

18 February 2008

P R E S E N T A T I O N O F



I N T E R N A T I O N A L O R G A N I Z A T I O N O F M O T O R V E H I C L E M A N U F A C T U R E R S

Additional Sound Emission Provisions

**Presentation of Research Results
and Revised OICA Concept**



Consideration for the OICA Concept

- Spirit of ASEP, written down in *TRANS/WP.29/GRB/2005/2/Rev.2, page 13*

[6.2.3.3.

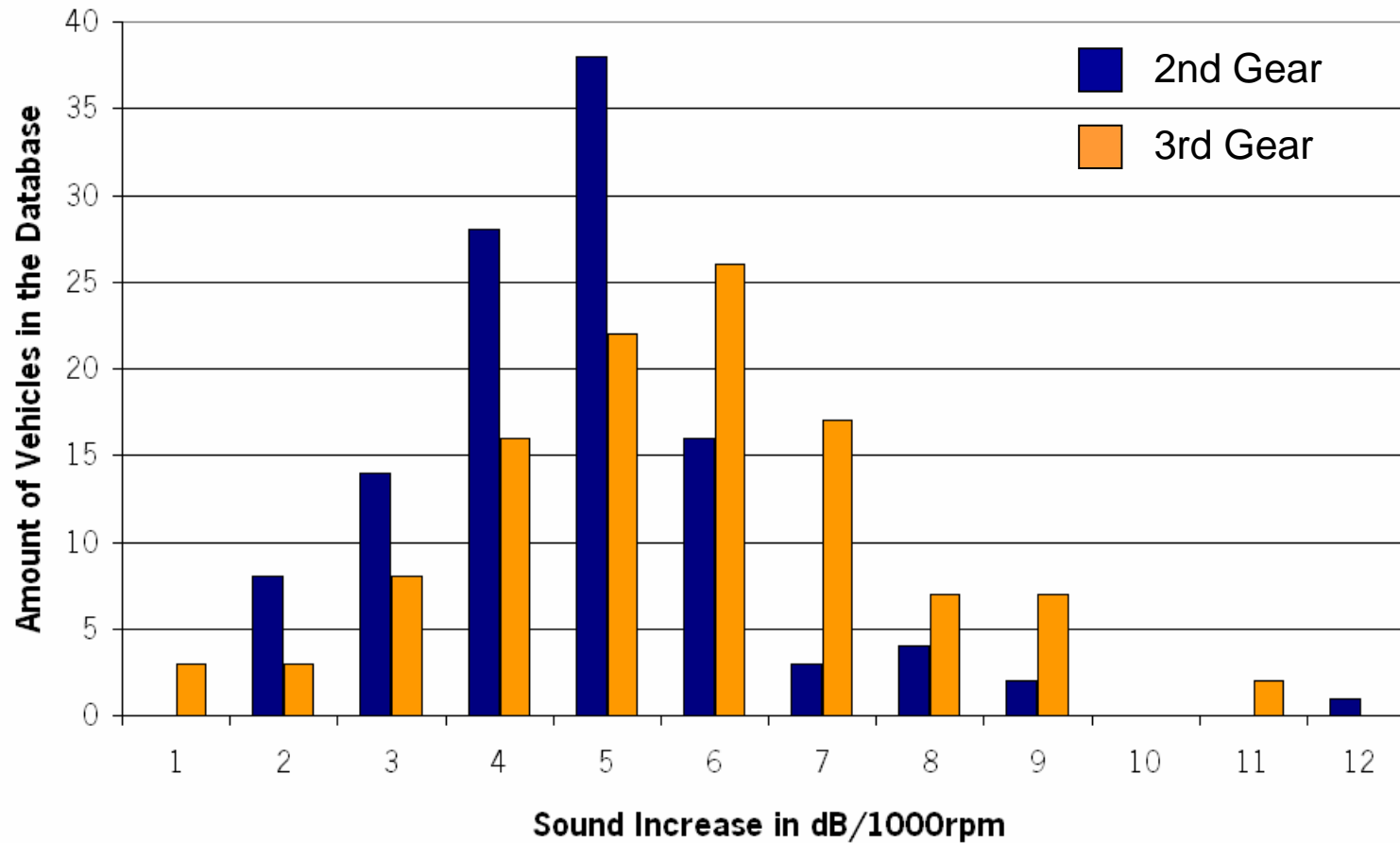
The sound emission of the vehicle under **normal driving conditions different from the conditions of the type approval test in Annex 3** shall not differ considerably from what can be expected from the type approval test result for this **specific** vehicle with regard to **technical practicability**. This is fulfilled if the **requirements of Annex 10** are met.]

• Question:

What can be expected for a specific vehicle ?

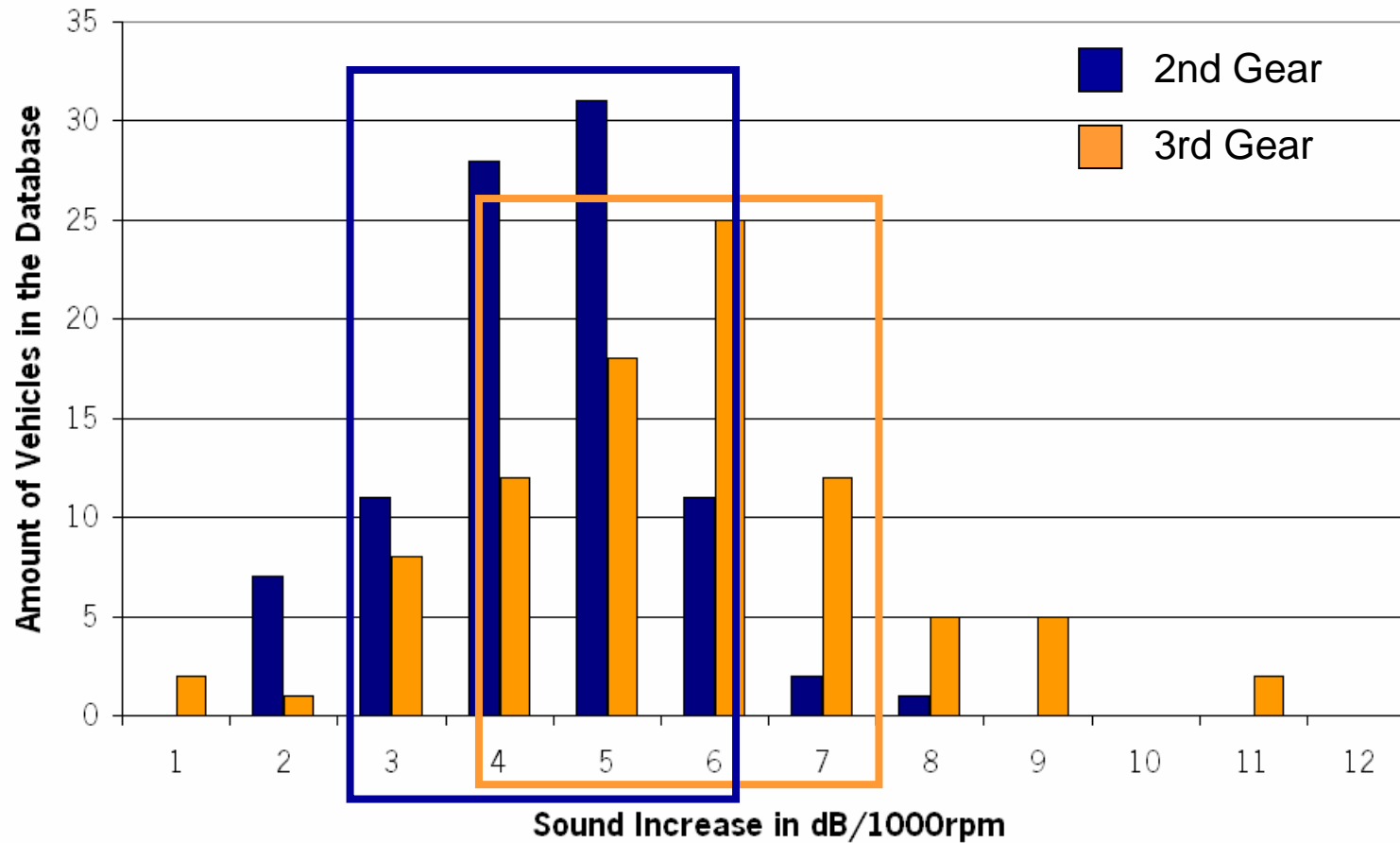


Analysis of the Sound Level Increase of ALL Vehicles of the Database

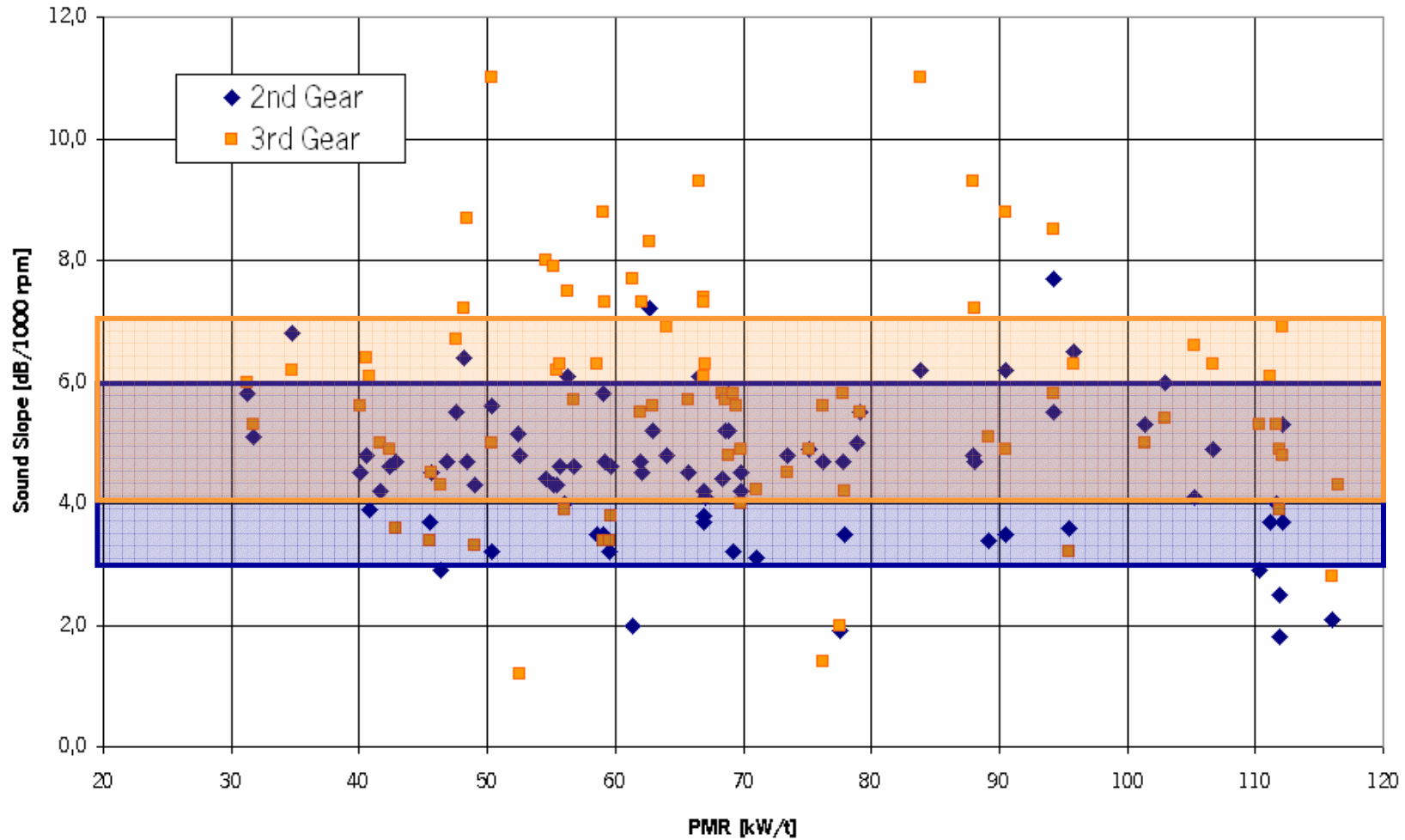




Analysis of the Sound Level Increase of **Vehicles <120 kW/t**



Analysis of the Sound Level Increase of **Vehicles <120 kW/t**





What can be expected from a vehicle:

