Brian Molefe, Group Chief Executive

TRANSNET

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Per Email: rmakgotlho@icasa.org.za

Dear Mr. Makgotlho

RE: Comments on the Draft International Mobile Telecommunication Roadmap

1. Transnet SOC Ltd ("Transnet") hereby provides comments on the Draft IMT (International Mobile Telecommunication) Roadmap published in Government Gazette No. 37948, hereinafter referred to as "the IMT Roadmap". The required questionnaire has been completed and is attached hereto marked Annexure "A".

2. Transnet is a state owned company (parastatal). Government is the sole shareholder with the Minister of Public Enterprises being the shareholder representative. There are five Operating Divisions, namely: Transnet Freight Rail ("TFR"), Transnet Engineering, Transnet National Ports Authority, Transnet Port Terminals and Transnet Pipelines. There are a further three specialist units, which are the Transnet Corporate Centre, Transnet Property and Transnet Capital Projects. Transnet's mission is to enable competitiveness, growth and development of the South African economy by delivering reliable freight transport and handling services that satisfy customer demand. TFR, which is the largest Operating Division, is involved in transporting bulk and containerised freight along 20500 route kilometres of rail network spread throughout South Africa. In terms of the Transnet 7 year Market Demand Strategy ("MDS") TFR is to rail 236 million tons (mt) in the 2014-2015 financial year.

3. Transnet activities are "mission-critical" services because of the importance to Transnet's government mandate and safety obligations. Transnet is regulated by the Railway Safety Regulator ("RSR") in respect of its rail operations and has to meet certain safety standards and requirements to conduct railway operations and maintain its railway operating permits. The key, critical features of a rail network are Reliability, Availability, and the ability to Maintain and Safety ("RAMS"). A rail operator's technology must guarantee at least 99.99% of RAMS in order to ensure continued operations. In essence, if a rail operator does not have connectivity

between the locomotive driver and the Command Centre, safe railway operations cannot take place.

4. Whilst technologies evolved from a commercial point of view, they also evolved within the rail environment albeit at a slower pace. European countries started deploying digital technologies such as TETRA ("Terrestrial Trunked Radio") and GSM-R ("Global Mobile Systems for Rail") as far back as the mid 1990's. In this regard it should be noted that "TETRA technology is constantly under review to accommodate evolving customer demands" (cf. TETRA + Critical Communications Association *TETRA and LTE Working Together* Version 1.1. June 2014 page 2.) However, even supporters of TETRA technology accept that:

5. *Cellular systems have moved through two generational shifts from 2G to 3G/HSDPA [High Speed Data Packet Access] and now to 4G/LTE. With each step, data speeds have increased and now are much faster than is possible in TETRA even with TEDS [TETRA Enhanced Data Services]. Although there is nothing on the horizon that can compete with TETRA voice services, some operators and prospective customers for TETRA are asking whether they should migrate to LTE for broadband data services now.* (cf. TETRA + Critical Communications Association *TETRA and LTE Working Together* Version 1.1. June 2014 page 2).

6. Transnet has been using an analogue open radio network system since the early 1970's and an analogue MPT1327 trunk network system since 1993 and has never deployed digital trunked technologies due to a number of reasons. The reasons for Transnet determining at the time that digital trunked technologies were operationally unsuitable for Transnet were based on the following:

    (a) When TETRA was introduced into the country it did not meet Transnet's data requirements and it was very expensive to rollout as a result of which Transnet used GPRS ("General Packet Radio Service") where it was available, which addressed the gap in data services. This had its own challenges and still has its challenges of network unavailability, unreliability and higher costs associated with expanding the coverage along the railway tracks.

    (b) An upgrade to the technology, "TETRA 2", was introduced into the market but still failed to meet Transnet's requirements.

