

**P R E S E N T A T I O N   O F**



**INTERNATIONAL ORGANIZATION OF MOTOR VEHICLE MANUFACTURERS**

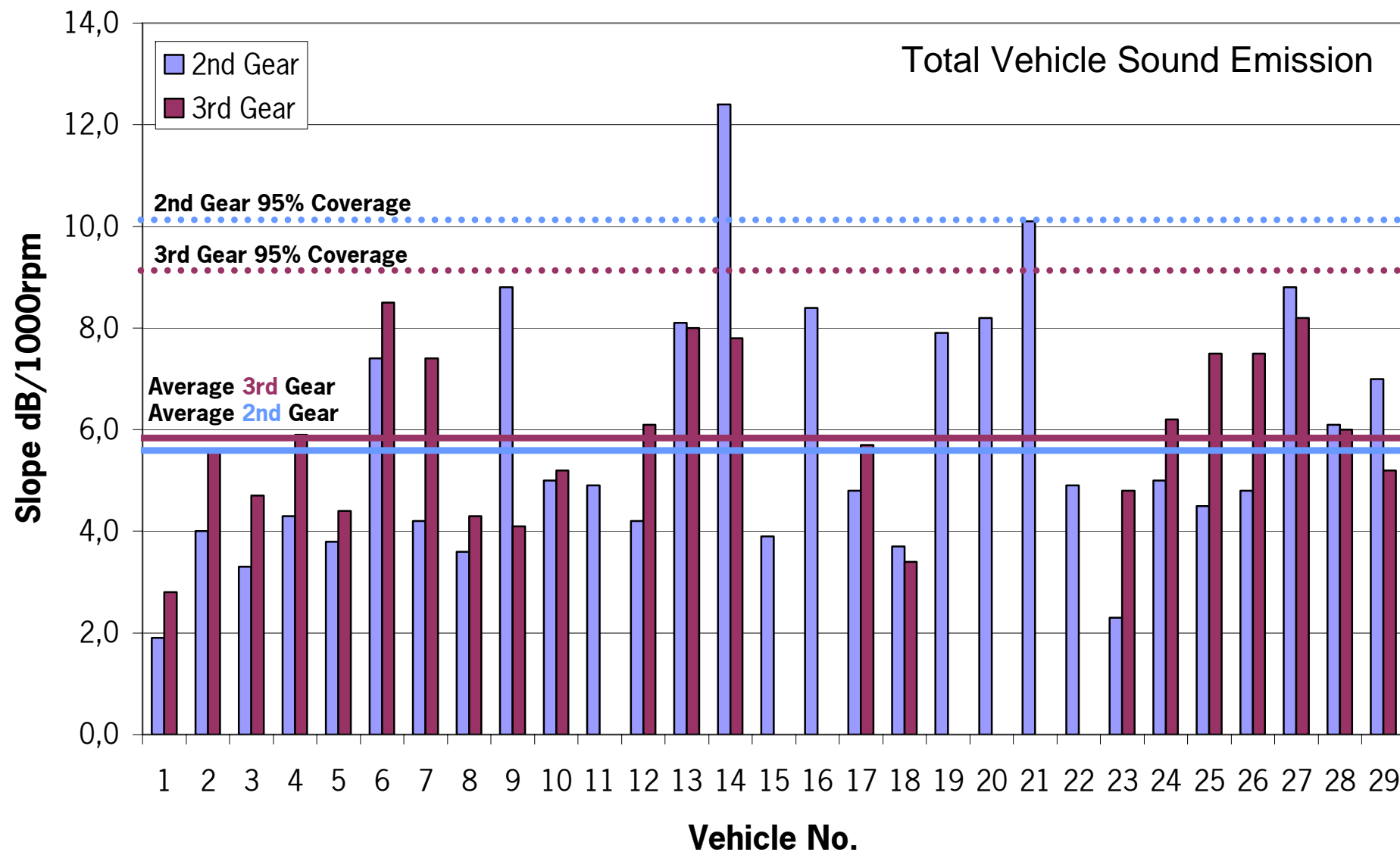
**Additional Sound Emission Provisions  
Presentation of Research Results**

