Cinterion® ALAS66A

Hardware Interface Overview

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1 Introduction

This document[1] describes the hardware of the Cinterion® ALAS66A products listed in Section 1.1. It helps you quickly retrieve interface specifications, electrical and mechanical details and information on the requirements to be considered for integrating further components.

1.1 Product Variants

This document applies to the following Gemalto M2M modules:
- Cinterion® ALAS66A-W
- Cinterion® ALAS66A-CN
- Cinterion® ALAS66A-E
- Cinterion® ALAS66A-US
- Cinterion® ALAS66A-J
- Cinterion® ALAS66A-K

Where necessary a note is made to differentiate between the various product variants and releases.

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1. The document is effective only if listed in the appropriate Release Notes as part of the technical documentation delivered with your Gemalto M2M product.

1.2 Key Features at a Glance

Feature	Implementation
General	
Frequency bands	**Note:** Not all of the frequency bands (and 3GPP technologies) mentioned throughout this document are supported by every ALAS66A products variant. Please refer to Section 1.2.1 for an overview of the frequency bands supported by each ALAS66A product variant.
GSM class	Small MS
Output power (according to Release 99)	GSM/GPRS/UMTS: Class 4 (+33dBm ±2dB) for EGSM850 and EGSM900 Class 1 (+30dBm ±2dB) for GSM1800 and GSM1900 Class E2 (+27dBm ± 3dB) for GSM 850 8-PSK and GSM 900 8-PSK Class E2 (+26dBm +3 /-4dB) for GSM 1800 8-PSK and GSM 1900 8-PSK Class 3 (+24dBm +1/-3dB) for all supported WCDMA FDD bands
Output power (according to Release 4)	TD-SCDMA: Class 2 (+24dBm +1/-3dB) for TD-SCDMA 1900, TD-SCDMA Bd39 and TD-SCDMA 2000, TD-SCDMA Bd34
Output power (according to Release 8)	LTE (FDD): Class 3 (+23dBm +-2dB) for all supported LTE FDD bands LTE (TDD): Class 3 (+23dBm +-2dB) for all supported LTE TDD bands
Power supply	$3.3V \leq V_{BATT+} \leq 4.2V$
Operating temperature (board temperature)	Normal operation: -30°C to +85°C Restricted operation: -40°C to +95°C
Physical	Dimensions: 48mm x 36mm x 3mm Weight: approx. 10.5g
RoHS	All hardware components fully compliant with EU RoHS Directive

Feature	Implementation
LTE features	
LTE Advanced up to 3GPP Release 11 LTE Advanced Pro up to 3GPP Release 12, 13	Downlink carrier aggregation (CA) to increase bandwidth, and thereby increase bitrate: • Maximum aggregated bandwidth: 80MHz • Maximum number of component carriers: 3 • Inter-band FDD, TDD • Intra-band FDD, TDD, contiguous, non-contiguous • Supported inter- and intra-band CA configurations: See Section 1.2.2. If 4x4 MIMO is supported by the mobile network: • Downlink: Up to 1Gbps CAT 16 with 4x4 MIMO 2 CA DL + 4(2)x2 MIMO 1 CA DL or up to 800Mbps CAT 15 with 4x4 MIMO 2 CA DL • Uplink: Up to 150Mbps CAT 13 with 2 CA UL If 4(2)x2 MIMO is supported by the mobile network: • Downlink: Up to 800Mbps CAT 15 with 4 CA DL • Uplink: Up to 150Mbps CAT 13 with 2 CA UL
HSPA features	
3GPP Release 8	UE CAT. 14, 24 DC-HSPA+ – DL 42Mbps HSUPA – UL 5.76Mbps Compressed mode (CM) supported according to 3GPP TS25.212
UMTS features	
3GPP Release 8	PS data rate – 384 kbps DL / 384 kbps UL
TD-SCDMA features	
3GPP Release 4	2.8 Mbps DL / 2.2Mbps UL
GSM / GPRS / EGPRS features	
Data transfer	GPRS: • Multislot Class 12 • Mobile Station Class B • Coding Scheme 1 – 4 EGPRS: • Multislot Class 12 • EDGE E2 power class for 8 PSK • Downlink coding schemes – CS 1-4, MCS 1-9 • Uplink coding schemes – CS 1-4, MCS 1-9 • SRB loopback and test mode B • 8-bit, 11-bit RACH • 1 phase/2 phase access procedures • Link adaptation and IR • NACC, extended UL TBF • Mobile Station Class B
SMS	Point-to-point MT and MO, Cell broadcast, Text and PDU mode

Feature	Implementation
Software	
Embedded Linux platform	Embedded Linux with API (ARC, RIL). Memory space available for Linux applications is 4GB in the flash file system, and 2GB RAM.
SIM Application Toolkit	SAT Release 99, letter classes b, c, e with BIP and RunAT support
Firmware update	Linux controlled firmware update.
GNSS Features	
Protocol	NMEA
Modes	Standalone GNSS (GPS, GLONASS, Beidou, Galileo) Integrated gpsOne 9HT support (GPS, GLONASS, Beidou, Galileo) QZSS and SBAS support
General	Power saving modes DC feed bridge and control of power supply for active antenna via GPIO
Interfaces	
Module interface	Surface mount device with solderable connection pads (SMT application interface). Land grid array (LGA) technology ensures high solder joint reliability and provides the possibility to use an optional module mounting socket. For more information on how to integrate SMT modules see also [2]. This application note comprises chapters on module mounting and application layout issues as well as on additional SMT application development equipment.
Antenna	50Ω. 2 GSM/UMTS/LTE main antennas, 2 LTE Diversity/MIMO antennas, (active/passive) GNSS antenna
USB	USB 2.0 High Speed (480Mbit/s) device interface or USB 3.0 Super Speed (5Gbit/s) device interface for debugging purposes
Serial interface	Linux controlled: ASC0: • 4-wire (8-wire prepared) (plus GND line) interface unbalanced, asynchronous • Fixed baud rates from 115,200 to 921,600bps • Supports RTS0/CTS0 hardware flow control ASC1: • 4-wire, unbalanced asynchronous interface • Fixed baud rates: 115,200bps to 921,60bps • Supports RTS1/CTS1 hardware flow control ASC2: • 2-wire, unbalanced asynchronous interface at GPIO9 (RXD2) and GPIO10 (TXD2) lines used for debugging purposes (optional)
UICC interface	Supported chip cards: UICC/SIM/USIM 2.85V, 1.8V
I²C interfaces	Linux controlled: 2 I²C interfaces
Audio	1 digital interface (I²S)
Power on/off, Reset	
Power on/off	Switch-on by hardware signal IGT Automatic switch-off in case of critical temperature or voltage conditions
Emergency-off	Emergency-off by hardware signal EMERG_OFF

Feature	Implementation
Special Features	
Antenna	SAIC (Single Antenna Interference Cancellation) / DARP (Downlink Advanced Receiver Performance) Rx Diversity (receiver type 3i - 64-QAM) / MIMO HORxD (Higher Order Receive Diversity) with up to 4 antennas
GPIO	Linux controlled: 18 I/O pins of the application interface programmable as GPIO.
External antenna switch	3 GPIOs permanently configured as optional external antenna switch interface.
Emergency call handling	EU eCall 3GPP Release 10 compliant (modem and GNSS) ERA compliant (modem and GNSS)
ADC inputs	Linux controlled: Analog-to-Digital Converter with unbalanced analog inputs for example for (external) antenna diagnosis
JTAG	JTAG interface for debug purposes
eMMC	Linux controlled: Embedded Multi-Media Card interface
PCIe	Linux controlled: PCIe interface
Evaluation kit	
Evaluation module	ALAS66A module soldered onto a dedicated PCB.

1.2.1 Supported Frequency Bands

The following table lists the supported frequency bands for each of the ALAS66A product variants mentioned in Section 1.1.

Table 1: Supported frequency bands for each ALAS66A variant

Band	-W	-CN	-E	-US	-J	-K
GSM/GPRS/EDGE						
850MHz	x			x	x	x
900MHz	x	x	x	x	x	x
1800MHz	x	x	x	x	x	x
1900MHz	x			x	x	x
UMTS/HSPA						
Bd.I (2100MHz)	x	x	x		x	x
Bd.II (1900MHz)				x		
Bd.III (1800MHz)	x	x	x		x	x
Bd.IV (1700MHz)				x		
Bd.V (850MHz)	x			x	x	x
Bd.VI (850MHz)	x				x	x
Bd.VIII (900MHz)	x	x	x		x	x
Bd.XIX (850MHz)	x				x	x
TD-SCDMA						
Bd.34 (2000MHz)		x				
Bd.39 (1900MHz)		x				
LTE-FDD						
Bd.1 (2100MHz)	x	x	x		x	x
Bd.2 (1900MHz)				x		
Bd.3 (1800MHz)	x	x	x		x	x
Bd.4 (1700MHz)				x		
Bd.5 (850MHz)	x			x	x	x
Bd.7 (2600MHz)	x	x	x	x	x	x
Bd.8 (900MHz)	x	x	x		x	x
Bd.12 (700MHz)				x		
Bd.13 (700MHz)				x		
Bd.18 (850MHz)	x				x	x
Bd.19 (850MHz)	x				x	x
Bd.20 (800MHz)	x		x		x	x
Bd.26 (850MHz)	x				x	x
Bd.28 (700MHz)	x		x	x	x	x

Table 1: Supported frequency bands for each ALAS66A variant

Band	-W	-CN	-E	-US	-J	-K
Bd.29 (700MHz) <supplementary downlink>				x		
Bd.30 (2300MHz)[1] <supplementary downlink only acc. FCC regulation>				x		
Bd.32 (1500MHz) <supplementary downlink>	x		x		x	x
Bd.66 (1700MHz)[2]				x		
LTE-TDD						
Bd.34 (2000MHz)	x	x			x	x
Bd.38 (2600MHz)	x	x	x		x	x
Bd.39 (1900MHz)	x	x			x	x
Bd.40 (2300MHz)	x	x			x	x
Bd.41 (2600MHz)[3]	x	x			x	x

1. Band 30 support is disabled by means of software due to AT&T advice.
2. With the Band 66 support, the frequency ranges 1755-1780 MHz and 2155-2180 MHz derived from pairing the 1710-1780 and 2110-2180 MHz frequency bands are compliant with §§27.5(h) and 27.75.
3. **Note:** Out of the 3GPP specified frequency range for LTE Band 41, only that part which is used in China and Japan (2545MHz to 2655MHz) is supported by ALAS66A. Therefore, support for Band 41 is disabled by means of software in ALAS66A-W and ALAS66A-K variants.

1.2.2 Supported CA Configurations

The following table lists the supported CA configurations for each of the ALAS66A product variants mentioned in Section 1.1.

