EUTELSAT

SPOTLIGHT

NEWSSPOTTER

COMPACT, INNOVATIVE
AFFORDABLE,

eutelsat

NEWSSPOTTER

COMPACT, INNOVATIVE,
AFFORDABLE,

Abstract

NewsSpotter is the state-of-the-art Satellite News Gathering (SNG) Product developed by Eutelsat to respond to an increasing demand to transfer rich media content from the field.

NewsSpotter is highly efficient as it allows transfer rates of up to 20 Mbps via extremely compact satellite terminals and is also particularly innovative as it provides native bidirectional IP connectivity, facilitating the integration with modern news production and media content management workflows.

NewsSpotter uses easy to deploy Satellite Terminals which are available at a fraction of the cost of traditional Ku satellite antennas. Extremely compact in size, NewsSpotter Terminals allow building more compact SNG vans, lowering the operational costs of SNG fleets, reducing the time to get to the breaking news site and more generally lowering the entry barrier to Satellite News Gathering.

Developed mainly with Broadcasters in mind, NewsSpotter can also serve the requirements of Webcasters, Press Agencies, Security and Emergency services and any other application requiring fast, easy-to-deploy, reliable, affordable, broadband bidirectional IP connectivity from the field.

NewsSpotter uses the state-of-the-art High Throughput Satellite EUTELSAT KA-SAT 9A, launched by Eutelsat at the end of 2010 and positioned at 9°East, whose coverage extends from Europe to Middle East and Northern Africa.

01

Introduction

The world of News production has radically changed in the last few years. On the reporting equipment side, electronic Field Production Cameras are increasingly compact, lightweight and cheap. They allow shooting in High Definition at a fraction of the cost that Broadcasters and News Agencies had to face only few years ago. Video Content is today stored and exchanged in the form of electronic files which can be easily edited in the field over PC or MAC platforms and exchanged the IP based network.

This revolution in news production and exchange has created a similar requirement for agility, portability, affordability and integration into IP Networks in systems and tools that are used to send video footage from the field to the Master Control Station.

Satellite newsgathering trucks, characterized by large dimensions, restricted agility and high deployment costs, have begun being replaced by 3G-based "Backpacks" and/or L-Band based satellite contribution systems, both offering improved portability and IP native connectivity.

Nevertheless, 3G-based "Backpacks" cannot offer committed information rates and tend to collapse whenever they are in competition with similar products in the field, a frequent occurrence in the case of breaking news events. L-Band based satellite contribution systems are normally very expensive to deploy and are limited to few hundred kilobits in throughput, which does not normally allow for the delivery of suitable quality.

In parallel, on the satellite transmission network side, the growing saturation of Ku-band frequencies over the main continental areas has led satellite operators to begin using the less cluttered Ka-band. Eutelsat introduced a Ka-band payload as early as 2002 on board the HOT BIRD 6 satellite, and in 2011 we put into service Europe's first all Ka-band satellite, EUTELSAT KA-SAT 9A, at 9 degrees East. The design of KA-SAT, which comprises 82 individual spotbeams, means that reporting of natural or man-made news-breaking events (which always occur in a relatively restricted area) can be uplinked at high throughputs using very small antennas. Once the event is reported from the area in question using Ka-band, it can then be re-broadcast over a much wider coverage, national, continental or even planetary, via one or several Ku-band satellites.

To respond to this increasing need for portability, performance and affordability, and based on its decade-long experience with Ka-band, Eutelsat has therefore developed NewsSpotter, a revolutionary Satellite News Gathering product in Ka-band. NewsSpotter delivers an IP Committed Information Rate via EUTELSAT KA-SAT 9A.

In section 2. we will introduce the KA-SAT Satellite and its Ground Network infrastructure, which is an essential part of the KA-SAT delivery network.

User Terminals which have been developed to be used over KA-SAT will be briefly presented and explained in section 3, focusing on the User Terminals for "Nomadic" use on the field, which provides the required portability and affordability for the use with NewsSpotter.

The main characteristics of NewsSpotter will be then presented in section 4, focusing on IP connectivity, the easy-to-use Booking system and the Commercialisation model.

To conclude, an in-depth analysis of expected performances and availability of the NewsSpotter service will be provided in section 5.

02

EUTELSAT KA-SAT 9A AT 9 degrees East

The EUTELSAT KA-SAT 9A Satellite (KA-SAT) was launched on 26 December 2010 and entered into operation in May 2011 from the orbital position 9°East. The satellite was manufactured by EADS-Astrium based on their Spacebus 3000 platform. The spacecraft is equipped with four multi-feed deployable antennas with enhanced pointing accuracy and a high efficiency repeater.

02.1

PRINCIPLE OF OPERATIONS OF KA-SAT

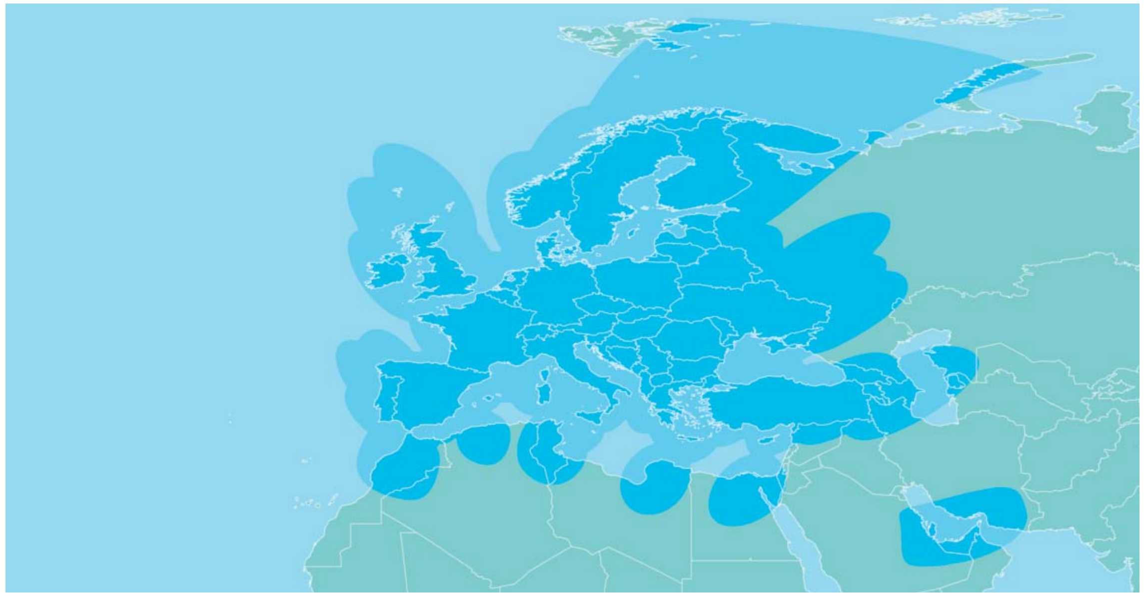
KA-SAT has been designed employing the most recent techniques exploited by High Throughput Satellites (HTS), allowing its users to reach a broader coverage area with a dramatic aggregate overall throughput of 70 Gbps.

