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## THE ISDB-T 8 MHZ TRIAL IN SOUTH AFRICA - FAILURE OR RESOUNDING SUCCESS

### 1. Background

The Department of Communications (DoC) in South Africa in 2005 established a Digital Migration Working Group (DMWG) to research all aspects associated with digital migration. The work of the DMWG and the public consultative processes that accompanied these constituted one of the largest public consultative processes ever undertaken in broadcasting in South Africa. The DMWG made recommendations based on consensus positions reached on amongst others the technology standards.

In parallel to these activities the DoC also established a national preparatory team to prepare the national frequency plan and the country's position to be taken at the ITU regional radio conference established to plan and coordinate the introduction of digital terrestrial broadcasting services across the region.

In both the DMWG and the national preparatory working group the same consensus position was reached on the standards to be implemented. South Africa consequently adopted DVB-T as the national standard for Digital Terrestrial Television (DTT) broadcasting with the South African Bureau of Standards in December 2005 publishing SANS 300744:2005<sup>1</sup> and the Broadcasting Digital Migration policy was published following a Cabinet decision on the matter, further confirming the decision<sup>2</sup>. South Africa's decision is further confirmed and communicated internationally by acceding to the ITU Geneva-06 agreement.

In early 2010 ISDB-T proponents started lobbying the SADC region and South Africa to re-consider their standards decision. On 13 August 2010 ISDB-T proponents announced that "a Brazilian delegation will test ISDB-T on an 8MHz band at Sentech, at the end of this month"<sup>3</sup>. It took, however, until 1 November 2010 for the rumoured ISDB-T 8 MHz trial to become a reality.

Two key events marked the ISDB-T test transmission in South Africa. The first was a technical demonstration at the Sentech Pretoria transmission site on 2 November 2010. The second was an official launch event at the Japanese Embassy on the 4<sup>th</sup> of November 2010. Both events were by invitation only.

<sup>1</sup> Available from SABS [https://www.sabs.co.za/Business\\_Units/Standards\\_SA/WebStore/search/detail.aspx?id=16150&lang=EN](https://www.sabs.co.za/Business_Units/Standards_SA/WebStore/search/detail.aspx?id=16150&lang=EN)

<sup>2</sup> Government Gazette No. 31408 of 8 September 2008, Pretoria, South Africa

<sup>3</sup> *Brazil to test ISDB-T in SA*, By Nicola Mawson, ITWeb, Brasilia, Brazil, 13 August 2010. Published to the Internet at [http://www.itweb.co.za/index.php?option=com\\_content&view=article&id=35858:brazil-to-test-isdbt-in-sa&catid=69&Itemid=58](http://www.itweb.co.za/index.php?option=com_content&view=article&id=35858:brazil-to-test-isdbt-in-sa&catid=69&Itemid=58)

Whilst neither the National Association of Broadcasters (NAB) of South Africa nor the Southern Africa Digital Broadcasting Association (SADIBA) were invited to any of the ISDB-T 8 MHz trial events, representatives of respective member organisations did attend and assisted in drafting this report.

The purpose of this report is to capture and report on the facts of the ISDB-T test transmissions in South Africa.

## 2. Stated Objectives for the ISDB-T Trial

The SADIBA analysis of the ITU-R recommendations of first- and second generation standards for Digital Terrestrial Television (DTT) clearly shows what the internationally published performance data for the respective systems is. The analysis confirms that DVB-T in 8 MHz outperforms ISDB-T in 8 MHz on several fronts<sup>4</sup>.

Based on the analysis of the ITU data on the respective standard it was clear that a comparative analysis would have confirmed the theoretical analysis.

