Eridan Communications

MIRACLE Tx/Rx Module EC-20/300-37C
For additional information
WWW: www.eridancommunications.com
Email: info@eridancommunications.com

EC-20/300-37C MIRACLE Power Transceiver

--PROVISIONAL--

Key Features

- Digital baseband input to RF power output integrated module
- +37 dBm peak output power
- 200-3000MHz dynamic tuning range
- Very high transmitter efficiency: 27dBm LTE downlink consumes $1W_{DC}$
- Modulation agnostic: GMSK, QAM, WCDMA, LTE, 5G-NR
- Max instantaneous signal BW 40 MHz
- Dual 12-bit data ports and SPI control interface

Options and Alternative Configurations

- Agile low-pass filter for multi-octave dynamic tuning applications
- Internal/external RF local oscillator
- 1-2500MHz dynamic tuning range
- 600-4200MHz dynamic tuning range
- 41dBm and 44dBm in development

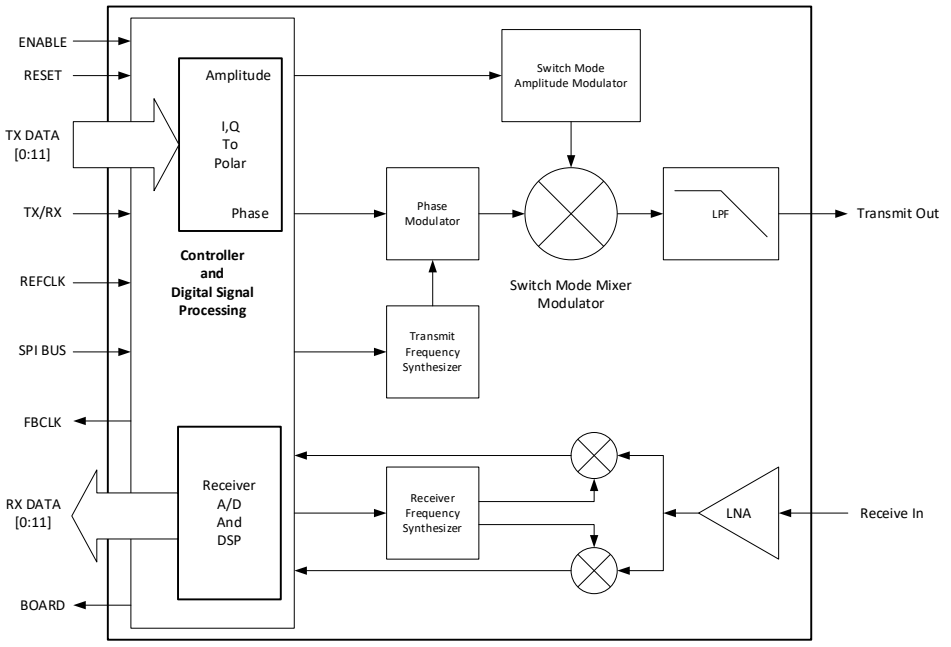

Figure 1: The block diagram for the MIRACLE TxRx module showing the digital data & control inputs and the RF input/output

Description

The MIRACLE Transceiver Module is a digital-baseband-input-to-RF-output integrated assembly that delivers mobile communications RF signal power at unprecedented system efficiency and "any signal at any frequency at any time" flexibility. Employed directly as a software-defined power transmitter (in conjunction with a separate receiver), or with the option of an internal receiver and employed as a full software-defined power transceiver, this technology is game changing for all things RF.

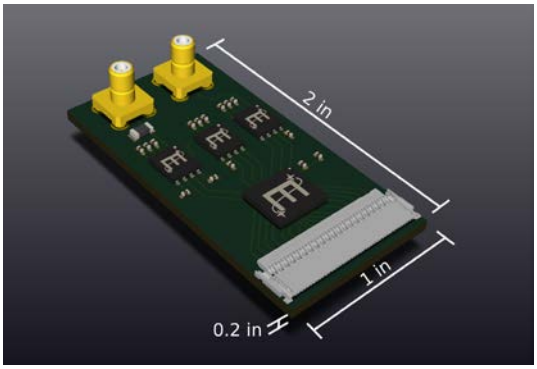

Figure 2: The MIRACLE transceiver requires a small footprint and is addressed via a low-profile flex connector.

