SAN BERNARDINO MICROWAVE SOCIETY, Incorporated

FOUNDED IN 1955

A NON-PROFIT AMATEUR TECHNICAL ORGANIZATION DEDICATED TO THE ADVANCEMENT OF COMMUNICATIONS ABOVE 1000 MC.

W6IFE Newsletter

December 2007 Edition

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At the **December 6 SBMS** meeting will be a talk by Larry, K6HLH on his new Software Defined Radio.
The SBMS meets at the American Legion Hall 1024 Main Street (south of the 91 freeway) in Corona, CA at 1900 hours local time on the first Thursday of each month. Check out the SBMS web site at http://www.ham-radio.com/sbms/.

REMINDER- NO PARKING IN THE CHURCH LOT UNTIL CLAIRIFICATION IS MADE.

5th Annual SBMS Christmas Party will be on Saturday, 8 December 2007 and will go from 12:00Noon to at least 4 PM. The venue will be a little different this year. Dave and Marilyn Glawson at "The Lab" have graciously hosted the previous four years. And while I know that they would love to host it again this year, the space is not available in the lab for a party this time. So, between Dave and I, it was agreed that the party would be held at my new QTH in Fullerton! There's lots of space, lot's of parking. And like the years past, this will be a potluck. And per Dave's instructions last year, I would say the same ... if you want to bring what you brought the year before, that would work great! Just send me a note so that we can keep track of what's coming. We will do a gift exchange - one set for the guys and one set for the gals! (And I know the guys will bring those leftover parts from their radio projects...). Who knows, with a little luck (and a little help) we might even try to have a drawing! I will be publishing more info, as we get closer. (I will also be looking for some volunteers to come out and help me get some things in order before the party -- I am STILL trying to move in to the new place and things are a bit disarrayed ... mainly in the workshop area ...which is where I KNOW the guys will want to hang out! So, I best have it in tip-top shape!)
So, for starters, **here's the location:**
Dennis' place (W6DQ) 1497 Marelen Drive Fullerton, CA 92835
Just an FYI - if you got to the Sizzler for this year's winter social you were a scant 200 yards from my new place! I WILL publish a map on how to get there in a couple of weeks.
So, put the date on your calendar and plan on joining in the festivities! Keep an eye on the SBMS reflector for more

updates soon!
73!-dennis W6DQ

Last meeting-Chris, N9RIN talked about LO's: What we have. What we need. This included the Qualcomm 3016, Peregrine Q3236 AP note AN11, National, TI and Analog Devices chips. Good talk, thank you Chris! A number of members talked about the contributions from Ken Halford, W6DTA (sk). Dick. K6HIJ proposed a modular 3.4 GHz transverter hardware project for the Society. Bill McNally, N6MN from Seal Beach, Bob Thornburg, WB6JPI of San Bernardino and Dave, K2FTO were our visitors. Dick, K6HIJ rewrote the by-laws to reflect the voted change to add licensed spouces as free members. Welcome to new members Helen Mahoney, KI6LQV and Judy Burns, KC6UTF. 30 people present.

OVRO trip on 27-28 December with teachers and students from LA area to do optical telescopes and science tour. Contact Doug K6JEY for more info. Doug reported on proposed extra studies at OVRO by his Post-Doctoral stepson.

Scheduling
Dec 8 Christmas party at N6DQ home.
Jan 3, 2008 Doug, K6JEY talk on frequency stability, time and Allan Variance.

