Changing the way the world performs maintenance.®

Computational Systems Incorporated
835 Innovation Drive
Knoxville, TN 37932
Phone 423-675-2110
Fax 423-675-3100

AGENCY AGREEMENT

December 8, 1998

Federal Communications Commission
Post Office Box 429
Colombia, MD 21045

Gentlemen:

I hereby appoint United States Technologies to act as our agent in the preparation of a application for equipment authorization of Model 4100 under Part 15 of the FCC Rules and Regulations. I certify that Exhibits 1 and 4 properly describe the device of system for which authorization is sought, that the information described in the User's Manual will be provided with each item manufactured or distributed by the applicant, and that the labels described by Exhibit 2 will be affixed to each item manufactured or distributed by the applicant. I further certify that appropriate arrangements have been made to insure that production units of this equipment bearing the name and FCC IDENTIFIER listed in this application will continue to comply with the Commission's requirements.

I further certify by signature below that no party [per 47 CFR 1.2002(b)] to the application is subject to denial of Federal benefits, including FCC benefits, pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988 21 U.S.C. 853(a).

This appointment also includes the authorization to complete FCC Form 731 on our behalf and sign the application as an authorized agent.

Name: James W. Pearce   Signature: /s/ .

Title: Lead Engineer, Wireless Product Development   Date: December 8, 1998

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Computational
Systems
Incorporated
835 Innovation Drive
Knoxville, TN 37932
Phone 423-675-2110
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December 8, 1998

Federal Communications Commission
Equipment Authorizations Branch
7435 Oakland Mills Road
Colombia, MD 21046

Gentlemen:

In regard to the submission of the Computational Systems Inc., FCC Part 15 Certification Application for the Model 4100 RF Smart Sensor under FCC ID: NL54100, I respectfully request under the provision of section 0.457 of the Code that all Schematics and Block Diagrams related to this application be provided confidential status as Trade Secrets.

Thank you for your assistance in this matter

Sincerely,

/s/

James W. Pearce, P.E.
Lead Engineer, Wireless Product Development

Computational Systems, Inc.

Antenna Description for Model 4100 RF Smart Sensor

Manufacturer: Cushcraft Corporation
48 Perimeter Road
P.O. Box 4680
Manchester, NH 03108

Type: Offset Patch

Model Number: Custom Made

Gain: 0 dBd

Connector: Hirose H.FL-R

Determination of Processing Gain for CSI Model 4100
November 17, 1998

The CSI Model 4100 incorporates a radio section that is identical to that used in the CSI Models 4200 and 4210. The only difference in the radio circuitry between the Model 4100 and the Model 4200 / 4210 is that the physical printed circuit board dimensions and characteristics were changed to accommodate the product application. The CSI model 4200 and 4210 have been granted an Equipment Authorization Certification with FCC Identifier of NL54200.

Since the Spread Spectrum Transceiver circuits of the products are identical, the processing gain of the Model 4100 will be identical with that of the Model 4200 / 4210. The report on the measurement of processing gain for the Model 4200 / 4210 is included in this application as being completely applicable to the Model 4100.

Determination of Processing Gain for CSI Models 4200 and 4210
July 27, 1998

Measurements were made to show the compliance of CSI Models 4200 and 4210 with 47 CFR 15.247(e) which requires a direct sequence spread spectrum transmitter to have a processing gain of at least 10dB.

The model 4200/4210 uses a baseband processor integrated circuit manufactured by Harris Semiconductor Corp., model HFA3824A. In the 4200/4210 the baseband processor is programmed to use a spreading code (PN code) with a length of 15 chips. The code used is a modified Barker code, 1F35. A spectrogram of the transmitter output signal using this PN code is shown in Figure 1. Note: The CSI Models 4200 and 4210 are identical except that the Model 4200 is line powered and the 4210 is battery powered.

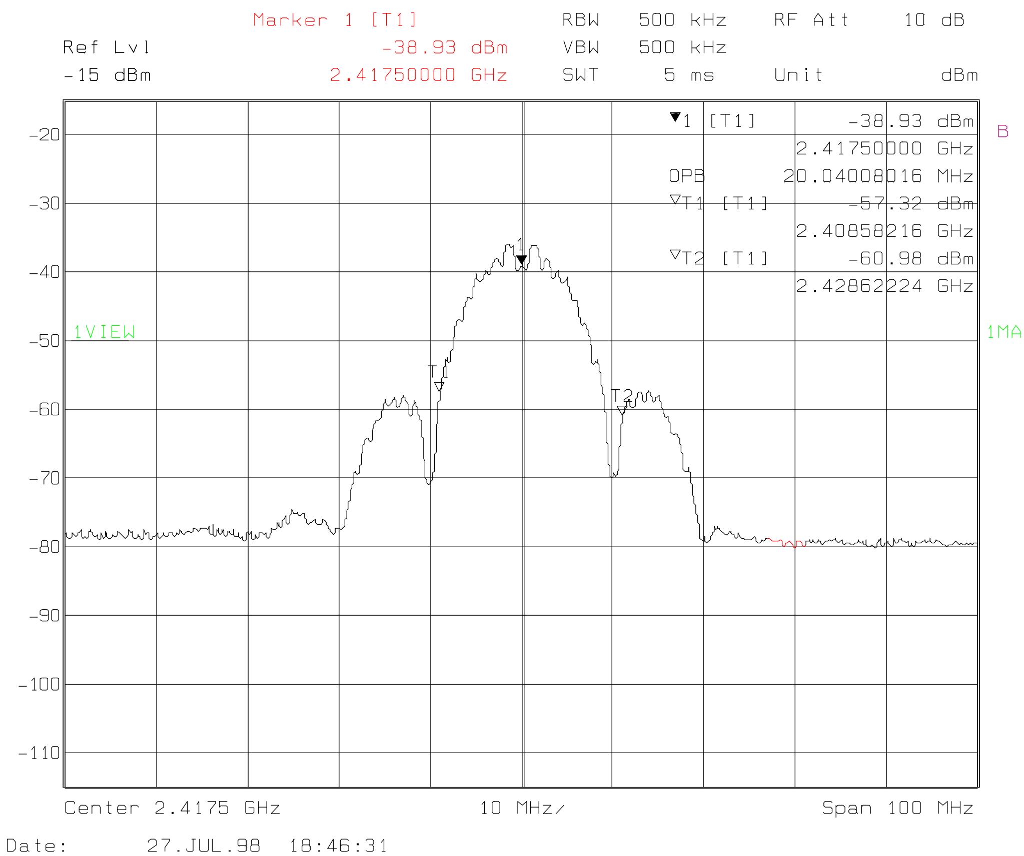


Figure 1 - Spectrum with Spreading Enabled

The processing gain was measured by comparing two bit-error rate (BER) versus signal strength curves; one with signal spreading enabled and the other with spreading disabled. The HFA3824A allows non-spread spectrum communication by setting the register that contains the spreading code to an all-ones value (7FFF for a 15-chip code).. A spectrogram of the transmitter output signal using this PN code is shown in Figure 2.

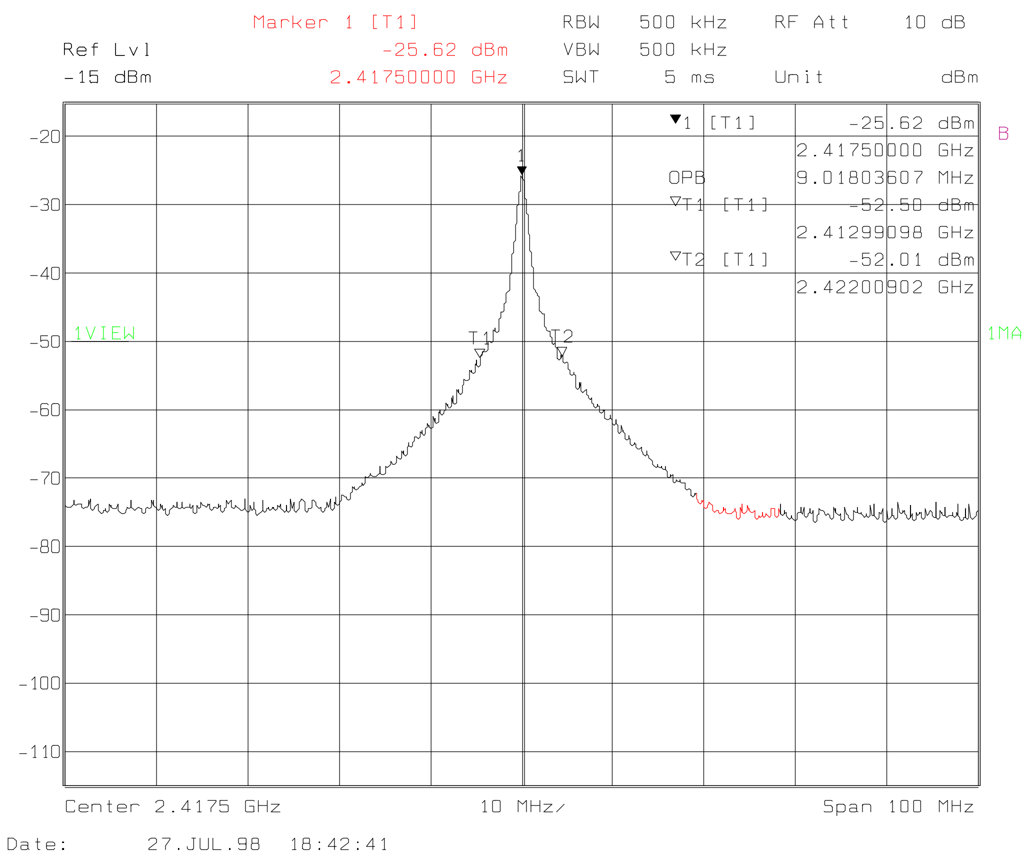


Figure 2 - Spectrum with Spreading Disabled

The experimental setup used to measure the processing gain is shown in Figure 3.