Eridan's existing V5.1 prototype delivers 5W peak RF output, rapidly tunes over a frequency range of 200-3000MHz, and meets the 3GPP specification for all communications protocols (both uplink and downlink) up to 10MHz instantaneous bandwidth (IBW). Most importantly, it delivers this capability with an average signal efficiency, $\eta_{RF}(avg)$, of 40-60%, where

$$\eta_{RF}(avg) = P_{RF}(avg)/(P_{DC} - P_{SYS}),$$

$P_{RF}(avg)$ is the signal-average RF output power, and P_{SYS} is the DC power consumed by the balance of system including processing of the digital baseband, all control functions, DACs, ADCs, and drivers (estimated to be <1W in the final product stage).

This breakthrough performance is made possible by Eridan's development of its GaN-based Switch-Mode-Mixer-Modulator (SM^3) technology. The MIRACLE transmitter circuit architecture separately amplifies phase and amplitude signals and recombines them in a single, ultra-efficient, and wideband final SM^3 stage. The transmitter element delivers 3GPP specification-compliant LTE uplink and downlink performance including 47-50dB ACLR. The MIRACLE SM^3 technology has also demonstrated unprecedented spectral efficiency, delivering a 14-bit, 16,384 QAM WCDMA signal with >40dB SNR and <0.5% EVM.

The pre-production prototype, currently in development and projected to be completed by Q3/18, will integrate the balance of system into a single 65-nm ASIC, extend the signal IBW to 40MHz, extend the frequency range over a larger portion of the 40-4200MHz available from the SM^3, and size-reduce the module to a total of $<1 \times 2 \times 0.2$ inches. Configurations extending the peak power operation to 41dBm (12W) and 44dBm (25W) are in development.

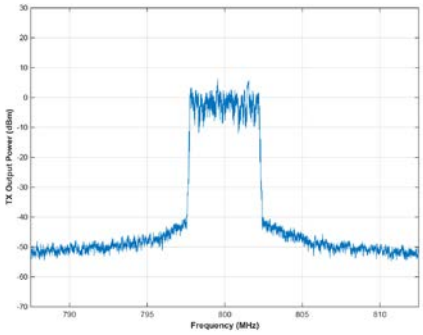

Figure 3: 5MHz LTE downlink

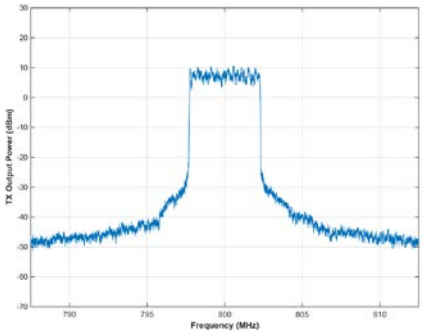

Figure 4: 5MHz LTE uplink

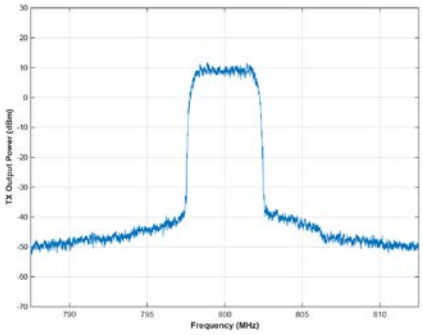

Figure 5: 16,384 QAM @ 84Mbps (~0.5% EVM)

