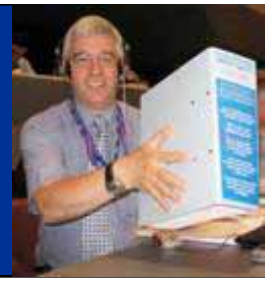
Fondazione Ugo Bordoni
Seminar “Radiofonia digitale”
30 June 2008, Rome



Pathways to Digital Radio Broadcasting in Europe

Nigel Laflin

Head of Spectrum Management, BBC Distribution
Chairman of EBU Spectrum Management Committee
Chairman of CEPT Project Team FM PT45 (broadcasting issues)

The views expressed in this presentation are those of the author and do not necessarily represent those of the BBC

Outline of presentation requested topics

- DAB, DAB+, DMB, DRM, DRM+, SDR, DVB-H, Visual Radio, and analogue radio broadcasting
- Focus topics
  - Spectrum allocation for the different services (in particular as regards Band III and Band L) and harmonization of spectrum policies
  - Impact of GE06 on resource planning for digital radio broadcasting
  - Radio broadcasting over IP (web-radio, etc.)
  - Foreseen timelines for digital radio broadcasting to take up in Europe, with some mention of what's happening outside Europe

Many ways to listen

- Analogue Radio
- DAB Digital Radio
- Digital Television
- Internet
- Podcasts & Downloads
- Mobile Phone
- Satellite Radio

Broadcasters need all platforms

Early beginnings
the founder

Guglielmo Marconi pioneered the use of radio waves from 1896

In 1922 Marconi's firm joined a consortium of wireless manufacturers that created the British Broadcasting Company

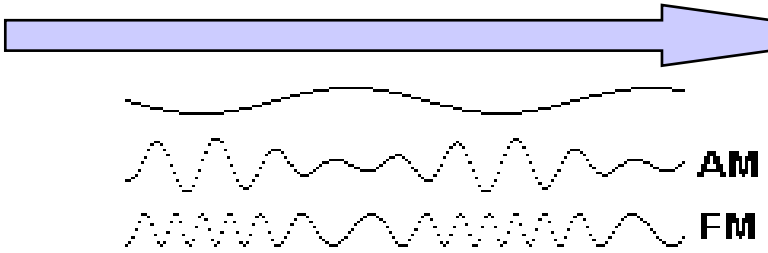
The company became the corporation by royal charter on January 1st 1927

Development of radio systems

Analogue Radio

AM

1906



FM

~1955

(published: 1936)

DAB transmission system

DAB Audio → **DAB-IP** → **T-DMB** → **DAB+**

1993

Radio

+Associated data, traffic information

6-9 prog. per mux

2005

Multimedia

2005

Mobile TV

3-4 prog. per mux

Visual radio

6-9 prog. per mux

2007

Radio

+Associated data, traffic information

15-27 prog. per mux

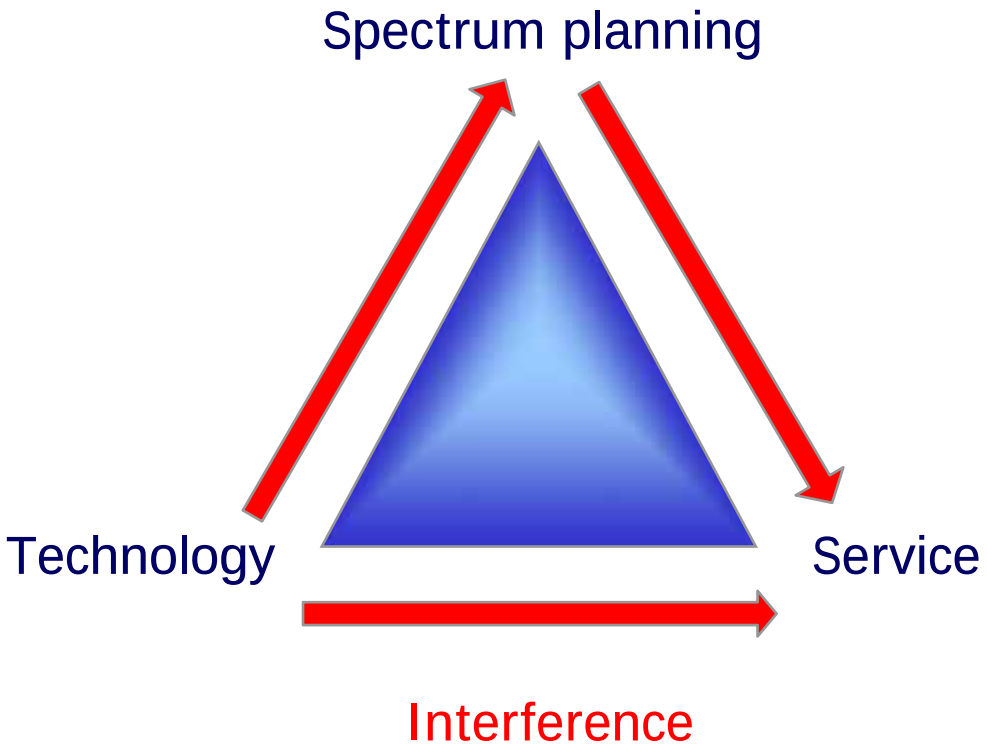
Radio Broadcasting is important

- Most people don’t listen on their computer
  - in cars
  - in the kitchen, bathroom, garden, in bed
  - at the factory, farm or building site
- Most people listen when they are busy
  - so listening needs to be easy

"People listen to radio to take their mind off the things they are doing; they watch TV to take their minds off the things they are not doing." (Patrick Barwise, LBS)

What determines success for new broadcasting services?

- Good technology
- Widespread coverage
- Affordable receivers
- Attractive content

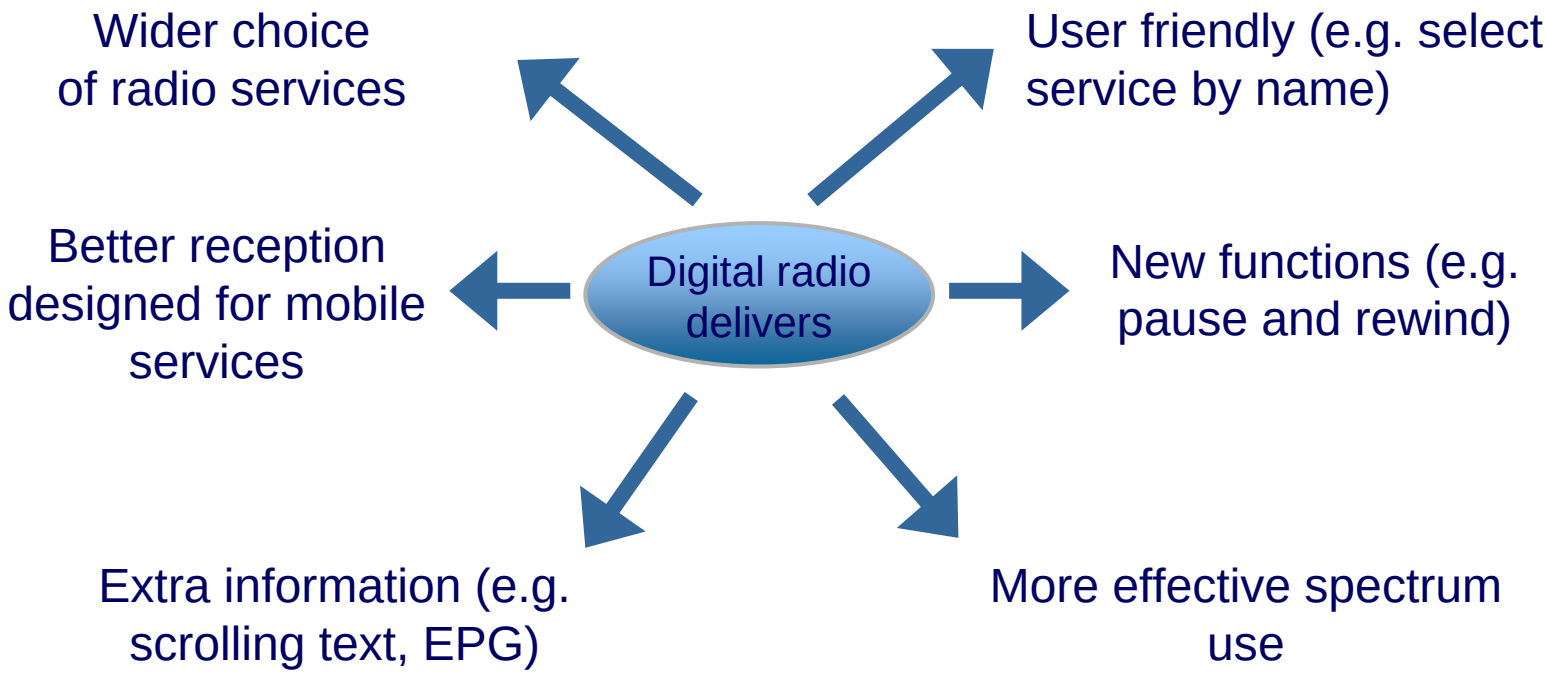


Which technology?

- Most users don't care much, providing
  - its easy to use
  - there's content they like
  - its affordable
- Most content providers don't care much, providing
  - They have advantages over competitors
  - They have an audience
  - Its not too costly for their business

The benefits of digital radio

Digital radio provides a number of benefits to consumers and to the UK as a whole, compared to analogue



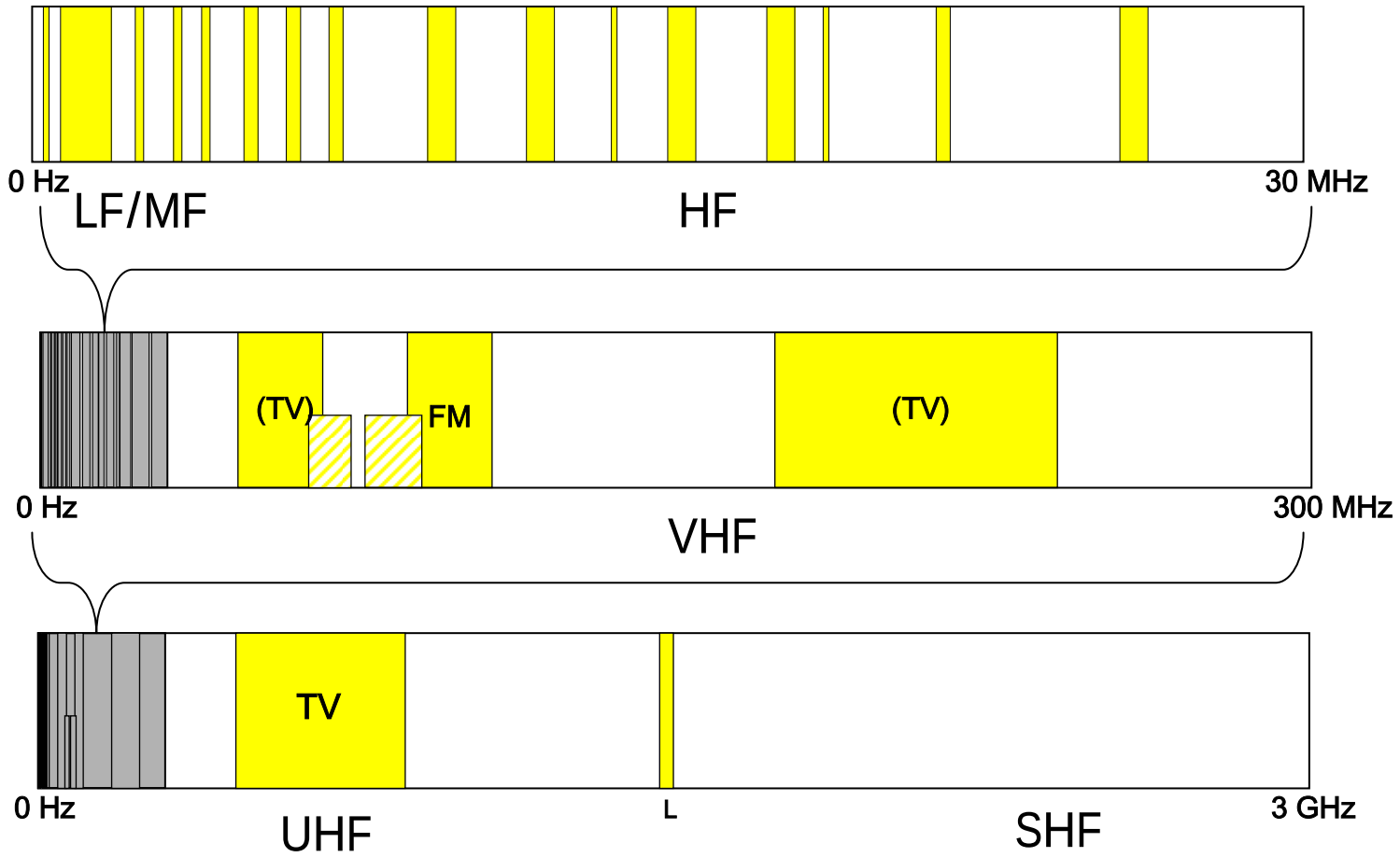
How important is terrestrial broadcasting?

- Requirements differ from country to country depending cultural requirements, national, regional, local coverage
- Terrestrial is probably the platform where broadcasters are in the best position to control delivery of their channels
- Terrestrial broadcasting can reach ”everybody” - if sufficient spectrum is available Terrestrial platform necessary to deliver portable and mobile services
- The terrestrial platform should be attractive in order to compete with other platforms

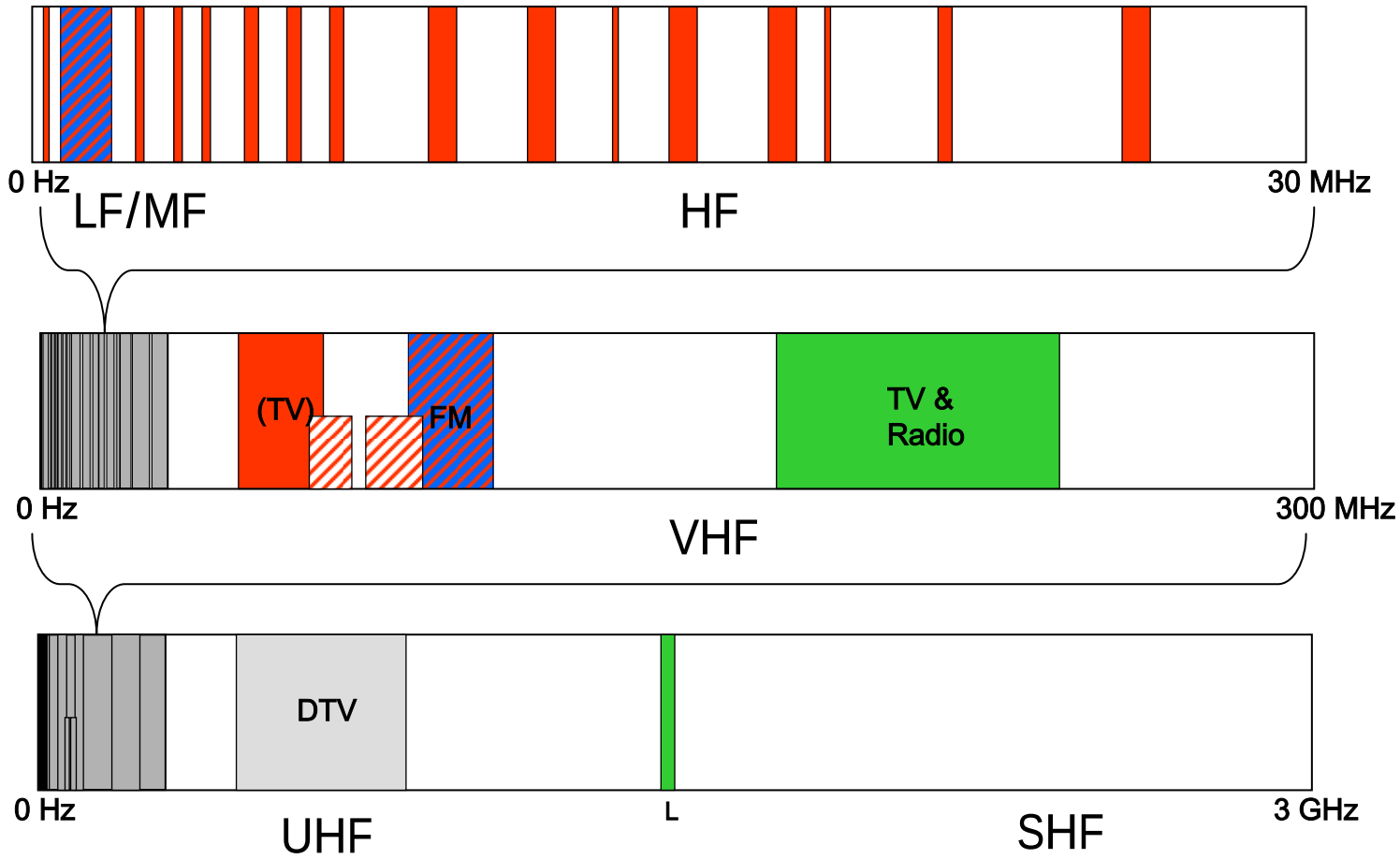
Frequency bands suitability for radio broadcasting

Band	Systems	Coverage
LF	AM DRM	Country wide. Some reduction of coverage at night due to reflections from the ionosphere.
MF	AM DRM	Regions of a country. Night time coverage is reduced by signals reflected from the ionosphere
HF	AM DRM	Long distance coverage. Range of frequencies needed to provide coverage during the day, night and year
VHF	DAB, DRM	Coverage up to around 50 to 70 km radius. For short time periods suffers long distance interference
UHF	DVB, DAB DSB	Similar to VHF requires many filler stations to overcome obstructions from the attenuation of terrain features.
SHF	DSB	Need line-of-sight path, signals blocked by buildings or other objects.