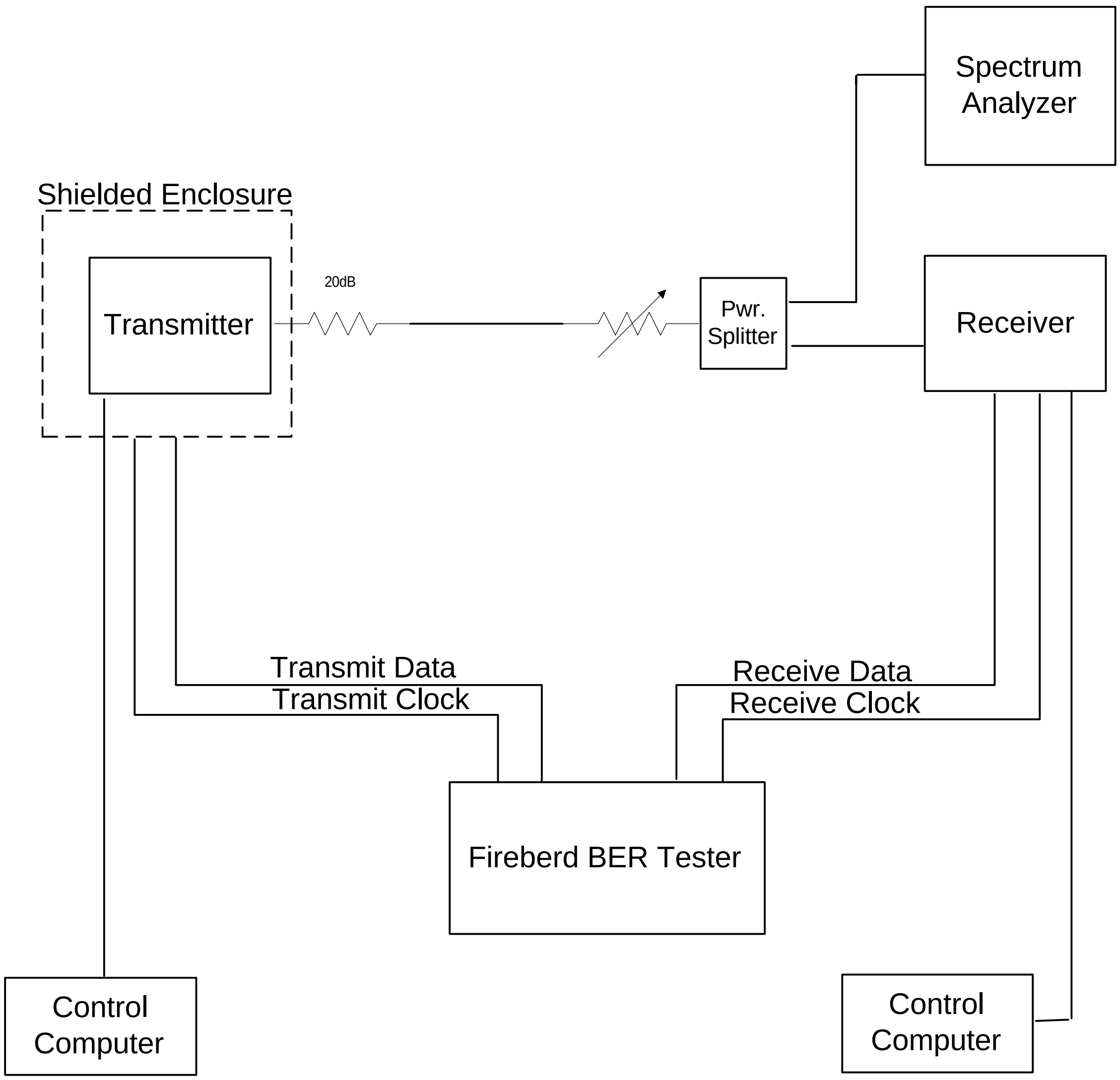


Figure 3 - Experimental Setup

The procedure used to determine the processing gain was as follows:

1. Set the transmitter and receiver to use the normal (1F35) PN code.
2. Set the variable attenuator to 0dB and measure the power delivered to the receiver. This is the reference power level.
3. Set the variable attenuator to the highest attenuation that still allows measurement of BER.
4. Record the BER and attenuator setting for this power level and successively lower attenuation levels until the BER becomes too low to be measured in a reasonable length of time.
5. Set the PN code to 7FFF.
6. Repeat steps 2 through 4 for this code.

The results of this are plotted in Figure 3. It is seen that at lower BER values the two curves have approximately the same slope but are separated by more than 10 dB of signal strength.

In order to arrive at a more precise determination of the processing gain a least squares fit of the data represented by the 5 lowest BER points was determined. Using the linear equation thus derived, the signal power necessary for the reference BER (1×10^{-6}) was determined. The results of this yield the following:

Power for reference BER with spreading = -95.394 dBm
Power for reference BER w/o spreading = -83.587 dBm

The processing gain is the difference in these two power levels:

Processing Gain = 11.807 dB

The theoretical processing gain for a 15 chip direct sequence spread spectrum system is given by:

Processing Gain = 10 x Log(15) = 11.761 dB

The agreement between the theoretical and measured processing gain is excellent and clearly shows that the Model 4200 complies with 47 CFR 15.247(e).

