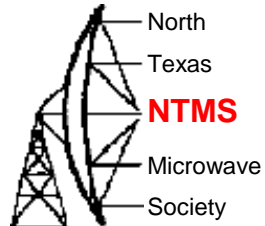


USRP and SodaRadio

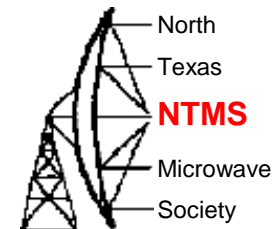
Eric Haskell – KC4YOE

USRP B200 Transceiver

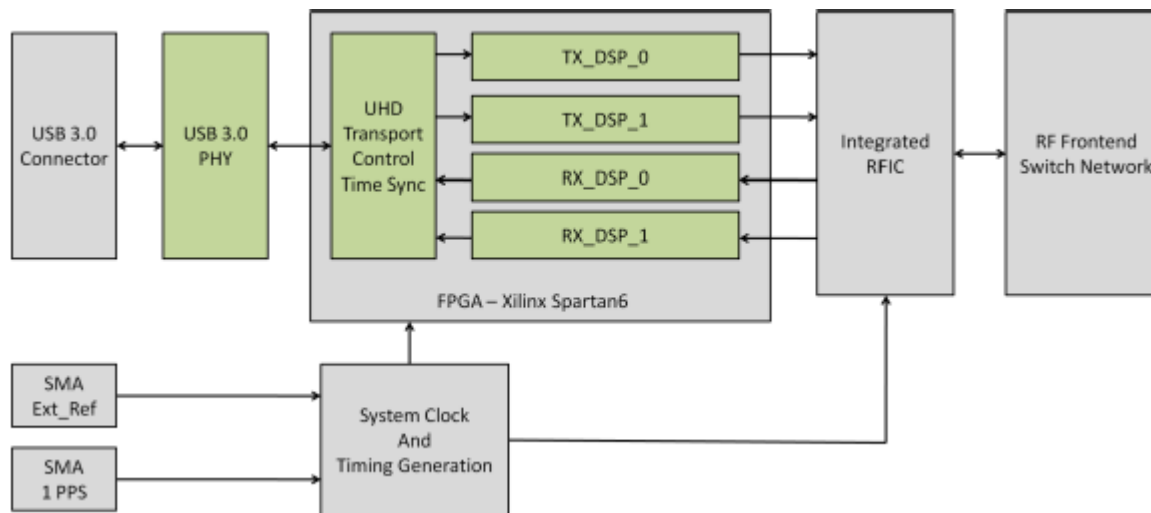
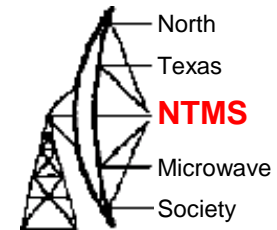


- The first fully integrated USRP device with continuous RF coverage from 70 MHz –6 GHz (unofficially 50MHz to 6GHz)
- Full duplex operation with up to 56 MHz of real time bandwidth (61.44MS/s quadrature)
- Fast and convenient bus-powered connectivity using SuperSpeed USB 3.0
- GNURadio and OpenBTS support through the open-source USRP Hardware Driver™ (UHD)
- Open and reconfigurable Spartan 6 XC6SLX75 FPGA with free Xilinx tools (for advanced users)
- Early access prototyping platform for the Analog Devices AD9361 RFIC, a fully integrated direct conversion transceiver with mixed signal baseband
- \$675 for the board From Ettus Research (Part of National Instruments)

