DM6000-2 DM6100-2 Circuit Description

1 Frequency configuration

The reference frequency of frequency synthesizer is provided by 16.8MHz crystal oscillator X3 TCXO. The receiver adopts quadric mixing mode. The first IF is 49.95MHz, and the second IF is 450kHz. The first local oscillation signal of the receiver is produced by frequency synthesizer and the second local oscillation signal selects the 3rd harmonics of 16.8MHz of crystal oscillator X3 TCXO. The signal of transmitter is produced by frequency synthesizer directly.
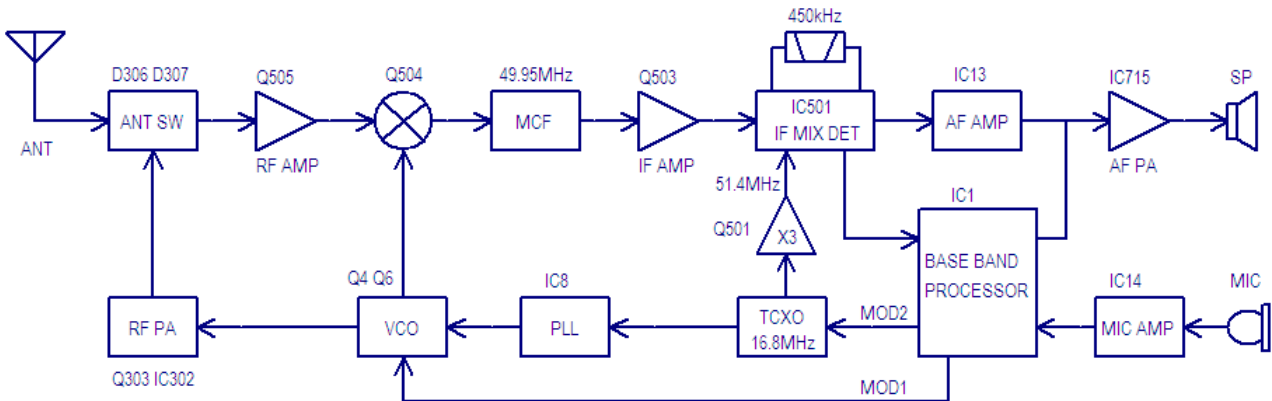
Figure 1 Frequency configuration

2 Receiver（Rx）

The receiver is double conversion superheterodyne,designed to operate in the frequency range of 400 to 470MHz,The frequency configuration in Fig 2
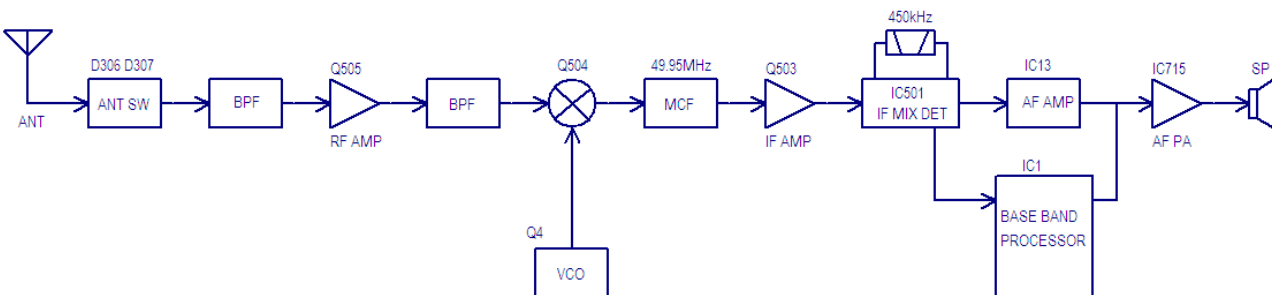
Figure 2 Receiver section configuration

Front End of Receiver

Signals from the antenna are filtered by BPF which consists of C570 C571 C573 C576 C574 L514 L515 D508 and D509 via RX/TX switch (D306 D307 and D309 D311). After being filtered out the useless out-of-band signals, the signals are amplified by LNA consisting of Q505 and external components. Signals from LNA are filtered again by BPF which consists of C557 C553 L510 L511 D505 D506 and

D906 before entering the 1st mixer (Q504).

The PWM wave is output by MCU composed of 29 foot and then commutated to adjustable voltage after filtering to change the capacity of varactor diode D505 D506 D508 D509 and D906 to control the center frequency of BPF.

1st mixer

The first IF (49.95MHz) signal is produced after mixing of the receiving signal from LNA and the 1st local oscillation signal from frequency synthesizer. The first IF signal is filtered out adjacent channel and other useless signals by crystal filter (XF501).

IF Circuit

The 1st IF signal from crystal filter is amplified by the first IF amplifier (Q503) before processing of IC in IF(IC501，GT3136).

IF IC consists of the 2nd mixer, 2nd local oscillation, IF amplifier, limiter, frequency discriminator and noise amplifier.

Frequency (16.8MHz) produced by TCXO(X3) is amplified and then selects 3rd harmonics (51.4MHZ) as the second local oscillator signal source. The second IF signals (450kHz) are generated after signals mixing of the second local oscillation (51.4MHz) and the first IF (49.95MHz) in IC501. Audio signals are demodulated and outputted by IC501 after the second IF signals are amplified and limited in IC501 and then filtered by ceramic filter(450kHz).
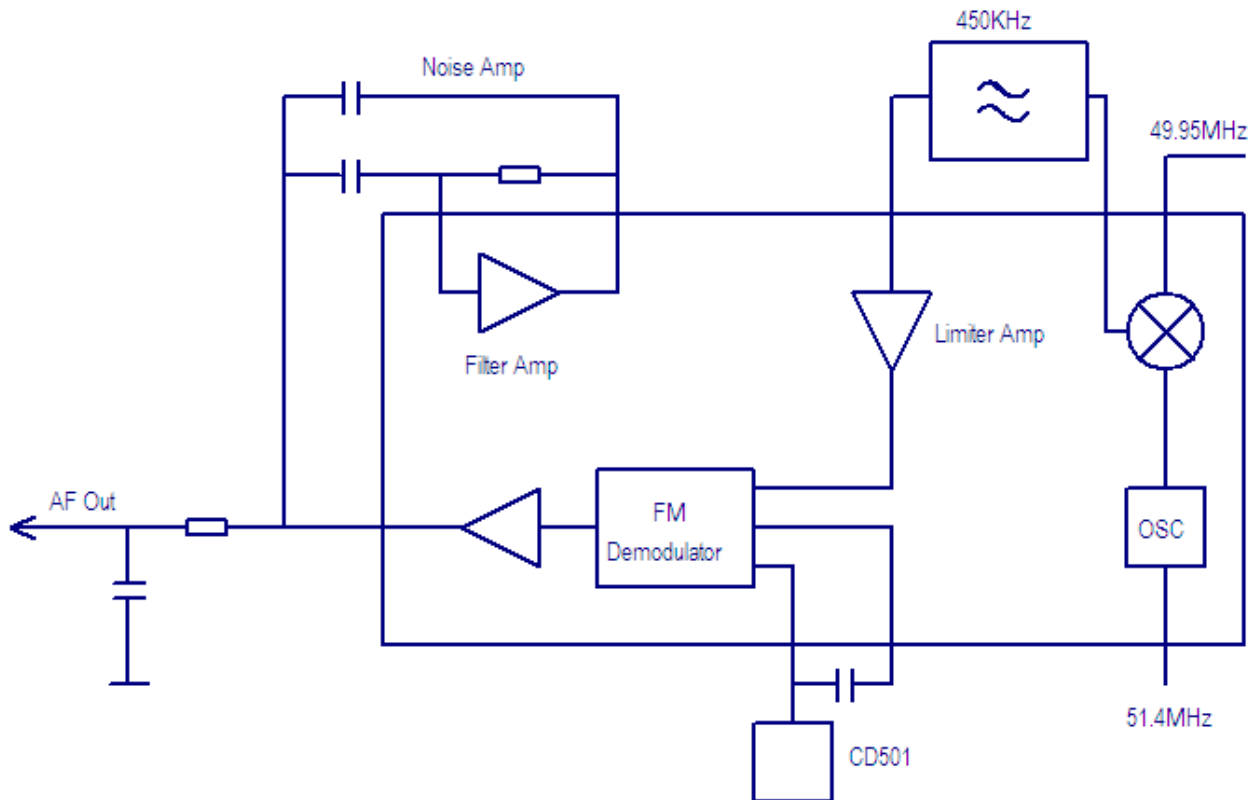

