The SKYWAN 5G DVB solution is a two-way broadband satellite communication network for high quality services using the widely adopted DVB-S2/S2X transmission standard and the ND SATCOM MF-TDMA technology. SKYWAN 5G DVB comprises a DVB-S2 outbound link and one or several TDMA carriers. SKYWAN 5G DVB performs policy-based routing and leverages DVB-S2/S2X and TDMA satellite access for highly-efficient bandwidth utilization to best fit the end users’ applications. The multi-service platform offers transmission of broadcast services, interactive services like Internet or database access, data content distribution, and trunking. The fully IP-based system provides seamless integration to terrestrial IP networks on both ends, the central site, and the remote terminals.

**KEY FEATURES**

- Multi-service IP platform
- Built-in Dual Demodulator (DVB-S2 & TDMA) in each SKYWAN 5G remote terminal
- Fast ACM control loop
- System design enables and supports multiple DVB outbounds independent of site location
- DVB-S2/S2X: Outbound is very efficient for point-to-multipoint applications
- TDMA: Statistical multiplex for meshed and real-time applications
- Content or application-based routing based on administrative rules

**PLUG AND PLAY**

- Simple integration of DVB Gateway at central or any other terminal site
- Remote DVB-S2 receiver configuration based on simple NMS Web-UI
- Automatic ACM configuration
- Automatic terminal registration at central site
- Automatic path selection over broadband DVB-S2/S2X or TDMA link controlled by hub router

**Figure 1:** Data transfer over satellite utilizing MF-TDMA Network with DVB broadband overlay
DVB-S2 & TDMA Solution Overview

If traffic analysis shows the need for broadband point-to-multipoint links in SKYWAN 5G networks, one can simply add these connections based on DVB-S2 links. DVB-S2 links within SKYWAN 5G networks may be established by deploying one or multiple DVB traffic hub sites in a network. Each DVB traffic hub supports a unidirectional data connection to a dedicated group of SKYWAN 5G remote stations with a potentially very high data rate. Since every SKYWAN 5G unit contains a DVB-S2 receiver, every SKYWAN 5G station in the network can be configured to be a DVB remote station. Data traffic from the remote stations to the hub or between remote stations will use the TDMA satellite link. This is also true for the network management connection and the signaling between hub and remote stations, making these data connections independent from the DVB link. Therefore, it is also possible to reconfigure the DVB links from the central Network Management System at any time. Customers thus benefit from the synergy of both satellite data-transfer methods: 1) the flexibility and network efficiency of MF-TDMA and 2) the spectral efficiency of DVB-S2, both resulting in an optimal use of costly satellite bandwidth.

DVB Traffic Hub

The following three devices form a DVB traffic hub:
- IP router or layer-3 switch supporting the dynamic routing protocols BGP and OSPF
- DVB Gateway

DVB Network Topology

The SKYWAN 5G DVB Solution stands out in the market through the synergy of the MF-TDMA core network and the integrated alternative transport method DVB-S2/S2X. The fully IP-based WAN transfer network is transparent to the users and seamlessly integrates to the customer’s LAN by utilizing standards well known in terrestrial networks:
- Ethernet as LAN interface
- OSPF for dynamic routing within autonomous systems
- BGP to exchange routing and reachability information among autonomous systems

Figure 6: SKYWAN 5G DVB Solution Overview
The hub router interconnects the user LAN with the SKYWAN 5G and the DVB Gateway based on ethernet connections. The hub router selects the forwarding path to the remote user LAN.

**Service Provisioning, Operation & Monitoring**

The SKYWAN 5G NMS offers an easy to use point & click web user interface for DVB service provisioning. The configuration is transferred to the SKYWAN 5G node controller located next to the DVB Gateway for configuration and management using the dedicated system VLAN. The SKYWAN 5G node controller monitors also the operational status of the DVB Gateway and reports it to the SKYWAN 5G NMS for display in the status area and DVB dashboard.

**Auto Registration, Link-Layer Signalling**

Once the remote SKYWAN 5G is authenticated in the MF-TDMA network, the built-in DVB-S2 receiver automatically registers itself at the DVB Gateway. Only after successful registration user traffic is forwarded by the DVB gateway to the remotes.