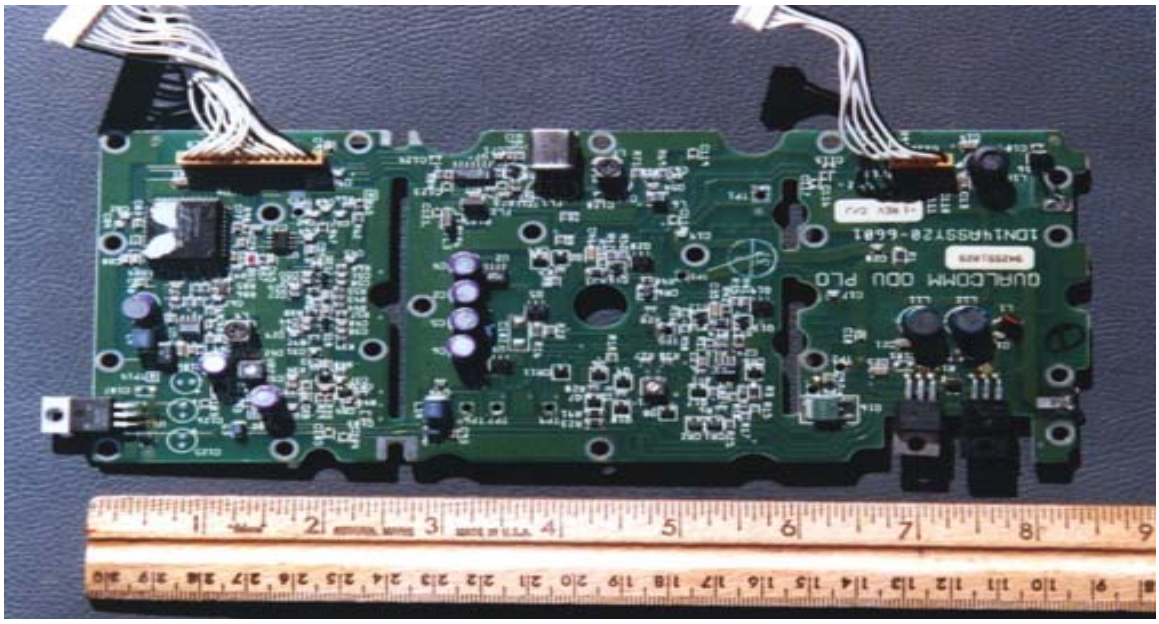
"Wants and Gots for sale".
For Sale- Programming sub-board for the Verticom and Stellex synthesizer. Assembled PCB, chip programmed for 11.880 GHz available from Chris N9RIN at: cshoaff@yahoo.com. SBMS member cost $6.00 not counting shipping.
Want- Qualcomm rectangular PLL board Chris N9RIN cshoaff@yahoo.com. 949-388-3121
Want 9.000000 GHz brick Dick WB6DNX 714-529-2800
Want service manual for Motorola R2000A comm. Analyzer Dan W6DFW 714-776-7718
Want Xband omni antenna. Mel WA6JBD 951-212-8245
Want schematic of HP 5087A Distribution Amplifier Tom WB6UZZ 714-402-1280
For Sale 10w 10 GHz TWTA with working power supply $60 Joonho KG6MQS
Need test cable for HP141/8555a spectrum analyzer Dick K6HIJ 760-253-2477
Want---A friend of mine in Europe has been experimenting with various mixer diodes on 122 GHz. To date the MA 46H146 Flip Chip Diode appears to be the most successful of all types tried. However, this is based on experiments with just one sample. He has asked me to obtain a small quantity of additional units (10-12) for further tests. In checking around, I find them available only in very large quantities. Does anyone have any of these around or can someone suggest a source for small quantity purchase? Thanks, Henry, KT1J
kt1j (at) madriver.com
Want: filament transformer 6V, 30A John KJ6HZ 951-288-1207 cell

