

ENGENESIS™

THE NEXT GENERATION 2/7GHZ BAS BAND SYSTEM SUPPORTING TWO-WAY COMMUNICATION BETWEEN BROADCAST TRUCKS AND TELEVISION STATIONS.

**PATENT
PENDING**

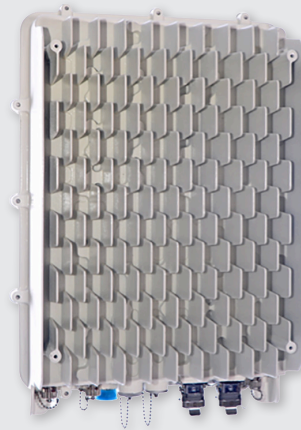
ENGenesis™ is based on industry standard Long Term Evolution (LTE) technology and adapted to operate in the 2/7GHz BAS Bands. LTE is the most advanced cellular industry standard with wide industry support from cellular equipment vendors and operators around the world and includes many advanced features that are applicable to a BAS Band System. ENGenesis™ does not use commercial cellular – it uses your current dedicated 2/7GHz BAS bands for private secure data transmission.

Benefits of ENGenesis™ Include:

- » **Bi-directional communication** – ENGenesis™ supports bi-directional data communication between the Receive Site Fixed Unit and the Mobile Unit. A/V streaming, Voice over IP (VoIP), IFB, file transfers, and any other Internet traffic, can be multiplexed onto a single 2/7GHz BAS channel with extremely low latency. The ENGenesis™ system operates in either 5,10 or 20 MHz channel bandwidth in Time Division Duplex (TDD mode).
- » **Exceptional System Robustness/Gain** – ENGenesis™ provides >16db more front end gain than any COFDM DVB-T system available today. This enhances the ability to operate either “on the move”, LOS or do “bounce shots” with low receive levels (<-105dbm) and maintain system lock and data capability. Receive site ranges of >45 miles can be reached without the use of expensive directional antennas/positioners and radomes. Simple High Gain Sector or Panel antennas are all that is required, not only easing the strain on the tower but also on your budget!
- » **All IP architecture** – The ENGenesis™ system provides IP connectivity between the Mobile Unit and the IP core network. The IP connection is a high bandwidth data pipe which carries data from different applications including A/V streams, VoIP, and other user data such as Internet traffic between the user device and the IP network.
- » **Quality of Service (QoS)** – The QoS feature built into the ENGenesis™ system offers both user and application priorities. User priority allows differentiation of data traffic priority between Mobile Unit. Application priority allows differentiation of data traffic between applications of the same Mobile Unit. For example, live A/V streams can have higher priority than IFB or telephony traffic. The QoS configuration is fully controllable by the operator to meet the network's and users' data priority policies.
- » **Dynamic bandwidth allocation** – ENGenesis™ is extremely efficient in managing bandwidth allocation among user devices in any broadcast vehicle connected to the Receive Site Fixed Unit. The bandwidth allocation is done in real time involving dynamic coding/modulation. For example, a Mobile Unit close to the Receive Site Fixed Unit uses less system resources than a Mobile Unit far away from the fixed station, while delivering the same bandwidth to each of the two Mobile Units. By using real-time dynamic bandwidth allocation, the ENGenesis™ system ensures the most efficient use of the system resource to optimally support multiple Mobile Units. The ENGenesis™ can support up to 5 Mobile Units on a single receive site sector at the same time.
- » **Software Upgradeable Future Proof Design** – The ENGenesis™ infrastructure equipment is software upgradeable via the Element Management System (EMS). The user device is upgradeable over-the-air through the ENGenesis™ air interface without any user intervention. This future proof design allows the ENGenesis™ system to include advanced features in future LTE releases



Truck Mobile Unit



Receive Site Fixed Unit



*Integrated QOS
Encoder/Decoder*



SYSTEM COMPONENTS

Truck

- » Single or Dual-Channel H.264 A/V encoder (*HEVC Available Q4/Q1*)
- » IFB in/out
- » IP connection for local laptops
 - » Packages can be locally edited and uploaded
- » Optional WiFi hot spot
- » GPS functionality
 - » Truck location can be tracked from the station
 - » Any video shot includes location information



