



18. ITG/VDE Fachtagung "Mobilkommunikation",
Osnabrück, Germany, May 15-16, 2013



Performance Aspects of
Pan-European eCall
in Live Networks

Ralf Weber



Disclaimer

Not to be used, copied, reproduced in whole or in part, nor its contents revealed in any manner to others without the express written permission of Qualcomm.

QUALCOMM is a registered trademark of QUALCOMM Incorporated in the United States and may be registered in other countries. Other product and brand names may be trademarks or registered trademarks of their respective owners.

This technical data may be subject to U.S. and international export, re-export or transfer (~~export~~) laws. Diversion contrary to U.S. and international law is strictly prohibited.

QUALCOMM Incorporated
5775 Morehouse Drive
San Diego, CA 92121-1714

Copyright © 2013 QUALCOMM Incorporated.
All rights reserved.



Outline

- Introduction
- Test Campaign Overview
- Overall Performance Review
- Special Performance Investigations
 - Investigation of Selected Networks (see paper)
 - [Weak Coverage Investigation](#)
 - [High Mobility Investigation](#)
- Conclusions



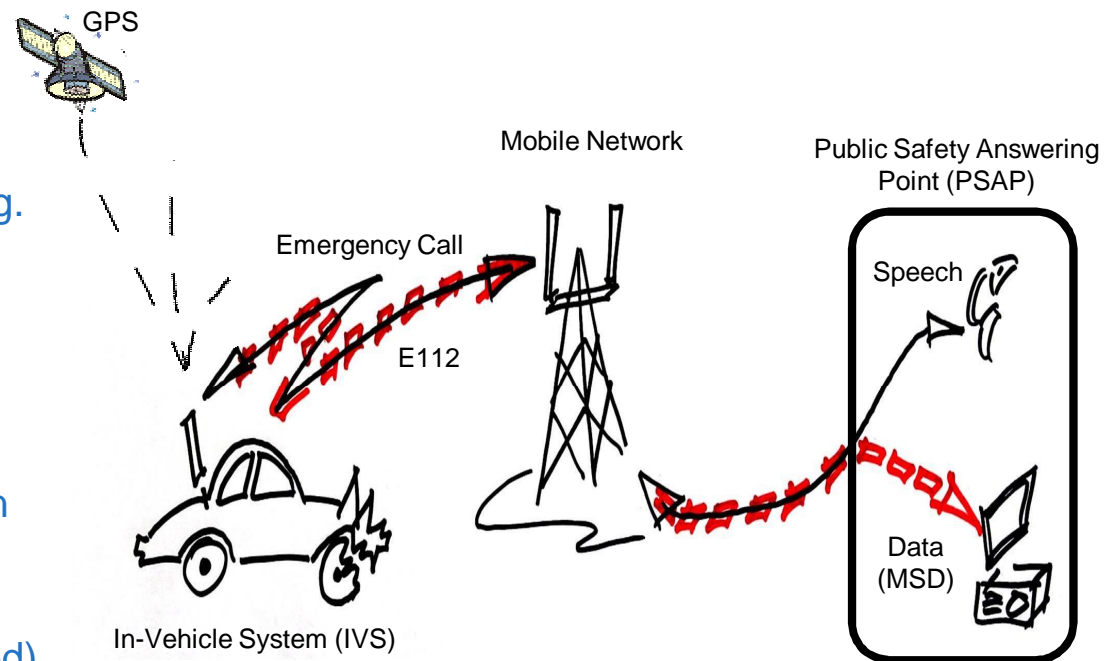
Introduction

What is eCall?

- eCall is the upcoming pan-European and Russian in-vehicle emergency call system utilizing connectivity over mobile networks
- eCall IVS to be installed in all new vehicles in the EU and Russia starting 2015

Requirements

- . Allow automatic and manual data transmission
- . `Minimum Set of Data` (MSD) e.g.
 - “ Position, orientation, direction, time
 - “ Car and fuel type
 - “ Severity of incident, # passengers
- . Employing existing emergency mechanisms (call prioritization)
- . Simultaneous speech connection to PSAP personnel
- . Data transmission over in-band modem (3GPP/ETSI standardized)



