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1 System and service overview

Tooway™ is based on the Surfbeam Product manufactured by ViaSat, which is built on the DOCSIS® standard for broadband cable connections:

Data Over Cable System Interface Standard
Open standard in wide use today, > 70M subscribers worldwide
Continuously being upgraded to add more value added services
Designed for very large networks

Satellite Modem (SM)
Utilise Cable Modem and DTH Set-Top-Box chipsets
Replace cable system physical (PHY) layer with satellite compatible PHY (modulation & coding)

Satellite Modem Termination System (SMTS) (Hub)
Utilise Cable Modem Termination System (CMTS) products
Replace cable system PHY layer with satellite compatible PHY
Add dynamically variable coding and modulation
Add fade mitigation algorithms to maximize throughput
Modified scheduler for use in satellite environment

Skylogic Network operation center
Turin SkyPark Network

> 14 hubs on 8 satellites
> Connection to Turin/Milan/Paris POP
> 2 Ka band antennas (W3A Africa and HB6 multiple transponders and spots) 24h/7days service
2 Basic technical data

2.1 Terminal Data

2.1.1 Downstream:
Symbol Rate: 5 to 30 Mbauds
Code Point Options: QPSK ½, 8PSK 2/3

2.1.2 Upstream
Symbol Rate: 160, 320, 640, 1280, 2560 kbps (QPSK ½ and 3/4)

2.1.3 Fade Mitigation
Full upstream & downstream fade mitigation process

2.1.4 SM
FWD and RTN link multi rate

2.1.5 SMTS
Multi-State Upstream Scheduler
Manual Hot Swap Redundancy
FWD and RTN link multi rate
Multicast enabled
2.2 Advantage versus other existing systems

Multi-Rate PHY Advantage

- Terminals in Clear-Sky receive packets at high Information Rate
- Transmissions to terminals experiencing fade are automatically sent at a more robust code point
- Large throughput advantage, since clear sky conditions usually prevail (typ. 95+%)
- Static PHY systems (e.g. DVB-S) must transmit at the more robust code point at all times to achieve desired availability

**SurfBeam**

- QPSK 1/2 CEVD 27.6 Mbps
- 1 dB<Fade<3.8 dB 0.3% of Year
- QPSK 1/2 CEVD 27.6 Mbps

**DVB - S**

- QPSK 1/2 CEVD 27.6 Mbps
- No Adjustment Possible

**SurfBeam Throughput:**

- 67.56 Mbps
- Averaged over Year

**DVB-S Throughput:**

- 27.6 Mbps
- Averaged over Year
3 The HOT BIRD™ 6 satellite at 13° East

Ka-band uplink coverage

Ka-band downlink coverage

D = Germany, current service on, Vertical Polarisation
I = Italy
E = Spain
F = France

X = horizontal Polarisation
Y = vertical Polarisation

<table>
<thead>
<tr>
<th></th>
<th>29.5 GHz</th>
<th>30.0 GHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>UP-LINK</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D K154</td>
<td>I K158</td>
<td>X</td>
</tr>
<tr>
<td>E K153</td>
<td>F K159</td>
<td>Y</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>19.7 GHz</th>
<th>20.2 GHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOWN-LINK</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E K153</td>
<td>F K159</td>
<td>X</td>
</tr>
<tr>
<td>D K154</td>
<td>I K158</td>
<td>Y</td>
</tr>
</tbody>
</table>
The Downlink Spectrum Plots
4 Safety Precautions

Important Safety Precautions and Notices

⚠️ Warnings.

Before installing the satellite modem, make sure your electrical outlet is properly wired and your computer equipment is properly grounded. Consult with a licensed electrician if you are not sure.

The satellite antenna must be properly grounded for lightning protection. Consult with a licensed electrician and your installer to ensure compliance with local codes.

RF Radiation Hazard. The transmitting equipment is capable of generating RF levels above the maximum permissible uncontrolled exposure level. Do not enter the radiation beam pattern of the transmitter fixed beam and/or antenna when the transmitter is on.

Before connecting and cables to the satellite modem, read and understand all safety precautions.

There are no user-serviceable parts inside any of the equipment in your system. There are potentially lethal voltages inside the equipment. It should only be opened by a technician trained and certified to service the product.

Before operating the satellite modem, read and understand all provided instructions.

When the Satellite Modem is powered on, DC voltage is present on the rear panel TX and RX connectors.

To prevent fire or shock hazard, do not expose this appliance to rain or moisture. The apparatus must not be exposed to dripping or splashing and no objects filled with liquids, such as vases, should be placed on the apparatus.

Postpone satellite modem installation until there is no risk of thunderstorm or lightning activity in the area.

To prevent electrical shock, if the unit is provided with a polarized plug, do not connect the plug into an extension cord, receptacle or other outlet unless the plug can be fully inserted with no part of the blades exposed.

The In-Line Power Supply input power cord must be connected to a properly grounded three-prong AC outlet. Do not use adapter plugs, or remove the grounding prong from the plug.

⚠️ Cautions.

Only use the in-line power supply provided with the SM. Using a different power supply may cause equipment damage.

To ensure regulatory and safety compliance, use only the provided power and interface cables.