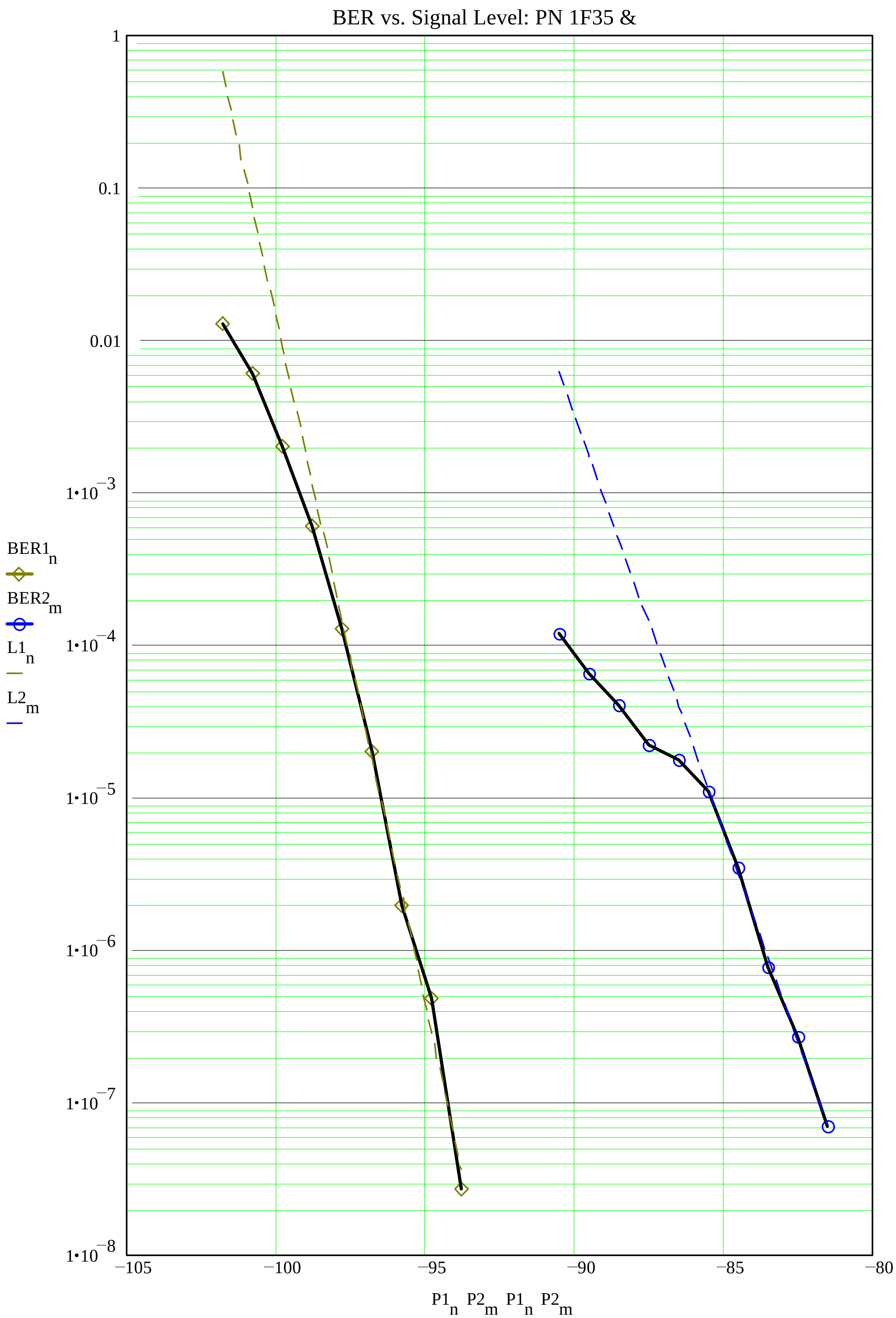
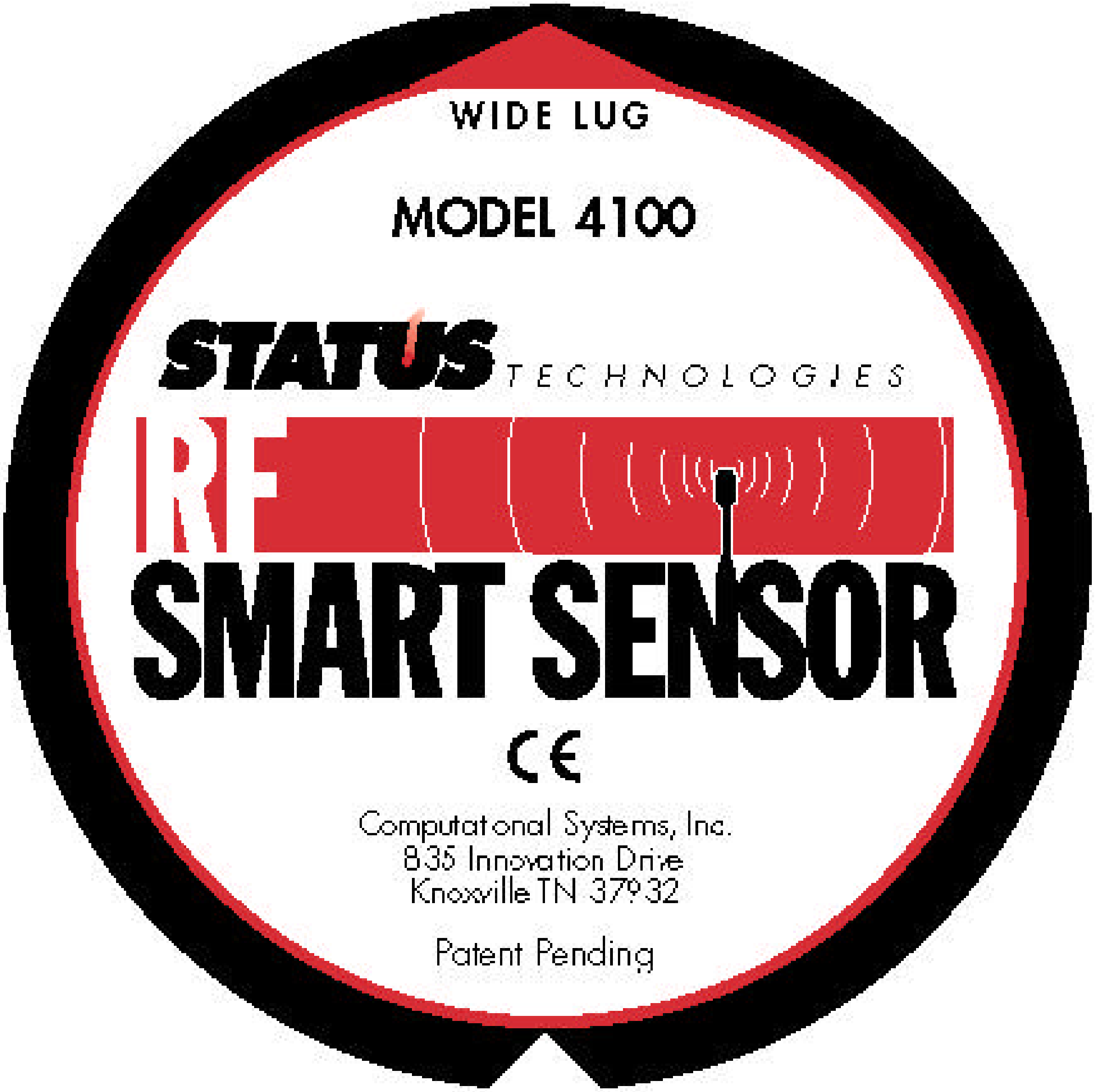


Figure 4 - Plot of Experimental Data

CSI RF Smart Sensor Model 4100 Labels

Overall View of Smart Sensor

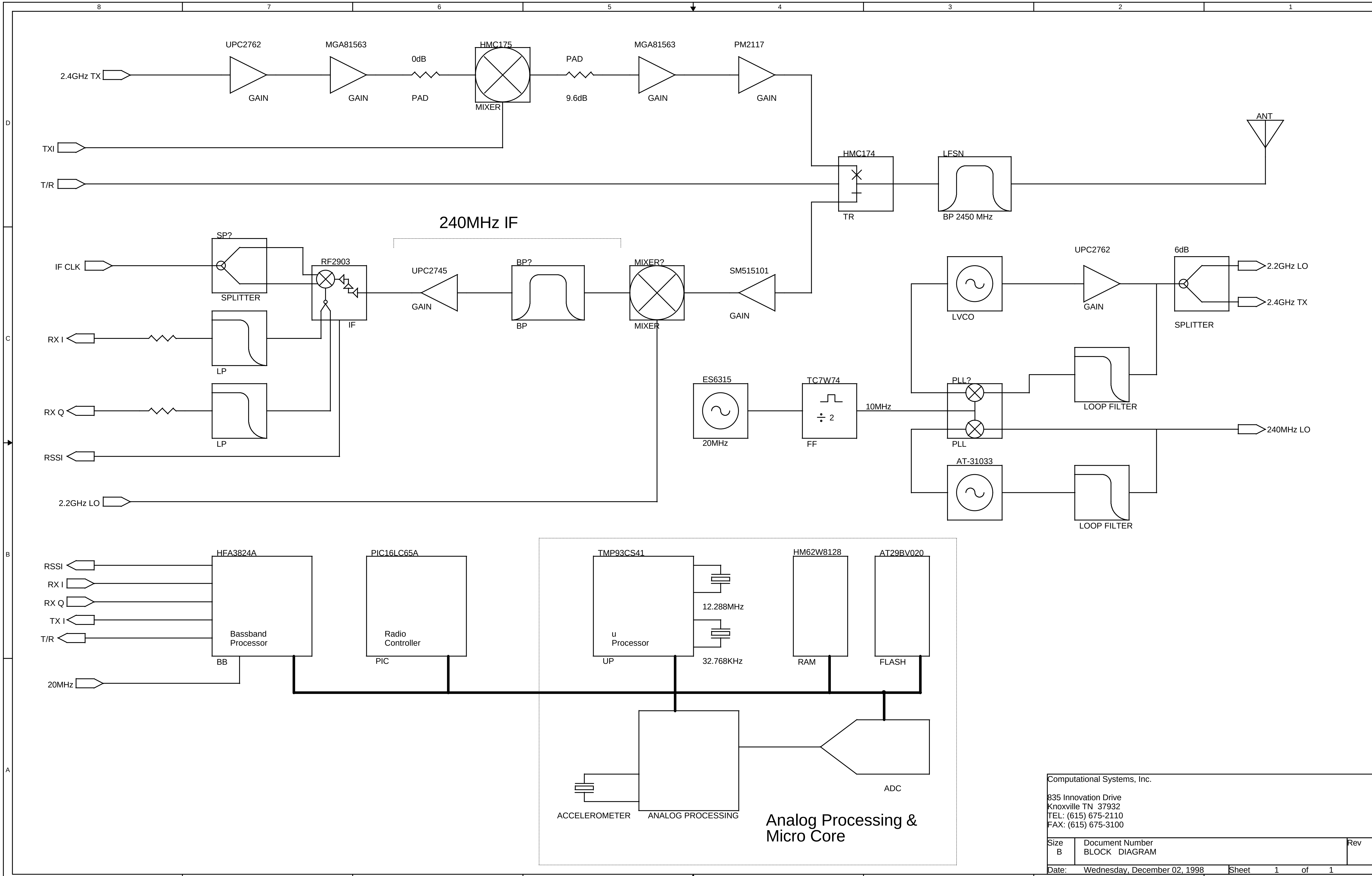

WIDE LUG
MODEL 4100
STATUS TECHNOLOGIES
RF
SMART SENSOR
CE
Computational Systems, Inc.
835 Innovation Drive
Knoxville TN 37932
Patent Pending

Top Label

FCC ID: NL54100

THIS DEVICE COMPLIES WITH PART 15 OF THE FCC RULES. OPERATION IS SUBJECT TO THE FOLLOWING TWO CONDITIONS: (1) THIS DEVICE MAY NOT CAUSE HARMFUL INTERFERENCE, AND (2) THIS DEVICE MUST ACCEPT ANY INTERFERENCE RECEIVED, INCLUDING INTERFERENCE THAT MAY CAUSE UNDESIRED OPERATION.

