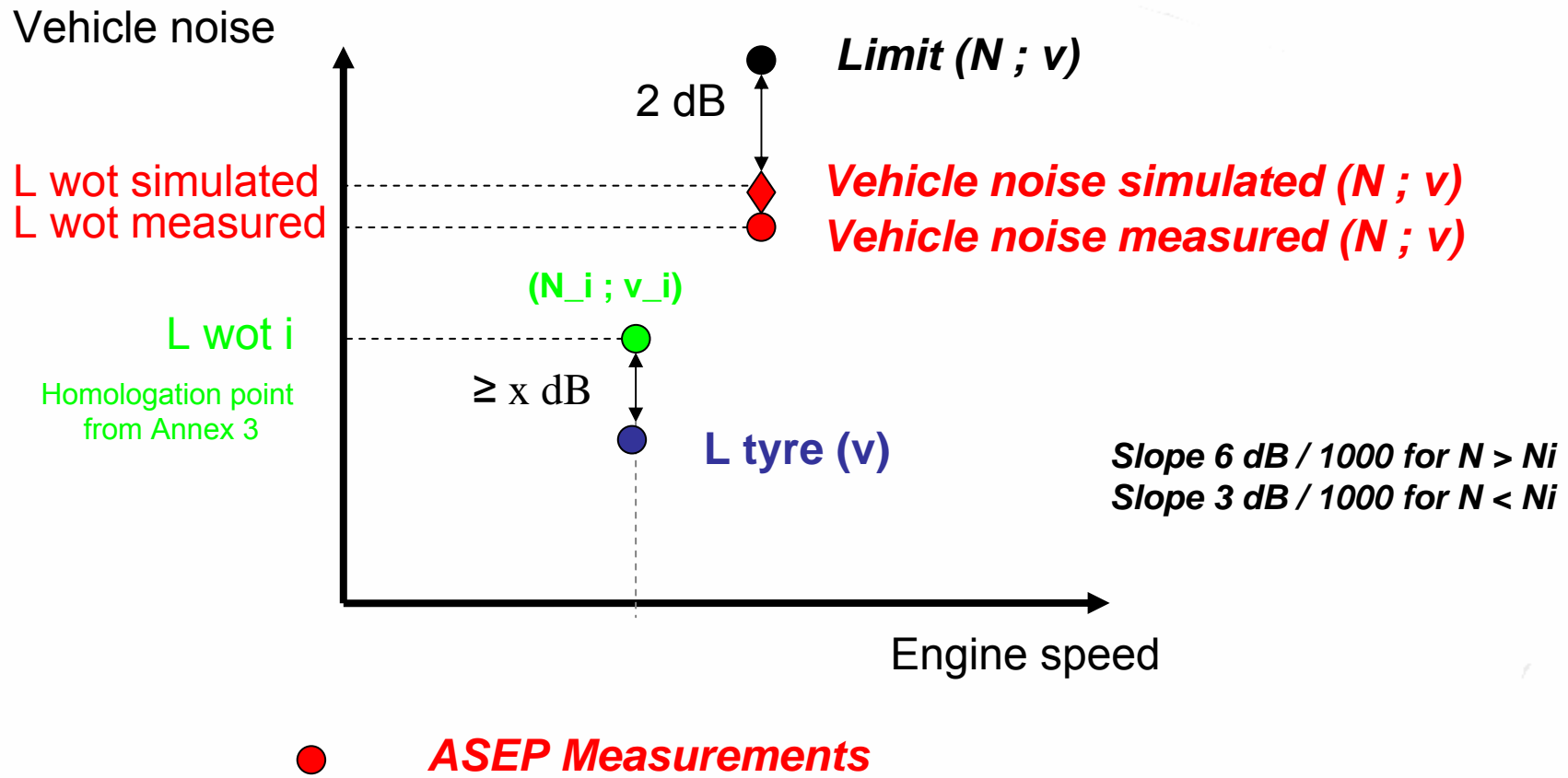# Additional Sound Emission Provisions

Can we simplify France/German method ?

