中国汽车技术研究中心有限公司
China Automotive Technology and Research Center Co., Ltd.

Proposal on Vehicles EMC Test under Dynamic Driving Condition

China Automotive Technology and Research Center Co., Ltd.

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The vehicle under test shall be operated under maximum radiated emission condition.

During the test, we discovered the impact of working conditions on test results.

Based on the idea proposed by DG Joint Research Centre, we present some some experimental findings on this topic, I will introduce our test results from the following aspects:

1. Measuring instrument:

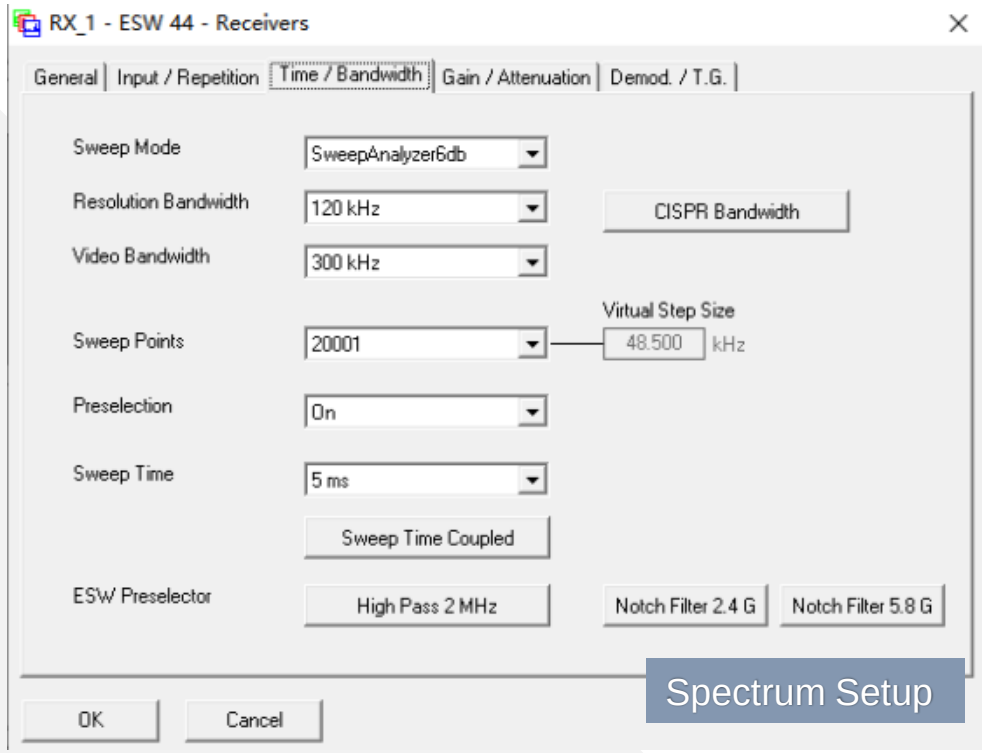
- Spectrum analyser;
- Scanning receiver;