ENGENESIS™ Mobile Unit

Parameter	Value
Operating Frequency	2GHz channel 1-7
Channel Bandwidth	5MHz, 10MHz
Duplex Mode	Time Division Duplex (TDD)
UE Category	Category 3 UE (maximum UE throughput 30Mbps/s)
Transmit Power	+40dBm (10W) ±1dB Power output
Standards Compliance	3GPP R9 LTE compliant
Radio Configuration	1 Transmit / 1 Receive
Power Supply	+28V DC Vehicle supply (MIL-STD-1275E), (+9V to +38V range)
Power Consumption	60 Watts Typical
Dimension	11.81" x 9.84" x 5.9"
Weight	13.2lbs
Antenna	Vehicle mounted antenna system via 2x N-Type connectors
Host Interfaces	100BaseT over Shielded RJ45 socket DC-In 28V 6x LEDs
Authentication	USIM 3.0V
Ethernet	100BaseT DHCP IP Address Allocation Web page based configuration
Operating Temperature	0°C to +40°C Ambient
Environmental	IP67 Enclosure
Humidity	0 to 95% condensing

Full Duplex, File Transfer, Telephony, QoS



Haivision Makito X Harsh Encoder

Feature	Benefit
Harsh environments	Industrial-grade fanless enclosure for high operating temperature environments
Low end-to-end latency	Supports mission-critical distribution and interactive communication challenge
4 HD encoding engines	Flexible encoding & compression, adapting to different network environments & applications
Multiple destinations per stream	Target different systems, networks, users, and platforms individually
Highly efficient encoding	Up to twice the quality or half of the bandwidth, using High Profile H.264
AES 256 bit encryption	Secure unicast or multicast end-to-end video distribution
Metadata support	Insert synchronized KLV into the MPEG stream from IP, embedded, or serial data sources
SRT and FEC	Maintain video quality over unqualified networks and low cost public internet connections
Integrated with Furnace, InStream and CoolSign	Complete end-to-end video solution

H.264, Single or Dual Channel, SDI/Composite Input, and IP Outputs



Haivision Makito X Harsh Decoder

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SRT and FEC	Maintain video quality over unqualified networks and low cost public internet connections
Integrated with Furnace, InStream and CoolSign	Complete end-to-end video solution

MPEG-2 and H.264, and IP Inputs, HDMI and SDI Outputs

Station

- » Supports BOTH unidirectional and/or bidirectional A/V communication to up to 6 trucks.
- » Can optionally receive ASI signals back from the trucks.
- » Supports “always-live” IFB to all trucks.
- » Pay-as-you-grow architecture: only get the functions you need.



Makito X Specifications

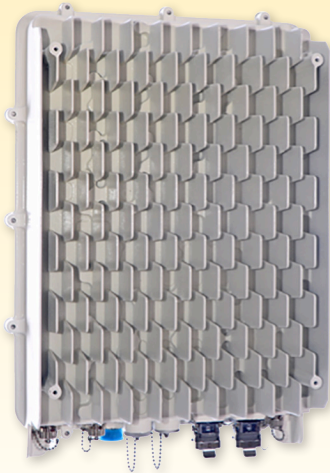
MAKITO X HARSH (SDI ENCODER & DECODER)	
Video Inputs (single or dual input encoder only)	
Composite	NTSC/PAL/PAL-M
SD-SDI	SMPTE 259M-C
HD-SDI	SMPTE 292M
	SMPTE 274M
	SMPTE 296M
3G-SDI	SMPTE 424M (Level A Only)
	SMPTE 425M
Video Outputs (decoder only - dual channel)	
HDMI 1.3	
SD-SDI / SMPTE 259M-C	
HD-SDI / SMPTE 292M & 296M & 274M	
3G-SDI / SMPTE 424M (Level A Only) & 425M	
Video Resolutions	
1920x1080p 60/59.94/50/30/29.97/25/24/23.98 Hz	
1920x1080i 60/59.94/50 Hz	
1280x720p 60/59.94/50/30/29.97/25 Hz	
720x480/576i 60/59.94/50 Hz	
(interlaced shown in fields per second)	
Audio Inputs/Outputs	
Available through a locking mini-DIN-8 connector	
Balanced stereo analog audio	
Unbalanced stereo analog audio	
Talkback	
Embedded Audio	
SD-SDI SMPTE 272M	
HD/3G-SDI SMPTE 299M	
HDMI (Decoder only)	
MAKITO X HARSH (DVI ENCODER)	
Video Inputs	
Y, Pb, Pr / RGBHV component analog	
Y, Cb, Cr / DVI component digital	
Video Resolutions	
1920x1080p 60/59.94/50/30/29.97/25/24/23.98 Hz	
1920x1080i 60/59.94/50 Hz	
1280x720p 60/59.94/50/30/29.97/25 Hz	
720x480/576i 60/59.94/50 Hz	
720x480/576p 60/59.54/50 Hz	
(interlaced shown in fields per second)	
Computer Resolutions	
1920x1200 60 Hz	1680x1050 60 Hz
1600x1200 60 Hz	1600x900 60 Hz
1440x900 75/60 Hz	1400x1050 75/60 Hz
1360x768 60 Hz	1280x1024 75/60 Hz
1280x800 85/75/60 Hz	1280x768 85/75/60 Hz
1152x864 75 H	1024x768 85/75/60 Hz
800x600 85/75/60 Hz	640x480 85/75/60 Hz

