Theory of operation; Alereon AL5721 UWB Module.

The Alereon AL5721 is a UWB radio device with a digital interface to the host computer. This device is intended to provide a short-range wireless connection for computers and peripheral devices. The AL5721 is powered from the host system to which it is attached. The digital interface between the host system and the AL5721 is the industry-standard USB 2.0 interface. The AL5721 operates in the frequency band defined in the FCC rules and Regulations for UWB devices. Specifically, it operates between the frequencies of 3.168 and 8.976 GHz per the industry-defined WiMedia 1.1 specification.

The AL5721 is comprised of two integrated circuit devices and supporting circuitry for filtering and power conditioning. The AL5721 has a permanently attached antenna external to the housing. The schematic diagram shows a connector, Hirose type U.FL, in the RF path. This connector, is not accessible from outside of the unit housing. Following the antenna connector is a Diplexer type bandpass filter having two sections. The LB section has a passband from 3.1 GHz to 4.752 GHz, the HB section has a passband from 6.336GHz to 9.504GHz. This filter provides suppression of unwanted out of band transmitter emissions below 3.168 GHz and above 9,504 GHz as well as receiver interference rejection in the 2.4 GHz and 5.1 GHz bands.

The AL5100 RF Transceiver generates the system reference frequency from a 44 MHz crystal resonator. The 44 MHz reference frequency is multiplied to 16.896 GHz internally in the AL5100 by a PLL multiplier. From this frequency the local oscillator frequencies for band frequencies for both transmit and receive modes are derived internally within the AL5100 by synthesis. The local oscillator frequencies are as listed as F*mid* per the following table.

BG	Channel	Ch1	Ch0	F_{low}	F_{mid}	F_{high}
N/A	N/A	0	0	-	-	-
1	1 (A)	0	1	3168 MHz	3432 MHz	3696 MHz
	2 (B)	1	0	3696 MHz	3960 MHz	4224 MHz
	3 (C)	1	1	4224 MHz	4488 MHz	4752 MHz
2	4 (A)	0	1	4752 MHz	5016 MHz	5280 MHz
	5 (B)	1	0	5280 MHz	5544 MHz	5808 MHz
	6 (C)	1	1	5808 MHz	6072 MHz	6336 MHz
3	7 (A)	0	1	6336 MHz	6600 MHz	6864 MHz
	8 (B)	1	0	6864 MHz	7128 MHz	7392 MHz
	9 (C)	1	1	7392 MHz	7656 MHz	7920 MHz
6	9 (A)	0	1	7392 MHz	7656 MHz	7920 MHz
	10 (B)	1	0	7920 MHz	8184 MHz	8448 MHz
	11 (C)	1	1	8448 MHz	8712 MHz	8976 MHz

In addition to the band frequencies, a 1056 MHz clock for ADCs and DACs within the AL5350 Baseband Processor/MAC is generated.

The interface between the AL5100 RF Transceiver and the AL5350 Baseband Processor/MAC consists of the analog RX-I and –Q signals and the analog TX–I and –Q signals all of which are baseband, having 2 MHz to 264 MHz frequency band. The interface also includes a 1056 MHz clock signal and CMOS logic-level control signals which determine the band frequency and mode.

The digital interface between the AL5350 Baseband Processor/MAC and the host system is selectable by a pin option on the module and in the AL5721 is permanently wired to be USB 2.0.

The AL5721 circuit also incorporates a C8051F326 USB function controller which connects to the host system via a second USB 2.0 interface. The USB function controller implements the WiMedia host-device security by secure association with the designated host system. The functioning of this device does not affect the operation of the UWB radio transceiver as it only stores a digital identification key for validating the host-device connection.

References.

WiMedia Physical Layer Specification 1.1.

WiMedai MAC-PHY Interface Specification 1.0.

Universal Serial Buss Specification 2.0