

Digital Terrestrial Television (DTT)



Network Architecture and Case Solutions

Ivan Reuter
Customer Solution Engineer,
INTELSAT Africa



Agenda

- **Introduction**
- **Analog switch-off**
- **DTT standards**
- **DVB-T2 Overview**
 - **Market**
 - **Features**
- **DVB-T2 business models and advanced features**
- **High level methodology to handle DTT network**
- **Intelsat added-value and innovative ideas to make your DTT network successful**

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Introduction

- **Purpose of this presentation**

- This presentation is designed to help Operators understand Digital Terrestrial Networks (DTT)
- It gives both a market and technology overview, especially DVB-T2 which is the technology of the future
- It provides a High-level methodology explaining the different phases of DTT network handling and deployment
- It explains what is Intelsat's added value

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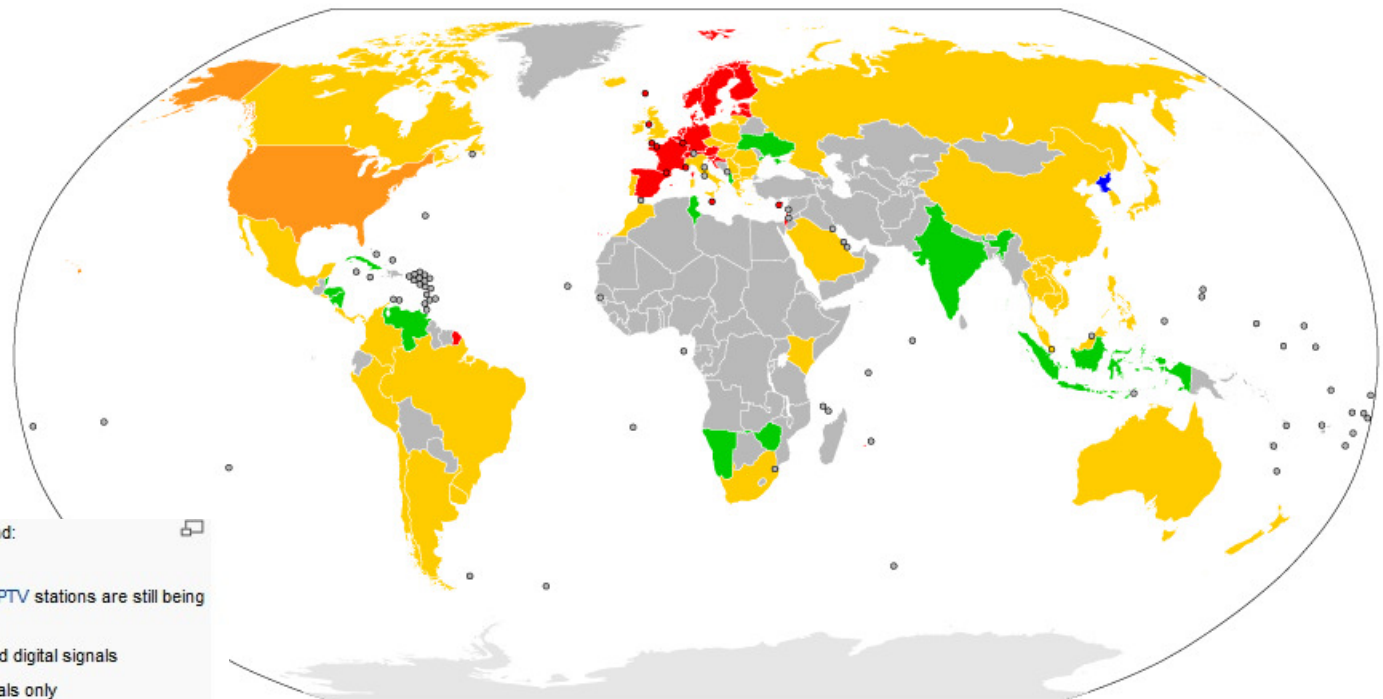
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Analog switch-off

- **Why Terrestrial TV goes Digital?**
 - **Spectrum efficiency**
 - Up to 6 MPEG-2 SD or 12 MPEG-4 SD TV channels instead of 1 analogue in the same bandwidth
 - Single Frequency Networks makes frequency planning much easier
 - **Power efficiency**
 - Up to 10 times less energy required in the transmitter for the same coverage
 - **Quality of service**
 - Better image & sound quality
 - New type of services such as HDTV, 3DTV and Electronic Program Guide)
- **Majority of African countries are committed to switch to Digital before end of 2016**

Analog switch-off

- **Analog to Digital migration status**
 - Completed in 26 countries
 - In progress in more than 40 countries



World map of digital television transition progress. Legend:

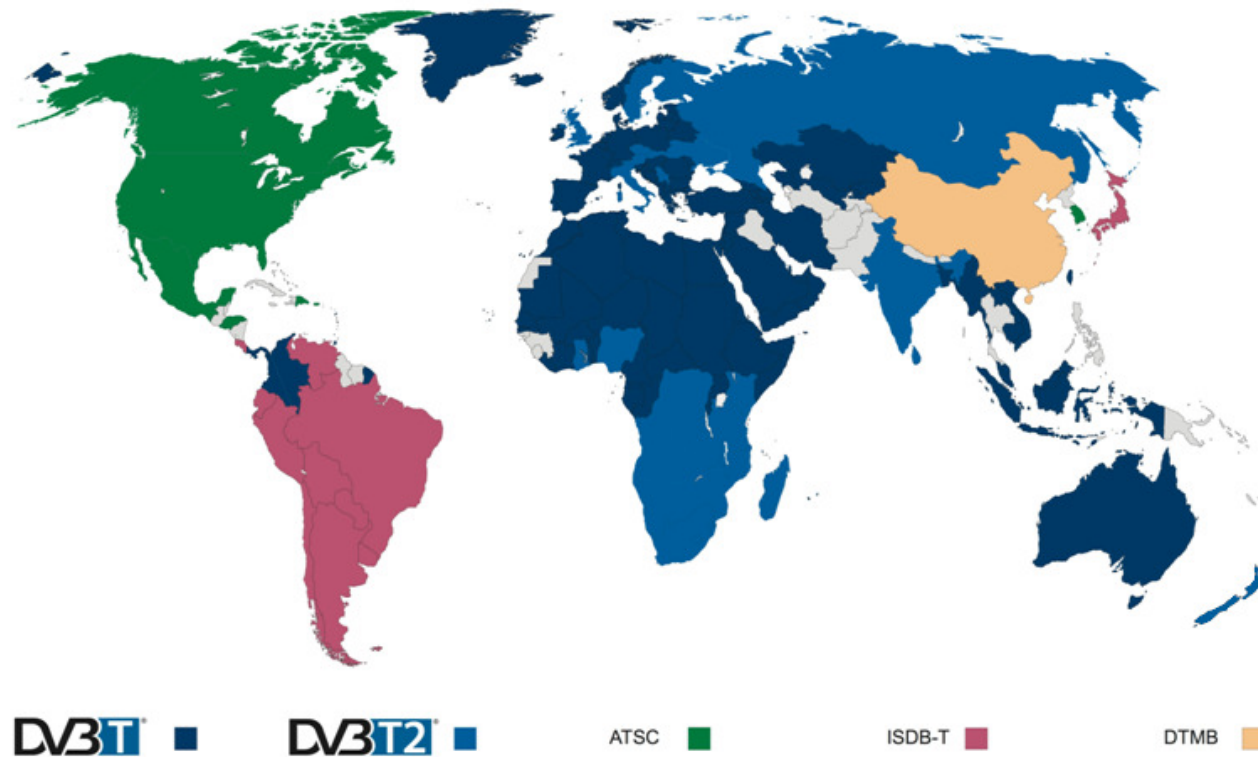
- Red: Transition completed, all analog signals terminated
- Orange: Transition completed for full-power signals; some LPTV stations are still being broadcast in analog
- Yellow: Transition in progress, broadcasting both analog and digital signals
- Green: Transition not yet started, broadcasting analog signals only
- Blue: Does not intend to transition, broadcasting analog signals only
- Grey: No information available

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DTT standards

- DVB is the dominant DTT standard



Digital Terrestrial Television Systems

Countries that have deployed or adopted DVB-T and DVB-T2 (including ITU RR06 Signatories and SADC Members). DVB and the DVB logo marks are registered trademarks of the DVB Project. October 2011

- DVB-T2 is 3 years old, but already selected by 47 countries !

DTT standards

- **DVB-T market figures**

- First DTT deployment in UK, in 1998
- Average of 3-4 new DTT launch per year
- DTT launch include national + regional services
- More than 65 countries have deployed DVB-T
- More than 125 Millions receivers sold !

Country	Population (million)	DVB-T Services Launched	Receivers Sold (million to nearest 0.5)
United Kingdom	60	1998 (2002 Freeview)	27
France	64	2005	8 (includes rentals)
Germany	82	2002	8
Spain	45	2000	8
Italy	59	2004	6.5
Australia	21	2001	2.5
Taiwan	30	2005	2.5

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DVB-T2 Overview (market)

- **Why DVB-T2?**
 - **Need for more bitrate within the same bandwidth**
 - Evolution from SD to HDTV and 3DTV
 - **Need for better coverage with less power**
 - Enhanced modulation and coding requiring less power or enabling larger coverage
 - MISO technology for better coverage in overlapping areas
 - Larger SFN cells
 - **Need for regionalization compatible with SFN networks**
 - Multiple PLP allowing regionalization and different business models

DVB-T2 Overview (market)

- **DVB-T2 market status**

- **Mid 2009 : only UK and Finland were investigating T2**
- **Beg 2012, Commercial Launch in :**

UK: BBC/Arqiva

Finland: DNA and Anvia

Sweden: Teracom

Italy: Europa7

Zambia: GOtv

Uganda : GOtv

Kenya : GOtv

Nigeria : Gotv

Vietnam : AVG

The Momentum is gaining in Europe ... and outside Europe !

DVB-T2 Overview (market)

- **DVB-T2 commercial roll-outs**



- **BBC/Arqiva (UK)**
 - March 30, 2010
 - Freeview HD: 5 FTA HD services
 - Over a million Freeview HD boxes sold (Feb 2011)
- **Europa 7 (Italy)**
 - October 11, 2010
 - 12 Services: 1 FTA SD, 5 HD paid subscription, 3 pay-per-view HD, 3 Adults channels (SD paid subscription)
- **Boxer (Sweden)**
 - November 1st, 2010
 - 9 FTA HD services (7 already available in SD)
- **DNA (Finland)**
 - December 2010
 - 2 HD services for now
- **GoTV Services (Zambia, Kenya, Uganda, Nigeria, more countries to come soon)**
 - Since July 2011
 - 19 pay tv services
- **IGLOO TV (New Zealand)**
 - Mid 2012
 - 12 SD services subscription



DVB-T2 Overview (market)

- **Adopted standard**

- Austria
- Czech Republic
- India
- Serbia
- Slovakia
- Sri Lanka
- Ukraine
- Norway
- Montenegro
- Turkey
- Slovakia
- Estonia
- Belarus
- Belarus
- Ghana
- Malaysia
- Kazakhstan
- Netherland Antilles
- Thailand
- Singapore
- New Zealand
- Vietnam
- Germany
- Russia
- Indonesia
- Colombia

Southern African Development Community selected DVB-T2 as official standard in Dec 2010



DVB-T2 Overview (market)

- **What about Set Top Boxes (STB)?**

- **Available in UK shops since March 2010**

- Set Top boxes (simple and/or with PVR)
 - TV with integrated DVB-T2 receiver
 - DVB-T2 STB are DVB-T/T2 , MPEG-2/4 and SD/HD compliant!



- **Price is decreasing quickly**

- April 2010 : price was 150€
 - Feb 2012 : price started at £30 in retail shops
 - March 2012 : less than 20€ FOB
 - Prices are comparable with HD DVB-T receivers!
 - More than 100 different models available
 - More than 5 million T2 receivers sold by end of 2012 in UK
 - New T2 deployment = Higher quantities = lower prices !



