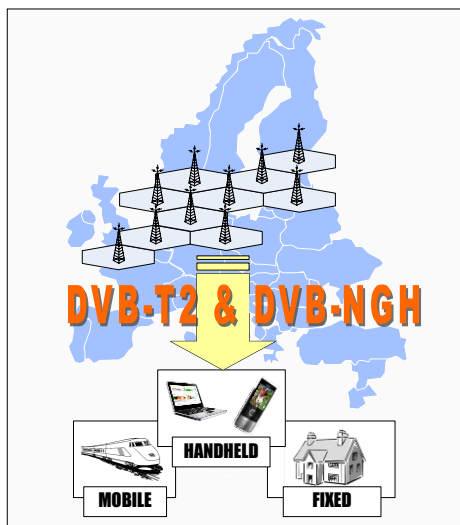


ENGINES – Results Brochure

Enabling Next Generation Networks for broadcast Services



Main Results

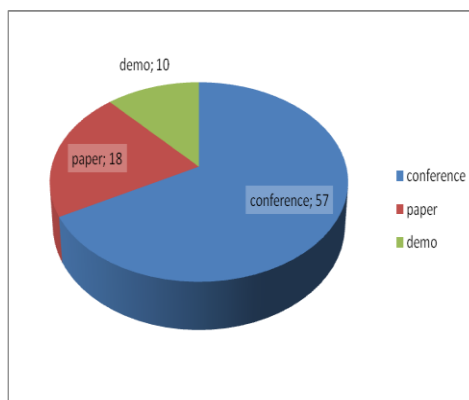
- Significant amount of contributions to DVB-T2 Lite and DVB-NGH standardization
- Channel model creation for MIMO and LMS (Land mobile Satellite) scenarios
- Studies on DVB-NGH building blocks, such as SC-OFDM, MIMO, TFS, SVC with multiple PLPs among others
- Studies on emerging technologies
 - Convergence of broadcast and mobile networks
 - Spectrum white space utilization
- Collecting simulation, lab and field trials on DVB-T2, T2 Lite and NGH
- 11 prototypes - commercial product already during the project
- Field and laboratory measurement campaigns

Dissemination presentations on major broadcast events and scientific forums (conferences, journals)

Main Focus

- Supporting worldwide deployment and DVB effort of high capacity broadcast networks (DVB-T2/T2Lite/NGH) for hybrid fixed-mobile reception scenario (DVB-T2Lite) or next generation Handheld (DVB-NGH).
- Development, verification and validation of Technical Concepts and Elements coming from expected DVB-NGH « Next Generation Handheld » standard (MIMO techniques, verify the use of TFS)
- Verification and validation of full DVB-T2 “Second Generation Terrestrial” standard (verify TFS parts of DVB-T2 specs, MPLP, PAPR features)

	DVB-T2	DVB-T2 Lite	DVB-NGH <small>NEW GENERATION HANDHELD</small>
System architecture		✓	✓
Prototyping / Laboratory Validation	✓	✓	✓
Experimentation	✓	✓	



ENGINES

Project ID: CP7-005

Start Date: 1 January 2010

Completion date: 31 Dec 2012

Partners:

- Abo Akademi University, FI
- Abertis Telecom, SP
- Axel Technologies, FI
- BBC, UK
- CNES, FR
- DiBcom, FR
- Digitalist, FI
- Digita, FI
- Elektrobit, FI
- ENENSYS Technologies, FR
- France Telecom R&D, FR
- Hispasat, SP
- INSA/IETR, FR
- Integrasys, SP
- Media Broadcast, DE
- Mier Comunicaciones, SP
- Mitsubishi Electric R&D, FR
- Nokia, FI
- RAI, IT
- Sony SDC, UK
- Suomen Schneider, FI
- Tampere University of Technology, FI
- TDF, FR
- Teamcast, FR
- Telecom Bretagne, FR
- Teleste, FI
- Teracom, SE
- Thomson Broadcast, FR
- Turku University Applied Sciences, FI
- Universidad del Pais Vasco, SP
- University of Turku, FI
- Univer. Politecnica de Valencia, SP
- Universidad Ramon LLull, SP

Coordinator

Jani Väre, Nokia, Finland
e-mail: jani.vare@nokia.com

Project web Site

www.celtic-engines.org

Standardization contributions

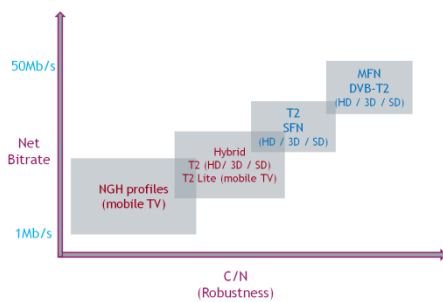
DVB-T2 LITE DVB-NGH

Designed to address the new mobile broadcast services

It is expected that by the 2015 timeframe, Rich Media content consumption will increase several-fold and the content will be consumed using a variety of devices. To facilitate this Rich media content consumption, an efficient, flexible and robust Next Generation Handheld (NGH) system is needed to accompany digital switchover and convergence of fixed and mobile services as well as telecommunication services.