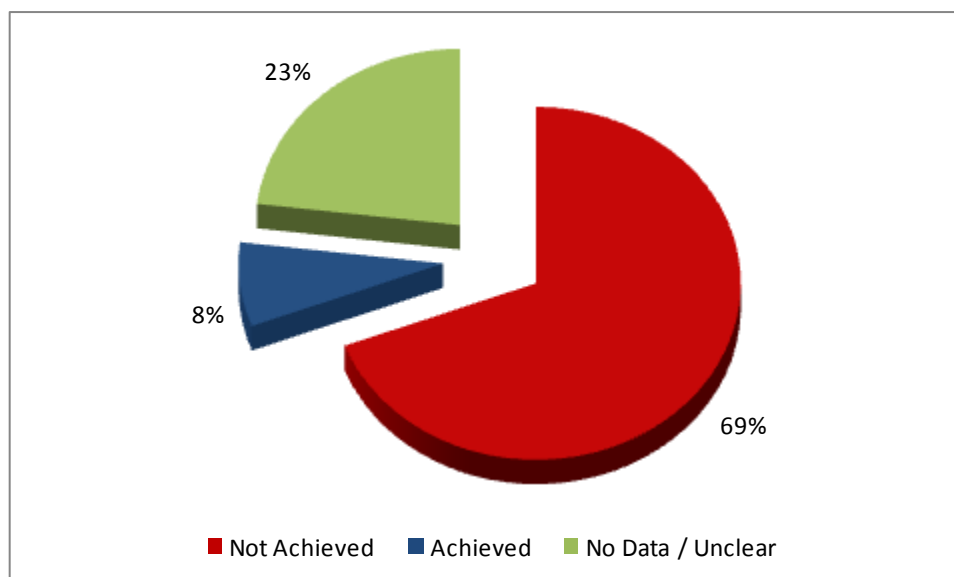
In September 2010 the Sentech Chairperson confirmed that the objective of the ISDB-T trial would not be to do comparative tests. “We are not trying to do comparisons with DVB-T (...) All they (the Japanese and Brazilians) are trying to do is show us their standards work”<sup>5</sup>.

A statement circulated on 3 November 2010 lists numerous objectives of the ISDB-T trial. These objectives are tabulated and commented on in Table 1. For each stated objective an assessment is given on the extent to which the ISDB-T 8 MHz trial had indeed achieved the stated objective.

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<sup>4</sup> *Comparison of Digital Terrestrial Television technologies based on an analysis of ITU data*, available on-line at [http://www.sadiba.co.za/PDFfiles/SADIBA\\_analysis\\_of\\_ITU-R\\_BT1306-4\\_and\\_ITU-R\\_BT1877\\_20101027.pdf](http://www.sadiba.co.za/PDFfiles/SADIBA_analysis_of_ITU-R_BT1306-4_and_ITU-R_BT1877_20101027.pdf)

<sup>5</sup> *Sentech to test alternative TV standards*, By Duncan McLeod, TechCentral, 9 September 2010, published to the Internet at <http://www.techcentral.co.za/sentech-to-test-alternative-tv-standards/16841/>



**Figure 1: Analysis of stated objectives for ISDB-T 8 MHz trial achieved**

Figure 1 illustrates the extent to which the stated objectives were achieved. The analysis shows that only 8 % of the stated objectives can be considered as achieved. The majority of the stated objectives (69%) were not achieved.

**Table 1: Comments on stated objectives of the ISDB-T 8 MHz trial transmission<sup>6</sup>**

Stated Objective of the ISDB-T (8MHz) field tests	Comment
Assess the propagation behaviour and coverage of the ISDB-T transmission	<b>Not done</b> - The short duration and nature of the trial transmission would have made it impossible to conduct any meaningful measurements, acquire statistically representative measurement samples or reach any scientific conclusions on propagation or coverage achieved.
Assess the field tests in a single frequency network operation	<b>Not done</b> - The transmission was from a single site. No single frequency network was ever established or demonstrated
Assess the compatibility of the ISDB-T network with the existing analogue television transmission network <ul style="list-style-type: none"> <li>• Co-channel scenario</li> <li>• Adjacent scenario</li> </ul>	<b>Not done</b> - It was however verified that the ISDB-T transmission in the way these were deployed (co-channel with analogue and digital transmissions in the same coverage area) resulted in harmful interference that severely disrupted analogue and digital transmissions in the area.
Assess picture and sound quality;	Subjective picture quality assessed during the technical demonstration was reportedly poor with “hum-bars” visible on the SD content
Assess the overall effect on encoding/decoding delay	No data available
Assess reception modes <ul style="list-style-type: none"> <li>• Fixed reception (line-of-sight and non-line-of-sight)</li> <li>• Mobile reception</li> </ul>	<b>Not done scientifically</b> - no measurement data or coverage measurement systems demonstrated. Mobile reception at launch event at Japanese Embassy not demonstrated through reception of Sentech transmission. Local in-house transmission generated. It would seem that the claims that ISDB-T would simultaneously deliver fixed SD reception as well as reliable mobile indoor coverage from one transmitter on existing transmission infrastructure were shown to be invalid.