To achieve such a significant overall throughput, KA-SAT implements a frequency re-use technique that is similar to the most current techniques adopted in mobile networks. This technique consists in covering the service area by means of individual spot beams (each spot is approximately 300 kilometers in diameter): adjacent spot use different frequencies and polarizations, while the geographical distance among beams allows non adjacent Beams to re-use the same frequencies slots.

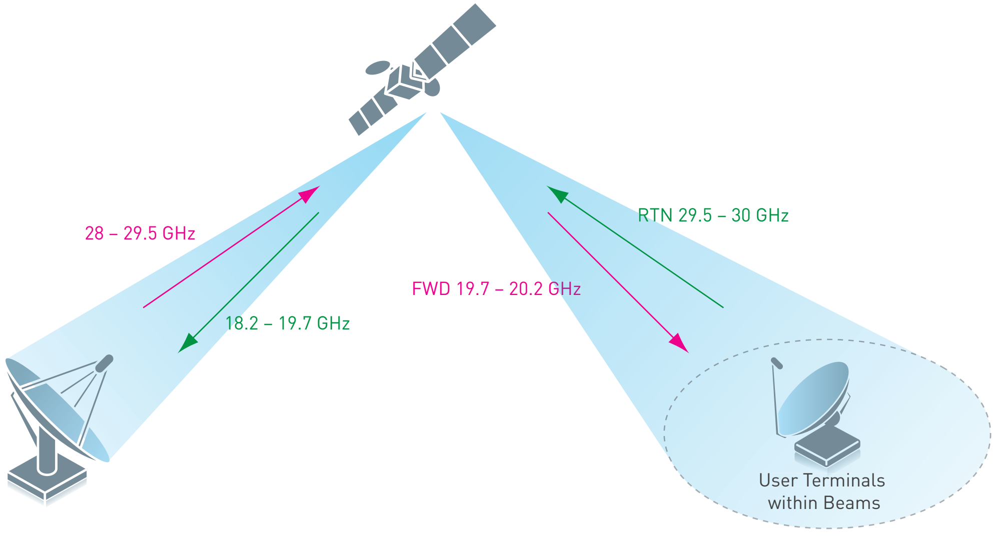
The KA-SAT Satellite is configured with 82 Beams over Europe, North Africa, the Mediterranean area and parts of Middle East; four different combinations of frequency and polarisation are used in the Beams, as indicated in the figure on the following page by means of different colours.

KA-SAT provides fully-bidirectional connectivity from compact and affordable remote User Terminals via the use of separate frequency slots for the Forward (FWD) and Return (RTN) communication links. The coverage shown in Figure 1 represents the Coverage as seen by user terminals; from within each of the beam, remote user terminals receive incoming traffic on the FWD communication link, and transmit outgoing traffic on the RTN communication link.

→ Figure 1. KA-SAT Multibeam Coverage



→ Figure 2. Gateways, User Terminals, Frequencies



02.2

THE KA-SAT GROUND INFRASTRUCTURE AND THE FIBER BACKBONE

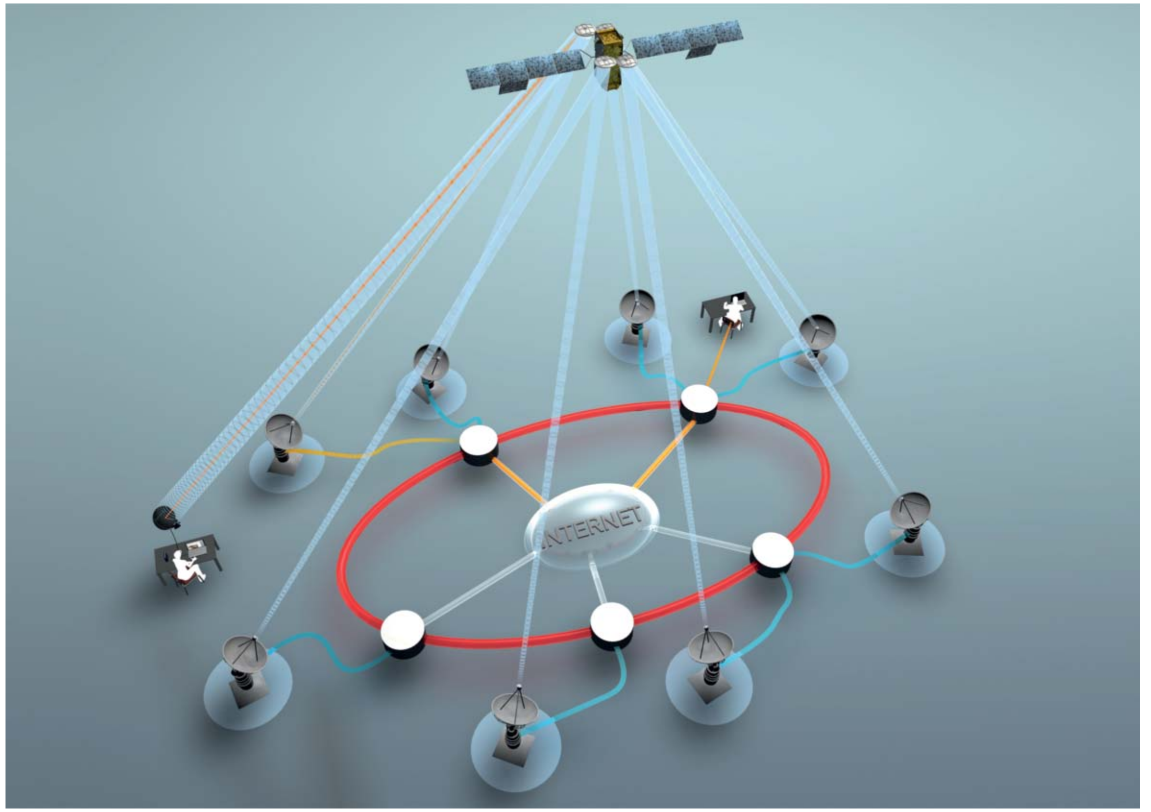
Traffic to/from user terminals is transmitted /received by a network of Satellite Gateways operated and managed by Eutelsat via its Italian subsidiary Skylogic.

The KA-SAT ground segment consists of a total of 10 Gateway Earth Stations: 8 of them are operational while 2 are used as a hot-standby backup. Gateways are interconnected via a fully redundant fiber ring which currently ensures a throughput of 200 Gbps on each direction of the ring and can easily be expanded in the future

The typical Satellite Gateway is a Ka-Band Earth Station whose dimension is in the range of 9 meters and which manages the traffic dedicated to terminals on more than one Beam.