Figure 3 Schematic Diagram for IF System

Receiving Audio Signal Processing:

The audio processing circuit of receiver consists of IC300. Voice signals from IC300 are sent to IC301（CTCSS signaling filter circuit.

Squelch Circuit

Part of the AF signal from the IC501 enters the FM IC again,and the noise component is amplified and rectified by a filter and an amplifier to produce a DC voltage corresponding to the noise level.

The DC signal from the FM IC goes to the analog port of the microprocessor(IC3).IC3 determines whether to output sounds from the speaker by checking whether the input voltage is higher or lower than the preset value.

To output sounds from the speaker,IC3 sends a high signal to the FM_MUTE and SPKSW lines and turns IC715 on through Q704 Q705and Q716.

Audio Power Amplification

The audio power amplifying circuit consists of IC715 and the peripheral components.
The signals are amplified by audio power amplifier to drive the speaker after collecting the receiving audio signals, voice signals and warning tone signals. The warning tone has no volume limitation.

When SPKSW is high level, Q716 is on, IC715 begins to work and the speaker sounds. Speaker Impedance: 8ohm

CTCSS Signal filtering

The audio signals after demodulation in IC13 may contain CTCSS (continuous tone control squelch system) or DCS（digital squelch）signals. The spectrum component of CTCSS/DCS is 67 to 250Hz. The filtering circuit composed of IC10 can filter out signals except CTCSS/DCS spectrum, which makes MCU decode the CTCSS/DCS more accurately.

3 Transmitter (Tx)
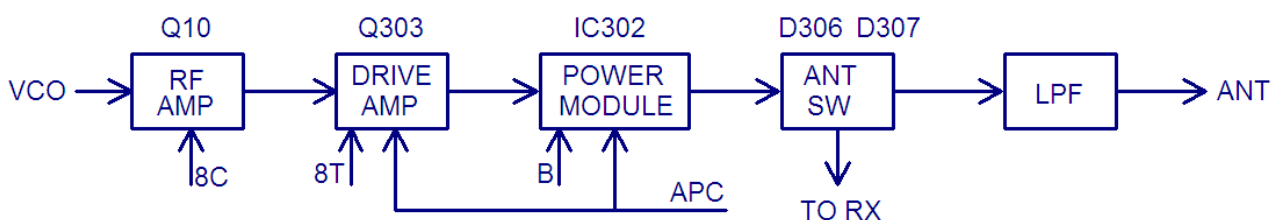
Transmitter Power Amplifier

Figure 4 Schematic Diagram for Power Amplifier and Antenna Switch

The modulated RF signals from VCO are amplified by Q10, Q303 before the power amplification in IC302.

Gate bias of Q303 and IC302 is controlled by APC circuit, so the output power of transmitter can be

controlled conveniently by changing the gate bias voltage.

APC（Automatic Power Control）

D313 and D314 are power amplification current detector, IC303 is power amplification current sampling amplifier and power comparison amplifier.

The power amplification current and IC303A output will increase with oversized output power of transmitter. When the output voltage of IC303B decreases, the bias voltage of Q303 and IC302 will decrease, finally the output power of transmitter will decrease or vice versa. Thus, the output power of transmitter will keep stable under any different working condition.

MCU can set the power by changing the voltage input to IC303B.

Audio Signal Processing of Transmitter
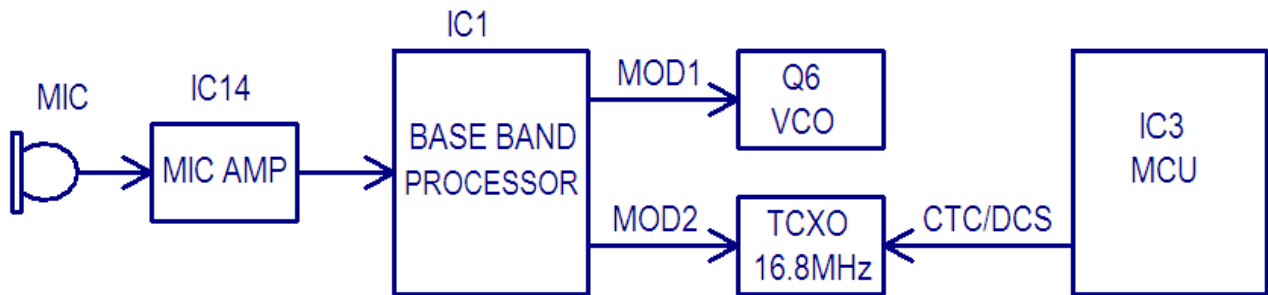
Figure 6 Schematic Diagram for Audit Circuit of Receiver

The audio signal processing circuit of Transmitter consists of IC14 and IC1. Voice signals from MIC are sent to VCO for modulation together with CTCSS/DCS after amplification, limitation and filtering.

IC1 is a bais band processor.

AGC circuit consists of D12, D13 and Q20,Q21. The signal amplitude is reduced to ensure no distortion in case of oversized MIC signal.

Q12, the power switch of voice processing circuit, controlled by MCU, will give power supply to IC14 only during transmission.

