

RM1S3 Host Commands

heig-vd
N.Brunner
V0.2

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1 Revision history

Version	Description
0.1	<ul style="list-style-type: none"> Initial version

2 General frame format

Multiple bytes values are in big endian. Here is the generic format, only the parameters will be described in the following chapters.

2.1 Generic Get format

Get Request		
Field name and value	Size	Description
0x01	1B	length of the frame
cmd_get	1B	Identifier of the frame

Get Reply		
Field name and value	Size	Description
1 + x + y	1B	length of the frame
cmd_get	1B	Identifier of the frame
param1	xB	1st parameter
param2	yB	2nd parameter (facultative)
		...

2.2 Generic Set format

Set Request		
Field name and value	Size	Description
1 + x + y	1B	length of the frame
cmd_set	1B	Identifier of the frame
param1	xB	1st parameter
param2	yB	2nd parameter (facultative)
		...

Set Reply		
Field name and value	Size	Description
0x01	1B	length of the frame
cmd_set	1B	Identifier of the frame

3 Frames

3.1 Firmware Version (Get:0x11)

Firmware Version		
Field name and value	Size	Description
Version	xB	Format free ascii string (maximum of 254 bytes)

3.2 Hardware Version (Get:0x13)

Hardware Version		
Field name and value	Size	Description
Version	xB	Format free ascii string (maximum of 254 bytes)

3.3 Unique Device ID (Get:0x15)

Unique Device ID		
Field name and value	Size	Description
Unique device id	12B	Unique ID provide by the STM32

3.4 Data Slot Count (Set:0x20, Get:0x21)

When a synchronization frame is received, this value is updated.

Data Slot Count		
Field name and value	Size	Description
Data slot count	1B	Number of data slot used, set by the beacon server

3.5 TDMA State (Get:0x27)

TDMA State		
Field name and value	Size	Description
Protocol state	1B	0: off 1: not synchronized 2: synchronized 3: synchronized in low power 4: tx synchronization 0xFF: uninitialized
Beacon ID	8B	Beacon ID of the server, this field is present only for protocol state 2 and 3

3.6 Statistics (Clear:0x2A, Get:0x2B)

Statistics		
Field name and value	Size	Description
rxOk	4B	Number of correctly received unicast/multicast frame
rxCrcError	4B	Number of CRC error in rx unicast/multicast
tx	4B	Number of tx unicast/multicast attempt
txLbtFail	4B	Number of tx unicast/multicast fail because of LBT
txAck	4B	Number of tx unicast frame acknowledged
txNack	4B	Number of tx unicast frame not acknowledged
syncRxOk	4B	Number of correctly received synchronization frame
syncRxCrcError	4B	Number of CRC error in rx synchronization
syncRxBadFrame	4B	Number of wrong frame type or wrong beacon id in rx synchronization
syncRxTimeout	4B	Number of timeout in rx synchronization
syncRxLost	4B	Number of loss of synchronization
syncMinDelta	2B	Minimum value for the delta of synchronization in tick (signed)
syncMaxDelta	2B	Maximum value for the delta of synchronization in tick (signed)
syncSumDelta	4B	Sum of all the delta of synchronization in tick (signed)
lpsyncRxOk	4B	Number of correctly received synchronization frame in low power
lpsyncRxCrcError	4B	Number of CRC error in low power rx synchronization
lpsyncRxBadFrame	4B	Number of wrong frame type or wrong beacon id in low power rx synchronization
lpsyncRxTimeout	4B	Number of timeout in low power rx synchronization
lpsyncRxLost	4B	Number of loss of synchronization in low power
lpsyncMinDelta	2B	Minimum value for the delta of synchronization in low power in tick (signed)
lpsyncMaxDelta	2B	Maximum value for the delta of synchronization in low power in tick (signed)
lpsyncSumDelta	4B	Sum of all the delta of synchronization in low power in tick (signed)
syncTxOk	4B	Number of successful tx synchronization
syncTxLbtFail	4B	Number of tx synchronization fail because of LBT
rxScanTime	4B	Cumulative rx scan time in second
rxTime	4B	Cumulative rx time (without scan) in second