<sup>6</sup> Statement entitled “ISDB-T Sentech Trial” issued by Nthabeleng Mokitimi, Manager: PR & Media, Sentech Ltd on 3 November 2010

Stated Objective of the ISDB-T (8MHz) field tests	Comment
Assess impact of channel segmentation	No data available - ISDB-T proponents could not provide clear factual information on data payload available in the transmission mode configured and demonstrated at the technical briefing session on 2 November 2010
In this regard, Sentech will conduct a full broadcast-chain system test in order to verify that the ISDB-T MPEG 4 (8MHz) system, including SFN functionality, can be successfully operated for the intended purpose, such as:	No Single Frequency Network was established.
<ul style="list-style-type: none"> <li>• Demonstrate compatibility with the existing head-end and satellite distribution system as implemented by Sentech.</li> </ul>	Unclear - It would seem that MPEG Transport Streams generated by Sentech could be re-purposed for transmission over ISDB-T
<ul style="list-style-type: none"> <li>• Demonstrate the functionality of three terrestrial transmission stations (Pretoria, Johannesburg and Helderkruijn) operating in a Single Frequency Network.</li> </ul>	<b>Not done</b> - The transmission was from a single site. No single frequency network was ever established or demonstrated
<ul style="list-style-type: none"> <li>• Verify, by means of test equipment, that these stations are operating in a synchronized manner</li> </ul>	<b>Not done</b> - The transmission was from a single site. No single frequency network was ever established or demonstrated
<ul style="list-style-type: none"> <li>• Verify fixed and mobile coverage and robustness.</li> </ul>	<p><b>Not done</b> - The short duration and nature of the trial transmission and context would have made it impossible to conduct any meaningful measurements or reach any imperial proof of mobile coverage and robustness.</p> <p>What was confirmed however was that the demonstration of the mobile component reception at the launch event at the Japanese Embassy was not based on indoor reception of the of the Sentech transmission but rather based on a locally generated transmission. It would seem that the claims that ISDB-T would simultaneously deliver fixed SD reception as well as reliable mobile indoor coverage from one transmitter on existing transmission infrastructure were shown to be invalid.</p>
<ul style="list-style-type: none"> <li>• Perform a SFN coverage prediction and verify the predicted coverage by means of a field-measurement survey using test equipment and two or three typical domestic receivers</li> </ul>	<b>Not done</b> - The transmission was from a single site. No single frequency network was ever established or demonstrated. The duration and nature of the trial transmission would have made it impossible to conduct any imperial field measurements or to acquire sufficient measurement data on which any conclusions on coverage and receiver performance could be reached.

### 3. Clandestine nature of demonstration

The SADIBA technical committee met on 21 September 2010 to discuss the importance of engaging the numerous debates on standards in order to provide accurate and clear information to decision makers. At the meeting SADIBA members and the academia were invited to formally participate in the DVB-T and DVB-T2 trial transmissions and to ensure that any tests and conclusions would be vetted and reviewed by independent and competent representatives from academic institutions across the region and South Africa.

The meeting expressed concern on the manner in which Sentech was pursuing the ISDB-T trial and the fact that no stakeholders in industry or the local academia had access to the ISDB-T trial, had been invited to participate or had access to any test equipment to independently vet any claims made.

A letter from SADIBA expressing concern on the matter and the desire to cooperate and participate in any upcoming ISDB-T trial was forwarded to the Sentech Chairperson on 27 September 2010.

However, when invitations were sent to selected stakeholders to observe the technical demonstration and launch events of the ISDB-T trials in November 2010 in South Africa these excluded members of the academia, the National Association of Broadcasters, the Southern African Digital Broadcasting Association and the South African Bureau of Standards.

Stakeholders that did get invited did not have any opportunity to conduct measurements or do any independent tests, they merely observed demonstrations.

In conclusion there were no independent measurements, nor any peer reviewed assessments of any aspect of the ISDB-T 8 MHz trial. Any claims made on any success or proof of performance achieved is solely made by the proponents of the ISDB-T system and this has not been verified, studied or assessed in any substantial manner by any independent entity or stakeholder.

#### 4. Lack of technical detail

It was unclear on what technical basis the demonstration was done. To date no detailed transmission specification for 8 MHz ISDB-T has been issued. The signal generated during the ISDB-T demonstrations did occupy 8 MHz channel bandwidth.