Activities reported at November meeting –Dave, WA6CGR reported that the link between the Cummings peak repeaters was complete; Dick, K6HIJ proposed the generation of square and round WR22 flanges and WR42 flanges from his shop and the creation of a 47 GHZ waveguide switch next month; Dan, W6DFW worked on Cactus stuff; Larry, K6HLH went to MUD; Eric K6XQ is collecting 10 GHz parts; Joonho, KG6MQS built a 10 GHz filter and has an Endwave 24 GHz rig in progress; Dick, K6HIJ went to MUD, sold some 24 GHz switches and is collecting 47 GHz test equipment; Jerry, N7EME has a 8w 10 GHz amp project; Dave WA6CGR has been helping others in the lab; Mike W6YLZ did some HF work; Mel. WA6JBD did Cactus work and moved a 6 GHz radio to 5.8 GHz; Steve W6QIWdid some 24 GHz work; Chris, N9RIN made the presentation and some boards for 3.4 GHz; Pat, N6RMJ had his 10 GHz rig die and the 24 GHz rig is back functioning; Gary, W6KVC had his house saved in the fire; Dennis, W6DQ is un-packing his new home; Doug K6JEY went to MUD, did a talk there, and has a new $300 78 GHz dish; Howard WA6YGB has a 1296 MHz amp that gives 120w for 12 w input and had a PSK31 2 meter contact over the hills to Lake Los Angeles; Jeff KN6VR was on vacation and found his 10 GHz feed was too narrow for his dish; Ed W6OYJ worked with ARES on the fires, the fires in San Diego cut power to the beacons, and Paul WA6PY had fire next to his house; Bill, WA6QYR went to MUD and toured PA, NJ and NYC; Chuck WA6EXVhas a new fence around the house and did some 10 and 24 GHz power amp work, Measured KN6VR feed, and is building a 2,3,5 and 10 GHz beacon for his local area; Frank, WB6CWN has a 4 cavity 10.3 GHz filter, is back on 144 and 440 MHz, and thinks his FT897 is great; Dick, WB6DNXis collecting 24 GHz parts for a beacon and won the WB6CWN prize for being first in getting the Endwave rig on the air. ATV check in's included N6IFU, K6LEK, and N6IWY.

Chris, N9RIN's talk about Local Oscillators

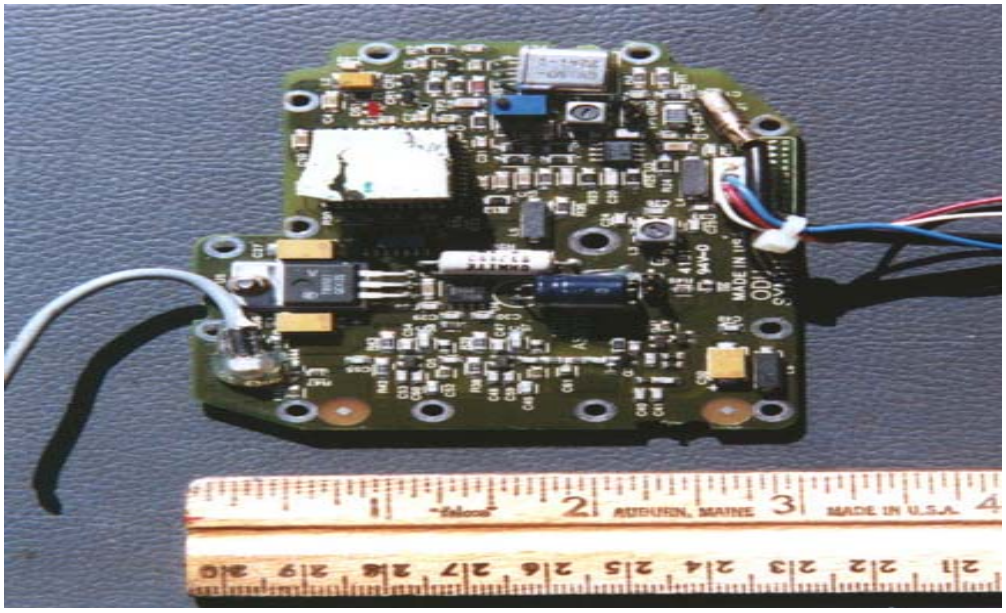
What we have:

Most of us know about or have used:

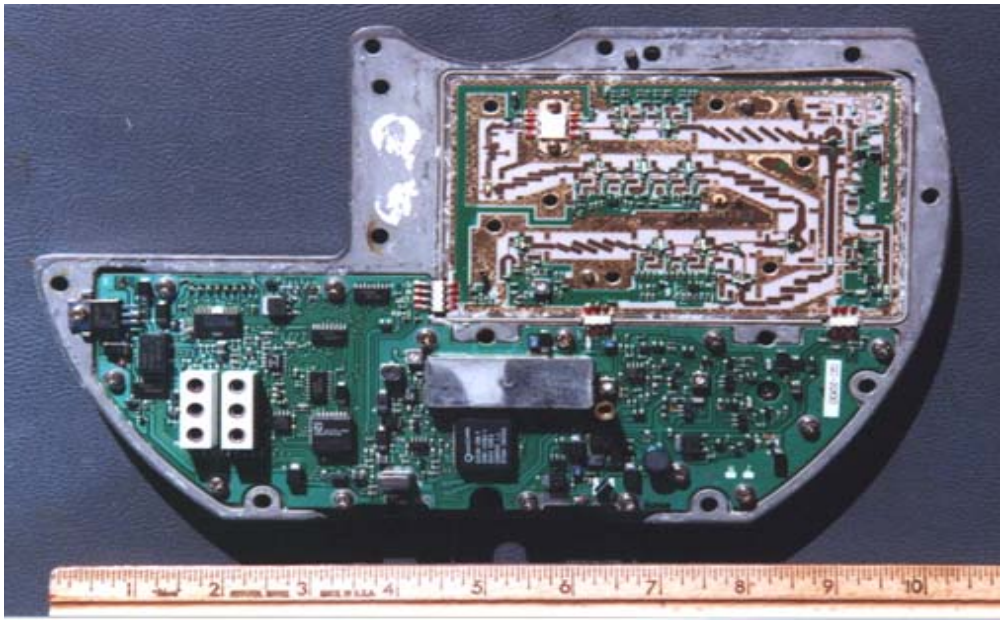


The Qualcomm Rectangular Board

Or



The Texas Board



The Lamb Chop

The good:
Well documented.
Easy to modify.
Reasonably priced.

The not-so-good:
Can draw several watts of power.
Not as available as they use to be.
Parts can be hard to find for repair.
Q3236 PLL chip is not produced, but can be found on the surplus market.
Don't count on getting it in small quantities.

There is an alternative to the Q3236.
Peregrine Semiconductor
Makes an almost drop-in replacement for the Q3236.

What is different?

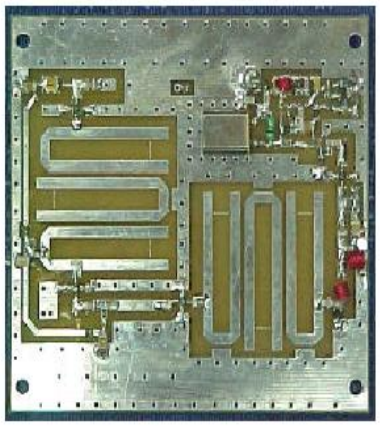
Pin Number	Qualcomm	Peregrine	Solution
All Power Supply Pins	5 Volts	3 Volts	Add Voltage Regulator if necessary
Pin 28 (fin)	Capacitor to GND	Capacitor and Resistor to GND	Add 51 Ω resistor
Pin 27 (fin)	Series Cap and 100 Ω to GND	Series Cap and 51 Ω to GND	Change resistor value
Pins 36 & 37	240 Ω Resistor to GND	No Resistor	Remove resistor
Pins 31 & 38	Vdd	Power supply for f_c & f_p buffer circuits	Leave pins floating
Pins 30 & 39	Output (possible resistor to GND)	Disabled test points (f_c & f_p)	No changes required
Pin 41	Capacitor to GND	Connect directly to GND	Replace capacitor with jumper
Pin 44	Q3236 mode select	Factory test mode select pin; must be tied to V_{DD}	Connect to V_{DD}
Digital Inputs	Internal pull-down resistors	No internal resistors	Connect unused pins to GND
	5-volt logic compatible	3-volt logic compatible	Add resistor divider networks
Phase Detector Gain	302 mV / radian	430 mV / radian	Adjust loop filter design

More details available in Peregrine app note AN11.

What else is there?
Down East Microwave has a kit, but……..