7. GSM-R was introduced after the introduction of commercial GSM technology and the commercial GSM technology has evolved to such a degree that commercial operators are now rolling out LTE. Whilst Transnet acknowledges that GSM-R might still continue to be used for a number of years to come, Transnet does not have any digital legacy system that it needs to accommodate but is rather looking at the future technologies that can be of relevance for the next 20-30 years. The advantages proposed by GSM-R for the railway environment such as voice broadcasting, and emergency call priority support is now available/supported on commercial LTE networks. However in respect of LTE-R (LTE for rail), it is expected that this will only be released in the third quarter of 2016. (cf. Radio Resource Media Group "Mission Critical PTT [Press To Talk] Set for LTE Release 13, Release 12 freeze likely in 2015" 2 September 2014 *Radio Resource Magazine*.) On the basis of this release date, countries have started debating the replacement of GSM-R:

8. *The current GSM-R standard is based on second generation GSM (2G). The upcoming adoption of LTE/SAE [System Architecture Evolution] technology is set to improve quality and lower costs of GSM-R networks. As the third generation [3G] of GSM evolves towards LTE/SAE, [which will be the fourth generation [4G], GSM-R is expected to evolve as well. That means that GSM-R networks will be able to work with LTE/SAE based equipment. This has the potential to greatly reduce costs while improving reach and reliability (less latency, higher data speeds)* (cf. http://gsmr-info.com).

General comments

9. Transnet submitted comments on the proposals made in the ICASA Frequency Migration Plan proposing, amongst others, that:

   (a) Transnet remains in its current allocation [assignment] and do[es] not incur any additional costs or disruptions to its service; and

   (b) Transnet continues to utilise analogue technology until such time that the digital technologies become stable, at which stage Transnet moves to digital technology, which should release some spectrum. (Transnet "Comments on Draft Frequency Migration Regulation and Frequency Migration Plan" 20 September 2012, is attached hereto marked as Annexure "B").

10. Alternative proposals were as follows:

    (a) *Transnet remains in the 450-470 MHz band with its 1.8 MHz block for its use, but is migrated to the side of 450-470 MHz band to allow contiguous re-allocation of the rest of the band to IMT.*

    (b) *ICASA allocates full spectrum (1.8 MHz block) to Transnet in the 410-420 MHz band.* (Transnet "Comments on Draft Frequency Migration Regulation and Frequency Migration Plan" 20 September 2012, is attached hereto marked as Annexure "B").

11. Transnet acknowledges that the statements made above in its submission of 20 September 2012 were relevant at that point in time. Since then Transnet has embarked on a number of initiatives including partnerships with manufacturers, and conducting pilot studies on future technologies based on Transnet's future requirements and continually increasing data requirements. Furthermore, numerous hours of research have been undertaken internally to investigate other possible future technologies and to benchmark against other freight rail operators. Examples of research are the pilot study on IMT technology that is currently being conducted in Cape Town and the benchmarking case studies for China and Russia on their deployments of LTE for rail environments. (cf. http://www.radio-electronics.com/info/cellulartelecomms/lte-long-term-evolution/lte-fdd-tdd-duplex.php; http://www.fiercewireless.com/tech/story/schoolar-lte-could-be-just-what-450-mhz-needs/2014-08-01)

12. During the 2013/2014 financial year that Transnet procured 1064 new locomotives as part of its implementation of the Market Demand Strategy (MDS) and assisting in growing the economy. These new locomotives come with more advanced technology requirements, which the current network and data throughput cannot meet.

13. Even though a decision regarding a future technology of choice for Transnet has not yet been taken, it is a reality that the goal posts have shifted and Transnet is currently exploring technologies that can serve its current and future telecommunication requirements for the next 20-30 years. It is for this reason that Transnet is considering and planning for a future migration of its network from analogue to digital technology, preferably within the 450 MHz band.

14. GSM-R is a mature technology that is reaching its end of life cycle. In the ecosystem none of the South African networks support GSM-R. In 2017, GSM-R as a technology will be phased out and will only be supported as a technology up until 2025.

15. Whilst the reference to "nextgen" (next generation) refers to technologies such as LTE, the failsafe operation on IP ("Internet Protocol") based nextgen technologies is currently being evaluated. (cf. Nkululeko Gobhozi "GSM-R vs IP Based Communications Network for Railway Application" Presentation at the IRSE [Institute for the Railway Signal Engineers] on 20 February 2014 Johannesburg).

16. Transnet's technology life cycle is 20-30 years. Given this timeline, and the capital expenditure required to bring Transnet's infrastructure in line with GSM-R, Transnet would not be able to recoup the capital cost invested in GSM-R by 2025. Furthermore, GSM-R does not meet Transnet's technical, financial and safety regulatory requirements.