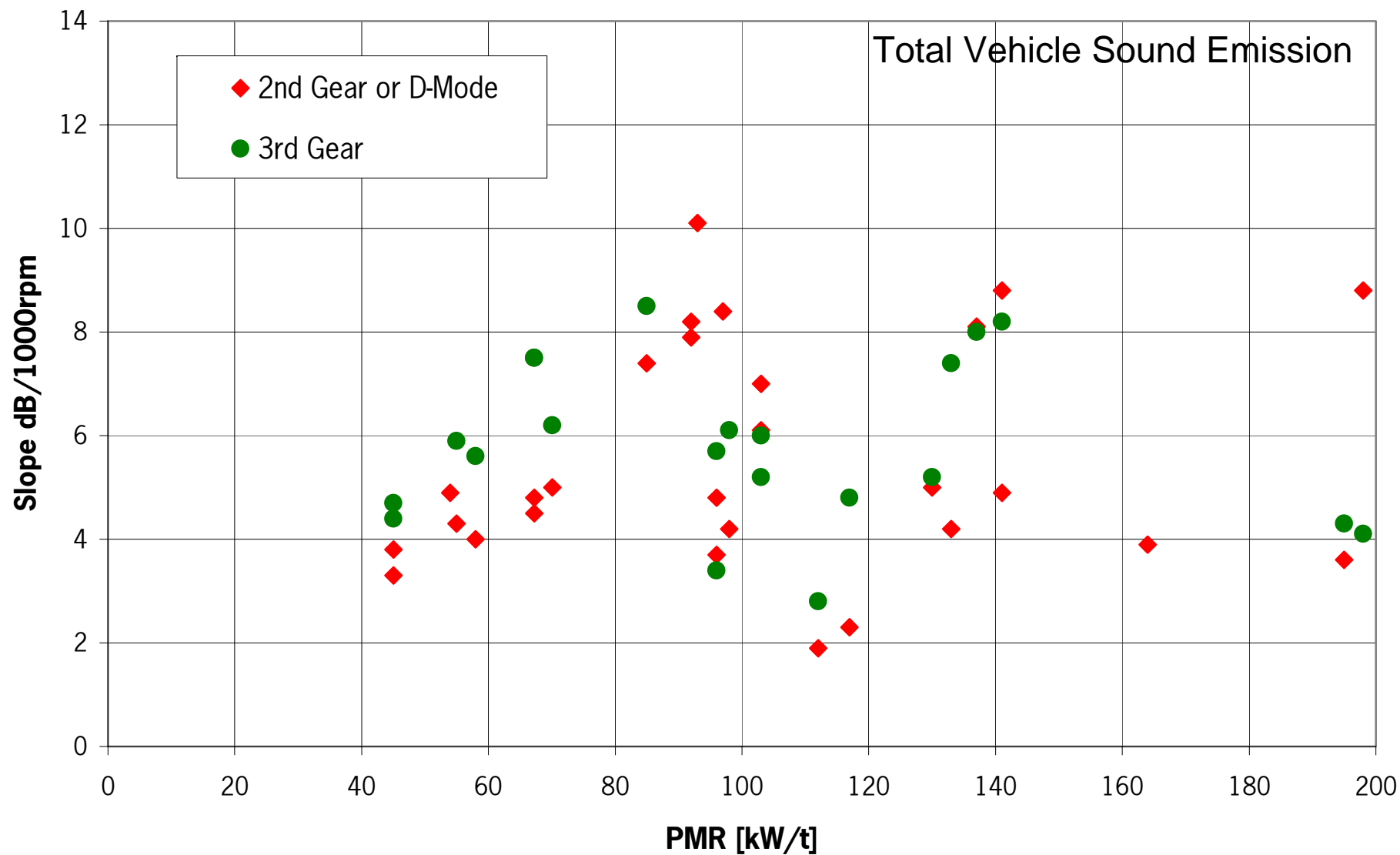
## **Status**

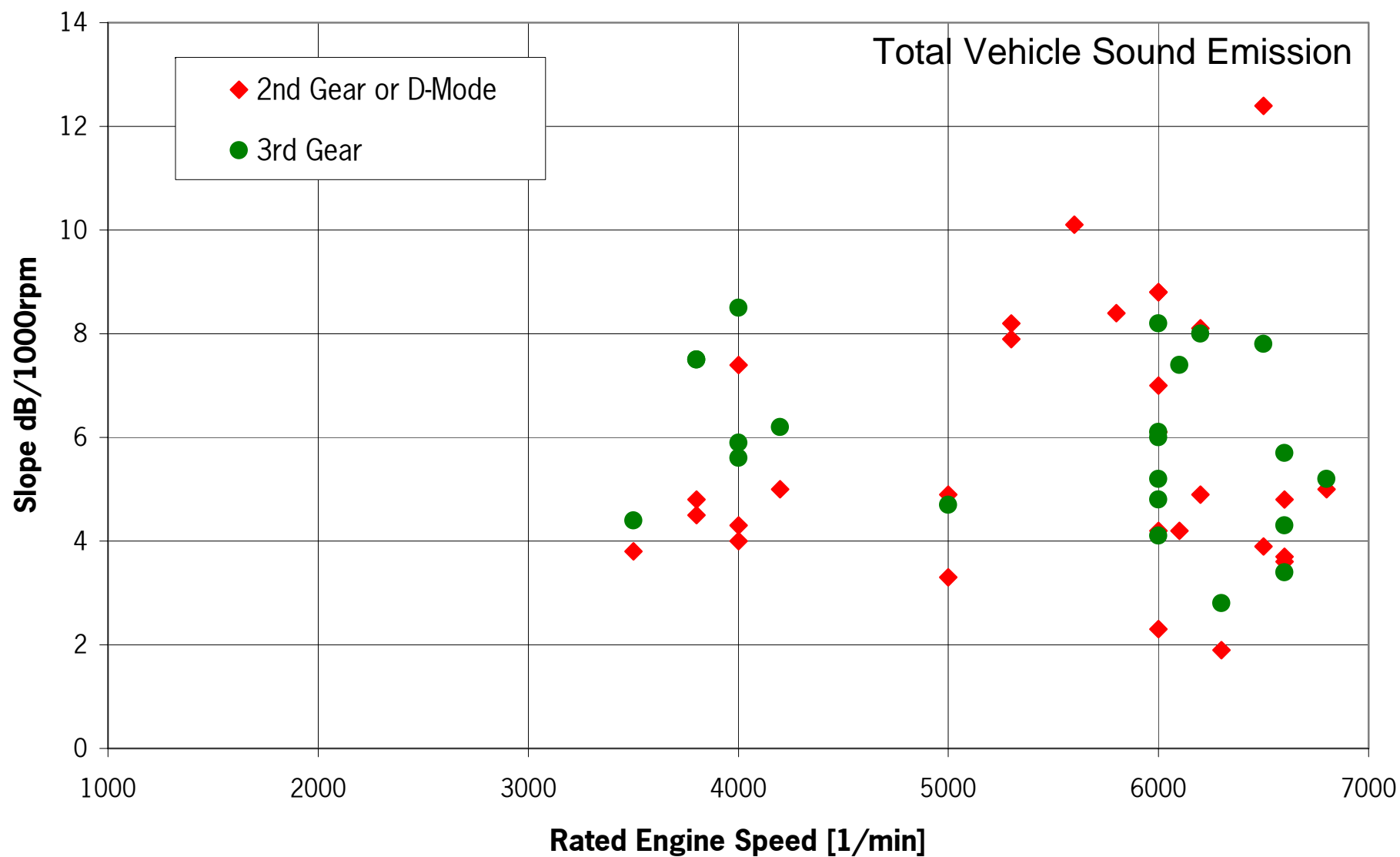
- Members of OICA have carried out measurements to contribute with information to the discussion about ASEP.
- This presentation summarizes the actual test results.
- Industry is actually investigating the quality of the regression curves which are proposed to evaluate the tolerable accuracy.
- At the current stage it is difficult to determine vehicles of concern, since it is not clear what vehicles of concern are.
- More research and data are needed. Studies are continuing. More data are expected by the end of this year.

## **Part 1 - Test Results**

- Measurements were carried out to
  - investigate the feasibility of pass-by tests at various test conditions.
  - check the representativity of the discussed vehicle slopes as limit curves
- Not all aspects have been analyzed so far.
- The shown results refer to the overall sound behaviour of the vehicles.
- No tyre correction was done. The tyre influence was not studied so far.







## **Conclusions:**

- The sound slope of a vehicle is very individual and dependent on the specific technology used.
- The sound slope is gear dependent. There is a tendency that the slope in 3rd gear is higher than in 2nd gear.
- The sound slope is neither dependent on the PMR ratio nor on the rated engine speed.
- The sound slope is no predictor for the noise behaviour in traffic.
- The spread of the vehicle technology is too big to define a general sound slope as a target for all vehicles.
- According to the goal of ASEP to detect irregular sound behaviour, the sound slope alone does not provide a satisfying answer.

