Network Rail

Business in the Community AWARDS 2008 Healthy Communities

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Dear Mr Austin

Re: Network Rail response to Ofcom Consultation; "....the way forward for the future use of the band 872 - 876 MHz paired with 917 - 921 MHz"

Network Rail, as the owner and operator of the Britain's railway infrastructure, is responding to this consultation as part of a wider rail industry initiative which includes separate responses from the Railway Safety and Standards Board (RSSB) and the Association of Train Operating Companies (ATOC). An industry-wide response, on this occasion, is prompted by a common realisation that potential future usage of the 872/917MHz spectrum presents both opportunities and risks on a number of levels.

For rail operational purposes, our response highlights the potential usability of this parcel of spectrum, as a single national allocation, to enhance both the capability and capacity of our current roll-out of over 2,500 trackside GSM-R sites and associated optical fibre backbone network connecting all these sites. We hope your evaluation process is able to relate the benefits with the effective use of government investment that would be achieved by implementing operational wireless connectivity for the rail industry using our GSM-R infrastructure.

We must however point-out in this covering letter; in our response to your questions; and in our supporting expression of interest paper, that a mobile broad band solution offering passenger internet or other commercial services cannot use GSM-R; any other rail infrastructure; or Network Rail's land. This is because it would add complexity and cost to the rail network and also could not be delivered using Network Rail's Permitted Development Rights.

We also wish to make clear the criticality of delivering cost effective and reliable mass-market RFID/SRD products that can be used by the railway. We urge Ofcom not to effectively lead the market into the development of products that can not be used on the railway infrastructure.

Above-all however, as an industry we must act, for our stakeholders and customers, to protect our railway system (infrastructure and trains) from developments which will reduce its effectiveness. We believe this means not only protecting the current GSM-R infrastructure, but also looking forward to the replacement technology, possibly LTE, and the potential need for additional radio spectrum to support an increased automation and control of the infrastructure.

In pursuing these aims, Network Rail and the train operators work closely with ORR and DfT to demonstrate how we will meet the increasingly stringent targets that are placed upon us. We hope Ofcom will be able to put in place, as a part of the information gathering associated with this consultation, meetings with Government departments having responsibility for the development of the UK's railway capacity and capabilities.

Yours sincerely

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Network Rail

Network Rail Response to Ofcom Consultation; "....the way forward for the future use of the band 872 - 876 MHz paired with 917 - 921 MHz"

Question 1: Do you believe that the uses listed in this section (Section 3) are possible candidates of the 872/917 MHz bands?

Answer 1: *Mobile broadband is a valid candidate technology for the band and could deliver important operational benefits to the railway. However, we must rule-out any delivery of commercial mobile broadband solutions to passengers using GSM-R or any other rail infrastructure or land. The provision of such commercial services would add complexity and cost to the rail network and could not be delivered using Network Rail's Permitted Development Rights.*

We note, however, that the market has proven its ability to deliver the type on non ubiquitous, non service critical wireless connectivity that has permitted the successful deployment of rail passenger internet services. Furthermore, the rapidly changing nature of this industry would render industry led initiatives in this area obsolete early in their system life.

If there is enough demand for broadband services for passengers on the move, commercial operators should be able to build on their existing services off the railway to meet it. Therefore, Network Rail advocates the development of fully commercial, off track solutions using existing licensed radio spectrum for the provision of passenger mobile broadband services.

GSM-R and GSM-RE in particular are technologies which will deliver huge societal benefit in-terms of safe and efficient railway operation, both for domestic and interoperable trans-European train services. The attached expression of interest paper, gives further background on potential benefits to GB Rail. GSM-RE may ultimately manifest itself in the form of LTE which has strong technical and functional synergies with Mobile Broadband.

Digital PMR/PAMR previously had access to this band but a business case never emerged and the spectrum remained un-used. It is suggested that other spectrum may give a better business case for PMR/PAMR users/operators on the basis of cost-effective pre-developed equipment being available in the mass market.

RFID and SRD are both areas of particular interest to the GB rail industry in building more efficient means to manage the train to infrastructure interface and to enable their customers, passenger and freight operators, to manage the vehicle to payload interface. We would urge Ofcom to exercise caution in not facilitating a de-facto UK standard for RFID & SRD products which cannot be used on and around the railway infrastructure due to RF interference issues.

