



Mobile Video Transmission via LTE

LiveU LU60 Backpack field trials at RTL



1. Diverse methods of mobile Video Transmission



- Requirements of mobile Video transmission
 - Live Stream
 - Stable connection
 - Constant video quality
 - Predictable
 - Store & Forward
 - Mobility
 - High video quality



- We have used the LiveU LU60 for the following events:
 - German regional elections
 - Presidential elections in France (Loaned French unit)
 - BVB Dortmund Championship Party
 - Various press conferences
 - Protest marches in Berlin, Frankfurt and Hamburg
- Plan to cover the Queen's Diamond Jubilee

3. Signal path



Encoder System

Requirements:

- 3.1.1 Interfaces
- 3.1.2 Video quality
- 3.1.6 Running time
- 3.1.7 Handling



Network

Requirements:

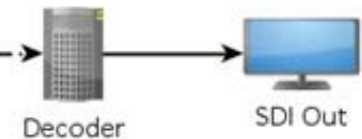
- 3.1.3 Transmission
- 3.1.4 Latency
- 3.1.5 Connectivity
- 3.1.8 Quality of Service



Decoder System

Requirements:

- 3.1.1 Interfaces
- 3.1.2 Video quality
- 3.1.7 Handling



LiveU LU60

- Bonding (8x)
 - LTE, WiMAX, HSPA, UMTS
 - Wifi, 2x Ethernet
 - BGAN
- Inputs
 - SDI, Firewire, USB
- Operational time
 - 2.5 Hours



5. Video quality evaluation

- Video quality for SD transmissions:

Video data rate	AviWest IBIS	LiveU LU60	Code One
1.5 Mbit/s	85,7 %	88,88 %	88,9 %
3 Mbit/s	86,1 %	89,5 %	89,4 %
6 Mbit/s	86,7 %	91,2 %	90,0 %

6. Long Term Evolution (LTE/4G)

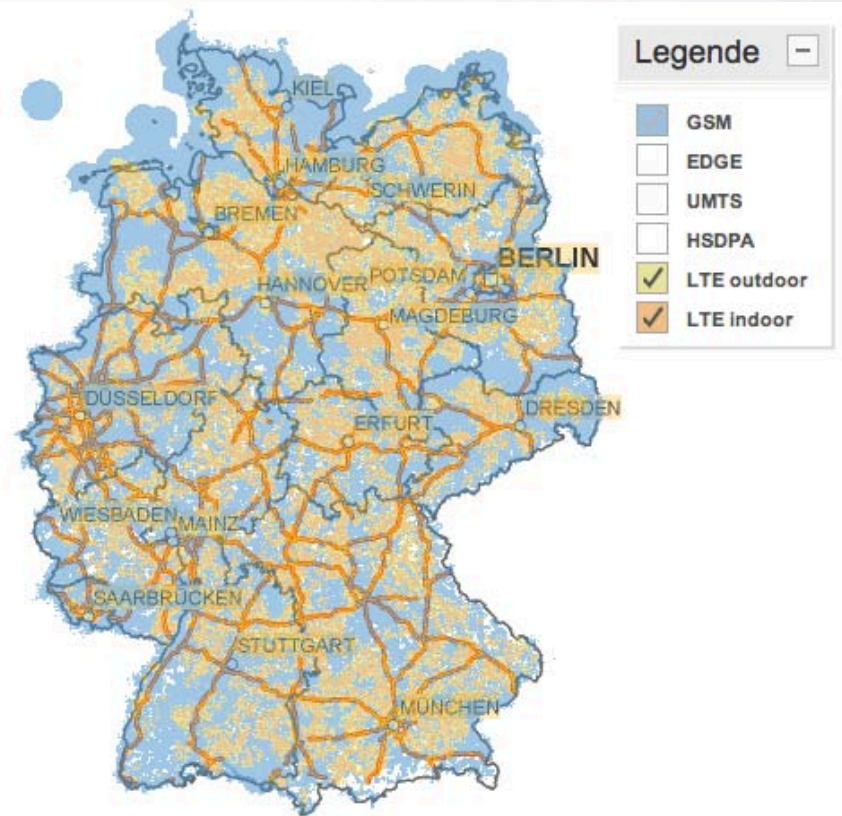
- High Data-rate
 - 75 Mbit/s Upload
- Low Latency
 - 5 ms
- Low power consumption
 - SC-FDMA
- Data packet based transmission
 - Quality of Service
- Improved mobility
 - up to 400km/h

- Vodafone LTE Services (Germany):

Max. data rate Limit	Surf Now 7200 [Mbit/s]	Surf Now 21600 [Mbit/s]	Surf Now 50000 [Mbit/s]
Download	7,2	21,6	50,0
Upload	1,4	5,7	10,0

