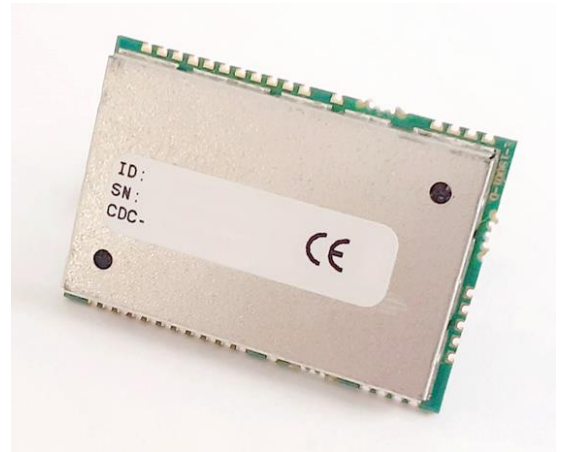


# KIM1

## Integration manual



Reference:

KINEIS-NT-19-0018

Issue:

2.0

Date:

June 16, 2020

## 1.1. Introduction

This document is an integration manual for the KIM1 transmitter module by Kinéis, complementing the component datasheet (see §5.3 **Related documents** for reference)

## 1.2. Revision history

Issue:	Date:	Ref:	Modifications:
1.0	April 23, 2019	JI	Document creation
1.1	April 30, 2019	JI	
1.2	June 4, 2019	AJ	Update
1.3	June 7, 2019	JI	Add notes
1.4	June 21, 2019	JI	Figure 3 modified
1.5	June 26, 2019	SV	Update of AT command
1.6	July 26, 2019	JI	Update 3.2.1 and 2.2 Update Table 2
2.0	June 12, 2020	CT	Suppression of the paragraphs (transferred into KIM1 Datasheet): <ol style="list-style-type: none"> <li>1. Product description</li> <li>2. Device information</li> <li>3. Electrical characteristics</li> </ol> Update of the paragraphs: <ol style="list-style-type: none"> <li>2. Typical application circuit</li> <li>3. UART communication</li> <li>4. Transmission protocol</li> </ol>

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## 3. UART Communication

The KIM1 serial interface uses a basic TTL 3.3V level signals with UART protocol. UART interface uses fixed parameters:

SPECIFICATION	DESCRIPTION
Baud Rate	4800 bps
Data bits	8 bits
Parity	None
Stop Bits	1 bit
Flow Control	No

Table 1 : UART Setting

### 3.1. AT commands syntax

There are three types of extended AT commands:

- Information type commands: allows to read only the module information.
- Parameter type commands:
  - "Set" to store a value or values for later use
  - "Read" the current value or values stored
- Action type commands: invokes a function of the equipment, which generally involves more than the simple storage of a value for later use.

For each AT command, there will be the following possible responses:

- OK, means the command is accepted and executed
- ERROR[, <ID>] means an error occurred during the execution of the command

The KIM1 can also send unsolicited responses occurring asynchronously between command execution:

- +RSP\_ID=... , where RSP\_ID is a response type followed by a list of values detailing the response

More generally, the AT command or responses will be a sentence terminated by <CR> on both side of communication.

## 3.2. Timing constraints

Once an AT command has been sent to module, one shall not send again a new command until previous has been completed with a response.

User shall wait at minimum 10ms before to send a new command after previous is completed.

## 3.3. AT commands description

### 1. Information type commands

#### a. ID number

ID – Read Kinéis ID number	
<b>AT+ID=?</b>	Read the Kinéis hexadecimal ID number of the module
<b>AT+ID=&lt;ID_length&gt;, &lt;ID_number&gt;</b>	Return message for the Read Kinéis ID number AT command  Parameters: <ul style="list-style-type: none"> <li>• <b>&lt;ID_length&gt;</b> - hexadecimal ID number length in bits (value is 28)</li> <li>• <b>&lt;ID_number&gt;</b> <ul style="list-style-type: none"> <li>○ Warning: should the ID number start with 0, this first digit may be omitted in the response</li> </ul> </li> </ul>