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DVB-T2 Overview (features)

- **Design requirements for DVB-T2**
 - **Re-use existing network infrastructure**
 - Head end (encoders, multiplexers, amplifiers, Tx antennas)
 - Domestic aerial (Rx VHF / UHF antennas)
 - **Best combination of DVB-T and DVB-S2**
 - Reuse of DVB-T features such as OFDM modulation, guard interval, bandwidth size, constellations, etc...
 - Adapt DVB-S2 features
 - Packaging of data in Base Band frames (BB Frames)
 - Use of LDPC Forward Error Correction (FEC)
 - Use of Multi-Stream principles through PLP – Physical Layer Pipes)
 - **Result : Increase over 30% the bitrate within the same bandwidth compared to DVB-T!**

DVB-T2 Overview (features)

- DVB-T and DVB-T2 features comparison

DVB-T

DVB-T2

FEC – Inner - Outer	CC (Convolution coding) RS (Reed-Solomon)	LDPC (Low Density Parity Check) BCH (Bose-Chaudhuri-Hocquengham coding)	Higher robustness
Code Rate	1/2, 2/3, 3/4, 5/6, 7/8	1/2, 3/5 , 2/3, 3/4, 4/5 , 5/6 (2/5 , 1/3 T2-Lite)	More flexibility
Constellation	QPSK, 16QAM, 64QAM Non-rotated	QPSK, 16QAM, 64QAM, 256QAM , Non-rotated, Rotated	Higher bitrate. Rotation aids robustness for low order constellations
Guard Interval	1/4, 1/8, 1/16, 1/32	1/4, 19/256 , 1/8, 19/128 , 1/16, 1/32, 1/128	More flexibility on network design
FFT Size	2K, 8K	1K , 2K, 4K , 8K, 16K , 16K ext. , 32K , 32K ext.	Resistance to Doppler effect (1k), better SFN performance (32k)
Scattered pilots	8% of total	1% , 2% , 4% , 8% of total	Bitrate flexibility
Continual pilots	2.6% of total	0.35% of total	Higher bitrate
Bandwidth	5, 6, 7, 8 Mhz	1.7 , 5 , 6, 7, 8, 10 MHz	Radio (1,7MHz) and contribution (10MHz)
Max. Bandwidth	31.66 Mb/s	50.34 Mb/s	Gain of +65%
Diversity	SISO (single-input,single-output)	SISO, MISO (Multi-input,single-output)	Coverage improvement through MISO gain
Max TX Distance in SFN	62 km (8k)	159 km (32K), 134 km (16K)	More carriers -> longer guard interval

DVB-T2 Overview (features)

- DVB-T and DVB-T2 capacity comparison

	DVB-T [®]	DVB-T2 [®]
FFT size	2K	32K
Guard Interval	1/32	1/128
Modulation	64 QAM	256 QAM
FEC	2/3 CC + RS (8%)	2/3 LDPC + BCH (0.3%)
Scattered Pilots	8%	1%
Continual Pilots	2,6%	0,35%
P1/P2 overhead	0%	0,7%
Bandwidth	Standard	Extended
Capacity	24,1 Mbit/s	40,2 Mbit/s

- Capacity of DVB-T2 = DVB-T +66%



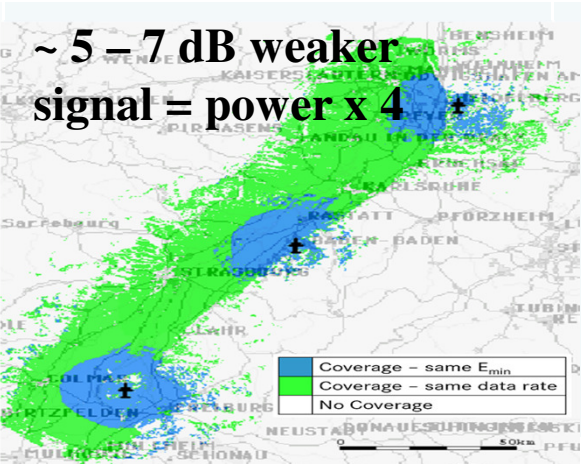

- Up to 6 HDTV channels or 20 SDTV channels in MPEG-4

DVB-T2 Overview (features)

- **DVB-T2 technical advantages**
 - **More bitrate, more robust, more coverage, less Tx power**
 - **SFN improvement**
 - Larger SFN cell (longer guard interval = increased max distance)
 - MISO for better cell overlap reception (multi-input single output)
 - **Multi PLP capability**
 - Splits frequency into different pipes – each can have a different bit rate, modulation and error protection parameters, such as DVB-S2 VCM
 - Allows different business models
 - **T2-MI protocol between Head-End and transmitters sites**
 - Transport for T2 structure and information (BBFrame, MPLP, MIP, etc)
 - Remote configuration of Exciters/Transmitters

DVB-T2 Overview (features)

- DVB-T2 key points

	More Coverage	Same Coverage
More bandwidth	<p>Trade-off between bitrate and robustness</p> 	
Same bandwidth	<p>~ 5 – 7 dB weaker signal = power x 4</p> 	<p>Reduction of TX power to 1/4 (-75%)</p> 

(source dvb.org)

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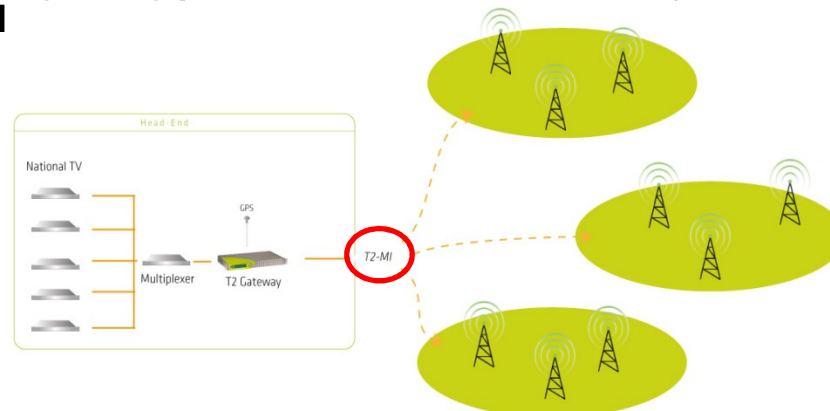
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- DTT standards
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DVB-T2 business models and advanced features

- **DVB-T2 advanced features**

- **Introduction of T2-MI**

- **T2-MI = Modulator Interface**
 - **Generated by the T2 Gateway and received by the modulator/transmitter**
 - **Encapsulates the MPTS/BBFrame into T2-MI packets**
 - **Provides information to DVB-T2 modulators (such as in-band configuration). All DVB-T2 modulators belong to the DVB-T2 Gateway information**
 - **Inserts signaling packet which contains the synchronization information for SFN**

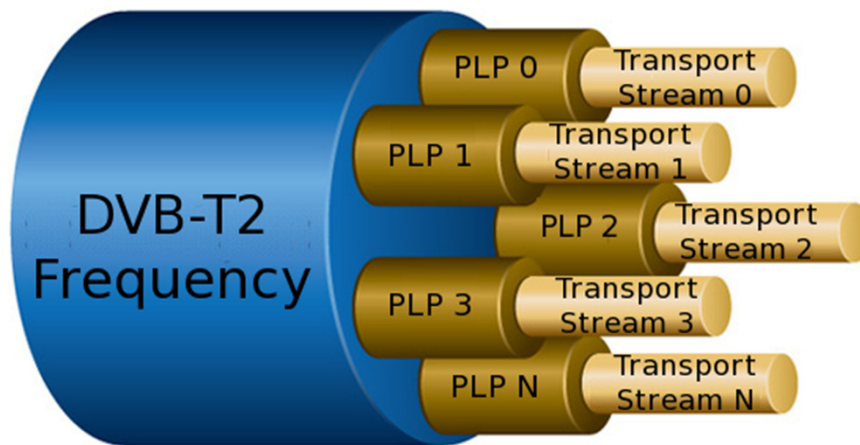


DVB-T2 business models and advanced features

- DVB-T2 advanced features

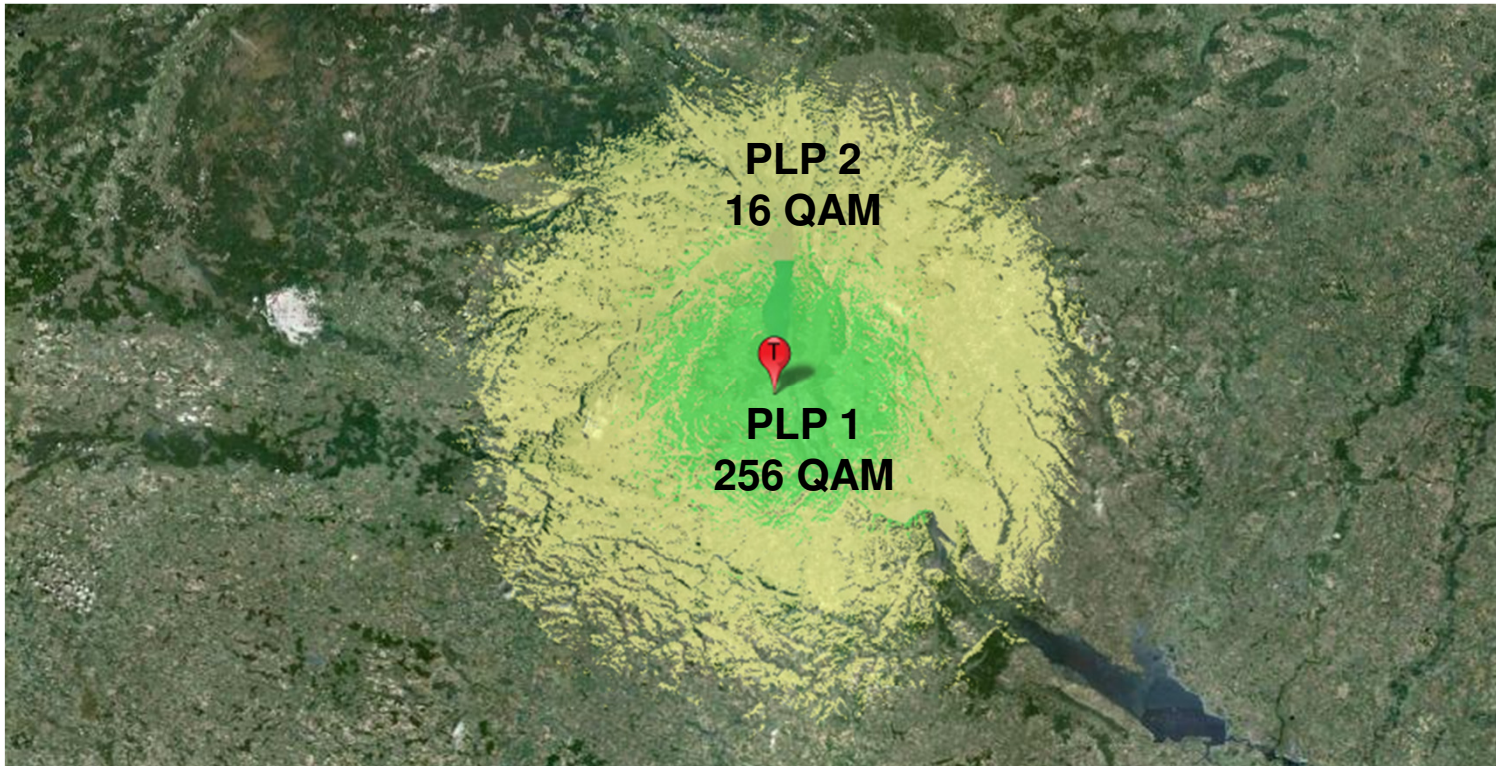
- Multi PLP

- Several MPTS can share the same T2 frequency. This provide more flexibility and new possibilities for the network operator
 - Allow service-specific robustness
 - Each PLP can have its own modulation, FEC code rate and interleaving
 - All PLPs are broadcasted over the same frequency, so that it is considered as a single DVB-T2 multiplex