We have no specific view on Telemetry, Remote Meter Reading, PMSE and UAVs, other than (particularly for the latter) the need to protect GSM-R and subsequent railway operational communication technologies from radio interference.

Question 2: Are there additional applications/services (not listed above (from Section 3)) that could make viable use of the 872/917 MHz bands that Ofcom should be aware of?

Answer 2: *We wish to make Ofcom aware of recent work coming out of the UIC [International Union of Railway Operators] concerning the question of which technology will replace GSM-R. A recent report anticipates that from 2015 onwards LTE will be rolled-out across Europe as the next-generation railway operational communications system. Such an extended roll-out across the member states will inevitably require an extended period of interoperability where additional radio spectrum will be required. To minimise the capital costs of change-out, UIC are viewing the 872/917MHz spectrum as being suited for pan-European mandate to allow existing GSM-R masts to be re-used with software defined GSM-R/LTE train mobiles. This approach has been under-pinned by the German regulator's allocation of 873-876/918-921MHz to Deutche Bahn.*

There are many applications associated with the improving the end to end journey experience for the 3.15m daily passengers, which can be allocated within this part of the spectrum. The attached expression of interest paper illustrates many examples including CCTV, infrastructure management, and Information services.

Question 3: What services do you believe should be authorised to use this band? Could you supply relevant information supporting your preference and include any economic data relating to the value of the spectrum in providing these services?

Answer 3: *For reasons of maximising the value of Government funded investment in Network Rail's roll-out of GSM-R and its associated national fibre-based transmission network, we believe the spectrum would deliver enhanced value, to the taxpayer and rail traveler, if deployed on the railway infrastructure. Through a T&D license for the 872/917MHz spectrum, granted by Ofcom in 2008, Network Rail and RSSB proved the viability of delivering operational trackside wireless connectivity from GSM-R sites alone.*

The relevant ETSI GSM standards and EIRENE specifications are currently being developed to include this frequency range for the railways, as well as the EU directive for ERTMS including the relevant Technical Specifications for Interoperability (TSIs).

Since the advent of public mobile voice and data communications on the GB railway infrastructure, the levels of coverage and availability have been insufficient to meet the requirements of a major element of Critical National Infrastructure. In delivering Government rail policy requirements on integrated journey planning, reliable operation, safety and cost efficiency we propose, based upon a premise of historical non-delivery by mobile operators, that only a deployment of wireless connectivity built to meet the needs of the GB rail industry will allow it to cost-effectively meet Government targets.

We believe there is particular merit in further work to understanding the potential compatibility between SRD/RFID and neighboring technologies (GSM, UMTS, GSM-R and LTE). We believe Ofcom should fully understand potential protection opportunities by distance, time and frequency. Only with this knowledge can

Ofcom take an informed decision that allows UK industry (including a potentially significant GB rail usage) to make most cost-effective usage of pre-developed products.

Question 4: Do you agree with the methods used to assess the potential to interfere with adjacent band services in a full licensed approach?

Answer 4: *We note that for GSM/UMTS 900 protection calculations, Ofcom have employed a free-space propagation model, but for GSM-R protection the more pessimistic Hata model has been employed. The consequence of this, when re-calculated for a 28dBm fixed station, raises Ofcom's 46m/89m GSM-R protection distance to 328m. We do not believe Hata is a realistic model for distances in the order of 100m, meaning railway infrastructure protection is under-stated in Ofcom's proposals.*

Question 5: Do you consider that the proposed technical licence conditions would be justified and appropriate.

Answer 5: *We accept Ofcom's technical reasoning underpinning the conditions and the need to protect all adjacent users, whilst believing the licensed approach to be the correct one. However, we also maintain that the BTS power levels proposed are too low to allow the band to fulfill an important role in delivering much-needed mobile IP wireless connectivity.*

Question 6: Do you agree with the methods used to assess the likelihood of services interfering with adjacent band services under the light regulatory approach?

