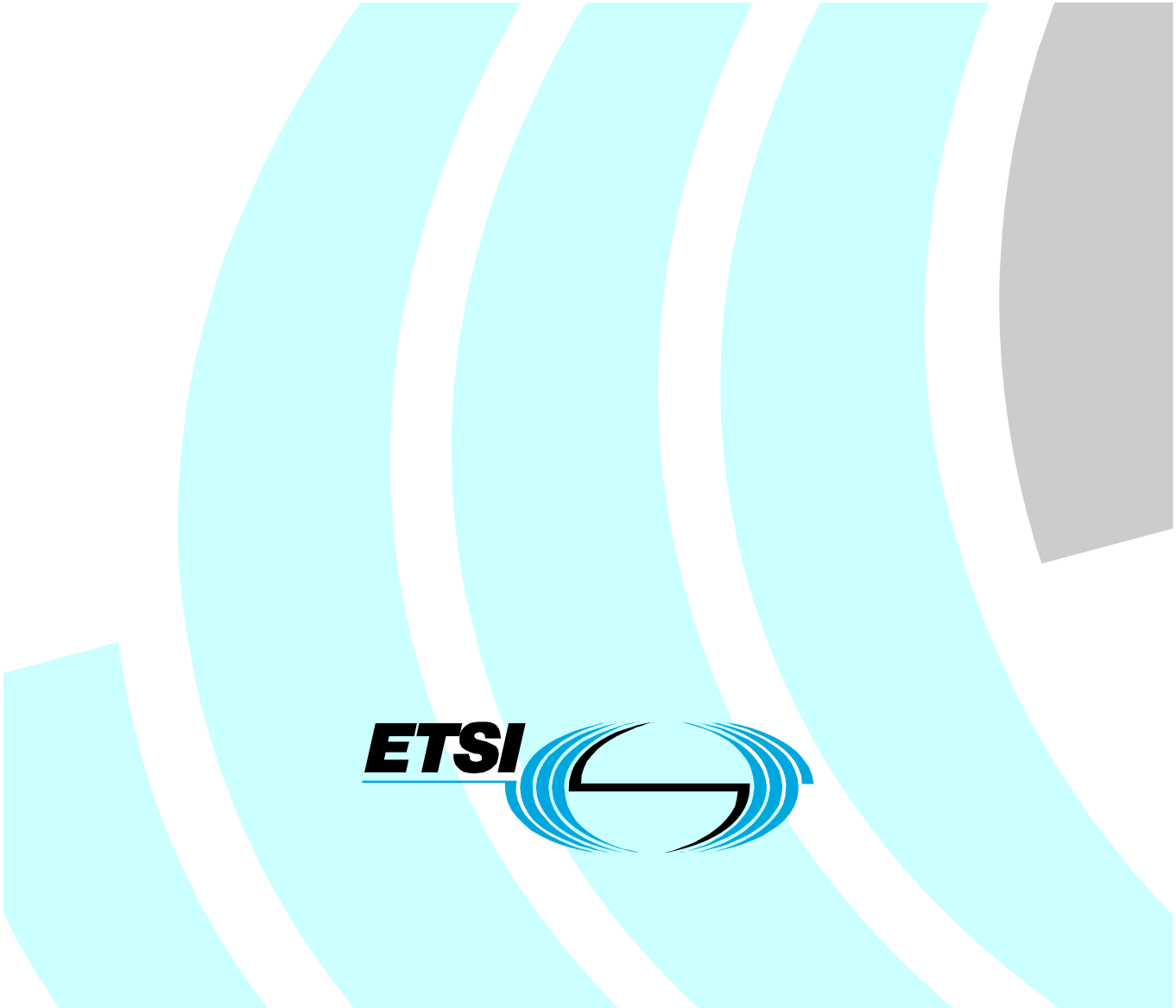
ETSI TR 102 753 V1.1.1 (2008-05)

Technical Report

Terrestrial Trunked Radio (TETRA); TETRA mobiles moving at high velocity



Reference
DTR/TETRA-01188

Keywords
MS, radio, TETRA

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

Contents

Intellectual Property Rights

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (http://webapp.etsi.org/IPR/home.asp).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Terrestrial Trunked Radio (TETRA).

1 Scope

The present document describes the setup and results of operational tests with TETRA terminals at high velocity. In September 2004 tests were performed with a mobile radio temporarily built into a fixed wing airplane. In March 2006 tests were performed using a portable radio in a high speed train.

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific.