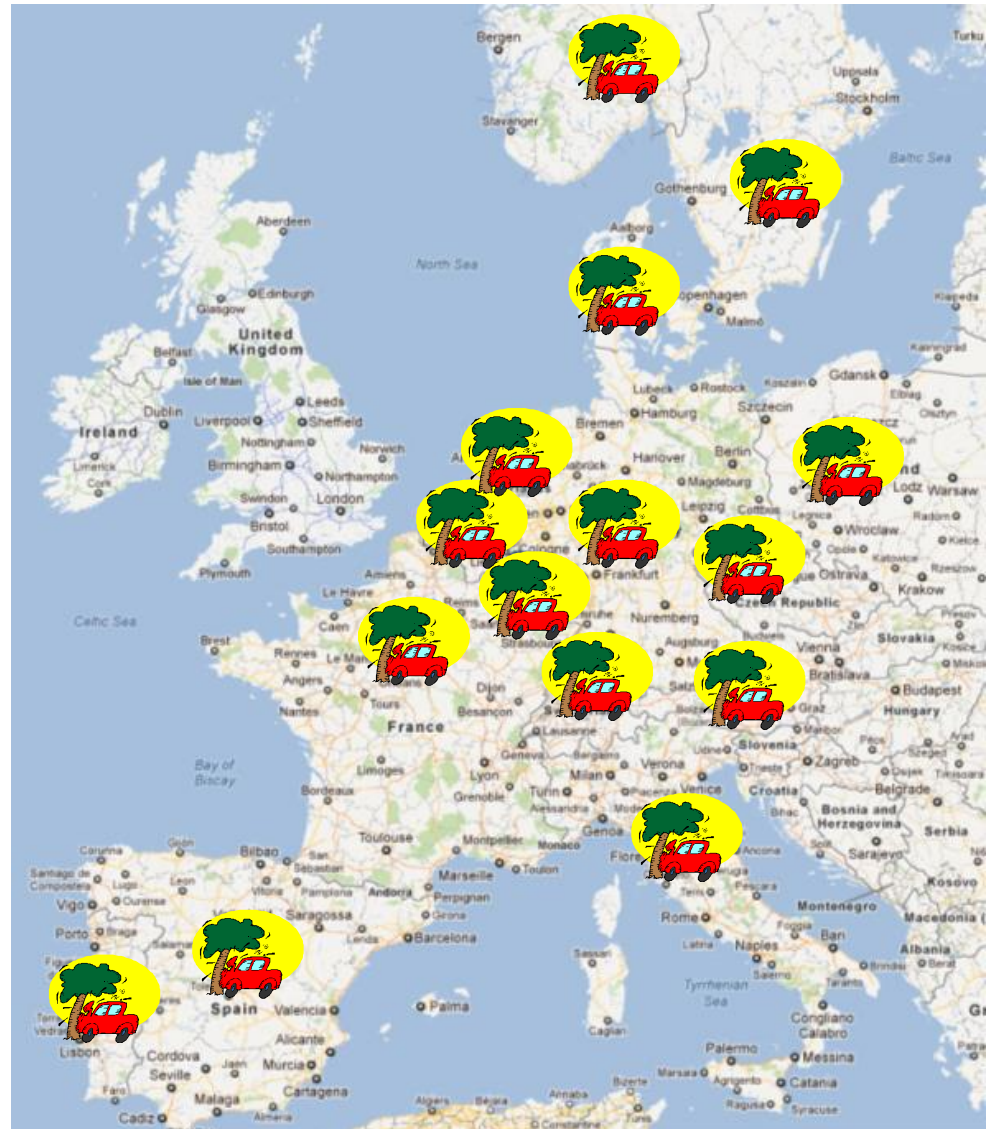
Test Campaign Overview

48 Networks in 15 countries

- ❑ 22 stationary locations
- ❑ 12 mobility routes
- ❑ >16000 calls
- ❑ >25000 MSD transmissions
- ❑ Feb 13 . Mar 02, 2012

Networks by country

Country	PLMN1	PLMN2	PLMN3	PLMN4
Austria	H3GA	ONE	A1	TMA
Belgium	BASE	Mobistar	Proximus	
Czech-Republic	EurostarCZ	TMCZ	OSKARCZ	
Denmark	TelenorDK	Telia	TDC	
France	Bouygues	SFR	OrangeF	
Germany	EPLUS	O2	TMD	VF
Italy	WIND	TIM	Omnitel	
Luxembourg	LuxGSM	OrangeLU	Tango	
Netherlands	KPN	BEN	VFNL	
Norway	TelenorN	NCOM		
Poland	PlusPL	OrangePL	ERAPL	PlayPL
Portugal	Optimus	TMN	VFPT	
Spain	OrangeES	YOIGO	VFES	TME
Sweden	Sweden3G	H3GS	TelenorS	
Switzerland	Sunrise	OrangeCH	Swisscom	