- Description of F/D proposal and J Proposal

- Limit line(s) instead of Limit Points –
  A possibility to converge to Japan Proposal

- Tyre noise close to vehicle noise –
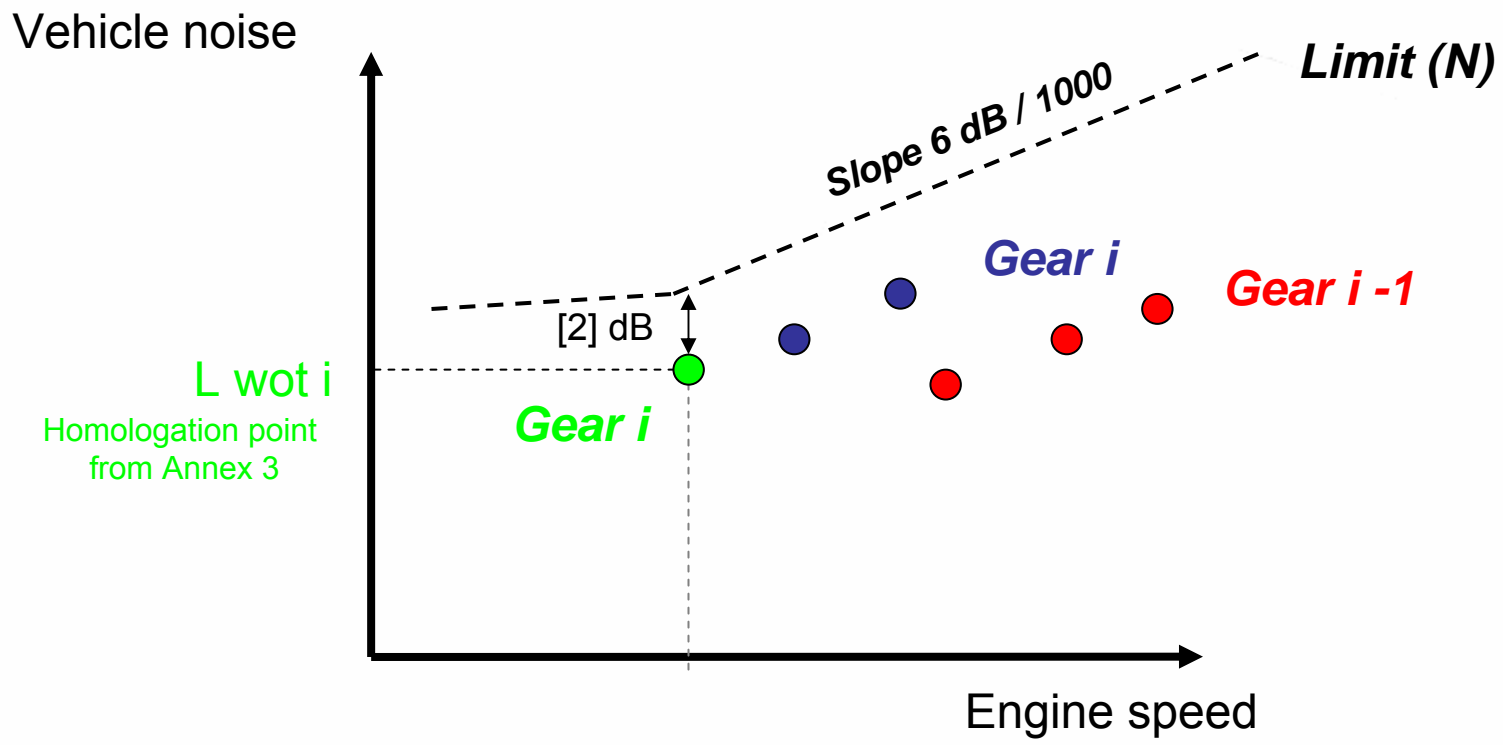 A possibility to solve the problem

Presentation of actual F/D Proposal

Model :
L tyre = L_tyre (v ref)+ a*log (v/v ref)
L engine expecting = L engine (N ref) + b (N – N ref)

L vehicle (N, v) = L engine expecting (N) « + » L tyre (v)
L limit = L vehicle (N, v) +2 dB

Vehicle noise

Limit (N ; v)

2 dB

L wot simulated   ***Vehicle noise simulated (N ; v)***
L wot measured   ***Vehicle noise measured (N ; v)***