- **For typical vehicles the sound level increases by 3-7 dB per 1000 rpm.**
- The sound slope is
 - individual for a specific technology.
 - gear dependent, in 3rd gear higher than in 2nd gear.
 - not dependent of the PMR and not a predictor of the noise behaviour in traffic.
- One single sound slope for all technologies does not provide a satisfying solution.
- **The OICA concept determines the sound level increase for every vehicle individually but within the boundaries as found above**
 - **3 dB to 6 dB for 2nd Gear**
 - **4 dB to 7 dB for 3rd gear**



Choice of Anchor-Point:

- Choosing an Anchor-Point different from the Annex 3 results will cause higher inaccuracy.
- The need of ASEP was justified by the circumstance that the Annex 3 test could lead to very low test engine speeds.
- The GRB-Draft ASEP wording asks for a relative comparison to the Annex 3 test results.
- **The OICA Concept chooses the Full Throttle Test result of the lowest gear tested in Annex 3 as the Anchor Point.**
- **As reference the line BB' is chosen.**
- **This delivers the highest engine speed of Annex 3.**



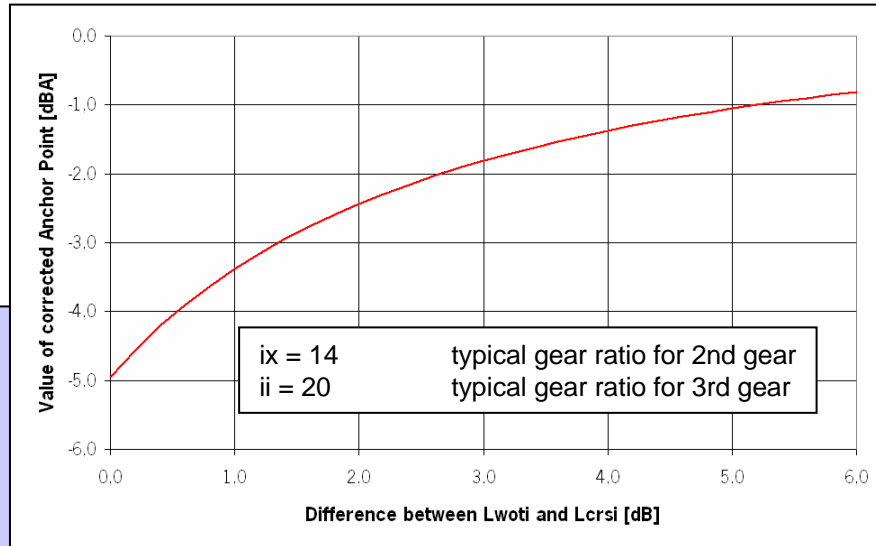
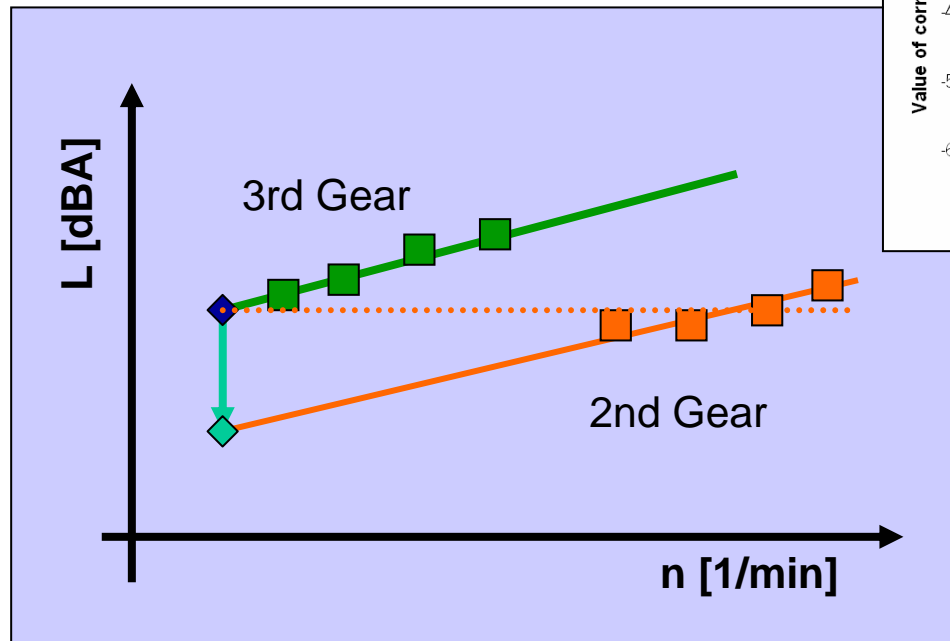
Consideration for the precision of the test method

- Tyre rolling sound is not a target in the ASEP test.
- However, if the ANNEX 3 test was carried out in high gears, even the full throttle test result can be influenced by rolling sound. This would lead to an anchor point which is too high as a starting point for low gears.
- **For the OICA concept the following assumptions are made:**
 - **Test will be carried out only in gear lower than gear i**
 - **For gears different than gear i, a correction of the anchor point is made according to the following formula**

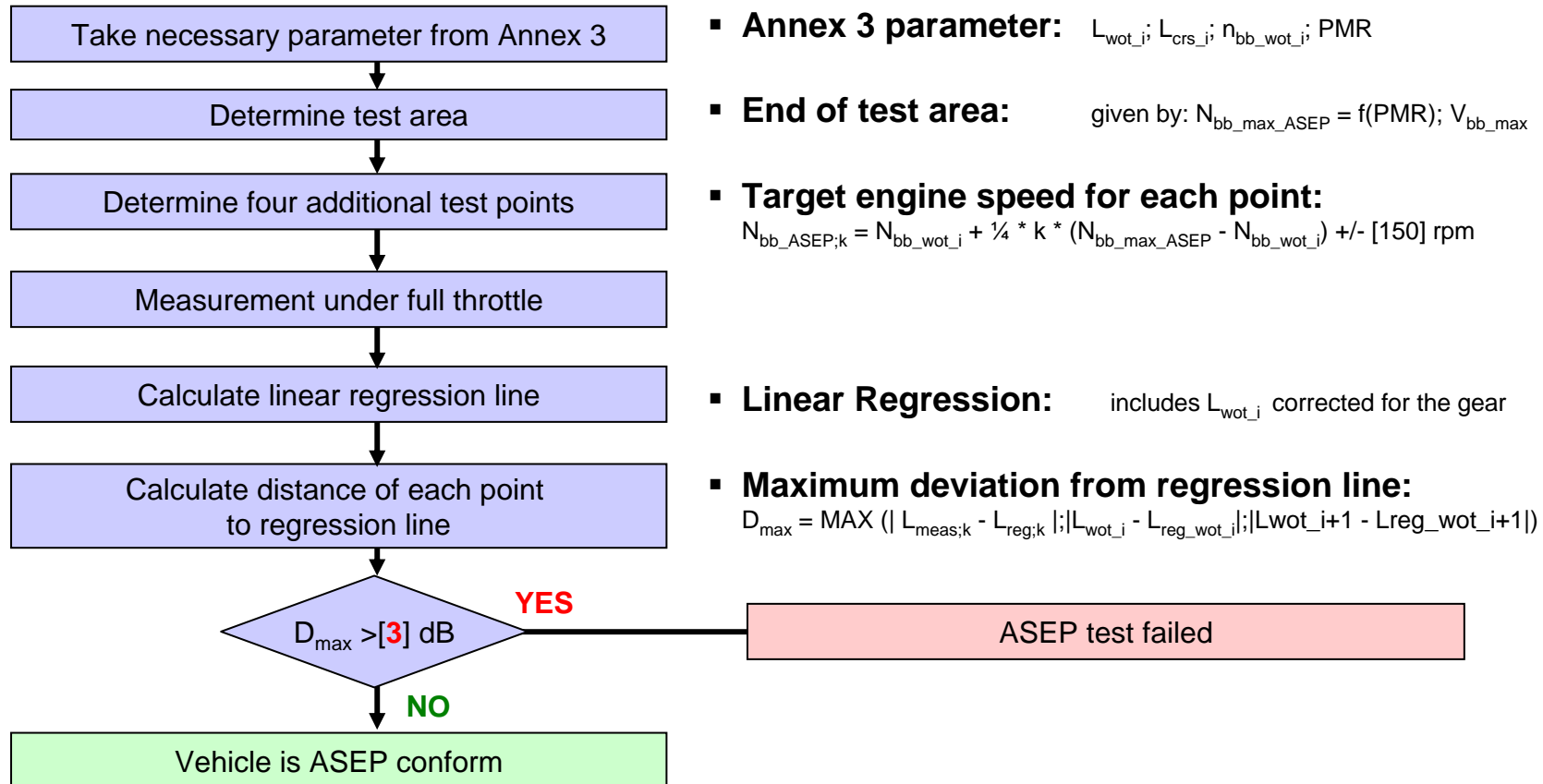
$$L_{\text{anchor}_x} = 10 * \text{LOG}(10^{(L_{\text{woti}}/10)} - 10^{(L_{\text{crsi}}/10)} + 10^{((32*\text{LOG}(ix/ii)+L_{\text{crsi}})/10)})$$

with ix = gear ratio of the gear to be measured and ii = gear ratio of the test gear i in Annex 3

Correction for the Anchor Point



Flow Chart for the Procedure





How to Carry out the OICA Test (Explained on Example 1-15)

1. Take Annex 3 Test Results:

$L_{woti} = 69,1 \text{ dB}$ $N_{woti} = 2954 \text{ rpm}$ $N_{max_ASEP} = 4347 \text{ rpm}$ $L_{crsi} = 66,4 \text{ dB}$

