AVL-10000T – AUDIO VIDEO LINK TRANSMITTER

TECHNICAL MANUAL

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This module contains protection circuitry to guard against damage due to high voltage, bad VSWR or over temperature. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this module. For proper operation, input and output voltages should be constrained to the ranges indicated in the Recommended Operating Conditions.

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1. GENERAL DESCRIPTION

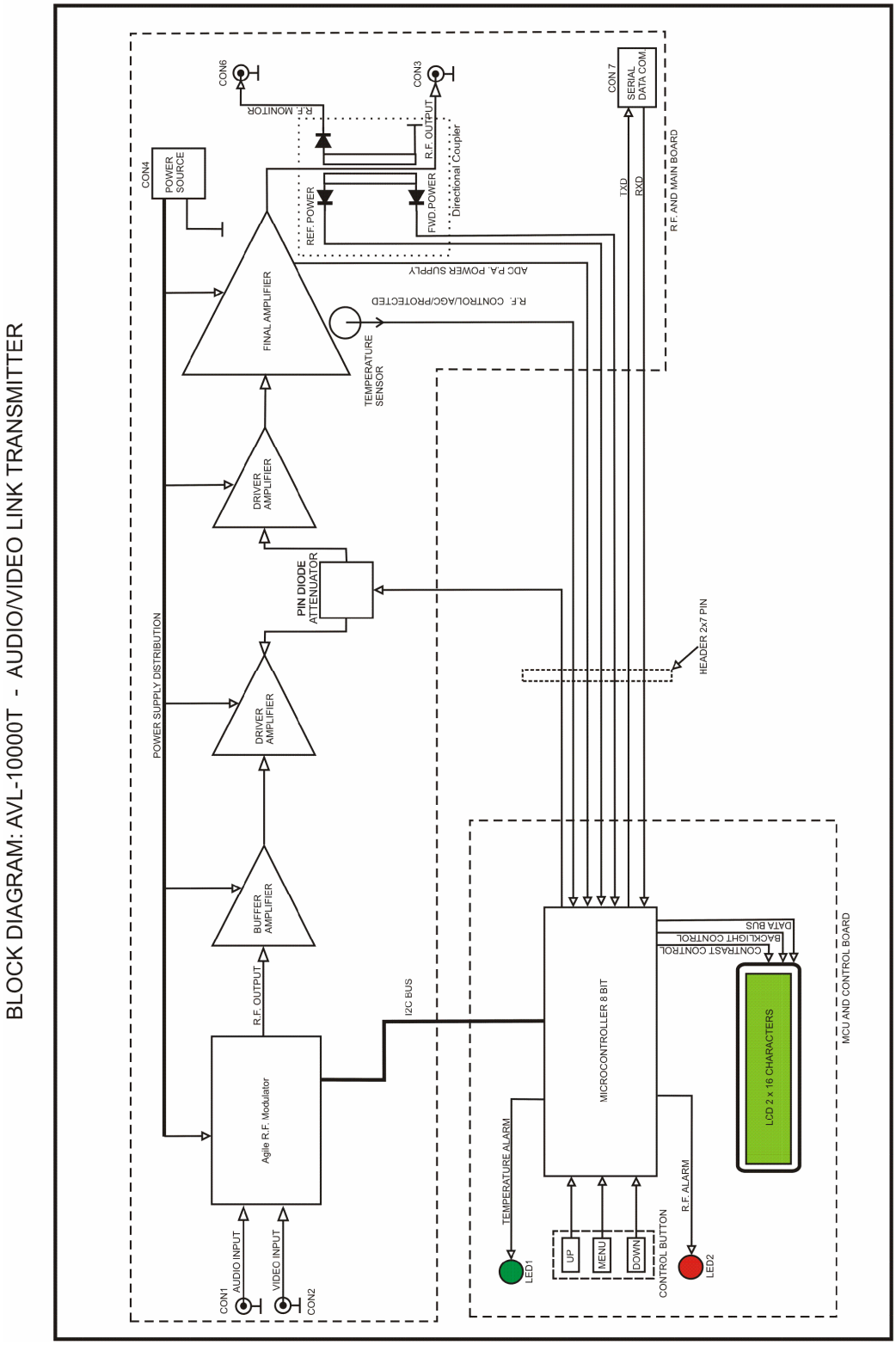
AVL-10000T is audio/video link module transmitter based Agile R.F. Modulator are for use in sending high quality and long range audio/video. It can be use as TV Broadcast for commercial band (VHF and UHF).