(N_i ; v_i)

L wot i

Homologation point
from Annex 3

$\geq$ x dB

L tyre (v)

Slope 6 dB / 1000 for N > Ni
Slope 3 dB / 1000 for N < Ni

Engine speed

● ***ASEP Measurements***

Presentation of actual Japan Proposal

Model :
L vehicle expecting = L wot i (N ref) + b (N − N ref)

L limit = L vehicle (N, v) +2 dB

Vehicle noise

Limit (N)

Slope 6 dB / 1000

Gear i

Gear i -1

[2] dB

L wot i

Homologation point
from Annex 3

Gear i

Engine speed

ASEP Measurements

ASEP Measurements

- Description of F/D proposal and J Proposal

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Some important elements for each proposal

Japan Proposal :

- Lpmax vs. rpm axis,
- Using simple line as limit
- Reducing time to do ASEP Test

F/D Proposal :

- Take into account the gap between vehicle noise gear i and vehicle noise gear i-1 (or gear i-2) due to tyre noise contribution
- Using continuous measuring device, V max and N max at Lpmax to be more precise and to take into account of downshift,
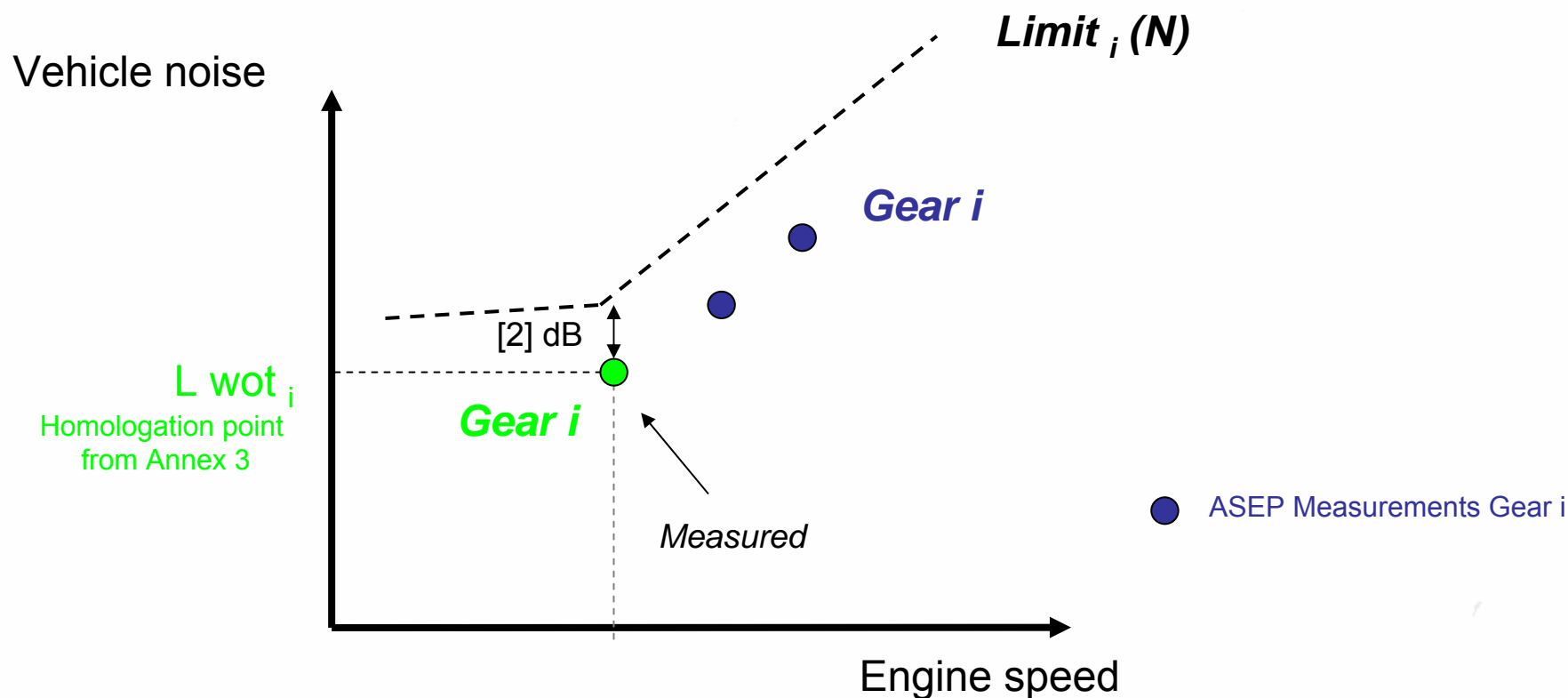
Limit line(s) basis idea