Table 2: Supported CA configurations

Downlink CA	Uplink CA	Bandwidth combination set	Product variants (ALAS66A-...)
Intra-band continuous			
CA_1C	-	0,1	E, W, CN, J, K
CA_2C	-	0	US
CA_3C	CA_3C	0	E, W, CN, J, K
CA_5B	-	0,1	US, W, J, K
CA_7B	-	0	E, US, W, CN, J, K
CA_7C	CA_7C	0, 1, 2	E, US, W, CN, J, K
CA_8B	-	0	E, W, CN, J, K
CA_12B	-	0	US
CA_38C	CA_38C	0	E, W, CN, J, K
CA_40C	CA_40C	0, 1	W, CN, J, K
CA_40D	-	0,1	W, CN, J, K

Table 2: Supported CA configurations

Downlink CA	Uplink CA	Bandwidth combination set	Product variants (ALAS66A-...)
CA_41C	CA_41C	0,1,2,3	CN, J
CA_41D	CA_41C	0	CN, J
CA_66B	-	0	US
CA_66C	-	0	US
Intra-band non-continuous			
CA_2A-2A	-	0	US
CA_4A-4A	-	0,1	US
CA_66A-66A	-	0	US
Inter-band (two bands)			
CA_1A-3A	-	0,1	E, W, CN, J, K
CA_1A-3C	CA_3C	0	E, W, CN, J, K
CA_1A-5A	CA_1A-5A	0, 1	W
CA_1A-7A	-	0	E, W, CN, J, K
CA_1A-8A	CA_1A-8A	0, 1, 2	E, W, CN, J, K
CA_1A-18A	CA_1A-18A	0, 1	W, J, K
CA_1A-19A	-	0	W, J, K
CA_1A-20A	-	0	E, W, J, K
CA_1A-26A	CA_1A-26A	0, 1	W, J, K
CA_1A-28A	CA_1A-28A	0, 1	E, W, J, K
CA_2A-2A-4A	-	0	US
CA_2A-2A-4A-4A	-	0	US
CA_2A-2A-5A	-	0	US
CA_2A-2A-12A	-	0	US
CA_2A-2A-13A	-	0	US
CA_2A-2A-66A	-	0	US
CA_2A-4A	-	0, 1, 2	US
CA_2A-4A-4A	-	0	US
CA_2A-5A	-	0, 1	US
CA_2A-12A	-	0, 1, 2	US
CA_2A-12B	-	0	US
CA_2A-13A	-	0, 1	US
CA_2A-28A	-	0	US
CA_2A-29A	-	0, 1, 2	US
CA_2A-66A	-	0,1,2	US
CA_2A-66A-66A	-	0	US
CA_2C-5A	-	0	US
CA_2C-12A	-	0	US
CA_2C-29A	-	0	US
CA_3A-3A-8A	CA_7C	0, 1	E, W, CN, J, K
CA_3A-5A	CA_3A-8A	0, 1, 2, 3,4	W, J, K
CA_3A-7A	-	0, 1	E, W, CN, J, K
CA_3A-7B	CA_3A-20A	0	E, W, CN, J, K

Table 2: Supported CA configurations

Downlink CA	Uplink CA	Bandwidth combination set	Product variants (ALAS66A-...)
CA_3A-7C	-	0, 1	E, W, CN, J, K
CA_3A-8A	-	0, 1, 2, 3	E, W, CN, J, K
CA_3A-19A	-	0	W, J, K
CA_3A-20A	CA_3C	0, 1	E, W, J, K
CA_3A-26A	-	0, 1	W, J, K
CA_3A-28A	CA_3A-20A	0,1	E, W, J, K
CA_3C-5A	-	0	W, J, K
CA_3C-7A	-	0	E, W, CN, J, K
CA_3C-7C	-	0,1	E, W, J, K
CA_3C-8A	CA_3C-8A, CA_3C	0	W, J, K
CA_3C-20A	-	0	E, W, J, K
CA_3C-28A	-	0	E, W, J, K
CA_4A-4A-5A	-	0	US
CA_4A-4A-7A	-	0, 1	US
CA_4A-4A-12A	-	0	US
CA_4A-4A-13A	-	0	US
CA_4A-5A	-	0, 1	US
CA_4A-7A	-	0, 1	US
CA_4A-12A	-	0,1,2,3,4,5	US
CA_4A-12B	-	0	US
CA_4A-13A	-	0, 1	US
CA_4A-28A	-	0	US
CA_4A-29A	-	0, 1, 2	US
CA_5A-7A	CA_5A-7A	0, 1	US, W, J, K
CA_5A-12A	-	0	US
CA_5A-66A	-	0	US
CA_5A-66A-66A	-	0	US
CA_7A-8A	-	0, 1,2	E, W, CN, J, K
CA_7A-12A	-	0	US
CA_7A-20A	CA_7A-20A	0, 1	E, W, J, K
CA_7A-28A	-	0, 1	E, US, W, J, K
CA_7B-28A	-	0	E, US, W, J, K
CA_7C-28A	CA_7C	0	E, US, W, J, K
CA_8A-20A	-	0, 1	E, W, J, K
CA_12A-66A	-	0,1,2,3,4,5	US
CA_12A-66A-66A	-	0	US
CA_13A-66A	-	0	US
CA_13A-66A-66A	-	0	US
CA_18A-28A	-	0	W, J, K
CA_20A-32A	-	0,1	E, W, J, K
CA_39A-41A	-	0	CN
CA_39A-41C	CA_41C	0	CN
CA_39C-41A	CA_39C	0	CN

Table 2: Supported CA configurations

Downlink CA	Uplink CA	Bandwidth combination set	Product variants (ALAS66A-...)
Inter-band (three bands)			
CA_1A-3A-5A	CA_1A-5A, CA_3A-5A	0, 1	E, W, J, K
CA_1A-3A-8A	CA_1A-8A, CA_3A-8A	0,1,2,3	E, W, CN, J, K
CA_1A-3A-19A	-	0	W, J, K
CA_1A-3A-20A	CA_3A-20A	0	E, W, J, K
CA_1A-3A-26A	-	0	W, J, K
CA_1A-3A-28A	-	0	E, W, J, K
CA_1A-5A-7A	CA_1A-5A, CA_5A-7A	0, 1	E, W, J, K
CA_1A-7A-8A	-	0	E, W, CN, J, K
CA_1A-7A-20A	-	0,1	E, W, J, K
CA_1A-7A-28A	-	0,1,2	E, W, J, K
CA_1A-18A-28A	-	0, 1	W, J, K
CA_1A-19A-28A	-	0	W, J, K
CA_2A-2A-4A-12A	-	0	US
CA_2A-2A-12A-66A	-	0	US
CA_2A-4A-4A-12A	-	0	US
CA_2A-4A-5A	-	0	US
CA_2A-4A-12A	-	0	US
CA_2A-4A-13A	-	0	US
CA_2A-4A-29A	-	0	US
CA_2A-5A-66A	-	0	US
CA_2A-12A-66A	-	0	US
CA_2A-12A-66A-66A	-	0	US
CA_2A-13A-66A	-	0	US
CA_3A-7A-8A	CA_3A-8A	0, 1,2	E, W, CN, J, K
CA_3A-7A-28A	-	0	E, W, J, K
CA_3A-7C-28A	-	0	E, W, J, K
CA_4A-7A-12A	-	0, 1	US

Note: Carrier aggregation (CA) is planned, and will be supported in a future version.

1.3 System Overview
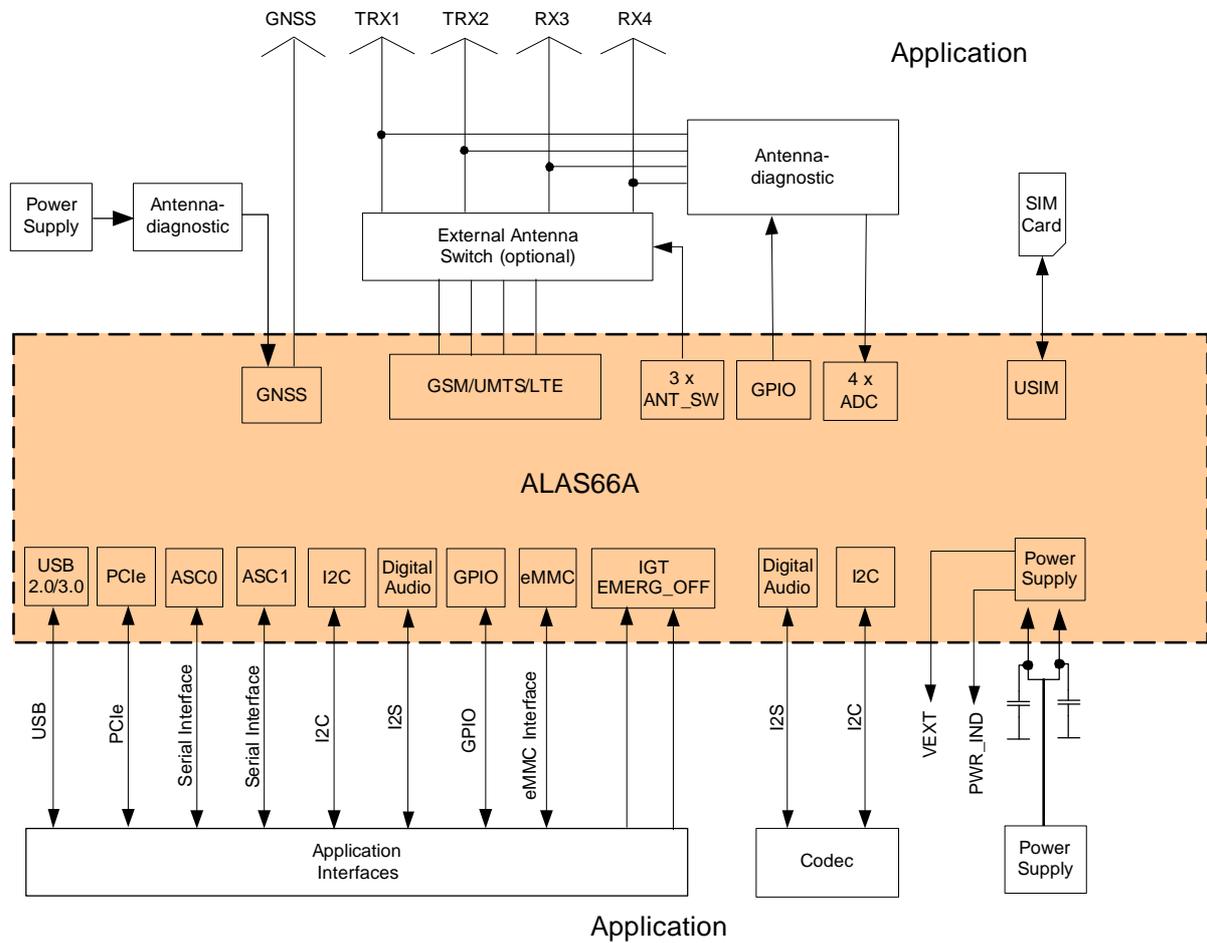
Figure 1: ALAS66A system overview

2   Interface Characteristics

ALAS66A is equipped with an SMT application interface that connects to the external application. The SMT application interface incorporates the various application interfaces as well as the RF antenna interface.

2.1   Application Interface

2.1.1   USB Interface

ALAS66A supports a USB 3.0 Super Speed (5Gbps) device interface, and alternatively a USB 2.0 device interface that is High Speed compatible. The USB interface is primarily intended for use as debugging interface.