Answer 6: *Control of usage that does not adversely affect GSM-R is an operational concern, but we note that work is underway elsewhere in Europe to assess if practical RFID equipment requires a lesser degree of protection than Ofcom's current proposals.*

However, of greater concern is the significant future requirement for RFID within the GB rail industry. Should this band become the de-facto RFID band in the UK, with equipment that cannot be used on railway infrastructure, the GB rail industry will be forced to source bespoke product; probably at increased cost and reduced performance. This scenario would import long-term costs into the industry which would inevitably have an inflationary impact upon rail fares and/or government subsidies.

Question 7: We would like stakeholder views on the cost and performance impact of the UMTS900 filters described above.

Answer 7: *Mindful of an emerging position, highlighted in a recent UIC report, where LTE is likely to become the interoperable replacement for GSM-R, the future may see some or all of the 872/917MHz band incorporated into ECC*

Decision (02)05 as designated railway spectrum. We would strongly suggest that Ofcom's analysis should include the impact of dealing with LTE fixed station emissions in the order of +60dBm EIRP, and the filtering that would be required to allow reasonable co-existence.

On the subject of neighbour protection, we would also like to make the point that usage of the spectrum for railway communications purposes would remove the obligation for GSM-R coordination.

Question 8: Are there are any other methods that would give the same protection as the filters? What costs and performance impacts would these have?

Answer 8: *Due to the parallel needs for public mobile operators to deliver business-led coverage enhancements of the railway and for the GB rail industry to deliver a ubiquitous mission-critical GSM-R (potentially moving to GSM-RE/LTE) service we believe the potential for co-ordination to be limited. This would seem to point to the need for enhanced filtering for both parties.*

Question 9: What are your views on the need for and justification of such mitigation measures and how their cost should be borne?

Answer 9: *We are concerned with Ofcom's apparent working assumption that public mobile operators should not bear any of the cost of filtering to support possible future deployment of UMTS at 900MHz. Looking forward to a future where some or all of the 872/917MHz band may become designated railway spectrum, Ofcom's current stance would appear to leave Government and/or rail travellers with the expense of safeguarding UMTS900 operators from the inability of their receivers to discriminate against bona-fide railway emissions in the adjacent band.*

Question 10: Stakeholders views are sought on whether the spectrum should be awarded as a single lot by frequency, or whether it should be split in to smaller frequency lots.

Answer 10: *The rail industry strongly believes in the award of a single lot to support the existing core national infrastructure in establising fit-for-purpose ubiquitous connectivity using existing infrastructure, we would view any significant sub-division as the loss of a unique opportunity for mainland UK.*

Question 11: We would like stakeholder's views on whether the packaging should be split GB/NI or if we should proceed with UK wide packages.

Answer 11: *As a GB only industry, and understanding the potential technical synergy between ROI and NI, we would suggest a GB/NI split. However, we would recommend Ofcom takes counsel from Northern Ireland Railways on their aspirations for LTE usage in any future EC mandated spectrum.*

Question 12: Would it be practical for RFID users and adjacent operators (e.g. GSM, UMTS, GSM-R) to co-ordinate locally on a case by case basis? The answers to this will help Ofcom develop its views on whether a database would be required.

Answer 12: *Ofcom's question implies a view that a license exempt approach could be established which effectively places an onus on users to carry-out their own site-clearance activities. Only Ofcom will be able to comment on whether license exempt users can be expected to abide by the conditions of usage. From a coordination point of view, DfT would need to consider who would bear the costs of managing rail industry coordination activities, which could be significant.*

Question 13: Do you agree with Ofcom's preliminary proposal that the separation distances suggest a light licensing regime if SRD/RFID use in this band were to be supported? If not, how should the interference into adjacent bands be managed?

Answer 13: *Until more work is undertaken to understand the impact of SRD/RFID in the 872/917MHz band upon its neighbours, we believe it is premature to propose a regime which potentially places an onus on those neighbours to manage that coordination exercise. As previously mentioned, we are also concerned that marketplace commodity products may be developed which are not usable on the railway infrastructure.*

END

Network Rail

Annex to Network Rail Consultation Response - Expression of Interest into Ofcom Spectrum 872 - 876 MHz paired with 917 - 921 MHz Based Upon Current GB Rail Industry Dialogue and Research

Purpose:

This paper's purpose is to outline the rationale behind potential GB rail interest in the 872/917MHz radio spectrum as the exact nature and composition of the spectrum opportunity presented by Ofcom is not clear at this time.