The extremely high throughput of KA-SAT requires the satellite to be operated by more than a single Gateway Earth Station (E/S). To understand this concept, it is sufficient to consider that each single beam makes available slightly less than 250 MHz of spectrum in each direction (i.e. 250 MHz on the FWD link plus 250 MHz on the RTN link); as there are a total of more than 80 beams, the overall frequency resource required by KA-SAT for feeding terminals on ground within the coverage of Figure 1 would be in the range of 20 GHz (80 beams* 250 MHs/Beam), i.e. 20 GHz of spectrum would be required to feed KA-SAT from ground with the overall content that it can manage.

As 20 GHz of spectrum are not available for feeding KA-SAT from Gateway E/S, the only possible technique is to re-use the same available slot of frequencies (28 GHz – 29.5 GHz from Gateway E/S to KA-SAT)



→ Figure 3. KA-SAT Fiber Backbone, Gateways, POPs

many different times. And the only way to re-use the same frequency slot many times without creating mutual interferences is to multiply the number of Gateways and ensure a proper geographical separation (mutual distance) between Gateways in such a way that their respective transmissions from ground are discriminated by directional antennas on board of the satellite.

The KA-SAT ground segment consists of a total of 10 Gateways E/S: 8 of them are operational while 2 are used as a hot-standby backup; each single Gateway consists of a 9 meter E/S Ka band dish with 500W Ka band amplifiers and carries the traffic to/from a set of 10 Beams. The "pairing" between the Gateway and the set of 10 Beams which it serves is fixed.

Gateways are interconnected via a fully redundant fiber ring (the KA-SAT Fiber Backbone) which currently ensures a throughput of 20Gbps on each direction of the ring and can be easily expanded in the future. The Fiber Backbone interconnects Gateways among each other and also ensures connectivity to major Telco Points of Presence (POPs), providing connectivity to the Internet backbone and from where IP traffic to/from user terminals via the KA-SAT Backbone can be exchanged with Customers (see Figure 3).

The whole design of the KA-SAT Ground Infrastructure and Fiber Backbone has been developed by Skylogic, the Italian subsidiary of Eutelsat based in Turin, Italy; Skylogic also assure operations of the entire ground infrastructure and of the entire KA-SAT network.

03

User terminals

The Business Model of KA-SAT is built around the provision of Broadband Internet access via Satellite for residential end-users; for making the Business Model viable it has been essential to build a new generation of Bidirectional IP based terminals offering the required simplicity of installation, economy of use and performance of the link

03

Eutelsat and its subsidiary Skylogic have retained the Surfbeam 2 Satellite system from ViaSat as the technology to be employed on KA-SAT. A range of terminals has been developed by ViaSat - and by other manufacturers employing the components of the ViaSat satellite terminal - for addressing both the Consumer and the Professional market.

→ **ViaSat**
http://www.viasat.com

ViaSat produces innovative satellite and other digital communication products that enable fast, secure, and efficient communications to any location. ViaSat brings today's new communication applications to people out of reach of terrestrial networks, in both the commercial and government sectors, with a variety of networking products and services.

The IDU, the ODU and the TRIA
The User Terminal consists of the "Indoor Unit" or IDU, i.e. the ViaSat Surfbeam2 Satellite Modem, and the "Outdoor Unit" or ODU, i.e. the ViaSat Surfbeam2 Satellite dish and its relevant Integrated Transmit-Receive Assembly or TRIA.

The IDU provides IP connectivity to the user via one or more Ethernet Ports and connects to the ODU via a single (or double) IF Cable. Three different versions of the IDU, all of them manufactured by ViaSat, are available for use on KA-SAT.

The Consumer IDU, which is capable of 10 Mbps Upload, 40 Mbps Download and provides one Ethernet Interface.

The Advanced IDU, which is capable of 20 Mbps Upload, 50 Mbps Download, provides one Ethernet Interface and is assembled into a metallic professional case.

The Professional Portable IDU has the same performance as the Advanced IDU, but includes a small router with 4 Ethernet Interfaces; it is also waterproof and is capable to operate in the field without requiring a PC for dish pointing.

→ Figure 4. The IDU, the ODU and the TRIA

→ Figure 5. Available Models of IDUs

CONSUMER IDU

ADVANCED IDU

03.1

FIXED TERMINALS

The Business Model of KA-SAT is built around the provision of Broadband Internet access via Satellite for residential end-users; for making the Business Model viable it has been essential to build a new generation of Bidirectional IP based terminals offering the required simplicity of installation, economy of use and performance of the link.

Fixed connectivity services can be provided by the following terminals developed by ViaSat and available through the network of distributors of KA-SAT services. The Advanced UT is delivered with a 120 cm dish, a 4W TRIA and the Advanced IDU (50Mbps download / 20Mbps upload) and is conceived for the provision of professional services.

→ Figure 6. The Fixed Basic User Terminal

→ Figure 7. The Fixed Advanced User Terminal

03.2

NOMADIC TERMINALS

The Nomadic User Terminal is a particular version which is assembled and conceived to be used on the move and for deployment in the field.
It makes use of the ViaSat IDUs and TRIAs which have been mentioned above, assembled into a configuration which simplifies field deployment.

Fixed connectivity services can be provided by different manufacturers of antennas, who have developed Nomadic User Terminals for use via KA-SAT in "Fly-Away" or "Rooftop Vehicular" configuration integrating into their technology the ViaSat IDU (mainly the Advanced IDU) and the 3 Watt and 4 Watt TRIA. User Terminals, to work on KA-SAT, have to undergo an approval process which is carried out by Eutelsat and which verifies that the terminal complies with rigorous rules of radiation and performance.

As the number of manufacturers willing to produce KA-SAT Nomadic User Terminals is constantly growing, the User should contact Eutelsat or Skylogic to get the most recent list of antenna models available and approved to work via KA-SAT. The following picture shows some of the Nomadic User Terminals available or under approval at the moment of writing.

It has to be pointed out that both Fixed and Nomadic terminals can be used to provide NewsSpotter Services. NewsSpotter connectivity via Nomadic Terminals will allow operating real SNG services at committed information rates from the field, while the use of NewsSpotter with Fixed terminals can be envisaged when Occasional Use connectivity at committed information rates is required repeatedly from the same venue.

→ Figure 8. Example of Nomadic User Terminals

The number of manufacturers willing to produce KA-SAT Nomadic User Terminals is constantly growing. Both Fixed and Nomadic terminals can be used to provide NewsSpotter Services.

03.3

LICENSING OF TERMINALS

Licensing of KA-SAT Terminals is ruled by decision 06/03 of the Electronic Communications Committee (ECC) on "Exemption from Individual Licensing of High EIRP Satellite Terminals (HEST) operating in the 10.70-12.75 GHz or 19.7-20.2 GHz Space to Earth and 14.00-14;25 GHz or 29.5-30.0 GHz Earth to Space Frequency Band ECC/DEC/06/03"

Decision 06/03 of the ECC exempts from individual licensing User Terminals operating on KA-SAT bands whose overall EIRP is lower than 60 dBW (the limit is lowered to 50 dBW in some countries ruled by ECC decisions).

