

MCDWR16 – Multi-channel Digital Wideband HF Receiver System

The MCDWR16 provides a flexible bank of HF receivers for spectrum monitoring, direction finding and beamforming applications

Features and benefits

- Up to 9 DWR16 direct digitisation receiver cards packaged in a small form-factor, 19" 2U high case
- Simultaneous monitoring of up to 36 narrowband channels
- Supports simultaneous 'N-Channel' DF on four narrowband frequency channels
- External 10MHz clock and synchronisation inputs
- Fully synchronous/phase coherent operation
- Dual unit configuration for applications requiring up to 18 phase coherent receivers
- USB2.0 control and data interface
- Windows®-based Signal Monitoring Application software and API



Description

The MCDWR16 provides a configurable bank of DWR16 HF receiver cards suitable for applications including multi-channel spectrum monitoring, direction finding (DF) and beamforming. Each individual receiver card directly digitises the full HF spectrum from a separate RF input and subsequently feeds four digital down-converters/digital drop receivers to provide four narrowband frequency channels in complex base-band (I/Q) format.

The MCDWR16-9 hardware configuration enables the 9 receiver cards to be software-configured to provide up to 36 independently tuned narrowband frequency channels for spectrum monitoring applications. Alternatively, for 'N-Channel' direction finding and beamforming applications, the software can configure the 9 receiver cards to provide 4 simultaneous narrowband channels that are phase coherently tuned across the 9 receiver cards.

The MCDWR16-8/1 hardware configuration provides a bank of 8 receivers that can be coherently tuned plus a completely independent 9th receiver. This configuration is typically used in applications that require a single monitoring receiver with the ability to hand-off signals of interest to an 8-channel DF receiver.

In addition, two MCDWR16 receiver units may be connected together to form systems with up to 72 independent narrowband frequency channels or 18 phase coherently tuner receivers (each providing 4 separate narrowband frequency channels).

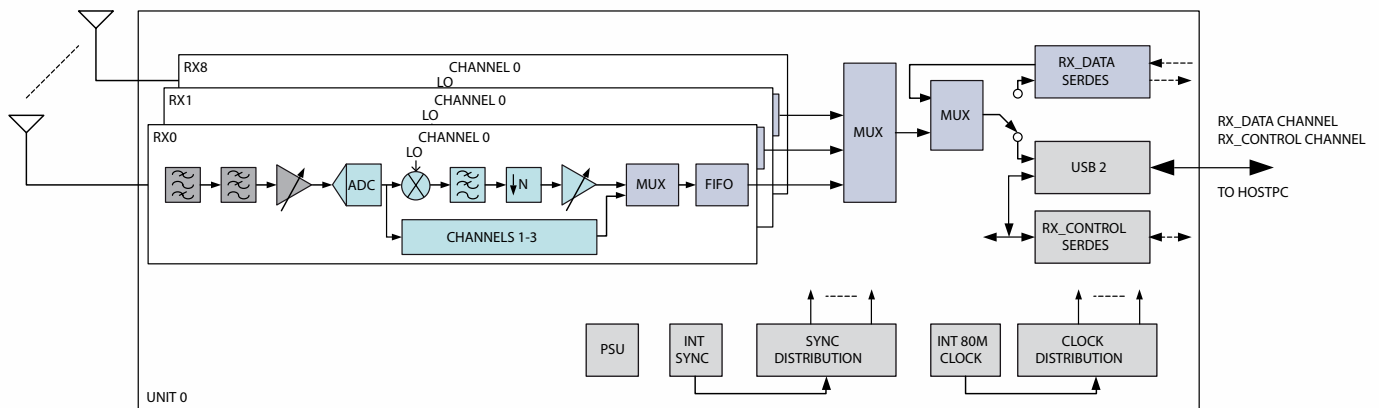
The MCDWR16 is controlled by software running on a Windows® PC. Receiver control commands and signal data from the unit are transferred via an industry-standard USB2.0 interface. When configured as an MCDWR16-8/1 the 9th receiver card is controlled and data received over a physically separate USB2.0 connection.

