Validation Report *HT20C15-LQ*

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1 Introduction

This Document will explain the test procedure to validate the redesigned HT20C15-LQ Rev 2. The device under test is from the first small production run. The date code for the batch is: 1524.
All aspects of the chip were fully tested including: oscillator circuit; demodulation circuit; modulation circuit; power consumption; temperature performance; full HART communication.

Figure 1: Picture of the Device under test showing date code.

2 Test Procedure / Requirements

For this set of tests, the new HT20C15 was installed in two different boards that utilize the original HT2015. The first is the CPU / communication board from a HART slave device. This board feeds the HT20C15 with an external clock generated by the CPU.
The second is HART communication board from a modem that works with a master device. This board utilizes the internal oscillator of the HT20C15 and also allows for manual manipulation of the transmit control lines. Both boards where put through the series of tests that follow.

2.1 Test Equipment

Agilent 3350B Waveform Generator
Agilent 34410A Multimeter
Agilent Infiniium Oscilloscope 3350B Waveform Generator
HP 34401A Multimeter
GW Dual tracking DC Power Supply GPC-3030
CSZ MicroClimate Environmental Chamber
Springfield Research PCB159 HART slave communication board Springfield Research PCB137 HART master communication board Springfield Research HIUSB usb HART modem
Windows PC running Springfield Research HART configuration software

2.2 Oscillator Circuit

2.2.a External Oscillator

The HT20C15 was feed with a clock generated from a CPU with a frequency of 460.8 kHz. The HT20C15 started successfully with all functional operation.

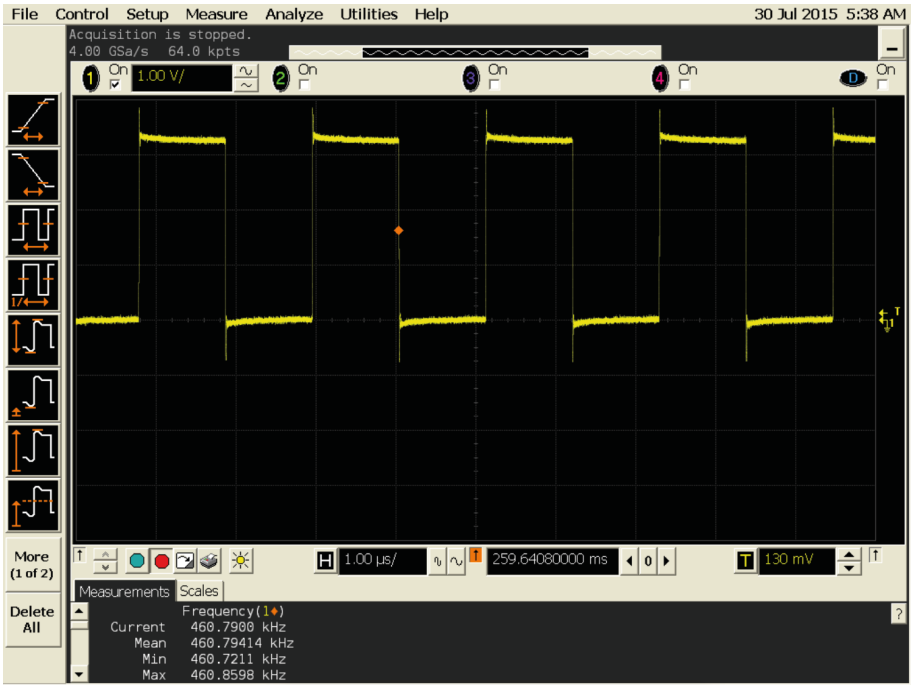

Figure 2: Screenshot of the external oscillation signal taken at OTXL.

2.2.b Internal Oscillator

The internal oscillator of the HT20C15 was set to drive a 455 kHz ceramic resonator. The HT20C15 started successfully with all functional operation. The frequency at the oscillator was measured at: 450.1 kHz.