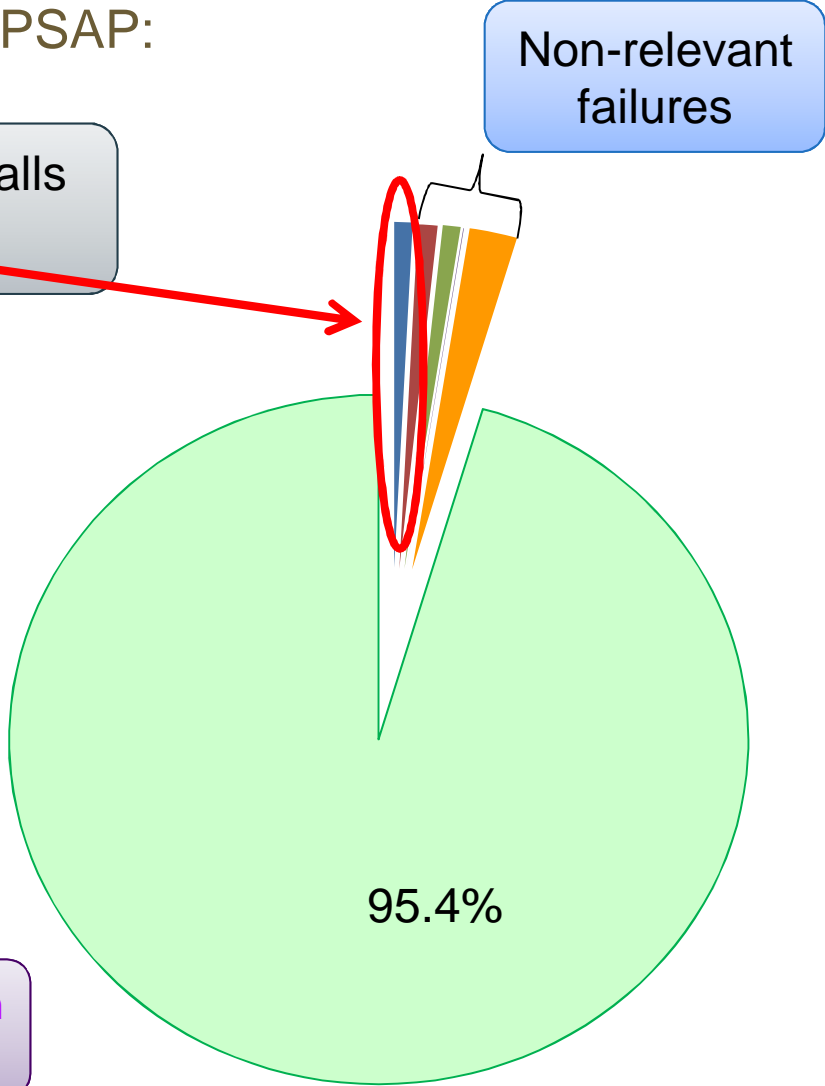


Overall Performance Review

Considered failures of eCalls reaching PSAP:

“ Most failures will not occur in real112 calls
“ Only 0.8% were realMSD failures

■ MSD Failures	= 0.8%
■ UE issues	= 0.9%
■ NW issues	= 0.8%
■ Test setup issue	< 0.1%
■ PSAP Issues	= 2.1%
■ Successful MSD	= 95.4%

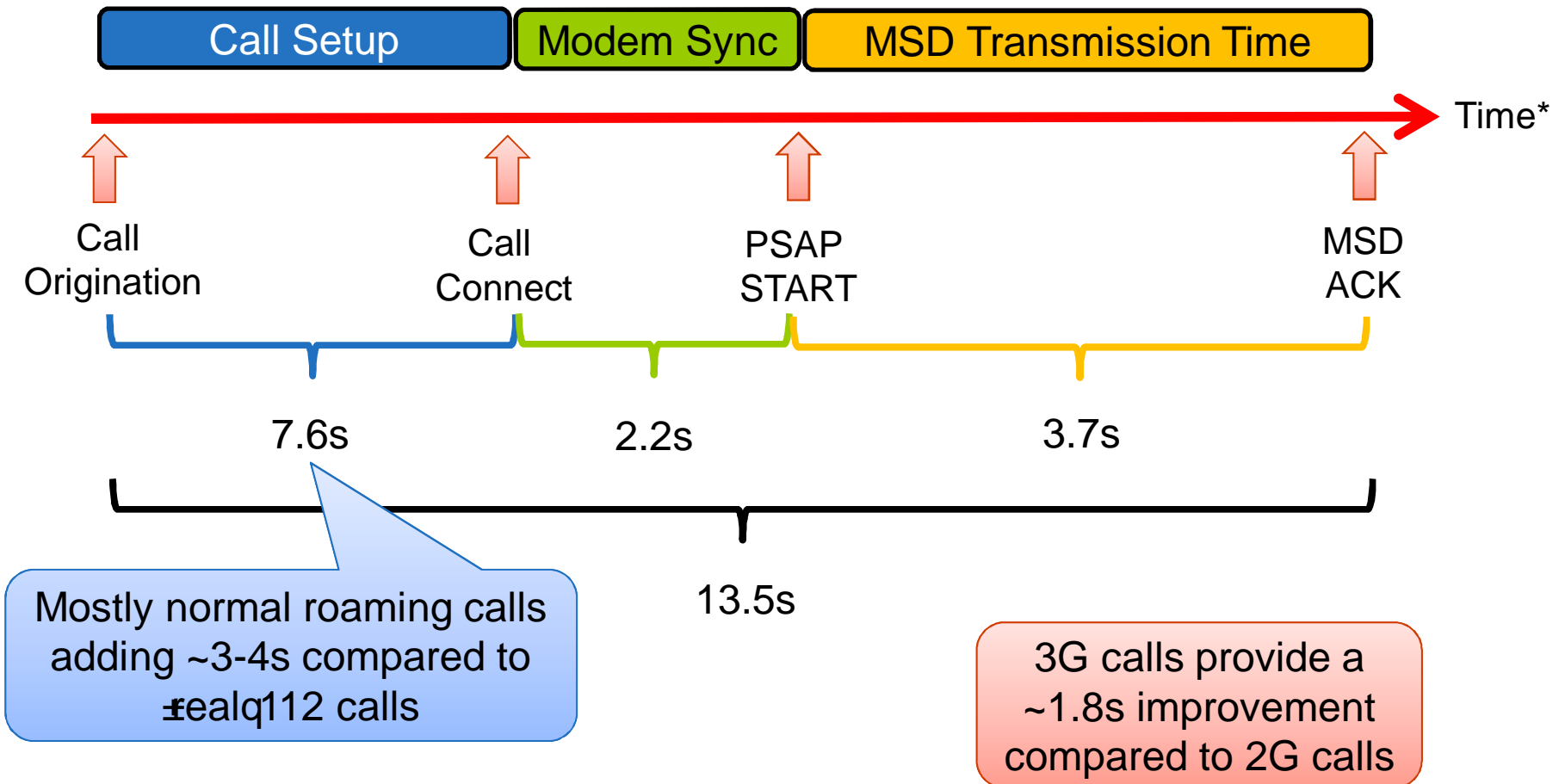


Network configuration issues

PSAP implementation bug discovered

Overall Performance Review (contd)