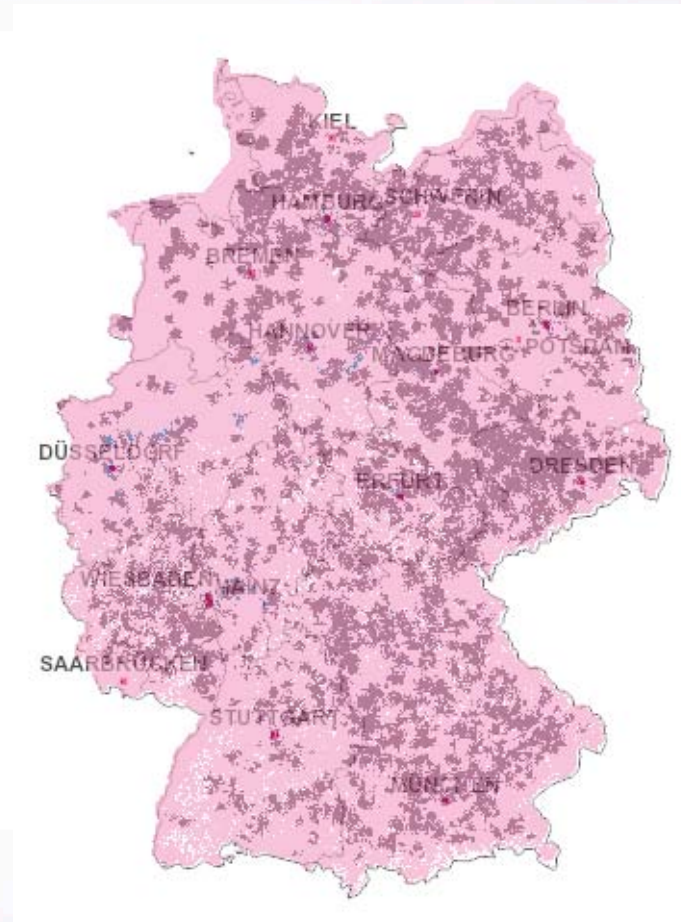
Vodafone Germany

- LTE Coverage
- Still under construction
- Will cover up to 90% of Germany by the end of 2013
- Uses only LTE 800
 - 842-852 MHz (Upload)
 - 801-811 MHz (Download)



T-Mobile Germany

- LTE Coverage
- Still under construction
- Will cover up to 90% of Germany by the end of 2014
- Uses LTE 800 and LTE 2600
 - 852-862 MHz / 2520 - 2540 MHz (Upload)
 - 811-821 MHz / 2640 - 2660 MHz (Download)



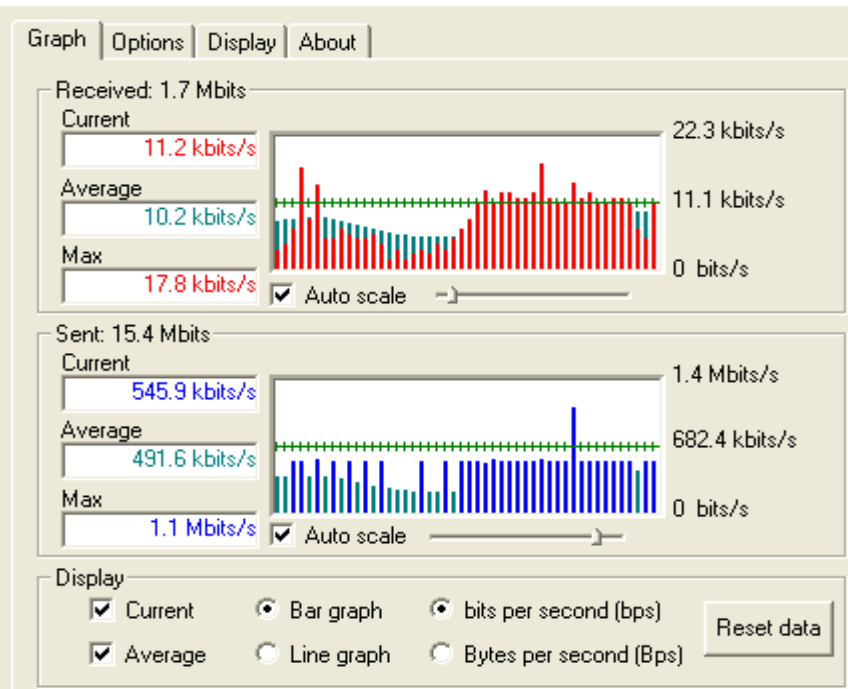
6. Long Term Evolution (LTE/4G) - Decay



LTE transmission:

- Decay through Buildings
- Varying data rate
- LTE indoor/outdoor

Parameter	Value
Time	15:23:16 2012 JAN 20
Timestamp	0:11:07.619.745
RAT Mode	E UTRAN (4G)
Cell ID (PCI)	126
Cell ID (GCI)	10240771
PLMN ID	26202
RSRP	-128.00





Up to -120dBm (RSRP)

- Stable transmissions
- Effective Data rate (5-7 Mbit/s)

- Live-Streams
- Store & Forward

Below -120dBm (RSRP)

- Unsteady transmissions
- Effective data rate only with bonding

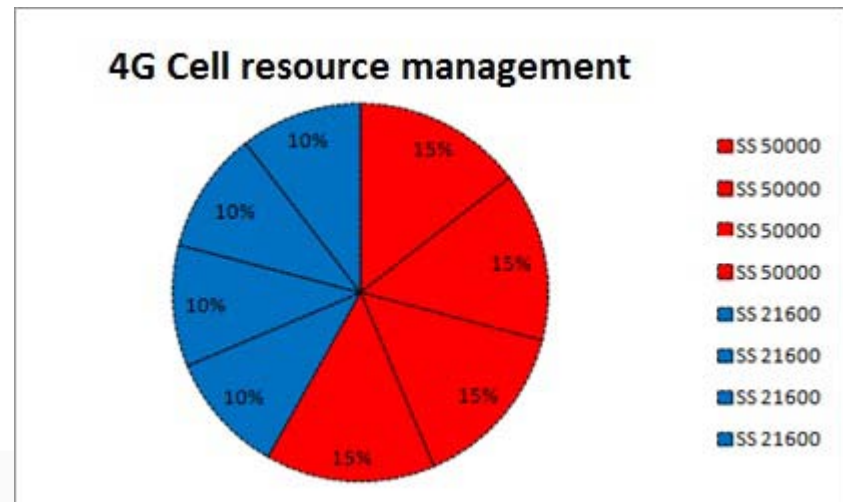
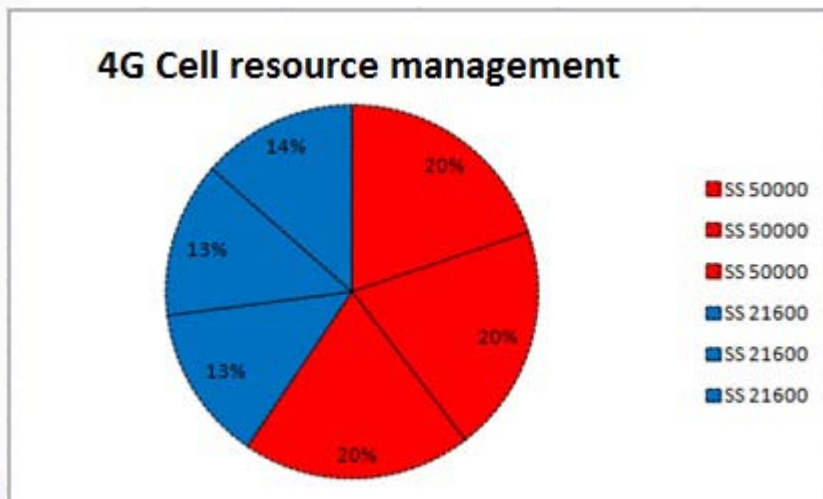
- Live-Streams with high latency
- Store & Forward

•RSRP: Reference Signal Received Power

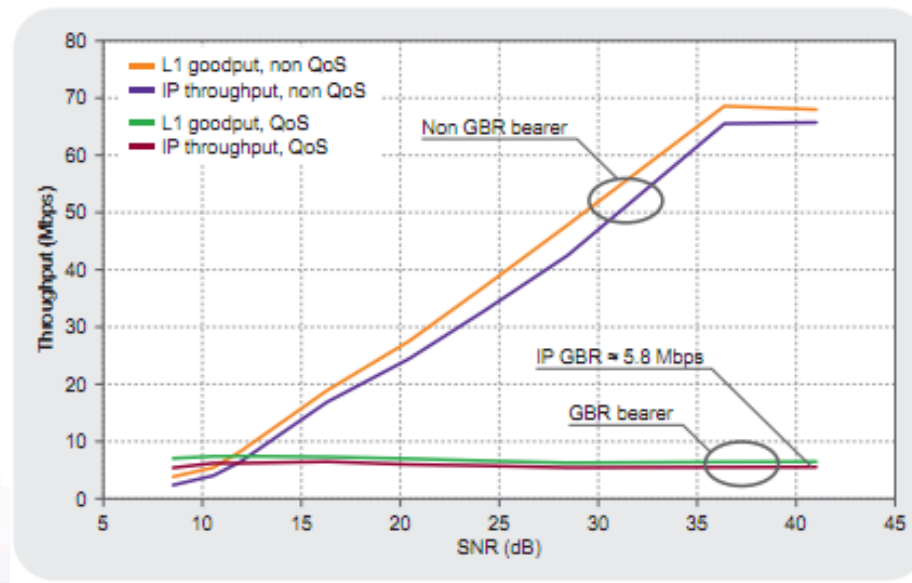
6. Long Term Evolution (LTE/4G) – Quality of Service