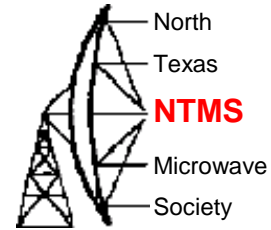
USRP B200 Transceiver



USRP B200 Transceiver



USRP B200 Transceiver



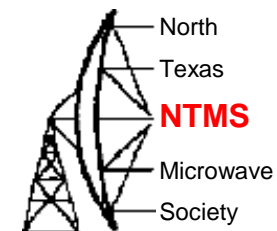
Spec	Typ.	Unit
Power		
DC Input	6	V
Conversion Performance and Clocks		
ADC Sample Rate (max)	61.44	MS/s
ADC Resolution	12	bits
ADC Wideband SFDR	78	dBc
DAC Sample Rate (max)	61.44	MS/s
DAC Resolution	12	bits
Host Sample Rate (16b) ***	61.44	MS/s
Frequency Accuracy	±2.0	ppm
W/ GPS Unlocked TCXO Reference	±75	ppb
W/ GPS Locked TCXO Reference	< 1	ppb

*All specifications are subject to change without notice.

*** See benchmark results for sample rates in various configurations.

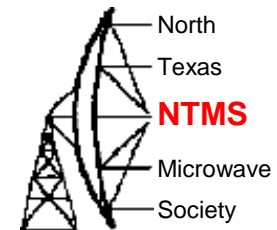
Spec	Typ.	Unit
RF Performance (single channel)		
SSB/LO Suppression	-35/50	dBc
