Grid Solutions

OMNI MU360 MODULAR PROCESS INTERFACE UNIT

Your Bridge From Physical to Digital Worlds: Process Interface Unit for Digital Substations

MU360 is the Process Interface Unit (PIU) with analog and binary interfaces for full switchyard modelling, control and digitization using IEC 61850 and IEC 61869 standards and protocols such as Sampled Values (SV), GOOSE, MMS and PTP.

The MU360 unlocks the full value of a completely digital substation, capable to be a single I/O interface for Protection, Automation and Control applications to bay IEDs. Limiting the field wiring just up to the MU360 reduces project complexity by reducing cabling, terminals, and physical connections, which combined with a complete set of logical nodes allows design standardization on the yard. Bay level IEDs can use data from redundant MU360 units, increasing system availability. Bay level IEDs can also be quickly replaced or added using IEC 61850 test modes as no field wiring is involved. The MU360 has the additional benefit of improving CT performance and cost through a lower connected burden and a reduction in the number of CT cores required for an application.

Key Benefits

- Compact form factor supports field installation options into circuit breakers cabinets, marshalling kiosks and metal-clad switchgear
- Two slots for CT/VT analog boards supports application on breaker-and-a-half lines, dual distribution feeders, and combination protection and metering installations.
- 14 slots for I/O cards allows multiple applications. Apply as Merging Unit, Switchgear Control Unit device or PIU. Right size and point count for all type of application
- High Speed High Break output contact option to directly operate into Circuit Breakers and Switchgears
- Up to 4 SV streams IEC 61869-9/IEC 61850-9-2 Ed 2.1compliants for Protection and Metering profile
- Full integration into the digital substation through up to 6 SFP interfaces, support for PRP and HSR redundancy protocols for availability networks, and IEEE 1588 Precision Time Protocol
- Easy commissioning through simple EnerVista Flex 2.0, simulated Sampled Values and Test modes controllable per Logical Device to integrate multiple circuit breakers and disconnectors in one MU360

Modular & Powerful

- MU360 stands as a modular device with flexible 40TE or 80TE enclosures, perfect to be your single process interface in the yard.
- Up to 14 flexible slots for Analog Acquisition (Protection and Measurement) and Binary I/O, including High Speed High Break.
- Up to 18 CT/VT Interface.
- Several combination options up to 224 Binary Inputs or up 140 Binary outputs.
- A single box for Protection, Control and Automation purposes.

Secure Switchyard Interface

- IEC 61850 dedicated data modelling for Circuit Breakers, Circuit Switches and Current and Voltage Transformers.
- Process Interface to model, monitor and control devices in the Switchyard using IEC 61850.
- All connectivity within protected according SL2 of IEC 62443 design.

Newest Standards Compliance

- Robust hardware and acquisition compliant to IEC 61869-13.
- Flexible configuration for multiple IEC 61869-9 sampled values profiles.
- Compliant to edition 2.1 of the IEC 61850-9-2.

Complete and Simple

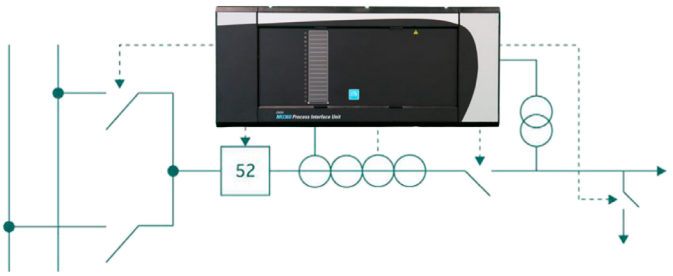
- Modern, clean, and simple IED Configurator Tool EnerVista Flex 2.0.
- Flexible and complete set of Logical Nodes for Protection, Control and Automation
- Intuitive Interface Digital Substation Projects.