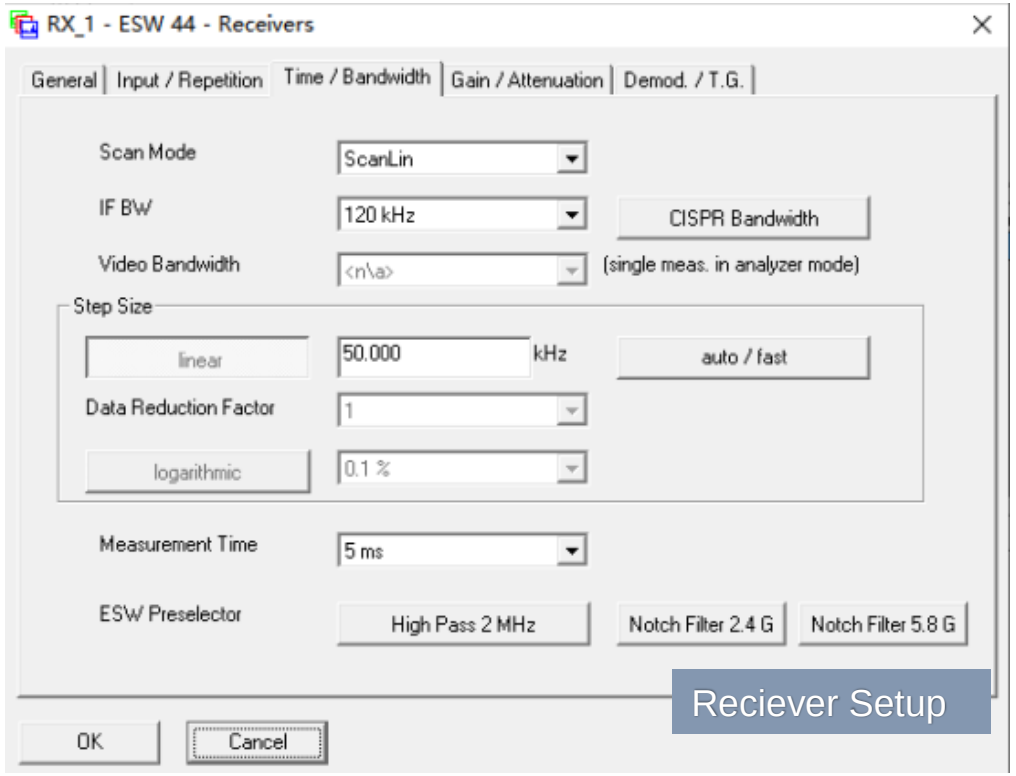
2. Vehicle information;
3. Driving condition:

- Constant condition-40km/h (Based on CISPR 12);
- Dynamic driving condition-0-40-0-40-0km/h;

Radiated emission test setup and limits was set according to UN Regulation No. 10 Revision 6.

1. Spectrum Setup





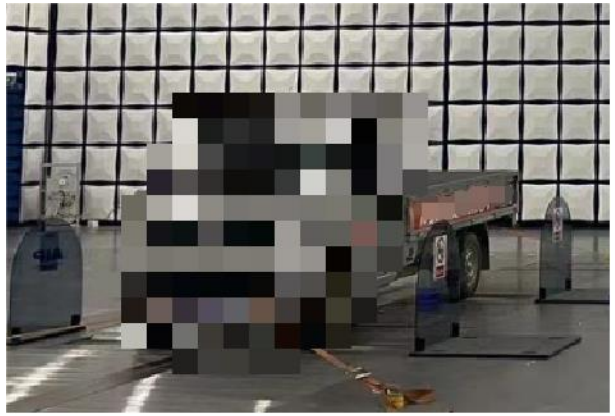
Mode: (1)Constant 40km/h; (2)Acceleration and deceleration, 0-40-0-40-0km/h;

Spectrum maxhold scan method was applied for dynamic driving condition;

Except for repetition time, other Spectrum and Recevier setting are the same;

Result comparison of the spectrum method and regular test method.