→ Lpmax vs. rpm axis,

→ Using simple line(s) as limit instead of points

→ Take into account the gap between vehicle noise gear i and vehicle noise gear i-1 (or gear i-2)

→ Reduce tyre noise measurements by measuring only L tyre 50 kph

→ Using continuous measuring device, V max and N max at Lpmax to be more precise and to take into account of downshift,

ASEP measurements only on Gear i :

- For manual and automatic transmission with constant gear ratios tested only on Gear i for ASEP

- For CVT

→ **Line limit concept for Gear i :** Limit $_i$ (N)

Vehicle noise

Limit $_i$ (N)

Gear i

[2] dB

L wot $_i$
Homologation point
from Annex 3

Gear i

Measured

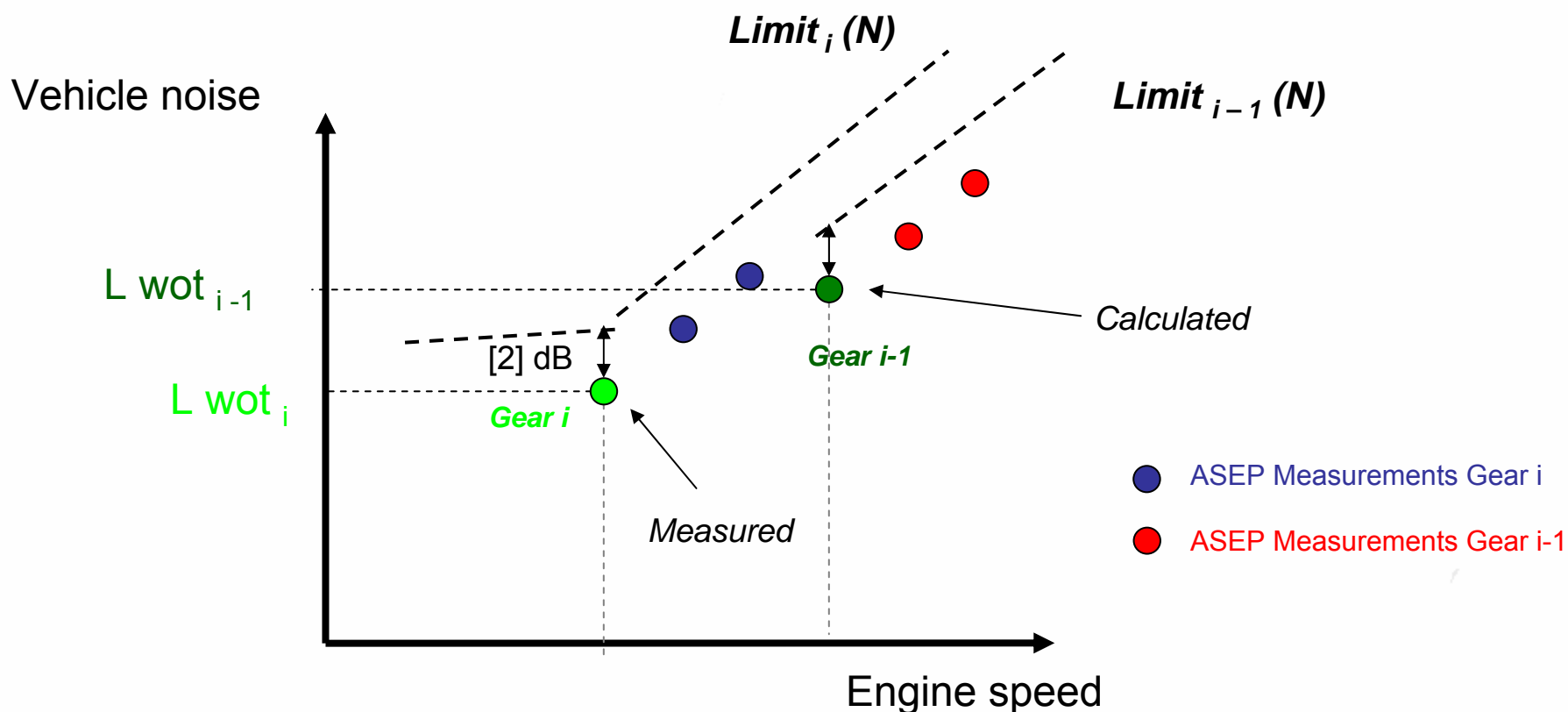● ASEP Measurements Gear i

Engine speed

Limit line(s) concept

ASEP measurements only on Gear i and Gear i-1 :

- For manual and automatic transmission with constant gear ratios tested on Gear i, gear i-1 (and gear i-2 if necessary) for ASEP