GE VERNOVA

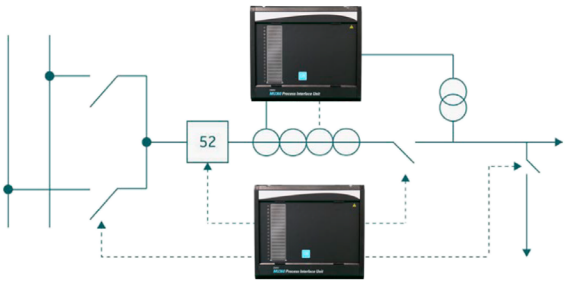
Applications

- Process Interface Unit (PIU) for full bay digitization
- Standalone Merging Unit (SAMU) for conventional instrument transformers
- Switchgear Control Unit (SCU) for interfacing and control primary equipment such as circuit breakers and disconnectors
- Bay unit for GE Vernova B30X distributed bus bar protection system
- Revenue accuracy and power quality metering applications
- Breaker-and-a-half line terminals using a single PIU device
- Two feeders in a single PIU device

Process Interface Unit



SCU + SAMU



Flexibility

By integrating binary inputs, outputs, and analogue connections into one box, the MU360 offers a cost-effective solution for a multitude of bay configurations. Up to two buses and two lines may be monitored per box with a flexible configuration of up to 224 binary inputs or 140 binary outputs.

Reliable, Interoperable and Future Proof

The MU360 complies with the main standards for digital substation IEC 61869-9, IEC 61850 edition 2.1 and IEC 61869- 13, which guarantees its interoperability and compliance to the requirements for being the physical to digital interface of modern digital substations. Furthermore, measurements of each CT/VT set may be broadcasted in protection and power quality profiles, allowing multiple Protection, Automation and Control applications to consume the data without needing extra footprint for acquisition.

Test Modes

IEC 61850 edition 2.1 provides standard mechanisms for testing purposes, reducing commissioning complexity and allowing new bay installations without affecting substation operation.

With the test modes in MU360 users can independently configure mode and behavior of each logical devices allowing then to operate as: *On, Test, Blocked, Test/Blocked and Off.*

A Safer and Cybersecure Substation

Transmitting the instrument transformers´ measurements digitally through optical fibers eliminates the risk of inadvertent mishandling of the current and voltage circuits and makes the relay room a safer work environment, eliminating hazards and reducing the risk of personnel injury.

To ensure MU360 have all this connectivity in a cybersecure way, it has been designed according to IEC 62443 and have all capabilities described by SL2 of this standard, including RBAC, secure boot and signed firmware.

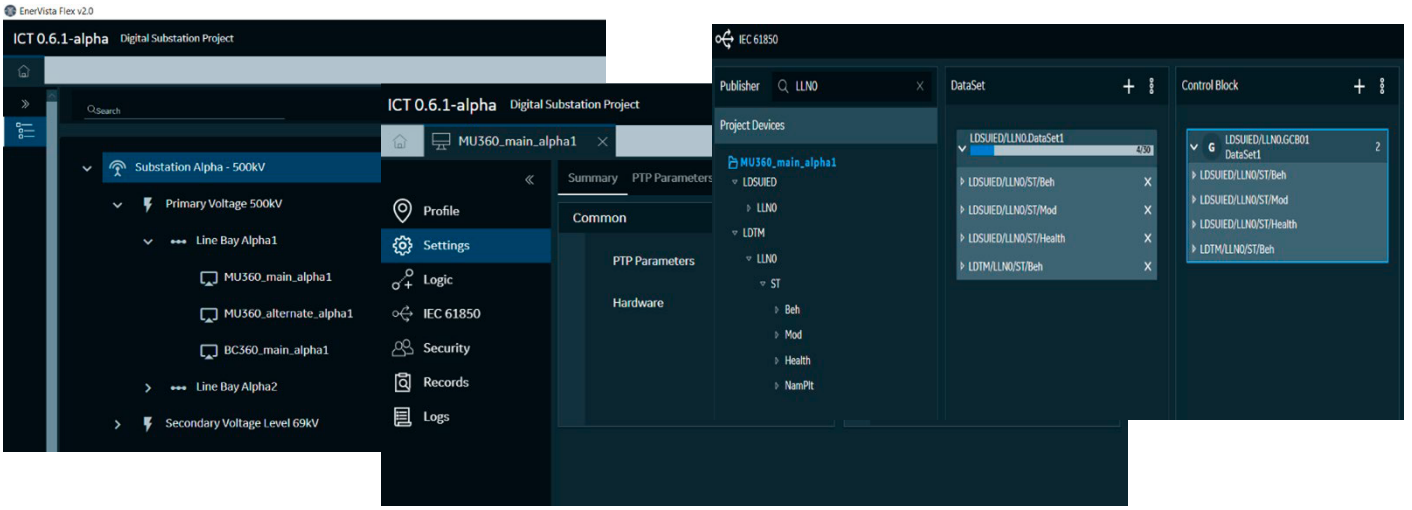
Reduce the Engineering Effort and Cost

The use of Process Bus with the MU360 drastically reduces the need for trenches, ducts, glands, cable trays and copper hardwiring, as the information is exchanged among IEDs using fiber optic cables and ethernet switches.