Do not open the unit. Do not perform any servicing other than that contained in the installation and troubleshooting instructions. Refer all servicing to qualified service personnel.

Avoid damaging the satellite modem with static by first touching the coaxial cable connector when it is attached to the earth grounded coaxial cable wall outlet. Always first touch the coaxial cable connector on the satellite modem when you are disconnecting or re-connecting your Ethernet cable from the satellite modem or your PC.

To prevent overheating, do not block the ventilation holes on the sides of the unit.

Only wipe the unit with a clean, dry cloth. To avoid equipment damage, never use cleaning fluids or similar chemicals. Do not spray cleaners directly on the unit or use forced air to remove dust.

The user shall install an AC surge arrester in the AC outlet to which this device is connected. This is to avoid damaging the equipment by local lightning strikes and other electrical surges.

⚠️ Notices

This product was qualified under test conditions that included the use of the supplied cable between system components. To be in compliance with regulations, the user must use this cable and install it properly.

Different types of cord sets may be used for connections to the main supply circuit. Use only a main line cord that complies with all applicable product safety requirements of the country of use.

Installation of this product must be in accordance with national wiring codes.

Hereby, ViaSat, Inc., declares that this Satellite Modem is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.
5 The Tooway™ terminal

**ODU (Out Door Unit)**
- Complete range of ODUs
- 67cm Ka-band
- Automated installation tools simplify antenna alignment and commissioning

**Very small and simple IDU**
(also called Satellite Modem)
- Simple customer interfaces:
  - Ethernet 10/100 Mbps

Connection between two units via Coaxial Cable called IFL (Inter Facility Link) Cable
Two Cables TX and RX/ Further details see chapter Cable Specification.
5.1 Satellite Antenna Assembly

5.1.1 Tools required:

- Socket set 10 mm to 16 mm
- Adjustable spanner/wrench
- Screwdriver Pozi Drive
- Cutter
- Crimp or Compress tool for connectors
- Field satellite meter
- Simple Multi Meter for checking DC Power supply if necessary
- Simple Laptop
- Ethernet Cable

Tooway™ Ka-band
5.1.2 Antenna Assembly Hardware

<table>
<thead>
<tr>
<th>QTY</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>6 5/16 UNC x 3/4&quot; carriage bolt</td>
</tr>
<tr>
<td>B</td>
<td>1 5/16 UNC x 2 1/2&quot; hex head tap bolt</td>
</tr>
<tr>
<td>C</td>
<td>4 5/16 UNC serrated flange nut</td>
</tr>
<tr>
<td>D</td>
<td>1 5/16 UNC x 1&quot; hex head tap bolt</td>
</tr>
<tr>
<td>E</td>
<td>5 5/16 UNC hex nut</td>
</tr>
<tr>
<td>F</td>
<td>4 5/16 UNC Lock Washer</td>
</tr>
<tr>
<td>G</td>
<td>4 5/16 UNC Washer</td>
</tr>
<tr>
<td>H</td>
<td>1 5/16 UNC x 2&quot; hex head tap bolt</td>
</tr>
<tr>
<td>I</td>
<td>2 1/4 UNC Washer</td>
</tr>
<tr>
<td>J</td>
<td>2 1/4 UNC Lock Washer</td>
</tr>
<tr>
<td>K</td>
<td>5 1/4 UNC x 1/2&quot; carriage bolt</td>
</tr>
<tr>
<td>L</td>
<td>7 1/4 UNC Serrated Flange Nut</td>
</tr>
<tr>
<td>M</td>
<td>4 1/4 UNC x 3/4&quot; hex head tap bolt</td>
</tr>
<tr>
<td>N</td>
<td>2 1/4 UNC x 1 1/4&quot; hex head tap bolt</td>
</tr>
<tr>
<td>O</td>
<td>1 1/4 UNC x 1/2&quot; hex head tap bolt</td>
</tr>
<tr>
<td>P</td>
<td>1 1/4 UNC hex nut</td>
</tr>
</tbody>
</table>

**TRIA Mounting Hardware**

<table>
<thead>
<tr>
<th>QTY</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q</td>
<td>4 #10-32 UNF x 2 1/4&quot; pozi pan head</td>
</tr>
<tr>
<td>R</td>
<td>4 Transceiver Spacer</td>
</tr>
</tbody>
</table>
5.1.3 Terminal antenna assembly (Nuts and Bolts are in real size)

-1-

-2-
5.2 Inter Facility Link Cables and Connectors

5.2.1 The cables

Two factors are important:
Electrical DC resistance (Ohm) for the power support from Satellite Modem to BUC
Maximum value (inner connector plus outer braid) = 2.27 Ohms

Signal Attenuation Signal: Maximum Value:
9.17 dB at 1000 MHz and 14.3 dB at 2200 MHz

This results to a maximum cable length between IDU and ODU of
30 m using RG59 Cable
50 m using RG 6 Cable
100 m using RG 11 Cable.
RG-6 2200-MHz
75 Ohm Coaxial Cable
Catalog # 5729
Non-Plenum
NEC/CEC:CM(UL) C(UL) CMG

CABLE CONSTRUCTION:
- Center Conductor: 16 AWG Bare Copper
- Inner Diameter: 0.0424" (1.07 mm)
- Dielectric: Polyethylene Diameter 0.1600" Min. 0.1500" Max.
- Foil: Aluminum Foil Tape 0.0003" Min. 0.0004" Max.
- Outer Diameter: 0.242" Min. 0.245" Max.