2. Determine Target Measurement Points

3. Correct L_{woti} for Gear if needed

4. Carry out sound measurements

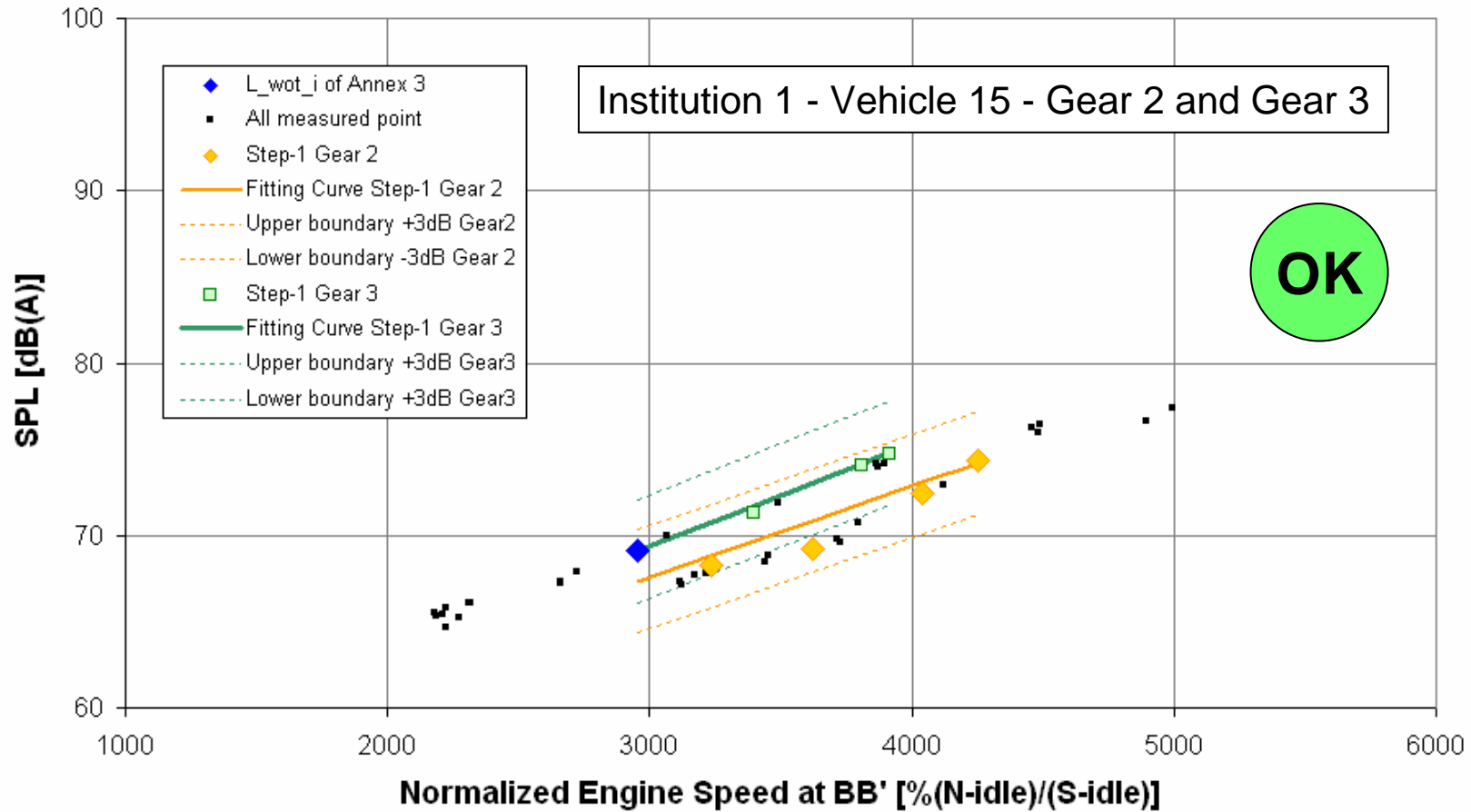
5. Calculate Fitting Curve inside Boundaries

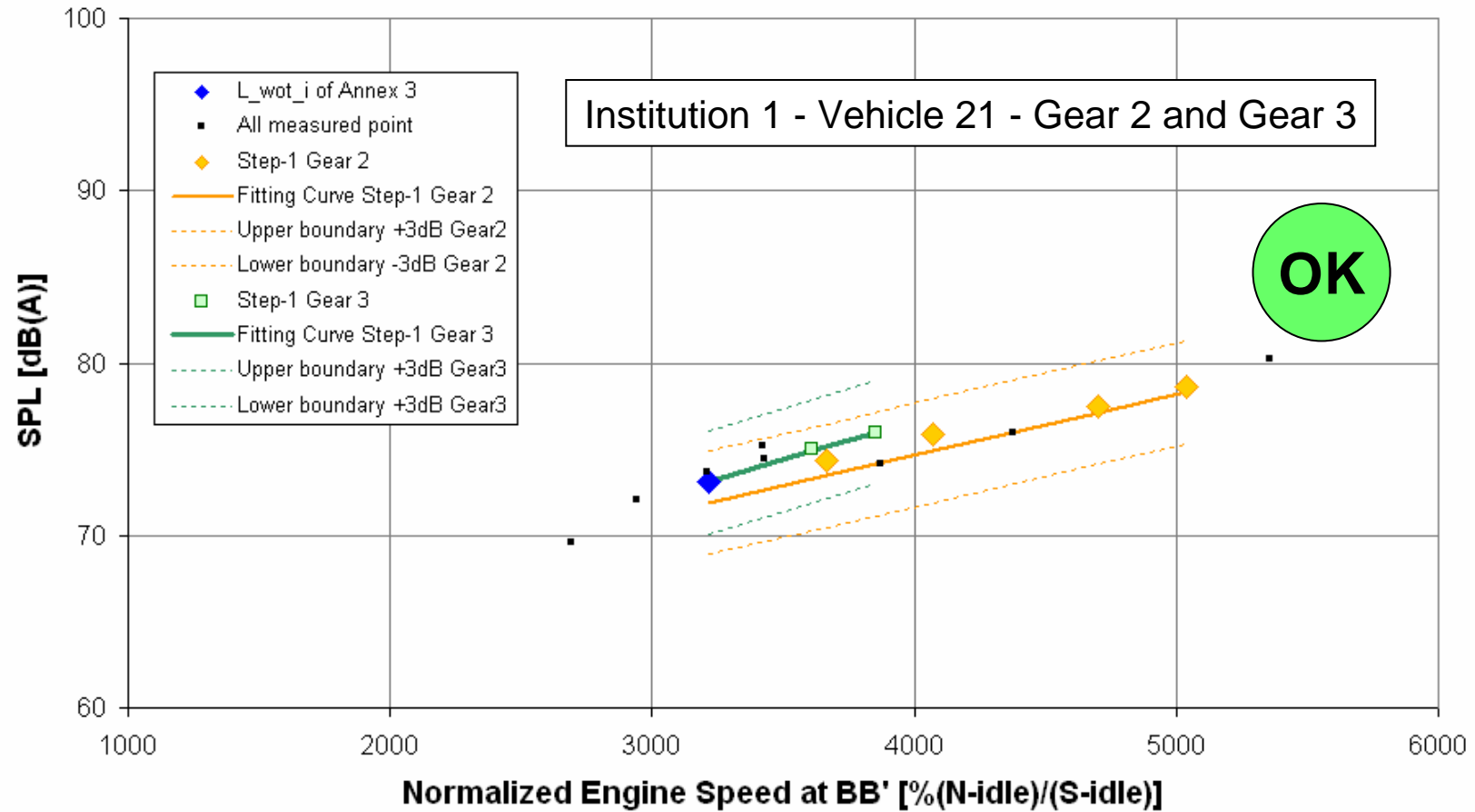
6. Calculate Distance of Each Point to Regression Curve

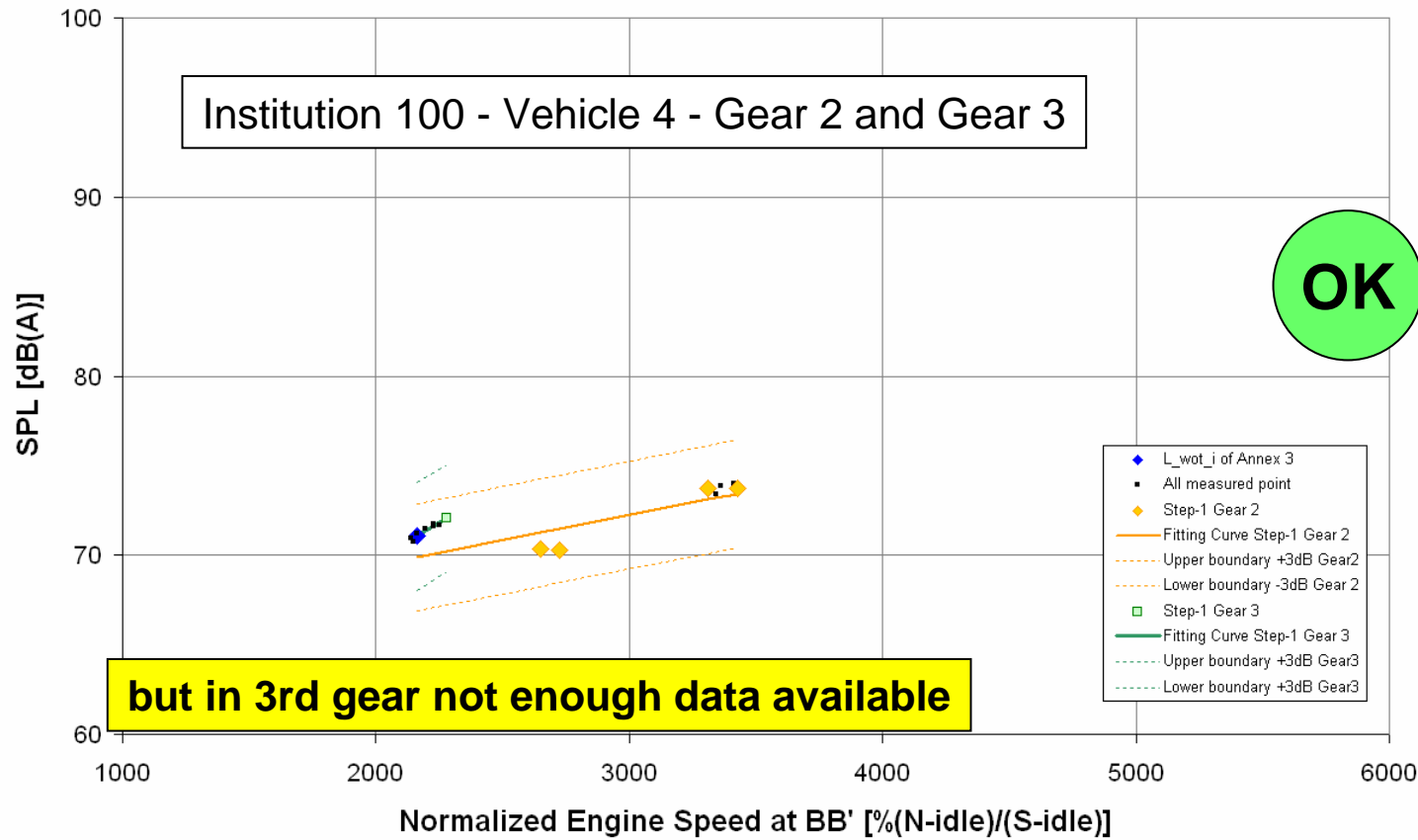
< 3 dB each ???