Decision 06/03 of the Electronic Telecommunications Committee is adopted in all the countries belonging to the CEPT - European Conference of Postal and Telecommunications Administrations, namely Albania, Andorra, Austria, Azerbaijan, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Macedonia, Malta, Moldova, Monaco, Montenegro, Netherlands, Norway, Poland, Portugal, Romania, Russian Federation, San Marino, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom and the Vatican City.

As the overall EIRP of 70 cm/3Watt terminals corresponds to 48.5 dBW, such Terminals can be used without requiring any license in all CEPT Countries. Terminals using 120 cm antennas and 4 Watt TRIA will normally require to be licensed in those countries having 50 dBW power limit.

04

How NewsSpotter Contribution via KA-SAT works

The particular structure of KA-SAT and its Ground Network infrastructure requires an approach to SNG contribution which is slightly different from the traditional point-to-point contribution operated on a wide beam coverage.

04

As explained in previous chapters, the traffic transmitted from all User Terminals within a given Beam will land on a given Satellite Gateway operated by Skylogic; the pairing between the Beam and the Satellite Gateway is fixed. As an example, the traffic to/from the Beam 24, which covers Ireland is operated by the Gateway located in Arganda near Madrid in Spain, i.e. the traffic reaching (or coming from) User Terminals located in Ireland will transmitted from (received by) the Gateway in Arganda.

In such a configuration, a User Terminal on the field willing to transfer audiovisual content to a distant Master Control Room (MCR), will typically go through the following path:

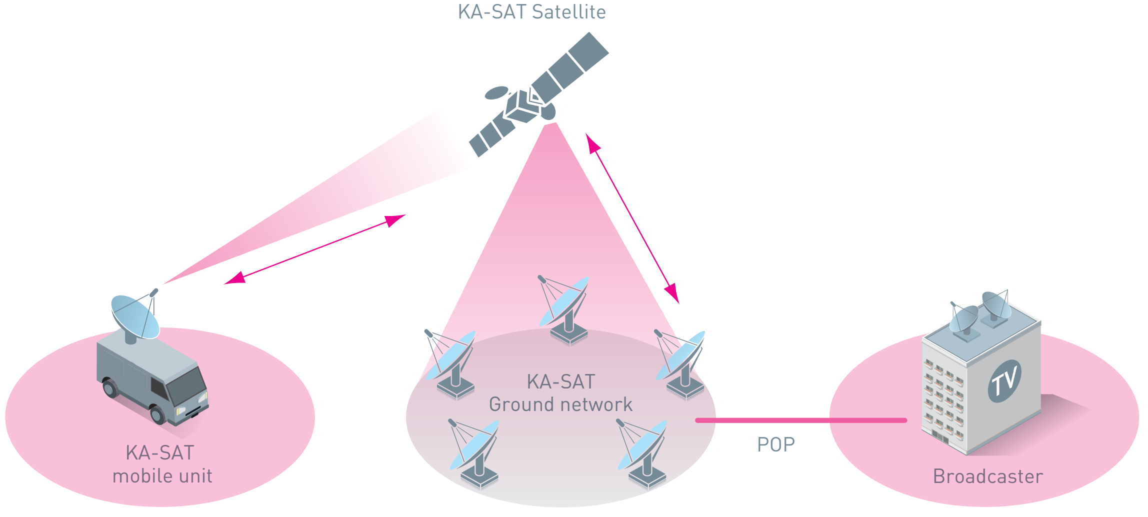
· from the Field to a "distant" Gateway via KA-SAT (which Gateway among the 8 Operational Gateways will depend on the Beam from which the contribution is done)
· from the Gateway into the KA-SAT Fiber Backbone
· from the Fiber Backbone to the MCR via the closest POP

The network infrastructure from the User Terminal up to the POP is a Fully Managed Network Infrastructure; it will thus be possible to allocate the desired bitrate on both the space segment and the ground segment to the POP, to ensure that the transmission is operated at the required quality.

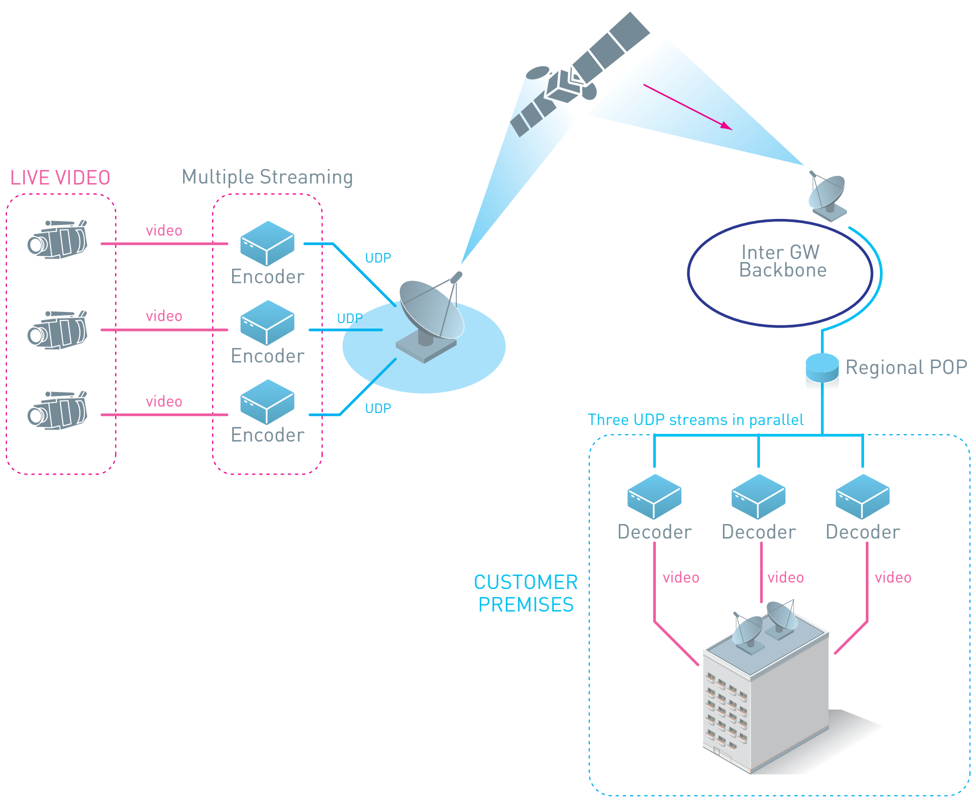
It has to be pointed out that the communication link between the User Terminal on the Field and the MCR will be based on IP protocol, which is the networking infrastructure which is natively provided via KA-SAT. The link will thus be fully bidirectional and it will allow even communications from the MCR to the User Terminal on the Field.