## **Part 2 - Administrative Treatment:**

- Vehicles Subject to ASEP
  - All M1 vehicles are basically subject to ASEP.
    - Vehicles with non active silencer systems should be excluded from ASEP, because there is no need to test those technologies.
    - Vehicles for which gear i in the new test is the 2nd gear can be excluded from ASEP, because they are tested already at very high engine speeds.
  - Not all N1 vehicles need to be subject to ASEP. According to the EU directive 70/220/EEC N1 vehicles of class II and class III shall be excluded from ASEP.
- During type approval the manufacturer will declare the compliance with the ASEP requirements. No tests will be carried out.
- Unless there is a need, no ASEP test shall be carried out.
- It is the basic understanding of OICA, that regulators want to get hand on technologies, which they understand to not comply to the spirit of the regulation. With the installation of ASEP this is done.



## **Part 3 - Ideas for General Test Conditions:**

- Test equipment of annex 3 can be used.
- Test area:
  - For combustion engines the test area is defined by the engine speed.
  - The test area is between the highest engine speed of the new test in annex 3 and the maximum engine speed for a vehicle according to the actual test (as carried out); but not exceeding 85% of S

$$n_{\text{max\_annex3\_new}} < n_{\text{ASEP}} < n_{\text{max\_ECE51.02}}$$

- Lower engine speed as  $n_{\text{max\_annex3\_new}}$  are covered by the new type approval test (annex 3) and are not subject of ASEP.
- The speed range is  $20 \text{ km/h} < v_{\text{ASEP}} < 70 \text{ km/h}$ . Speeds higher than 70 km/h cannot be achieved on all test tracks.
- For alternative drives no engine speed is specified, the test area is defined by the vehicle speed.

## **Ideas for Gear Selection:**

- Gear choice:
  - All tests should be carried out in one gear. This avoids errors in the post processing of the data for the determination of the sound slope.
  - There are multiple definitions for the selection of the appropriate gear, however to maintain the gear selection design independent, the following definition is proposed:
    - The test shall be carried out in the gear ratio  $i-1$ , based on the definition that gear ratio  $i$  is specified as the lowest gear used in annex 3.
    - If gear  $i$  in annex 3 is equal to 2, no ASEP test needs to be carried out.
  - An open question are vehicles with automatic transmission.

## **Ideas for Simplification of the Test:**

- Throttle condition:
  - All test runs are carried out in full throttle condition.
  
- Number of runs:
  - The test should be carried out at all 500 1/min in the test area beginning at the first full 500 above  $n_{\text{max\_annex3\_new}}$  (e.g.  $n_{\text{max\_annex3\_new}} = 1870\text{rpm}$ ; then  $n1_{\text{ASEP}} = 2000\text{rpm}$ ,  $n2_{\text{ASEP}} = 2500\text{rpm}$ , ...).
  - The advantage of the definition is:
    - clear defined work load
    - limited work load
    - uniform provisions for test houses

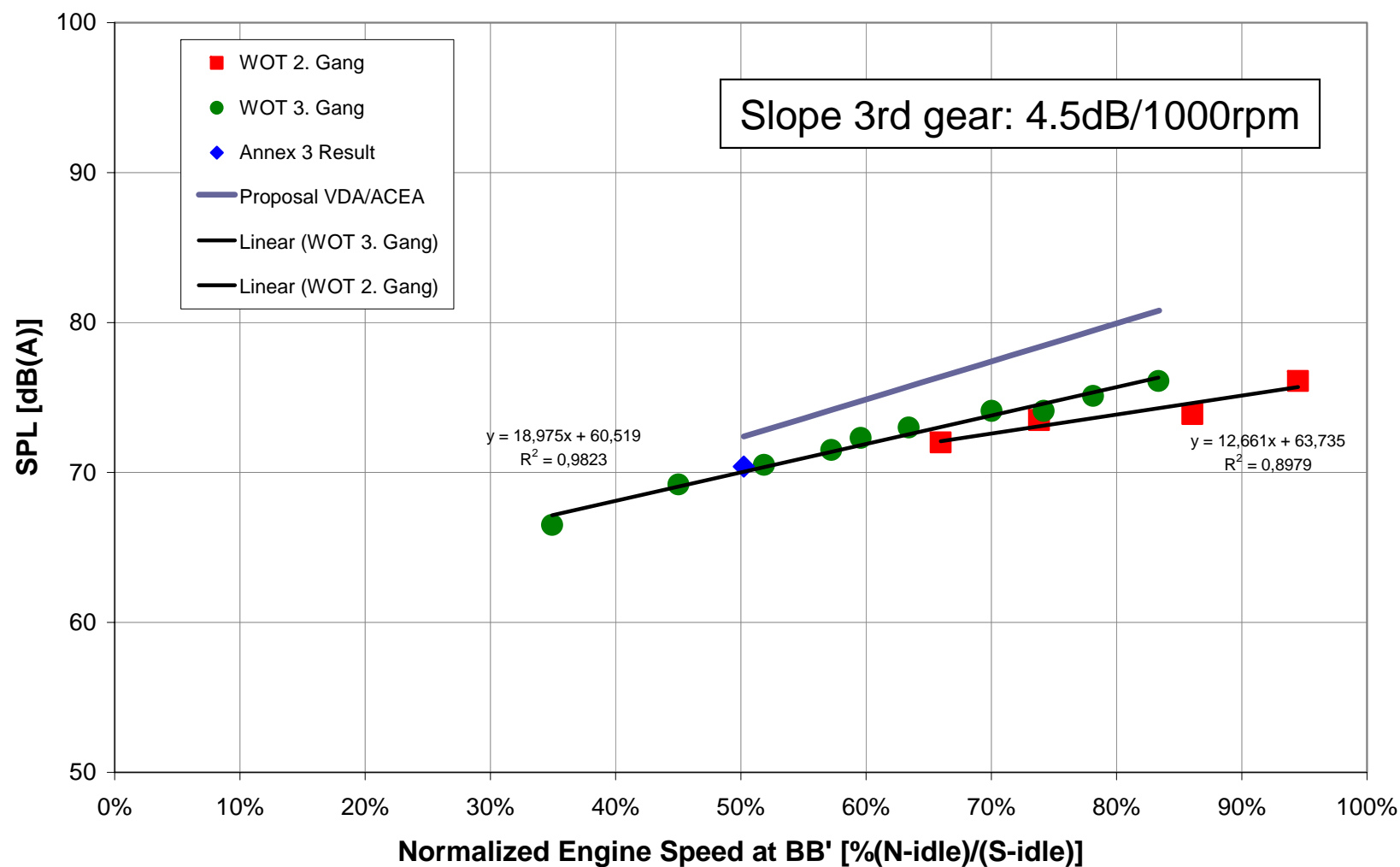
## **Report of test results and data interpretation:**

- For vehicles with combustion engine the test results are reported versus engine speed (However one could consider to report the test results also over vehicle speed, since test are carried out in one gear alone).
- For vehicles with alternative drives the test results are reported versus vehicle speed.
- A linear regression line is drawn through the measured points to determine the sound slope for each individual gear.