DVB-T2Lite (2011) standard and DVB-NGH specification are designed to operate at least in the frequency bands III, IV and V, L-band and S-band.

DVB-NGH is designed to operate with RF channel bandwidths of 1.7, 5, 6, 7, 8, 10, 15 and 20 MHz. It shall meet interference levels and spectrum mask requirements as defined by GE06 (and hence not cause more interference than DVB-T or T-DAB would do).

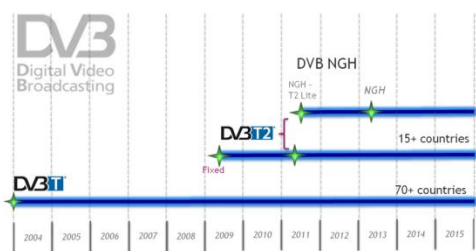


Contributions through ENGINES and outputs to standardisation bodies

In order to fulfil the NGH commercial requirements, the DVB Project issued a Call for Technologies in Nov. 2009. This call intended to invite technology inputs that would facilitate an appropriate NGH physical layer on which a successful full NGH system could be built.

33 proposals were submitted to the CfT, out of which 26 from 19 ENGINES Project Partners. During the standardization process over 100 technical contributions were presented to DVB by the ENGINES Project Partners.

Main studies: MIMO - PAPR - Rotated Constellation - Modulation - T2 / NGH compatibility - TFS - ROHC- Physical layer inter-leaver, BBiFEC - Turbo codes - SC OFDM frame (satellite and hybrid terrestrial/satellite) - T2 functional improvement for mobile performance - Synchronisation mechanisms - FEF



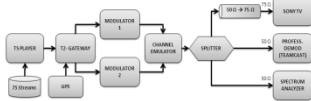
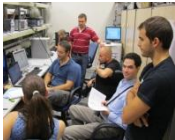
Terrestrial broadcast Access categories	Reception conditions (in the service area)	Full service (terminal) Max. Speed	Typical Service bit rate	Receiver Screen dimension	Receiver Antenna/Power source
Portable access	Indoor and Outdoor	0 to 15 km/h	SDTV 4 to 1 Mbps <i>(HDTV possible)</i>	Portable set 5 to 19 inch	Wireless, Embedded antenna with external power source with internal backup
Slow mobile access	Indoor and Outdoor	0 to 15 km/h	Mobile TV	Telco Handset 2,5 to 5 inch	Wireless, Embedded antenna with internal power source (Battery)
Mobile vehicular access	In-vehicle	15 to 350 km/h	Mobile TV	Telco Handset 2,5 to 5 inch	Wireless, Embedded antenna with internal power source (Battery)
	Outdoor		Mobile TV	Fixed/Portable 5 to 19 inch	Vehicle mounted antenna with power from vehicle battery



Achievements highlights

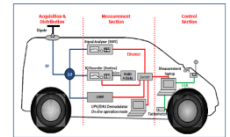
Plug fests

- ✓ Two Plug Fests carried out
 - ✓ Oct. 2011 (Barcelona) - “DVB-T2 Advanced Features Lab Test”
 - ✓ Features tested: PAPR, Null FEFs, Multiple PLP, SFN, T2-MI.
 - ✓ Sep./Dec. 2012 (Barcelona/Rennes) - “NGH-Ph.1 Lab Test”
 - ✓ Features tested: T2-Lite, Mixed T2-Base/T2-Lite, SFN, SC-OFDM.



Measurement campaigns

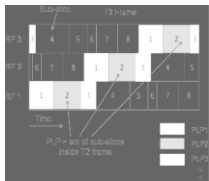
- ✓ Two Measurements Campaigns carried out
 - ✓ Nov. 2011 (Barcelona) - “DVB-T2 Advanced Features Field Trials”
 - ✓ Features tested: Multiple PLP.
 - ✓ Sep./Oct. 2012 (Barcelona) - “T2-Lite Field Trials”
 - ✓ Features tested: T2-Lite, Mixed T2-Base/T2-Lite, SFN



Simulation and Validation

Test of TFS (Time and Frequency Slicing)

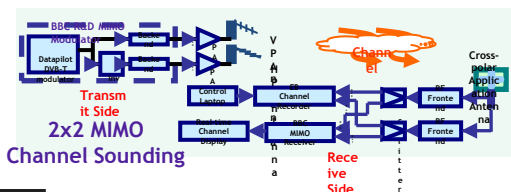
TFS consists of sending a large content streams (up to 200MB/s) across several discontinuous UHF frequencies. This allows to average the SNR and gain bitrate in channel with higher propagation loss.