Average MSD transmission times w/o NEC disabler tone (2G+3G)



* Time line not to scale



Special Performance Investigations

- Investigations of selected networks showing poorer eCall performance in terms of MSD success rate and transmission time (see paper)
- eCall performance depends on the availability of the mobile network
 - eCall will not work in areas where there is no coverage of any network
- Call setup and retention performance is the same as for normal voice calls
 - Call setup delays as well as call drops depend on the level of network optimization by the corresponding network provider
- eCall MSD transmission duration and success rate depends on the underlying call quality provided in the location of the incident
 - The required network optimization belongs to the day-to-day tasks of a mobile network operator to ensure high quality services
- Investigations were conducted for specific call scenarios that are expected to degrade the normal call quality and continuity at
 - Weak radio coverage
 - High vehicular speed



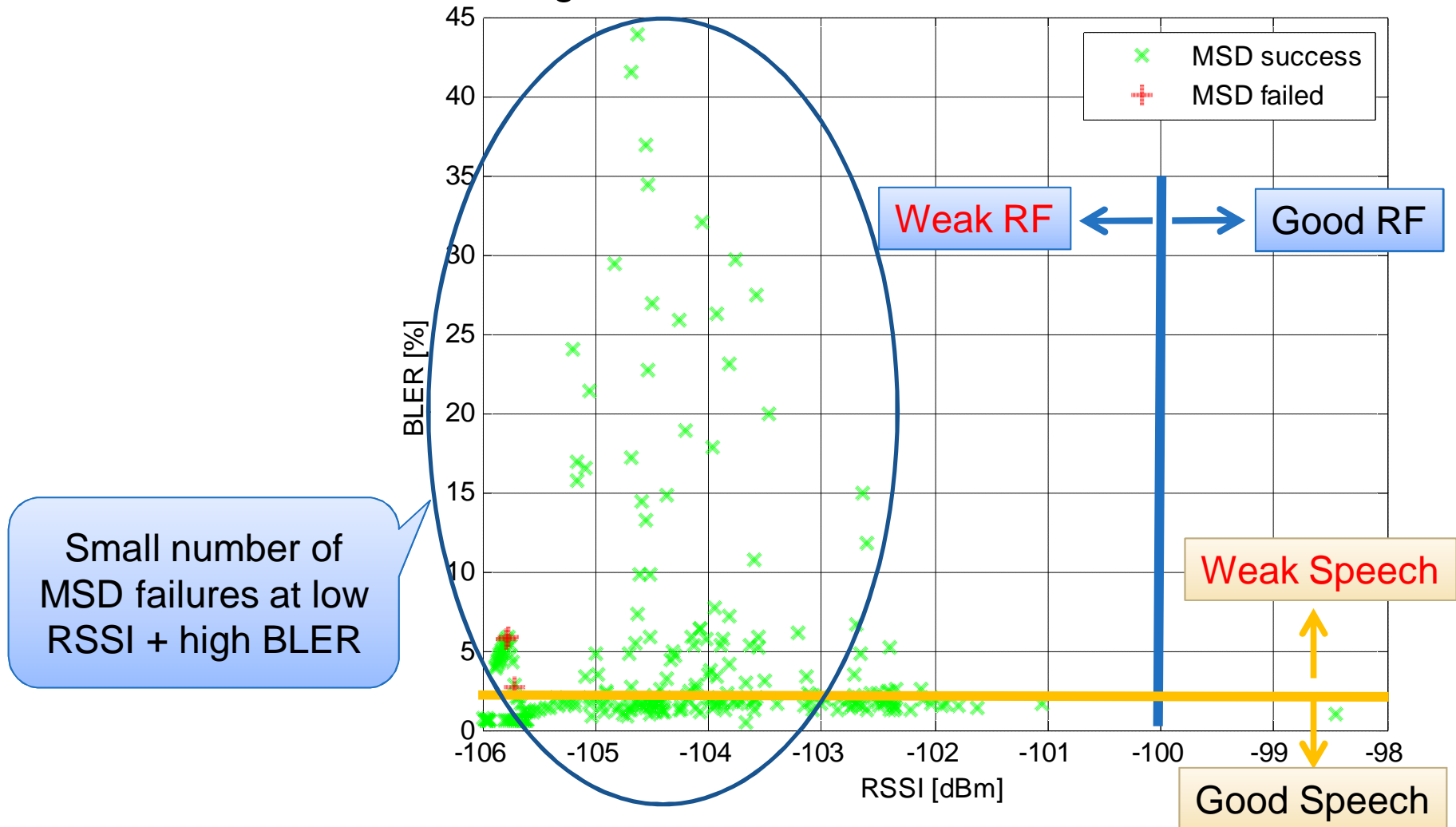
Weak Coverage Investigation

- Weak coverage scenarios may occur at the border or in a coverage hole of a cellular network, where radio signals are too poor to be properly received
- Call Setup performance of eCall and normal voice/TS12 calls are the same
 - eCalls and TS12 voice calls will use the same idle and connected mode parameters, e.g. common and dedicated power allocations, RACH assignments etc
- Difference in service quality can be only apparent during a call
 - MSD success rate
 - Speech quality, e.g. measured as block/frame error rate (BLER)
- To investigate the eCall performance, repeated calls were setup in weak RF coverage scenarios
 - Weak RF coverage is considered when RSSI goes below -100 dBm
 - Speech quality is considered to be affected when BLER goes above 2%
 - Most networks are dimensioned to provide coverage for speech communications at 1% BLER