17. A desktop study was conducted on the iron ore line during the first half of 2014, using LTE/4G in different frequency bands. Using LTE in a higher band than 450 MHz would result in additional infrastructure costs (antenna masts, fibre optic splicing, earthing and buildings) and the need to double the number of high sites on the iron ore line which will have a substantial environmental impact. (In this regard it should be borne in mind that the granting of environmental authorisations is not guaranteed where such authorisations are required in terms of environmental regulatory requirements.) The following diagram illustrates the use of the 450 MHz frequency band with Transnet's existing infrastructure in terms of coverage on a Transnet heavy haul line (the Iron Ore Line):

18. The diagram in paragraph 17 indicates that the existing infrastructure can be adapted to accommodate nextgen digital technologies such as LTE/4G within the 450 MHz frequency band with minimal capital investment as compared to relocating to a higher IMT frequency. The first approach would satisfy the communication requirements of Transnet.

19. In terms of the locomotive real estate (space on top of the locomotive roof) there is no more space for the addition of different frequency band antennae due to horizontal antennae separation constraints which will result in desensing/interference between various antennae lobes. The period required to develop a new train antenna system can be reduced (significantly) if existing antennae only need to be reconfigured to accommodate a broader band within the 450-470 MHz frequency band as opposed to a total train antennae system redesign to accommodate a new band. The key principle ultimately is that in order to ensure safe train movement, connectivity is essential.

20. In terms of the MDS, Transnet has procured around 1065 locomotives with new train antennae systems configured for the 450 MHz frequency band. The logistics of reconfiguring these locomotives for a total new train antennae system outside of the 450-470 MHz frequency band would be burdensome which would undermine Transnet's business performance and result in increased costs to the economy as the locomotive capacity that was to be provided is no longer available as and when initially committed. Antennae must be protected and isolated from up to 50kV AC in the traction environment. If redesign is required as a result of a frequency band change, this will further require Transnet Quality Assurance (which process involves QA approval and EMS (Electromagnetic Compatibility) according to SABS (South African Bureau of Standards) standard approval). The timeline for developing, evaluating, testing and obtaining final approval of each antenna is approximately 18 months.

Specific Comments

Ad paragraphs 2.1 and 7.1

21. Transnet understands and supports the SA Connect Broadband Policy objective of "broadband for all", which is intended to assist with economic growth and job creation. Transnet as a state owned company has similar developmental objectives from government to facilitate job creation and economic growth. The MDS Strategy

of Transnet requires that by 2019, Transnet would be transporting 350 mt of commodities on an annual basis. Part of the implementation of this strategy of volume growth is to upgrade rail infrastructure and rolling stock in order to be on par with market demand and to make Transnet one of the top five railway operators in the world.

22. It is against this backdrop that Transnet is investigating a future technology that will be around for at least the next 20-30 years, and which can service the rail environment as the infrastructure is upgraded. Transnet is looking at other rail network operators in locations such as China and Russia that have started introducing broadband technologies like LTE-R for railways as their future technology of choice. An investigation is however still underway to decide on a future technology that will not require Transnet to migrate in the short to medium term and one that will also accommodate the increasing data requirements such as the installation of video on locomotives and alongside the track to minimise level crossing incidents.

23. Transnet believes that as a government wholly owned state entity, it has a role to play in assisting government to achieve its objectives and targets in the SA Connect Broadband Policy from a socio-economic point of view. Transnet proposes that the 450 MHz frequency band be set aside for LTE-R for railways or that it at least remains a flexible option available for entities like Transnet (various OEM suppliers are in the process of evaluating the feasibility of having the protocol of GSM-R adopted for LTE technologies). Transnet sees greater value in remaining in the 450 MHz frequency band both from a cost perspective and a socio-economic contribution. Transnet's network traverses the entire country including rural unserved areas adjacent to the railway line. It is therefore Transnet's view that if it were to remain in the 450-470 MHz frequency band (which is the preferred option coupled with migrating from analogue to digital (broadband) technology within the same frequency band), it might be able to make a portion of its bandwidth available on a wholesale basis to retail operators, thereby extending their reach for rural broadband development in areas where Transnet has a presence.