#### b. Firmware version

FW – Read Firmware version	
<b>AT+FW=?</b>	Read the firmware version from KIM1 module
<b>AT+FW=&lt;fw_version&gt;</b>	Return message for the Read Firmware version AT command  Parameter: <ul style="list-style-type: none"> <li>• <b>&lt;fw_version&gt;</b> - Firmware version flashed into the module</li> </ul>

### c. Serial number

SN – Read Serial Number	
AT+SN=?	Read the serial number from KIM1 module
AT+SN=<sn>	Return message for the Read Serial Number AT command  Parameter: <ul style="list-style-type: none"> <li>• &lt;sn&gt; - KIM1 serial number</li> </ul>

## 2. Parameter type commands

**Important:** All configuration parameters are stored and maintained in the KIM1 flash memory. Therefore, it is not necessary to set them before each transmission if the same settings are to be used for all transmissions (even if the module has been powered down).

### a. Frequency band

BAND – Frequency band for transmission	
AT+BAND=<band>	Set the frequency band for transmission  Parameter: <p>&lt;band&gt; - transmission frequency band</p> <ul style="list-style-type: none"> <li>• B1 - [401.620-401.680](default)</li> <li>• B2 - [401.540-401.600]</li> <li>• B3 - [401.470-401.530]</li> <li>• B4 - [401.390-401.460]</li> <li>• B5 - [401.320-401.390]</li> <li>• B6 - [401.120-401.180]</li> <li>• B7 - [401.020-401.080]</li> <li>• B8 - [399.980-400.040]</li> <li>• B9 - [399.910-399.970]</li> </ul> <p>Warning: as of June 2020, Kinéis satellites only receive on frequency band B1.</p>



## b. Frequency offset

FRQ - Frequency offset within the band	
AT+FRQ=<freq>	<p>Set the frequency offset within the band for transmission.</p> <p>Parameter:</p> <p><b>&lt;freq&gt;</b> - an integer which specifies the frequency offset within the band, in step of 100 Hz:</p> <ul style="list-style-type: none"> <li>• between 0 and 800 for bands B4 and B5</li> <li>• between 0 and 600 for other bands</li> </ul> <p><u>Example</u> : for band B1:</p> <ul style="list-style-type: none"> <li>• 0 for 401.620MHz</li> <li>• 300 for 401.650MHz (default)</li> <li>• 600 for 401.680MHz</li> </ul>
AT+FRQ=?	Read the frequency offset used by module

## c. Transmission power

PWR - Transmission power	
AT+PWR =<pwr>	<p>Set the transmission power in mW of the module.</p> <p>Parameter:</p> <p><b>&lt;pwr&gt;</b> - an integer that specifies the transmission power in mW</p> <ul style="list-style-type: none"> <li>• 250 (default)</li> <li>• 500</li> <li>• 750</li> <li>• 1000</li> </ul>
AT+PWR=?	Read the transmission power in mW used by module

### 3. Action type commands

#### a. Message transmission

TX – Transmit one message	
<b>AT+TX= &lt;data&gt;</b>	<p>Transmit one message</p> <p>Parameter:</p> <p><b>&lt;data&gt;</b> - user data in a hexadecimal string</p> <ul style="list-style-type: none"> <li>• Minimum length is 24 bits (6 hexadecimal digits)</li> <li>• Up to 7 other 32-bit (8 hexadecimal digits) blocks are available</li> <li>• Maximum length is thus 248 bits (62 hexadecimal digits)</li> <li>• If the last block is not complete, the module performs zero-padding</li> </ul> <p>Note: for this AT command, the response OK, will only be returned by the module once the transmission is completed.</p>
<p><b>Return message</b></p> <p><b>+TX_INFO:</b></p> <p><b>&lt;Transmission&gt;,</b></p> <p><b>&lt;ChipStatus&gt;</b></p>	<p>Once the transmission is completed, an asynchronous message is returned:</p> <p>+TX_INFO:&lt;Transmission&gt;,&lt;ChipStatus&gt;</p> <p>Parameters:</p> <p><b>&lt;Transmission&gt;</b> - an integer which indicates the transmission status</p> <ul style="list-style-type: none"> <li>• 1 - done</li> <li>• 0 - fail</li> </ul> <p><b>&lt;ChipStatus&gt;</b> - an integer which indicate the chipset status</p> <ul style="list-style-type: none"> <li>• 0 - no error</li> <li>• In case of any other value, please reach out to Kinéis technical support</li> </ul>
<b>AT+TX=?</b>	<p>Get the previous AT+TX command that has been executed</p>