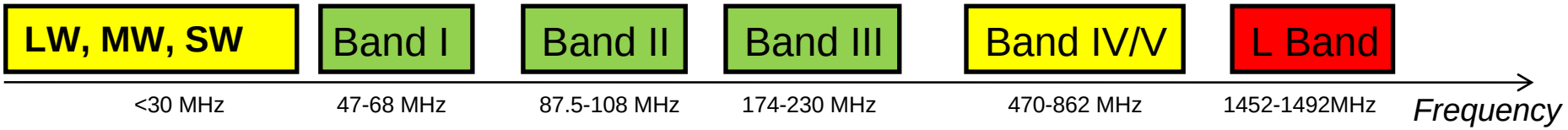
Spectrum:
the broadcasting bands



Spectrum:
the broadcasting bands for digital radio



Importance of frequency



Low frequencies

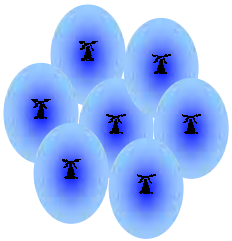
High frequencies

Antenna size

Big antennas

Small antennas

Network costs



Large coverage

Limited coverage
= more transmitters needed

A fast changing market situation

- A variety of standards for digital radio exists
  - DAB, DAB+, DMB
  - DRM, HD-Radio
  - DVB-T, -S, -SH, -C
- Multi-function equipment including radio
  - TV's, PCs mobile phones MP3 players...
- Growing importance of Internet Radio
- Changing ways of using radio

The DAB family

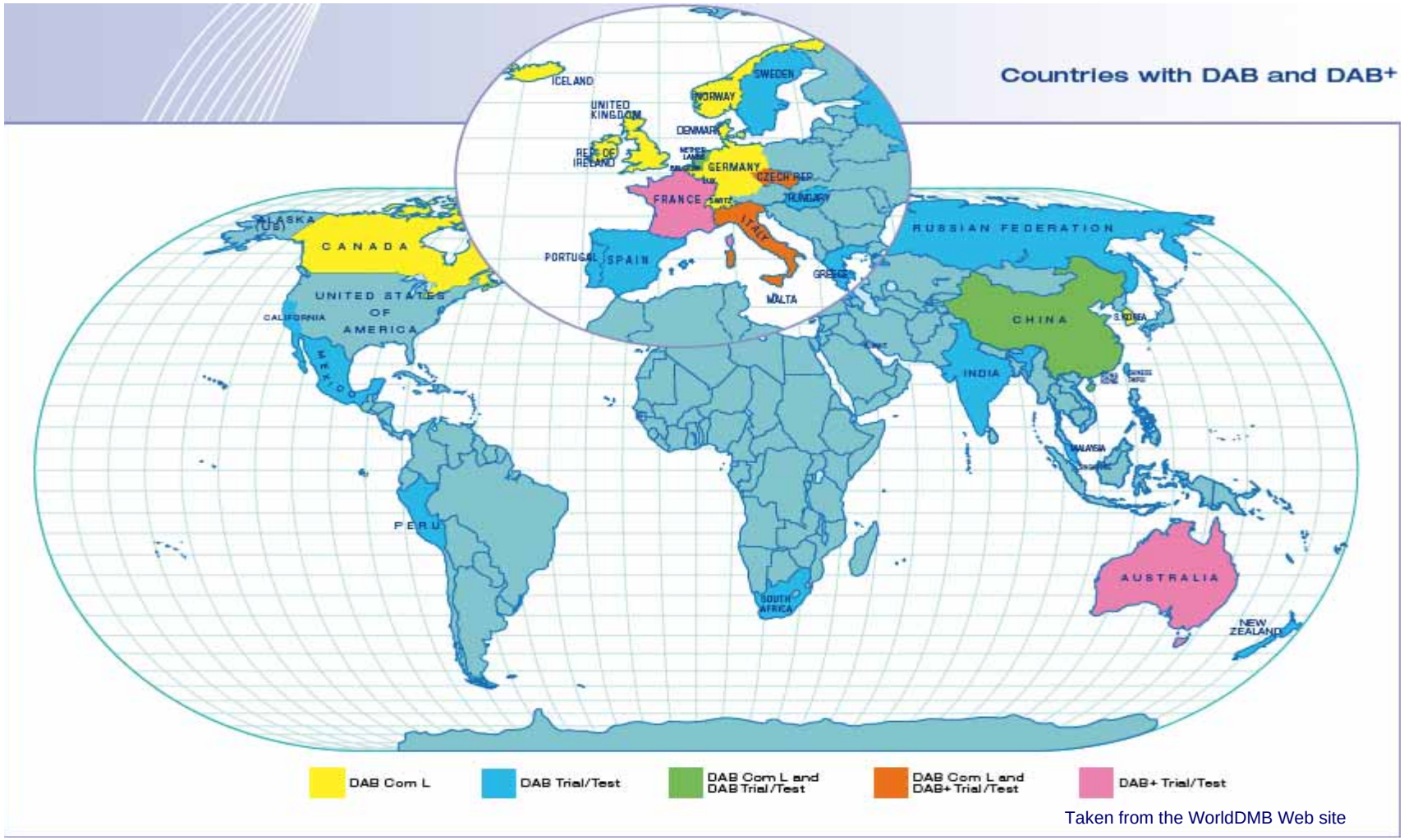
- DAB, DAB+, DMB, DAB-IP are complementary and have been scaled for radio (DAB/DAB+) and mobile television broadcasting (DMB/DAB-IP)
- All rely on the same DAB transmission layer and so can co-exist inside the same multiplex without compatibility problems
- The ability of DMB and DAB-IP to carry video stream means they can both be used for radio with pictures (so called “visual radio”)

DAB MPEG1L2 Audio, pictures, text, EPG, service linking, BWS, TPEG

DAB+ HEAACv2 Audio, pictures, text, EPG, service linking, BWS, TPEG

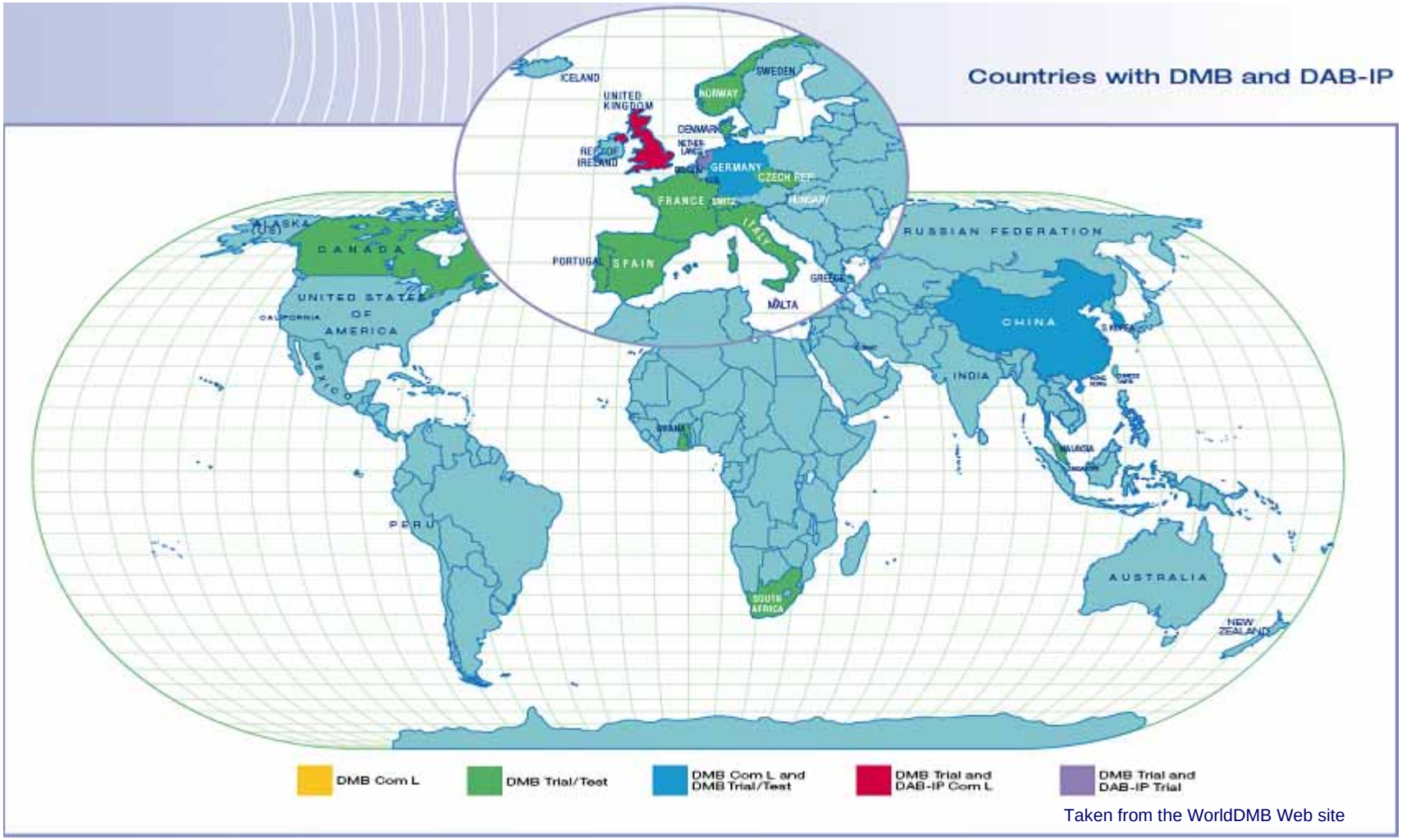
DMB H.264 video, AAC/BSAC audio, BIFS data