ELECTRICAL PROPERTIES:
- Shield: 100% Braid Copper 20 AWG Min.
- Impedance: 75 ± 0.5 Ω at 1 GHz
- Velocity of Propagation: 0.68 c
- DC Resistance: 35.3 Ω Min.
- Attenuation: 15 dBA at 2000 MHz 105% Swapped Twisted Pair

MECHANICAL PROPERTIES:
- Minimum Bend Radius:
  - Line: 20 Times Cable OD
  - 20 Times Cable OD

CABLE TERMINATION:
- Type: "CHR"

ATTENUATION:

<table>
<thead>
<tr>
<th>DB/100 ft (Nom.)</th>
<th>@ FREQUENCY, MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.65 dl</td>
<td>1 MHz</td>
</tr>
<tr>
<td>0.60 dl</td>
<td>10 MHz</td>
</tr>
<tr>
<td>1.00 dl</td>
<td>100 MHz</td>
</tr>
<tr>
<td>1.05 dl</td>
<td>100 MHz</td>
</tr>
<tr>
<td>2.64 dl</td>
<td>300 MHz</td>
</tr>
<tr>
<td>3.70 dl</td>
<td>600 MHz</td>
</tr>
<tr>
<td>5.65 dl</td>
<td>700 MHz</td>
</tr>
<tr>
<td>3.78 dl</td>
<td>800 MHz</td>
</tr>
<tr>
<td>4.11 dl</td>
<td>1000 MHz</td>
</tr>
<tr>
<td>0.72 dl</td>
<td>1200 MHz</td>
</tr>
<tr>
<td>7.45 dl</td>
<td>1400 MHz</td>
</tr>
<tr>
<td>6.45 dl</td>
<td>1600 MHz</td>
</tr>
<tr>
<td>5.65 dl</td>
<td>2000 MHz</td>
</tr>
</tbody>
</table>

Dimensions not to Scale
Specifications subject to change
Revision: 06-07-02
**DESCRIPTION**

Indoor Isometa drop coaxial cable - 75 Ohm

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Cu</th>
<th>PEE</th>
<th>Al/Pet/Al</th>
<th>Cu/Sn</th>
<th>Lead free</th>
<th>PVC</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.80</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.59</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.99</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.00 x  5.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**CONSTRUCTION DATA**

A. Inner conductor of plain annealed copper wire.
   
   (Cu)  0.80 +/- 0.02 mm

B. Dielectric of physical foam Polyethylene.
   
   (PEE)  3.50 +/- 0.10 mm

C. Outer conductors:
   
   Alluminium/Polyester/Alluminium tape longitudinally overlapped
   
   (Al/Pet/Al)  18 x 0.048 mm

D. Braid of tinned copper wires.
   
   (CuSn)  18 x 6 x 0.10 mm

   Lay of braid: 50 mm

   Coverage (IEC 90-1) 50%

E. Outer sheath of white lead free PVC
   
   (PVC)  11.00 x 0.03 +/- 0.10 mm

"CAVEL 2 x DG 80 MADE IN ITALY 75 Ohm CENE017-2-4 8/Alas (asentimana, aspanne)"

Weight of copper conductors: 22.6 Kg/Km

Total weight of cable (approx.) 59.0 Kg/Km

Minimum bending radius for single/repeated bending (10 bendings max.): 25/60 mm

**ELECTRICAL PARAMETERS**

- Characteristic impedance: 75 ± 3 Ohm
- Sheath dielectric strength
- Capacitance: 55 ± 2 pF/m
- (spark test) 2.5 kV
- Velocity ratio: 86%
- Attenuation (at 20°C): dB/100m

<table>
<thead>
<tr>
<th>Frequenza</th>
<th>Attenu.</th>
<th>± 5%</th>
<th>Frequenza</th>
<th>Attenu.</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 MHz</td>
<td>1.6</td>
<td>1.6</td>
<td>1350 MHz</td>
<td>29.9</td>
</tr>
<tr>
<td>50 MHz</td>
<td>5.4</td>
<td>5.4</td>
<td>1750 MHz</td>
<td>34.3</td>
</tr>
<tr>
<td>200 MHz</td>
<td>11.1</td>
<td>11.1</td>
<td>2050 MHz</td>
<td>37.3</td>
</tr>
<tr>
<td>470 MHz</td>
<td>17.3</td>
<td>17.3</td>
<td>2150 MHz</td>
<td>38.2</td>
</tr>
<tr>
<td>862 MHz</td>
<td>23.8</td>
<td>23.8</td>
<td>2450 MHz</td>
<td>40.5</td>
</tr>
<tr>
<td>1300 MHz</td>
<td>25.7</td>
<td>25.7</td>
<td>3000 MHz</td>
<td>46.4</td>
</tr>
</tbody>
</table>

Inner conductor resistance: 35.0 Ohm/Km  S.R.L.: 30 - 470 MHz > 28 dB
Outer conductors resistance: 18.8 Ohm/Km

Screening attenuation (Av): 5 - 30 MHz > 75 dB  30 - 1000 MHz > 60 dB  1000 - 2100 MHz > 75 dB

