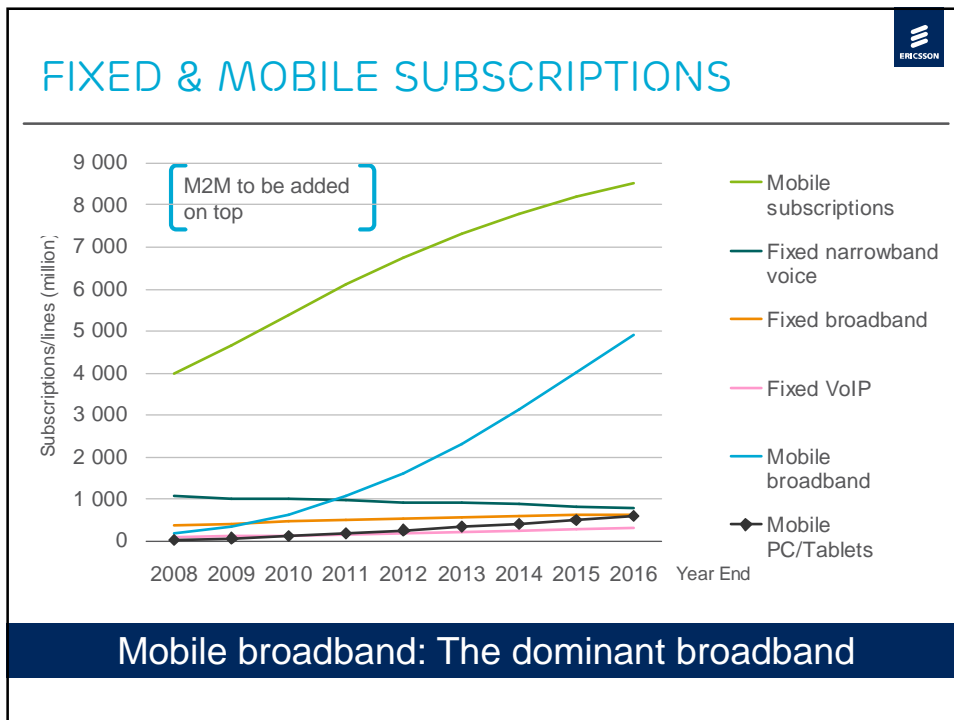


# SPECTRUM USAGE IN THE UHF-BAND

HAKAN OHLSEN  
LASSE WIEWEG




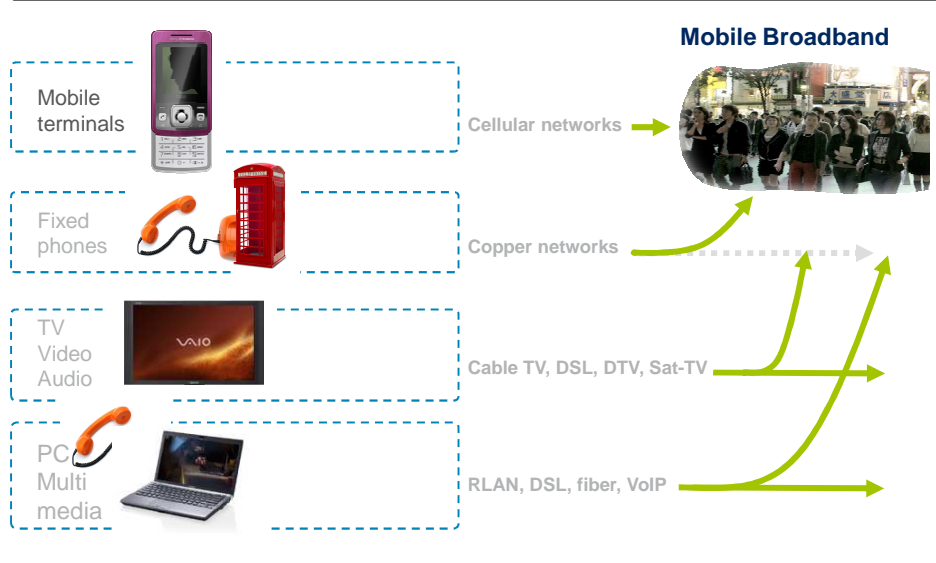
## KEY MARKET TRENDS

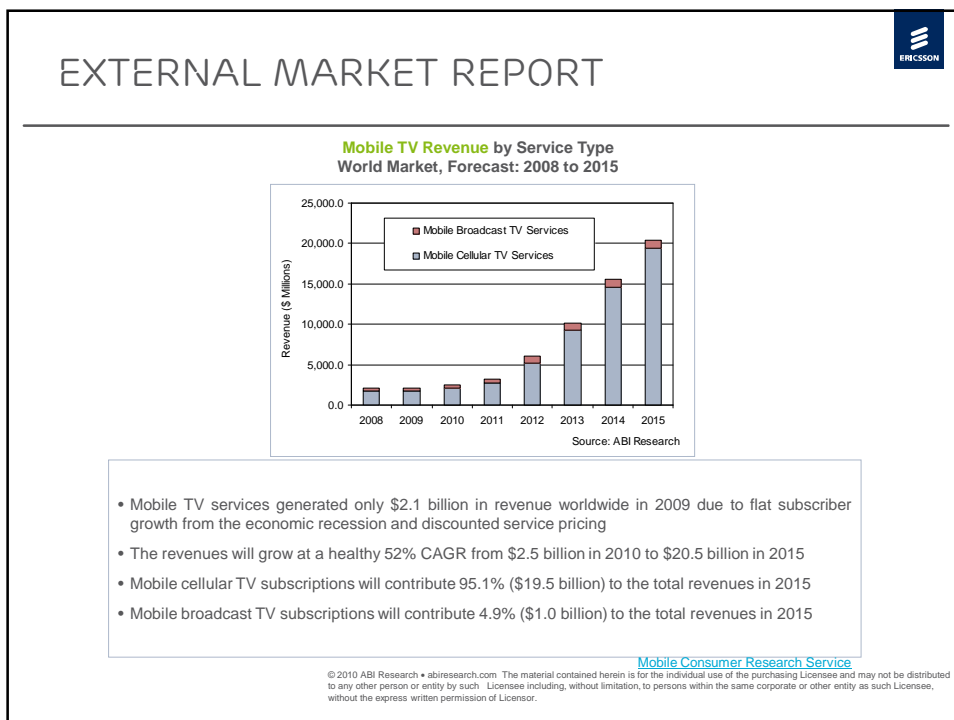