The USB host is responsible for supplying the VUSB_IN line. This line is for voltage detection only. The USB part (driver and transceiver) is supplied by means of BATT+. This is because ALAS66A is designed as a self-powered device compliant with the "Universal Serial Bus Specification Revision 3.0"[1].
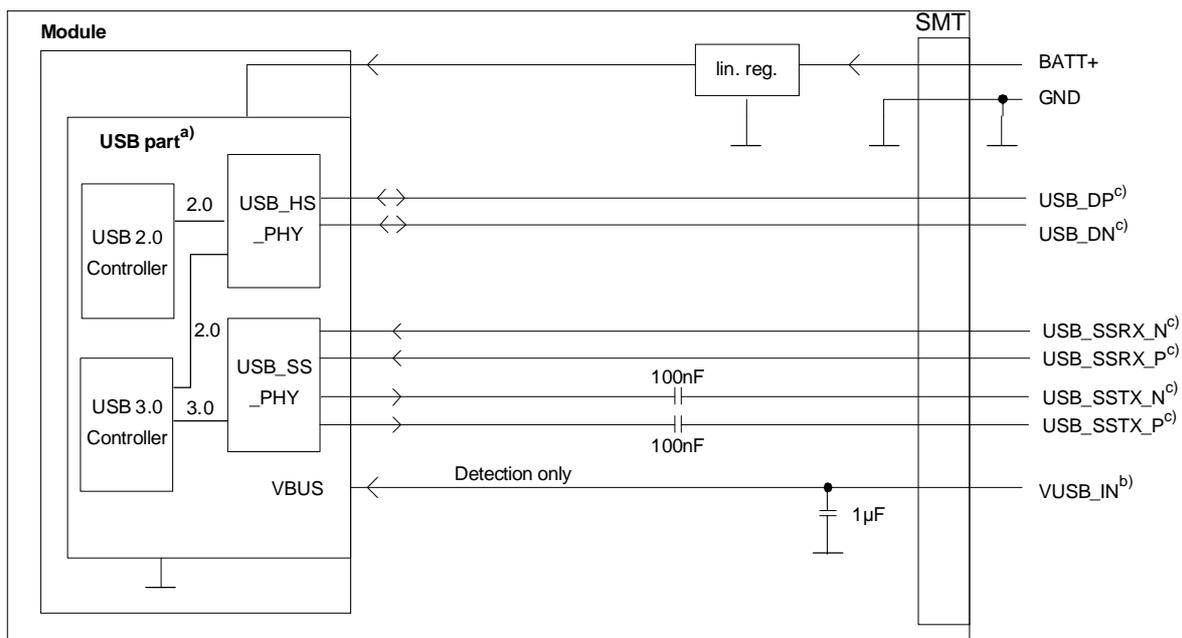
a) All serial (including R$_S$) and pull-up resistors for data lines are implemented .

b) Since VUSB_IN is used for detection only it is recommended not to add any further blocking capacitors on the VUSB_IN line.

c) If the USB interface is operated with super or high speeds, it is recommended to take special care routing the data lines. Application layout should implement a differential impedance of 90 ohms for proper signal integrity .

Figure 2: USB circuit

To properly connect the module's USB interface to the external application, a USB 3.0 or 2.0 compatible connector and cable or hardware design is required. Furthermore, the USB driver distributed with ALAS66A needs to be installed.

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1. The specification is ready for download on http://www.usb.org/developers/docs/

2.1.2   Serial Interface ASC0

ALAS66A offers a 4-wire (8-wire prepared) (plus GND) unbalanced, asynchronous interface ASC0 conforming to ITU-T V.24 protocol DCE signaling. The electrical characteristics do not comply with ITU-T V.28. The significant levels are 0V (for low data bit or active state) and 1.8V (for high data bit or inactive state).

ALAS66A is designed for use as a DCE. Based on the conventions for DCE-DTE connections it communicates with the customer application (DTE) using the following signals:
• Port TXD @ application sends data to the module's TXD0 signal line
• Port RXD @ application receives data from the module's RXD0 signal line
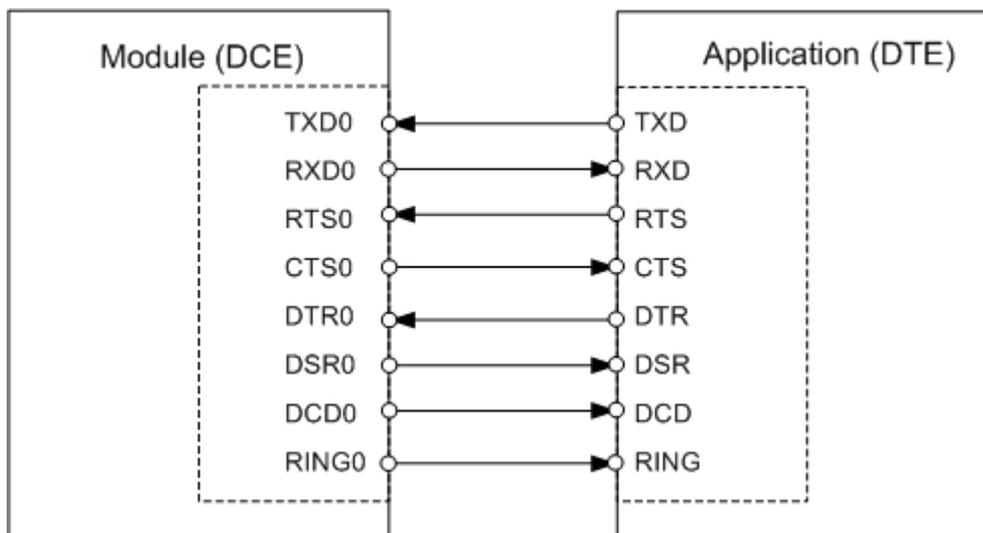
Figure 3: Serial interface ASC0

Features:
• Includes the data lines TXD0 and RXD0, the status lines RTS0 and CTS0. The modem control lines DTR0, DSR0, DCD0 and RING0 are not yet implemented.
• The RING0 signal serves to indicate incoming calls and other types of URCs (Unsolicited Result Code). It can also be used to send pulses to the host application, for example to wake up the application from power saving state. Not yet implemented.
• Configured for 8 data bits, no parity and 1 stop bit.
• ASC0 can be operated at fixed bit rates from 115,200 to 921,600bps.
• Supports RTS0/CTS0 hardware flow control.

Note: If the ASC0 serial interface is the application's only interface, it is suggested to connect test points on the USB signal lines as a potential tracing possibility.

2.1.3 Serial Interface ASC1

Four ALAS66A lines can be configured as ASC1 interface signals to provide a 4-wire unbalanced, asynchronous interface ASC1 conforming to ITU-T V.24 protocol DCE signaling. The electrical characteristics do not comply with ITU-T V.28. The significant levels are 0V (for low data bit or active state) and 1.8V (for high data bit or inactive state).

ALAS66A is designed for use as a DCE. Based on the conventions for DCE-DTE connections it communicates with the customer application (DTE) using the following signals:
• Port TXD @ application sends data to module's TXD1 signal line
• Port RXD @ application receives data from the module's RXD1 signal line
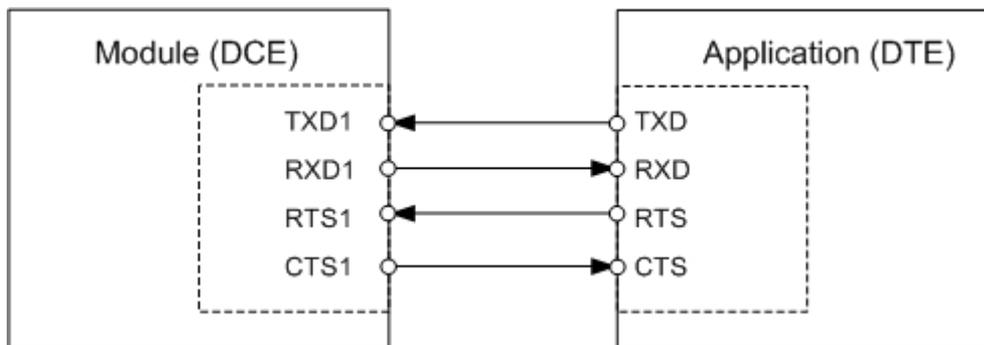
Figure 4: Serial interface ASC1

Features
• Includes only the data lines TXD1 and RXD1 plus RTS1 and CTS1 for hardware handshake.
• On ASC1 no RING line is available.
• Configured for 8 data bits, no parity and 1 or 2 stop bits.
• ASC1 can be operated at fixed bit rates from 115,200 bps to 921,600 bps.
• Supports RTS1/CTS1 hardware flow.

2.1.4 I²C Interface

ALAS66A provides two I²C interfaces. I²C is a serial, 8-bit oriented data transfer bus for bit rates up to 400kbps in Fast mode. It consists of two lines, the serial data line I2CDAT and the serial clock line I2CCLK. The module acts as a single master device, e.g. the clock I2CCLK is driven by the module. I2CDAT is a bi-directional line. Each device connected to the bus is software addressable by a unique 7-bit address, and simple master/slave relationships exist at all times. The module operates as master-transmitter or as master-receiver. The customer application transmits or receives data only on request of the module.

The applications I²C interface can be powered via the VEXT line of ALAS66A. If connected to the VEXT line, the I²C interface will properly shut down when the module enters the Power Down mode.

In the application I2CDATx and I2CCLKx lines need to be connected to a positive supply voltage (e.g., VEXT) via a pull-up resistor.
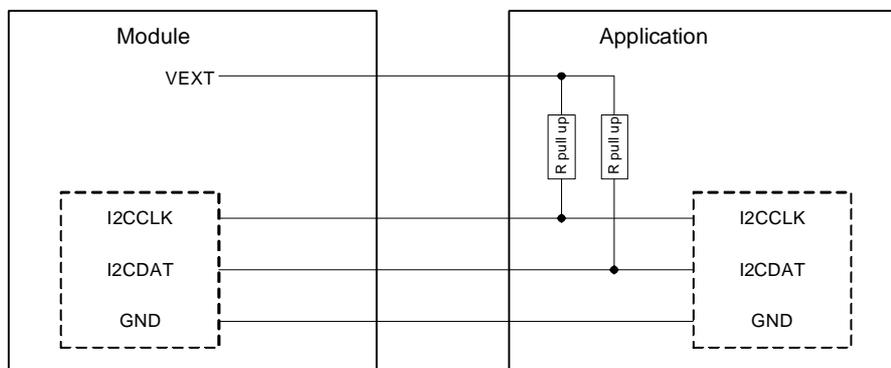
Figure 5: I²C interface connected to VEXT

Note: Good care should be taken when creating the PCB layout of the host application: The traces of I2CCLK and I2CDAT should be equal in length and as short as possible.

2.1.5   UICC/SIM/USIM Interface

ALAS66A has a UICC/SIM/USIM interface compatible with the 3GPP 31.102 and ETSI 102 221. It is wired to the host interface in order to be connected to an external SIM card holder. Five pads on the SMT application interface are reserved for the SIM interface.

The UICC/SIM/USIM interface supports 2.85V and 1.8V SIM cards.

The CCIN signal serves to detect whether a tray (with SIM card) is present in the card holder. Using the CCIN signal is mandatory for compliance with the GSM 11.11 recommendation if the mechanical design of the host application allows the user to remove the SIM card during operation. To take advantage of this feature, an appropriate SIM card detect switch is required on the card holder. For example, this is true for the model supplied by Molex, which has been tested to operate with ALAS66A and is part of the Gemalto M2M reference equipment submitted for type approval. See Chapter 7 for Molex ordering numbers.

Table 3: Signals of the SIM interface (SMT application interface)

Signal	Description
GND	Ground connection for SIM interfaces. Optionally a separate SIM ground line may be used to improve EMC.
CCCLK	Chipcard clock line for SIM interface.
CCVCC	SIM supply voltage line for SIM interface.
CCIO	Serial data line for SIM interface, input and output.
CCRST	Chipcard reset line SIM interface.
CCIN	Input on the baseband processor for detecting a SIM card tray in the holder. If the SIM is removed during operation the SIM interface is shut down immediately to prevent destruction of the SIM. The CCIN signal is active low. The CCIN signal is mandatory for applications that allow the user to remove the SIM card during operation. The CCIN signal is solely intended for use with a SIM card. It must not be used for any other purposes. Failure to comply with this requirement may invalidate the type approval of ALAS66A.

Note: No guarantee can be given, nor any liability accepted, if loss of data is encountered after removing the SIM card during operation. Also, no guarantee can be given for properly initializing any SIM card that the user inserts after having removed the SIM card during operation. In this case, the application must restart ALAS66A.