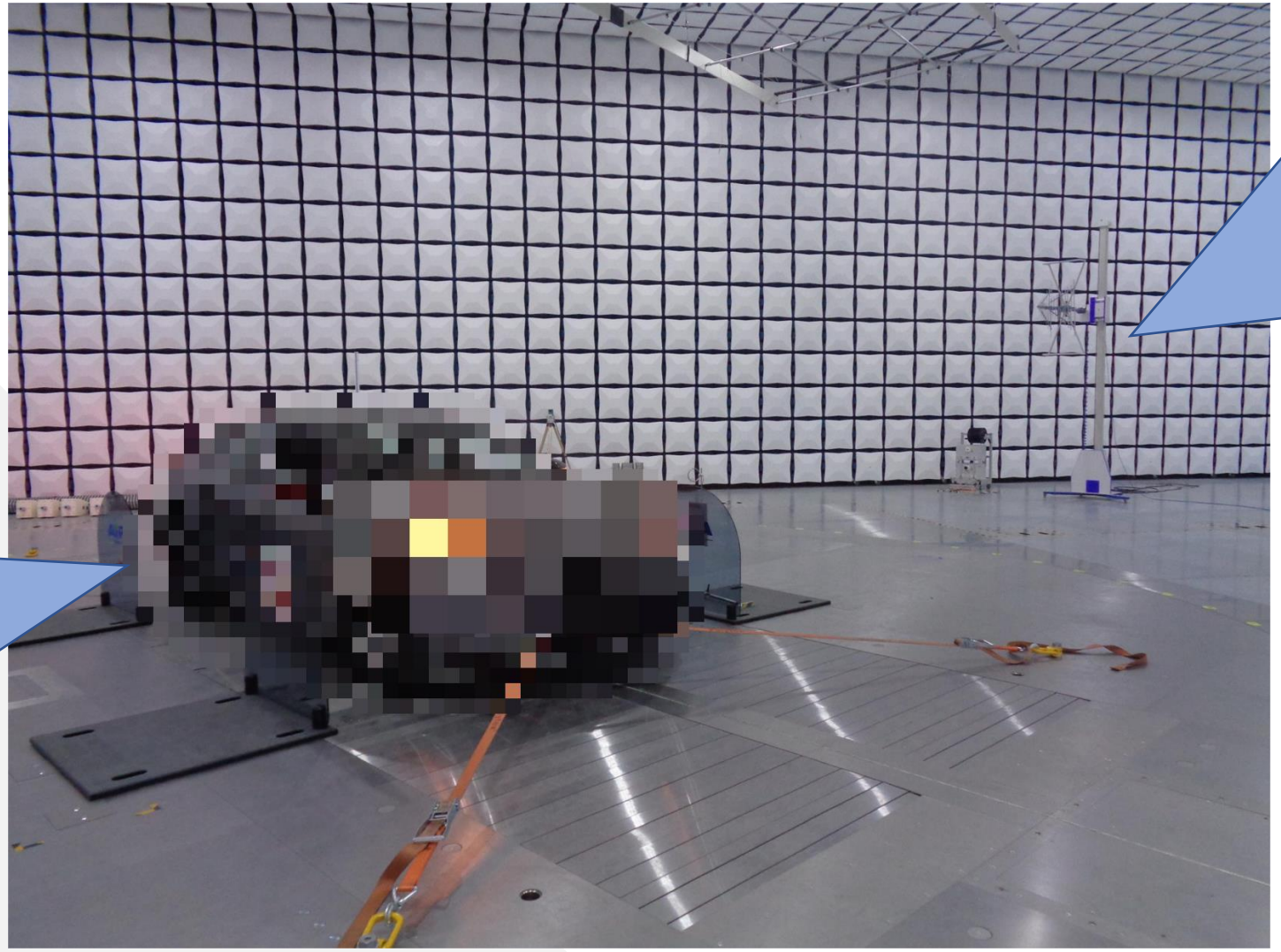
2. Test Setup——Vehicle information



Parameter	Information
Energy type	E-motor (Pure electric drive)
Battery capacity	86kWh
Max. Power	200 kW
Testing service/laboratory	China Automotive Technology and Research Center Co., Ltd

Parameter	Information
Energy type	Internal Combustion Engine
Capacity	1.5L 4-cylinder
Max. Power	90/6000 kW
Testing service/laboratory	China Automotive Technology and Research Center Co., Ltd