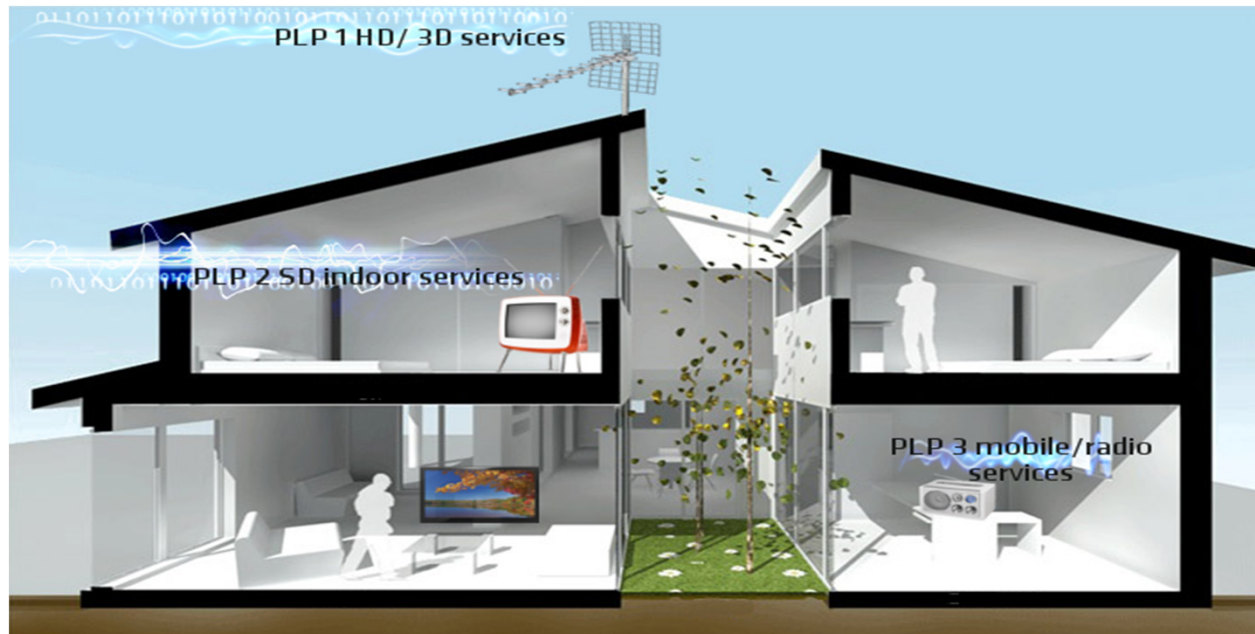
DVB-T2 business models and advanced features

- DVB-T2 advanced features
 - Example of coverage using 2 different PLPs



DVB-T2 business models and advanced features

- DVB-T2 new business models
 - Carrying both TV and Radio services on the same frequency
 - 3D/HD/SD services : 1 PLP can carry 3D and/or HD services with low robustness (to achieve the required BW) while another PLP can carry SD services with high robustness
 - Radio services : they can be carried on a different PLP with high robustness so that it can be received indoor

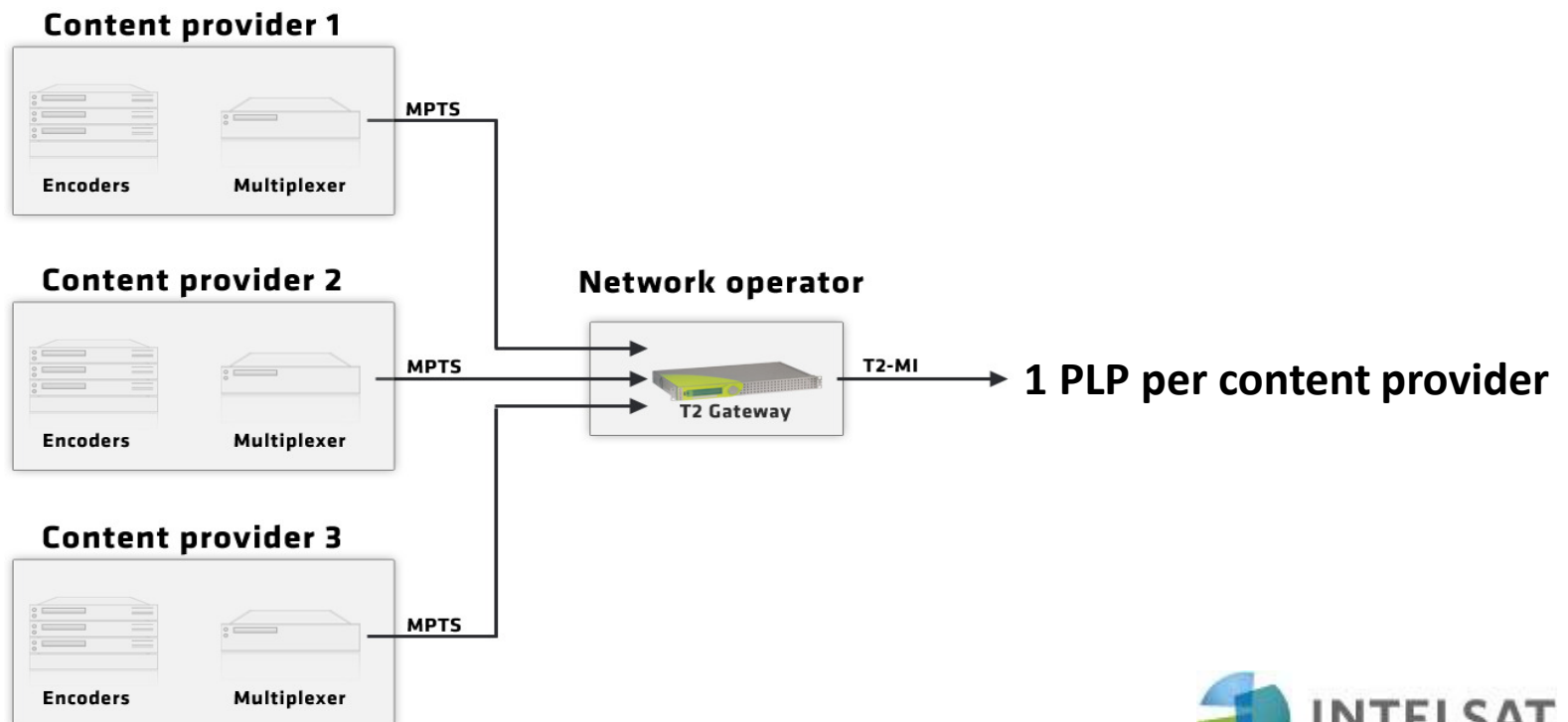


DVB-T2 business models and advanced features

- DVB-T2 new business models

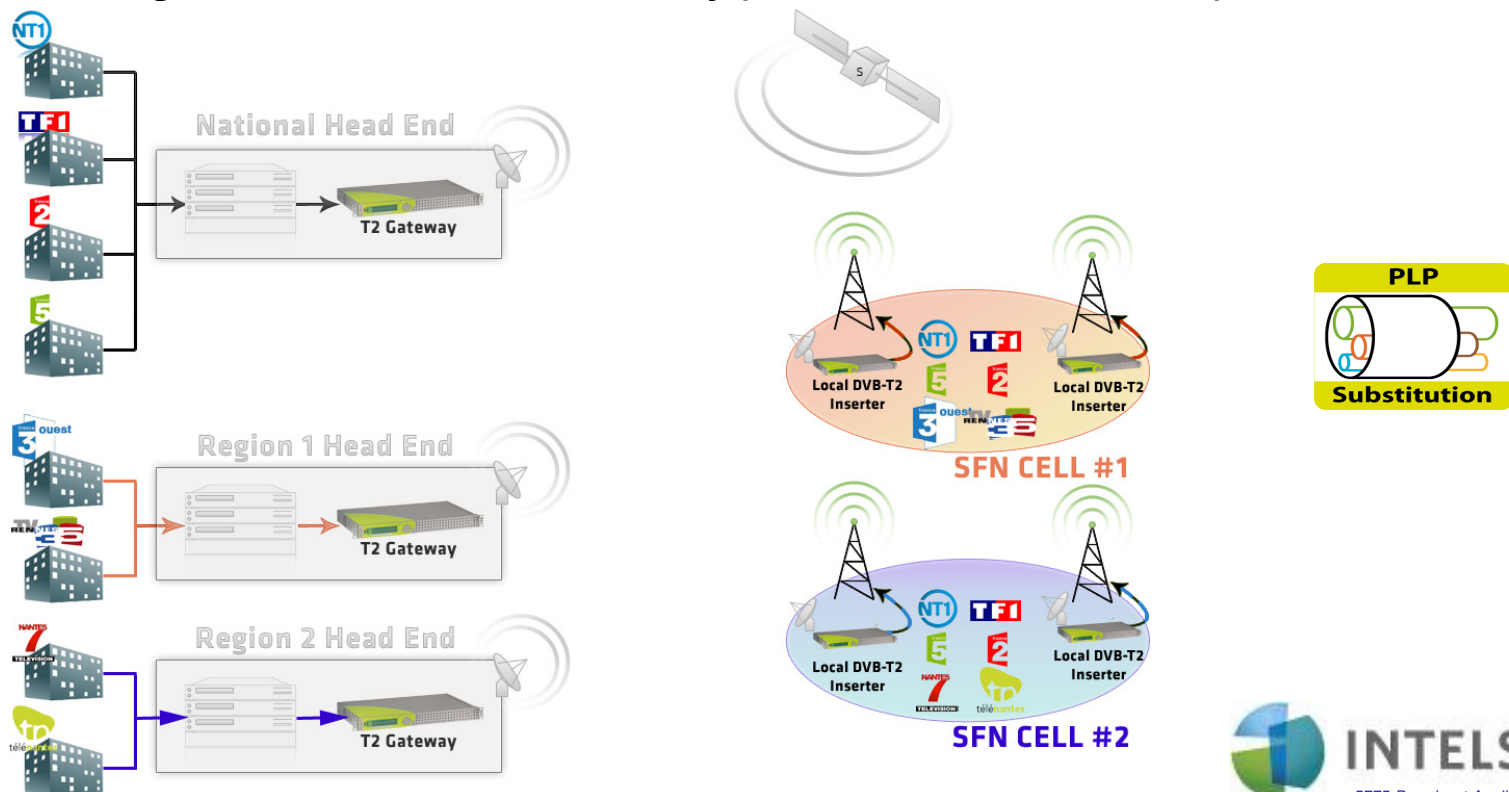
- Frequency sharing between content providers / broadcasters

- Multiplex sharing : several providers share the same T2 multiplex in dedicating a PLP per provider in order to guaranty bitrate allocation and adapt robustness according to their needs



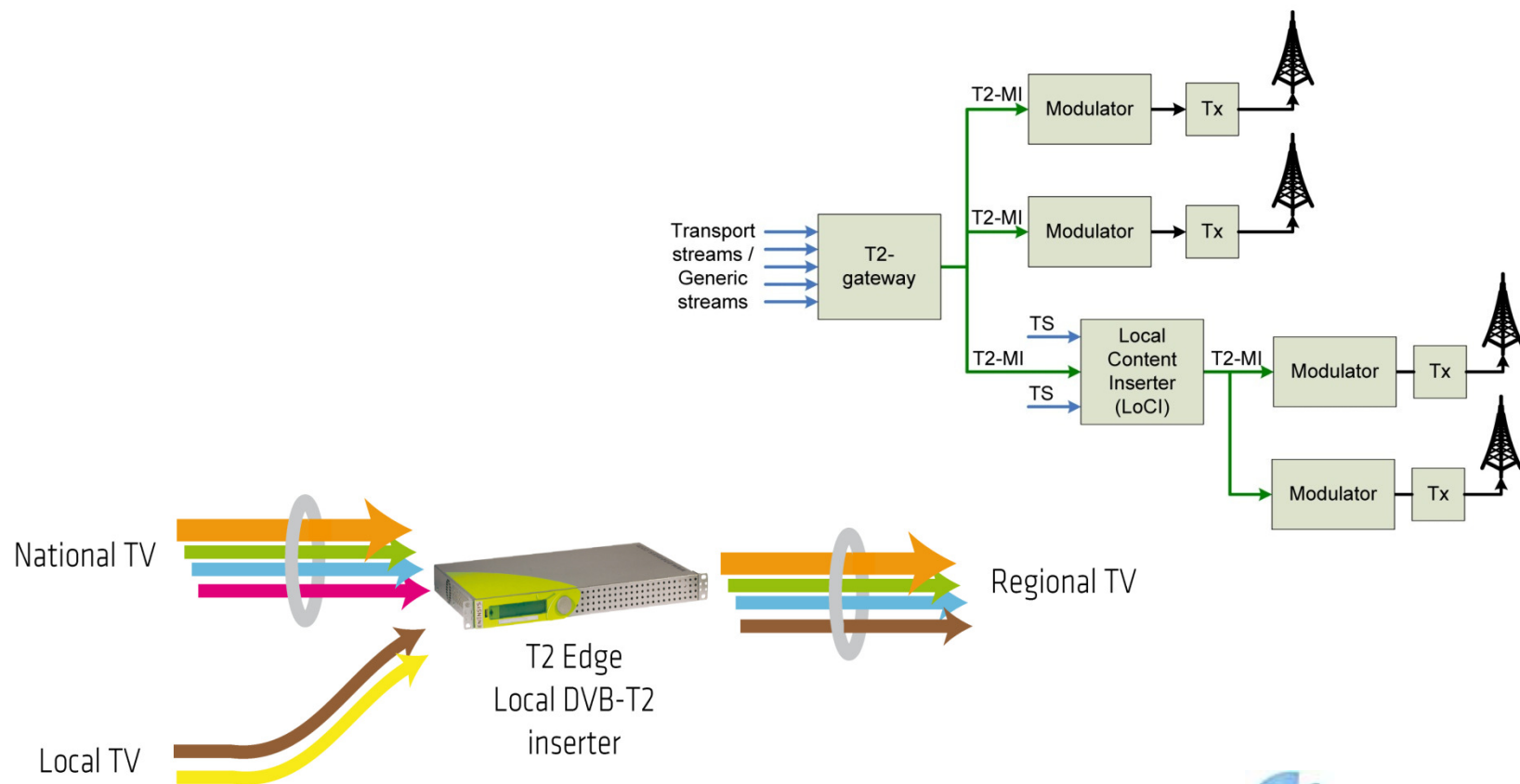
DVB-T2 business models and advanced features