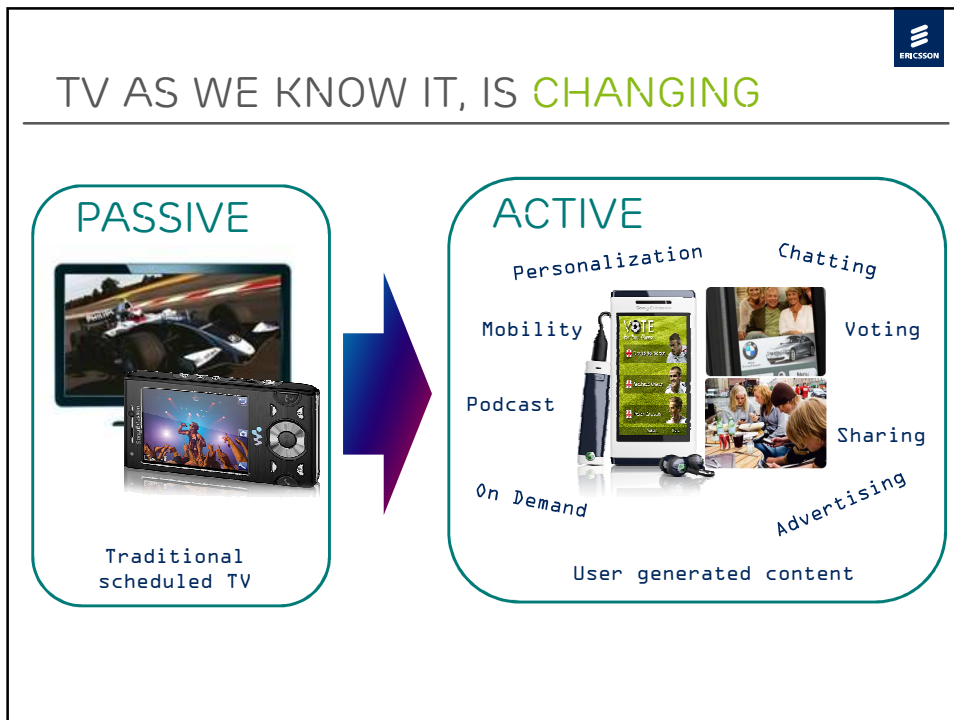
- › Smartphone uptake in all markets, high and low ARPU
- › Low cost Smartphones entering the market
- › Wide Tablet introduction ongoing
- › Coverage expansion ongoing
- › LTE introduction