**Adaptive Coding and Modulation (ACM)**

ACM allows the transmission parameters to be changed on a frame-by-frame basis, depending on the particular delivery path conditions for each individual remote. ACM signaling between the remote DVB receivers and the DVB Gateway is exchanged automatically on a regular basis. The ACM controller keeps track of each remote’s feedback and resolves problems arising from, e.g., fast changing reception quality ("feedback implosion") or single remote constantly reporting bad reception quality ("crying baby"). The ACM controller provides the necessary information for adaptive coding and modulation to the IP/DVB transmission stack so the modulator utilizes the optimum ModCod for transmission to the respective remote terminal or group of terminals. Other vendors’ DVB Gateways or DVB modulators can operate with the SKYWAN 5G DVB-S2 receiver in a static set-up without the benefit of auto registration, ACM, and signaling of receiver availability.

**User Traffic Forwarding, Path Selection**

The hub IP router selects the forwarding path based on routing information maintained by OSPF, BGP, and administrative rules (Policy Based Routing) to use the link that best fits the application.

**Network Benefits**

The MF-TDMA core network carries user traffic and signaling data, thus providing a wide range of network advantages:

- Automatic registration of the DVB remote terminal at DVB Gateway
- DVB service provision and configuration changes for the point-to-multipoint connections that are enabled any-time
• Immediate detection of link issues and reaction to it based on dynamic routing protocols
• Fast ACM loop (100ms...1s) based on feedback from the remote terminals to select optimum ModCod for transmission
• Policy-Based Routing using best transport link for the service

DVB-S2/S2X Link and Service Characteristics
DVB is a widely adopted transmission standard that multiplexes IP data for one or multiple destinations into a single DVB outbound. It uses a powerful FEC system based on concatenation of BCH with LDPC inner coding to deliver performance that approaches the theoretical Shannon limit. The focus on spectral efficiency using an outer block code adds extra processing time in the forwarding path, which is negligible for most services. DVB-S2 defines two FEC Frame sizes, namely short (16200 Bit) and normal (64800 Bit), whereas DVB-S2X introduces an additional medium FEC Frame (32400 Bit). DVB-S2/S2X is best suited for:
• Star type networks
• Broadcast services
• Interactive services like Internet or database access
• Data content distribution
• Trunking

MF-TDMA Link and Service Characteristics
SKYWAN 5G uses the MF-TDMA access scheme for outbound and inbound, delivering the highest quality to users with superior performance based on Turbo-Φ coding. Turbo-Φ sequentially encodes and decodes data without adding extra processing time in the forwarding path. The FEC Frame size is set individually per carrier and can range from 1600 Bit up to 24000 Bit. The optimum FEC Frame size is based on the transferred services and is designed with the TDMA calculator tool. MF-TDMA links are best suited for:
• Voice and video
• Real time services requiring QoS, low jitter (< 4 ms)
• Exceptional VoIP service quality (e.g. MOS 4.0 for G.729, proven with Spirent TestCenter SPT-3U with Hypermetrics Extension Card)
• Carrier grade links
• Services with guaranteed datarates – no throttling, i.e., fading during bad weather is compensated by raising power

Growth Scenarios: Network Extensions, Options
The SKYWAN 5G DVB solution architecture is scalable and offers a high degree of flexibility for network extensions. The following are a few examples.

Increased Return Link Capacity, Node Controller and Receiver Redundancy
When the network is growing and the number of users is increasing, one may require the need for higher return link capacity to the DVB traffic hub. SKYWAN 5G units can be stacked easily to increase the inbound data throughput from 20 Mbps up to 80 Mbps per SKYWAN 5G node. Redundant units in hot-standby mode can be added also to backup any failed unit of the SKYWAN 5G node.

Multiple DVB Outbounds, Redundancy
With an additional DVB Gateway installed at a site, one can implement redundancy or use it as just another DVB-S2/S2X outbound in parallel to address more users. In the case of hot and standby gateways located in the same LAN, the SKYWAN 5G node controller monitors closely the DVB gateway and backup DVB gateway and controls its transmit status. Up to four DVB gateways can be operated per site organized in up to four modulator groups and up to four members over all groups, i.e.:
• Four groups each with one active modulator
• Two groups each with one active and one backup modulator
• One group with one active and three backup modulators

The following network example serves two user groups, each having one active DVB gateway/modulator and a redundant unit in hot-standby.

Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>DVB</td>
<td>Digital Video Broadcasting</td>
</tr>
<tr>
<td>DVB-S2/S2X</td>
<td>EN 302307-1 / EN 302307-2</td>
</tr>
<tr>
<td>ACM</td>
<td>Adaptive Coding and Modulation</td>
</tr>
<tr>
<td>FEC</td>
<td>Forward Error Correction</td>
</tr>
<tr>
<td>ModCod</td>
<td>Modulation and Coding</td>
</tr>
<tr>
<td>ULE</td>
<td>Unidirectional Lightweight Encapsulation</td>
</tr>
<tr>
<td>MPE</td>
<td>Multi Protocol Encapsulation</td>
</tr>
<tr>
<td>GSE</td>
<td>Generic Stream Encapsulation</td>
</tr>
<tr>
<td>BCH</td>
<td>Bose-Chaudhuri-Hocquenghem</td>
</tr>
<tr>
<td>AES</td>
<td>Advanced Encryption Standard</td>
</tr>
<tr>
<td>BGP</td>
<td>Border Gateway Protocol, RFC 4271</td>
</tr>
<tr>
<td>OSPF</td>
<td>Open Shortest Path First, RFC 2328</td>
</tr>
<tr>
<td>ARP</td>
<td>Address Resolution Protocol, RFC 826</td>
</tr>
<tr>
<td>QoS</td>
<td>Quality of Service</td>
</tr>
<tr>
<td>RFC 2475</td>
<td>DiffServ</td>
</tr>
<tr>
<td>RFC 2597</td>
<td>Assured Forwarding</td>
</tr>
<tr>
<td>RFC 3246</td>
<td>Expedited Forwarding</td>
</tr>
<tr>
<td>MF-TDMA</td>
<td>Multi Frequency TDMA</td>
</tr>
<tr>
<td>TDM</td>
<td>Time Division Multiplex</td>
</tr>
<tr>
<td>MOS</td>
<td>Mean Opinion Score</td>
</tr>
<tr>
<td>LDPC</td>
<td>Low Density Parity Check</td>
</tr>
</tbody>
</table>

Figure 5: SKYWAN 5G Node in 3+2 configuration (receive up to 60 Mbps with two hot-standby units)
Network Examples

With SKYWAN 5G DVB, networks can grow from one MF-TDMA network segment with one DVB traffic gateway to multiple MF-TDMA network segments with several locations for application-driven DVB traffic injection points. Such highly complex networks are typical of larger companies with multiple affiliates and several regional headquarters. This is also the case for organizations where connectivity to Internet or Cloud services requires more than one DVB Gateway for both security and traffic volume reasons. With the existing routing protocol support, sub-organizations and affiliates may use individual MF-TDMA networks and also share a global infrastructure implemented by the DVB-S2/S2X outbound links.

DVG Gateways transmitting to multiple TDMA network segments benefit from the redundancy capability while each TDMA network segment uses SKYWAN Master/Backup Master to ensure 100% availability.

Border Control

Database access, check persons and vehicles

Figure 8: Application Example Search & Rescue

Search & Rescue

Hospital

Reliable voice communication

Figure 9: Application Example Border Control
**Verticals and Applications (Examples)**

<table>
<thead>
<tr>
<th>Vertical</th>
<th>Application</th>
<th>Suitable transport</th>
</tr>
</thead>
<tbody>
<tr>
<td>Border Control</td>
<td>Video Surveillance</td>
<td>++</td>
</tr>
<tr>
<td>Broadcast</td>
<td>Video Contribution</td>
<td>++</td>
</tr>
<tr>
<td></td>
<td>Video Distribution</td>
<td>+++</td>
</tr>
<tr>
<td></td>
<td>Fleet Management</td>
<td>+++</td>
</tr>
<tr>
<td>ATC</td>
<td>Push to Talk</td>
<td>+++</td>
</tr>
<tr>
<td></td>
<td>Radar data</td>
<td>++</td>
</tr>
<tr>
<td>Defence</td>
<td>Mission Critical Voice Communication</td>
<td>+++</td>
</tr>
<tr>
<td></td>
<td>Crew Welfare</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>Secure Management</td>
<td>+++</td>
</tr>
</tbody>
</table>

**Suitable transport**

- TDMA
- DVB Broadband outbound

**Air Traffic Control**

- Connect remote towers
- Relay Push to talk
- Distribute Radar data
- Booking systems
- Weather data