Weak Coverage Investigation (cont)

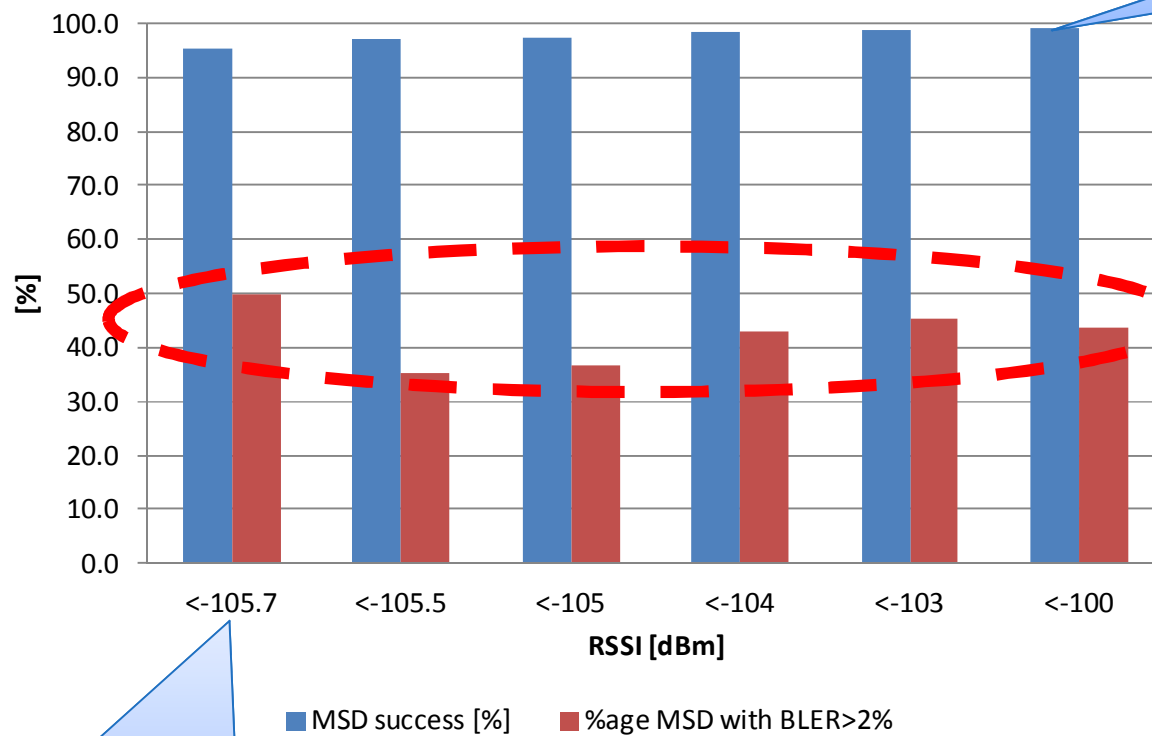
- Relation between average RSSI and BLER





Weak Coverage Investigation (contop)