7. Verify whether Difference is within Boundaries +/- 3dB

OICA-Method - Gear 2						
	Anchor	1	2	3	4	
Target	2954	3302	3650	3998	4347	
	2954	3237	3622	4042	4252	RGP
	67,3	68,3	69,2	72,4	74,3	0,0053 51,233
FIT	67,3	68,8	70,9	73,1	74,2	0,0053
DELTA	0,0	0,5	1,7	0,7	0,1	





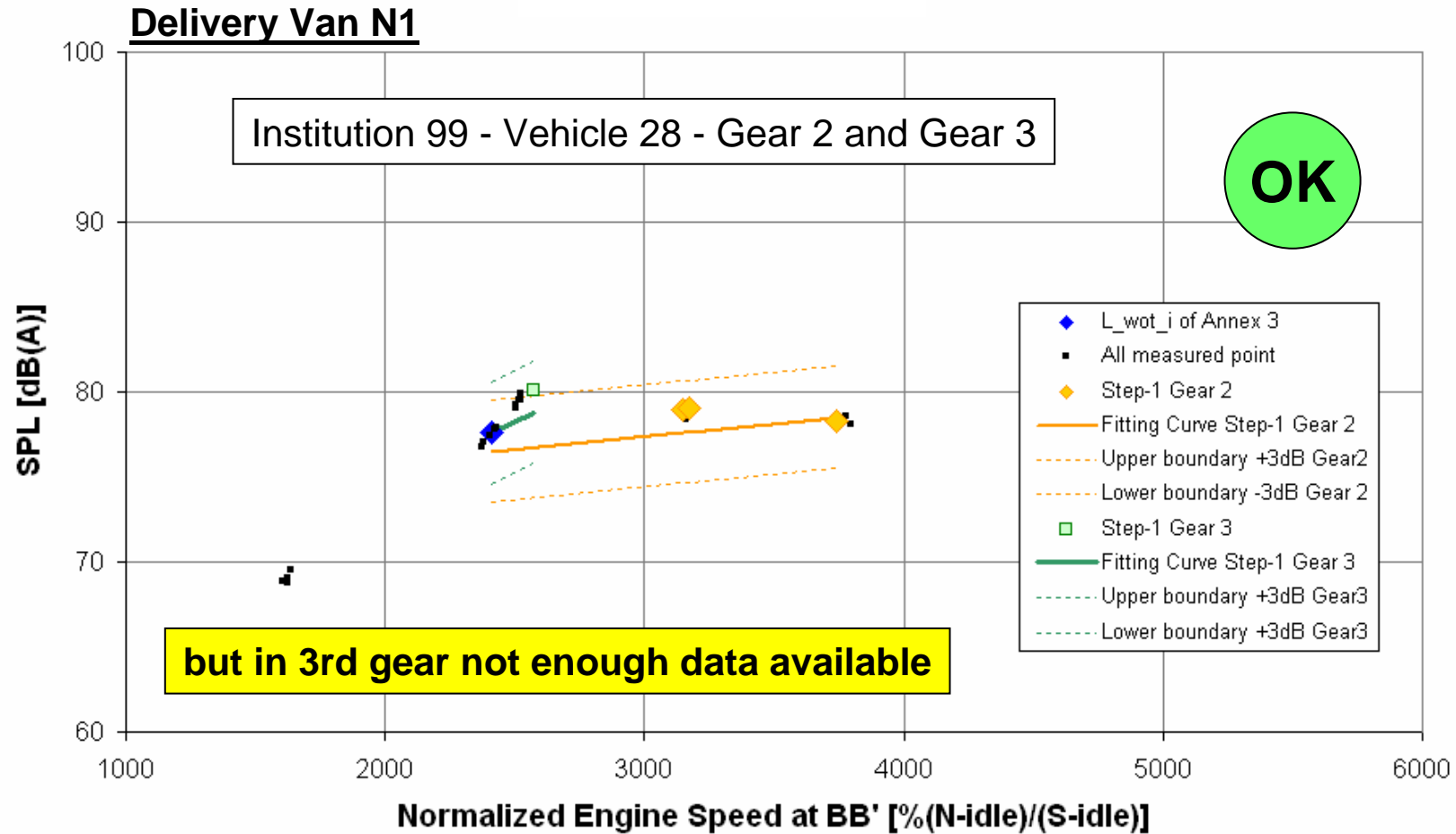




INTERNATIONAL ORGANIZATION OF MOTOR VEHICLE MANUFACTURERS

Vehicle Data					D/F-Proposal							OICA							ID
ID	eng concept	transmission	PMR	Lurban	Lmax				84	8	18					96	7	3	ID
				73,3	2nd	3rd	4th	D	PASS	O	FAIL	2nd	3rd	4th	D	PASS	O	FAIL	
113				70,6															
9947	Diesel	manual	31,3	72,5	1	1			1	0	0	1	1			1	0	0	9947
9939	Diesel	manual	31,7	70,8	1	1	1		1	0	0	1	1	-		1	0	0	9939
301	diesel DI	manual	34,7	71,8	1	1			1	0	0	1	1			1	0	0	301
9928	Diesel	manual	36,7	74,8	-1	-1	1		0	0	1	1	1	-		1	0	0	9928
151	diesel	manual	40,1	68,2	1	1	1		1	0	0	1	1			1	0	0	151
10004	Diesel	manual	40,5	69,6	1	1	1		1	0	0	1	-	-		1	0	0	10004
106	Fuel Cell	Elec	40,7	69,9					0	0	0					0	0	0	106
9904	petrol	manual	40,8	69,0	1	1			1	0	0	1	1			1	0	0	9904
10015	Diesel	manual	41,3	72,7	-	1	1		1	0	0	-	-	-		0	0	0	10015
201	diesel	manual	41,7	71,2	1	1			1	0	0	1	1			1	0	0	201
122	diesel	manual	42,4	68,3	-	1			1	0	0	-	1			1	0	0	122
10014	Diesel	manual	42,5	73,7	-	1	1		1	0	0	-	-	-		0	0	0	10014
9907	petrol	manual	42,9	68,2	1	1	1		1	0	0	1	-	-		1	0	0	9907
10708	Diesel	manual	43,2	70,3	1	1	1		1	0	0	-	-	-		0	0	0	10708
9915	Petrol	manual	45,5	70,8	1	1	1		1	0	0	1	1	-		1	0	0	9915
303	Hybrid	CVT	45,6	68,3	1	1			1	0	0	1	1			1	0	0	303
139	petrol	manual	46,3	69,8	1	1			1	0	0	1	1			1	0	0	139
9923	Diesel	automatic	46,9	74,4	-1	-		-1	0	0	1	1	-		1	1	0	0	9923
204	petrol	manual	47,6	75,5	1	1			1	0	0					0	0	0	204
107	Hybrid	Elec	48,1	69,9					0	0	0				0,5	0	1	0	107
9903	Diesel	manual	48,2	68,8	1	1	1		1	0	0	1	1	-		1	0	0	9903
9911	Diesel	manual	48,4	70,0	1	1	1		1	0	0	1	1	-		1	0	0	9911
9925	Petrol	manual	49,0	69,3	1	1			1	0	0	1	-			1	0	0	9925
206	diesel	CVT	50,1	72,7	-	-			0	0	0	-	-			0	0	0	206
10009	Petrol	manual	50,3	70,4	1	1	1		1	0	0	1	1	-		1	0	0	10009
302	diesel DI	manual	50,4	73,0	1	1			1	0	0	1	-			1	0	0	302
10710	Petrol	automatic	52,4	69,2	1	1	1	1	1	0	0	1	1	-	-	1	0	0	10710
112	petrol	CVT	52,5	69,0				1	1	0	0				1	1	0	0	112
113	petrol	CVT	52,5	66,1			1		1	0	0			1		1	0	0	113
9924	Diesel	manual	54,6	69,5	1	1	1		1	0	0	1	1	-		1	0	0	9924
9908	petrol	manual	55,2	69,2	1	1	1		1	0	0	1	1	-		1	0	0	9908

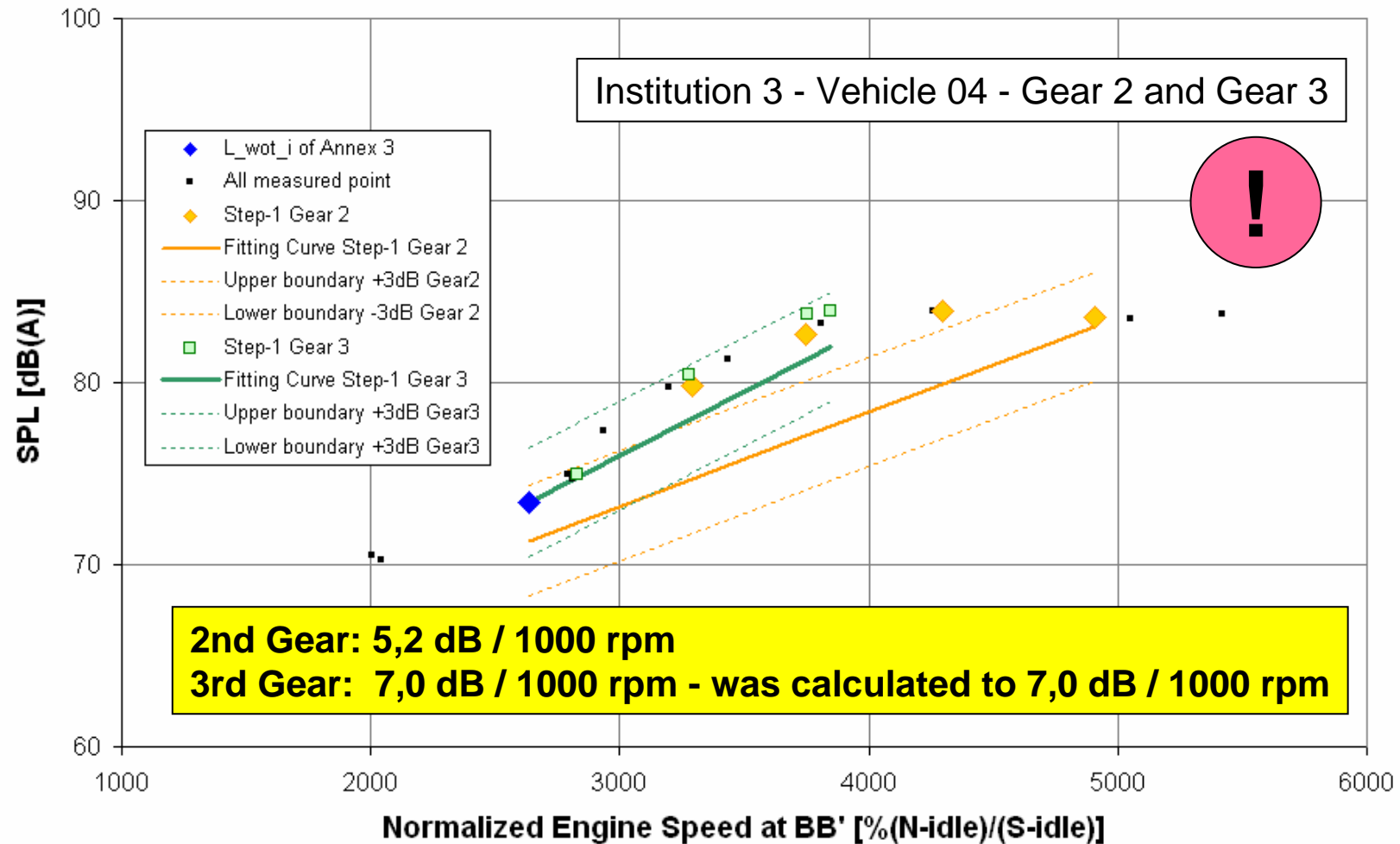
Overview of the Test Results for Vehicles with PMR<120 kW/t





