 LTE-Lite™ GPSDO EVALUATION KIT CUSTOMER FAQ
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1. Why did you choose a 20MHz TCXO rather than the more typical 10MHz output frequency?

The unit can generate a 10MHz output frequency on the synthesized RF output in parallel to the 20MHz output of the TCXO. Using a 20MHz TCXO allows for better phase noise at 20MHz. The 20MHz TCXO was also more readily available than the 10MHz TCXO, and 20MHz and higher are more common frequencies for the Small Cell applications that this module is targeted at.

2. What features does the LTE-Lite Evaluation board support?

It contains coax connectors for the TCXO output, the synthesized RF output, the GPS antenna, and the 1PPS output. It also contains various switches and buttons to allow access to many of the LTE-Lite features, as well as headers for configuration, and LEDs for status. It has a USB connector for communications (NMEA) and 1PPS transfer to GPSD (NTP), as well as an optional +5V power input for operation independent of the USB port. Lastly it contains a DIP-14 footprint for an optional external 3.3V TCXO so the customer can try the External Oscillator option. This FAQ is written for the LTE-Lite Evaluation Kit.

3. Does the LTE-Lite have an external 1PPS input?

No. To be able to meet the price target we had to keep some of the functions such as this one out of the product.

4. Does the LTE-Lite have a software control (SCPI) serial port?

No. To be able to meet the price target we had to keep some of the functions such as this one out of the product. All configuration of the LTE-Lite is done by TTL straps with internal pull-up resistors. The LTE-Lite does however have two NMEA serial output ports, one driven by the GPS receiver, and one driven by the JLT control microprocessor sending out a proprietary NMEA message with oscillator lock status and health information. Oscillator status is also given by various TTL output status lines that can be used to drive LED’s etc

5. Is the LTE-Lite Glonass capable?

At this time the unit only supports QZSS and GPS. Glonass support may be added later.

6. What antenna connections are available?

The LTE-Lite Eval Board has a built-in MMCX antenna connector and a U.FL antenna connector in parallel to the MMCX connector. Either connector can be used without requiring any configuration. Both connectors provide 3.3V DC antenna power.

7. Does the LTE-Lite support Position-Hold Mode and Auto-Survey?

Yes. By default the unit will start a 2000-fix Auto Survey upon power-on or reset. The unit can also be manually forced to start an auto survey by pressing the AUTO SURVEY button on the LTE-Lite Eval board for one second or longer.

8. Are there LED's to indicate GPS fixes and the activity of the Auto Survey process?

Yes. An LED on the LTE-Lite module is constantly on to indicate power status when not receiving GPS fixes, and blinks at 1Hz when receiving GPS fixes. Another LED is on to indicate the Auto Survey being active, and yet other LED's show ALARM, WARMUP, and LOCK OK status.

9. What do I have to do if I don't need the Auto Survey and want to use the unit in a mobile application?

You can insert a jumper into the ROM-BOOT header (pins 1 and 2 of connector J3 on the eval board) while the power is turned-off. The unit will then boot into a mobile GPS mode and not use any Auto Survey process.

10. The LTE-Lite Eval Kit schematics show a "10MHz" output and connector. Is the frequency on this signal 10MHz or 20MHz?

This output (connector J2 on the Eval Board) is the direct output of the TCXO with only a buffer inserted. So if a 19.2MHz TCXO is ordered the output frequency on this connector will be 19.2MHz. The "10MHz" label is just a placeholder as we had initially planned to use 10MHz TCXOs but will now ship with either 20MHz or 19.2MHz TCXOs.

11. How does the unit generate the synthesized output frequencies from the TCXO frequency?

The TCXO frequency is multiplied by a VCO-based PLL and then divided to generate the output frequency. Thus n/m integer ratios of the TCXO crystal frequency are possible such as 16MHz from a 20MHz TCXO. In this example the math works as follows: 20MHz * 4 / 5 = 16MHz. The unit only supports integer multiple/division of the TCXO, which minimizes spurs but also limits the possible output frequency choices.

12. Is it possible to program the synthesized output frequency via the serial port or is it just a set of presets selected by the links?