- DVB-T2 new business models
 - Regionalization of content
 - Some PLPs can carry National content and another PLP Regional content
 - Regional content is inserted locally (notion of PLP substitution)



DVB-T2 business models and advanced features

- DVB-T2 new business models
 - Regionalization of content



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High level methodology to handle DTT networks

- **From theory to practice**
 - **First step consists on fixing the general organization**
 - Who owns the network? (private company(ies), government, etc...)
 - Who operates the network? (private company(ies), government, etc...)
 - How many broadcasters are allowed and by who are they regulated?
 - How the different multiplexes are going to be composed?
 - Will it be a SFN or MFN network (or combination of both)?
 - Frequencies allocations, coordination with border countries and license price
 - **Second step consists on identifying which DTT standard is the best suited to your country needs and economical / political constraints**
 - Is it DVB-T, DVB-T2, ISDB-T, etc...?
 - Which standard offers the largest choice of STB and is their price affordable for people?

High level methodology to handle DTT networks

- **From theory to practice**

- **Third step consist on surveying the existing analogue TV infrastructure**
 - Are the existing pylons in good shape and reusable?
 - Are the existing pylons ideally situated to cover the targeted area?
 - Are the Analogue Amplifiers in good shape and reusable?
- **Fourth step consists on running a coverage study according to the result of infrastructure survey**
 - Similar to a Multi-destination link budget analysis but for terrestrial coverage (some companies are expert in this job)
 - Requires to have a clear idea of the targeted coverage area and may depend on reuse of existing Amplifiers (potential power limitation) or use of new amplifiers

High level methodology to handle DTT networks

- **From theory to practice**

- **Fifth step consists on acquiring/upgrading the Head-end according to the number of channels to be broadcasted**
 - Are the contribution links from Content provider to Head-end facilities existing?
 - Will MPEG-2 or MPEG-4 be used?
 - Is statistical multiplexing required?
 - Is EPG going to be deployed and how the inherent data will be managed?
- **Sixth step consists on choosing the distribution network technology**
 - Is it satellite?
 - Is it terrestrial through fiber or Microwave links?
- **Seventh step consists on acquiring Transmitters and deploying the network**
- **Eighth step consists on testing/validating the on-filed coverage and making necessary fine tuning/ adjustments**

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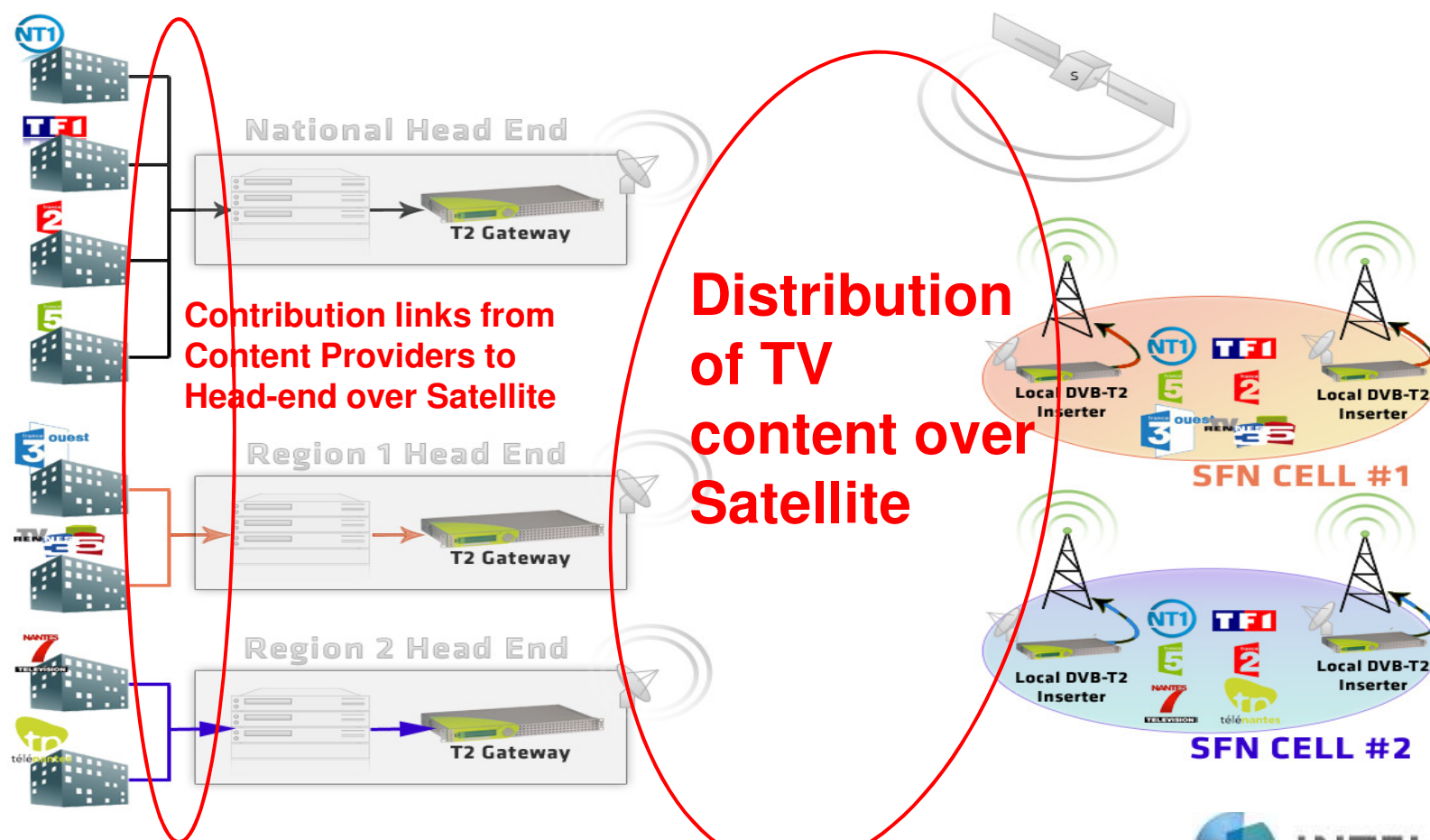
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Innovative ideas to make a DTT network successful

- **How Intelsat can help?**
 - **As the world leading provider of Satellite capacity, Intelsat offers the largest choice of satellite coverage over Africa**
 - Intelsat can offer valued satellite capacity to interconnect your Head-End and your Transmitters sites, but also your content providers and your Head-end
 - Zone capacity or Hemi capacity can be offered depending on your needs
 - New Dawn MCPC platform can help to fulfill your country-wide coverage (and even beyond) in case of gaps in your DTT network
 - Our different MCPC platforms can help you to broadcast your content all over the world
 - Our different Ku-band spot coverage across Africa can also help to both fulfill DTT network gaps + offering backup/redundancy capacity in case of transponder failure / strong interferences on the main C-band link

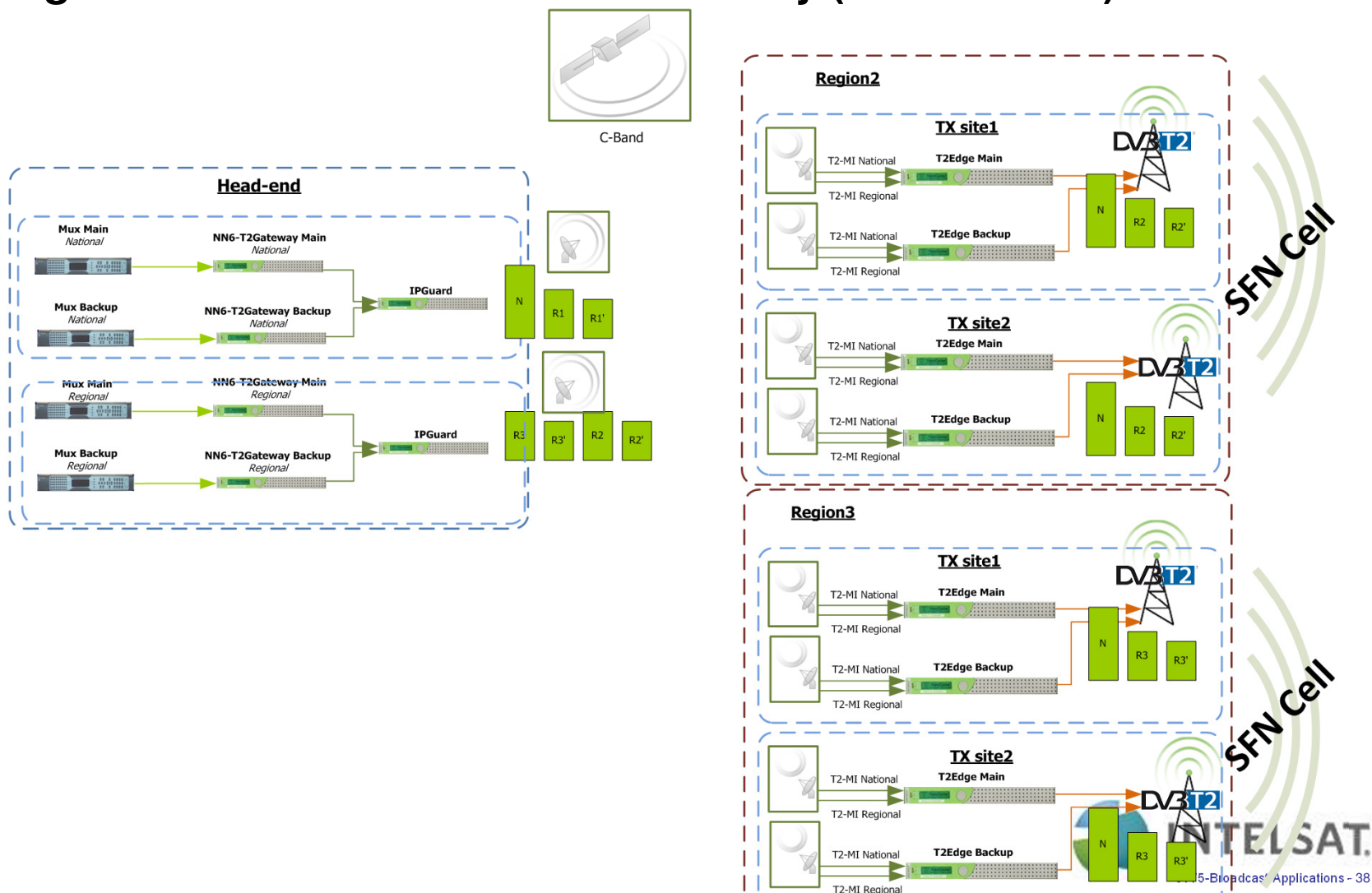
Intelsat added-value and innovative ideas to make your DTT network successful

- Intelsat helps interconnecting your Content Providers with your Head-end and your Head-end with your Transmitters