3.5 GHz	1.0	deg RMS
6 GHz	1.5	deg RMS
Power Output	>10	dBm
IIP3 (@ typ NF)	-20	dBm
Receive Noise Figure	<8	dB
Physical		
Dimensions	9.7x15.5x1.5	cm
Weight	350	g

AD Integrated RF to digital chip AD9361



- RF 2×2 transceiver with integrated 12bit DACs and ADCs
- 70 MHz to 6.0 GHz
- Tunable channel bandwidth :<200kHz to 56 MHz
- Dual receivers:
- 6 differential or 12 single ended inputs
- Noise figure of 2 dB at 800MHz
- Dual transmitters: 4 differential outputs
- Highly linear broadband transmitter
- TX EVM: ≤ -40 dB
- TX noise: ≤ -157 dBm/Hz noise floor
- Integrated fractional N synthesizers 2.4 Hz maximum LO step size

My USRP B200



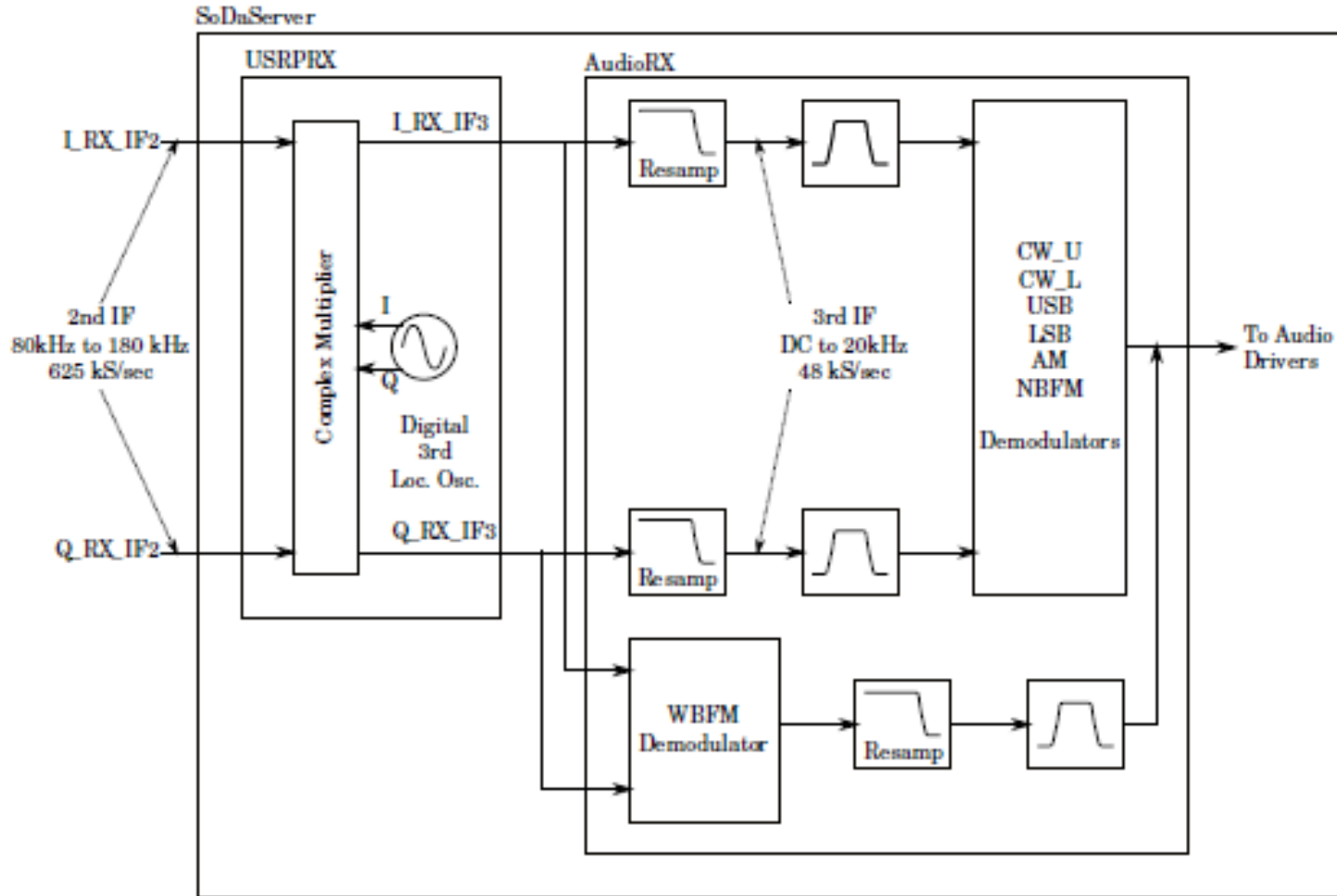
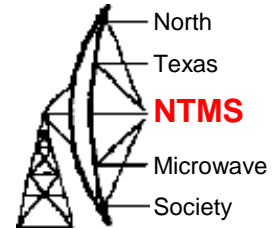
SoDaRadio Software