It has to be underlined as well that the network infrastructure from the User Terminal up to the POP is a Fully Managed Network Infrastructure; it will thus be possible to allocate the desired bitrate on both the space segment and the ground segment to the POP to ensure that the transmission is operated at the required quality. The typical provision of the NewsSpotter service foresees the delivery of the traffic at the closest POP; nevertheless, Skylogic and Eutelsat can agree with the Customer to interconnect its MCR to the KA-SAT Backbone via a dedicated link.

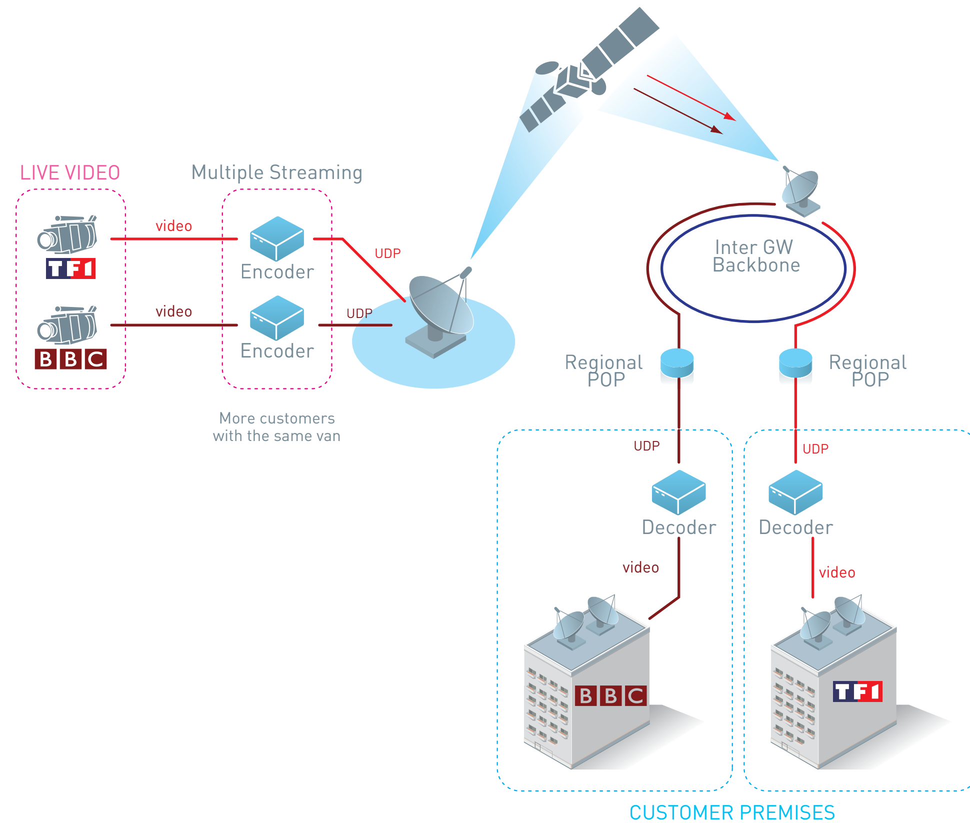
→ Figure 9. How SNG via KA-SAT Works



→ Figure 10. Streaming multiple takes to the same MCR



→ Figure 11. Streaming different takes to more than one MCR



In case the MCR is not or cannot be connected to the KA-SAT backbone, an alternative configuration can be operated. In this case the MCR itself will be equiped with a second KA-SAT User Terminal (a Fixed Terminal would be sufficient). The traffic in this case will go through the KA-SAT Satellite, land over a Gateway, travel on the Backbone to (likely) another Gateway, go over the Satellite and finally land on the User Terminal at the MCR. The Terminal in the Field and the Terminal at the MCR could actually be located in two different beams and it would be quite likely that the 2 beams are served by two different Gateways.

The link provided by NewsSpotter between the Field and the MCR will be in the form of an IP Network over Ethernet Interfaces. IP Networking via NewsSpotter can be easily tailored to the actual requirements of the Customer; it can provide static or dynamic IP addressing, Public or Private Address, addresses belonging to the Customer's pool or to a pool provided by Skylogic as preferred. Layer2 switching is also possible via the Advanced terminal.

Operating in IP will typically require MPEG Encoders on the Field and MPEG Decoders at the MCR provided with IP interfaces; these are today very common, as most of the equipment available on the market provides Transport Stream over IP In/Out. The transmission to the MCR will be typically done in the form of rtp:// streaming of a Transport Stream over IP, from the Encoder on the Field to the Decoder at the MCR. Different other scenarios are possible, like for instance the use of very new generation systems supporting Adaptive Streaming over http://. It has to be noted that the NewsSpotter system will route automatically the traffic to the proper destination address (the receiver at the MCR), through the networking infrastructure managed and operated by Skylogic. The use of native IP connectivity over NewsSpotter will also allow additional flexibility like streaming to multiple destinations, even at different MCRs.

The link provided by NewsSpotter between the Field and the MCR will be in the form of an IP Network over Ethernet Interfaces. IP Networking via NewsSpotter can be easily tailored to the actual requirements of the Customer; it can provide static or dynamic IP addressing, Public or Private Address, addresses belonging to the Customer's pool or to a pool provided by Skylogic as preferred. Layer2 switching is also possible via the Advanced terminal.

04.1

Other Data Services provided via KA-SAT and difference with NewsSpotter

Eutelsat and its subsidiary Skylogic offer other connectivity services via KA-SAT, services which should not be confused with NewsSpotter as they are not normally capable of providing the same level of Quality of Service (QoS). The main characteristic of NewsSpotter is that it can provide a Committed Information Rate which is essential to operate live streaming contributions from the field, normally operated in the form of CBR (Constant Bit Rate) encoded video.

4.1.1. Tooway™

The principal service offered via KA-SAT is named Tooway™. The Tooway™ Service has been conceived for providing Internet Broadband connectivity services for residential end-users not reached by ADSL-like offering. Tooway™ is normally provided via the Fixed Basic Terminal (Figure 6) and provides best efforts Internet connectivity via Satellite restricted by FAP (Fair Access Policies). The Tooway™ Service is restricted to work from a single Beam, the Beam from which it has been activated for the first time.

4.1.2. Professional Data Services

Skylogic and Eutelsat have also conceived Professional Connectivity Services to be operated on KA-SAT.
Such services are normally provided via the Advanced Fixed Terminal shown in Figure 7. Professional Data Services via KA-SAT can offer either Best Efforts or Committed information rate. When offering Committed Information Rate, their main difference with NewsSpotter is that they are normally conceived to be operated on a permanent basis and from terminals which are not supposed to move.