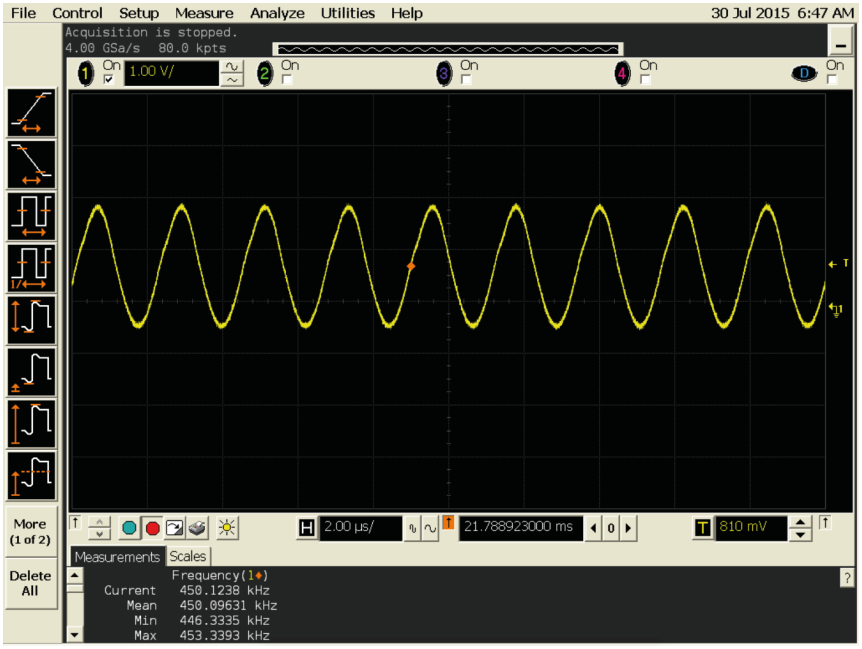

Figure 3: Screenshot of the internal oscillation signal taken at OTXL.

2.3 Demodulator - Receive circuit

The received circuit was tested by using a function generator to apply frequency to the HART line. The receive channel of a slave device with the new HT20C15 was monitored for correct reception.

For this test, the measured voltage at IAREF: 1.121V. The measured voltage at ICDREF: 1.038V. The difference of IAREF to ICDREF: 83 mV

In the following screenshots:
Yellow waveform = Signal at IRXA
Green waveform = Signal at OCD
Purple waveform = Signal at ORXD

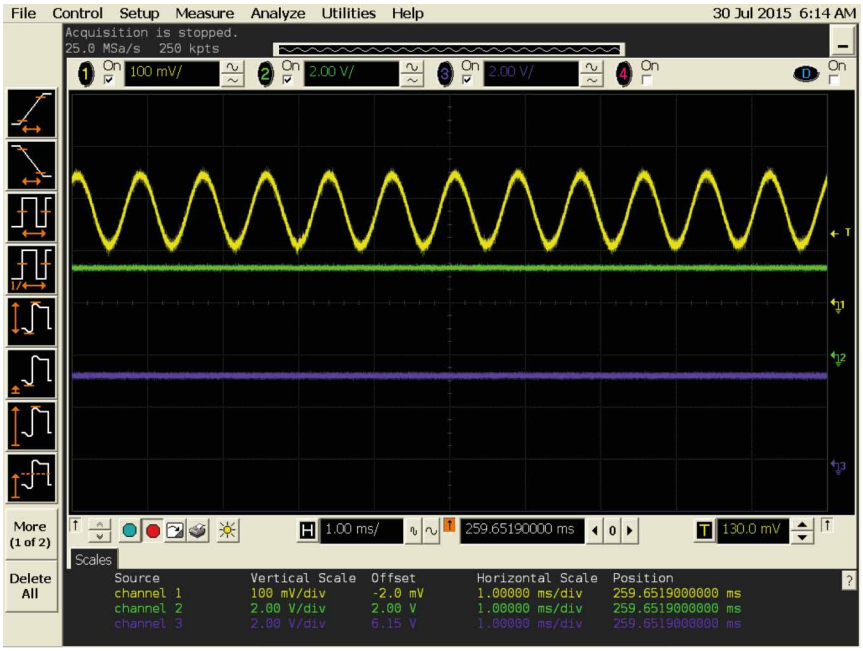

Figure 4: 1200 Hz signal, with amplitude 400 mV P-P on the HART line.