- LTE Network prioritization
 - Different levels of priority
 - No equality
 - Best mobile plan = Best data rate

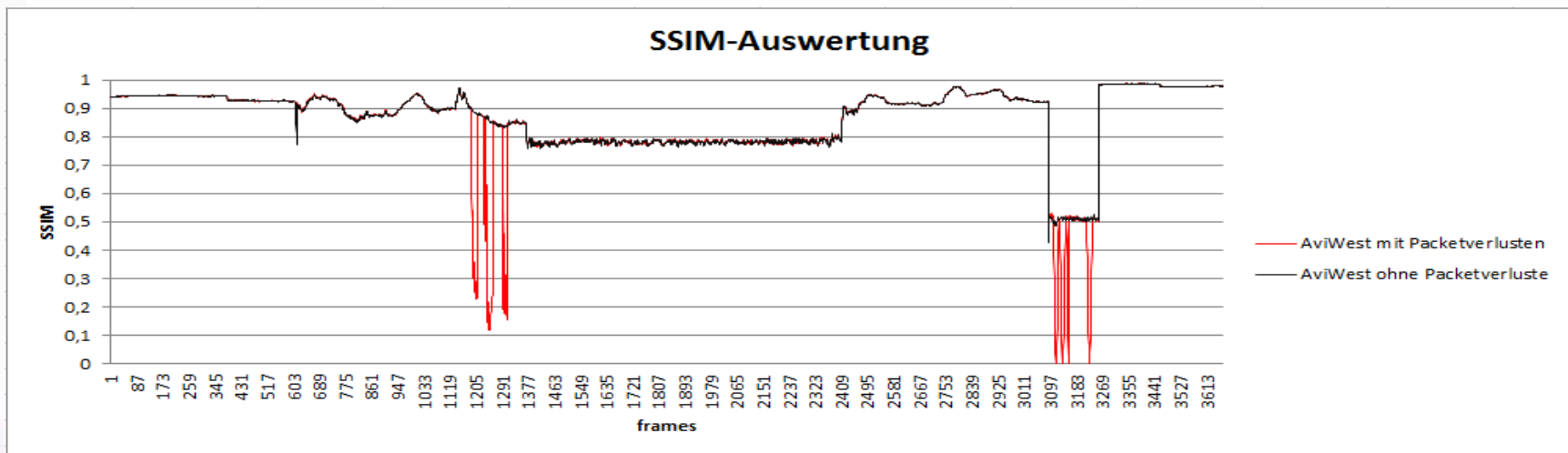


- Guaranteed Bit-rate (GBR)
 - Constant Data rate
 - minimum and maximum data rate adjustable
 - Best case for mobile Networks



Packet loss on LTE Networks

- Abrupt starting data traffic
- Short-Term errors at the Cell
- Several Video Transmission Systems using the same Cell



Evasive action:

- Bonding of several connections
 - LTE, UMTS, HSPA etc.
 - Optimal: 2x LTE + 6x HSPA
- Increasing the latency
- Store & Forward

6. Results

Pro

- Effectual data rate
- Constant data rate
- low latency (50 ms)
- good mobility
- Quality of Service
 - GBR
 - Prioritization

Contra

- Shared Medium
- Network coverage
- Indoor transmission can be very problematic



- LTE is a big improvement on 3G for mobile Video transmissions
 - Secure, fast and qualitatively better
- Important advantages compared to UMTS/HSPA
 - Latency, Data rate and stability, improvements
 - Improved Video quality
- Quality of Service possible
- New Use-Cases
 - SNG (Backup/complimentary coverage)
 - Fringe coverage of Sports Events (“News-rights” situation)
 - „breaking News“



- Events:
 - Without any planning:
 - „breaking News“
 - Playout with Store & Forward
 - File transfer (FTP)
 - With planning:
 - Press conferences
 - Events from known locations (previous experience of venue)
 - With a prior site survey, very high % of venues possible

Thank you for your time!