

Squared_Modem

Evaluation kit

Evaluation kit **Squared_Modem** is intended for performance evaluation of **Squared_Link** SDR platform. **Squared_Modem** includes **Squared_Link**, RF board and motherboard in mezzanine construction placed into comfortable enclosure. It can be used as standalone solution too.

Applications

- ◆ Point-to-point links
- ◆ White space radios
- ◆ Unmanned vehicles
- ◆ Hobby



Features

- ◆ Communication technology: scaled OFDM1024 with unique technology for mixing of wide-band, narrow-band, spread spectrum and fragmented spectrum signals in one air link frame.
- ◆ Duplexing mode: TDD or FDD.
- ◆ Bandwidth: 1–20 MHz (smoothly variable).
- ◆ Modulation: BPSK; QPSK; 8QAM; 16QAM; 64QAM; 256QAM.
- ◆ FEC: LDPC.
- ◆ FEC rates: 1/2; 2/3; 3/4; 5/6.
- ◆ Spread spectrum mode features:
 - spreading factor: 2–106 (any even number);
 - SNR (BER=10⁻⁶, spreading factor 106): –17.0 dB;
 - maximal signal search duration: 1 sec.
- ◆ MIMO features (maintenance depends on hardware version):
 - number of antennas: 2;
 - working modes: SISO, SIMO, MISO, MIMO;
 - space time code in MISO and MIMO modes: Alamouti code.
- ◆ Air link frame duration: 2–20 ms.
- ◆ Cyclic prefix duration: 1/32; 1/16; 1/8; 1/4.

- ◆ Carrier frequency range: 1910–2500 MHz¹.
- ◆ Maximal TX output power:
 - normal mode: +16.5 dBm;
 - low power mode: +14.5 dBm.
- ◆ RX sensitivity depends on bandwidth, modulation and FEC rate. Tables 1 and 2 show sensitivity values for Squared_Modem's receiver operating in 10 MHz bandwidth.

Table 1. Squared_Modem's receiver sensitivity [dBm] in high speed mode

FEC rate	Modulation					
	BPSK	QPSK	8QAM	16QAM	64QAM	256QAM
1/2	-102.1	-99.1	-96.1	-93.6	-88.6	-82.6
2/3	-100.6	-97.6	-94.1	-90.6	-84.6	TBD
3/4	-99.6	-96.6	-93.1	-88.6	-82.6	TBD
5/6	-98.6	-95.6	-91.6	-87.6	-81.6	TBD

Table 2. Squared_Modem's receiver sensitivity [dBm] in spread spectrum mode

Spreading factor						
4	8	16	32	40	64	106
-105.3	-109.3	-112.3	-114.3	-115.3	-117.3	-119.5

- ◆ Information rate depends on bandwidth, modulation and FEC rate. Tables 3 and 4 show information rates for 10 MHz bandwidth and cyclic prefix length 1/32.

Table 3. Information rate [Mbps] in high speed mode

FEC rate	Modulation					
	BPSK	QPSK	8QAM	16QAM	64QAM	256QAM
1/2	4.06	8.12	12.18	16.24	24.37	32.48
2/3	5.41	10.83	16.24	21.66	32.48	43.32
3/4	6.09	12.18	18.28	24.36	36.56	48.72
5/6	6.77	13.54	20.31	27.08	40.62	54.16

Table 4. Information rate [Mbps] in spread spectrum mode

Spreading factor						
4	8	16	32	40	64	106
2.03	1.01	0.507	0.253	0.203	0.096	0.058

¹ For operation with Squared_Modem in field user must get an appropriate license from local wireless regulator. Buyer acknowledges and agrees that it is solely responsible for compliance with all legal and regulatory requirements concerning operation with Squared_Modem

- ◆ Network configurations: P2P; PMP; mesh networking².
- ◆ Interfaces:
 - universal: Ethernet 100 BASE-T;
 - control: USB 2.0;
 - debug: UART, JTAG (internal connectors of motherbaord).
- ◆ Connectors:
 - Ethernet RJ45;
 - USB micro-B;
 - antenna connectors 2xSMA;
 - power connector: barrel type (internal diameter 2 mm, external diameter 5.5 mm).
- ◆ Power: 7-15 V.
- ◆ Available hardware versions:
 - 5CEBA5 FPGA (only SISO mode with bandwidth up to 12 MHz);
 - 5CEBA7 FPGA (SISO, SIMO, MISO);
 - 5CEBA7 FPGA (SISO, SIMO, MISO).
- ◆ Power consumption (bandwidth 12 MHz, 5CEBA7 FPGA):
 - full TX: 3.0 W (1TX); 4.5 W (2TX); 2.3 W (1TX, low power); 3.1 W (2TX, low power);
 - full RX: 2.3 W (1RX); 2.7 W (2RX).
- ◆ Operating temperature range:
 - commercial version: 0°C to +70°C;
 - industrial version: -40°C to +85°C.
- ◆ Physical dimensions: 55(L)x40(W)x8(H) mm.