→ **Line limit concept for Gear i :** Limit $_i$ (N)

Line limit concept for Gear i : $\text{Limit}_i (N) = L \text{ wot}_i + b (N - N_i) + 2 \text{ dB}$

Line limit concept for Gear i-1 : $\text{Limit}_{i-1} (N) = L \text{ wot}_{i-1} + b (N - N_{i-1}) + [x]\text{dB}$

Line limit concept for Gear i-2 : $\text{Limit}_{i-2} (N) = \ldots$

with $b = [6] \text{ dB} / 1000 \text{ rpm}$ for $N > N_i$ and $b = |3] \text{ dB} / 1000 \text{ rpm}$ for $N < N_i$

→ L wot$_{i-1}$ is **calculated** by L wot$_i$ and L tyre 50 kph*

Determination of L wot $_{i-1}$:

Basis datas : L wot$_i$ from Annex 3 and additionnal measurements L tyre 50 kph*

$L \text{ wot}_{i-1} = [L \text{ engine} (N_i) + b (N_{i-1} - N_i)] \ll + \gg [L \text{ tyre 50 kph}]$
    with L engine $(N_i) = L \text{ wot}_i \ll - \gg L \text{ tyre 50 kph}$

N$_i$ is engine speed at 50 kph* on gear i
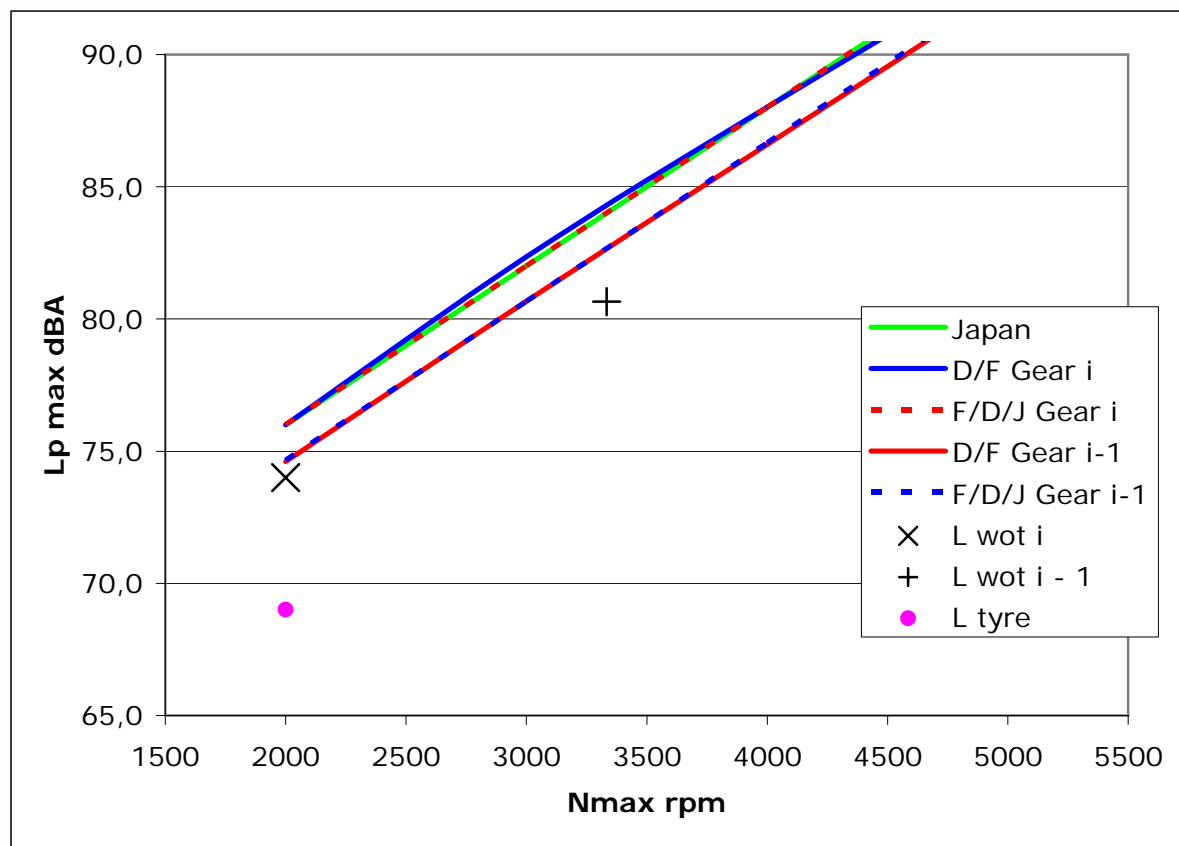N$_{i-1}$ is engine speed at 50 kph* on gear i - 1