1.1. Features

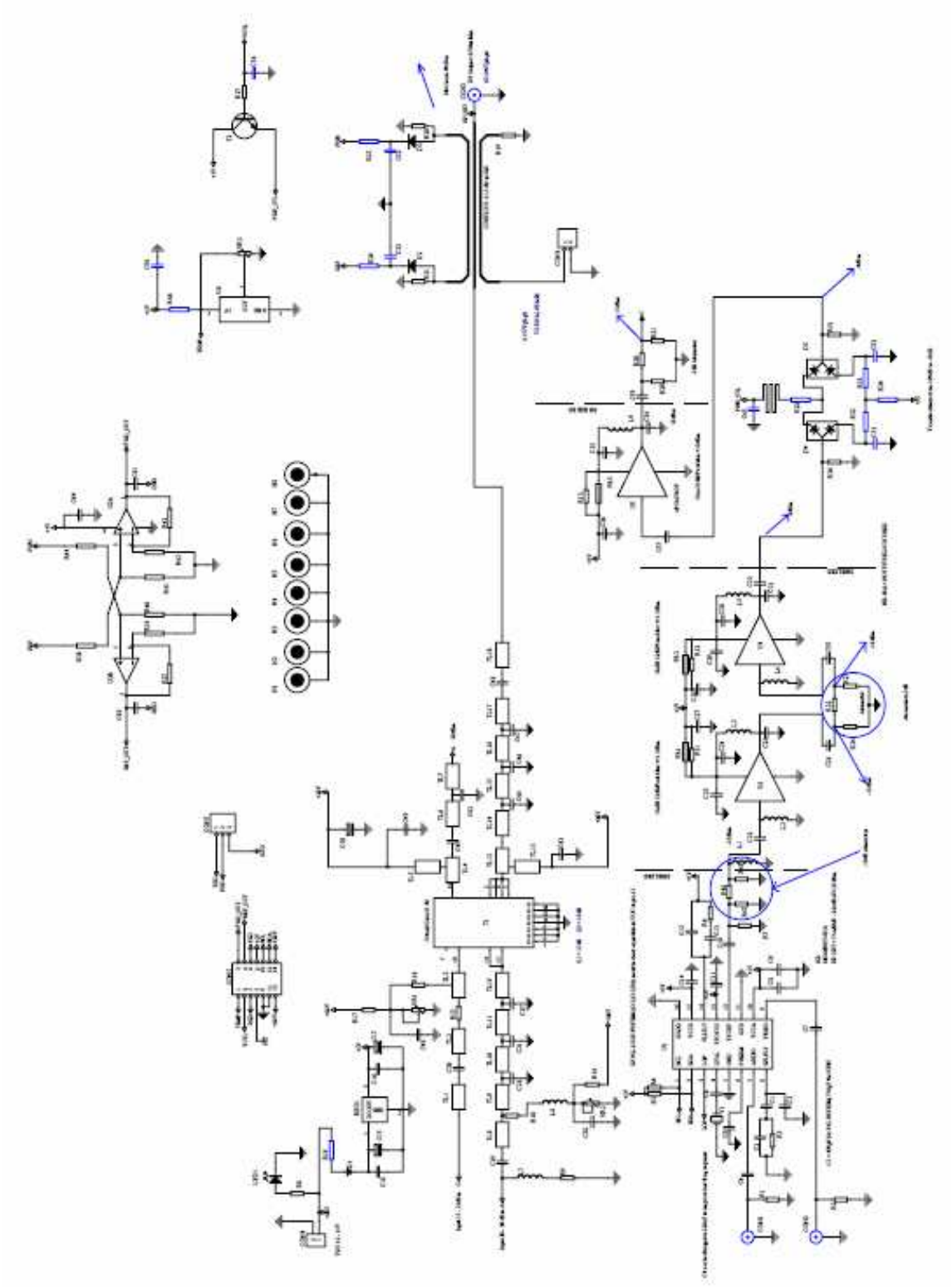
AVL-10000T have the following features:

- UHF frequency range: 460 MHz – 860 MHz
- VHF frequency range: 100 MHz – 460 MHz
- Multi system, Support PAL/NTSC
- Multi standard modulator can handle the following system: B/G,I,D/K,M/N
- Fixed video modulation depth (82% typical)
- Peak white clip disabled by LCD control panel
- Programmable picture/sound carrier ratio (12dB and 16dB)
- Programmable sound sub carrier oscillator (4.5,5.5,6.0 and 6.5 MHz)
- On board Test pattern and audio signal
- High R.F. output, Max. 40dBm/10 Watts
- Adjustable R.F. power through LCD control panel
- Temperature sensor monitor through LCD
- Voltage final amplifier monitor through LCD
- Forward and reflector power meter monitor through LCD
- Over temperature protector
- Wideband operation

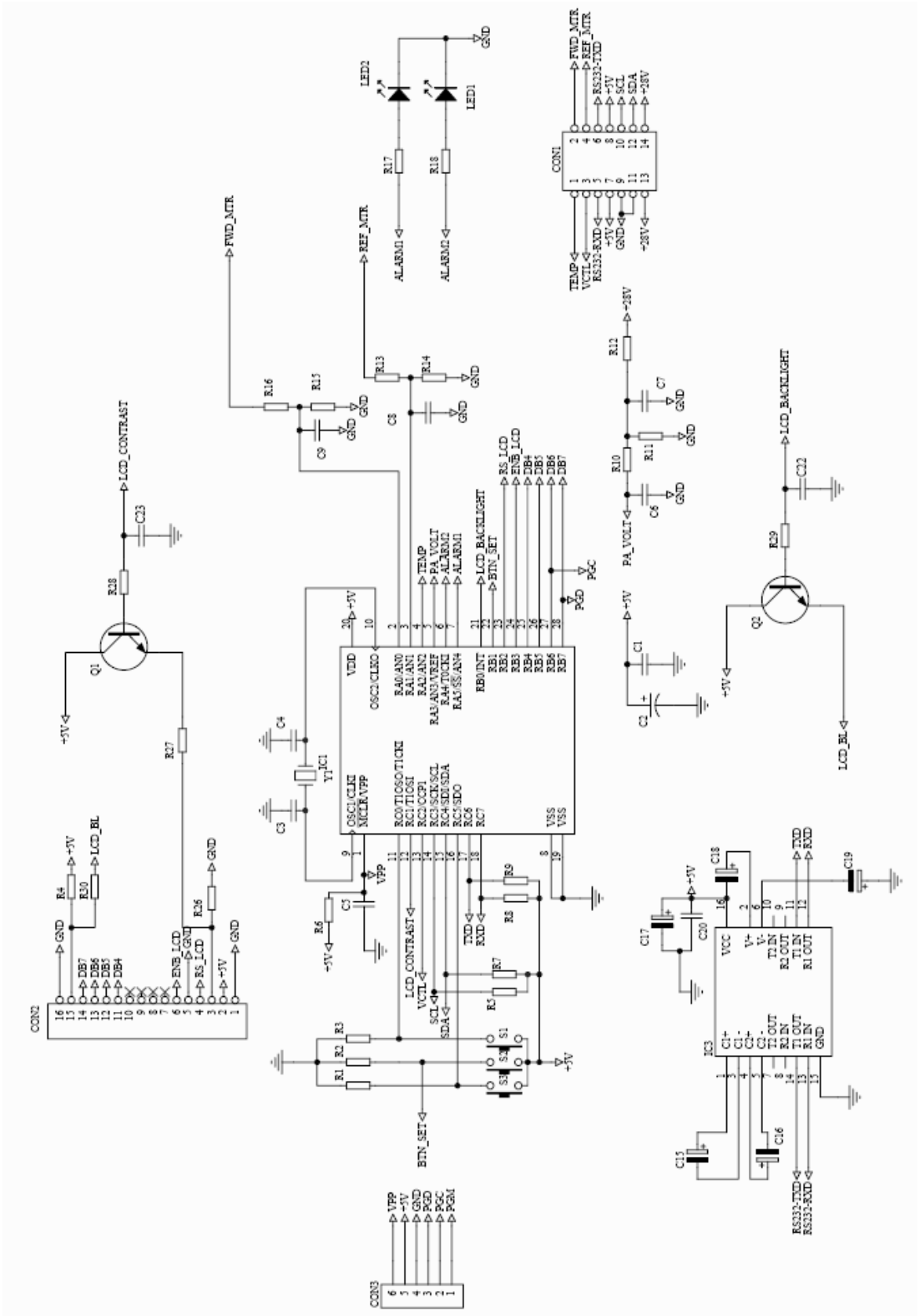
1.2. Block Diagram



1.3. Circuit Diagram



Circuit Diagram R.F. section



Circuit Diagram MCU. section

2. FUNCTIONAL AND CIRCUIT DESCRIPTION

2.1. Agile R.F. Modulator

Agile R.F. Modulator is used to provide the R.F. output. The modulator is controlled via the microcontroller I2C interface and can tune the R.F. Output to broadcast at frequency for commercial band.
The modulator has two input. One called audio input for the base band encoded audio, and one called video input for the video.

Audio Input from CON1 (RCA type) entering pin 7 of IC1 through capacitor C4, to improve low frequency response, C4 can be change to 220nF (default is 100nF). Video input from CON2 (RCA type) entering pin 9 of IC1 through capacitor C7. R1 and R2 is limiting