Ad paragraphs 2.1 and 3.2

24. Transnet notes that the Frequency Migration Plan ("FMP") and the IMT Roadmap indicate that the use of the 450-470 MHz band will be subject to a feasibility study which shall address: the existing usage; the various channel plan options for the 450-470 MHz band; the availability of spectrum in this band; as well as the availability of

IMT equipment. Although a consultation meeting was held with Transnet in respect of the feasibility study conducted by ICASA, Transnet is concerned that a single meeting is limiting and that it did not provide enough opportunity for detailed engagement regarding the feasibility study. Transnet requests clarity from ICASA whether the outcome of the feasibility study formed part of the draft IMT Roadmap as the results were never shared with Transnet, who is an interested and affected party.

Ad paragraph 2.1 in general

25. Position regarding the following statement: "The assignment of frequencies as per regulation 7(1) of the RFSR 2011 [Radio Frequency Spectrum Regulations] will follow after the RFSAPs [Radio Frequency Spectrum Assignment Plan] and will be the subject of a process that will eventually lead to an Invitation to Apply (ITA)". This process will detail the actual mechanism of assignment (including market-based mechanisms, etc.)." Transnet is concerned about this statement by ICASA as it suggests that for entities such as Transnet to have access to the 450 MHz frequency band, it might have to compete with commercial operators. Transnet proposes that spectrum in bands like 450/700/800 MHz be set aside to accommodate state owned companies and smaller operators who cannot compete with commercial operators financially.

Ad paragraph 2.2

26. ICASA refers to the IMT700 and IMT800 as the most important bands for coverage and capacity. Transnet proposes that ICASA license these two bands in the short to medium term to extend the reach to under-served areas, whilst allowing development of technologies in the 450 MHz band to stabilise and mature. It is Transnet's view that beyond these under-served areas it might be impractical for most operators to access unserved areas where return on investment is non-existent. This is a gap that might require government intervention or a partnership of sorts to enable government to fulfil its obligation to its citizens to provide telecommunication access - hence, Transnet's proposal to make a portion of its bandwidth available in rural areas where it has presence since the telecommunication network already exists. This would only be practical if Transnet is allowed to remain and deploy broadband technology in the 450 MHz band.

Ad paragraph 2.3

27. Transnet supports the view that the IMT450 band is beneficial in rural areas due to the propagation benefits leading to reduced equipment rollout costs, hence Transnet's proposal as alluded to in paragraph 2.3.4 above. SA Connect proposes a combination of different technologies to address the issue of "broadband for all". For this to become a reality, a number of interventions are necessary from government, including a drive to educate and upskill the people in those unserved areas and to subsidise the CPE's ("Customer Premises Equipment"). ICASA may need to consider the capabilities of the distributing set top boxes that will be subsidised to those under-served and unserved communities against rolling out a network in the 450 MHz band and against using satellite to cover such communities. In this regard it should be borne in mind that the cost of a set top box is approximately 15% more expensive than a satellite dish.

28. Transnet supports the use of the 450 MHz for TDD ("Time Division Duplexing") configuration. However, the proposal made by ICASA to combine IMT450, IMT750 etc. and to assign those bands to one wholesale operator is of concern to Transnet. Transnet prefers to remain within the 450 MHz frequency band but has no intention of becoming a commercial operator who would be a national wholesale provider. As already indicated, Transnet is prepared to share limited bandwidth in unserved areas where it has presence with any licenced retail operator.

29. The timeline of 2-9 years for migration is inadequate. A pilot study will take at least two years to complete, and finalisation of the date of the migration will, if it takes place for Transnet, take a minimum of ten years to complete full migration. This is based on the following:

    (a) Transnet will need to identify a solution that meets adequate safety requirements, and then conduct a market assessment.
    (b) The second stage is the implementation of a pilot study installation that will have to comply with RSR safety requirements.
    (c) The third stage is approval of shortlisted technologies and type approval of the technologies.
    (d) The fourth stage is the implementation phase and the local supplier development phase to stimulate the local economy.

(e) A transition period is required wherein the phasing-in of the new technology and the phasing-out of the old technology needs to overlap to ensure that rail operations do not suffer.