The module does not accept any serial input at this time, and all output frequency selections are made using three jumpers on a header block.

13. Can the synthesized RF output be disabled?

Yes, by default it is disabled. Jumpers will need to be inserted into the three TTL strap pins on header-block JP1 to enable the synthesized output frequency.

14. Is the TCXO output frequency gated or can it be disabled?

No. The unit will generate an RF signal on connector J2 as soon as power is turned-on, and the direct TCXO output cannot be gated (disabled)

15. Could you clarify the availability of each frequency?

The unit has one TCXO direct-output frequency, and a secondary PLL-synthesized output using the main frequency as a reference.

The unit will be offered with either a 19.2MHz or a 20.0MHz TCXO. Other frequencies are available upon special request, but will have minimum buy quantity requirements as we do not stock the crystals in other frequencies. The LTE-Lite Eval Board also has a standard DIP-14 footprint for an external 3.3V TCXO that the user can solder into the board, and frequencies such as 10MHz, 20MHz, 15.36MHz, 19.2MHz and others are supported for that external oscillator.

The available synthesized frequencies for a given TCXO frequency are listed in a table on the second page of the LTE-Lite specsheets available on the LTE-Lite product page on the www.jackson-labs.com website.

16. Is the Phase Noise performance of the secondary synthesized PLL frequency output similar to the Phase Noise on the direct TCXO connector?

No. The internal synthesizer of the LTE-Lite module uses a silicon VCO, and the phase noise of this output and its spurs are significantly higher than from the direct TCXO output. If the best possible phase noise is required, the direct crystal output should be used.

17. How did you measure the Phase Noise and ADEV performance?

The LTE-Lite module contains an internal buffer for the TCXO RF frequency output (19.2 or 20MHz) that we used to directly drive a TSC5125A and a Time-Pod input through a DC-block to protect the analyzers. We used an HP 58503A as a reference for the analyzers. For the un-buffered synthesized output we added an external CMOS buffer before feeding the signal to the analyzers. We covered the boards from airflow by putting them into ESD protection bags to avoid exposure to ambient airflow. We then let the boards run for several days to fully stabilize before starting the ADEV measurements.

18. If we need 16MHz what will be the best TCXO to select - 10MHz or 20MHz?

The 20MHz TCXO is available on the module today. The 10MHz TCXO would be an external TCXO at this time. So if 16MHz are required the 20MHz TCXO should be ordered.

19. Is the synthesized RF output phase-coherent to the TCXO and thus to UTC?

Yes. The RF output frequency is integer n/m locked to the TCXO, and the TCXO is phase-locked to UTC, thus the unit really generates for example 16,000,000.000,000Hz on the synthesized

output when averaged long enough from the 20MHz TCXO. The ADEV performance of the synthesized RF output is thus almost identical to the ADEV plot of the TCXO output itself, except for some PLL loop noise very close-in (additive phase noise).

20. Is the Extended Temperature version available by default or only on request?

The units can be run in extended temperature mode by default without any special ordering required, but the thermal stability specification then changes to +/-250ppb.

21. How sensitive is the unit to airflow and temperature changes, and motion?

Since this is a TCXO-based unit and not an OCXO, and it is a very small TCXO, the sensitivity to airflow, thermal changes, and tilt etc are quite high. It is recommended that the unit be placed in a shielded container (it fits into a standard Hammond enclosure for example) and that any airflow, even convective airflow(!), is kept away to achieve the best stability. It is also recommended that the unit is not moved, accelerated, or tilted during operation to avoid the g-sensitivity of the crystal to affect the frequency stability or phase noise.

22. Is the external oscillator a specific option ?

The unit can be run with the external oscillator at any time by soldering-in a DIP-14 TCXO, and then turning the EXT-TCXO switch to the EXTERNAL position. This will disable the internal TCXO, and enable operation from the external TCXO.

