Microwave Engineering Project

E-Mail: w5nyv@yahoo.com
Web: www.delmarnorth.com/microwave

SBMS Transverter

Test Plan

Test Results

Kerry Banke N6IZW, Michelle Thompson W5NYV
18 January 2009

The SBMS Transverter Project

The SBMS Transverter Project 2
Test Plan 4
Test Results 8
Applicability to MEP 8

Figure 1: N6RIN 3.4GHz Transverter 3
Figure 2: 3GHz Local Oscillator 4
Figure 3: Transverter Receive Amplitude and Phase Measurement Setup 5
Figure 4: Transverter Transmit Amplitude and Phase Measurement Setup 6
Figure 5: Test Setup Plot of Amplitude and Phase Over 200MHz Span 7
Figure 6: Test Setup Plot of Amplitude and Phase Over 20MHz Span 8

The San Bernardino Microwave Society designed a transverter as a club project, with the first set of kits ordered in early 2009.

The transverter project was designed to be constructed from commercially available parts, amount to minimal cost, and provide useful communications. While not a high-performance transverter, MEP became interested in evaluating this transverter because the same board can be used on both the 3.4GHz and 5.6GHz bands[1], and would be substantially cheaper than other microwave transverters.

The SBMS board uses a 2m intermediate frequency (IF), one Watt maximum transmit drive power, and is capable of operation on either 3456MHz or 3400MHz. A single coaxial connector is used between the IF radio and the transverter Switching between transmit and receive is accomplished by a push-to-talk signal. The single local oscillator will be separate from the transverter assembly. A connector for an external RF switch is provided. Microwave transmit and receive signals are on separate connectors. The circuit assembly uses 0.063 FR-4 fiberglass. Circuit board materials are not critical to the operation of this transverter. This allows low-cost boards to be to be fabricated from a variety of suppliers.

Please see "The San Bernardino Microwave Society Club Project: A 3456MHz Transverter" by Chris Shoaff N9RIN, Jerry Mulchin N7EME, and Dick Kolbly K6HIJ from Proceedings of Microwave Update 2008 for more information about the transverter design.

The following figures show the power connections and board layout of the transverter and 3GHz local oscillator provided by Chris Shoaff N9RIN.

[1] Chris Shoaff et al, "The San Bernardino Microwave Society Club Project: A 3456MHz Transverter" Proceedings of Microwave Update (2008):150