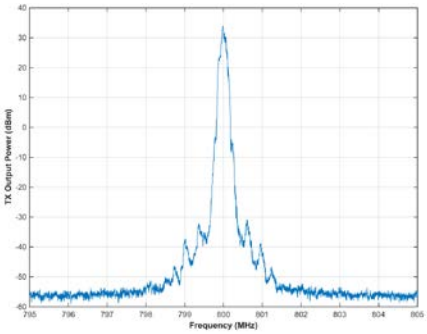

Figure 6: GMSK

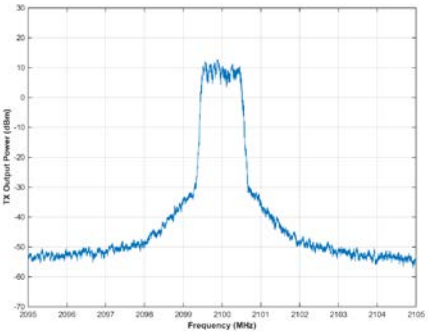

Figure 7: 1.4MHz LTE downlink

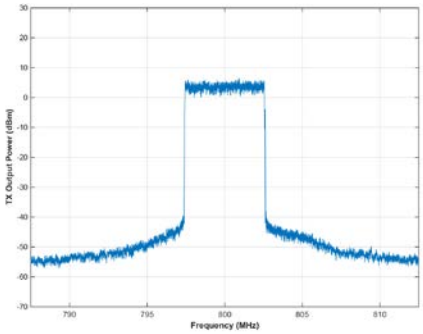

Figure 8: 5MHz 5G-NR

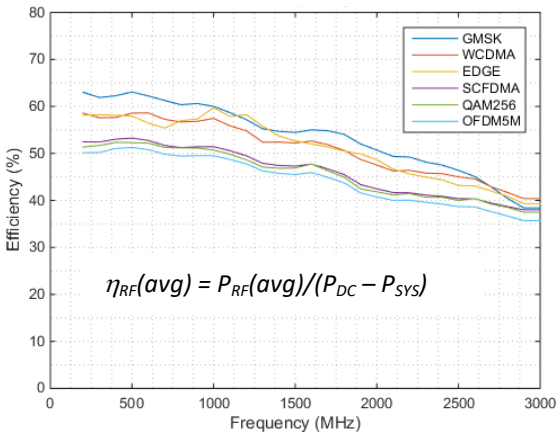

Figure 9: The average signal efficiency, $\eta_{RF}(avg)$, of the TxRx module as a function of carrier frequency. Average signal efficiency is the full DC-to-RF signal conversion efficiency of the module (digital input to power RF output), less the balance of system power, P_{SYS}.

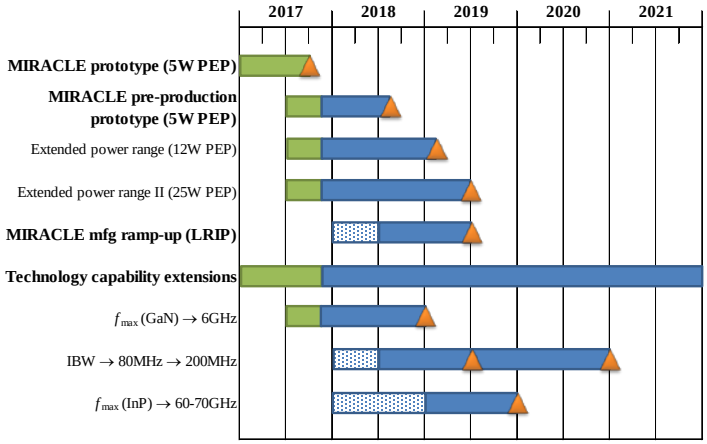

Figure 10: The technology roadmap for the MIRACLE transceiver family of products including power extensions to 12W and 25W, IBW extensions to 80MHz and 200MHz, and transition to InP for operation in the 60-70GHz frequency band.

Parameter	Prototype V5	Prototype V5.1	Prototype V6	Pre-Production Prototype	Product Release
Integration	Ext. FPGA Board w/ FMC	Interposer FPGA board	Onboard FPGA	ASIC	ASIC
Release Data	11/2016	Q1/2017	Not for release	Q3/2018	Q1/2019
PCB Area	2.5" X 5.05"	2.5" X 5.05"	2.5" X 7"	1" X 2"	1" X 2"
IBW (max)	5MHz	10MHz	40MHz	40MHz	40MHz
Configuration	Tx only	Tx Only	TxRx	TxRx	TxRx
Interface rate	40MSPS	40MSPS	Var, ≤80 MSPS	Var, ≤ 80MSPS	Var, ≤ 80MSPS
P_{SYS}	15W	6W	5W	<2W	<1W

Table 1: The rollout plan for the MIRACLE TxRx module integration.