2.1 Application Interface
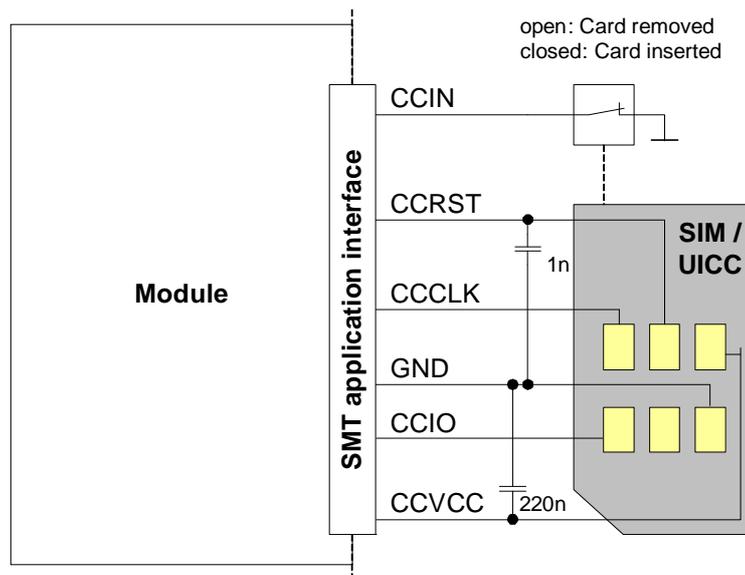
Figure 6: First UICC/SIM/USIM interface

The total cable length between the SMT application interface pads on ALAS66A and the pads of the external SIM card holder must not exceed 100mm in order to meet the specifications of 3GPP TS 51.010-1 and to satisfy the requirements of EMC compliance.

To avoid possible cross-talk from the CCCLK signal to the CCIO signal be careful that both lines are not placed closely next to each other. A useful approach is using the GND line to shield the CCIO line from the CCCLK line.

2.1.6 Digital Audio Interface

ALAS66A supports one digital audio interface that can be employed as inter IC sound (I2S) interface.

2.1.6.1 Inter IC Sound Interface (I²S)

The I²S Interface is a standardized bidirectional I²S ("Inter-IC Sound Interface") based digital audio interface for transmission of mono voice signals for telephony services.

The I²S properties and capabilities comply with the requirements layed out in the Phillips I2S Bus Specifications, revised June 5, 1996.

2.1.7 Analog-to-Digital Converter (ADC)

ALAS66A provides four unbalanced ADC input lines: ADC[1-2...4-5]_IN. They can be used to measure four independent, externally connected DC voltages in the range of 0.1V to 1.7V.

2.1.8 GPIO Interface

ALAS66A has 18 GPIOs for external hardware devices. Each GPIO can be configured for use as input or output.

2.1.9 eMMC Interface

ALAS66A has an eMMC interface that can be used for test purposes, e.g., to write crash dumps from the module's FFS to eMMC.

2.2   GSM/UMTS/LTE Antenna Interface

The ALAS66A GSM/UMTS/LTE antenna interface comprises two GSM/UMTS/LTE main antennas as well as two UMTS/LTE Rx diversity/MIMO antennas to improve signal reliability and quality[1]. The interface has an impedance of 50Ω. ALAS66A is capable of sustaining a total mismatch at the antenna interface without any damage, even when transmitting at maximum RF power.

The external antennas must be matched properly to achieve best performance regarding radiated power, modulation accuracy and harmonic suppression. Matching networks are not included on the ALAS66A PCB and should be placed in the host application, if the antenna does not have an impedance of 50Ω.

Regarding the return loss ALAS66A provides the following values in the active band:

Table 4: Return loss in the active band

State of module	Return loss of module	Recommended return loss of application
Receive	≥ 8dB	≥ 12dB
Transmit	Undefined mismatch	≥ 12dB

---

1. By delivery default the UMTS/LTE Rx diversity/MIMO antennas are configured as available for the module since its usage is mandatory for LTE. Please refer to [1] for details on how to configure antenna settings.

2.2.1   Antenna Installation

The antennas are connected by soldering the antenna pads (ANT_TRX1, ANT_TRX2, ANT_RX3, ANT_RX4; ANT_GNSS) and their neighboring ground pads directly to the application's PCB.

The distance between the antenna pads and their neighboring GND pads has been optimized for best possible impedance. To prevent mismatch, special attention should be paid to these pads on the application' PCB.

The wiring of the antenna connection, starting from the antenna pad to the application's antenna must result in a 50Ω line impedance. Line width and distance to the GND plane need to be optimized with regard to the PCB's layer stack.

To prevent receiver desensitization due to interferences generated by fast transients like high speed clocks on the external application PCB, it is recommended to realize the antenna connection line using embedded Stripline rather than Micro-Stripline technology. Please see Section 2.2.2 for instructions of how to design the antenna connection in order to achieve the required 50Ω line impedance.

For type approval purposes(i.e., FCC KDB 996369 related to modular approval requirements), an external application must connect the RF signal in one of the following ways:
• Via 50Ω coaxial antenna connector (common connectors are U-FL or SMA) placed as close as possible to the module's antenna pad.
• By soldering the antenna to the antenna connection line on the application's PCB (without the use of any connector) as close as possible to the module's antenna pad.
• By routing the application PCB's antenna to the module's antenna pad in the shortest possible way.

2.2.2   RF Line Routing Design

2.2.2.1   Line Arrangement Instructions

Several dedicated tools are available to calculate line arrangements for specific applications and PCB materials - for example from http://www.polarinstruments.com/ (commercial software) or from http://web.awrcorp.com/Usa/Products/Optional-Products/TX-Line/ (free software).

Embedded Stripline
This below figure shows line arrangement examples for embedded stripline.

Figure 7: Embedded Stripline line arrangement

Micro-Stripline

This section gives two line arrangement examples for micro-stripline.

Coated Coplanar Waveguide With Ground 1B		
Substrate 1 Height	H1	1000,000
Substrate 1 Dielectric	Er1	4,4000
Lower Trace Width	W1	800,0000
Upper Trace Width	W2	800,0000
Ground Strip Separation	D1	185,0000
Trace Thickness	T1	25,0000
Coating Above Substrate	C1	15,0000
Coating Above Trace	C2	15,0000
Coating Dielectric	CEr	4,0000

Coated Coplanar Waveguide With Ground 1B		
Substrate 1 Height	H1	1500,000
Substrate 1 Dielectric	Er1	4,4000
Lower Trace Width	W1	800,0000
Upper Trace Width	W2	800,0000
Ground Strip Separation	D1	165,0000
Trace Thickness	T1	25,0000
Coating Above Substrate	C1	15,0000
Coating Above Trace	C2	15,0000
Coating Dielectric	CEr	4,0000

Coated Coplanar Waveguide With Ground 1B		
Substrate 1 Height	H1	1000,000
Substrate 1 Dielectric	Er1	4,4000
Lower Trace Width	W1	1050,000
Upper Trace Width	W2	1050,000
Ground Strip Separation	D1	275,0000
Trace Thickness	T1	25,0000
Coating Above Substrate	C1	15,0000
Coating Above Trace	C2	15,0000
Coating Dielectric	CEr	4,0000

Coated Coplanar Waveguide With Ground 2B		
Substrate 1 Height	H1	708,0000 ±
Substrate 1 Dielectric	Er1	4,5000 ±
Substrate 2 Height	H2	90,0000 ±
Substrate 2 Dielectric	Er2	4,0000 ±
Lower Trace Width	W1	800,0000 ±
Upper Trace Width	W2	775,0000 ±
Ground Strip Separation	D1	190,0000 ±
Trace Thickness	T1	25,0000 ±
Coating Above Substrate	C1	20,0000 ±
Coating Above Trace	C2	20,0000 ±
Coating Dielectric	CEr	3,0000 ±

Notes: (First 5 lines will print)

Figure 8: Micro-Stripline line arrangement samples

2.2.2.2   Routing Examples

Interface to RF Connector

Figure 9 and Figure 10 show a sample connection of a module's antenna pad at the bottom layer of the module PCB with an application PCB's coaxial antenna connector. Line impedance depends on line width, but also on other PCB characteristics like dielectric, height and layer gap. The sample stripline width of 0.50mm/0.75mm and the spaces of 0.35mm/0.3mm are only recommended for an application with a PCB layer stack resembling the one of the ALAS66A evaluation board, and with layer 2 as well as layer 3 cut clear. For different layer stacks the stripline width will have to follow stripline routing rules, avoiding 90 degree corners and using the shortest distance to the PCB's coaxial antenna connector.
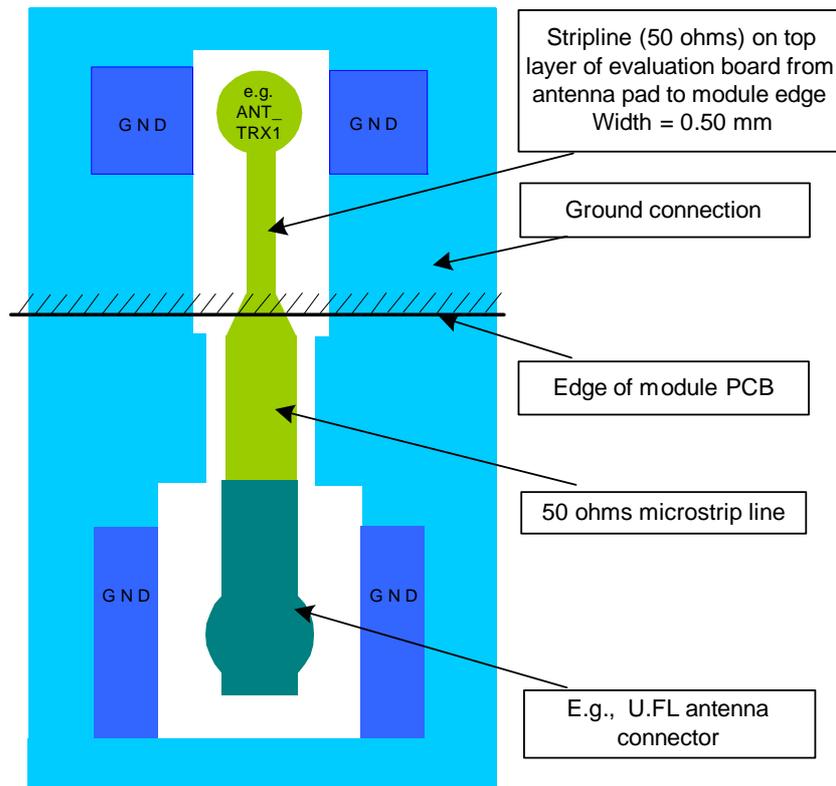
Figure 9: Routing to application's RF connector
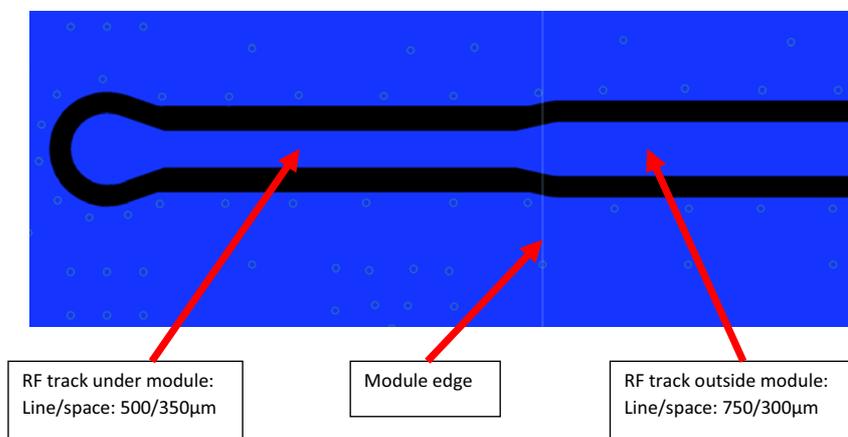
Figure 10: Routing detail

2.3   GNSS Antenna Interface

In addition to the RF antenna interface ALAS66A also has a GNSS antenna interface. The GNSS pad's shape is the same as for the RF antenna interface (see Section 2.2.1).