It is not intended to replace any future process of more formal expressions of interest in the spectrum.

GB rail business case:

The GB rail network, based upon a privatised structure that was enacted by the government circa 1994, spans the majority of GB mainland and consequently has a diverse geography which varies from straightforward to very challenging environments for reliable radio based communications. The public mobile network providers have focussed their attentions on population coverage for commercial reasons, resulting in a less than full in GB rail coverage as a whole. Consequently, numerous 'high integrity' rail applications require multi-public network support in order to meet requirements for reliable coverage and wide bandwidth which can be complex, inefficient and incur higher cost.

The current socio-economic factors arising from an increasing population, demographics and the combination of lower cost/higher reliability of and higher dependency on electronic devices of rail passenger and freight users is driving a demand that trends and studies show has no clear end date. This is only increasing the demand for more radio bandwidth. A recent study[1] commissioned by the Railway Safety and Standards Board (RSSB), for example indicates that the growth in bandwidth demand on UK rail from present day to 2018 could be as high as 335% on trains, 66% on stations, 84% on Depot, Control Centre and Office Applications and anywhere between 22% and 169% for trackside applications (depending on type of track). This, in conjunction with the recent Association of Train Operating Companies (ATOC) report on the billion passenger railway[2] which recorded that in 2007 passenger railways in Britain delivered 1.2m passenger journeys, generating 30,103,000,000 (30bn) passenger miles; a figure not quite achieved in the only previous peak of 1946 (29 bn). This feat is even more impressive with consideration that the GB rail network today is around half the size it was in the post-WWII era (due to the 1960's 'Beeching' cuts).

An earlier report published by ATOC in 2007[3] recorded that the growth in passenger-kilometres was some 42% and tonne-kilometres for freight some 60% up on figures from the previous 10 years. We are presently enjoying a boom time on GB rail. Other recently published figures for population growth in the next 50 years in Britain suggest anywhere

[1] – RSSB T817 Assessing Bandwidth Demand for Future Communications Needs on UK Railways - Phase 1 Report, draft 3 Oct 09

[2] - ATOC 'The Billion Passenger Railway Lessons From The Past : Prospects For The Future' April 2008

[3] – ATOC 'Ten year European Growth-Trends Britain's railways the fastest growing in Europe' Oct 2007

between 10 and 20 million more people who will all need to be considered against any long term future demand predictions.

For train driver to signaller communications, for example, Network Rail are installing a GSM-R network, mandated under European legislation on rail interoperability as a consequence of the loss of legacy radio spectrum and its approaching life expiry. In doing so, the risks associated with increasing capacity for other operational bandwidth requirements are would be prohibitive as it would add unreasonable complexity and cost. Furthermore, using GSM-R or any other rail infrastructure to deliver non-operational (i.e. commercial) traffic is ruled out by Network Rail as we would not be able to use our permitted development rights to deliver such services.

The case for GB rail is currently being quantified with all industry stakeholders, but comprises of an aspiration to integrate various on and off train technologies using new spectrum to give a wireless medium rail-network-wide, that in turn can deliver some or all or the benefits identified in the following section to the GB rail industry as a group. The GB rail group see the provision of a ubiquitous wireless network that aligns with existing rail corridors as a critical requirement in its endeavours to meet current and predicted future bandwidth and application demand. There is also increased interest in this particular band from mainland European rail as they explore the migration options from GSM-R as it becomes obsolete (estimated to be within the next 20 years). The interest expressed now reflects the awareness that having invested heavily in EU specified GSM-R infrastructure, the case for adjacent frequency bandwidth is very attractive. This is due to the ability to make use of the same equipment (masts, etc) to deliver the new bandwidth.

The various licensing scenarios for potential GB rail use of trackside wireless connectivity are provided below with an indication of the rationale for the clear preference for the single licensed approach, should this be made available under the final proposals.