- For a specific reference, subsequent revisions do not apply.
- Non-specific reference may be made only to a complete document or a part thereof and only in the following cases:
  - if it is accepted that it will be possible to use all future changes of the referenced document for the purposes of the referring document;
  - for informative references.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

For online referenced documents, information sufficient to identify and locate the source shall be provided. Preferably, the primary source of the referenced document should be cited, in order to ensure traceability. Furthermore, the reference should, as far as possible, remain valid for the expected life of the document. The reference shall include the method of access to the referenced document and the full network address, with the same punctuation and use of upper case and lower case letters.

NOTE: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long term validity.

2.1 Normative references

The following referenced documents are indispensable for the application of the present document. For dated references, only the edition cited applies. For non-specific references, the latest edition of the referenced document (including any amendments) applies.

Not applicable.

2.2 Informative references

The following referenced documents are not essential to the use of the present document but they assist the user with regard to a particular subject area**.** For non-specific references, the latest version of the referenced document (including any amendments) applies.

Not applicable.

3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

GPS	Global Positioning System
MER	Message Erasure Rate
MS	Mobile Station
RSSI	Received Signal Strength Indication

4 Air to ground field test

4.1 Configuration and test area

The test at high speed was part of a general Air to Ground field test held in September 2004 in the Netherlands. For the Air to Ground test a fixed wing airplane was used with a mobile TETRA radio. See figures 1 and 2.

Figure 1: Airplane used during the test

Figure 2: Mobile radio built into a cradle

The test was performed in the north west part of the Netherlands at the coast of the IJsselmeer. See figure 3.

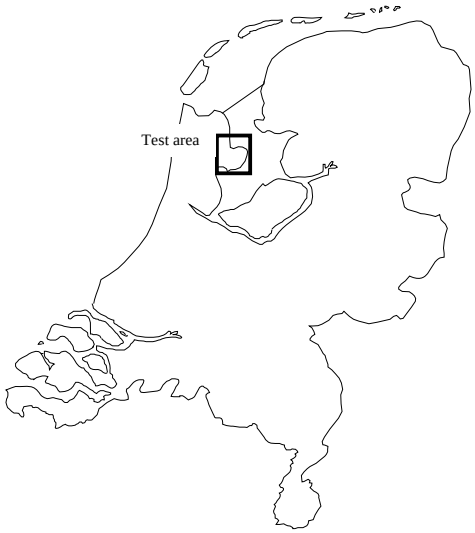


Figure 3: Test area Air to Ground high speed

The MS behaviour and the position, speed and altitude of the airplane were recorded with a laptop PC running logging software. For this the laptop PC was connected to the mobile and a GPS receiver.

4.2 Results

The normal air speed of the airplane used for the test is around 200 km/h. Due to a strong tale wind and descent of the airplane a ground speed just above 300 km/h was reached during the test.

Figure 4 shows the recorded ground speed versus time.

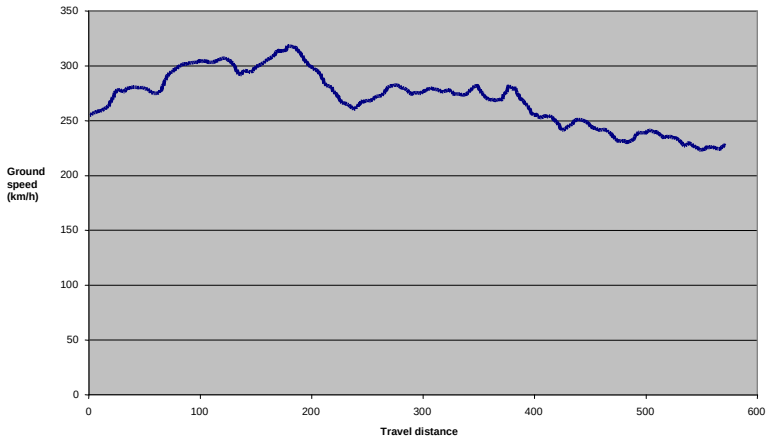


Figure 4: Ground speed during the trip

In figure 5 the Received Signal Strength Indication (RSSI) during the flight is shown. In the area with speeds above 300 km/h (between travel distance 80 km to 180 km) the RSSI is between -80 and -75 dBm. The max value of the RSSI in the test stretch is -50 dBm, when the airplane is very close to the Air to Ground base station.