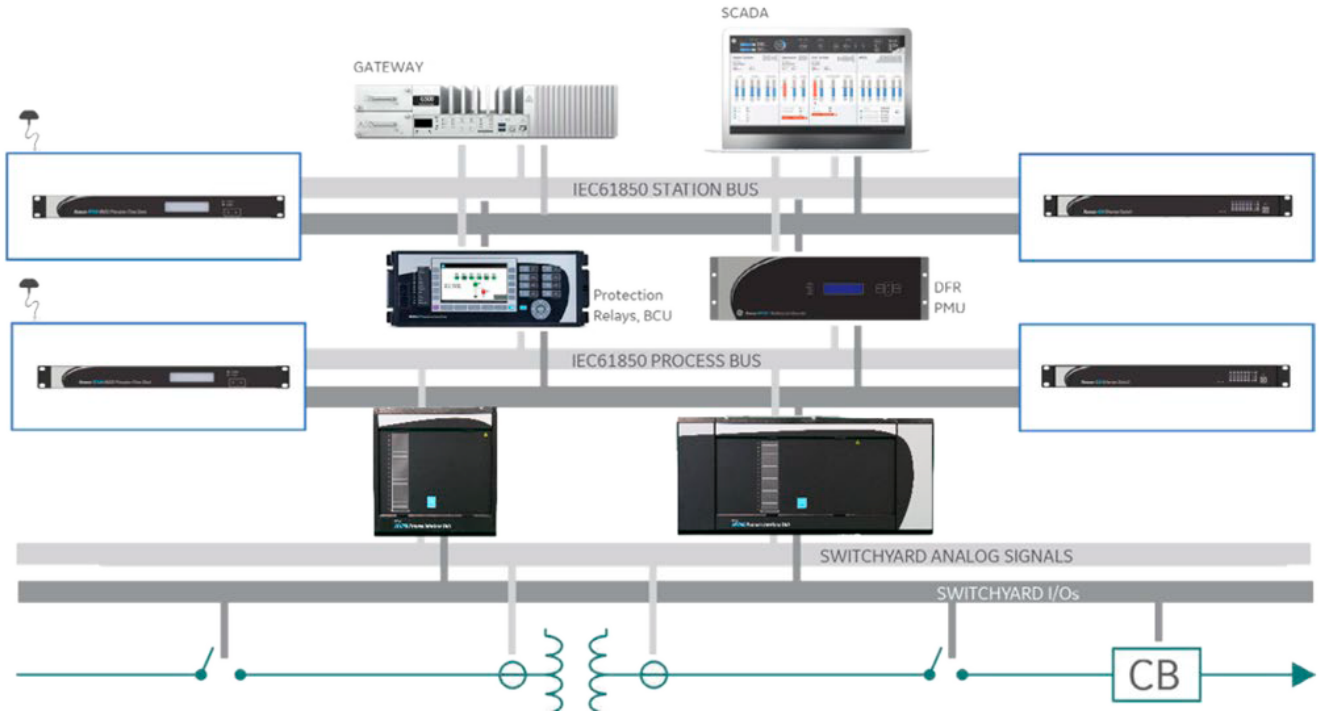
Fewer cables to manage also means reduced engineering complexity as extensive wiring schematics are replaced by standardized version-controlled configuration files. Future reconfigurations are automatically documented by the IED configuration tool.

Powerful Configurator Tool EnerVista Flex 2.0

MU360 emphasizes its modernity through its IED Configurator Tool (ICT) EnerVista Flex 2.0 built over modern technology and user interface, allowing to configure substations with a holistic view in view clicks.