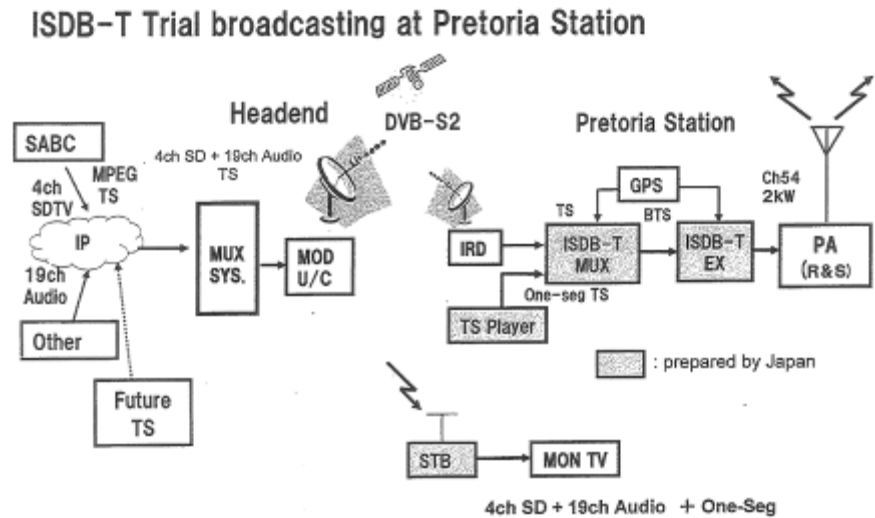


Figure 2: Diagram of ISDB-T test set-up distributed at technical demonstration event

The trial thus confirmed that an 8 MHz ISDB-T signal can be generated. This is however, neither revolutionary nor innovative, but merely confirmation that old 1<sup>st</sup> generation standards can be modified to operate in 8 MHz as it should have been able to do since 1997 when this ability was included within the capabilities of "System C" as defined in ITU-R BT.1306-1.

It remains unclear if the trial transmission was actually operated to a detailed and final transmission specification for ISDB-T 8 MHz and which specification this might have been. When delegates at the technical demonstration enquired to what the data payload of the transmission was, no clear answer was provided. This uncertain and unclear response raised doubt on whether the ISDB-T 8 MHz demonstration was based on a clear and final specification/standard or not.

## 5. Receivers and test equipment

Only a very limited number of ISDB-T STBs capable of receiving and decoding an 8 MHz ISDB-T signal were seen at both the technical demonstration and the launch events. These were not “off-the-shelf” products representative of mass produced consumer products that should be used to assess performance of a system and standard.

Massive investment would be required to industrialise the 8 MHz ISDB-T solution and commence with mass volume production runs. It is highly unlikely that this investment would be made for only a small fragmented STB market in a few counties. Claims of low cost receivers coming on-stream are not backed up by STB pricing data<sup>7 8</sup>.

A greater number of 1-Seg only devices were shown. It must be considered that the 1-Seg receiver is not required to receive the entire 8 MHz channel bandwidth. It is unclear if the 1-Seg segment radiated in the 8 MHz trial in South Africa occupied the same bandwidth as in a 6 MHz ISDB-T deployment or if indeed the 1-Seg component demonstrated in South Africa had been configured to operate in the 1-Seg bandwidth as would be required in a properly standardised 8 MHz ISDB-T transmission.

Test equipment shown was limited to spectrum analysis tools rather than professional digital television analyser devices. Only one instrument capable of Level and BER /MER measurement from one Japanese supplier was on display. A subsequent search for the product on the suppliers’ web site yielded no results. The displayed unit seems to have been a prototype instrument with the product not being available off the shelf.

The lacking availability of any 3<sup>rd</sup> party test and analysis equipment from reputable international suppliers that would be capable of testing and measuring performance of 8 MHz ISDB-T remains a significant concern.

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<sup>7</sup> The National Association of Broadcasters (SA) commissioned Farcombe Consulting to research and report on pricing of ISDB-T STB found in retail in Brazil, the report is available in the Internet at

[http://www.nab.org.za/contentfiles/84\\_Farncombe%20Brazil%20Case%20Study%20Report%28final%29.pdf](http://www.nab.org.za/contentfiles/84_Farncombe%20Brazil%20Case%20Study%20Report%28final%29.pdf)

<sup>8</sup> The initial STB pricing study done in May 2010 was revisited in November 2010 to re-check the STB pricing situation in Brazil and include Argentina, Chile and Peru. No evidence of a USD 20-30 ISDB-T receiver was found. The updated receiver pricing study has not been published on-line. A copy can be obtained from the NAB at [johann@nabsa.co.za](mailto:johann@nabsa.co.za)

## 6. Interference

The ISDB-T trial transmission at the Pretoria<sup>9</sup> transmission site resulted in massive disruptive and harmful interference to licensed services operational in the area.

The implications of wide-spread harmful interference resulting from switching on channel 54 in the Pretoria area were clearly known and considered in the Terrestrial Broadcasting Frequency Plan (TBFP)<sup>10</sup>, and hence the analogue to analogue frequency changes required for the licensed services listed in Annexure H (i.e. CSN at the Pretoria North station and MNET at the Rustenburg Cashan station) were included as required before channel 54 could be switched on in the Pretoria area.