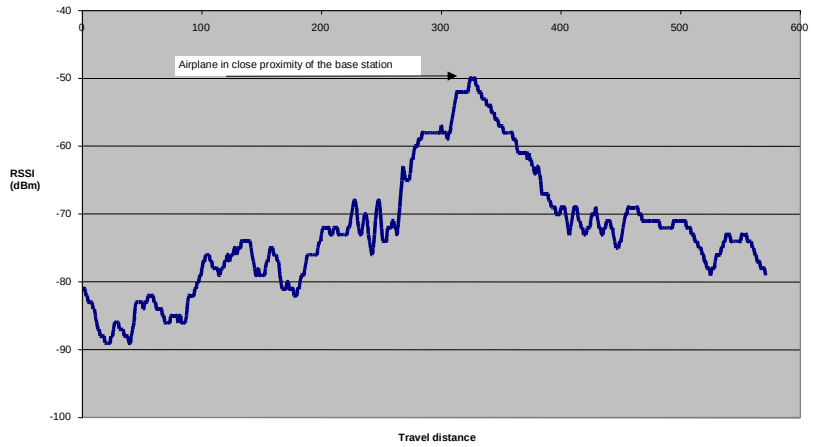


Figure 5: RSSI during the flight.

Figure 6 shows the Message Erasure Rate (MER) during the flight. At speeds > 300 km/h the MER remains zero.

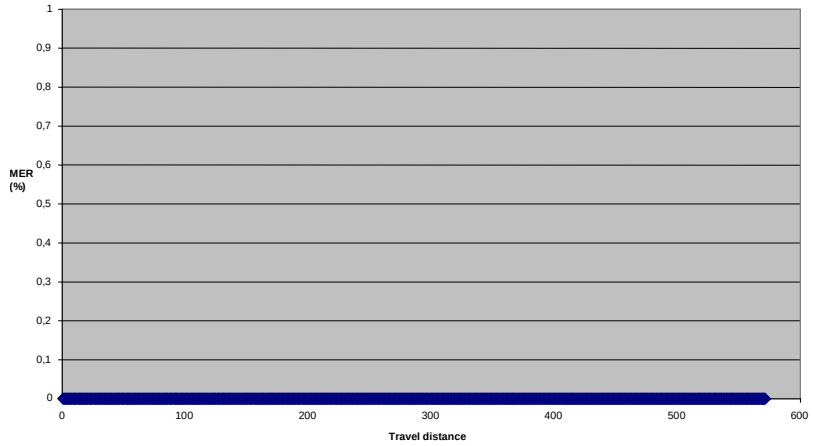


Figure 6: Message Erasure Rate (MER) during the flight

5 Performance test in High speed train

5.1 Configuration and test area

The test at high speed was part of a general performance test held in March 2006 in the Netherlands. For the coverage test a portable TETRA radio was used in the High speed train. See figures 7 and 8.

Figure 7: The High speed train

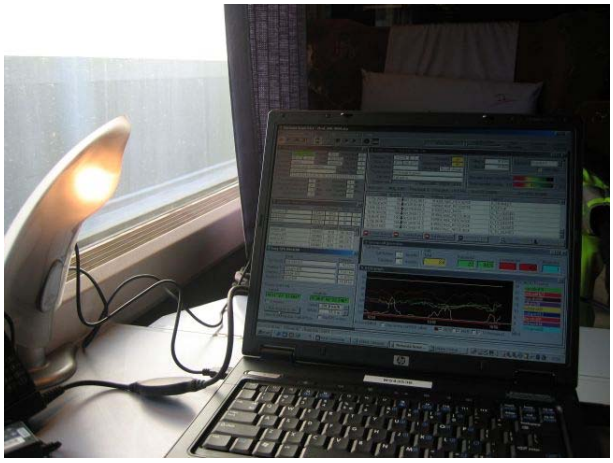


Figure 8: Test setup (portable radio on the far left)

The radio was positioned close to the window. The MS behaviour and position and speed of the train were recorded with a laptop PC running logging software. For this the laptop PC was connected to the MS and a GPS receiver.

The test was performed in the south-western part of the Netherlands travelling from Rotterdam towards the Belgian border. See figure 9.