Countries with DAB and DAB+



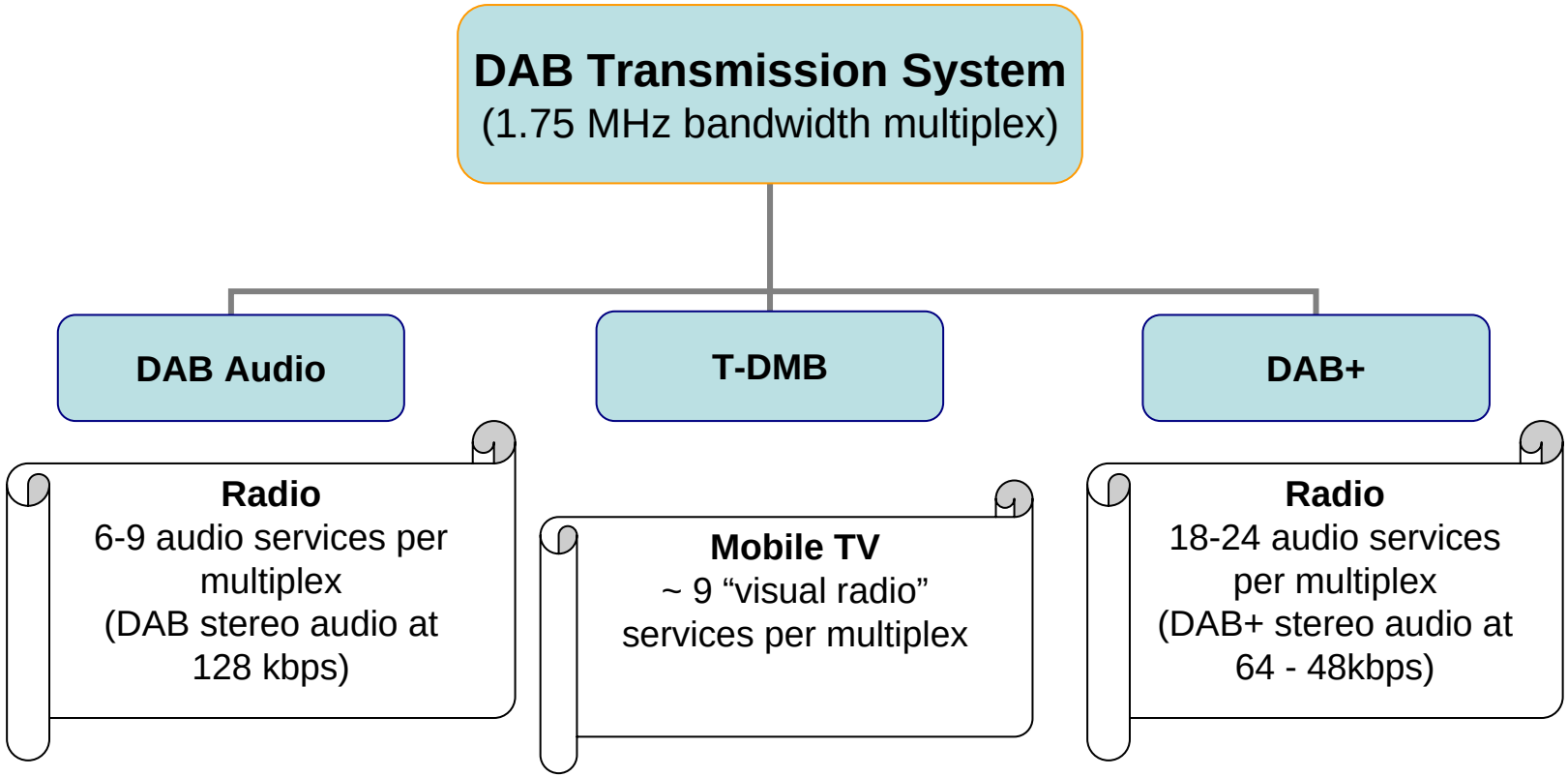
Taken from the WorldDMB Web site

Countries with DMB and DAB-IP

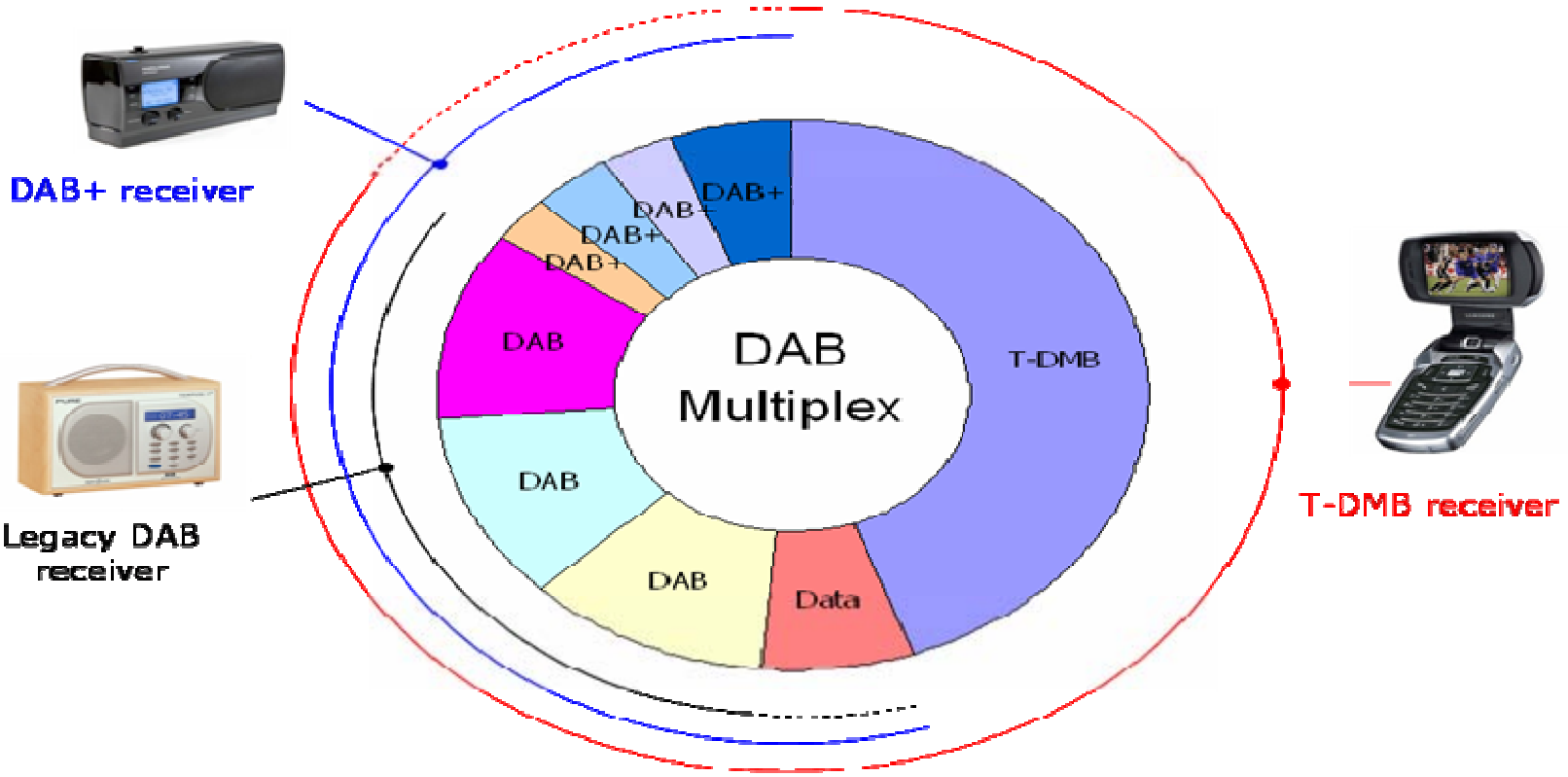


Taken from the WorldDMB Web site

Mobile Radio & Multimedia
basic assumptions to derive service demands



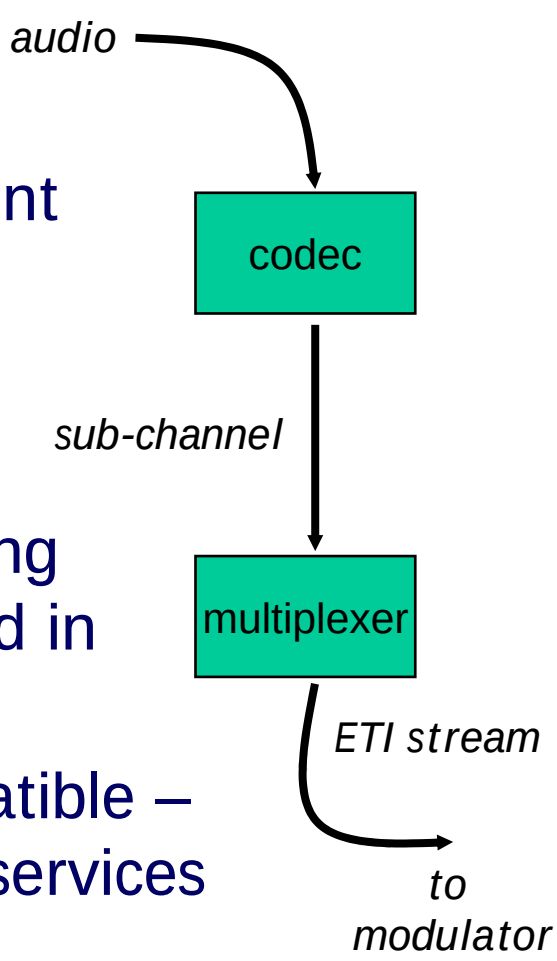
DAB multiplex composition example



- DMB receivers can receive DMB video and DAB audio
- DAB+ receivers do both DAB+ and DAB
- Original DAB receivers are not upgradeable to either DMB or DAB+

What is this DAB+?

- DAB+ is not a new technology – it's an extension to the existing DAB standard
- All it does is to permit the use of a different audio codec
- No change in the transmission
- No need for new transmitters
- Only impact on existing services on existing receivers is if services have to be removed in order to make space for new services
- Existing receivers are not forwards-compatible – so new receivers will be needed for new services



Audio quality for DAB and DAB+
Sample audio clips

DAB

- MP2 the original audio coding system
  - 98% of stereo stations using a bit rate of 128 kbit/s with the MP2 audio codec

DAB +

- HEAAC incorporates Spectral Band Replication (SBR) and Parametric Coding to provide greatly improved coding efficiency
  - tests by the European Broadcasting Union indicated that HE-AAC at 48 kbit/s provided "Excellent" quality

DMB for Radio

- DMB uses MPEG TS for both audio and video components
- France has embraced the “DAB Family” and plans to use “DMB Audio”
  - Accords to the ETSI DMB standard (ie video + audio streams) but allows “video at 0kbit/s”
  - BIFS channel required for any rich text etc.
- Basic audio-only receivers can be made at a small increased cost to DAB+ (no text, pictures, etc)

DAB, DAB+ or DMB?

- Different versions of the DAB Family will be used across Europe (and the world)

- DAB will not be a complete success until cars include factory-fitted DAB as a standard
- Car manufacturers are keen to include DAB, but have stalled because of confusion caused by multiple standards (DAB, DAB+ and DMB)

- WorldDMB recognises that DAB, DAB+ and DMB are all part of the same standard and is working with EBU and EICTA in communicating some clarity

WorldDMB Recommendation for DAB and DMB services

After careful consideration technical issues in June 2007 of the, receiver industry, broadcaster content requirements and consumer markets, WorldDMB concluded

- **audio-centric services should be delivered using DAB or DAB+**
- **video-centric services should be delivered using DMB**

DAB can be successful

- The UK is positive proof
- Denmark: 35 of homes use DAB
- Norway, Switzerland also successful
- Korea DMB is successful

but...

Broadcasters are confused by the DAB/DAB+/DMB options and consequently of the best way forward for them

DAB success in the UK

- 28% of all homes have DAB (source: RAJAR Q1/08)
- 15 million listeners use DAB radios
- 11% of all radio listening is via DAB (source: RAJAR Q1/08)
- DAB is the most popular digital radio platform
- Content choice is the number one consumer driver
- Ease of use, reception quality, audio quality and text features rate very highly
- 7 million DAB receivers sold to date (source: GfK)
- DAB receivers are cheap – from £18 (€23)

DAB vs Local Radio Coverage - current

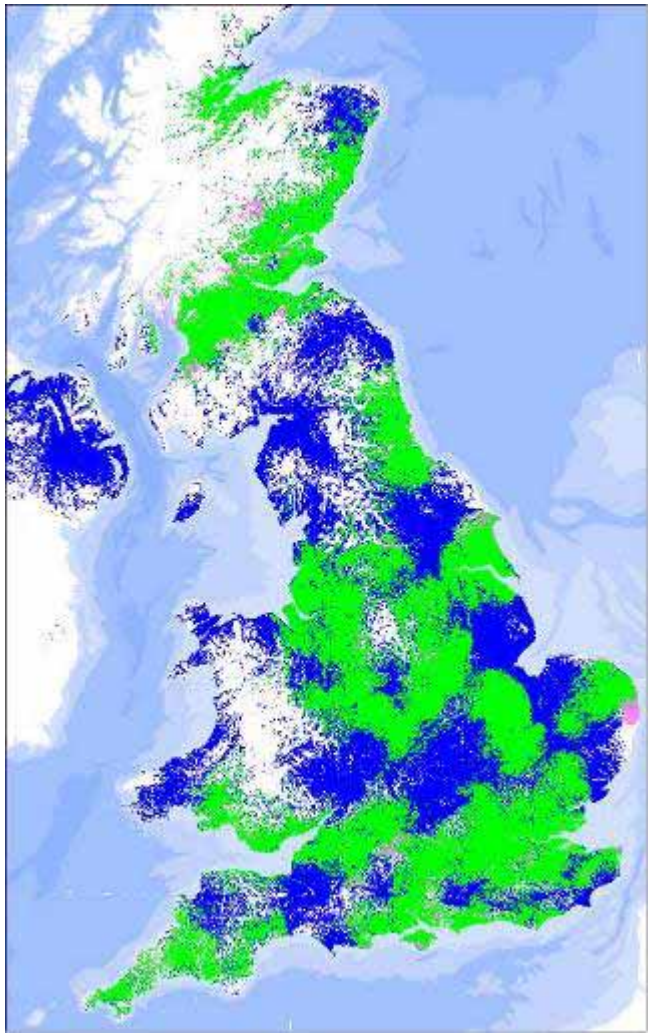
Currently the BBC is covering 86% of the UK population and has secured funding to extend to 90%.

Key

Green BBC network and local radio available on DAB

Blue BBC network on DAB only

Pink BBC Local Radio on DAB only



Digital Radio listening in the UK
Share of audience by platform

	Share of all radio	Home penetration	Notes
FM/AM	82%	99%	In decline
DAB	11%	28%	2/3 of all digital listening
Digital TV	3%	85%	Satellite + DTTV
Internet	2%	70%	Streaming + Podcast

Adjusting the share % to account for differing home penetration % shows that DAB is

10 x more popular than DTV

13 x more popular than radio via the internet

(source: RAJAR March 08)

Résumé on the DAB family

- It is currently considered that there will be no single winning standard for digital radio, DAB, DMB and even DVB may have a role
- Radio broadcasters will move beyond audio-only to produce programme associated graphics and video content in order to play a key role as providers of multimedia content to digital platforms
- Whatever mainstream system is adopted, DAB or DMB, in assessing the longer term needs it is necessary to allocate sufficient spectrum to broadcasting services to support technology upgrades

Frequencies
Why Broadcasters have Conferences?

- Broadcasters have to co-operate internationally
- The broadcasting requirements are different to other radio users
  - Economics dictate high powers transmitters to cover large areas and to facilitate cheap receivers
  - Potential interference at long distances require agreements for interference avoidance between broadcasters and users of other services
  - Equitable access is a major issue

Current ITU Broadcasting Agreements

ST61 Stockholm 1961, television and sound broadcasting in the European broadcasting area, revised Geneva, 2006 - now only covers analogue TV in Band I, II and III (162-174 MHz)

GE75 Geneva 1984, Broadcasting Service in the MF Bands in Regions 1 and 3 and in the LF Bands in Region 1.

GE84 Geneva 1984, VHF Sound Broadcasting (Region 1 and Part of Region 3) in Band II

GE06 Geneva 2006, digital terrestrial broadcasting services in Region 1 and in the Islamic Republic of Iran, in the bands 174 - 230 MHz and 470 – 862MHz

International Regulation
RRC-06 and the GE06 Agreement

- The Regional Radio Conference 2006 (RRC-06) development of terrestrial broadcasting towards an all-digital future through the GE06 Agreement
- Frequency plans that allow for digital transmission: T-DAB and DVB-T in Band III and DVB-T in Bands IV and V with a transition period from 2006 to 2015
- The digital dividend is the spectrum made available over and above that required to accommodate the existing analogue television services in a digital form, in VHF (Band III: 174-230 MHz) and UHF bands (bands IV and V: 470-862 MHz)
- The 'Mask' concept devolved during RRC-06 facilitates the introduction of alternative technologies

Special Broadcasting Arrangements for CEPT countries

WI95 Wiesbaden 1995 provided two T-DAB layers on the basis of national requirements either in VHF Band III or the 1.5 GHz band

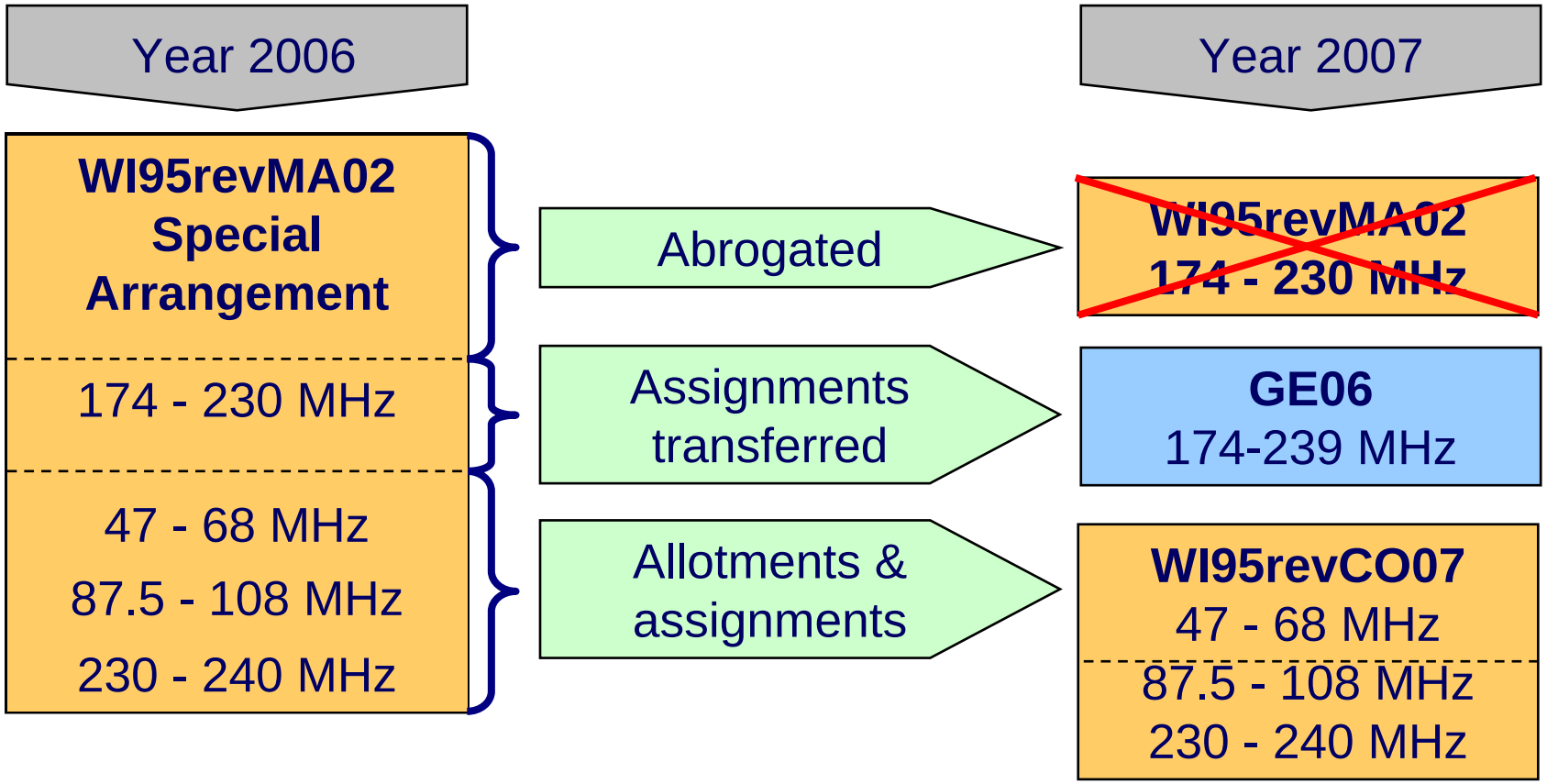
MA02 Maastricht 2002 provided one additional T-DAB layer in the 1452 – 1479.5 MHz band and all the L-band plans were incorporated in the agreement

WI95revMA02 Maastricht 2002 revision of WI95 containing only VHF provisions

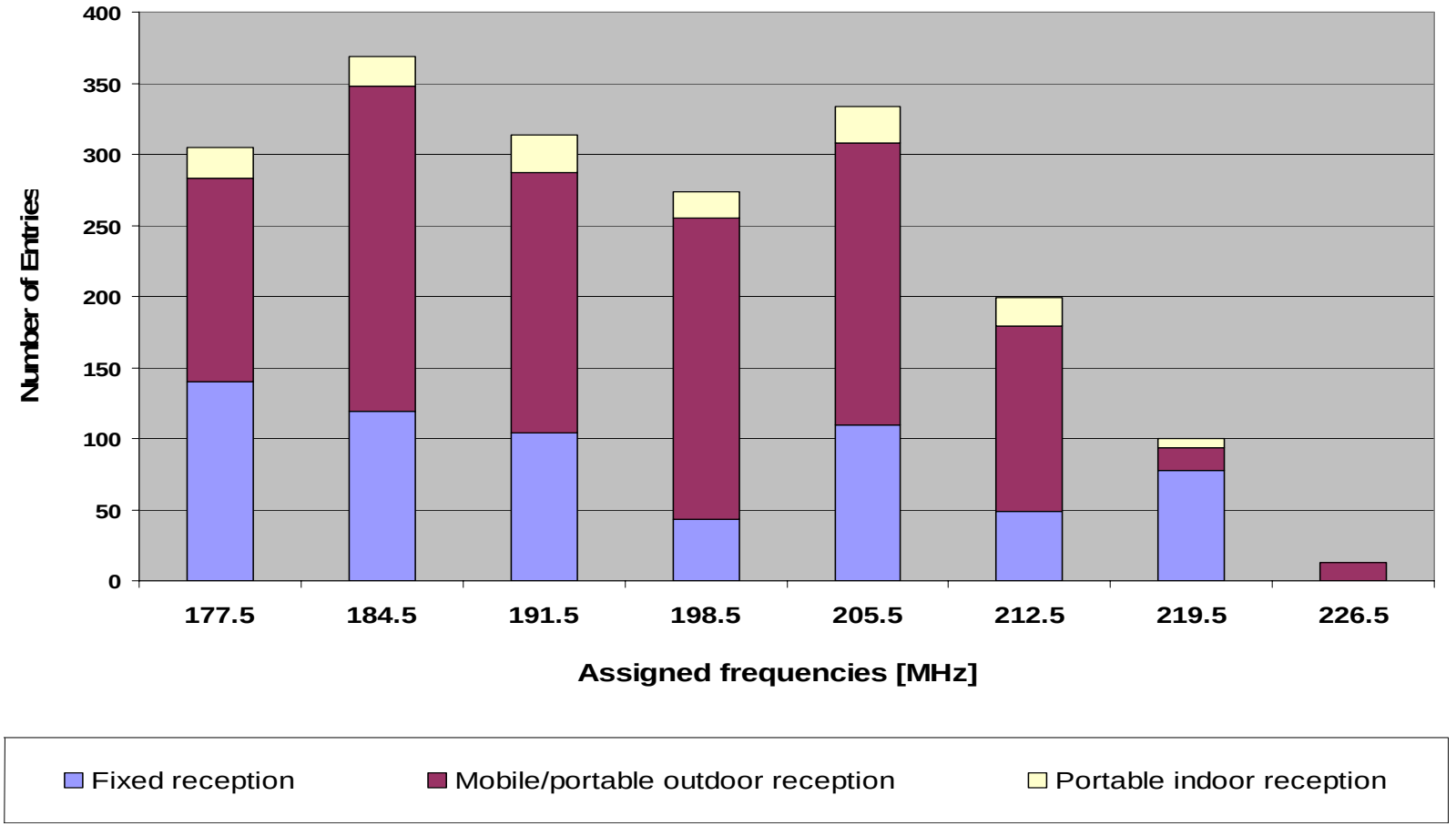
MA02revCO07 Constanta 2007 revision of MA02 with provisions for mobile multimedia services

