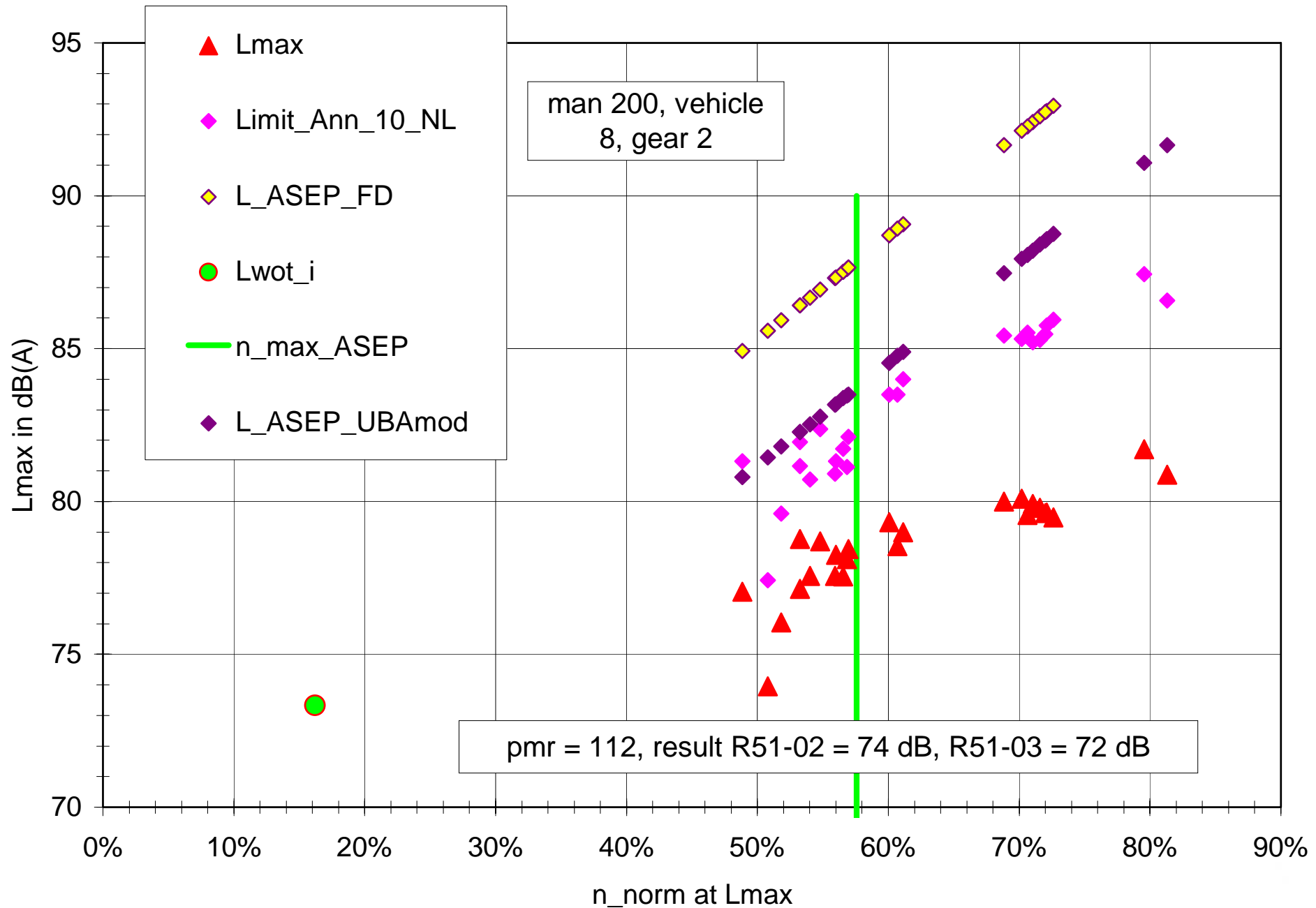


Figure 17

# Measurement results, vehicle 8



# Measurement