impedance input for audio and video. IC1 will process the audio and video signal for modulation and mixing with R.F. Signal. Finally the signal was process will output at pin 12 of IC1. We will discuss this output later. C5 is pre-emphasis capacitor for IC1, the value is 470pF for PAL System or 750pF for NTSC. C1,C2,C3 and R3 is sound PLL loop filter for modulator. C12,C13 with R6 is circuit for R.F. PLL loop filter. Crystal Y1 is used for frequency reference for PLL and C6 is load capacitance for Y1, the value C6 is depend of crystal characteristic, but 27pF will be ok. C8,C9,C11 and C14 is used for DC coupling when entering IC1, It's important to make this DC smooth to prevent any noise on modulator. Pin 1 and 2 of IC1 is I2C bus will be used to control almost parameter on this modulator, we will discuss this later. R4 and R5 is pull-up resistor for I2C bus.

2.2. Buffer Amplifier

The R.F. output from modulator (pin 12/IC1) have power about 82dBuV or -25dBm. This signal will amplified by U3 through coupling capacitor C10 and C22 for amplified. R47,R48,R49 is -10dB ∏ Attenuator, it used to suppress load variation and to suppress gain as preventing oscillation. The use of resistor is an effective design method for suppressing load variation caused by the IC's on/off switching and gain variation that tends to occur in multi-stage connections. Finally the R.F. output will increase (-/+ -16dBm) after attenuation. U3 is silicon MMIC that have high gain (23db typ), low noise and was design for wideband operation.