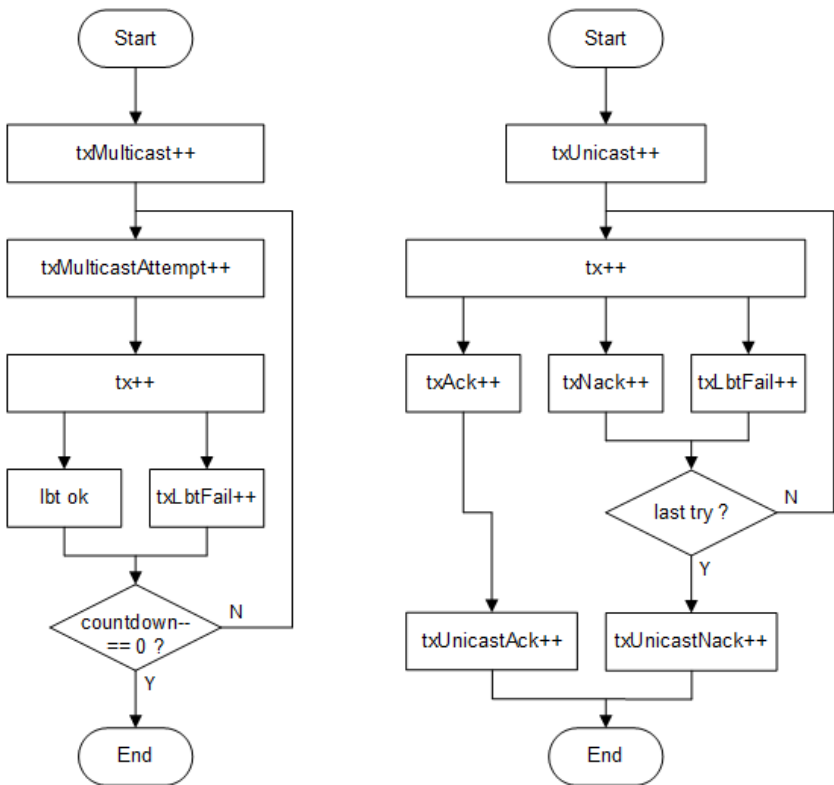
txTime	4B	Cumulative tx time in second
txUnicast	4B	Number of unicast demand (return no error)
txUnicastAck	4B	Number of acknowledged unicast
txUnicastNack	4B	Number of not acknowledged unicast
txMulticast	4B	Number of multicast demand (return no error)
txMulticastAttempt	4B	Number of multicast transmission attempt (txMulticast * (countdown + 1))
rxUnicastOk	4B	Number of correctly received unicast frame
rxMulticastOk	4B	Number of correctly received multicast frame
rxBadFrame	4B	Number of wrong frame type or size in a data slot
rxWrongBeaconId	4B	Number of received frame with the wrong beacon id
rxUnicastDuplicate	4B	Number of duplicate unicast frame received
rxUnicastWrongAddress	4B	Number of unicast frame with wrong destination address received
rxMulticastWrongGroup	4B	Number of multicast frame with wrong destination group received

SyncRx / IpsyncRx:

	timeout
	crcError
	badFrame
ok	

Rx on data slot:

rxOk				rxCrcError
<i>rx unicast frame</i>		<i>rx multicast frame</i>		rxBadFrame
	rxUnicastWrongAddress		rxMulticastWrongGroup	
rxUnicastOk	rxUnicastDuplicate		rxMulticastOk	



3.7 Active Channels (Set:0x2C, Get:0x2D)

When a synchronization frame is received, this value is updated.

The radio module hop on the active channel. When a beacon client needs to synchronize, it scans only the active channels.

By default, all channels are active.

Active Channels (ETSI)		
Field name and value	Size	Description
Active channels	4B	Bitfields of 31 bits setting which channels is active

First 27 frequencies are: $863.15 + 0.2 * \text{channel_index}$ [MHz].

Last 4 frequencies are: 868.85 MHz, 869.05 MHz, 869.85 MHz, 869.525 MHz.