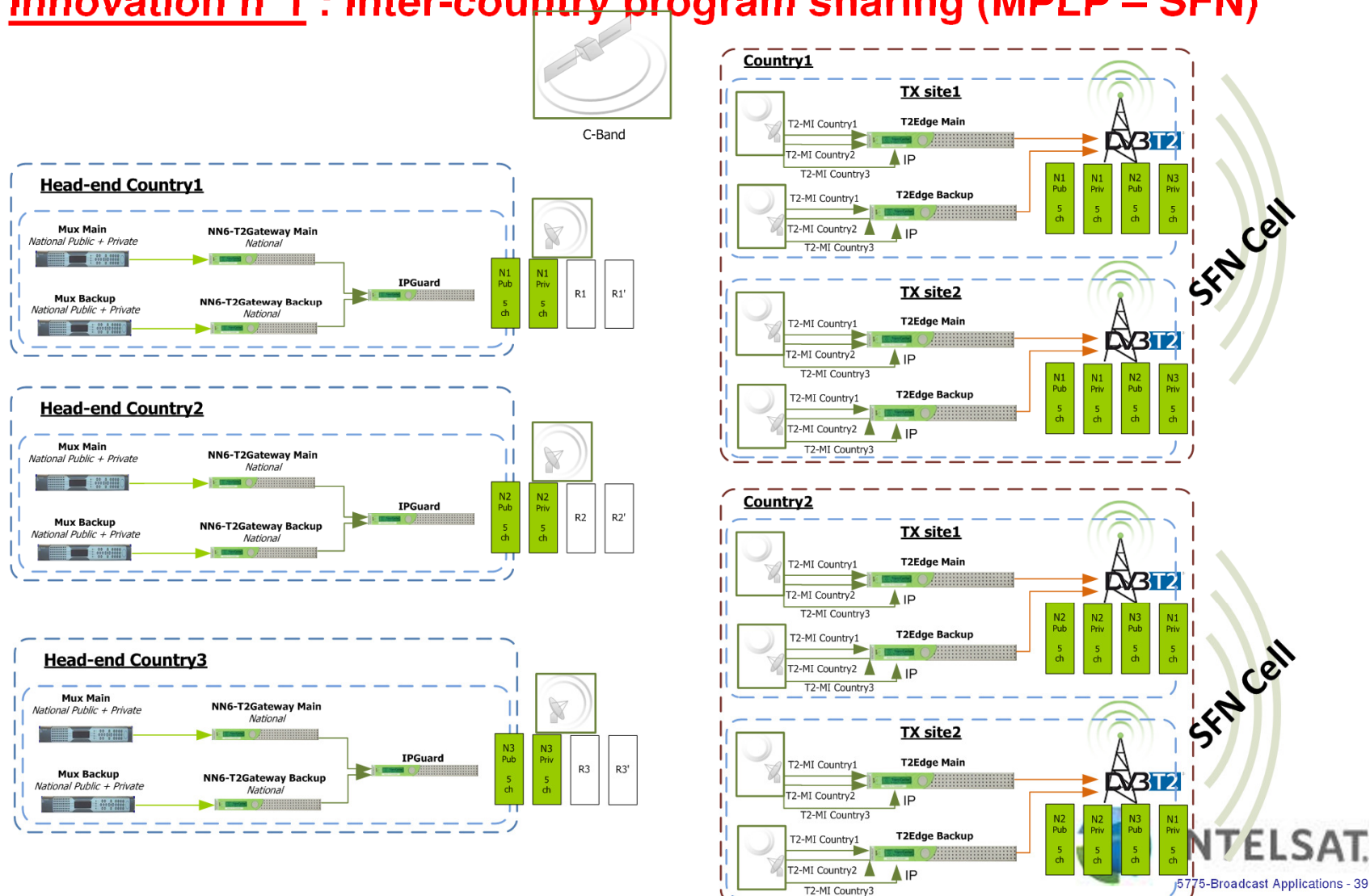
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- Regionalization of content intra-country (MPLP – SFN)



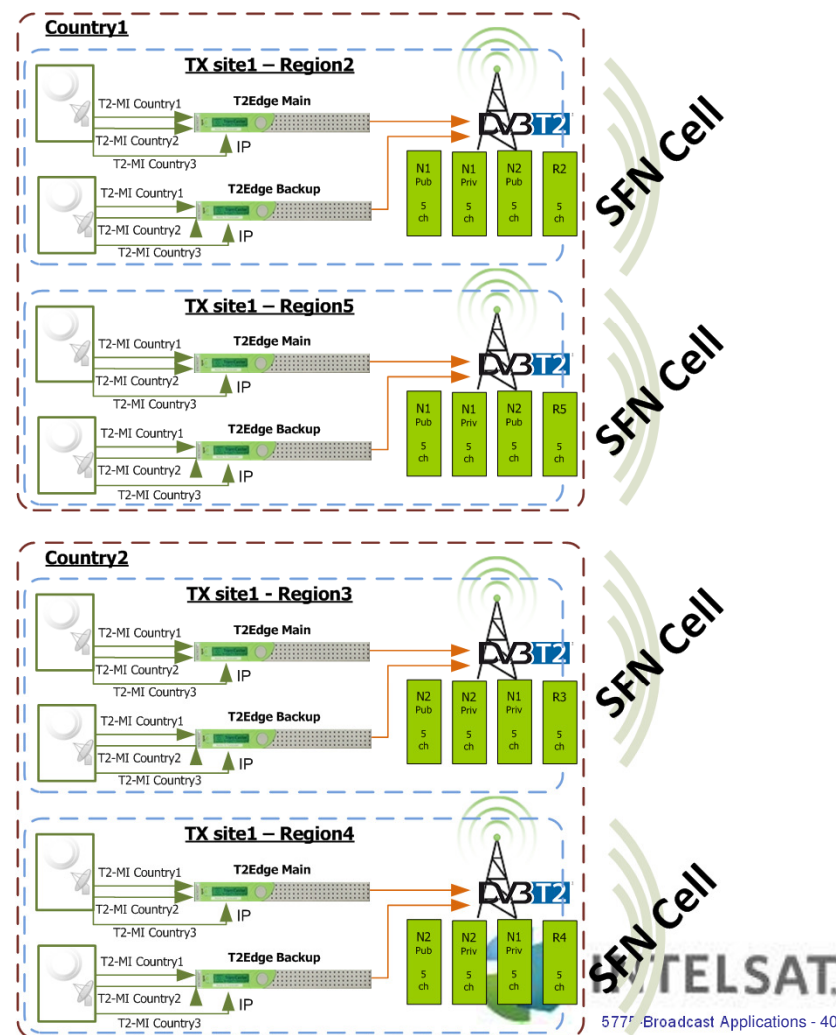
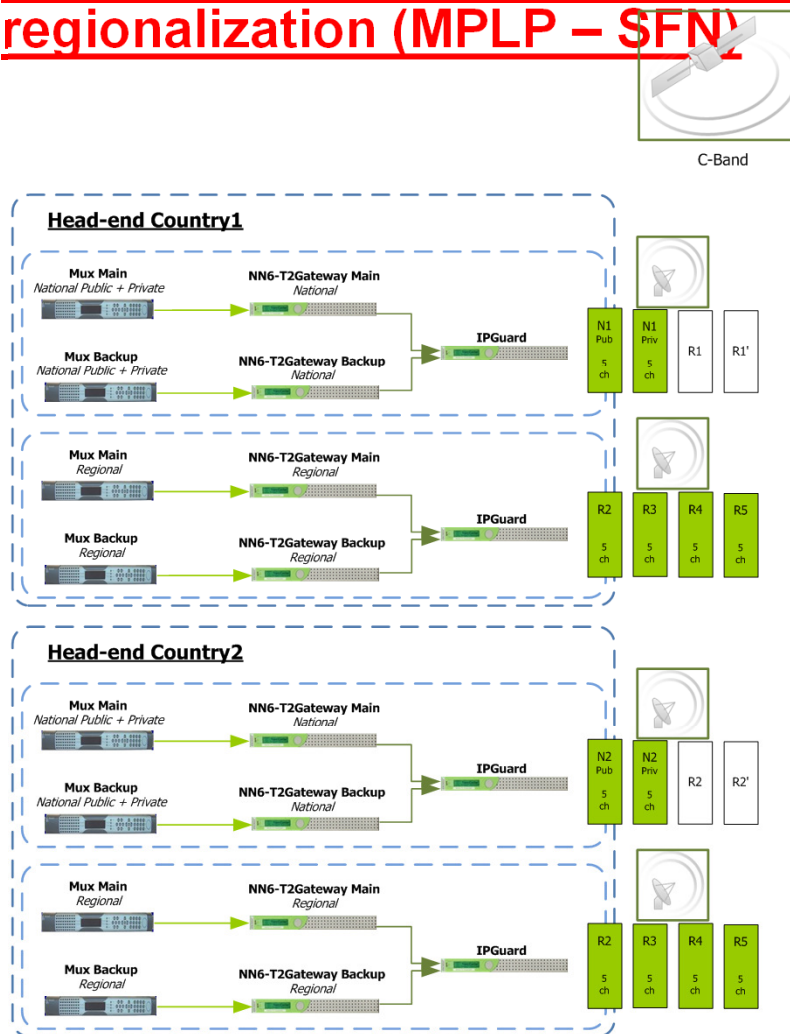
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- Innovation n°1 : Inter-country program sharing (MPLP – SFN)**



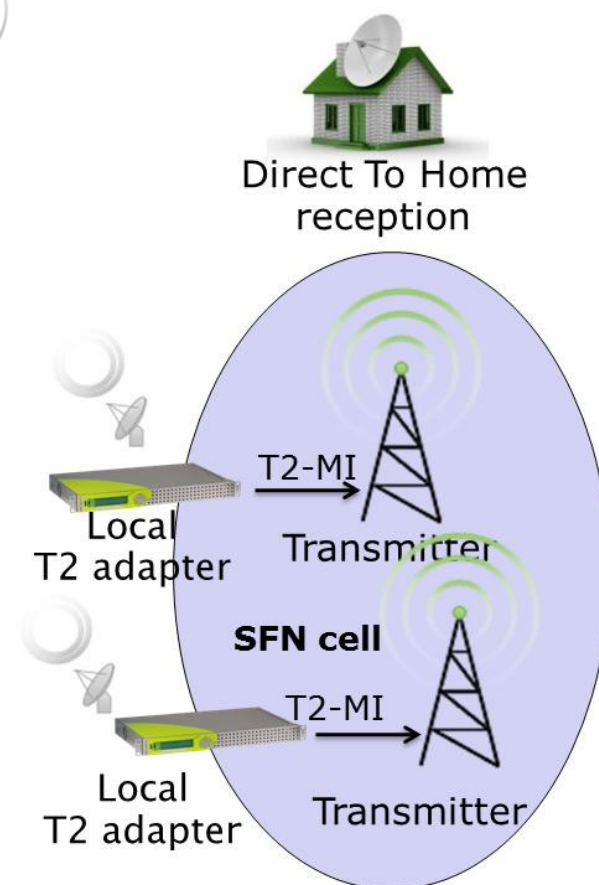
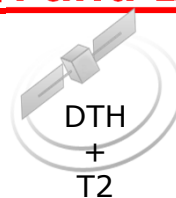
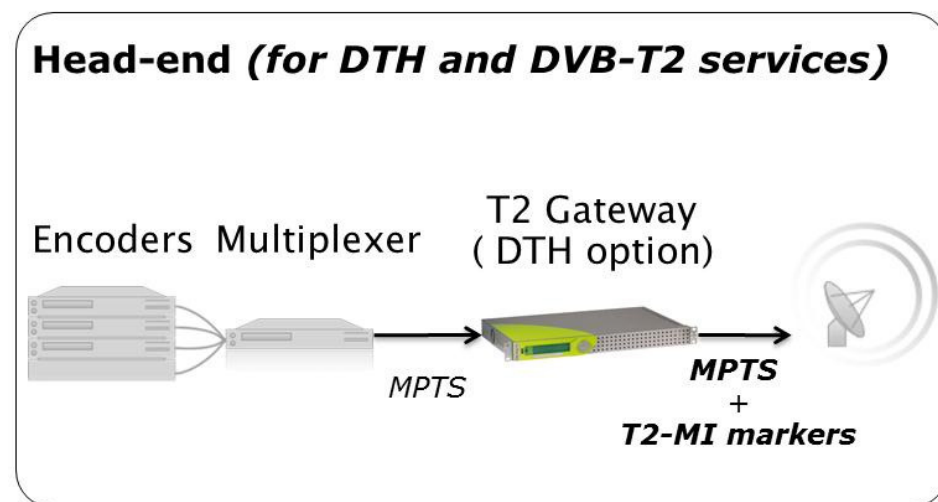
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- Innovation n°2 : inter-country program sharing + intra-country regionalization (MPLP – SFN)**



