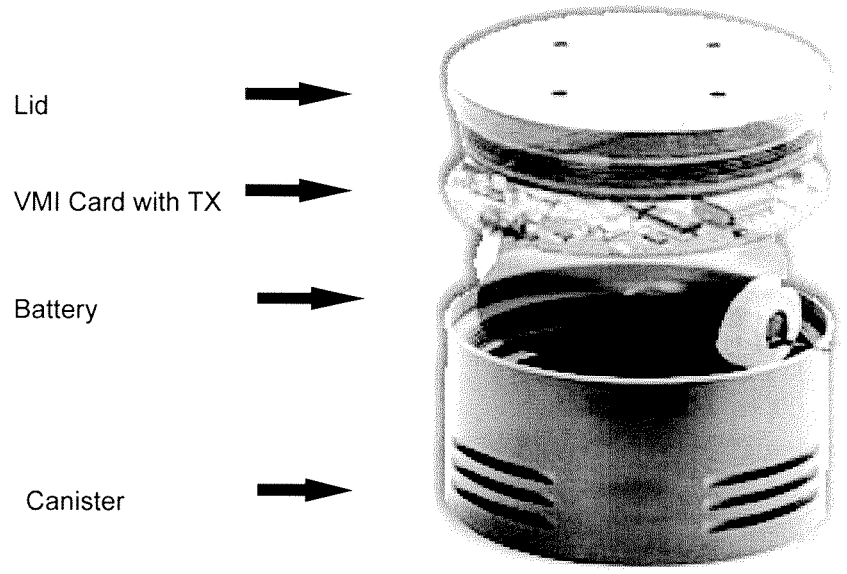
Operational description:

The G4 Groundhog® consists of several main components. These are the thermoplastic canister with lid, lithium battery power source, main VMI (vehicle magnetic imaging) processor card and the wireless transmitter.



Canister and Lid: Molybdenum disulfide filled nylon thermoplastic material machined with wall thickness of 0.6 in, overall diameter is 6 in. Lid is threaded and uses two silicon o-rings to build a water tight seal.

VMI Card with TX: The main PCB controls the VMI sensors, power management, short term storage of collected data and control of the RF transmitter.

Battery: Lithium Thionyl Chloride battery pack , 4 D cell shrink pak, capacity is 72 Ah. 3.6 VDC nominal

Active electrical components:

Main PCB (VMI Card)

Analog Section– Channel A		
S1	GMR Sensor 1	
U9	MAX417CSA	Low power analog amplifier
U11	LT1017CS8	Low power analog comparator
U6-A	M74HC132D	NAND Gate
Analog Section– Channel B		
S2	GMR Sensor 2	
U12	MAX417CSA	Low power analog amplifier
U11	LT1017CS8	Low power analog comparator
U6-B	MC74HC132D	NAND Gate
Digital Section		
U1-A	MC68HC711E9CFN2	Microprocessor with 8MHz crystal based clock
U6-C	MC74HC132D	NAND Gate
U4 A-D	CD4066BM	Bilateral Switch
U5 A-D	CD4066BM	Bilateral Switch
U8-A	DS1305EN	Real Time Clock Chip with 32.768 KHz crystal

Active components continued Main PCB

RF Section:

U2-A	RFCEDW	Intellon Spread Spectrum Chip
Y2	Crystal	25.175 MHz crystal
U3	MC74HC04D	Digital inverter
MOD1-A	RF Module	915 MHz TX RF module

MOD1-A RF Module active components

U3	SAW Resonator	915 MHz SAW signal source
Q1	BFS17CT	RF transistor
U1	UPC2757T	RF signal mixer
U2	UPC2709CT	Microwave RF amp
Q2	NE68530	RF Amplifier transistor
Q3	NE68530	RF Amplifier transistor
U4	UPG152TA	RF Switch

RF Module Operational explanation.

General:

The design of the MOD1-A section was based on the need for a 915 MHz centered carrier with two opposing sidebands for frequency diversity in addition to the advantages of the spread spectrum baseband data. RF power is limited via a fixed resistor network on the output section as well as a limited helical antenna application to focus RF emissions primarily above the unit for roadbed applications.

Other requirements included zero power usage during off periods, fast carrier attack time <10 msec, and limited harmonic and spurious outputs to allow low power intentional transmission for domestic use in the USA and Canada.

Circuit operation:

Saw generator and carrier generating circuitry:

Saw resonator U3 is the primary frequency controlling component and forms the core oscillating circuit in conjunction with Q1 and associated components. L3, L1 are used to sustain oscillations and maintain build an RF envelope for insertion to U1.

Active mixer and bandpass filter:

U1 a UPC2757T active mixer is used to combine the 915 MHz RF input and the 5 MHz baseband data from the input data conditioning circuit. The resultant mixing provides a sum, difference, and the two original signals. A simple bandpass circuit made up of L4, L5, C13, C5, C10 and C6 assists in proper amplitude control and harmonic rejection prior to signal presentation to the first RF Pre-Amp.

Pre-amp and first helical filter:

U2 a UPC2709CT microwave amplifier is used to gain the already mixed signal to approximately 3-5 dBM. This signal is then presented to a precision tuned helical resonator type filter that provides extremely narrow bandwidth control within the 902-928 MHz band. The resultant output is at approximately 0 dBm and is presented to the Output amp and filter circuit.