For FCC_64:

8B with frequency = $902.3 + 0.4 * \text{channel_index}$ [MHz]

For FCC_64_LO:

8B with frequency = $902.3 + 0.2 * \text{channel_index}$ [MHz]

For FCC_64_HI:

8B with frequency = $915.1 + 0.2 * \text{channel_index}$ [MHz]

For FCC_128:

16B with frequency = $902.3 + 0.2 * \text{channel_index}$ [MHz]

3.8 Data Slot Range Type (Set:0x3A)

Data Slot Range Type		
Field name and value	Size	Description
First data slot	1B	First data slot index
Last data slot	1B	Last data slot index
type	1B	Bit 0: 1 to allow rx Bit 1: 1 to allow tx

3.9 Data Slot Type (Set:0x3C, Get:0x3D)

Data Slot Type		
Field name and value	Size	Description
Data slot	1B	Data slot index
type	1B	Bit 0: 1 to allow rx Bit 1: 1 to allow tx

3.10 Last Rx Sync Info (Get:0x31)

Last Rx Sync Info		
Field name and value	Size	Description
State	1B	0: desynchronized 1: synchronized
Rx miss	1B	The current number of consecutive beacon miss
Source address	1B	The address of the beacon server
RSSI	1B	RSSI of the last beacon received
Slot ID	4B	The slot ID where the last beacon was received

3.11 Pattern (Set:0x40, Get:0x41)

Pattern		
Field name and value	Size	Description
Pattern	4B	Pattern of the radio frame, must be the same on all radio module than need to communicate together (default: 0x3D 0x47 0x78 0x34, different from RM1S2)

3.12 Address (Set:0x44, Get:0x45)

Address		
Field name and value	Size	Description
Address	1B	The address of the radio module

3.13 Group (Set:0x4C, Get:0x4D)

Group		
Field name and value	Size	Description
Group	4B	Bitfield representing the membership or not of the 32 possible multicast group

3.14 Tx Retry Count (Set:0x5C, Get:0x5D)

Tx Retry Count		
Field name and value	Size	Description
Retry count	1B	The number of retry for unicast frame before giving up

3.15 RF Power (Set:0x60, Get:0x61)

RF Power		
Field name and value	Size	Description
RF power	1B	Power level at the output of the CC1125

3.16 RF Phy (Set:0x62, Get:0x63)

If the hardware doesn't allow the usage of a phy, it will respond with an error.

RF Phy		
Field name and value	Size	Description
RF Phy	1B	0: ETSI, 133 kbps 4GFSK, LBT, CRC, 20 ms timeslot, tx sync each 10 slot 1: ETSI, 100 kbps 2GFSK, for radio test 2: FCC_128, 100 kbps 2GFSK, for radio test 3: FCC_64, 133 kbps 4GFSK, LBT, CRC, 20 ms timeslot, tx sync each 10 slot 4: FCC_64_LO, 133 kbps 4GFSK, LBT, CRC, 20 ms timeslot, tx sync each 10 slot 5: FCC_64_HI, 133 kbps 4GFSK, LBT, CRC, 20 ms timeslot, tx sync each 10 slot 6: FCC_128, 133 kbps 4GFSK, LBT, CRC, 20 ms timeslot, tx sync each 10 slot

3.17 Phy Channels Plan Size (Get:0x65)

Since RM1S3:0.1.5

Phy Channels Plan Size		
Field name and value	Size	Description
Channels Plan Size	xB	Byte array with the channels plan bytesize for each Phy. Will return 0 for phy not supported by the hardware.

3.18 RF Power dBm (Set:0x66)

Since RM1S3:0.1.6

Program the closest power level corresponding to the desired dBm. Conversion table is hardware specific.

RF Power dBm		
Field name and value	Size	Description
RF power dBm	1B	The radio power in dBm (0 to 30).

3.19 Radio Mode (Set:0x70, Get:0x71)

Radio Mode		
Field name and value	Size	Description
Radio mode	1B	0: off 1: TDMA 2: radio test

3.20 Event Indication (Set:0x74, Get:0x75)

Event Indication		
Field name and value	Size	Description
Event indication	1B	1 to enable the notification of TDMA state change

3.21 Sync Mode (Set:0xA0, Get:0xA1)

Sync Mode		
Field name and value	Size	Description
Sync mode	1B	0: Tx 1: Rx active 2: Rx low power 3: Rx low power group

3.22 Sync Rx (Set:0xA2, Get:0xA3)

Sync Rx		
Field name and value	Size	Description
Sync interval	1B	Interval between 2 beacon rx (1 = listen to all beacon)
Miss max	1B	Maximum number of consecutive beacon miss for staying synchronized
Scan first on time	2B	Duration in millisecond of the first active scanning phase (0xFFFF: infinite duration)
Scan on time	2B	Duration in millisecond of the active scanning phase.
Scan off time	3B	Duration in millisecond of the sleeping phase.