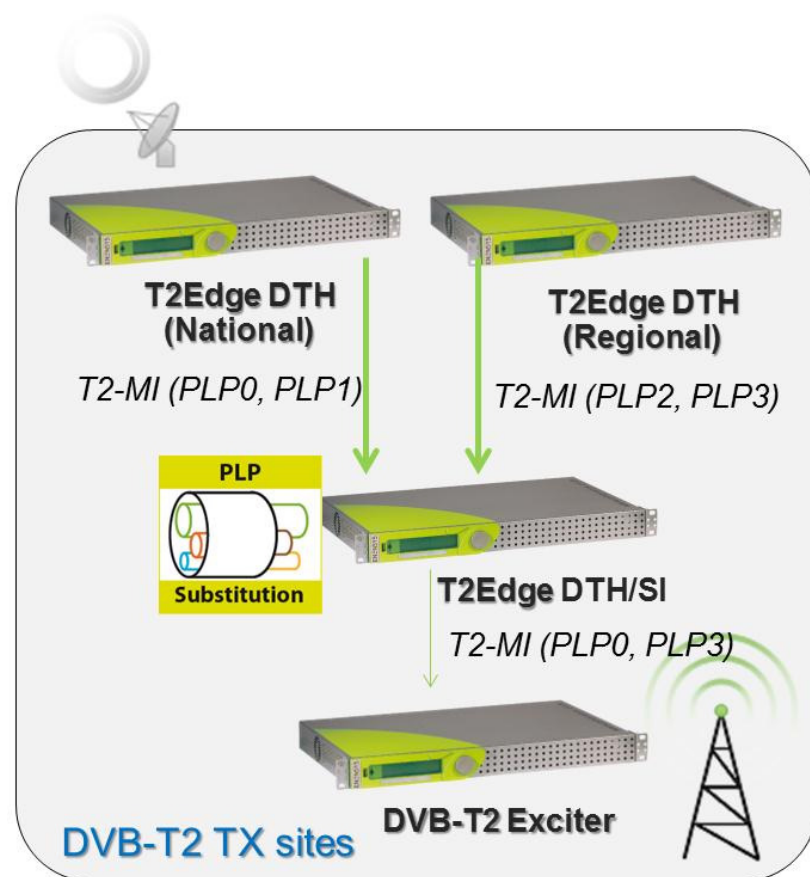
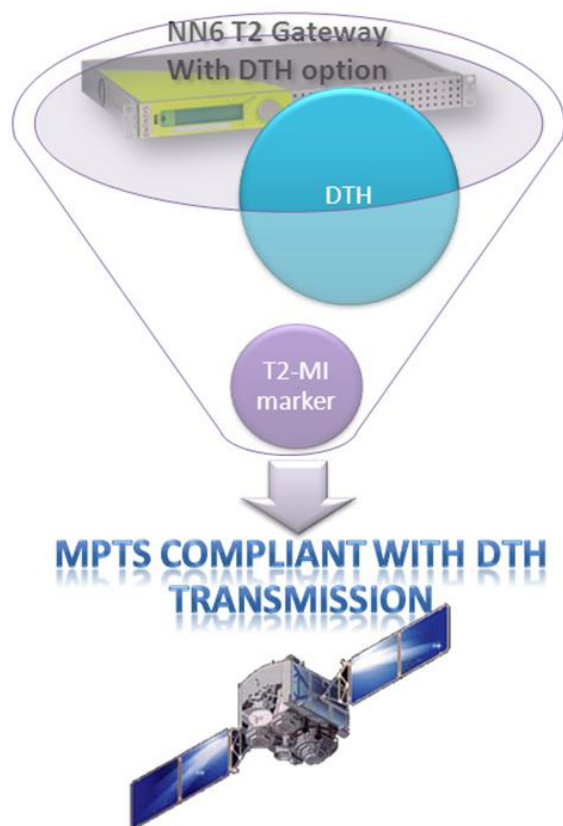
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- **Innovation n°3 : Combination of DTH and DVB-T2 using Ku-Band**



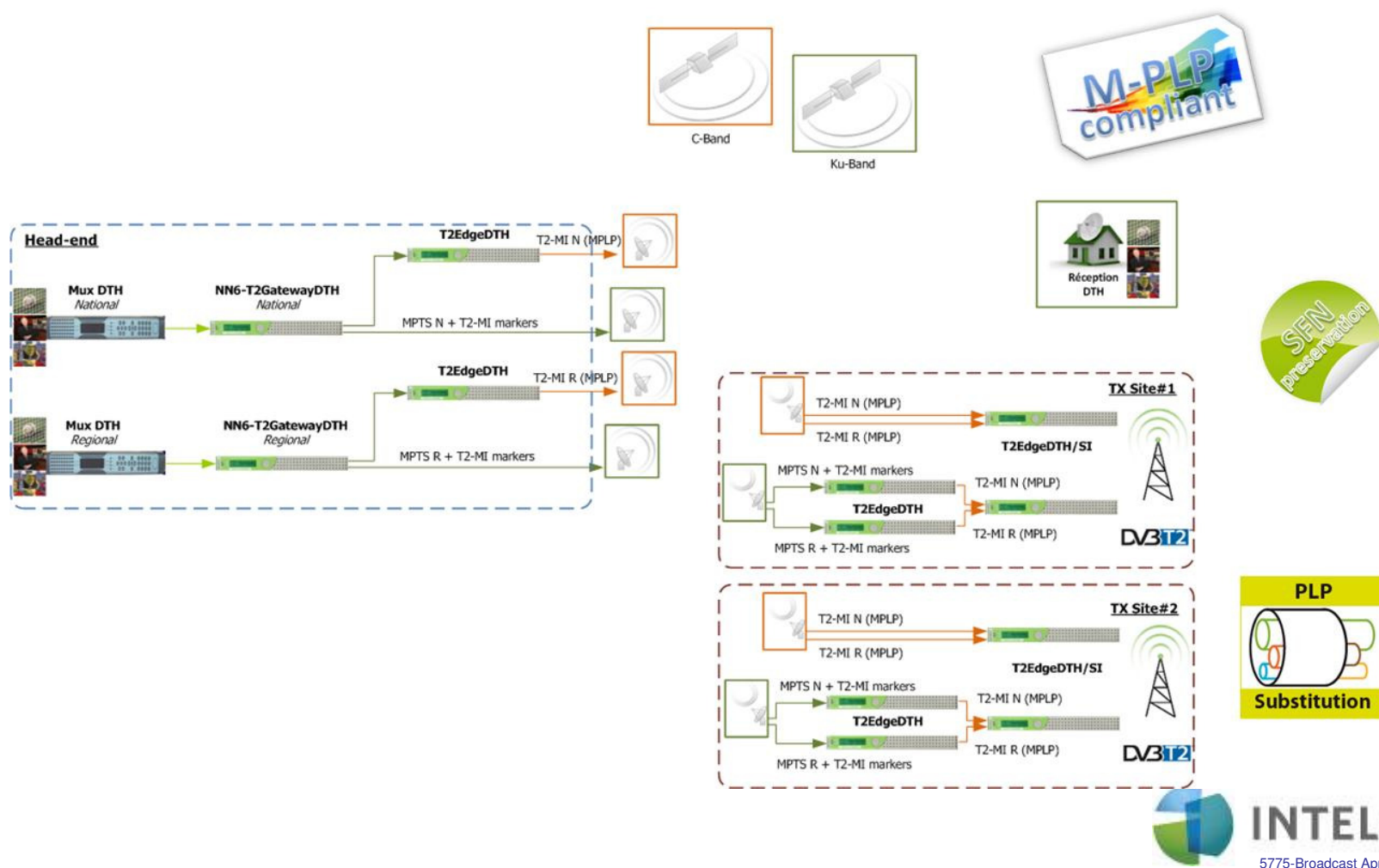
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- **Innovation n°3 : Combination of DTH and DVB-T2 using Ku-Band**



Intelsat added-value and innovative ideas to make your DTT network successful

- Innovation n°4 : Ultime combination of C-band and Ku-Band for both DTH and DVB-T2 with redundancy**



Intelsat added-value and innovative ideas to make your DTT network successful

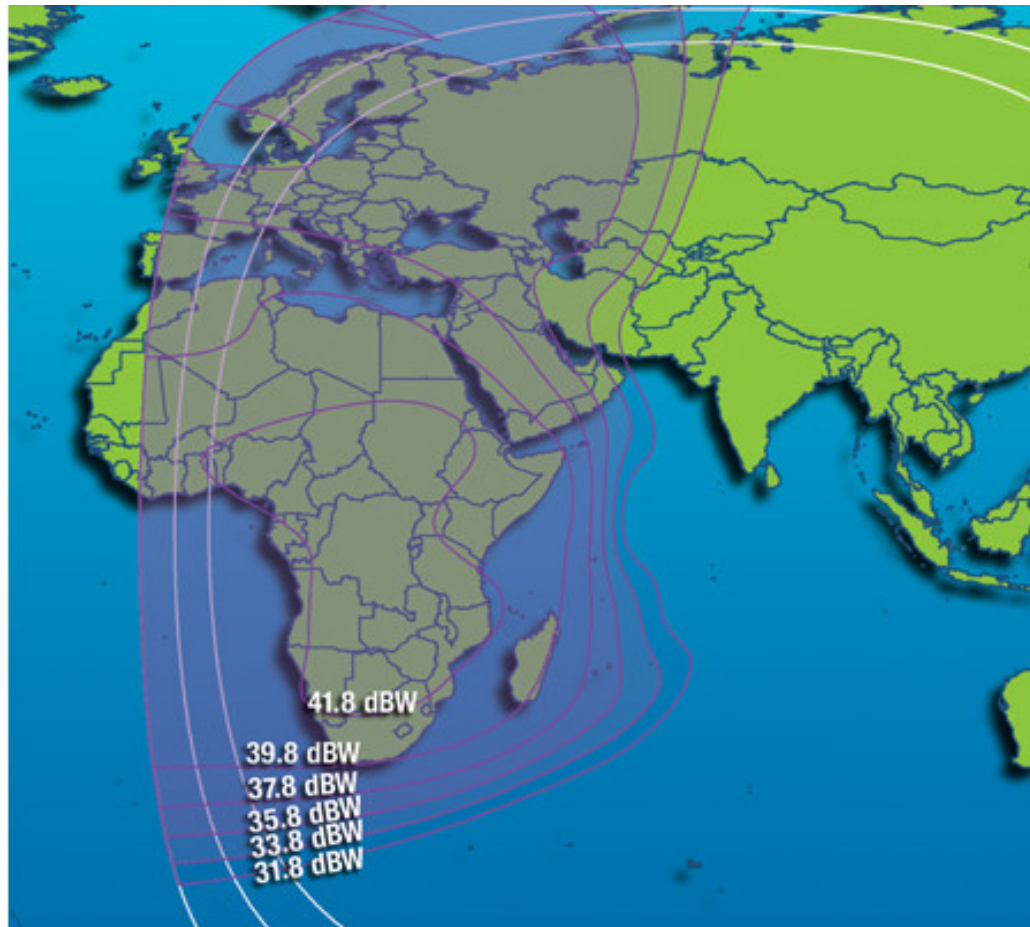
- **Distribution of TV content from Head End to Tx sites over satellite helps to :**
 - **Save the cost of a massive terrestrial network infrastructure**
 - Huge cost of IP / Fiber / Microwave network deployment
 - Huge time to deploy such kind of terrestrial network
 - Huge maintenance cost and complexity to manage
 - **Achieve the best possible availability**
 - Intelsat provides 99.96% availability in C-Band all over Africa
 - Terrestrial distribution networks can't provide such availability unless deploying very expensive redundancy links
 - **Backhaul your content wherever in Africa and Europe for free**

Intelsat added-value and innovative ideas to make your DTT network successful

- **Choosing Hemi capacity offers several advantages**
 - **Interconnecting your Head-End and Tx sites within your country**
 - **Backhauling for free your content to Africa New Dawn platform so that all your channels (or part of them) can be broadcast over satellite in Ku-Band**
 - **Helps fulfilling DTT gaps**
 - **Helps reaching diaspora all over New Dawn coverage**
 - **Provide backup/redundancy in case of failure on main C-Band link**
 - **Backhauling for free your content to Europe IS 905 MCPC platform so that all your channels (or part of them) can be broadcast over satellite in Ku-Band**
 - **Helps reaching diaspora all over IS905 coverage**
 - **Possibility to inject part of your content into neighbor countries DTT network (if agreement) to help diaspora keeping in touch with their country**