30. Due to the safety requirements that must be adhered to and the economic development initiatives of government, it is impossible to migrate a system in less than ten years.

Ad paragraph 2.4

31. Transnet proposes that limited bandwidth within the IMT1800 or IMT1900 band be made available for utilities and entities like Transnet for use in more densely populated urban areas to combine with the 450 MHz band for interface for IMT. These are entities who need broadband access but with lower data throughput. Transnet is part of a pilot study on IMT technology in Cape Town using the 1800 MHz frequency band. The higher band works better in urban dense areas by alleviating congestion, whilst lower bands work better is rural areas due to the penetration requirements of the various proposed frequency bands.

Ad paragraph 2.5

32. Transnet is concerned that if ICASA allocates three bands such as 450 MHz, 750 MHz and 2600 MHz to one retail operator, then wholesale-open access for rural, semi-urban and urban areas will have to be under the control of a commercial operator. Mission critical bandwidth is required continuously for safe rail operations. The concern is that Transnet will not be prioritised by the commercial operator, whose objectives differ from that of Transnet and as a consequence Transnet will lose configuration management and inevitably be dependent on an commercial wholesaler that does not have Transnet as a priority customer.

Ad paragraph 5.2

33. Position regarding the following statement: "The Frequency Migration Plan does not necessarily identify the destination bands for out migrating users or uses because the appropriate destination band will vary from user to user, depending on the specific requirements of the user. The spectrum pricing regime is intended to facilitate this process and guide users to the 'optimal' choice". Transnet supports the view that the FMP does not identify destination bands as the suitable destination band will vary

from user to user. However, Transnet does not support using market-based mechanisms to licence non-commercial operators as a way of giving effect to the spectrum pricing regime, such as by way of spectrum auctions.

34. The proposed timeframe for migration to a new frequency band is five years from the moment of publication of the IMT Roadmap in the *Government Gazette*. This is a matter of concern for Transnet as ICASA has not indicated that there is any urgency to exit the 450 MHz band and furthermore IMT technologies in the 450 MHz are not yet stable and mature. Transnet proposes that ICASA categorises the migration period in order of priority for all the identified bands (e.g. short, medium and long term), as follows:

    a. Short term – 5 years;
    b. Medium term – 10 - 15 years; and
    c. Long term – 20 years.

Ad paragraph 6.3.3

35. When referring to IP based TDD technologies such as LTE data transmission, the requirement for configuration may be suited for the proposed rural data transmission of having more downlink slots than uplink slots. Due to the non-static nature of locomotives (where one cannot predict where locomotives will stand on the rail network) there is a higher ratio for uplink as opposed to downlink. Transnet will consider an uplink versus downlink ratio of 3:1. With the advantage of custom configured upload and download slots, the network can be balanced to cater for Transnet requirements and rural requirements.

36. Position regarding the following statement: "Unpaired LTE is also optimally suited to cover future M2M [Machine-to-Machine] and 'Internet of Things' [IoT] demands which will be predominantly uplink-oriented. Also, video uploads from closed circuit television (CCTV) result in a higher uplink bandwidth capacity requirement which have to be taken into account in specialised schemes". Transnet supports the statement for applications in its own environment given the services Transnet wishes to deploy.

Ad paragraph 7.1.1

37. Potential M2M solutions for Transnet (rail, ports and pipeline) include:

(a) Monitoring through existing infrastructure- track and trace;
(b) Monitoring application on the "health status" in terms of safety and condition compliance to loading profiles and train conditions;
(c) Asset tracking (locomotives, wagons, ships etc.);
(d) Voice over IP and CCTV where recording takes place through switchboards;
(e) Locomotive on board measurement and management systems considered as safety critical in terms of loss of life and revenue;
(f) Track side measurement systems monitoring track status and locomotive status (such as hot bearing detectors) for safety; and
(g) Failsafe signalling applications such as ATP ("Automatic Train Protection"), in cab signalling or OBC ("On Board Computers").

Ad paragraph 8.3.1

38. ICASA's monitoring report on the 450 MHz spectrum bands suggested a limited usage. Transnet questioned the methodology used to reach this conclusion and requested further engagement with the ICASA monitoring team, which engagement never took place. Transnet therefore questions the findings of inefficient usage of the Transnet assigned spectrum as the report even referred to some of the Transnet spectrum assignment as "unknown licensee". Transnet notes that the studies were only undertaken for metro areas and not rural areas. Transnet further questions the outcome of 20% usage and the methodology used to obtain the outcome. Transnet has only 1.8 MHz out of a total allocation of 20 MHz.