Down East Microwave Inc. 954 Route 519, Frenchtown NJ 08825
Phone: 908-996-3584 (Voice) 908-996-3702 (Fax) http://www.downeastmicrowave.com

DEM Part Number MICROLO and MICROLOK
Microwave Transverter Local Oscillator



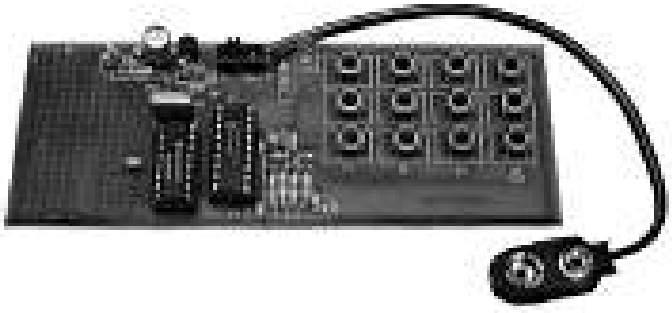
Theory and Operation:

The LO is intended to be used as part of an DEMI's line of microwave transverters. It may also be used as a stand alone oscillator. The following table provides crystal information and multiplication factors for DEMI microwave transverters and converters using a 144 MHz IF and low side injection. These are the standard "Weak Signal" frequency's configurations. Other frequency's may be used within the ranges given for other microwave transverters or converter schemes.

Band	Crystal Frequency	LO Output Frequency and Output Power	Multiplication	Xverter LO Frequency
2304	180.000 MHz.	1080.000 MHz. +3dBm	X2	2160.000 MHz.
2400	188.000 MHz.	1128.000 MHz. +3dBm	X2	2256.000 MHz.
3456	184.000 MHz.	1104.000 MHz. +3dBm	X3	3312.000 MHz.
5760	187.200 MHz.	1123.200 MHz. +3dBm	X5	5616.000 MHz.
10368	189.333 MHz.	1136.000 MHz. +3dBm	X9	10224.000MHz.

It would still need multipliers, more than the Qualcomm boards.

What else?
PLL EXPERIMENTER KIT TO 185MHZ



Not too useful, lots of multipliers needed.

What else?
Our very own N7EME has an LO.
Model 5112 Phase Locked Oscillator

Designed to replace the crystal oscillator LO chain in the DB6NT 10GHz Transverter unit used by Amateur Radio Microwave operators.

That is what we have so far.

What we need:

An LO that has at least the same RF performance as the Qualcomm boards.
Lower DC power usage.
Small size.
Small cost.
Repeatable design.
Where to start.
Select a PLL and VCO for the frequency you need.
Figure out the loop filter.
Usually starts with something like this:

$$F_{OUT} = \sqrt{F_{min} F_{max}}$$

$$N = \frac{F_{OUT}}{F_{com}}$$

$$\varpi_C = 2\pi F_C$$

$$T1 = \frac{\left(\frac{1}{\cos\phi}\right) - \tan\phi}{\varpi_C\left(1 + \frac{T3}{T1}\right)}$$