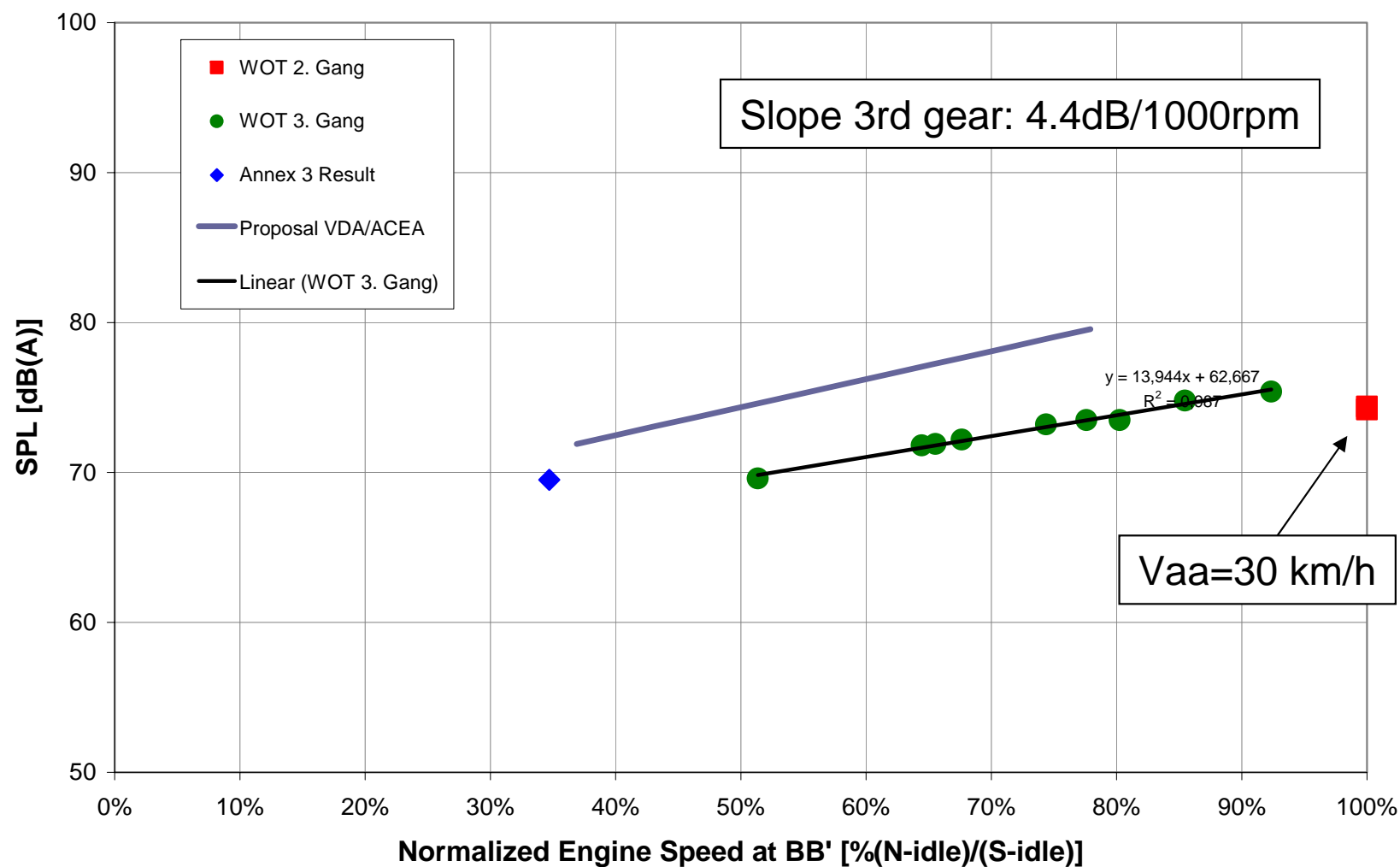
## **General Ideas for a Limitation Curve:**

- The engine speed area around the annex3 engine speeds are most important as they represent the typical driving speeds in urban traffic.
- Engine speeds that differ from those in annex3 might be also important, but are less often used.
- The higher the engine speed becomes the more unrealistic is the condition.
- Therefore it is not realistic to define a limitation curve which is equal severe in all engine speed conditions.
- Possible Approach that has been used in the following slides to evaluate the data:
  - A general tolerance of 2dB was applied to cover the measurement uncertainties.
  - The limitation curve has a slope which is +1.5dB/1000rpm higher than the slope of the gear concerned of the individual vehicle.