3.23 Sync Rx Low Power (Set:0xA4, Get:0xA5)

Sync Rx Low Power		
Field name and value	Size	Description
Group	4B	Rx low power group. Used when in rx low power group , if a bit of the group is activated in both rx and tx, the sync mode will be rx active otherwise it will be in low power.
Sync interval	1B	Interval between 2 beacon rx (1 = listen to all beacon)

3.24 Sync Tx Low Power (Set:0xA6, Get:0xA7)

Sync Tx Low Power		
Field name and value	Size	Description
Group	4B	Tx low power group, bitfield for putting in active mode the registered client.

3.25 Sync Beacon ID (Set:0xA8, Get:0xA9)

When the first synchronization frame is received, this value is updated.

Sync beacon ID		
Field name and value	Size	Description
Beacon ID	8B	Should be set by the beacon server and get by the beacon client.

3.26 Sync User Data (Set:0xAA, Get:0xAB)

When a synchronization frame is received, this value is updated.

Sync User Data		
Field name and value	Size	Description
Sync user data	xB	User data added to the beacon frame, Should be set by the beacon server and get by the beacon client.

3.27 Associated Beacon ID (Set:0xB0, Get:0xB1)

Used by the beacon client.

Associated Beacon ID		
Field name and value	Size	Description
Associated Beacon ID	8B	Allow the synchronization to this Beacon ID even when the server doesn't allow unassociated.

3.28 Accept Unassociated (Set:0xB2, Get:0xB3)

Used by the beacon server.

Accept Unassociated		
Field name and value	Size	Description
Accept Unassociated	1B	Boolean flag when not set, the clients will only synchronize if their Associated Beacon ID matches the server Beacon ID.

3.29 Host Baudrate (Set:0xC4, Get:0xC5)

Host Baudrate		
Field name and value	Size	Description
Host baudrate	3B	Host UART baudrate in baud

3.30 Tx Retry Restriction (Set:0xC8, Get:0xC9)

Tx Retry Restriction		
Field name and value	Size	Description
Tx retry restriction	1B	0: retry on the same data slot 1: retry on next tx data slot

3.31 RF Frame Max Size (Get:0xCB)

RF Frame Max Size		
Field name and value	Size	Description
Sync user data size	1B	Maximum size of sync user data
Unicast size	1B	Maximum size of payload for unicast frame
Multicast size	1B	Maximum size of payload for multicast frame

3.32 Host UART Settings (Set:0xCC, Get:0xCD)

Host UART Settings		
Field name and value	Size	Description
Parity	1B	0: no parity 1: even 2: odd
Stop bits	1B	0: 1 stop bit 1: 2 stop bits
Flow control	1B	0: no flow control 1: RTS/CTS flow control

3.33 GPIO0 Signal (Set:0xE0, Get:0xE1), GPIO1 Signal (Set:0xE2, Get:0xE3), GPIO2 Signal (Set:0xE4, Get:0xE5), GPIO3 Signal (Set:0xE6, Get:0xE7)

GPIO Signal		
Field name and value	Size	Description
GPIO signal	1B	0: None (input => high impedance) 1: Sync 2: Timeslot 3: Sync time 4: Tx pending 5: Tx ack 6: GPIO In 7: GPIO Out 8: Clock check input

3.34 GPIO Out (Set:0xE8)

GPIO Out		
Field name and value	Size	Description
Value	1B	The value to put on the GPIO pin

3.35 GPIO In (Get:0xE9)

GPIO In		
Field name and value	Size	Description
Value	1B	The value read from the GPIO pin

3.36 CTS (Set:0xEA)

CTS		
Field name and value	Size	Description
Value	1B	The value to put on the CTS pin

3.37 RTS (Get:0xEB)

RTS		
Field name and value	Size	Description
Value	1B	The value read from the RTS pin

3.38 Clock Check (Clear:0xEC. Get:0xED)

Check the LSE clock with a GPIO set with "Clock check input".

Clock Check		
Field name and value	Size	Description
Input pulse count	2B	Count the pulse from the GPIO set with "Clock check input"
Tick	4B	Number of LSE tick between the first and last pulse

3.39 Send Unicast (0xD2)

Send Unicast		
Field name and value	Size	Description
Destination	1B	Address of the destination
Data slot	1B	Data slot to use (0xFF for first data slot available for tx)
Data	xB	The data to send

3.40 Send Multicast (0xD4)

Will send multiple multicast frames with a decrementing countdown field.

