ADuCM350 UART Protocol and Commands

All commands, parameters and return values are 32-bit unsigned integers. Therefore each command, parameter and return value requires a UART transfer of 4 bytes. For each command and parameter, the least significant byte must be transferred first.

The serial port settings are as follows:

- Baud Rate: 115200
- Data Bits: 8
- Parity: None
- Stop Bits: None
- Flow Control: None
- Termination Character: Disabled

The protocol is initialized by transmitting the *Initialize Protocol* command. A successful initialization will return an Acknowledge (*ACK*).

Once initialized, the ADuCM350 will wait for a command.

The command is transmitted to the ADuCM350, immediately followed by its parameters (where applicable).

The ADuCM350 will perform the required command and echo the command code, followed by a 32-bit value which is the number of return values.

The return values should then be read from the serial port.

The ADuCM350 will then transmit an *ACK*.

Table 1. Command List

Command	Command Code	Parameters	Return Values
Initialize Protocol	0x434F4D4D	0	0
MMR Write	0x00000001	2	0
MMR Read	0x00000002	1	1
AFE Initialize	0x00000101	0	0
AFE Power Up	0x00000102	0	0
Excitation Channel Power Up	0x00000105	0	0
Excite Channel Cal. (attenuated)	0x00000106	0	0
Excite Channel Cal. (no atten.)	0x00000107	0	0
TIA Channel Calibration	0x00000108	0	0
AC Measurement	0x0000010F	4	4
AFE Power Down	0x0000010C	0	0

ACK = 0xAAAAAAAA

Table 2. MMR Write

Command	Parameter 1	Parameter 2
MMR Write	MMR Address	Data

Table 3. MMR Read

Command	Parameter 1
MMR Read	MMR Address
	Return Value 1
	MMR Contents

Table 4. AC Measurement

Command	Parameter 1	Parameter 2	Parameter 3	Parameter 4
AC Measurement	Frequency Control Word (FCW)	Amplitude (DAC Code)	Attenuation	Switch Matrix Configuration
	Return Value 1	**Return Value 2**	**Return Value 3**	**Return Value 4**
	RCAL Real Component	RCAL Imaginary Component	Load Real Component	Load Imaginary Component

AC Measurement Parameters:

1. FCW $= \frac{F_{OUT}}{F_{ACLK}} \times 2^{26}$, where $F_{ACLK} = 16\text{MHz}$
2. DAC LSB size = 195.36µV_{PEAK} (without attenuation applied)
   Example: $9\text{mV}_{RMS} = \left(\frac{1303 \times 195.36\mu\text{V}}{40}\right) \times \sqrt{2}$
3. 0 = Attenuation (Div 40) Disabled
   1 = Attenuation (Div 40) Enabled
4. For Switch Matrix Configuration parameter, see ADuCM350 Hardware Reference Manual AFE_SW_CFG register (address 0x4008000C)

AC Measurement Results:

$$RCAL_{MAG} = \sqrt{RCAL_{REAL}^{\ 2} + RCAL_{IMAG}^{\ 2}}$$

$$LOAD_{MAG} = \sqrt{LOAD_{REAL}^{\ 2} + LOAD_{IMAG}^{\ 2}}$$

$$RCAL_{PHASE} = \tan^{-1}\frac{RCAL_{IMAG}}{RCAL_{REAL}}$$

$$LOAD_{PHASE} = \tan^{-1}\frac{LOAD_{IMAG}}{LOAD_{REAL}}$$

$$UNKNOWN\_IMP_{MAG} = \left(\frac{RCAL_{MAG}}{LOAD_{MAG}}\right) \times RCAL_{VALUE}$$

$$UNKNOWN\_IMP_{PHASE} = RCAL_{PHASE} - LOAD_{PHASE}$$

$RCAL_{MAG}$ = The magnitude of the RCAL resistor (Ω).

$RCAL_{PHASE}$ = The phase of the RCAL resistor (rad).
$LOAD_{MAG}$ = The measured magnitude of the load impedance (Ω).
$LOAD_{PHASE}$ = The measured phase of the load impedance (rad).
$RCAL_{VALUE}$ = The known/measured value of the RCAL resistor.
$UNKNOWN\_IMP_{MAG}$ = The magnitude of the unknown impedance (Ω) with respect to RCAL.
$UNKNOWN\_IMP_{PHASE}$ = The phase of the unknown impedance (rad) with respect to RCAL.