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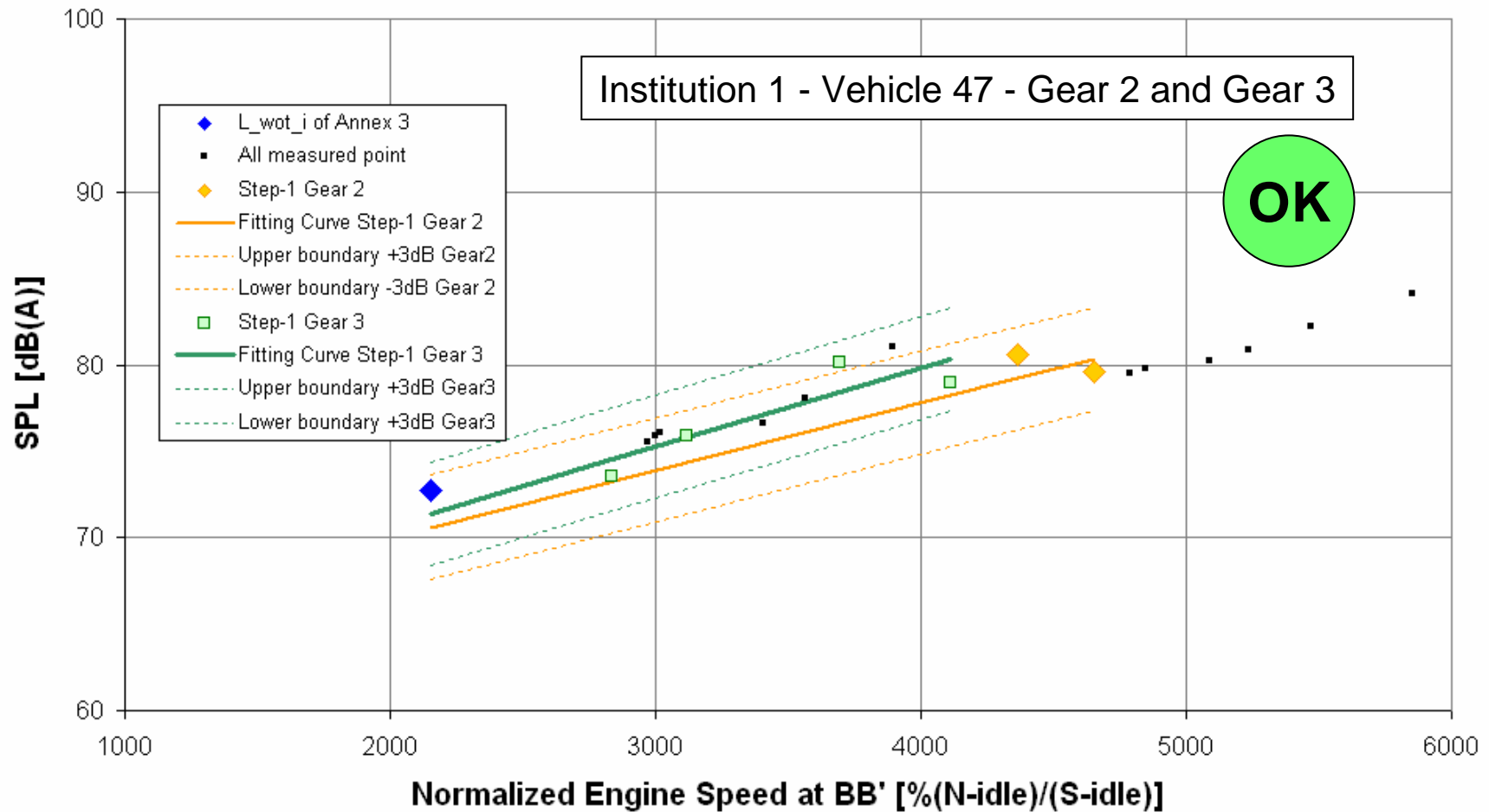
Vehicle Data					D/F-Proposal							OICA							ID
ID	eng concept	transmission	PMR	Lurban	Lmax				84	8	18					96	7	3	
113				73,3 70,6 66,5	2nd	3rd	4th	D	PASS	O	FAIL	2nd	3rd	4th	D	PASS	O	FAIL	
9920	Petrol	manual	55,4	70,8	1	1	1		1	0	0	1	1	—		1	0	0	9920
9922	Diesel	manual	55,7	70,4	1	1	1		1	0	0	1	1	—		1	0	0	9922
140	diesel	automatic	56,0	69,2	-	1			1	0	0	-	1			1	0	0	140
205	petrol	automatic	56,1	72,0	1	1			1	0	0	-	1			1	0	0	205
10704	Diesel	manual	56,3	70,0	1	1	1		1	0	0	1	—	—		1	0	0	10704
305	petrol	manual	56,7	71,8	0,5	-1			0	0	1	1	1			1	0	0	305
136	diesel	manual	58,6	67,9	1	1			1	0	0	1	1			1	0	0	136
9919	Petrol	manual	59,0	70,8	1	1	1		1	0	0	1	—	—		1	0	0	9919
9902	Diesel	manual	59,1	71,3	1	1			1	0	0	1	1			1	0	0	9902
9905	Diesel	manual	59,2	68,7	1	1	1		1	0	0	1	1	-		1	0	0	9905
10706	Petrol	manual	59,5	73,5	1	-1			0	0	1	1	1			1	0	0	10706
142	petrol	manual	59,7	71,1	1	0,5			0	1	0	1	1			1	0	0	142
304	petrol	manual	61,4	72,7	-1	-1			0	0	1	-1	1			0	0	1	304
120	petrol	manual	61,9	69,8	1	1			1	0	0	1	1			1	0	0	120
9948	Petrol	manual	62,1	68,8	1	1	1		1	0	0	1	—	—		1	0	0	9948
9912	Diesel	manual	62,7	70,4	1	1	1		1	0	0	1	1	-		1	0	0	9912
110	petrol	CVT	62,9	67,4				1	1	0	0				1	1	0	0	110
111	petrol	CVT	62,9	67,1	1	1			1	0	0	1	1			1	0	0	111
9906	petrol	manual	64,0	69,1	1	1	1		1	0	0	1	1	-		1	0	0	9906
9909	Diesel	automatic	64,8	69,7	-	1		1	1	0	0	-	1		1	1	0	0	9909
10025	Petrol	manual	65,5	70,6	0,5	0,5	1		0	1	0	1	1	—		1	0	0	10025
118	diesel	manual	65,7	69,2	1	1			1	0	0	-	1			1	0	0	118
10008	Petrol	automatic	66,5	72,2	1	1		1	1	0	0	1	1		1	1	0	0	10008
123	diesel	manual	66,9	69,5	1	1			1	0	0	1	1			1	0	0	123
126	diesel	manual	66,9	66,5	1	1			1	0	0	1	1			1	0	0	126
128	diesel	manual	66,9	67,1	1	1			1	0	0	1	1			1	0	0	128
9916	Petrol	manual	67,0	69,7	1	1	1		1	0	0	1	1	-		1	0	0	9916
152	diesel turbo	manual	68,4	70,5	1	1	1		1	0	0	1	1			1	0	0	152
141	diesel	manual	68,6	70,1	1	1			1	0	0	-	1			1	0	0	141
181	diesel	manual	68,6	70,1	1	1			1	0	0	-	1			1	0	0	181

