

**Product Description
for
AT2220**

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Revision Record

Revision	Rationale	Release Date
001	Initial Release	18 June 2014



WARNING: *This device emits radio frequency (RF) energy when in transmit mode. In order to comply with FCC RF Exposure limits, the unit must be installed in such a way as to ensure that a minimum separation distance of 18.5 inches (47cm) is maintained between the antenna and any nearby persons.*

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1 SCOPE

This product definition document defines essential characteristics and functionality of the ViaSat AT2220 Terminal.

2 REFERENCE DOCUMENTS

Table 1: Reference Documents

Document Number	Document Title	Revision	Date
1178156	ViaSat Mobile Satellite Services Overview and Description	002	4/12/2013

3 TERMINAL OVERVIEW AND OPERATIONAL CONCEPT

The ViaSat AT2220 Terminal enables reliable and instant IP-based communications via satellite for rotor and fixed-wing aircraft.

Powered by ViaSat L-band Managed Service (VMS), this satcom terminal's two-way networking capability enables both real-time monitoring of position location information using built in GPS receiver, and data and voice communications. FIPS-certified data link layer encryption is employed to ensure the integrity of user data is protected. The terminal features easy-to-use interfaces and provides flexibility to configure to nearly any sensor system or IP data application. Examples of operational scenarios that the AT2220 Terminal supports range from fleet management, emergency first responders, homeland security forces, disaster aid workers, corresponders, mobile workforce management and tracking of high-valued assets. This is all within an integrated single assembly package that is optimized for airborne data transmission. A single cable provides DC power and Ethernet for wired connections to an IP device, eliminating the need of RF cable typically required for connection between modem and antenna. The transceiver also supports Wi-Fi and Bluetooth for wireless connections to multiple tablets or smartphones. The AT2220 Terminal is powered by ViaSat advanced waveform that allows for a low latency and highest capacity of users to operate on a single L-band channel. A rendering of the AT2220 Terminal is shown in the Figure 1. Terminal size, weight and characteristics are provided in Section **Error! Reference source not found.**

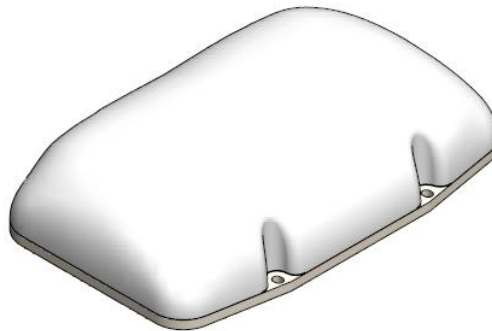


Figure 1: AT2220 Mobile Terminal

The AT2220 terminal is designed to be flexible in application, incorporating features and functions that are important in M2M mobile applications. In particular, the terminal is tailored to provide the followings:

- Ruggedized design to handle harsh environments
- Integral antenna & modem in a single low profile unit
- Ethernet, Wi-Fi, Bluetooth interface options
- Two-way send/receive connectivity
- Low latency for instant message transfer and real time monitoring
- Push To Talk (PTT) voice
- Low service cost with a bandwidth efficient waveform
- Optional dual receiver capability (can receive two forward links simultaneously)

Figure 2 illustrates the concept of operation. End-users operating on mobile or fixed platforms access satellite service through the AT2220 terminals and assigned satellite channel. A ViaSat hub accesses a satellite provider's RF feeder link to provide satellite service to the end-users and connectivity to the AT2220 transceivers in a hub-spoke topology. A terrestrial VPN link connects the ViaSat Network Operation Center (NOC) to the hub for network management and control through a commercial router.