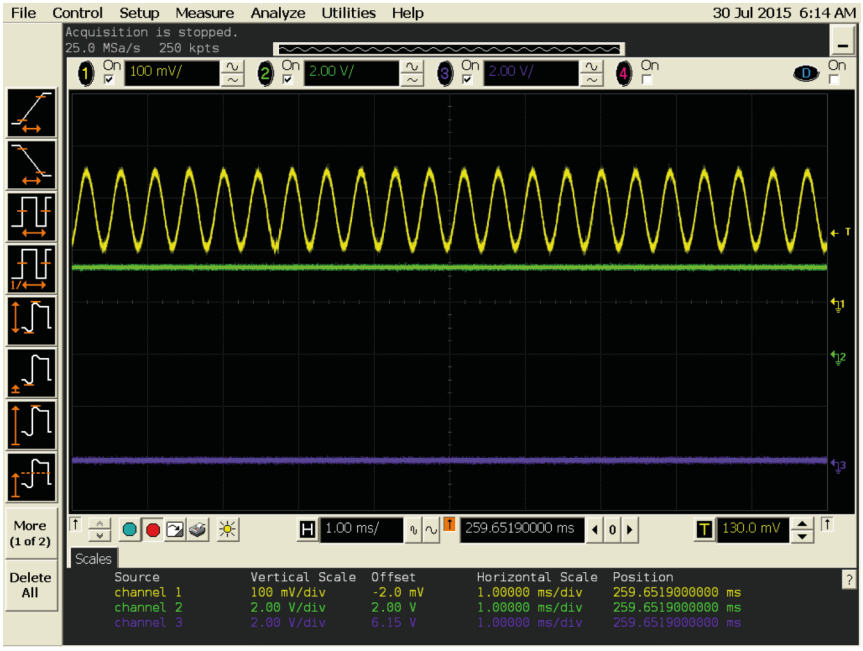

Figure 5: 2200 Hz signal, with amplitude 400 mV P-P on the HART line.

The amplitude of the signal from the waveform generator was lowered until the HT201C15 would no longer decipher the signal (as seen from the OCD line). The lowest received amplitude was recorded from each frequency.

For 1200 Hz, reception worked until 94 mV P-P signal on the line.

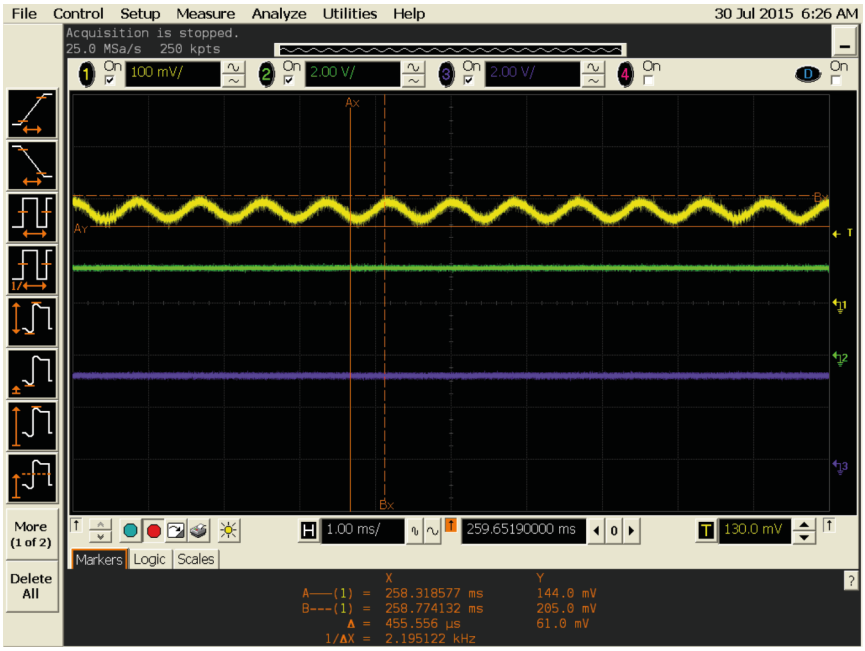

Figure 6: 1200 Hz signal, with amplitude 94 mV P-P on the HART line.

For 2200 Hz, reception worked until 100 mV P-P signal on the line.