results, vehicle 8

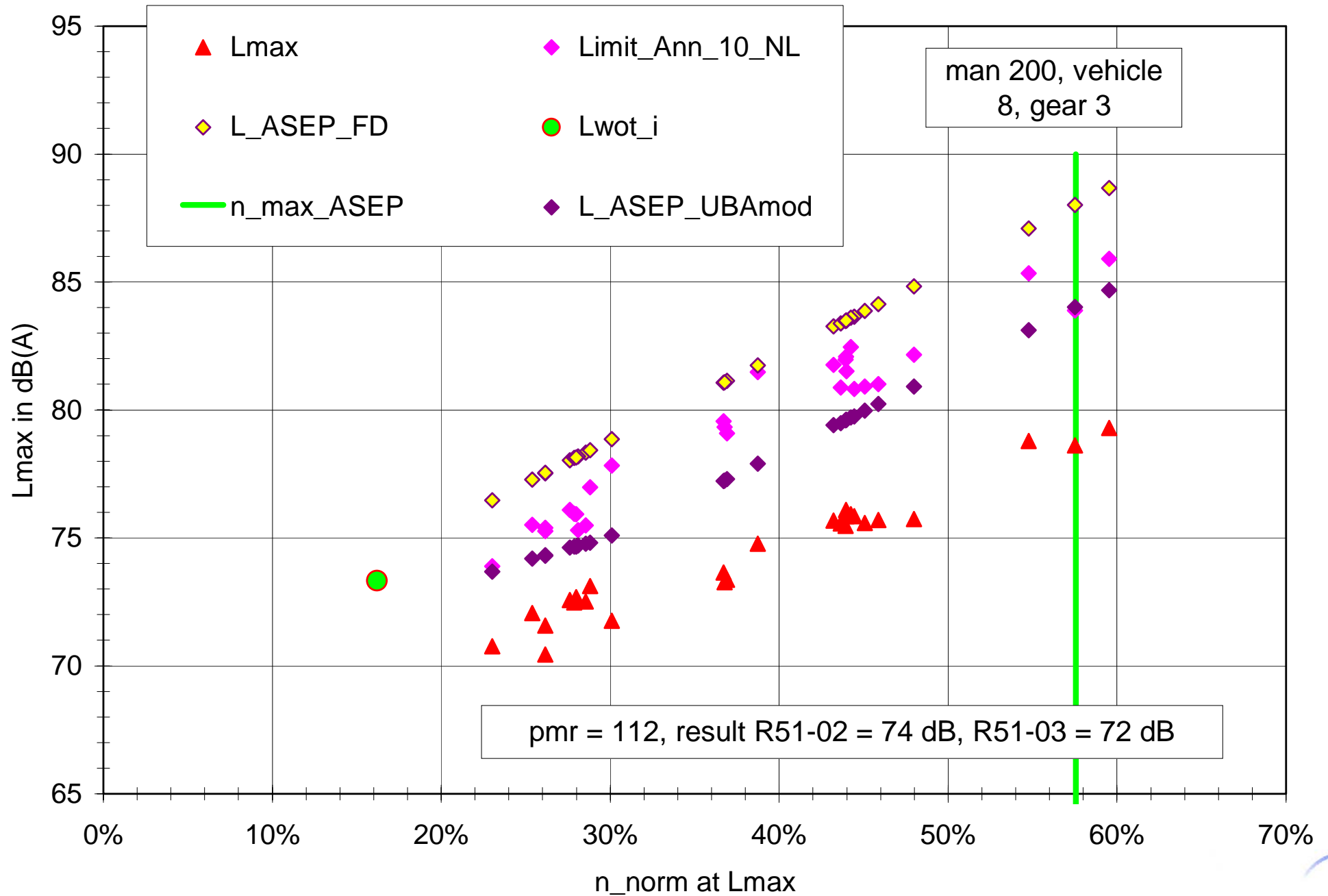


Figure 19

# Measurement