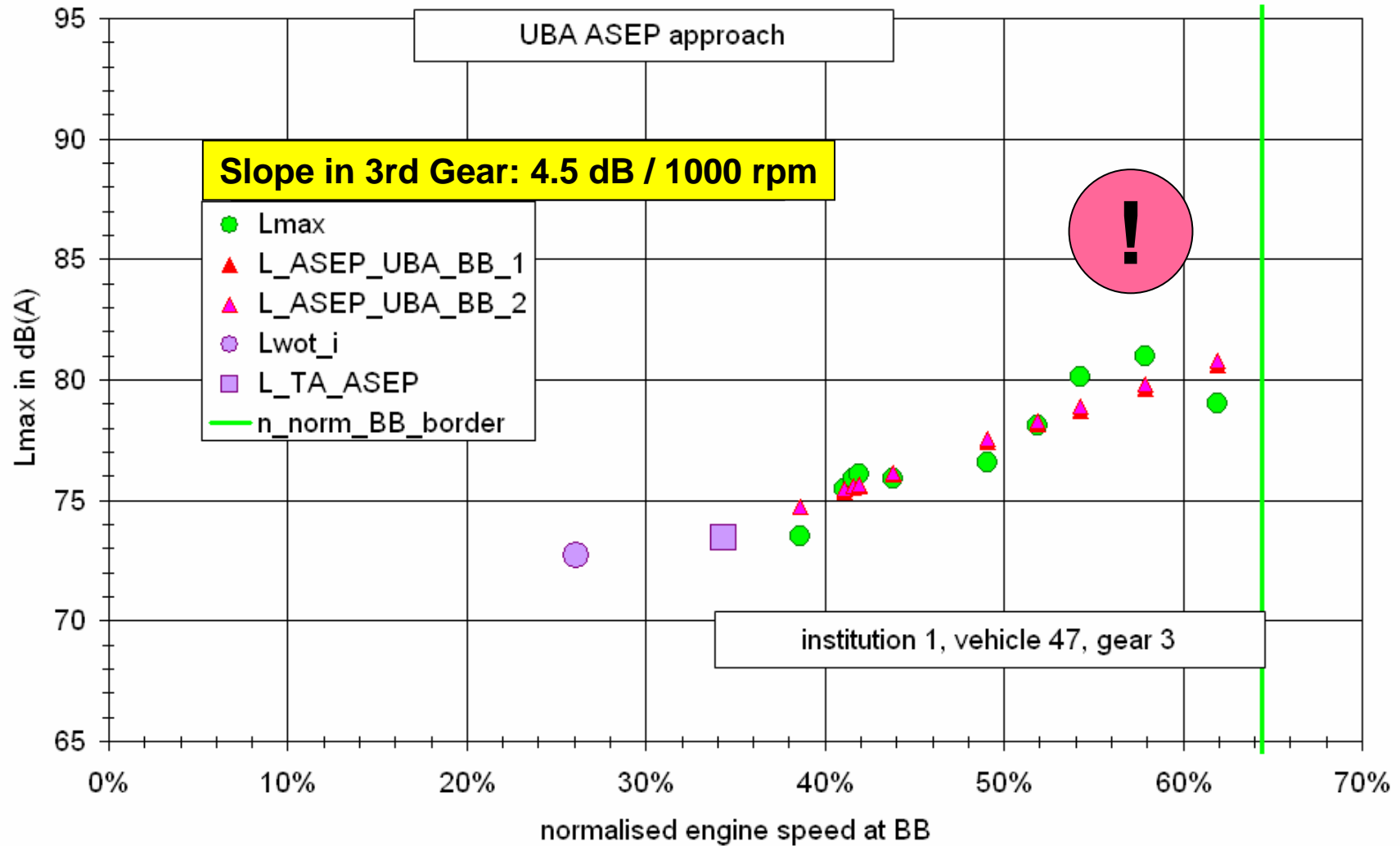




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Vehicle Data					D/F-Proposal							OICA							ID		
ID	eng concept	transmission	PMR	Lurban	Lmax				84	8	18					96	7	3			
					2nd	3rd	4th	D	PASS	O	FAIL	2nd	3rd	4th	D	PASS	O	FAIL			
				73,3																	
				70,6																	
113				66,5																	
114	petrol	CVT	68,8	68,9				1	1	0	0				1	1	0	0			114
115	petrol	CVT	68,8	68,0	1	1			1	0	0				1	0	0			115	
137	petrol	manual	69,2	69,6	1	1			1	0	0				1	0	0			137	
146	diesel	manual	69,5	71,9	-	1			1	0	0				1	0	0			146	
124	diesel	CVT locked	69,8	69,7	1	1			1	0	0				1	0	0			124	
127	diesel	CVT locked	69,8	70,9	1	1			1	0	0				1	0	0			127	
10707	Diesel	automatic	71,0	70,8	1	1	1	1	1	0	0			-	1	0	0			10707	
207	petrol	manual	73,5	71,4	1	1			1	0	0				1	0	0			207	
9910	petrol	automatic	75,1	72,4	1	1	1	1	1	0	0				1	0	0			9910	
144	diesel	manual	76,2	72,1	-	1			1	0	0				1	0	0			144	
9918	Petrol	automatic	76,2	72,5	1	1		1	1	0	0				1	0	0			9918	
150	petrol turbo	automatic	77,5	69,5	1	1			1	0	0				0	1	0			150	
119	petrol	manual	77,8	69,9	1	1			1	0	0				1	0	0			119	
143	petrol turbo	manual	77,9	69,8	1	1			1	0	0				1	0	0			143	
108	petrol	automatic	78,9	69,2				1	1	0	0				1	0	0			108	
109	petrol	automatic	78,9	68,3	1				1	0	0				1	0	0			109	
117	diesel	manual	79,1	68,8	-	1			1	0	0				1	0	0			117	
9942	Petrol	manual	81,1	71,9	0,5	0,5	0,5		0	1	0				1	0	0			9942	
9913	Petrol	automatic	83,9	73,3	1	1	1	1	1	0	0				1	0	0			9913	
9936	petrol	manual	87,4	72,8	-1	-1	-1		0	0	1				1	0	0			9936	
134	petrol	automatic	87,9	69,2	1	1			1	0	0				1	0	0			134	
131	petrol	manual	88,1	68,6	1	1			1	0	0				1	0	0			131	
147	petrol DI	automatic	89,2	71,5	0,5	-1			0	0	1				1	0	0			147	
9921	Petrol	manual	90,5	69,7	1	1	1		1	0	0				1	0	0			9921	
153	petrol	manual	90,5	71,0	1	1	1		1	0	0				1	0	0			153	
9914	Petrol	automatic	91,0	71,8	1	1		1	1	0	0				0,5	0	1	0		9914	
202	petrol	manual	94,2	70,7	1	1			1	0	0				1	0	0			202	
203	petrol	manual	94,2	70,4	-1	-1			0	0	1				0,5	1	0	0		203	
154	petrol turbo	manual	95,4	70,5	1	0,5	1		0	1	0				1	1	0	0		154	
194	petrol turbo	manual	95,4	70,1	1	0,5	1		0	1	0				1	1	0	0		194	