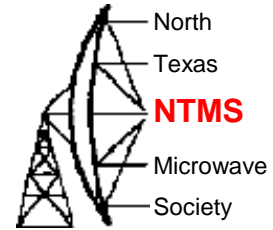
SoDaRadio is an allmode VHF/UHF transceiver built for the Ettus Research USRP N2xx and B2xx software defined radio platforms. It is designed for use by amateur radio operators by Matt Reilly, KB1VC

- All mode receiver: CW_U, CW_L, USB, LSB, AM, NBFM, WBFM
- Multi-mode transmitter: CW_U, CW_L, USB, LSB, NBFM
- Tested with Ettus N200 and WBX Module (tunes from 50MHz to 2100MHz)
- Tested with Ettus B210 (tunes from 50MHz to 6GHz)
- Developed for use with microwave transverters
- GUI has built in distance and bearing calculator

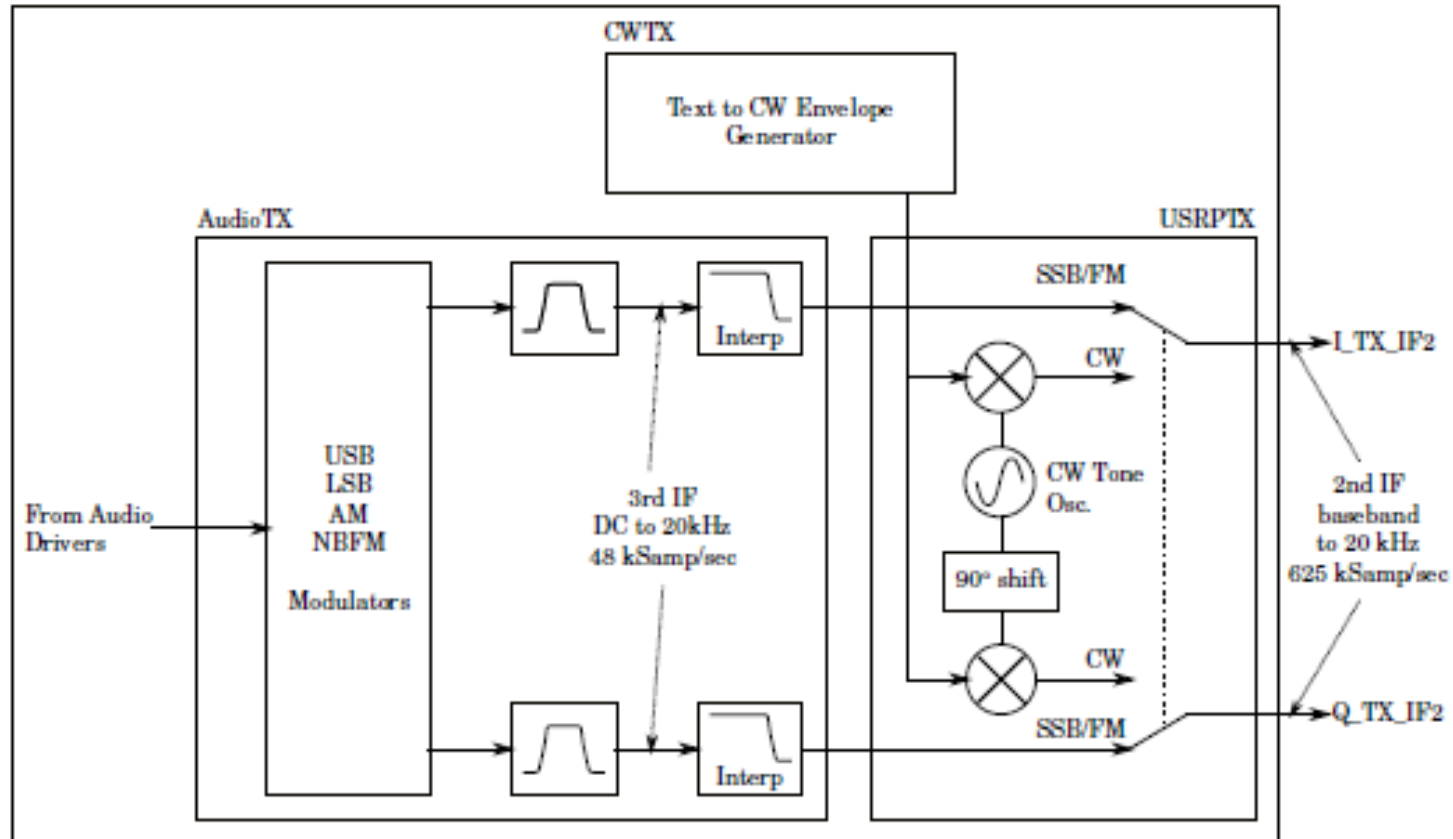
SoDaRadio Rx



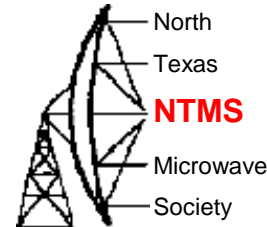
SoDaRadio Tx



SoDaServer



SoDaRadio Software



SoDa Radio
File Configure QSO Actions Help

Waterfall Periodogram

Band Spread: 200 kHz
Center Frequency: 162550
Y Rng (dB/box): 10dB
Y RefLevel (dB): 0

Mode: NBFM
AF Bandwidth: 2000 Hz
AF Gain: [Slider]
RF Gain: [Slider]
TX Frequency: 146.520 000
TX=RX Lock:
RX Frequency: 162.550 000
Tune

From Grid: Bearing 000 T 015M
To Grid: Rev. Bearing 000 T 015M
To Call: Range 35 km