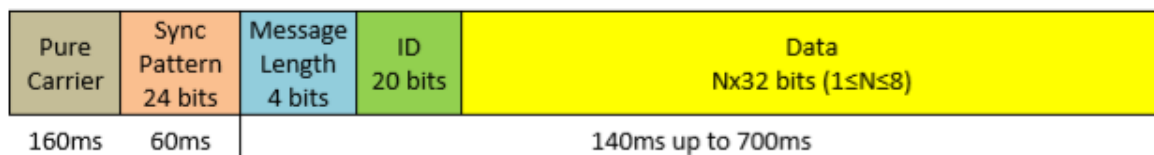
## 3.4. Error responses

ERROR – Error response	
<b>ERROR =&lt;error_id&gt;</b> <b>[,&lt;parameter_index&gt;]</b>	<p>Error response to an AT command from the KIM1 module.</p> <p>Parameters:</p> <p><b>&lt;error_id&gt;</b> - an integer that specifies the error type</p> <ul style="list-style-type: none"> <li>• 1 - Parameter formatting issue</li> <li>• 2 - Parameter out of range</li> <li>• 3 - Missing parameters</li> <li>• 4 - Too many parameters</li> <li>• 5 - Invalid user data length</li> <li>• 6 - Invalid user data format</li> <li>• 7 - Incompatible value for parameter</li> <li>• 8 - Unknown AT command</li> <li>• In case of any other value, please reach out to Kinéis technical support</li> </ul> <p>Optionally, <b>&lt;parameter_index&gt;</b> can appear to explicitly inform which parameter has generated the error.</p>

## 4. Transmission protocol

### 4.1. Message format

The messages transmitted by the KIM1 follow the low-data rate Argos-2 message format shown below:



#### Low-data rate Argos-2 message format

The KIM1 module performs the message formatting in a transparent way for the integrator:

- Pure Carrier
- Sync Pattern
- Message Length (computed from the specified Data field)
- ID number (hard coded in the KIM1 memory and unmodifiable by the integrator)
- Data (specified with AT+TX command)

**Warning:** for KIM1, the ID number is coded over 28 bits. The first 8 bits of the Data field are thus reserved for the end of the ID number, leaving only 24 bits for the first 32-bit block.

### 1. ID number

Each KIM1 module has a unique ID number, expressed in two different formats:

- Hexadecimal format, for integration in the transmitted message (28 bits or 7 hexadecimal digits), programmed into the module and unmodifiable by the integrator
- Decimal format, for online access to the transmitted data, written on the KIM1 marking (see KIM1 Datasheet)

**Warning:** there is no possible conversion between these two formats, only an allocation table. To find out the ID number in one format from the other, please reach out to Kinéis technical support.

### 2. Data field

This is the only field that can be specified explicitly by the integrator, with the AT+TX command.

The Data field must be written in hexadecimal format and follow one of the following length values (N being the number of 32-bit blocks, as shown in the message format figure above):

N	Data length (Bytes)	Data length (bits)	Data duration (ms)	Message duration (ms)
1	3	24	60	360
2	7	56	140	440
3	11	88	220	520
4	15	120	300	600
5	19	152	380	680
6	23	184	460	760
7	27	216	540	840
8	31	248	620	920

If the data specified with the AT+TX command does not follow one of these length values, it will be completed with bits at value 0 by the KIM1 until it reaches the next possible length value.

If the data length is greater than 31 Bytes, and an error will be returned by the KIM1 on the UART communication interface and the message will not be transmitted.