4 PLL Frequency Synthesizer
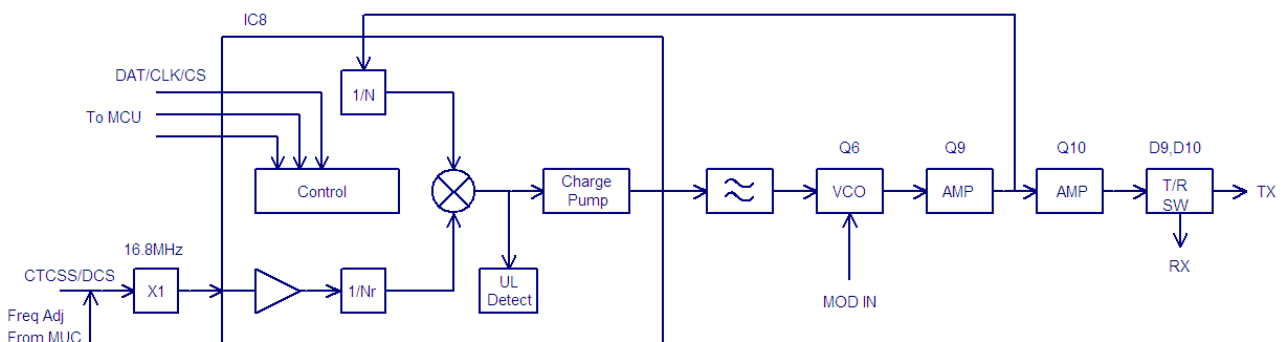
Figure 7 Schematic Diagram for Frequency Synthesizer

The DM6000-2 adopts PLL frequency synthesizer.

Frequency synthesizer consists of reference oscillator, voltage controlled oscillator (VCO), programmable frequency divider (PFD), phase comparator and low pass filter (LPF).

RX VCO Unit consists of Q4 D3 D5 L12 C45 C49 and C51.

TX VCO Unit consists of Q6 D4 D6 D7 L11 C46 C50 and C52, D7 is the modulation circuit of VCO.

IC8 (SKY72310) is PLL integrated circuit and contains programmable parametric frequency divider (PPFD), programmable frequency divider (PFD), phase comparator and charge pump, etc.

Low pass filter consists of R7 R159 R160 C171an C196.

Reference frequency is provided by X3 (TCXO, 16.8MHz).

Reference frequency of TCXO (Temperature-controlled Crystal Oscillator) is divided by PPFD in IC3 to produce reference frequency of 5kHz or 6.25kHz (controlled by MCU based on the set channel frequency).

The oscillation frequency of VCO is compared with reference frequency to produce error signal after divided by PFD in IC607. The error signal is filtered by low pass filter before changing the VCO frequency to the set value in VCO (it is locking).

$$N=F_{VCO}/F_R$$

N：Division Frequency

F_{VCO}：VCO Oscillation Frequency

F_R：Reference Frequency

Lock lost detection: When PLL is out of lock, IC pin4 will output low level signal to MCU，and then MCU prohibit transmitter from transmitting with a warning tone.

Q8, the power filter, can provide PLL with more purified power to reduce the noise of frequency synthesizer.

5 Base Band Processor

HR_C5000-1 (IC1) is a low power high performance base band processor supporting Tier 1 and Tier 2 of the DMR protocol. it completes the entire physical layer and data link layer, and voice processing part of the call control layer of DMR compliant with ETSI TS 102 361.
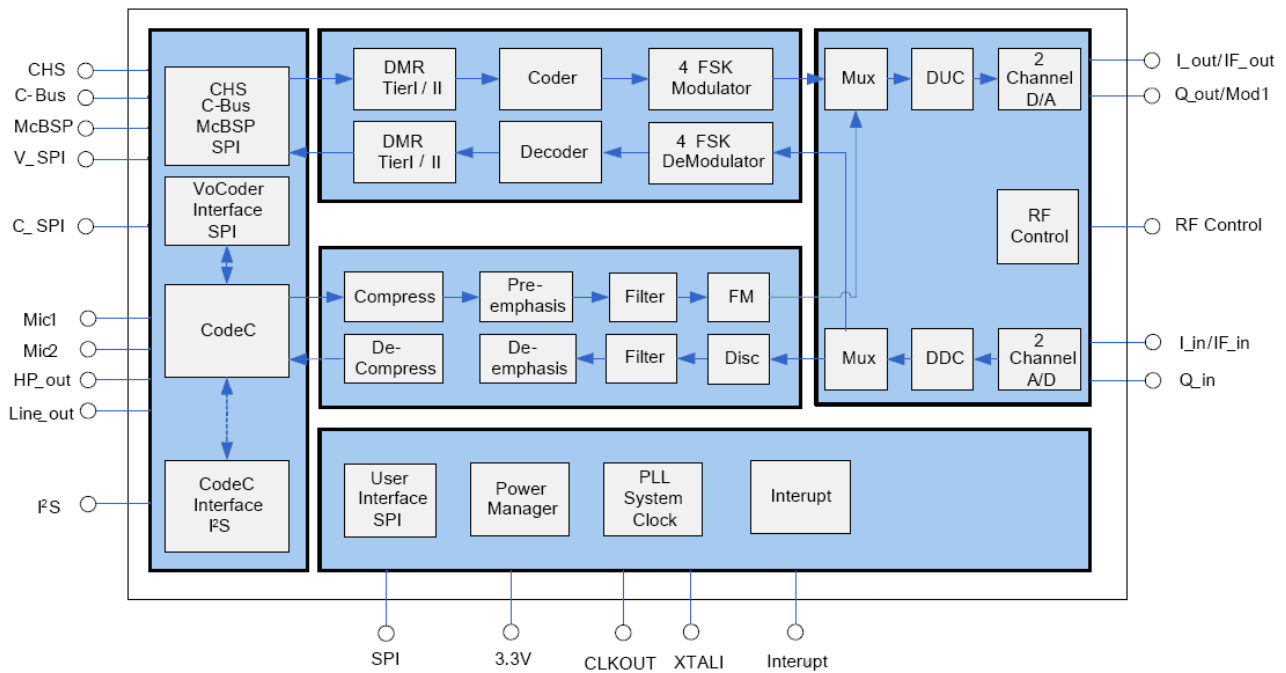
Figure 8 Base Band Processor

6 Voice Circuit：

The station is equipped with Voice Prompt Function, which is very useful during night or under dark condition.

The speaker will voice the current channel number when changing the channel every time because of the voice memory chip (IC15), which stores channel voice prompts. It will repeat the current channel number once pressing "Voice Prompts".

The speaker will voice the current channel number under standby state if the Voice Prompt Function is set. Press "Voice Prompts" for reset to switch voice types. Press "Voice Prompts" repeatedly for power connection, then the voice types will be switched in circle in the order of "Chinese male voice—English male voice—Chinese female voice—English female voice—no prompts".

7 Power Supply：

The station use 13.8V power supply, while transmitter amplifier circuit IC302 and receiver audio amplifier (IC715) use directly for power supply, and other circuits use regulated voltage (8V 5V and 3.3V).