39. This radio spectrum is used primarily to control the movement of trains nationally by way of voice authorisations and to direct transmissions parallel to the rail line. It forms a critical part of Transnet's operations as a backup medium, as signalling is the primary control. The 450 MHz band is primarily used to authorise train movement and as a backup communication medium. Spectrum usage monitoring would be difficult due to antenna alignment parallel to the rail as opposed to omni-directional coverage.

Ad paragraph 8.3.4

40. Position regarding the following statement: "The Authority forecasts that the 450-470 MHz band will become increasingly attractive for basic internet connectivity, upload-heavy and emergency services in South Africa". Transnet supports the statement regarding upload-heavy services as Transnet's requirements are upload heavy. Due

to the TCP (Transmission Control Protocol)/IP nature, the M2M application adopts the server client relationship where the remote users are the clients, with the result that uploading is used to relay large batches of telemetry information. Downloading is restricted to situations where firmware (i.e. upgrading of software) is requested of remote terminals. This service is very small compared to the upload demand.

41. Position regarding the following statement: "The 20 MHz bandwidth provided by the 450-470 MHz is small compared, for instance, with the 60 MHz or more available in higher frequencies. Therefore, the 450-470 MHz band is appropriate for services requiring lower data rates and capacity". Transnet supports this statement regarding lower data rates and capacity, thereby implying that this band is suitable for Transnet broadband as Transnet's data rates and capacity are lower compared to the requirements of the general consumer.

42. Position regarding the following statement: "The user penetration could be significantly increased by Wi-Fi-offloading of classical smart phones with Wi-Fi-capability and IMT-backhauling. There might be some Mobile Virtual Network Operators (MVNOs) offering hotspot broadband internet in their restaurants or Wi-Fi Kiosks to low-income groups in areas currently not covered." Transnet proposes that it uses safety critical information on the 450 MHz band throughout the whole rail network and that those localised upload destinations such as arrival and departure yards use Wi-Fi.

43. Position regarding the following statement: "Expected services are uplink-oriented/focussed, like M2M, messaging, VoIP (Voice over Internet Protocol) over IMS and uplink use of broadcasting services. M2M and IoT or smart metering/grid services might need different network parameters optimised for uplink or for small data rate requirements. Any congestion due to millions of small-sized messages needs to be prevented. Therefore an optimised network for M2M applications seems more cost efficient". Transnet supports this statement as it is aligned to Transnet's communication model and the result is spectrum efficient.

44. Position regarding the following statement: "For both coverage bands (IMT450 and IMT700), it is expected to be embedded in connected car solutions as backhaul technology to other Wi-Fi-capable devices. Potentially larger antenna sizes due to lower frequency are feasibly more possible within car or home environments than small smart phones". Transnet supports this statement since its hardware is already

prepared for this scenario. The larger antenna sizes that Transnet has in its hardware are already adapted and optimised for long range communication.

45. ICASA has indicated that there are still free bandwidths other than 450MHz to consider. Transnet therefore proposes that ICASA allocates those bands for PPDR (Public Protection and Disaster Relief or Recovery) and allows the South African Police Services to be the PPDR owner.

Ad paragraph 8.3.5.3

46. Position regarding the following statement: "End of migration in 5 years, i.e. 2022; the dual illumination phase could be started regionally from 2017 onwards. Thus a maximum of 3 years dual illumination is required".

47. Transnet wishes to highlight the following aspects in respect of the above:

    (a) Safety critical devices need to be submitted to the RSR for approval - which requires a practical piloting phase. Furthermore, it also needs to comply with Transnet Equipment Build characteristics, which are based on Transnet's accepted norms and standards. Voice communication for mission critical services such as train control is a primary medium for safe operations. According to *Radio Resource Media Group* the mission critical voice for the LTE standard in release 13 is set for finalisation in the third quarter of 2016. (Volume 13 2 September 2014.)

    (b) Infrastructure development needs to interface with new equipment.