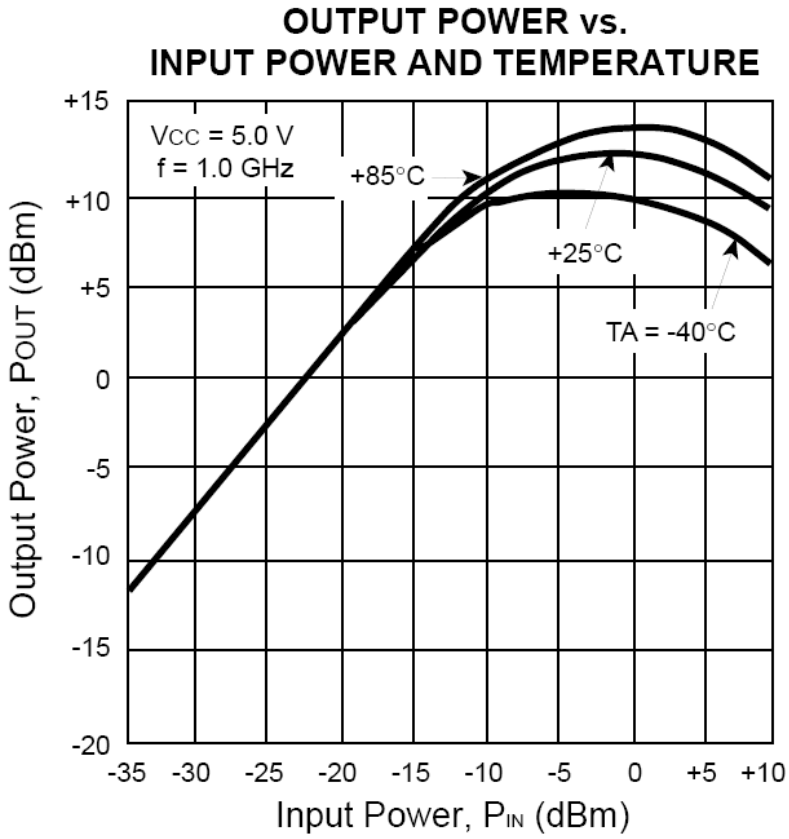


Figure 1. Input Power vs Output Power for U3

2.3. Driver Amplifier

This circuit is two stages wideband amplifier for amplified the R.F. output from buffer amplifier up to 15dBm (after attenuation). For this purpose, we still trust to MMIC R.F. Amp device. To make sure stable for all band, we insert a pi-type 3-dB pad to each stages for suppress load variation and to suppress gain as preventing oscillation. After being amplified by U3 and U4, the signal enters in the PIN diode attenuator, then is amplified again by U5. The PIN diode attenuator is controlled, through R28 resistor , by the APC circuit of the MCU board. When the transmitter is turned on "RF OFF" position, the functioning of the amplifier is inhibited by the attenuation of PIN diode block is lead to the maximum.

2.4. Final Amplifier

This circuit will amplified R.F. output from Driver amplifier up to 40dBm / 10 Watts. The main device is LDMOS transistor designed for analog/digital TV-Transmitters and have overall gain 25dB. VR1, VR2, R16,R10,R14,R17 is voltage divider and current control for bias the final transistor. This bias control is use to set the gain of amplifier so it can set the output R.F. power.

2.5. Four Diode ∏ Attenuator

These circuits are used to set the power level of an RF signal from a voltage control. The microcontroller (IC1) was place on MCU CONTROL BOARD (see block diagram) have PWM (pulse with modulation) port that can be used to generate analog output (0-5 volts). PWM output from microcontroller entering T2 through resistor R27 is APC

circuit that will control voltage of PIN diode attenuator. So, we can easy to set the PWM output digitally and finally will get full control R.F. Power of final amplifier.

2.6. Temperature Sensor

These circuits are used to monitor the temperature of main transistor of final amplifier through microcontroller. Microcontroller will monitor the temperature every 10 seconds, when the temperature have threshold limit, microcontroller will decrease the voltage to APC circuit that will decrease R.F. output.