IC711:8C 8R 8T (8V LDO)

IC713:8M (8V LDO)

IC710：5C (5V LDO)

IC21 ：3.3V DC/DC

IC7 ：3.3V LDO, is the supply power of frequency synthesizer

8 MCU Unit:
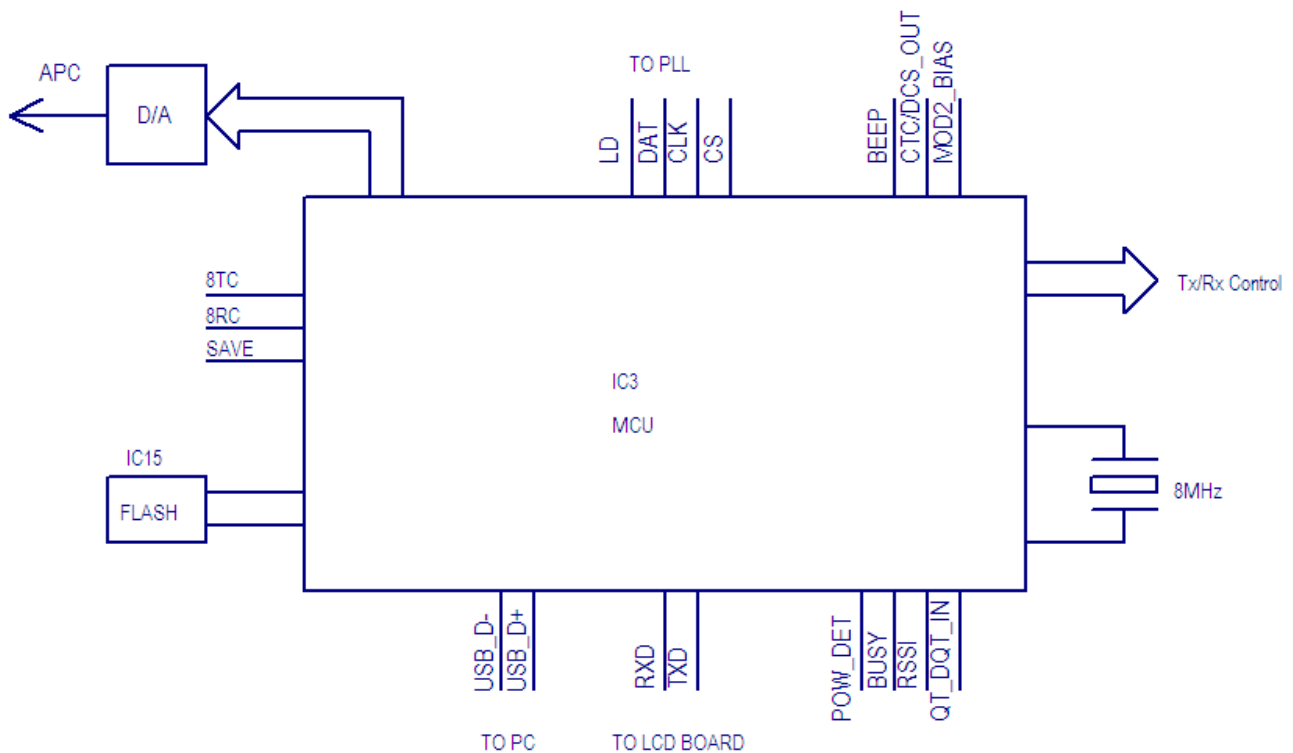
Figure 9 Schematic Diagram for MCU Unit

MCU Unit controls the operation of every unit to realize all functions of the DM6000-2.

Communication with external PC

State data access

Control PLL for the generation, receiving and transmitting of local oscillation frequency

Access to the current channel state

Control LED status indicator

Control power supplied condition of every unit

Detect action of every function key

Produce CTCSS signal

Produce DCS signal

Produce power controlled signal

Finish CTCSS decoding

Finish DCS decoding

Squelch detection and control

Control voice prompt content

Memory (FLASH)

Channel data, CTCSS/DCS data and other function setting data and parameter adjustment data.

CTCSS/DCS signal coding and decoding:

CTCSS/DCS signals from MCU are sent to TCXO for modulation respectively .

CTCSS/DCS signals from receiver are sent to MCU(pin 25) for decoding, and then MCU test if there

are CTCSS/DCS signals with the same setting of the station to decide whether open the speaker or not.

CTCSS (continuous tone control squelch system, hereinafter referred to as CTCSS), is a kind of squelch control system with modulation on carrier and continuous sub-audio signals as pilot tone. If CTCSS function is set, the call is available only at the same CTCSS frequency of both receiving and transmitting parties to avoid the disturbance of other signals.

The station has 39 groups of standard CTCSS frequency for your selection, such as Table 1.

CTCSS signals produced by MCU are sent to TCXO for modulation.

Table 1 　　CTCSS Frequency Table

No.	Frequency [Hz]	No.	Frequency [Hz]	No.	Frequency [Hz]	No.	Frequency [Hz]
1	67.0	11	94.8	21	131.8	31	186.2
2	69.3	12	97.4	22	136.5	32	192.8
3	71.9	13	100.0	23	141.3	33	203.5
4	74.4	14	103.5	24	146.2	34	210.7
5	77.0	15	107.2	25	151.4	35	218.1
6	79.7	16	110.9	26	156.7	36	225.7
7	82.5	17	114.8	27	162.2	37	233.6
8	85.4	18	118.8	28	167.9	38	241.8
9	88.5	19	123.0	29	173.8	39	250.3
10	91.5	20	127.3	30	179.9		

DCS signaling：

DCS (Digital code squelch), is a kind of continuous digital code modulated on carrier with voice signal and used for squelch control. If DCS function is set, the speaker is available only when receiving the same DCS code to avoid the disturbance of useless signals.

The station has 83 kinds of standard codes including positive and inverse code for your selection, such as Table 2.

DCS signals produced by MCU (PWM waveform) are sent to TCXO for modulation.

CTCSS/DCS signals from receiver are sent to MCU for decoding, and then MCU test if there are DCS codes with the same setting of the station to decide whether open the speaker or not.

Table 2 　　DCS Coding Schedule

023	114	174	315	445	631
025	115	205	331	464	632
026	116	223	343	465	654
031	125	226	346	466	662
032	131	243	351	503	664
043	132	244	364	506	703
047	134	245	365	516	712
051	143	251	371	532	723
054	152	261	411	546	731

065	155	263	412	565	732
071	156	265	413	606	734
072	162	271	423	612	743
073	165	306	431	624	754
074	172	311	432	627	

9 Description of Semiconductor Devices

The distribution of each pin goes as the table 3.

Table 3---Definition of CPU Base Pin:

Pin	Type	Pin Name	Port Name	Function
1	O	PE2	FLASH_CS	SPI Flash Chip Select
2	O	PE3	FLASH_SCLK/ LCD_DB6	SPI Flash Serial Clock/ LCD_DB6(multiplexing)
3	I	PE4	FLASH_SDO	SPI Flash Serial Data
4	O	PE5	FLASH_SDI/ LCD_DB7	SPI Flash Serial Data Output(MCU)/ LCD_DB7(multiplexing)
5	O	PE6	DMR_SLEEP	DMR POWERDOWN(High Active)
6	S	VBAT	VBAT	Connected to VDD
7	O	PC13	NC	
8	O	PC14	NC	
9	O	PC15	NC	
10	S	VSS_5	VSS_5	Connected to VSSA.
11	S	VDD_5	VDD_5	Connected to 3.3V.
12	I	OSC_IN	OSC_IN	8MHz Crystal Input
13	O	OSC_OUT	OSC_OUT	8MHz Crystal Output
14	I	RESET	RESET	Reset Input(Low Active)
15	I	PC0/EXTI0	TIME_SLOT_INTER R	DMR TIME_SLOT Interrupt
16	I	PC1/EXTI1	SYS_INTER	DMR SYS Interrupt
17	I	PC2/EXTI2	RF_TX_INTER	DMR RF_TX Interrupt
18	I	PC3/EXTI3/ AD123_IN13	2T/5T	2T/5T data input
19	S	VDD	VDD	Connected to 3.3V
20	S	VSS	VSS	Connected to VSSA
21	S	VREF+	VREF+	Connected to 3.3V.
22	S	VDDA	VDDA	Connected to 3.3V.
23	I	PA0/ ADC123_IN0	NC	
24	I	PA1/ ADC123_IN1	BATT	DC Input;