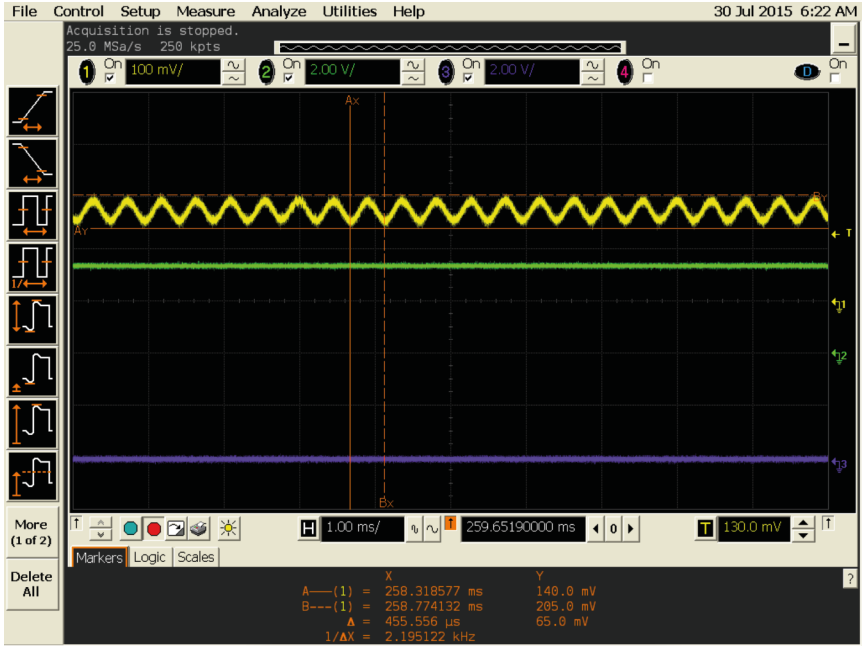

Figure 7: 2200 Hz signal, with amplitude 100 mV P-P on the HART line.

For the final section of this test, the frequency generator was removed and communication on the hart line was sent from a HART master. ORXD was monitored for correct demodulation.

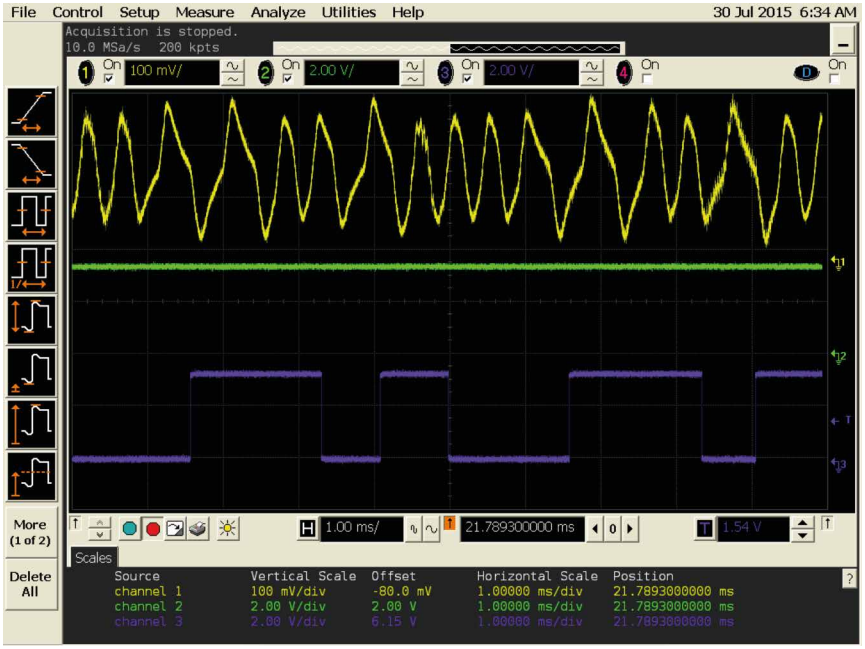

Figure 8: Demodulation of full HART message with frequency transitions.

2.4 Modulator - Transmission circuit

The figure below show the modulation with RTS low and ITXD high. The waveform is 1200 kHz with a P-P amplitude of 500 mV and a rise time of 288.9 uS. This signal meets the HART specification.