    (c) New equipment need to interface with legacy devices such as RS232.

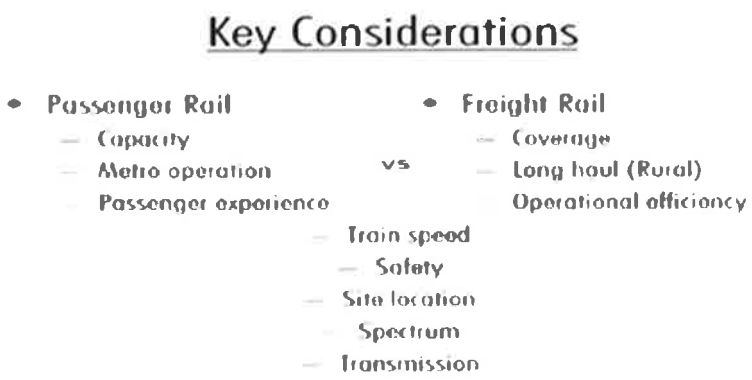
48. Transnet notes the proposed destination bands of 410-413 MHz/420-423 MHz and the alternative technology which is TETRA for the 406-426 MHz band. TETRA is not optimised for the transmission of data over TCP/IP networks. Initial testing did not satisfy the data requirement for communication based measurement systems.

49. Transnet is amenable to sharing the 450 MHz frequency band with other M2M users such as in smart grid applications.

Ad paragraphs 8.5.1.2, 8.5.1.2.1 and 8.5.1.2.2:

50. The European rail network is different to the African rail network. The European network comprises primarily of high speed passenger trains and no heavy haul, whilst Transnet's South African rail network is almost exclusively heavy haul and is approximately 20500km in length. The logistics of establishing base stations at 7-15km intervals as compared with the coverage of 450 MHz IMT by base stations at intervals of approximately 40km are onerous. On a simple calculation to illustrate the number of base stations that would be required for a GSM-R 900 MHz technology versus 450 MHz IMT technology on the Transnet South African Rail network, there would be 1500 base stations for GSM-R 900 MHz compared to 600 base stations for 450 MHz IMT. (For the 450 MHz band Transnet currently has 600 base station (in analogue) and the ratio between 450 MHz and GSMR is 2:5). The whole network will become vulnerable to theft and vandalism as GSM-R 900 MHz would need to be deployed next to the railway line which would increase visibility and access. Furthermore, increased personnel will be required to maintain the increased number of base stations, and statistically meantime between failures will increase with the increase in base stations, resulting in lower availability of the network. Logistics costs will also increase with greater inventory requirements. The European rail network is designed around a high speed, high throughput network, whereas Transnet's requirement is for a low speed, relative low throughput network. GSM-R 900 MHz is not adapted to South Africa's current signalling philosophy.

51. GSM-R 900 MHz has been developed and adapted to accommodate fail safe train operations where network reliability takes precedence over network cost. Furthermore, GSM-R has been adapted specifically for passenger railway operators such as the European railway operators. The following diagram illustrates the main differences and commonalities between passenger and freight railways:



52. In Transnet various other factors such as operational safety, coverage and operational efficiency takes precedence due to the fact that Transnet has reduced safety requirements because it does not transport people. GSM-R coverage and throughput is of primary concern to Transnet. The current minimum data rates required in TFR is >3G (384 kbps) rates. GSM-R can only deliver in excess of 240 kbps, thus the current requirement of Transnet is not even satisfied. The second concern is the coverage area:

Frequency (MHz)	Cell radius (km)	Cell area (km^2)	Relative Cell Count
450	48.9	7521	1
850	29.4	2712	2.8
950	26.9	2269	3.3
1800	14.0	618	12.2
1900	13.3	553	13.6
2500	10.0	312	24.1

TABLE I
CELL RADIUS VS FREQUENCY

53. As can be seen from the above table, the proposed network coverage for 450 MHz is roughly double that of the coverage of GSM-R.

54. We thank you for the opportunity to comment on the IMT Roadmap. Transnet requests an opportunity to make oral representations at the public hearings to be held on 9 and 10 October 2014.

Kind regards

P.P.

Brian Molefe
Group Chief Executive

Date: 07/10/2014

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