## CONVERGENCE

DRIVEN BY THE MOBILE BROADBAND ECOSYSTEM








## MOBILE TV DRIVERS

- › FASTER NETWORKS 3G, HSP, LTE
- › FALLING DATA CHARGES
- › MONETIZING ON COMPELLING CONTENT
- › ADVANCED DEVICES
- › GLOBAL UNIFIED STANDARDS (3GPP)
- › NEW CONSUMER TRENDS
  - Internet user behavior
  - From passive to active
  - From consumers to “prod-sumers”



## EFFICIENT USE OF SPECTRUM









**More use of spectrum; is more efficient use of spectrum**

698 – 960 MHz (Mobile)

- › MBB, return signalling and ENG/OB (HDTV)
- › real-time HDTV is possible
- › Uploading of non real-time content
- › Internet & streaming

470 – 698 MHz (Mobile & Broadcasting)

- › MBB and BC collaboration
- › Mobile TV, unicasting and broadcasting
- › Internet & streaming



## WHAT IS MBMS IN MOBILE SYSTEMS?



› *When several users want the same content, deliver it once*

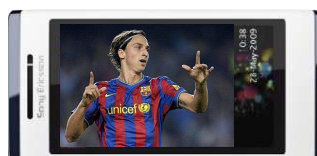
- MBMS = Multimedia Broadcast and Multicast Services
- MBMS support is an integral part of LTE and WCDMA/HSPA

Unicast



*On demand  
Personalized content*

Broadcast



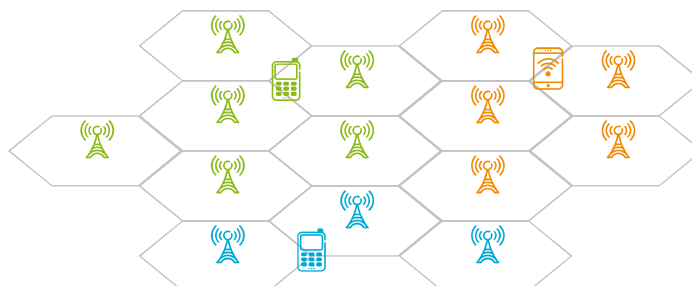
*Big events  
Known in advance to  
have many users*



## MBSFN – LTE SOLUTION FOR MBMS



- › MBSFN – MBMS with Single Frequency Network
- › The same signal is transmitted synchronously from multiple base stations
  - Improves performance → higher bitrates possible
  - The transmission scheme of LTE (OFDM) is especially well suited for MBSFN
    - › Same principle as used in DVB
  - Unicast and MBSFN can share the same carrier




THE ROYAL WEDDING IN SWEDEN  
PRODUCED WITH 4G LTE TECHNOLOGY



4G for Live  
ENG/OB




SPECTRUM USAGES IN THE TV UHF BAND



Two examples of increased spectrum usages

1. LTE as a broadcasting technology
2. LTE as a complementing broadcasting service



## EXAMPLE 1 BROADCASTING TV IN THE USA

**Current situation of TV in the USA**

54-72 MHz,  
76-88 MHz,  
174-216 MHz, and  
**470-698 MHz**  
(= appr. 300 MHz)