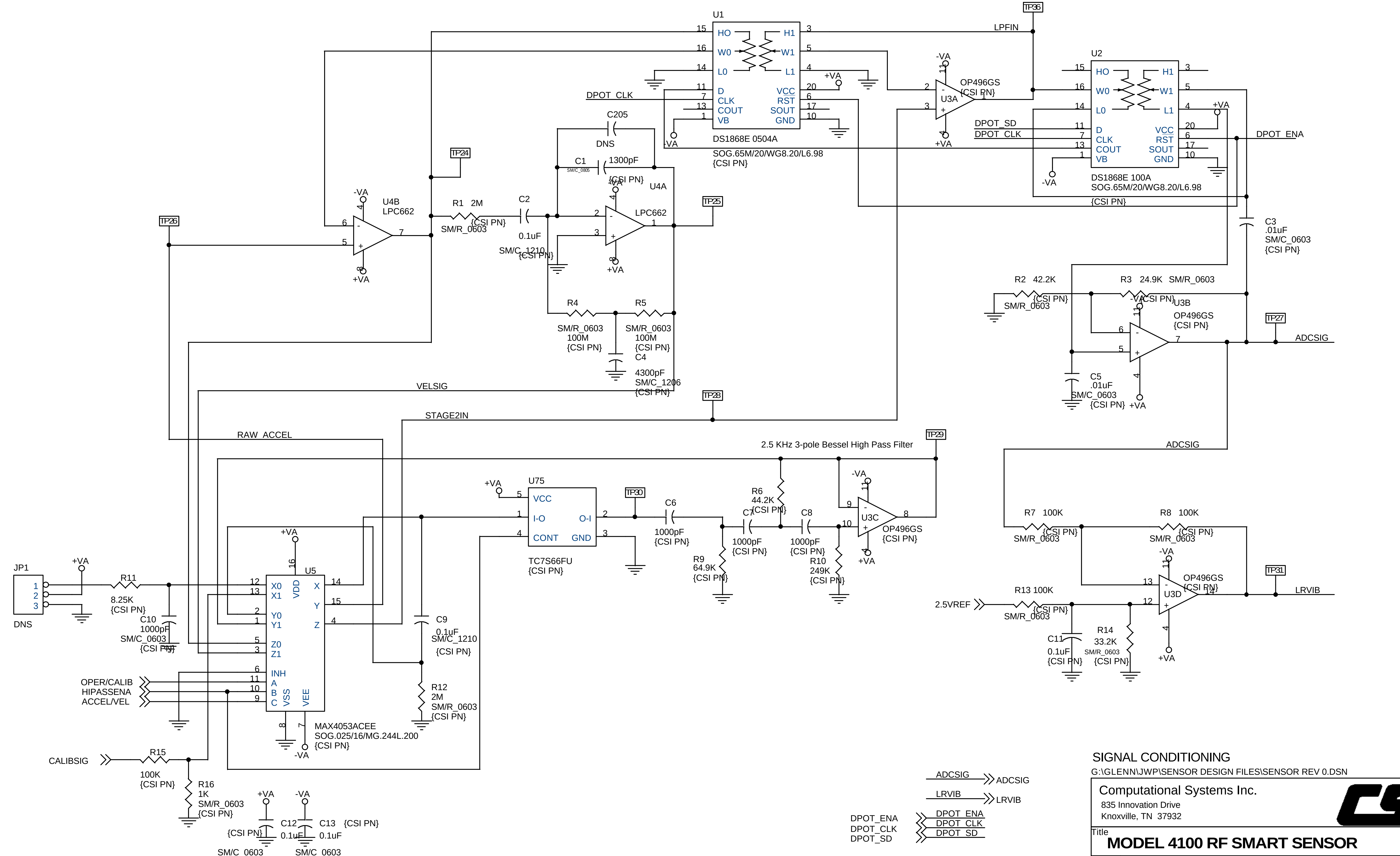
Side Label



Computational Systems, Inc.
835 Innovation Drive
Knoxville TN 37932
TEL: (615) 675-2110
FAX: (615) 675-3100

Size	Document Number	Rev
B	BLOCK DIAGRAM	

Date: Wednesday, December 02, 1998 Sheet 1 of 1



SIGNAL CONDITIONING

G:\GLENN\JWP\SENSOR DESIGN FILES\SENSOR REV 0.DSN

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Knoxville, TN 37932

Title	MODEL 4100 RF SMART SENSOR	
Size B	Document Number D24158 SC	Rev 0
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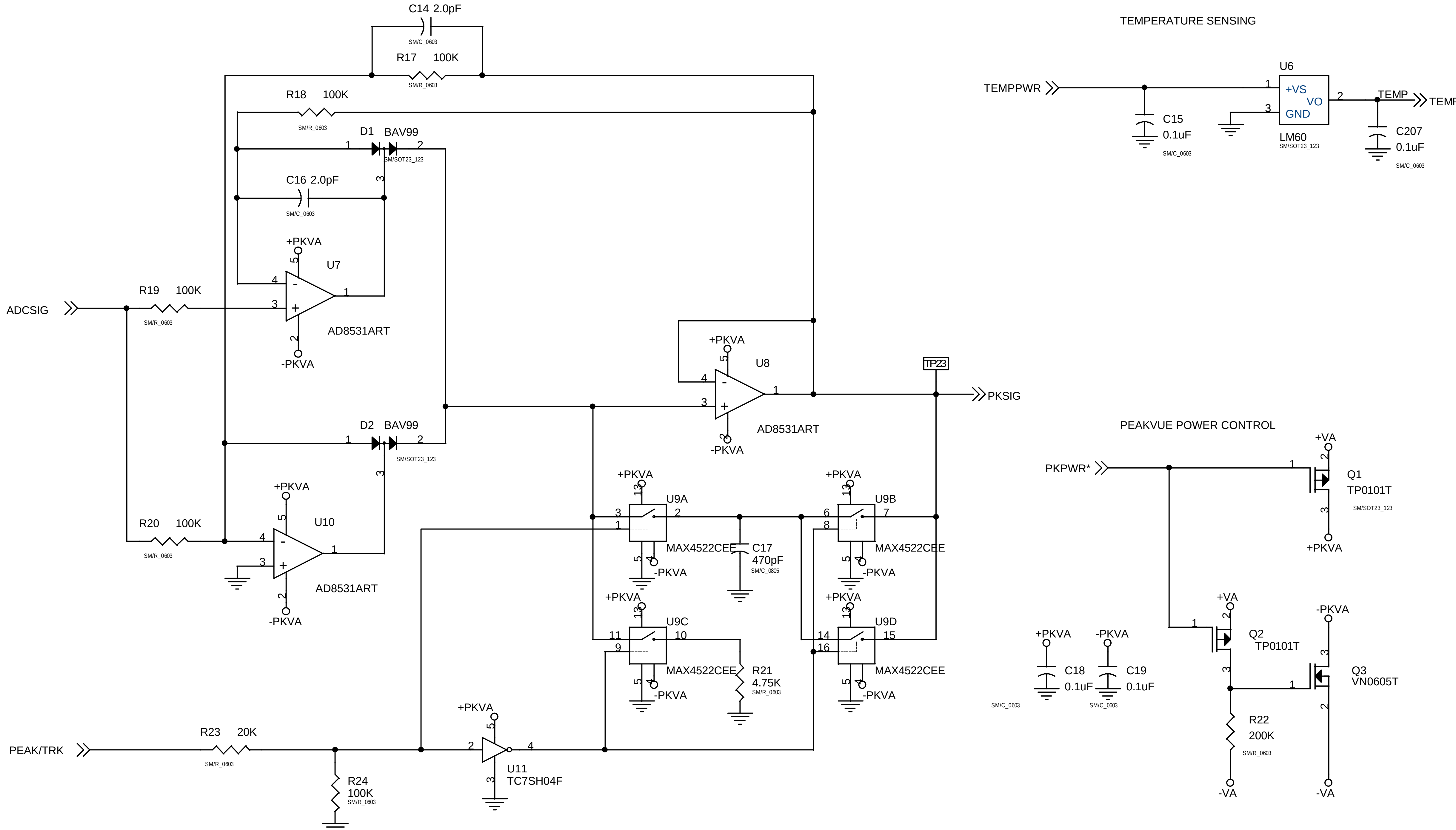