$$T3 = \left(\frac{T3}{T1}\right) T_1$$

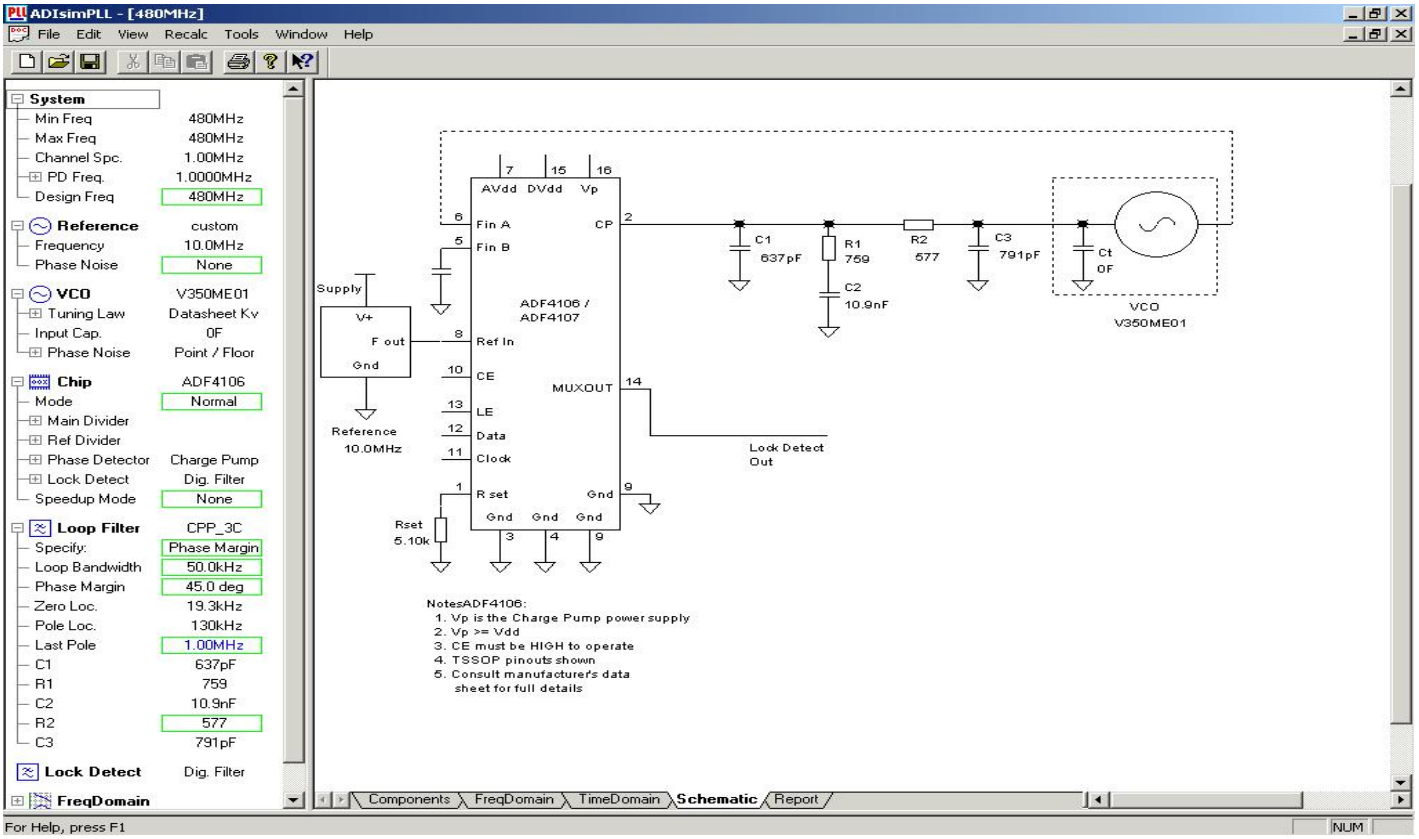
$$T2 = \frac{1}{\varpi_C^2 (T1+T3)}$$

$$C1 = \frac{T1}{T2} \times \frac{K_{VCO} K\phi}{\varpi_C^2 N} \times \left[\frac{1 + (\varpi_C T2)^2}{\left(1 + \varpi_C^2 T1^2\right)\left(1 + \varpi_C^2 T3^2\right)}\right]^{\frac{1}{2}}$$

$$C2 = C1\left(\frac{T2}{T1} - 1\right), \quad C3 = \frac{C1}{10}$$

$$R1 = \frac{T2}{C2}, \quad R2 = \frac{T3}{C3}$$

Is there an easier way?
Yes.
Analog Devices and Peregrine make some tools to help with the design of a PLL circuit.



Is there something easier?

Yes.

LO on a chip.

The PLL, VCO and loop filter is built into a chip.

So all that is needed is the chip, board, uC, regulator, RF amplifier, misc. caps and resistors.