**ITALIANA CONDUTTORI s.r.l.**

V.le Zanott 36 - 27027 Groppello Cremona (PV) - Italy
Tel. 0365-815156 - Fax: 0365-814812

<table>
<thead>
<tr>
<th>DATE</th>
<th>RESPONSABILE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apr. 22, 2005</td>
<td>P. Piccinini</td>
</tr>
</tbody>
</table>
DESCRIPTION
Double shielded coaxial cable - 75 Ohm
A+ Screening Class

<table>
<thead>
<tr>
<th>Diam.</th>
<th>1,00</th>
<th>4,75</th>
<th>4,97</th>
<th>5,37</th>
<th>0,00 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cu</td>
<td>PEE</td>
<td>AIPet/Surlyne</td>
<td>CuSn</td>
<td>PVC</td>
<td></td>
</tr>
</tbody>
</table>

CONSTRUCTIVE DATA
A. Inner conductor of plain annealed copper wire. (Cu) \( \phi \ 1,00 \pm 0.02 \) mm
B. Dielectric of physical foam Polyethylene. (PEE) \( \phi \ 4,75 \pm 0.10 \) mm
C. Aluminium/Polyester/Surlyne tape (AIPet/Surlyne) 10 mm x 50/12/25 \( \mu \)m longitudinally overlapped and bonded to the dielectric.
D. Braid of twisted copper wires. (CuSn) 16 x 6 x 0.10 mm
   Lay of braid: 50 mm
   Coverage (IEC 90-1) 53%
E. Outer sheath of white PVC printed by black inkjet.

CAVEL RP61B MADE IN ITALY 75 Ohm EN50173-2-A Class A+ wavy meter marking (wawawaw...year)

Weight of copper conductors: 14,1 Kg/Km
Total weight of cable (approx.): 41,1 Kg/Km
Minimum bending radius for single/repeated bonding (10 bendings max.): 26/0 mm

ELECTRICAL PARAMETERS
Characteristic Impedance: 75 \pm 3 Ohm
Sheath dielectric strength 54 \pm 2 pF/m
Voltage ratio: 92%
Nom. attenuation (at 20°C and dB/100m):

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Atten.</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 MHz</td>
<td>1,7</td>
</tr>
<tr>
<td>10 MHz</td>
<td>2,3</td>
</tr>
<tr>
<td>30 MHz</td>
<td>3,5</td>
</tr>
<tr>
<td>50 MHz</td>
<td>4,5</td>
</tr>
<tr>
<td>200 MHz</td>
<td>9,0</td>
</tr>
<tr>
<td>300 MHz</td>
<td>4,5</td>
</tr>
<tr>
<td>470 MHz</td>
<td>14,0</td>
</tr>
</tbody>
</table>

Inner conductor resistance: 22,5 Ohm/Km
S.R.L.: 5 – 470 MHz > 30 dB
Outer conductors resistance: 13,2 Ohm/Km
470 – 1000 MHz > 38 dB
1000 – 2000 MHz > 38 dB
2000 – 3000 MHz > 22 dB

Screening attenuation (As): 30 – 1000 MHz > 96 dB

ITALIANA CONDUTTORI s.r.l
VIA Zenotti 90 – 27127 Grapallo Caroli (PV) Italy
Tel: 0382-815158 – Fax: 0382-814212

DATE: May 10, 2007
RESPONSIBLE: P.Ricchini
CommSpace®

RG 11 Drop Cable
CommSpace Cables

Construction and Dimensions

<table>
<thead>
<tr>
<th>Item</th>
<th>Standard Shield</th>
<th>Tri-Shield</th>
<th>Quad-Shield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter of Inner conductor (mm)</td>
<td>1.63</td>
<td>1.63</td>
<td>1.63</td>
</tr>
<tr>
<td>Diameter of Dielectric (mm)</td>
<td>7.11</td>
<td>7.11</td>
<td>7.11</td>
</tr>
<tr>
<td>Diameter of 1st outer conductor (mm)</td>
<td>7.52</td>
<td>7.52</td>
<td>7.52</td>
</tr>
<tr>
<td>Diameter of 2nd outer conductor (mm)</td>
<td>7.80</td>
<td>7.80</td>
<td>7.80</td>
</tr>
<tr>
<td>Diameter of 3rd outer conductor (mm)</td>
<td>/</td>
<td>7.90</td>
<td>7.90</td>
</tr>
<tr>
<td>Diameter of 4th outer conductor (mm)</td>
<td>/</td>
<td>/</td>
<td>8.20</td>
</tr>
<tr>
<td>Diameter of Jacket (mm) C</td>
<td>10.20</td>
<td>10.30</td>
<td>10.60</td>
</tr>
<tr>
<td>Approximate weight (kg/km)</td>
<td>76</td>
<td>78</td>
<td>84</td>
</tr>
<tr>
<td>Diameter of messenger and wire (mm)</td>
<td>1.80</td>
<td>1.80</td>
<td>1.80</td>
</tr>
<tr>
<td>Steel wire weight (kg/km)</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
</tbody>
</table>

Annotations:
1) Material of 1st outer conductor and 3rd outer conductor is bonded foil, non-bonded foil, 3rd outer conductor is non-bonded foil.
2) Coverage of 2nd outer conductor and 4th outer conductor is 40%, 50%, 60%. Other different specifications of the product can be made as per customer’s requirement.