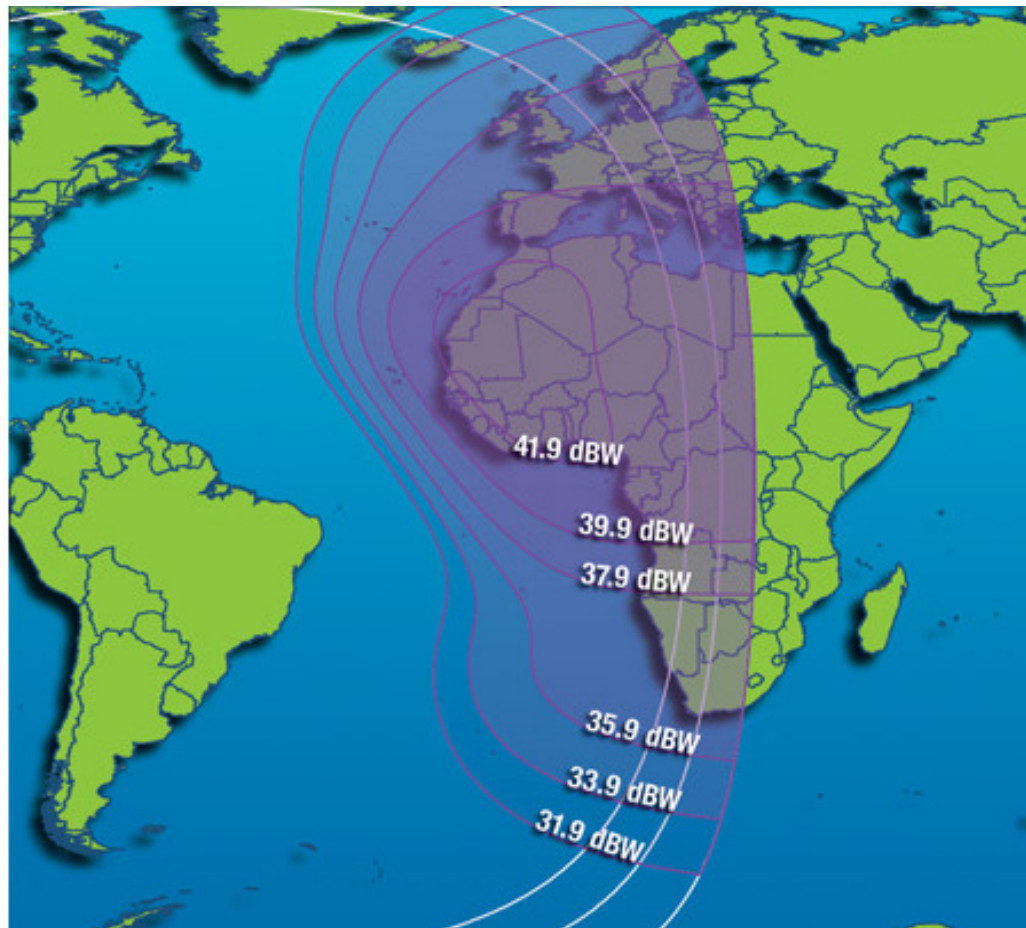
Intelsat added-value and innovative ideas to make your DTT network successful

- IS22 Hemi Coverage



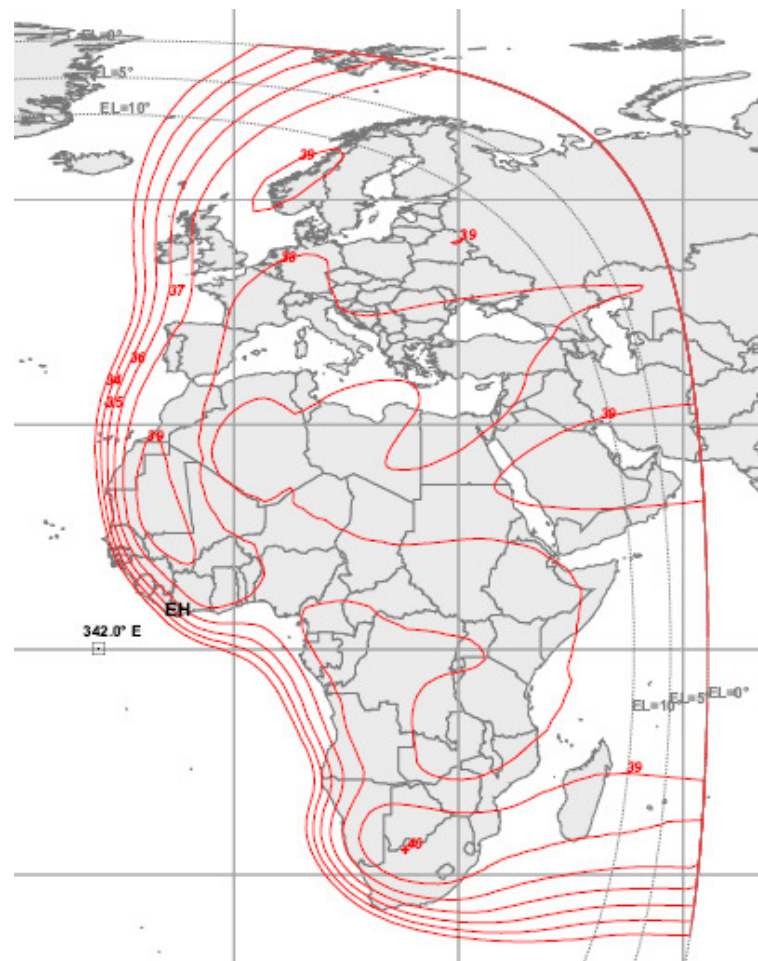
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- IS23 Hemi Coverage



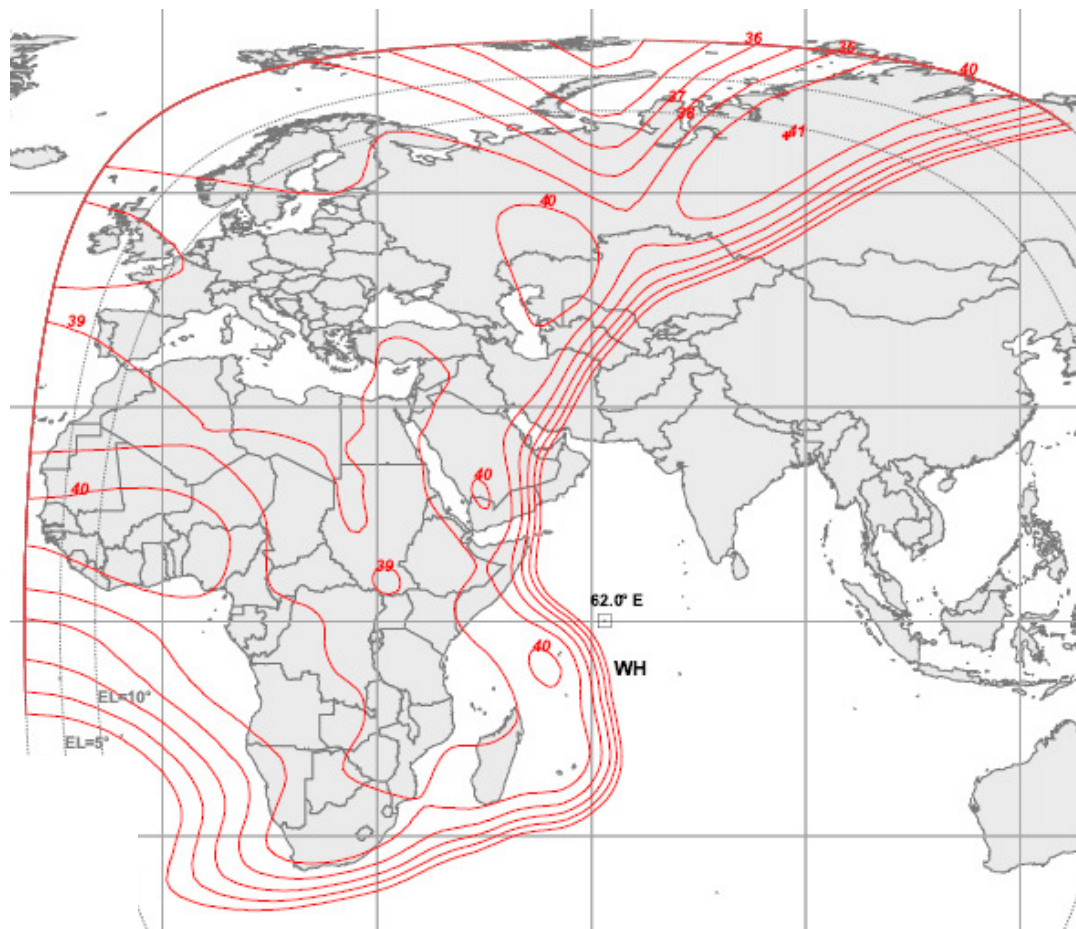
Intelsat added-value and innovative ideas to make your DTT network successful

- IS901 Hemi Coverage



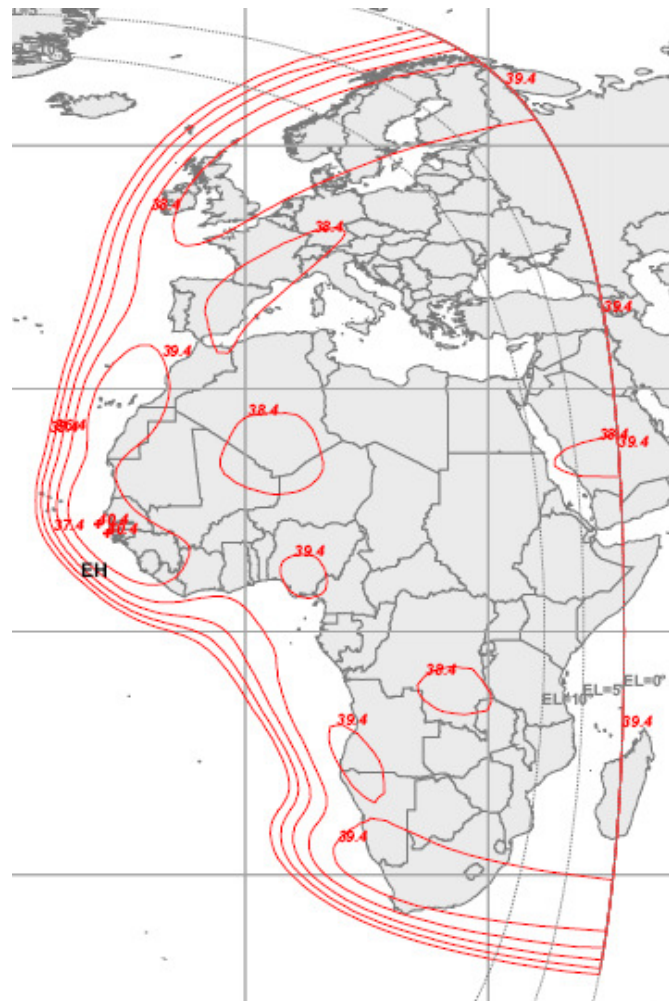
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- IS902 Hemi Coverage