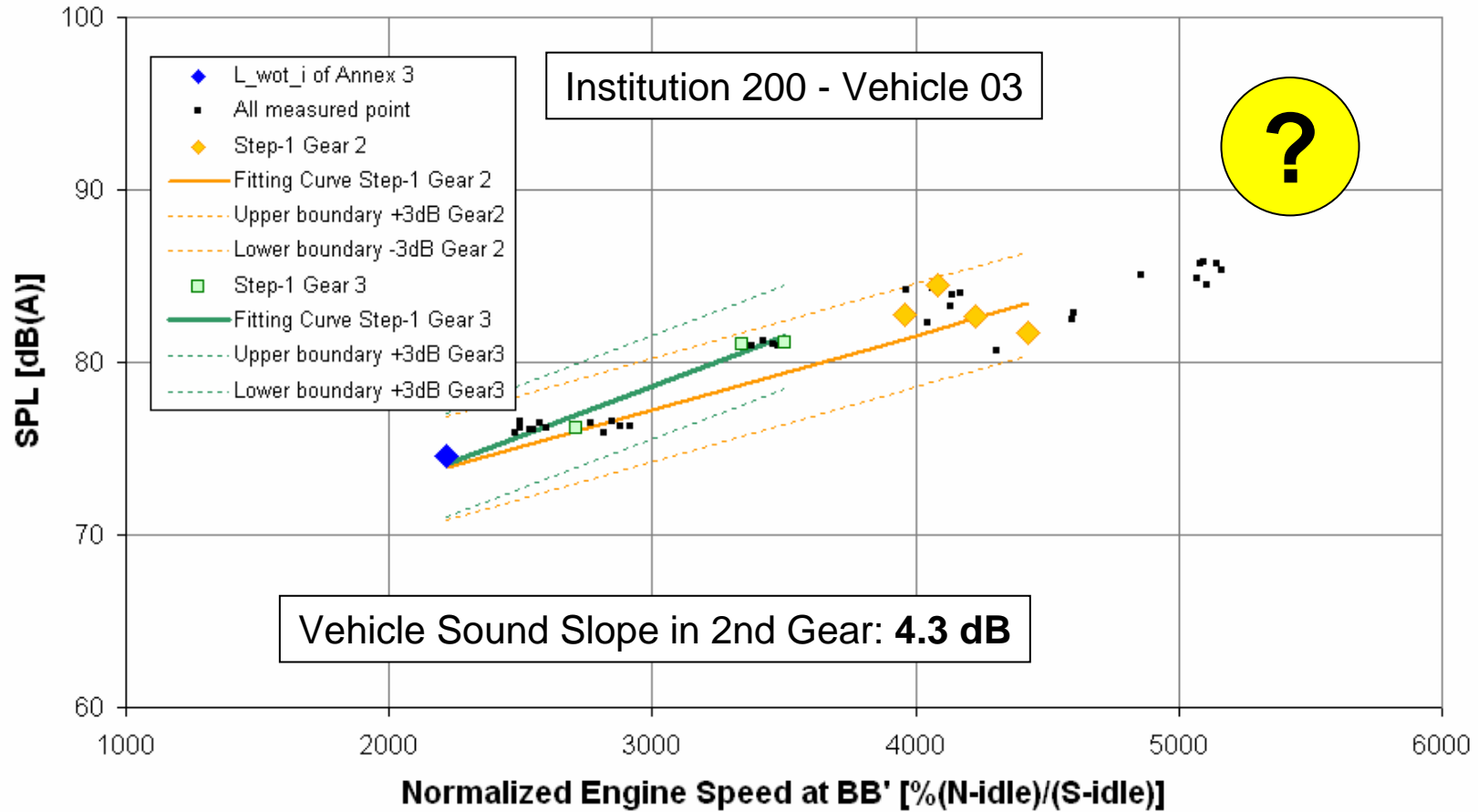


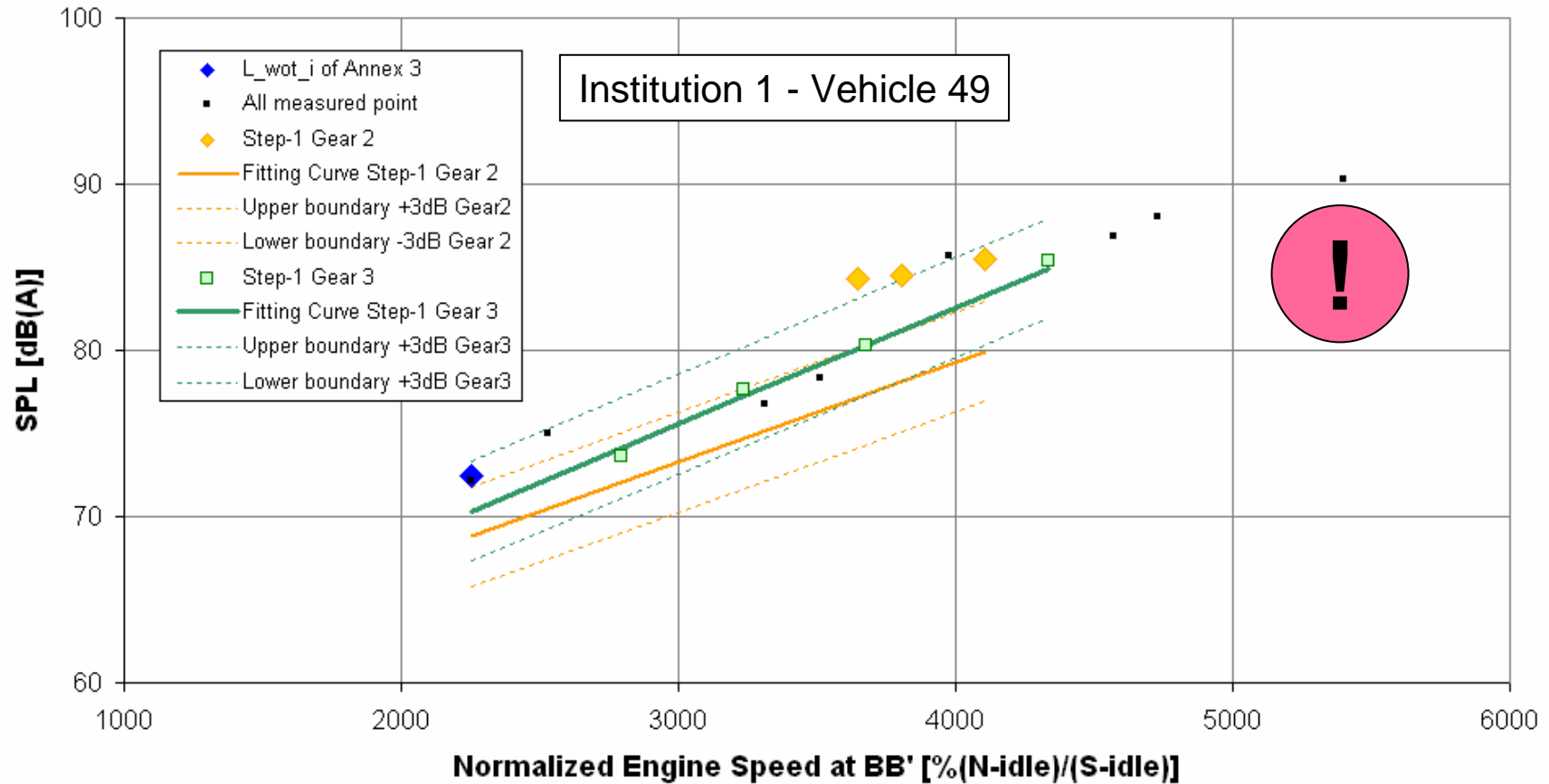


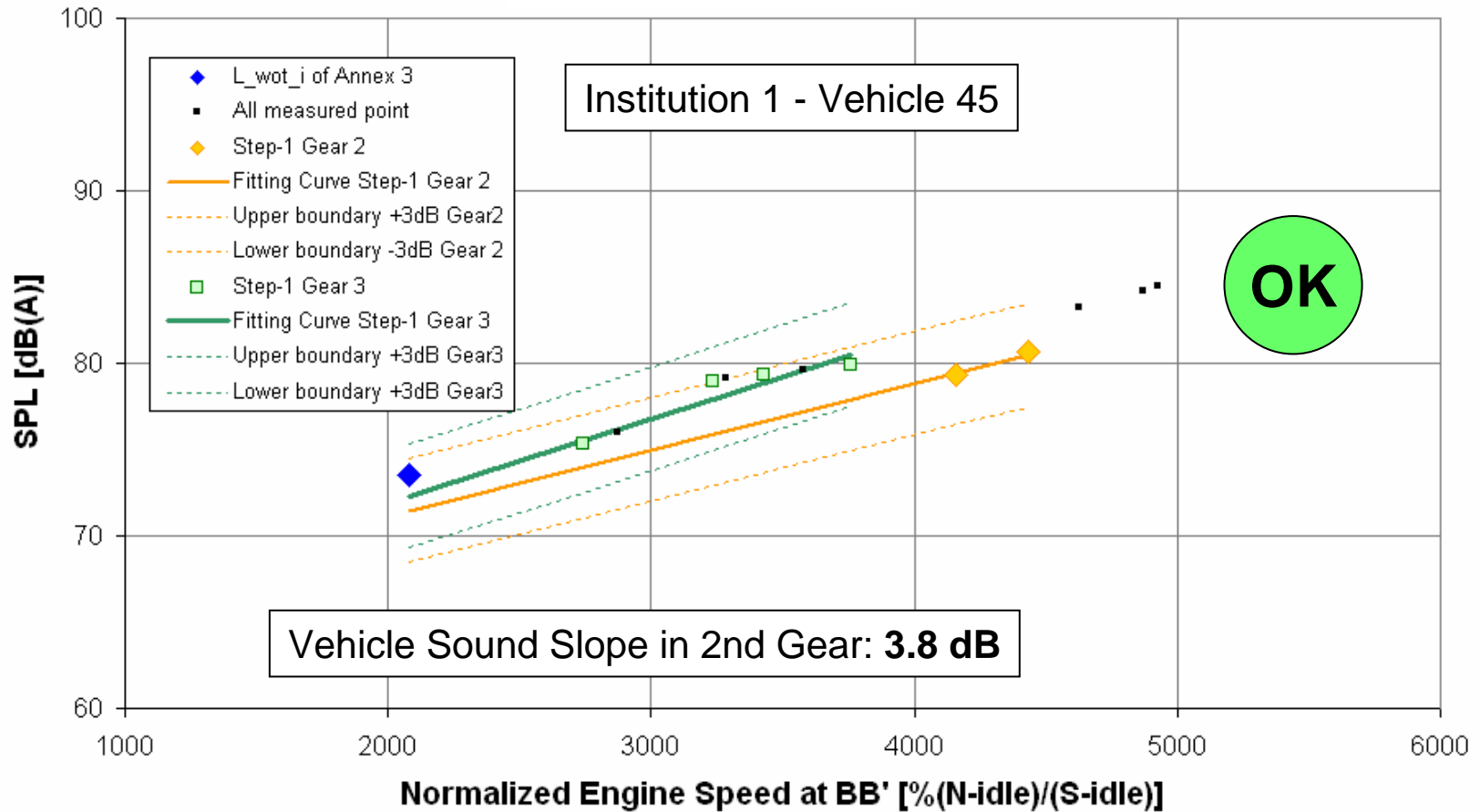


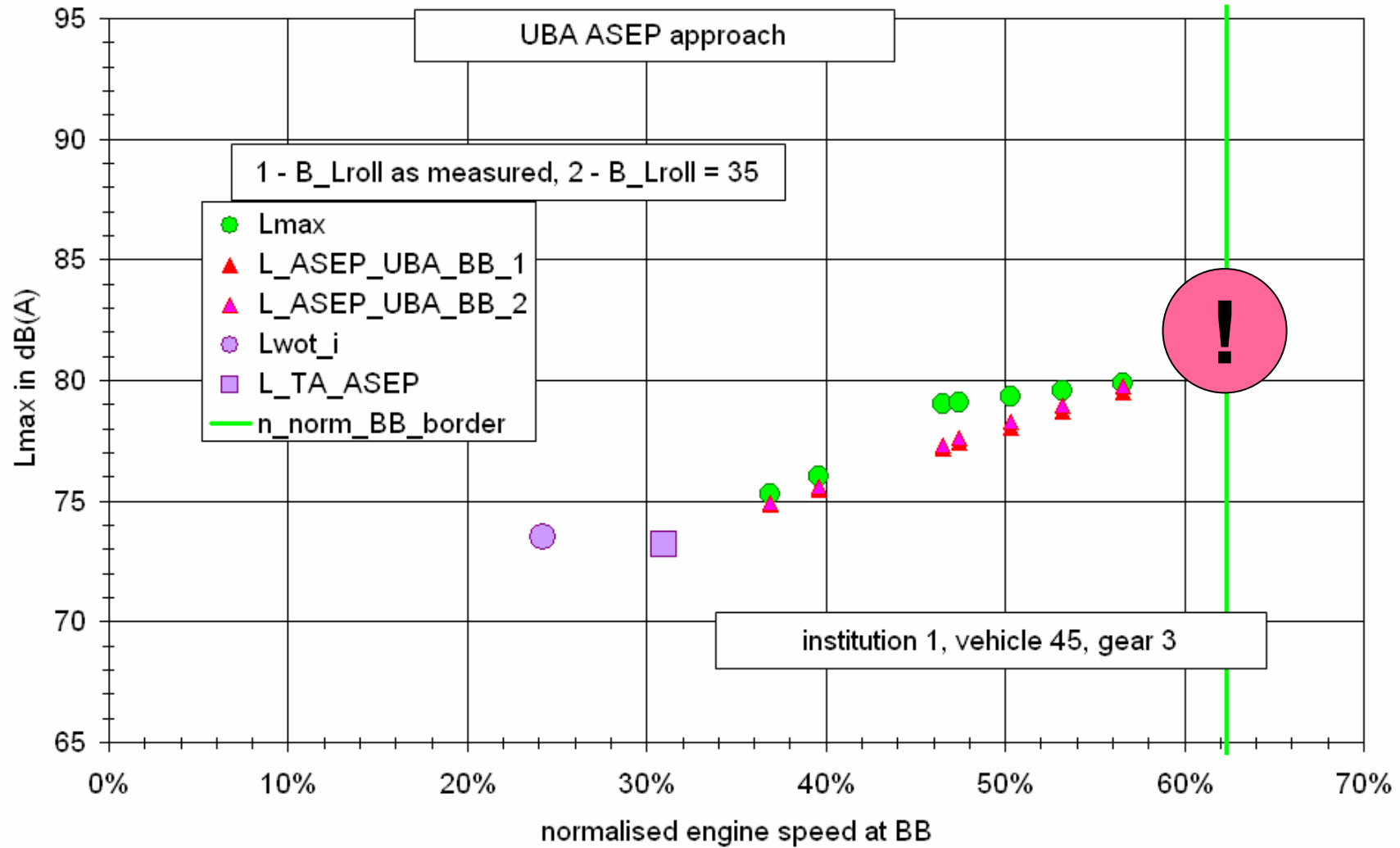
INTERNATIONAL ORGANIZATION OF MOTOR VEHICLE MANUFACTURERS

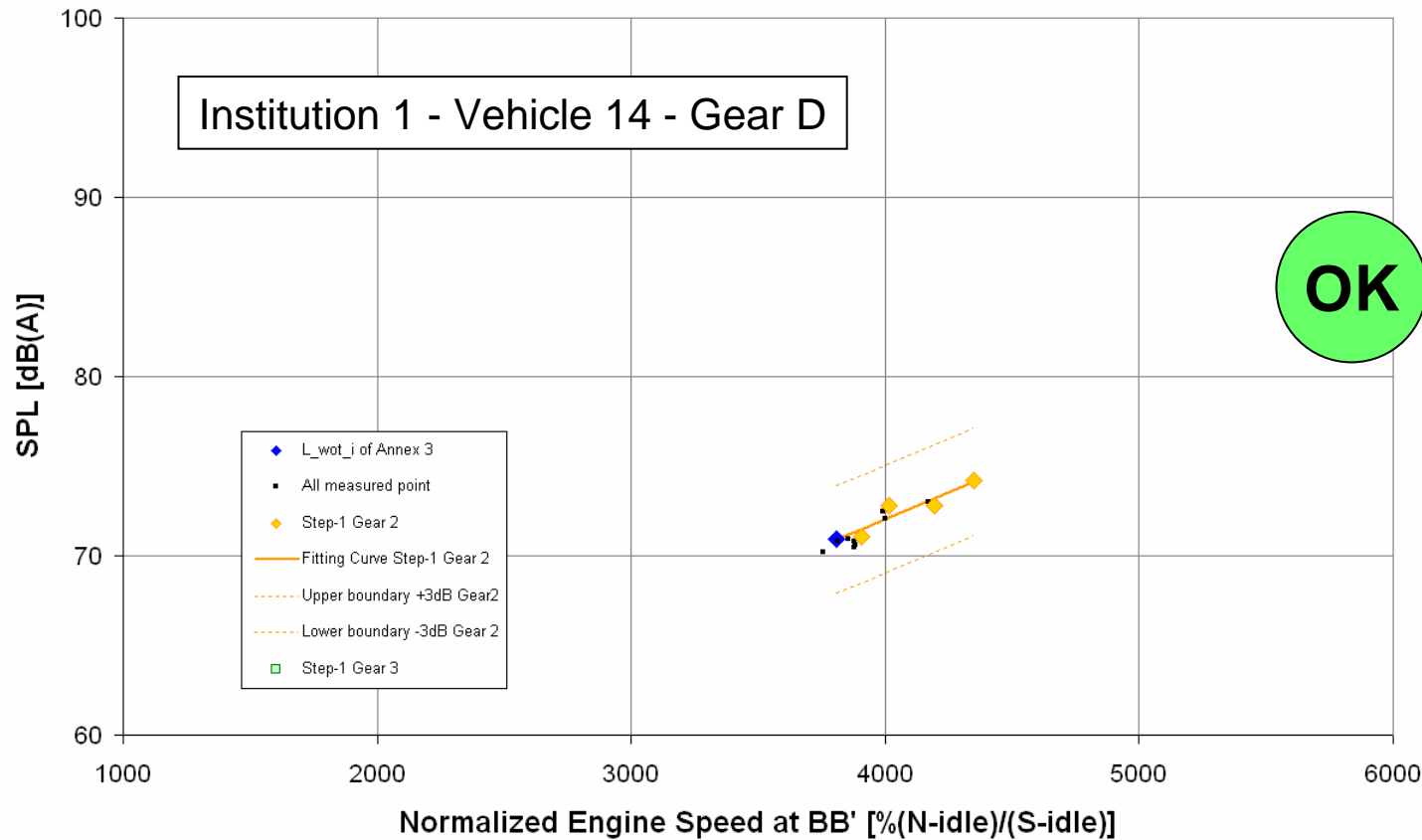
Vehicle Data					D/F-Proposal							OICA							ID
ID	eng concept	transmission	PMR	Lurban	Lmax				84	8	18					96	7	3	
113				73,3 70,6 66,5	2nd	3rd	4th	D	PASS	O	FAIL	2nd	3rd	4th	D	PASS	O	FAIL	
101	petrol	automatic	95,8	71,9	-1	0,5			0	0	1	1	0,5			0	1	0	101
145	petrol turbo	manual	101,4	72,3	-1	-1			0	0	1	1	1			1	0	0	145
9917	Petrol	automatic	101,9	73,1	1	1		0,5	0	1	0	1	1		1	1	0	0	9917
125	petrol	manual	103,0	66,9	1	1			1	0	0	1	1			1	0	0	125
20002	Petrol	automatic	105,3	71,7	1	1	1	1	1	0	0	1	1	1	-	1	0	0	20002
20042	Petrol	automatic	105,3	71,8	1	1	1	1	1	0	0	1	1	1	-	1	0	0	20042
148	petrol DI	automatic	106,7	70,4	-1	0,5			0	0	1	-1	1			0	0	1	148
121	petrol	manual	110,3	71,1	1	1			1	0	0	1	1			1	0	0	121
116	petrol	CVT	110,9	69,0				1	1	0	0			1	1	0	0	0	116
20004	Petrol	manual	111,2	70,1	-1	1	1		0	0	1					0	0	0	20004
20044	Petrol	manual	111,2	69,7	-1	1	1		0	0	1	1	1	-		1	0	0	20044
133	petrol	automatic	111,7	71,5	0,5	0,5			0	1	0	1	1			1	0	0	133
173	petrol	automatic	111,7	71,5	-1	-1			0	0	1	1	1			1	0	0	173
20003	Petrol	manual	111,9	71,7	-1	-1	-1		0	0	1	0,5	1	-		0	1	0	20003
20008	Petrol	manual	111,9	72,2	1	1	1		1	0	0	1	1	-		1	0	0	20008
20048	Petrol	manual	111,9	71,0	1	1	1		1	0	0	1	1	-		1	0	0	20048
149	petrol DI	automatic	112,1	71,8	-1	-1			0	0	1	-1	1			0	0	1	149
20001	Petrol	manual	112,2	70,8	1	1			1	0	0	1	1			1	0	0	20001
20005	Petrol	manual	116,0	71,9	1	-1	-1		0	0	1	1	1	-		1	0	0	20005
20045	Petrol	manual	116,0	71,9	1	-1	0,5		0	0	1	1	1	-		1	0	0	20045
10003	Petrol	automatic	116,4	71,4	-	1	1	1	1	0	0	-	-	-	1	1	0	0	10003
132	petrol	automatic	116,5	71,3	0,5	0,5			0	1	0	0,5	1			0	1	0	132