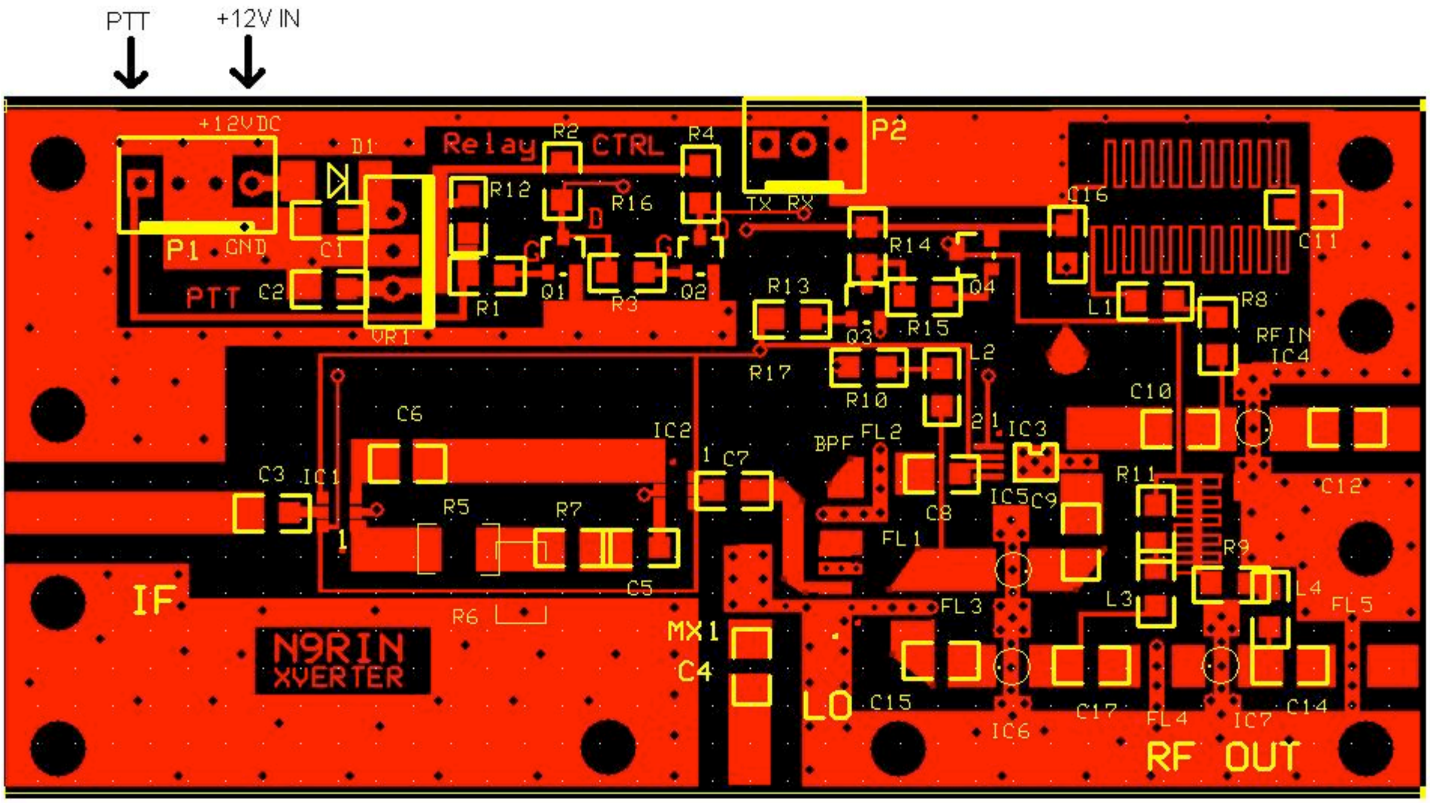

Figure 1: N6RIN 3.4GHz Transverter

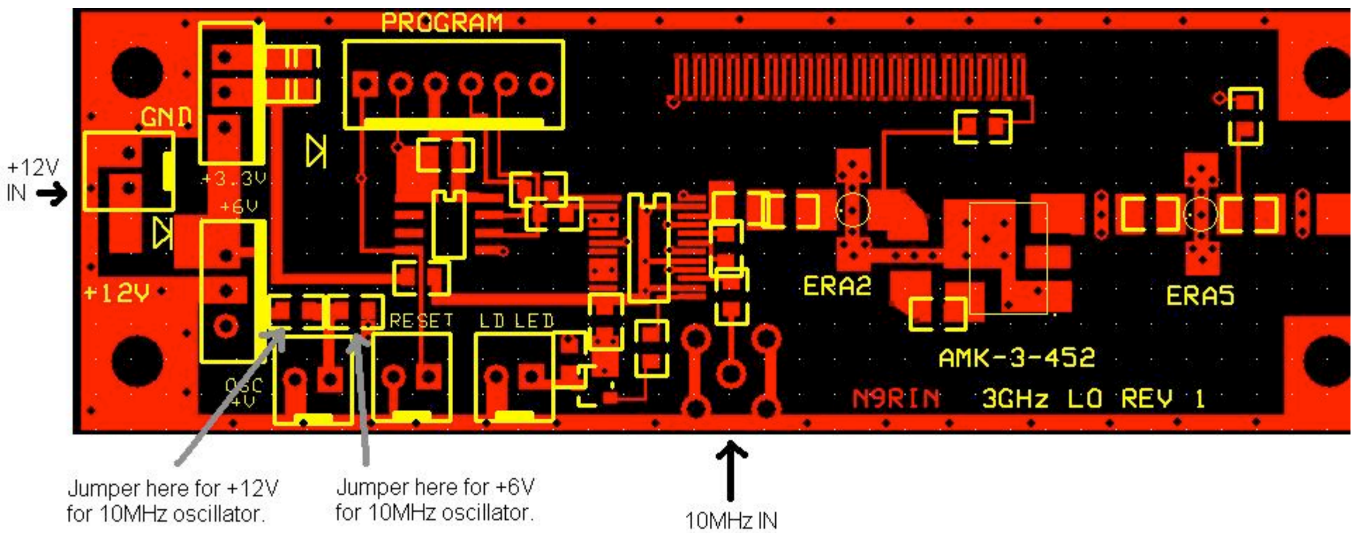

Figure 2: 3GHz Local Oscillator

Test Plan

3456 MHz Transverter Test Setup
by N6IZW 16 January 2009

The intent of this test setup is to be able to characterize the SBMS 3456 MHz transverter and other possible transverters in the future. The setup should allow measurement of gain and phase variation over some frequency span using a network analyzer (HP 8410 at N6IZW QTH) for both receive and transmit functions.

Some form of MDS (minimum discernable signal) measurement will be made, initially using a CW signal and SSB receiver.

The following figures show the test setup that will be used for the gain/phase measurements and pictures of a couple of test plots of my own 3456 MHz transverter in the receive configuration. In this case Kerry N6IZW did not make absolute measurements but only relative measurements in order to show the variation with frequency.

The 3312 MHz generator and mixer is used to convert the 144 MHz receive IF back up to 3456 MHz in the receive configuration. In the transmit configuration the generator and mixer convert the 3456 MHz swept signal down to 144 MHz for input to the transverter IF.