US Digital TV standard: ATSC

**Task: improve the spectrum use...**  
[see US NATIONAL BROADBAND PLAN, March 16, 2010]

## NUMBER OF TV CHANNELS

### DATA FROM FCC TV DATA BASES FOR EXEMPLARY MARKETS

**Lincoln-Kearney-Hastings**  
number of channels

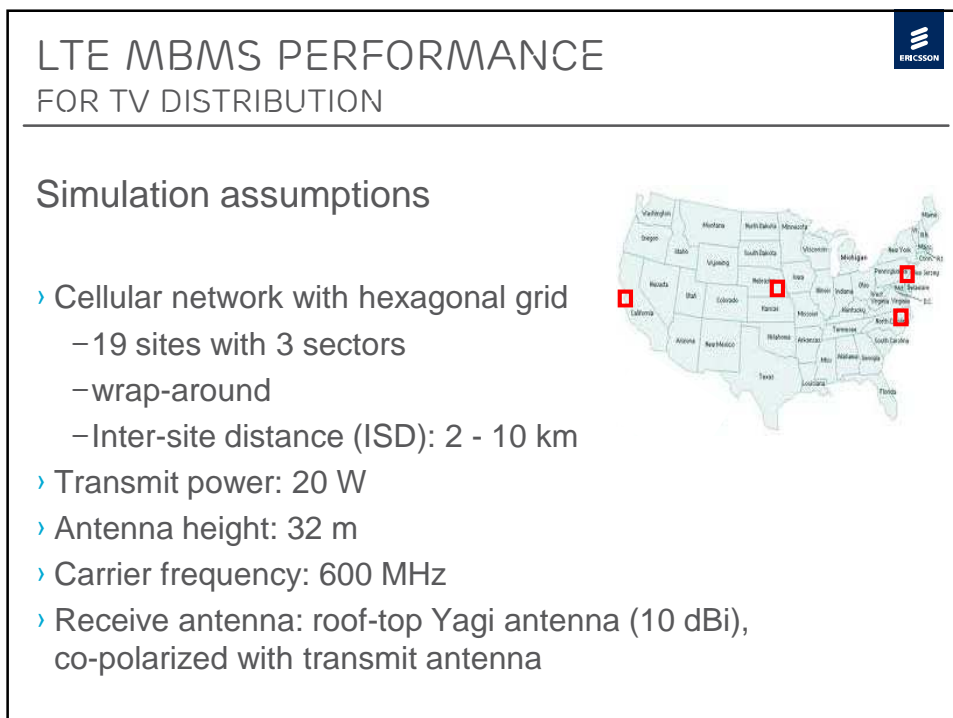
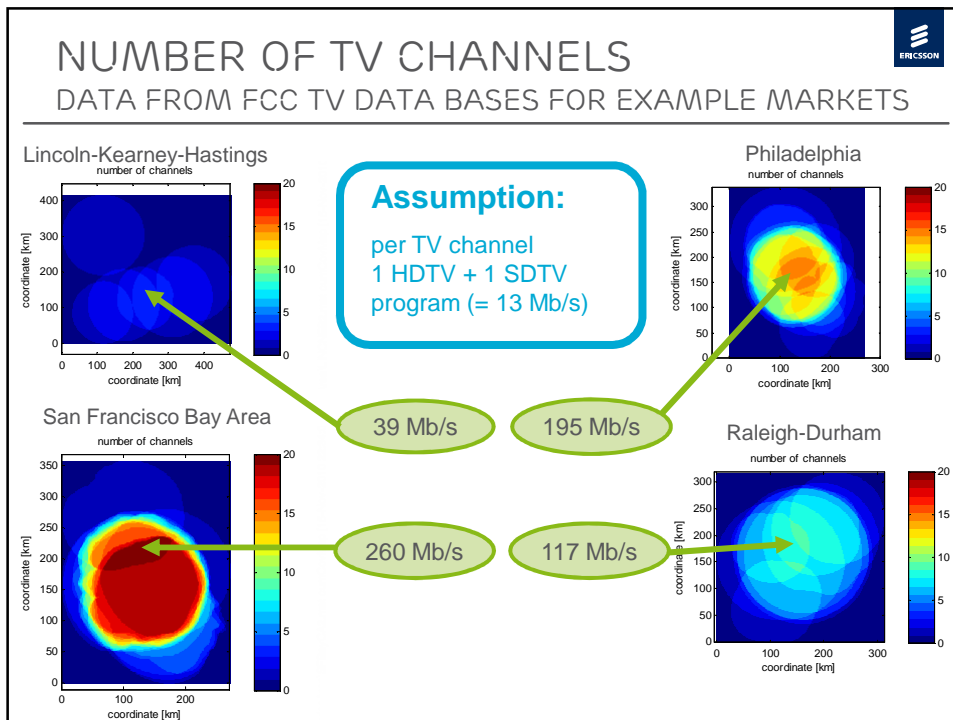
**Philadelphia**  
number of channels

	Exemplary US TV markets			
	<i>RDU</i>	<i>SFBA</i>	<i>LIN</i>	<i>PHIL</i>
Population per km <sup>2</sup>	2,500	3,000-6600	1,167	4,405
total #TV channels	10	20	6	17
max # overlapping TV channels	9	20	3	15