*Figure 10: Application Example Air Traffic Control & Management*

**Broadcast**

- News Events
- Studio
- On the move

*Figure 11: Application Example Broadcast, ad hoc news*

**Defence**

- Anchor Station
- Cell Tower
- Tactical station transportable

*Figure 12: Application Example Defence Tactical Communication*
MF-TDMA Core Network & DVB-S2 Remote
The SKYWAN 5G (1) satellite router provides the MF-TDMA core network and is used in the hub and at all remote locations. The SKYWAN 5G NMS manages the DVB outbound and the built-in DVB-S2 receivers. The SKYWAN 5G software supports DVB services and the built-in DVB receiver. Terminals with active DVB receiver combine and forward IP traffic to the user LAN. The return traffic always uses MF-TDMA. The seamless integration and automated processes allow for easy configuration and operation of the DVB service.

DVB Service Provision
Using the SKYWAN 5G NMS, only two easy steps are required to activate the DVB service and bind a terminal to its hub. The first step: the DVB Gateway transmitter parameters, the encapsulation, ACM, IP addresses, and BGP are defined. Multiple DVB gateways can be specified and used in the network. The NMS configures the DVB Gateway transmitter parameters using the AT-60 management IP interface.

The second step: the remote SKYWAN 5G built-in DVB receivers are assigned to the desired hub in the DVB Service Configuration simply by point and click. Setup and changes to the DVB service can be done on the fly anytime as all SKYWAN 5G units stay connected over the MF-TDMA core network.

Technical Specifications: SKYWAN 5G (1)

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethernet</td>
<td>4 onboard GbE, RJ45</td>
</tr>
<tr>
<td>User Data Throughput</td>
<td>Tx 20 Mbps/Rx up to 80 Mbps per stack, plus 40 Mbps receive on DVB-S2</td>
</tr>
<tr>
<td></td>
<td>Switching packet rate up to 65,000 pps</td>
</tr>
</tbody>
</table>

Ordering Options

<table>
<thead>
<tr>
<th>Ordering Options</th>
<th>Order Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>SKYWAN 5G-SR</td>
<td>SKYWAN 5G with SMA connectors E-11817369</td>
</tr>
<tr>
<td>SKYWAN 5G</td>
<td>SKYWAN 5G with F-connectors E-11814129</td>
</tr>
<tr>
<td>SKYWAN 5G Outdoor</td>
<td>SKYWAN 5G ruggedized version with N-connectors E-11816946</td>
</tr>
</tbody>
</table>

Software Licenses

No BGP license is required to enable and operate the DVB service on SKYWAN 5G. Required software features are based on engineering.

(1) For full specification refer to the SKYWAN 5G datasheet
ND SatCom offers a Cisco 4000 Series Integrated Services Router (ISR) as hub IP router. The specific model is a Cisco ISR 4351.

The Cisco 4351 is validated as hub IP router in the SKYWAN 5G DVB solution. The hub router is responsible for:
- Outbound traffic analysis
- Outbound path selection (TDMA or DVB)
- Dynamic routing on DVB receiver availability

Router Characteristics & Functions
- 3 LAN Ethernet ports
- BGP (RFC 4271)
- OSPF (RFC 2328)
- Consistent performance for concurrent services
- Policy-Based Routing

Benefits with Cisco ISR 4351
- ISR model 4351 is validated
- Can easily expand your branch offices with these industry-leading router capabilities:
  - Networking, services, computing, and storage integrated into a single form factor
  - Consistent, gigabit performance while multiple services run concurrently
  - Modular Cisco IOS® XE Software that quickly adapts to changing needs
  - Integrated Cisco Intelligent WAN features, including application awareness, quality of service, and WAN optimization
  - SDN-based automation of IWAN feature configuration with IWAN app
  - Comprehensive security with VPN options, threat defense services, and consistent policy enforcement
  - Trust Anchor Technologies protects against modern cyberattacks as well as counterfeit and unauthorized modification of hardware and software
  - A range of WAN access connectivity options such as 4G LTE, T1/E1, T3/E3, xDSL, serial, and fiber Gigabit Ethernet
  - Auto-configuration of Cisco Intelligent WAN features helps deliver software-defined, wide-area networking (SD WAN) to enterprise networks