Figure 9: Test area High speed train

5.2 Results

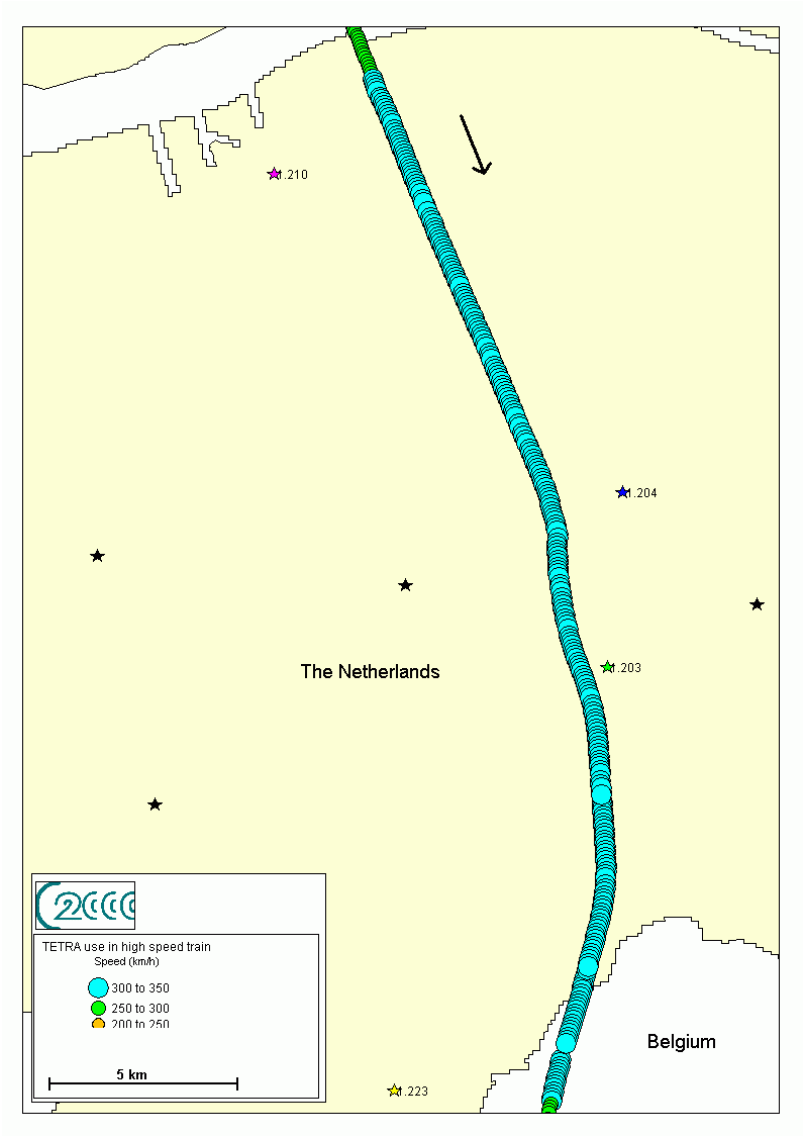


Figure 10: Speed (km/h)

Figures 10 and 11 show the speed of the train during the test run. Most of the run the speed was over 300 km/h. The maximum speed that was reached was 332 km/h.

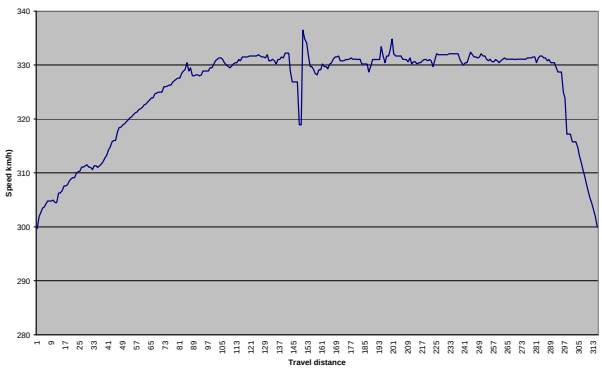


Figure 11: Speed (km/h)