The DTT trial authorisation by the Authority given to M-Net and Orbicom in 2008 was clearly conscious of the interference implications of the use of channel 54 in the Pretoria area and therefore did not license it but in order to avoid harmful interference chose to authorise channel 58 in the Pretoria area instead.

The protection ratios as defined by the ITU, contained in GE-06 and referenced in Annexure I of the TBFP, were used in calculating the interference impact of the switch-on of the ISDB-T transmission on CH54 at 2 kW at the Pretoria transmission site. The interference analysis shows the normal licensed coverage area of the respective service (i.e. the entire shape displayed) and in colour shows the interference level calculated. Green = No Interference; Blue = Some Interference (signal may come and go); Red = Serious Interference (unable to receive wanted signal).

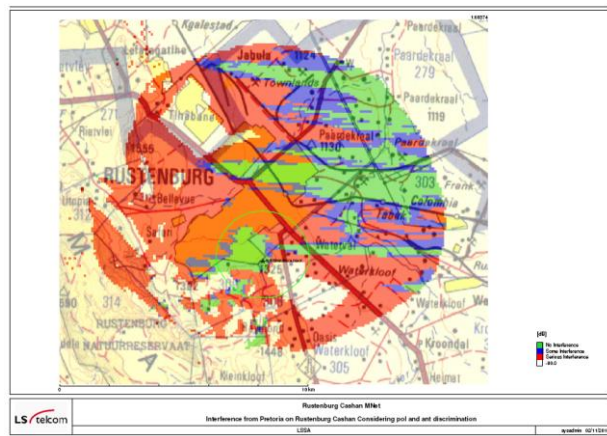


Figure 3: Rustenburg Cashan M-Net coverage interfered with by the Pretoria CH54 ISDB-T transmission (fixed directional receive antenna)

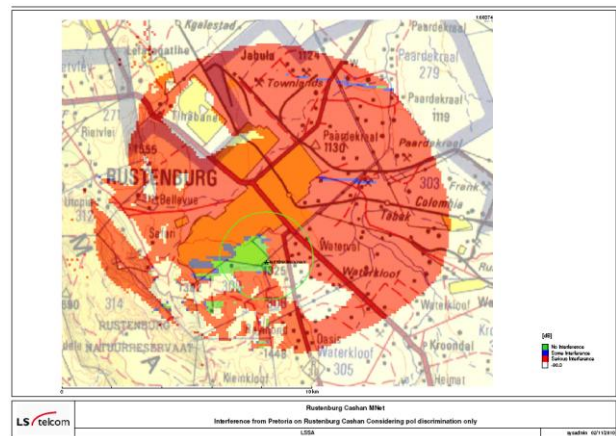


Figure 4: Rustenburg Cashan M-Net coverage interfered with by the Pretoria CH54 ISDB-T transmission (stub receive antenna)

<sup>9</sup> The License granted by the Authority and signed by the ICASA chairperson on 26 November 2010 clearly references the Sentech Johannesburg and Helderkruijn sites and not the Pretoria transmission site as being authorised for the trial broadcast.