* Nota : 50 kph can be in fact the real speed value V $_{Lmax}$ at L max (L wot i)

Comparison of D/F limit concept and this liimit line(s) concept :

L wot i	74
N i	2000
L tyre 50	69
Tyre slope	40
ci	25
cj	15
Nj	3333

L engine i	72,3
L engine i-1	80,3
L wot i-1	80,7
slope vehicle	6

	Gear i		Gear i-1		
	F/D/J	**F/D**	**F/D/J**	**F/D**	**Japan**
2000	76,0	76,0	74,7	74,6	76,0
3000	82,0	82,4	80,7	80,7	82,0
4000	88,0	88,0	86,7	86,6	88,0
5000	94,0	93,4	92,7	92,5	94,0

Difference between F/D proposal and this limit line(s) concept

Comparison of D/F limit concept and this liimit line(s) concept :

L wot i	74
N i	2000
L tyre 50	72
Tyre slope	40
ci	25
cj	15
Nj	3333

L engine i	69,7
L engine i-1	77,7
L wot i-1	78,7
slope vehicle	6
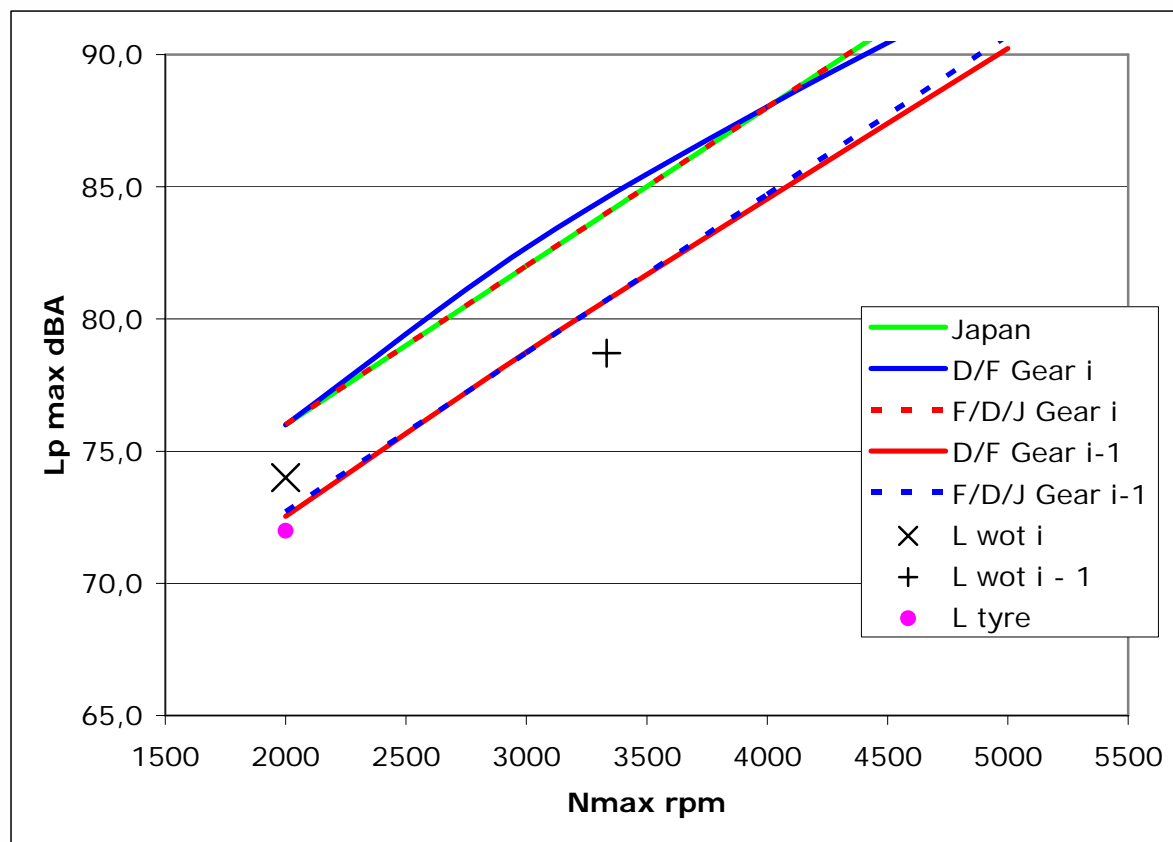
	Gear i		Gear i-1		
	F/D/J	F/D	F/D/J	F/D	Japan
2000	76,0	76,0	72,7	72,5	76,0
3000	82,0	82,7	78,7	78,7	82,0
4000	88,0	88,0	84,7	84,5	88,0
5000	94,0	92,8	90,7	90,2	94,0

- Description of F/D proposal and J Proposal

- Limit line(s) instead of Limit Points –
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A possibility to solve the problem