**San Francisco Bay Area**  
number of channels


**Raleigh-Durham**  
number of channels

**Peak: 20 channels = 120 MHz**  
Remaining 180 MHz are underused due to reuse





## TV SPECTRUM REQUIREMENT FOR LTE MBMS – PEAK SERVICE AREA




- › Peak service rate: 260 Mb/s (20 channels)
- › MBMS spectral efficiency: 3.1 b/s/Hz (ISD of 2km)
- › Total spectrum requirement:  $260 \text{ Mb/s} / 3.1 \text{ b/s/Hz} = 84 \text{ MHz}$

- Today's TV services could be provided with 84 MHz via LTE MBMS compared to 300 MHz via ATSC
- 216 MHz could be freed for more usages
  - 37% by channel sharing (program stream multiplexing)
  - 63% of the savings is due to the LTE SFN

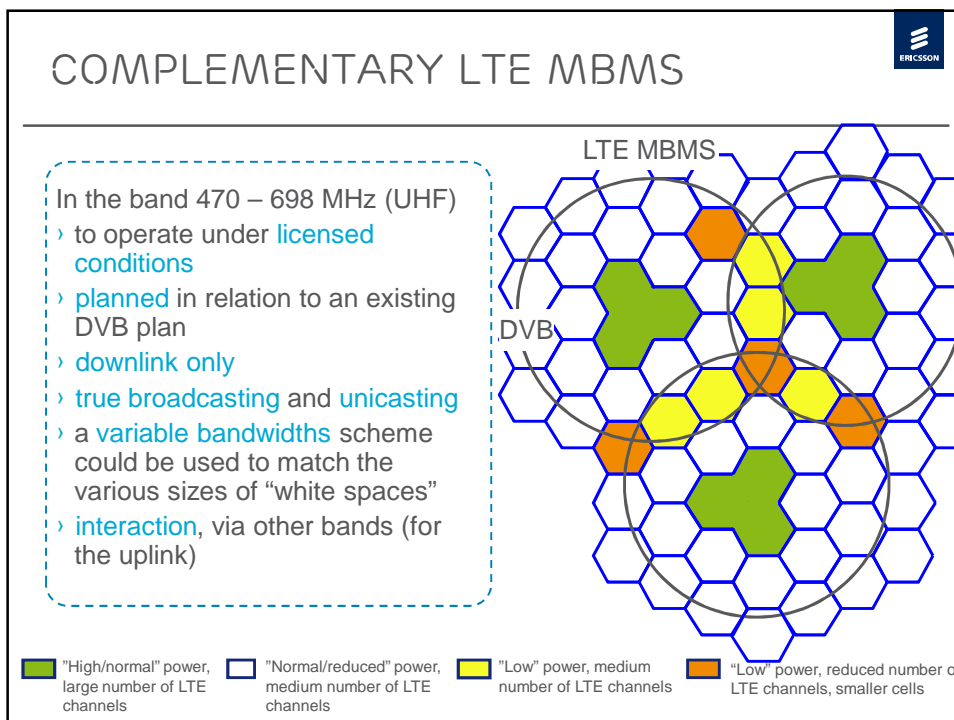
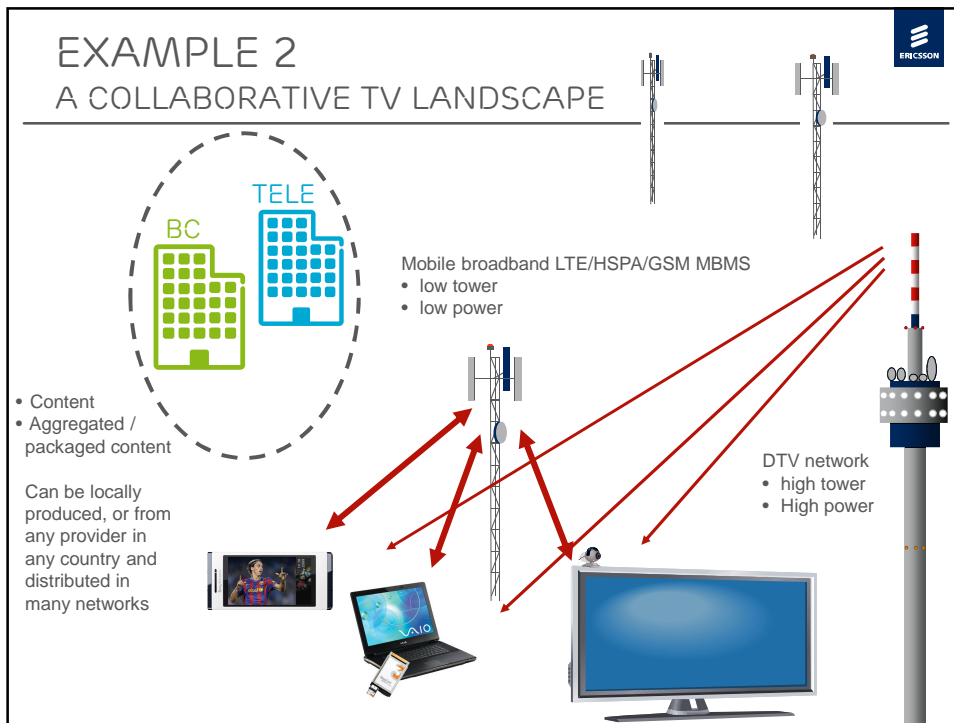
2011 IEEE International Symposium on Dynamic Spectrum Access Networks (DySPAN); "Spectrum Requirements for TV Broadcast Services using Cellular Transmitters", by Jörg Huschke, Joachim Sachs, Kumar Balachandran, Jörgen Karlsson, p22-31