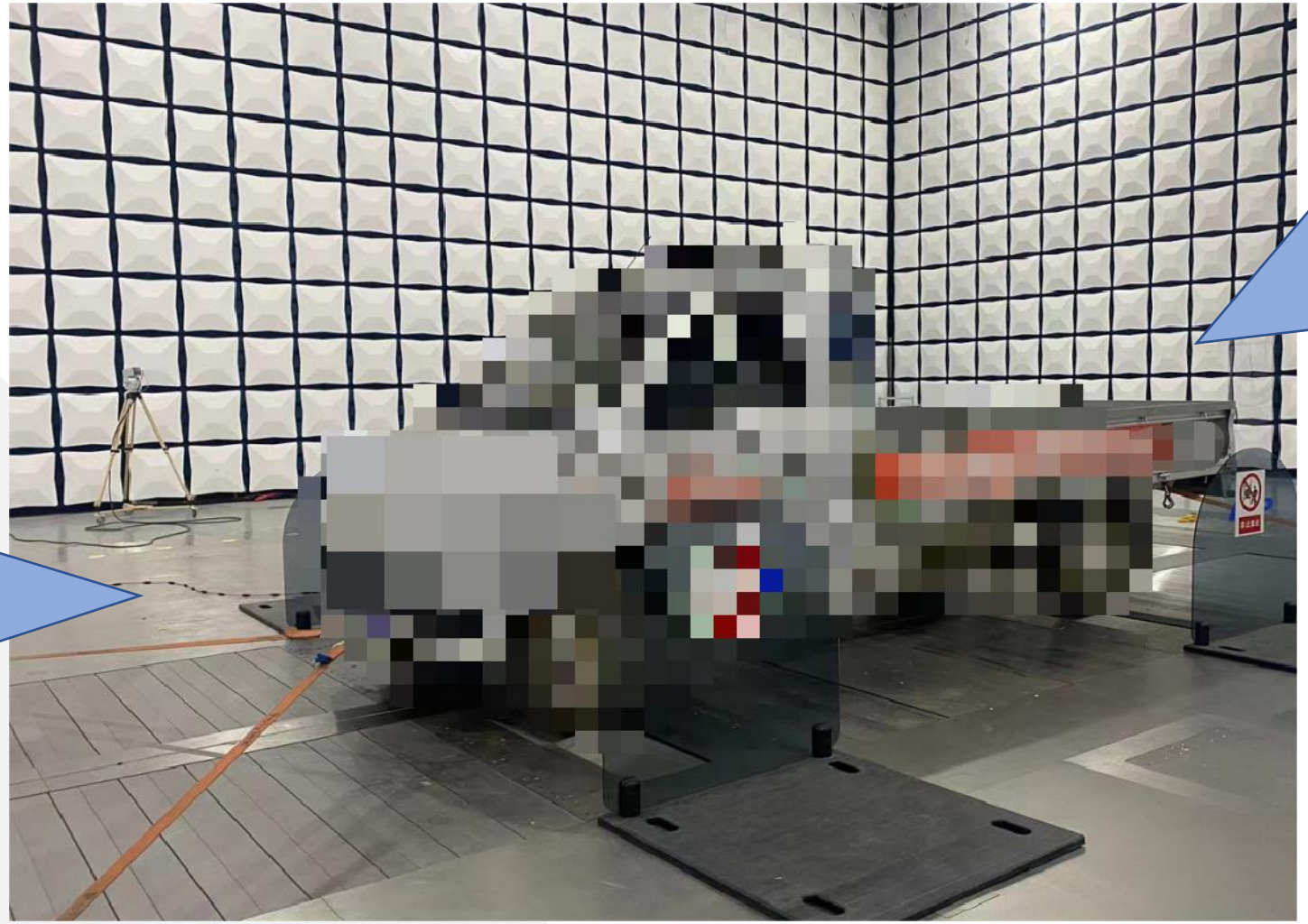
2. Test Setup



Driving Condition:
constant 40km/h
compared to
non-constant
0-40-0-40-0km/h

Test Method:
ECE R10.5 10M
Broadband radiated emission:
ANNEX 4 + CISPR 12;
Narrowband radiated emission:
ANNEX 5 + CISPR 12