## 4.2. Transmission strategy

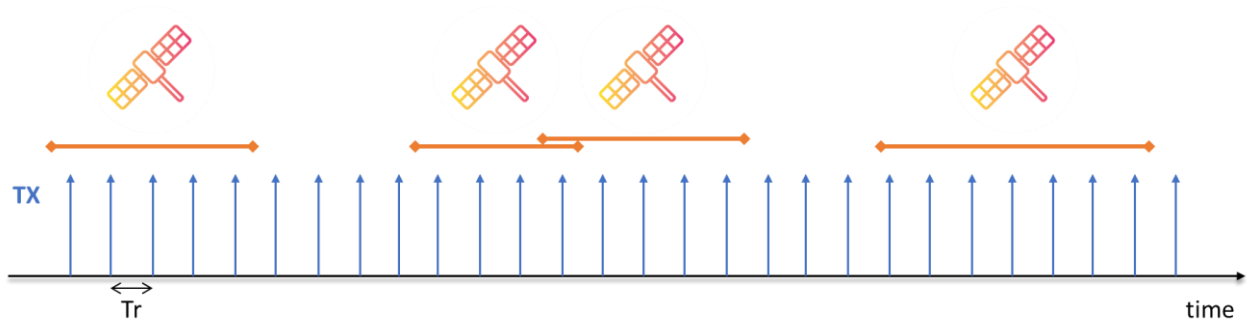
Kinéis system offers the possibility to collect short messages of up to 31 Bytes of useful data in a regular basis. With 8 satellites available today and more to come, Kinéis system provides many timeslots per day in which data can be transmitted to the satellites, enabling to collect up to 2kB of useful data per day.

Depending on the latitude of the terminal, the satellite passes occur more or less often and the revisit time varies. Transmitting data between the satellite passes means that they will not be received by any satellite, and it can be very costly for the terminal in power consumption.

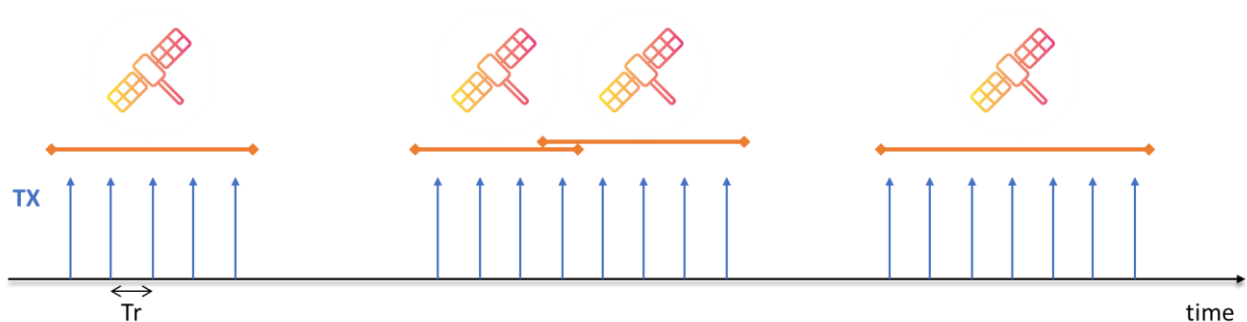
Kinéis can offer transmission strategy recommendations to define the best transmission strategy to optimize power consumption and maximize the probability of good reception of your data by the system.

2 types of transmission strategies are possible with the KIM1:

- Random periodic transmission: the device does not know anything about satellites passes, it can only transmit randomly. Depending on satellite availability, it will transmit more messages than necessary.



- Transmission on satellite passes, thanks a satellite pass prediction algorithm developed for embedded targets and provided by Kinéis, thus saving on battery power and increasing the probability of good reception by the satellites.



$T_r$  is the repetition period of a message transmission by the KIM1 and **must not be set below 30 seconds**.

## 5. Additional information

### 5.1. Contact & support

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Product information, technical support and commercial contact are available from Kinéis at the following link: <https://www.kineis.com/contact/>

### 5.2. Versioning

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First manufacturing batches of KIM1 modules are designated "Engineering Samples" in this document:

- Decimal ID numbers starting with 179 (hexadecimal ID numbers starting with 5DDB1 and 5EC80)
- SN starting with 0719-, 1219- and 0120-

### 5.3. Related documents

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- **KIM1 Datasheet** from Kinéis (ref **KINEIS-SP-20-0147**)
- **PTT-A2/PMT-A2 Physical Layer Requirements** from CNES, (ref **2098**)
- **Services and message formats – General Specifications** from CNES (ref **A4-SYS-IF-0086-CNES**)

### 5.4. Legal Notices

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KIM1 module is guaranteed for a period of 6 months from the date of delivery, as long as the module is used under the conditions described in the datasheet and the integration manual.

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