Attenuation

<table>
<thead>
<tr>
<th>Frequency (MHz)</th>
<th>Max value (dB/100m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>1.19</td>
</tr>
<tr>
<td>50</td>
<td>1.20</td>
</tr>
<tr>
<td>55</td>
<td>1.29</td>
</tr>
<tr>
<td>200</td>
<td>6.40</td>
</tr>
<tr>
<td>211</td>
<td>6.57</td>
</tr>
<tr>
<td>300</td>
<td>7.83</td>
</tr>
<tr>
<td>400</td>
<td>9.04</td>
</tr>
<tr>
<td>450</td>
<td>9.59</td>
</tr>
<tr>
<td>500</td>
<td>10.20</td>
</tr>
<tr>
<td>550</td>
<td>10.70</td>
</tr>
<tr>
<td>600</td>
<td>11.18</td>
</tr>
<tr>
<td>750</td>
<td>12.49</td>
</tr>
<tr>
<td>800</td>
<td>13.16</td>
</tr>
<tr>
<td>860</td>
<td>13.38</td>
</tr>
<tr>
<td>1000</td>
<td>14.43</td>
</tr>
<tr>
<td>1350</td>
<td>17.10</td>
</tr>
<tr>
<td>1750</td>
<td>19.47</td>
</tr>
<tr>
<td>2156</td>
<td>21.58</td>
</tr>
</tbody>
</table>

Electrical Performance

| DC Resistance of Inner conductor (Ω/km) | 40 CCX | 8.0 BC |
| DC Resistance of Outer conductor (Ω/100m) | 26 AL  | 13 TC  |
| Impedance (Ω)            | 75 2.20 |
| Capacitance (pf/m)       | 50 2.3.0 |
| Wave velocity %          | 85%    |
| VHF 5~300MHz             | 26dB   |
| UHF 300~900MHz           | 18dB   |

Options

Packing: wooden spool 305 meters (1000 Ft)
Printing: ink- engraved—every one meter
DESCRIPTION

COAXIAL CABLE - 75 Ohm

CAVEL SAT 50 M

<table>
<thead>
<tr>
<th>Description</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.00 Cu</td>
<td>4.75 PEE</td>
</tr>
</tbody>
</table>

CONSTRUCTION DATA

A. Inner conductor of plain annealed copper wire.

B. Dielectric of physical foam Polyethylene.

C. Outer conductors: Aluminum/Polyester tape longitudinally overlapped.

D. Braid of tinned copper wires.

E. Outer sheath of white PVC printed by ink-jet.

CAVEL SAT 50 M MADE IN ITALY 75 Ohm EN50117-2-4.wavy meter marking [wawa wawa wawa]

Weight of copper conductors: 11.4 Kg/km
Total weight of cable (approx.): 38.6 Kg/km

Minimum bending radius indoor/outdoor: 35/70 mm

ELECTRICAL DATA

Characteristic impedance: 75 +/- 3 ohm
Capacity: 54 pF/m +/- 2
Velocity ratio: 0.2%
Attenuation (at 20°C): dB/100m

<table>
<thead>
<tr>
<th>Frequency (MHz)</th>
<th>Attenu. (dB)</th>
<th>(-C%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 MHz</td>
<td>2.0</td>
<td>502 MHz</td>
</tr>
<tr>
<td>10 MHz</td>
<td>2.3</td>
<td>1000 MHz</td>
</tr>
<tr>
<td>30 MHz</td>
<td>3.3</td>
<td>1750 MHz</td>
</tr>
<tr>
<td>50 MHz</td>
<td>4.3</td>
<td>2150 MHz</td>
</tr>
<tr>
<td>200 MHz</td>
<td>9.9</td>
<td>2350 MHz</td>
</tr>
<tr>
<td>300 MHz</td>
<td>10.5</td>
<td>2490 MHz</td>
</tr>
<tr>
<td>470 MHz</td>
<td>13.6</td>
<td>3000 MHz</td>
</tr>
</tbody>
</table>

Outer conductor resistance: 33.0 Ohm/Km

S.R.L: 5 - 470 MHz > 30 dB
470 - 1000 MHz > 28 dB
1000 - 2000 MHz > 26 dB
2000 - 3000 MHz > 22 dB
3000 MHz > 20 dB

Transfer impedance: 5-50 MHz < 6.0 mOhm/m

Screening Attenuation (Aq): 30 - 1000 MHz > 65 dB
1000 - 2000 MHz > 80 dB
2000 - 3000 MHz > 70 dB

ITALIANA CONDUTTORI s.r.l.

