RTT TECHNOLOGY TOPIC
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LTE T2 TV

Our May 2009 Technology Topic **LTE TV** reviewed the MBSFN (multicast broadcast single frequency network) standard and compared the relative merits of using LTE or DVB-T as a broadcast physical layer for mobile and portable devices.

http://www.rttonline.com/tt/TT2009_005.pdf

In this month's technology topic we revisit mobile TV to see if standards and technical developments have brought us closer to having commercially effective TV receivers in mobile devices and discuss the likely impact of second generation terrestrial TV standards on mobile market adoption.

Four years of standards work – progress in the US?

Over the past four years and four standards releases (3GPP Release 9,10,11 and 12), MBSFN has evolved into eMBMS, a similar physical layer but with the ability to flexibly allocate carrier bandwidth for unicasting (one to one), multicasting (one to many) and broadcasting (one to all).

The MBSFN area is a group of LTE base stations over which the same eMBMS content can be synchronously transmitted.

Verizon has announced that they will introduce eMBMS services in 2014. The commercial argument for eMBMS is that it leverages LTE scale and provides a better return on network hardware investment.

This however implies that eMBMS will be deployed with at least some band harmonisation across the three ITU regions. This seems unlikely.

It also implies that a critical mass of operators adopt the technology. Given that AT and T (and potentially DISH) are putting equivalent effort into developing supplemental downlink bandwidth in Channels 55 and 56 (716-728 MHz) band then this also seems unlikely.

American and Canadian operators also have the option of including ATSC (the US digital TV standard) in mobile user devices. There is some chip set support for mobile compatible devices but free to air TV is not presently an obvious addition to an operator's service offer.

Four years of standards work - progress in Europe and Asia?

As in the US, some infrastructure vendors including Ericsson and Huawei are promoting eMBMS as an evolving network service for Europe and Asia.

For this to make any sense however requires eMBMS to be supported in user devices. Given that there will be no band commonality with devices for the US market it would seem this is going to be low priority for the RF component and user device vendor community.

The counter argument is that eMBMS could be supported as an integral part of carrier aggregation, in effect a supplemental downlink with enhanced unicasting, multicasting and broadcast functionality.

The large number of operator specific band plan combinations is however likely to make this unworkable in terms of RF supply chain economics.

It is therefore hard to avoid the conclusion that mass market adoption of eMBMS is unlikely in Europe and Asia. This must also call into question the economic viability of Verizon's eMBMS market plans.

Neither eMBMS nor SDL appear to be close to practical implementation. Four years of standards and technical effort has yielded little commercial progress.

DVB T2 as an option?

In our technology topic four years ago we put forward the technical case for using DVB-T. The only problem with it was generally insufficient flux density which we argued could be addressed by transmitting the DVB- T multiplex from cellular base stations.

This would also make coexistence between mobile broadband and TV easier to manage particularly if terrestrial TV transmissions could be transitioned from multi frequency to single frequency networks. The use of T2 with an 8K carrier makes this easier (the longer symbol duration supports a longer guard interval).

The first version of the T2 standard was published in 2009 with a 2011 update known as T2 Lite for mobile and portable reception. T2 receiver chip sets are now the same price as T1 chip sets, around 25 dollars, the benefit of global market scale.

T2 services were launched in the UK in March 2010 with subsequent launches in Italy, Sweden, Finland, Zambia, Namibia, Nigeria, Kenya and Uganda.

The commercial problem still revolves around the ambivalence of mobile broadband operators to free to air TV and the consequent lack of motivation for the supply chain to include T2 demodulators and receiver front ends in user devices. Mobile operators would understandably prefer users to consume content for which they have to pay.

In reality this is no different from Wi Fi. Wi Fi is more efficient than cellular for certain tasks- localised high bandwidth downloads for example. This efficiency gain translates into a significantly improved user experience – applications work better, batteries last longer and delivery costs for the operator should be lower.

Terrestrial TV particularly T2TV is more efficient than cellular for certain tasks. The IP overheads in LTE take 3 dB off the link budget and absorb network and spectral bandwidth. A 24 M/bit/s DVB T2 carrier will work at a carrier to noise ratio of 10.8 dB, 6 dB better than standard DVB-T. This efficiency gain translates into an improved user experience – applications work better, batteries last longer. As with Wi Fi, delivery costs will be lower for particular types of traffic, broadcast or large scale multicast.