- application of the envelope concept
- aggregation of T-DAB blocks to accommodate wider bandwidths

Special Broadcasting Arrangements for CEPT countries VHF Bands

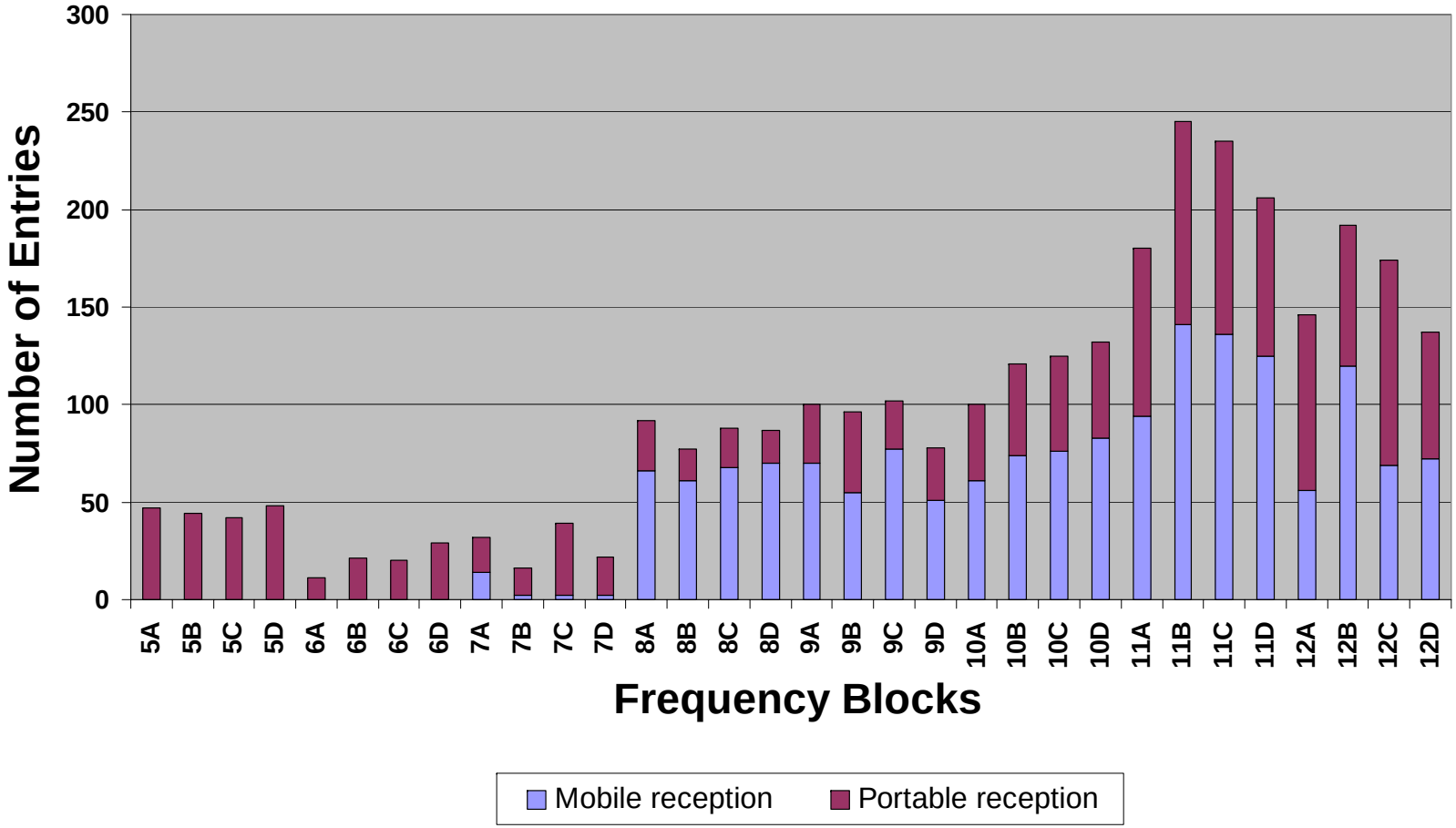


GE06: indicated channel usage in Band III for DVB-T 7 MHz channels in CEPT countries



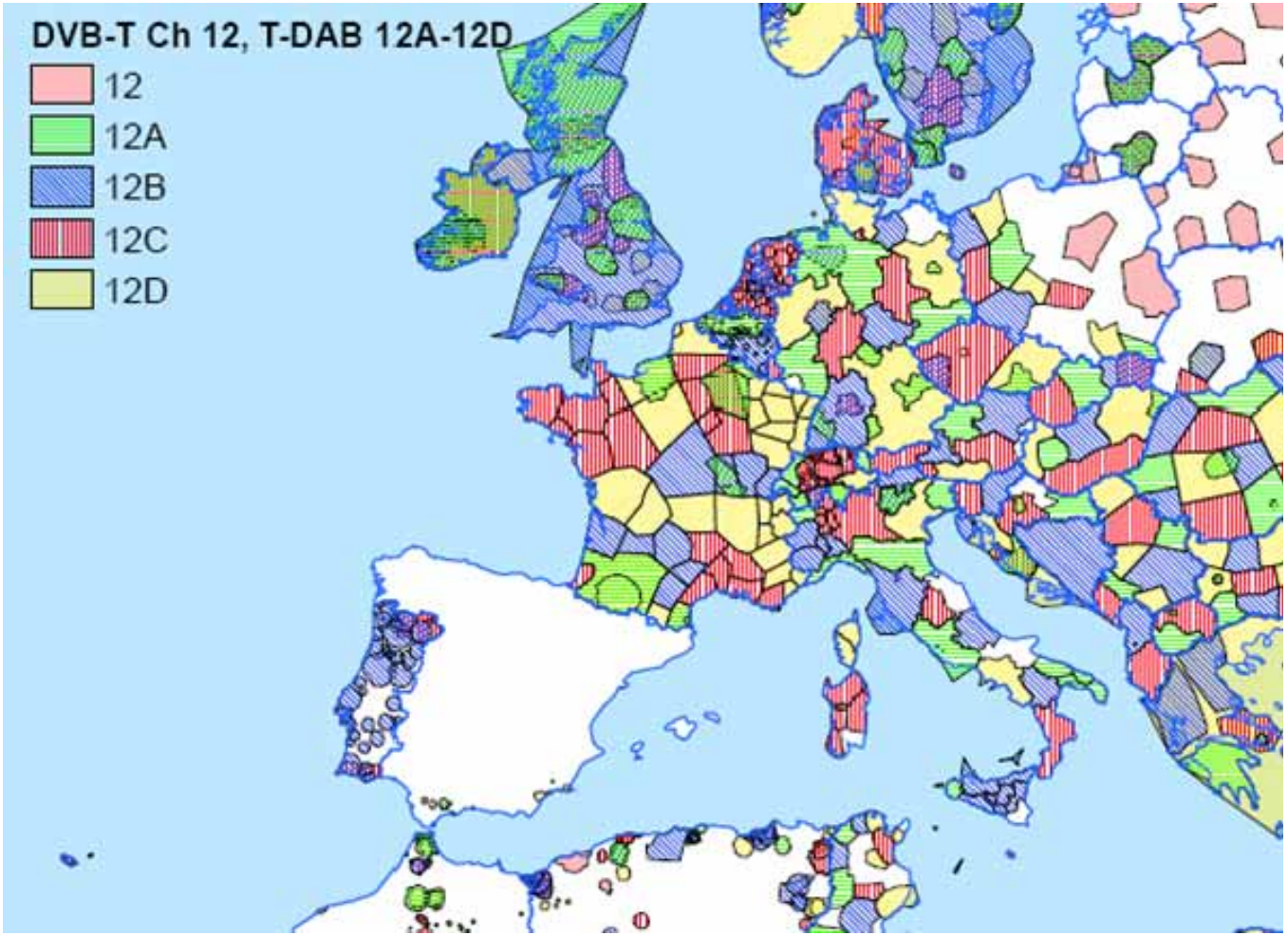
Source: EBU Technical Department

GE06: indicated channel usage in Band III for T-DAB in CEPT countries

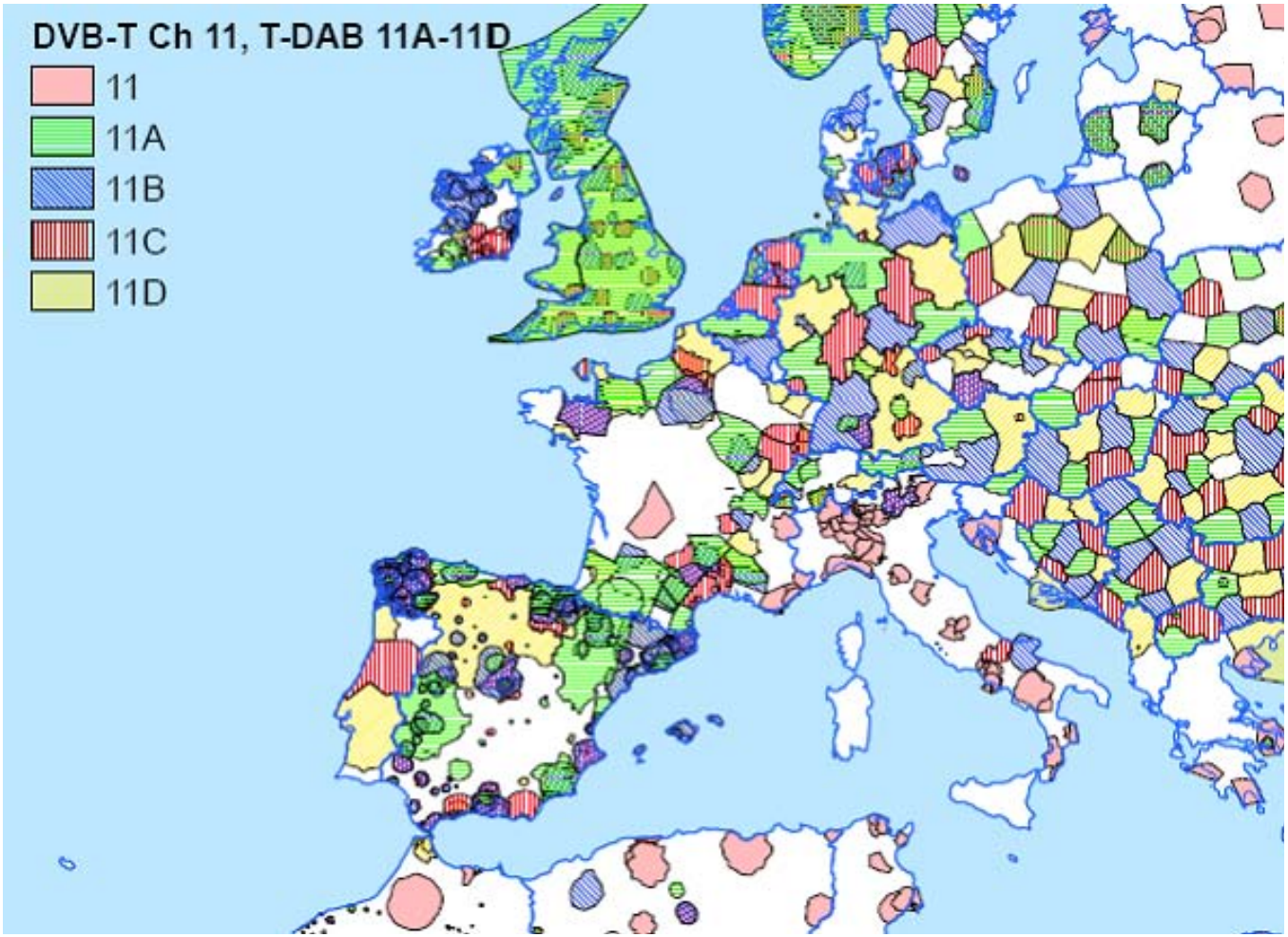


Source: EBU Technical Department

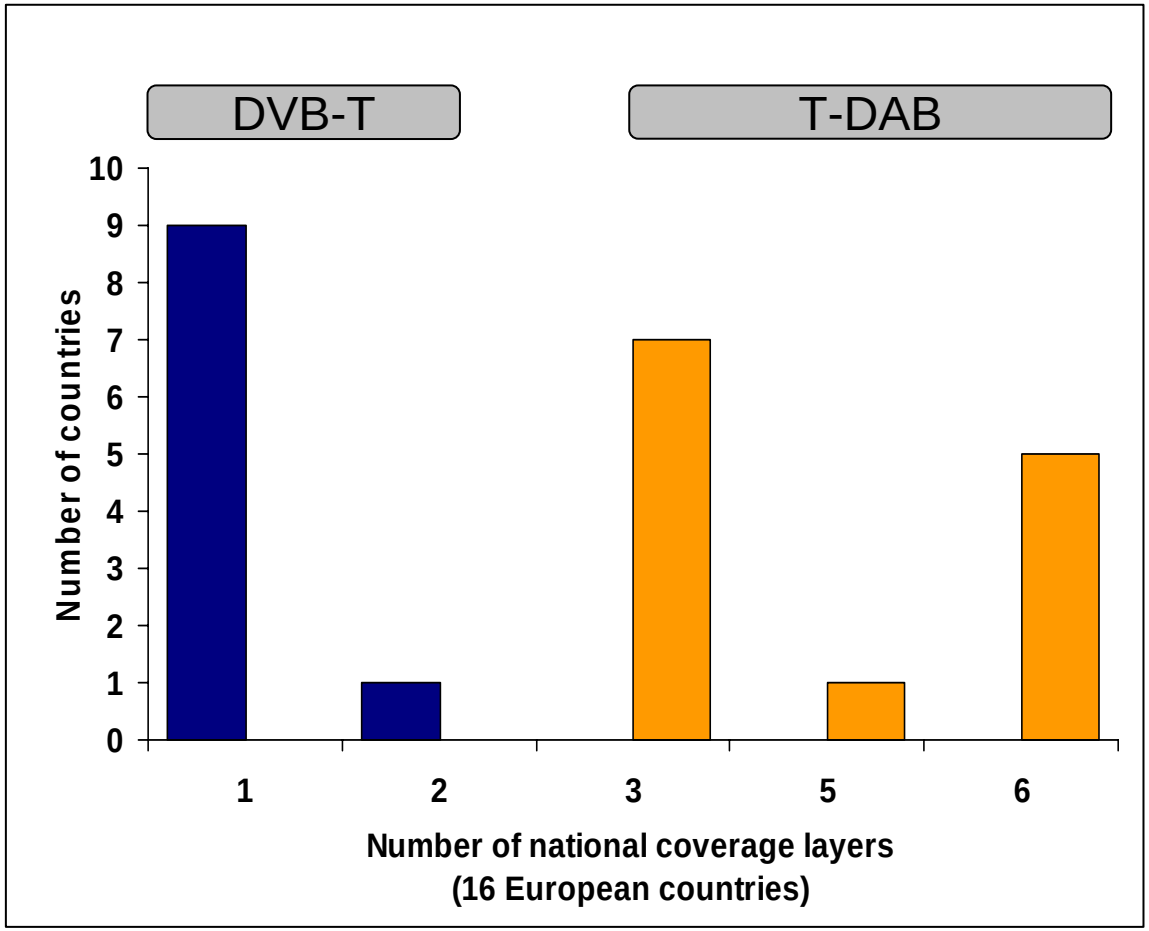
GE06 Frequency Plan for Band III, Channel 12



GE06 Frequency Plan for Band III, Channel 11



GE06 plan
Capacity of band III for broadcasting in Europe

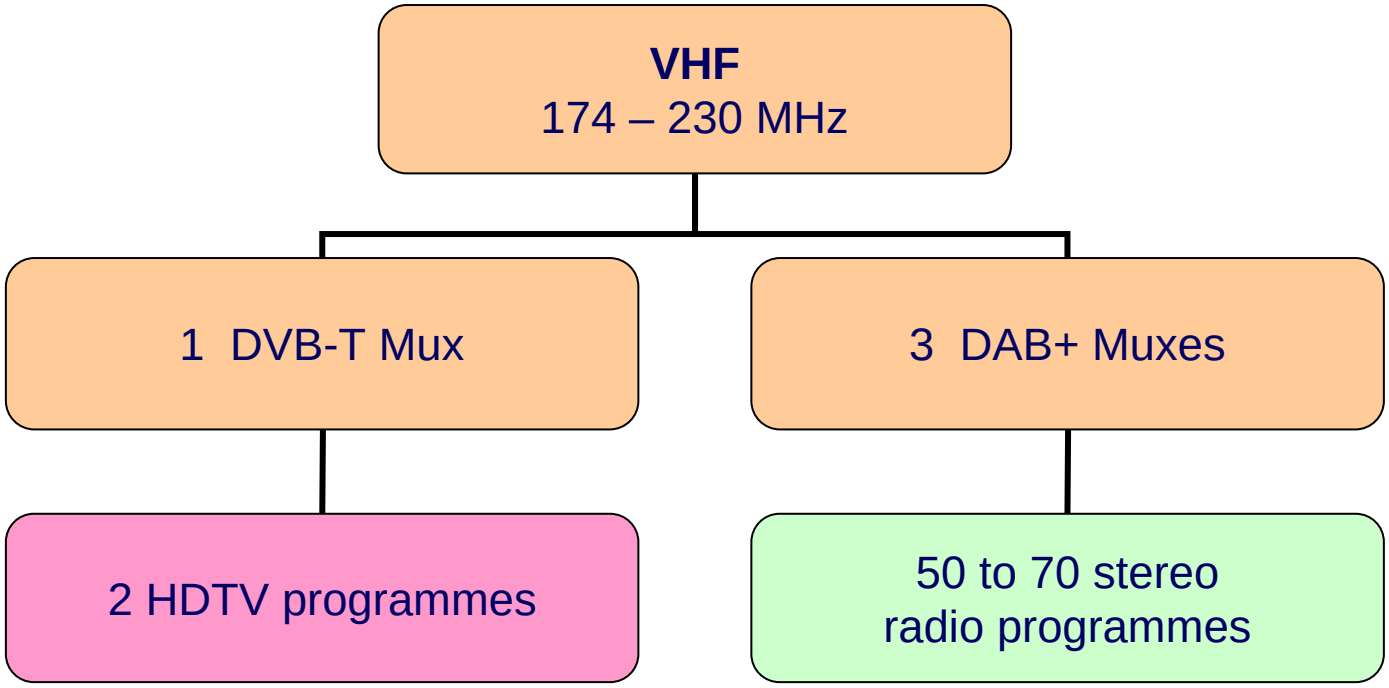


A (7 MHz) DVB-T channel can be converted into 4 (1.75 MHz) T-DAB blocks.