<sup>10</sup> Government Gazette 32728 of 18 November 2009



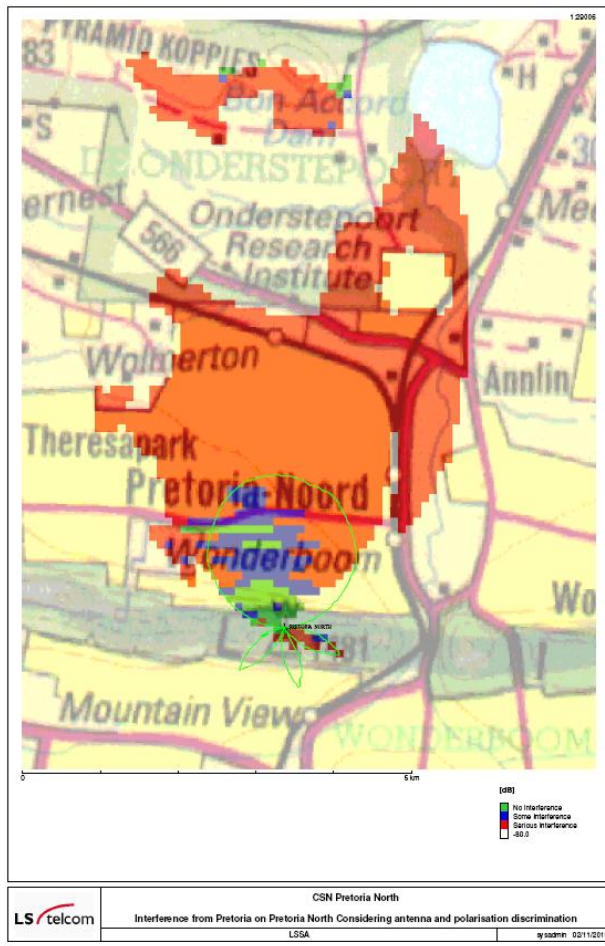


Figure 5: Pretoria North CSN coverage interfered with by the Pretoria CH54 ISDB-T transmission (fixed directional receive antenna)

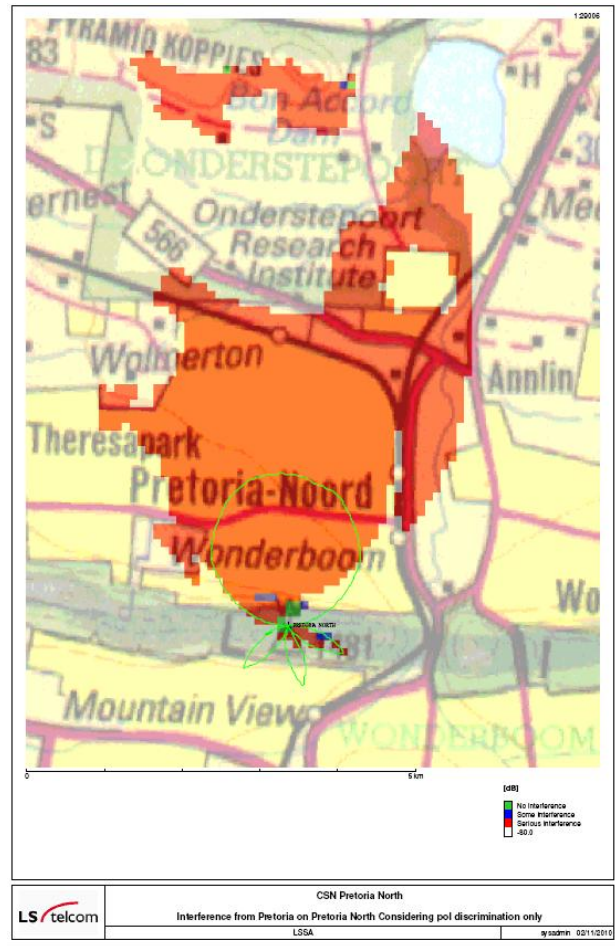


Figure 6: Pretoria North CSN coverage interfered with by the Pretoria CH54 ISDB-T transmission (stub receive antenna )

In-field measurements on 2 November 2010 confirmed the existence of the interference and that licensed services are disrupted and the ability of members of the public to receive the licensed service was negatively impacted by the ISDB-T trial transmission.



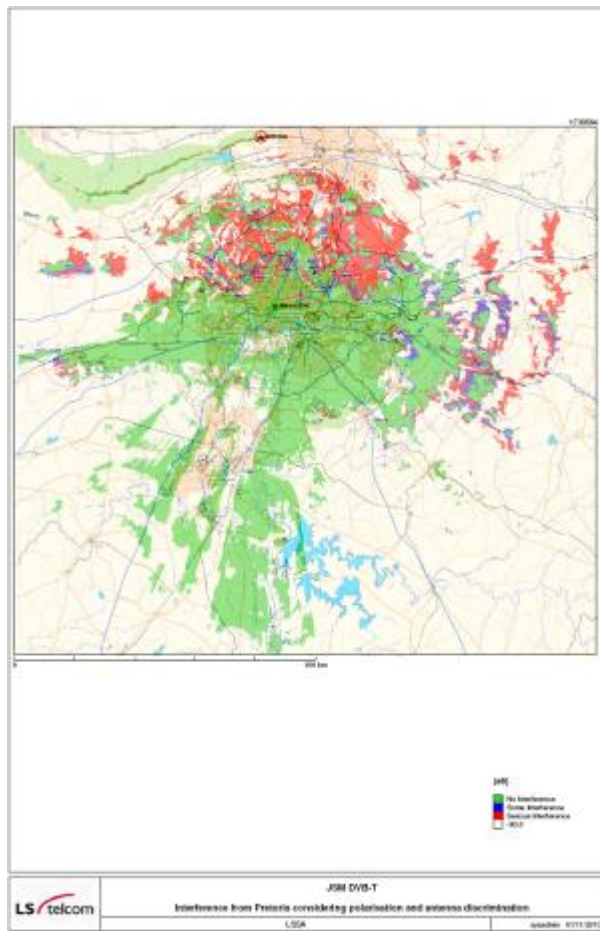


Figure 7: Licensed DTT trial coverage from JSM interfered with by the Pretoria CH54 ISDB-T transmission (fixed directional receive antenna)