Example application of IEC 61850 Architecture



Functions and IEC 61850 Data Modeling

One of the main advances brought by IEC 61850 is the way it allows the IEDs to standardize their model through elements such as Logical Nodes and Control Blocks. The main functions that the MU360 supports in this regard are:

LN GROUP	LOGICAL NODES	DESCRIPTION
System Logical Nodes (L)	LLN0, LPHD, LCCH, LGOS, LTIM, LTMS, LTRK, LSYN*, LSET, LPDI*, LPDO*, LPAI*, LMBI*, LMSI*, LPLD*	System information and behavior
Control (C)	CALH, CSYN	Controls for alarm and synchronization conditions
Functional Blocks (F)	FXOT, FXUT	Function Blocks of over and under thresholds
Generic Features (G)	GAPC, GGIO	Generic automation process and I/O
Archiving (I)	ISAF	Safety Alarm function
Non-electric Primary Equipment (K)	KPMP, KFAN,	Non-electric primary equipment like pump and fan
Protection Functions (P)	PTRC, PTOC	Logical Nodes representing protection functions coming from relays
Protection Related Functions (R)	RBRF	Protection function related for Breaker Failure
Supervision and Monitoring (S)	SIMG, SIML, SBAT, SFIR	Supervision of gas, liquid, battery and fire
Instrument Transformers and Sensors (T)	TCTR, TVTR	Representation of the instrument transformers (VT/CT)
Switchgears (X)	XCBR, XSWI, XCMD*	Switchgears as Circuit Breakers and Disconnectors
Further Power System Equipment (Z)	ZAXN, ZBAT, ZBTC, ZCON, ZGEN	Other equipment in power systems as battery and generators

** Extended Logical Nodes*

Technical Specification

ENVIRONMENTAL CONDITIONS SPECIFICATION

Operating temperature range	-25°C (-13 °F) ... +55°C (+131°F)
Tested as per IEC 60068-2-1: 2013	-25°C (-13°F)
Tested as per IEC 60068-2-2: 2013	+70°C (+158°F)
Temporarily permissible temperature under operation	-25°C (-13°F) ... + 70°C (+ 158°F) (Tested for 96 hours with 50% of binary I/O continuously activated)

DIMENSIONS OF THE EQUIPMENT

Height	177.8 mm/7 inches (4 U)
Width	203 mm/8 in (40TE) 406 mm/16 in (80TE)
Depth	203 mm/8 in

POWER SUPPLY SPECIFICATIONS BIU261S

Operating nominal voltage	48 to 250 VDC, 110- 240 Vac
Operating voltage range	40 to 300 VDC
Inrush current	19.4 A @ 110 VDC for 110 ms 43.8 A @ 220 VDC for 92 ms
Power consumption	38.7 W @ 220 VDC 38.5 W @ 110 VDC
Insulation	> 100 M? at 500VDC
Dielectric Strength	2.2 kV - 60 Hz for 1 minute

DIGITAL INPUTS SPECIFICATIONS

Wetting Voltage	Input Voltage	Pick-up Threshold	Drop-off Threshold	Rated Power
A01	24 VDC	10 VDC	8 VDC	0.077 W
A02	48 VDC - 60 VDC	17.4 VDC	12.5 VDC	0.14 W
A03	110 VDC - 125 VDC	50 VDC	29.9 VDC	0.26 W
A04	220 VDC	86 VDC	67 VDC	0.42 W
A07	110 VDC - 125 VDC with 80% threshold	86 VDC	67 VDC	0.26 W
A08	220 VDC with 80% threshold	176 VDC	132 VDC	0.42 W

BINARY OUTPUT CONTACT SPECIFICATIONS

Description	Values
Switching voltage	24 to 250 VDC/230 VAC
Maximum continuous current	5 A
Making capacity (rated inrush current)	5 A continuously 30 A for 500 ms (open for 40 s afterwards) or 250 A for 30 ms
Making time	< 7 ms
Breaking capacity	Breaking capacity for 100 000 Operations: DC: 150 W resistive, 15 W inductive (L/R = 20 ms) AC: 1500 VA resistive Breaking capacity reduced to 90 000 operations: AC: 1500 VA inductive (power factor = 0.7) Breaking capacity confirmed after 10 000 operations (contact resistance still lower than 250 MΩ): DC: 30 W inductive (L/R = 40 ms)
Dielectric strength of the coil and the contacts	5000 VAC
Isolation	2.2 kV (CM) AT 60 Hz for 1 minute
8 single-pole relays	Normally open contacts
2 double-pole relays	1 common for 2 output contacts (NO/NC changeover)
Number of operations	Unloaded contact: > 100 000 Loaded contact: >10 000