4.1.3. NewsSpotter advantages

NewsSpotter is the only professional service specifically conceived for the Video market, which can provide Committed Information Rate from Nomadic Terminals on an Occasional Use basis.
To work with NewsSpotter, User Terminals will be configured to be "Beamless", i.e. they may travel around the whole coverage of KA-SAT and Uplink from whichever Beam.
To be capable of providing Committed Information Rate, NewsSpotter requires airtime to be booked in advance to avoid any possible case of conflict in contention. Nevertheless, when not booked, a NewsSpotter User Terminal can provide connectivity on a Best Efforts basis, making available ancillary operations (like FTP push of Video Content edited in the field) not strictly requiring Committed Information Rate.

04.2

Booking of Capacity (Throughput) via NewsSpotter

The overall throughput that can be provided via a single KA-SAT Beam is in the range of 900 Mbps, equally divided between the FWD and the RTN links; as there are 80 Beams, the overall throughput of KA-SAT reaches the exceptional value of around 70 GBps.

From within a single Beam (whose diameter is in the range of 300 km) it will thus be possible to access to a capacity in U/L (i.e. from User Terminals to KA-SAT) of around 450 Mbps. Such a throughput will be shared between all of the User Terminals within the Beam, i.e. including Basic Terminals providing Internet Access to residential users. It has to be pointed out that residential users browsing on Internet will mainly use the FWD capacity (i.e. the capacity from KA-SAT to the User Terminal) as they will be mainly receiving content from the Internet, and not the RTN capacity (i.e. the capacity FROM the User Terminal to KA-SAT); in other words, most of the RTN capacity will be available for professional applications like NewsSpotter.

If we estimate that from within a single Beam the average population of residential users browsing on Internet will use 150 Mbps of RTN capacity, we still remain with 300 Mbps of capacity available for use with NewsSpotter. 300 Mbps of capacity correspond to 30 simultaneous Contributions at 10 Mbps each, and this from within a Beam of 300 km of diameter.

This is a lot of capacity, which should solve most of the potential risk of conflict. Nevertheless, some additional capacity on the RTN link from a Beam could be reserved for other uses, or exceptional breaking news events could generate a number of requests causing conflict on the RTN link of the Beam. The only way to avoid this potential risk – and to be 100% sure that the requested throughput is available – is to request the throughput in advance via Booking.

Booking for NewsSpotter via KA-SAT can be operated directly by the user.

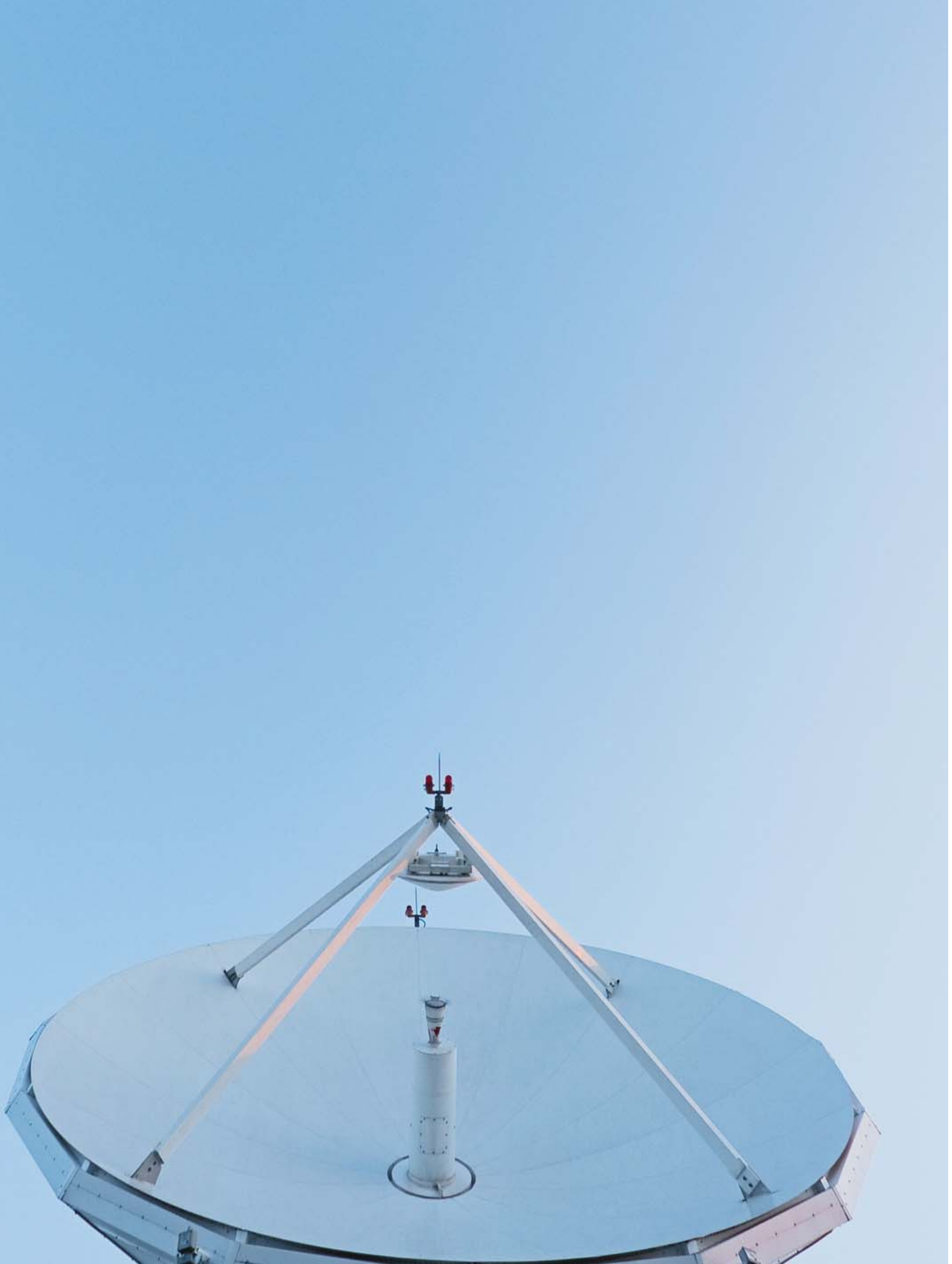
When subscribing to KA-SAT Data Connectivity Services (either Tooway™ or Professional Data Services or NewsSpotter), the User receives a set of Credentials for connecting to a secured web portal managed by Skylogic (OSS Portal). The Skylogic OSS Portal is on the public Internet, i.e. it can be accessed from any computer connected to the Internet via a generic web browser. The Skylogic OSS Portal will allow the user to get detailed information on his terminals and their status (SNR, connectivity, traffic exchanged and so on). When User Terminals are configured to work on NewsSpotter, the user will have access to a Booking page on the OSS Portal.