MAKITO X HARSH (DVI ENCODER) cont.
Audio Inputs/Outputs
Available through a locking mini-DIN-8 connector
- Balanced stereo analog audio
- Unbalanced stereo analog audio
- Talkback
Embedded DVI Audio
VIDEO ENCODING/DECODING
Compression Standard
H.264 (MPEG-4 AVC part 10)
ISO/IEC 14496-10
Baseline, Main, and High Profiles
Up to Level 4.2 and lower intermediate levels
I, IP, IBP, IBBP framing
Configurable Group of Picture (GOP) size
Configurable frame rate
Deblocking filter
Bit Rates
SD/HD from 32 kbps to 25 Mbps
Rate Control
CBR/VBR
Latency (encoder only)
Less than 55ms
AUDIO ENCODING/DECODING
Compression Standard
MPEG-2 AAC-LC ISO/IEC 13818-7
MPEG-4 AAC-LC ISO/IEC 14496-3
Audio Channels:
2 analog audio per blade
16 embedded audio per blade (SDI)
2 embedded audio per blade (DVI /HMDI)
Bit Rates:
From 56 to 320 kbps per audio pair
Frequency Response:
From 20 Hz to 22 kHz
METADATA (OPTIONAL)
CoT to KLV conversion
KLV or CoT over serial RS-232/422
KLV or CoT over UDP
KLV over SDI
SMPTE 336M compliant
MISB 0601.8 compliant
MISB 0604.2 compliant
Asynchronous & synchronous modes as per MISB 0604.2
High precision timecode insertion as per MISB 0604.2

IP NETWORK INTERFACES
Standard
Ethernet 10/100/1000 Base-T, auto-detect, Half/Full-duplex
Static IP/DHCP
Connector
RJ45
Networking Protocols
Unicast streaming
Multicast streaming (IGMP v3)
Multiple unicast streaming
MPEG transport stream over UDP / RTP
RTMP
SAP (RFC 2974)
Direct RTP - H.264 over RTP (RFC 3984)
SRT (Secure Reliable Transport)
ADVANCED FEATURES
Multi-bitrate (MBR) streaming
HD/SD de-interlacing
Built-in downscaling
EIA-608-B/NTSC Line 21 closed captioning
EIA-708-B/SDI closed captioning
Forward Error Correction (FEC)
AES encryption 128/256-bit with Furnace or SRT
Aspect ratio configuration
Active Format Description (AFD)
Wide Screen Signaling (WSS)
Logo overlay
Selective Mute
Talkback (encoder only)
Color Space Conversion (DVI only)
MANAGEMENT INTERFACES
Standard
RS-232
RJ45 to RS-232 (DB-9 Management Cable Req'd.)
Ethernet
Management
HTTPS (web browser)
Command line over SSH/Telnet/RS-232 SFTP/FTTP/SCP
SNMP v3
HARSH ENVIRONMENT CHASSIS OPTION
Fanless operation for high temperature applications
Dimensions
44mm H x 137mm W x 202mm D (1.73"H x 5.4"W x 8.0"D)
Weight
4 lbs. / 1.8 kg
Power
12VDC, 20W
100-240VAC 30W external locking power supply
Temperature
Operating: -20° to 70°C (-4° to 158°F)
Non-operating: -40° to 85°C (-40° to 185°F)