An example:

TEXAS INSTRUMENTS
www.ti.com

TRF3761

SLWS181F–OCTOBER 2005–REVISED JANUARY 2007

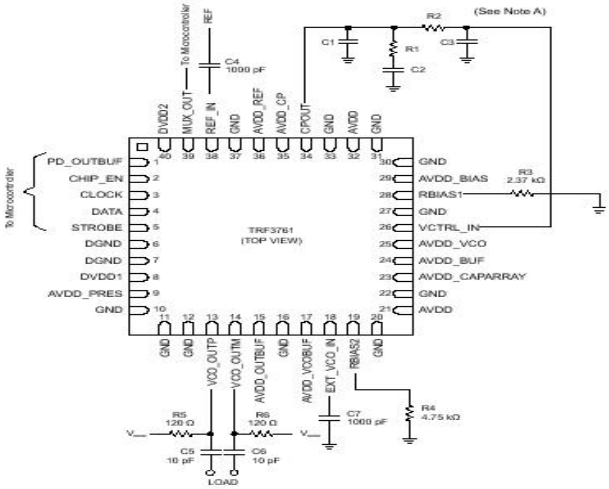
INTEGER-N PLL WITH INTEGRATED VCO

FEATURES

- **Fully Integrated VCO**
- **Low Phase Noise: –137dBc/Hz (at 600kHz, f_{VCO} of 1.9GHz)**
- **Low Noise Floor: –158dBc/Hz at 10MHz Offset**
- **Integer-N PLL**
- **Input Reference Frequency range: 10MHz to 104MHz**
- **VCO Frequency Divided by 2-4 Output**
- **Output Buffer Enable Pin**
- **Programmable Charge Pump Current**
- **Hardware and Software Power Down**
- **3-Wire Serial Interface**
- **Single Supply: 4.5V to 5.25V Operation**

APPLICATIONS

- **Wireless Infrastructure**
  - **WCDMA, CDMA, GSM**
  - **Wideband Transceivers**
  - **Wireless Local Loop**
  - **RFID Transceivers**
  - **Clock generation**
  - **IF LO generation**



A. See the Application Information section for Loop Filter Design procedures.

There is something to watch out for.
The TI chip will only go up to 2.386 GHz.
Not quite a direct replacement if you need 2.556 GHz.
This would work as a LO for bands below 2.4 GHz.
To replace a Qualcomm board.
This chip would work:

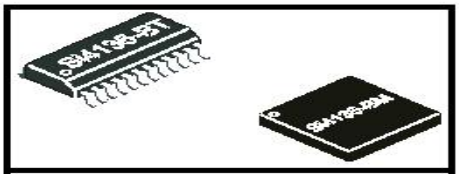
SILICON LABORATORIES

Si4136/Si4126

ISM RF SYNTHESIZER WITH INTEGRATED VCOs FOR WIRELESS COMMUNICATIONS

Features

- Dual-band RF synthesizers
  - RF1: 2300 MHz to 2500 MHz
  - RF2: 2025 MHz to 2300 MHz
- IF synthesizer
  - 62.5 MHz to 1000 MHz
- Integrated VCOs, loop filters, varactors, and resonators
- Minimal external components required
- Low phase noise
- 5 µA standby current
- 25.7 mA typical supply current
- 2.7 V to 3.6 V operation
- Packages: 24-pin TSSOP, 28-lead MLP



Ordering Information:
See page 29.

Applications

- ISM and MMDS band communications
- Wireless LAN and WAN
- Dual-band communications

Description

The Si4136 is a monolithic integrated circuit that performs both IF and RF synthesis for wireless communications applications. The Si4136 includes three VCOs, loop filters, reference and VCO dividers, and phase detectors. Divider and powerdown settings are programmable through a three-wire serial interface.

So far these are good for multiplying up with existing systems.
Next will be to develop a board that will give an LO signal directly at 9.936 GHz (for 432 MHz IF) or 10.224 GHz (for 144 MHz IF) or 23.760 GHz (for 432 MHz IF).
How about something on FR4, 0.062” thick, 2 layer board from Expresspcb like the previous board?