And just because a service or part of a service is free to air does not mean mobile operators cannot make money from it.

Present regulatory policy for TV Band IV (470 to 790 MHz) and Band V (790-862 MHz) is based on the assumption that mobile operators will be prepared to bid for additional channel bandwidth over and above present allocations. This includes the proposed APT (a) and (b) 700 MHz bands in Asia, an equivalent APT (a) band in Europe and the potential incentive auction of 600 MHz spectrum in the US.

The difficulty with this is that mobile operators will incur clearance costs and on-going coexistence management costs which are difficult to estimate and therefore represent an undefined commercial risk.

Adding SDL or eMBMS into these bands is likely to increase rather than decrease these costs.

The TVWS to WSTV transition?

The question then arises as to how the DVB-T1 to T2 transition if coupled with a multi frequency to single frequency transition might be able to realise additional value from 700 MHz spectrum for all stakeholders including the broadcast, mobile broadband, fixed broadband and PMSE community.

This can be expressed as value gained from problems solved or mitigated, value gained from reduced delivery costs and value realised from an enhanced consumer experience.

The transition from multi frequency to single frequency DVB-T is a non-trivial undertaking potentially involving new aerial and distribution amplifiers, splitters, combiners and filter equipment for consumer installations.

It would make it harder to deploy White Space devices due to the improved spectral utilisation/geographic spectral density achieved through the use of SFN.

It would however make it easier to allocate dedicated spectrum to PMSE devices (wireless microphones) which would ease present regulatory concerns.

It would also make it easier to manage DVB-T to LTE and LTE to DVB-T coexistence, either through the use of additional guard band and/or (as stated earlier) by retransmitting DVB-T2 though cellular base stations (equal flux density). The additional flux density would make T2 transmissions visible to portable and mobile devices even when used indoors.

T2 can replace and has replaced existing DVB-T channels. This has proved to work well for HD services. The constraint is that legacy receivers cannot decode the T2 bit stream.

Another alternative is to implement T2 adjacent to mobile broadband services in the 700 MHz band.

For example the 25 MHz duplex gap in the proposed CEPT 700 MHz band plan could support three 8 MHz 8K carrier T2 channels or two channels with the spare 8 MHz used for enhanced PMSE services.

This is in effect White Space TV (WSTV) and arguably makes more sense technically and commercially than TV White Space (TVWS).

User devices for Europe, Africa and Asia would have an LTE 700 MHz transceiver front end integrated with a T2 receiver which could either tune across the whole UHF band or support regionally available spectrum (the duplex gap in Europe being one example).

The benefit to the consumer would be a more closely integrated experience between linear TV including national, regional and local broadcasts and other rich media content.

The benefit to the user device vendor community would be a more closely integrated TV and mobile broadband hardware platform. (The T2 demodulator can also process DVB-C and DVB-S transmissions).

The benefit to broadcasters and mobile broadband operators would be a more closely integrated service proposition and lower per bit delivery costs.

The ability to integrate national, regional and local TV into the mobile broadband and fixed broadband service offer could be particularly useful.

The cellular industry has a thirty year history of working with the broadcast engineering community on site sharing. Similar integration opportunities are now being developed in content and application sharing.

Bringing LTE and DVB-T2 together would move this cooperation to an altogether higher level.

Resources

Samsung eMBMS white paper
https://www.samsung.com/global/business/business-images/resource/white-paper/2013/02/eMBMS-with-Samsung-0.pdf

Qualcomm sponsored eMBMS white paper
http://www.qualcomm.com/sites/default/files/document/files/igr_qlabs_lte_broadcast_white_paper_final1.pdf

Verizon/Ericsson eMBMS announcement
http://news.verizonwireless.com/news/2013/01/ericsson-4G-LTE-broadcast.html

ATSC mobile TV chip sets
http://www.siano-ms.com/index.php/products-a-solutions/atsc-mh-receivers

DVB T2 fact sheet
http://www.dvb.org/technology/fact_sheets/DVB-T2_Factsheet.pdf

Cooperative Networks White Paper September 2009
https://connect.innovateuk.org/documents/2849135/3712563/Cooperative+networks+positioning+paper.pdf/e2a93100-8a8a-4d04-8aef-59eb908dfcab

The inter relationship of TV broadcast and mobile broadband technology is discussed in RTT's fourth book '**Making Telecoms Work- from technical innovation to commercial success'** available from the **RTT book shop.**

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