For having a constant timing between transmission, care should be taken with data slot configuration.

Send Multicast		
Field name and value	Size	Description
Destination	4B	Group of the destination
Countdown	1B	The countdown value of the first transmitted frame. The number of transmission attempts (can fail because of LBT) will be countdown + 1.
Data slot	1B	Data slot to use (0xFF for first data slot available for tx)
Data	xB	The data to send

3.41 Load Default Parameters (0xF6)

No parameters.

4 Asynchronous Frames

Asynchronous frames are data received without replying to a previously sent request.

4.1 TDMA State Changed (0x73)

Can be received only after [event indication](#) is set.

TDMA State Changed		
Field name and value	Size	Description
state	1B	New TDMA state (same as TDMA State)

4.2 Unicast Received (0xD3)

Unicast Received		
Field name and value	Size	Description
Source	1B	The address of the source
Data slot	1B	The data slot used by the received frame
RSSI	1B	The RSSI of the received frame
LQI	1B	The LQI of the received frame
Data	xB	The data received

4.3 Multicast Received (0xD5)

Multicast Received		
Field name and value	Size	Description
Source	1B	The address of the source
Group	4B	The destination group
Countdown	1B	The countdown
Data slot	1B	The data slot used by the received frame
RSSI	1B	The RSSI of the received frame
LQI	1B	The LQI of the received frame
Data	xB	The data received

4.4 Sync User Data Changed (0xD9)

Only for beacon client, received after the beacon server change the sync user data.

Sync User Data Changed		
Field name and value	Size	Description
Sync user data	xB	The new sync user data

5 Errors

When the radio module receives a command, it can reply with an error.

Error		
Field name and value	Size	Description
0x02	1B	length of the frame
0x03	1B	Identifier of the error frame
Error id	1B	Identifier of the error type

Error types		
Error id	Name	Description
0x02	Invalid size	The command expects an other frame size
0x03	Invalid index	A command's argument used as index to select a parameter is out of range
0x04	Invalid argument	A command's argument to set a parameter is out of range
0x05	Timeout	A timeout occurred (announced data size not received in time)
0x06	Context	The current context doesn't allow the requested command execution
0x07	Invalid command	The command is not defined
0x10	Protocol not ready	Protocol is not yet ready
0x11	Not tx data slot	The data slot doesn't allow a transmission
0x12	Not synchronized	The frame can't be transmitted because the radio is not synchronized
0x13	Frame too big	The frame can't be transmitted because the size exceed the maximum allowed size
0x14	No free buffer	All the buffer are used so no more free buffer are available
0x18	Data unavailable	Can't get the info of an event that didn't happens

6 Usage

6.1 Gateway

Initialisation:

- [Increase host baudrate](#)
- [Set data slot count](#)
- [Configure data slot type](#) tx for data slot 0, rx for the others
- [Set pattern](#) (can use default value)
- [Set retry count](#)
- [Set address](#)
- [Set sync mode tx](#)
- [Set Sync Beacon ID](#)
- [Start TDMA](#)

In hexadecimal:

```
// code for increasing baudrate should be the same than RM1S2
02 20 09 // data slot count = 9
03 3C 00 02 // data slot 0 in tx
04 3A 01 08 01 // data slot 1-8 in rx
02 5C 02 // tx retry count = 2
02 44 00 // address = 0
02 A0 00 // sync mode tx
09 A8 01 02 03 04 05 06 07 08 // replace with the correct beacon ID
02 70 01 // start TDMA
```

Wake up single sensor:

- [Set sync user data](#) with sensor id

Wake up group:

- [Set group to wake up](#)

Send data to the sensors:

- [Unicast](#) or [multicast](#)

6.2 Sensor

Initialisation:

- [Increase host baudrate](#) to 20000
- [Configure data slot type](#) rx for data slot 0, tx for the sensor data slot, off for the others
- [Set pattern](#) (can use default value)
- [Set retry count](#)
- [Set address](#)
- [Set group](#)
- [Enable TDMA state changed event](#)
- [Set sync mode](#) Rx low power group
- [Set sync rx](#)
- [Set sync rx low power](#)
- [Start TDMA](#)

Wake up when sync user data correspond to the sensor id:

- [Set sync mode](#) Rx active

Send data to the gateway:

- [Unicast](#)