Transmit CW Text

TX PTT: **TX OFF**

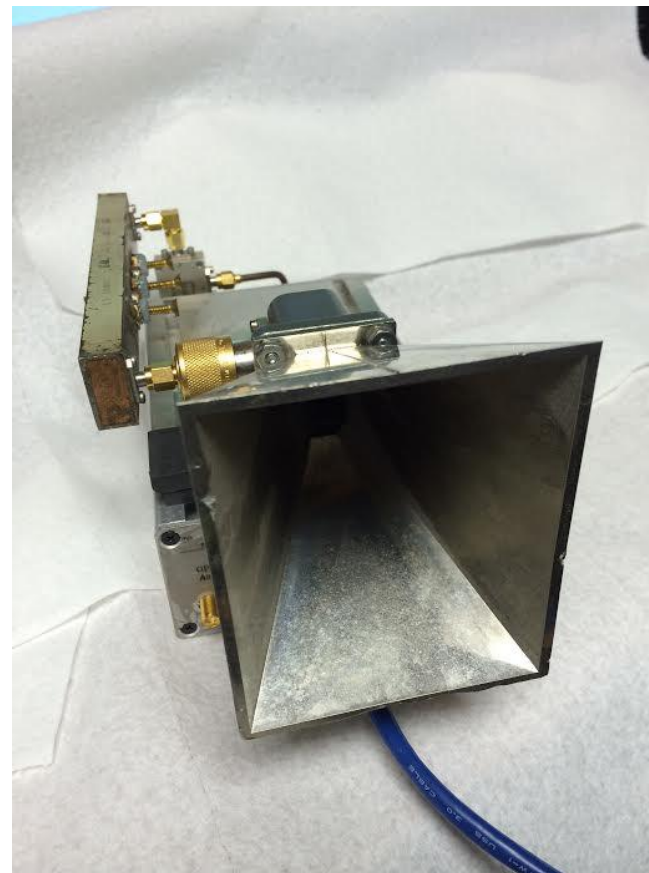
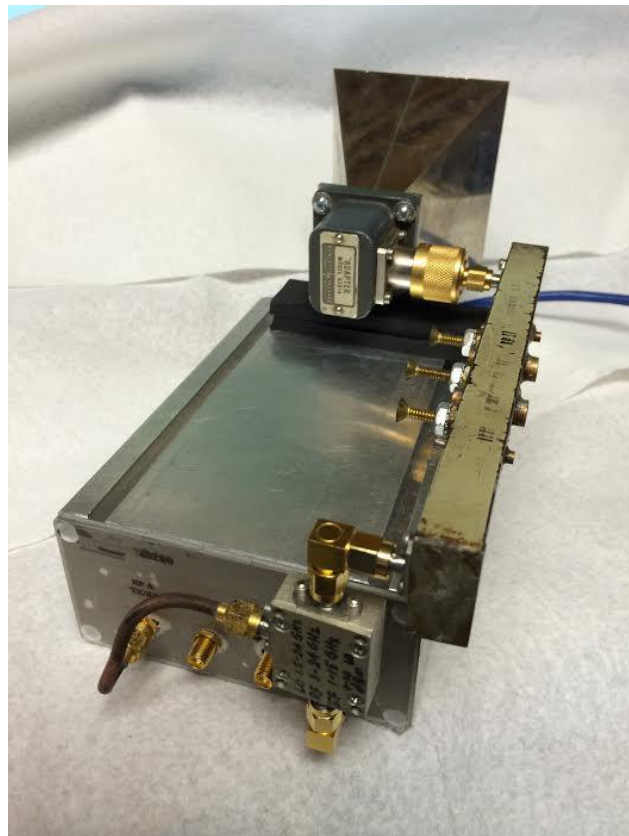
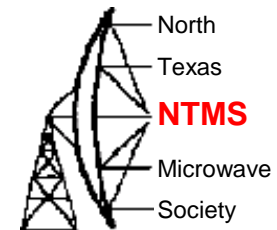
TIME (UTC): 00::00:00
LAT: 00.00
Grid: XX99xx
LON: 00.00

Set Power, Speed, Sidetone
CW Control: Exchange My Info My Call My Grid QSL BK 73 V Carrier Repeat: 1 Clear CW Buffer

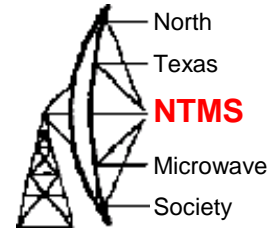
Log Comment: [Text Box] Edit Log

^C Set To Call ^G Set To Grid ^L Enter Log Comment ^X Enter CW Text SoDa.soda_log