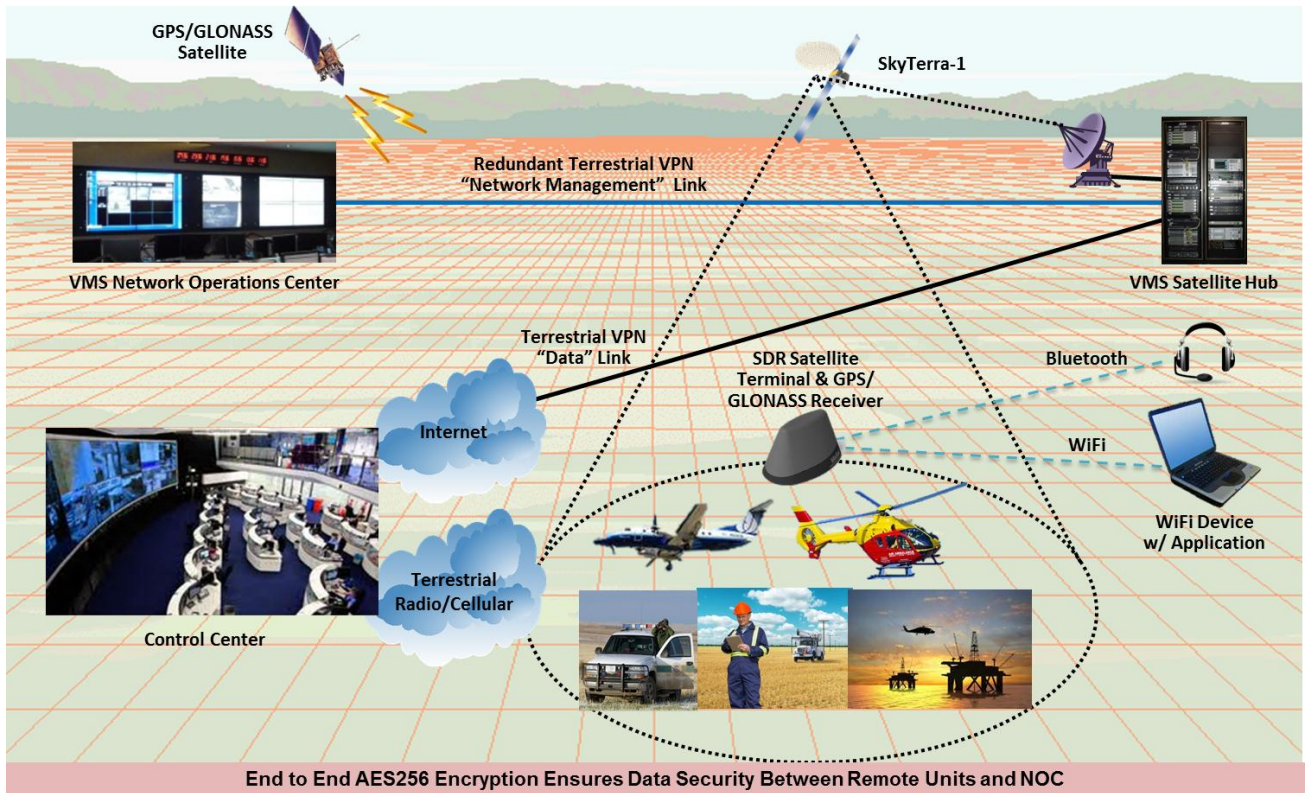


Figure 2: End-users access satellite service via Terminal operating hub-spoke with Hub

4 SPECIFICATIONS

The following subsections list specifications for the AT2220 terminal.

4.1 General Specifications

Antenna Polarization:

RHCP & LHCP, software configurable

Frequency band:

TX: 1626.5 – 1675.0 MHz

Rx: 1518.0 – 1559.0 MHz

Forward Link waveform:

BPSK, QPSK, 8-PSK and 16-APSK

Spread and unspread modes supported

FEC – Low Density Parity Check (LDPC)

Return: CRMA, GMSK code rate 1/3 and 1/5

Return Link waveform:

ViaSat patented CRMA ALOHA burst multiple access, packets sent immediately upon arrival

GMSK spreading modulation

Direct Sequence Spread Spectrum with spreading factor $4 \leq K \leq 22$

FEC – Turbo code, $r=1/3$ and $r=1/5$

Transmit EIRP:

Up to +8 dBW, configurable in 0.1 dB steps

Receive G/T:

Up to -21.0 dB/K

Data Rate:

Forward: Up to 1 Mbps *

Return: 1 kbps to 20 kbps* burst rate, multiple terminals can transmit simultaneously on the same channel, increasing system throughput

Voice codec:

MELPe, 600/1200/2400 bps

Transmission Security

Link encryption: AES-256

Cryptographic certification: Certifiable to FIPS-140-2 Level 2

GNSS

GPS + GLONASS

Input Power

DC: 10-32 V

60 Watts max

(*) = Achievable data rate is dependent on satellite channel parameters/link budget

4.2 Interface

The AT2220 terminal provides the following external interfaces:

Power	10-32 VDC, via multi-pin connector with short circuit protection
Ethernet	via multi-pin connector
Bluetooth	4.0
Wi-Fi	IEEE 802.11 B/G, 2.4 GHz
GNSS	L1 frequency

4.3 Mechanical

Size:	8.85 in. x 6.77 in. x 3.14 in.
Weight:	2.0 lbs.
Finish:	Plastic radome with painted metal housing, both suitable for continuous outdoor exposure

4.4 Environmental Conditions

Table 2: Environmental Conditions

Environmental and EMI Tests	DO-160G Section	Test Category
Temperature and Altitude:	4	
Low Temp	4.5.2	F2
High Temp	4.5.3 & 4.5.4	F2
In-Flight Loss of Cooling	4.5.5	X, no test performed
Altitude	4.6.1	F2
Decompression	4.6.2	X, no test performed
Overpressure	4.6.3	X, no test performed
Temperature Variation	5	A
Humidity	6	C
Operational Shocks & Crash Safety	7	A
Vibration	8	Category S, Curves L, M, and Y Category U2, Curves F and F1
Explosive Atmosphere	9	E
Waterproofness	10	S
Fluids Susceptibility	11	F
Sand and Dust	12	S
Fungus Resistance	13	F
Salt Spray	14	T
Magnetic Effects	15	Z

