A technical documentation which has description of the agreed on UART communication protocol between STM and PC

The purpose of the protocol is to provide two-way data exchange in real time. In our work, we will use PC and STM.

Key points and programs we need when working with STM:
Setup environment (Kei+STM32CubeMX)
Implement UART driver (UART_S PC->STM)
Checksum calculation
Implement protocol handing
Implement: Key generation
Implement data storage
Implement key identification
Enable readout protection

And for PC:
Setup environment
Application design
Implement UART communication
Checksum calculation
Implement protocol handling
Input file
Read file

Generate key

PC->STM	0x01	0	0	0	0	chks
STM->PC	0x01	xx	xx	xx	xx	chks

The first button is the button for generating a unique key, on the STM side, which is then transmitted to the PC

xx-shows the key already generated.

- **PC -> STM:**

  PC sends command 0x01 with four zero bytes (0x00) and a checksum (Checksum).

- **STM -> PC:**

  STM generates a 4-byte key and sends it along with the response.

Input key						

PC->STM	0x02	xx	xx	xx	xx	chks	
STM->PC	0x02	0	0	0	0	chks	incorrect
STM->PC	0x02	0	0	0	1	chks	correct

Key input - to transfer the key from PC to STM to check its correctness.

xx-key transmitted

- **PC -> STM:**

  PC sends command 0x02, key (4 bytes) and checksum.

- **STM -> PC:**

  STM checks the received key:

  Incorrect:

0	0	0	0	chks	incorrect

  Правильний:

0	0	0	1	chks	correct

	Send key						

PC->STM	0x03	size	xx	…	xx	chks	
STM->PC	0x03	0	0	0	0	chks	incorrect
STM->PC	0x03	0	0	0	1	chks	correct

Data transfer:

At this stage, the data transfer from STM to PC shows the correctness/incorrectness of the key.

size-number of bytes of data transferred.

- **PC -> STM:**

PC sends command 0x03, data size, data itself and checksum.

- **STM -> PC:**

STM checks the received data

	Get data size				

PC->STM	0x04	0	0	0	0	chks
STM->PC	0x04	size	0	0	0	chks

Getting the data size

size-size of available data

- **PC -> STM:**

PC sends command 0x04 with zero bytes and checksum.

- **STM -> PC:**

STM responds by indicating the data size

	Get data					

PC->STM	0x05	offset	0	0	0	chks
STM->PC	0x05	size	xx	...	xx	chks

Data reception

size-amount of data to receive

- **PC -> STM:**

PC sends command 0x05, offset, data size and checksum.

- **STM -> PC:**

STM transmits requested data

Checksum calculation

When you download files from certain websites, they have a very long string of numbers and letters called a checksum or MD5 or SHA-1 checksum. Checksums are used to ensure the integrity of a file when it is transferred from one device to another. This can be over the Internet or simply between two computers on the same network.

In any case, if you need to make sure that the transferred file exactly matches the original file, you can use a checksum. The checksum is calculated using a hash function and is usually included with the upload. To verify the integrity of the file, the user calculates the checksum using a checksum calculator program and then compares the two to make sure they match.

XOR (bitwise "exclusive OR")

This is a simple and fast method, often used in UART protocols.

How it works:

XOR (logical exclusive OR) is calculated between all bytes of the packet, except for the synchronization byte (if any).