Adaptive Modem for E-band

bc011, “E-Band”

The Binary Core modulation scheme bc011, “E-Band”, is specifically designed to operate in 250 MHz channel spacing for E-Band applications. All square and cross modulation formats from 4- up to 1024-QAM are supported. A finely tuneable coding scheme allows to optimize the trade-off between throughput and error performance.

Features

- Eight modulation formats (4-, 16-, 32-, 64-, 128-, 256-, 512-, and 1024-QAM).
- Up to 2 Gbit throughput in 250 MHz channel spacing.
- Adaptive modulation switching based on channel measurement and internal service channel signalling.
- Modem latency independent of the modulation format.
- Byte interface compatible with both asynchronous and synchronous data flow.
- Finely tuneable symbol frequency.
- Polynomial predistortion.
- TX and RX I/Q impairments recovery (amplitude and phase unbalance).
- Timing recovery with digital re-sampling.
- Carrier recovery with pilot symbols for improved robustness to phase noise, with automatic frequency recovery for fast carrier acquisition.
- 20-tap adaptive fractionally spaced equalizer.
- Finely tuneable multilevel coding scheme based on inner code on the two least significant bits, concatenated Reed-Solomon code, with interleaving of selectable depth.

FEC Reconfigurability and Throughput

The Binary Core bc011 Modem "E-Band" provides a wide range of dynamically reconfigurable parameters in order to best target your application. For example

- Optional pilot symbols. The number of pilot symbols in a 960-symbol radio frame, N_{pilot}, is independently selectable in a wide range of values for each modulation format, even in the case of adaptive modulation.
- Inner code rate R_{in} independently selectable for each modulation format, even in the case of adaptive modulation. Allowed rates $R_{\text{in}} = 0.5, 0.688, 0.8, 0.875, 1$ (bypass).
- Outer Reed Solomon code parity bytes P_1, P_2, P_3, P_4, P_5 selectable in the range 0÷16, independently for each of the 5 external partition levels, and for each modulation format, even in the case of adaptive modulation.
- Configurable convolutional interleaver.

The transmission bit rate depends on channel spacing, modulation format, pilot symbol rate, inner code rate, outer code rate and internal service channel. Example throughputs are as follows.

- With 128-QAM, $R_{\text{in}} = 0.8$, no pilot symbols, $P_1 = P_2 = 16$ and $P_3 = P_4 = P_5 = 0$, we obtain

  $$\eta = 6.32 \text{ b/2D},$$

  which is adequate for SDH STM-1 transmission in 28 MHz channel spacing.
- An example adaptive modulation scheme that switches between 8 modulation formats is defined in the following table.

N	R_{in}	P_1	P_2	P_3	P_4	P_5	N_{pilot}	η (bit/2D)
4-QAM	0.5	16	n.a.	n.a.	n.a.	n.a.	0	0.864
4-QAM	0.800	14	n.a.	n.a.	n.a.	n.a.	0	1.479
16-QAM	0.800	16	8	n.a.	n.a.	n.a.	0	2.790
32-QAM	0.800	16	10	10	n.a.	n.a.	0	4.290
128-QAM	0.500	16	16	0	0	n.a.	0	5.715
512-QAM	0.500	16	16	0	0	n.a.	31	7.469
1024-QAM	0.500	16	16	0	0	0	47	8.301
1024-QAM	1.000	16	10	0	0	0	47	9.241