- Observed MSD success rate



99% reliable MSD
for RSSI < -100dBm

High %age
of BLER > 2%

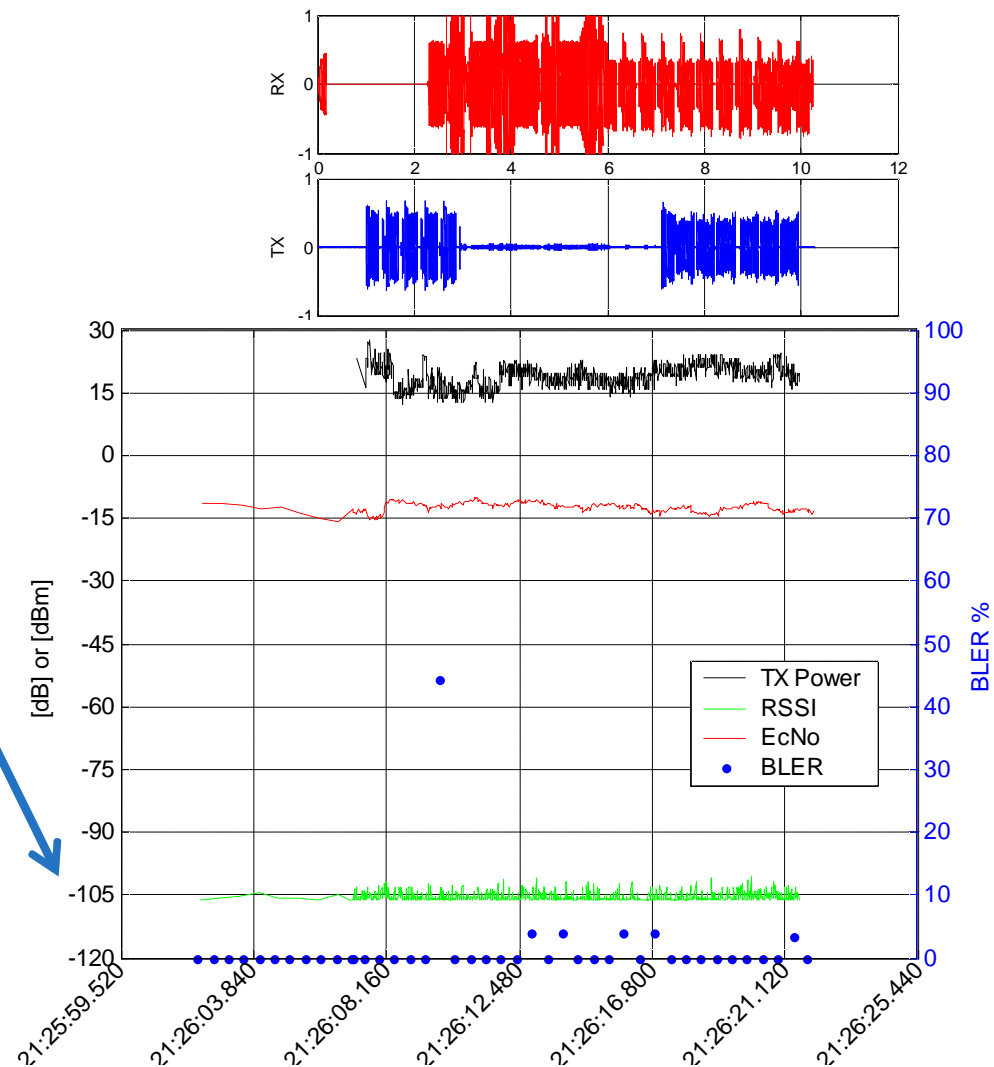
Still 95.5% reliable MSD
for RSSI < -105.7dBm



Weak Coverage Investigation (cont)