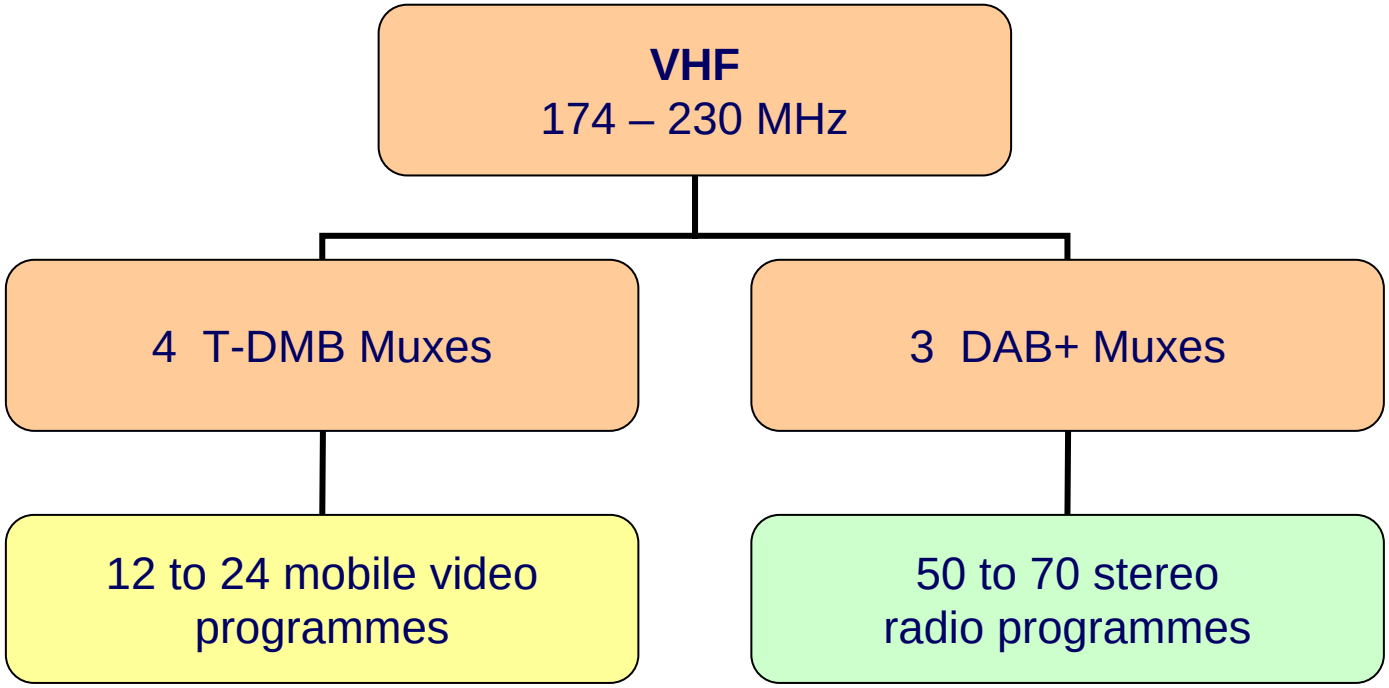
An alternative arrangement for Band III is 7 layers of DAB+ or T-DMB

(information extracted from DigiTAG/EBU Report, January 2008, "Mobile Broadcasting in Europe"Q1/08)

Example use of Band III capacity an option for DVB and DAB



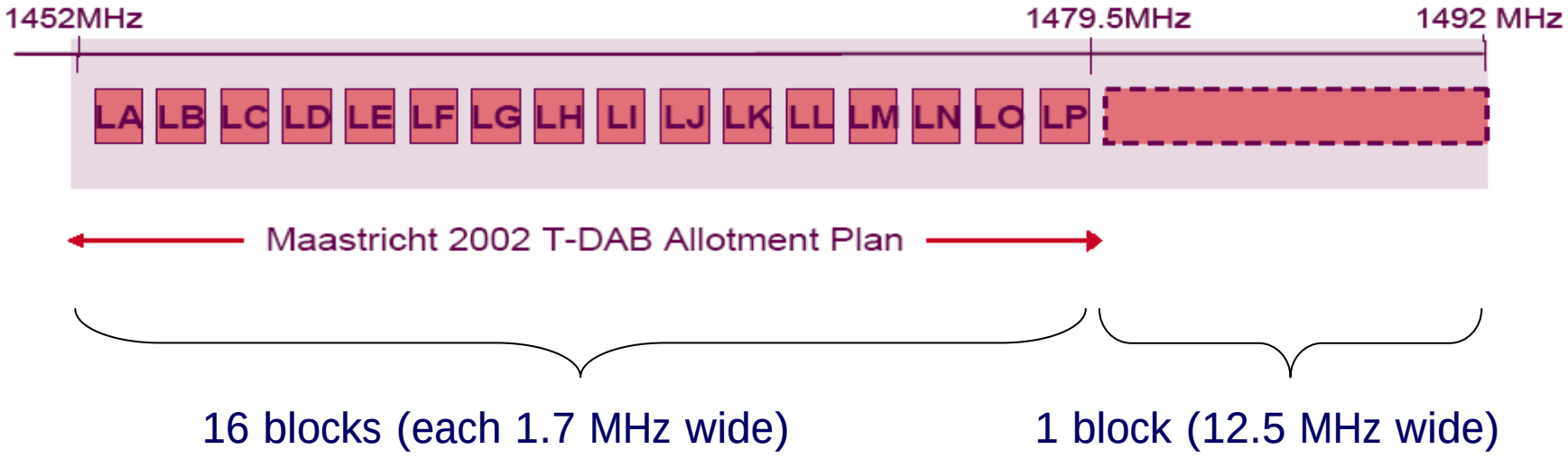
Example use of Band III capacity an option for DMB and DAB+



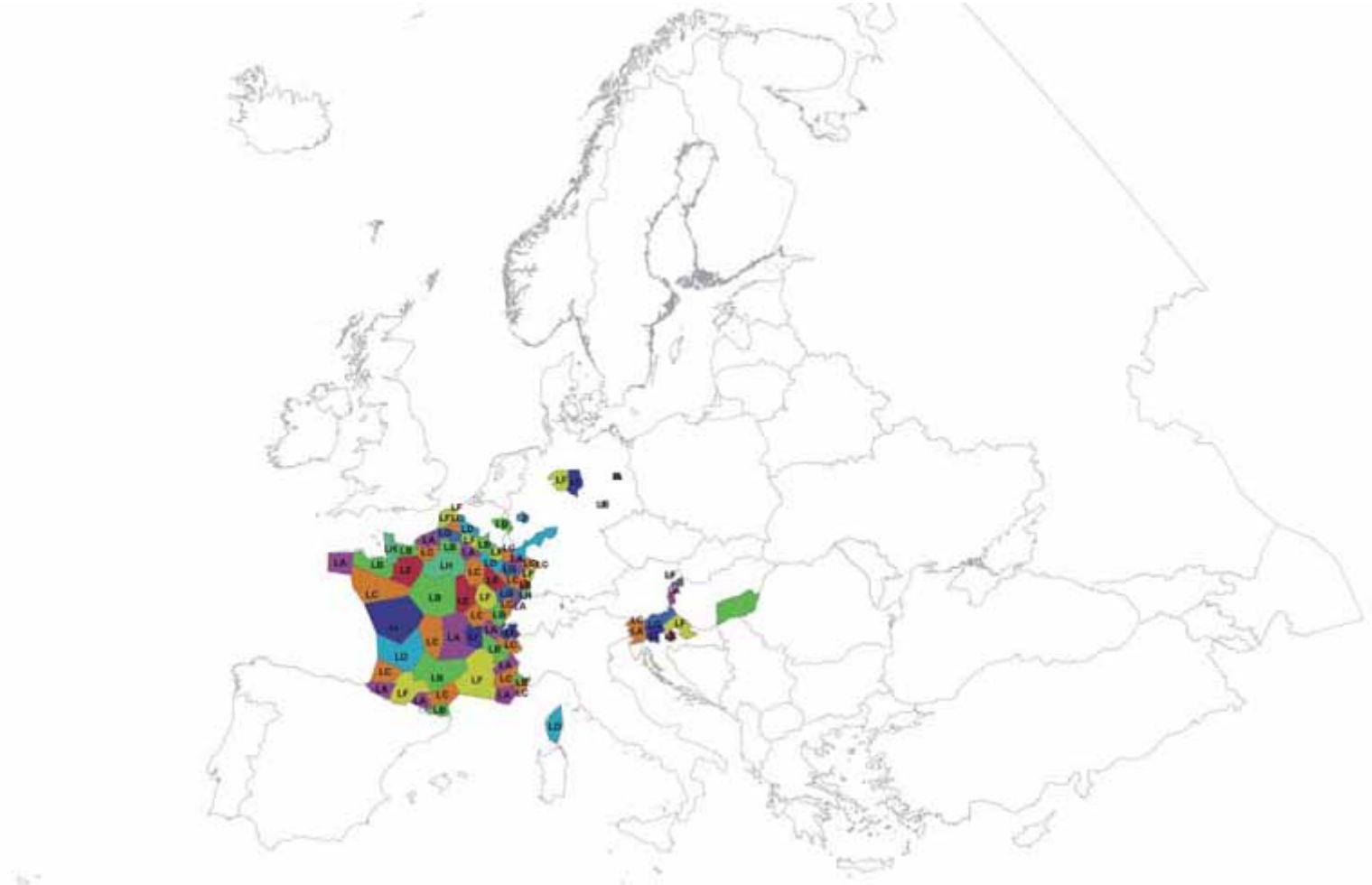
Note: assuming that a (7 MHz) DVB-T channel is converted into 4 (1.75 MHz) T-DAB blocks

DAB Spectrum availability
L-Band (1452 to 1492 MHz)

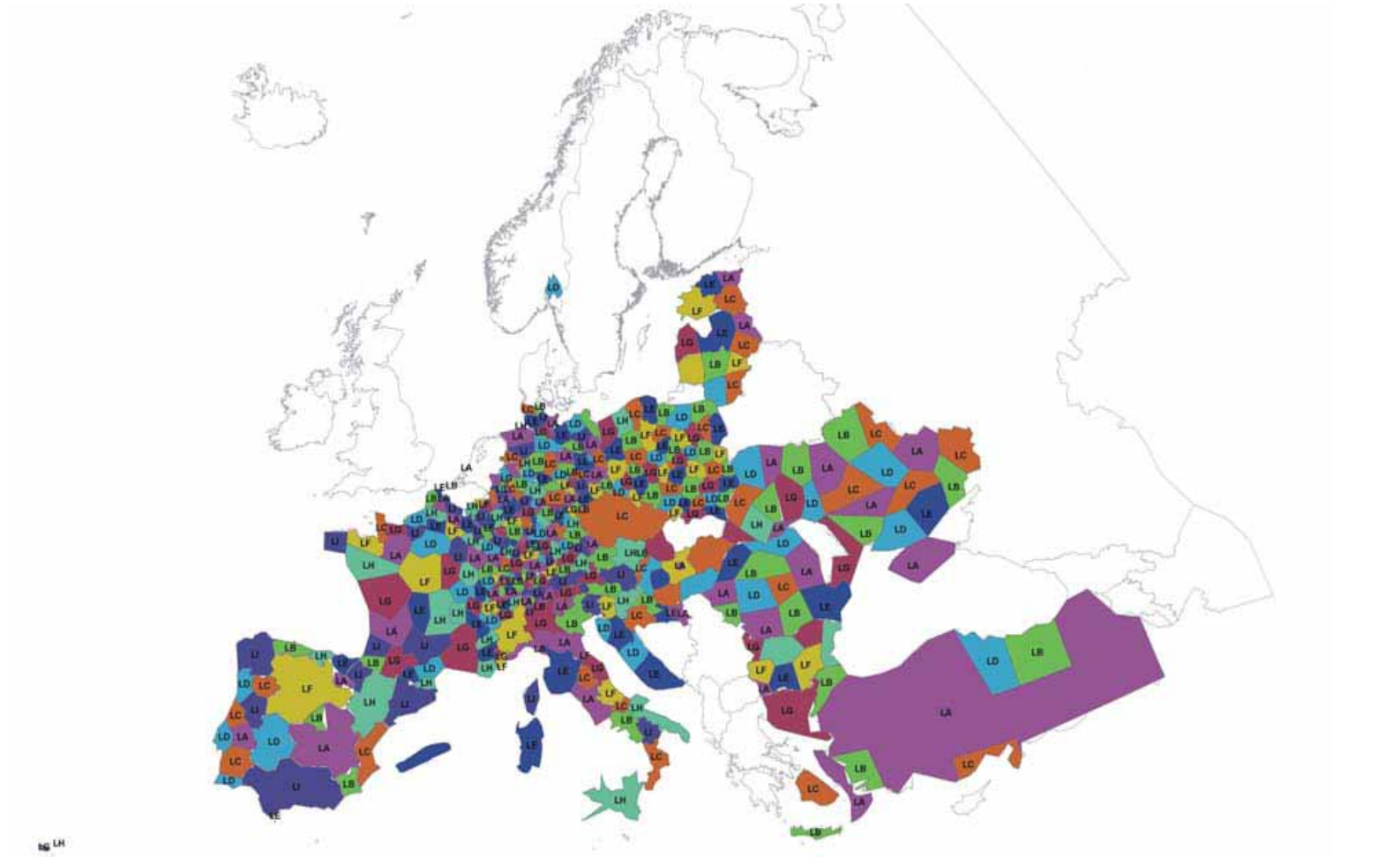
- L-band is a worldwide allocation (except for the US)
- In Europe this 40 MHz wide band is the only band in the range 1000 to 3000 MHz available for the use of Broadcast Satellite Service (sound)
- The lower 16 blocks (1452 – 1467 MHz) are primarily intended for terrestrial services - the upper 12.5MHz block is designated for satellite services