On the Booking Page the user will have to specify:

The Terminal that shall be used to perform the U/L (each single Terminal has a unique identifier)
The City from which the U/L will be performed
The date and the timeslot required
The throughput required (in Mbps) on the FWD and RTN link

From the information provided via the Portal, the Skylogic booking system will first of all check the availability of the throughput within the required timeslot, and if the capacity is available, it will be blocked for use with the specified Terminal from the specified Beam.

At the moment of writing Capacity should be reserved at least 30 mn in advance of its use; Skylogic is presently working to further reduce to zero the required advance to make it possible to book Capacity from the very same terminal on site.



04.3

The Sales Model of NewsSpotter

The sales model which has been conceived for NewsSpotter is based on a price per GByte transferred.

NewsSpotter Terminals will be sold by usual antenna manufacturers (and their distribution network), while Airtime will be typically sold by the usual distribution channels, i.e. SNG Service Providers and/or Distributors of KA-SAT Professional Services.

In a typical configuration a Customer will be equiped with a fleet of User Terminals, in either Fixed or Nomadic Configuration, enabled to use the NewsSpotter Service.

Airtime Contracts foresee the User to commit to use a minimum amount of throughput (expressed in Volume or GByte) in a year; for example a User owning 10 Terminals will sign a Contract to use 500 GByte in a year. The throughput which is committed in the year will be available to the whole population of user Terminals of the Customer, without restriction on respecting min or max volume limits on individual Terminals. If for example the User books a certain throughput (xx Mbit/sec) on a certain timeslot (yy hours) via a given terminal, the Volume generated by the Booking (xx Mbit/sec * yy hours) will be deducted from the amount of the Volume Committed Contractually. If the user does not perform a Booking and uses Best Efforts capacity, the used volume will be deducted from the Volume Committed Contractually.

As is normally done when booking MHz in Ku, the Volume which is Booked via the Booking Portal will be charged regardless of whether or not it has been used. When using Best Efforts (uncommitted) capacity via NewsSpotter, the volume effectively used will be deducted from the Contractually Committed Volume.

In general terms, the higher the Committed Volume, the lower the cost of the GByte; when compared to traditional Ku Occasional Use Contribution costs, NewsSpotter will cost around 1/3 of Occasional use via Ku Satellites.

Customers should get in touch with Skylogic to get the most updated pricing and offers on NewsSpotter.

05

Availability of the NewsSpotter Service

One of the major concerns expressed by potential users willing to use NewsSpotter is represented by the risk of rain fade due to the higher sensibility to rain attenuation that Ka presents with respect to Ku.

Despite Ka frequencies presenting higher sensitivity to rain fade than Ku frequencies, a number of techniques have been implemented in KA-SAT and User Terminals hardware to minimize the effect of rain attenuation.

As a first element, it should be considered that the KA-SAT satellite makes use of extremely concentrated power within the beams, which means the Satellite EIRP on ground is at least 7/8 dB higher than more recent Ku widebeam Satellites; KA-SAT therefore features margins that are sufficient to easily compensate rain attenuation in most situations.

A second consideration concerns the use of ACM (Adaptive Code and Modulation), which is automatically implemented by the Surfbeam 2 Modems used over KA-SAT. In case of rain fade, the modem will first of all try to compensate by increasing the transmission power. In case the transmission power is not sufficient for compensating the attenuation caused by rain, the system will automatically switch to a more robust Modulation scheme, by playing on different combinations of Modulation (8PSK, QPSK), FEC (from 1/3 to 8/9) and Symbol Rate (from 625 ksps to 20 Msps). The system will thus try to keep the Link available, at the expense of the available throughput should weather conditions become extremely severe.

05.1

Performance assessment under clear sky conditions

The aim of the following part of this White Paper is to present the results of the evaluation of the robustness of the Ka-Sat system under different weather conditions.

To pursue this goal, the first step was to assess the performance of the User Terminal (UT) under clear sky conditions, i.e. in the absence of rainfall and heavy clouds. This test allows for understanding the relationship between the path loss expressed in dB and the return link carrier. The path loss has been simulated by means of antenna miss-pointing.

The performance of the system has been measured decreasing the antenna pointing in steps. For every step, the Forward Link (FL) and Return Link (RL) signal to interference plus noise ratio SNR have been recorded and put in relation with the RL symbol rate and the IDU tx power. The tx power might in principle vary upon the UT installation as it could depend on the cable resistance, on the connector attenuation and on the individual TRIA, which could present varying tolerances of construction. However, by tracking the tx power changes with several different UTs, it was verified that although the absolute power level can vary, the relative incremental power is independent from the hardware used.

The following Figure shows the results of the above mentioned test for an Advanced User terminal with 70 cm Antenna and 3 Watt TRIA. Tests were carried out in Turin, using a user terminal locked to beam 20, which is managed by the Cork Gateway. All the tests results reported here were carried out in clear sky conditions at the remote Cork Gateway. The system was configured to use 8-PSK digital modulation with a ¾ LDPC channel code on the RL over the following possible carriers:

10000	ksps
5000	ksps
2500	ksps
1250	ksps
625	ksps

As the Figure shows, increasing the depointing of the antenna caused a constant decrease in the Received SNR (Blue: the SNR as received by the Terminal), while the Transmit SNR (Red: the SNR seen by the Satellite) tried to remain constant by means of increases of the Terminal Transmit Power (Black: IDU Tx Power) while the Carrier Transmitted by the User Terminal (Green) switched the Symbol Rate down.

The following table below shows the increment of the TX power, or the equivalent maximum path loss, that the system can tolerate when staying on the same RL carrier. Starting from 10Msps RL home channel, it was calculated which is the total loss that forces the RL to switch to a lower SR carrier.

→ Figure 12: Results of Depointing Tests

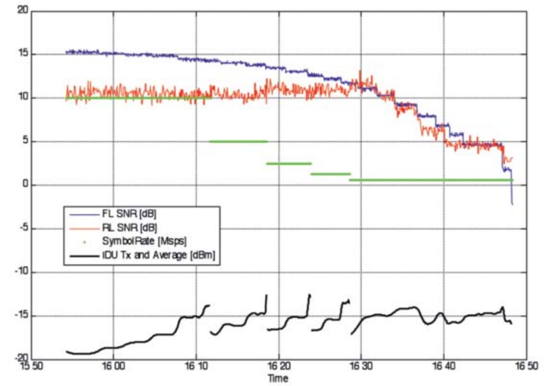


Table 1. Max SNR Loss causing the system to switch to Lower SR Carriers

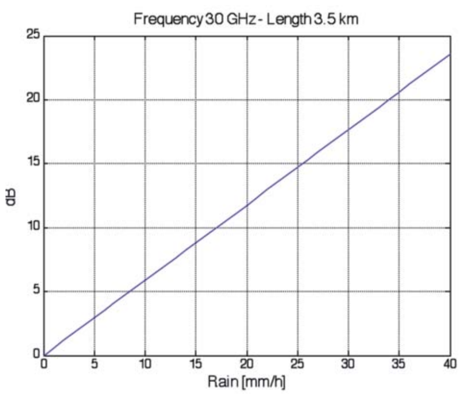
RL home channel [ksps]	Max SNR loss before stepping down RL carrier [dB]	Total SNR loss from a 10Msps RL carrier [dB]
10000	~ 5.5	
5000	~ 4.5	[5-6]
2500	~ 4	[9-10]
1250	~ 4	[13-14]
625		[16-18]

The measured path loss was then converted into rain attenuation using ITU recommendation P.838 "Specific attenuation model for rain for use in prediction methods".