Environmental and EMI Tests	DO-160G Section	Test Category
Power Input		Category B (14V & 28V)
Voltage Spike	17	A
Audio Frequency Conducted Susceptibility	18	B
Induced Signal Susceptibility	19	AC (interference-free operation is desirable)
Radio Frequency Susceptibility	20	Category T (conducted) Category T (radiated)
Emission of Radio Frequency Energy	21	H (in direct view of receiver antenna)
Lightning Induced Transient Susceptibility	22	B4K4X
Lightning Direct Effects	23	1A2A
Icing	24	C
Electrostatic Discharge	25	A
Fire and Flammability	26	X, no test performed

4.5 Software Design Assurance Level

The embedded software of the AT2220 is in compliance with the applicable airworthiness regulations for the software aspects of airborne systems per DO-178C Level E.

4.6 Regulatory Approvals

The AT2220 terminal is designed to satisfy all necessary requirements to obtain approvals for the following:

CE	Per R&TTE Directive 1999/5/EC, Low Voltage Directive 2006/95/EC
FCC	Title 47 Section 15, Title 47 Section 25
RCM	AS/NZS CISP22
	Safety IEC/EN/AS/NZS 60950-1, IEC/EN/AS/NZS 60950-22
RoHS	Per European Union Council Directive 2011/65/EU
REACH	Per European Union Council Directive 1907/2006/EC
WEEE	Per European Union Council Directive 2012/19/EU

4.7 Features and Capabilities

The AT2220 terminal supports the following features and capabilities

- IPv4 (IPv6 upgradable):
- Full IPv4 support including unicast, multicast and broadcast capabilities, supporting IP based user applications
- Low latency which is ideal for data reporting, remote device control, voice communications and messaging
- Secure communication
- The VMS network provides enhanced end to end data security
- Over-The-Air (OTA) SW Upgrades
- Terminal software upgrades performed over the air
- Push to Talk (PTT) secure netted voice:
- One talk, Multiple listen. PTT capabilities include customized private call groups with other VMS terminals and Internet based users
- GPS NMEA Server
- NMEA stream from the embedded GPS receiver is accessible to IP based applications providing easy access to GPS data for user applications
- Automatic Vehicle Location (AVL) Server
- An AVL server is embedded within the terminal providing full AVL services for aircraft installations

4.8 Terminal Management

The AT2220 terminal supports control, configuration and status via both the attached host platform and OTA.

Local management:

Using an embedded HTTP server or a 3GPP based AT command set. Both HTTP and 3GPP interfaces are available.

Remote management:

Using the VMS network terminal command and control interface

The AT2220 terminal management interfaces support the following features:

- Terminal health and status monitoring, including connection state, forward/return signal levels
- Terminal/end user data usage monitoring: bytes sent/received, session duration
- Terminal location reporting
- Terminal diagnostic fault reporting and log retrieval
- Terminal IP network configuration
- Historical terminal status/statistics retrieval
- Initiation and monitoring of OTA Software Download activities to terminals for software/firmware upgrades

- Reboot, re-login, and channel switch

4.9 FCC Regulatory Information

Compliance Statement (Part 15.19)

The enclosed hardware device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received including interference that may cause undesired operation.

Warning (Part 15.21)

Changes or modifications not expressly approved by ViaSat could void the user's authority to operate the equipment. Manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications to this equipment.

Compliance Statement (Part 15.105(b))

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in an industrial installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio/TV technician for help

4.10 Industry Canada (IC) Regulator Information

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie

Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Class B Digital Device Notice

This Class B digital apparatus complies with Canadian ICES-003, RSS-Gen and RSS-210.

Cet appareil numérique de la classe B est conforme à la norme NMB-003, CNR-Gen et CNR-210 du Canada.

5 PRODUCT PACKAGE

The following deliverables will be included in a standard AT2220 package

- AT2220 terminal
- User documentation pack including installation manual, getting started manual and reference card
- Power/ Ethernet cable assembly
- Warranty card

A APPENDIX - ACRONYMS

Acronym	Definition
AVL	Automatic Vehicle Location
CRMA	Code Reuse Multiple Access
kbps	Kilobits per second
IP	Internet Protocol
GMSK	Gaussian Minimum Shift Keying
GPS	Global Positioning System
LDPC	Low Density Parity Check
LHCP	Left Hand Circular Polarization
M2M	Machine-to-Machine
Mbps	Megabits per second
MeLP	Mixed-excitation Linear Prediction
NMEA	National Marine Electronics Association
NOC	Network Operation Center
OTA	Over The Air
PTT	Push-To-Talk
RF	Radio Frequency
RHCP	Right Hand Circular Polarization
SW	Software
USB	Universal Serial Bus
VMS	ViaSat L-band Managed Services
VNO	Virtual Network Operator