Receiver functions

A detailed description of the receiver cards are covered in the LOCATE DWRI6 datasheet. Features specific to the multi-channel system are:

- Coherently sampled receivers permit either independent or coherent phase tuning
- Internal 80MHz or external 10MHz clock options.
- External synchronisation input for GPS 1PPS signal or other hardware synchronisation signal
- Clock and sync distribution extendable to support second multi-channel receiver unit
- Control and data channels to/from second multi-channel receiver unit
- Ganged or independent analogue gain control of the receiver input signals
- Ganged or independent digital gain control of the narrowband frequency channel signals

Block diagram



Signal Monitoring Application software

The MCDWR16 is supplied with a Windows®-based Signal Monitoring Application software package. This software configures the MCDWR16 to operate the unit as a bank of 36 independently tuned narrowband receivers and provides a user-interface for receiver control and signal processing of the received signals.

The signal processing for each narrowband frequency channel includes:

- Tuning over the range 0Hz to 40MHz with 1Hz resolution
- Bandwidths ranging from 56Hz to 32kHz,
- Demodulation modes (AM, FM, CW, USB, LSB, ISB and I/Q)
- Gain control: automatic (fast, medium, slow) and manual (6dB steps)
- Audio output and recording



The software displays a summary of the status of each of the 36 narrowband frequency channels with the channels from each receiver card arranged in columns.

The raw data stream from the receivers can be recorded in real-time and subsequently played back off-line using different narrowband channel bandwidths and demodulation modes.

A client / server version of the software is provided to enable the receiver hardware to be connected to a remote server PC that converts the USB traffic into TCP/IP protocol. The re-formatted data is then transferred over Ethernet to a client PC running the main control interface and signal processing functions.

A control and data interface is provided to allow third-party software applications to control the receivers and access the demodulated signals for further processing (e.g. signal classification).

For custom application software developments a number of APIs are available. The main MCDWR16 interface API enables a number of different modes of operation to be utilised. For instance the digital drop receivers in the DWR16 receiver cards can be configured for larger bandwidths (e.g. 600kHz) by trading either the number of narrowband channels per receiver card or the number of receiver cards used, subject to the capacity of the high-speed USB2.0 link. Alternatively, the digital drop receivers can be programmed to phase-coherently track an LFM CW signal for ionospheric chirp-sounding applications. Please contact Roke for further details.

Specifications

Frequency range	9kHz to 40MHz (reduced performance for <500kHz and >30MHz)
Frequency resolution	1Hz
Frequency accuracy	+/- 1ppm (typ), +/- 4.6 ppm over temperature and 20 year aging
Internal reference	80MHz
External reference (optional)	10MHz, 0dBm into 50 Ω
Phase noise	-135dBc/Hz at 1kHz offset
Antenna input	1 input per receiver, 50 Ω
VSWR	< 2.0:1 (max), <1.5:1 (typ)
Input level	\leq -12dBm at max sensitivity (typ) \leq +18dBm at min sensitivity (typ)
Max input level (non destructive)	+30dBm
Preselection	30MHz low-pass filter
Input attenuation	automatic or manual, 31dB range, 1dB step
ADC resolution	16 bits
DDC aliasing suppression	>90dB, 110dB (typ)
Spurious signals	< -92dBm (typ) [input: -14dBm tone, max sensitivity]
2nd order intercept point (at max sensitivity)	> +60dBm, $f \geq$ 1MHz > +50dBm, $500\text{kHz} \leq f <$ 1MHz

3rd order intercept point (at max sensitivity)	\geq +22dBm, $1\text{MHz} \leq f <$ 30 MHz \geq +17dBm, $500\text{kHz} \leq f <$ 1 MHz
Noise figure	\leq 14dB at max sensitivity
Demodulation modes	AM, FM, CW (IF bandwidth \leq 16kHz), USB, LSB, ISB, I/Q
Narrowband IF bandwidths	56Hz to 32kHz
Shape factor (3dB/60dB)	< 1:1.2 (typ)
Gain control	automatic (fast, medium, slow) manual (-18dB to +72dB in 6dB steps)
Analogue audio	Audio output from PC/laptop
Control and data interface	USB2.0 (High Speed)
Operating temperature range	0°C to 50°C
Storage temperature range	-40°C to +70°C
Humidity	< 95% non-condensing
Power supply	110-240VAC, 2.5A
Power consumption	35 W
Size	448 x 90 x 315mm (W x D x H) 19", 2U high
Weight	5.25kg
PC/laptop requirements	1.7GHz Intel® P4 or better, Windows® XP, Vista, Win 7. USB2.0 (High Speed)
Software	Signal Monitoring Application software package. API available on request



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Ordering Information
MCDWR16 part number: X72/1/2233/511

Please contact Roke for hardware configuration details

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