25	I	PA2/ ADC123_IN2	QT/DQT_IN	CTCSS/DCS Input
26	I	PA3/ ADC123_IN3	VOX	VOX Input
27	S	VSS_4	VSS_4	Connected to VSSA
28	S	VDD_4	VDD_4	Connected to 3.3V.
29	O	PA4/ DAC_OUT1	APC/TV	APC/TV D/A Output
30	O	PA5/ DAC_OUT2	MOD2_BIAS	TCXO Frequency D/A Adjust
31	I	PA6/ ADC12_IN6	POWER_DET	Power Detect(High Active)
32	O	PA7	POWER_C	Power Control(High Active)
33	I	PC4	TEMP1	Temperature 1 input
34	I	PC5	TEMP2	Temperature 2 input
35	I	PB0/ ADC12_IN8	RSSI	RSSI Detect Input
36	I	PB1/ ADC12_IN9	BUSY	Carrier Detect Input
37	I/O	PB2/BOOT1	FM_SW	FM Receive IF Switch(High Active)
38	O	PE7	FM_MUTE	FM RX Mute(High Active)
39	O	PE8	VCOVCC_SW	RXVCO/TXVCO Control(High for RX)
40	O	PE9	DMR_SW	DMR Receive IF Switch(High Active)
41	I	PE10	RF_APC_SW	RF Amplifier Switch(High Active)
42	O	PE11	8RC	8R Power Switch Control(High Active)
43	I	PE12	NC	
44	I	PE13	ALARM_KEY	Top Key Input
45	I	PE14	NC	
46	I	PE15	8TC	8T Power Switch Control(High Active)
47	I	PB10	TXD	Serial data output
48	I	PB11	RXD	Serial data input
49	S	VCAP_1	VCAP_1	Connect a Capacitor to Ground
50	S	VDD_1	VDD_1	Connected to 3.3V
51	O	PB12/ SPI2_NSS	DMR_CS	C5000 Chip Select
52	O	PB13/ SPI2_SCK	DMR_SCLK	C5000 Serial Clock Output(From MCU)
53	I	PB14/ SPI2_MISO	DMR_SDO	C5000 Serial Data Input
54	O	PB15/ SPI2_MOSI	DMR_SDI	C5000 Serial Data Output
55	I	PD8	PLL_LD	PLL Lock Detect(High Active)
56	O	PD9	PLL_CS	PLL Chip Select

57	O	PD10	PLL_DAT	PLL DATA Output
58	O	PD11	PLL_CLK	PLL Clock Output
59	O	PD12	NC	
60	O	PD13	PT2257-SDA	To PT2257
61	O	PD14	PT2257-SCL	To PT2257
62	O	PD15	FL_C	Fast Lock Switch Control(High Active)
63	O	PC6/TIM8_CH1	FAST_LOCK	Fast Lock PWM Output
64	O	PC7/TIM8_CH2	CTC/DCS_OUT	CTCSS/DCS TCXO Output
65	O	PC8/TIM8_CH3	BEEP	BEEP/ALARM/DTMF Output
66	O	PC9	EXT_PTT	Ext PTT Input
67	O	PA8	IGN	Ignition Sense H:IGN Sense off, L:IGN Sense on
68	I	PA9/USART1_TX	GPS-TXD	GPS serial data output
69	I	PA10/USART1_RX	GPS-RXD	GPS serial data input
70	I/O	PA11/USBDM	USBD-	USB DM
71	I/O	PA12/USBDP	USBD+	USB DP
72	I/O	JTMS-SWDIO/PA13	NC	
73	S	VCAP_2	VCAP_2	Connect a Capacitor to Ground
74	S	VSS_2	VSS_2	Connect to Ground
75	S	VDD_2	VDD_2	Connect to 3.3V。
76	I/O	JTCK-SWCLK/PA14	Port1	Programmable port 1
77	O	PA15/I2S3_WS	I2S_FS	DMR I2S_FS
78	O	PC10/I2S3_CK	I2S_CK	DMR I2S_CK
79	O	PC11/I2S3ext_SD	I2S_RX	DMR I2S_RX
80	I	PC12/I2S3_SD	I2S_TX	DMR I2S_TX
81	I/O	PD0	SPKSW	Speaker Output Control(High Active)
82	I/O	PD1	Port2	Programmable port 2
83	I/O	PD2	Port3	Programmable port 3

84	I/O	PD3	MIC_MUTE	MIC mute H: MIC mute
85	I/O	PD4	EXT_SW	EXT MIC SW
86	I/O	PD5	WIDE	25kHz
87	I/O	PD6	NARROW	12.5kHz
88	O	PD7	V_CS	DMR V_CS
89	O	PB3/ SPI3_SCK	V_SCLK	DMR V_SCLK
90	I	PB4/ SPI3_MISO	V_SDO	DMR V_SDO
91	O	PB5/ SPI3_MOSI	V_SDI	DMR V_SDI
92	O	PB6	SPM	Audio Amplifier Control(High Active)
93	O	PB7	NC	
94	I	BOOT0	BOOT0	Connect a 10K resistor to Ground
95	O	PB8/ I2C1_SCL	SCL	Software Control Watch Dog Serial Clock
96	O	PB9/ I2C1_SDA	SDA	Software Control Watch Dog Serial Data
97	O	PE0	MICPWR_C	MIC Power Switch(High Active)
98	O	PE1	INT	Interception
99	S	VSS_3	VSS_3	Connect to Ground
100	S	VDD_3	VDD_3	Connect to 3.3V

Table 4 Functional description of semiconductor device

Item	Model	Function Description
IC8	SKY72310	Frequency Synthesizer
IC303	NJM12904RB1	APC, Voltage Comparison, Driving
IC501	GT3136	Receiver 2nd Local Oscillation, 2nd IF Amplification, Limitation, Demodulation, Noise Amplification
IC13	NJM2902V	Receiver demodulated signal Amplification, Filtering
IC14	TA75W01FU	MIC Amplification
IC715	TDA2003	Audio Frequency Power Amplification
IC15	W25Q80	FLASH, Channel Frequency Data Storage, Function Setting Parameter, Debug Mode Parameter
IC3	STM32F405VGT6	MCU
IC4	PST9124NR	MCU Reset Circuit
IC1	HR_C5000-1	Base Band Processor
IC401	W25Q64FVSIG	LCD board FLASH
IC403	R5F212BCSNFP	LCD board MCU

Table 5 Definition of the connector J4

Pin No.	Name	Function Description
1	VOL_OUT	Received audio output
2	EXT-MIC	External MIC signal input
3	IGN IN	Ignition input
4	DEO	Received signal demodulation output
5	EXT_PTT	External PTT
6	Port1	Programmable auxiliary port
7	Port2	Programmable auxiliary port
8	GND	Gnd
9	Port3	Programmable auxiliary port
10	5C	DC+5V
11	USB_D-	USB-
12	USB_D+	USB+
13	DTMFIO	DTMF signal input or output
14	GPS-TXD	GPS serial data output
15	GPS-RXD	GPS serial data input

