SIERRA WIRELESS
HEART OF THE WIRELESS MACHINE™

Letter of Submittal and Compliance

December 22, 1999

Federal Communications Commission
Authorization and Standards Division
7435 Oakland Mills Rd.
Columbia, M.D. 21046

RE: FCC ID: LL9MP200V Grantee: Sierra Wireless Inc.
Equipment Class: Non-Broadcast Transmitter
Application for Class II Permissive Change dated December 21, 1999

Dear Madam/Sir:

The following information is submitted in support of a Class II Permissive Change to the certification of the LL9MP200V transmitter. There are no physical or electrical changes exceeding those allowed in Section 2.1001a. The following section explains the changes that make the application for permissive change necessary. Along with the updated schematic (Appendix A), the updated Bill of Material (Appendix B) and the detailed circuit description currently on file at FCC for this type, this section outlines the modifications and the circuits that are affected.

The conducted tests that are required for part 22 type acceptance have been performed in-house on a representative upgraded unit. Sierra Wireless Incorporated has tested this transmitter in accordance with the requirements contained in the appropriate Commission Regulations. To the best of my knowledge, these tests were performed using measurement procedures consistent with the Industry or Commission standards and demonstrates that the equipment complies with the published standard. The results are presented in this document.

Radiated tests for unintentional radiators (15.109), radiated spurious emission (2.993), and maximum permissible emission (2.1091) have been performed at an FCC certified site, Intertek Testing Services, in Menlo Park, California. We enclose their reports that show the device is compliant with the Commission standards.

Sierra Wireless wishes to establish the acceptability of a category of antennas (instead of specific models) as defined below for purposes of satisfying MPE compliance for 2.1091 of the FCC rules with the MP210V-GPS (FCC ID LL9MP200V). To qualify this category of antenna we have provided test results (see MPE report by ITS) using five examples within the category and that, we believe, represent the extremes of radiation levels that might be seen in this category.

These examples include the longest, shortest and nominal lengths of antennas of similar configuration and are intended to demonstrate the worst case and nominal performance for this category.

We refer to this category as the "3dB gain Cellular Mobile" whip antenna. This category is defined by these attributes:

- rated gain of 3 dBd
- the radiator is a collinear array of two vertical elements. A base fed lower element of length 85 mm +/-30 mm, connected at its highest point to a matching coil. The top of the coil is, in turn, connected to an upper vertical element of length 200 mm +/- 35 mm. The matching coil may be an open-air type or encapsulated.
- Intended for mounting on a horizontal metallic surface of vehicle body using either a through-hole or magnetic base.
- Cable loss of more than 0.5 dB

The five example antennas tested include open coil types, encapsulated coil types, magnetic mount and through-hole mount.

We ask that the Grant condition referring to antenna type be worded to include this category.

Sincerely

Ron Vanderhelm
Director, RF Development

Expository Changes (2.1001(b)(2))

This section describes the changes made on the MP210V-GPS.

The reference oscillators (TCXO or temperature compensated crystal oscillators) provide the frequency references for the two synthesizers used to generate the transmit carrier. The parts that had been used until now for this reference oscillator function have been discontinued by its manufacturer. These old oscillator modules included an internal microprocessor to provide temperature compensation and a serial digital interface for zeroing the frequency error. The part that we will be replacing them with do not support this digital interface. Our new circuitry adds a small microprocessor to serve as a translator between the old interface and the new.

Two TCXOs are affected. One (formerly U16, now U19) is used as the reference for the transmit IF signal at 81.75 MHz. The second (formerly U17, now U16) is used as the reference for the transmitter LO at 755 MHz +/-12.5 MHz. The oscillator frequencies do not change; the IF reference is 14.4 MHz, and the LO reference is 16.8 MHz, as it was in the old design.

The new oscillators are functionally equivalent to the old discontinued ones once our new interface circuitry is added to provide DC voltage for trimming frequency error to zero. The circuitry to provide temperature stabilization remains within the crystal oscillator module and is not part of our added circuitry. The following circuit descriptions provide more detail.

Other changes are made including minor upgrades in part type to four other components including the synthesizer prescalers (U12 and U14), the AMPS modem IC (U27) and the DSP (U22). These upgrades are minor in that, in each case, the new chip is a manufacturing upgrade from the old, from the same manufacturer. Their functionality and performance do not change significantly. These changes are listed in detail in a later section of this statement.

Reference Oscillators

The RX and TX Temperature Voltage Controlled Crystal Oscillators (TCXOs) have been replaced. Figure 1 shows the circuitry newly implemented.