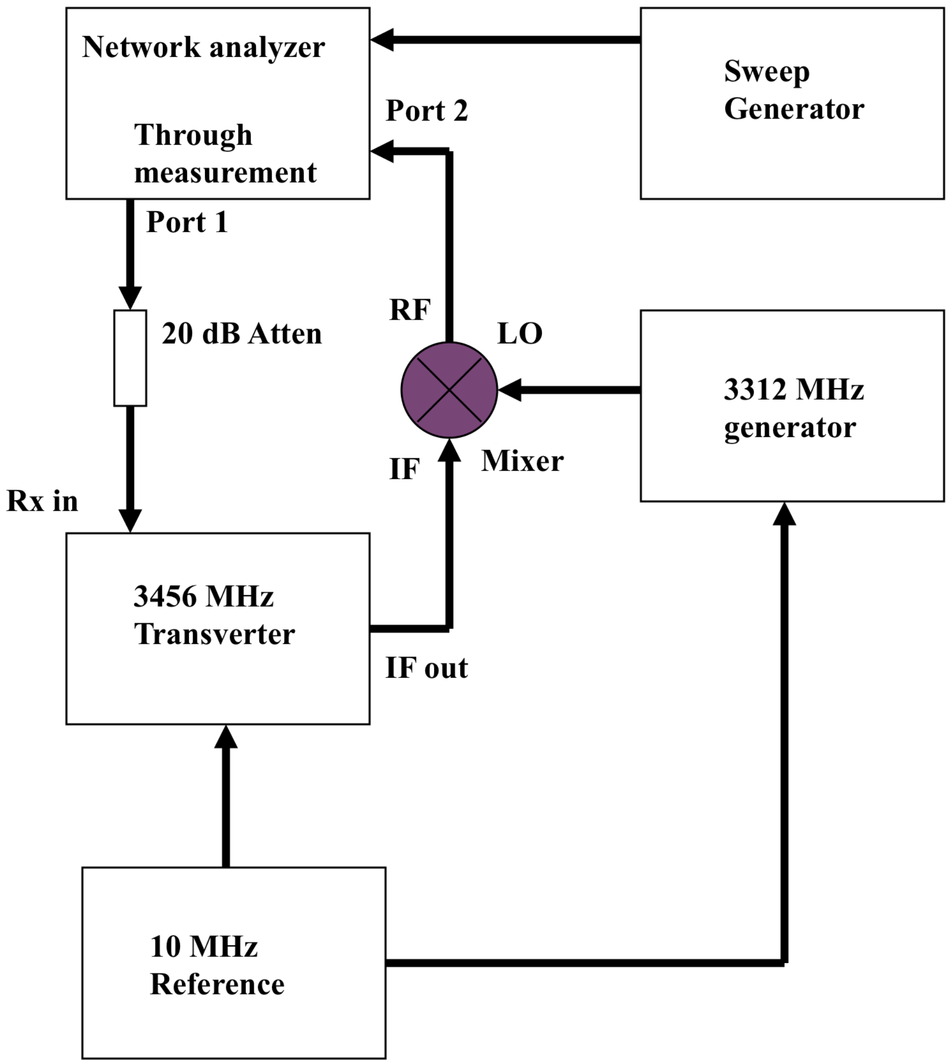

Figure 3: Transverter Receive Amplitude and Phase Measurement Setup

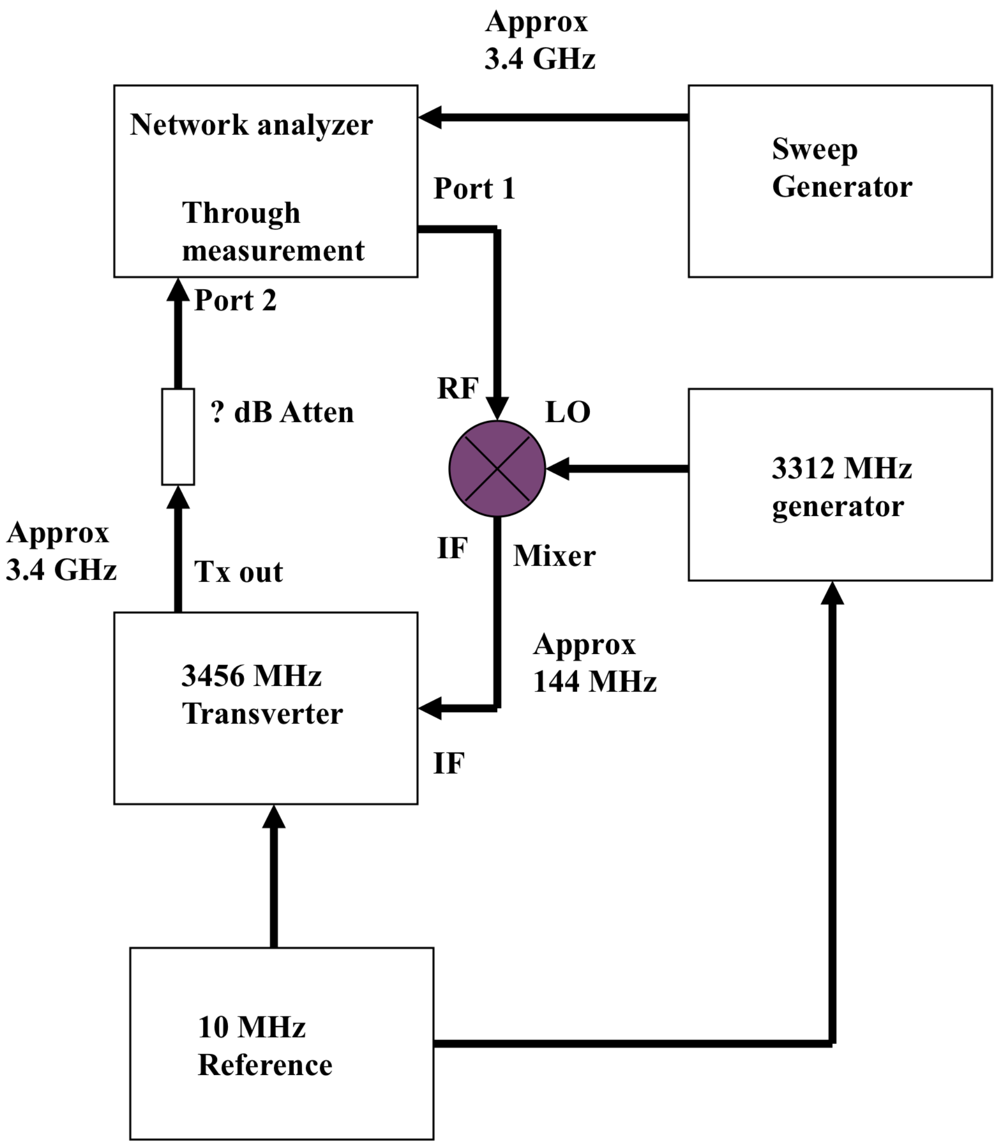

Figure 4: Transverter Transmit Amplitude and Phase Measurement Setup

The plots taken of the N6IZW 3456 MHz transverter were completed in the receive configuration as a test of the setup. It is expected that the transmit configuration will work in a similar manner. The plots show relative phase and amplitude with frequency. No absolute gain calibration was performed but will be done on the SBMS unit.