PEAK HOLD

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Title
SENSOR - PEAK HOLD

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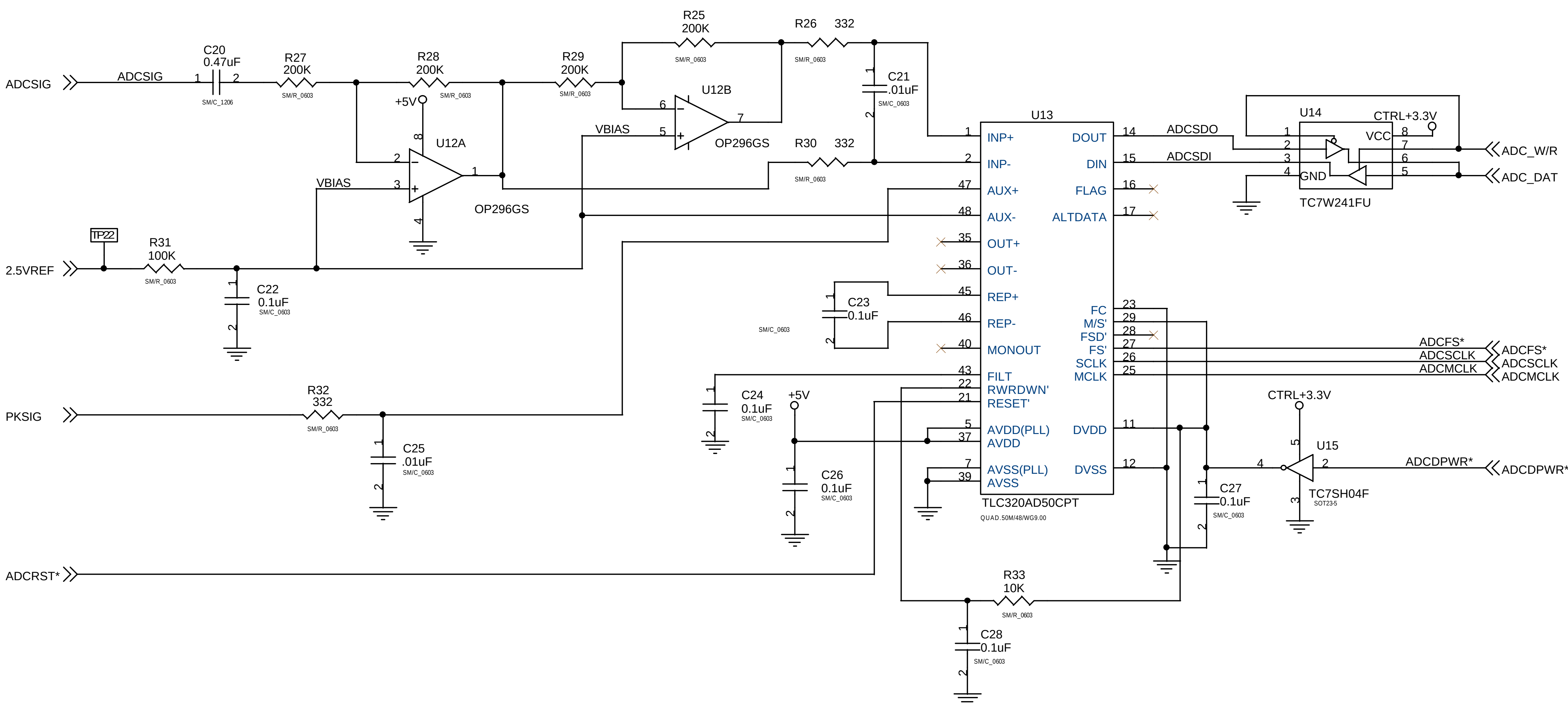

ADC

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CSi

Title
GLENN SENSOR - ADC

Size	Document Number	Rev
B	D24158 SC	0

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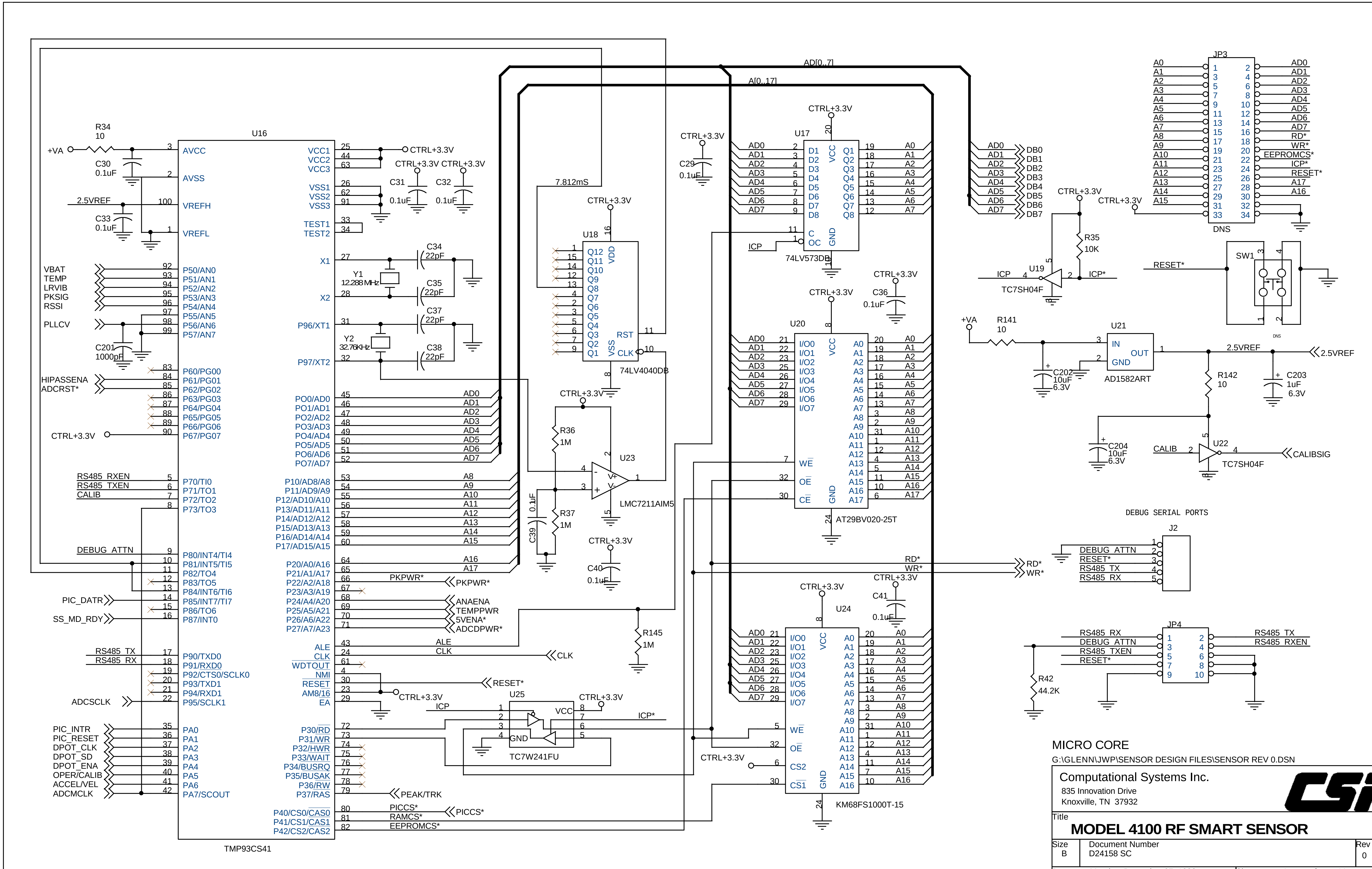