2. Test Setup



Driving Condition:
constant 40km/h
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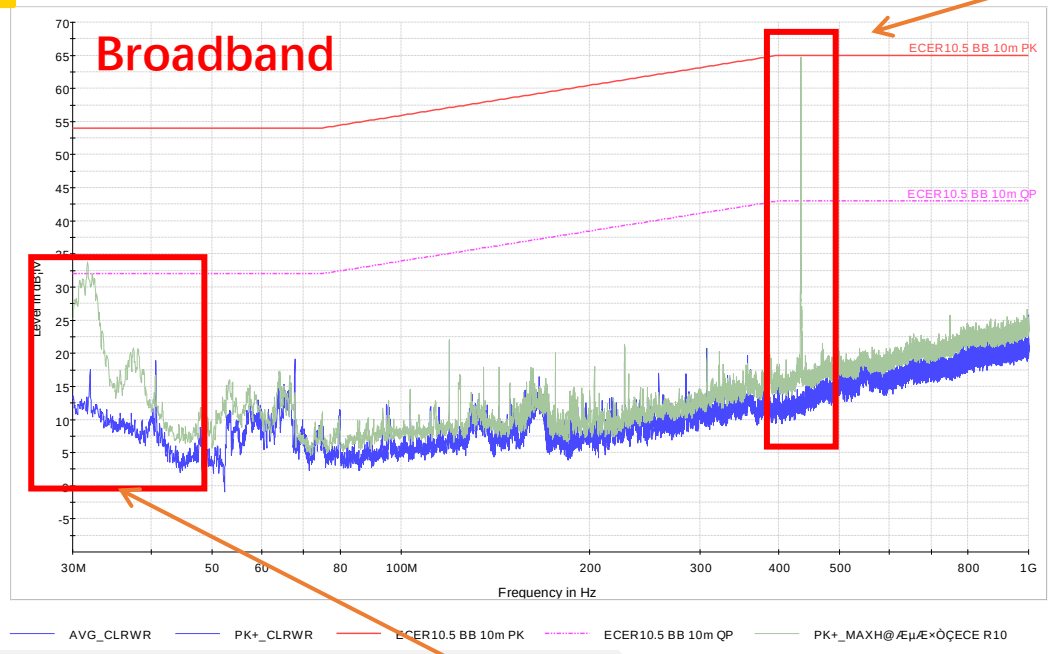
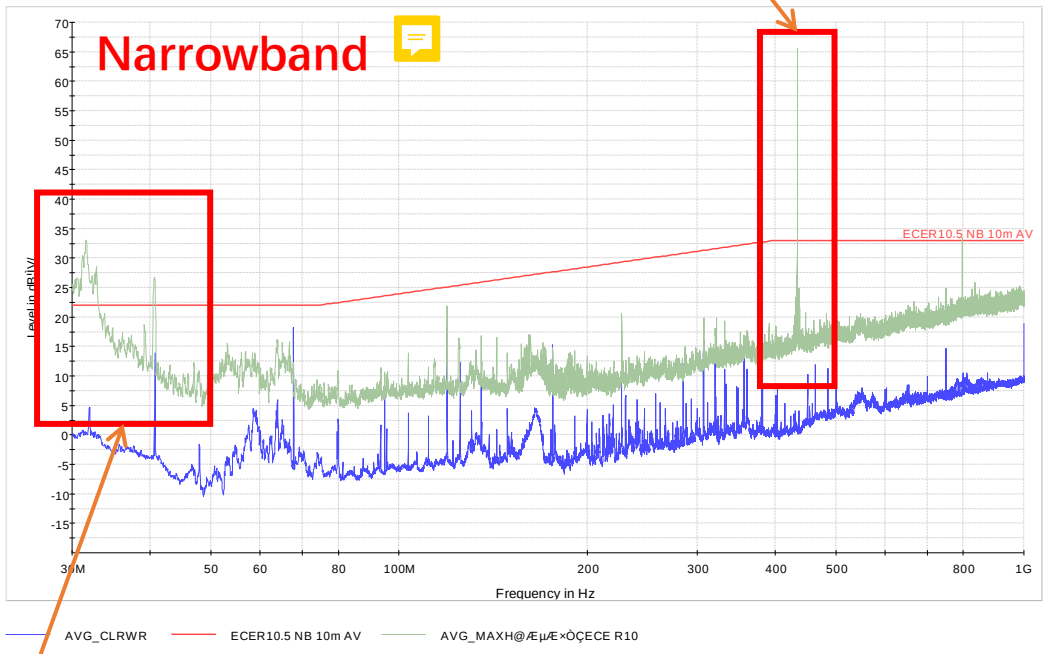
3. Result Comparison——Pure electric vehicle

433MHz PEPS/TPMS signal during constant scanning





Caused by different driving condition

The test result under dynamic driving conditions over the limit, and the result is reproducible.

Narrowband radiated emission was lifted by 15dBµV/m.