It is possible to connect active or passive GNSS antennas. In either case they must have 50Ω impedance. The simultaneous operation of GSM/UMTS/LTE and GNSS is implemented.

ALAS66A provides the signal GNSS_EN to enable an active GNSS antenna power supply. Figure 11 shows the flexibility in realizing the power supply for an active GNSS antenna by giving a sample circuit realizing the supply voltage for an active GNSS antenna.
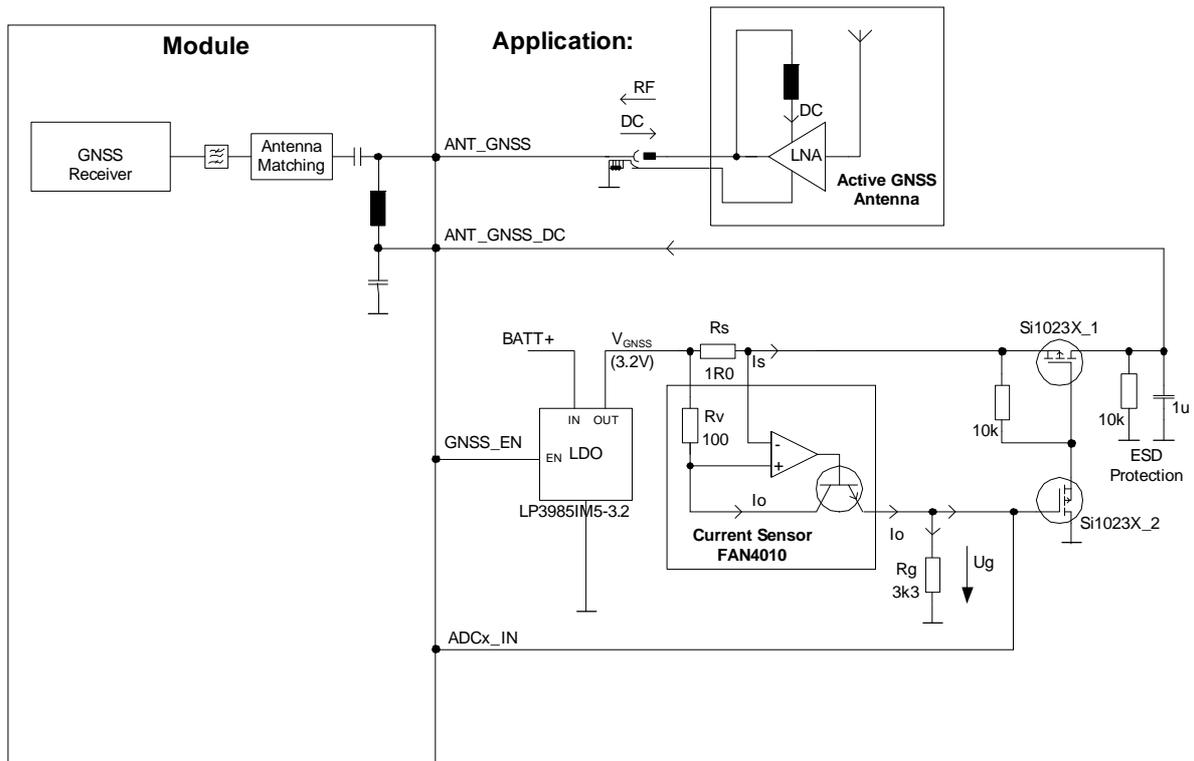
Figure 11: Supply voltage for active GNSS antenna

Figure 12 shows a sample circuit realizing ESD protection for a passive GNSS antenna. Connecting the input ANT_GNSS_DC to GND prevents ESD from coupling into the module.
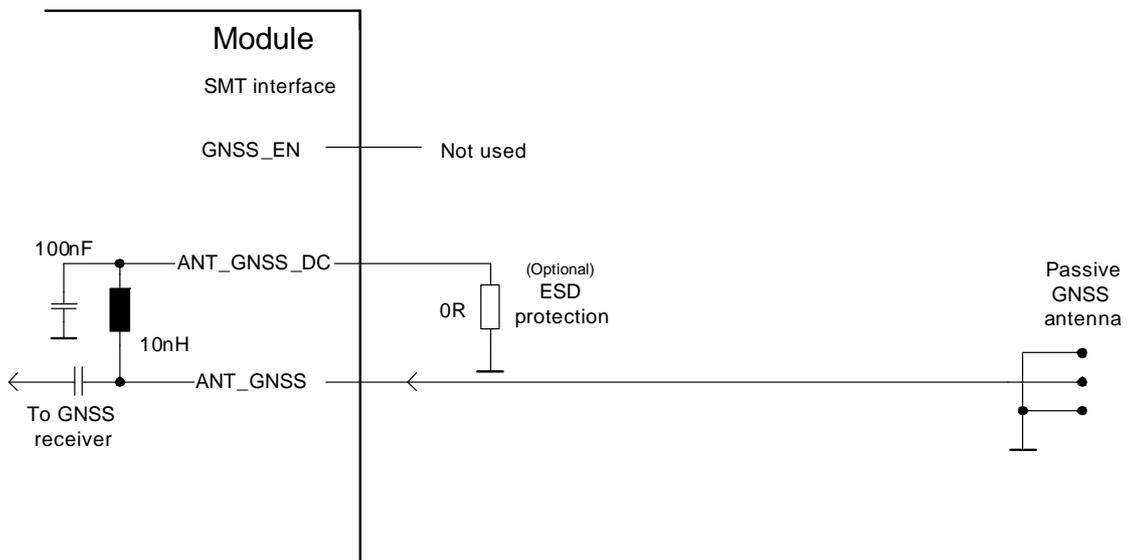
Figure 12: ESD protection for passive GNSS antenna

2.4   Sample Application

Figure 13 shows a typical example of how to integrate an ALAS66A module with an application.

The PWR_IND line is an open collector that needs an external pull-up resistor which connects to the voltage supply VCC μC of the microcontroller. Low state of the open collector pulls the PWR_IND signal low and indicates that the ALAS66A module is active, high level notifies the Power Down mode.

If the module is in Power Down mode avoid current flowing from any other source into the module circuit, for example reverse current from high state external control lines. Therefore, the controlling application must be designed to prevent reverse flow.

**While developing SMT applications it is strongly recommended to provide test points for certain signals, i.e., lines to and from the module - for debug and/or test purposes. The SMT application should allow for an easy access to these signals. For details on how to implement test points see [2].**

The EMC measures are best practice recommendations. In fact, an adequate EMC strategy for an individual application is very much determined by the overall layout and, especially, the position of components.

Some LGA pads are connected to clocks or high speed data streams that might interfere with the module's antenna. The RF receiver would then be blocked at certain frequencies (self interference). The external application's PCB tracks connected to these pads should therefore be well shielded or kept away from the antenna. This applies especially to the USB and UICC/SIM interfaces.

Depending on the micro controller used by an external application ALAS66A's digital input and output lines may require level conversion.

Disclaimer:
No warranty, either stated or implied, is provided on the sample schematic diagram shown in Figure 13 and the information detailed in this section. As functionality and compliance with national regulations depend to a great amount on the used electronic components and the individual application layout manufacturers are required to ensure adequate design and operating safeguards for their products using ALAS66A modules.

2.4 Sample Application
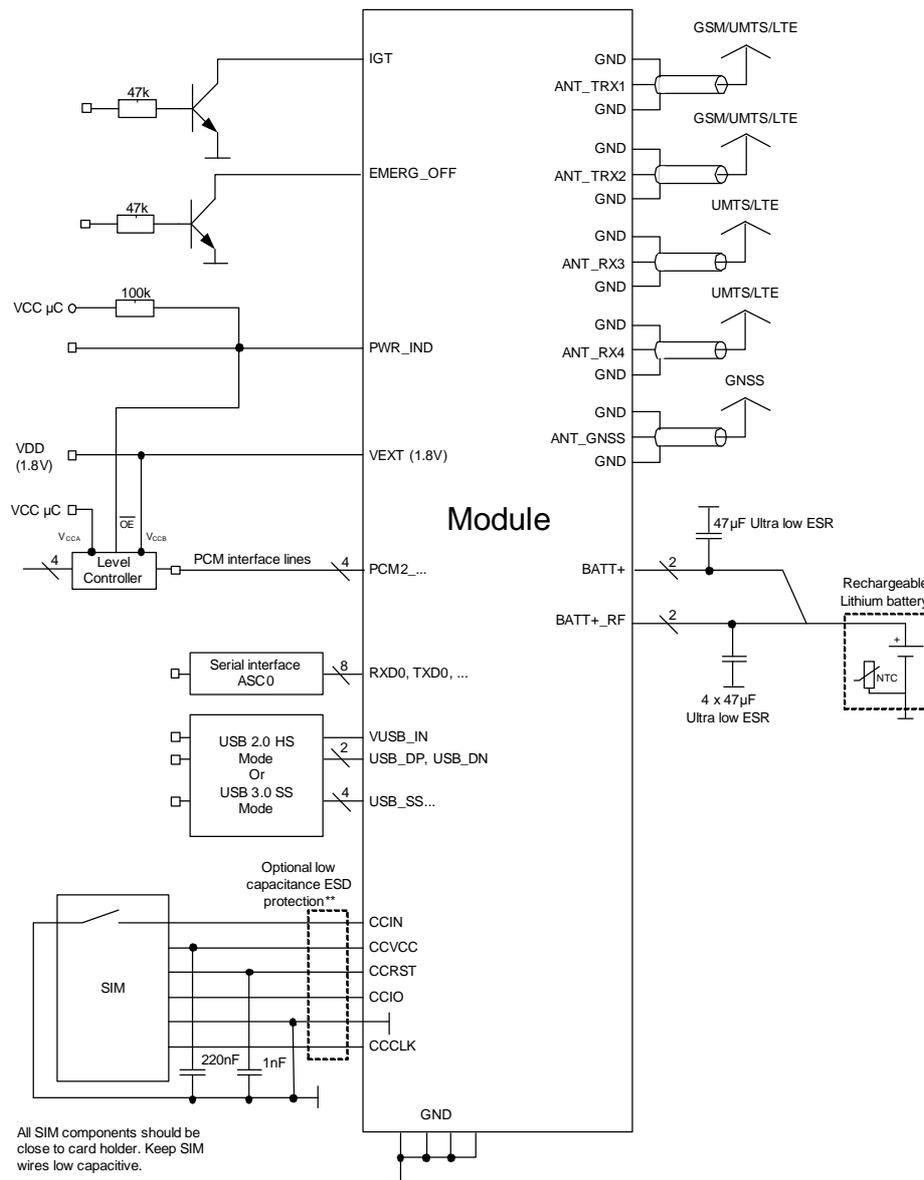
Figure 13: ALAS66A sample application

3 GNSS Interface

ALAS66A integrates a GNSS receiver that offers the full performance of GPS/GLONASS technology. The GNSS receiver is able to continuously track all satellites in view, thus providing accurate satellite position data.