SoDaRadio Software



SoDaRadio Software



SoDa Radio B210

File Configure QSO Actions Select Band Help

Waterfall Periodogram

Band Spread: 200 kHz

Center Frequency: 10368100

RX->CFreq

Y Rng (dB/box): 5dB

Y RefLevel (dB): 0

Mode: CW_U

AF Bandwidth: 2000 Hz

AF Gain: [Slider]

RF Gain: [Slider]

TX Frequency: 10,368.102 388

TX=RX Lock

RX Frequency: 10,368.102 388

Tune

From Grid: [Field]

Bearing: 000 T 015M

To Grid: [Field]

Rev. Bearing: 000 T 015M

To Call: [Field]

Range: 35 km

Transmit CW Text: VVVVVVVVVVVV

TX PTT: **TX OFF**

TIME (UTC): 00::00:00

LAT: 00.00

Grid: XX99xx

LON: 00.00

Set Power, Speed, Sidetone

CW Control: Exchange My Info My Call My Grid QSL BK 73 V Carrier

Repeat: 1

Clear CW Buffer

Log Comment: [Field]

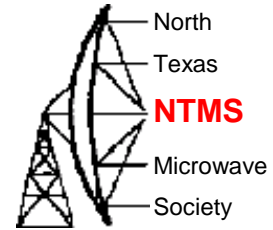
Log Contact: [Field]

Edit Log

^C Set To Call ^G Set To Grid ^L Enter Log Comment ^X Enter CW Text

SoDa.soda_log

SoDaRadio Software



Band Configuration

Band Name

RX Antenna Band ID Number

Lower Band Edge MHz Transverter Mode

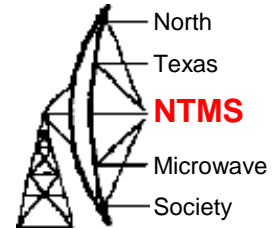
Upper Band Edge MHz LO from TX2 Port

Default Modulation Mode Injection Low Side High Side

Enable Transmit Transverter LO Frequency MHz

Transverter Multiplier

SoDaRadio Software



TX Frequency

00,144,284,611 TX->RX Last TX

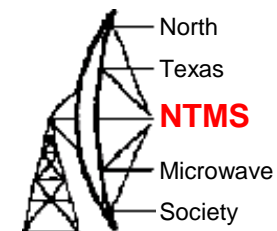
RX Frequency

00,144,295,944 RX->TX Last RX

Ext Ref Enable · Ref Locked · RX LO Locked · TX LO Locked · Transverter LO Cal

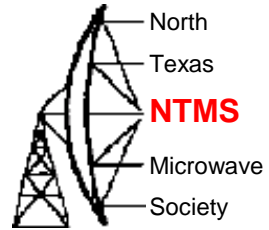
Done

My Progress



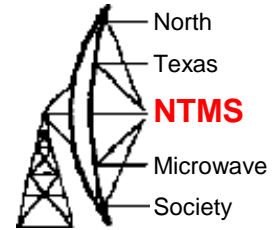
- Downloaded Ettus Live Image of MINT Linux with USRP tools and Demos
- Compiled and ran SoDaRadio 3.5 on the Ettus Image.
- Still having some issues with Image on Laptop HD
- Installed B200 board in \$13 China eBay extrusion after cutting of about an inch and adding light pipes
- Added Matt's T/R interface board with optoisolator and relay
- Designed and built 145MHz, 10 MHz BW 2 resonator BPF
- Confirmed improved antenna sensitivity with wideband LNA and filter

Plans



- Load new FPGA image with T/R interface enabled
- Add T/R switching and band switching and control
- Add more filter bands
- Add PA's
- Add transverter for 10GHz

Resources



- <http://sodaradio.sourceforge.net/Site/SoDaRadio.html>
- <http://www.ettus.com/product/details/UB200-KIT>
- <http://www.ettus.com/>