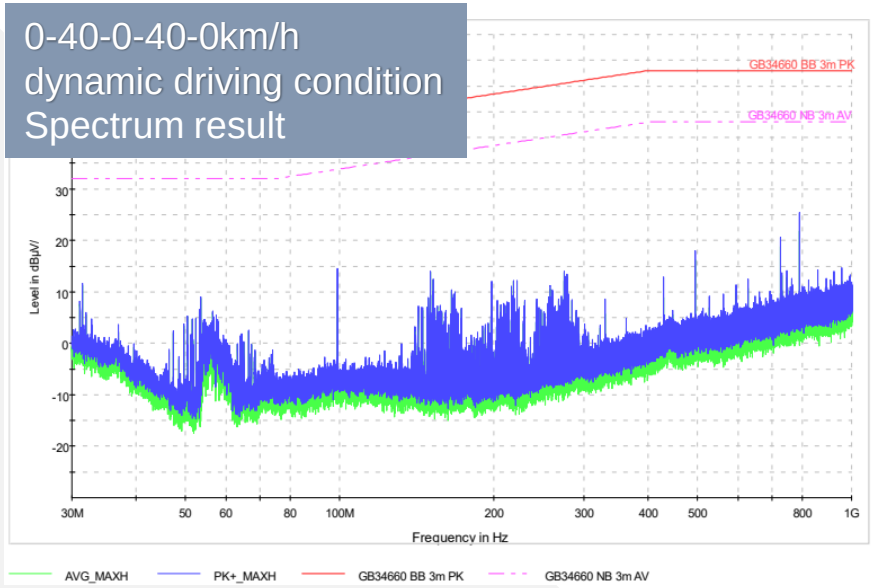
Broadband radiated emission was lifted by 2.5dBµV/m.

Blue – Receiver result（constant condition）

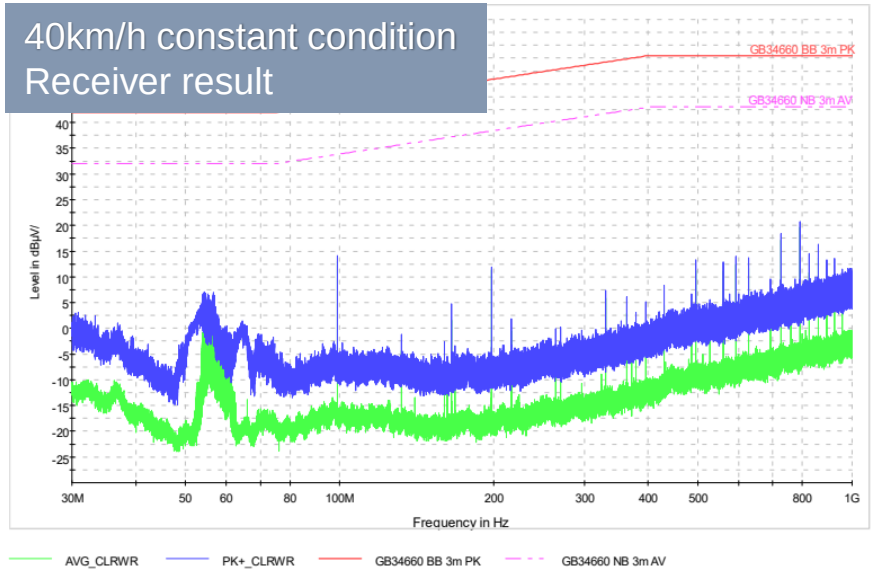
Gray – Spectrum result（dynamic driving condition）