▪ Example of successful MSD transmission

- MSD TX time = 2.8s
- Avg BLER = 2%
- Avg RSSI = -105.4 dBm





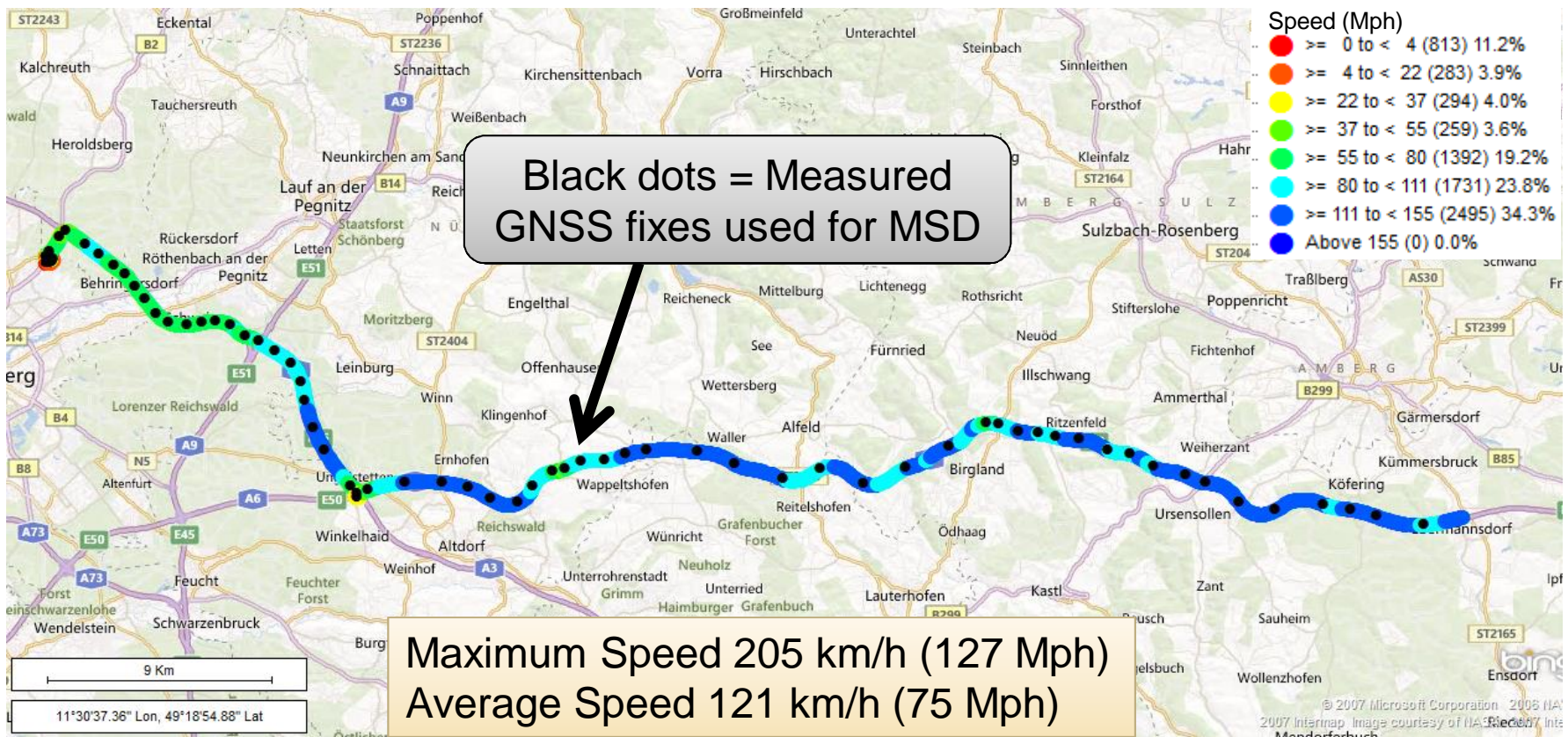
High Mobility Investigation

- Expect eCalls to be made from stationary or quasi-stationary vehicles
 - Tests were conducted at high speed to investigate limits of eCall modem operation
 - eCall tests within the HeERO pilots may be conducted in mobility environments where speed can vary during automated call initiations by a drive test setup
- Call setup and retention performance is the same as for normal voice/TS12 calls
 - eCalls and normal voice calls will use the same idle and connected mode parameters
- Main factors impacting eCall mobility performance are the number of handovers
 - Higher probability of lost speech frames
 - Increased call drop rate due to handover failures
- To investigate the eCall performance, repeated calls were setup in high mobility scenarios
 - Drive route along a highway, country roads and downtown streets



High Mobility Investigation (contd)

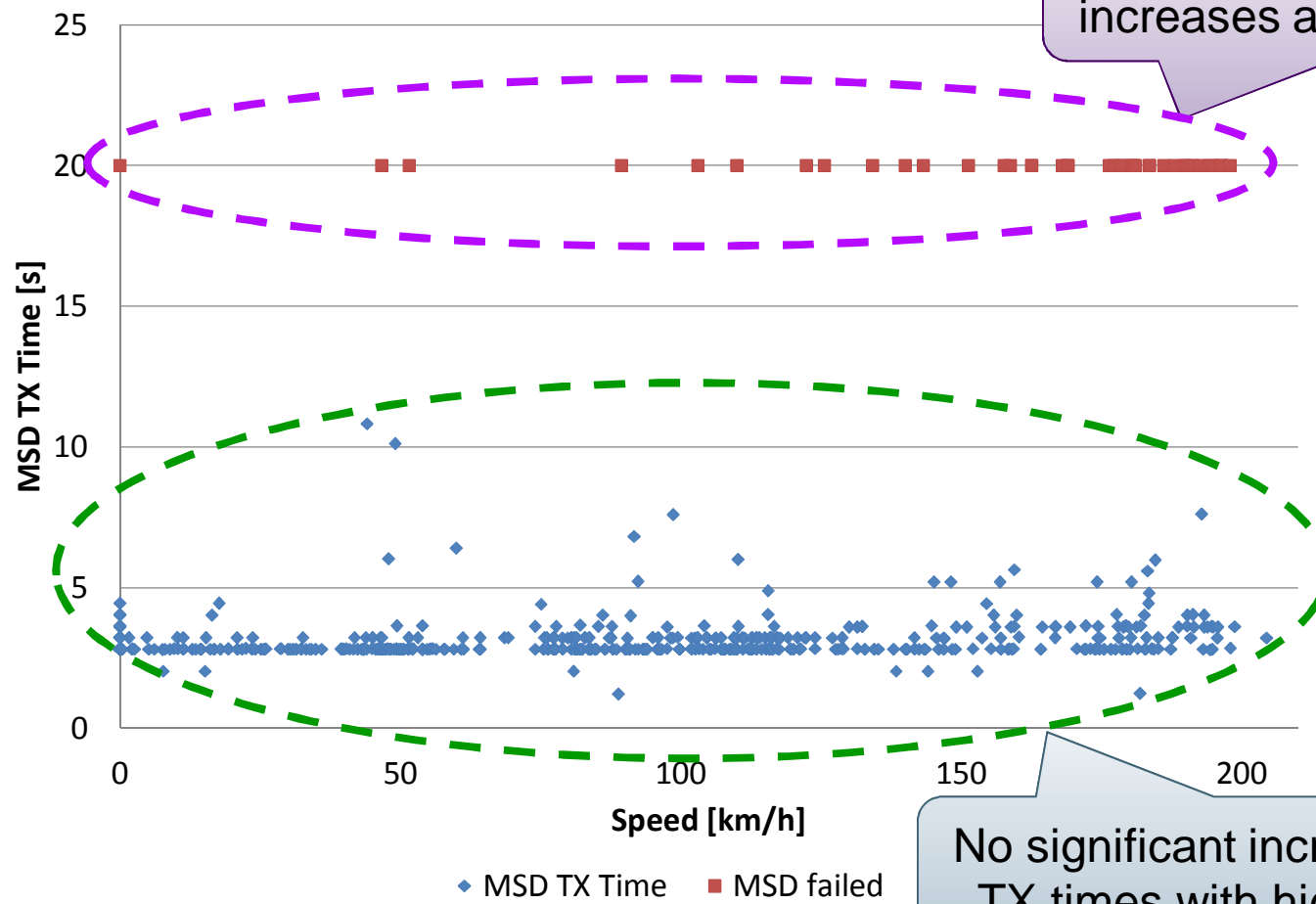
- Drive route example showing speed (Mph color coded) and measured GNSS fixes (black dots)





