DynamicVOICE FreedomMic
Theory of Operation

The FreedomMic is a wireless personal dictation device. The hand-held FreedomMic operates in conjunction with the CSL9000 base unit (FCC ID JVN-CSL9000B) in a semi-duplex mode of operation. Upon power up, the FreedomMic will scan a pre-configured list of base station frequencies stored in its memory. The FreedomMic will not attempt to connect to a base station if the base station frequency is in use. When connecting to a base station the FreedomMic sends a proprietary coded 20-byte connecting message to the base station. The base station must echo this message as a reply and the FreedomMic must receive and verify it for communication to begin. This elaborate protocol is necessary to insure only one FreedomMic may be connected with any one base unit at any time. The operation of the FreedomMic is very similar to the DynamicVOICE LLC VoiceCRUISER product (FCC ID JVNVCP1000H), with the exception that the FreedomMic is not capable of full duplex operation. The CSL9000B base station is typically connected to a dictation storage device by telephone line, or to a computer network which stores dictation in "WAVE" files.

Microprocessor Control

All functions of the FreedomMic are controlled by a 68HC705 (U13) series microcontroller. The microcontroller SPI (Serial Peripheral Interface) bus is used to read system data from the non-volatile EEPROM IC (U15) and load channel information into the PLL IC (U8). The microcontroller SCI (Serial Communications Interface) is used to create a full duplex serial port RS232 interface via connector J1. This interface is used to program channel information and user keyboard options via a personal computer. The microcontroller also controls whether the unit is in transmit or receive mode via RCVR on/off transistor (Q16). Other functions serviced by the microcontroller include receiver audio level and muting, reading the keypad, the low battery indication, and AFSK (Audio frequency shift keying) modem control. The 300-baud AFSK modem data, transferred over the RF link, provides for control of the communications channel between the FreedomMic and base station through keyboard keystrokes.

Power Supply

A single Lithium Ion 3.4 volt AA rechargeable battery provides power for the FreedomMic. The battery voltage is raised to 5 volts by a switching boost regulator (U12). The receiver and transmitter circuitry has been designed for very low power consumption in order to extend battery life. The battery can be recharged from a 5 volt commercially available (3.5mm plug TIP +) regulated power supply plugged into J1.

Frequency Synthesizer

The FreedomMic uses a single multifunction synthesizer IC (U8), 2nd order low pass filter (R57-C71, and R49-C66), VCO transistor (Q9), and varicap diode (CR2) which combine to provide the circuitry to make a PLL frequency synthesizer. The TCXO (U4) frequency of 12.8 MHz is divided down by U8 to provide the PLL reference frequency of 25kHz. The reference frequency determines the smallest channel step available (25kHz). The frequency range for the FreedomMic transmitter is 922 – 927.9 MHz (corresponding to the CSL9000B receiver range). The frequency range for the receiver is 905 – 911 MHz which when utilized with a 21.4 MHz IF frequency results in a high side local oscillator frequency of 926.4 – 932.3 MHz. These frequency ranges are divided into 112 possible channel pairs that have been selected to minimize interference when multiple units are operated close together. The synthesizer programs the transmitter frequency when the DICATE button is pressed and the unit goes into transmit mode. The transmit mode is also enabled when keypad keys are pressed enabling the sending of AFSK data commands to the base station, otherwise the unit is in receive mode and the receive frequency is programmed.

Transmitter

The single transistor amplifier (Q8) is preceded by two buffer amplifiers to provide VCO isolation and is followed by a Pi-T low pass filter insuring that harmonic frequencies are not radiated. The switching path between receive and transmit is provided by T/R switch (Q5 & CR1). The transmit output power is designed to be 600 to 700 uW. The transmitter output/receiver input is connected to a ¼ Wave antenna located on the keypad board. The FreedomMic uses narrow band frequency modulation in order to provide for multiple users in a small local area. Frequency deviation is limited to +/- 5 kHz.

Receiver

The FreedomMic receiver is a dual conversion super heterodyne type design. The receiver signal passes through two dielectric filters (FL1 & FL2) and preamplifiers (Q3 & Q4). The high side, low injection power mixer receives the 926.4 – 932.3 MHz local oscillator signal from VCO buffer amplifier Q6. The buffer amplifier utilizes a band pass filter design in the collector circuit, to insure low radiated harmonics of the LO signal. The first IF frequency is 21.4 MHz and is filtered by XF1 & XF2. All IF filter bandwidths are optimized for FM +/- 5 kHz frequency deviation signals. The second mixer function, 455 kHz IF amplification plus filtering (CF1), and quadrature audio detection (Y2) is provided by integrated circuit U3. The second local oscillator frequency of 20.945 MHz is generated utilizing a colpitts oscillator inside U3. Volume control function is provided by an EEPOT (U5) that is controlled by U13. The EEPOT output is connected to Audio amplifier U1 which provides audio amplification to the speaker.

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Test Department alignment procedure

1. Open the "FreedomMic Test" program on the computer.

2. Attach the serial adapter cable from the computer serial port to the FreedomMic.

3. Press the 1 keypad button and then the PWR button on the FreedomMic for program mode.

4. From the Test program select "Application Utilities", click on "Upload Default Application Settings"

5. Click on "Close", now select "Audio Test" and click on "Enable Tx on Channel". Place channel bar on Channel 1 (922.000 MHz) and click "ok".

6. Attach special RF adapter cable between the modulation analyzer and the FreedomMic. Select the frequency counter function.

7. Using a DC voltmeter monitor the TV (VCO tuning voltage) test point. Adjust the trimmer capacitor C65 for a voltmeter reading of 2.4 Volts +/- 0.1Volt.

8. Adjust the TCXO (U4) trimmer capacitor for a frequency reading of 922.0000 MHz +/- 100 Hz.

9. Using the special audio cable, connect an audio generator set to a frequency of 1 kHz and an output level of 0.1 volt RMS to TP11 of the FreedomMic. Change the modulation analyzer to read Deviation. Set Deviation adjust potentiometer R29 for a deviation reading of +/- 5 kHz.

10. This concludes the alignment part of the FreedomMic test procedure. Proceed to Final Specification Check procedure.