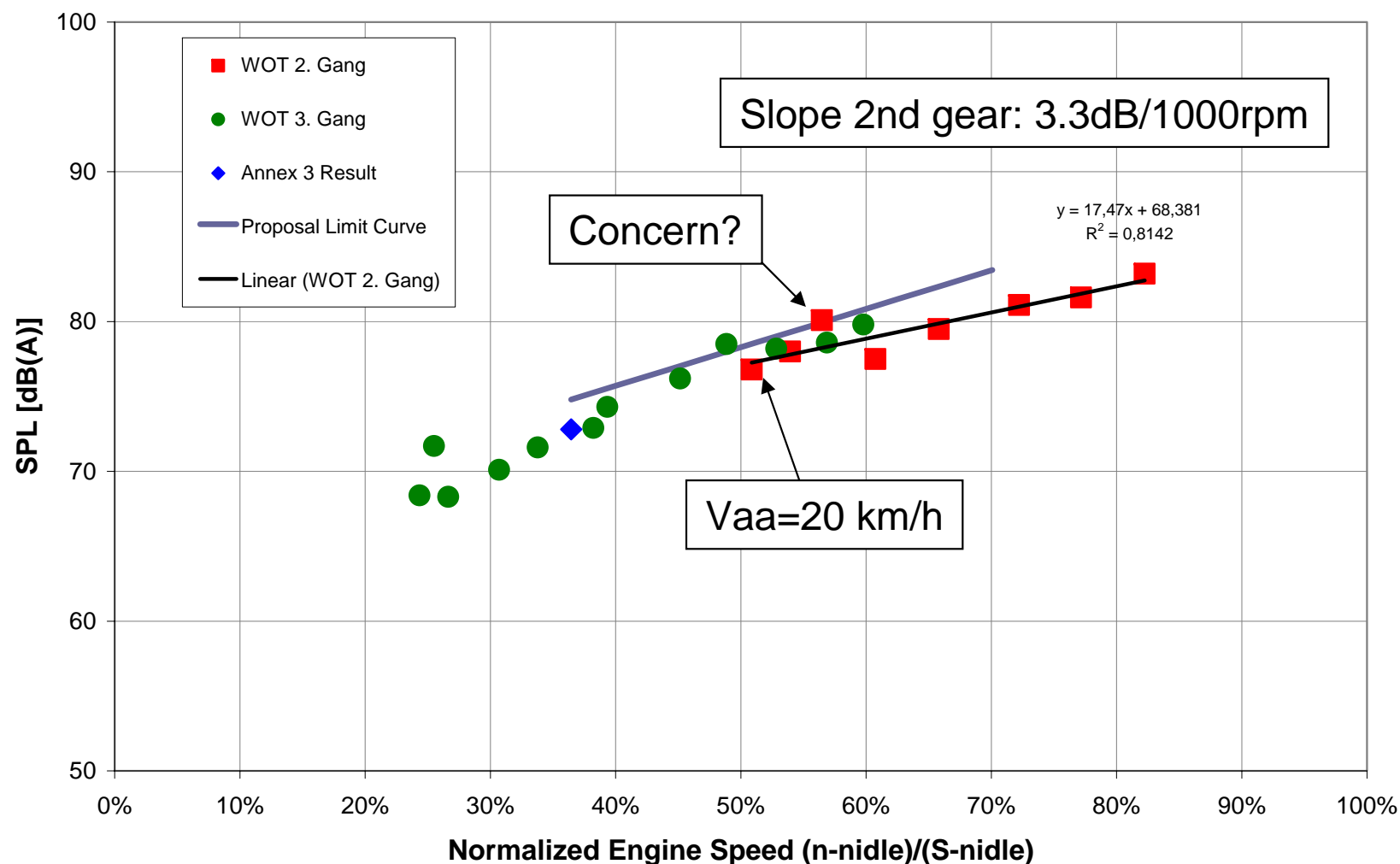
Vehicle 46kW/t - S=5000rpm



Vehicle 58kW/t - S=4000rpm

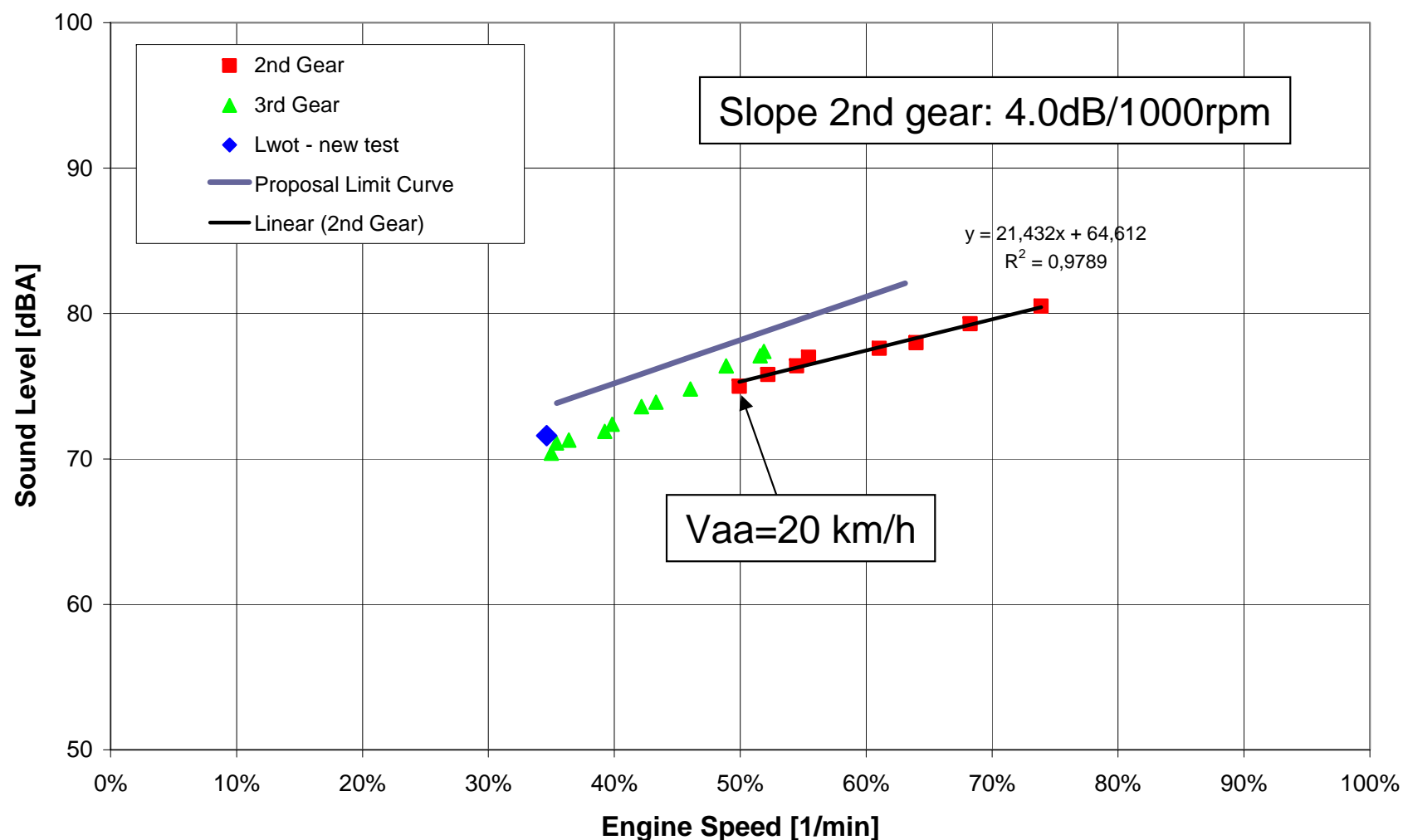


Vehicle 98kW/t - S=6000rpm

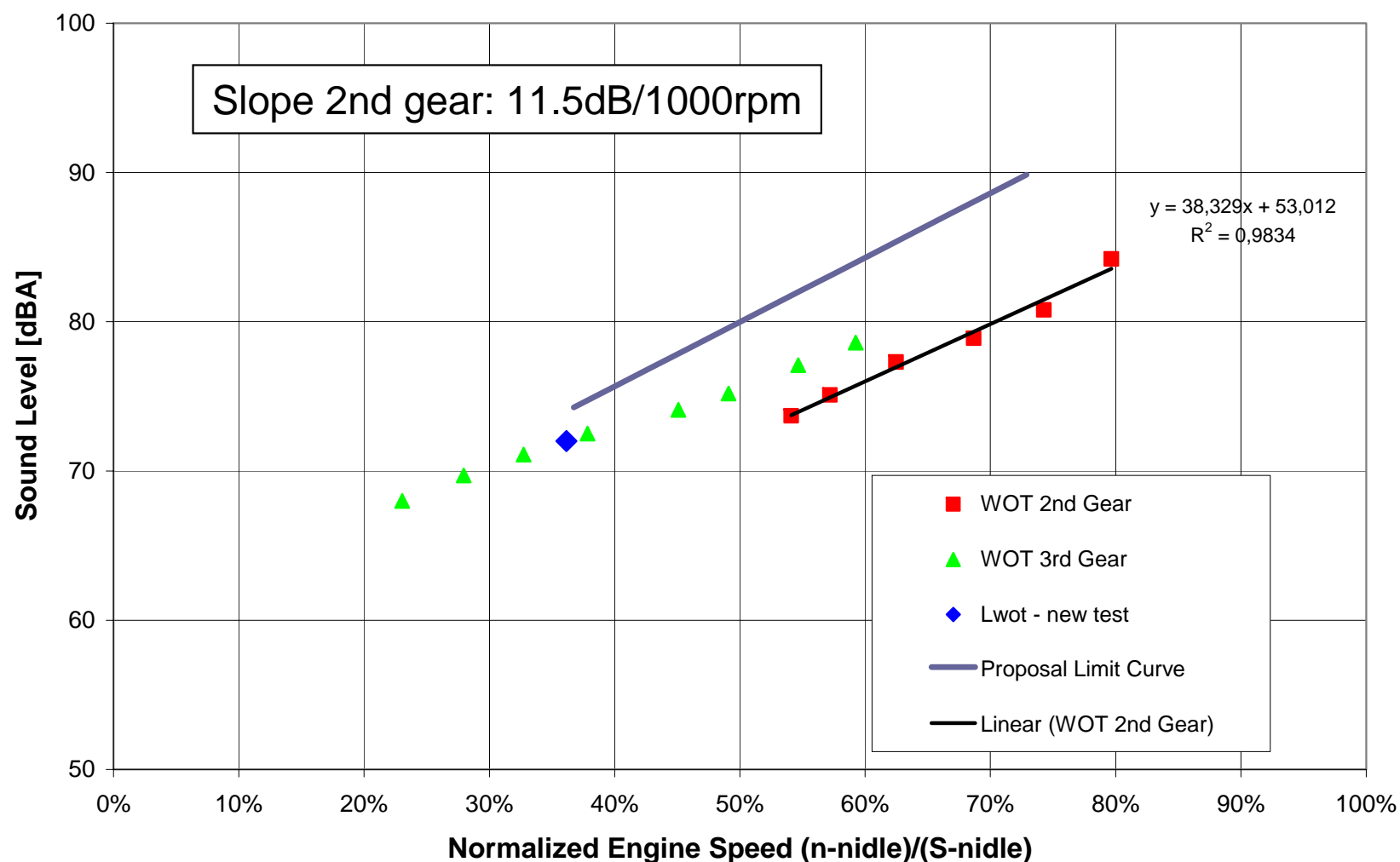




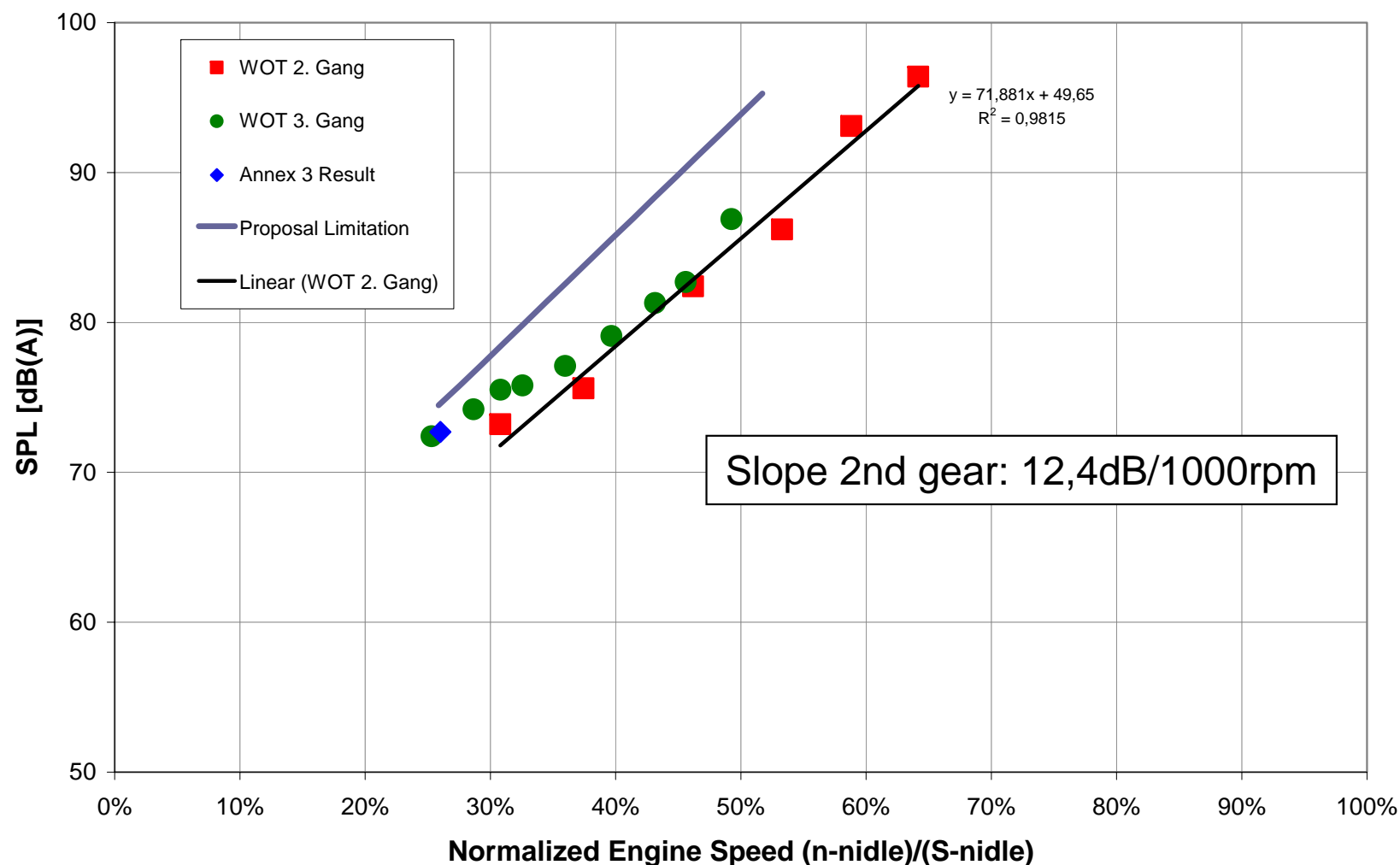
Vehicle 133kW/t - S=6100rpm



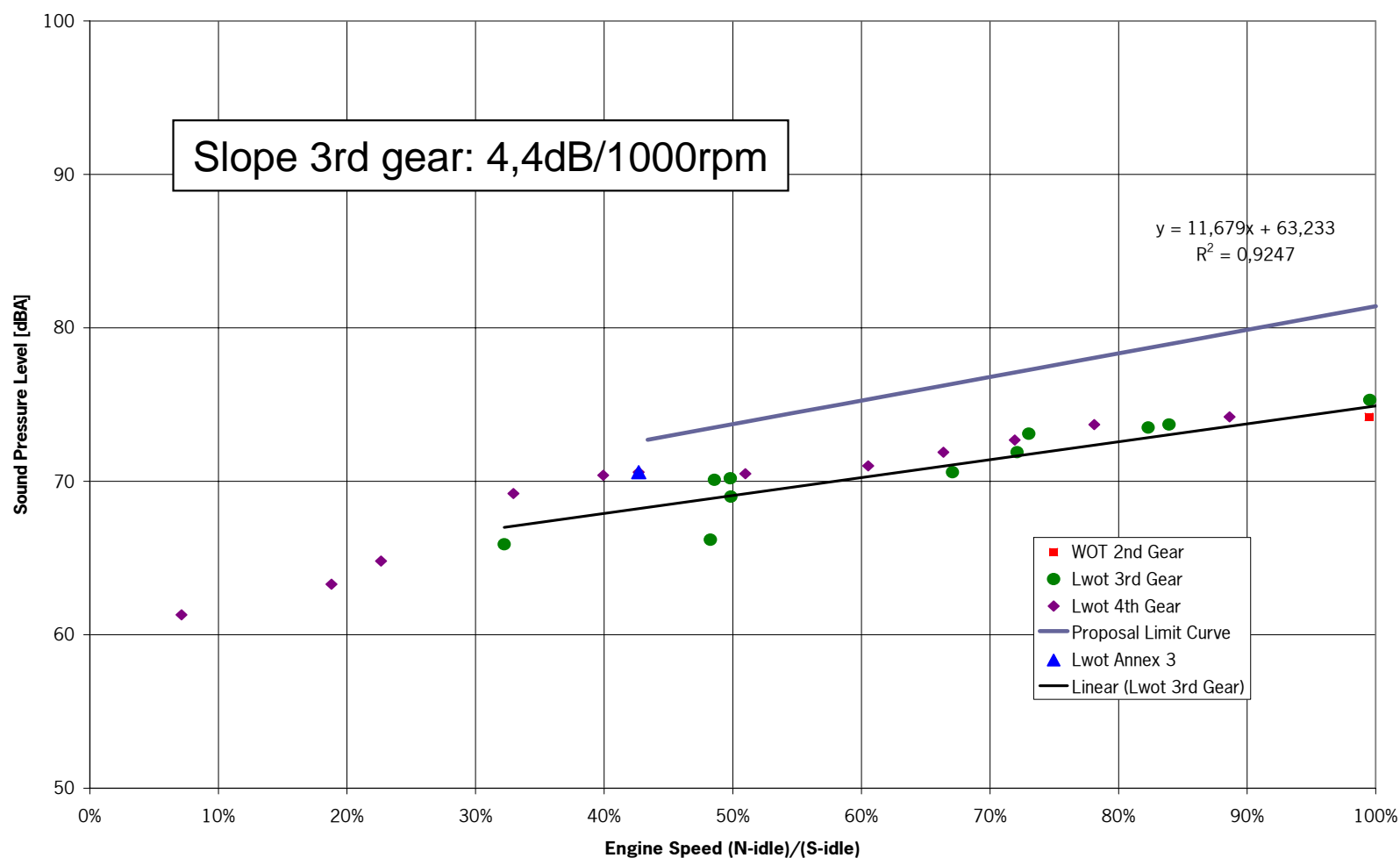
Vehicle 85kW/t - S=4000rpm



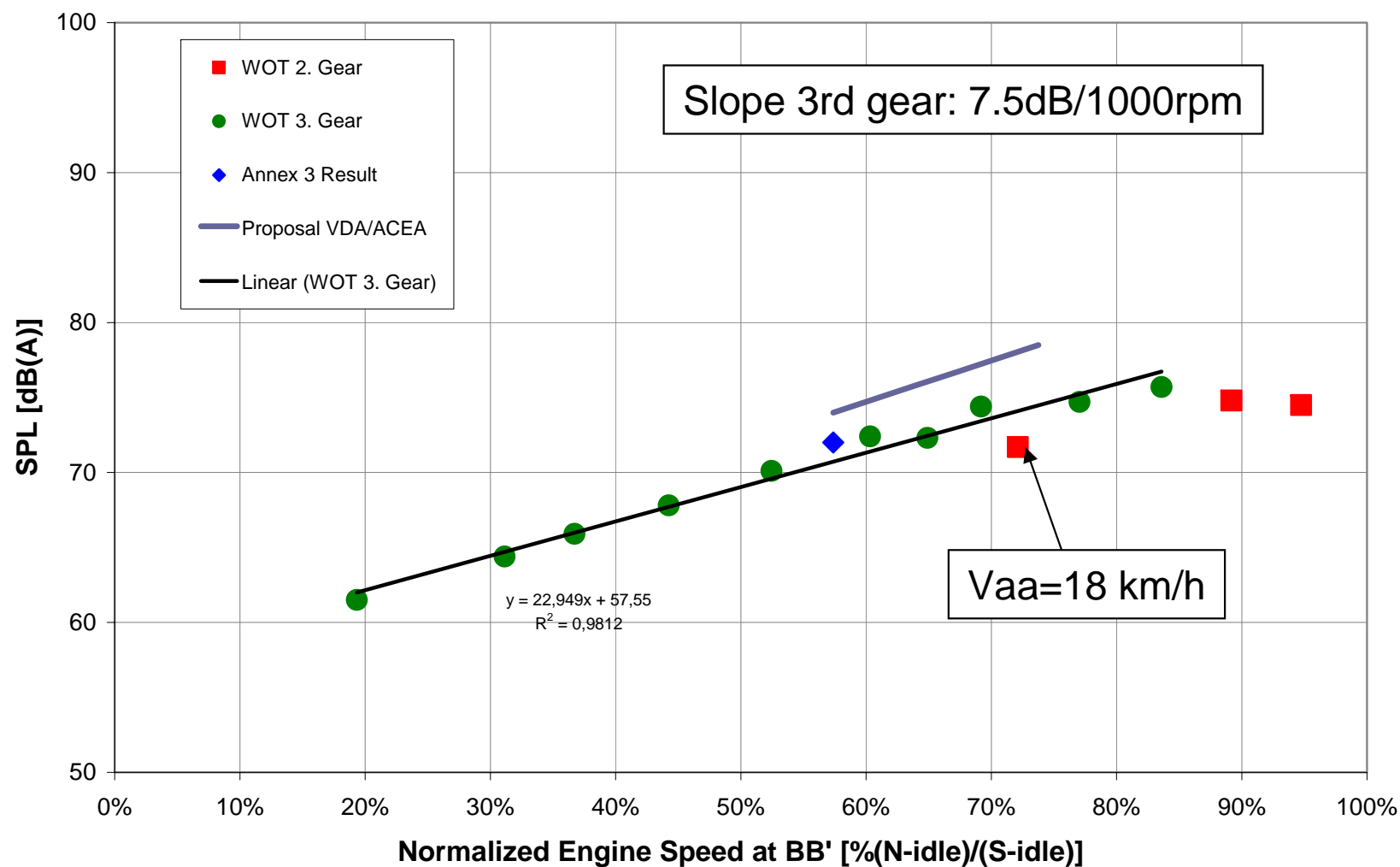
Vehicle 246kW/t - S=6500rpm



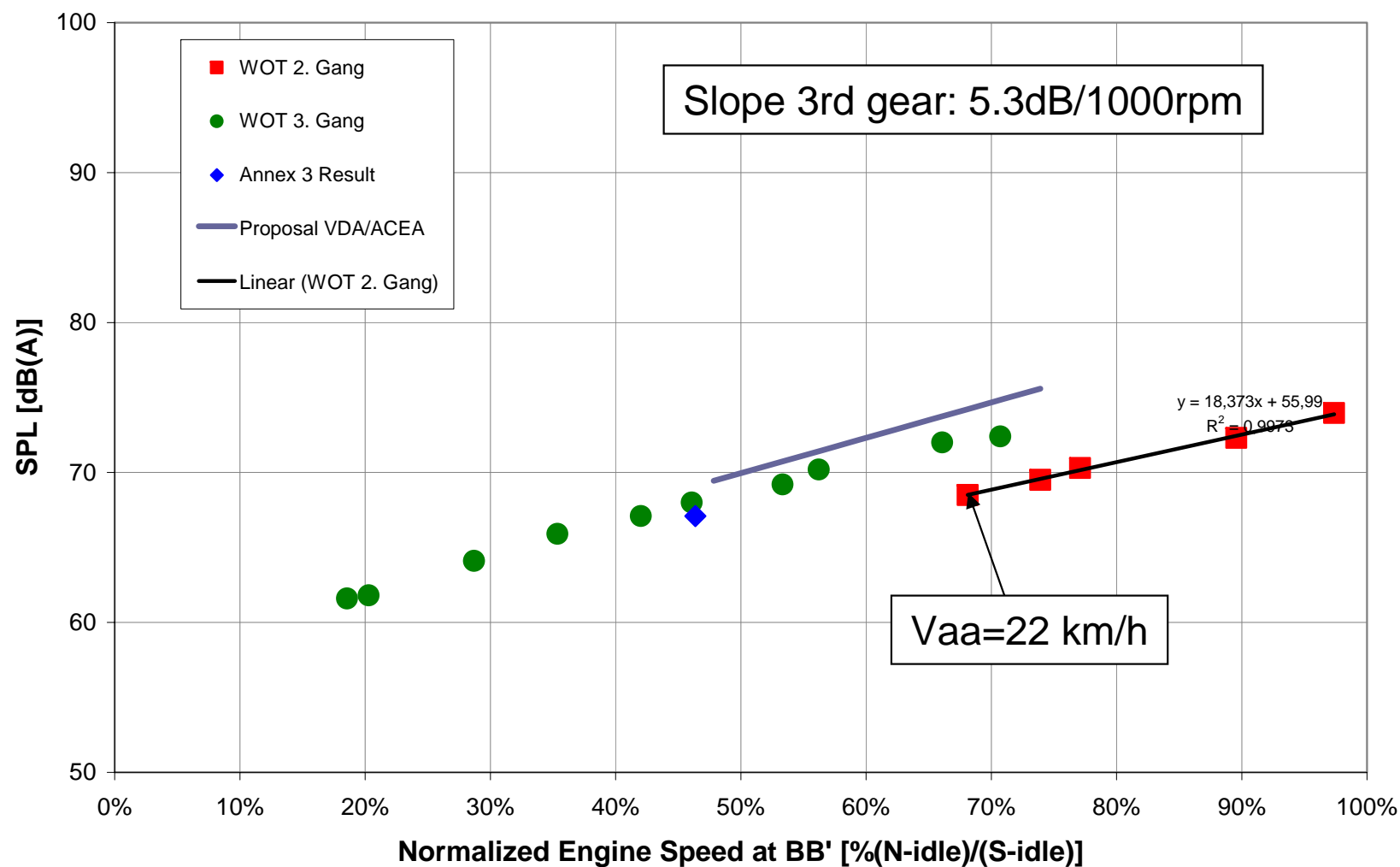
Vehicle 30kW/t - S=3500rpm



Vehicle 67kW/t - S=3800rpm



Vehicle 70kW/t - S=4200rpm