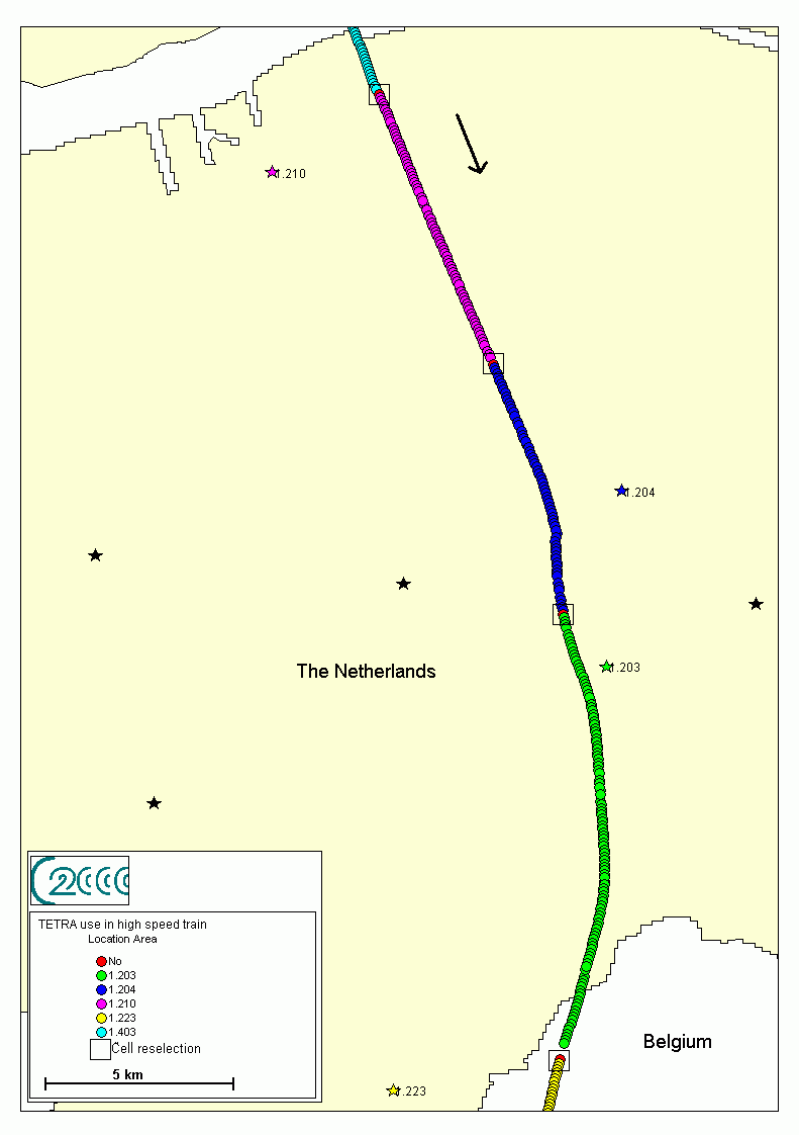


Figure 12: Cell reselection behaviour

Figure 12 shows the cell reselection behaviour of the TETRA radio during the test run. At the start of the test run the radio uses base station 1403 (not on the map). Soon it switches to basestation 1210, followed by basestation 1204, 1203 and 1223.