results, vehicle 9

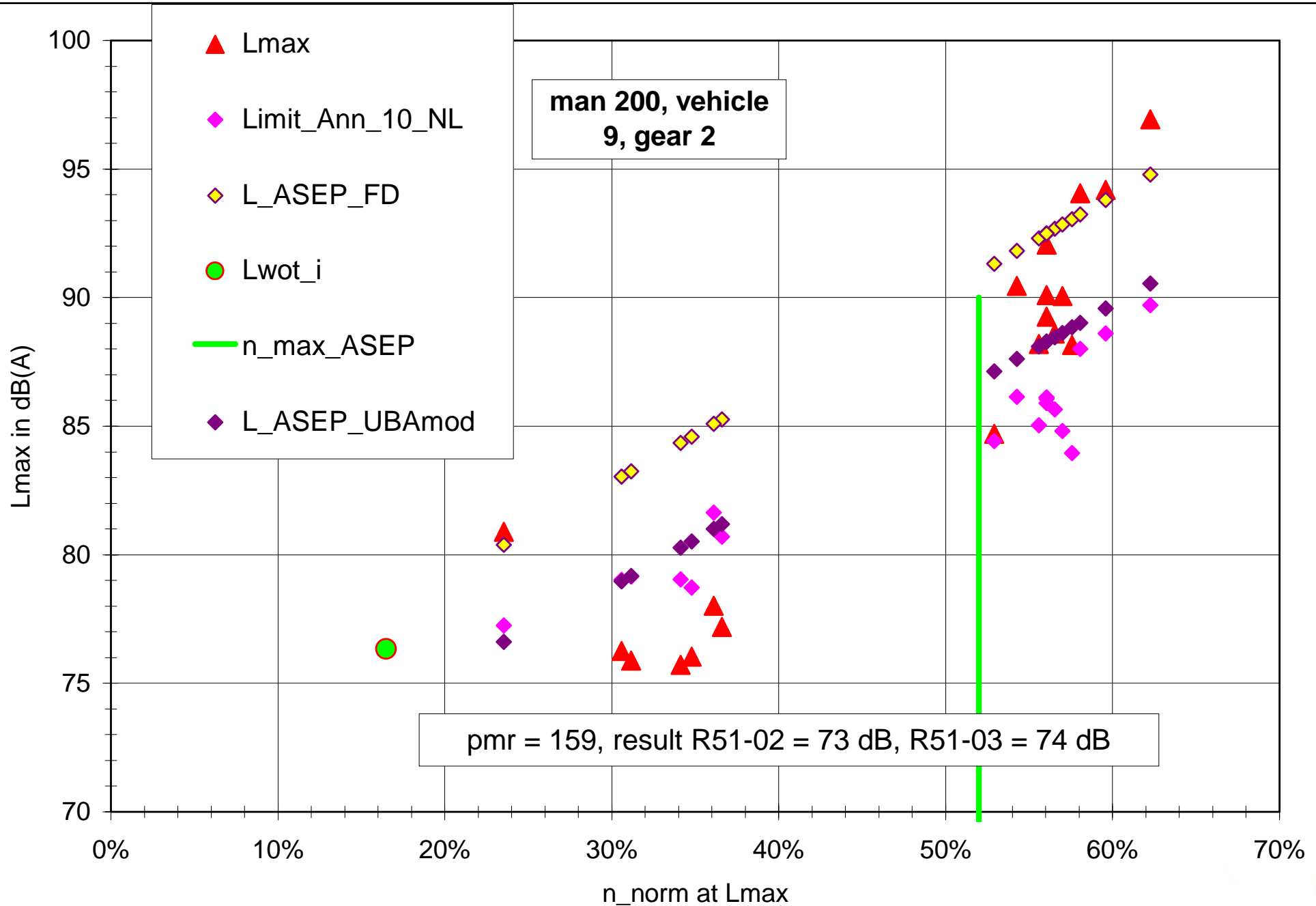


Figure 20



# Measurement results, vehicle 