The ITU recommendation provides a relation between the rainfall expressed in mm/h, and the attenuation in dB/km at different frequencies. The 30 GHz frequency was used, as it is the highest frequency used by a User Terminal transmitting to KA-SAT. As attenuation is expressed in dB/km, it was assumed that the average thunderstorm presents a "cloud depth" of 3.5 km.

The graph in Fig 13 shows thus the attenuation in dB caused by a rainfall (expressed in mm/h) extended over a depth of 3.5 km at the Frequency of 30 GHz.

→ Figure 13. Results of Depointing Tests

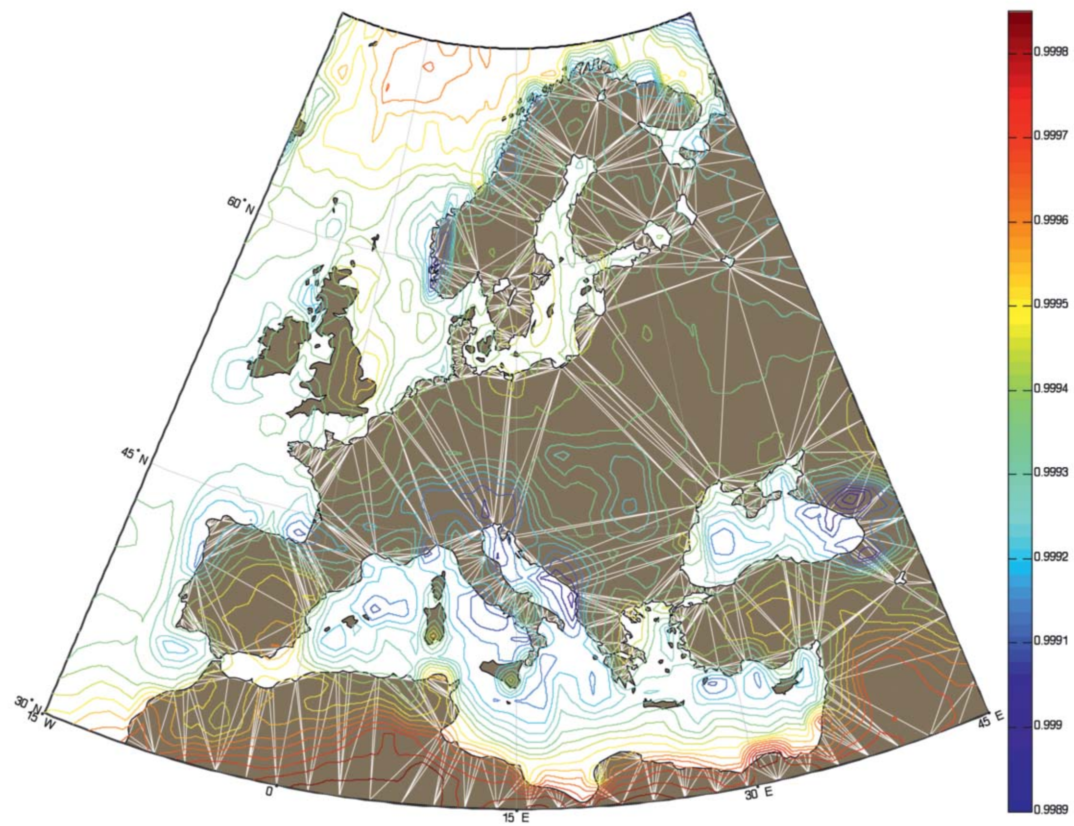


By crossing the Terminal behaviour as measured in Table 1 and the Rainfall attenuation values according to the ITU model, it was possible to compute the available Bitrate from the Terminal (obtained from the SR used by the Terminal) with the Rainfall model. On top of rain attenuation over a depth of 3.5 km, a further attenuation caused by heavy clouds and by a wet antenna were also taken into account and were estimated to be around 1 and 2 dB respectively [S. K. A. Rahim , A. Y. Abdulrahman , T. A. Rahman, M. R. Ul Islam, "Measurement of Wet Antenna Losses on 26GHz Terrestrial Microwave Link in Malaysia", 2010, Wireless Personal Communications Springer]. The results of such computation are shown in the following Table.

Table 2. Available Bitrate from a 70 cm Antenna + 3 Watt TRIA vs Rainfall

RL bitrate [ksps]	Required RL carrier	Total Tolerated Rain Intensity [mm/h]
512	625	>25
1024	625	>25
2048	1250	~ 25
4096	2500	~ 18
6144	5000	~ 12
8192	5000	~ 12
10240	5000	~ 12
122800	10000	~ 4

→ Figure 14. Availability of 5 Mbps Carrier via NewsSpotter



By putting together ITU Models as described in P.840.4 "Cloud attenuation on satellite links in the Ka/V-band and the effect of changes in the effective cloud temperature", P.618-9 "Propagation data and prediction methods required for the design of Earth-space telecommunication systems", P.676-8 "Attenuation by atmospheric gases", and ITU digital maps for rain intensity and rain height, it was possible to calculate the availability map for a given RL carrier.

The availability map of the 5 Msps Carrier is shown in the following figure. As the Figure shows, the availability of the 5 Msps link via NewsSpotter is higher than 99.90% in most of Europe. As already shown in Table 2, the 5 Msps Carrier – in combination with the proper FEC – will allow rates up to 11.25 Mbps. It can thus be concluded that from most of Europe the NewsSpotter system will provide 11.25 Mbit with an availability of around 99.9% from a 70 cm antenna with a 3 Watt TRIA.

To conclude, it has to be pointed out that the present results have been obtained on the basis of an 8PSK Carrier @ FEC ¾. Different results in term of available Bitrate and behaviour in term of rain fade can be obtained by changing parameters like FEC Values (for instance 2/3), Symbol Rate and modulations. Skylogic and Eutelsat have done extensive simulations on the behaviour of the systems, paired with practical tests on the field, which are available upon request.

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November 2012

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Electronic Communications Committee (ECC) Decision 06/03 - Exemption From Individual Licensing of High EIRP Satellite Terminals (HEST) operating in the 10.70-12.75 GHz or 19.70-20.20 GHz Space to Earth and 14.00-14.25 GHz or 29.50-30.00 GHz Earth to Space

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