Note. All specifications are subject to change without notice.

² PMP and mesh networking are maintained only with external MAC level.

Functional description

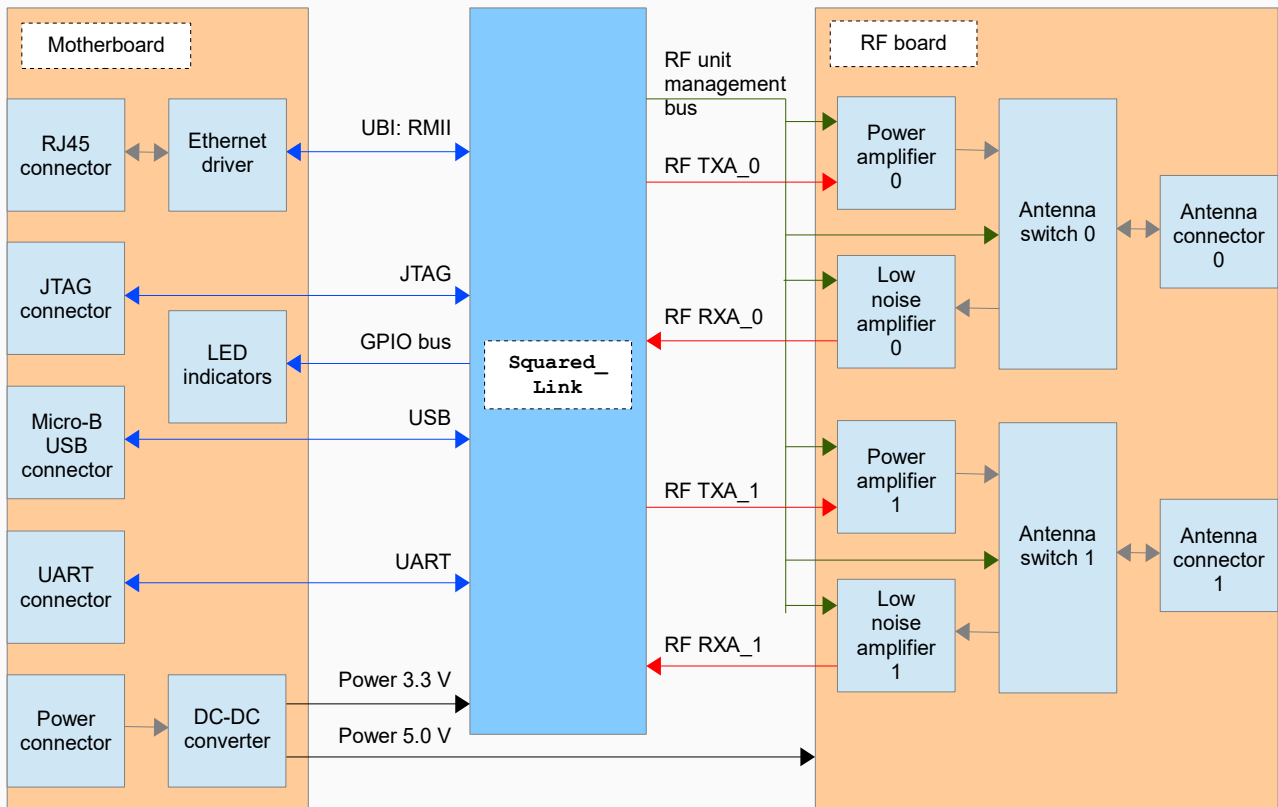


Figure 1. Squared_Modem Functional Block Diagram

Configuration of **Squared_Modem**, receiving the statistical information about wireless channel and information exchange all these operations can be done by one Ethernet interface. Configuration of microcontroller and FPGA and receiving the statistical information is available also by USB control interface and **SDR_surfer** software.

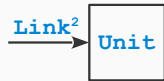
Squared_Modem can work in one of the two modes.

1. Standalone mode is used in point-to-point and relay networks.

In this mode **Squared_Modem** process all information frames autonomously with no aid from external MAC level.

2. MAC mode is maintained for all network configurations.

In this mode **Squared_Link** works as PHY level together with external MAC level using Ethernet as connecting interface between them.



Contacts

Link2Unit.
Sankt-Petersburg, Russia
E-mail: mail@link2unit.ru
URL: www.link2unit.ru/com