Technical Specifications: Cisco ISR 4351

<table>
<thead>
<tr>
<th>Component</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ethernet</strong></td>
<td>3 onboard GbE, RJ45</td>
</tr>
<tr>
<td><strong>Aggregate Throughput</strong></td>
<td>200 Mbps to 400 Mbps (license upgrade)</td>
</tr>
<tr>
<td><strong>Default memory DDR3</strong></td>
<td>4 GB</td>
</tr>
<tr>
<td><strong>Dimensions (H x W x D)</strong></td>
<td>88.9 x 438.15 x 469.9 mm (2RU, width 19&quot;, rack-mountable)</td>
</tr>
<tr>
<td><strong>Weight (no modules)</strong></td>
<td>13.1 kg (packaging adds 2.9 kg)</td>
</tr>
<tr>
<td><strong>Input Power / Frequency</strong></td>
<td>100 to 240 VAC autoring, 47 to 63 Hz</td>
</tr>
<tr>
<td><strong>Typical Power (no modules)</strong></td>
<td>48 Watt</td>
</tr>
<tr>
<td><strong>Temperature</strong></td>
<td>Operational: 0° to 40° C</td>
</tr>
<tr>
<td></td>
<td>Storage: -40° to 70° C</td>
</tr>
<tr>
<td><strong>Relative Humidity</strong></td>
<td>Operational: 5% to 85%</td>
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<tr>
<td></td>
<td>Storage: 5% to 95%</td>
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</table>

**Ordering Options**

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cisco Router 4351</td>
<td>External router with BGP support for automatic path routing between DVB Gateway and IDU; provides 3 LAN ports</td>
</tr>
</tbody>
</table>

For full specification refer to Cisco webpage
The DVB Gateway AT-60 combines an IP encapsulator, which supports state-of-the-art encapsulations such as MPE or GSE (1), and a fully DVB-S2/S2X compliant modulator. The SKYWAN 5G remote DVB-S2X (2) receivers support ACM feedback. The AT-60 DVB link in the SKYWAN 5G DVB solution transmits data on an outbound link after automatic authentication and registration of the SKYWAN 5G remotes. DVB link availability information from the AT-60 enables the hub IP router to perform dynamic policy-based routing either using TDMA links or the DVB-S2/S2X link.

The AT-60 is an encapsulator and traffic shaper that combines real-time traffic shaping functionalities with robust and efficient IP encapsulation software. It is also a high-quality, wide-output range DVB-S2/S2X modulator. This high integration level allows for easy installation of the AT-60 at the hub side of a DVB-S2/S2X enabled IP network. A direct interface to the modulator gives the AT-60 full control over modulation and coding parameters on a per-frame basis, which allows for optimum operation in VCM/ACM mode. The included ACM controller implements the ACM feedback interface. The ACM controller monitors the signal reception conditions at the remote sites of the network and selects either automatically or based on operator constraints the most efficient modulation and coding parameters for each BB-Frame. The satellite link budget is therefore always used most effectively.

Traffic-shaping policy is applied to the dedicated data input interface of the AT-60, consisting of a hierarchical, priority-based shaper, that organizes traffic on a per-user or group-of-users basis. The shaping algorithm manages different traffic classes such as constant bit rates (CBR), variable bit rates (VBR), and best effort (BE), allowing for an adaptive, equal, or weighted bandwidth distribution.

Traffic-shaping policy is applied to the dedicated data input interface of the AT-60, consisting of a hierarchical, priority-based shaper, that organizes traffic on a per-user or group-of-users basis. The AT-60 meets the highest production quality standards and includes local redundancy for fast and seamless switchover.

Key Features

- AT-60 firmware optimized for integration with SKYWAN 5G (ACM, auto registration, path selection)
- Constant Coding and Modulation (CCM), Variable Coding and Modulation (VCM), and Adaptive Coding and Modulation (ACM) operation modes
- Carrier ID support
- DVB-S2 and DVB-S2X compliant (EN 301421, EN 302307)
- Wide L-Band output range from 950 – 2150 MHz
- QPSK / 8PSK / 16APSK / 32APSK modulation
- 15/30/45 Msps output rates, field upgradable
- Support for MPE and GSE encapsulation (MPE section packing, ULE & GSE extensions)
- Full IPv4 / IPv4 multicast4 / IPv6 support (3)
- Adaptive traffic shaping and policing
- Web based device configuration and monitoring
- LCD front panel for local operation
- SKYWAN 5G NMS controls RF parameters
- Alarm output with dual switch contacts
Technical Specifications: DVB Gateway AT-60