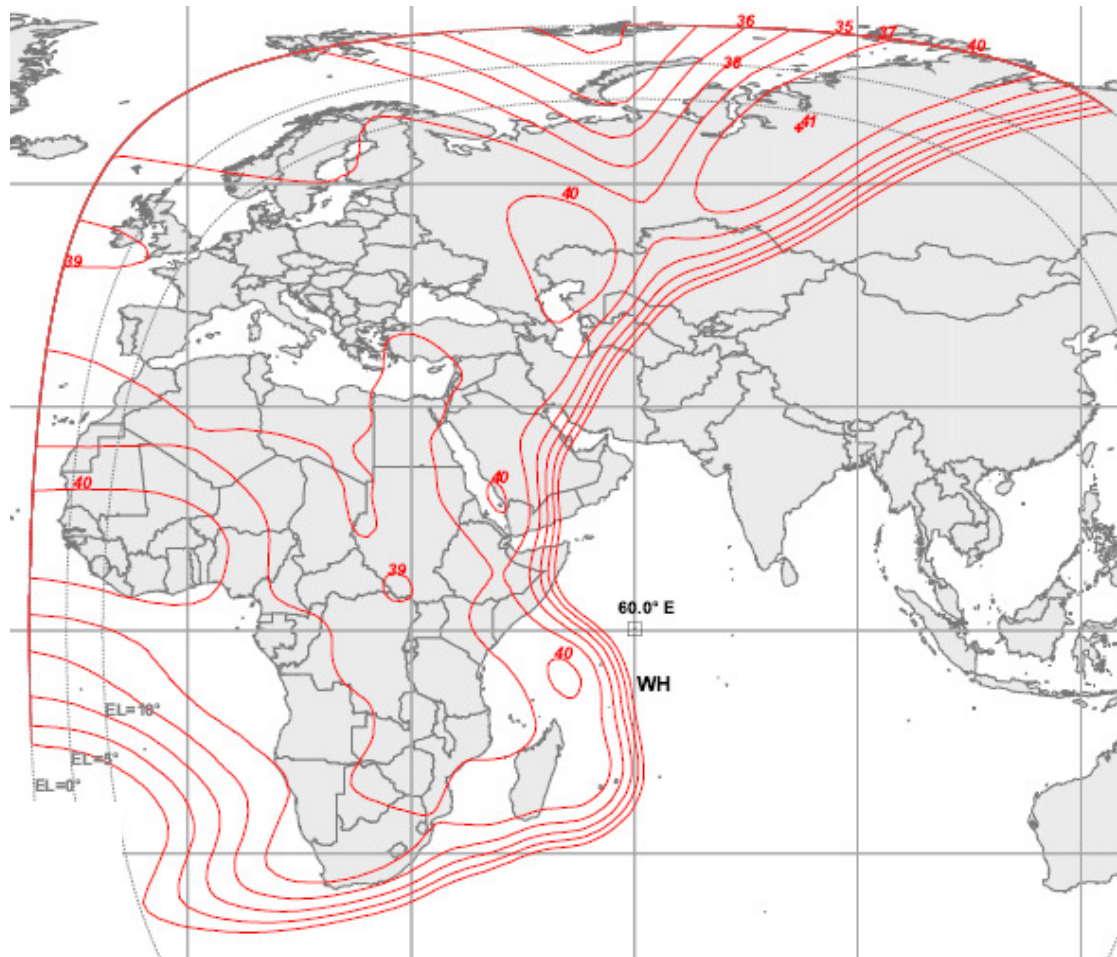
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- IS903 Hemi Coverage



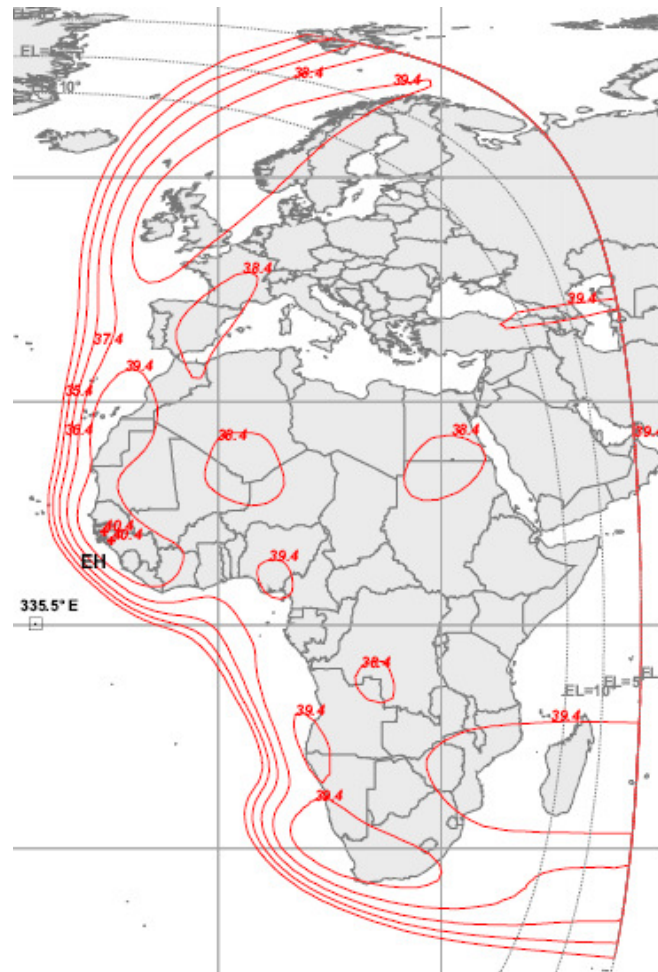
Intelsat added-value and innovative ideas to make your DTT network successful

- IS904 Hemi Coverage



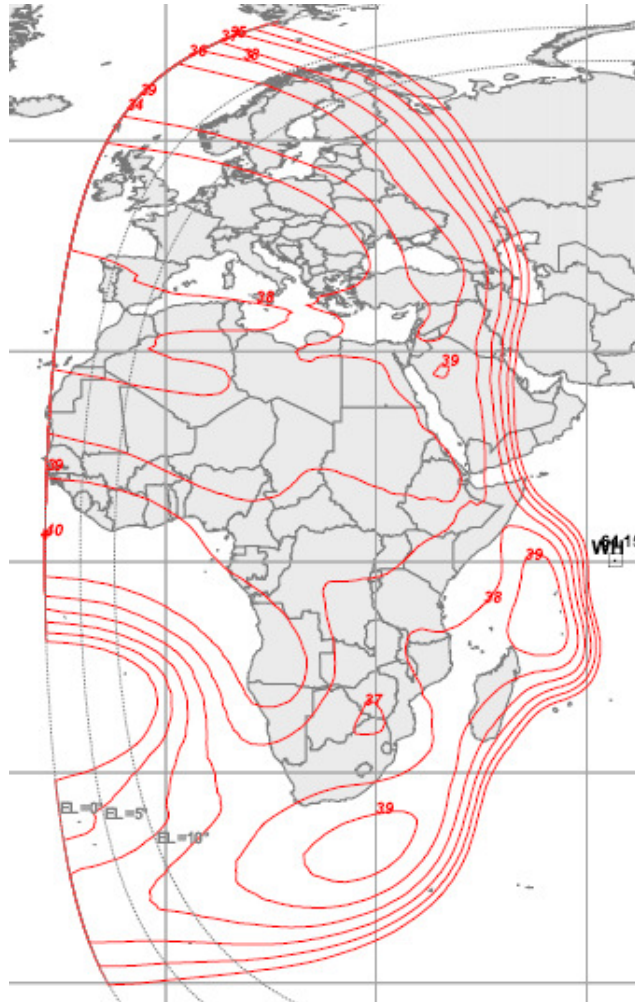
Intelsat added-value and innovative ideas to make your DTT network successful

- IS905 Hemi Coverage



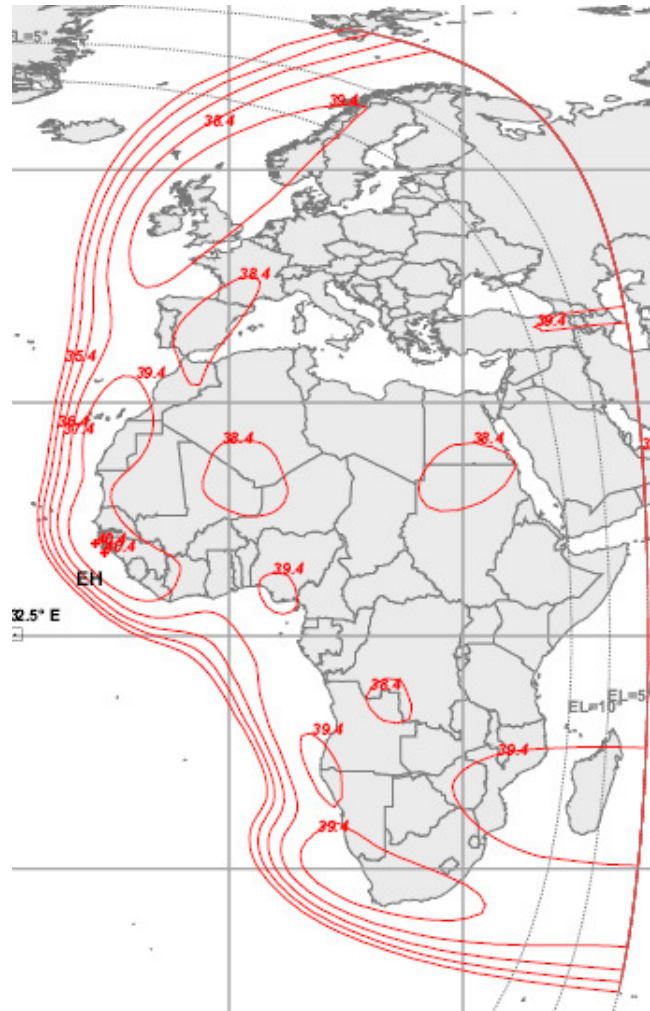
Intelsat added-value and innovative ideas to make your DTT network successful

- IS906 Hemi Coverage



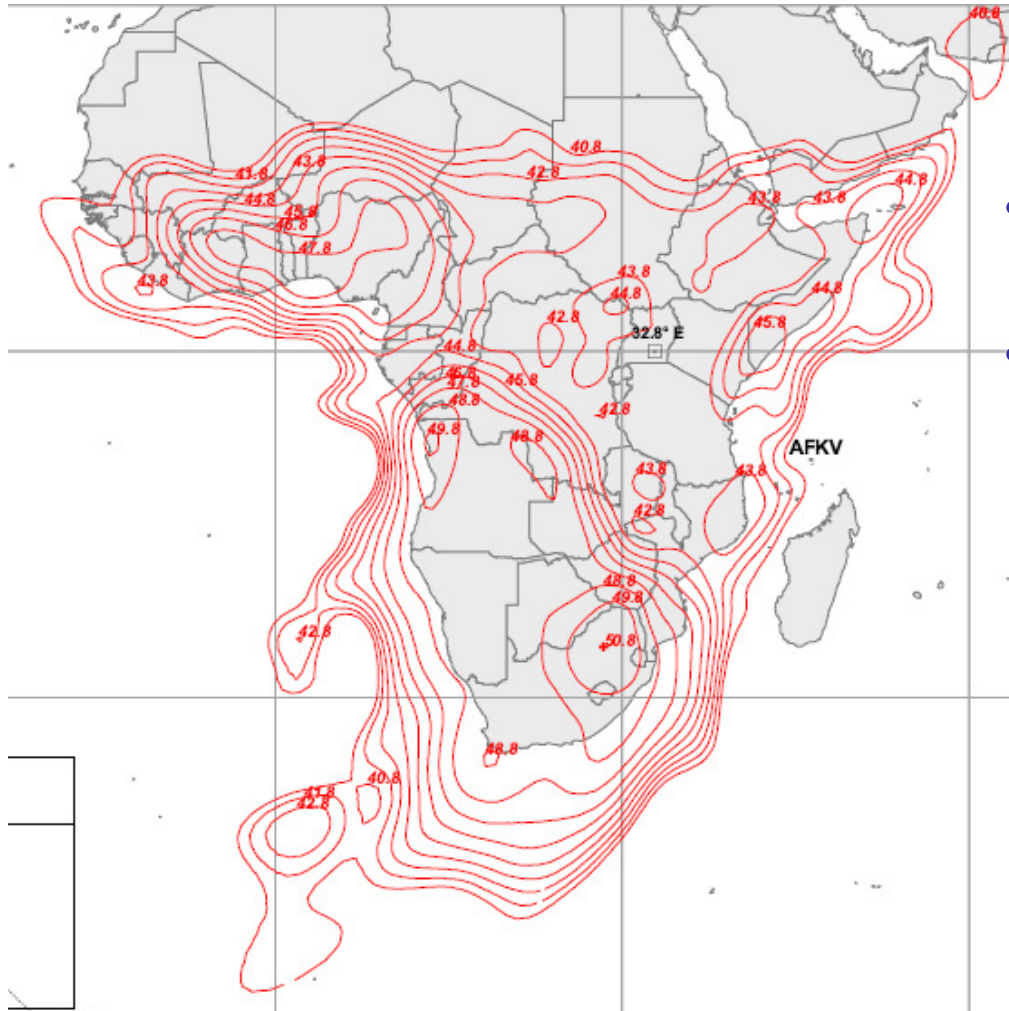
Intelsat added-value and innovative ideas to make your DTT network successful

- IS907 Hemi Coverage



Intelsat added-value and innovative ideas to make your DTT network successful

- **IS New Dawn DTH Ku-band coverage**



- **Uplink to IS ND is available in Johannesburg**
- **Enables DTH Ku band coverage**
 - Fulfill DTT gaps in your country with small antenna dish and standard DVB-S2 STB
 - Reach diaspora in more than 2/3 of Africa continent

On the way to success with Intelsat !

Thank you !

This presentation has been designed with the participation of Enensys Technologies, world leader in DTT/DVB-T2 technologies