The first plot shows a 200 MHz span from 3.4-3.5 GHz with the phase at 90 deg/div and the amplitude at 2.5 dB/div for an amplitude variation of over 15 dB across 200 MHz and a phase variation of some 450 deg over the 200 MHz.

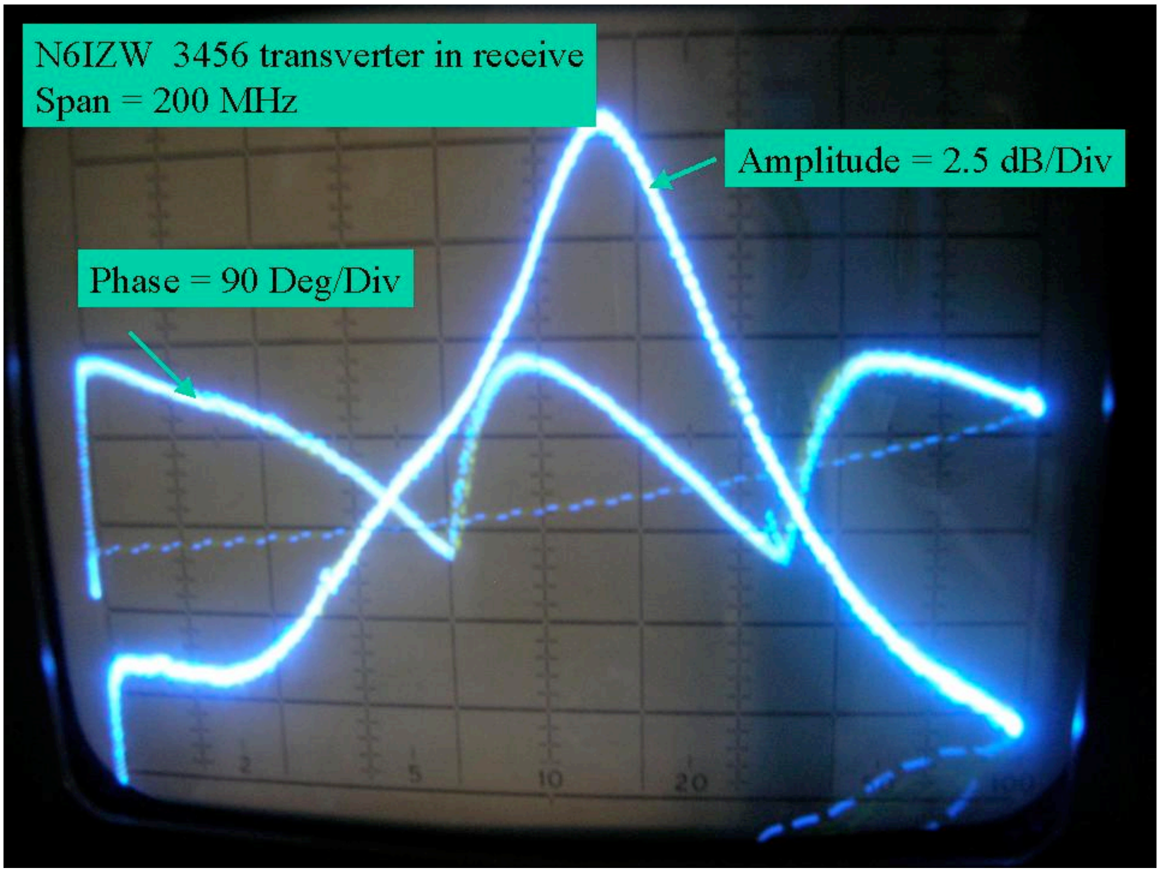

Figure 5: Test Setup Plot of Amplitude and Phase Over 200MHz Span

The 20 MHz plot is from 3446 MHz to 3466 MHz and shows a gain variation of about 5dB over 20 MHz and a phase variation of about 135 deg over 20 MHz.