## **Observations and Open Questions:**

- Measurement uncertainties
  - The run-to-run variability is +/- 1dB
  - The precision for determination of engine speed is +/-100rpm
  - The overall test variability for a single point can be a cloud of +/-2dB
- Number of necessary runs for stable results
  - Are steps of 500rpm for measurements sufficient?
- For most vehicles the 3rd gear covers best the requested test area, better than the 2nd gear. Refine the gear selection definition!
- How to treat local exceeding ? This should not be a problem if points before and after the concerned point are below the limit curve.
- For the definition of an appropriate limitation curve it is necessary to consider which kind of sound increase can be realistically detected in the outside environment? Otherwise there is the risk of too severe requirements which are of no value for the practical use.

## Time Table:

- To allow adequate technical and political decisions, OICA proposes the following time table to finalize the work on ASEP, based on the assumption that ECE R51.03 with the new type approval test is published in 2010:
- **End of 2007:** Clarification of the technical key elements, which are
  - Existing variability of sound slopes of vehicles
  - Influence of the tyre sound during the ASEP measurement - decision about the need for tyre correction
  - Investigation on how to measure vehicles with automatic transmission
- **End of 2008:** Finalization of regulation text, technical refinement
  - Wording of main body
  - Wording of Annex 10
- **In 2009:** Political Decisions
  - Amendment of ECE R 51 with ASEP in GRB
  - Presentation of Results to WP29