## TV SPECTRUM REQUIREMENT FOR LTE MBMS – RURAL AREA



- › Rural areas: inter-site distance of 10km rather than 2km
- › Service rate (Lincoln): 39 Mb/s (3 channels)
- › MBMS spectral efficiency: 1 b/s/Hz (ISD of 10km)
- › Total spectrum requirement:  $39 \text{ Mb/s} / 1 \text{ b/s/Hz} = 39 \text{ MHz}$

- 84 MHz also sufficient for rural areas
  - reduced MBMS spectral efficiency (larger inter-site distances)
  - smaller number of TV programs



## THE NEW TV LANDSCAPE

### THE HOME SCREENS

- DTV
- LTE - MBMS
- IPTV
- WEB-TV
- INTERACTION
- SIM
- BLUETOOTH
- WLAN
- DLNA

**ERICSSON**

## THE "UHF" BAND 698 - 960 MHz

### ON A REGIONAL BASIS FOR MOBILE BROADBAND

Region	Band	Frequency Range (MHz)	Bandwidth	Directionality
EME/Africa	The band 800 MHz (DD1)	791 - 821	30 MHz	Downlink
	The band 900 MHz	880 - 915, 925 - 960	35 MHz	Downlink
APAC/Africa	The band 700 MHz (AWG)	703 - 803	2x45 MHz	Downlink
	The band 850 MHz	824 - 844, 869 - 890	20 MHz	Uplink
	The band 900 MHz	889 - 915, 935 - 960	26 MHz	Downlink
Americas	The band 700 MHz (USA)	698 - 716, 728 - 746, 768 - 777, 798	2x18+2x10+2x10 MHz	Downlink
	The band 850 MHz	824 - 849, 869 - 894	25 MHz	Uplink

**Momentum**

**OPPORTUNITY TO ENABLE BROADBAND FOR ALL**

Legend: ■ = Downlink, ■ = Uplink

**ERICSSON**

## THE UNIFIED APT 700 MHz

HARMONIZED APT/AWG 2X45 MHz ARRANGEMENT

*Harmonised FDD Arrangement of 698-806 MHz band*

*TDD Arrangement of 698-806 MHz band*

“...coexistence of mobile services with adjacent broadcasting services below the 698 MHz spectral boundary is an important aspect of the conventional duplex arrangement in the band 698 – 806 MHz. [Further studies to determine the appropriate UE out of band emission limits](#) and related implementation issues are required.”

**3GPP** **Develop LTE specifications 2011-12, for products 2012-13. Duplexer sizes and performance defined in 3GPP specification work.**

## SUMMARY

- END USER EXPERIENCE IS KEY
- BRING MOBILE TV TO THE MASSES
- FUTURE PROOF SOLUTION
- LTE MBMS & BROADCASTING - COLLABORATION FOR EFFICIENT SPECTRUM USE IN UHF-BAND
- MONETIZE ON CHANGING TV CONSUMPTION HABITS