The integrated GNSS receiver supports the NMEA protocol via USB or ASC0 interface. NMEA is a combined electrical and data specification for communication between various (marine) electronic devices including GNSS receivers. It has been defined and controlled by the US based National Marine Electronics Association. For more information on the NMEA Standard please refer to http://www.nmea.org.

Depending on the receiver's knowledge of last position, current time and ephemeris data, the receiver's startup time (i.e., TTFF = Time-To-First-Fix) may vary: If the receiver has no knowledge of its last position or time, a startup takes considerably longer than if the receiver has still knowledge of its last position, time and almanac or has still access to valid ephemeris data and the precise time.

By default, the GNSS receiver is switched off. It has to be switched on and configured.

Dead Reckoning Sync Line:
Dead reckoning solutions are used in (automotive) platforms to determine the (vehicles) location even when there is no GNSS signal available (e.g. in tunnels, basement garages or even between high buildings in cities).

In addition to dead reckoning related NMEA sentences, ALAS66A provides a dead reckoning synchronization line (DR_SYNC line) to be employed in external dead reckoning applications. DR_SYNC is derived from the GNSS signal clock as 1 pulse per second (1PPS) signal. The DR_SYNC signal is provided as long as synchronized with the GNSS satellite clock, and continues after GNSS signal loss.

4   Mechanical Dimensions and Mounting

4.1   Mechanical Dimensions of ALAS66A

Figure 14 shows a 3D view[1] of ALAS66A and provides an overview of the board's mechanical dimensions[2]. For further details see Figure 15.

Length:	48mm
Width:	36mm
Height:	3mm
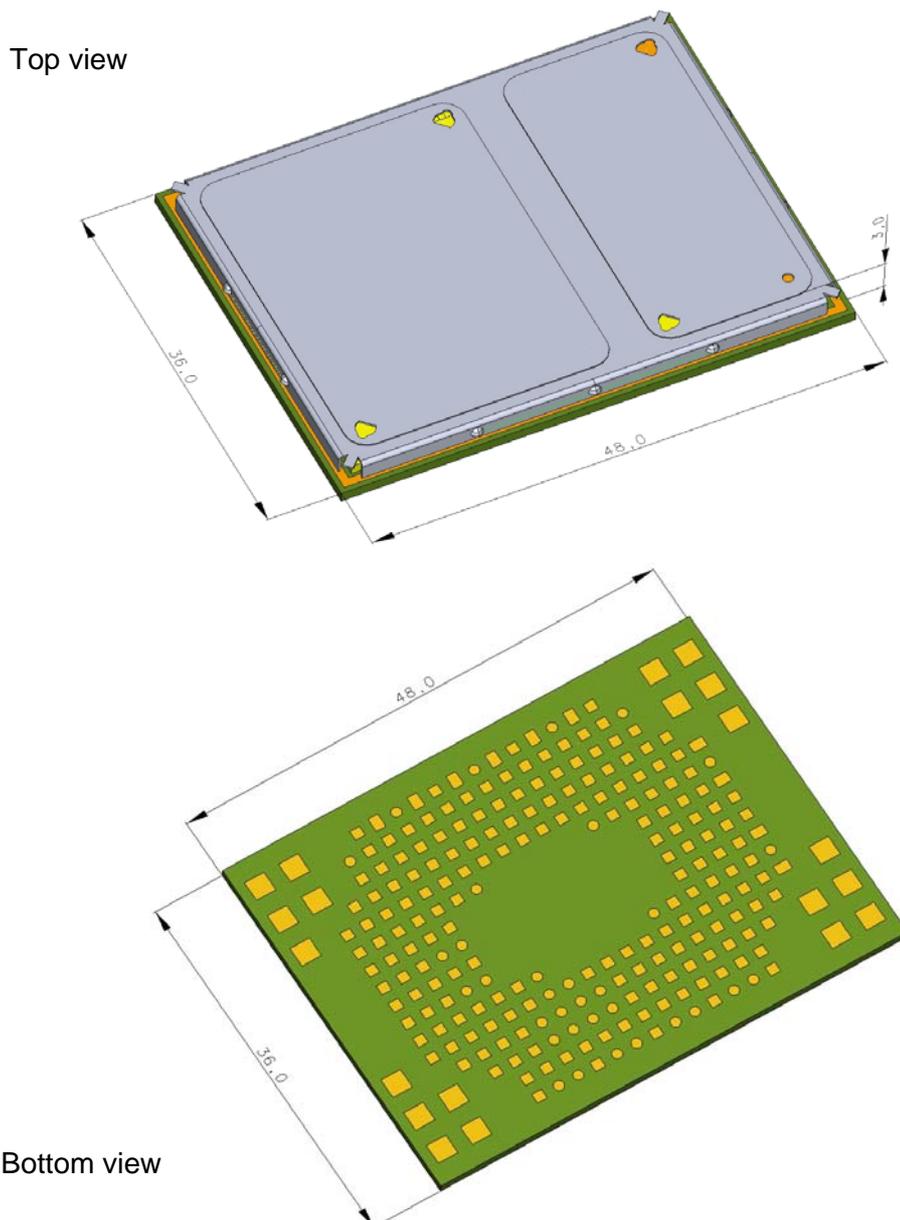
Figure 14: ALAS66A – top and bottom view

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1. The coloring of the 3D view does not reflect the module's real color.
2. **Note:** The holes in the shielding (top view) are significantly smaller than the radiated wavelength from the module. Gemalto guarantees that there will be no emissions outside the limits from these. The RF circuitry of the module is fully shielded.

4.1 Mechanical Dimensions of ALAS66A

bottom view
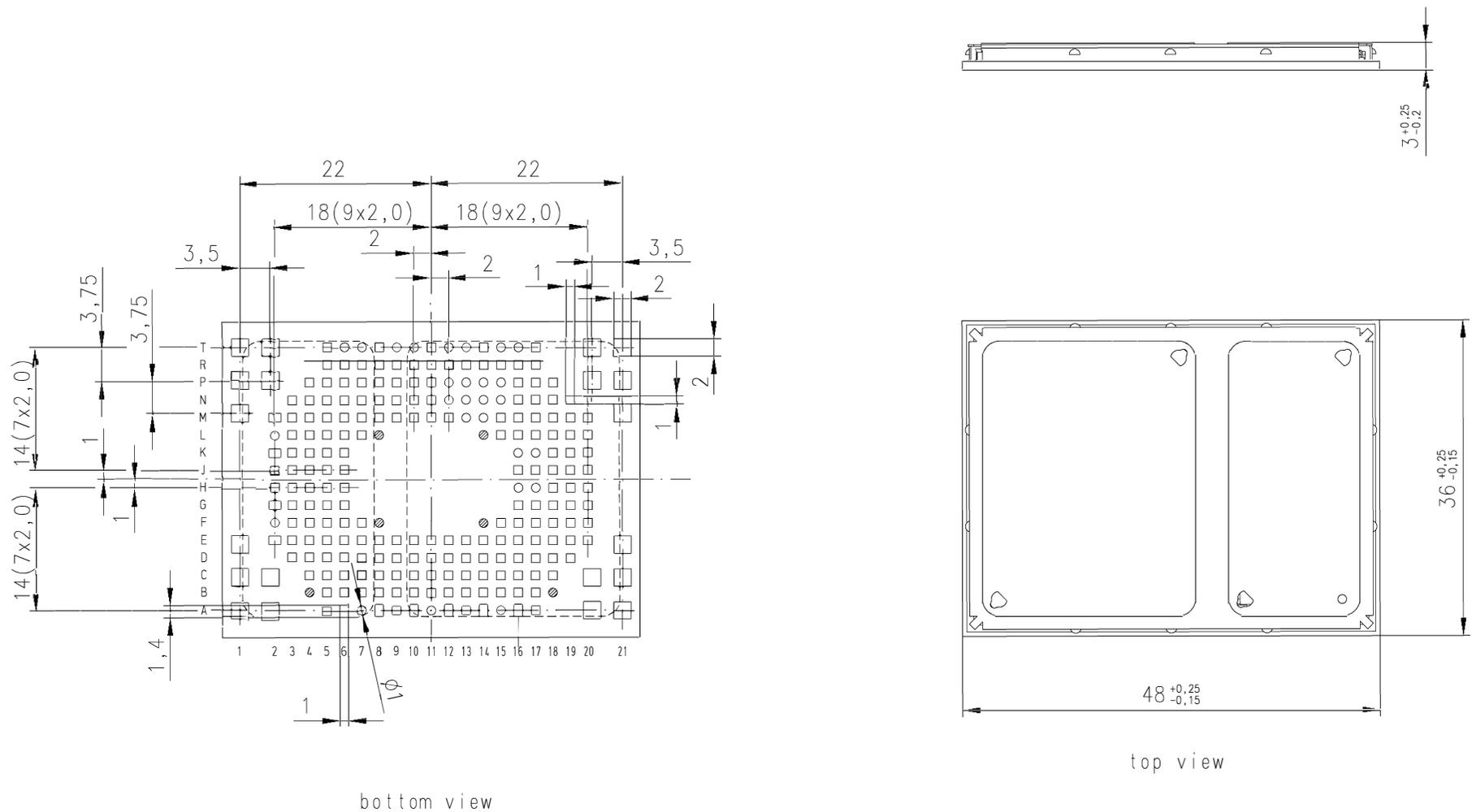
⌀ no solder pads /keep area free

top view

Figure 15: Dimensions of ALAS66A (all dimensions in mm)

5   Regulatory and Type Approval Information

5.1   Directives and Standards

ALAS66A has been designed to comply with the directives and standards listed below.

It is the responsibility of the application manufacturer to ensure compliance of the final product with all provisions of the applicable directives and standards as well as with the technical specifications provided in the "ALAS66A Hardware Interface Description".[1]

Table 5: Directives

2014/53/EU	Directive of the European Parliament and of the council of 16 April 2014 on the harmonization of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/05/EC. The product is labeled with the CE conformity mark.
2002/95/EC (RoHS 1) 2011/65/EC (RoHS 2)	Directive of the European Parliament and of the Council of 27 January 2003 (and revised on 8 June 2011) on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS)

Table 6: Standards of North American type approval[1]

CFR Title 47	Code of Federal Regulations, Part 22, Part 24, Part 27, and Part 90; US Equipment Authorization FCC
OET Bulletin 65 (Edition 97-01)	Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields
UL 60 950-1	Product Safety Certification (Safety requirements)
NAPRD.03 V5.35[2]	Overview of PCS Type certification review board Mobile Equipment Type Certification and IMEI control PCS Type Certification Review board (PTCRB)
RSS132, RSS133, RSS139	Canadian Standard

1. Standards apply to ALAS66A-W and ALAS66A-US only.
2. ALAS66A-US complies with NAPRD.03 V5.38.

Table 7: Standards of European type approval

3GPP TS 51.010-1	Digital cellular telecommunications system (Release 7); Mobile Station (MS) conformance specification;
ETSI EN 301 511 V12.5.1	Global System for Mobile communications (GSM); Mobile Stations (MS) equipment; Harmonized Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU
GCF-CC V3.70[1]	Global Certification Forum - Certification Criteria

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1. Manufacturers of applications which can be used in the US shall ensure that their applications have a PTCRB approval. For this purpose they can refer to the PTCRB approval of the respective module.