Option	**Consideration**
Single License, GB Rail governance	Most desirable approach, GB rail could make the necessary long term advances in would ideally need under its own governance to deliver the best societal and economic benefits.
Single License, private governance	Less desirable approach, GB rail would need to engage third party(s) to deliver best societal, business and economic benefits which may present a short term ethos at the cost of longer term investment
Band Manager, private governance	A similar scenario to single license, private governance approach with the added duties, responsibilities and considerations associated with band management.
Band Manager, GB rail governance	Less flexible than single license options above due to diversion of rail resources to non-rail application spectrum management, less flexibility if new GB rail applications evolve due to need to assess these across whole licensed user base.

Benefits Analysis:

The RSSB undertook a study to explore future GB rail bandwidth demand under its T817 project which has identified the following applications and features that are considered of most direct and indirect benefit, whether it be on a single licence or another approach. The benefits of having a wireless network that was omnipresent for GB rail in any form would present a modal shift in services available on even the best public network served routes today. The study focussed on the emerging trends and recent explosion in the use of electronic devices with a 10 year window (to 2018) so it is entirely possible that with GB rail formulating proposals for integrated operational wireless communications across the rail infrastructure, many more applications will come to light that may present an even stronger case for rail. Linking the future demographics of a much larger and older customer bias with the increasing congestion on other surface transport modes, the case for GB rail will only strengthen if the economy of Britain is to achieve continued growth over the medium term. Where this paper makes reference to any perceived societal benefits, it must be understood that these are not currently identified for GB rail and are being presented here as examples of what could potentially be provided in the future.

In addition to the benefits that feature below, from the applications identified, there exists a number of additional factors which currently offer an even stronger case for GB rail's adoption of this new spectrum. These arise from the 'opportunity costing' perspective concerning the intended network rollout of the European Railway Traffic Management System which currently is proposed to utilise the GSM-R (876/921MHz) band for carrying its radio traffic. Being close to the offered spectrum, could present a future opportunity by utilising the same infrastructure to achieve GB and mainland Europe rail coverage for example. These opportunities include the greater European marketplace, competition and economics for future products that a joint GB and mainland Europe rail network would present.

On-Train Applications

Application	Comments	Key Benefits/Beneficiary
Data Applications		
Railway System Condition Monitoring, Data	Gathers data on performance and condition of railway assets. Turns data into information and action via operational, maintenance and other business processes. Automated linkage to safety critical systems - eg apply TSR if poor rail adhesion detected.	Greater efficiency, higher train availability, greater seamless journey potential and stronger customer confidence
Monitoring System for Safety Security and Health, comprising:	Broken into 2 sub-categories for the model:	
• CCTV, low resolution, train to shore	Allowing download from CCTV hard disks at fixed locations, and low resolution real time viewing of one CCTV camera at a time on moving train.	Societal & Safety
• CCTV, high resolution, train to shore real time	Allows high resolution download from CCTV cameras in real time from a moving train.	Societal and Safety

Application	Comments	Key Benefits/Beneficiary
Traffic Management	Optimisation and efficient management of trains through the network. Includes ETCS but not ATO. Also in case of disruption.	Societal and Economic
ATO and Driverless Trains	Control systems for ATO and driverless trains. Includes ETCS as an enabler.	Economic
Rolling Stock Interior Design, comprising:		
• Passenger information (LED, LCD)	Including state of the art systems capable of receiving and displaying multimedia.	Societal
Intelligent Monitoring	Prediction of residual life of railway systems and feedback for optimization of maintenance and future investment decisions.	Economic and Societal due to higher availability of services
Yield Management	Making improved utilisation of existing capacity by persuading customers to adapt travelling behaviour. E.g. pricing, journey info.	Societal and economic
Capacity Driven by Market Demand in Real Time	Dynamic management of capacity based on real-time monitoring of demand. Ability to add capacity to respond to unplanned demand.	Economic – possible freight optimisation at under utlilised periods or routes.
Multi-Purpose Core Routes	Improving capacity on key core railway routes through improved management of mixed traffic, enhanced rolling stock and infrastructure.	Societal and economic. Less congestion on other multimodal route options
Control of Train Operations, Data	Signalling systems, train describers and driver to shore communications. Other staff communications (e.g. guards, station staff, catering staff). Excludes voice, which is dealt with separately.	Safety and Societal
Ticketing and Revenue Collection	Ticketing systems, credit card verification.	Societal and Economic
Delay Attribution	Gathering train movement data and delay causation.	Revenue
Provision of Onboard Catering/Retailing	Stock control and reordering.	Societal and Revenue
Voice Applications		
Control of Train Operations, Voice	The voice components of the application described above.	Safety and Societal