Temperature sensor circuit is based LM135 (U6). LM135 is precision temperature sensors which can be easily calibrated. R46 is limiter current for U6, VR1 is calibrated adjustment for sensor. To calibrated the sensor is easy, set the VR1 until you get 2.98 volts at pin V+ of LM135 at 25 oC. The sensor output will go to microcontroller (IC1 on MCU and CONTROL BOARD) at pin 4. This pin is analog to digital converter with resolution 10 bit(0-1023) for 0 to 5 volts. The software routine on microcontroller will convert the analog to digital and display the value (in Celsius) on LCD.

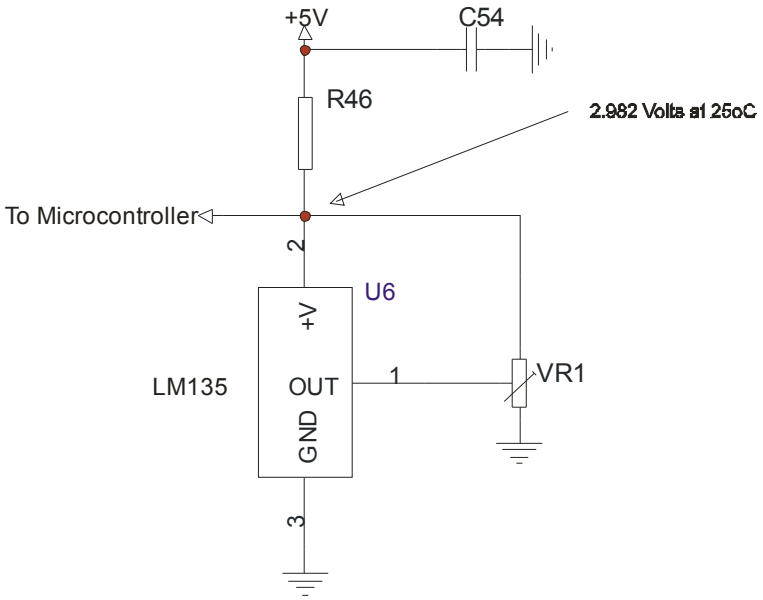


Figure 2. Temperature Sensor Circuit

2.7. Directional Coupler

The directional coupler realized in Microstrip technology. the output of the directional coupler connected to CON6 connector to monitor the RF output.
On the other two outputs of the coupler, are the signal proportional to the direct power delivered by the transmitter and to the reflected power by the dummy load. These signals are measured by the diodes D2 and D3, amplified by U2, filtered and then sent to MCU board.