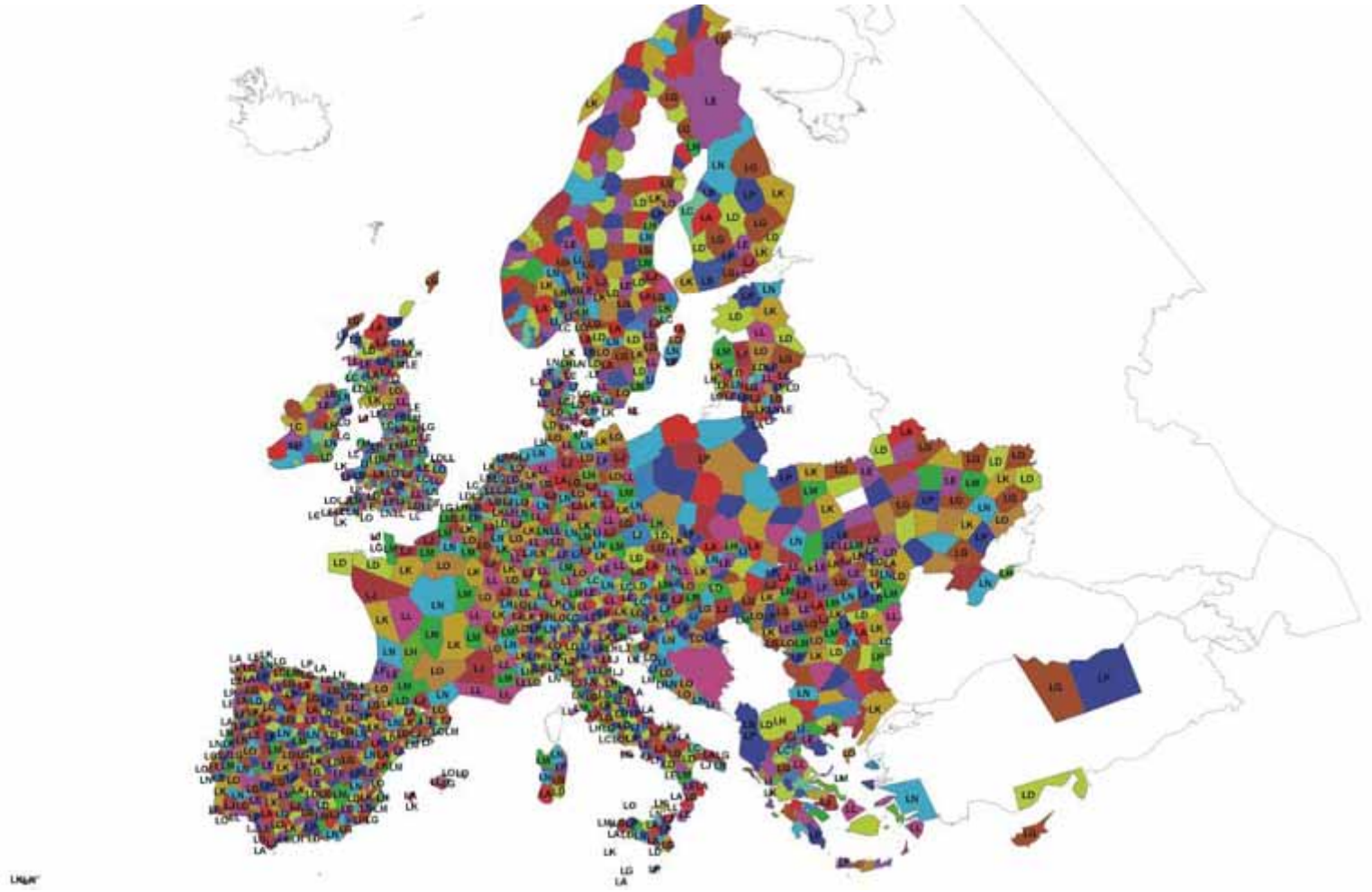
The CEPT L-Band plan
Layer 1 originating from WI95



The CEPT L-Band plan
Layer 2 originating from WI95



The CEPT L-Band plan
Layer 3 originating from MA02



Situation of L-band in the UK

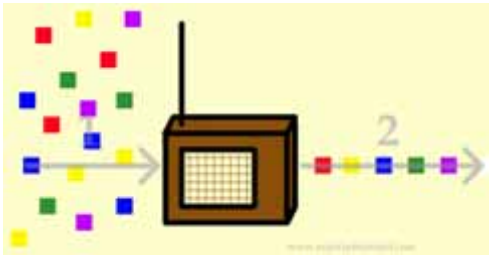
- ‘Qualcomm UK Spectrum Ltd’ were recently awarded (by auction process) L-Band Spectrum in the UK
- 1452 - 1492 MHz band = 40MHz of spectrum
- Uses can be mobile television, wireless broadband and satellite radio
- Bid was £8.33m
- Technology neutral basis for the award
- The use is up to Qualcomm

DAB by itself may not be enough

- Some remote areas may never be commercially viable for DAB
- Smaller stations – commercial & community – not best suited to DAB
- More demand for national stations than the available (GE06) national DAB multiplexes can satisfy
- DRM could be a complement to DAB in these situations

The future of Radio in Band II

- FM radio is a success but Band II is the last broadcasting band without a digital system!
  - Band II fully occupied in many areas
  - degradation of existing services
- Which digital system?
  - Three digital terrestrial broadcasting systems are currently proposed for use in Band II
  - DRM+, HD-Radio and FMeXtra.SMC
- Some broadcasters are also interested in the use of DRM at 26 MHz to provide local coverage
- EBU and CEPT (FM PT45) are studying these issues



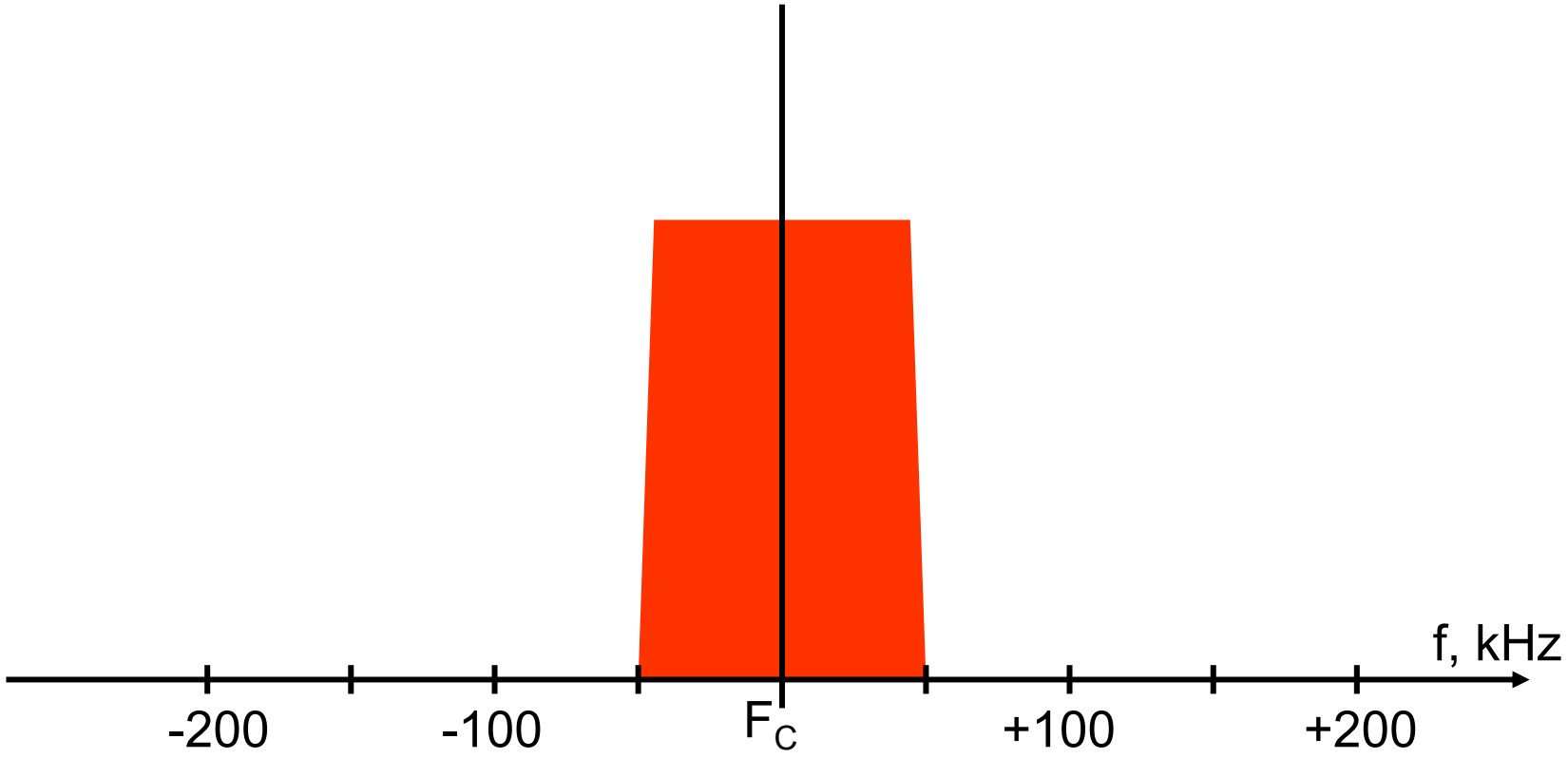
HD-Radio

- Digital radio for MF and FM bands
- Developed by iBiquity Corporation
- Based on NRSC-5A US standard
  - Full details are not available publicly
- In common with DRM makes use COFDM modulation techniques
- Suited to local and regional broadcasting
- Provides analogue and digital together
  - Full digital modes are possible
- Multiplex
  - Up to 8 services (audio, data) (FM band)
- Optimised for use with FCC spectrum masks

DRM+

- Extends the DRM system into Bands I and II
- Good audio quality
- Easy tuning
- SFN operation possible
- Text, EPG, SlideShow, etc
  - Same multimedia applications as DAB/DAB+
- Efficient delivery of a single service
- Bit-rates up to 185 kbps in 100 kHz channel
- DRM+ is under development
  - Testing and verification will be completed before standardisation

Waveform: DRM+ (47..108 MHz)



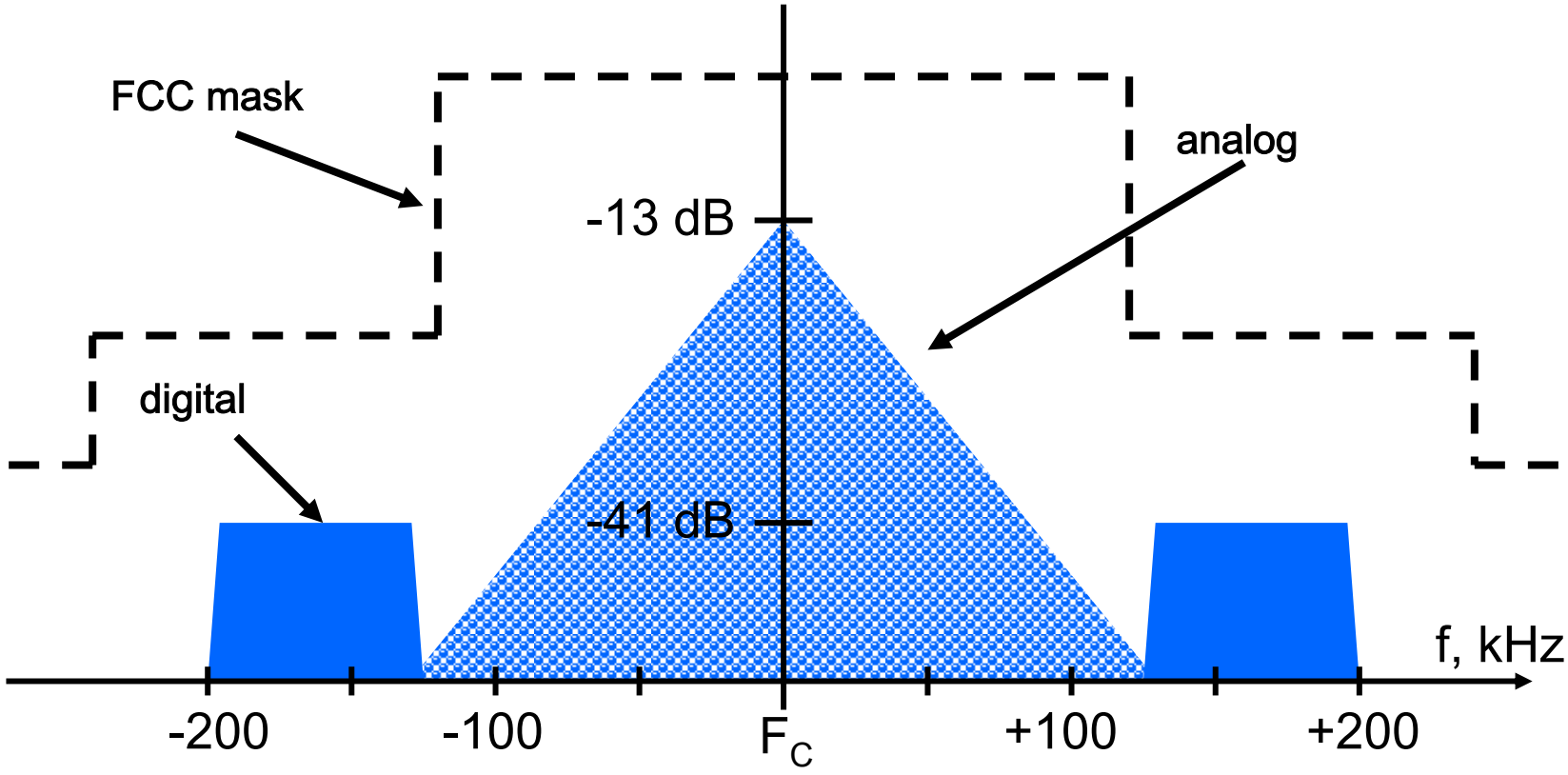
Source: DRM Consortium

HD-Radio

- Strengths
  - smooth transition from analogue to digital
  - no need for additional spectrum or multiplexes
  - same transmission infrastructures
- Concerns
  - compatibility with adjacent channels and not proven for use in a dense FM plan such as exists in Europe (GE84)
  - propriety standard
  - fees on coders and receivers

Further studies are required to assess its suitability for wide scale deployment in Europe

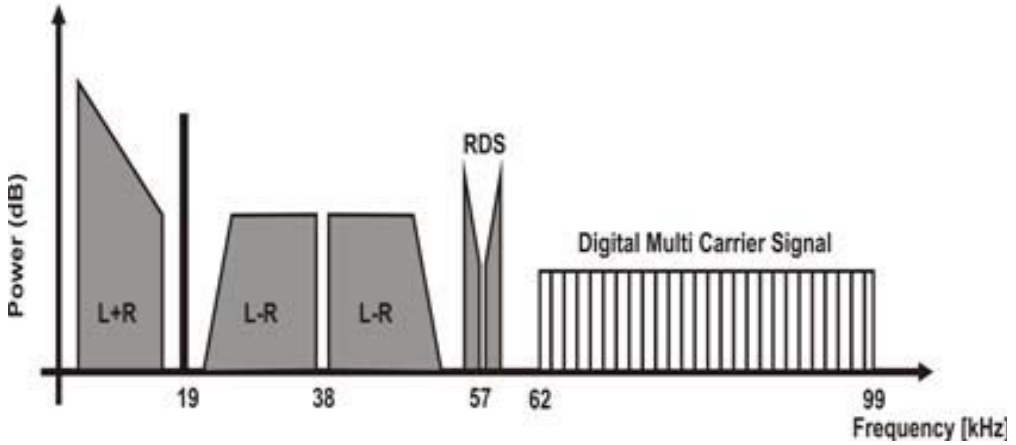
Waveform: HD-Radio (FM)



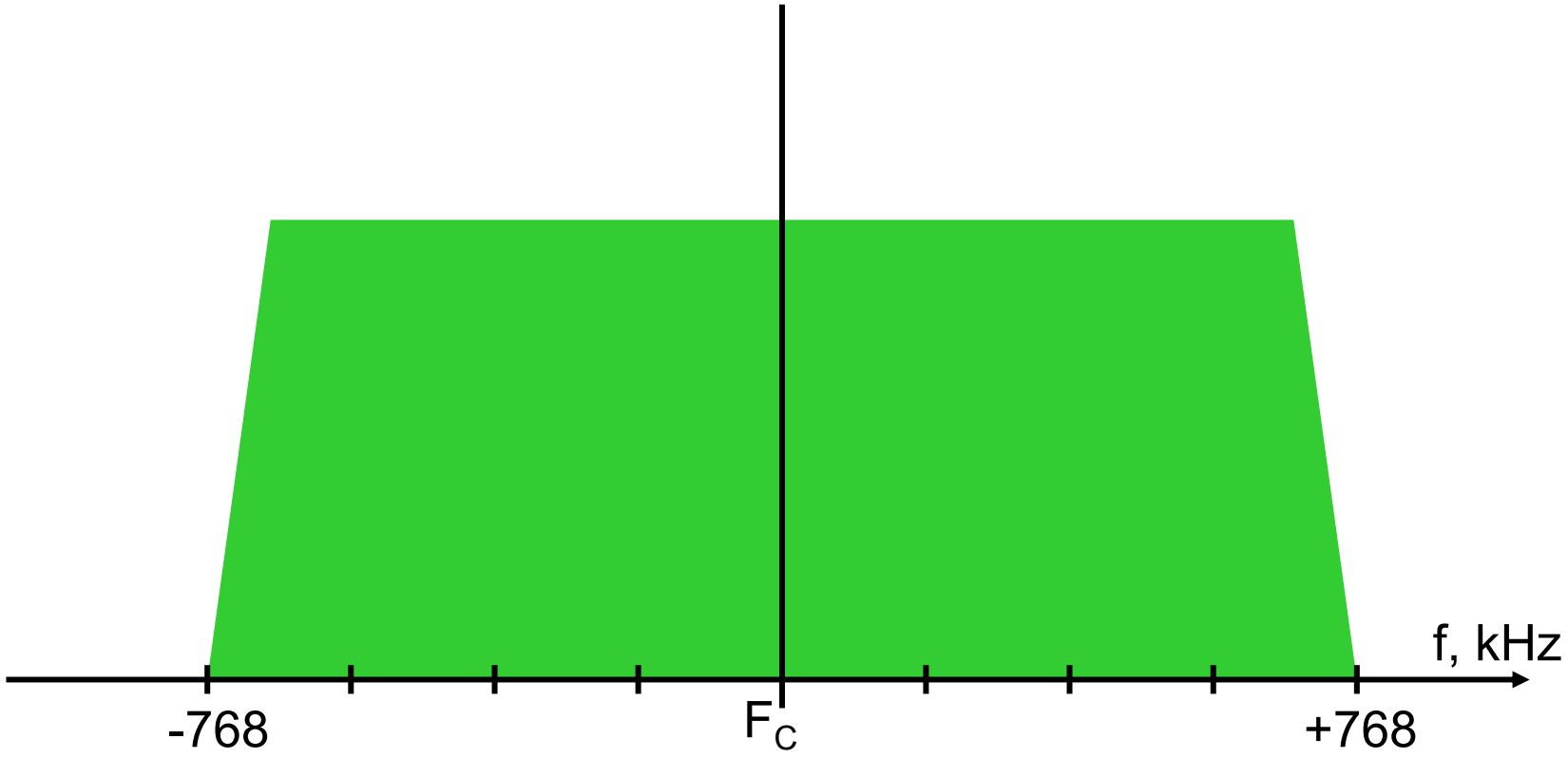
Source: P.Priestley, iBiquity Corp

The FMeXtra system

- The digital signal is incorporated into the FM multiplex signal
- A base band signal is generated which contains the FM stereo signal, RDS and a digital multi-carrier part.
- The multiplex signal is modulated onto the RF carrier in the standard FM manner with a maximum data rate of 50 kbits/sec
- Fits European raster
- No SFN operation possible