V.le Zarottl 50 - 27027 Gropello Cairoli (P) - Italy
Tel. 0382-815100 - Fax: 0382-814212

DATE: Jan 31, 2007
RESPONSIBLE: P. Piccinini
5.2.2 The Connectors

Ensure connectors are compatible with cable (check with cable suppliers)

IF Cables

**OUTDOOR**

- **RG 6**
  - Cablecon and Stirling compression connectors

**INDOOR**

- **RG 11**
  - Cablecon FM 32 and Cablecon and Stirling compression connectors

**Cablecon and Stirling compression connectors**
5.3 The Satellite Modem

Power: input + 30 V DC from Power Supply

Ethernet LAN: 10/100 base T Ethernet, RF 45 Jack

RX In: L Band Input 1000 – 1500 MHZ (Ka) Type F 75 Ohm female connector

TX Out: S Band Output 1800 – 2300 MHz (Ka) Type 75 Ohm female connector, provides DC power to BUC and LNB

5.3.1 Connection of the Modem
### 5.3.2 Modem Front panel Indicators

<table>
<thead>
<tr>
<th>Function</th>
<th>Indicator Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>PWR</strong></td>
</tr>
<tr>
<td>Power is not applied</td>
<td>Off</td>
</tr>
<tr>
<td>Power is applied (startup)</td>
<td>Momentary On</td>
</tr>
<tr>
<td>Power is applied (after startup)</td>
<td>On</td>
</tr>
<tr>
<td>Downstream acquisition in progress</td>
<td>On</td>
</tr>
<tr>
<td>Upstream ranging in progress</td>
<td>On</td>
</tr>
<tr>
<td>Registration in progress</td>
<td>On</td>
</tr>
<tr>
<td>Software download in progress</td>
<td>On</td>
</tr>
<tr>
<td>SM successfully ranged/registered (normal)</td>
<td>On</td>
</tr>
<tr>
<td>Fault as a result of POST</td>
<td>On</td>
</tr>
</tbody>
</table>
6 Antenna pointing of Tooway terminal

6.1 Elevation and Azimuth Angles

For getting the relevant pointing angels of your location, please look to the following URL:
http://www.satsig.net/maps/lat-long-finder.htm

The following graphs give an indication about the Elevation and Polariasation angels in Europe:
Elevation *Angales
Polarisation Angeles
6.1.1 Antenna installation

It is presumed that the antenna is well assembled and the cable installed. **Important: mark the TX cable on both ends so you do not swap cable between modem and ODU.**

At the selection of the antenna installation place, consider a solution that hides the antenna and ensures that there is also in the upcoming years nothing in the line of sight to the satellite. (Trees, planned buildings) In southern direction.

Install the antenna mount (Wall mount or non-penetrating mount) according to local security regulations and the requirements of the local environment. (Condition of walls or ground)

**Important:** make sure that the part of the mount that will take the antenna is precise vertical position

Hook the antenna AZ/EL mount on the antenna mount and fix the antenna so that it can be moved in Azimuth.

Adjust the elevation angle of the city nearby from the table above. Use the El reading at the antenna.

Adjust approximately the polarisation angel by turning the entire reflector and the feed arm to the spot required.

The example below is for the German Spot on HOT BIRD™ 6. RX Vertical.
Connect the TX cable to the TX connector at the Transceiver.

Connect your field satellite meter with the RX connector of the Transceiver.

Adjust field satellite meter to see a digital carrier at ----- MHz IF Frequency, carrier size today 15 MSymbols. These values are subject to change please verify before installation

Connect the TX cable to the Modem and power up the modem.

6.1.2 Pointing of the antenna

Important information:
Although the antenna size is only 0.67 m in Ka band it corresponds to about a 1.1 m antenna in Ku band. The opening angle to detect any carrier is about 2°. Unfortunately the accuracy of the elevation reading on the antenna is also only about 2° to 3°.

Turn the antenna in southern direction until you see the carrier.

If you do not see any carrier please lower the elevation by about 2° and repeat the previous step.

If you still do not see any carrier please raise the elevation by about 4° and repeat the previous step.

If you still do not see any carrier please please repeat the previous steps until you change the elevation angle by 8°.

If you still do not see any carrier the problem is not your pointing please check the following points:

Does you Satellite meter show a noise floor? (Is there a difference in the basic level if you disconnect the RX cable?)

Are your pointing angels correct? Please verify via the URL, sometimes cities with the same name are in different countries. (There are seven cities called Moscow located in the US.)
Are there any obstacles in the line of sight? Roughly optimise the carrier level and fix the antenna.

6.1.3 Pointing optimisation
Optimise the carrier read out to the maximum value in two rounds:

6.1.3.1 First round:
Elevation fine adjustment => Polarisation fine Adjustment => Azimuth fine adjustment

6.1.3.2 Second Round:
Elevation fine adjustment => Polarisation fine Adjustment => Azimuth fine adjustment

Tighten all screws to fix the antenna in Elevation, Azimuth fine adjustment and Polarisation, watch and readjust if necessary possible changes of the carrier values. Make sure that the antenna is not moving

Disconnect the power from the satellite modem,
Disconnect the satellite meter cable form the RX connector of the transceiver,
Connect the RX cable to transceiver and satellite modem,
Power up the satellite modem.

Wait for about 15 minutes maximum until the RX LED is on steady.