HIGH SPEED OUTPUT CONTACT SPECIFICATIONS

Description	Values
Nominal operating voltage range	Up to 250 VDC/250 VAC + 20%
Carry (steady state current)	Single pole: 10 × 10 A at 55°C Double pole: 5 × 16 A at 40°C
Making capacity (rated inrush current)	33 A for 3 s
Maximum inrush current	100 A for 30 ms
Making time	< 0.5 ms
I^2t rating	300 A^2/s
Contact resistance	Make: 33 mΩ Carry: 10 mΩ
Breaking capacity	Breaking capacity for 10 000 operations: DC: 7500 W resistive, 2500 W inductive (L/R = 40 ms) AC: 7500 W resistive, 2500 W inductive
Number of operations	Unloaded contact: > 100 000 Loaded contact: > 10 000
Isolation	2.2 kV (CM) at 50 Hz for 1 minute, 5 kV impulse

ANALOG CURRENT INPUTS (METERING PROFILE)		
Description	**Values**	**Values**
Model	1A	5A
Nominal AC current (In)	1 A_{RMS}	5 A_{RMS}
Minimum measurable current with same accuracy	12,5 mA @ 0.4% Error and 20’ (0,0125 In 0.4% Error and 20’)	62,5 mA @ 0.4% Error and 20’ (0,0125 In 0.4% Error and 20’)
Maximum measurable current	50 mA - 2 A @ 0.2% Error and 10’ (0.05 In - 2 In 0.2% Error and 10)	250 mA - 10 A 0.2% Error and 10’ (0.05 In - 2 In 0.2% Error and 10’)
Frequency	50 or 60 Hz ± 10%	50 or 60 Hz ± 10%
Overload	* 2,5 A Continuous * 50 A @ 5 s (2.5 In Continuous 10 In @ 5 s)	* 2,5 A Continuous * 50 A @ 5 s (2.5 In Continuous 10 In @ 5 s)

ANALOG CURRENT INPUTS (PROTECTION PROFILE)		
Description	**Values**	**Values**
Model	1A	5A
Nominal AC current (In)	1 ARMS	5 ARMS
Minimum measurable current with same accuracy	200 mA - 800 mA @ 0.4% Error and 20’ (0,2 - 0,8 In 0.4% Error and 20’	1 A - 4 A @ 0.4% Error and 20’ (0,2 In - 0,8 In 0.4% Error and 20’)
Maximum measurable current	800 mA - 2 A @ 0.2% Error and 10’ (0.8 In - 2 In 0.2% Error and 10) 2 A - 30 A @ 1% Error and 2° (120’) (2 In - 30 In 1% Error and 2° (120’)) 30 A - 60 A @ 6TPM10-180 30 In - 60 In (6TPM10-180)	4 A - 10 A @ 0.2% Error and 10’ (0.8 In - 2 In 0.2% Error and 10) 10 A - 150 A @ 1% Error and 2° (120’) (2 In - 30 In 1% Error and 2° (120’)) 150 A - 300 A @ 6TPM10-180 30 In - 60 In (6TPM10-180)
Frequency	50 or 60 Hz ± 10%	50 or 60 Hz ± 10%

ANALOG VOLTAGE INPUTS	
Description	**Values**
Nominal AC voltage	Phase Voltage: 2 V - 240 V
Measurable range	2 V - 20 V @ 0.4% Error - 20’ 20 V - 200 V @ 0,2% Error - 10’ 200 Vn - 240 Vn
Overload withstand	2.4 Vn Continuous 2.6 Vn @ 10 s

OPTICAL ETHERNET PORTS SPECIFICATION (6 PORTS)	
Interface	1000 BASE-LX
Bitrate	1000 Mbps
Wavelength	1300 nm
Connector	LC
Fiber type	monomode 1310 nm
Emission power	-20 dBm
Sensitivity	-32 dBm
Maximum applicable power	-14 dBm

Safety Related Tests

TEST	TEST STANDARD	TEST LEVEL
Impulse voltage	IEC 60255-27:2013	5 kV, 1.2/50 µs, 0.5 J
Dielectric voltage	IEC 60255-27:2013	2.2 kV rms, 1 minute
Insulation resistance	IEC 60255-27:2013	> 100 MΩ, 500 V
Protective bonding resistance	IEC 60255-27:2013	< 0.1 Ω at 20 A