	Max. freq. difference	TFS Gain		TFS Gain Equivalent SNR	
		Average SNR	SNR + 6 dB	SNR + 12 dB	SNR + 20 dB
A	128 MHz (16 Channels)	4.8	4.4	4.0	3.8
B	272 MHz (34 Channels)	6.4	5.5	4.7	4.4
C	320 MHz (40 Channels)	3.0	2.8	2.8	2.5
D	256 MHz (32 Channels)	5.7	5.2	4.5	4.3
E	192 MHz (24 Channels)	5.4	4.8	4.3	4.1
F	208 MHz (26 Channels)	5.0	4.5	3.9	3.8

MIMO channel modelling and validation of MIMO schemes for DVB-NGH

- ✓ 2x2 MIMO channel sounding in Helsinki (2010)
- ✓ Simulation of MIMO coding schemes for DVB-NGH



Prototypes

11 prototypes, from 15 contributing organisations



Teamcast DVB-T2 modulator



Teamcast DVB-T2 demodulator

Thomson Broadcast DVB-T2 transmitter



Mier DVB-T2 transmitter



Mier DVB-T2 gap filler



LaSalle DVB-T2 Gateway



ENGINES – List of deliverables

- D01 Project promotion brochure
 D03 Project Progress Report 2011
 D04 Project Final Report
 D05 Project results brochure
- D2.1 Report on DVB-NGH System architecture (D)
 D2.2 Report on DVB-NGH receiver issues (D)
 D2.3 Report on advanced concepts for DVB-T2 (D)
 D2.4 Report on novel access technologies in broadcasting frequencies (D)
 D2.5 Report on end-to-end system integration (D)
- TR1.1 Interim report DVB-NGH Concepts (M)
 TR2.1 Interim report 1 Receiver algorithms (M)
 TR2.2 Interim report 2 Receiver algorithms (M)
 TR3.1 MIMO channel models (M)
 TR3.2 Interim report MIMO concepts (M)
 TR4.1 Interim report 1 Hybrid access technologies
 TR4.2 Interim report 2 Hybrid access technologies (M27)
 TR5.1 Interim report Cognitive radios (M)
 TR5.2 Final report Cognitive radios (M)
 TR6.1 Interim report 1 End-to-end system integration (M)
 TR6.2 Interim report 2 End-to-end system integration (M)
 TR7.1 Interim report on use-cases and scenarios associated to CBS (M)
 TR7.2 Final report on use-cases, scenarios and impact on architecture associated to CBS (M)
- D8.1 DVB-T2 interoperability Tests
 D9.1 Comparison of simulation, lab and field measurements
 D9.2 Evaluation on NGH
 D9.3 Network structure requirements for T2 and NGH
 D10.1 IDENTIFICATION AND SPECIFICATION OF "FULL T2" PROTOTYPES TO BE BUILT
 D10.2 IDENTIFICATION AND SPECIFICATION OF "NGH-PH.1" PROTOTYPES TO BE BUILT
 D10.3 Full T2 prototypes
 D10.4 NGH-Ph.1 prototypes
 TR11.1 DVB-T2 Advanced Features Test Plan
 D11.1 DVB-T2 Advanced Features Lab Test Report
 TR11-2 NGH-Ph.1 Lab test validation plan
 D11.2 NGH-Ph.1 Laboratory Test Report
- TR12.1 DVB-T2 ADVANCED FEATURES TEST PLAN
 D12.1 DVB-T2 Advanced features test report
 TR12.2 T2-LITE FIELD TRIALS PLANNING
 D12.2 FIELD TRIALS FOR TESTING T2 LITE AND MIXED T2 BASE / T2 LITE RECEPTION IN URBAN MOBILE SCENARIOS
 TR13.1 TIME-FREQUENCY SLICING (TFS) ANALYSIS, MEASUREMENTS AND SIMULATIONS
- D14.B Dissemination activity
 D15.B DVB-T2 and DVB-NGH standardisation activity
 D14.C Dissemination activity
 D15.C DVB-T2, DVB-T2Lite and DVB-NGH standardisation activity

Download: www.celtic-engines.org

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New book

Next generation Mobile Broadcasting - book with important contribution from Engines

Editor: David Gómez-Barquero
 Published 14 March 2013