Table 7: Standards of European type approval

ETSI EN 301 489-01 V2.1.1	Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements; Harmonized Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU and the essential requirements of article 6 of Directive 2014/30/EU
Draft ETSI EN 301 489-19 V2.1.0	Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 19: Specific conditions for Receive Only Mobile Earth Stations (ROMES) operating in the 1,5 GHz band providing data communications and GNSS receivers operating in the RNSS band (ROGNSS) providing positioning, navigation, and timing data; Harmonized Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU
Draft ETSI EN 301 489-52 V1.1.0	Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 52: Specific conditions for Cellular Communication Mobile and portable (UE) radio and ancillary equipment; Harmonized Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU
ETSI EN 301 908-01 V11.1.1	IMT cellular networks; Harmonized Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU; Part 1: Introduction and common requirements
ETSI EN 301 908-02 V11.1.2	IMT cellular networks; Harmonized Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU; Part 2: CDMA Direct Spread (UTRA FDD) User Equipment (UE)
ETSI EN 301 908-13 V11.1.2	IMT cellular networks; Harmonized Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU; Part 13: Evolved Universal Terrestrial Radio Access (E-UTRA) User Equipment (UE)
EN 60950-1:2006/ A11:2009+A1:2010+A1 2:2011+A2:2013	Safety of information technology equipment

1. ALAS66A-US complies with GCF-CC V3.72.

Table 8: Requirements of quality

IEC 60068	Environmental testing
DIN EN 60529	IP codes

Table 9: Standards of the Ministry of Information Industry of the People's Republic of China

SJ/T 11363-2006	"Requirements for Concentration Limits for Certain Hazardous Substances in Electronic Information Products" (2006-06).
SJ/T 11364-2006	"Marking for Control of Pollution Caused by Electronic Information Products" (2006-06). According to the "Chinese Administration on the Control of Pollution caused by Electronic Information Products" (ACPEIP) the EPUP, i.e., Environmental Protection Use Period, of this product is 20 years as per the symbol shown here, unless otherwise marked. The EPUP is valid only as long as the product is operated within the operating limits described in the Hardware Interface Description. Please see Table 10 for an overview of toxic or hazardous substances or elements that might be contained in product parts in concentrations above the limits defined by SJ/T 11363-2006.

Table 10: Toxic or hazardous substances or elements with defined concentration limits

部件名称 Name of the part	有毒有害物质或元素 Hazardous substances					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
金属部件 (Metal Parts)	O	O	O	O	O	O
电路模块 (Circuit Modules)	X	O	O	O	O	O
电缆及电缆组件 (Cables and Cable Assemblies)	O	O	O	O	O	O
塑料和聚合物部件 (Plastic and Polymeric parts)	O	O	O	O	O	O

O:

表示该有毒有害物质在该部件所有均质材料中的含量均在SJ/T11363-2006 标准规定的限量要求以下。

Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in SJ/T11363-2006.

X:

表示该有毒有害物质至少在该部件的某一均质材料中的含量超出SJ/T11363-2006标准规定的限量要求。

Indicates that this toxic or hazardous substance contained in at least one of the homogeneous materials used for this part *might exceed* the limit requirement in SJ/T11363-2006.

5.2   SAR requirements specific to portable mobiles

Mobile phones, PDAs or other portable transmitters and receivers incorporating a GSM module must be in accordance with the guidelines for human exposure to radio frequency energy. This requires the Specific Absorption Rate (SAR) of portable ALAS66A based applications to be evaluated and approved for compliance with national and/or international regulations.

Since the SAR value varies significantly with the individual product design manufacturers are advised to submit their product for approval if designed for portable use. For US and European markets the relevant directives are mentioned below. It is the responsibility of the manufacturer of the final product to verify whether or not further standards, recommendations or directives are in force outside these areas.

Products intended for sale on US markets
ES 59005/ANSI C95.1 Considerations for evaluation of human exposure to electromagnetic fields (EMFs) from mobile telecommunication equipment (MTE) in the frequency range 30MHz - 6GHz

Products intended for sale on European markets
EN 50360   Product standard to demonstrate the compliance of mobile phones with the basic restrictions related to human exposure to electromagnetic fields (300MHz - 3GHz)
EN 62311:2008   Assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0 Hz - 300 GHz)
IMPORTANT:
Manufacturers of portable applications based on ALAS66A modules are required to have their final product certified and apply for their own FCC Grant and ISED Certificate related to the specific portable mobile.

5.3   Reference Equipment for Type Approval

The Gemalto M2M general reference setup submitted to type approve ALAS66A is shown in the figure below: Figure 16 illustrates the setup for general tests and evaluation purposes. The evaluation module can be plugged directly onto an Audio Adapter. The GSM/UMTS/LTE/ GNSS test equipment is still connected via SMA connectors on the evaluation module. The PC is connected via USB interface on the evaluation module, and the audio test equipment via audio jack on the Audio Adapter.
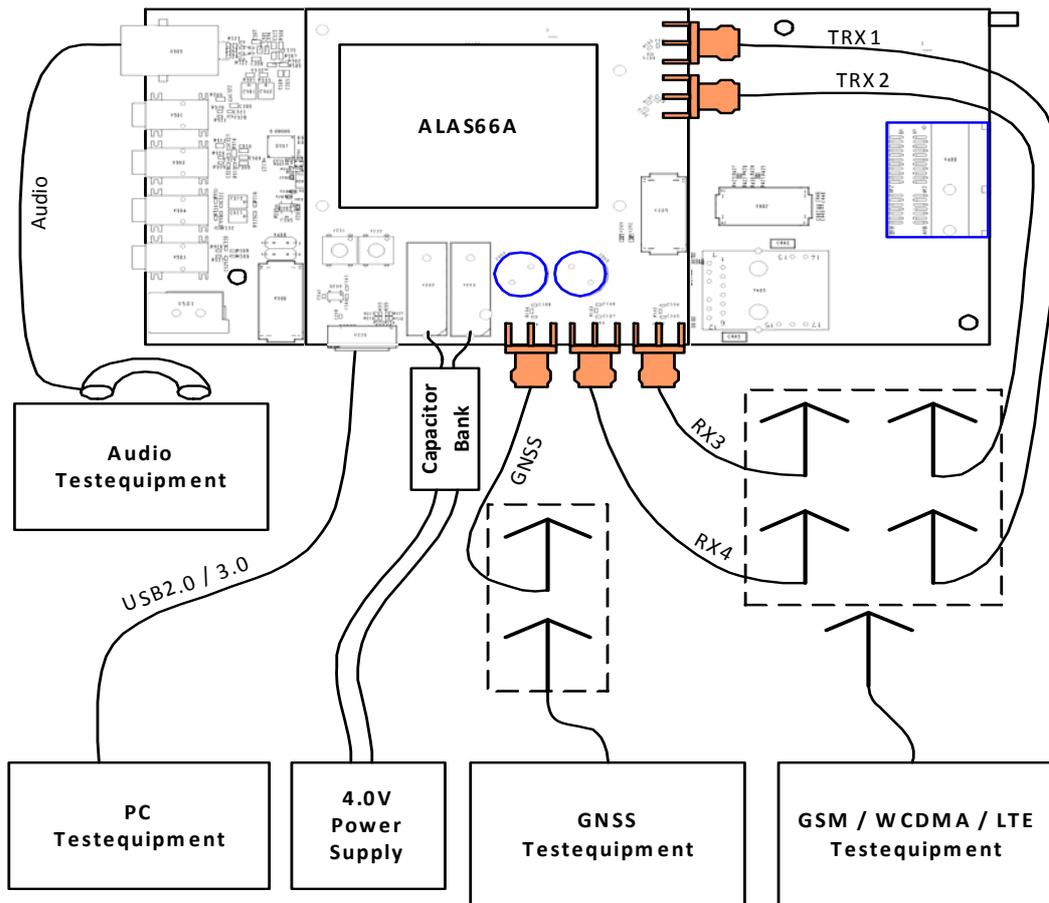

Figure 16: Reference equipment for type approval

Please note that for EMC and RF performance tests, slightly different reference equipment configurations are used. If necessary, please contact Gemalto for further details.

5.4 Compliance with FCC and ISED Rules and Regulations

The Equipment Authorization Certification for the Gemalto M2M modules reference application described in Section 5.3 will be registered under the following identifiers:

- ALAS66A-W:
  FCC Identifier QIPALAS66A-W
  Granted to Gemalto M2M GmbH

- ALAS66A-US:
  FCC Identifier QIPALAS66A-US
  ISED Certification Number: 7830A-ALAS66AUS
  Granted to Gemalto M2M GmbH

Manufacturers of mobile or fixed devices incorporating ALAS66A-W modules are authorized to use the FCC Grants and ISED Certificates of the ALAS66A-W modules for their own final products according to the conditions referenced in these documents. In this case, the FCC label of the module shall be visible from the outside, or the host device shall bear a second label stating "Contains FCC ID: QIPALAS66A-W"or "Contains FCC ID: QIPALAS66A-US", and accordingly "Contains IC: 7830A-ALAS66AUS". The integration is limited to fixed or mobile categorized host devices, where a separation distance between the antenna and any person of min. 20cm can be assured during normal operating conditions.

For mobile and fixed operation configurations the antenna gain, including cable loss, must not exceed the limits listed in the following Table 11 and Table 12 for FCC and/or ISED.

Table 11: Antenna gain limits for FCC for ALAS66A-W

Maximum gain in operating band	FCC limit	Unit
850MHz (GSM)	2.5	dBi
1900MHZ (GSM)	8.0	dBi
Band V (UMTS)	8.5	dBi
Band 5 (LTE-FDD)	9.4	dBi
Band 7 (LTE-FDD)	12.0	dBi
Band 26 (LTE-FDD)	9.8	dBi

Table 12: Antenna gain limits for FCC and ISED for ALAS66A-US

Maximum gain in operating band	FCC limit	ISED limit	Unit
850MHz (GSM)	3.4	0.1	dBi
1900MHZ (GSM)	2.0	2.0	dBi
Band II (UMTS)	7.5	7.5	dBi
Band IV (UMTS)	4.7	4.7	dBi
Band V (UMTS)	8.4	5.1	dBi
Band 2 (LTE-FDD)	9.1	8.5	dBi
Band 4 (LTE-FDD)	6.5	6.5	dBi
Band 5 (LTE-FDD)	9.4	6.1	dBi

Table 12: Antenna gain limits for FCC and ISED for ALAS66A-US

Maximum gain in operating band	FCC limit	ISED limit	Unit
Band 7 (LTE-FDD)	6.5	6.5	dBi
Band 12 (LTE-FDD)	9.2	5.9	dBi
Band 13 (LTE-FDD)	8.7	5.6	dBi
Band 66(LTE-FDD)	6.4	6.4	dBi

IMPORTANT:
Manufacturers of portable applications incorporating ALAS66A-W/-US modules are required to have their final product certified and apply for their own FCC Grant and/or ISED Certificate related to the specific portable mobile. This is mandatory to meet the SAR requirements for portable mobiles (see Section 5.2 for detail).

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules and with ISED license-exempt RSS standard(s). These limits are designed to provide reasonable protection against harmful interference in a residential 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.

This Class B digital apparatus complies with Canadian ICES-003.

If Canadian approval is requested for devices incorporating ALAS66A modules the above note will have to be provided in the English and French language in the final user documentation. Manufacturers/OEM Integrators must ensure that the final user documentation does not contain any information on how to install or remove the module from the final product.

Notes (ISED):

(EN) This Class B digital apparatus complies with Canadian ICES-003 and RSS-210. 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.

(FR) Cet appareil numérique de classe B est conforme aux normes canadiennes ICES-003 et RSS-210. Son fonctionnement est soumis aux deux conditions suivantes: (1) cet appareil ne doit pas causer d'interférence et (2) cet appareil doit accepter toute interférence, notamment les interférences qui peuvent affecter son fonctionnement.

(EN) Radio frequency (RF) Exposure Information
The radiated output power of the Wireless Device is below the Industry Canada (IC) radio frequency exposure limits. The Wireless Device should be used in such a manner such that the potential for human contact during normal operation is minimized.
This device has also been evaluated and shown compliant with the IC RF Exposure limits under mobile exposure conditions. (antennas are greater than 20cm from a person's body).