Trackside Applications

Application	Comments	Key Benefits/Beneficiary
Data Applications		
Control of Train Operations, Data	Signalling systems, train describers and driver communications. Other staff communications (e.g. guards, station staff, catering staff). Excludes voice, which is dealt with separately.	Safety and Societal
Railway System Condition Monitoring	Gathers data on performance and condition of railway assets. Turns data into information and action via operational, maintenance and other business processes. Automated linkage to safety critical systems - eg apply TSR if poor rail adhesion detected.	Greater efficiency, higher train availability, greater seamless journey potential and stronger customer confidence

Application	Comments	Key Benefits/Beneficiary
Traffic Management	Optimisation and efficient management of trains through the network.	Safety
Elimination of Risk at Level Crossings	Automated communication and action based on obstacle detection. Also includes current systems for risk elimination – data communications only.	Safety
Intelligent Monitoring	Prediction of residual life of railway systems and feedback for optimisation of maintenance and future investment decisions.	Economic
Voice Applications		
Control of Train Operations, Voice	The voice components of the application described above.	Safety and Societal
Elimination of Risk at Level Crossings	The voice components of the application described above.	Safety

Station Applications

Application	Comments	Key Benefits/Beneficiary
Data Applications		
Station Design and Crowd Management, Data	Developments to improve interaction between customers and station facilities. Systems for active management of crowd dynamics and passenger flow including information and revenue protection systems. Excludes voice, which is dealt with separately.	Safety, Efficiency, Societal, Economic and Security
Monitoring System for Safety Security and Health	Broken into 6 subcategories for the model:	Safety and Security
• CCTV, crowd control low speed links	Crowd control cameras offer wide angle views.	Safety and Security
• CCTV, crowd control high speed links		
• CCTV, passenger safety low speed links	Passenger safety cameras offer views of individuals, e.g. for evidential purposes.	Safety and Security
• CCTV, passenger safety high speed links		
• CCTV, fixed radio download from train (wifi)	Allows download from train-based CCTV networks by a high speed fixed radio link.	Security and Societal
• CCTV, backhaul to storage	Backhauls CCTV images from stations and/or trains to remote storage facilities.	Economic
Yield Management	Making improved utilisation of existing capacity by persuading customers to adapt travelling behaviour. E.g. pricing, journey info.	Economic
Capacity Driven by Market Demand in Real Time	Dynamic management of capacity based on real-time monitoring of demand. Ability to add capacity to respond to unplanned demand.	Safety, Security and Economic
Ticketing and Revenue	Ticketing systems, credit card verification.	Revenue

Application	Comments	Key Benefits/Beneficiary
Collection		
Voice Applications		
Station Design and Crowd Management, Voice	The voice components of the application described above.	Safety and Security

Applications at Depots, Control Centres and Offices

Applications	Comments	Key Benefits/Beneficiary
Data Applications		
Control of Train Operations, Data	Signalling systems, train describers and driver to shore communications. Other staff communications (eg guards, station staff, catering staff etc). Excludes voice, which is dealt with separately.	Safety, Efficiency and Societal
Monitoring System for Safety Security and Health	Broken into 2 subcategories for the model:	Safety and Security
• CCTV, fixed radio download from train (wifi)	Allows download from train-based CCTV networks by a high speed fixed radio link.	Security and Societal
• CCTV, backhaul to storage	Backhauls CCTV images from depots and/or trains to remote storage facilities.	Economic
Disruption Management, Data	Fast assessment of disruption allowing prompt communication with passengers.	Safety, Security and Societal
Staff communications, Fixed Data	General data communications.	Efficiency
Voice Applications		
Control of Train Operations, Voice	The voice components of the application described above.	Safety and Security
Staff Communications, Voice	General voice communications.	Safety, Efficiency and Security

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