Important at the end of this step the RX LED needs to be on steady, If not refer to the section troubleshooting of the satellite terminal
7 Trouble shooting Satellite Terminal

<table>
<thead>
<tr>
<th>Symptom</th>
</tr>
</thead>
<tbody>
<tr>
<td>PWR Indicator - Does Not Light</td>
</tr>
<tr>
<td>RX Indicator – 1 Flash Continuously</td>
</tr>
<tr>
<td>RX Indicator – 2 Flashes Continuously</td>
</tr>
<tr>
<td>RX Indicator – 3 Flashes Continuously</td>
</tr>
<tr>
<td>RX Indicator – On but Cannot Access Internet</td>
</tr>
<tr>
<td>TX Indicator - Does Not Flash During Upstream Transmission</td>
</tr>
<tr>
<td>LAN Indicator - Does Not Flash or Light</td>
</tr>
<tr>
<td>RX Indicator - Flashing Very Fast</td>
</tr>
</tbody>
</table>

7.1.1 PWR Indicator – Does not light
Check that Sate Modem is Power connected. => OK?
Unplug Power connection, wait for one Minute and plug it again => OK?
Change Modem or call Help Line

7.1.2 RX indicator – 1flash continuously => Terminal not acquiring downstream
(more than 20 minutes)
Check cables Satellite Modem and ODU and swap cables => OK?
Check DC Power at the TX input of Transceiver => OK?
Check antenna Pointing => OK?
Check weather conditions => OK?
Unplug Power connection, wait for one Minute and plug it again => OK?
Change Modem or Transceiver or call Help Line

7.1.3 RX indicator – 2flash continuously => Downstream acquired, trying to range
Check antenna Pointing => OK?
Check weather conditions => OK?
Change Transceiver => OK?
Unplug Power connection, wait for one Minute and plug it again => OK?
Change Modem or call Help Line

RX indicator – 3flash continuously => Ranging OK, Terminal tries to register
Unplug Power connection, wait for one Minute and plug it again => OK?
Change Modem or call Help Line

7.1.4 TX indicator - Does not Flash during Upstream Transmission

TX indicator flashed shortly during power up => No, change modem
Possible to surf the Internet => Yes, change modem
Unplug Power, wait for one Minute and plug it again => No, call Help Line

7.1.5 LAN indicator does not flash or light

Check Ethernet Cable => OK?
Check computer network configuration => OK?
All other indicators as for nominal operation? => YES
Unplug Power, wait for one Minute and plug it again => OK?
Change Modem or call Help Line

7.1.6 RX indicator On but cannot access internet

Check that only one computer is connected to satellite modem => OK?
Unplug Power, wait for one Minute and plug it again => OK?
Change Modem or call Help Line

7.1.7 RX indicator flashing very fast => Terminal boot failure

Unplug Power connection, wait for one Minute and plug it again => OK?
Change Modem or call Help Line

8 Finishing the work

After finishing the work, please make sure that you leave the customer’s place tidy and clean and that you have all your tools and waste produced either with you or at the customer’s bin.
9 Terminal Self activation

9.1 The principle, acronyms and procedures

The Tooway service procedures are focussing on supporting a big amount of terminals and installations per distributor with standard service accounts in a low cost automated way.

9.1.1 Pre-registration

9.1.1.1 Satellite terminals
Upon arrival of the bulk, of ordered terminal hardware the distributor pre-registers at Skylogic the MAC address of all satellite modems received. This gives information about the modems that will be installed in the next time and is imperatively required for the self activation process. The MAC pre-registration has no further commitment nor any associated cost for the distributor.

9.1.1.2 Service accounts
Administration Tools of the OSS (explained in the following) allows the distributor to create immediately service accounts. As long as the terminal is not activated the services account is not associated to a specific MAC address of a terminal and consequently this has no further commitment nor any associated cost for the distributor.

For each service account, the OSS provides to the distributor two numbers:

- The Satellite Account Identifier (SAI) and the PIN number.
- The PIN number consists of a prefix (identifier of the distributor) and a Serial Number.

The SAI number is for the distributors internal account administration whereas the PIN number is necessary for the terminal self-activation. Consequently, either the final customer and/or the installer need to have this number.

Skylogic can allow the distributor to choose the format and length of both numbers. Only characters and numbers are allowed.

In this stage, the terminal MAC address is not jet linked to a service account, the terminal modem is in the state “Unprovisioned”.

The self-activation process links a terminal MAC address to a service account, the satellite modem is than in the state “Provisioned”, the account activated and from that moment, Skylogic bills for the service.
9.2 Self activation Process step by step

Connect your laptop to the satellite modem with an Ethernet cable and power up the laptop.

Configure Network Connections of laptop to get IP address from DHCP server.

Open the Internet browser on the laptop, either Internet Explorer or Firefox, check browser configuration to ensure that “Java Script” is enabled.

At a terminal in an unprovisioned stage the browser is directed to the Self Activation Interface whatever page it requests. In the first stage, the Tooway NOC checks automatically the RF parameters of the terminal to activate. (Today just the Signal to Noise Ratio (SNR) that shall be above 5dB) If all parameters are above threshold, the following screen will appear requesting to enter the serial number, which is the PIN number without the prefix.

By pressing the button “Show details”, the screen presents you the measured RF and terminal data:
Today just the Signal to noise level shall be as high as possible at the minimum above 5 dB.

After entering the Serial Number, the self-activation process is finished and the following screen shall appear.