9

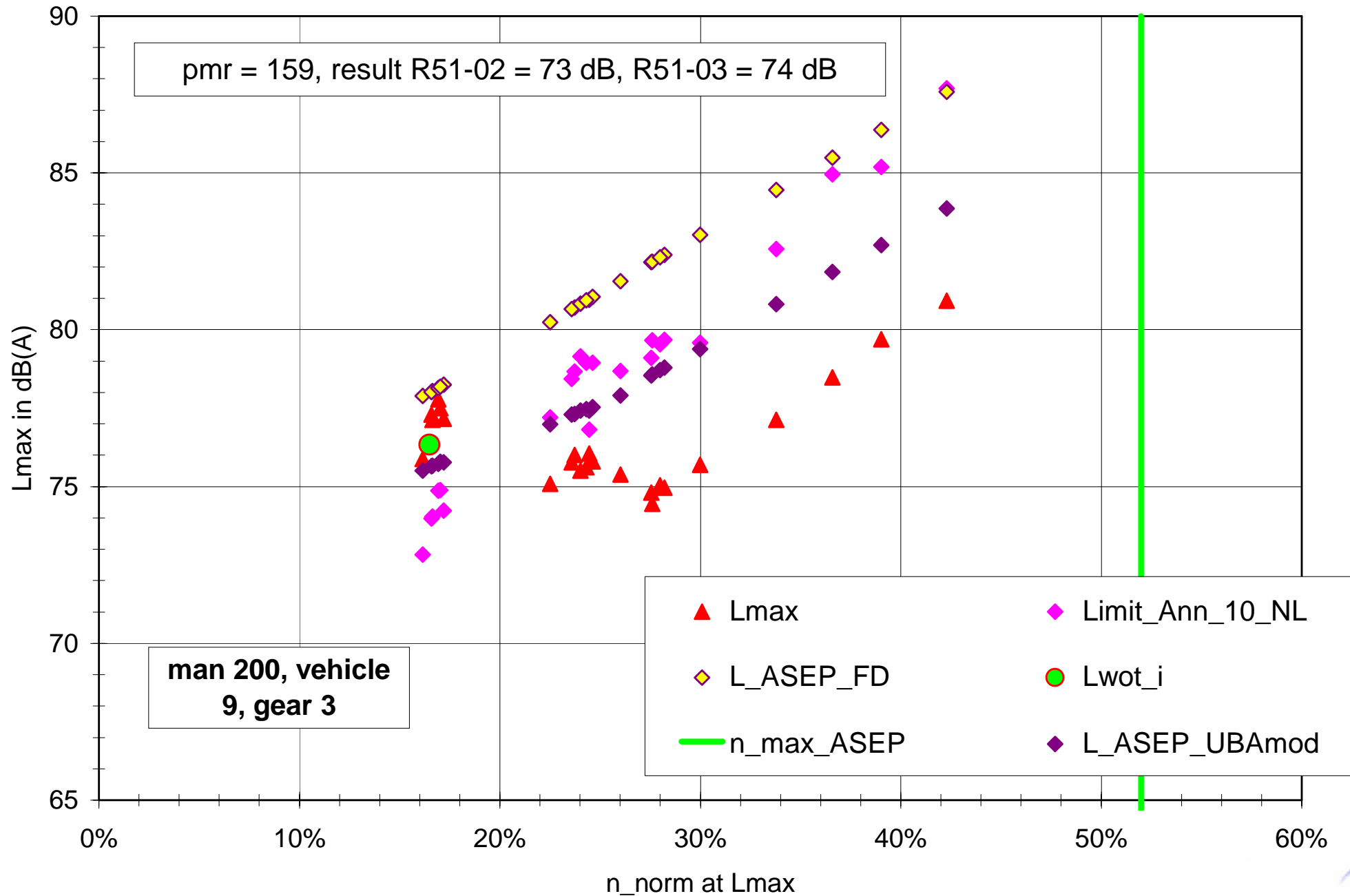


Figure 21

# Measurement results, vehicle 10