Table 6 Definition of the connector J5 and J902

Pin No.	Name	Function Description
1	SPGND	AF GND
2	SPOUT	AF out
3	8M	8V DC supply
4	RXD	RXD/PC serial data
5	TXD	TXD/PC serial data
6	POWER	Power key
7	MIC	Microphone input
8	GND	GND

Table 7 Definition of the connector J901

Pin No.	Name	Function Description
1	CM	MIC data detection
2	HOOK/RXD	HOOK / PC serial data
3	MIC	MIC signal input
4	ME	MIC GND
5	PTT/TXD	PTT / PC serial data
6	GND	GND
7	PSB	8V DC supply for MIC
8	MBI	Key detection

ADJUSTMENT

1 Required Test Equipment

Table 1

Number	Name	Parameter requirements
1	Computer	Above P2, compatible IBM PC, WINDOWS 98/ME/2000/XPOperating System
2	Programming software	CPS2015
3	Programming cable	
4	Dubbing cable	CPL-02
5	DC regulator	Output voltage:13.8V, output electric current:≥ 20A
6	RF power meter	Test range: 0.5---60W Frequency range: 100MHz—500MHz Resistance: 50Ω SWR≤1.2
7	Frequency meter	Frequency range: 0.1—600MHz Frequency accuracy: higher than±1×10^{-6} Sensitivity: higher than 100mV
8	Frequency deviator	Frequency range: DC—600MHz Test range: 0--±5kHz
9	DMM	Input resistance: above 10MΩ/V DC, capable of measuring voltage, electric current and resistance.
10	Audio signal generator	Frequency range:2---3000Hz Output level: 1---500mV
11	RF power attenuator	Decrement: 40db or 50db Receive power : higher than 60W
12	Standard signal source	Frequency range:10MHz---1000MHz Output level:0.1uV~32mV (-127dBm~-17dBm)
13	Oscillograph	Frequency range: DC~20MHz Test range: 10mV~20V
14	Audio Frequency voltmeter	Test range: 10mV~10V

Recommend how to use: item 6, 7, 8, 10, 11 and 12 which listed in the table can be substituted by integrated tester HP8920/HP8921.

2 Adjustment Items

Some detection and adjustment shall be made to the station technical data after changing the components during the maintenance. The debugging introduction of some related circuits goes as follows:

Some parameters of the product can be adjusted ("Interphone Performance Tuning") by use of ARD001 Programming Software of our company. The adjustable parameters are as follows：

1) Frequency stability"
2) Transmitting power
3) Alarm threshold for battery low-voltage
4) Squelch level
5) QT frequency offset
6) DCS frequency offset
7) Receiving sensitivity

Steps for adjustment：

a、Enter Computer Test Mode by selecting "Test Mode" in main menu of ARD001 Programming Software.

b、Select the items to be adjusted in choice menus, and then adjust the parameters by function keys on the computer keyboard.

c、Exit Computer Test Mode after adjustment.

3 Adjustment

3.1 VCO Adjustment

Close "Power-saving Mode". Set receiving frequency to low frequency point (see Table 2) and in the receiving state, test voltage of PD by DMM and adjust fine-tuning capacitor TC1/TC2 to get CV voltage of 1.0V±0.2V

Set transmitting frequency to high frequency point (refer to Table 2), press PTT and test voltage of PD by DMM, which shall less than 4.0V

Table 2 High/ Intermediate/ Low Frequency Point of All Models

	Low Frequency Point	Intermediate Frequency Point	High Frequency Point
DM6000-2 DM6100-2	400.100 MHz	435.100 MHz	469.975 MHz

3.2 PLL frequency calibration

Double-click to enter "Frequency Stability" in "Interphone Performance Tuning" to achieve the rated transmitting frequency by adjusting the number from 0 to 255 (Error<200Hz).

3.3 Transmitting frequency adjustment

Double-click to enter "Transmitting High Power" in "Interphone Performance Tuning" to adjust the five

frequency points including "Lowest", "Low", "Mid", "High" and "Highest" respectively and set transmitting power to over 45W by adjusting the number from 0 to 255 and observe the operating current (≤10A) at the same time.

Double-click to enter "Transmitting Low Power" in "Interphone Performance Tuning" to adjust the five frequency points including "Lowest", "Low", "Mid", "High" and "Highest" respectively and set transmitting power to over 25W by adjusting the number from 0 to 255.

3.4 Transmitting low-voltage alarm

Adjust power voltage to 10V and double-click to enter "Transmitting Low Voltage" in "Interphone Performance Tuning" Mode for automatic detection of the software, and then click "Save" for exit after no or little variation in numbers.

3.5 Frequency offset adjustment

Input audio signal (12mV, 1000Hz) at MIC jack of interphone. Adjust and set frequency offset to ±4.2kHz.

3.6 DCS transmitting signal waveform and frequency offset adjustment

Double-click to enter "DCS frequency offset" in "Interphone Performance Tuning" Mode, adjust potentiometer VR1 to observe demodulated signal (the waveform shall be smooth and similar to square wave), and then click "Broadband" to adjust all points including "Lowest", "Low", "Mid", "High" and "Highest" respectively for frequency offset of 0.8kHz. After that, click "Narrowband" to adjust the frequency offset to 0.4kHz.

3.7 CTCSS frequency offset adjustment

Double-click to enter "QT(67) frequency offset" in "Interphone Performance Tuning" Mode and click "Broadband" to adjust the five frequency points including "Lowest", "Low", "Mid", "High" and "Highest" respectively to 0.75kHz and then click "Narrowband" to adjust the frequency offset to 0.35kHz.

Select "QT(254) frequency offset" in "Interphone Performance Tuning" Mode, and the debugging method is the same as that of "QT(670) frequency offset".

3.8 Receiving Sensitivity

Double-click to enter "Receiving Sensitivity" in "Interphone Performance Tuning" Mode to adjust the five frequency points including "Lowest", "Low", "Mid", "High" and "Highest" respectively and the number from 0 to 255 for setting max sensitivity of all points.

3.9 Receiver Squelch setting

Double-click to enter "SQL9 open" in "Interphone Performance Tuning" Mode and click "Broadband" to make the frequency of the transmitting signal corresponding to the receiving frequency (level of -116dBm, modulation signal of 1kHz and frequency offset of 3kHz) showed at each frequency point of the software. Enter all points including "Lowest", "Low", "Mid", "High" and "Highest" respectively for automatic adjustment of software and then press next point after no big change to numbers. After that, adjust "Narrowband", the debugging method is the same as that of "Broadband" except the input modulation signal is changed to frequency of 1kHz and frequency offset of 1.5kHz.

Select "SQL9 open" in "Interphone Performance Tuning" Mode and click "Broadband" to make the frequency of the transmitting signal corresponding to the receiving frequency (level of -118dBm, modulation signal of 1kHz and frequency offset of 3kHz) showed at each frequency point of the software. Enter all points including "Lowest", "Low", "Mid", "High" and "Highest" respectively for automatic

adjustment of software and then press next point after no big change to numbers. After that, adjust "Narrowband", the debugging method is the same as that of "Broadband" except the input modulation signal is changed to frequency of 1kHz and frequency offset of 1.5kHz.