(FR) Informations concernant l'exposltion aux fréquences radio (RF)
La puissance de sortie émise par l'appareil de sans fil est inférieure à la limite d'exposition aux fréquences radio d'Industry Canada (IC). Utilisez l'appareil de sans fil de façon à minimiser les contacts humains lors du fonctionnement normal.
Ce périphérique a également été évalué et démontré conforme aux limites d'exposition aux RF d'IC dans des conditions d'exposition à des appareils mobiles (les antennes se situent à moins de 20cm du corps d'une personne).

6 Document Information

6.1 Revision History

Preceding document: "Cinterion® ALAS66A Hardware Interface Overview" v00.001
New document: "Cinterion® ALAS66A Hardware Interface Overview" **v01.000a**

Chapter	What is new
1.2.1	Revised support for LTE-FDD Band 41. Added LTE-FDD Band 30. Added note for LTE-FDD Band 66.
1.2.2	Added note that carrier aggregation is planned, and will be supported in a future version.
4.1	Added note to Figure 14.
5.4	Revised section and added antenna gain limits.

New document: "Cinterion® ALAS66A Hardware Interface Overview" v00.001

Chapter	What is new
--	Initial document setup.

6.2 Related Documents

[1] ALAS66A Release Note
[2] Application Note 48: SMT Module Integration
[3] Universal Serial Bus Specification Revision 3.0
[4] Universal Serial Bus Specification Revision 2.0

6.3 Terms and Abbreviations

Abbreviation	Description
ANSI	American National Standards Institute
ARP	Antenna Reference Point
CA	Carrier Aggregation
CE	Conformité Européene (European Conformity)
CS	Coding Scheme
CS	Circuit Switched
CSD	Circuit Switched Data
DL	Download
dnu	Do not use
DRX	Discontinuous Reception
DSB	Development Support Board
DTX	Discontinuous Transmission
EDGE	Enhanced Data rates for GSM Evolution
EGSM	Extended GSM
EMC	Electromagnetic Compatibility
ESD	Electrostatic Discharge
ETS	European Telecommunication Standard
ETSI	European Telecommunications Standards Institute
FDD	Frequency Division Duplex
GPRS	General Packet Radio Service
GSM	Global Standard for Mobile Communications
HiZ	High Impedance
HSDPA	High Speed Downlink Packet Access
I/O	Input/Output
IMEI	International Mobile Equipment Identity
ISED	Innovation, Science and Economic Development Canada
ISO	International Standards Organization

Abbreviation	Description
ITU	International Telecommunications Union
kbps	kbits per second
LED	Light Emitting Diode
LGA	Land Grid Array
LTE	Long term evolution
MBB	Moisture barrier bag
Mbps	Mbits per second
MCS	Modulation and Coding Scheme
MIMO	Multiple Input Multiple Output
MLCC	Multi Layer Ceramic Capacitor
eMMC	Embedded MultiMediaCard
MO	Mobile Originated
MS	Mobile Station, also referred to as TE
MSL	Moisture Sensitivity Level
MT	Mobile Terminated
nc	Not connected
NTC	Negative Temperature Coefficient
PCB	Printed Circuit Board
PCIe	Peripheral Component Interconnect Express
PCL	Power Control Level
PCS	Personal Communication System, also referred to as GSM 1900
PD	Pull Down resistor
PDU	Protocol Data Unit
PS	Packet Switched
PSK	Phase Shift Keying
PU	Pull Up resistor
QAM	Quadrature Amplitude Modulation
R&TTE	Radio and Telecommunication Terminal Equipment
RF	Radio Frequency
rfu	Reserved for future use
ROPR	Radio Output Power Reduction
RTC	Real Time Clock
Rx	Receive Direction
SAR	Specific Absorption Rate
SELV	Safety Extra Low Voltage
SIM	Subscriber Identification Module

Abbreviation	Description
SMD	Surface Mount Device
SMS	Short Message Service
SMT	Surface Mount Technology
SRAM	Static Random Access Memory
SRB	Signalling Radio Bearer
TE	Terminal Equipment
TPC	Transmit Power Control
TS	Technical Specification
Tx	Transmit Direction
UL	Upload
UMTS	Universal Mobile Telecommunications System
URC	Unsolicited Result Code
USB	Universal Serial Bus
UICC	USIM Integrated Circuit Card
USIM	UMTS Subscriber Identification Module
WCDMA	Wideband Code Division Multiple Access

6.4   Safety Precaution Notes

The following safety precautions must be observed during all phases of the operation, usage, service or repair of any cellular terminal or mobile incorporating ALAS66A. Manufacturers of the cellular terminal are advised to convey the following safety information to users and operating personnel and to incorporate these guidelines into all manuals supplied with the product. Failure to comply with these precautions violates safety standards of design, manufacture and intended use of the product. Gemalto M2M assumes no liability for customer's failure to comply with these precautions.

♥	When in a hospital or other health care facility, observe the restrictions on the use of mobiles. Switch the cellular terminal or mobile off, if instructed to do so by the guidelines posted in sensitive areas. Medical equipment may be sensitive to RF energy. The operation of cardiac pacemakers, other implanted medical equipment and hearing aids can be affected by interference from cellular terminals or mobiles placed close to the device. If in doubt about potential danger, contact the physician or the manufacturer of the device to verify that the equipment is properly shielded. Pacemaker patients are advised to keep their hand-held mobile away from the pacemaker, while it is on.
✈	Switch off the cellular terminal or mobile before boarding an aircraft. Make sure it cannot be switched on inadvertently. The operation of wireless appliances in an aircraft is forbidden to prevent interference with communications systems. Failure to observe these instructions may lead to the suspension or denial of cellular services to the offender, legal action, or both.
🔥	Do not operate the cellular terminal or mobile in the presence of flammable gases or fumes. Switch off the cellular terminal when you are near petrol stations, fuel depots, chemical plants or where blasting operations are in progress. Operation of any electrical equipment in potentially explosive atmospheres can constitute a safety hazard.
📺	Your cellular terminal or mobile receives and transmits radio frequency energy while switched on. Remember that interference can occur if it is used close to TV sets, radios, computers or inadequately shielded equipment. Follow any special regulations and always switch off the cellular terminal or mobile wherever forbidden, or when you suspect that it may cause interference or danger.
SOS	IMPORTANT! Cellular terminals or mobiles operate using radio signals and cellular networks. Because of this, connection cannot be guaranteed at all times under all conditions. Therefore, you should never rely solely upon any wireless device for essential communications, for example emergency calls. Remember, in order to make or receive calls, the cellular terminal or mobile must be switched on and in a service area with adequate cellular signal strength. Some networks do not allow for emergency calls if certain network services or phone features are in use (e.g. lock functions, fixed dialing etc.). You may need to deactivate those features before you can make an emergency call. Some networks require that a valid SIM card be properly inserted in the cellular terminal or mobile.

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7 Appendix

7.1 List of Parts and Accessories

Table 13: List of parts and accessories

Description	Supplier	Ordering information
ALAS66A	Gemalto M2M	Standard module Gemalto M2M IMEI: Packaging unit (ordering) number: L30960-N5000-A100 (ALAS66A-W) L30960-N5010-A100 (ALAS66A-E) L30960-N5020-A100 (ALAS66A-CN) L30960-N5030-A100(ALAS66A-US) Module label number: L30960-N5000-A100[1] (ALAS66A-W) L30960-N5010-A100[1] (ALAS66A-E) L30960-N5020-A100[1] (ALAS66A-CN) L30960-N5030-A100[1] (ALAS66A-US)
ALAS66A Evaluation module	Gemalto M2M	Ordering number: L30960-N5001-A100 (ALAS66A-W) L30960-N5011-A100 (ALAS66A-E) L30960-N5021-A100 (ALAS66A-CN) L30960-N5031-A100 (ALAS66A-US)
Audio Adapter for ALAS66A Evaluation modules	Gemalto M2M	Not available
Votronic Handset	VOTRONIC / Gemalto M2M	Votronic ordering number: HH-SI-30.3/V1.1/0 Votronic Entwicklungs- und Produktionsgesellschaft für elektronische Geräte mbH Saarbrücker Str. 8 66386 St. Ingbert Germany Phone: +49-(0)6 89 4 / 92 55-0 Fax: +49-(0)6 89 4 / 92 55-88 Email: contact@votronic.com
SIM card holder incl. push button ejector and slide-in tray	Molex	Ordering numbers: 91228 91236 Sales contacts are listed in Table 14.
U.FL antenna connector	Molex or Hirose	Sales contacts are listed in Table 14 and Table 15.

1. Note: At the discretion of Gemalto M2M, module label information can either be laser engraved on the module's shielding or be printed on a label adhered to the module's shielding.

Table 14: Molex sales contacts (subject to change)

Molex For further information please click: http://www.molex.com	Molex Deutschland GmbH Otto-Hahn-Str. 1b 69190 Walldorf Germany Phone: +49-6227-3091-0 Fax: +49-6227-3091-8100 Email: mxgermany@molex.com	American Headquarters Lisle, Illinois 60532 U.S.A. Phone: +1-800-78MOLEX Fax: +1-630-969-1352
Molex China Distributors Beijing, Room 1311, Tower B, COFCO Plaza No. 8, Jian Guo Men Nei Street, 100005 Beijing P.R. China Phone: +86-10-6526-9628 Fax: +86-10-6526-9730	Molex Singapore Pte. Ltd. 110, International Road Jurong Town, Singapore 629174 Phone: +65-6-268-6868 Fax: +65-6-265-6044	Molex Japan Co. Ltd. 1-5-4 Fukami-Higashi, Yamato-City, Kanagawa, 242-8585 Japan Phone: +81-46-265-2325 Fax: +81-46-265-2365

Table 15: Hirose sales contacts (subject to change)

Hirose Ltd. For further information please click: http://www.hirose.com	Hirose Electric (U.S.A.) Inc 2688 Westhills Court Simi Valley, CA 93065 U.S.A. Phone: +1-805-522-7958 Fax: +1-805-522-3217	Hirose Electric Europe B.V. German Branch: Herzog-Carl-Strasse 4 73760 Ostfildern Germany Phone: +49-711-456002-1 Fax: +49-711-456002-299 Email: info@hirose.de
Hirose Electric Europe B.V. UK Branch: First Floor, St. Andrews House, Caldecotte Lake Business Park, Milton Keynes MK7 8LE Great Britain Phone: +44-1908-369060 Fax: +44-1908-369078	Hirose Electric Co., Ltd. 5-23, Osaki 5 Chome, Shinagawa-Ku Tokyo 141 Japan Phone: +81-03-3491-9741 Fax: +81-03-3493-2933	Hirose Electric Europe B.V. Hogehillweg 8 1101 CC Amsterdam Z-O Netherlands Phone: +31-20-6557-460 Fax: +31-20-6557-469

About Gemalto

Since 1996, Gemalto has been pioneering groundbreaking M2M and IoT products that keep our customers on the leading edge of innovation.

We work closely with global mobile network operators to ensure that Cinterion® modules evolve in sync with wireless networks, providing a seamless migration path to protect your IoT technology investment.

Cinterion products integrate seamlessly with Gemalto identity modules, security solutions and licensing and monetization solutions, to streamline development timelines and provide cost efficiencies that improve the bottom line.

As an experienced software provider, we help customers manage connectivity, security and quality of service for the long lifecycle of IoT solutions.

For more information please visit
www.gemalto.com/m2m, www.facebook.com/gemalto, or Follow@gemaltoIoT on Twitter.

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