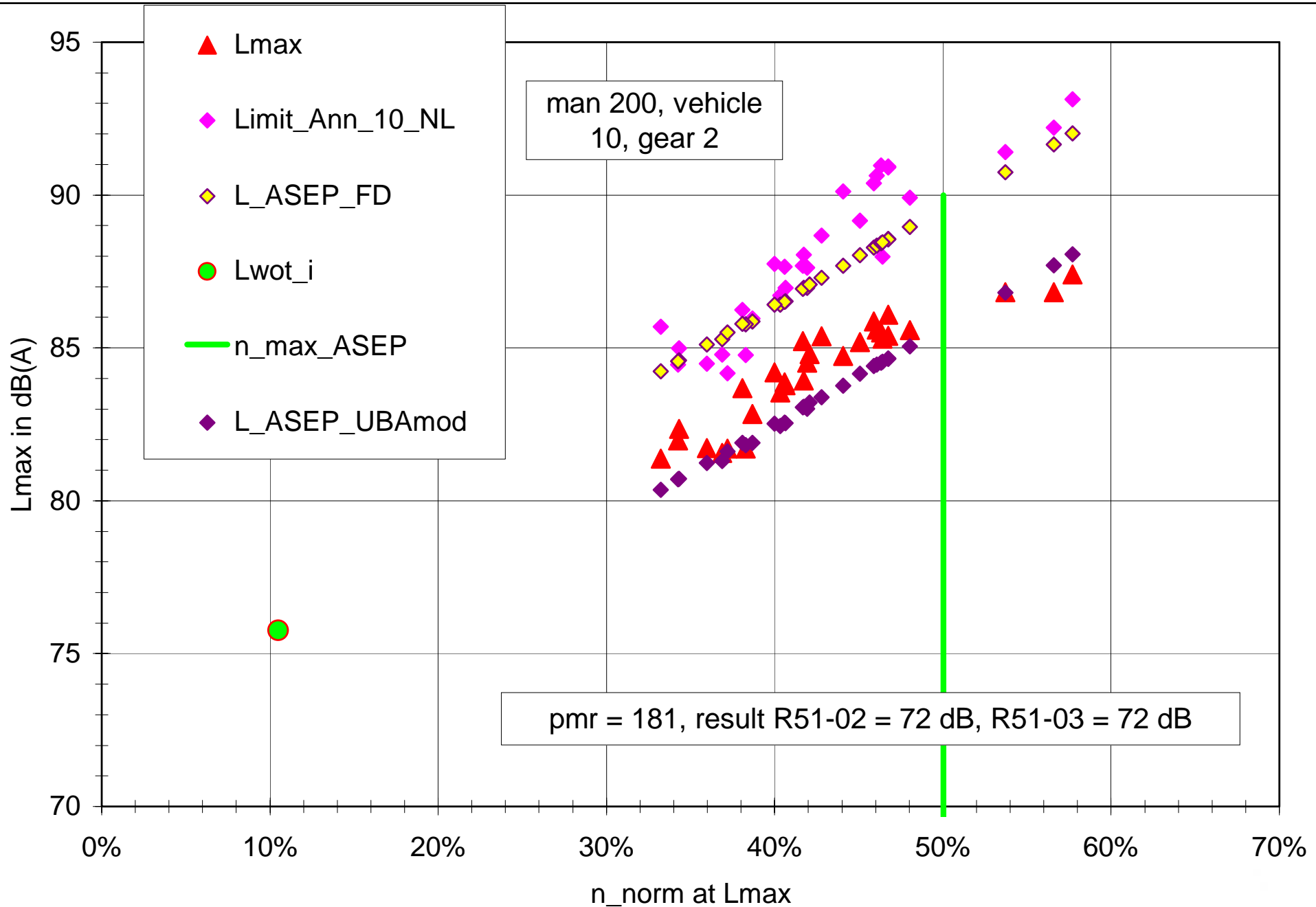


Figure 22

# Measurement results, vehicle 10

