Range of operating power levels and a description of the means by which the RF power is varied

The Spider 4 is a Class 1 CDPD MES (Mobile End Station) as defined by the CDPD Forum (CDPD System Specification - Release 1.1)

Class 1 CDPD systems have ten defined nominal power levels. For each discrete power level there is an allowable range of power about the nominal value of +2 dB to - 4 dB. Class 1 CDPD power levels (0,1,2,3,4,5,6,7,8,9,10) correspond in order with the following powers (+6,+2,-2,-6,-10,-14,-18,-22,-22,-22,-22) dBw or expressed again as Watts (4, 1.58, 0.63, 0.25, 0.1, 0.04, 0.016, 0.0063) Watts

The modems transmit power levels are controlled directly by the AMPS base station. The base station makes a determination of the appropriate power level for modem transmission based on its RSSI (Received Signal Strength Indication). During normal modem operation there are no means provided by which the end user may modify transmit power levels. Special pass-worded software debug modes will allow the power level to be changed but these protected modes are not available to end users.

Maximum RF power rating

The maximum RF power that the Nextcell Spider 4 modem (a class 1 CDPD mobile end station) may transmit is defined by the CDPD Forum (CDPD System Specification - Release 1.1) Class 1 systems are specified to have a nominal level of 6 dBw and are restricted to a transmission power of no more than 8 dBw. Stated in Watts the maximum power allowed is 6.3 Watts. The Spider 4 is designed to transmit at a nominal level of 4 watts during "full power transmit".

By design transmit amplifier saturation will prevent transmission at any higher power. Closed loop automatic gain circuitry within the Spider 4 constantly monitors and adjusts the control voltage of the PA. The AGC circuitry will prevent will sense excessive transmit power and reduce the output power if for any reason.

The dc voltages applied to and dc currents into the elements of the final rf amp for normal operation over the specified power range or at specific power level

11.45 Vdc is applied to the final RF power Amp, the dc current range from 30 mA to 1 A over 0.0063 watts to 4 watts.

Description of all circuitry and devices provided for determining and stabilizing frequency, for suppression of spurious radiation, for limiting modulation, and for limiting power.

The Frequency determination and Spurious Radiation suppression are performed by the Spider Modem as describe below and please refer to Answer 8 for limiting power.

Frequency determination.
All local oscillators, clocks and timing signals are derived from one crystal source. This source is a 15.36 MHz temperature compensated crystal oscillator which is designed for cellular applications and purchased to a specification indicating compliance to frequency tolerance requirements for this class of equipment. There are no other free running oscillators, clock sources, or timing generating devices in the modem. This one reference is used for all frequency generating circuits.

The final transmitted signal is generated from the mixing of a transmit LO and the main LO. The transmit LO is a 180 MHz VCO phase locked to the 15.36 MHz reference oscillator with a reference frequency of 60 KHz when in CDPD mode. The main LO is also phase locked to the

reference oscillator with a 30 KHz phase reference clock. It will be tuned from 914.01 MHz to 938.57 MHz with a step size of 30 KHz. The receiver uses the main LO and a receive LO. The receive LO is at 90 MHz and is also locked to the reference oscillator and uses a 24 KHz phase reference clock. All three phase lock loop circuits have lock indicator signals that verifies proper operation of the circuitry. This signal is provided to the modem processor and is monitored during normal operation. The transmitter will not be enabled unless all phase lock loops are indicating that they all properly locked to their assigned frequency.

The frequency stability of the reference oscillator is specified to a temperature of -30 to + 70 degrees C. The modem is specified with an operational temperature range of 0 to +45 degrees C. An internal temperature sensor is included in the modem to detect temperature conditions outside 0 to + 70 degrees C. When detecting a temperature range outside this range the modem processor will not allow transmissions to occur.

Spurious Radiation suppression.
A metal shield is required around the entire modem to suppress spurious emissions. The modem housing provides this function. In order to ensure the top and bottom cover are connected electrically, the grounding tabs on the 15-pin connector must be bent at roughly 45 degree angles at the time of assembly. All test data was taken with the grounding tabs utilized.

Description of the digital modulation technique, a detailed description of the modulation system to be used, including the response characteristics (frequency, phase, and amplitude) of any filters to be used

The transmitter covers the band of 824.010 MHz to 848.970 MHz and is tuned in 30 KHz steps. In CDPD mode, the modulation type is a Gaussian Minimum Shift Keying (GMSK) with BT= .5. The data rate is fixed at 19.2 Kbps. Modulation of a carrier is done at the Transmit LO (180 MHz) with an I and Q modulator in CDPD mode. The baseband I and Q waveforms, with all of the filter characteristics required to meet the emissions mask, have been described digitally and stored permanently in non-volatile memory. A microcontroller is used to translate the data stream to be transmitted into the appropriate baseband signals. The digital signals are generated at 16 times over sampling, and the analog signals are recreated with an 8-bit digital-to-analog conversion process. This modulation technique requires no tuning or adjustments to meet the emissions mask. Also, because the data is encoded with a pseudo random sequence, the modulation mask is constant and independent of the data being sent. The output spectrum is constant and independent of user controls except for on/off commands.