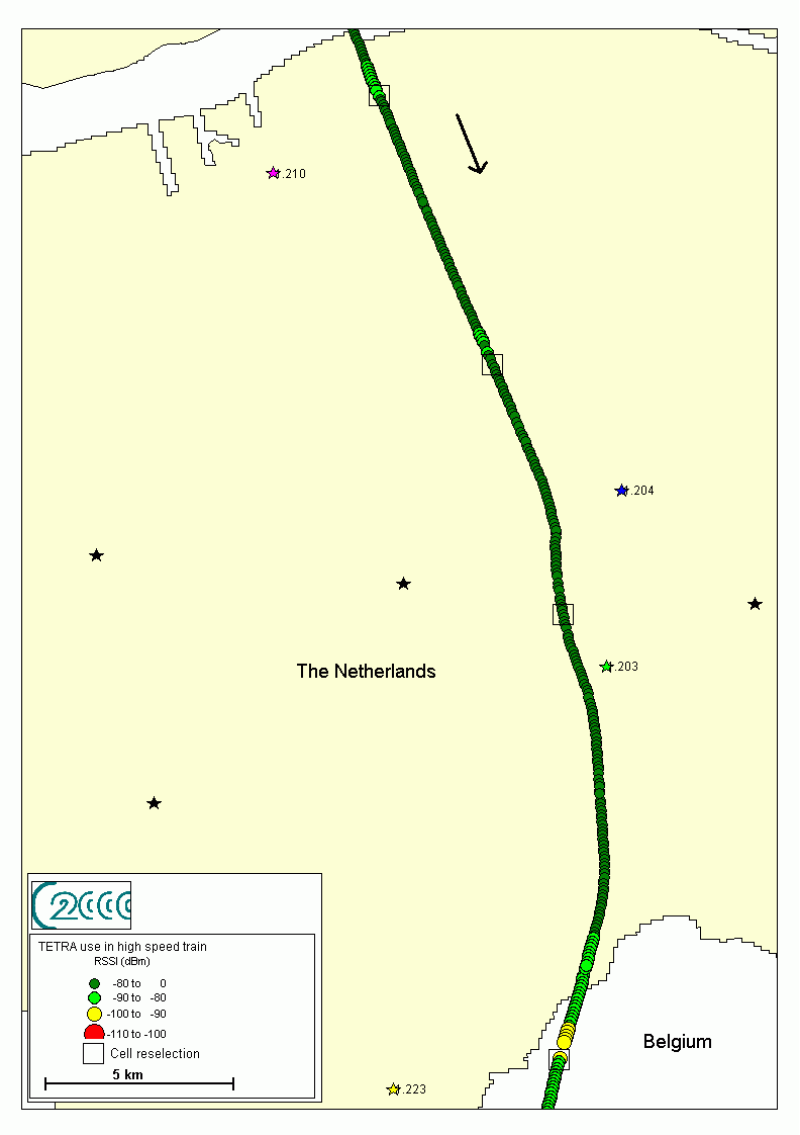


Figure 13: Received Signal Strength Indication (dBm)

Figure 13 shows the Received Signal Strength Indication (RSSI) as reported by the TETRA radio. Most of the run the level is above -80 dBm. At the Belgian border the reported level is between -90 dBm and -100 dBm.

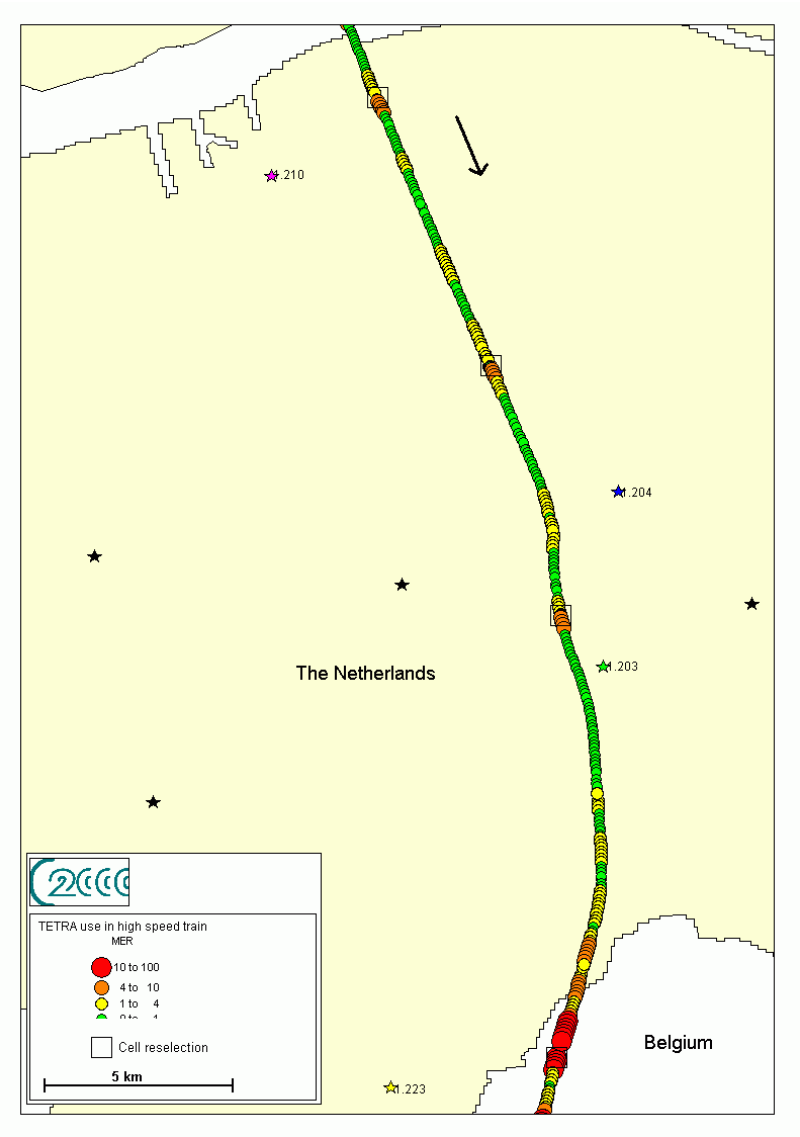


Figure 14: Message Erasure Rate (%)

Figure 14 shows the Message Erasure Rate (MER) reported by the TETRA radio. Around the cell reselections the MER increases to 10 %. At the cell reselection near the Belgian border the MER exceeds 10 % and the radio loses coverage for a short while. During the rest of the high speed part of the test run the MER stays below 4 %.

History

Document history		
V1.1.1	May 2008	Publication