MICRO CORE

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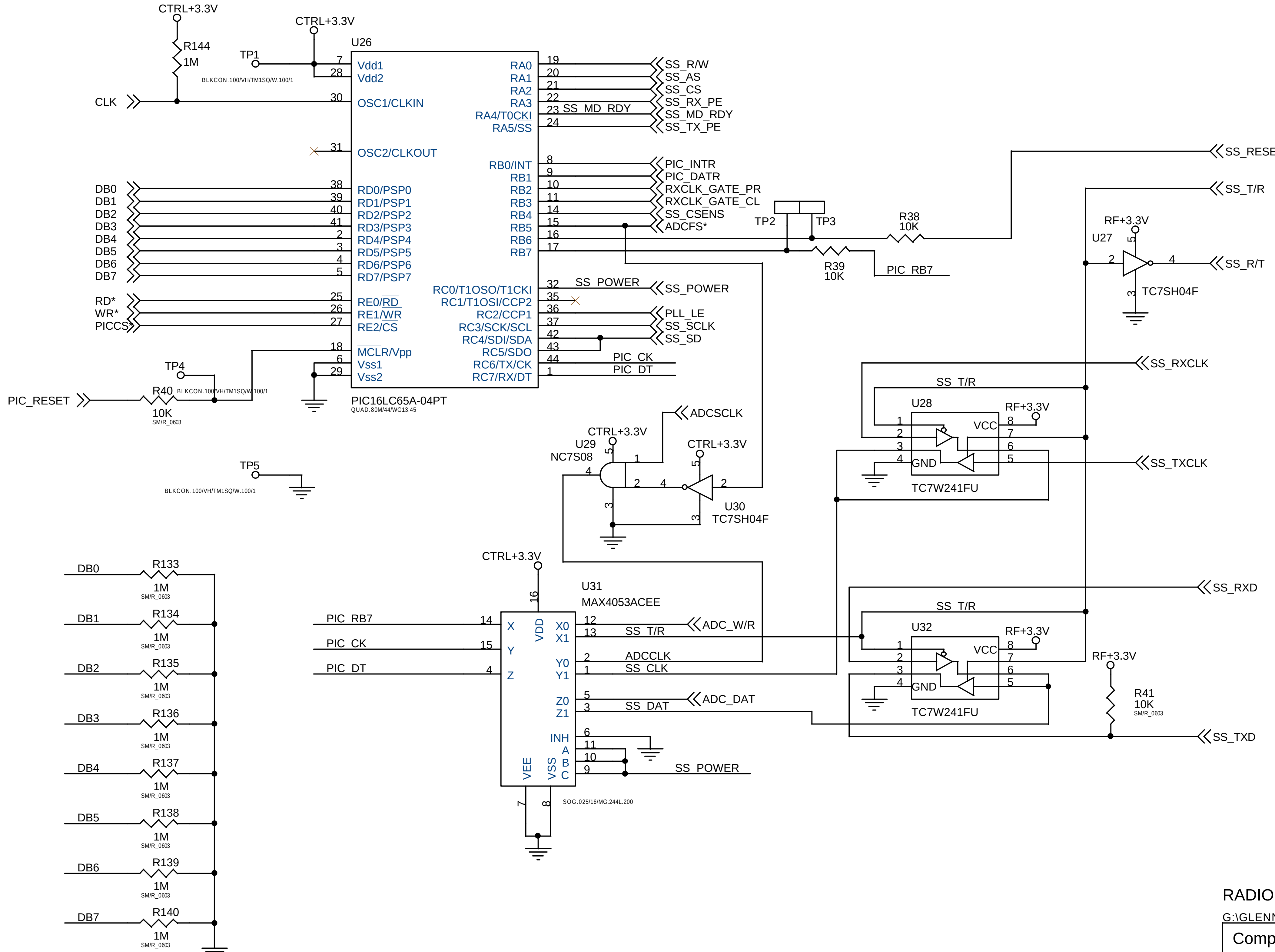

RADIO CONTROLLER

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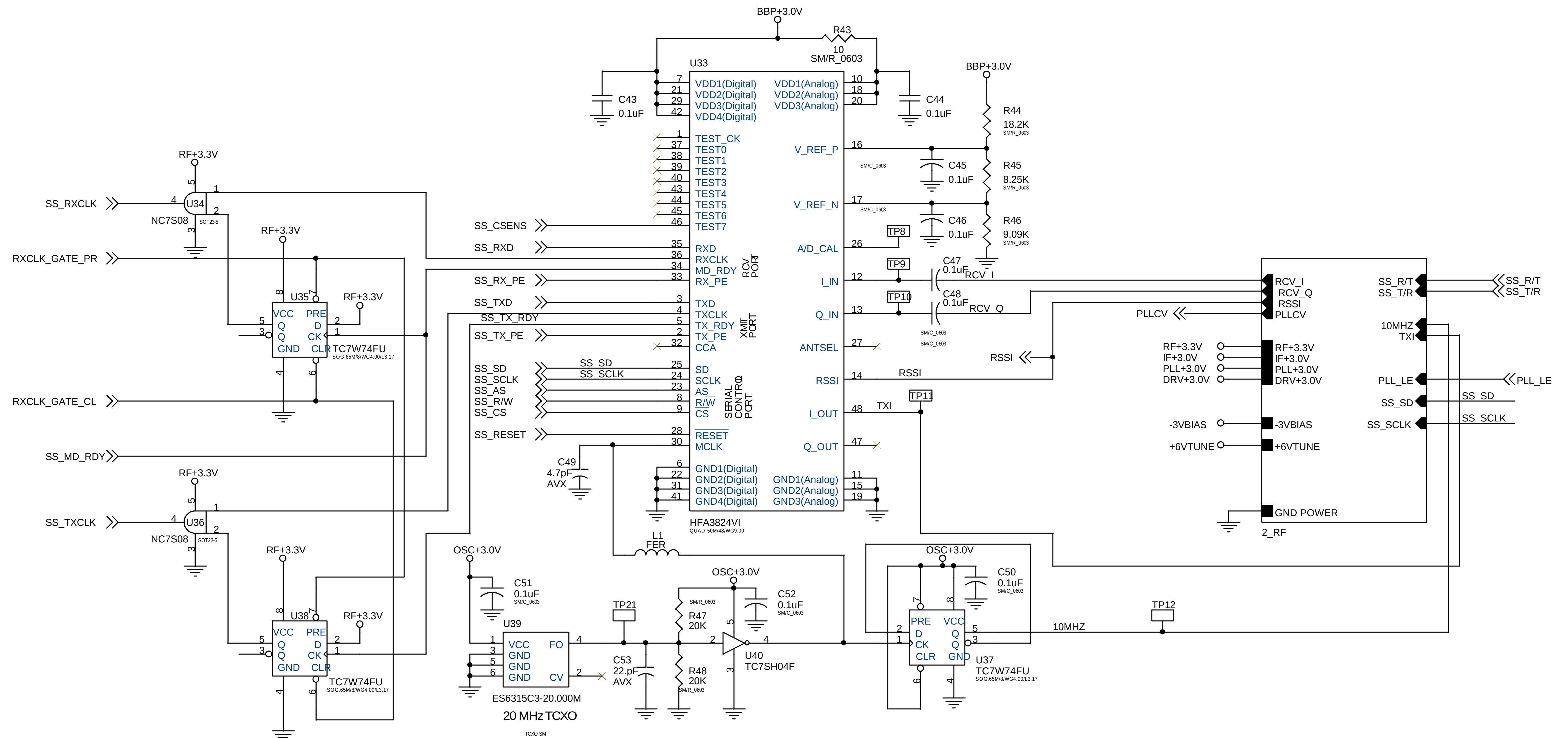