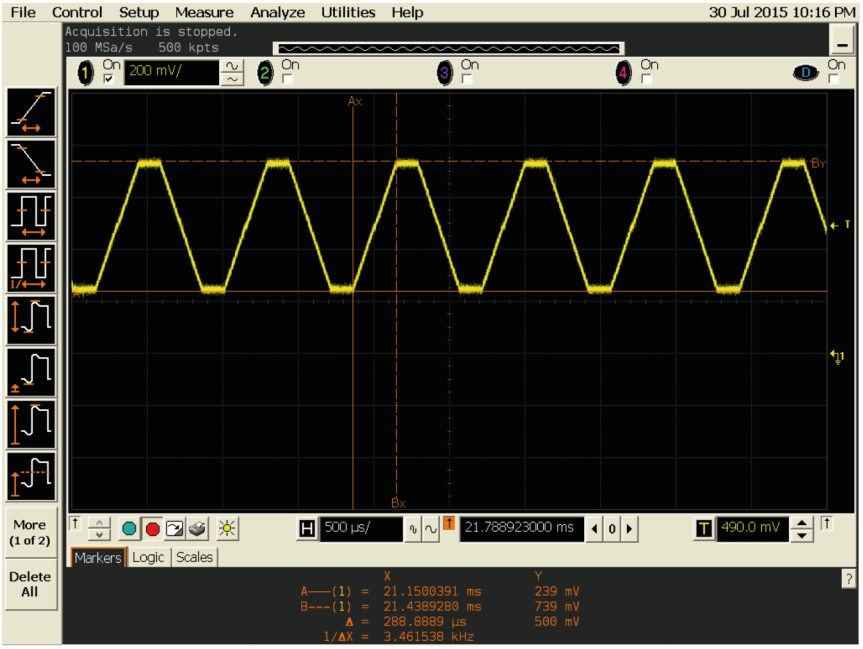

Figure 9: Modulation 1200 Hz signal

The figure below show the modulation with RTS low and ITXD low. The waveform is 2200 kHz with a P-P amplitude of 500 mV and a rise time of 155.6 uS. This signal meets the HART specification.

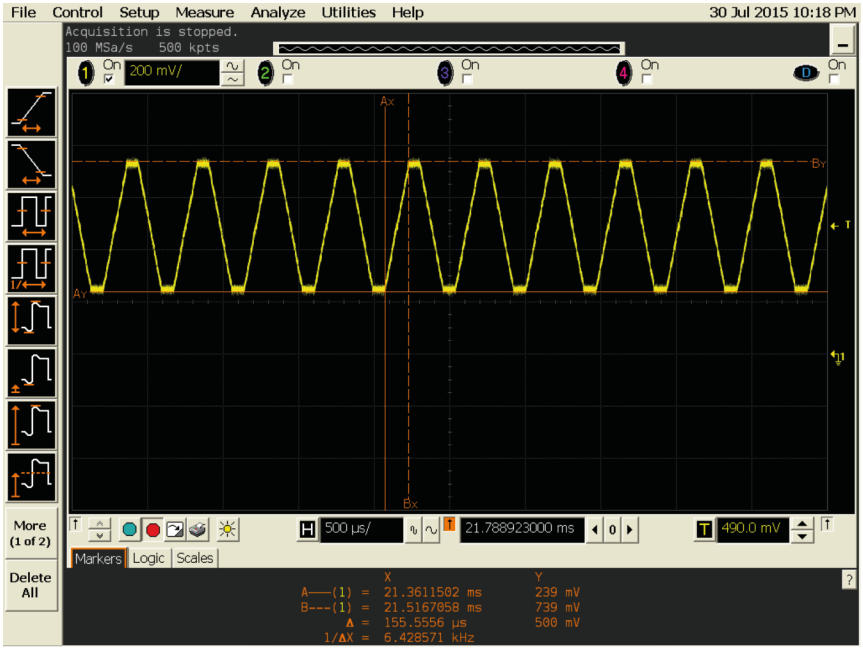

Figure 10: Modulation 2200 Hz signal

Next shows the transmission of a normal HART message showing proper tracking of the ITXD signal.

Yellow waveform = Signal at OTXA
Green waveform = Signal at ITXD

Figure 11: Modulation of HART message with transitions between frequencies.

2.5 Power Consumption

2.5.a 3V3 Operation

Measured power consumption idle state: 227 uA
Measured power consumption while transmitting: 230 uA

2.5.b 5V0 Operation

Measured power consumption idle state: 218uA
Measured power consumption while transmitting: 222uA

2.6 Temperature Performance

The HART slave device was assembled inside an environmental chamber. At each temperature point the device was left for 1 hour to allow time for the temperature to settle. Then communication was monitored from a pc running HART configuration software from outside of the chamber.

2.6.a -40 Deg C:

Communication successful. 100 messages sent and received without error.

2.6.b 80 Deg C:

Communication successful. 100 messages sent and received without error.

2.7 Communication

A HART network was setup with a communication channel between the slave device with the new HT20C15 and a PC using using the HART modem board also with the new HT20C15. The PC was loaded with a custom data logging software to log the communication. 1000 messages where sent between the two devices with 0 retrials and 0 lost messages.

3 Conclusion

The HT20C15 Redesign passes all internal tests and is approved for external beta testing.

4 Approval

T. K.

Supplied by:

HART Expert
For people working with HART transmitters

HART Expert Ltd
31 Kingfisher Way,
Romsey,
Hampshire,
SO51 7RY, UK
Phone: +44 (0)7966 233639
Email: info@hart-expert.co.uk
Web: www.hart-expert.co.uk

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Springfield Research Corporation
3350 NW 22nd Terrace Suite 500 • Pompano Beach, FL USA 33069
Tel: +1 (954) 657.8849 • Fax: +1 (954) 657.8895 • sales@springres.com • www.springres.com

HART COMMUNICATION PROTOCOL