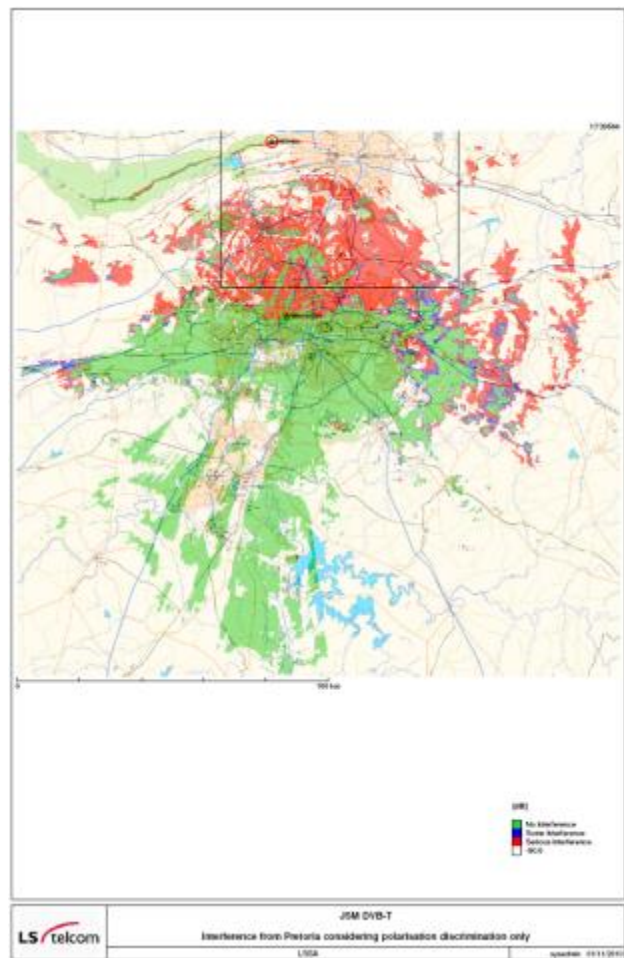


Figure 8: Licensed DTT trial coverage from JSM interfered with by the Pretoria CH54 ISDB-T transmission (stub receive antenna)

Further reception complaints were received from DTT trial participants that experienced reception difficulty following the switch-on of the ISDB-T transmissions on Monday 1 November 2010.

The ISDB-T transmission was clearly in conflict with the protection parameters defined by the ITU for the coexistence of analogue and digital services as contained in GE-06 and referenced in Annexure I of the TBFP. The ISDB-T transmission resulted in harmful interference to viewers of the services impacted and consequently negatively affected network availability and the quality of service received.

The ISDB-T transmissions were therefore not in compliance with the standards and requirements of neither the ITU, nor the parameters defined by the Authority in the TBFP to be maintained in order to avoid harmful interference.

SADIBA is aware that formal complaints have been made to ICASA in this regard. It has further been reported that Sentech engineering staff had warned of the interference risk and had recommended against the switch-on of the transmission on CH54.

In-field measurements confirmed that the ISDB-T test transmission was switched-off in an attempt to time limit the interference.

The ISDB-T trial transmission was terminated on Thursdays evening 4 November 2010 following the “launch” event at the Japanese Embassy. Sentech’s national transmission centre confirmed on Friday 5 November 2010 that there was no intention to switch the ISDB-T transmission on again.

## 7. Sporadic transmissions

The ISDB-T transmissions that caused significant harmful interference were time limited in order to reduce the impact and were subsequently on air for only a few hours a day over a period of less than 4 calendar days.

The available time to do measurements was limited and reduced the ability to capture sufficient statistical samples on which any scientific assessment could be based. No assessment of the long-term stability and availability was possible.

As outlined above the co-channel ISDB-T transmissions caused harmful interference to other licensed services and would in some locations also have experienced interference from the other licensed services. Large area coverage and propagation measurements would have been negatively impacted. It was impossible to derive conclusive scientific findings on these aspects under these test conditions.