RADIO INTERFACE

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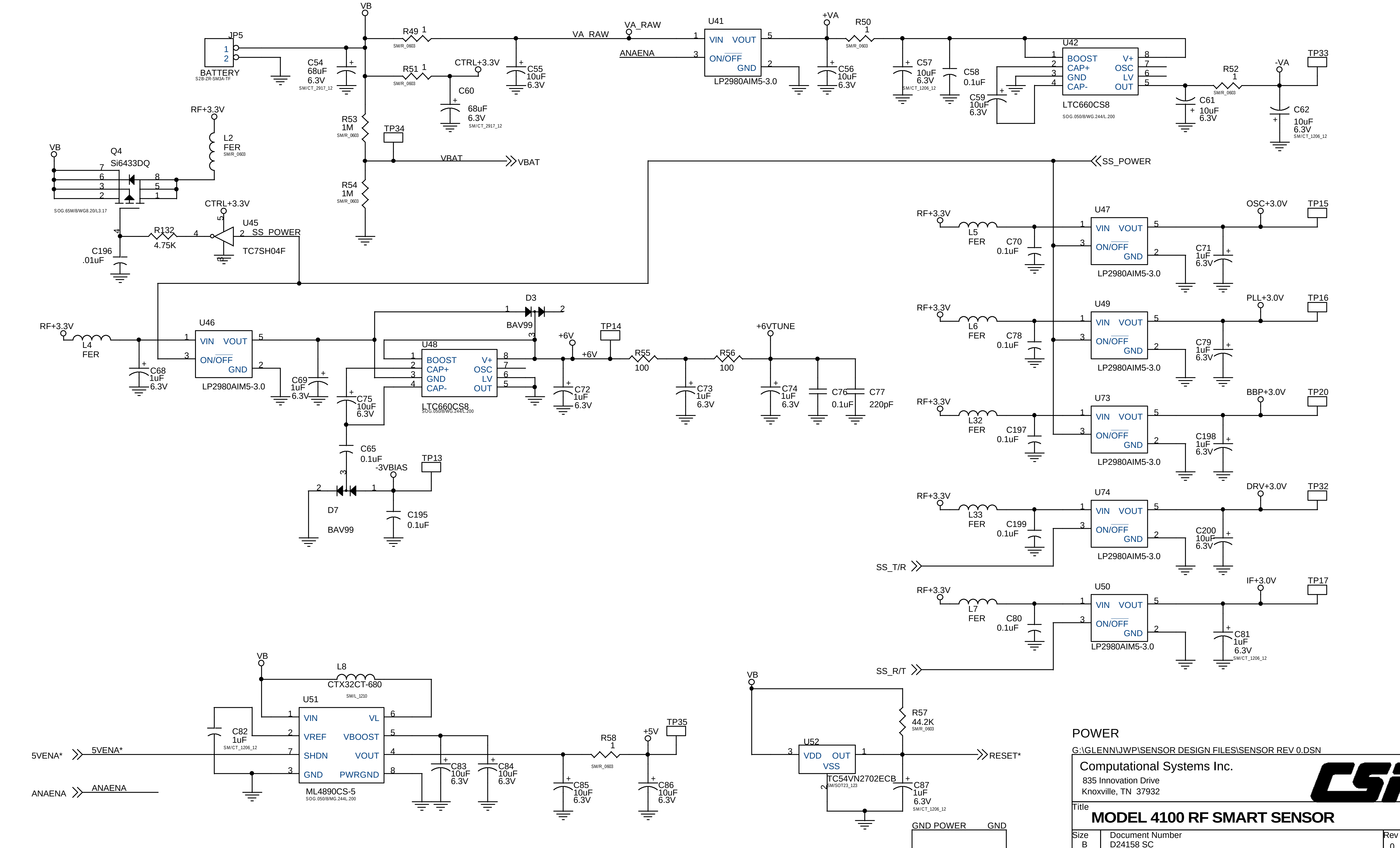

POWER

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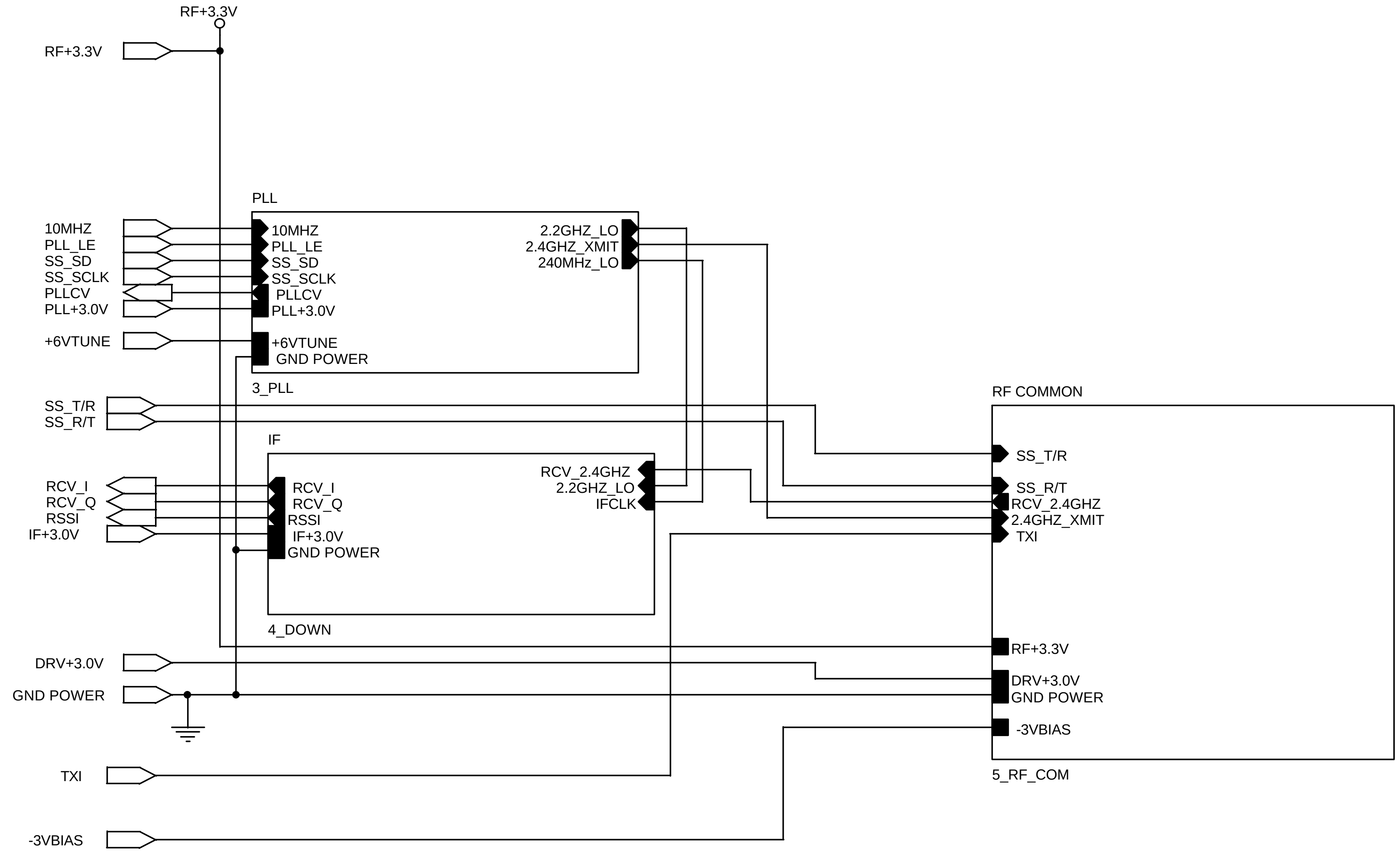

RF TOP LEVEL

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CSi

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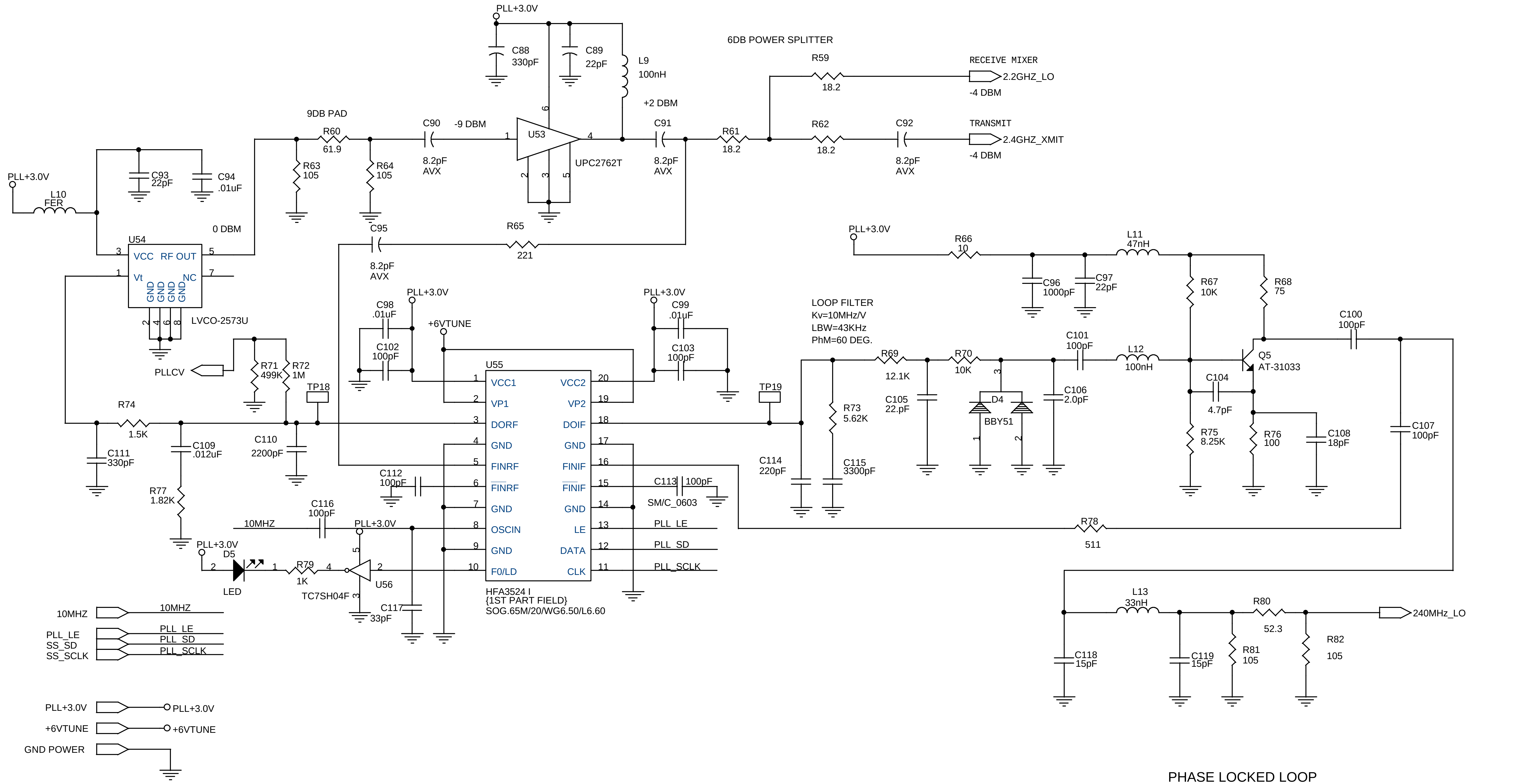
Date: Thursday, December 03, 1998 Sheet 8 of 11



