Requirements and Constraints of Streaming Raw ADC Data Over a Serial Interface

There are 2 options as interface:

- UART
- SPI

Constraints 🔗

Bit Rate 🔗

Interface vs Device	xwr1843	ESP32-WROOM-32D	Comments

UART	3.125 Mbps (awr1843_TRM)
	
	Also in code:
	
	`101`
	`102 #define MMWDEMO_DATAUART_MAX_BAUDRATE_SUPPORTED 3125000`
	`103`
		[5 Mbps](#)	These are theoretical values.

SPI	40 MHz (awr1843 datasheet)	[10 MHz](#) when slave	

Requirements 🔗

Bit Rate 🔗

Frame Based Analysis 🔗

Parameter	Explanation	Example
Nadc	Number of ADC samples per chirp	512
Byte size	number of bits in 1 byte	8 (constant)
CR	Complex or real data 0:Real, 1:Complex	1
NTx	Number of transmit antenna	1
NRx	Number of receive antenna	4
NChirp	Number of chirps per frame	16
Tc	Chirp time	100e-6
Tf	Frame period (seconds).	0.1
DataSize	Total data size in bits that should be sent for each frame Nadc * (Byte size) * (2^CR) * NTx * NRx * NChirp	= 524.3 kb
Minimum Required BitRate1	**DataSize / Tf**	**= 5.243 Mbps**

Tf-f	Interframe time. Tf - NChirp * Tc	= 0.0984
Minimum Required BitRate2	Very similar to BitRate1, but use only interframe time for data streaming DataSize / Tf-f	**= 5.329 Mbps**

This seems feaseble with two prerequisites:

- Good wiring between processors to achieve ~5.2 Mbps. Maybe it is impossible with TTL.
- Good software architecture to be able to use whole frame period for transmitting.
  - Using only interframe time is simple in terms of coding, and required bit rate difference is negligible. Hence, we should implement interframe data streaming. We do not need to use whole frame time for data streaming. In any case, we need to create a new task just for data streaming.

Chirp Based Analysis 🔗

Parameter	Explanation	Example
Nadc	Number of ADC samples per chirp	512
Byte size	number of bits in 1 byte	8 (constant)
CR	Complex or real data 0:Real, 1:Complex	1
NTx	Number of transmit antenna	1
NRx	Number of receive antenna	4
Tc	Chirp time	100e-6
Minimum Required Bit rate	**Nadc * (Byte size) * (2^CR) * NTx * NRx / Tc**	**= 327.68 Mbps**

This data rate can be sent only over LVDS. (DCA1000)