3. Board Layout

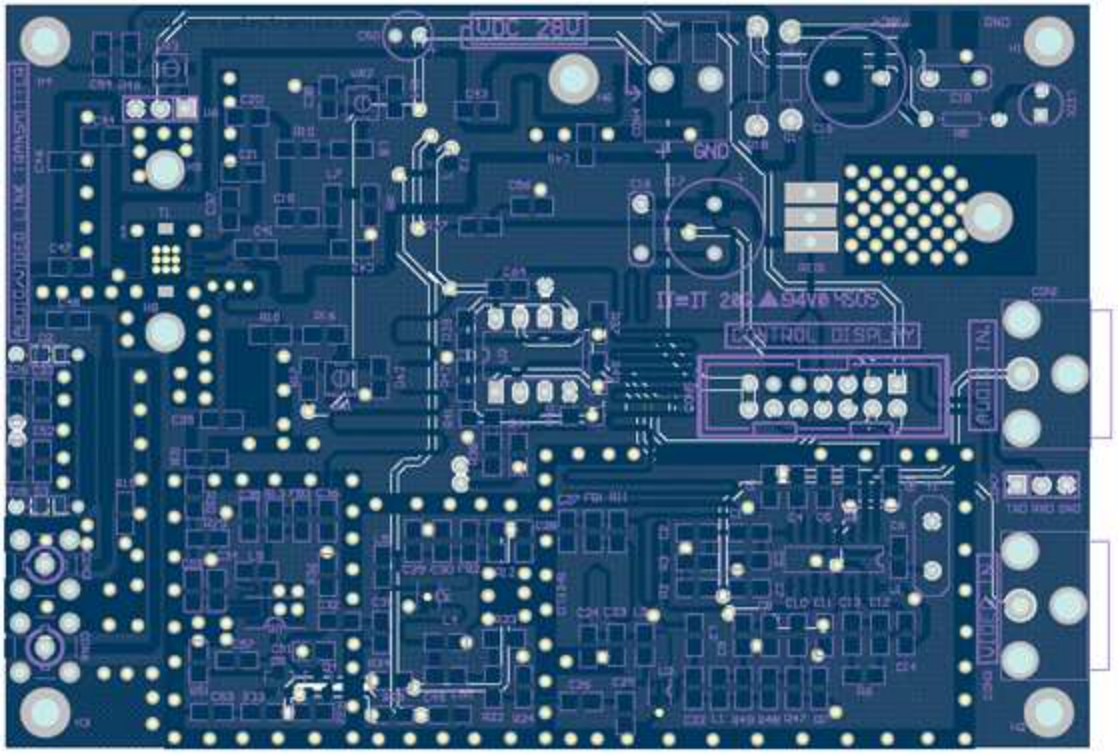


Figure 3. R.F. Main Board

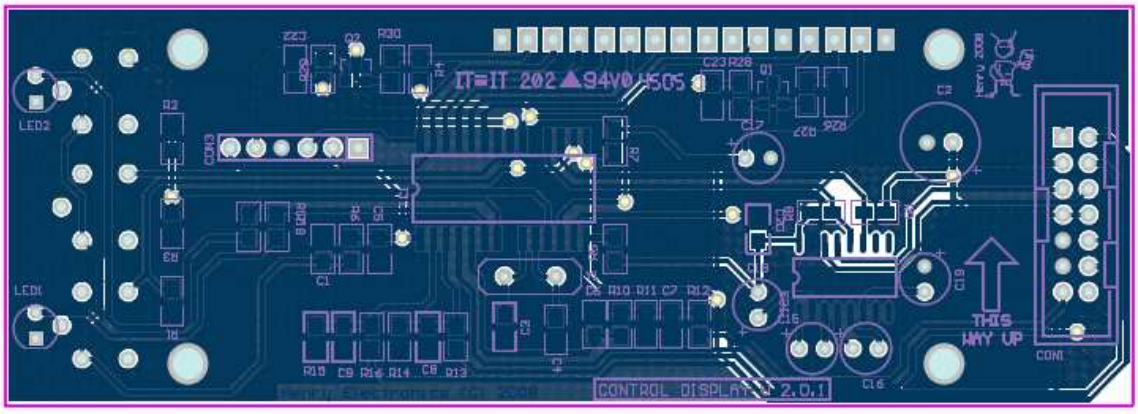


Figure 4. MCU and Control Board

4. LCD and Control setup

After power up, the transmitter will show the text of model the transmitter. Press "Down Key" if you want to see software version and press "UP Key" to reset configurations. This action will be deleted your configuration and back to default value. This menu only available for 30 second after transmitter power up.

After few second the transmitter will go to main display. On this mode transmitter will show the channel number, band and locked condition. After few second lcd will show the visions frequency following to show sound frequency and back to make animation. On the background, microcontroller will check the temperature, swr, and voltage every 10 second and trigger the alarm if there's problem with the transmitter like over temperature, over voltage and bad swr.

All configuration on the transmitter can change easily with three buttons. Press "Menu Key", when you reach the config that you want change, press "UP Key" or "Down Key" to change it and press "Menu Key" when finished, it will bring you to main display. For more details, see Menu Explorer on the next page.

5. Menu Explorer