ANNEXURE-1

CCSDS TM-TC ACQUISITION & PROCESSING UNIT

CCSDS Telemetry (TM) data is to be acquired and frame synchronized using an external hardware circuit and transferred to a Personal Computer via USB port, which has Microsoft Windows-7/10 operating system. Also same hardware should handle CCSDS format Tele-command (TC) message reception from Personal Computer, frame formatting and distributing to Spacecraft. Driver Software should have library functions, which can be accessed through high level application programs (designed and developed in VB 6.0/VC++/VB.NET/VC++.NET/Lab Windows) for data transfer. Driver Software has to store incoming Telemetry data continuously on computer hard disk. Stored data can be Microsoft Access format with date & time stamp. Signal details are given below.

Input Signals (Telemetry)	Telemetry Data, Telemetry Clock and GND reference
Input Signal Amplitude	5V CMOS Buffer O/P via 1k resistor
Clock and Data Relationship	TM channel Clock and Data are synchronous and Data changes during falling edge of the clock
Data Bit Sequence	Most significant Bit first
Frame Length	256 Bytes (including frame sync 4 bytes)
Number of Frames	8/16/32/64
Frame Sync code	4 byte (1A-CF-FC-1D in hex) first 4 bytes in each frame
TM Data format	Randomised as per CCSDS standard
Output Signals (Tele-command)	Window signal, Burst clock, TC Data and GND reference
Output Signal Amplitude	5V, Via CMOS Buffer CD4050
Window, Clock and Data Relationship	• NRZ- L Data synchronized with Clock signal • Data change with rising edge of clock • WINDOW rising edge before data start with a duration of 8 data bits • WINDOW falling edge after data end with a duration of 8 data bits • Burst Clock during data transfer period

S NO	SPECIFICATIONS	
	A. HARDWARE	
1.	Number of Input Channels (Telemetry)	TWO (minimum)
2.	Input Connector	9-Pin D-Type Male Connector
3.	Output Port Type	USB
4.	Acquisition Unit Data rate	Up-to 64 kBps
5.	Input Isolation	Opto-coupler / DATA ISOLATOR
6.	Input Current Drawn	< 0.5 mA with opto-coupler
7.	Power Supply (TM section)	USB Power
8.	Number of Output Channels	(Tele-command) One (minimum)
9.	Output Connector	9-Pin D-Type Female Connector
10.	Tele-command data rate	Programmable from 100Hz to 10 kHz with variable resolution 1Hz to 25Hz
11.	Tele-command data size	Programmable from 1 to 1024 bytes
12.	Tele-command output	CD4050 buffer O/P via 1K resistor
13.	Tele-command input output Isolation	via opto-coupler / Data Isolator
14.	Power Supply (TC section)	USB Power for TC input circuitry and External 5V provision for TC Opto-coupler circuitry / not required for Data Isolator
16.	Dimension	Light weight and compact in size with ABS plastic body
	B. SOFTWARE	
17.	Driver Software Compatibility	Microsoft Windows-7/10
18.	Storage	Continuous storage of incoming Telemetry Data
19.	Stored Data Format	Microsoft Access compatible database
20.	Data conversion	De-randomization of acquired TM data as per CCSDS standard