Click Next!
The satellite terminal will reboot now and after the reboot, the terminals shall have a different IP address assigned form the NOC.
To connect to the terminals the Laptop need to request a new IP address from the DHCP server.
Important Note: This is not an automatic process please use one of the following options:

Reboot the Laptop  or

Disable the Ethernet connection with the Modem and enable it again  or

Open the MS DOS window and type “ipconfig /renew”

This finishes the self-activation process, the terminal MAC address is now linked to the service account, the terminals is provisioned and Skylogic will bill the service from this moment onwards.

10. Self Activation Procedure

The SelfActivation procedure allows for the activation of tooway™ accounts on unprovisioned Terminal; this procedure is based on automatic operations between the Terminal and the tooway™ platform, and requires a very minimal intervention from end user (or installer) through a self guided web interface.

SelfActivation can be performed either at first activation, or in other cases (e.g. Terminal swap).

Aim of the SelfActivation is to:

• to verify a series of connectivity parameters;
• to bind an unprovisioned Terminal to a tooway™ account and its service class through end user authentication.

SelfActivation pre-requirements are:

• a valid account is already created on OSS, and its Locking Status is “Not Locked”;
• Equipment installation (antenna, cabling, terminal) on end user site meet specifications.

1 By default, for tooway™ standard products, all “free” Accounts are set on “Not Locked”

10.1 The Satellite Terminal Activation Interface

The SelfActivation procedure can be initiated through the Satellite Terminal Activation Interface, a web interface automatically available to any CPE (Customer Premise Equipment) connected via Ethernet to an un-provisioned Terminal; end users are not required to install any specific software.

In order to access to this interface, it is necessary to check the following conditions:
Tooway™ terminal must be synchronized (online) into the tooway™ network; this requires:

- a proper ODU (Outdoor Unit) installation and pointing,
- that the Terminal is properly connected to the ODU;
- that the Terminal is properly connected to a DC supplier;
- that the Terminal RX led is stable.

Then it is needed to verify that end user CPE is properly connected to the Terminal through an Ethernet straight cable (please verify that TCP/IP configuration on the CPE is in automatic mode for both IP and DNS); end user CPE must have installed an internet browser (e.g., IExplorer, Firefox, or Opera).

Then, as soon as the end user tries to reach any web site, he/she will be automatically redirected to the Satellite Terminal Activation Interface (see Figure 1), and the SelfActivation procedure starts.

NB: once in the Satellite Terminal Activation Interface, end users may change the language through the options on the top-right of the page; it is possible to change as needed between English, German, French, Italian, and Spanish.

### 9.2 Step 1

SelfActivation procedure initiates when the end user clicks on the “Activate” button on the Satellite Terminal Activation Page:

- if the antenna dish is well pointed and SNR (Signal to noise Ratio) values are acceptable, it will then appear the message shown in screenshot at Figure 1.

- If not so, it will be displayed a message informing on the bad SNR value; in these cases end users are suggested to contact their distributor contact point to request for further assistance.
If needed to have details on current RF (Radio Frequency) details, such as, RX and TX power in dBm and Upstream SNR value, it is now possible to click on the “Show Details” button.

If the terminal has been properly registered in advance in Skylogic OSS (Terminal Registration), the “Company ID” (previously known as Prefix) field will be already pre-filled and it will be grey back grounded, otherwise this field will be empty and, in order to proceed, it will be needed to insert the “Company ID” string manually.

After typing the “Activation Code” (previously known as Serial Number) in the text field, end user shall click on the “Activate” button, so that all information can be sent to Skylogic OSS for verification.

**Step 2 and 3**

If all data are confirmed to be valid, the end user will be displayed of a confirmation page (Figure 2); to proceed it is now needed to click on “Next” button in order to reboot the terminal and let it load the new service configuration file sent remotely by the system (see Figure 3); If, diversely, the end user has inserted a wrong “Company ID”, or “Activation Code” the message shown at Figure 4 will appear.
Step 2 of 4
Activation successfully completed.

Your satellite terminal has been activated. Click now on "Next" to reboot the satellite terminal. This operation may take a few minutes. After the satellite terminal reboot, you will be able to proceed the registration procedure for your WonderConnectTest access.

Figure 2 – Confirmation Page

Step 3 of 4
Activation successfully completed.

Your satellite terminal has been activated. Click now on "Next" to reboot the satellite terminal. This operation may take a few minutes. After the satellite terminal reboot, you will be able to proceed the registration procedure for your WonderConnectTest access.

Please wait while the satellite terminal is rebooting...

Figure 3 – Terminal Reboot

Figure 4 - Error Message Page

Sorry, but the Company ID or serial number (Activation Code) you entered are incorrect. Please check that you wrote them correctly and try again. If the problem persists, please contact us at +39 0123 4567890.

Figure 4 - Error Message Page
Step 4

After the reboot, the following page will appear (see Figure 5): service has been properly activated; end user may commence to browse the internet, and SelfActivation procedure has been successfully completed.

![Satellite terminal activation interface](image)

**Figure 3 – Activation Confirmation Page**

### List of literature used:

- Surf beam satellite modem Installation and configuration guide, Release 3.2, Viasat
- System Integration installation documents
- Eutelsat and Skylogic internal presentations
- Documentation created and updated by Eutelsat System Integration Team. Your comments are most welcome please send them to SIT@eutelsat.fr