## 8. Inability to demonstrate the features claimed on Mobile TV in ISDB-T

The launch event took place at the Japanese Embassy in Pretoria<sup>11</sup>. Observers at this event noted that the stream used to demonstrate the 1-Seg Mobile TV service was not received live from the ISDB-T transmission but was generated and transmitted locally with a stand-alone low power transmitter. It would seem that the Mobile TV component of the ISDB-T transmission was not reliably receivable within the Japanese Embassy (or did not work for other undisclosed reasons).

The fact that the mobile component of the ISDB-T transmission was not receivable within the demonstration area is in complete contradiction to the claims made that ISDB-T would deliver both fixed and mobile indoor TV coverage from one transmitter on existing infrastructure and that ISDB-T could deliver these services cheaper requiring only one network.

The ISDB-T trial in South Africa verified that although one can include a mobile service within an ISDB-T transmission it is not reliably receivable with a mobile device<sup>12</sup> and was not successfully demonstrated.

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<sup>11</sup> The area is screened off from Johannesburg, Rustenburg and the Pretoria North CSN transmission and would not have experienced any harmful interference from other licensed transmissions in the area.

<sup>12</sup> The physics that dictate that a different network infrastructure is required in order to deliver reliable mobile indoor reception are outlined in amongst others slides 16-20 of **Overview of Processes followed in evaluating and selecting a standard for DTT in South Africa and SADC 19 July 2010** available on-line at [http://www.sadiba.co.za/PDFfiles/011\\_SADIBA\\_on\\_DTT\\_Standards\\_for\\_Namibia\\_20100719v2.pdf](http://www.sadiba.co.za/PDFfiles/011_SADIBA_on_DTT_Standards_for_Namibia_20100719v2.pdf) or slides 11-14 of **DVB presentation in Namibia of 19 July 2010** available on-line at [http://www.sadiba.co.za/PDFfiles/Laven\\_DVB\\_Namibia\\_2010-07-19.pdf](http://www.sadiba.co.za/PDFfiles/Laven_DVB_Namibia_2010-07-19.pdf)

## 9. Conclusions

The ISDB-T 8 MHz trial in Pretoria, South Africa was highly problematic. Only 8 % of the stated objectives can be considered as having been achieved. The majority of the stated objectives (69%) were not achieved.

The trial was not conducted in an open and transparent manner and key industry stakeholders, members of the academia and 3<sup>rd</sup> party engineering experts were not able to participate. No independent measurements nor peer review assessment of the ISDB-T 8 MHz trial were done. Any claims made on any success or proof of performance achieved is solely made by proponents of the ISDB-T system and has not be verified, studied or assessed in any substantial manner by any independent entity or stakeholder.

The trial confirmed that an 8 MHz ISDB-T signal can be generated with prototype modulators and received on prototype hand-build receivers. This confirms what had been claimed of the system's ability since 1997.

Proponents of ISDB-T were unable provide clear and detailed information on the payload of the demonstration transmission and it remains unclear if the trial transmission was actually operated to any detailed technical specification.

Only a very limited number of ISDB-T STB capable of receiving and decoding an 8 MHz ISDB-T signal were seen at both the technical demonstration and launch events. No "off-the-shelf" STBs were used in the demonstration. Massive investment would be required to industrialise the 8 MHz ISDB-T solution and commence with mass volume production runs. This is highly unlikely to be made for only a small fragmented market in a few counties.

The lacking availability of any 3<sup>rd</sup> party test and analysis equipment from reputable international suppliers that would be capable of testing and measuring performance of 8 MHz ISDB-T remains a significant concern.

The ISDB-T transmission resulted in massive disruptive and harmful interference to numerous licensed services operational in the area. In-field measurements confirmed that the ISDB-T test transmission was switched-off in an attempt to time limit interference.

Consequently the ISDB-T test transmissions were on air for only a few hours a day over a period of less than four calendar days. This significantly reduced test and measurement time and the ability to capture sufficient statistical samples on which any scientific assessment could be based. No assessment of the long-term stability and availability was possible.

The ISDB-T trial in South Africa verified that although one can include a mobile service within an ISDB-T transmission it is not reliably receivable within a mobile reception environment. The reception of both fixed and mobile signals from the same transmitter network could not be demonstrated at the launch venue.

The ISDB-T trial transmission was terminated on Thursday evening 4 November 2010, following the “launch” event at the Japanese Embassy. Sentech’s national transmission centre confirmed on Friday 5 November 2010 that there was no intention to switch the ISDB-T transmission on again.

It is SADIBA’s view that the ISDB-T trial has not provided South African stakeholders with any new insights or reason to consider it as an alternative standard to the adopted national standard DVB-T. Considering the number of objectives achieved against those not achieved it is not possible to claim that the trial was a resounding success.

End of report.