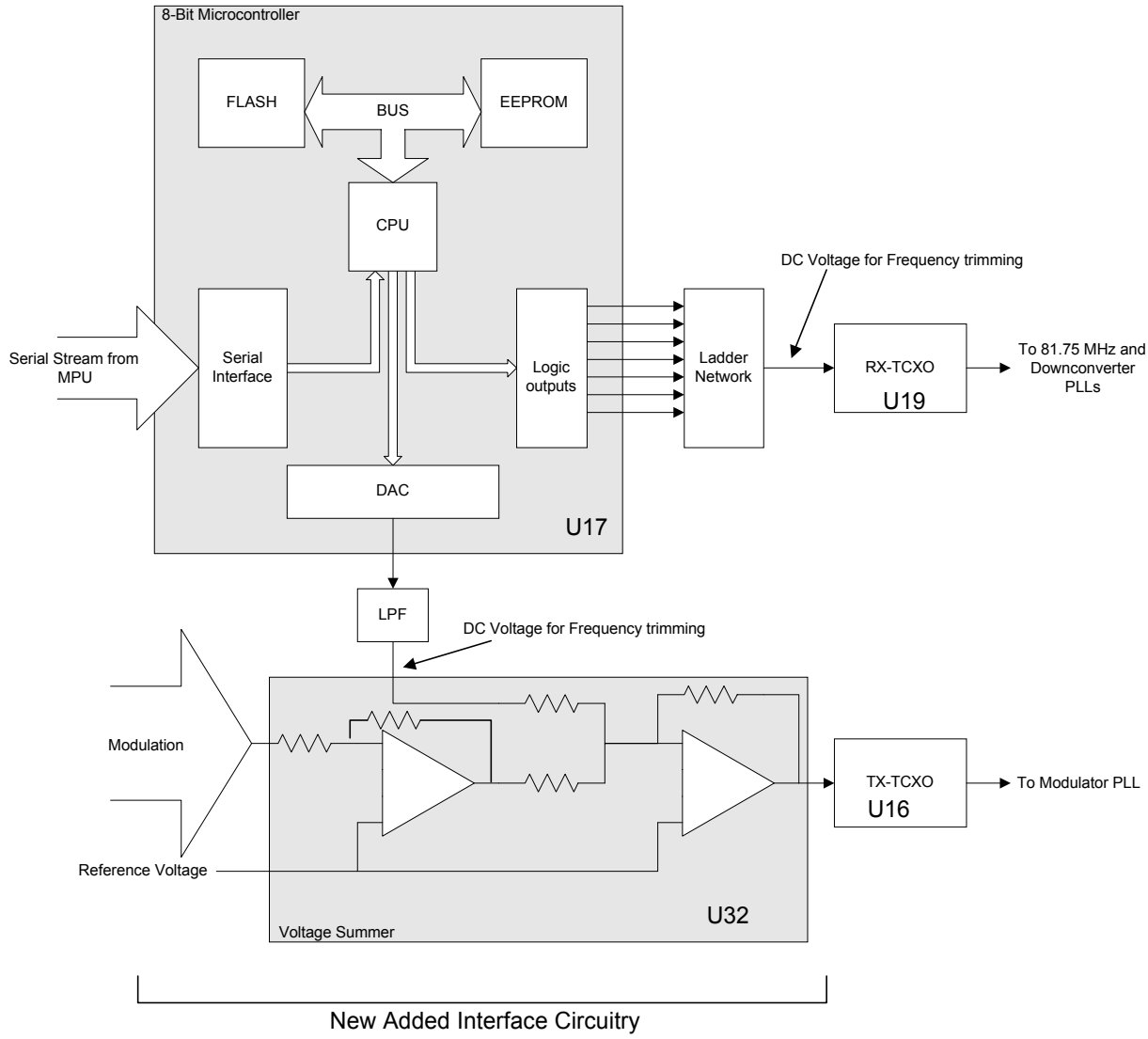

Figure 1: TCXO Interface Circuits

The RX oscillator (RX-TCXO) signal, at 14.4 MHz, is the reference of the two PLLs used to generate the first LO and second LO of the dual conversion, superheterodyne receiver. The first LO signal (F_{LO}= RF_{RX}+82.2 MHz) is only used on the receiver side whereas the second LO (81.75 MHz) signal is also used in the transmitter as its IF signal.

The TX LO oscillator is modulated using a two port approach. Basically, it is a PLL that uses classic FM modulation (baseband signal directly FM modulates the VCO) with a slight variation. Because our digital

modulation signal has significant low frequency components, the reference crystal is also FM modulated to extend modulation bandwidth to DC. High frequency components of the baseband GMSK signal are passed on to the RF by the VCO whereas the low frequency ones are tracked up by the PLL.

The obsolete crystal oscillators have integrated logic and EEPROM that support a serial link with the Main Processing Unit (MPU) of the modem, two Digital to Analog Converters (DACs) as well as a calibration look-up table. During the initial factory calibration process, the CPU sends serial streams to the RX and TX TCXOs with incrementing calibration values. When the generated RF frequency error is minimum, the MPU sends a command so the current calibration value is written onto the EEPROM. Because the replacing parts doe not integrate logic circuits, we have added an 8-Bit microcontroller. Figure 1 shows the diagram of the circuitry newly implemented. The microcontroller's main functions are to read calibration values on EEPROM, to receive and process the commands going to the serial interface, to implement a DAC, and to control logic outputs, these one being part of a ladder network DAC. The DAC and Ladder Network are two DACs that allow control of the DC voltage at the voltage control input of the two TCXOs. Since the baseband signal modulates the TX-TCXO, a summer made of operational amplifiers combines the frequency adjust DAC voltage output and the information signal.

All the circuitry presented in this sub-section is viewable on page sheet #3 of the schematic diagram (see Appendix)

Signal Path

As is explained in the previous sub-section, the modulation signal path is slightly changed. Indeed, the op-amp configuration replaces the internal circuitry that was implemented in the previous TX-TCXO (see figure 1). However, the high port path remains unchanged. Changes affect only the low frequency range (below 300Hz of the signal, which is the approximate cutoff frequency of the loop filter).

On the receiver side, the signal path is affected by the upgrade of the DSP IC (DSP1634AE, U22 on sheet #6 of Schematic in Appendix) and the obsolescence of a the voice compander IC (SA577, U29 on sheet #8 of Schematic), that was previously used for its expander capability . This feature is now integrated to the new DSP; U29 is therefore no longer populated.

Other Secondary Changes

Other minor changes include:

- Upgrade of the prescalers (U12 sheet #1 and U14 sheet #2).
- Upgrade of the DPROC (AMPS modem) IC (U27 sheet#7). 100% compatibility with the obsolete part, the UMA1000.