### DVB-S2/S2X Output Characteristics

**IF Output Frequency**
- 950 to 2150 MHz

**IF Output Characteristics**
- Frequency Resolution: 1 Hz
- Impedance: 50 Ω
- Return Loss: >16 dB
- Output Power: -30 dBm to 0 dBm, 0.1 dB steps
- Accuracy: ± 0.5 dB
- Output Power muted: < -85 dBm

**IF Output Connector**
- N female

**IF Monitoring Output**
- Impedance: 50 Ω
- Return Loss: >16 dB
- Output Power: -20 dB of IF Output

**Spurious Outputs (signal related)**
- < -67 dBc (unmodulated carrier, 950 to 1900 MHz)
- < -55 dBc (unmodulated carrier, 1900 to 2150 MHz)
- < -45 dBc (unmodulated carrier, out of band)

**Phase Noise**
- 10 Hz: -45 dBc/Hz
- 10 kHz: -75 dBc/Hz
- 100 kHz: -100 dBc/Hz
- 1 MHz: -88 dBc/Hz

**Frequency and Clock Stability**
- ±2 x 10⁻⁷ (0 °C ... 50 °C, after warm up), aging: ±2 x 10⁻⁸ per day, ±1 x 10⁻⁶ per year

**Symbol Rate**
- Up to 45 Msps (depending on order code\(\text{(4)}\)); Step size: 1 sps

**Data Rate**
- 3 KBit/s to 115 MBit/s (depending on order code)

**Modulation-Encoding in DVB-S2**
- Outer Coding:
  - short and normal frames (16200 and 64800 bits)
- Inner Coding (LDPC)\(\text{(1)}\):
  - QPSK: 1/4, 1/3, 2/5, 1/2, 3/4, 4/5, 5/6, 8/9
  - 8PSK: 3/4, 4/5, 5/6, 8/9, 9/10
  - 16APSK: 2/3, 3/4, 4/5, 5/6, 8/9, 9/10
  - 32APSK: 3/4, 4/5, 5/6, 8/9, 9/10

**Signal Spectrum Mask**
- DVB-S2: \(\alpha = 0.35, 0.25, 0.20\)
- DVB-S2X: \(\alpha = 0.35, 0.25, 0.20, 0.15, 0.10, 0.05\)

### Baseband Interfaces

**Control Network**
- GbE, RJ-45

**Data Network**
- GbE, RJ-45

**Local Control**
- LCD / operation keys

**Monitoring and Control**
- Protocol: SNMP
- Connection: UDP/IP over Ethernet/RJ-45 or in-band via satellite link
- Protocol: HTTP (web browser interface)
- Connection: TCP/IP over Ethernet/RJ-45 or in-band via satellite link

**Traffic Shaper/QoS on IP Level**
- 255 independent rules, guaranteed and limited bandwidths, fixed or dynamically integrated into ACM (bind to MODCOD), match criteria: source/destination IP subnet, source MAC, UDP/TCP port ranges, TOS/DS field, packet size

### Physical / Environmental

**Dimensions and Weight**
- 483 x 44 x 505 mm\(^3\) (WxHxD), 1 RU (19"), 10 kg

**Temperature Ranges**
- Operational: 0° to 50° C
- Storage: -30° to 80° C

**Relative Humidity**
- < 95 % non condensing

**Input Power / Power Consumption**
- 100 to 240 V AC nominal, 90 to 264 V AC max, 50 to 60 Hz / typical 65 VA / 45 W

**Power Connector**
- IEC-60320-C14 style Connector, 2P+E (single phase)

**Compliance**
- Fully CE compliant with RoHS and REACH, Fully EMC compliant

### Ordering Options

**AT-60**

**DVB-S2X Gateway with 15 Msps**
- includes MPE and GSE, ACM support, ACM Controller, DVB-S2X support up to 32APSK, working in bridge mode
- F-11B18252

**DVB-S2X Gateway with 30 Msps**
- includes MPE and GSE, ACM support, ACM Controller, DVB-S2X support up to 32APSK, working in bridge mode
- F-11B18253

**DVB-S2X Gateway with 45 Msps**
- includes MPE and GSE, ACM support, ACM Controller, DVB-S2X support up to 32APSK, working in bridge mode
- F-11B18254

\(\text{(1)}\) Depending on SKYWAN 5G
\(\text{(2)}\) Partly compliant
\(\text{(3)}\) Future release
\(\text{(4)}\) License upgrade for symbolrate