Select "SQL1 open" and "SQL1 close" respectively in "Interphone Performance Tuning" Mode, and adjust by the same method except the open level of transmitting signal changed to 123dBm and the close level to 125dBm.

4 Receiving Low-voltage Alarm

Adjust power voltage to 10V and double-click to enter "Receiving Low Voltage" in "Interphone Performance Tuning" Mode for automatic detection of the software, and then click "Save" for exit after no or little variation in numbers.

5 Adjusting explanation

Table 3 Voltage controlled oscillator

Item	Test condition	Instrumentation	Test point	Correcting member	Requirement	Remarks
Setting	Supply voltage battery terminal:7.4V	DMM	CV			
Locking voltage	CH: Receiving low frequency point			TC2	1.0V±0.2V	Adjustment
	CH: Transmitting high frequency point				≤4.0V	Observation

Table 4 Receiving part

Item	Test condition	Instrumentation	Test point	Correcting member	Requirement	Remarks
Audio Power	Test frequency: Intermediate Frequency Point Antenna Interface Input: RF OUT : -53dBm(501μV) MOD：1kHz DEV：±3.0kHz Audio load: 16Ω	RF signal generator Oscillograph Audio frequency voltmeter distortion tester	Speaker Interface		(Volume knob clockwise to the end) Audio Power>0.3W	Power of the internal speaker：>2W

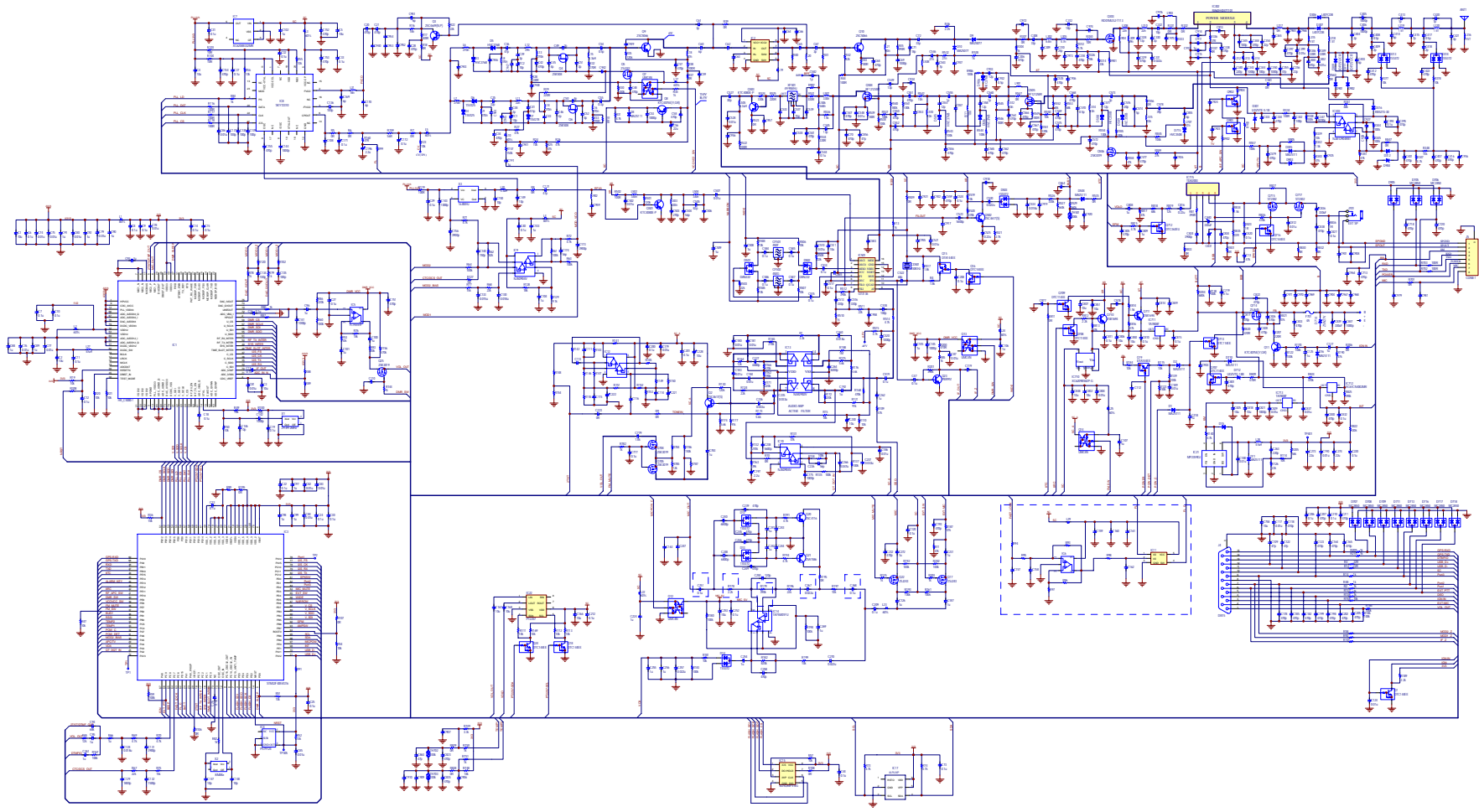|				Computer Adjustment	SINAD: 12dB or higher	
Sensitivity	CH: Low Frequency Point CH: Intermediate Frequency Point CH: High Frequency Point RF OUT:-119dBm(0.25μV) MOD: 1kHz DEV: ±3.0kHz	/Integrated tester				
Squelch Enable Sensitivity	CH: Receiving Center Frequency Point			Computer Test Mode	Normal squelch opening after adjustment	
	Level-9 RF OUT output:-116dBm					
	Level-1 RF OUT output:-123dBm				Normal squelch opening after adjustment	

Table 5 Transmitting part

Item	Test condition	Instrumentation	Test point	Correcting member	Requirement	Remarks
RF rate		Frequency Counter / Integrated Tester		Computer Test Mode	Within ±200Hz	
DCS waveform (balance)		Oscillograph / Integrated Tester		Computer Test Mode	Nearly flat waveform Square wave	
Power(Hi)	Power 13.8V	Power Tester / Integrated Tester Ammeter		Computer Test Mode	Adjust to 45W	Within ±0.2W
Power(Lo)	Power 13.8V	Power Tester / Integrated Tester Ammeter	Antenna	Computer Test Mode	Adjust to 25W	Within ±0.2W
Max Modulation Frequency Offset	CH: Transmitting Center Frequency Point AG: 1kHz/120mV	Frequency deviator/Integration Tester		Computer Test Mode	Adjust to ±4.2kHz	±200Hz
Modulation Sensitivity	CH: Transmitting Center Frequency Point AG: 1kHz/12mV				Check Frequency Offset 2.2kHz~3.6kHz	
CTCSS DEV	CTCSS: 67Hz	Frequency deviator/Integration Tester		Computer Test Mode	Adjust to ±0.75kHz	±50Hz
DCS DEV	DCS: 023N	Frequency deviator/Integration Tester		Computer Test Mode	Adjust to ±0.75kHz	±50Hz