3. Result Comparison——Gasoline vehicle

0-40-0-40-0km/h dynamic driving condition Spectrum result

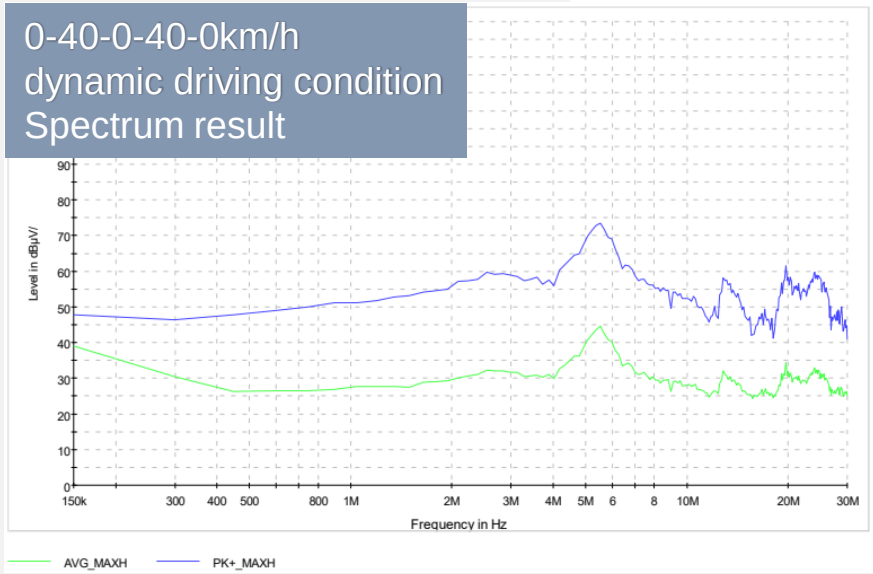


40km/h constant condition Receiver result

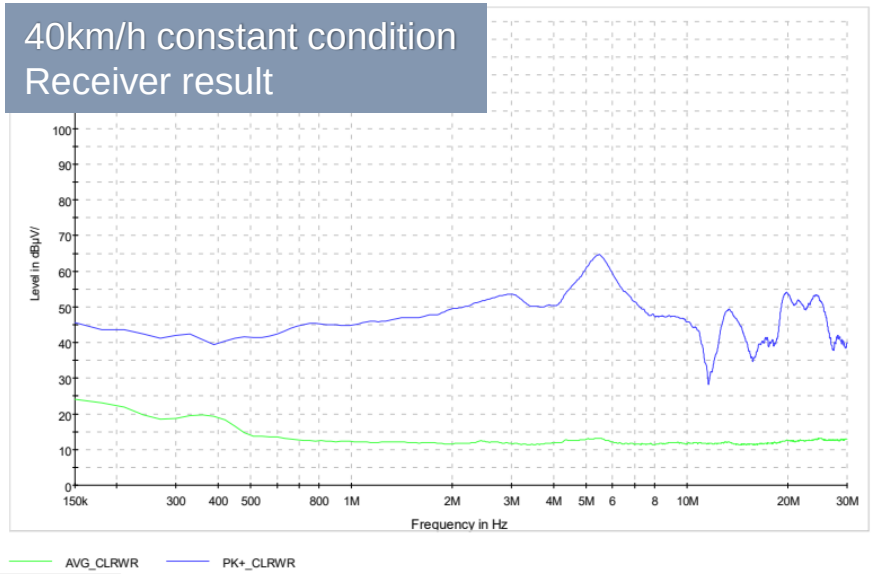


Gasoline vehicle's both constant and dynamic result pass, but still has a huge difference.

0-40-0-40-0km/h dynamic driving condition Spectrum result



40km/h constant condition Receiver result



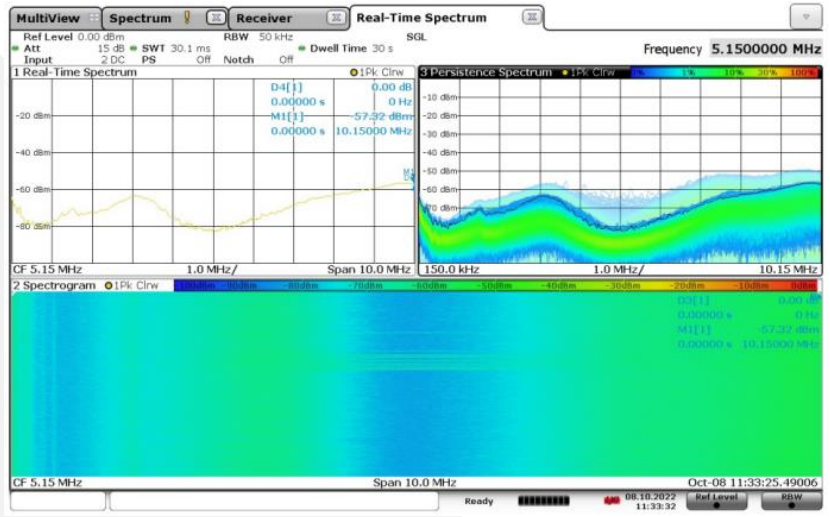
Test method based on:

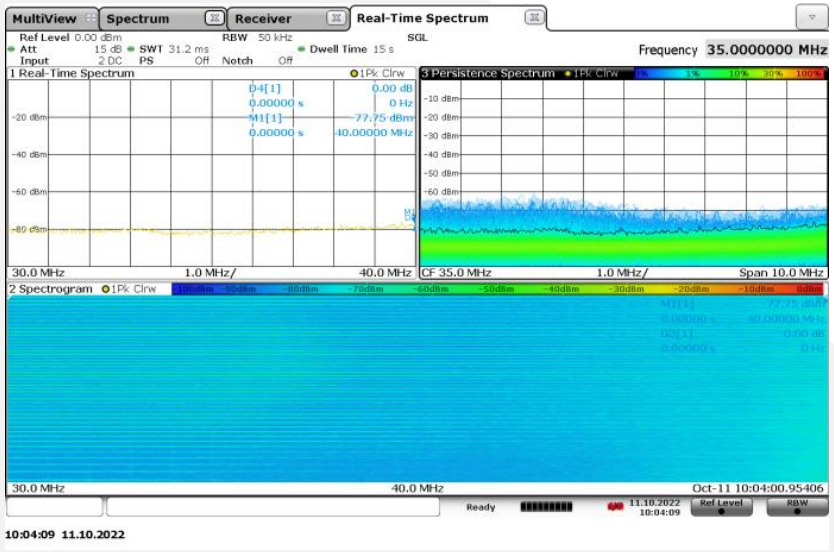
SAE J551-5 2012

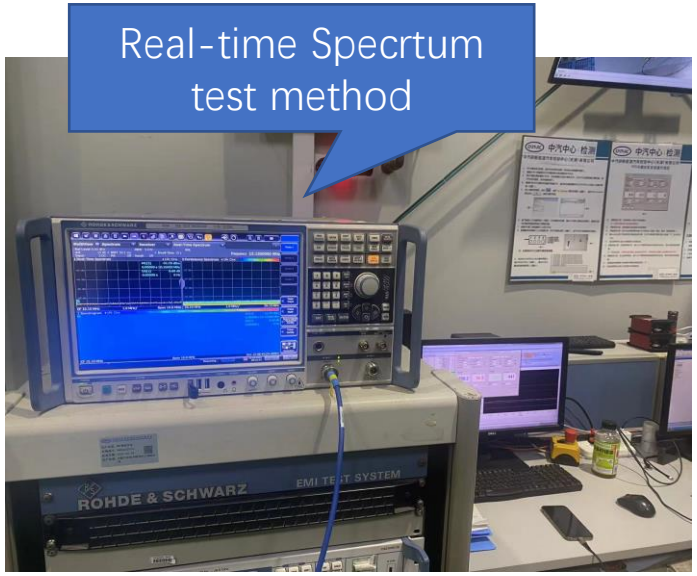
GB/T 18387-2008

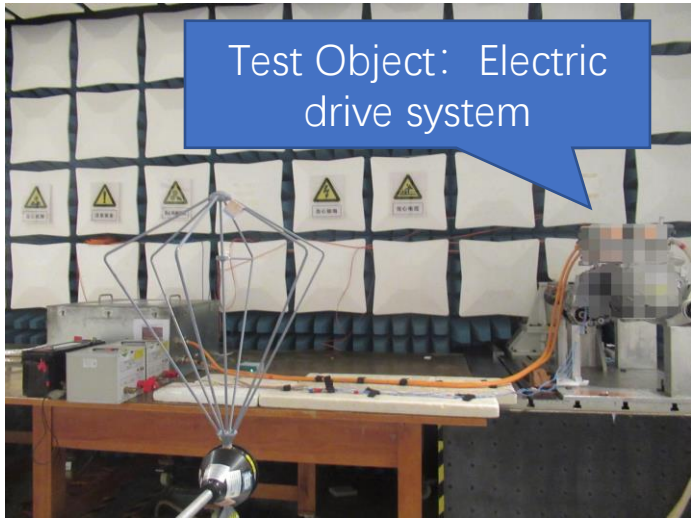
150kHz-30MHz

4. Real-time Specrtum Test method









Test setup based on CISPR 25-2021;

The dynamic driving condition real-time spectrum test results compare with the CISPR 25 constant condition test results.

The difference is about 10 dBμV/m to 20 dBμV/m.

It’s a accurate way to measure time-domain signals in the future.

5. Summary

- We carried out experiments to confirm DG Joint Research Centre's claim. It was discovered that the test results for both the vehicle and the electric drive system were significantly influenced by different driving condition.
- Normal conditions: The effects of different working conditions on radiation emission test results are significant. There will be difference between laboratory results and the actual electromagnetic radiation emissions from vehicles on the road. Using 40 km/h as a standard working condition?

Design a test conditions for emc	Acceleration and deceleration conditions	Driving cycle as test conditions e.g NEDC

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