Conclusion

An LO can be made for just your needs or in general for the band of interest.
A LO can be made the traditional way using crystals or PLL, or by using the new integrated approach.
Software is available to help in the design whichever method is chosen.
Making your own LO is an educational experience.
Making your own LO allows you to experiment and push the limits.
When making your own LO, you have the choice of making it a one off or a repeatable design that others can use.
EBAY will most likely not prove to be a reliable source for repeatable LO’s. (Unless you put your own design there.)
73’s Chris

Emails-Hello Friends, for those interested I again tonight received a signal from the newly launched Japanese Lunar Orbiter. This was received with my newly built S-Band down converter and a 3 1/2-turn helix antenna. Frequency drifted due to Doppler from 2263.605Mhz to 2263.581MHz before it went around the other side. I later acquired it after it came back around. I have not yet established a period of orbit. This was a great way to test my down converter. Loren WA7SKT

Neat! What was the received signal strength and your antenna gain/front-end NF? Anyone know how long the vehicle is supposed to remain in lunar orbit and actively transmitting? If you can pick it up with a basic handheld antenna, it could be a nice benchmark test source.-- john, KE5FX

Congratulations on the reception. Now you've got me interested. Info I just looked up says frequencies are 2212, 2219, 2287, 8456. So do you think your 2263 was Doppler shifted 2287? I wonder if the satellite Doppler has much effect vs. the moon itself. Calculating the exact Doppler must be quite a math exercise.
Are you still planning to try the 8 GHz frequency too? Or have you already?
A wiki for the satellite says the period of the main satellite is 2 hrs.
For John, the links say it will be at the moon for about a year. At the end they intend to do a soft landing on the moon.
Here are some links I found tonight, (there are lots more.)
Selene (Kaguya):
http://en.wikipedia.org/wiki/SELENE
http://www.selene.jaxa.jp/en/communication/com_faq_e.htm
http://www.selene.jaxa.jp/index_e.htm
transmitters & freqs described in this one:
http://ivs.nict.go.jp/mirror/publications/gm2006/kawano/
http://www.aerospaceguide.net/spacecraft/selene.html
http://www.lpi.usra.edu/meetings/lpsc2006/pdf/1233.pdf
Seems the Chinese also have a satellite, Chang'e, orbiting the moon too. http://en.wikipedia.org/wiki/Chang'e_1
I couldn't find any information about downlink frequencies for the Chinese one. Does anyone know anything about that one? Some of the information seemed to say it would be playing Chinese music. Rex,

As per Paul Marsh the frequency for the Chinese orbiter Doppler beacon is 2234.533 +/- Doppler. Loren

John, I received signal only on Spectran. I only have a temporary single stage Connifer LNA on the 3 1/2-turn helix. Then signal comes in coax from LNA to the mixer. IF is an IC-R7000 receiver. I threw the helix together a week or so ago. I have a couple of other LNA's I will try when I get them built. The LNA I have now probably has at least 2db noise figure I bet. I am using a Minicircuits mixer and a 1GHz PLO with a Mini-Kits filter-multiplier to 2 GHz. Loren

The **TRACO** Power Products DC/DC converter T3006-01A that Dick, WB6DNX had for sale. Here are the connections---
Input pins 2,3 negative; pins 22,23 positive input voltage 9 to 15 volts DC
Output pins 11 negative; (9 is connected to 16) for Plus 12v out put; pin 14 for plus 24v out put.
Output is isolated from input so you can make either a positive or negative supply. About 400 ma is max current. The outputs are pretty much regulated up to about 400 ma.
Viewed from bottom
(2) (3) (9) (10) (11)
Neg. input +12 neg.

Pos. input +12 +24
(23)(22) (16)(15) (14)
Pins 1,12,13,24 are missing on the module. Pins are numbered on base.

Doug, K6JEY purchased a new 78 GHz dish at MUD 07. He now has it mounted for field operation.

The **San Bernardino Microwave Society** is a technical amateur radio club affiliated with the ARRL having a membership of over 90 amateurs from Hawaii and Alaska to the east coast and beyond. Dues are $15 per year, which includes a badge and monthly newsletter. Your mail label indicates your call followed by when your dues are due. Dues can be sent to the treasurer as listed under the banner on the front page. If you have material you would like in the newsletter please send it to Bill WA6QYR at 247 Rebel Road Ridgecrest, CA 93555, bburns@ridgecrest.ca.us, or phone 760-375-8566. The newsletter is generated about the 15th of the month and put into the mail at least the week prior to the meeting. This is your newsletter. SBMS Newsletter material can be copied as long as SBMS is identified as source.

San Bernardino Microwave Society newsletter
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