SYSTEM COMPONENTS

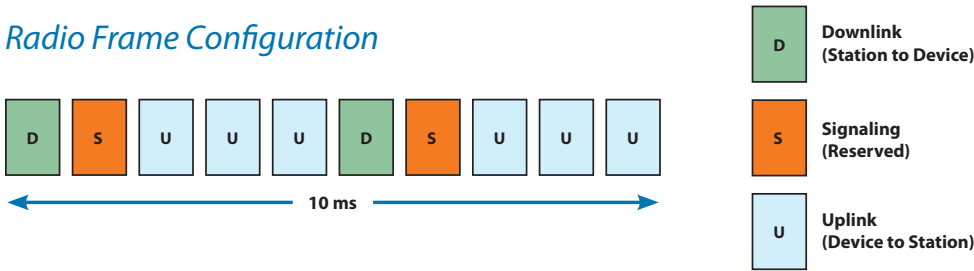
Receive Site Fixed Unit



Receive Site Fixed Unit Specifications Summary	
RF Power Output	+33dBm (2W) maximum per antenna port
Antenna Connector Type	4 x antenna connectors — 2x Tx/Rx. 50-ohm 7/16-DIN female 2x Rx only. 50-ohm Type-N.
Operating Frequency	2GHz BAS channels 1 - 7 2025 – 2110 MHz
Bandwidth	5MHz and 10MHz
3GPP Compliance	Rel.9 LTE Software upgradeable to 3GPP Rel. 10
Duplex Method	TDD
Backhaul Interface	2x Gigabit Ethernet. Either RJ45 connector for copper Ethernet or LC connector for multimode fiber Ethernet
LMT Interface	Serial port connection
Power Consumption	250W maximum
Dimension	22" x 7.87" x 14.5"
Weight	35.3lbs
Voltage	-36 to -72 VDC
Operating Temperature	-40 to +55°C (-40 to +131°F)
Water and Dust Proof	IP65 (IEC529) and NEMA 4X
Safety Approvals	UL 60950 RoHS Directive 2002/95/EC

The ENGenesis™ system operates in either 5 MHz or 10 MHz channel bandwidth in Time Division Duplex (TDD) mode. In a TD-LTE system, the uplink (Truck Mobile Unit to Receive Site Fixed Unit) and downlink (Receive Site Fixed Unit to Truck Mobile Unit) bandwidth allocation can be adjusted by changing the time slot assignments. For the ENGenesis™ system, more bandwidth is required for the uplink A/V streams from the broadcast truck to the receiving station. Conforming to the 3GPP LTE standards, the radio frame configuration shown in Figure 4 is recommended for ENGenesis™ system. The radio frame arrangement is referred to as Configuration 0 in the LTE standards. It provides 2 downlink and 6 uplink time slots for a network designed to carry the majority of traffic on the uplink.

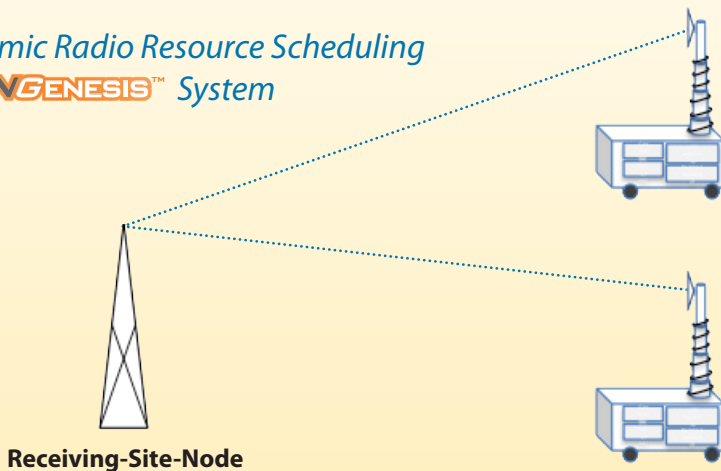
Radio Frame Configuration



Uplink and downlink bandwidth allocations to individual Truck Mobile Units are carried out in real time and based on the prevailing radio channel condition between the Truck Mobile Unit and the Receive Site Fixed Unit, and the bandwidth requirement of the applications. Figure 5 illustrates this real time bandwidth resource scheduling of the ENGenesis™ system. The example shows two Truck Mobile Units and both of them have the same bandwidth demand for uplink video streaming and two-way Internet traffic. Since Mobile Unit #1 is closer to the Receive Site Fixed Unit, the ENGenesis™ system can use higher modulation/coding combination to deliver the bandwidth to Mobile Unit #1. Mobile Unit #2 is farther away from the Receive Site Fixed Unit and experiences suboptimal radio channel conditions.

The ENGenesis™ system uses a lower modulation/coding combination to deliver the same bandwidth to Mobile Unit #2. The use of lower modulation/coding requires the ENGenesis™ system to utilize more time slots to deliver the same amount of data over the radio link. Radio resource scheduling is done in real time in the ENGenesis™ system. When there are more Truck Mobile Units attached to the Receive Site Fixed Unit, they share the available bandwidth. The ENGenesis™ system can efficiently schedule multiple Truck Mobile Units in the same radio frame and across different radio frames.

Dynamic Radio Resource Scheduling of ENGenesis™ System



Truck-User-Equipment #1



Truck #1 experiences favorable radio channel conditions as it is close to the station site. Little system resources (time slots) are allocated to deliver the required bandwidth.

Truck-User-Equipment #2



Truck #2 experiences suboptimal radio channel conditions as it is farther away from the station site. More system resources (time slots) are allocated to deliver the video bandwidth.