

Iceni 432MHz Transverter Technical Description

Introduction

Iceni is a 432MHz to 28MHz low power transverter module featuring a low noise local oscillator for excellent phase noise performance, overdriven double balanced ring mixer and high dynamic range HEMTS MMICs for low noise and excellent performance under strong out-of-band signal conditions.

The project was designed to use solid analogue design circuits to provide a frills-free, easy to use and low cost 70cm transverter module that could be used with an existing HF transceiver to produce a high quality signal on 432MHz as well as having excellent strong receive signal handling performance.

Surface mount components are used almost throughout. The PCB features a large number of plated through holes so that home production of the board is not recommended. Boards and short kits are available from the author.

Parameter	Measured	Comments
Rx noise figure	2.0dB	Usual uncertainties apply
Rx gain	21dB +/-1dB	Fixed gain
Rx maximum input level	0dBm	Max non-damage level
Rx IIP3	-10dBm +/-1dB	Measured at -37dBm/tone
RX Bandwidth	8.5MHz	3dB bandwidth
Tx gain	16.5dB +/-0.5dB	Tx attenuator at minimum
Tx IF Input level	0dBm	Max +6dBm at attenuator minimum
Tx output power	+20dBm	At +6dBm IF input. 0dBm max IF input recommended
Tx IMD	-50dBc/-38dBc	+7dBm/+10dBm per tone at output
Tx spurious	<-60dBc	Except second harmonic -53dBc at +16.5dBm output
Receive current	260mA at 12v	Unchanged from 9V to 14V
Transmit current	280mA at 12v	Unchanged from 9V to 14V

Table 1 measurements on unit serial number #4006

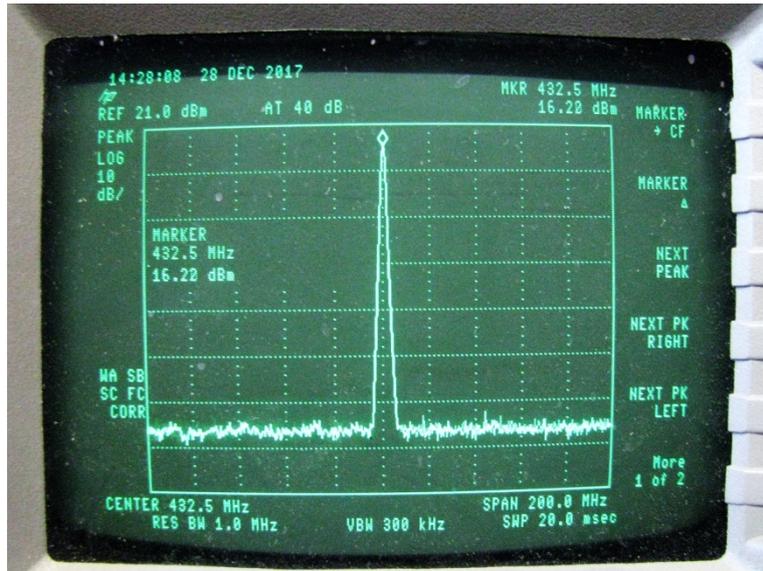


Photo 1 Icen output spectrum at +16.5dBm output showing the clean spectrum, with LO and image over -60dBc

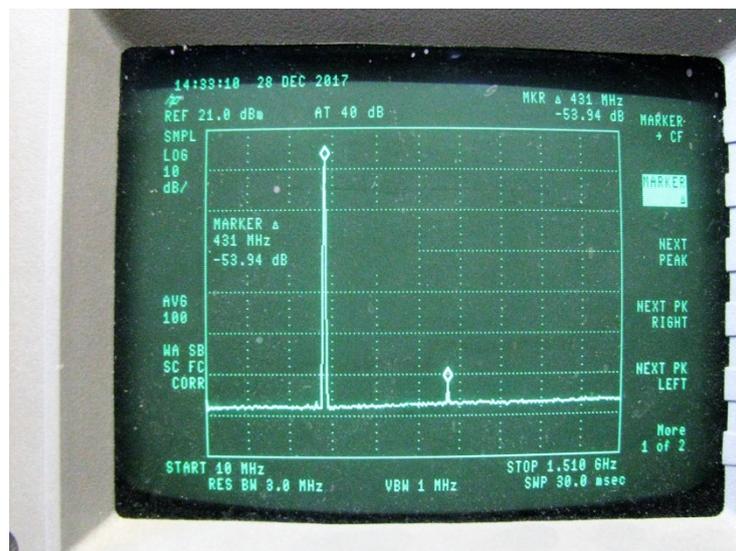


Photo 2 Icen spectrum at +16.5dBm output and from 10MHz to 1510MHz. The only harmonic is the second at -53dBc

Circuit description

The Icen uses similar circuitry to the 144MHz Anglian 3L transverter previously described. The original low noise crystal controlled local oscillator has been modified to produce a high level 404MHz output that is used to drive a 1.3GHz rated mixer. This mixer was chosen for low cost and good LO to RF isolation. Poor LO to RF isolation usually leads to higher than wanted LO appearing at the transverter transmit converter output. The Icen meets CEPT recommendations in terms of unwanted spurious output signals. Six poles of helical filtering help to ensure the excellent spectral purity of the output signal.

On receive a low noise, high dynamic range MMIC input amplifier is preceded by a low loss 432MHz noise matching band pass filter. The MMIC is followed by a diode PIN switch, three pole helical filter and then the single double balanced mixer, also used on transmit. Following the mixer a high pass, low pass diplexer feeds a very high dynamic, low noise MMIC post mixer amplifier to provide a 14dB lift to the IF signal. This is followed by a two stage IF (29MHz CF) bandpass filter to ensure that the following HF transceiver is not subject to LO or other out of band mixer products.

On transmit a separate IF input is provided with level adjustment before a bandpass filter centred on 29MHz ensures that unwanted out of band IF signals are much reduced by this and the following diplexer before feeding the mixer. The optimum level of IF drive is -3dBm, although IF inputs up to about +20dBm (100mW) can be used if the transmit gain attenuator is used to reduce them to no more than 0dBm at the mixer input.

Two stages of transmit amplification are separated by a three pole helical filter. The first amplifier stage uses the same low noise, high dynamic range MMIC as the LO amplifier and receive converter RF stage. This provides 22dB of gain before the helical filter, which has approximately 4dB loss. Following the second filter a high dynamic range MMIC provides another 14dB of gain before the output low pass filter. The output power is 100mW (+20dBm). Maximum recommended output is +17dBm. Most small add-on 1-2w amplifier modules require no more than 10-20mW drive for full output. A range of these are available at low cost on EBay (why compete?)

It is possible to lock the Icen1 local oscillator, for higher stability, by injecting a low level 101MHz signal to the LO input/output port.

+5V on transmit and a ground on transmit (EOT) output are provided for interfacing to any add-on amplifier and transmit is enabled with a press to talk (PTT) ground input.

The recommended power supply voltage is 10V, although up to 13.5V may be used. However the excess voltage will be lost as heat dissipation in the 5V regulator. This is not recommended, but if only a 13.5V supply must be used, then it is recommended that a 1.5W rated 10Ω resistor is connected in series with the input and located external to the Icen1.

The Icen1 should be mounted into the recommended tin plate box. As an alternative, 4x 3mm holes are provided in the PCB to enable the board to be mounted direct to a box chassis, using suitable length threaded pillars and screws.

Kits (not built units) are available from G4DDK. See www.g4ddk.com for prices and full build information.

73 de Sam, G4DDK

DDKits