PHASE LOCKED LOOP

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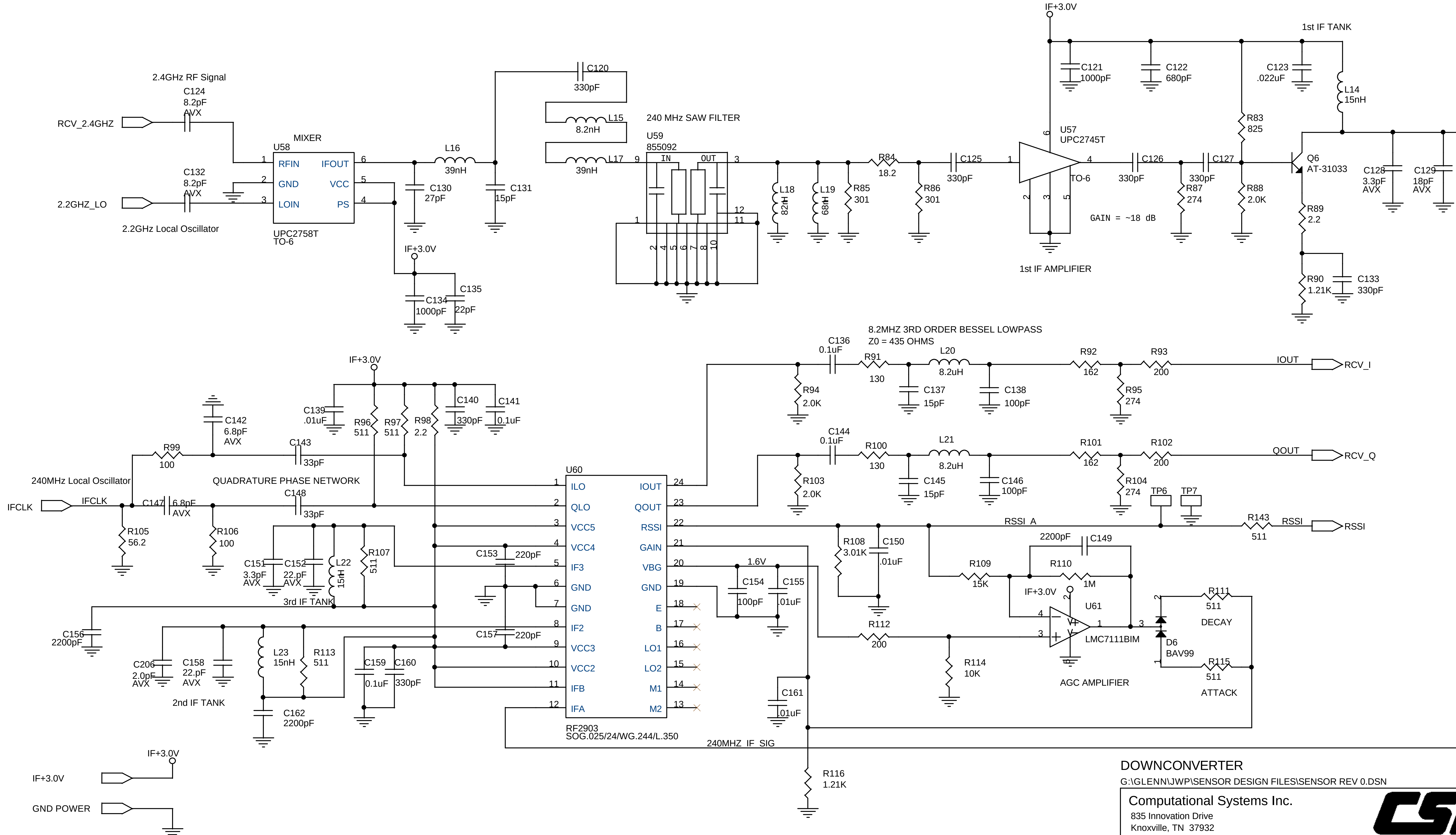

DOWNCONVERTER

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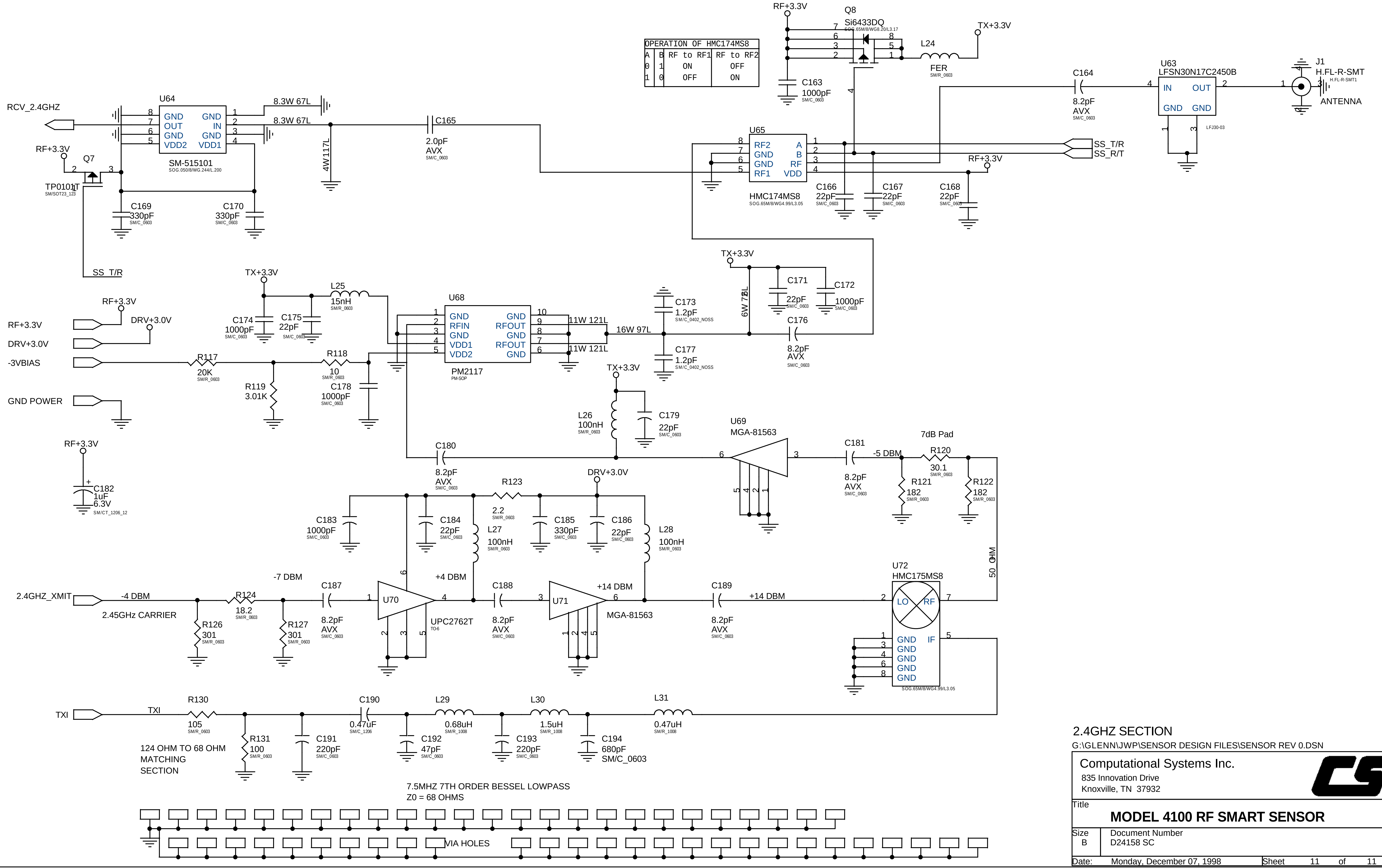

OPERATION OF HMC174MS8

A	B	RF to RF1	RF to RF2
0	1	ON	OFF
1	0	OFF	ON

2.4GHZ SECTION

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