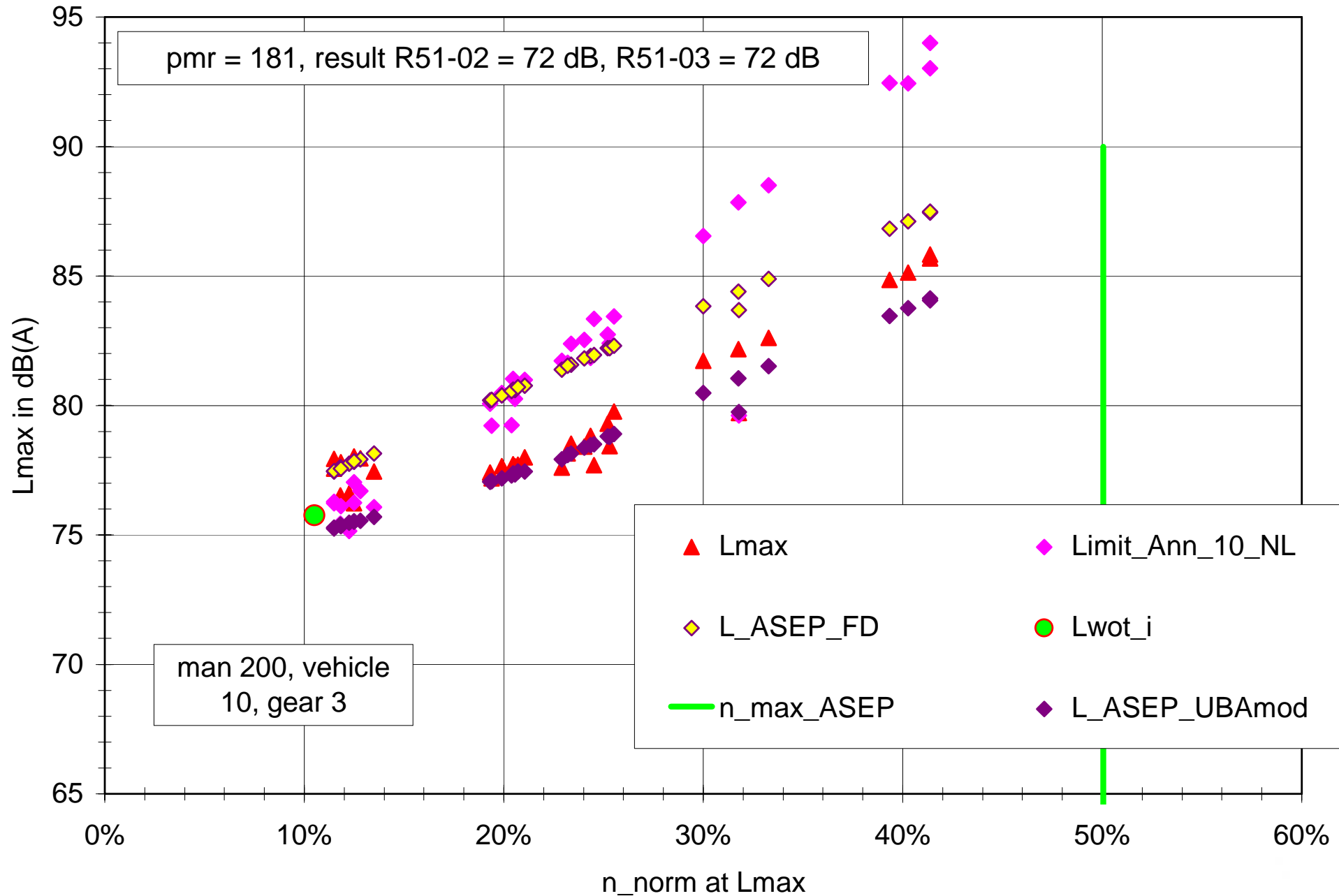


Figure 23

# The End

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