Mechanical Tests

TEST	TEST STANDARD	TEST LEVEL
Vibration	IEC 60255-21-1: 1988	Class 1
Shock	IEC 60255-21-2: 1988	Class 1
Bump	IEC 60255-21-2: 1988	Class 1
Seismic	IEC 60255-21-3: 1993	Class 1

Climatic Tests

TEST	TEST STANDARD	TEST LEVEL
Cold test - Operational	EN 60068-2-1: 2007	Test Ad -25°C, 96 hrs
Cold test - Storage	EN 60068-2-1: 2007	Test Ab -40°C, 96 hrs
Dry heat test - Operational	EN 60068-2-2: 2007	Test Bd +70°C, 96 hrs
Dry heat test - Storage	EN 60068-2-2: 2007	Test Bb +70°C, 96 hrs
Change of temperature	EN 60068-2-14: 2009	Test Nb -25°C to +55°C
Damp heat cyclic	EN 60068-2-30: 2005	Test Db +55°C, 93% RH +25°C, 97% RH 6 days
Damp heat steady state	EN 60068-2-78: 2013	Test Ab +40°C, 93% RH 10 days
Enclosure protection	IEC 60529: 2013	IP40 front face IP20 sides of case IP20 rear of case

DC Auxiliary Supply Tests

TEST	TEST STANDARD	TEST LEVEL
Inrush current	IEC 60255-1: 2009 Sub-clause 6.10.4.3	110 VDC, I < 19.4 A, T < 110 ms 220 VDC, I < 43.8 A, T < 92 ms
DC voltage interruption and dips	IEC 61000-4-29: 2000	ΔU 100% for 50ms ΔU 30% for 100ms ΔU 60% for 100ms
Reverse polarity	IEC 60255-27: 2013 Sub-clause 10.6.6	Polarity - for the lower potential of the supply Polarity + for the lower potential of the supply
Voltage ripple in DC	IEC 61000-4-17: 1999	15% of rated DC value, 100Hz
Gradual shut-down/ start-up	IEC 60255-26: 2013	Shut-down ramp 60 s Power off 5 min Start-up ramp 60 s

Electromagnetic Compatibility (EMC) Tests

TEST	TEST STANDARD	TEST LEVEL
	CISPR 11: 2010	Class A 30 MHz to 230 MHz 50 dB (µV/m) quasi peak at 3 m 230 MHz to 1 000 MHz 57 dB (µV/m) quasi peak at 3 m
Radiated emission	CISPR 22: 2008	Class A 1 GHz to 3 GHz 56 dB (µV/m) Average 76 dB (µV/m) peak at 3m 3 GHz to 6 GHz 60 dB (µV/m) Average 80 dB (µV/m) peak at 3m
Conducted emission	CISPR 22: 2008	Class A 0.15 MHz to 0.5 MHz 79 dB (uV) quasi peak 66 dB (uV) average 0.5MHz to 30MHz 73 dB (uV) quasi peak 60 dB (uV) average
Electrostatic discharge	IEC 61000-4-2: 2008	Level 4: 8 kV contact/15 kV air
Radiated immunity	IEC 61000-4-3: 2006	80 to 2700 MHz 10 Vrms @ 1 kHz 80% AM Spot tests at 80, 160, 380, 450, 900, 1850, 2150 MHz
Fast transient immunity	IEC 61000-4-4: 2012	Level 4: 4 kV 5 kHz and 100 kHz
Surge immunity	IEC 61000-4-5: 2005	Level 4: 4 kV (line-to-earth) 2 kV (line-to-line)
Conducted immunity	IEC 61000-4-6: 2008	10 Vrms @ 1 kHz 80% AM 150 kHz to 80 MHz Spot tests at 27 MHz, 68 MHz
Power frequency magnetic field	IEC 61000-4-8: 2009	100A/m continuous 1000A/m short duration (3 seconds)
Power frequency	IEC 61000-4-16: 1998	30 A/m continuous 300 A/m 10s
Damped oscillatory wave	IEC 61000-4-18: 2006	Level 3: 1 kV (line-to-line) 2.5 kV (line-to-earth) 100 kHz and 1 MHz

For more information, visit
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