High Mobility Investigation (contd)

- MSD transmission time vs vehicular speed

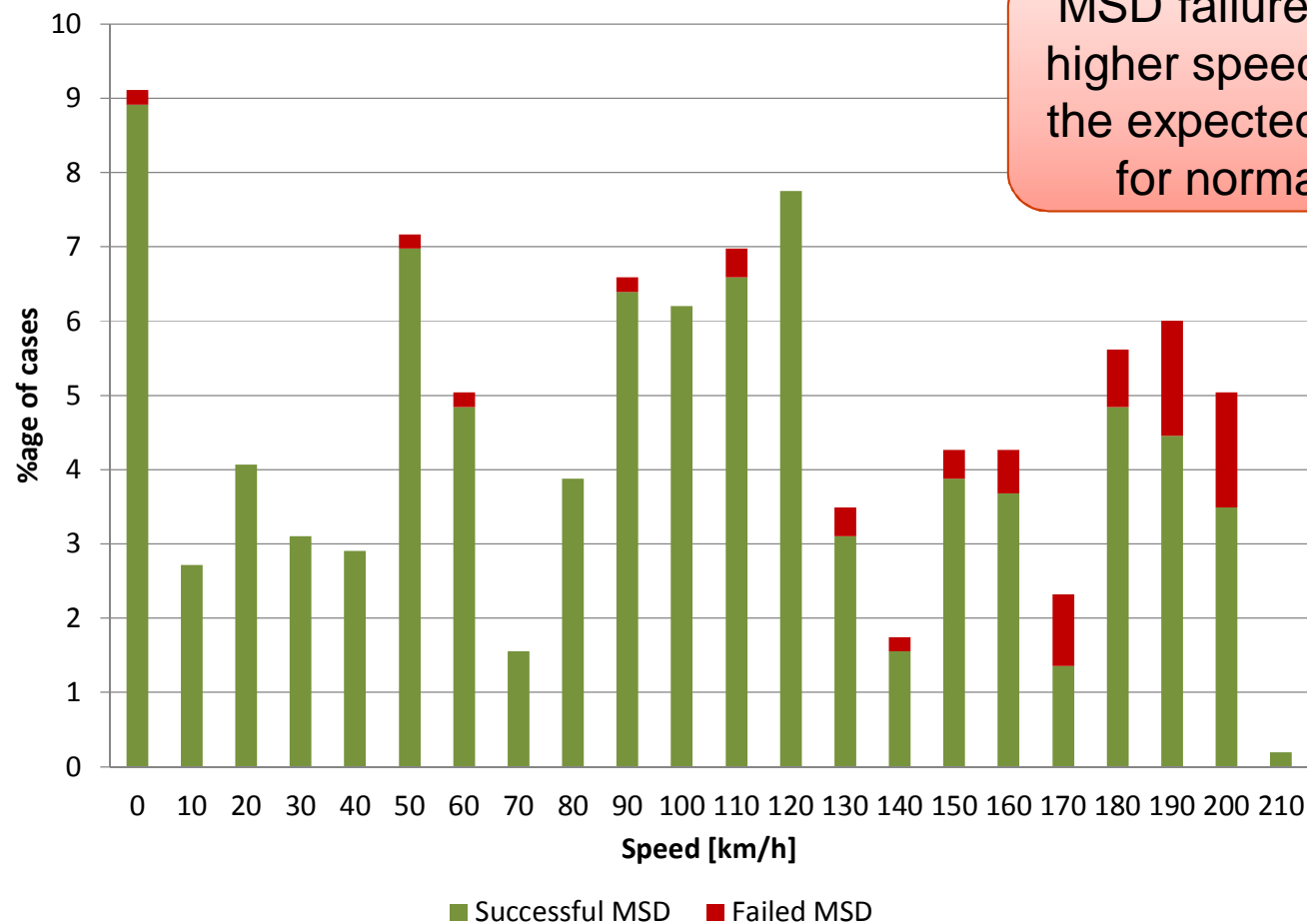


No significant increase of MSD TX times with higher speeds



High Mobility Investigation (cont'd)

- Percentage of successful and failed MSD vs. vehicular speed





Conclusions

- General eCall performance confirmed to be good
 - . Main issues occurred due to implementation or configuration deficiencies
- eCall performance is affected in the same way as normal voice calls
 - . Network parameters for call setup and retention are the same
- Weak coverage investigations
 - . MSD success rate reduces when signal strength approaches the receiver sensitivity
 - . However, MSD transmission could still be possible even in cases when normal voice communication may not be intelligible anymore
- High mobility investigations
 - . MSD transmission time does not increase with higher vehicular speeds
 - . MSD success rate can degrade in very fast changing radio conditions due to increased risk of handover failures
 - . However, such scenarios are not concerning as calls are expected to happen in stationary or quasi-stationary conditions



Thank You !

Questions?



Contact:

- [Ralf Weber \(rweber @ qualcomm.com\)](mailto:rweber@qualcomm.com)