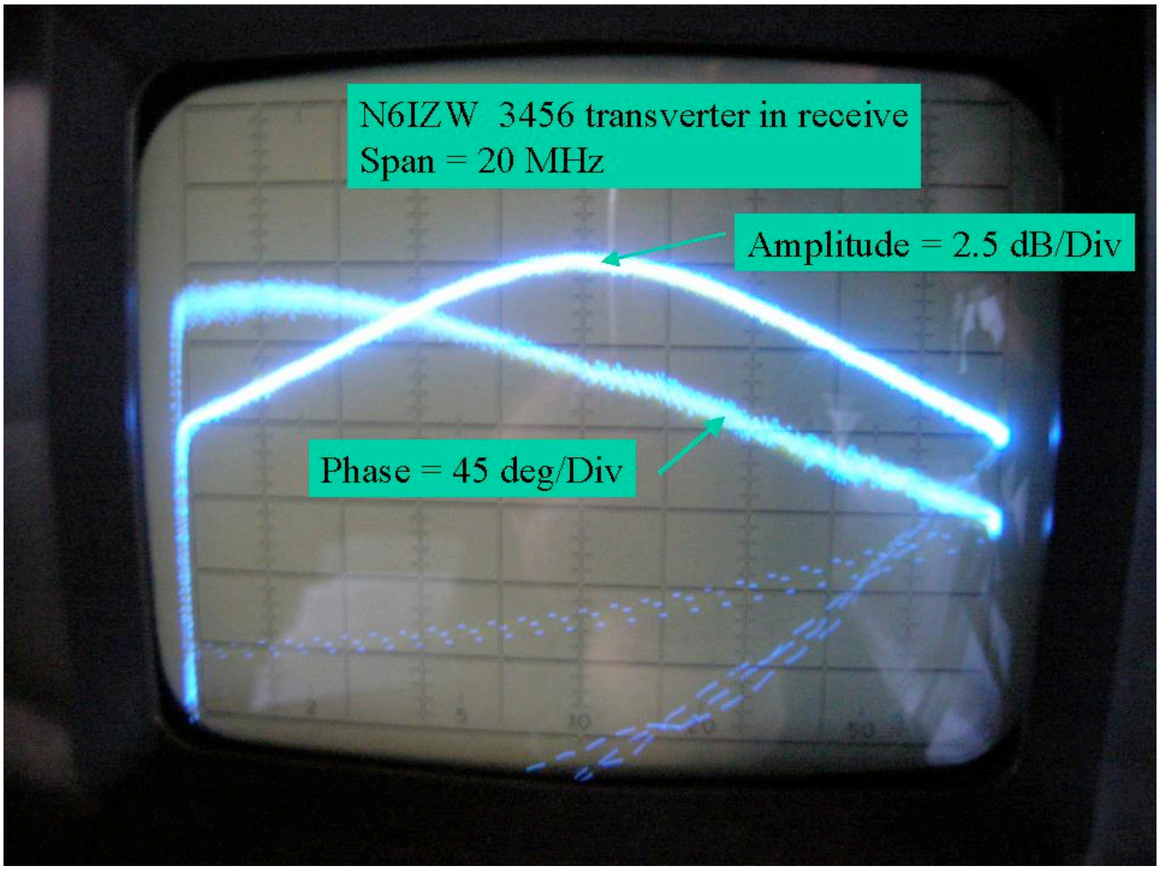

Figure 6: Test Setup Plot of Amplitude and Phase Over 20MHz Span

Kerry believes the large amplitude and phase variations are mainly due to the shape of the 3456 MHz filter placed ahead of the mixer inside the transverter.

Test Results

Here will be the test results.

Applicability to MEP

Transverter usefulness on MEP?

Thank you to Kerry Banke and Chris Shoaff. More soon !
-Michelle