23. How do I connect external oscillators other than DIP-14 ones?

You should be able to solder a wire to pin 1 of the DIP-14 footprint for the EFC signal (range of 0V to 3.0V). Then feed the RF signal from the external oscillator into connector J2 which now becomes an input rather than an output. Make sure to select the external TCXO switch SW2 to the “EXTERNAL” setting prior to turning on power to avoid having the module generate an output frequency on connector J2.

24. Can the time-constant be changed for locking external oscillators?

Not at this time. You may be able to add some analog delay in the EFC line, and use a low-noise opamp to scale the EFC voltage as required. Reducing the voltage range is equivalent to increasing the time-constant of the loop, and vice-versa, so clever scaling using an opamp and a variable resistor may allow you to modify the time-constant of the loop for longer time-constants.

25. Do we need to tell the LTE-Lite module the frequency of the external TCXO somehow?

No, the LTE-Lite will auto-detect the following TCXO frequencies at this time: 10MHz, 15.36MHz, 19.2MHz, 20MHz.

26. How do I select the synthesized RF frequency or disable that output?

The synthesized output frequency is selected or disabled via three TTL straps. Up to three jumpers can be inserted into the debug header block to select the output frequency. The synthesized RF output is fully disabled (default) when no jumpers are inserted. The LTE-Lite module specsheets contain a cross-reference table for the required TTL strap to generate a specific output frequency.

27. Is there a time-delay for the synthesized frequency output to be valid?

Yes. This is a software-controlled output, and it takes up to one second for it to stabilize. The PHASE-LOCK TTL status output (pin 7 on the LTE-Lite module) can be used to gate the use of the synthesized output, as it indicates when that output is stable. This PHASE-LOCK output can also be used as a generic RESET# signal to other circuits on the users' board since it behaves exactly like a RESET# signal, going high (3.3V) shortly after power-on.

28. What status information is available?

The LTE-Lite module has several TTL status output lines such as TCXO warmup, ALARM fault, LOCK OK, Survey Active, and synthesized RF output Phase Lock. The unit also sends out a binary health status parameter in the JLT NMEA status sentence that encodes all of the available lock and health status bits into a single binary number for easy parsing and decoding.

29. How can I use the USB port?

The LTE-Lite Eval Board supports NMEA output on the USB serial port. A switch selects either direct NMEA output from the GPS receiver (1Hz or 5Hz update rate) or the JLT-proprietary NMEA oscillator status output message. The module does not accept serial input at this time. The unit also provides the oscillator-generated 1PPS output phase-locked to UTC to the DCD# pin of the USB serial port for use with NTP time server programs etc. Connecting the USB port will also provide power to the system.

30. Does the unit send the 1PPS signal to the USB serial port DCD# line for NTP?

Yes.

31. Is the raw-GPS-1PPS signal available?

Yes, it is on pin 12 of JP1. This is the un-corrected, un-buffered raw 1PPS signal from the GPS receiver, and still has the sawtooth error on it.

32. Why is there a NMEA/STATUS switch on the Eval Board?

The LTE-Lite has two serial output ports: one is driven directly by the GPS receiver and contains NMEA messages for the GPS receiver, and the other is driven by the JLT Microprocessor software and contains status information for the oscillator, disciplining loop, and hardware. This

switch allows sending either the NMEA PVT data or the NMEA Status data to the USB serial controller.

33. Is the LTE-Lite Eval Board software-upgradeable?

Technically yes, but JLT will not send out software upgrades for this product to the field. All upgrades will have to be handled by the JLT factory.

34. How do I switch to 5Hz NMEA update rate?

Insert a jumper between pins 3 and 14 of the debug connector JP1

35. Can the unit be powered from an external power supply?

Yes. Usually the unit is powered through the USB port. If better isolation is needed etc. then a 5V DC power supply can be connected to JP2. These two power inputs are isolated through safety diodes on the PCB.

36. What are the specifications for the optional external oscillator?

- CMOS or TTL VCTCXO or OCXO
- 3.3V power (3.1V to 3.5V operating range) – or externally powered
- DIP-14 package with EFC control input on pin-1 if soldered onto PCB
- 50mA max power consumption recommended if soldered onto PCB
- Frequency of either 10MHz, 15.36MHz, 19.2MHz or 20MHz