For L wot i – L tyre50 < 2 dB → **L tyre50 is fixed to L wot i – 2dB**

CONCLUSIONS
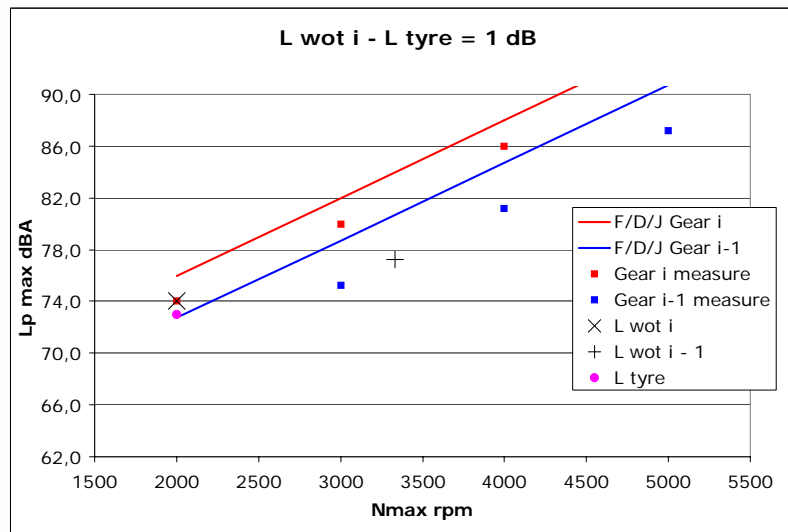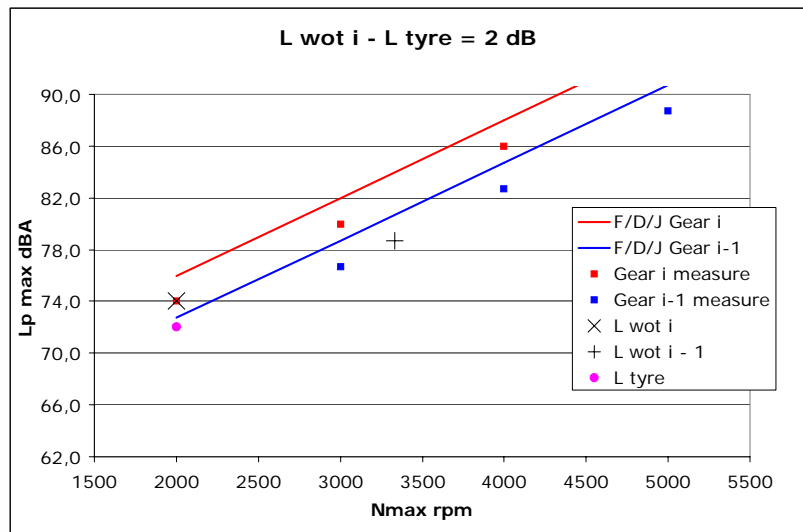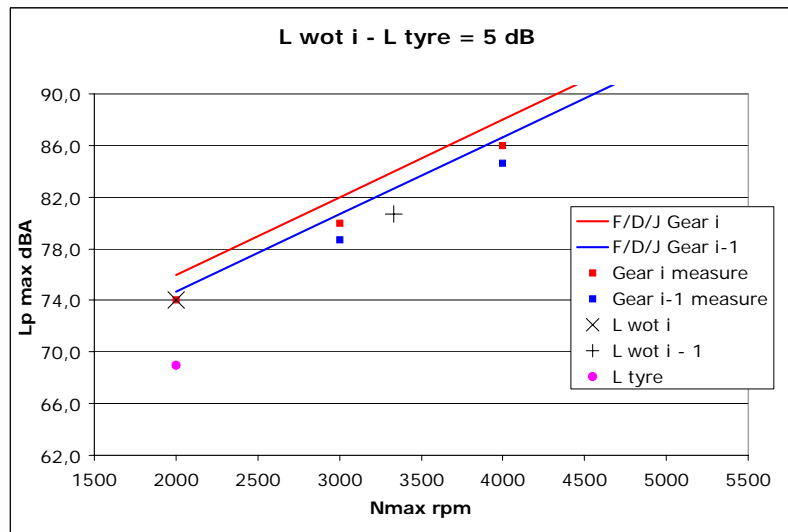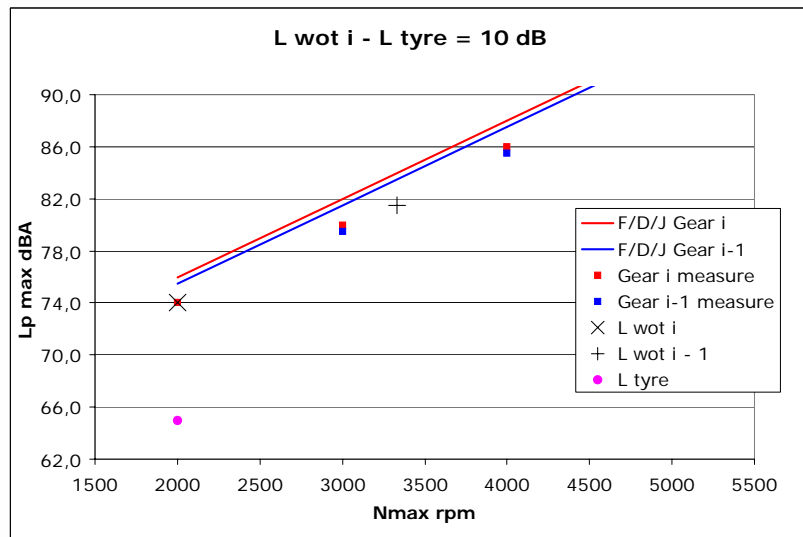
- It seems to be possible to simply F/D proposal to converge to Japan proposal on a simple model which take account of tyre noise with a quite good precision.

- It seems to be possible to take into account of tyre noise close to vehicle noise in the F/D proposal.

- More studying must be done to validate these approaches.

- One question to choose method :

  Is « non linearity » level be in relation to audible trouble ?