Waveform: DAB/DAB+

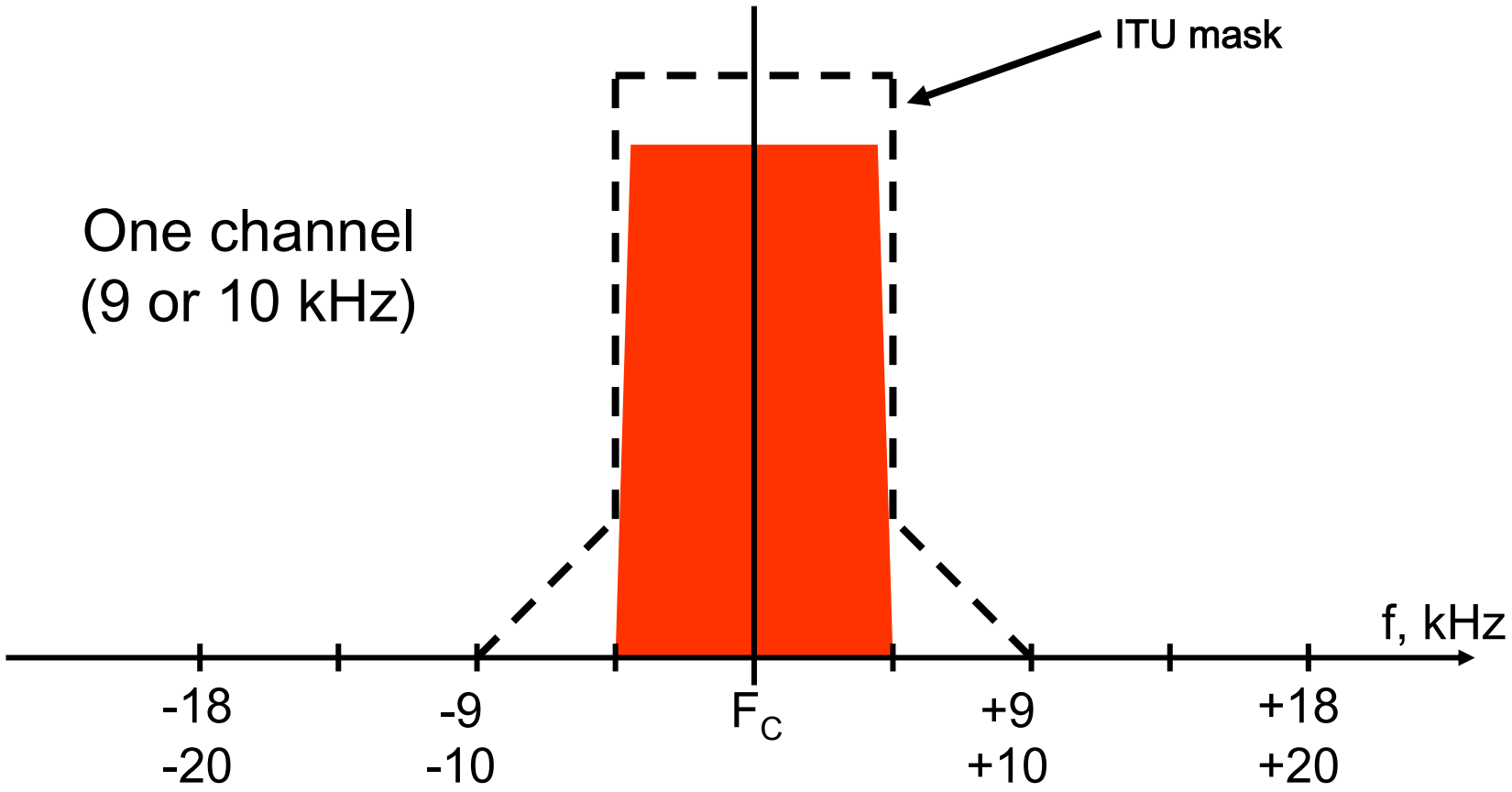


Source: ETSI EN 300401

What does DRM (Digital Radio Mondiale) do?

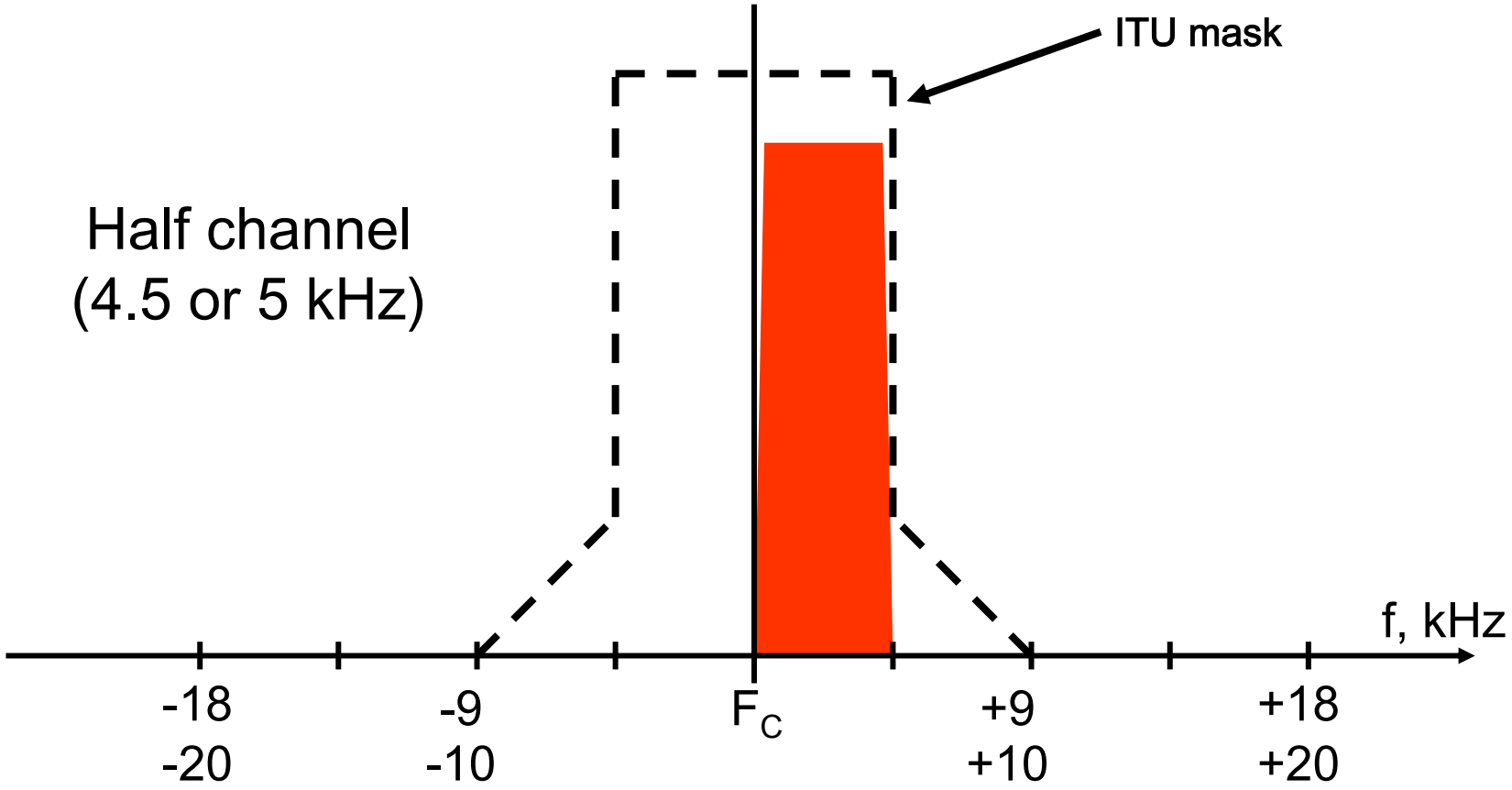
- Digital system for long, medium and shortwave - uses standard ITU 9 or 10 kHz AM channels plus half and double channel modes
- Large scale coverage with few transmitters
- Improved audio quality compared to AM (but lower than FM)
- Easy tuning
- Generally: no multiplex, 1 transmitter = 1 program
- Limited capacity, sensitivity to interferences
- Complementary to higher-frequency digital systems Text, EPG, slideshow, etc using the same multimedia applications as DAB/DAB+/DMB

Waveform: DRM (< 30 MHz)



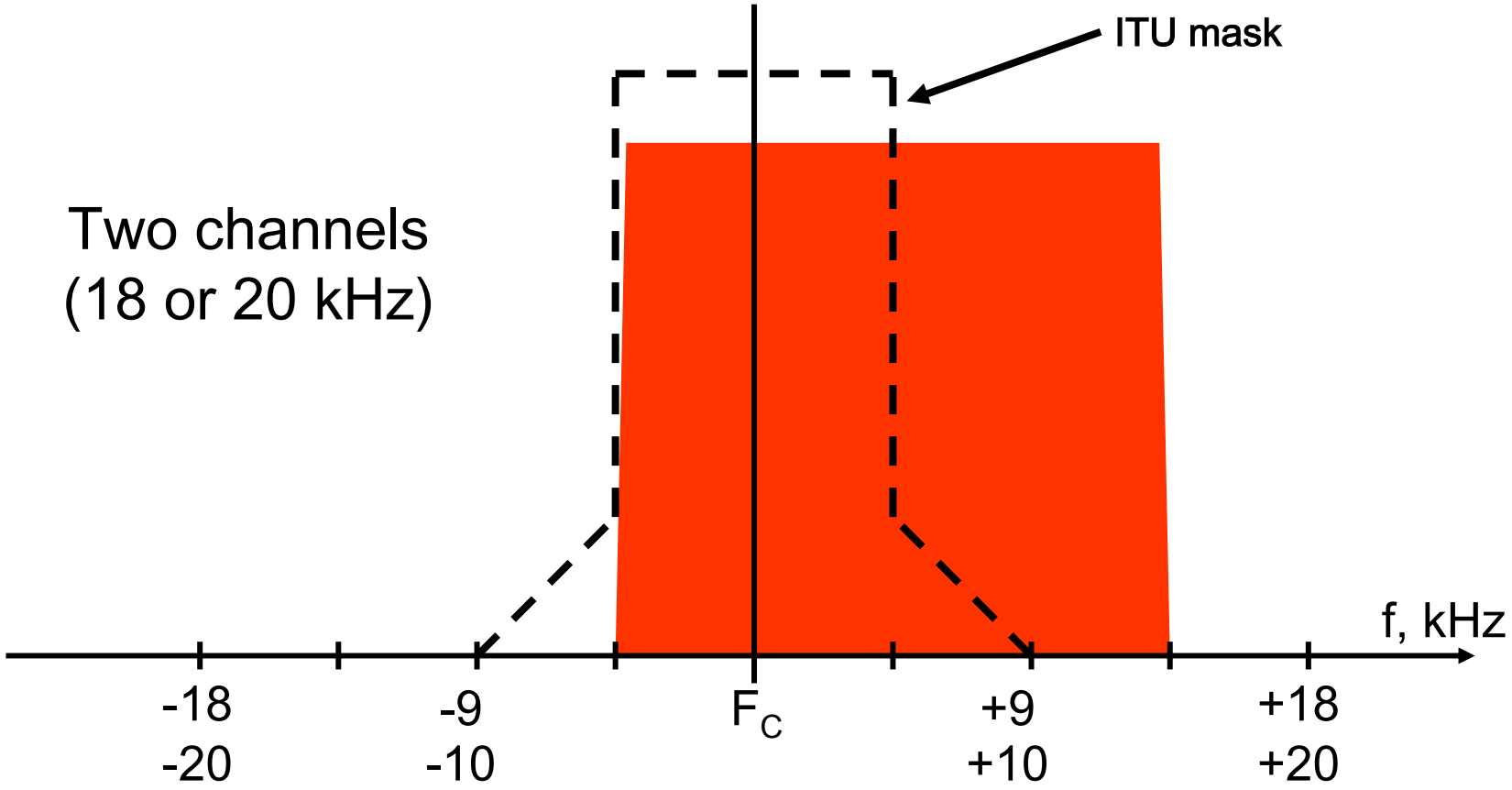
Source: ETSI ES 201980

Waveform: DRM (< 30 MHz)



Source: ETSI ES 201980

Waveform: DRM (< 30 MHz)



Source: ETSI ES 201980

DRM's Unique Selling Points

- Universal geographical coverage
  - Including Nation-wide road systems even in rural/mountainous regions
- Complementary to higher-frequency digital systems:
  - DAB/DMB/DVB-H
  - "Universal" modules & chip-sets already developed
  - Others in pipeline
- Excellent spectrum efficiency
  - One service per frequency, low-bit-rates, very flexible
- Can also provide Community, Local and City coverage
  - "26MHz" mode very similar to FM

Digital Radio: paradigm shift

- Broadcast transmission as digital pipe

- DRM: 20kb/s service delivers c. 1.5 G bytes per week *per listener* !

- DRM can cover 50M + population from one transmitter!

The BBC's interest in medium wave

- BBC is the largest user of medium wave in the UK
- Some simulcasting (FM/AM) but medium wave still primary radio platform for some services
- Frequently used to provide choice of listening

BBC RADIO 1 2 3
BBC LOCAL RADIO
BBC RADIO CYMRU
BBC RADIO NAN GAIDHEAL
FM

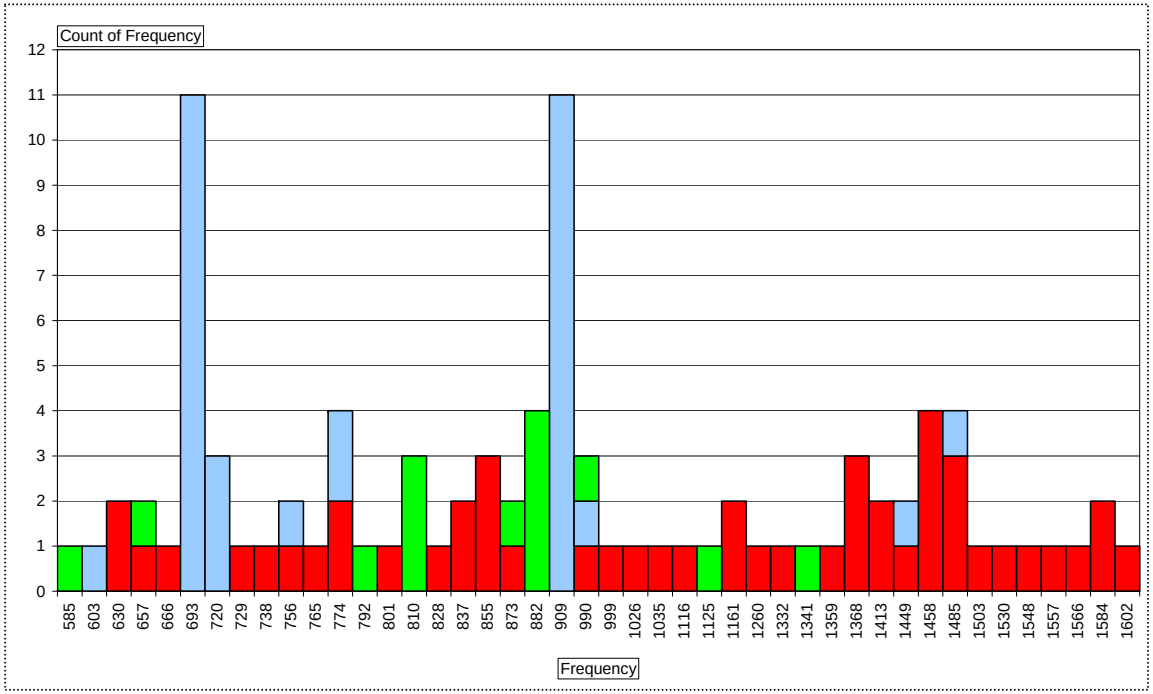
BBC RADIO 5 live
BBC RADIO 5 live sports extra
BBC RADIO WALES
primary AM

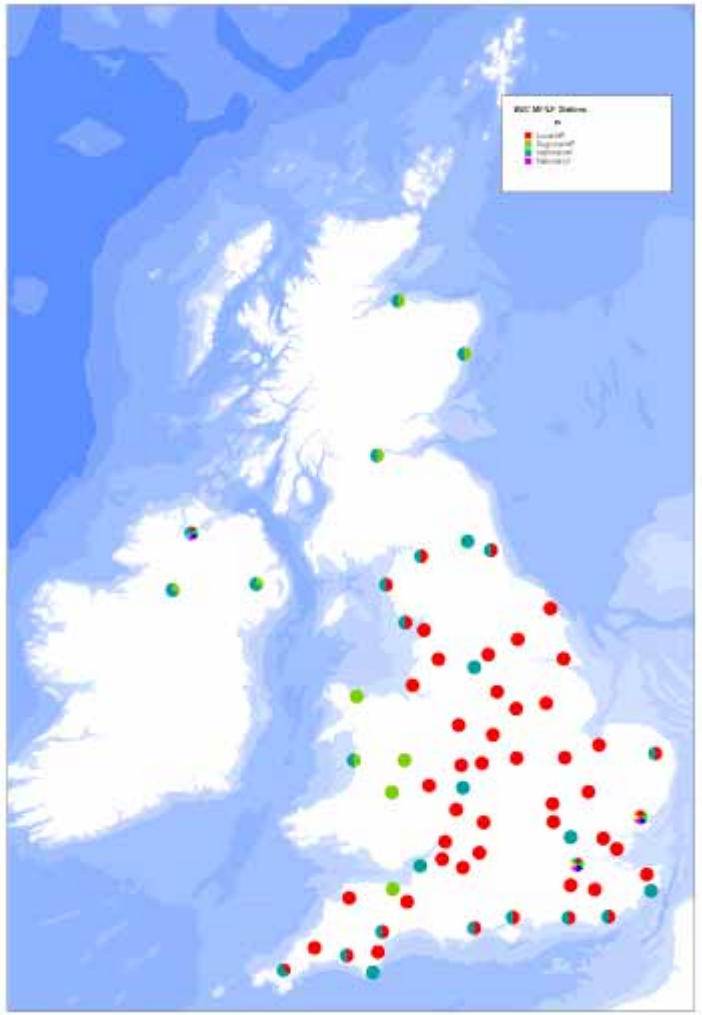
BBC RADIO 4
92–95 FM & 198 LW
BBC LOCAL RADIO
BBC RADIO SCOTLAND
BBC RADIO ULSTER
AM choice

...plus DAB, DTT, DSat, cable, internet, downloads...