DM6000-2 DM6100-2 BLOCK DIAGRAM
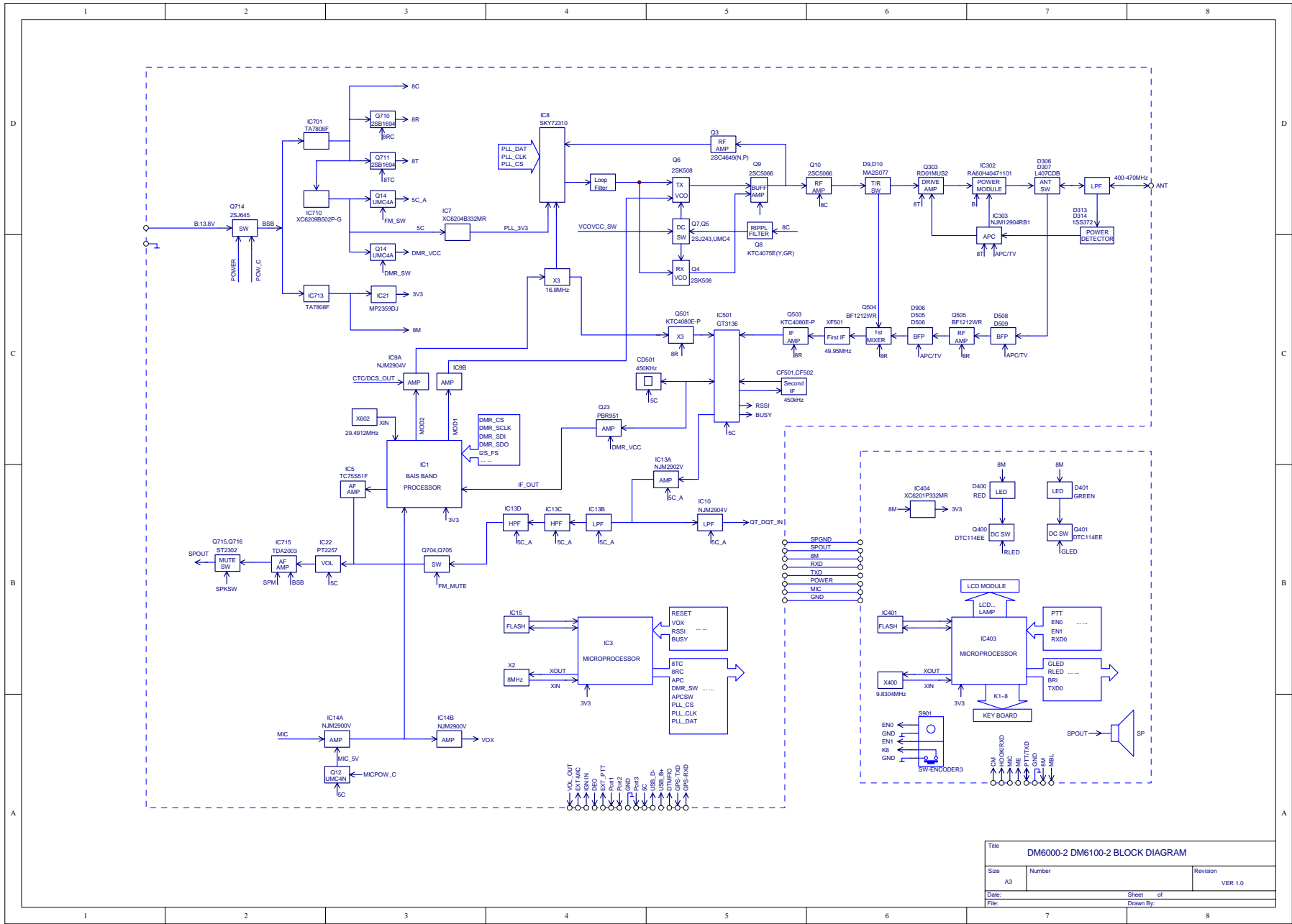
Title	DM6000-2 DM6100-2 BLOCK DIAGRAM	
Size A3	Number	Revision VER 1.0
Date:	Sheet of	
File:	Drawn By:	

LCD

J903
18pinFPC

CS1 RES A0 DB6 DB7 V0D VSS VOUT C3P C3N C2P C2N V4 V3 V2 V1 V0

S901
SW-ENCODER3

D913 D914
MC2850 MC2850

SPK

SPGND SPGN
SPOUT SPOU
8M 8M
RXD0 RXD
TXD0 TXD
POWER POWE
MIC MIC

J902
CON8-1

IC404
XC6201P332MR
OUT IN
GND

C901 C925 C408 C410 C416 C417
0.1u 0.1u 10u 470p 470p 1u

R1 0R
C1 C2 C3 C4
1u 1u 0.1u 0.1u

C5 1u
C6 1u
C7 1u
C8 1u
C9 1u

R5 1k
R7 10k
R6 R2 R3 R4
1k 1k 1k 1k

C917 C918
1u 0.01u

R8 R9 R10
100R

C952 C953
0.047u 0.047u

R902 4.7k
R903 4.7k

C910 1000p
C915 100p
K5
C10 100p
C11 100p

R15 100R
R16 100R

IC401
W25Q64FVSIG
/CS VCC
DO /HOLD
/WP CLK
GND DIO

R411 47k
C776 0.01u

Q403
DTC144EE
R409 1k
C409 3p
C412 10p

X400
9.830MHz

C415 10p

R412 4.7k
L901 601s

IC400
NC VCC
SUB
GND OUT
PST9124NR

C403 470p
R400 330k
C401 C400
0.1u

RESET

R907 0R
D901
R901 0R

IC902
OUT IN
GND

C960 100p
C902 C903
0.1u 0.1u

D903 D904
MC2850 MC2850

R11 1k
R12 1k
R13 1k
R14 1k

C957 C959 C961
100p 100p 100p

D902
UDZVTE-6.2B

D905 D912
MC2850 MC2850

J901
CM 1
HOOK/RXD 2
MIC 3
MIC 4
PTT/TXD 5
GND 6
PSB 7
MBL 8
8PIN

C956 100p

LED TX   LED BUSY

R417 10R

D400 D401 D402
HT19 HQ19 HQ19

Q400 Q401
DTC114EE DTC114EE

C402 470p
R410 8.2k
R402 220R
R403 100R
C406 470p
R426 8.2k

IC403
R5F212BCSNFP

NC NC NC K1 K2 K3 K4 K6 K7 K8 RXD0 TXD0 GLED RLED NC NC NC

LCD5 VCC VREF NC BRI AVSS NC NC NC NC NC NC NC NC NC NC NC

C922 C924 C954
1000p 0.1u 1u

BRI

BRI

Q903
2SB1132(Q,R)

R922 D906 D907
100R OLED OLED
R923 D908 D909
100R OLED OLED
R924 D910 D911
100R OLED OLED

R917 3.9k
R918 820R
Q904 UMG3N
R909 1k
C951
R919 2.7k
R920 33k
R921 47k

C955 C912 C929
1000p 1000p

R904 0R K1
R905 0R K2
R906 0R K3
R908 100R K4
R914 1k K6
R915 1.5k K7

R910 1.5k
R916 R913 R911 R912
47k 47k 47k 47k

CM
MICDEY
PTT