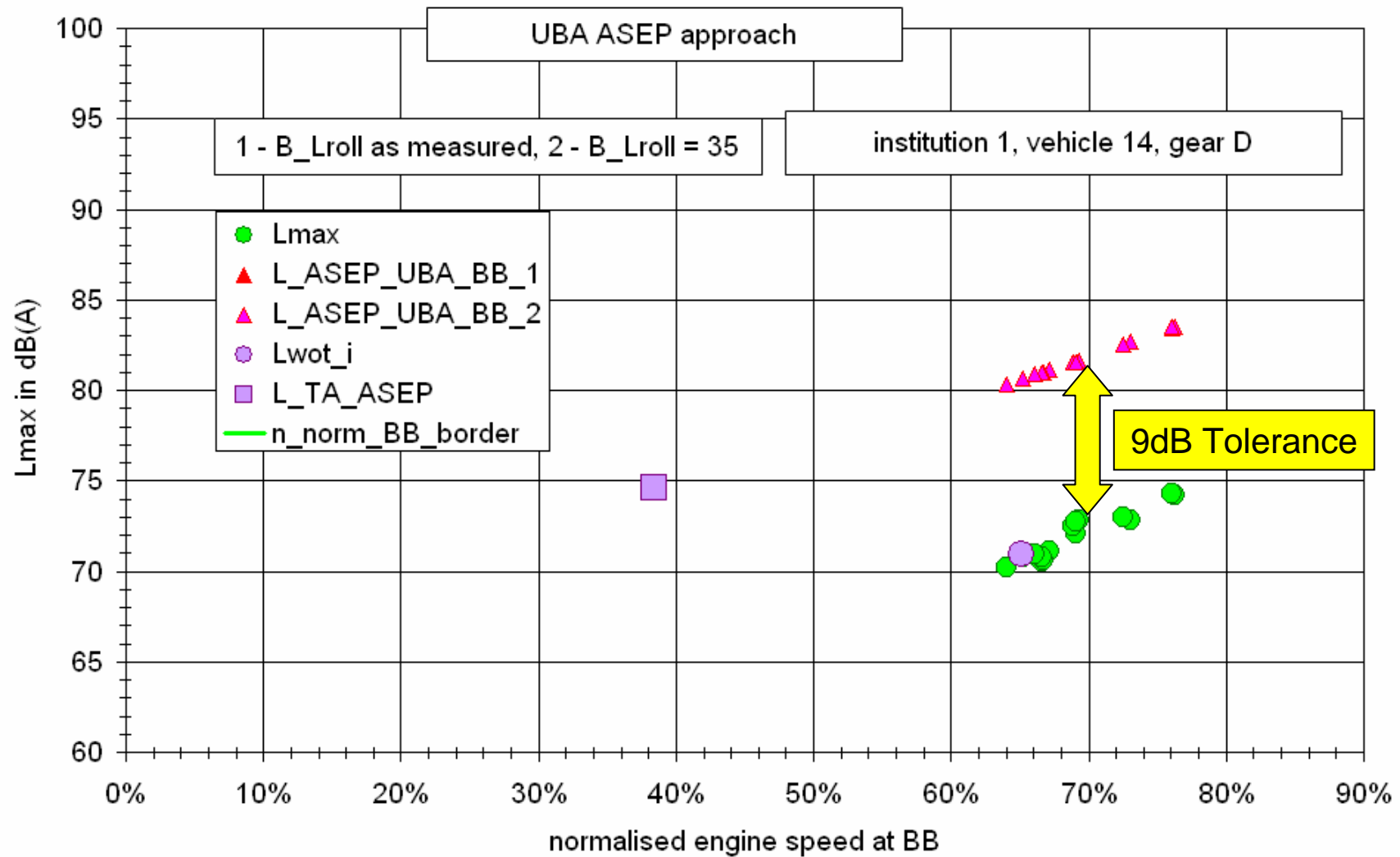






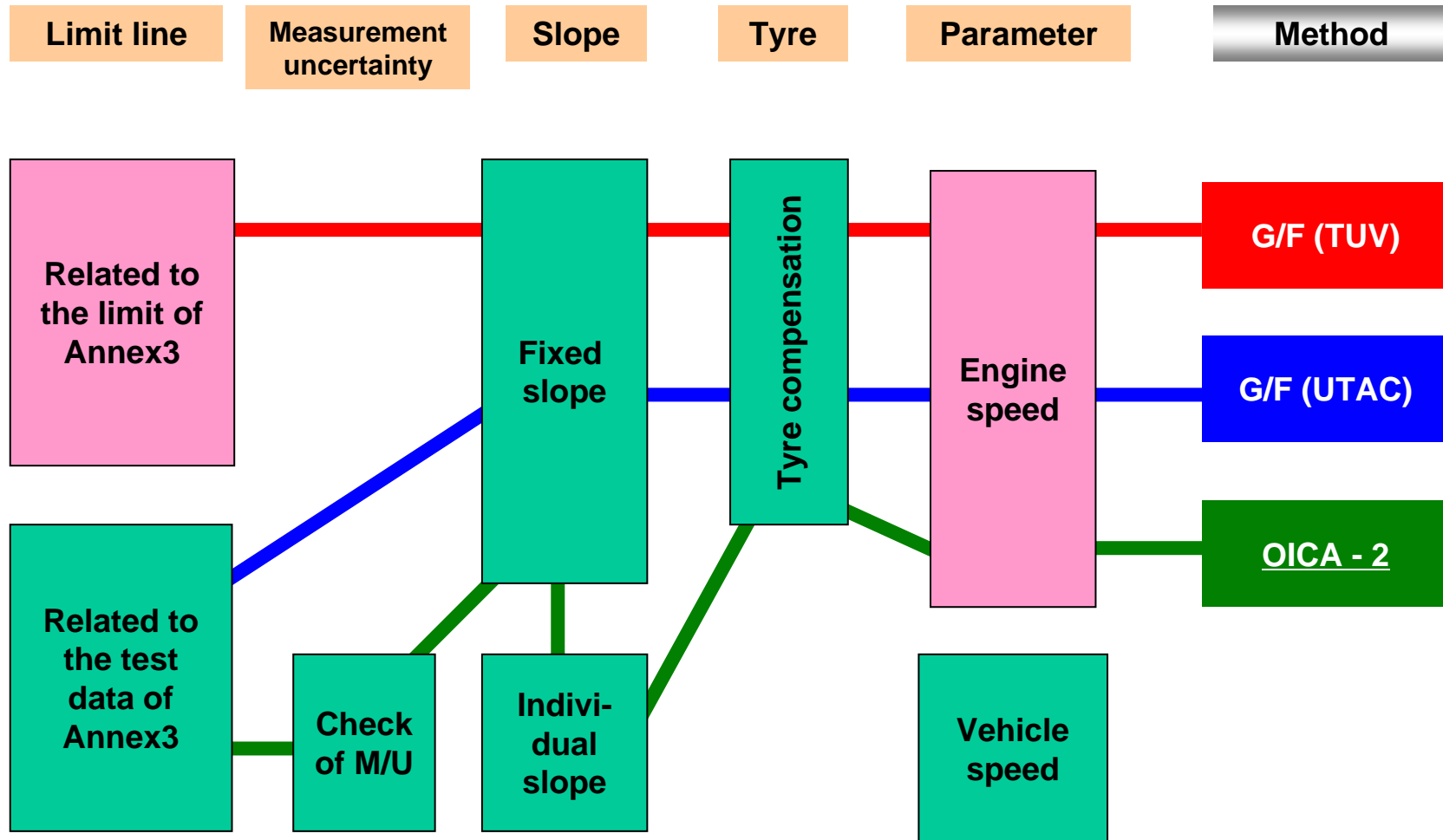








Methods and components





Comparison of the 2 Test Proposals

	D/F-Proposal	OICA	6.2.3.3 and ToR
Reference for Data Acquisition	Max_L or [BB']	BB'	not specified
Required Test Equipment	Continuous [as Annex 3]	as Annex 3	not specified
Test Area	below and above N _{Annex 3}	above N _{Annex 3}	higher than Annex 3
Vehicle Test Condition	Full Throttle	Full Throttle	higher than Annex 3
Anchor Point			
Engine Speed	from statistics independent from Annex 3 test result	Result from Annex 3 N _{wot_i}	Compare to Annex 3 Test Result
Level	Calculated from Limit and Cruiseby Level using statistical kp	Result from Annex 3 L _{wot_i}	Compare to Annex 3 Test Result
Tyre Influence	via L _{crs_i} Slope Assumption 34 dB/logv	Correction of L _{wot_i} for different Gears Slope Assumption 32 dB/logv	not specified
Borderline	Fix	Range 3dB to 7 dB Gear dependent	technical practical

ToR §3

The informal group shall develop a complementary test method and evaluation criteria for insertion into Annex 10. The complementary test method shall cover the noise emission under **higher engine speeds and loads** than the proposed procedure in TRANS/WP.29/GRB/2005/5, as amended.



Summary:

- OICA Concept leads to very stable and reliable results. Also vehicles with automatic transmission and CVT can be tested.
- Within the boundaries for normal vehicle behaviour, the vehicles have always a margin of [3] dB.
- In a first step the vehicles with a **PMR < 120kW/t** have been investigated.
- 3 vehicles exceed the given tolerance of 3 dB, while 7 vehicles come close to this border.
- **The proposed margin of [3dB] must not be understood as borderline proposal. It shall help to figure out vehicles worth to be looked at.**
- **Further investigations and consideration within GRB must clarify, whether those vehicles shall be justified as vehicles of concern.**



Can the OICA concept become a part of the D/F-Proposal ?

- Both test use the same kind of testing
- Both test have a similar construction based on an anchor point and a definition of sound increase as a function of engine speed
- So far the anchor point of each test is defined differently and further investigation and discussion of advantages and disadvantages is needed.
- The same needs apply to the question whether a fixed or variable slope is technically needed/possible and for regulatory purposes helpful.
- There is only a small step to introduce components of the OICA concept to the D/F-Proposal.



Thank You !