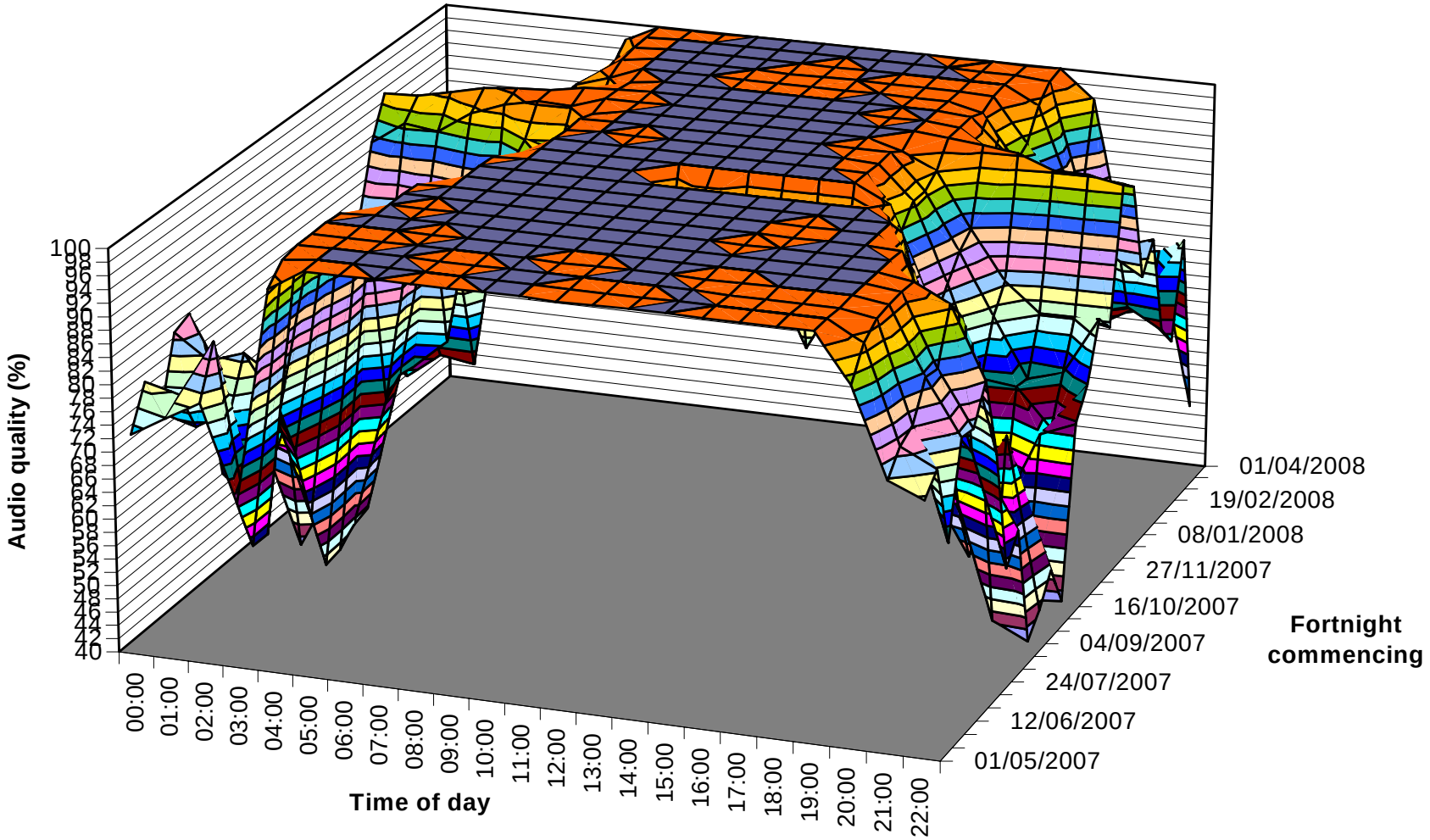
As a result, BBC has an extensive MF network

- 95 transmitters as a result
  - 49 for local radio
  - 14 for regional radio
  - 32 for network radio





Performance of DRM reception during a medium wave trial on 855 kHz



Conclusions from DRM medium wave trial

- Broadcasters need to determine what counts as a ‘service’ for DRM
  - good daytime coverage (better than AM)
  - night-time availability
  - simulcast / unique services
  - audio quality vs. ruggedness
  - what is DRM’s role amongst other technologies, e.g. DAB?

- Will there be a critical number of receivers available?
  - will DRM become ‘factory fitted’?
  - could DRM ever be built in as a no premium item?
  - how is the catch-22 broken?

  no receivers = no services – no services = no receivers

Satellite Digital Sound Broadcasting (DSB)

System	WORLDSPACE SATELLITE RADIO	SIRIUS SATELLITE RADIO	XM SATELLITE RADIO
Standard	System D/F Rec. BO1130-3	Proprietary	Proprietary
Frequency	1.5 GHz	2.3 GHz	2.3 GHz
Orbit	GEO	HEO	GEO
Coverage	AfriStar: Africa (+ Europe/Italy late 2008) AsiaStar: Asia	US	US
Reception	Line of site (mobile in Europe?)	Mobile	Mobile
Business model	Transponder lease	Subscription Advertising	Subscription Advertising

Merger in progress

Satellite Digital Sound Broadcasting (DSB): some thoughts

- DSB has yet to find its position in the European media landscape
- Broadcasters should consider the future of satellite DSB in the context of other developing media capable of providing large area coverages (DRM and Internet)
- Frequency availability in L-band is key to DSB services which are require a complementary terrestrial component to provide for mobile reception
- Advantageous for future satellite DSB systems to have maximum communality with the existing terrestrial DAB systems - coherent frequency planning possibilities and receiver compatibility

Radio broadcasting over IP
new and complimentary opportunities

- Freedom of space
  - listen wherever your are
- Much more content
  - programme archives, listen when you want, audio files
- Freedom of time
  - on demand streaming
- Downloading
  - catch-up, mobile and portable, pod casts
- Interactivity
  - Visualisation, feedback, programme material and information

...but can be expensive for the listener

  - broadband capacity or using mobile phone

BBC on the internet
Live streaming and iPlayer

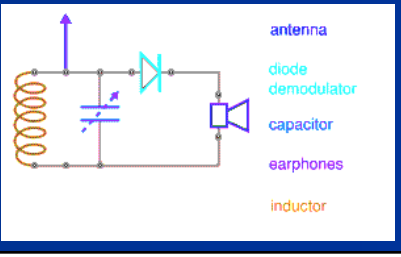
Mobile television and radio broadcasting
Why not develop DVB radio?

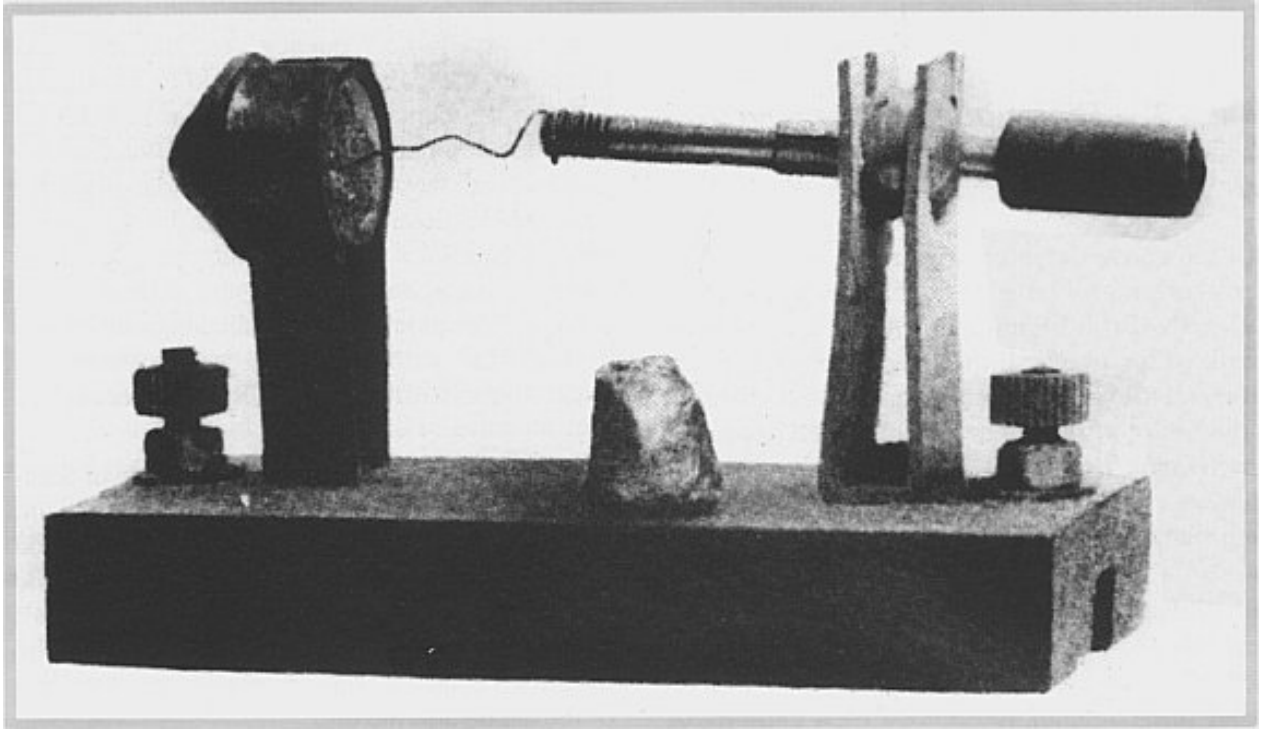
- Mobile TV has lots of standards and could deliver radio to hand held devices

  DVB-H, DVB-SH, T-DMB, MediaFLO, MBMS

- Claims such as *"DVB-T is better than DAB"* and *"DVB-H is better than DAB"* are wrong
- Will mobile TV be successful?
- In practice, delivery of digital-only radio services via DVB-S and DVB-T actually encouraged sales of DAB radios

The first radio receivers - circa 1900





A very early receiver using a galena crystal and cat's whisker (fine wire) as the detector. Connected to a tuned circuit, antenna and headphones this formed a very useful receiver – it doesn't need a power supply!

Integrated receivers are important

- Possible to produce sets with a single station list of DAB, FM, DRM, AM services as well as Internet radio capabilities
- Clear consumer benefits:
  - easier tuning – “all your favourite stations and more in a single list”
  - More “future-proof”
- Makes ‘digital migration’ more attractive to listeners

SOLUTION: RECEIVER PROFILES

WorldDMB is drafting a set of Receiver Profiles to clarify and simplify

Work in progress . . .

- Profile 1: Standard DAB (MP2) with basic text display (e.g. 2 x 16 characters)
- Profile 2: DAB and DAB+ (AAC) with 2 x 16 text display (or better)
- Profile 3: DAB, DAB+ & DMB-audio (no video decoder) with minimum display
- Profile 4: DMB video with graphics driver and screen

Example of current digital receiver technology

Revo – Blik	DAB	£49.99	
Revo – Blik	DAB/FM	£44.00	
Revo – Blik	Blik WiFi	£89.00	
Revo – Blik	DAB/WiFi	£148.53	
Revo – Blik	DAB/WiFi/FM	£149.00	

(source: amazon.co.uk & superfi.co.uk 18.06.08)

Software Defined Radio (SDR)

- Use of programmable processing to emulate existing radios (DAB, DRM, DVB...)
- Easily incorporate new coding and modulation standards in the future, so that listeners can keep pace with advances
- An SDR-based device can dynamically change protocols and update communications or broadcasting systems over the air as a service provider allows (danger?)
- It has been claimed that a software-defined radio with zero am demodulation scheme (phase demod.) can give better AM performance and interference rejection

Position of receiver manufacturers information provided by EICTA

- Only mass markets will allow for the low price levels expected by consumers
- Industry will provide receivers for all standards relevant in the market provided economy of scale can be achieved
- Economy of scale and mobility of consumers require market of European dimension
- Current fragmentation needs to be overcome
- Development cycles of car industry have to be taken into account: migration scenario

EICTA: European Information & Communications Technology Industry Association

Summary

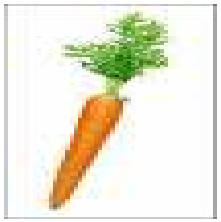
- Need to clarify the use of DAB standards, particularly in Europe
- All interested parties need to give clear guidance to provide a harmonious, unified digital radio market (WorldDMB, EBU, EICTA etc.)
- Indecision and fragmentation will only damage radio's digital future

Résumé of Digital radio systems suitability

- DAB Family (DAB, DAB+, T-DMB)
  - "Bouquet" (multiplex) of programs, flexible
  - Public and private groups, aggregation of broadcasters
  - Rich content, audio quality
  - National, regional
- DRM
  - Single program delivery (no multiplex)
  - International broadcasters, local/community broadcasters
  - DRM+: local broadcasting (testing)
- Internet
  - Worldwide availability, more content, on demand, catch-up, interactivity

Digital radio requirements

- There's no possible success of digital radio without
  - A clear support, incentive from the government
  - A clear intention and strategy from public and private broadcasters
  - Marketing and promotion including retailers



- Rollout implies
  - Reorganisation of production for new content and multimedia
  - Investments for network, long term strategy for migration from analogue

UK Digital Radio Working Group
Interim Findings (June 2008)

- DAB is main replacement for analogue. This requires:
  - increased coverage to match FM geographically where possible
  - future-proofed devices
- Medium-term mixed ecology of:
  - DAB as primary platform
  - FM for smaller local and community radio stations
  - IP delivery to complement DAB
- Longer-term digital switch over (by 2020?)
  - All national services and large local on DAB only
  - Hand back MW

A European vision for 2015……

- Broadcasters using combination of DRM and DAB+/DMB
- AM migration underway: some FM being discussed
- "Radio" Receivers all support
  - DRM & DAB+/DMB = Digital Radio
    - digital equivalent of AM-FM
  - EPG and PVR functionality
  - *Some* degree of harmonisation
    - MMI, red/blue button etc.

- Broadcasters collaborating closely
  - With broadcasters
  - With receiver manufacturers, through
- European "Digital Radio Group"
  - Pan-industry harmonising function, agree standards, formal collaborative forum

Action needed

- Digital radio is an opportunity
  - Counteract audience decrease through new attractive content
  - Free to air, efficient, universal
- It is important to act now
  - Broadcasters: content production (reorganization), promotion
  - Government: incentive, framework, spectrum allocation

- European digital radio standard
  - DAB/DAB+/(T-DMB): group of programs, multimedia
  - DRM/(DRM+): single programs, international/local broadcasters
  - Co-existence through multi-standard receivers

Thank you for your attention

Acknowledgments

The presenter would like to thank those who either supplied material, or inspiration, for the content of this presentation, in particular

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